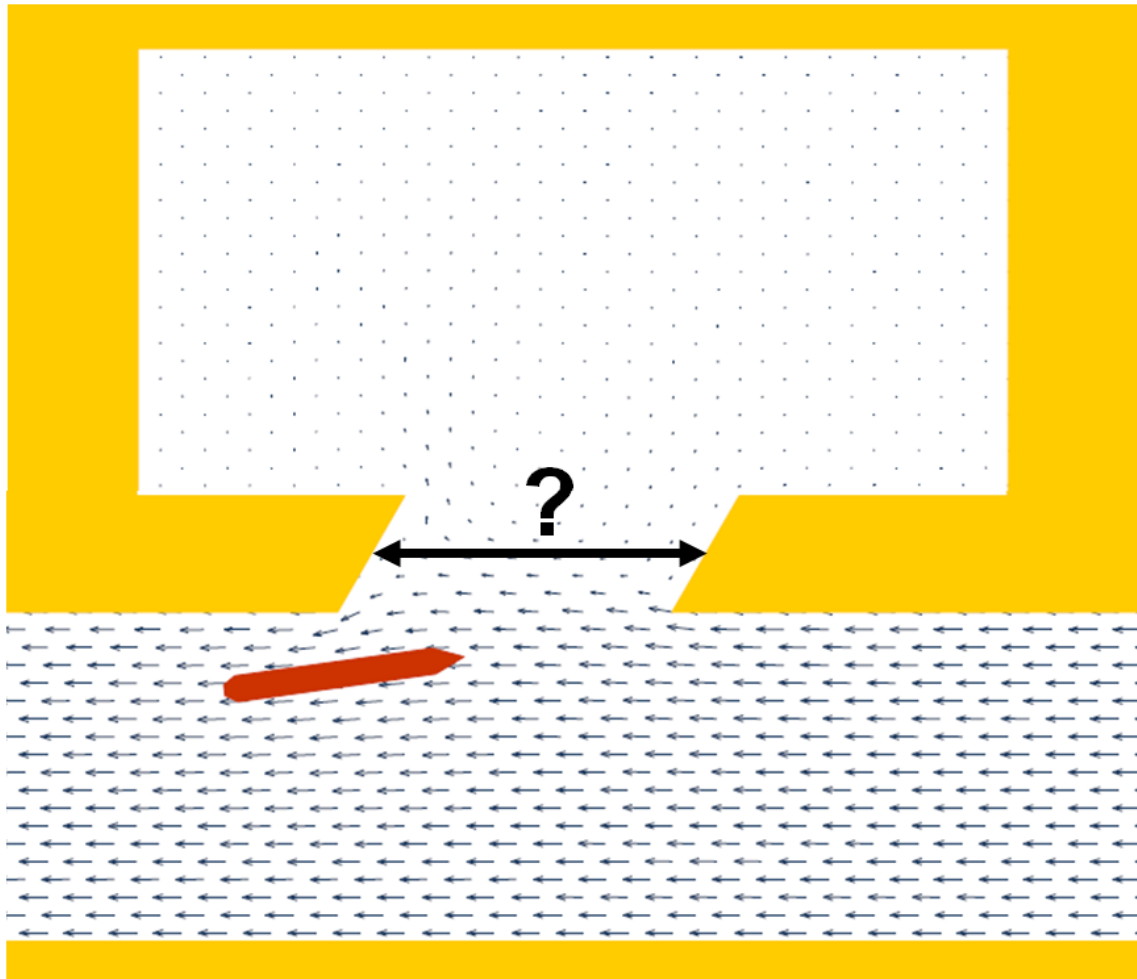


# Minimum entrance width for inland ports

## *Appendix G*



Master thesis

**M.D. Buckers**

June 2017





## SHIPMA output plots

In this appendix the output plots of the conducted SHIPMA runs are shown. This appendix is part of the MSc. thesis of M.D. Buckers. An electronic version of this thesis is available at: <https://repository.tudelft.nl/>

The output of the SHIPMA runs are presented in track plots and data plots. In the track plots every 20 seconds a ships contour is plotted and the distance of the followed path is indicated every 100 meters. The non-water parts of the layouts are covered by a yellow contour. The following plots are provided for each run:

- Figure A1: Track plot overview of entire situation with the water depth, bank suction lines, current, implemented track and ship snapshots. Close-up of the port entrance with the swept path, implemented ship track and ship snapshots.
- Figure A2: Track plot close-up of the port basin, entrance and the waterway in front of the port. In this plot the current, bank suction lines, implemented track and ship snapshots are included.
- Figure B: Data plots with the propeller revolutions (rev/s), rudder angle (deg) and bow thruster force (kN) plotted as a function of the travelled distance (m). The bow thruster force (kN) plotted against the time (min) is also included.
- Figure C: Data plots with the longitudinal ship speed (m/s), transverse ship speed (m/s) and the rate of turn (deg/s) plotted as a function of the travelled distance (m). The track distance plotted against the time (min) is also included.

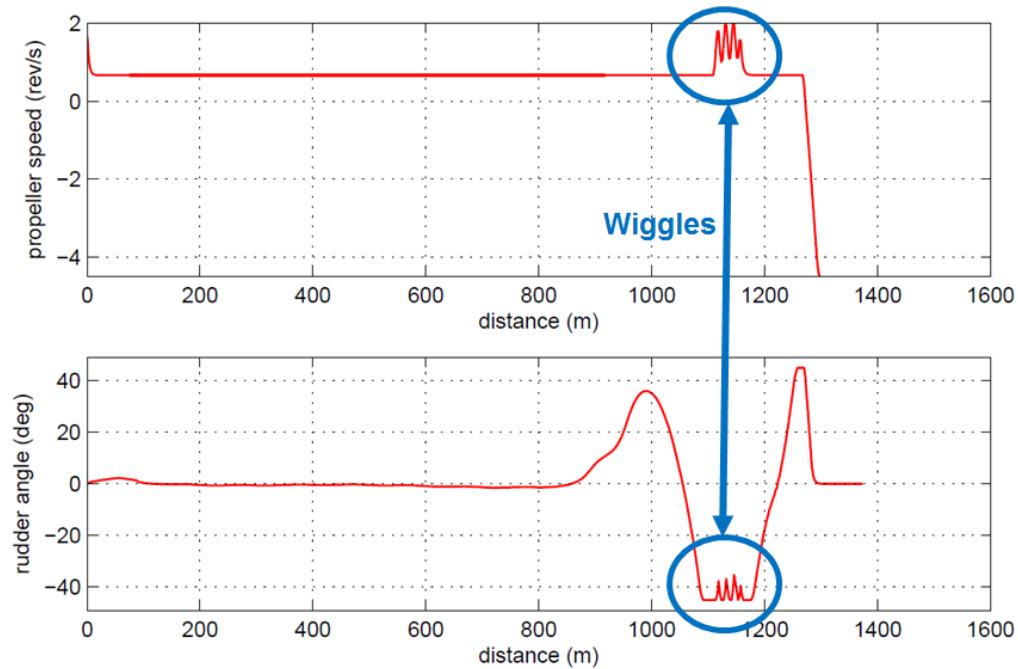
In every figure the layout number is indicated. An overview of the different layouts used in the simulation study is given in Table 3-2.

The scenarios with a backward manoeuvre are split into two runs:

- Part a: Ship is sailing in downstream direction and stops downstream of the port entrance.
- Part b: Ship is sailing backward into the port. Note that the backward manoeuvres are conducted in upstream direction.

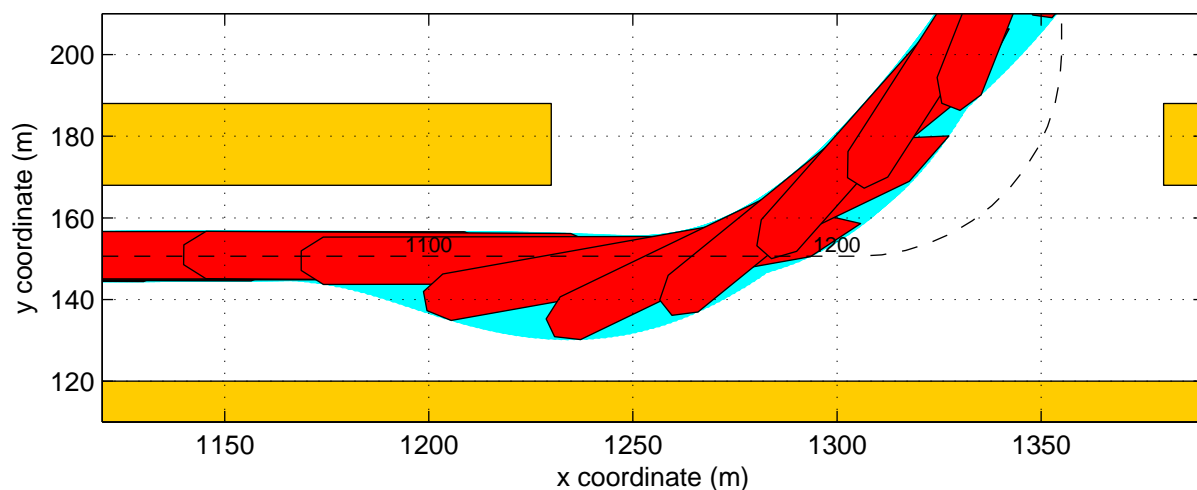
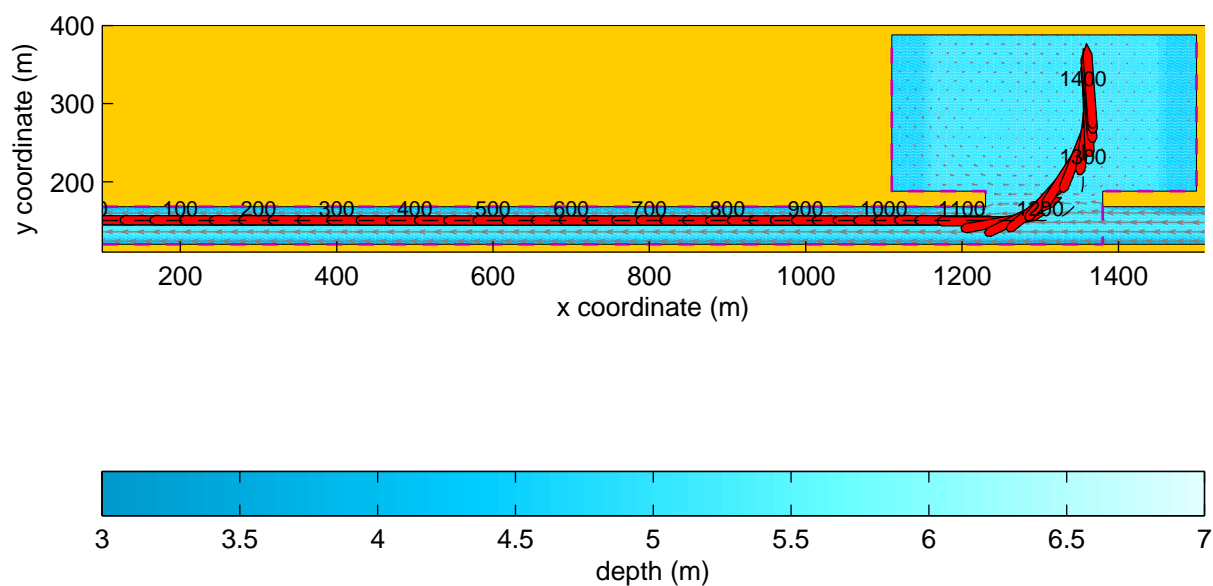
The ship snapshots from part a are coloured red and the snapshots from part b are coloured green. The data plots for both runs are given.

In several runs, wiggles can be observed in the data plots of the propeller revolutions and the rudder angle. An example is illustrated in Figure G-1. These wiggles occur when the SHIPMA model is operating on the edge of using a power burst to increase the steering capacity of the ship. When using the power burst, the rudder angle reduces slightly because not all obtained steering capacity created by the power burst is required. These wiggles can be removed by manually increase the propeller speed along the track where the wiggles occur. The obtained output for the ship manoeuvres used in this research is similar for a situation with wiggles and without wiggles. Hence, these wiggles are not problematic for the output. However, it should be mentioned that the wiggles in the propeller revolutions are not in agreement with the steering behaviour of a human operator.



**Figure G-1: Example of wiggles in the propeller and rudder angle data plots.**





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

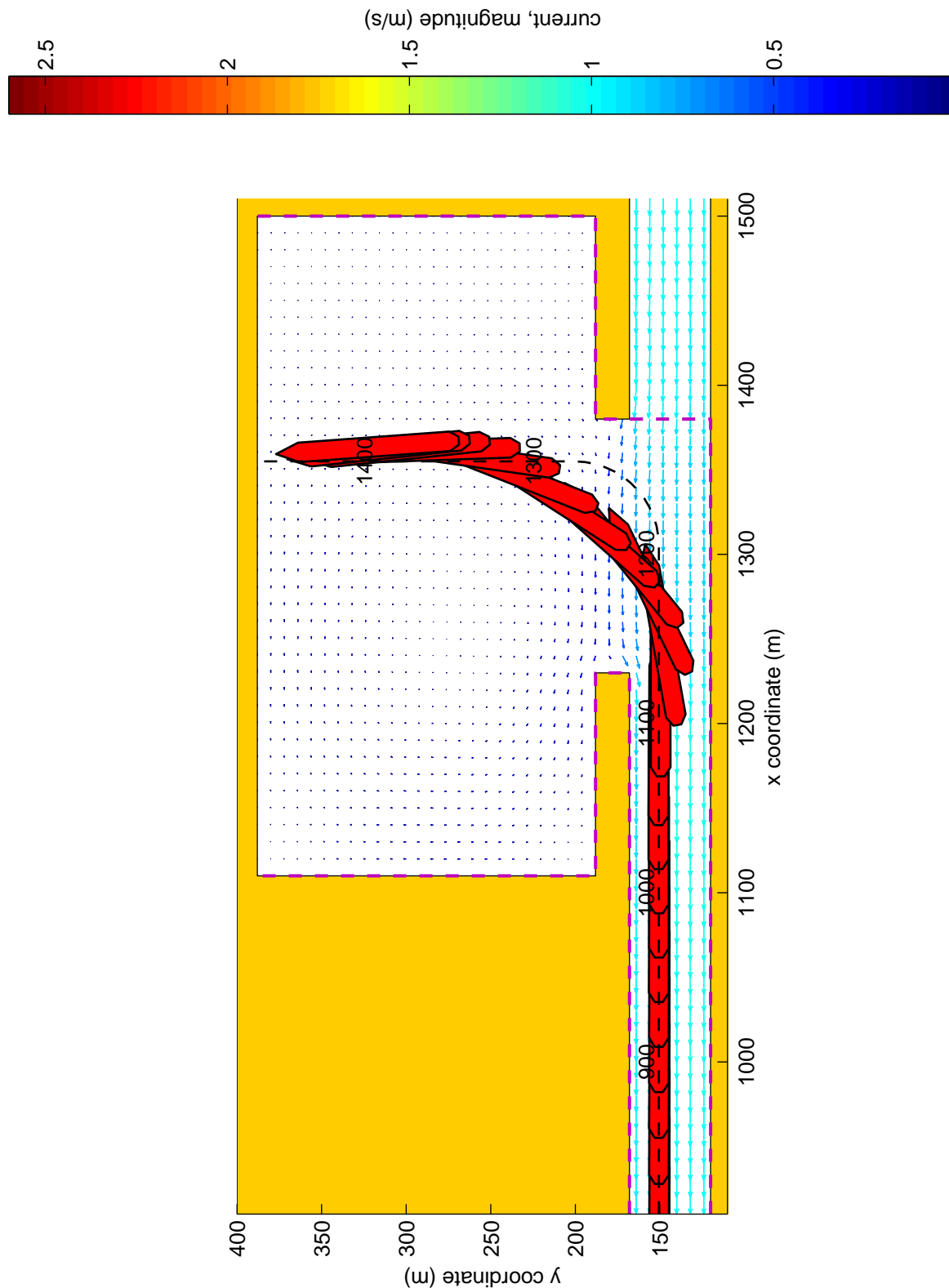
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 1

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

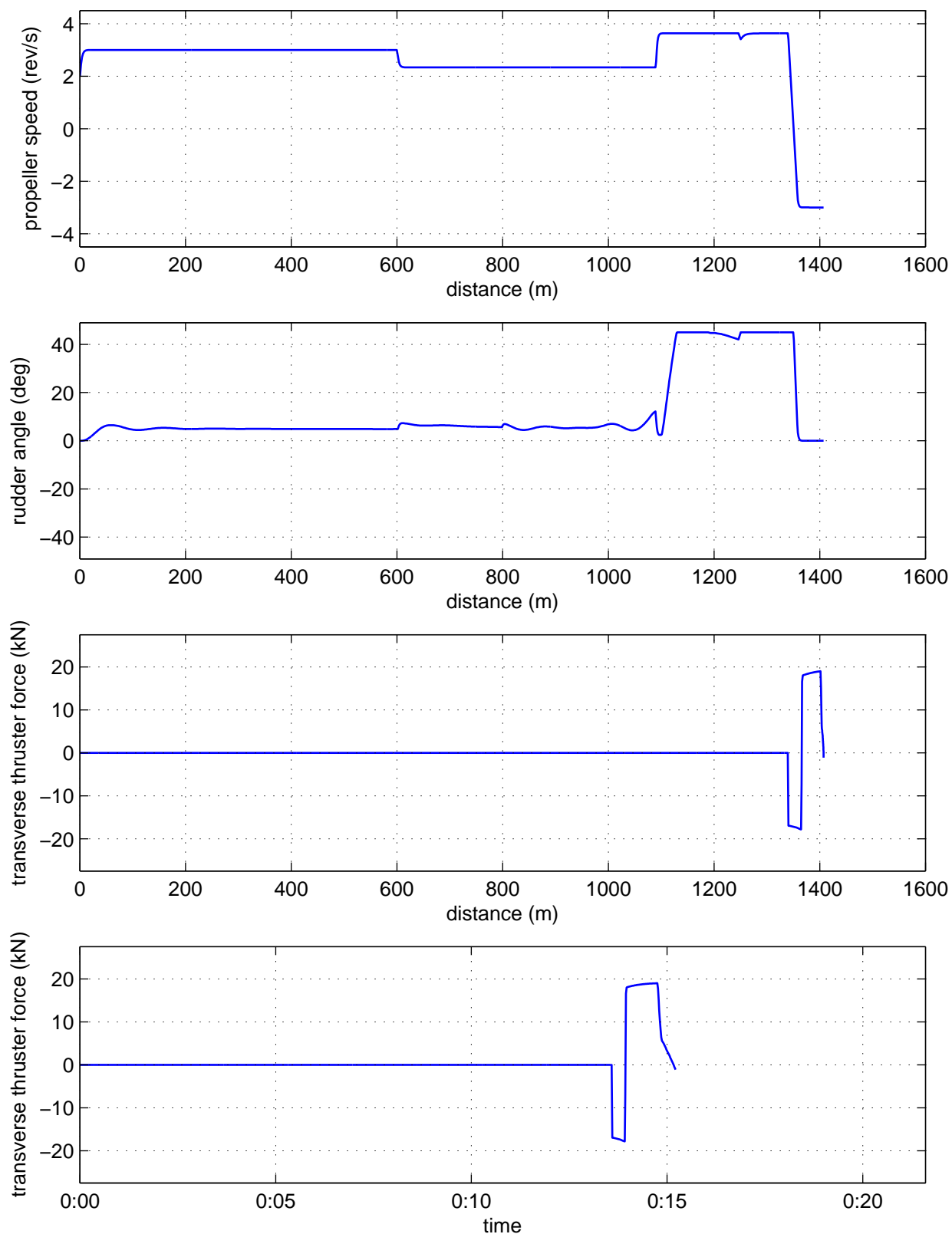
Current: 1.0 m/s

SHIPMA 7.4.2

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Run 1

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

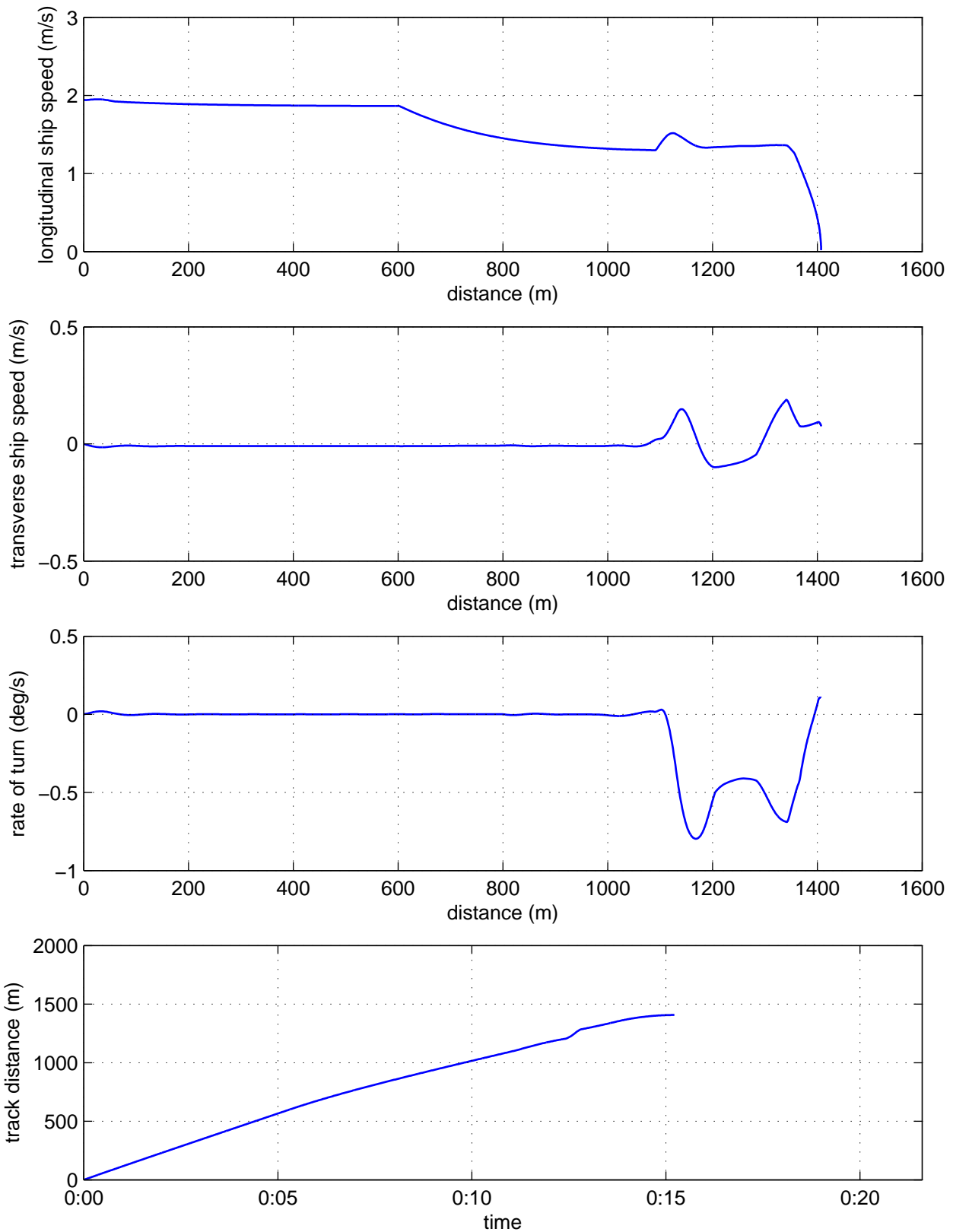
Current: 1.0 m/s

SHIPMA 7.4.2

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Run 1

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

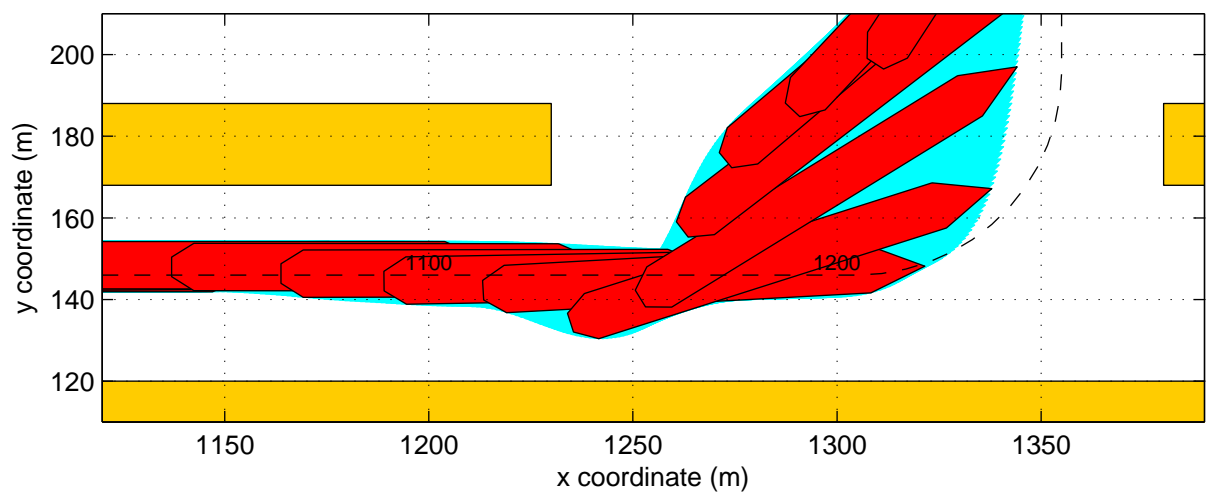
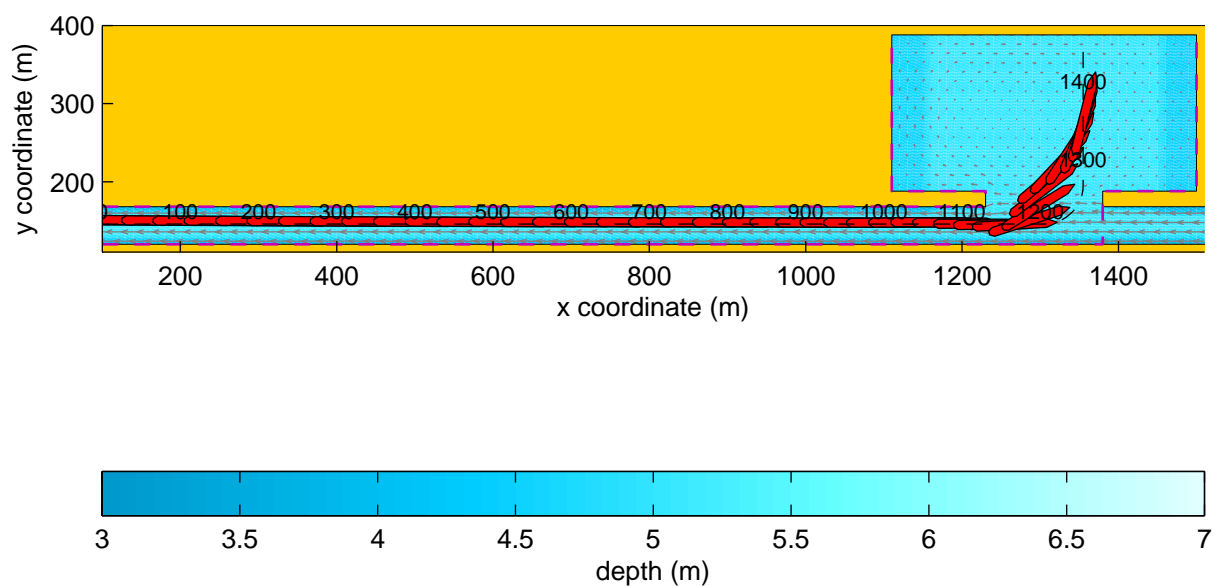
Current: 1.0 m/s

SHIPMA 7.4.2

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Run 1

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

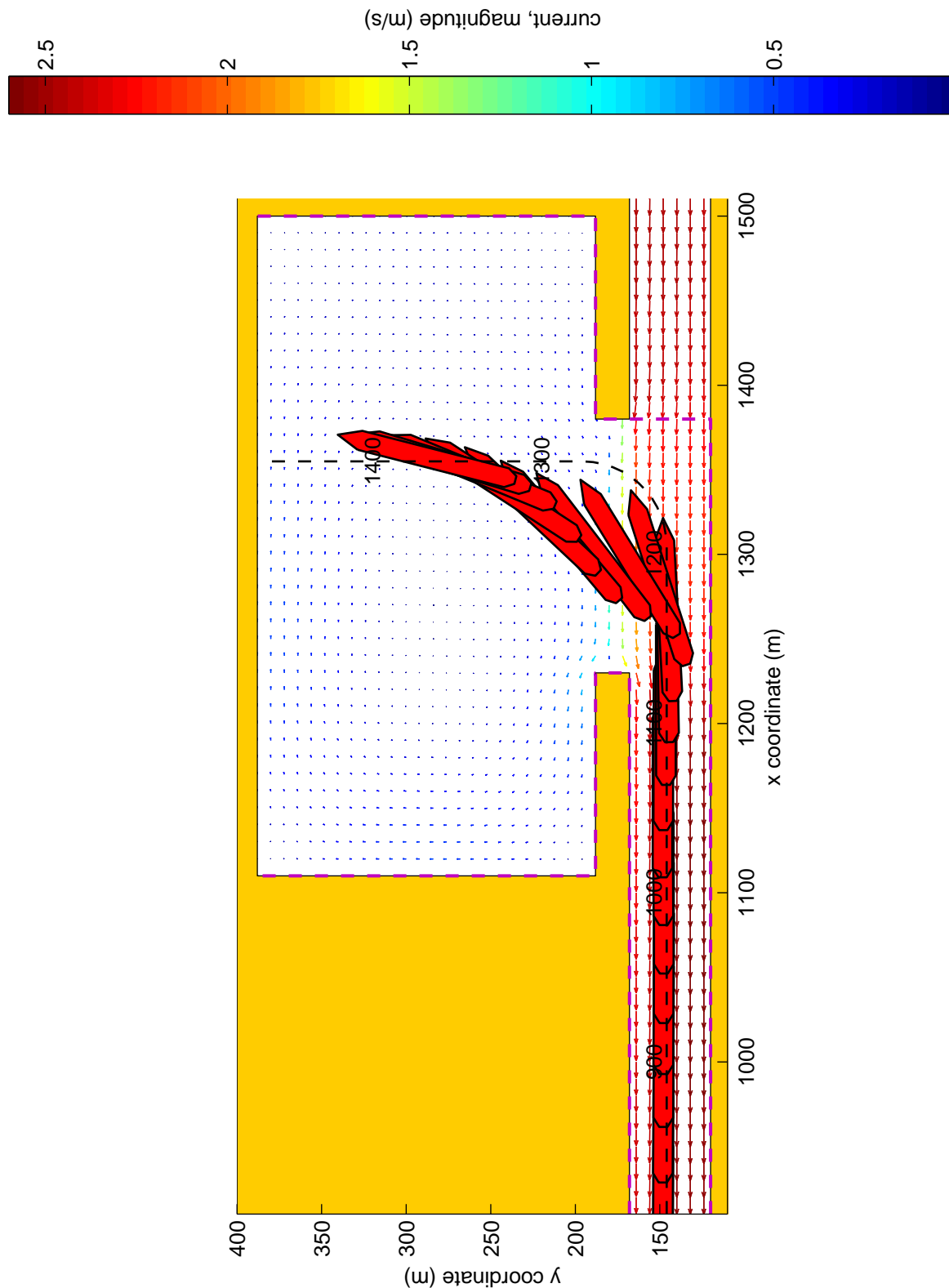
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 2

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

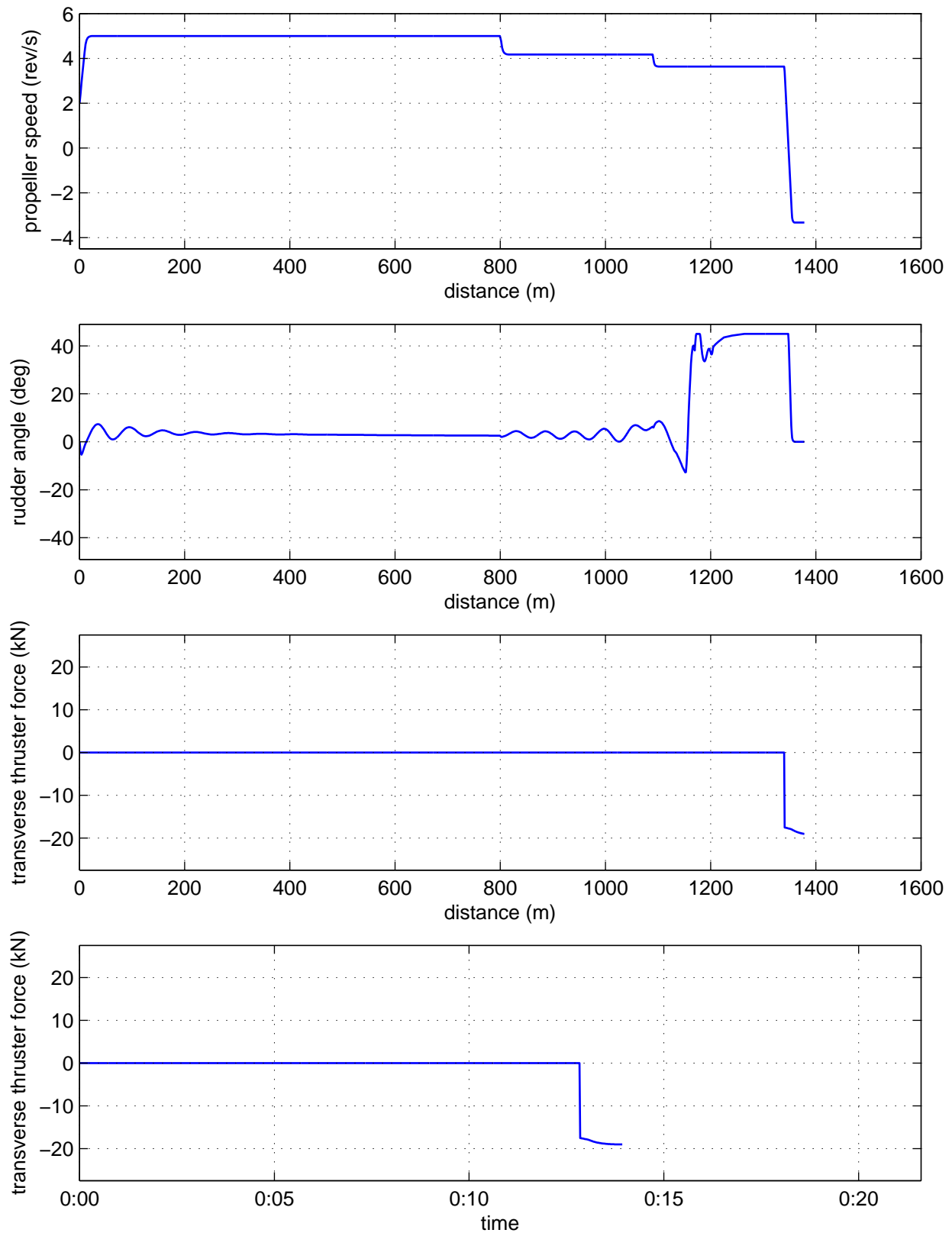
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 2

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

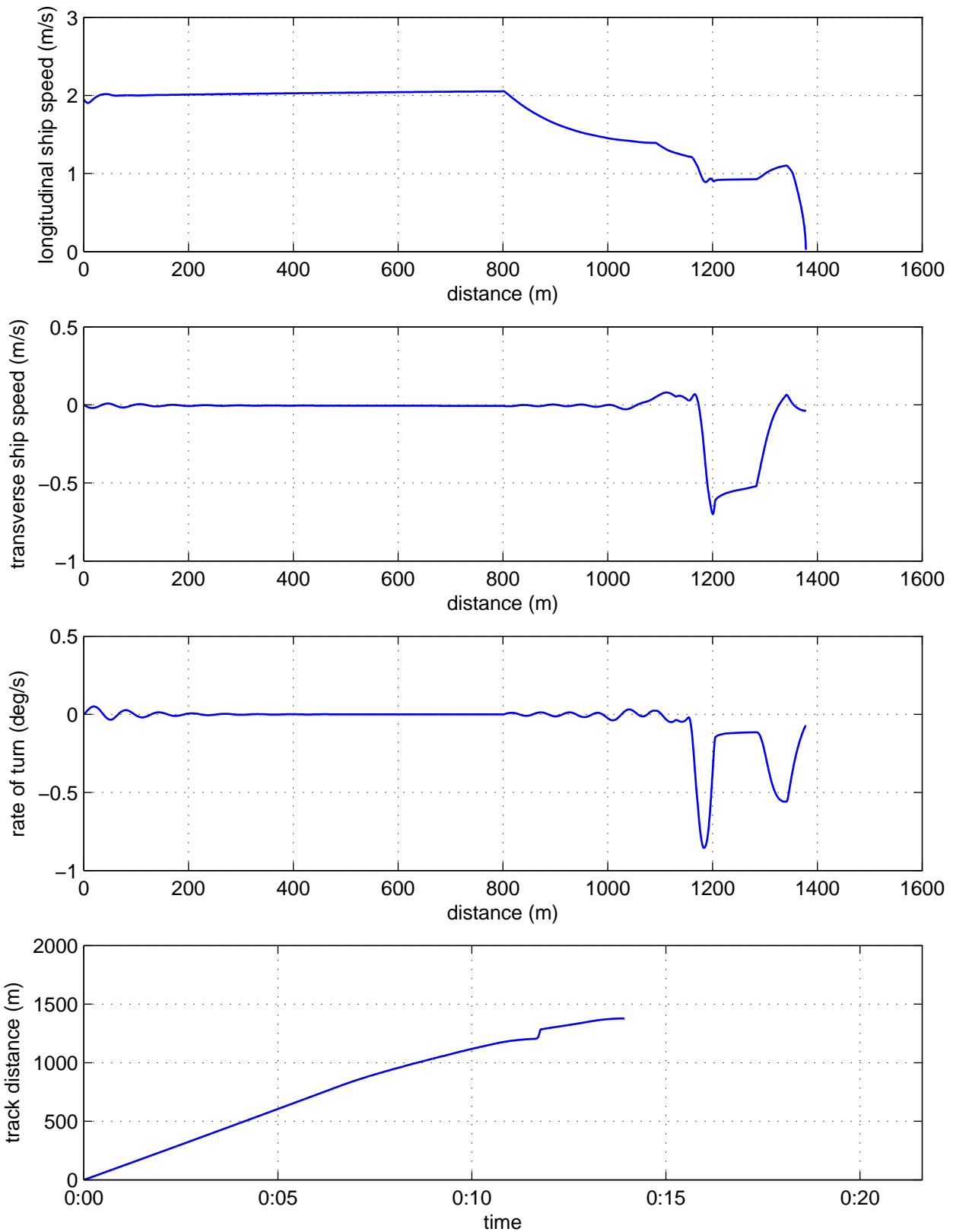
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 2

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

Current: 2.5 m/s

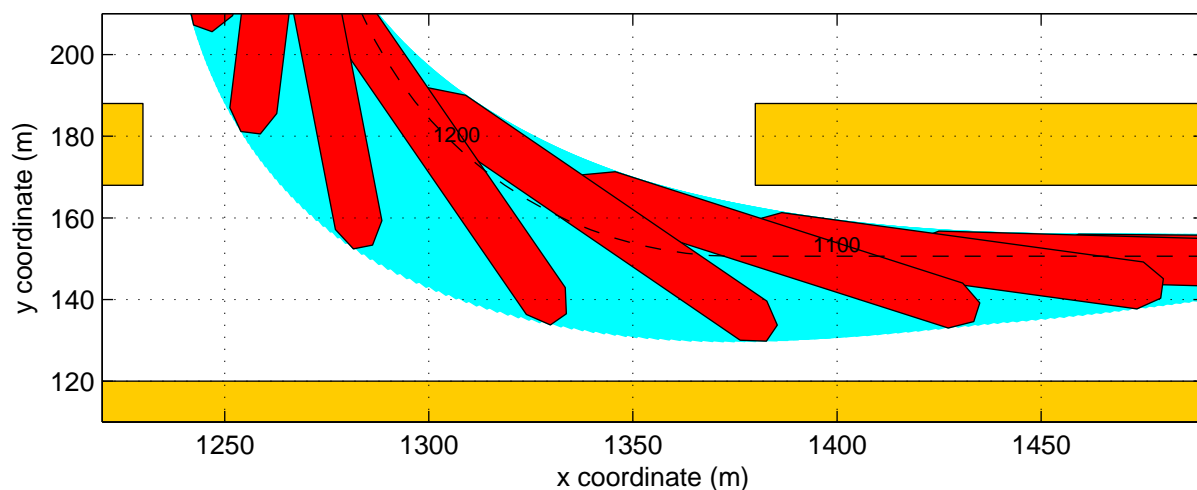
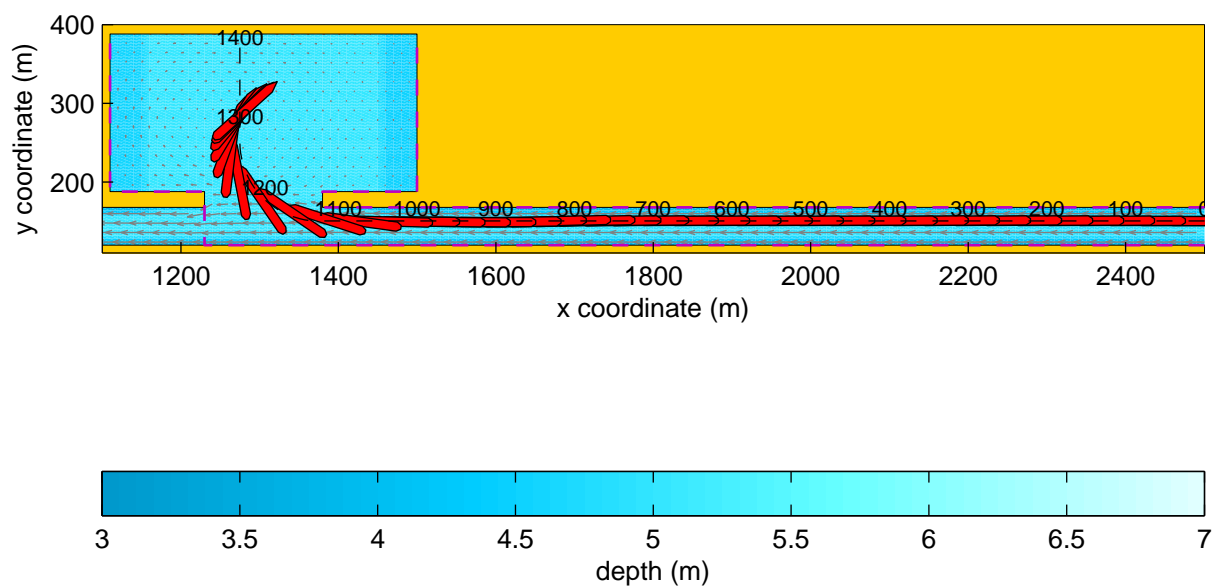
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 2

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

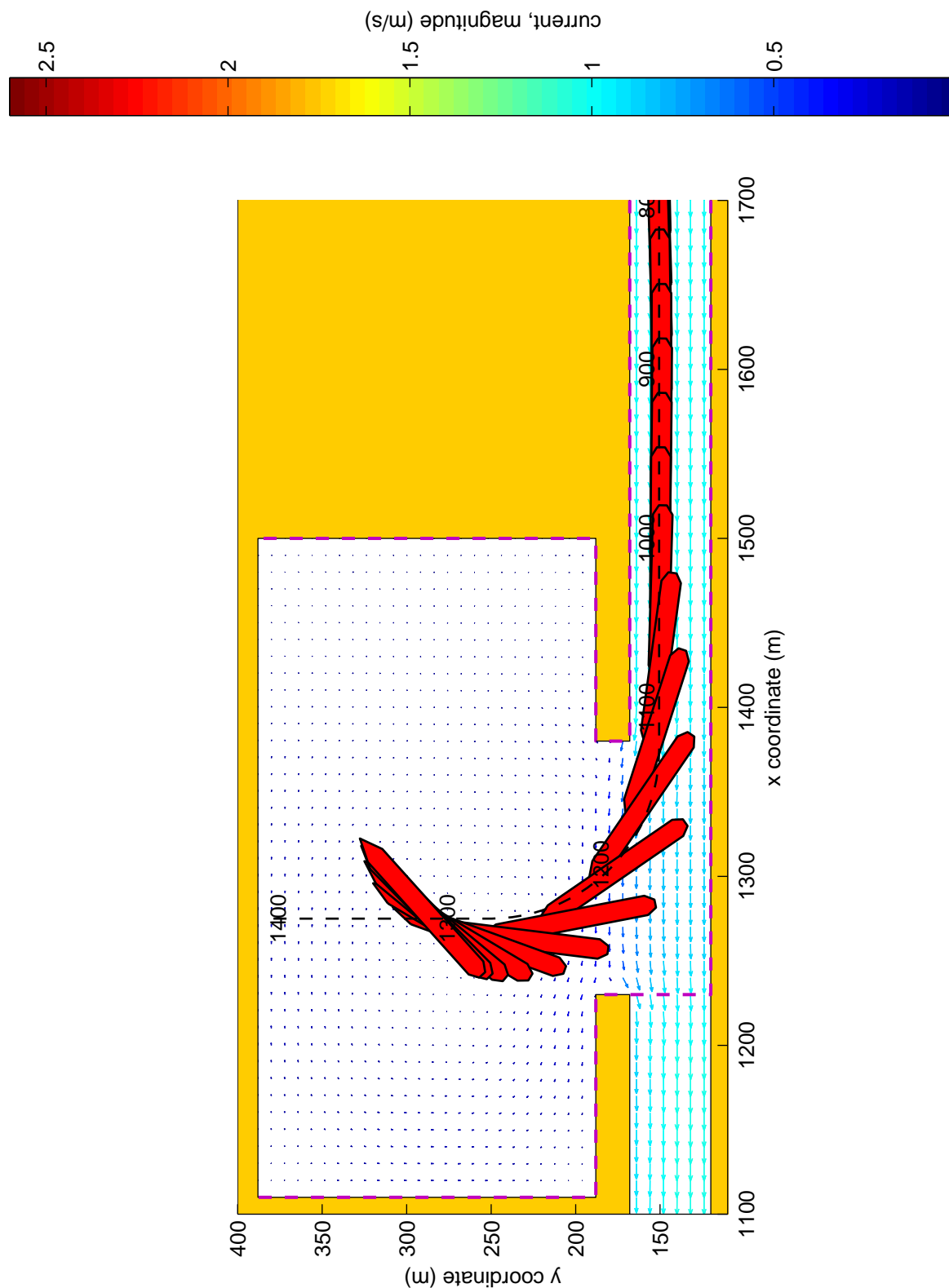
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 3

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

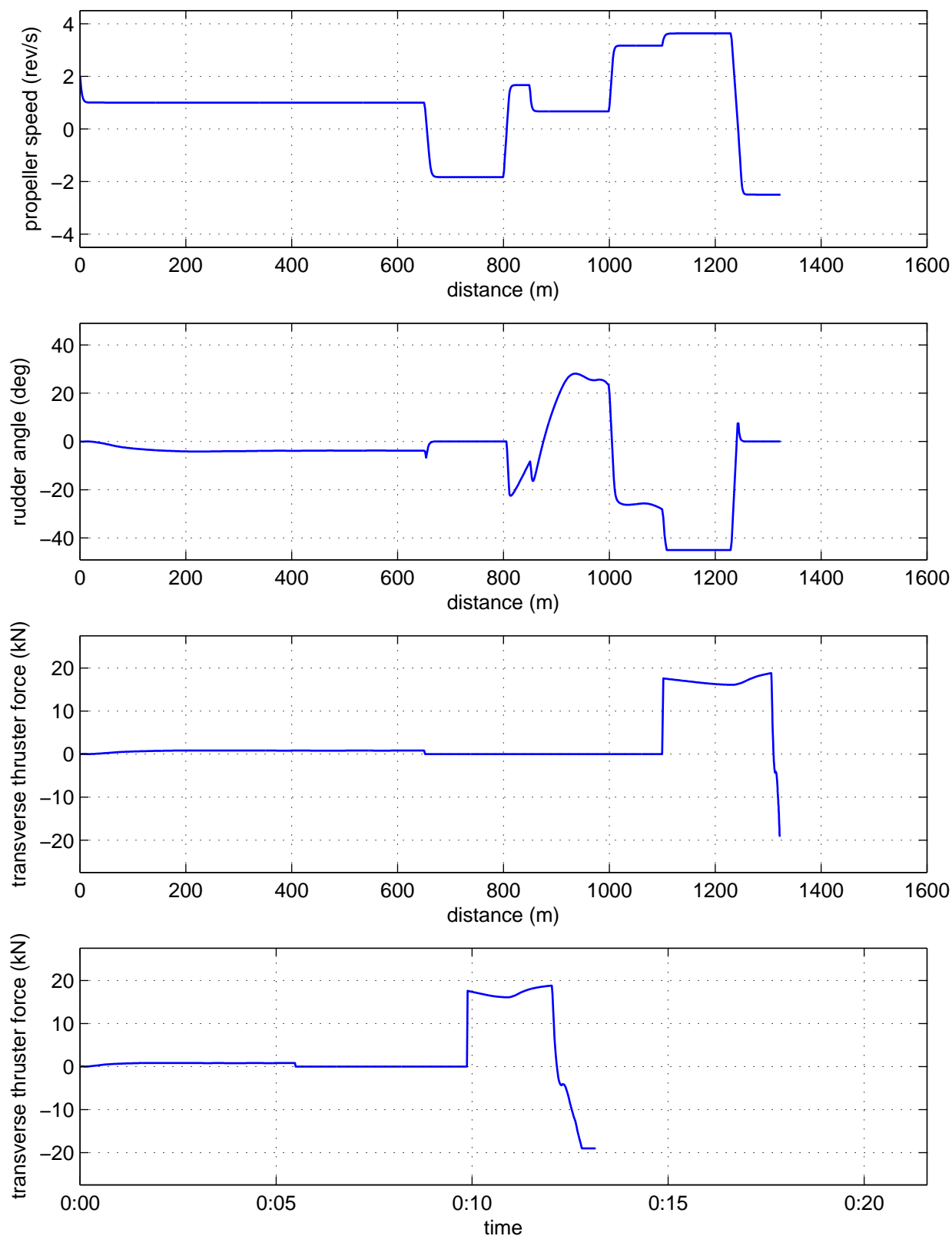
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 3

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

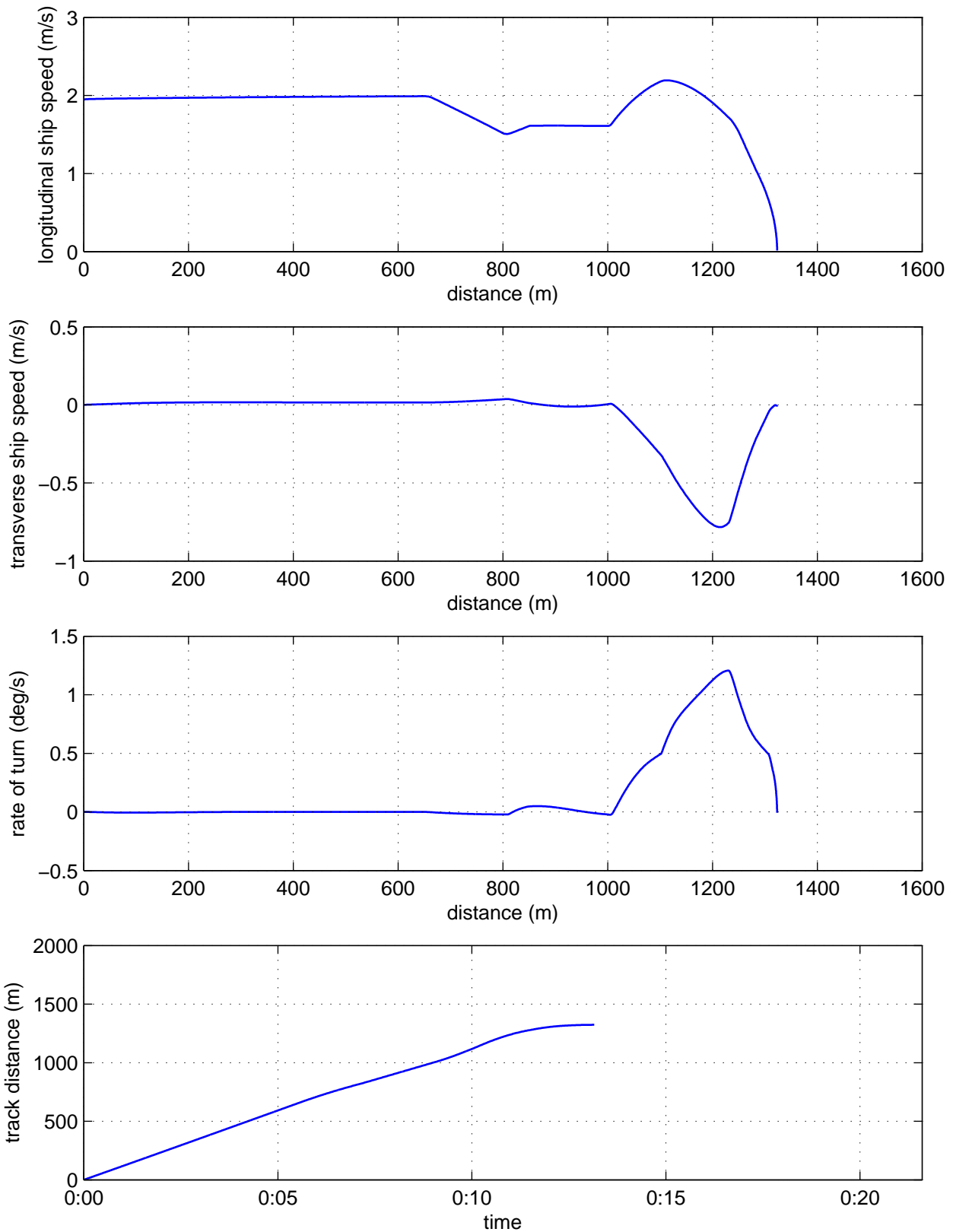
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 3

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

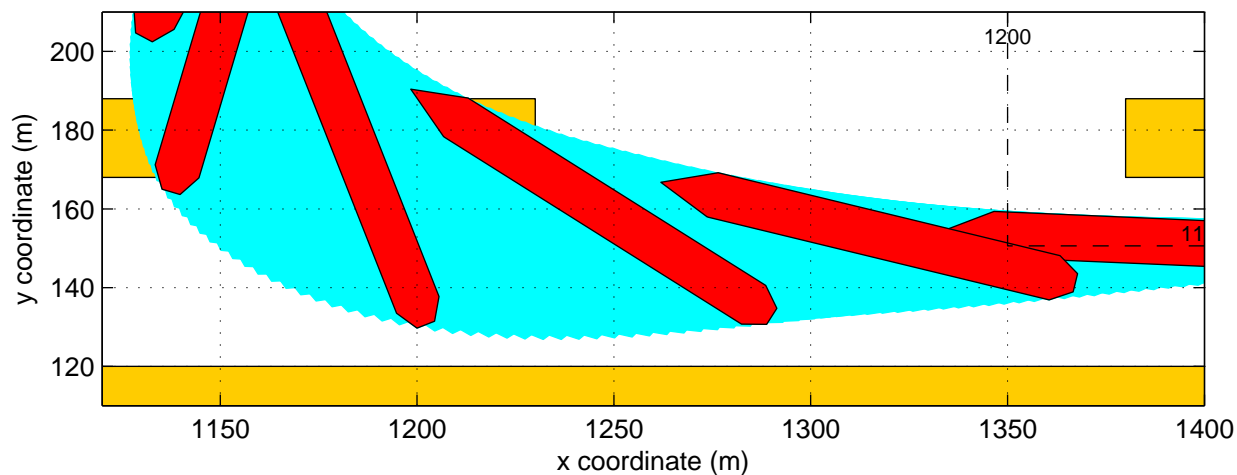
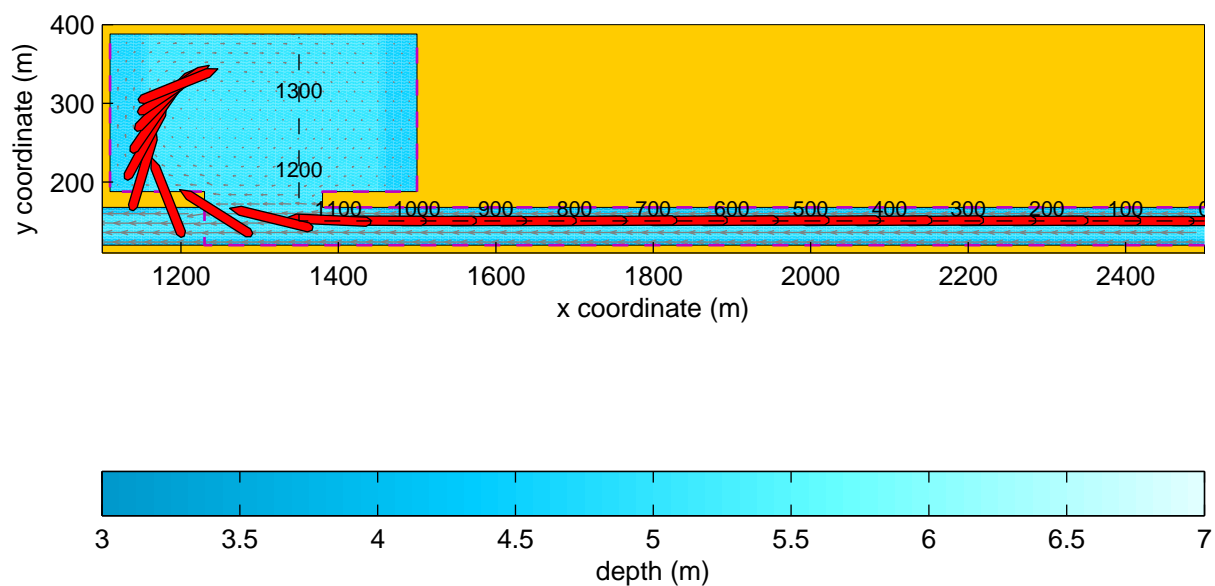
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 3

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

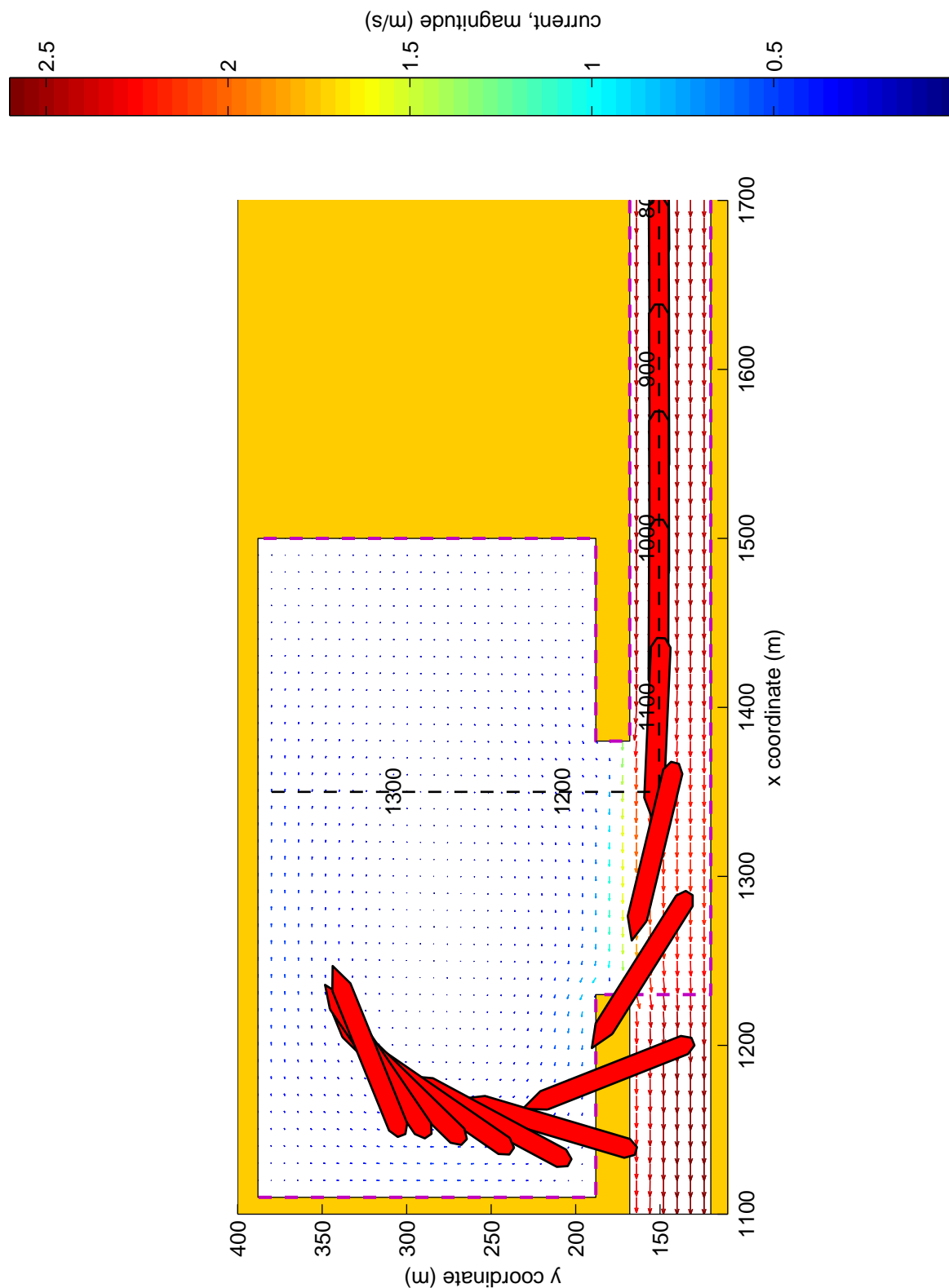
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 4

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

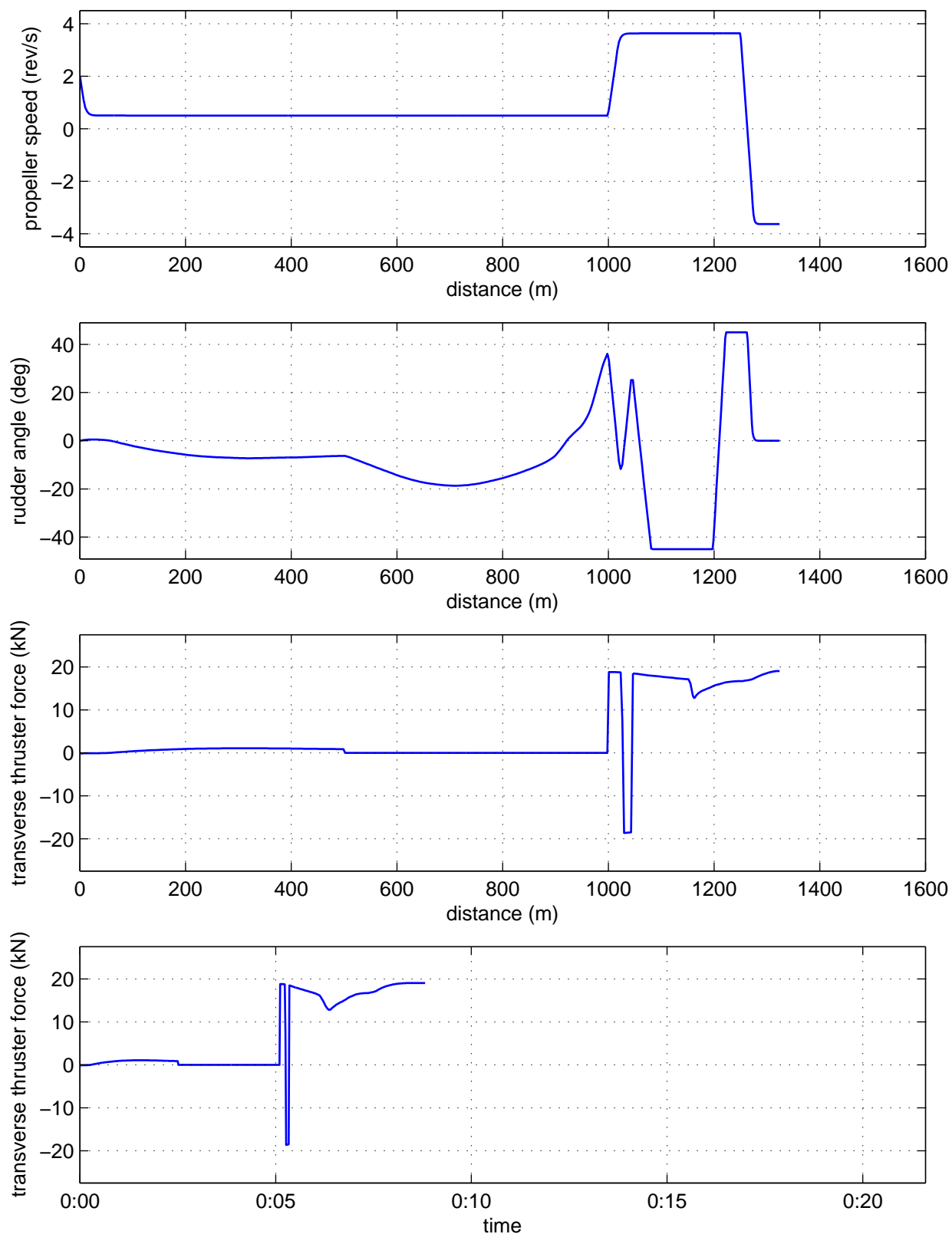
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 4

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

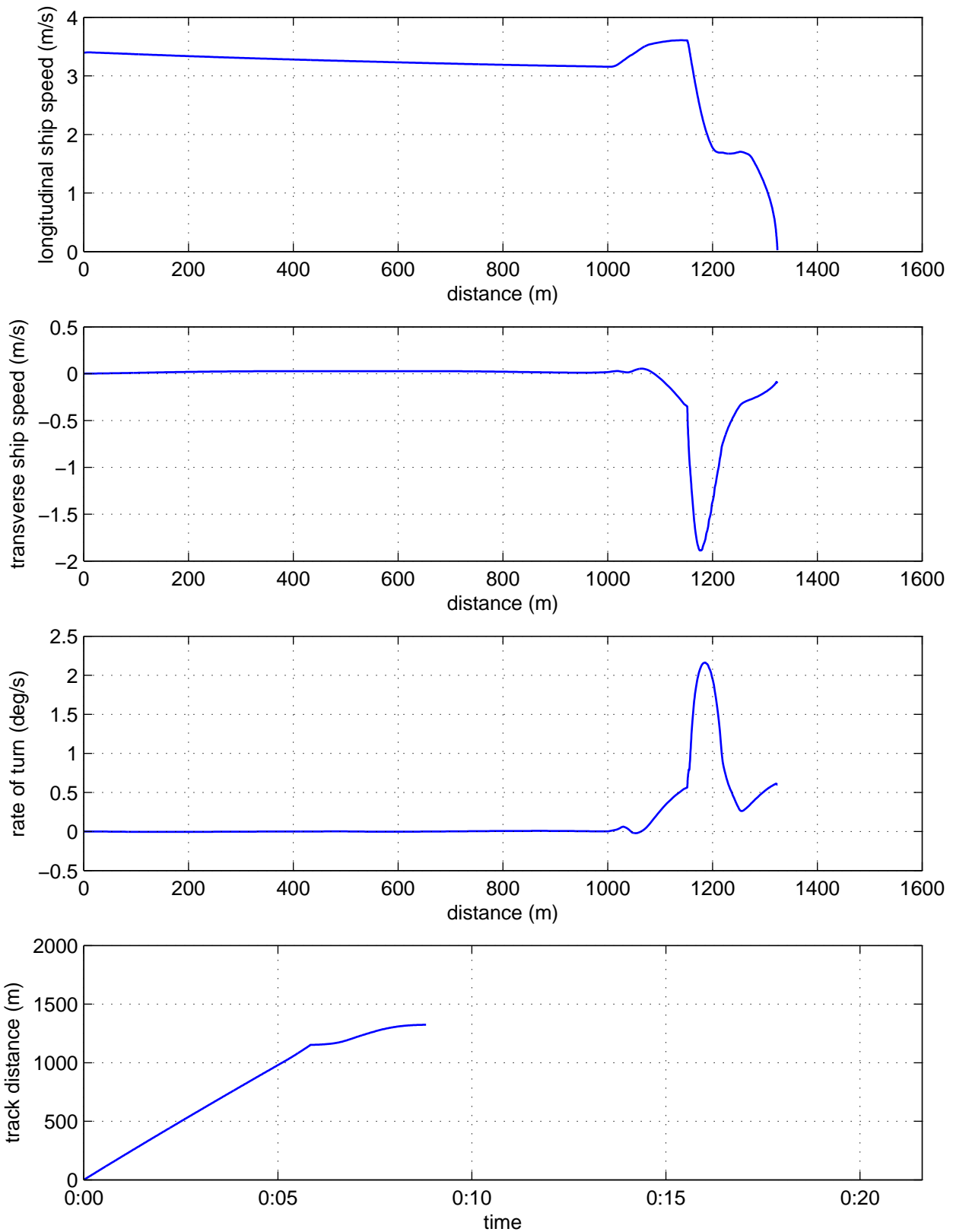
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 4

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

Current: 2.5 m/s

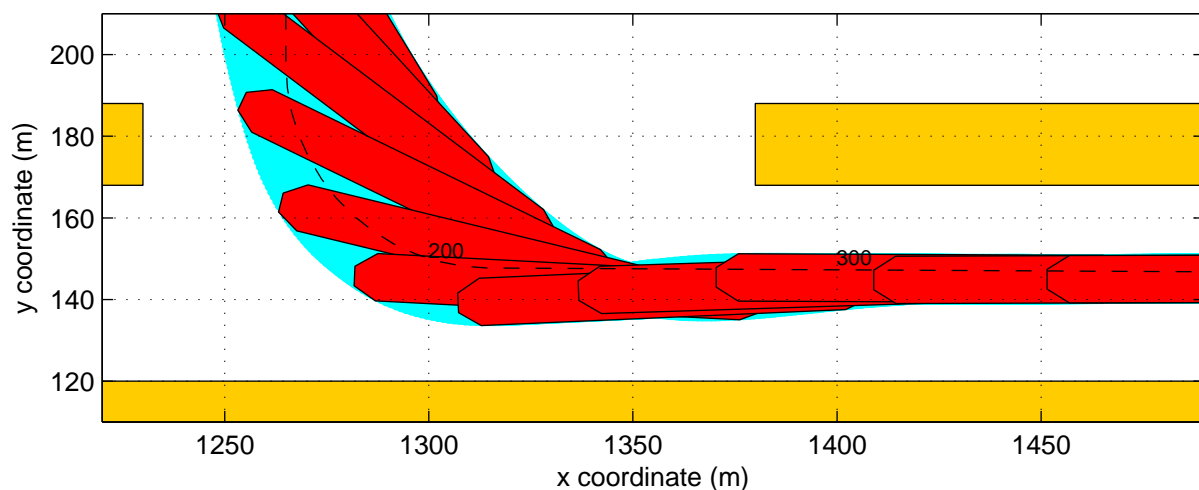
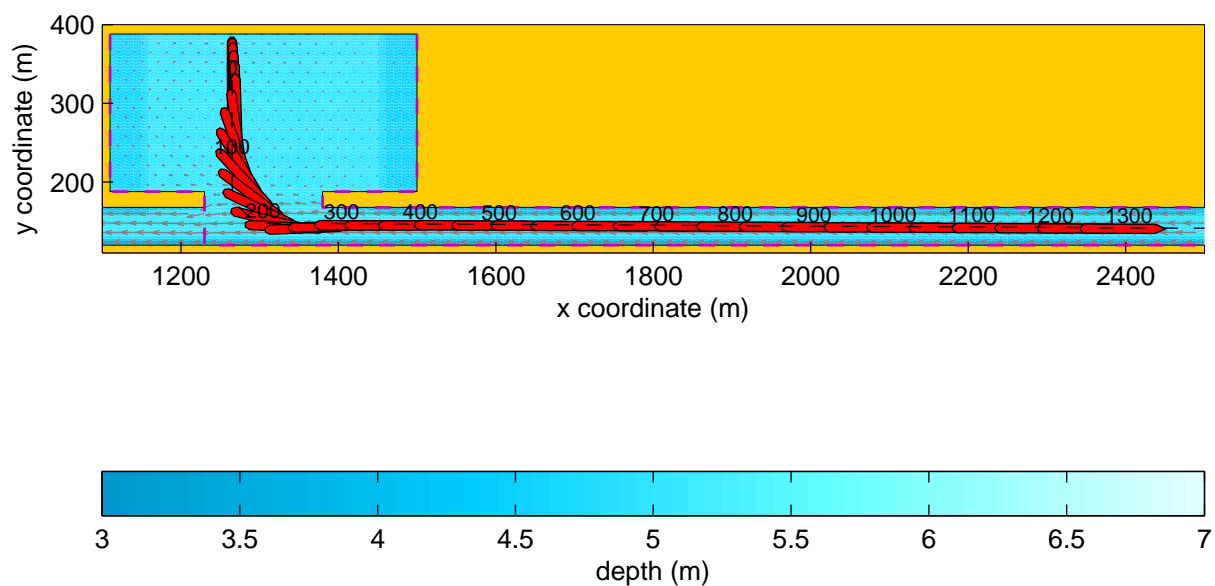
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 4

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

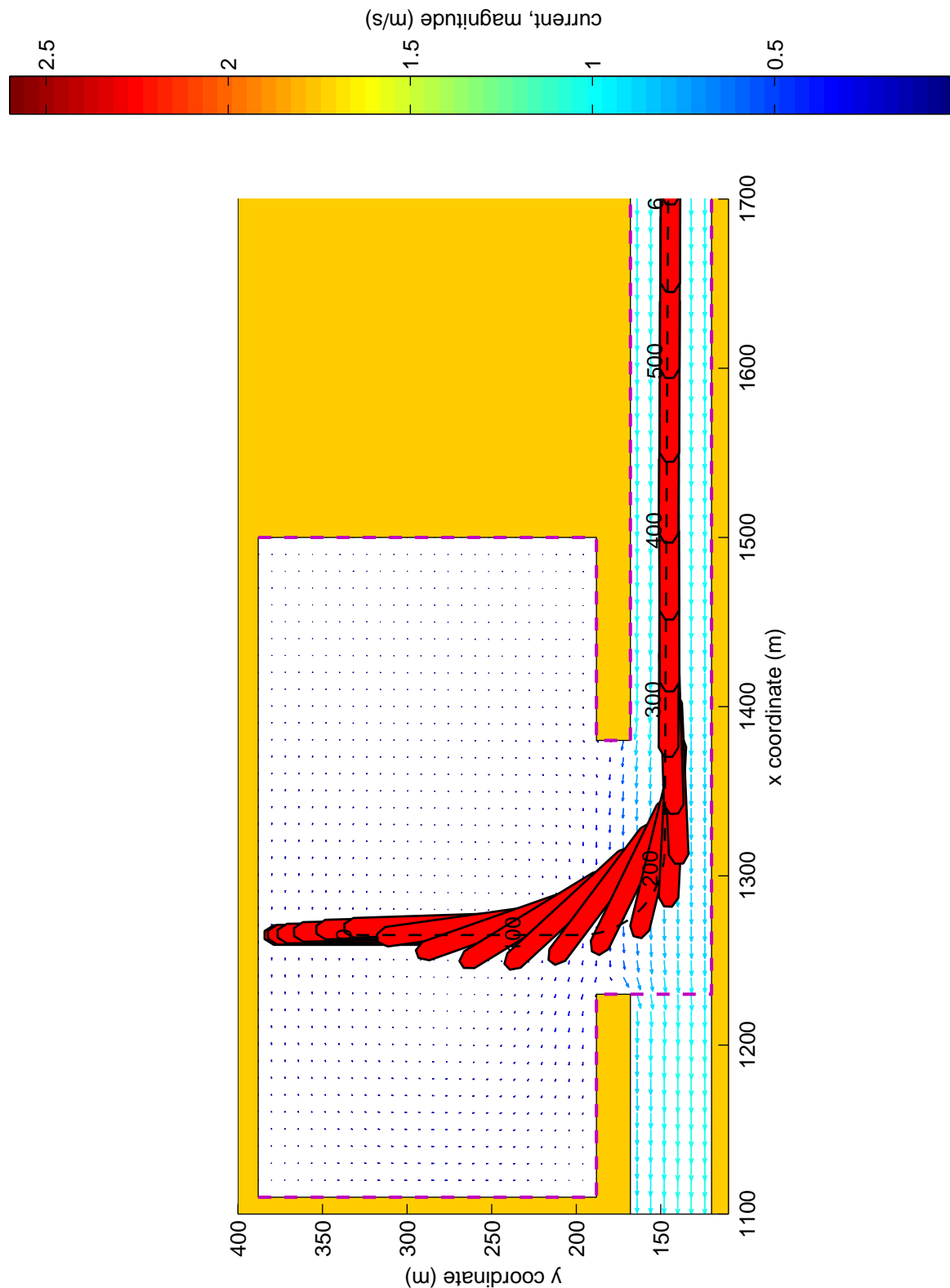
Current: 1.0 m/s

SHIPMA 7.4.2

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Run 5

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

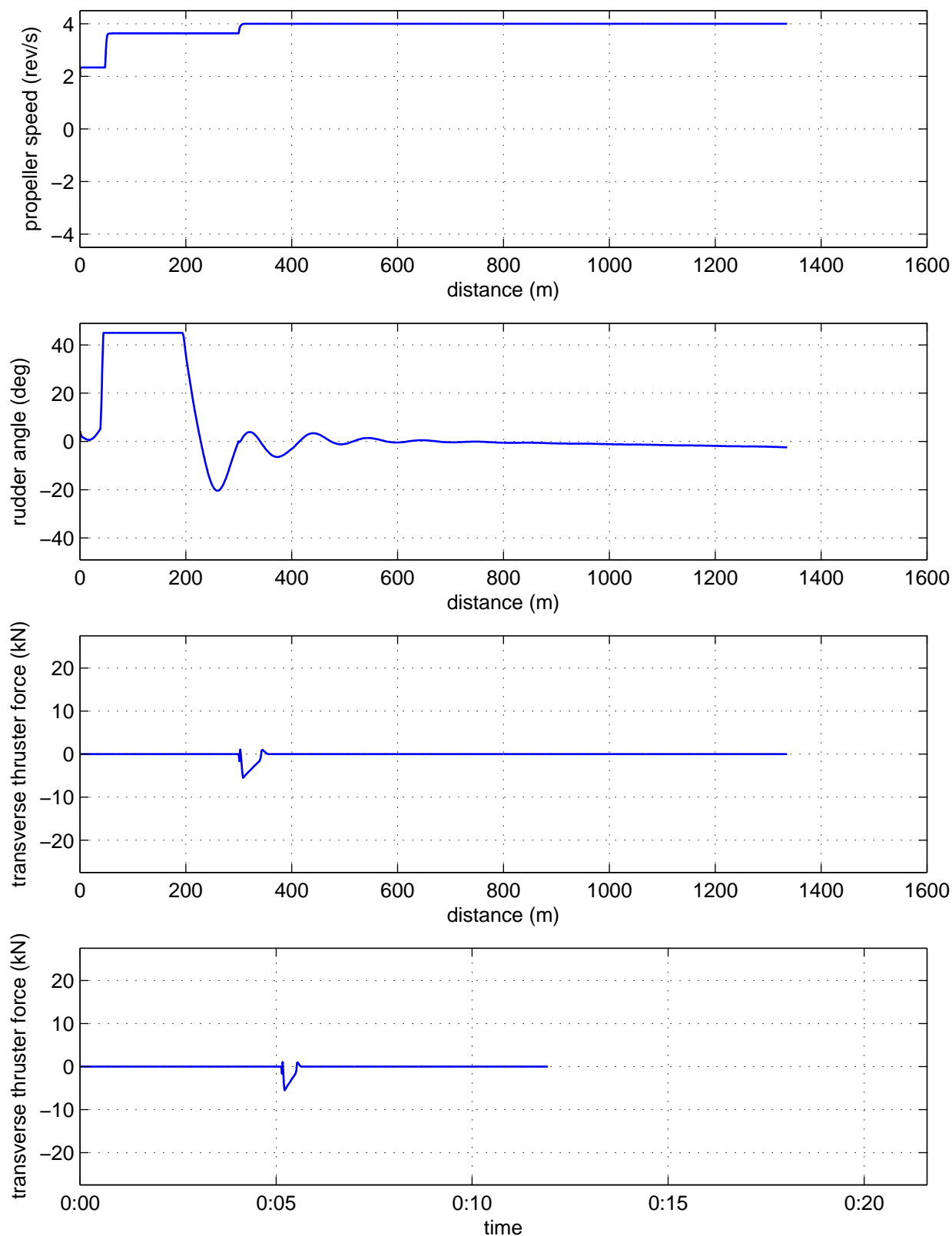
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 5

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

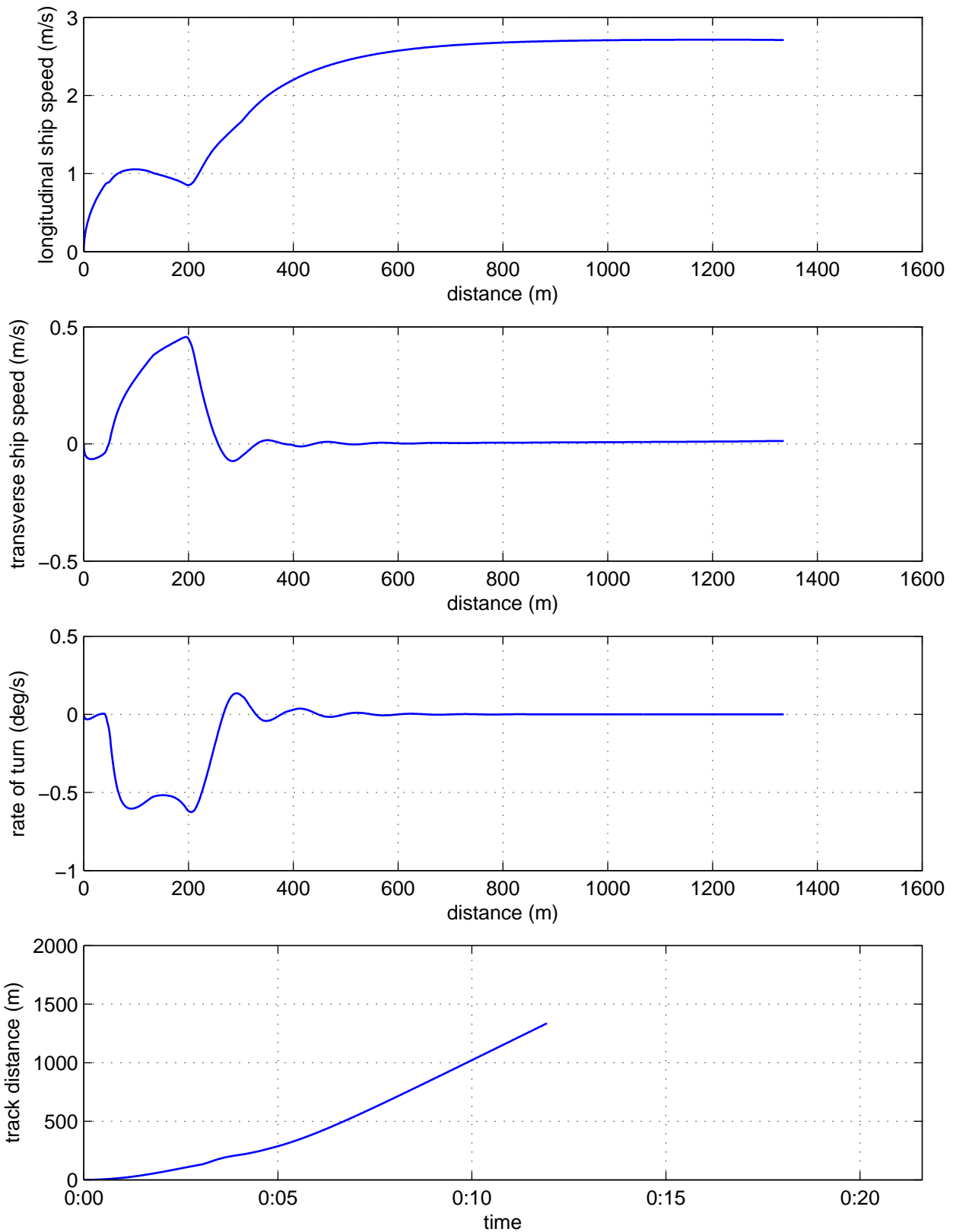
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 5

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

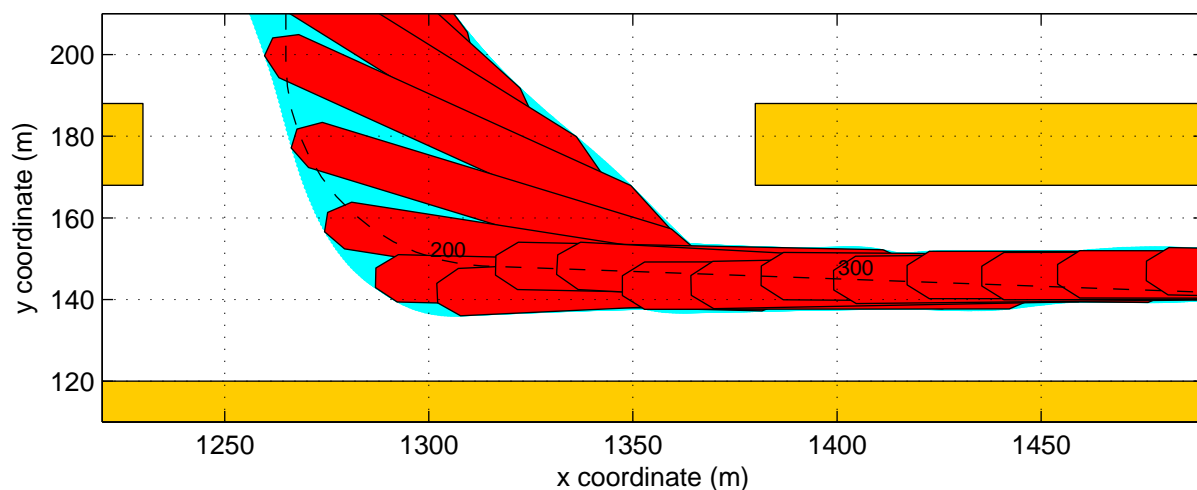
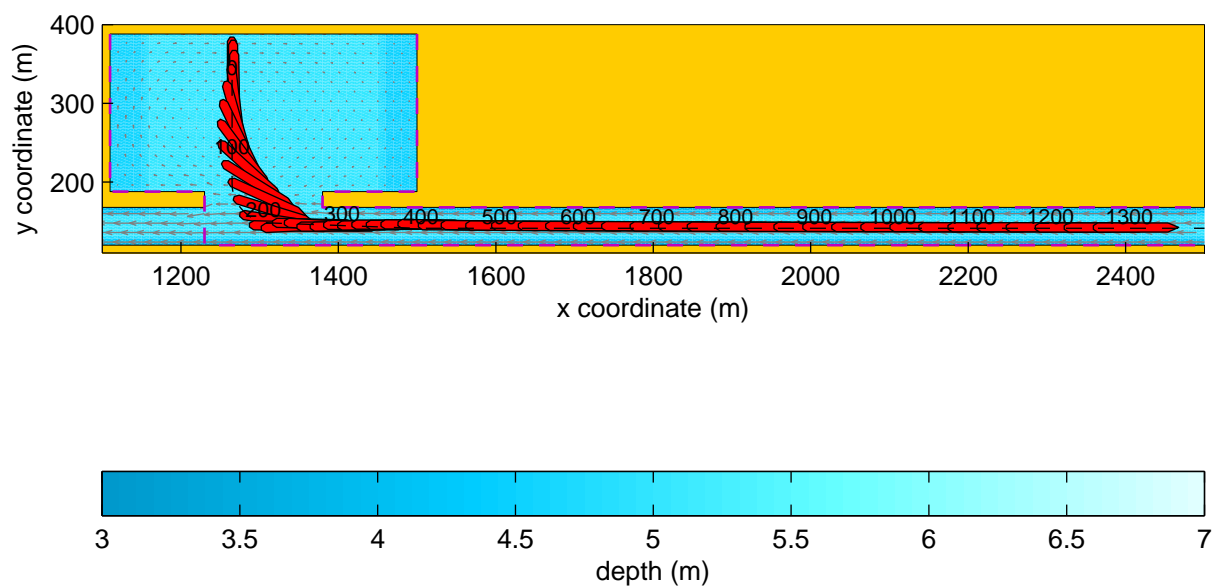
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 5

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

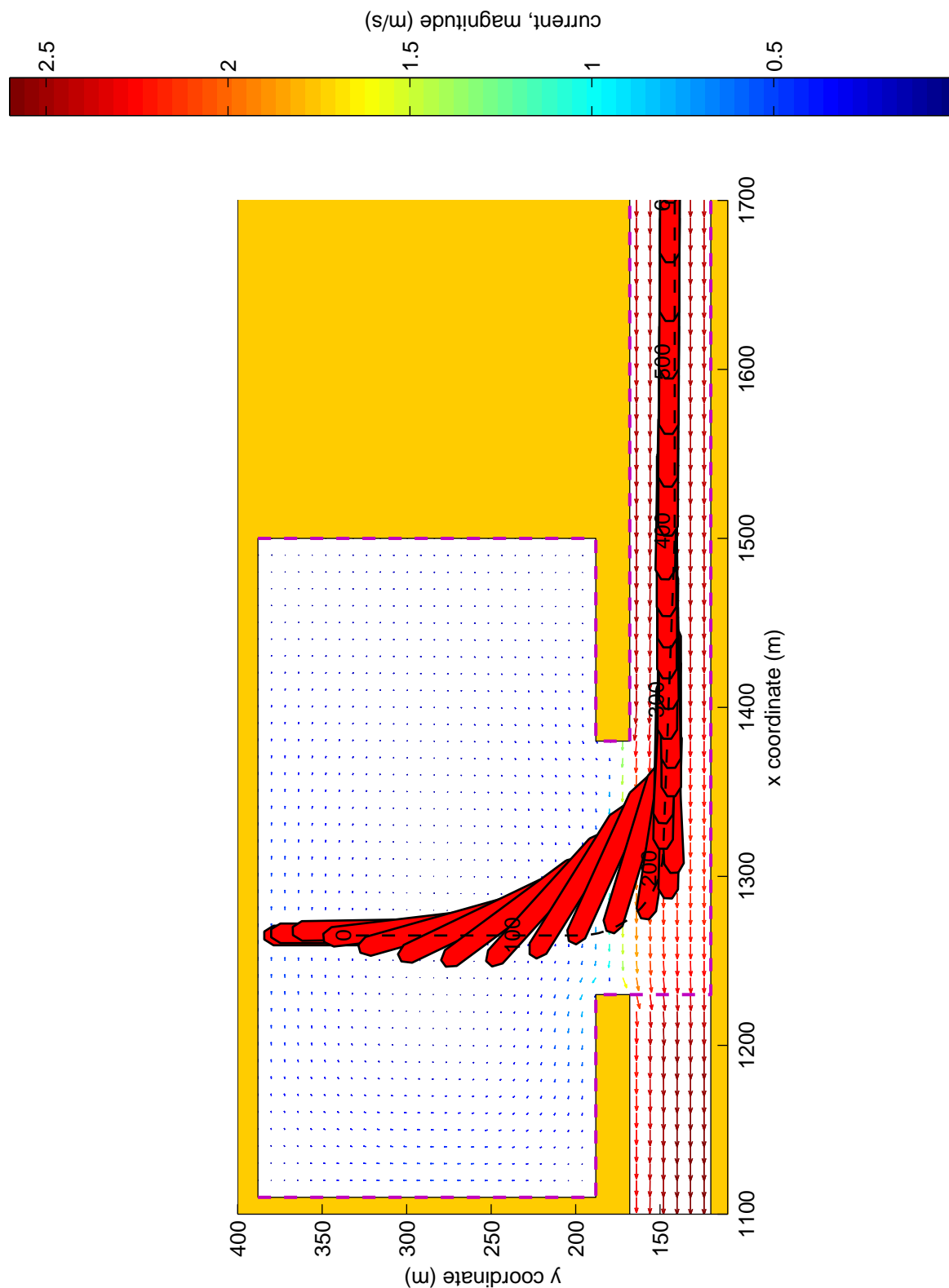
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 6

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

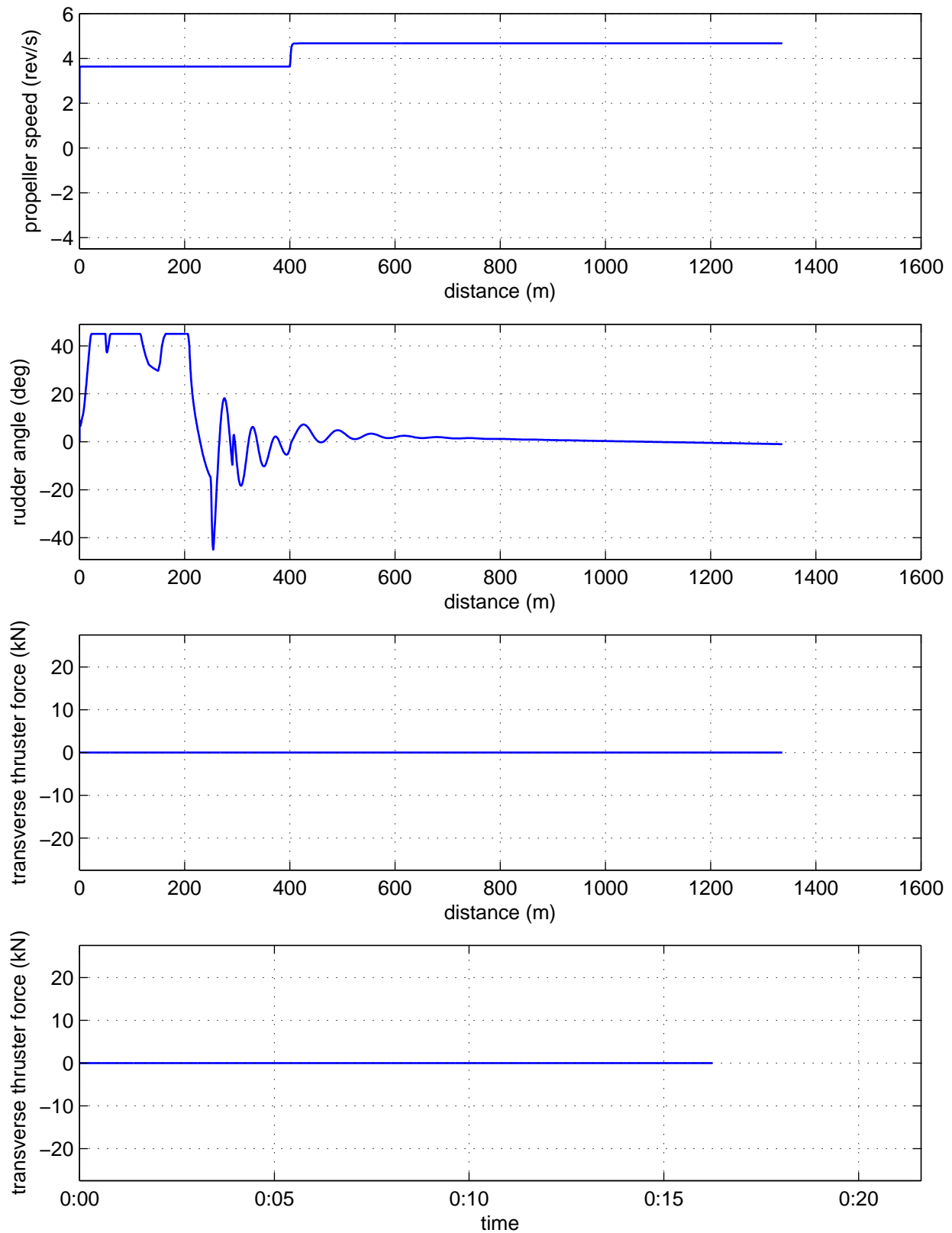
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 6

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

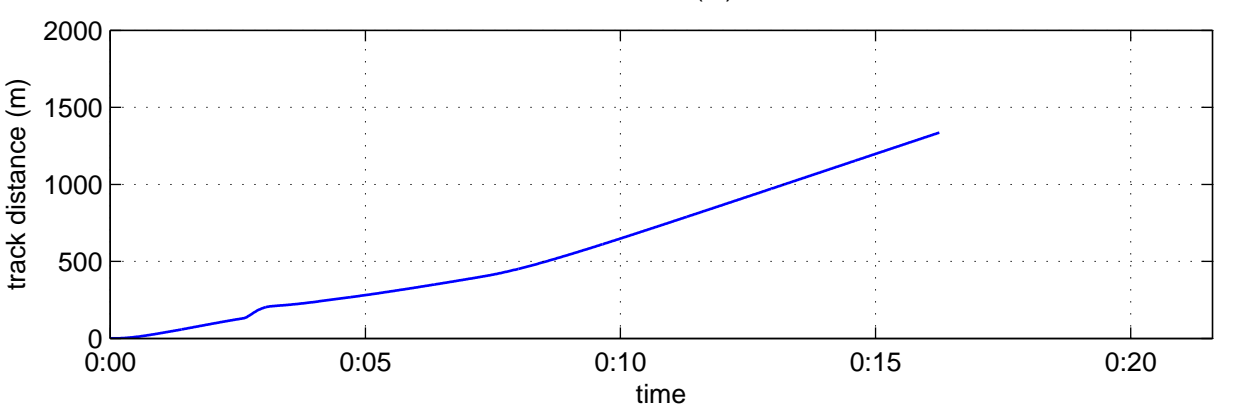
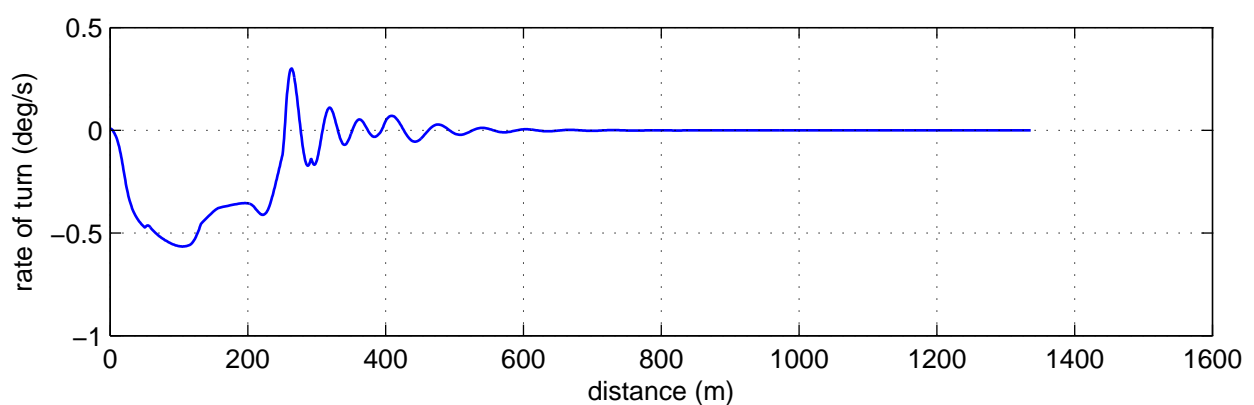
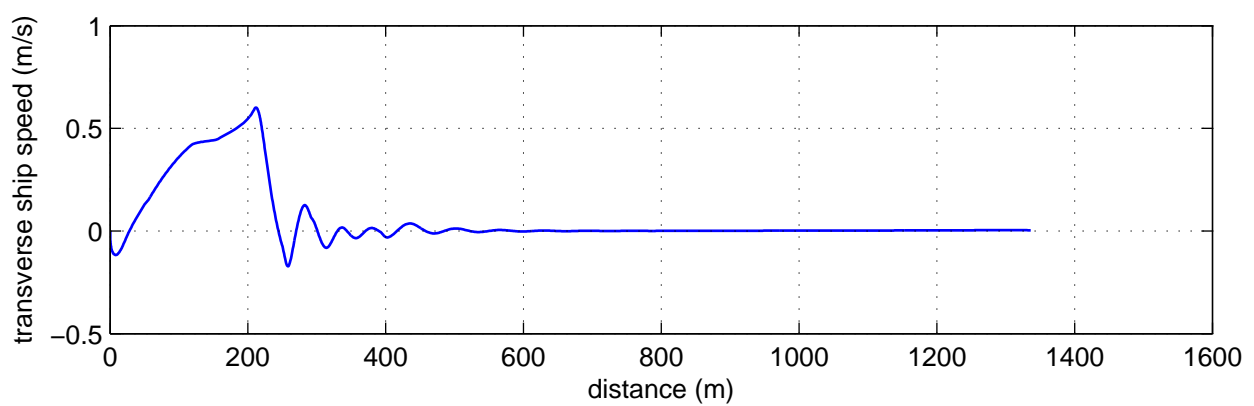
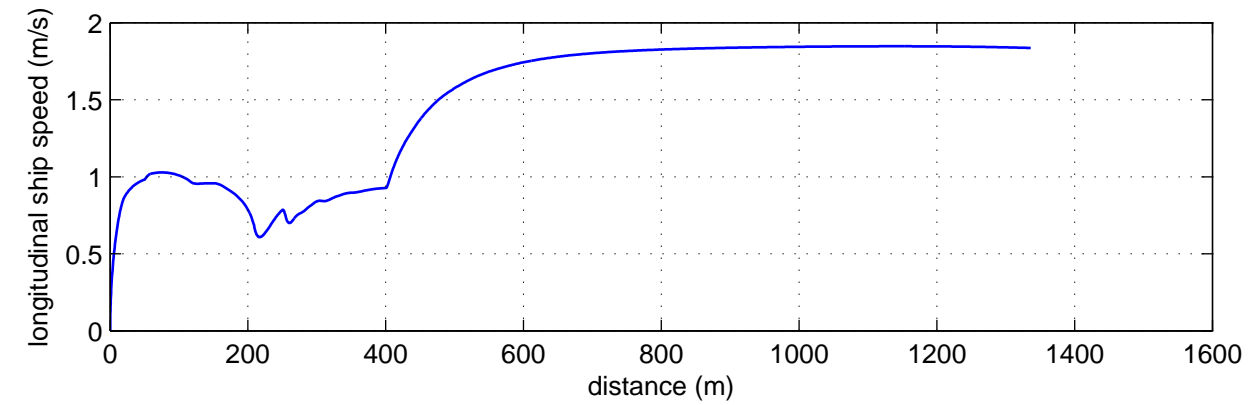
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 6

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

Current: 2.5 m/s

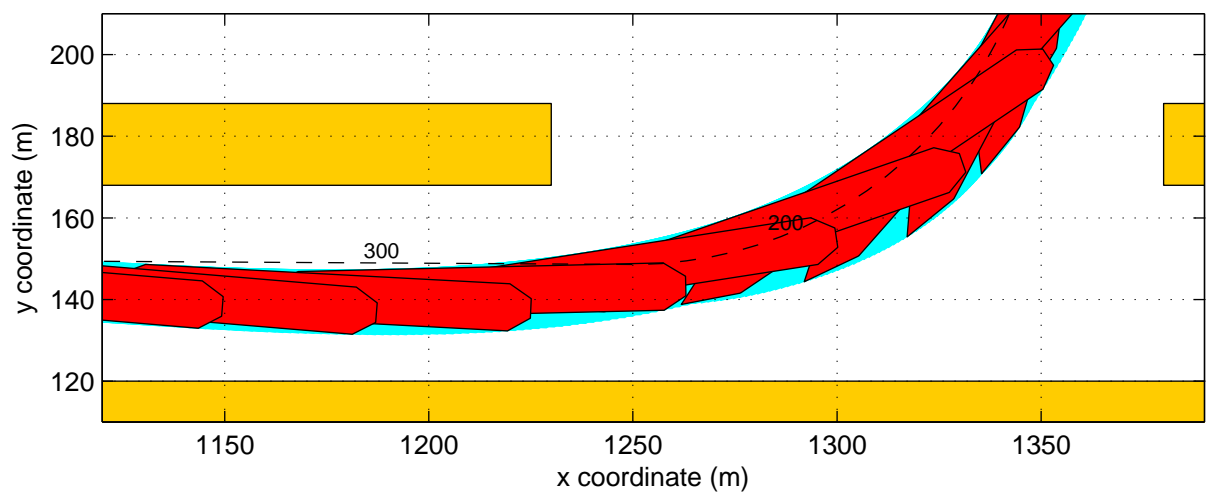
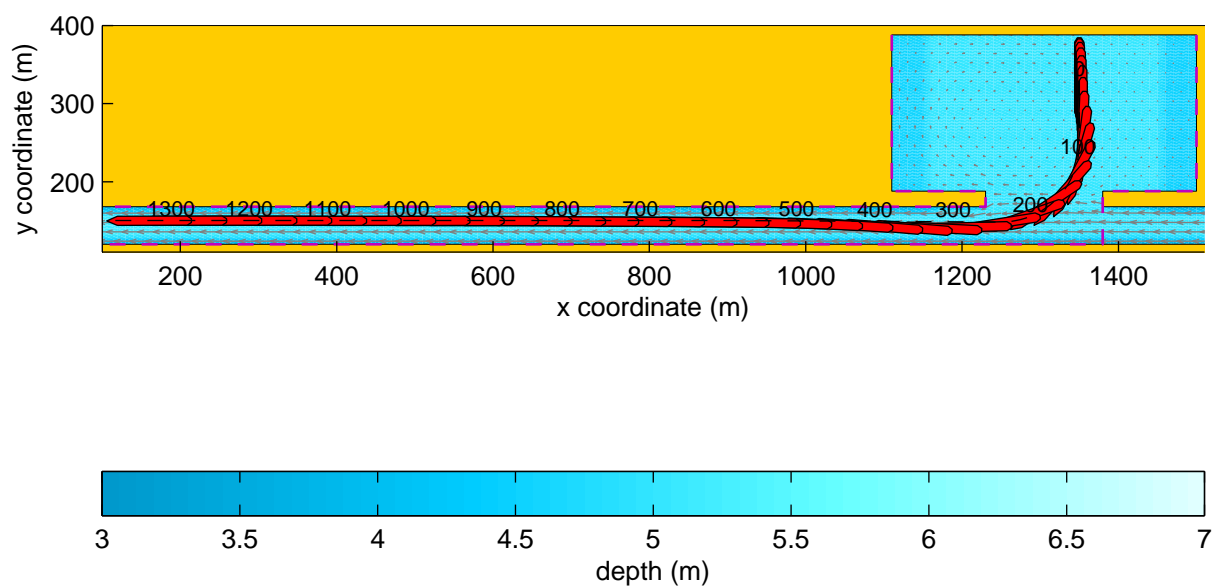
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 6

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

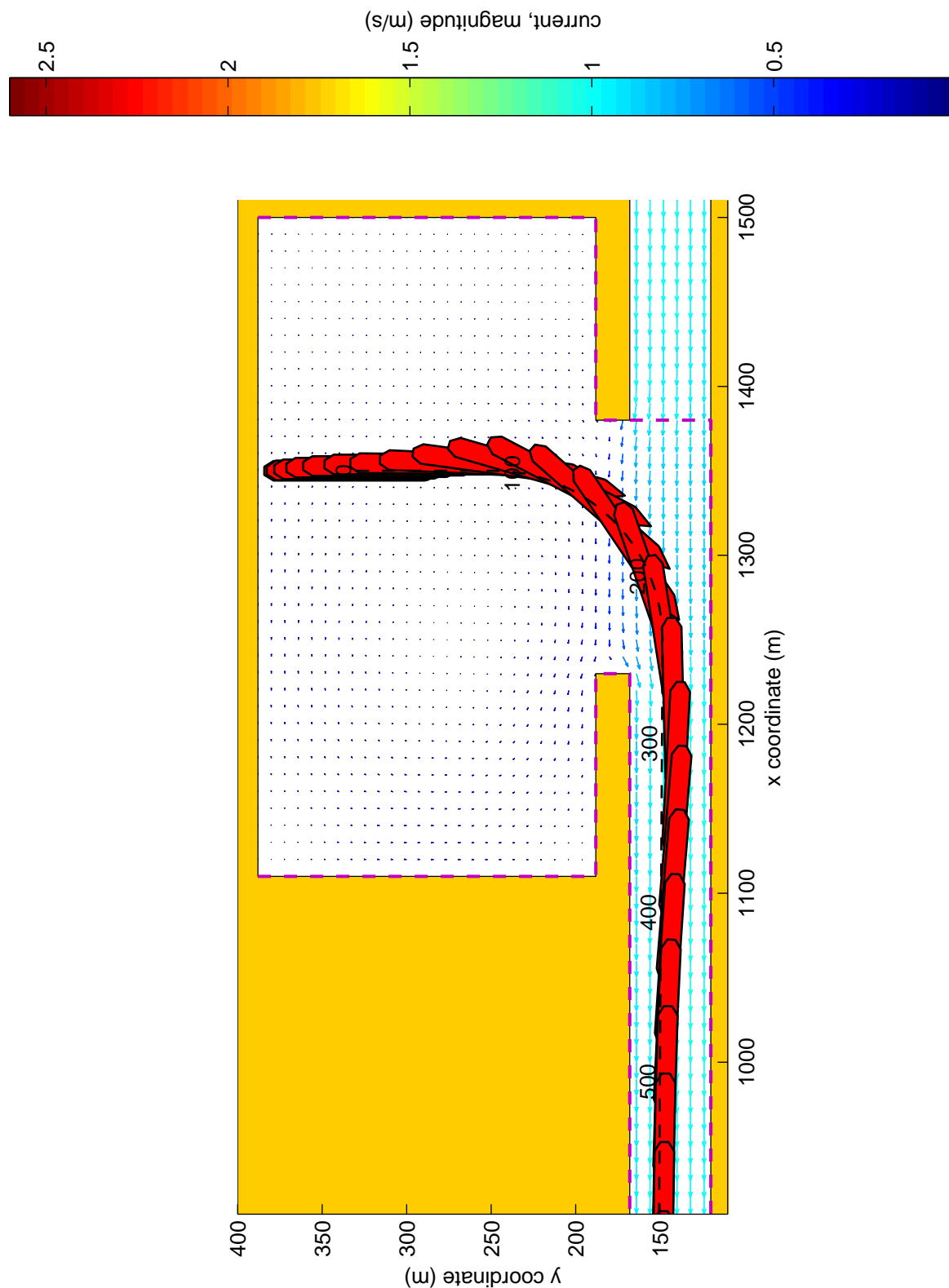
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 7

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

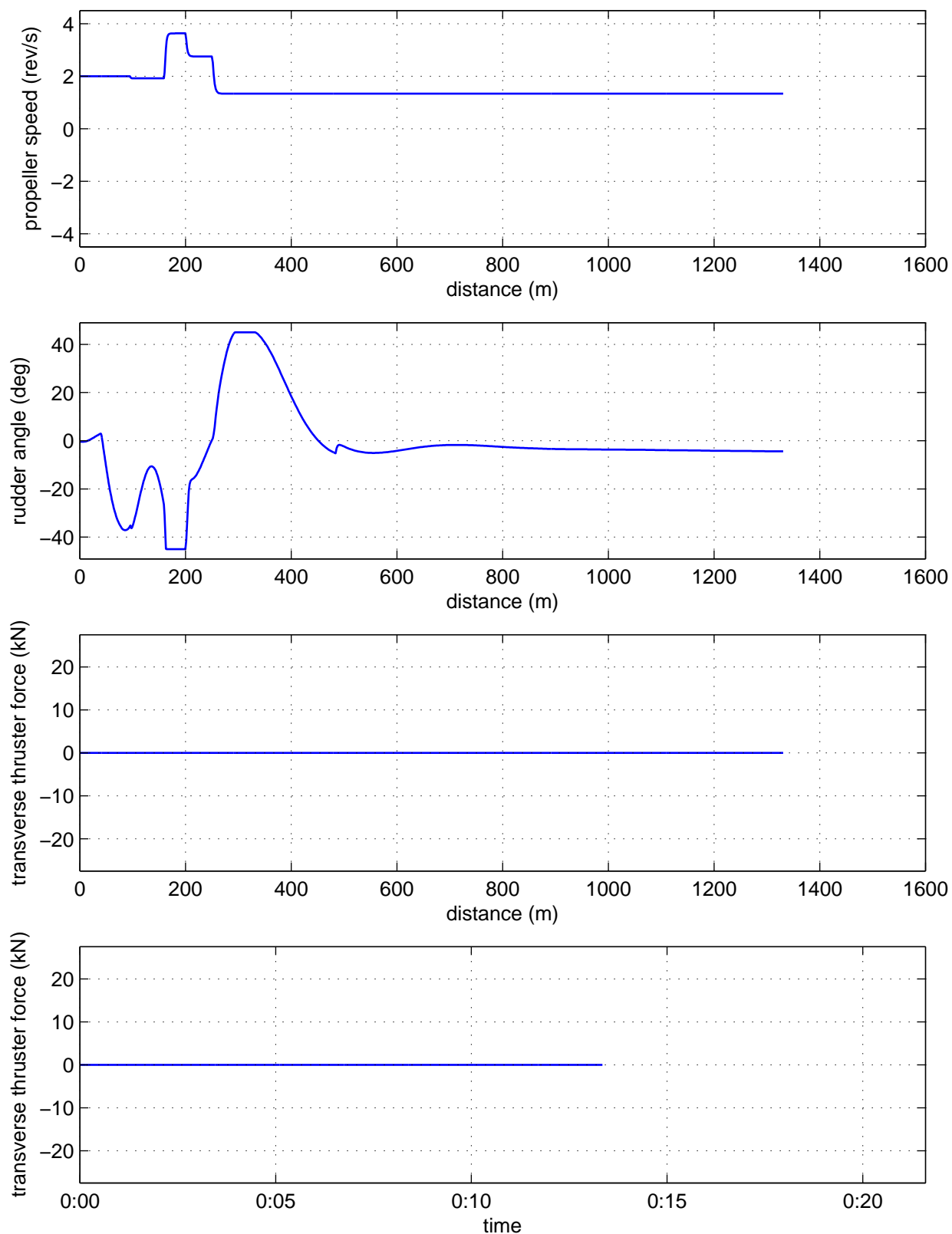
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 7

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

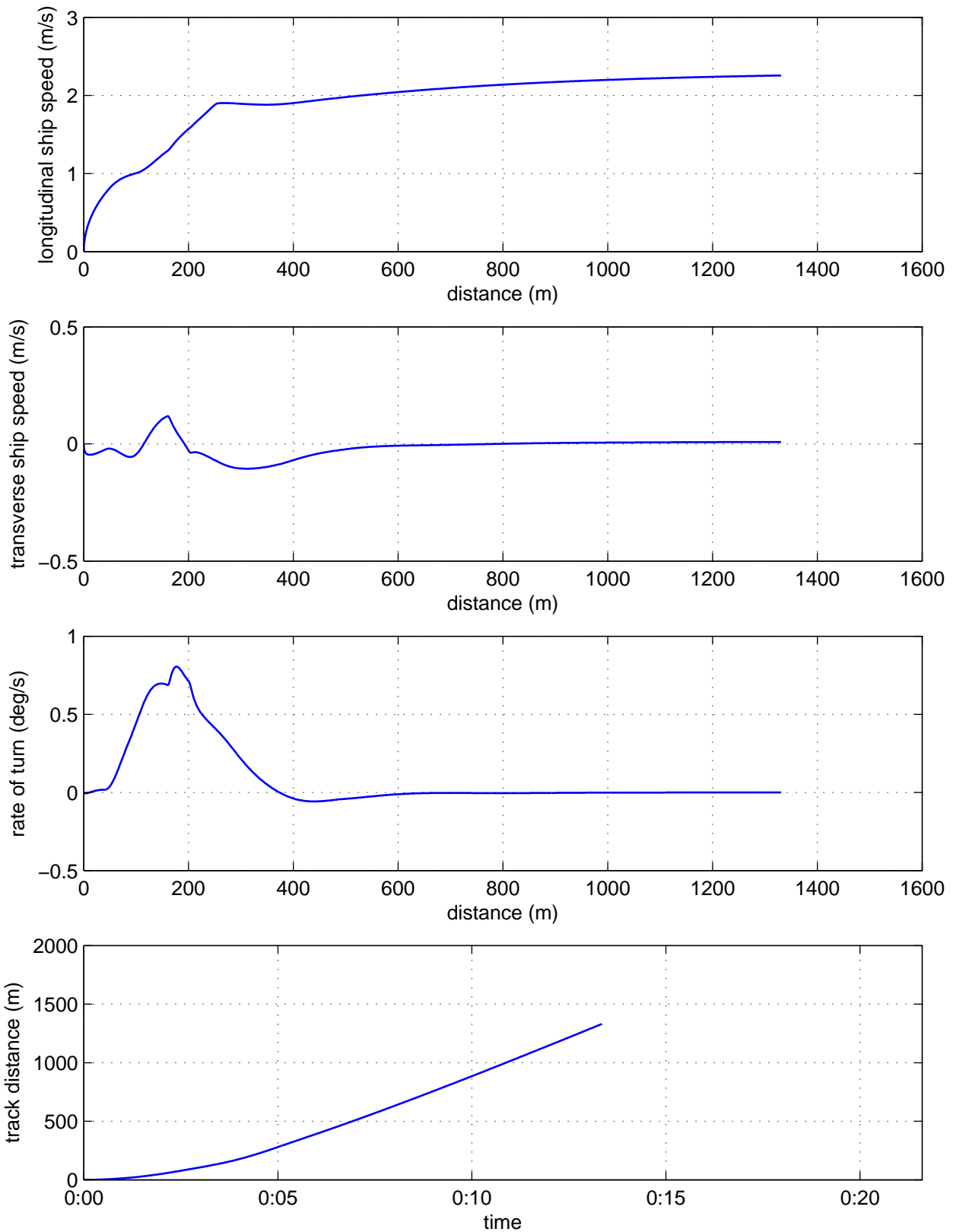
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 7

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

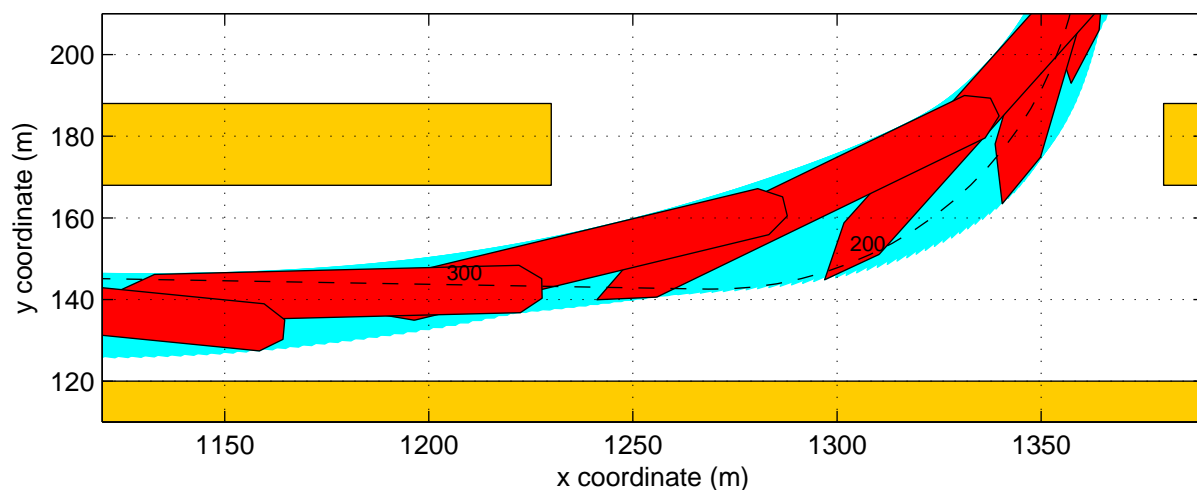
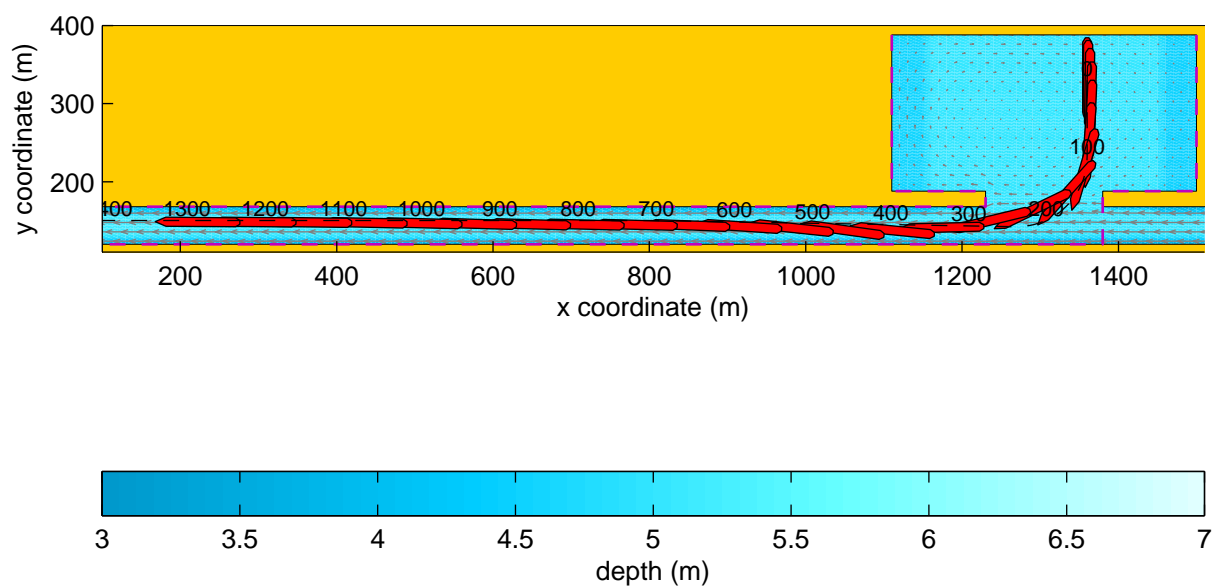
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 7

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 1

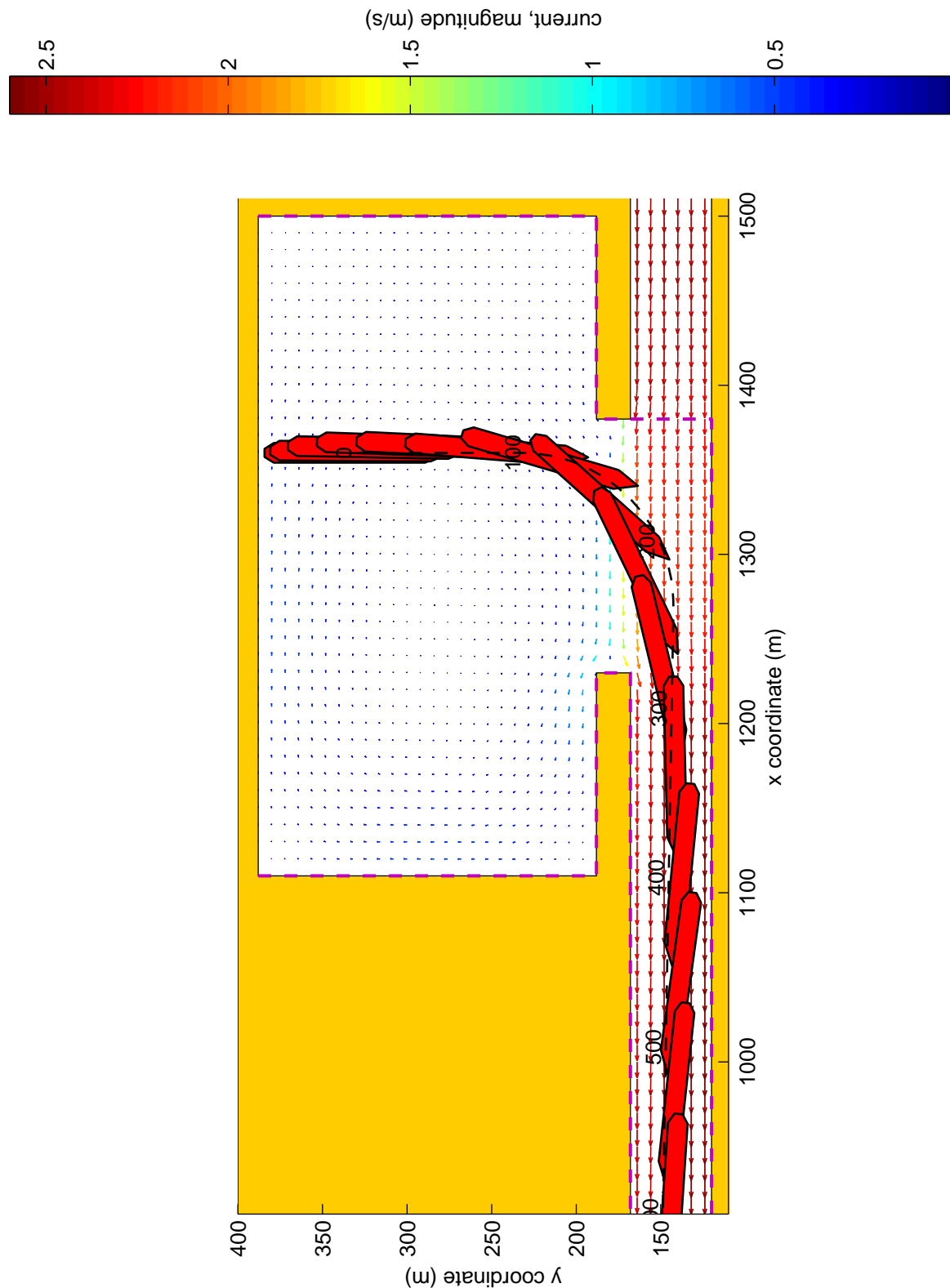
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 8

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 1

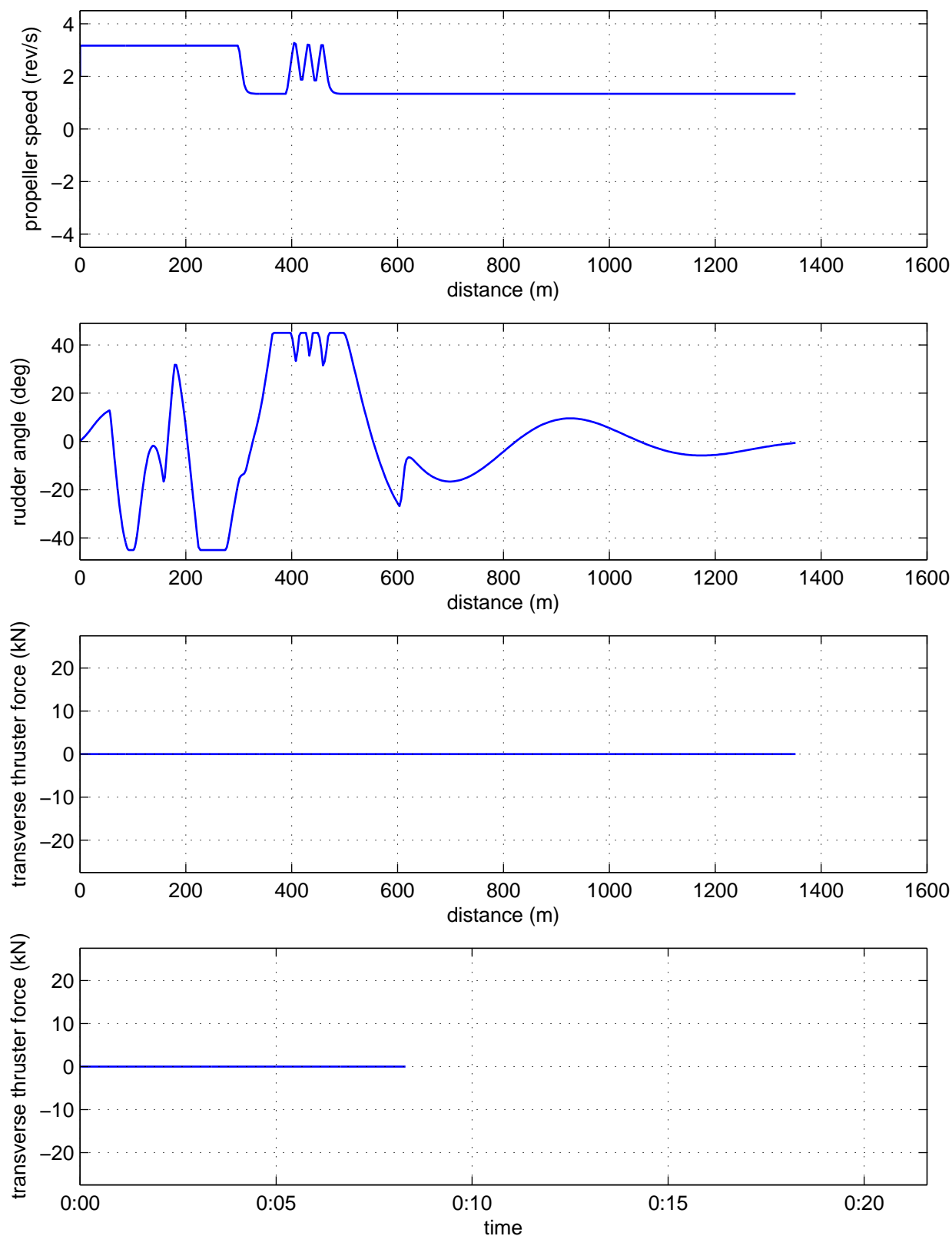
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 8

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 1

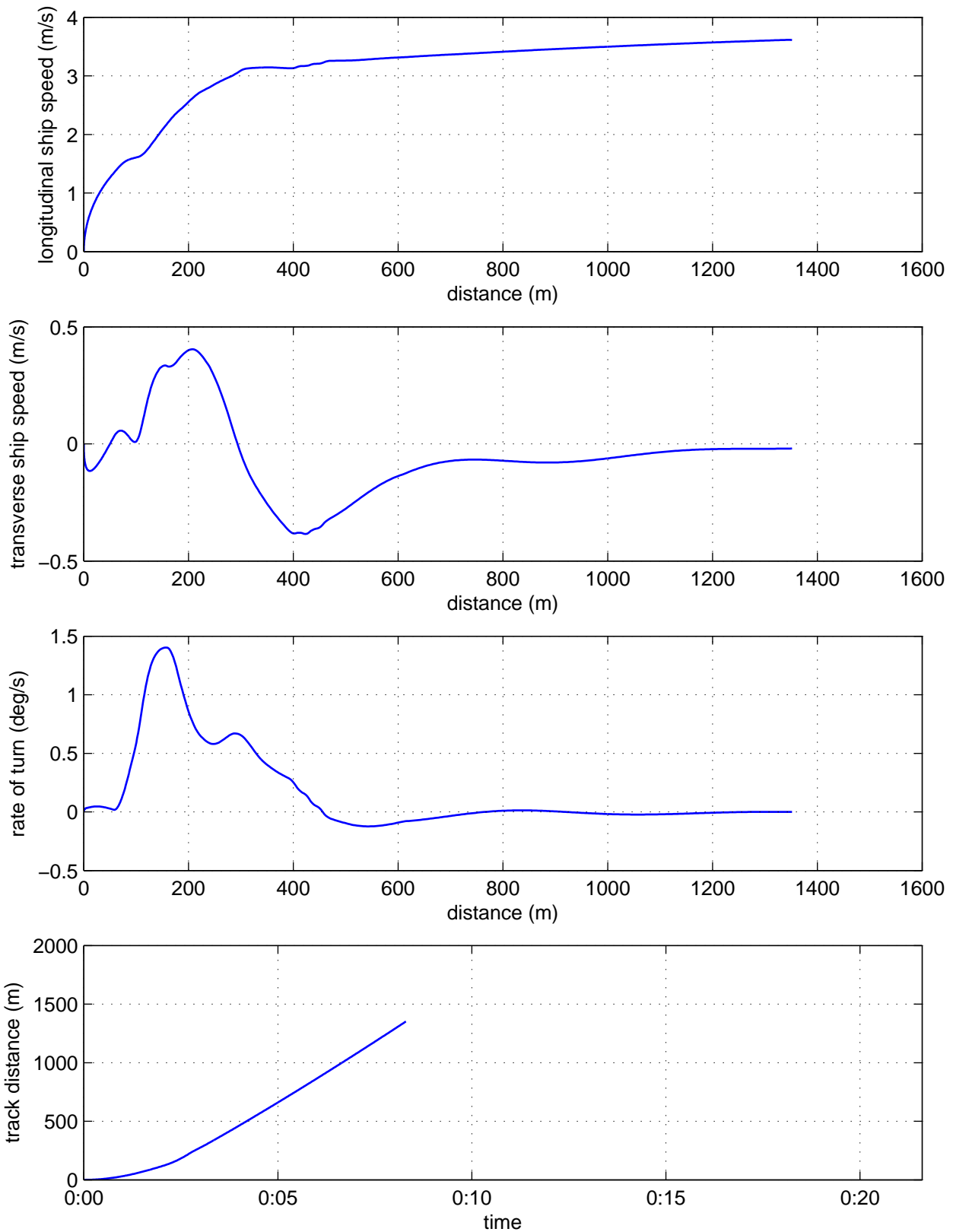
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 8

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 1

Current: 2.5 m/s

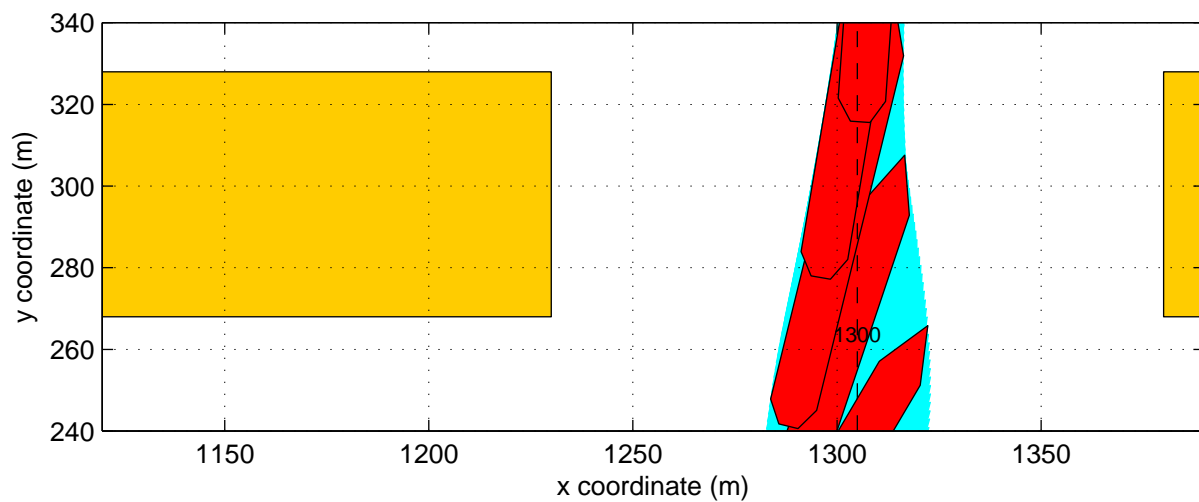
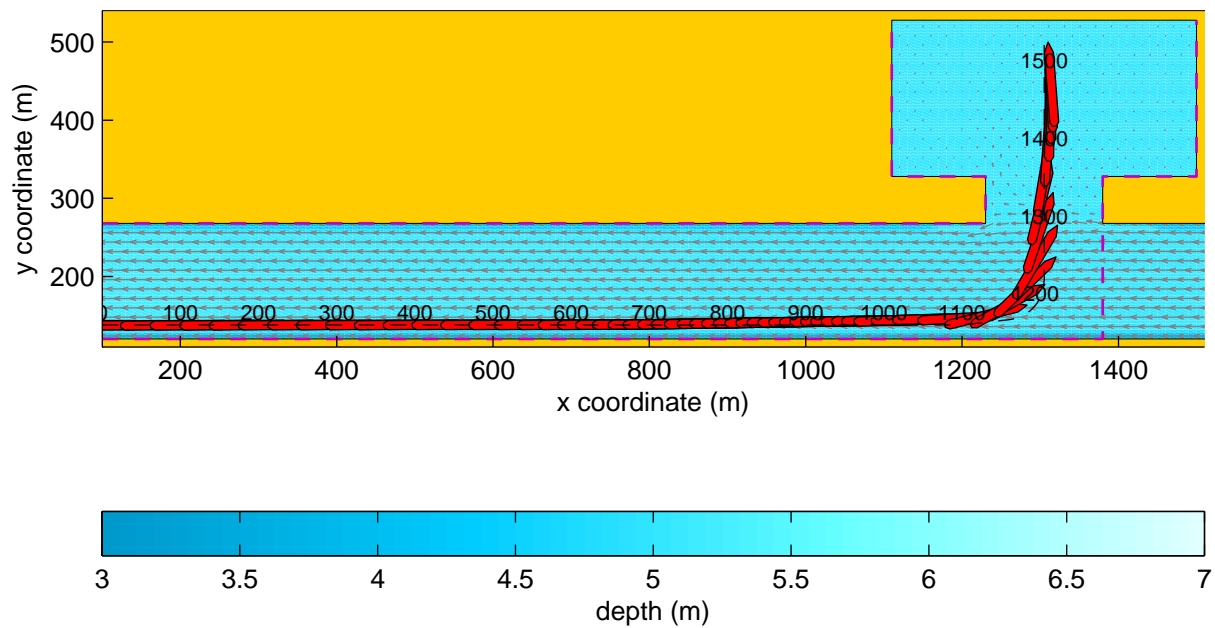
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 8

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

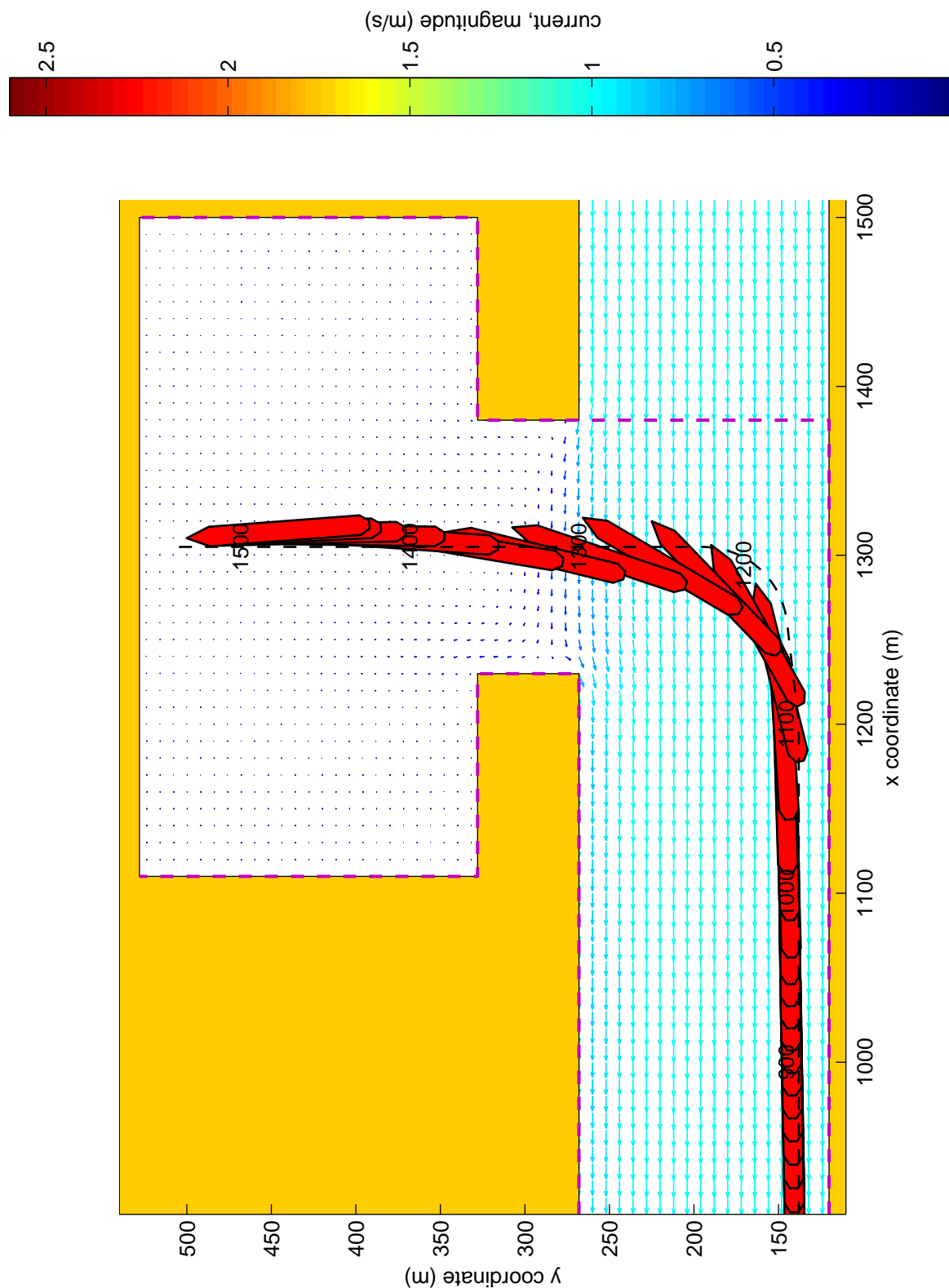
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 9

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

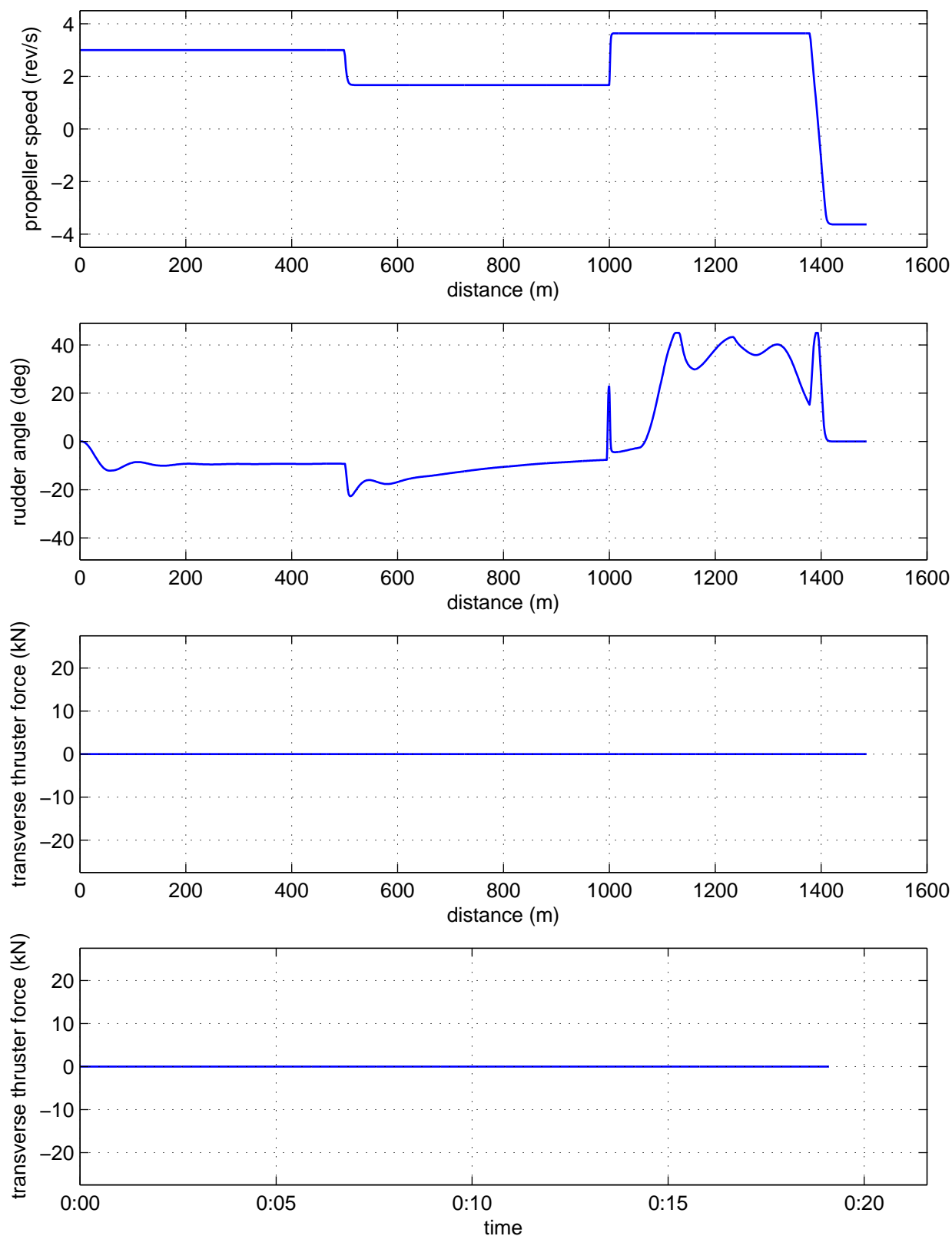
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 9

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

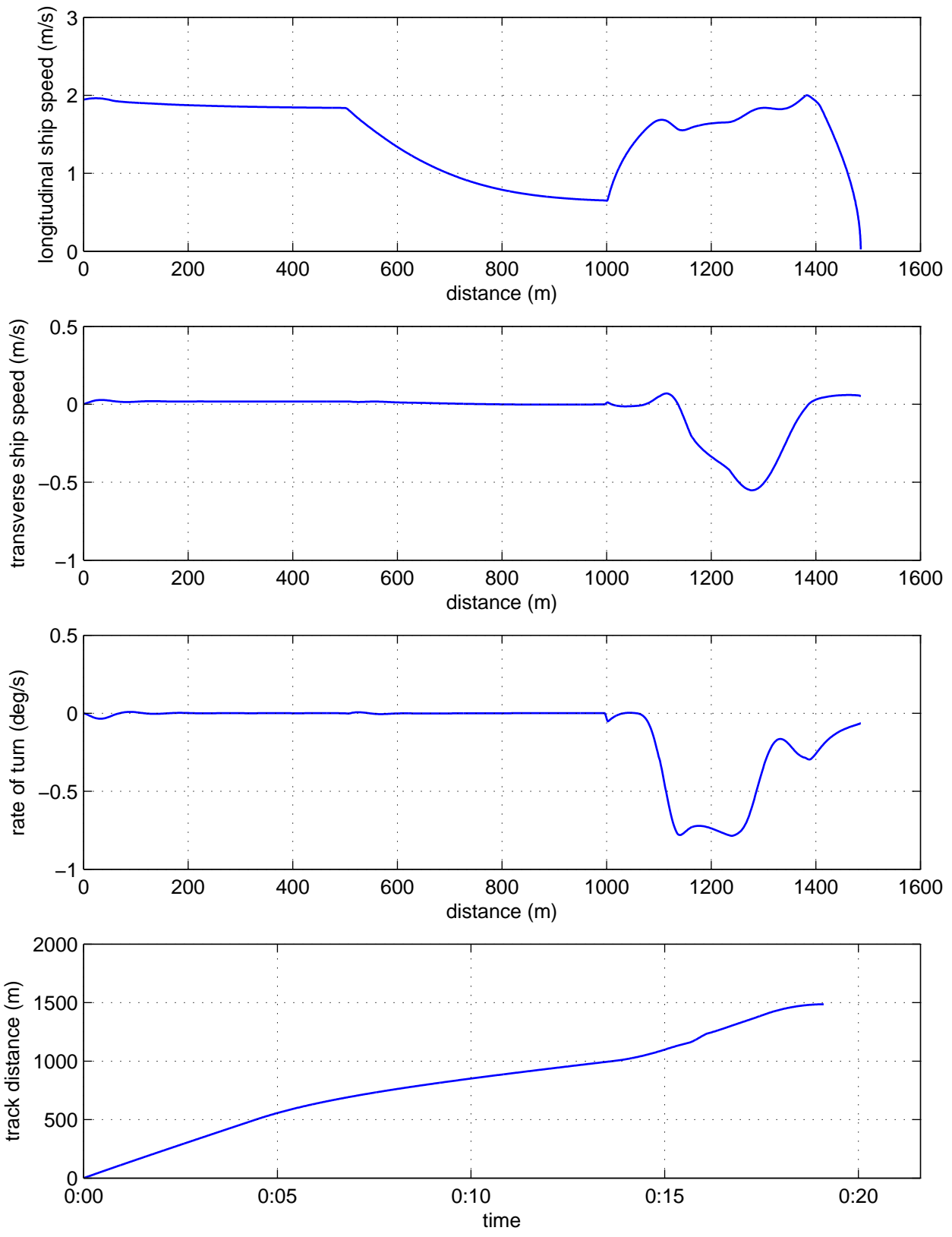
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 9

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

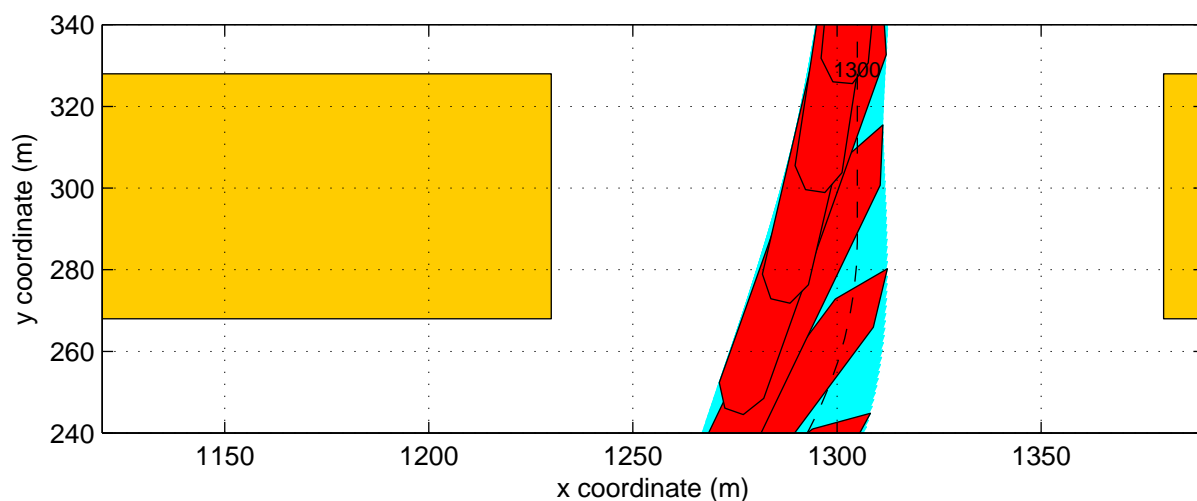
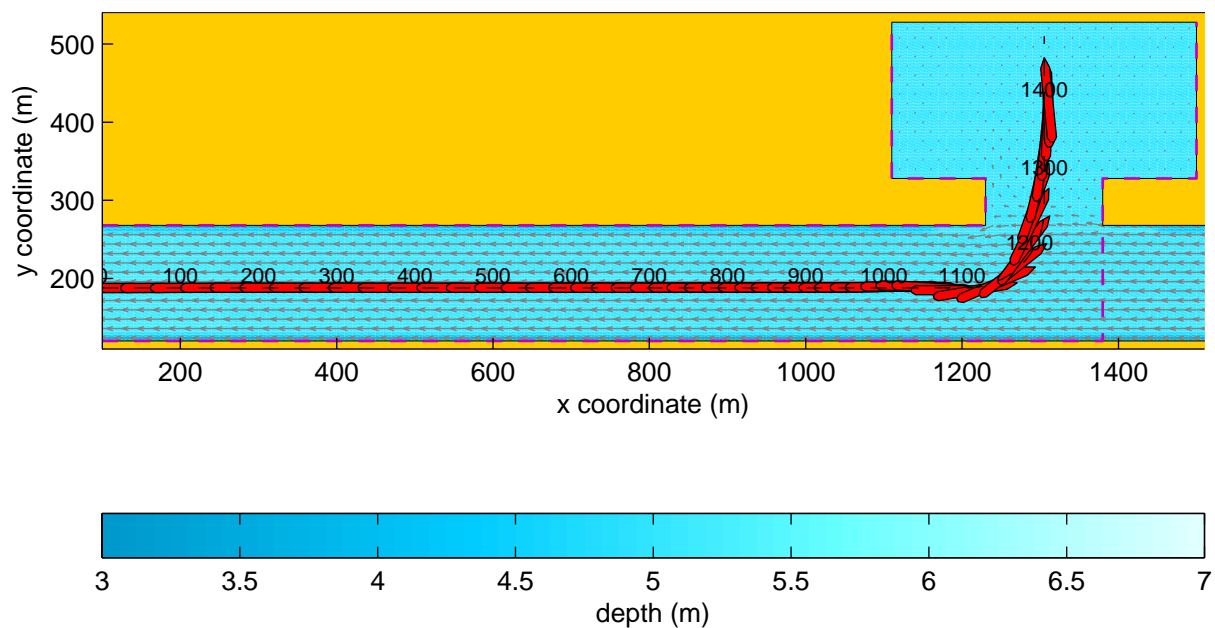
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 9

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

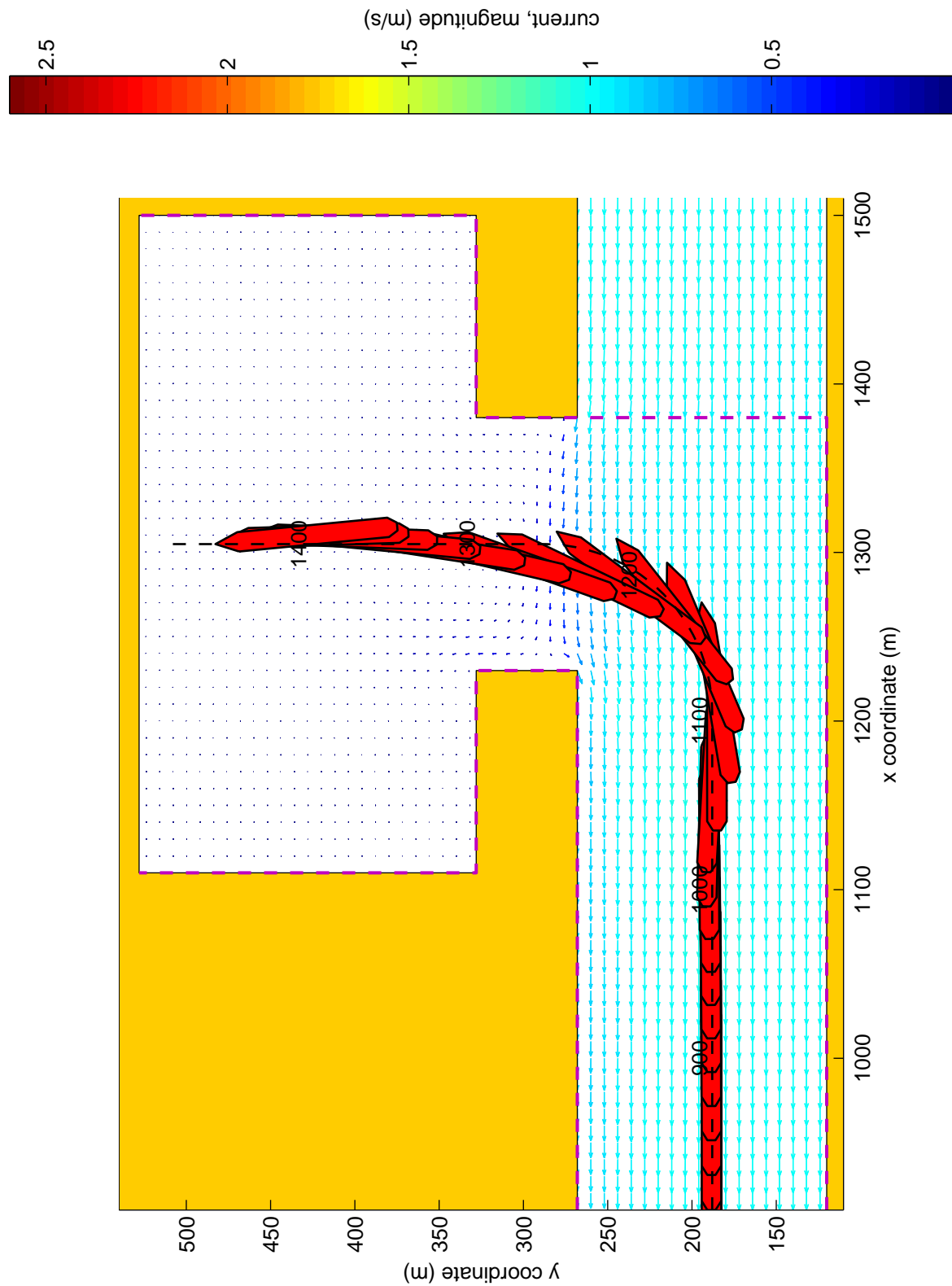
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 10

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

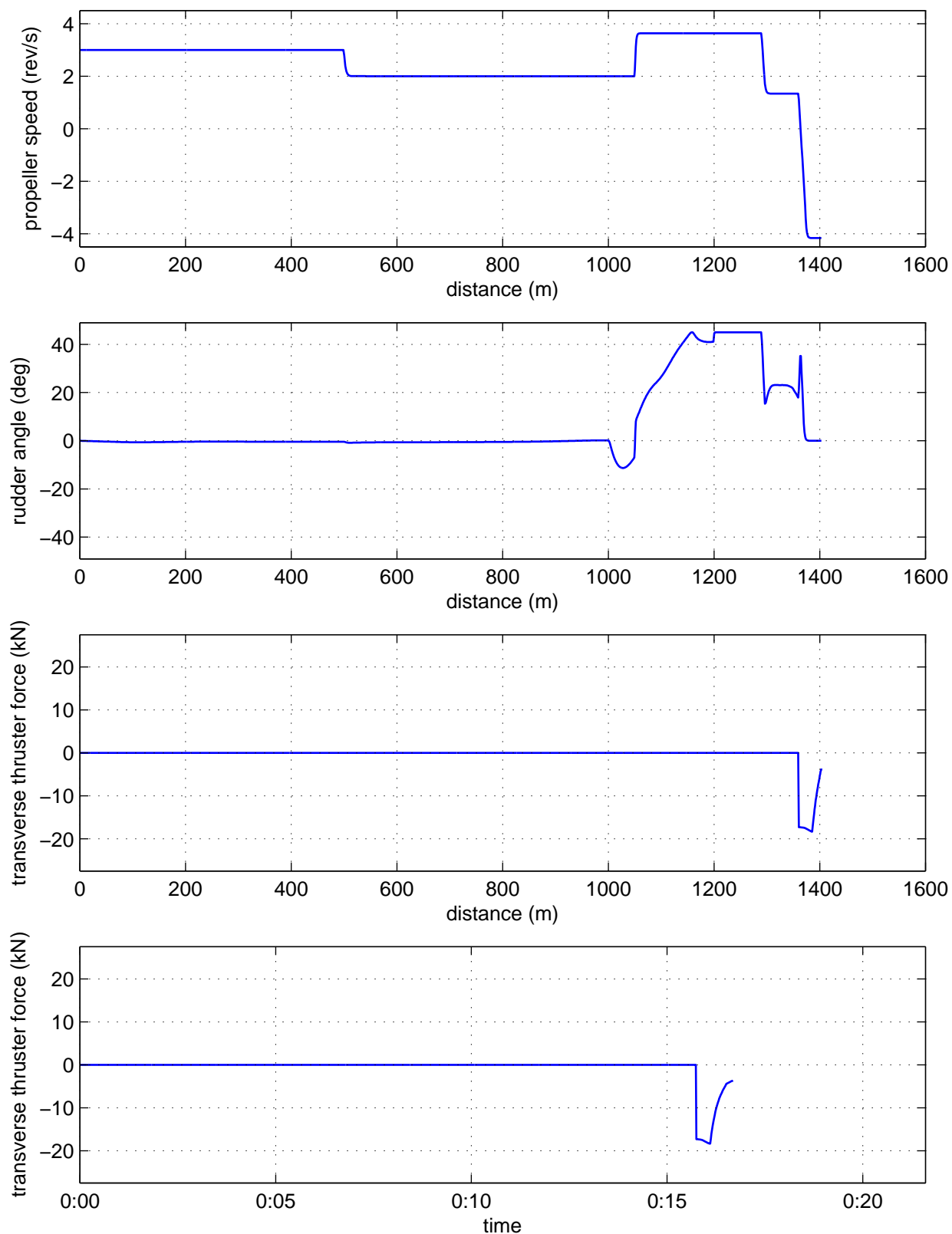
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 10

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

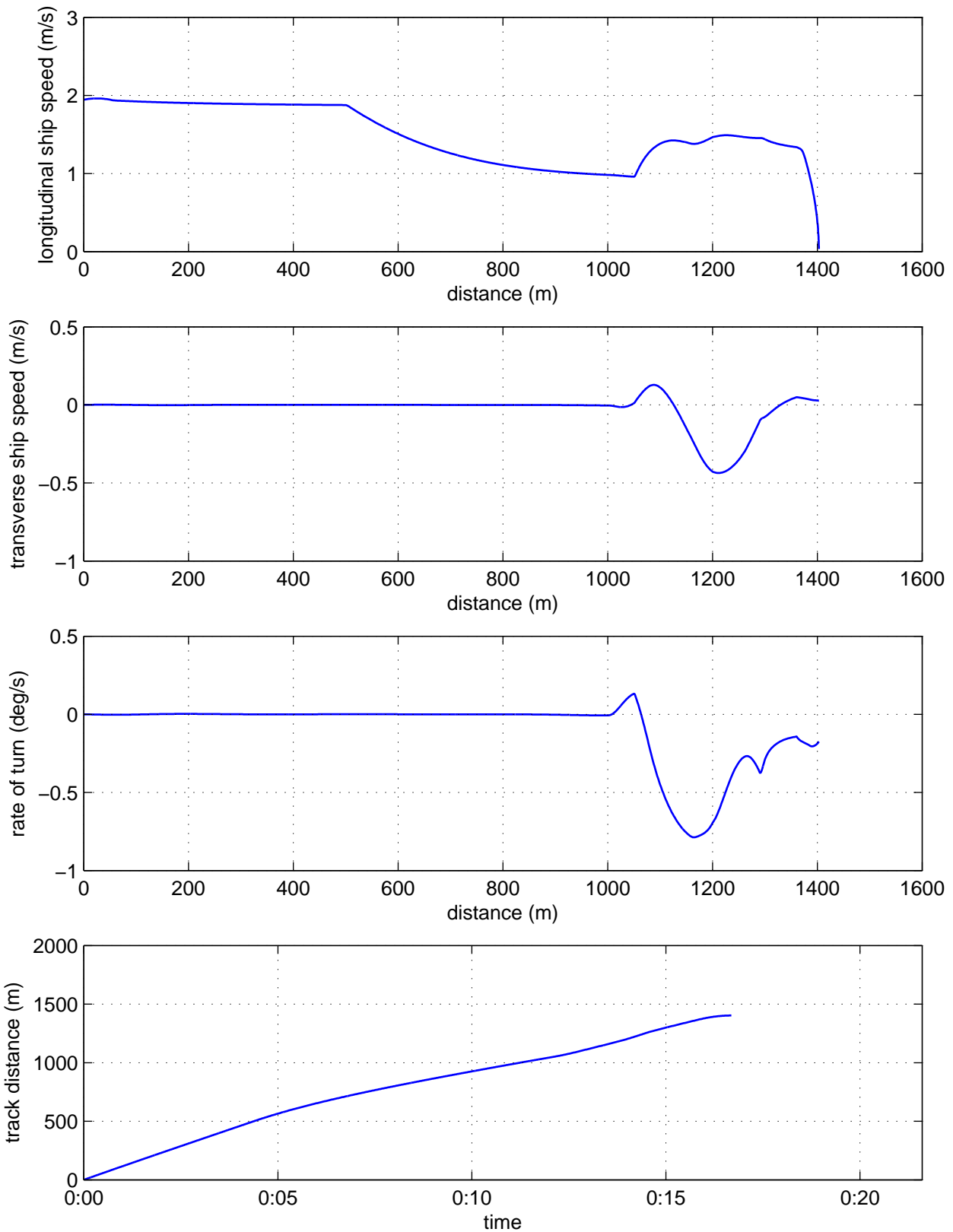
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 10

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 1.0 m/s

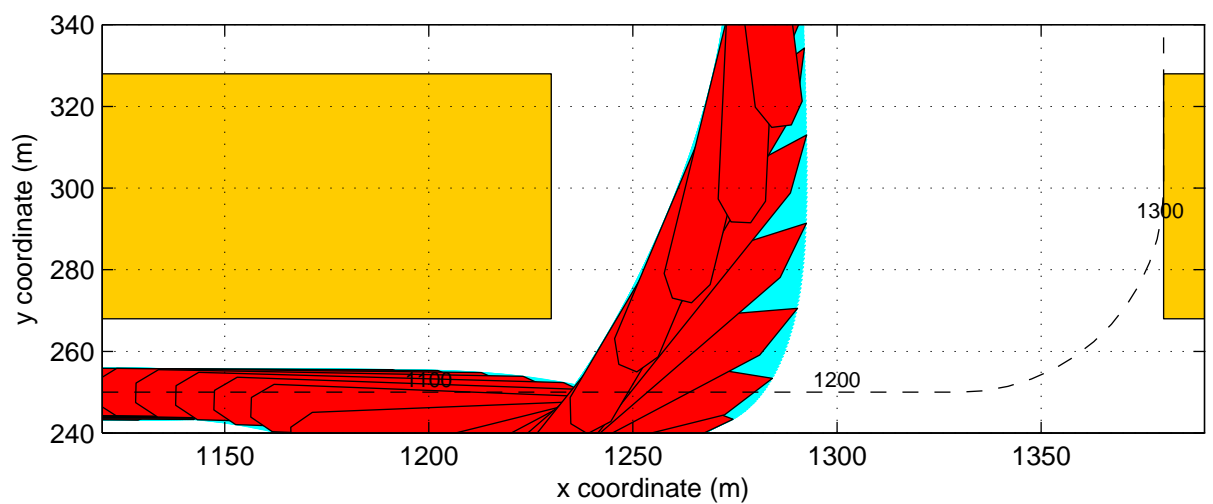
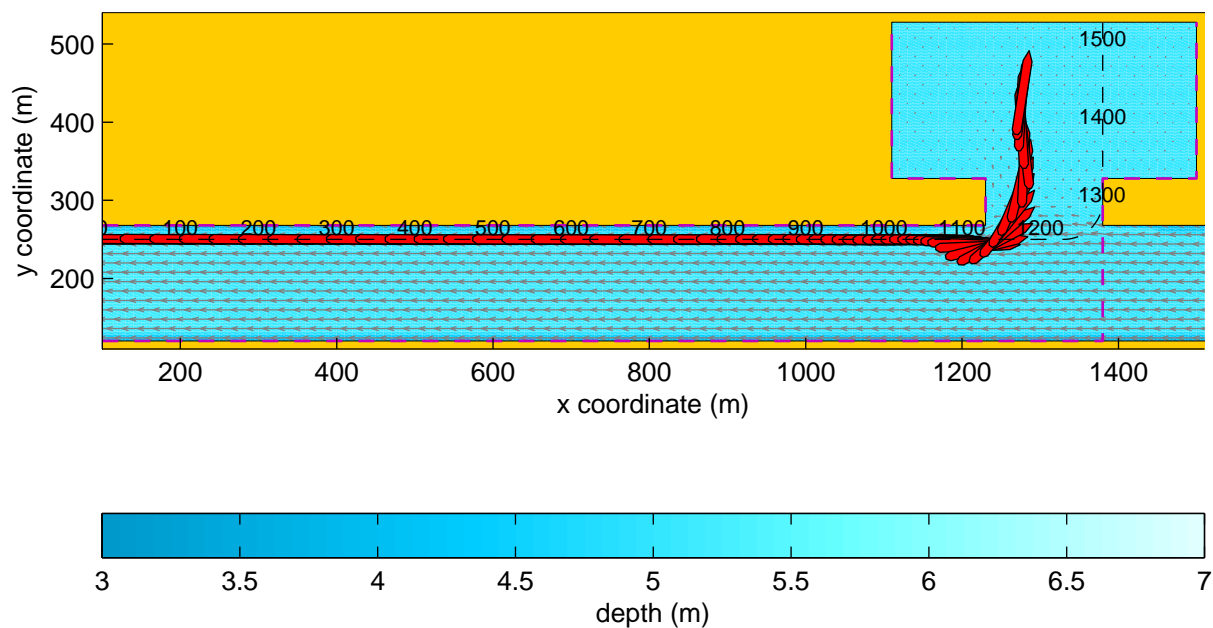
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 10

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

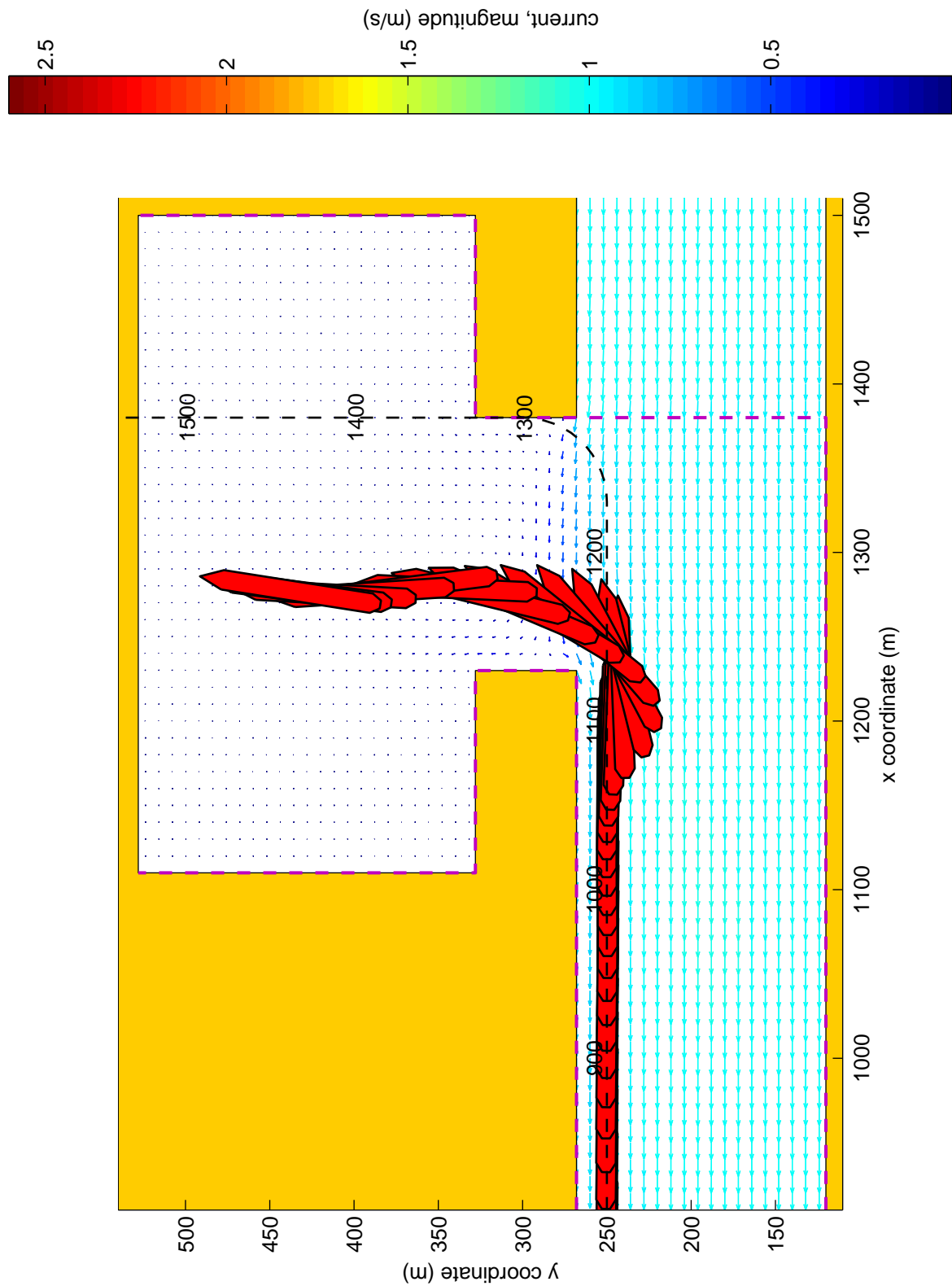
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 11

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

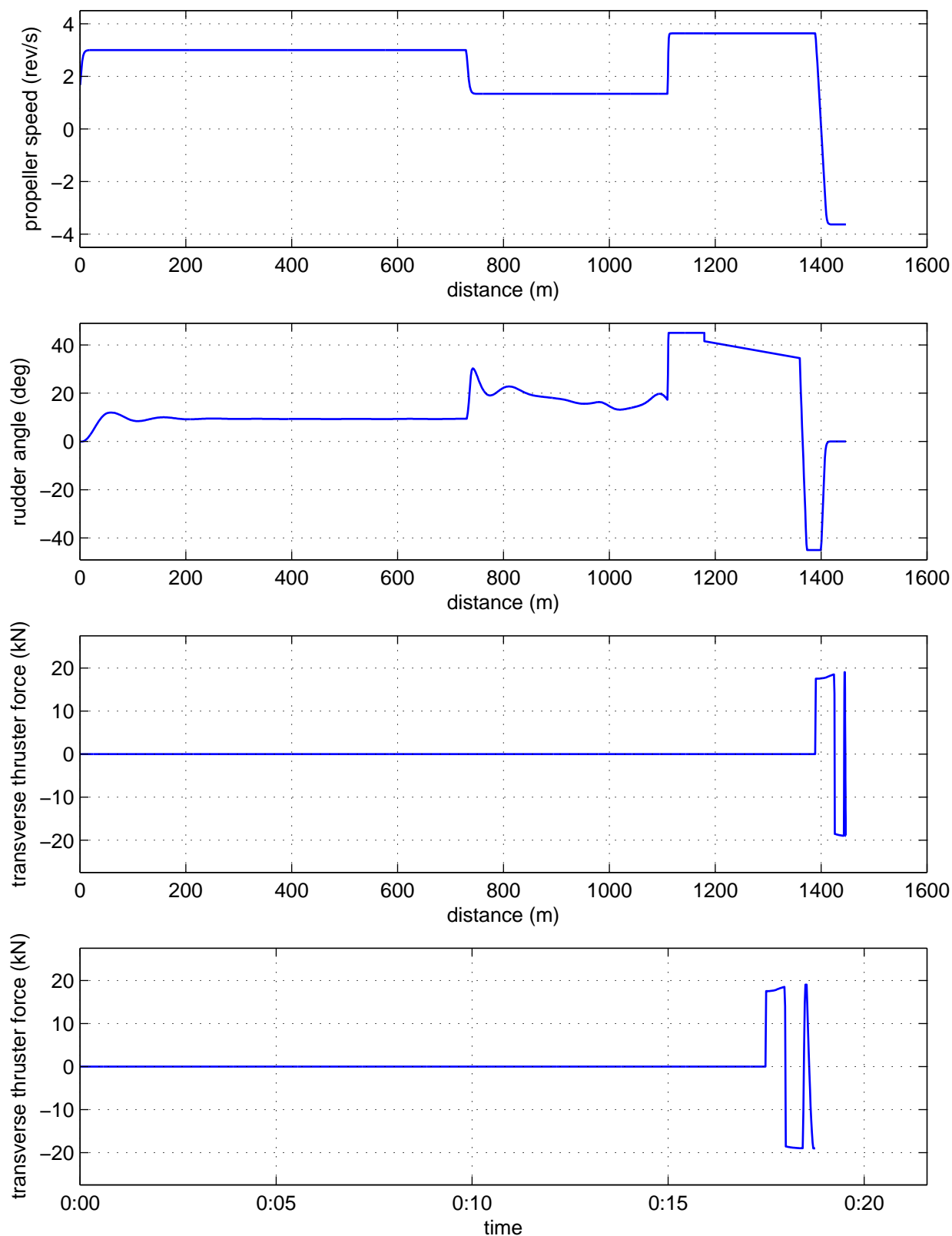
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 11

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

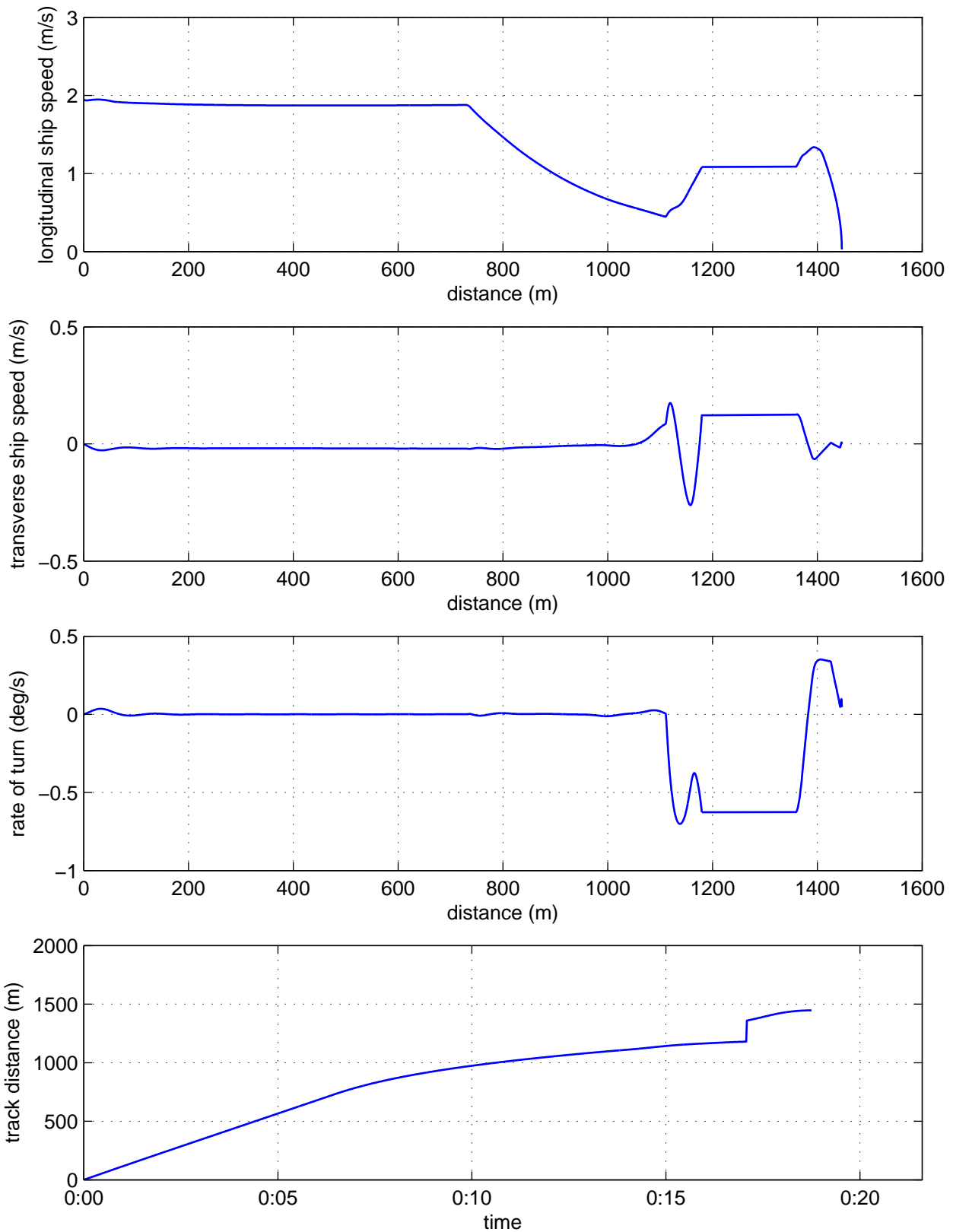
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 11

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

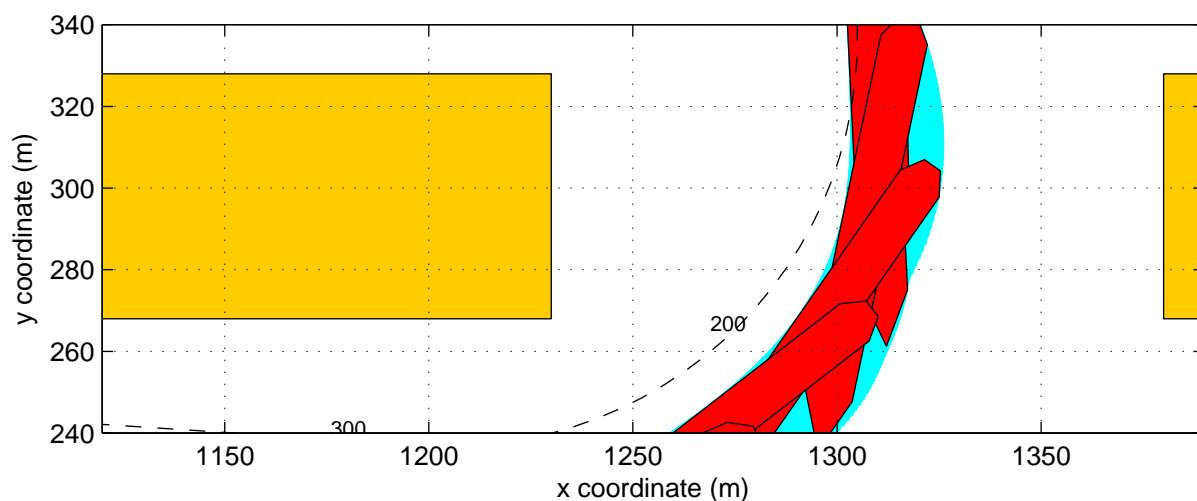
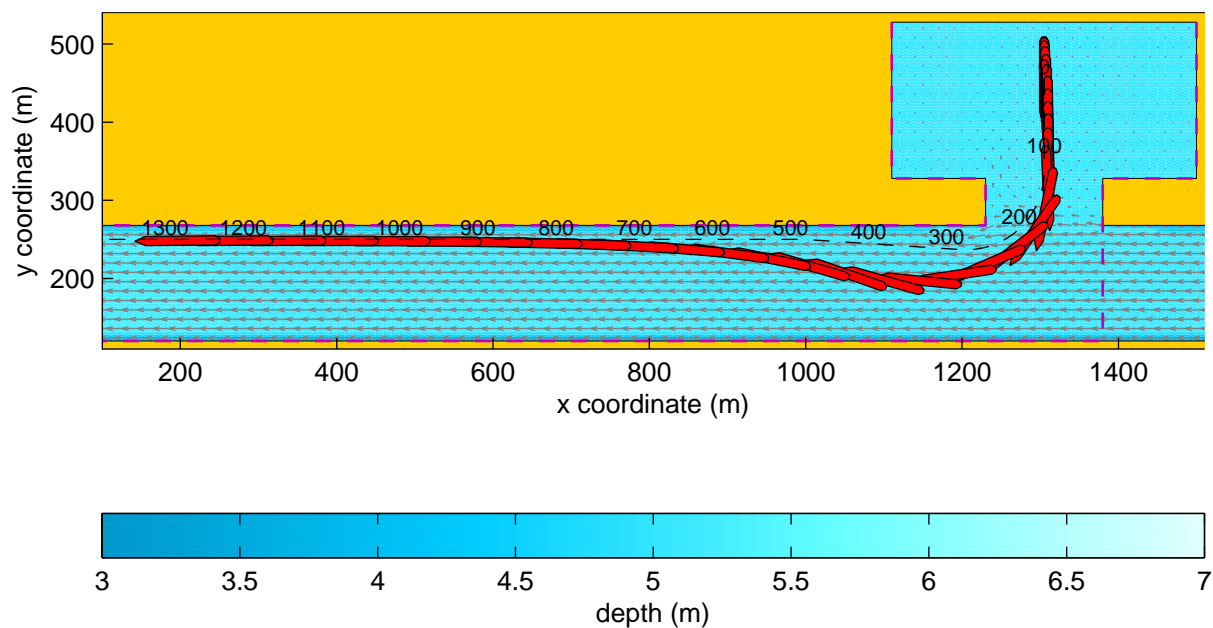
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 11

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

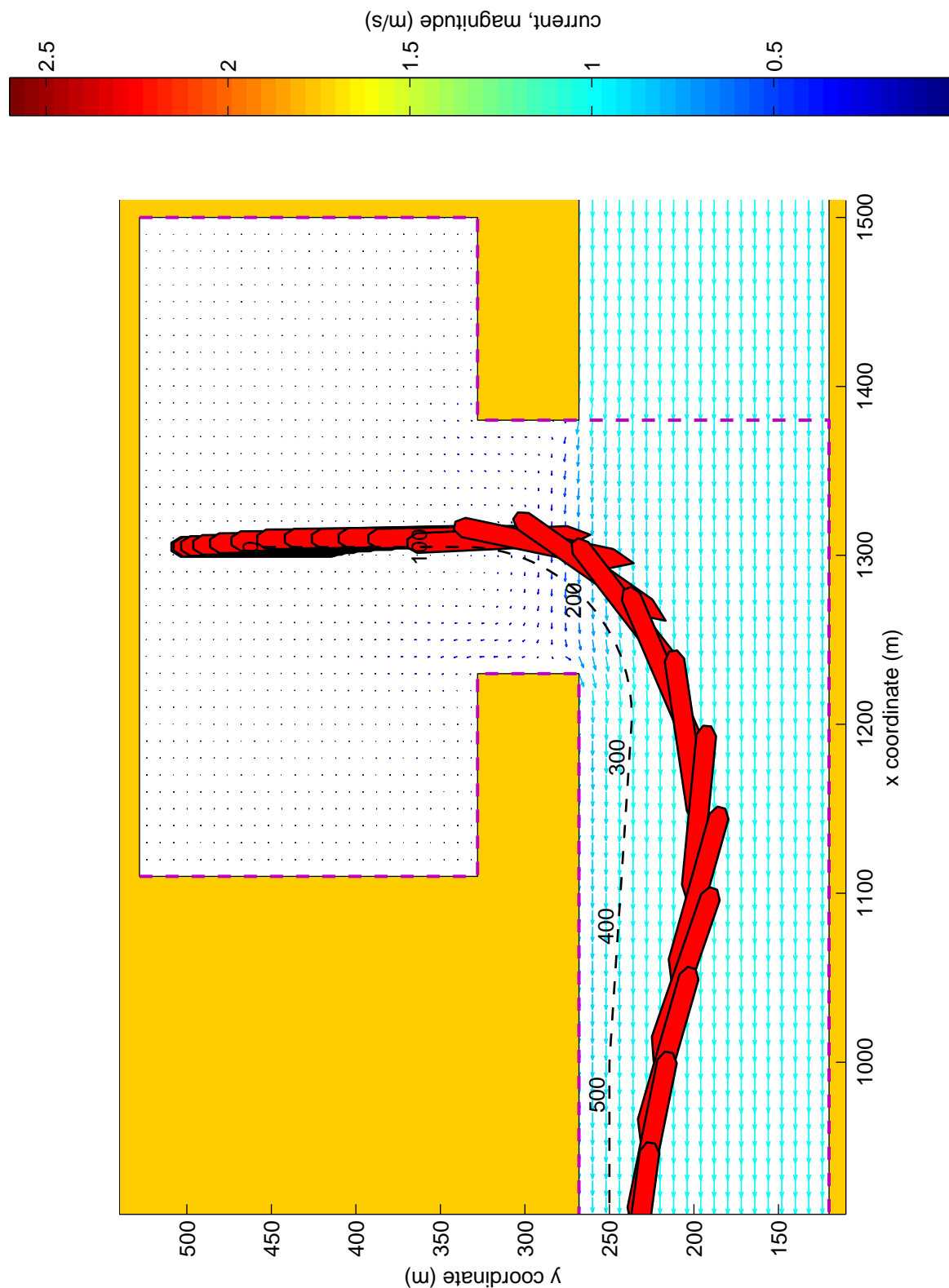
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 12

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

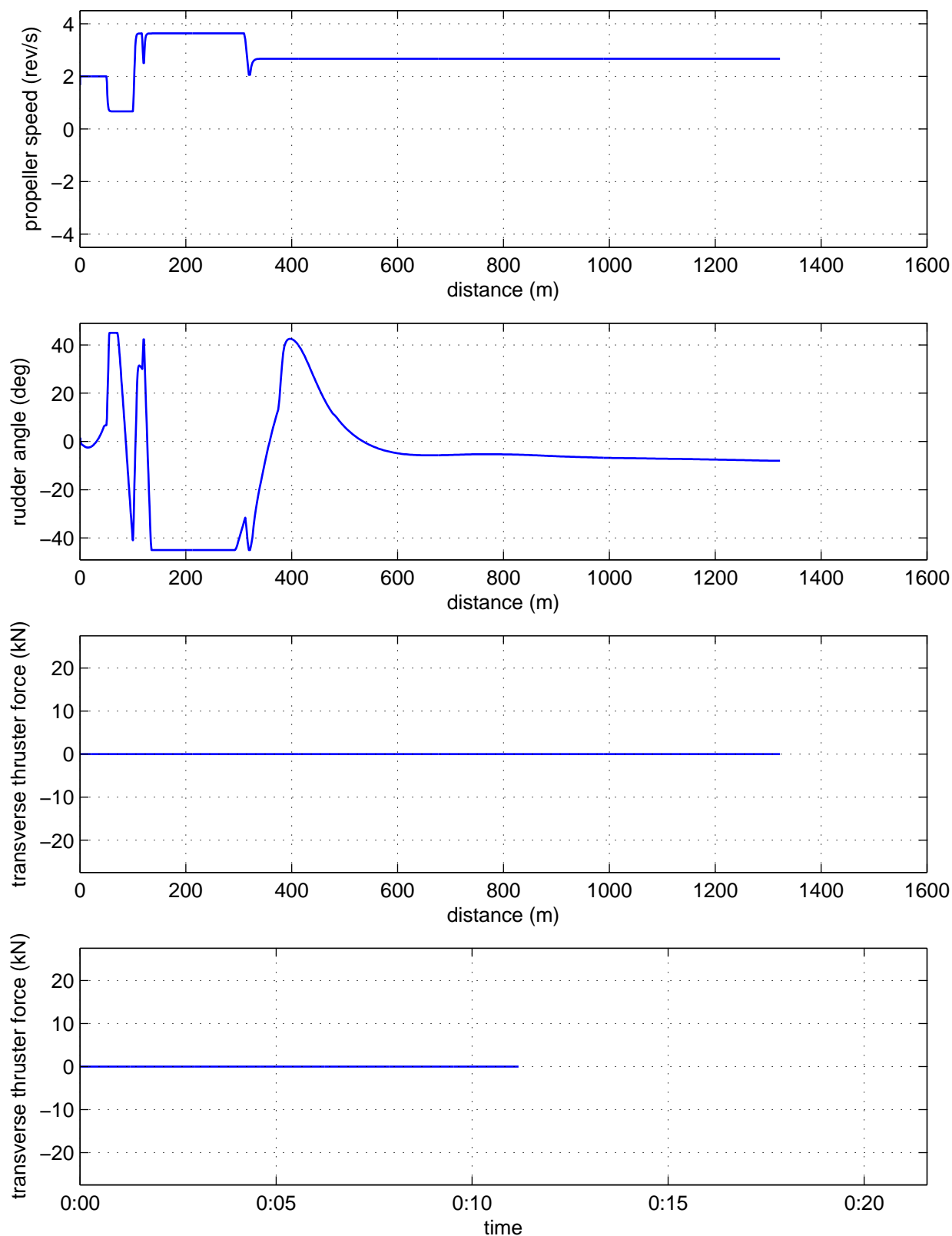
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 12

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

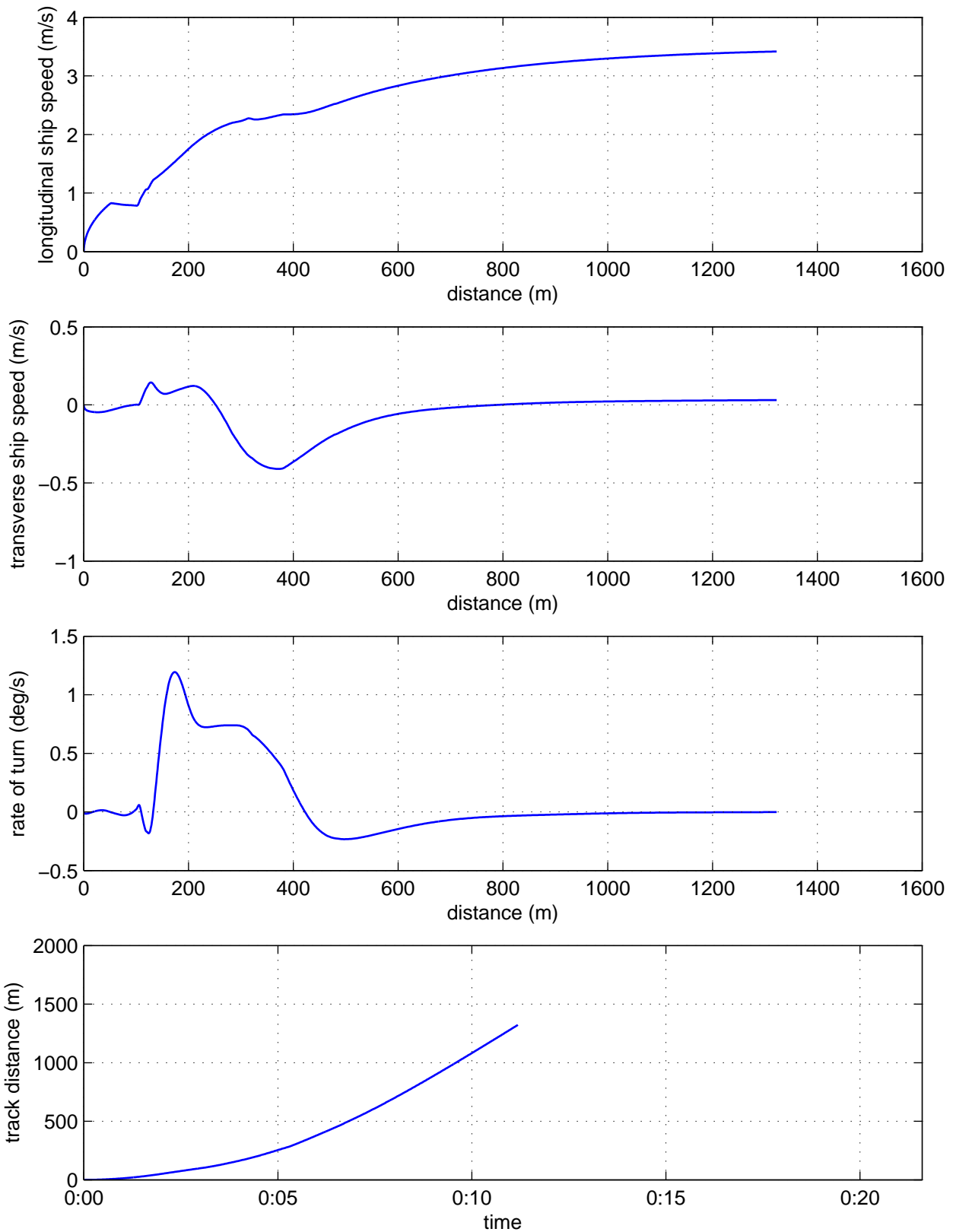
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 12

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 1.0 m/s

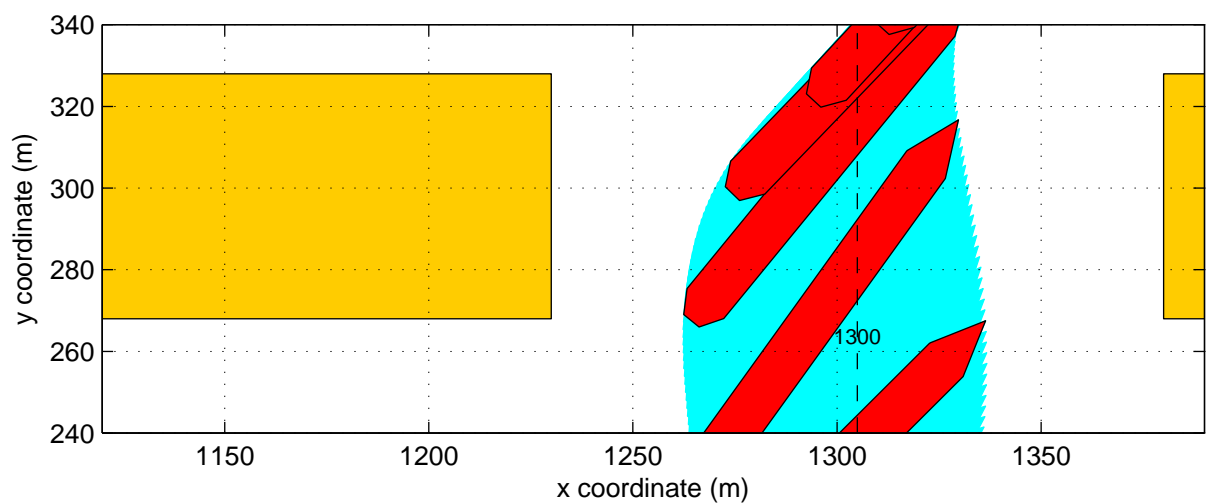
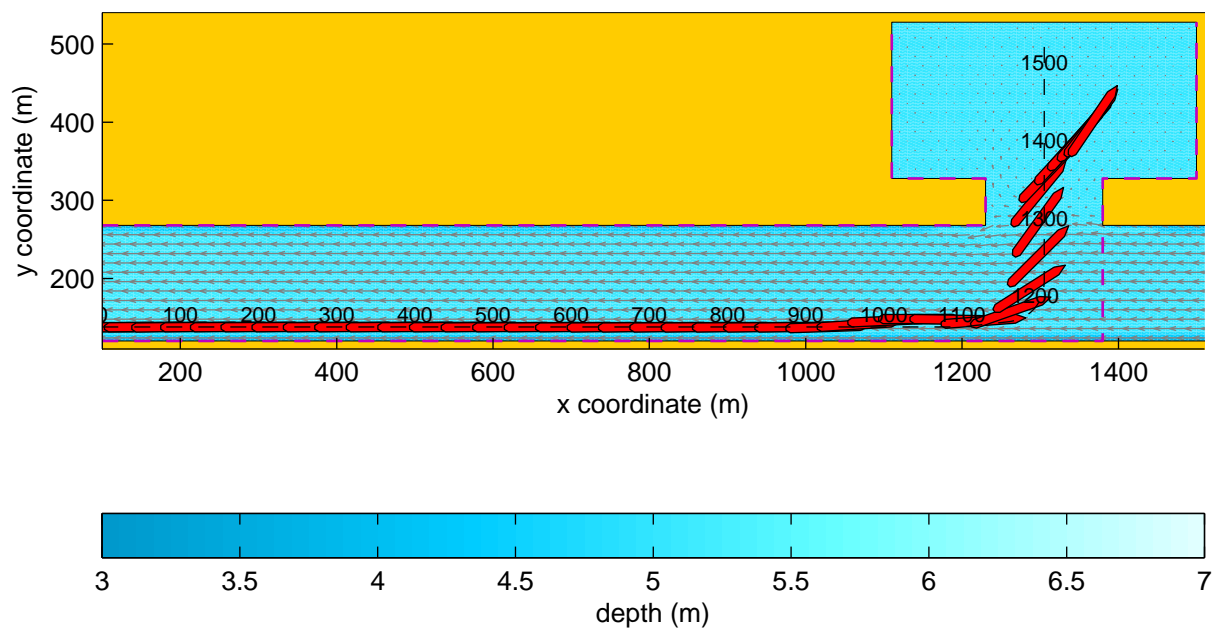
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 12

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

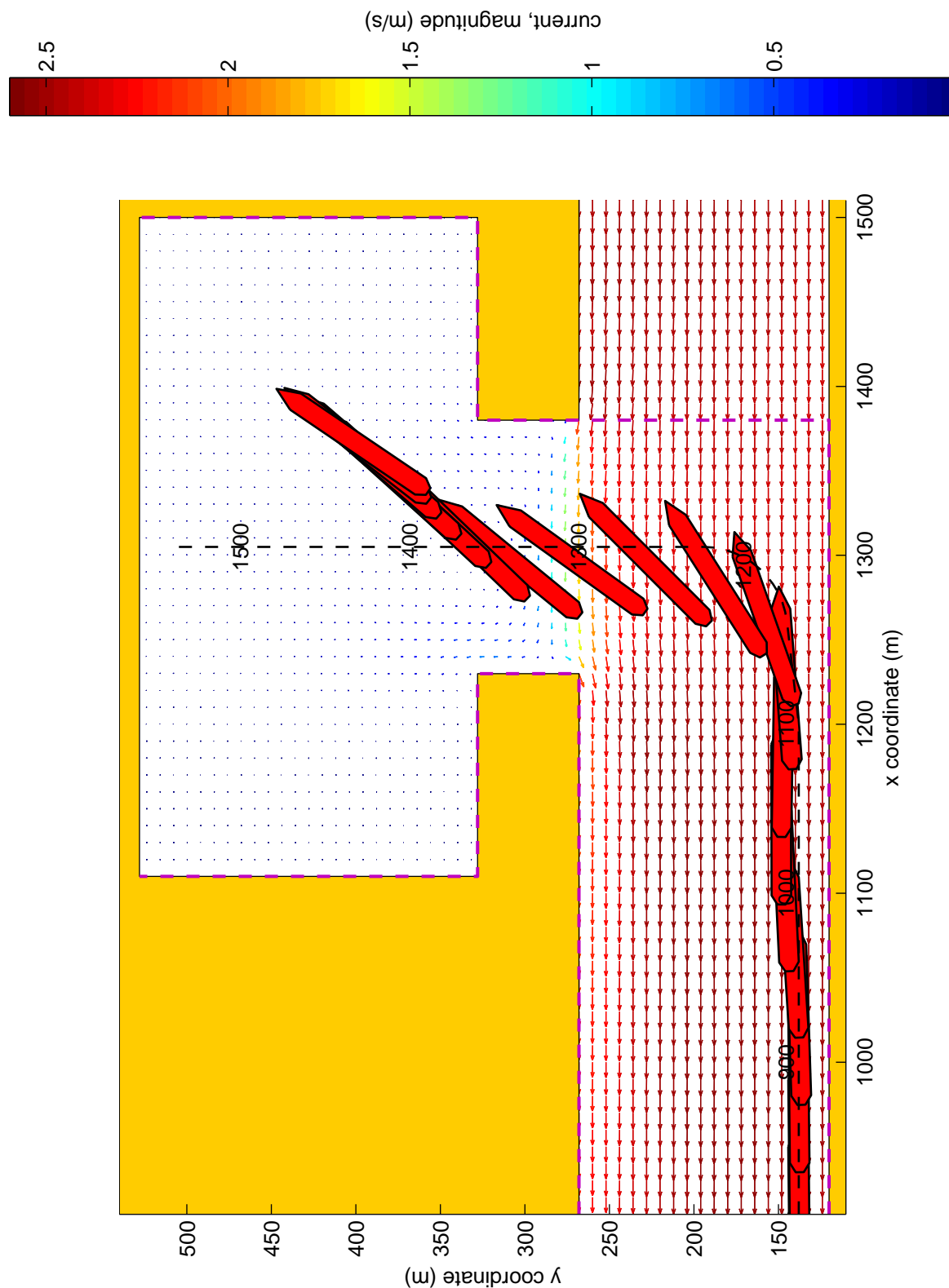
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 13

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

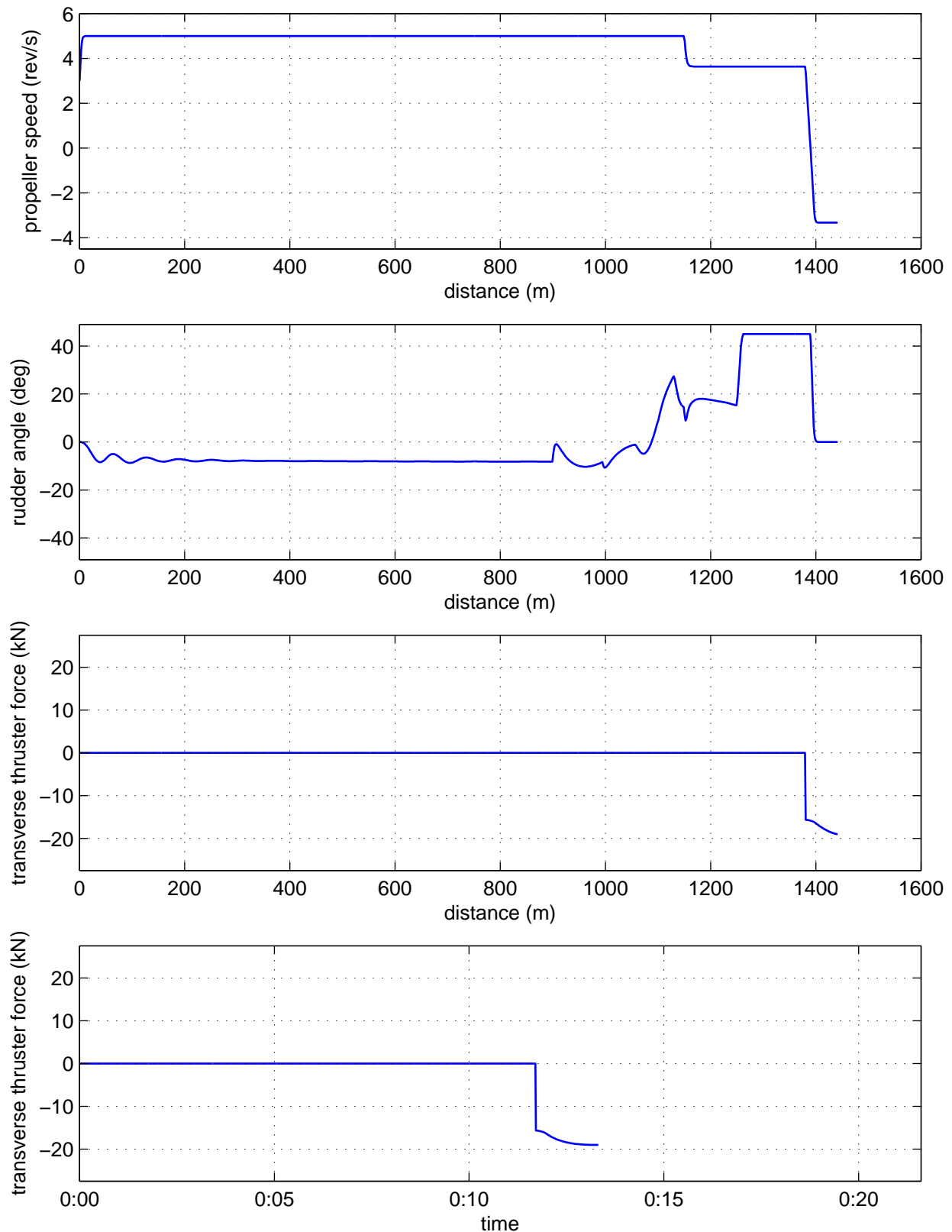
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 13

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

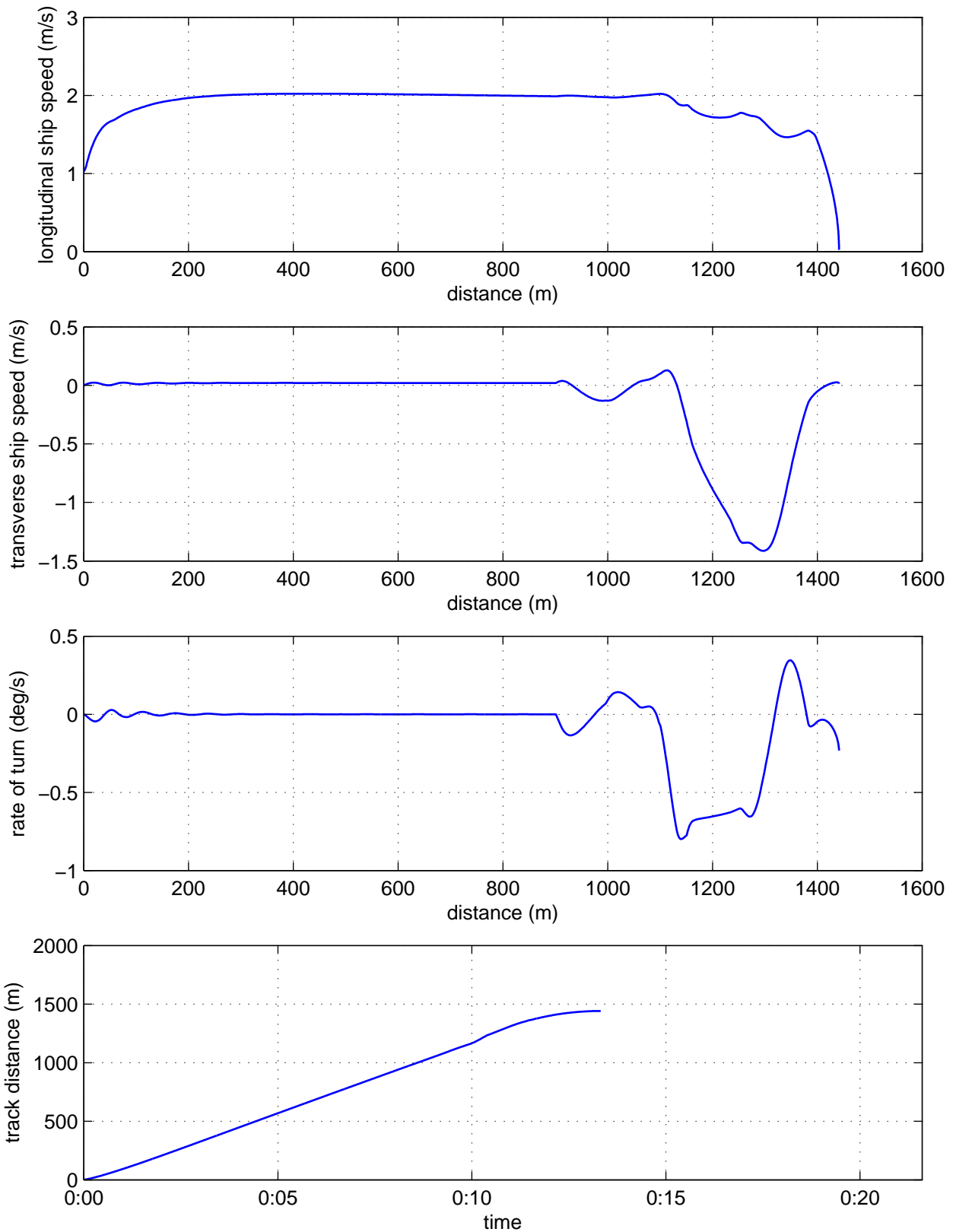
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 13

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

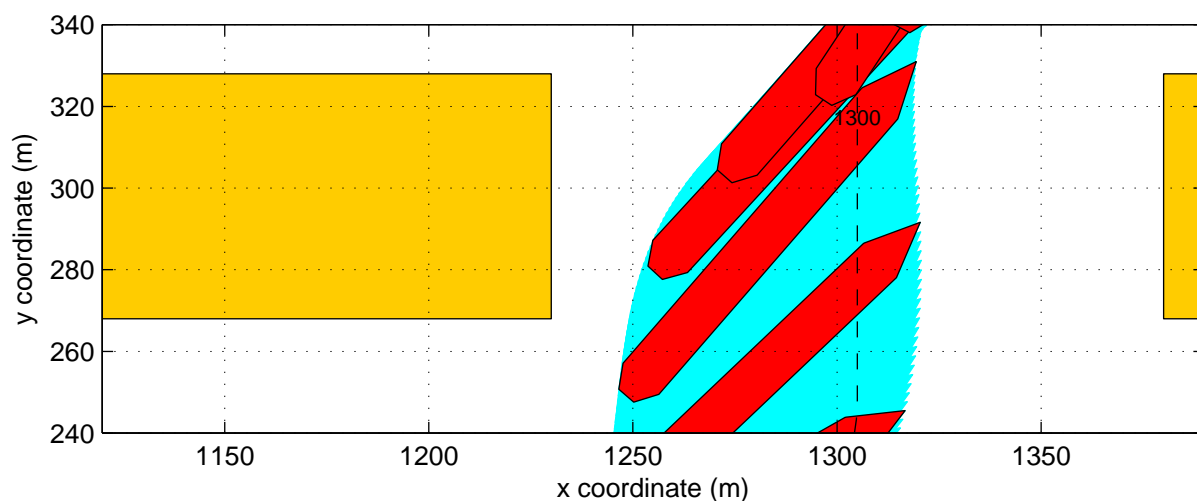
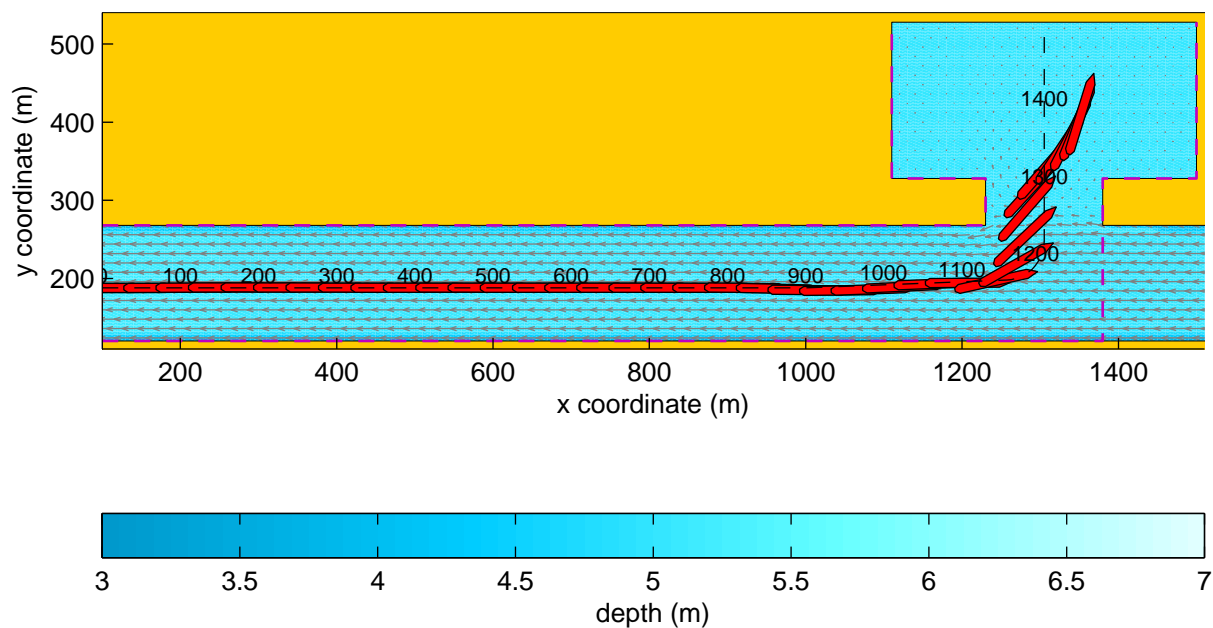
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 13

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

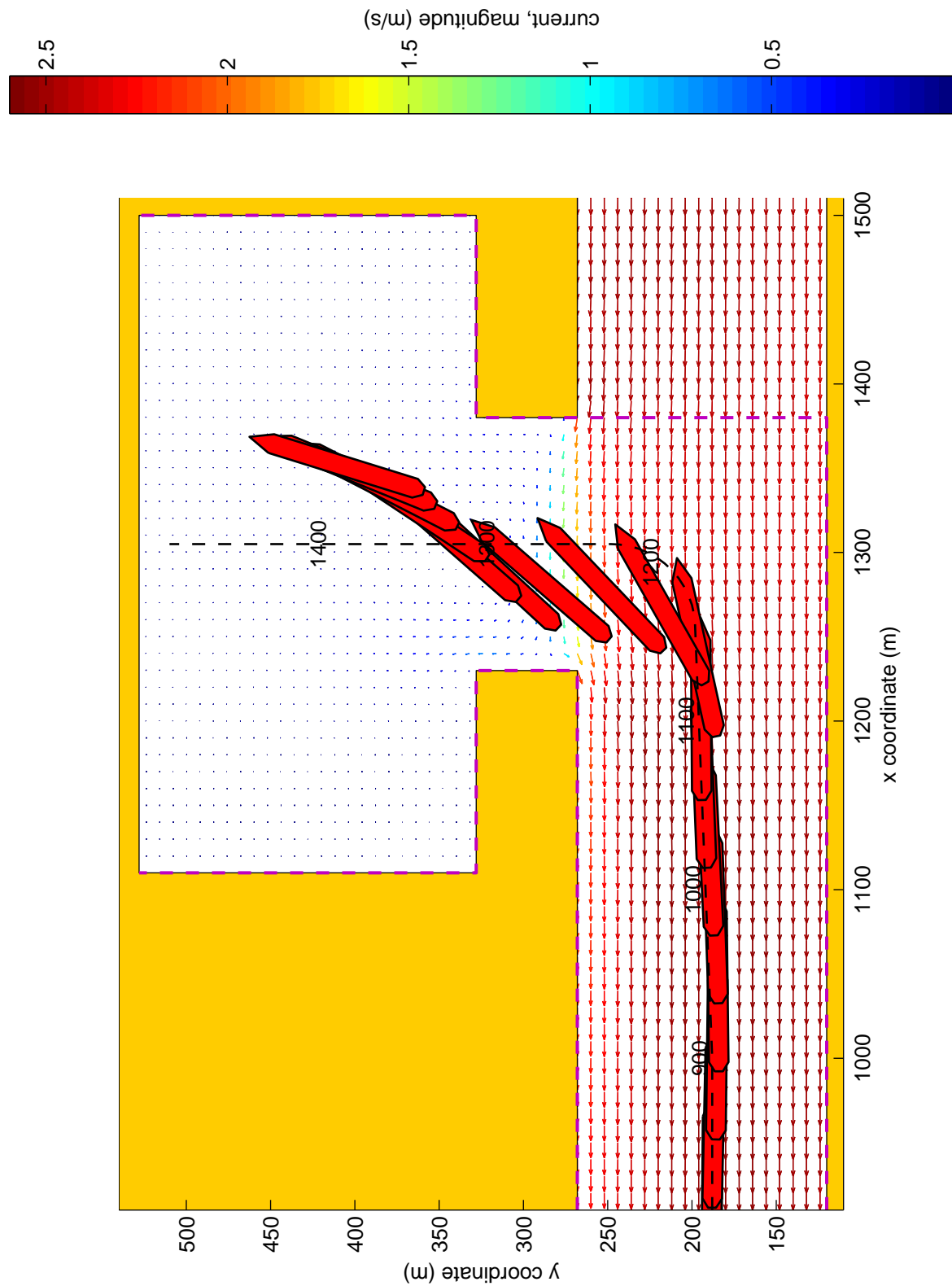
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 14

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

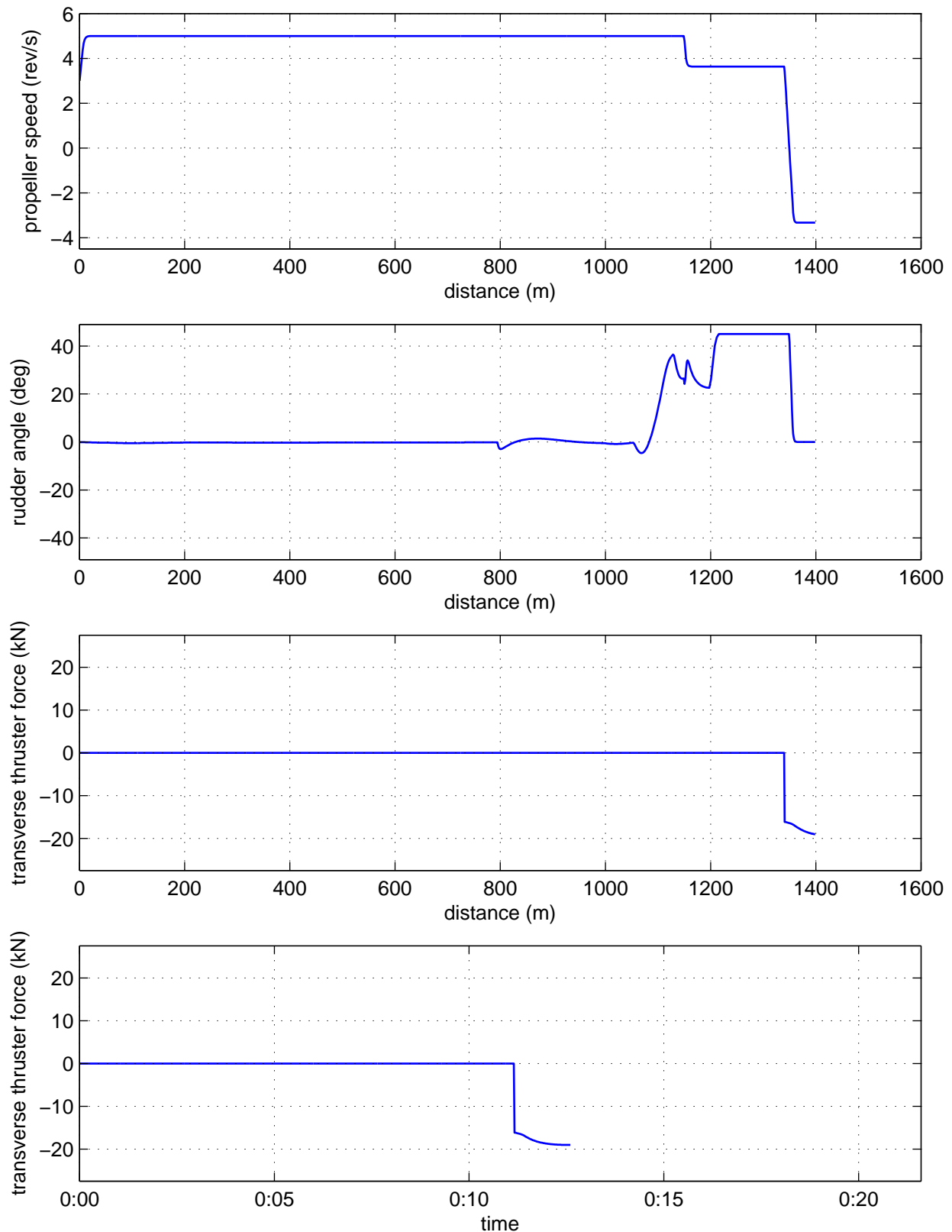
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 14

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

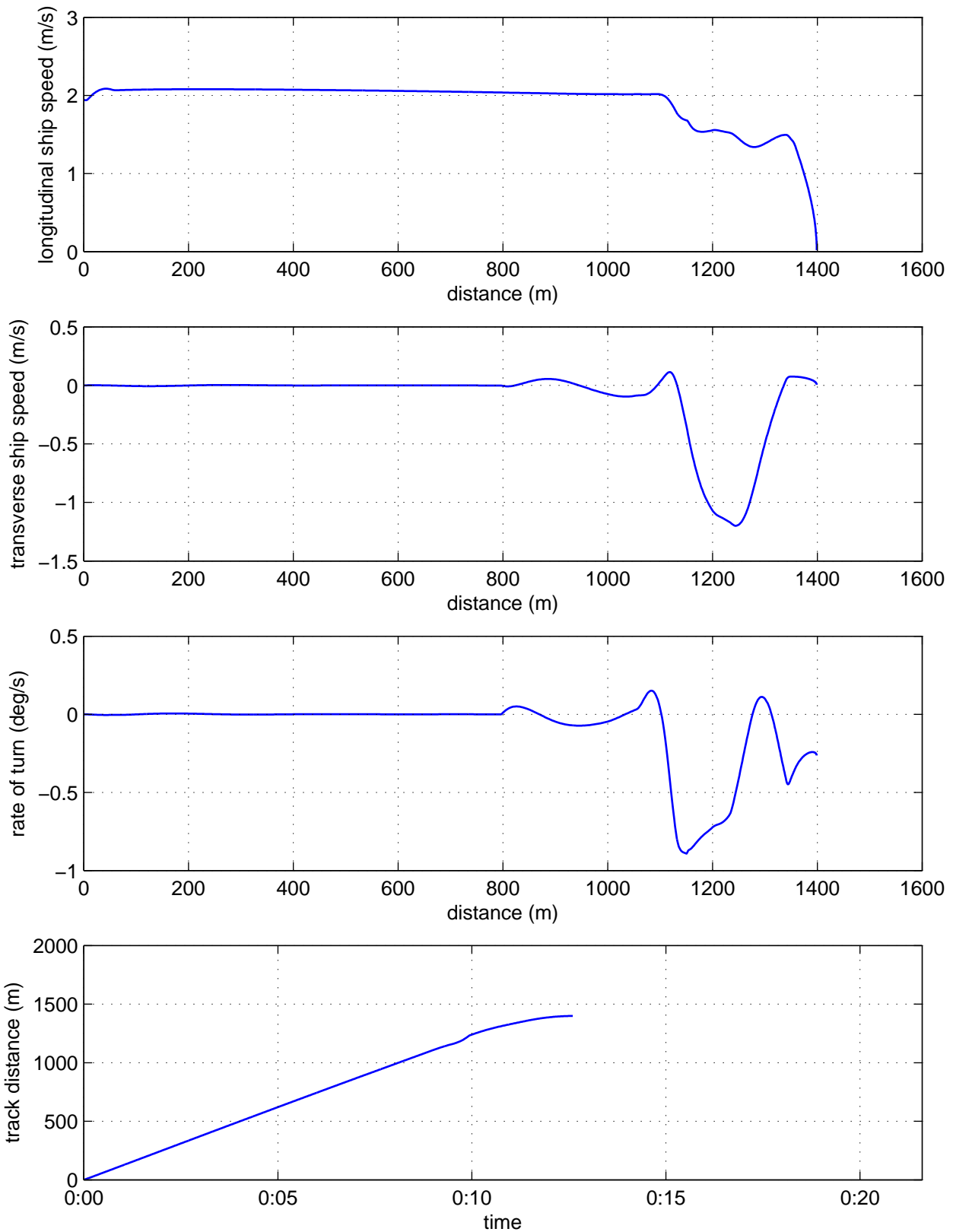
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 14

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 2.5 m/s

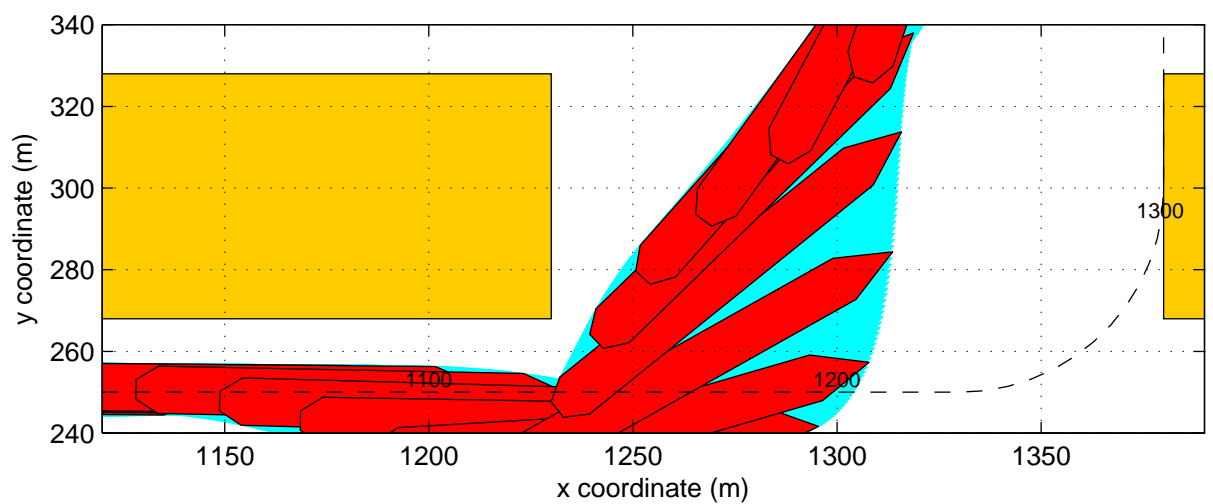
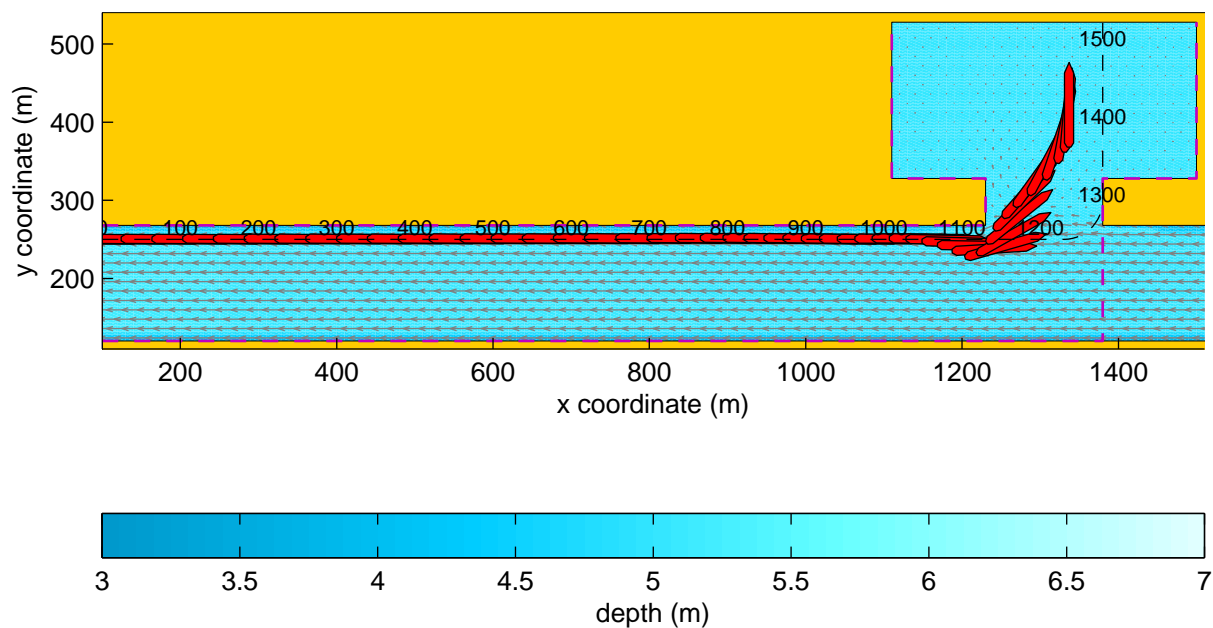
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 14

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

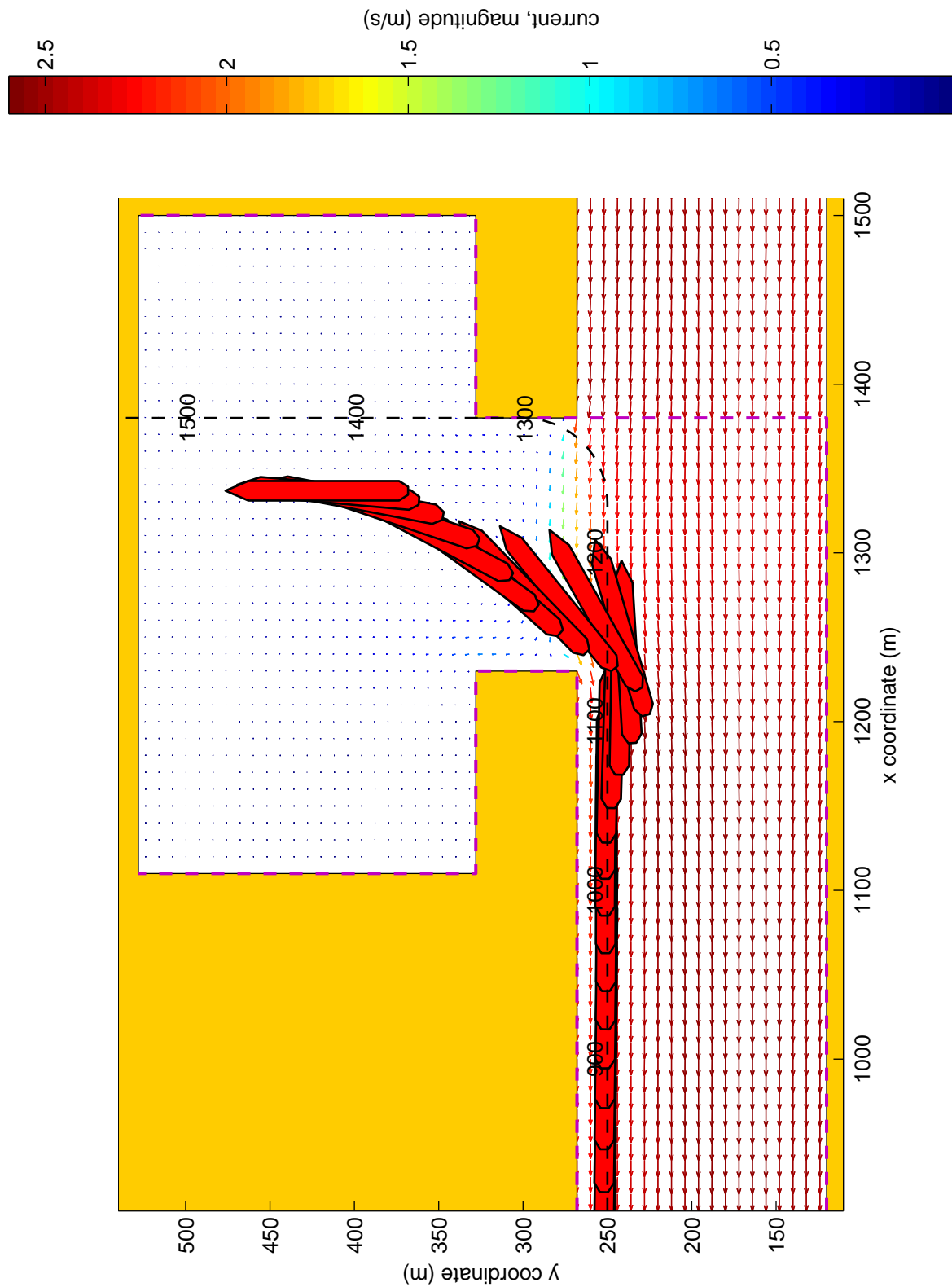
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 15

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

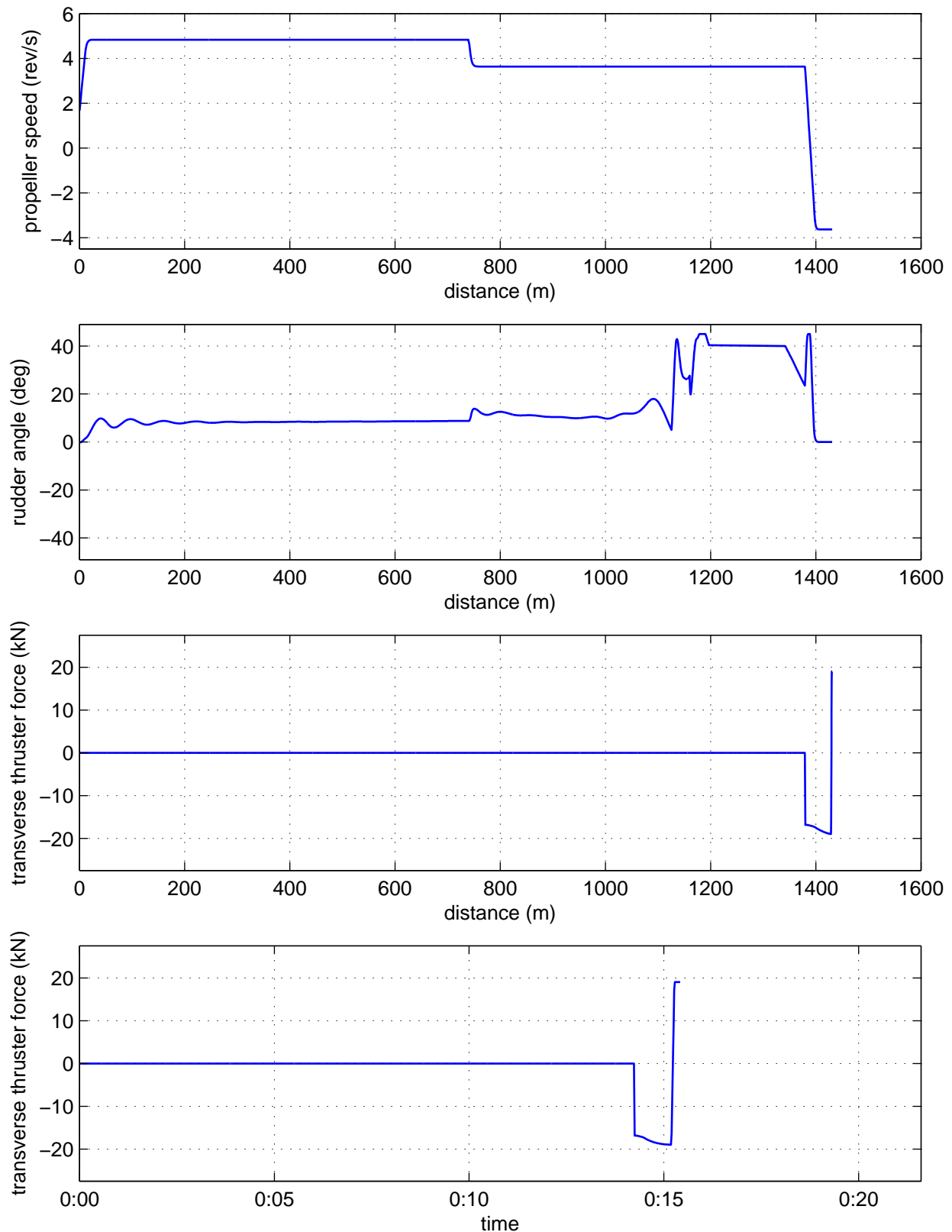
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 15

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

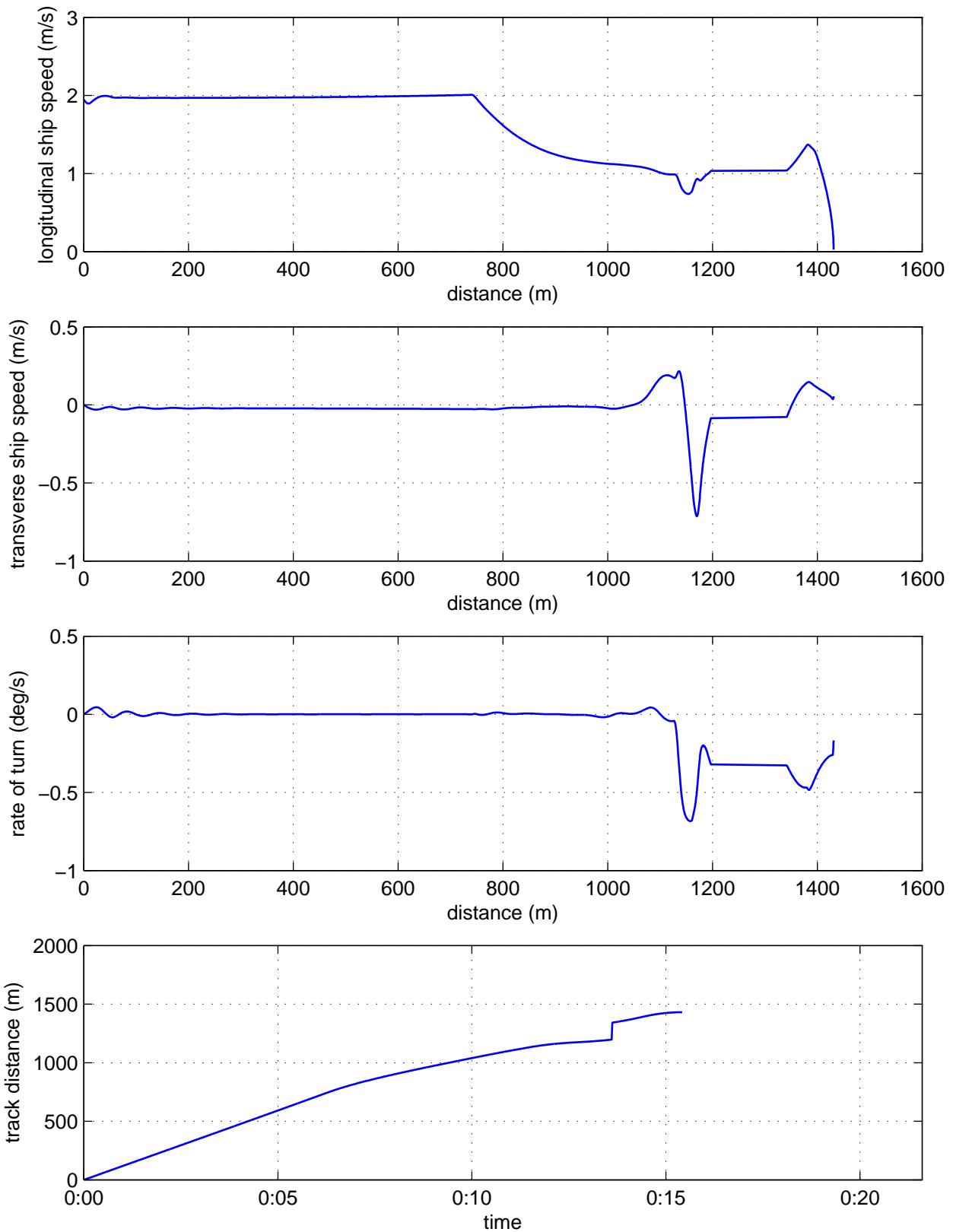
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 15

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

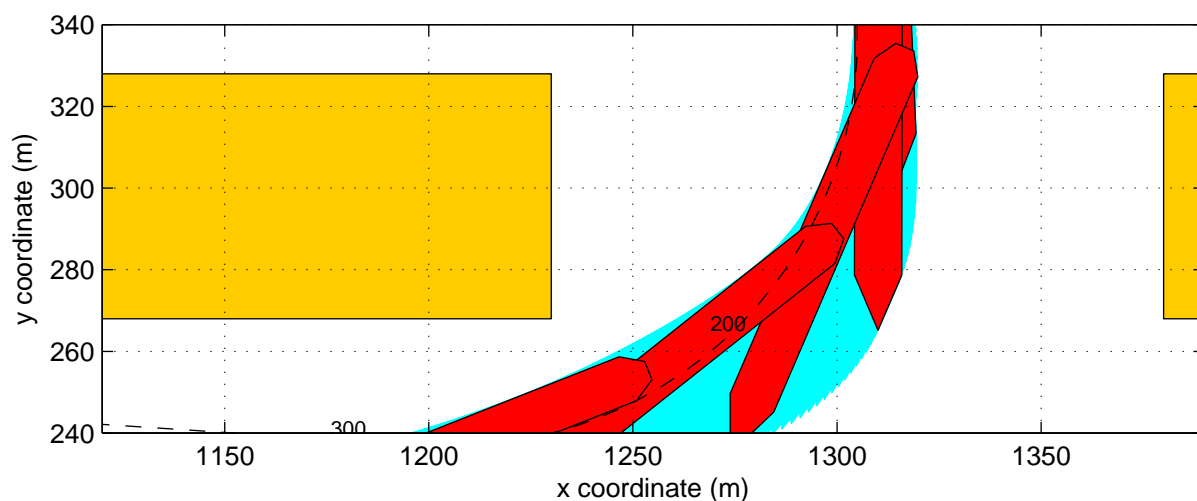
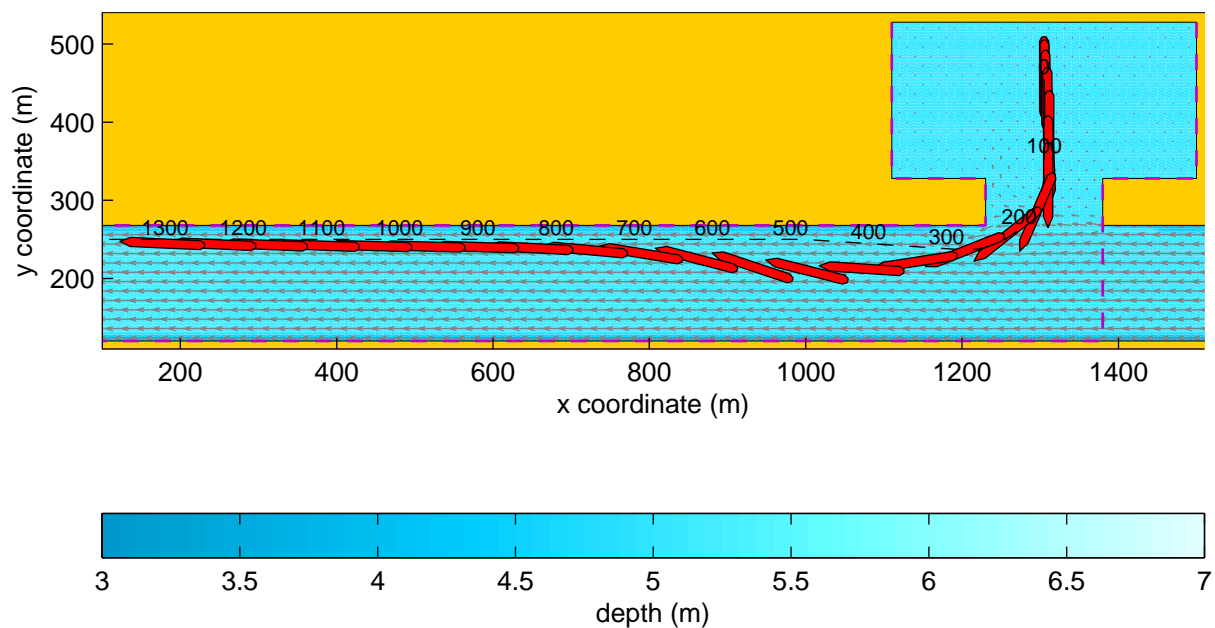
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 15

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 16

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

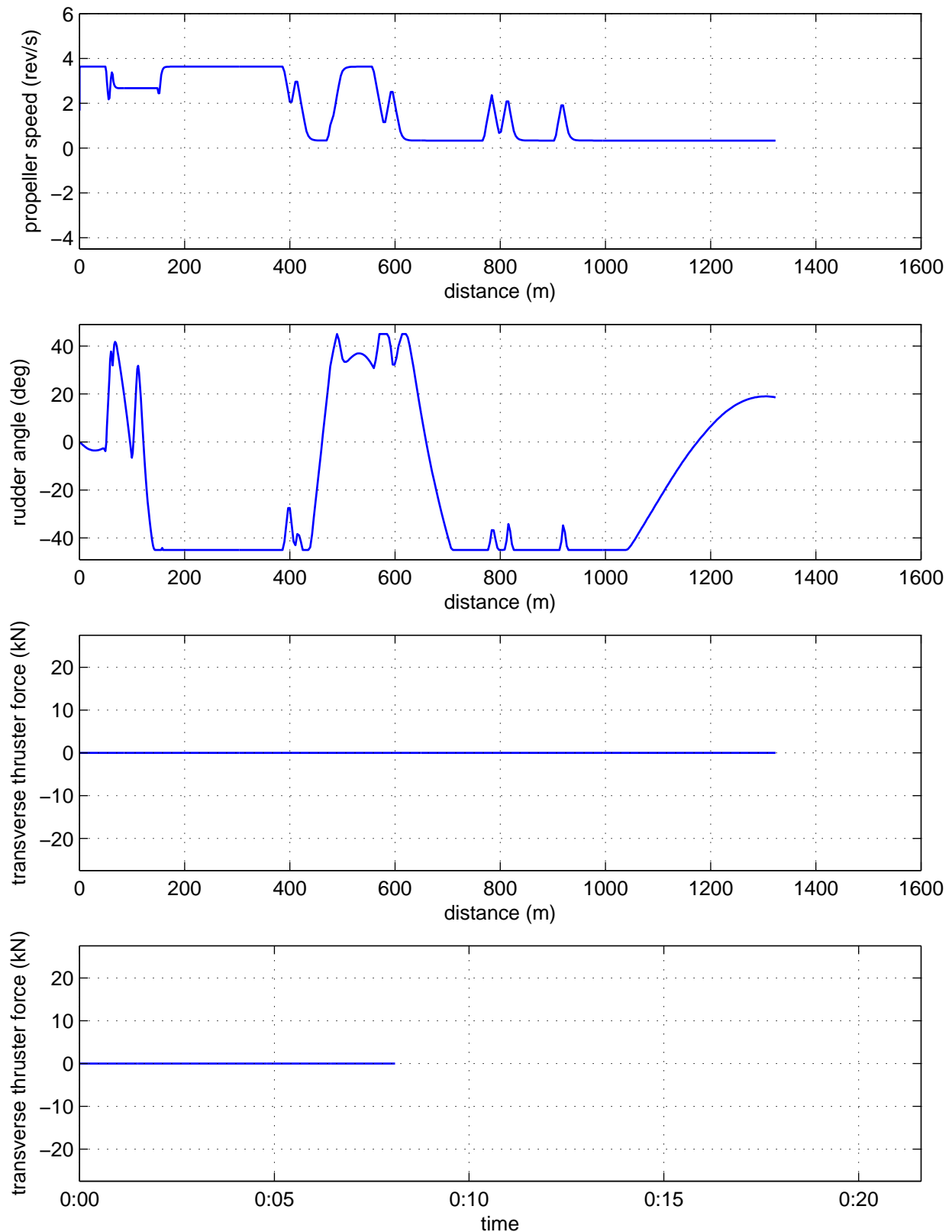
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 16

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

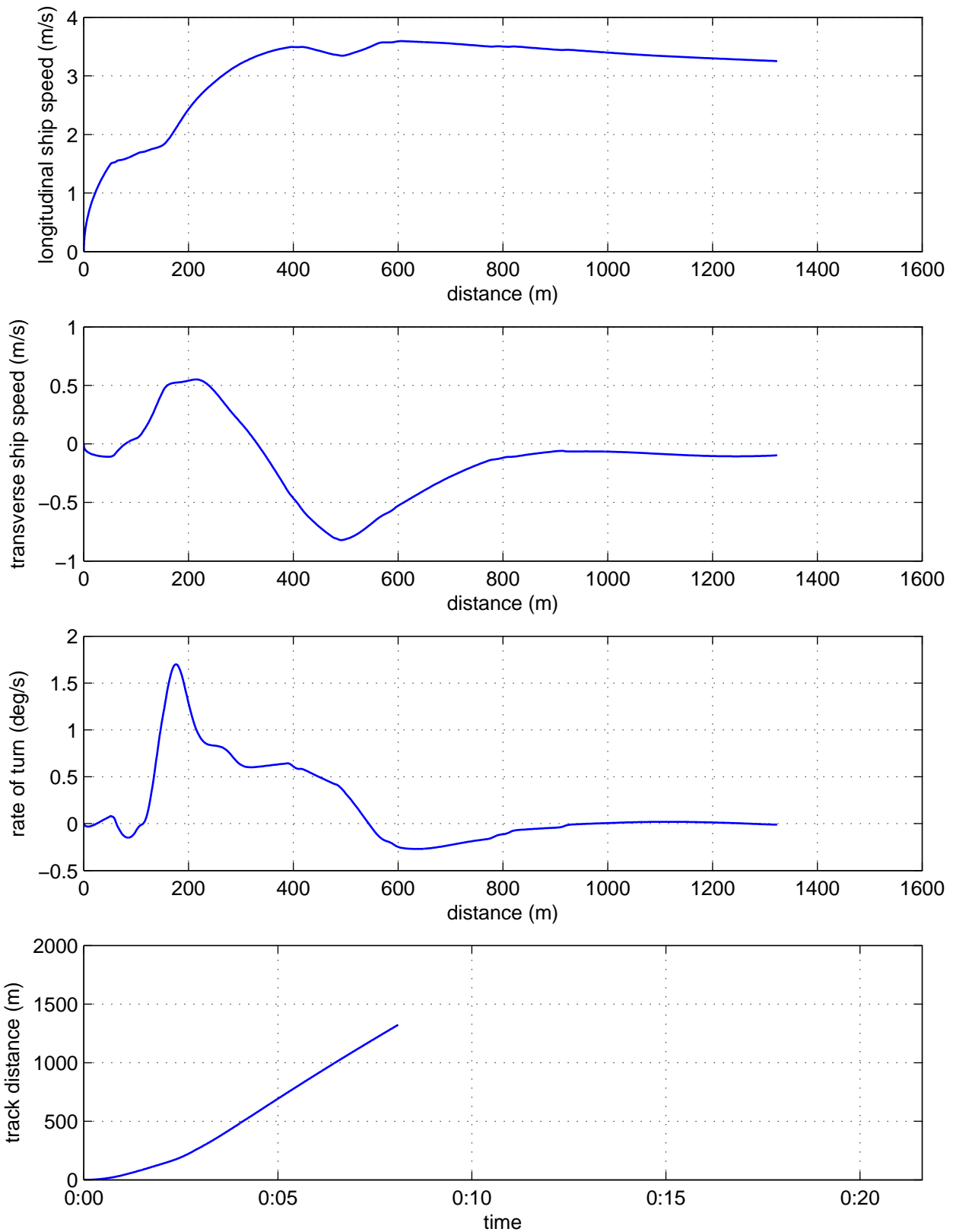
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 16

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 2.5 m/s

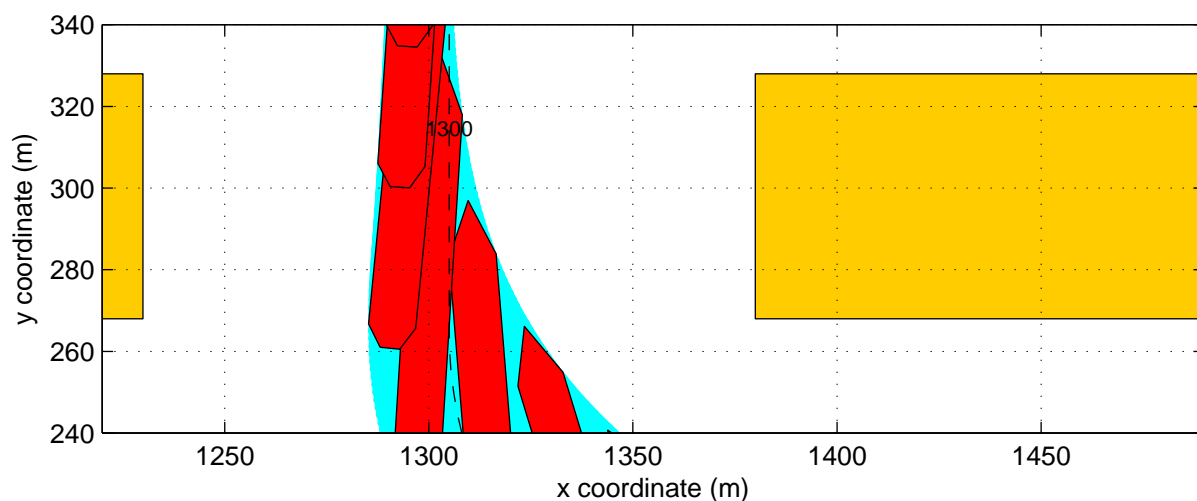
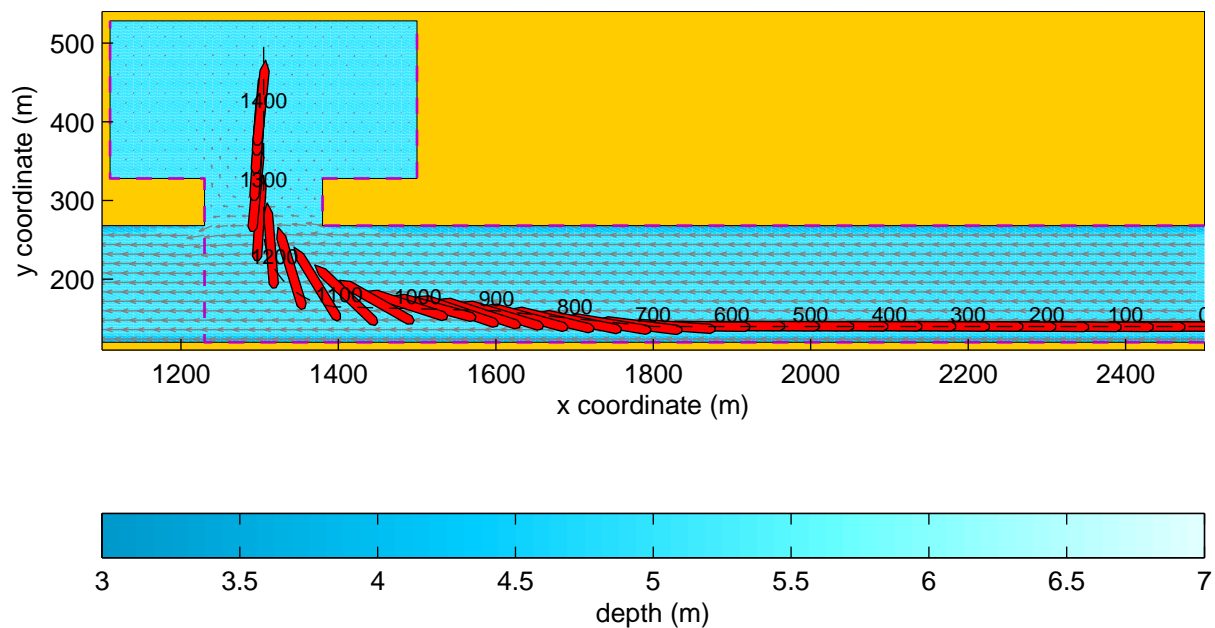
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 16

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

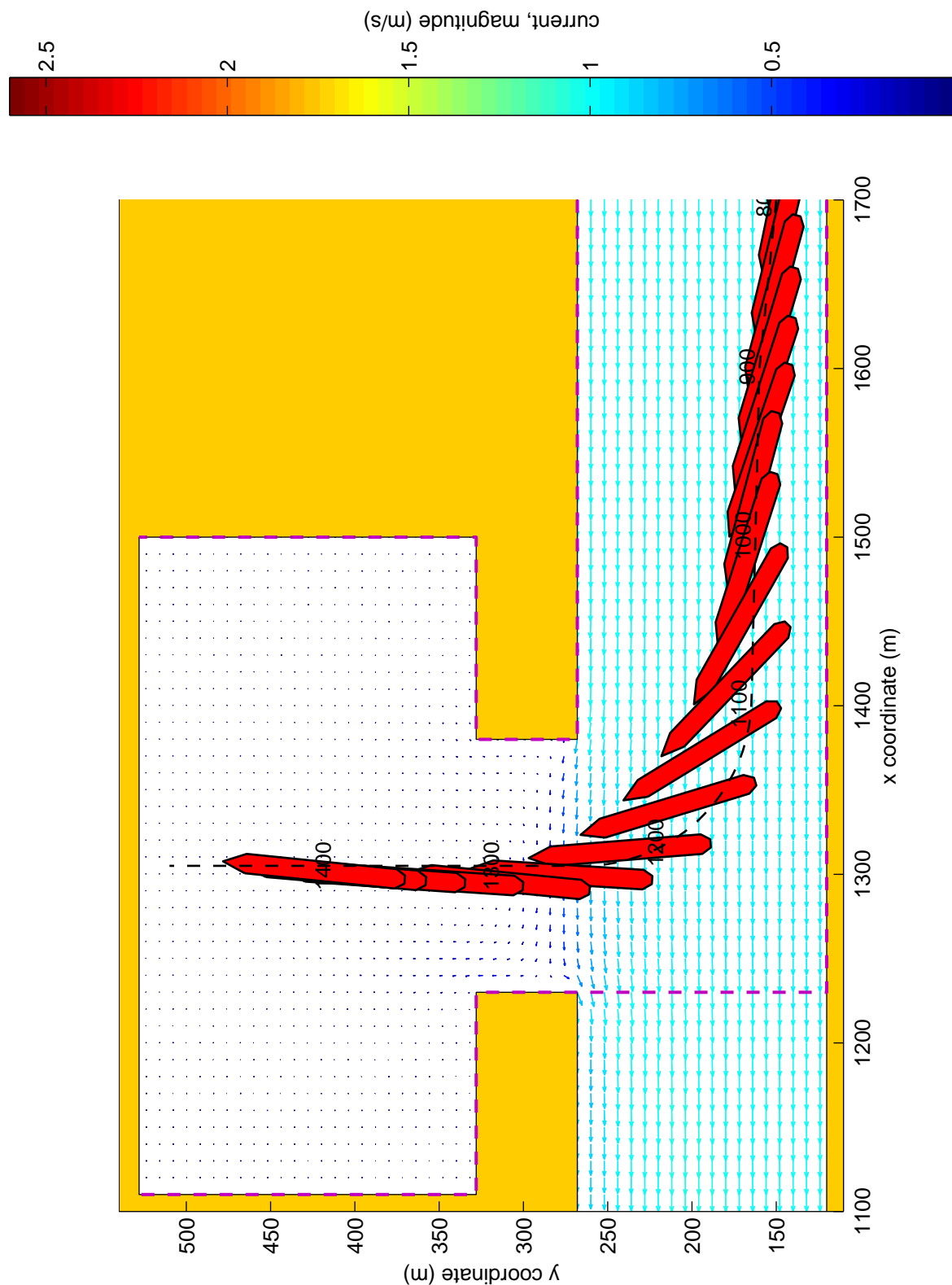
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 17

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

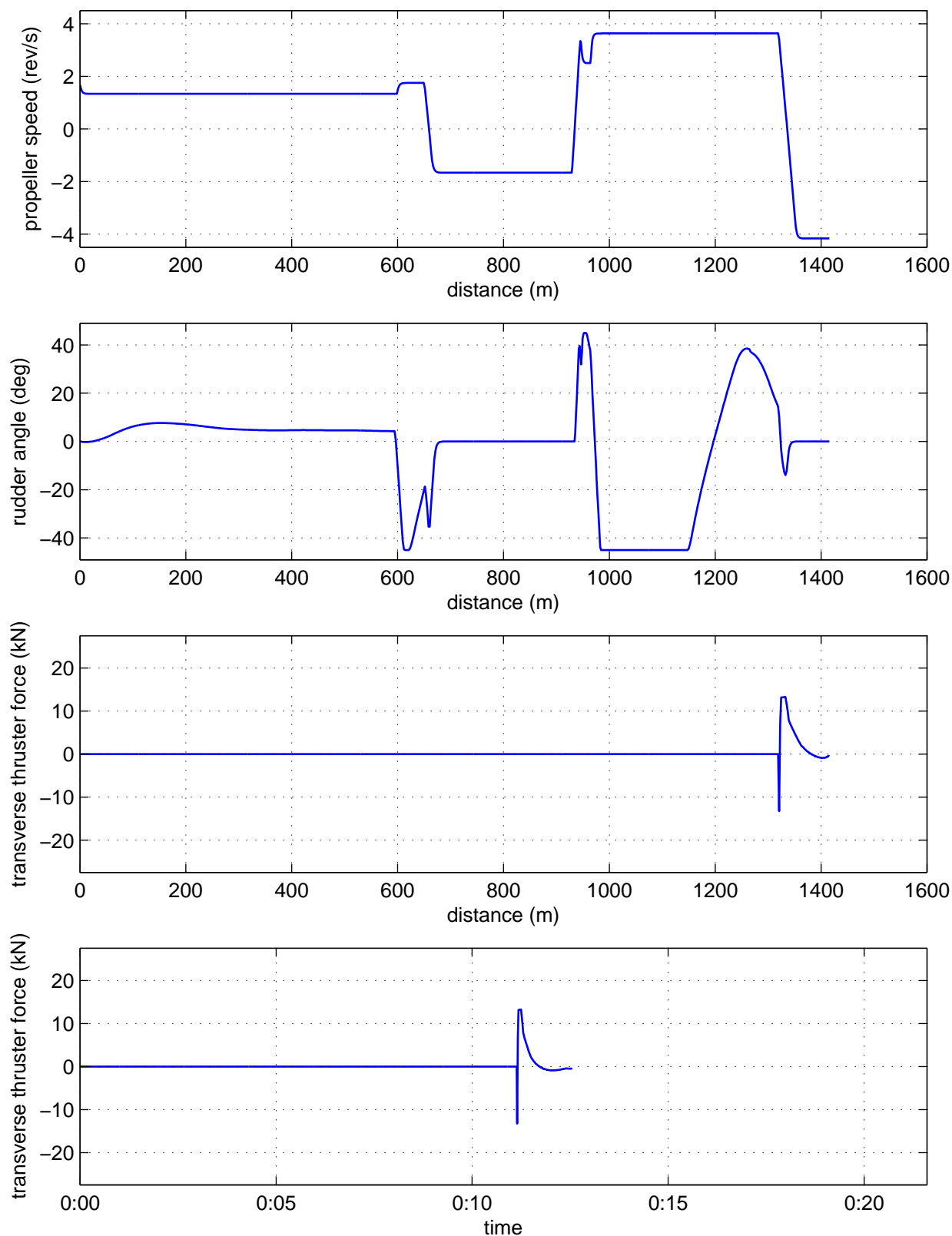
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 17

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

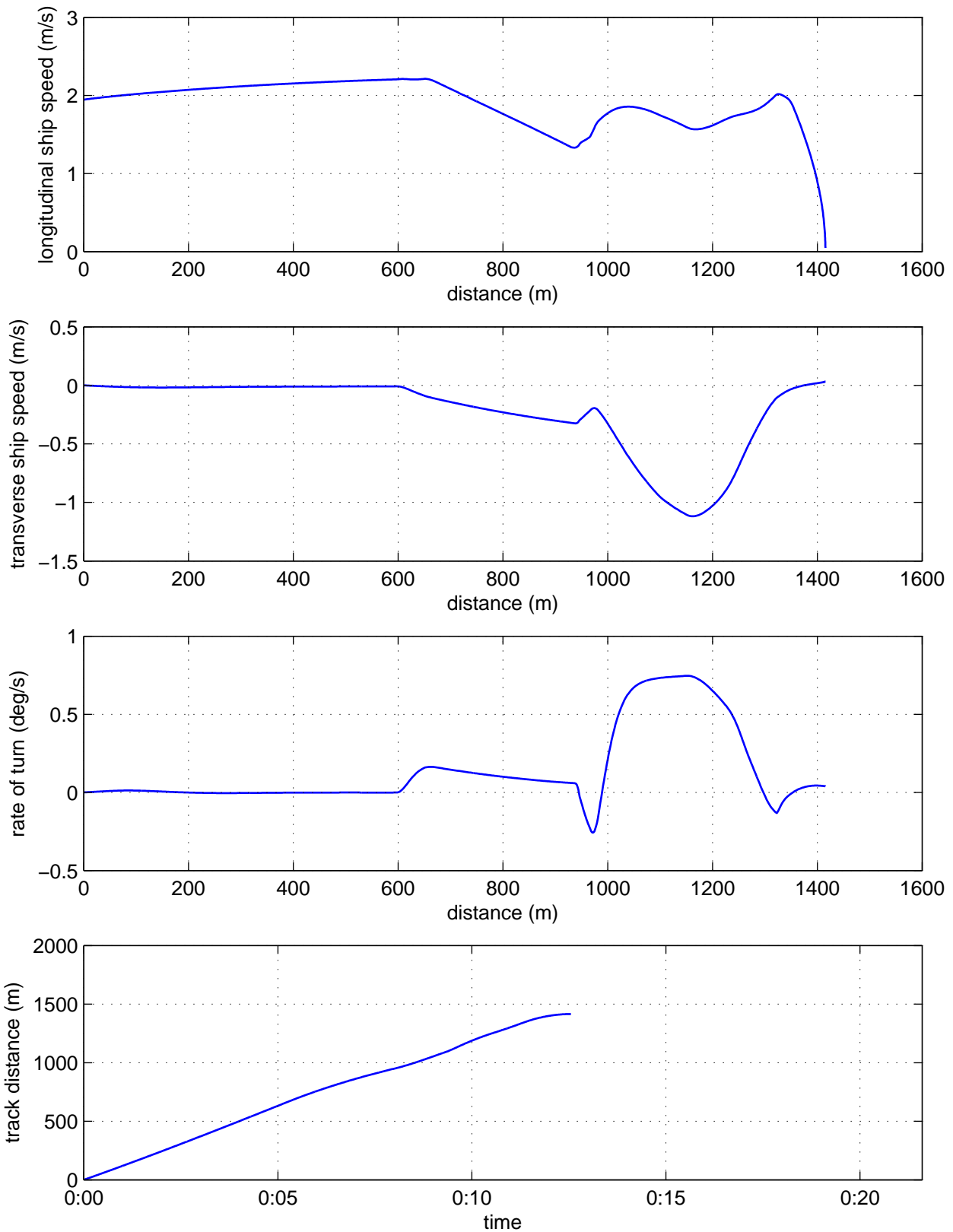
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 17

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

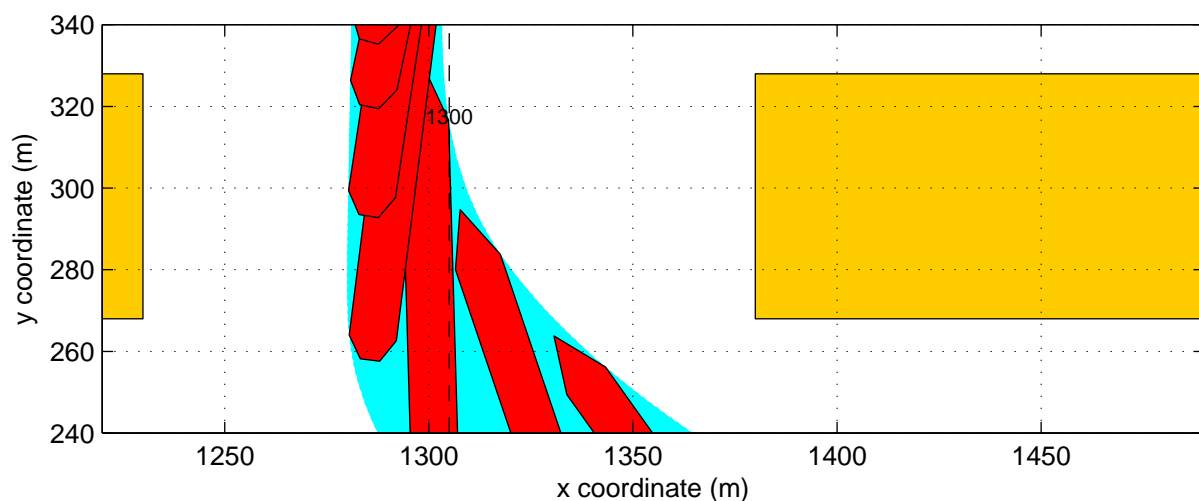
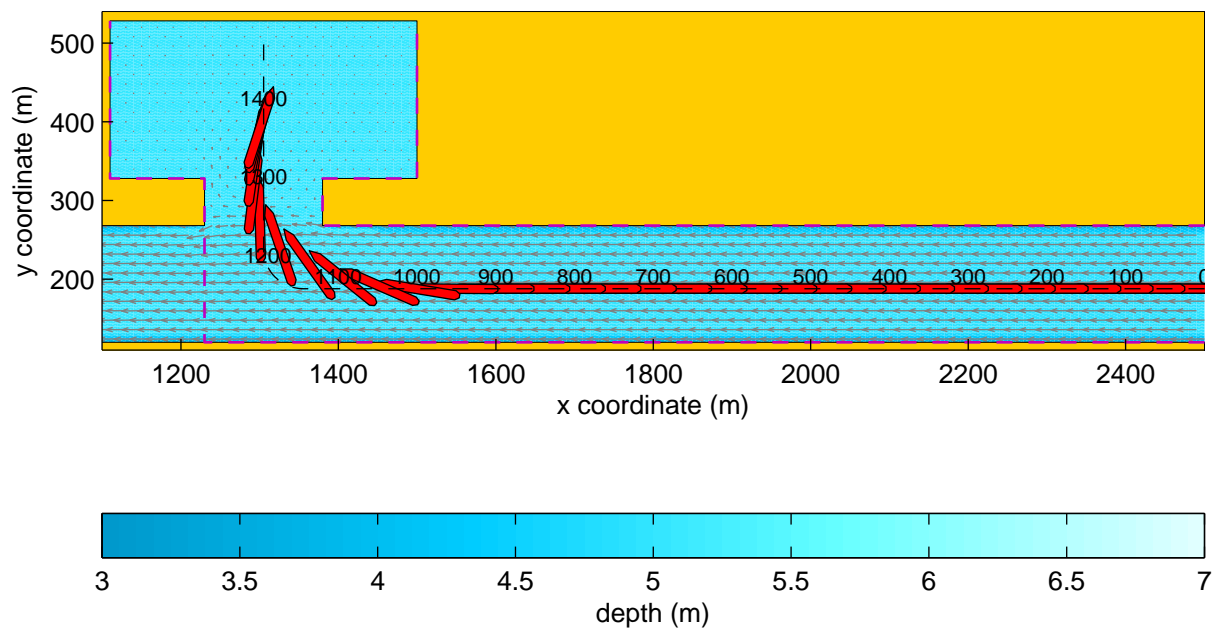
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 17

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 18

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

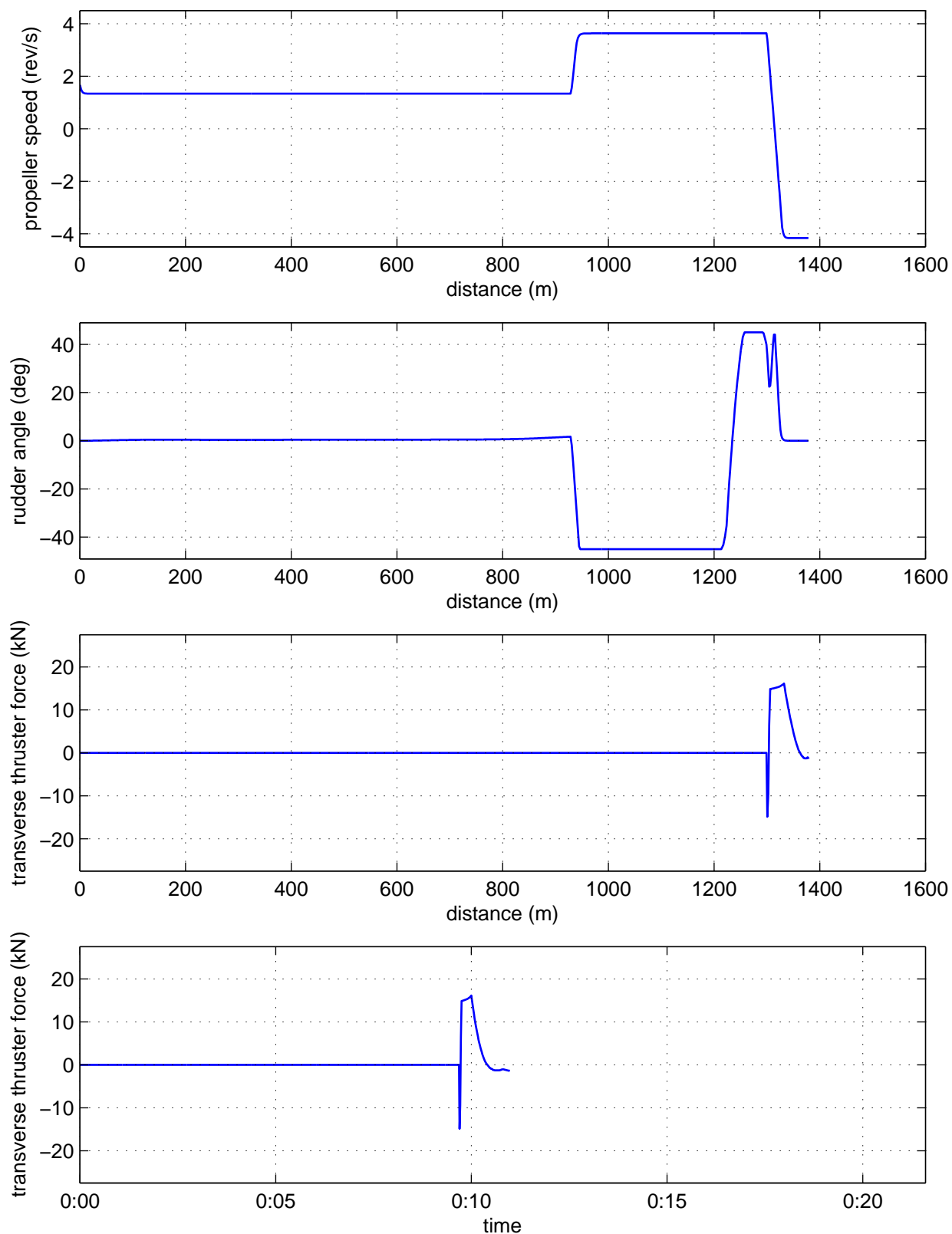
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 18

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

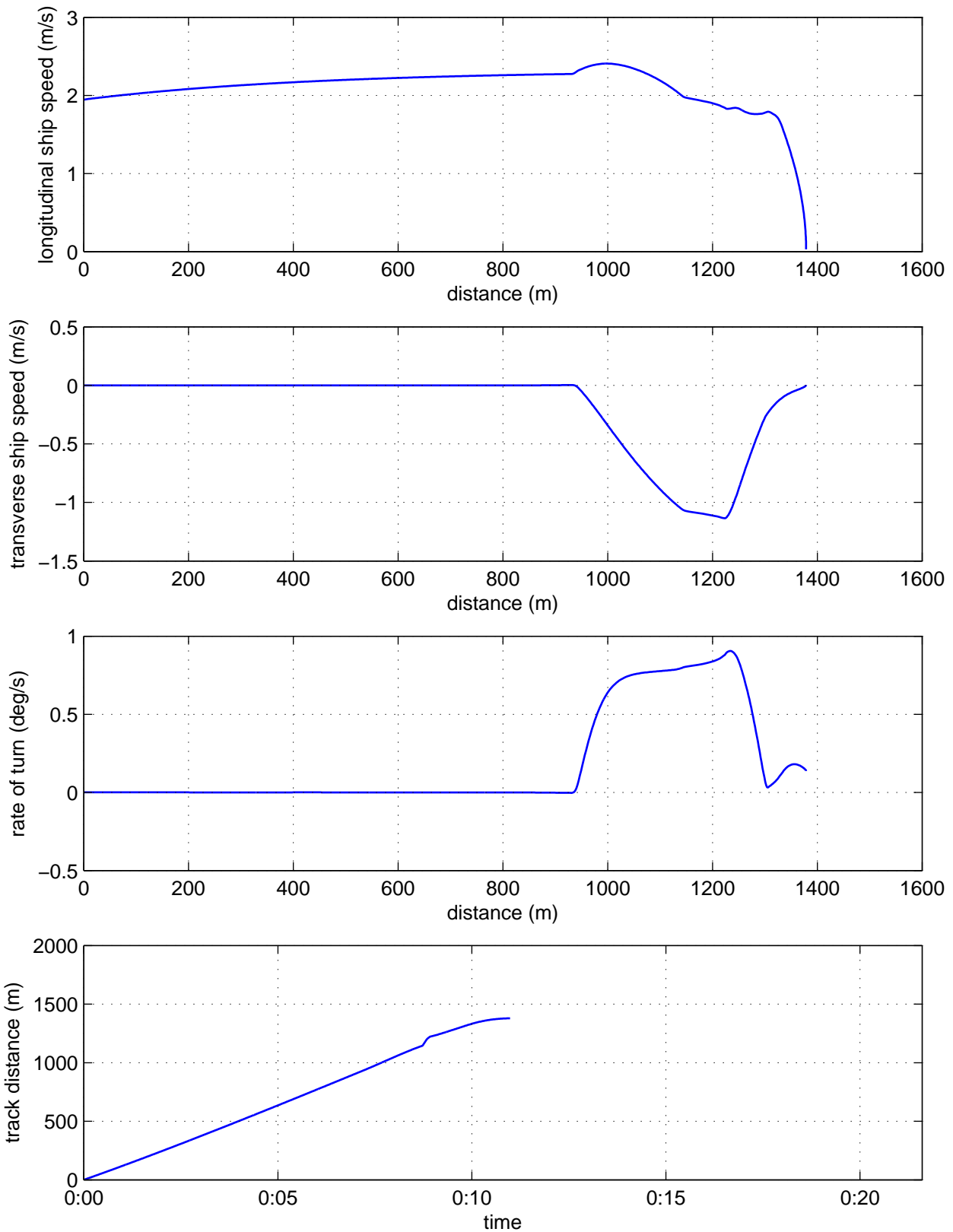
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 18

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 1.0 m/s

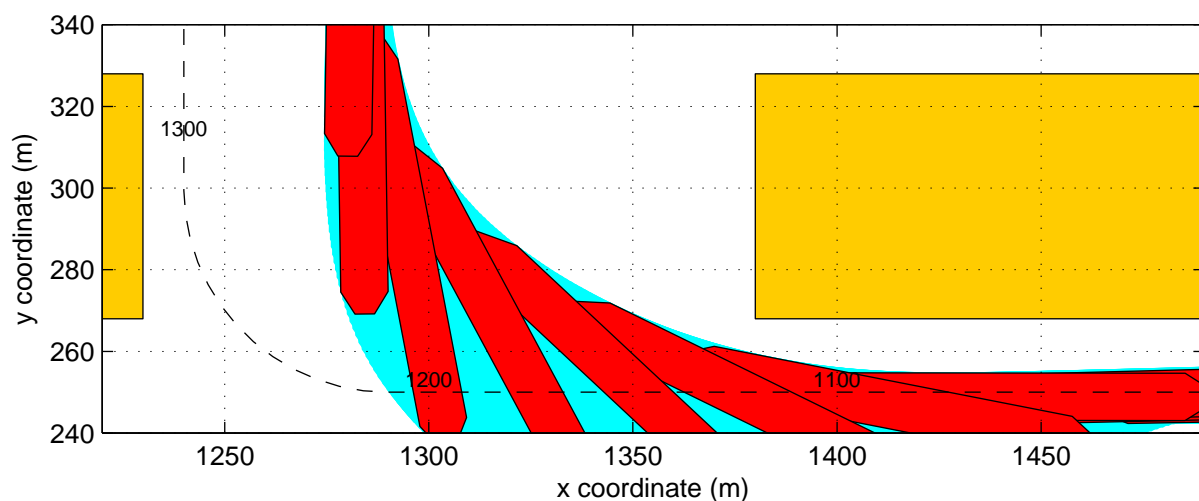
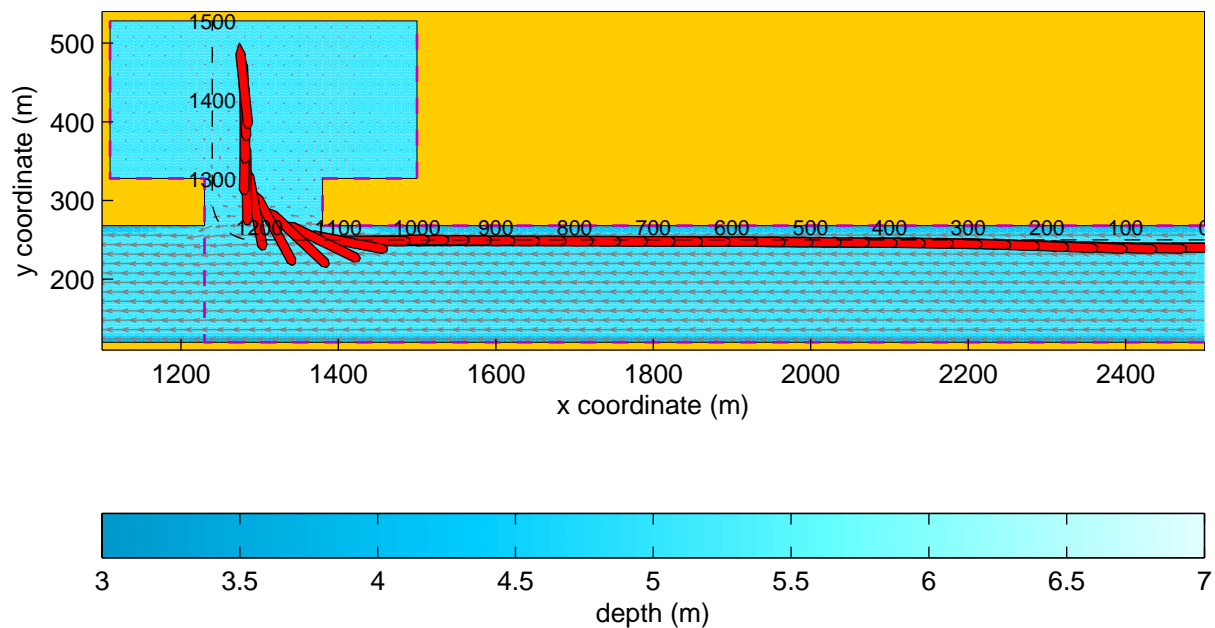
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 18

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 19

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

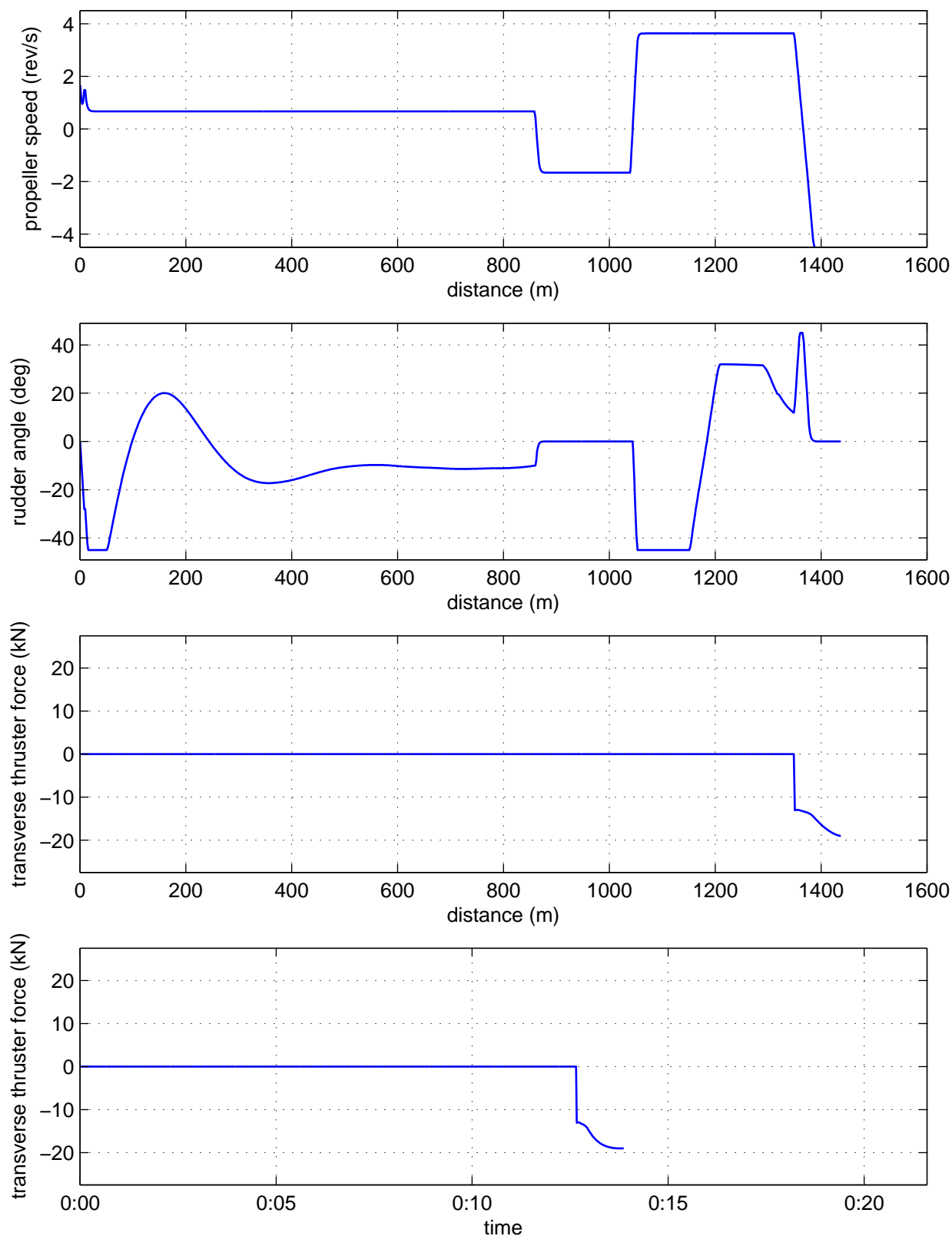
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 19

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

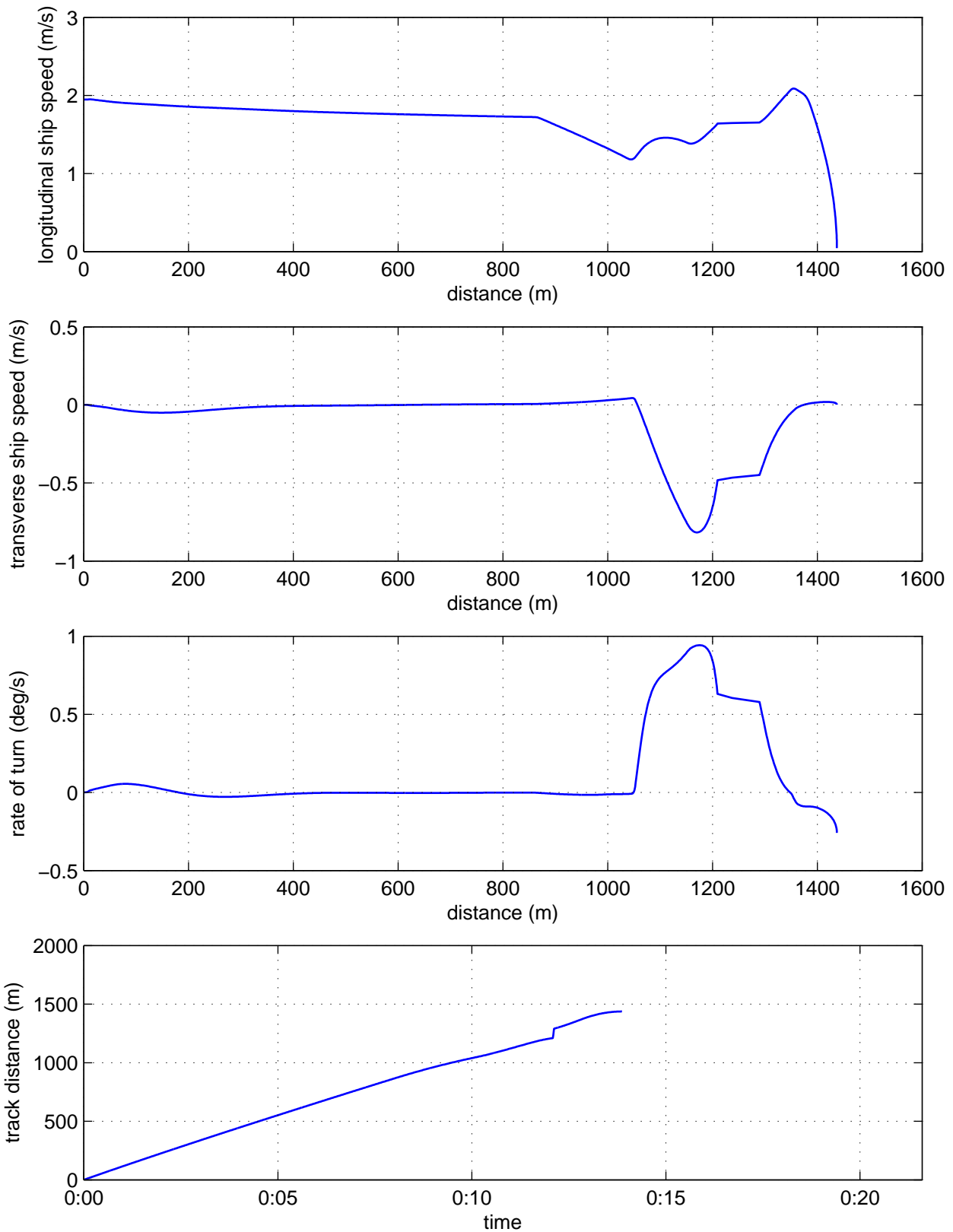
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 19

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

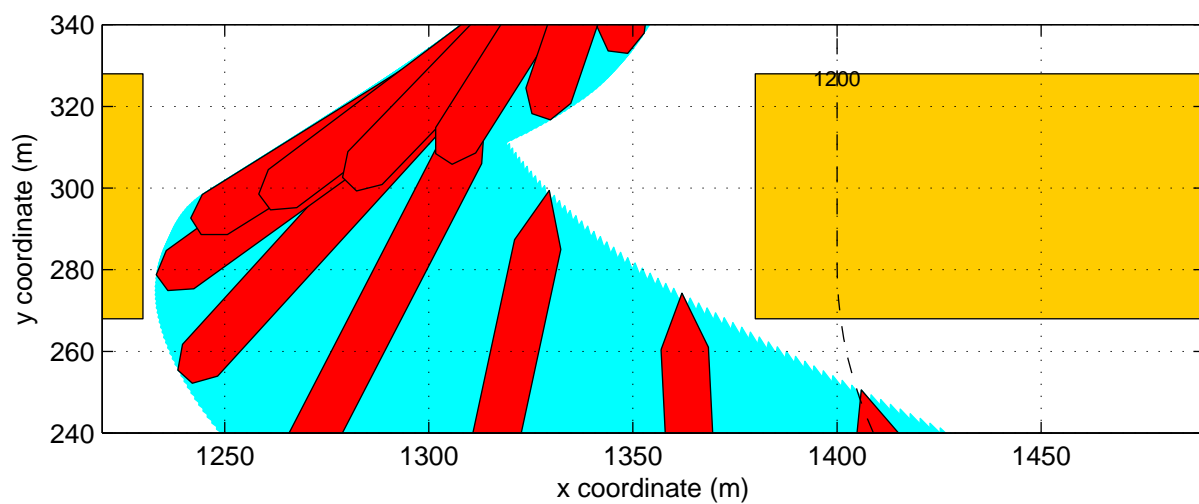
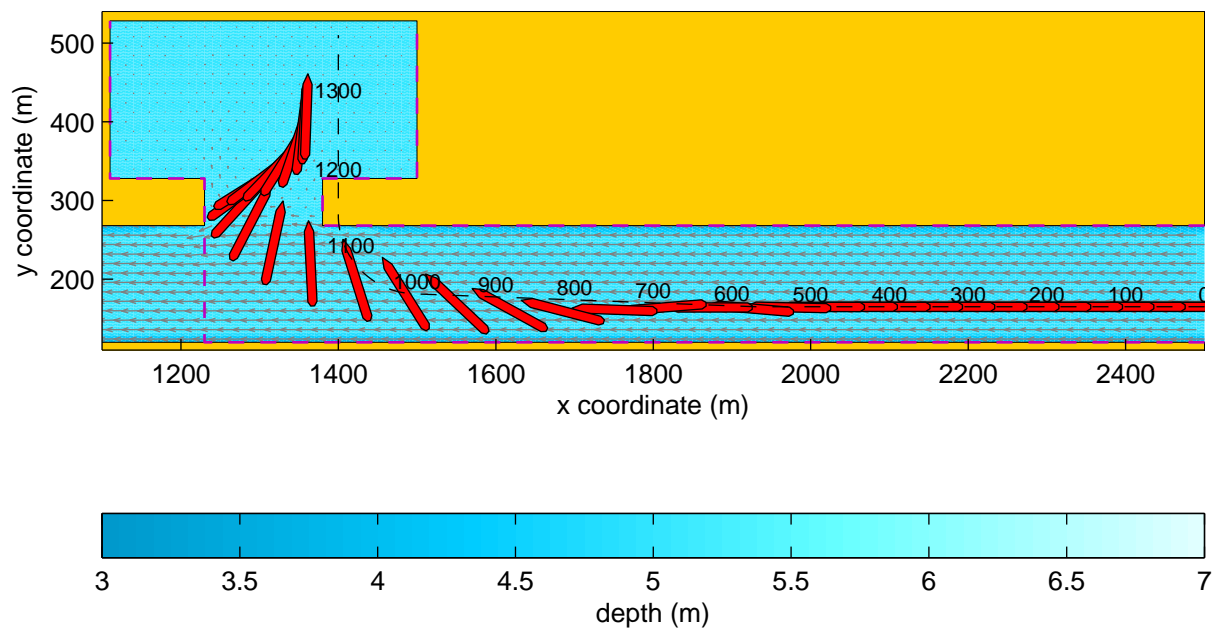
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 19

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

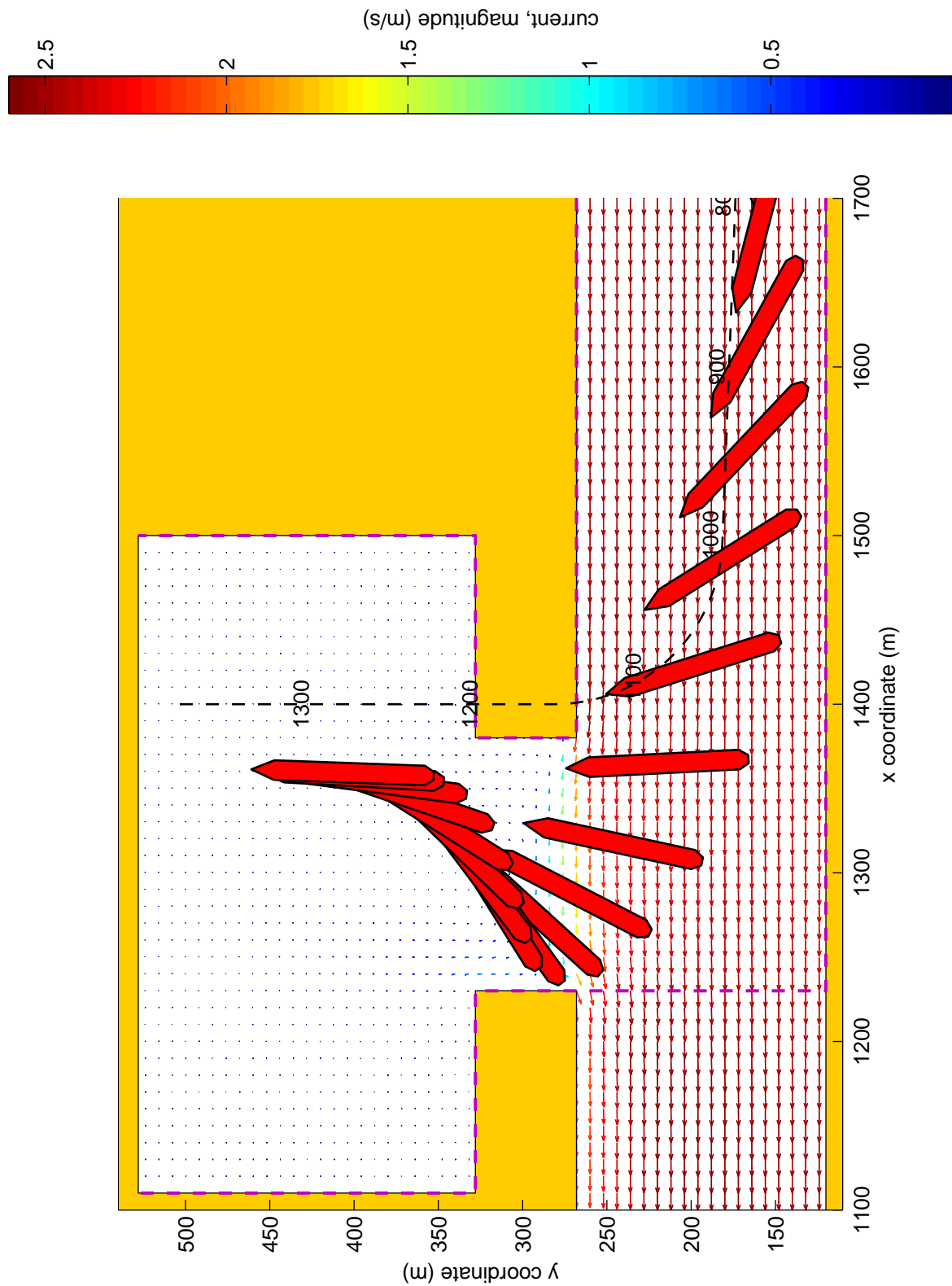
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 20

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

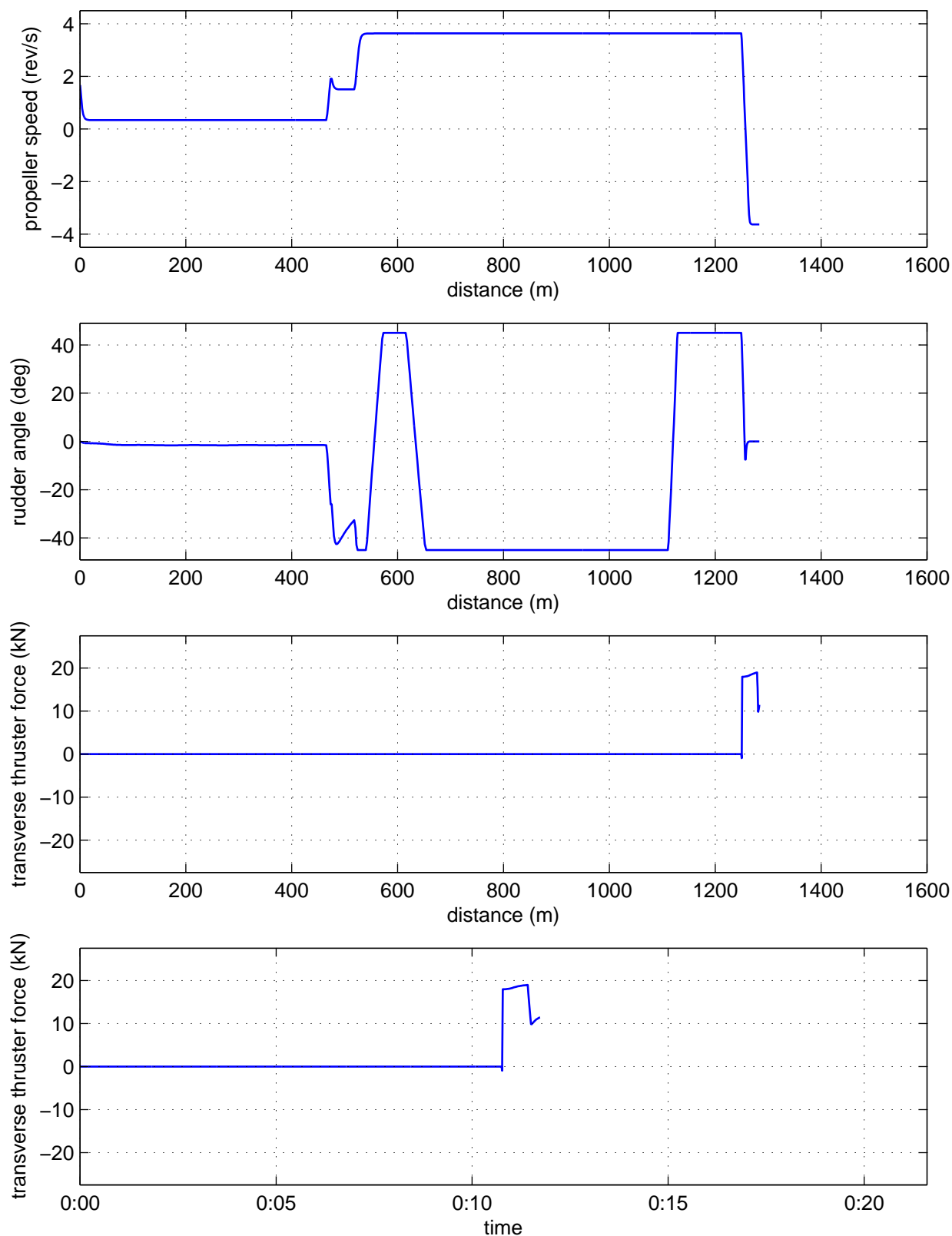
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 20

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

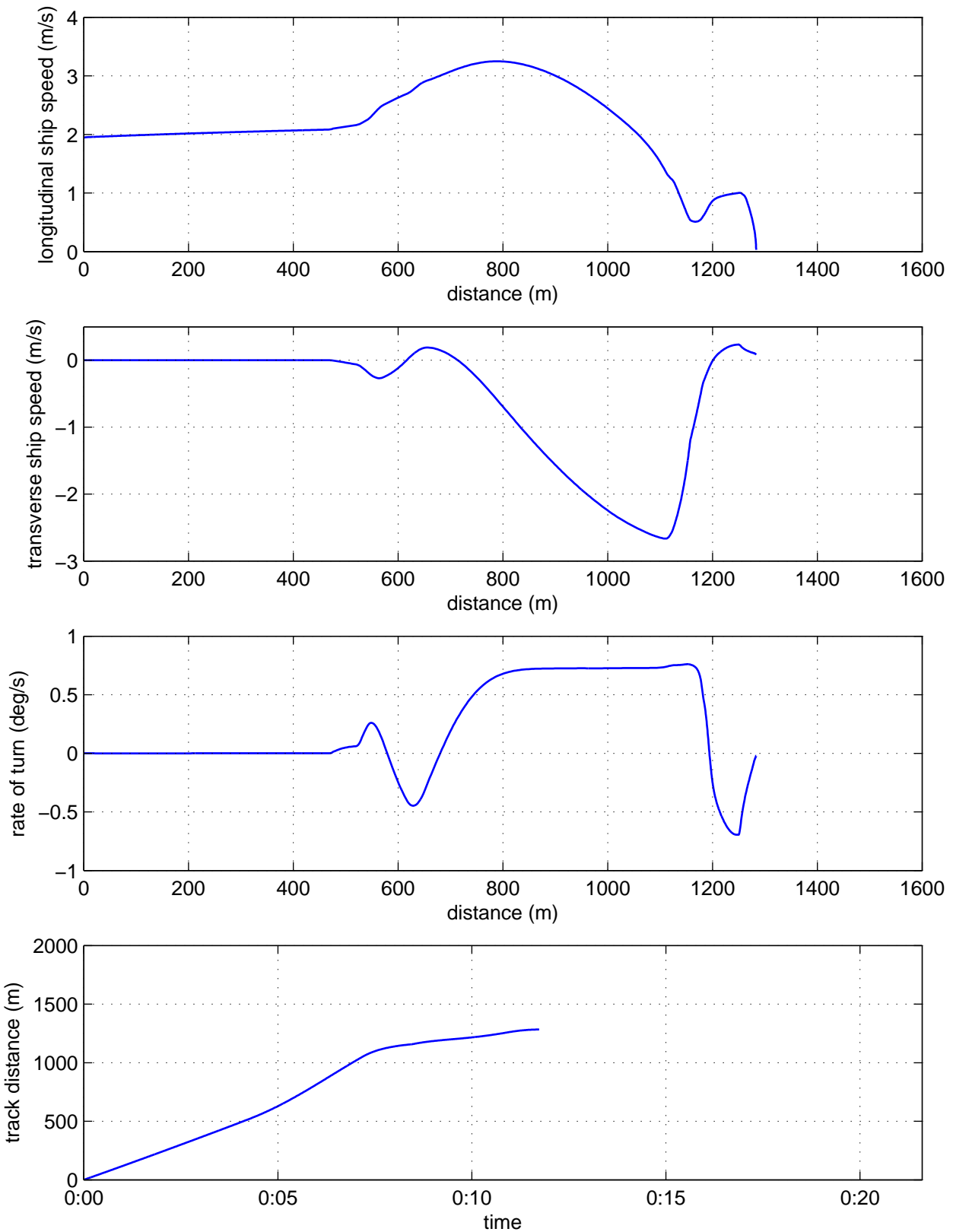
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 20

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 2.5 m/s

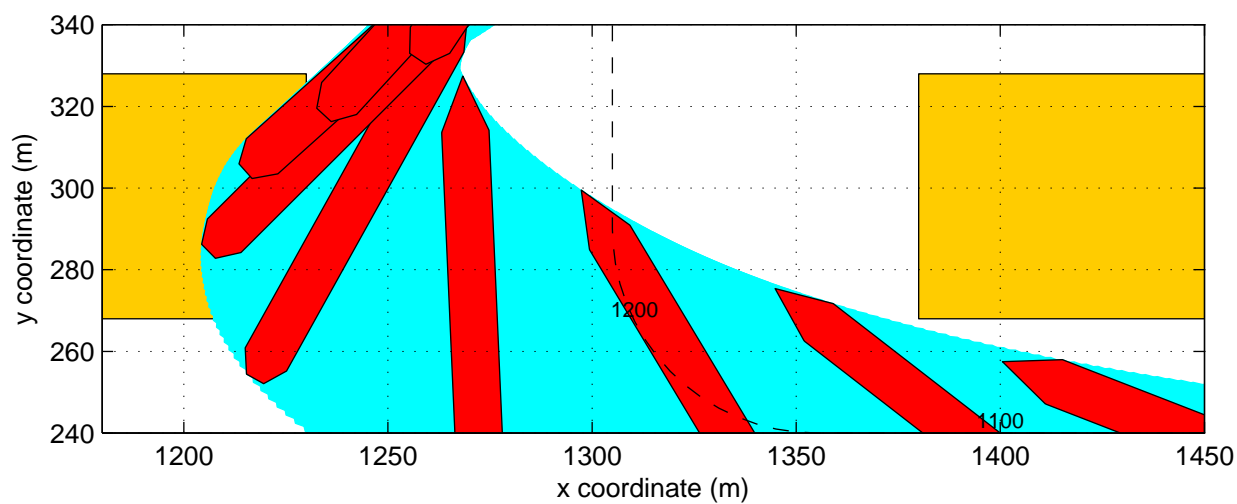
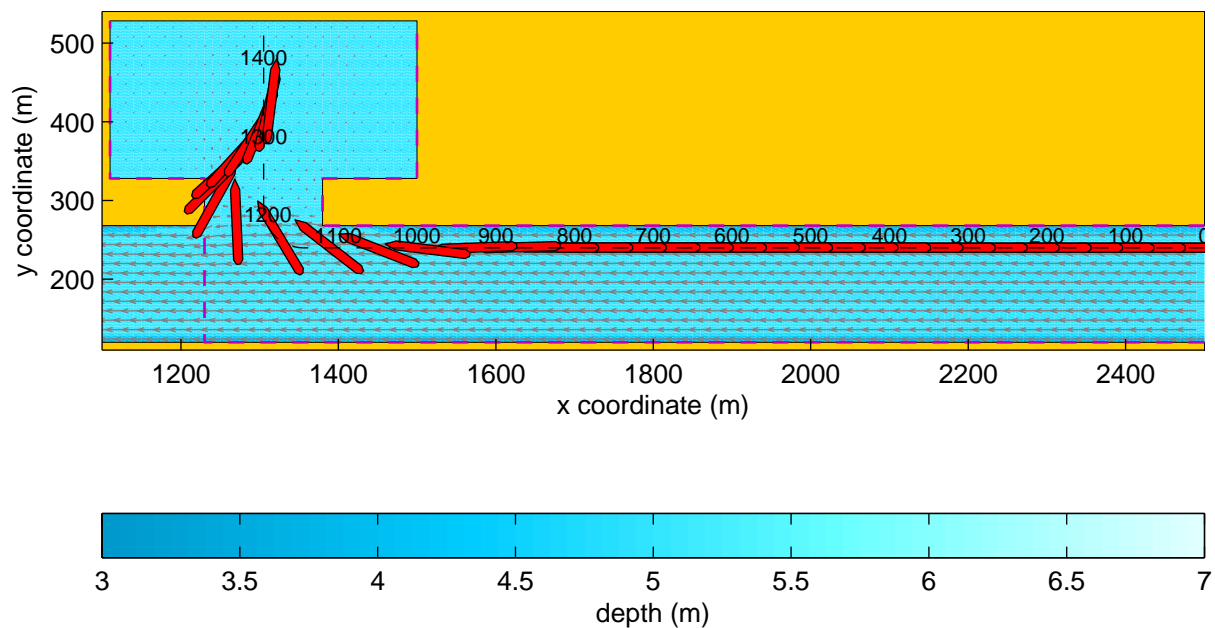
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 20

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 2

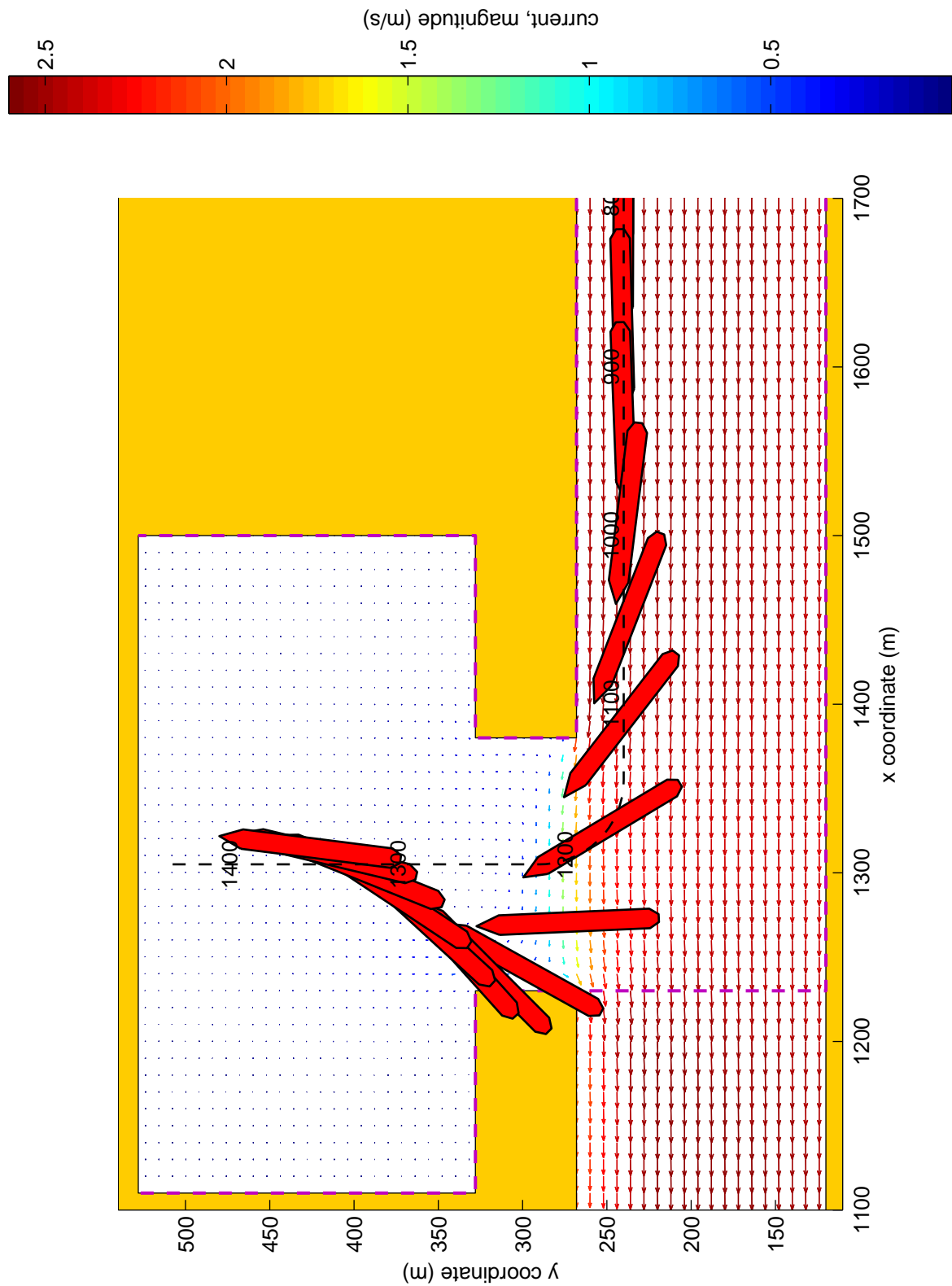
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 21

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 2

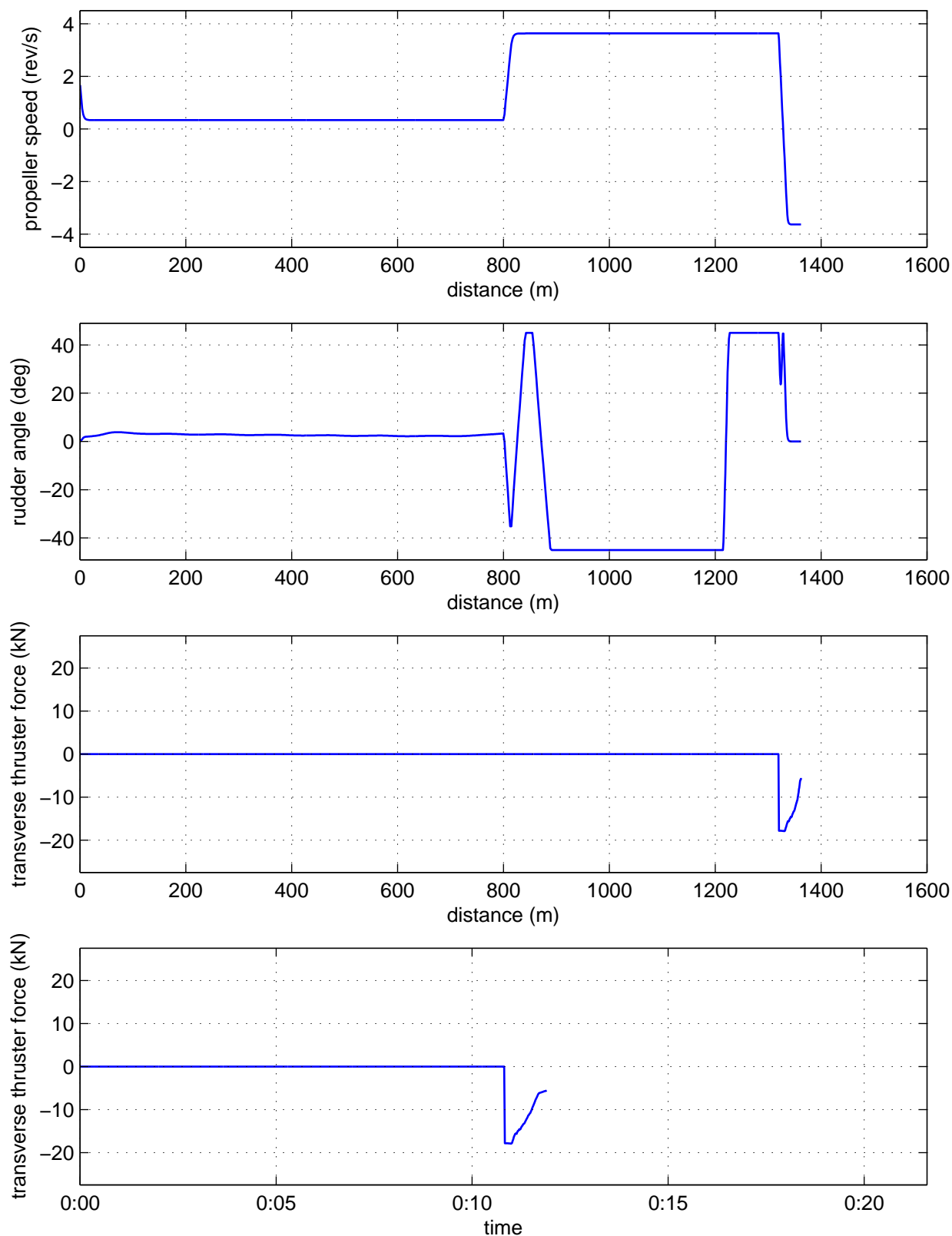
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 21

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

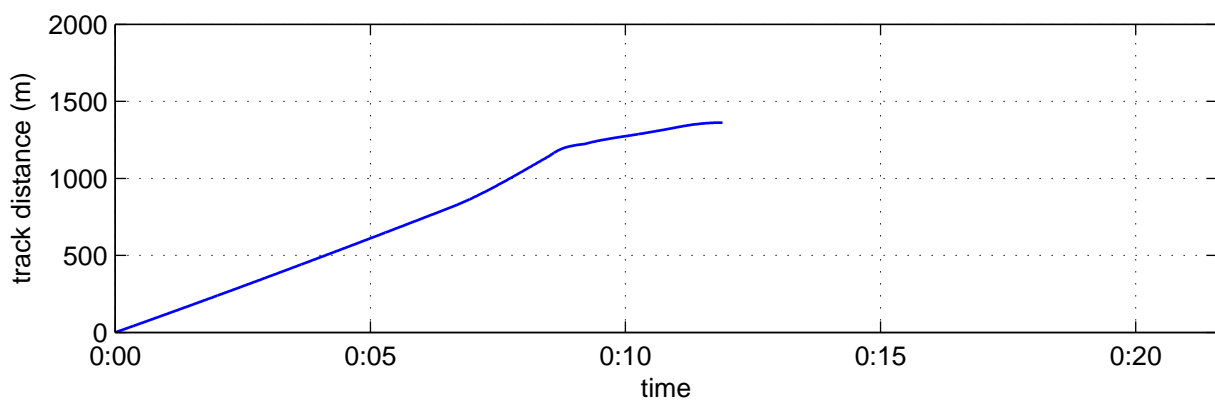
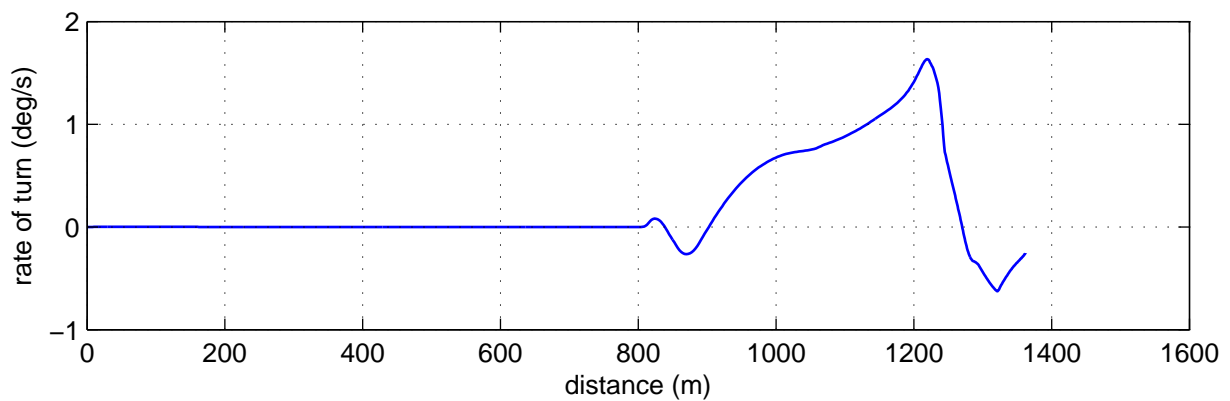
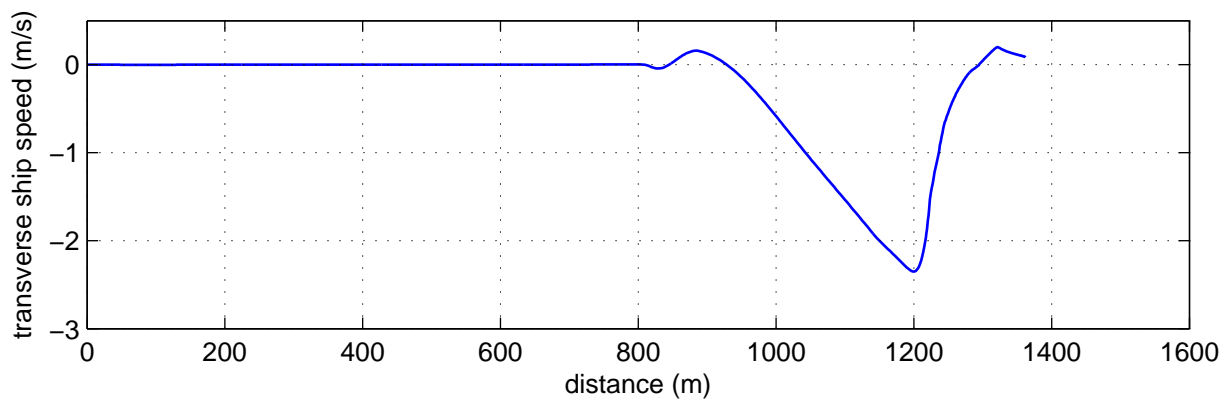
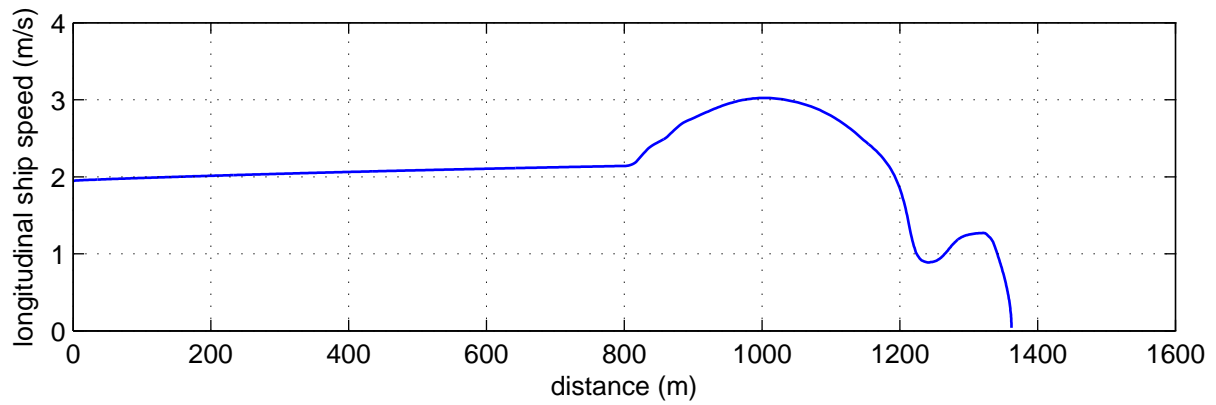
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 21

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

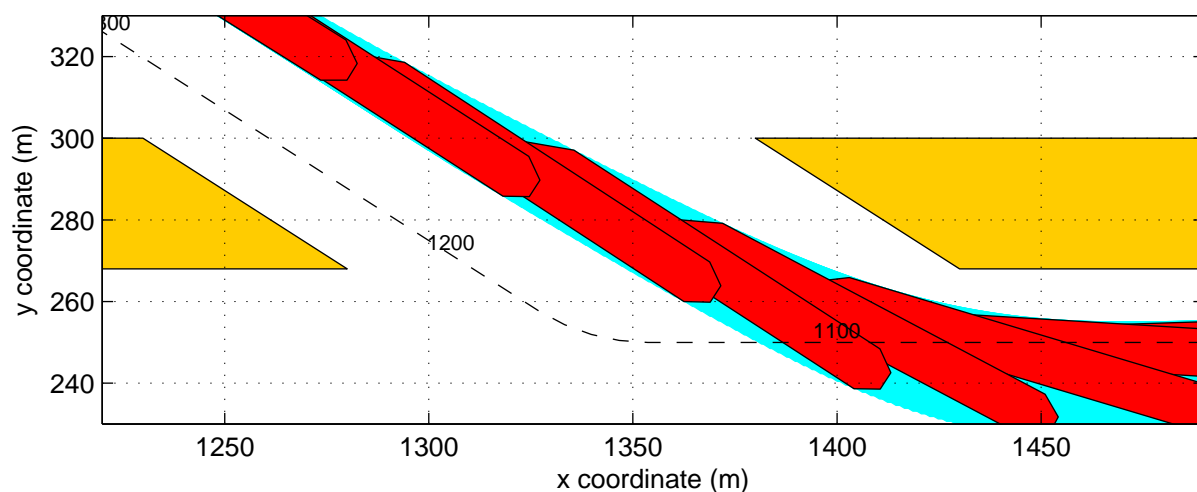
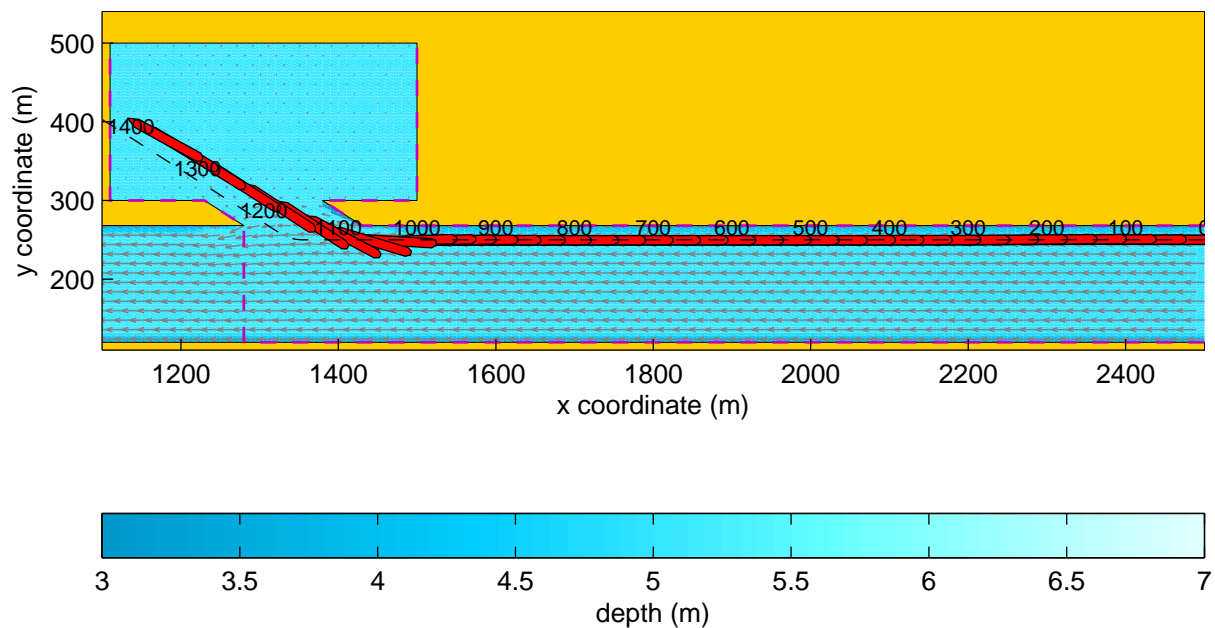
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 21

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 3

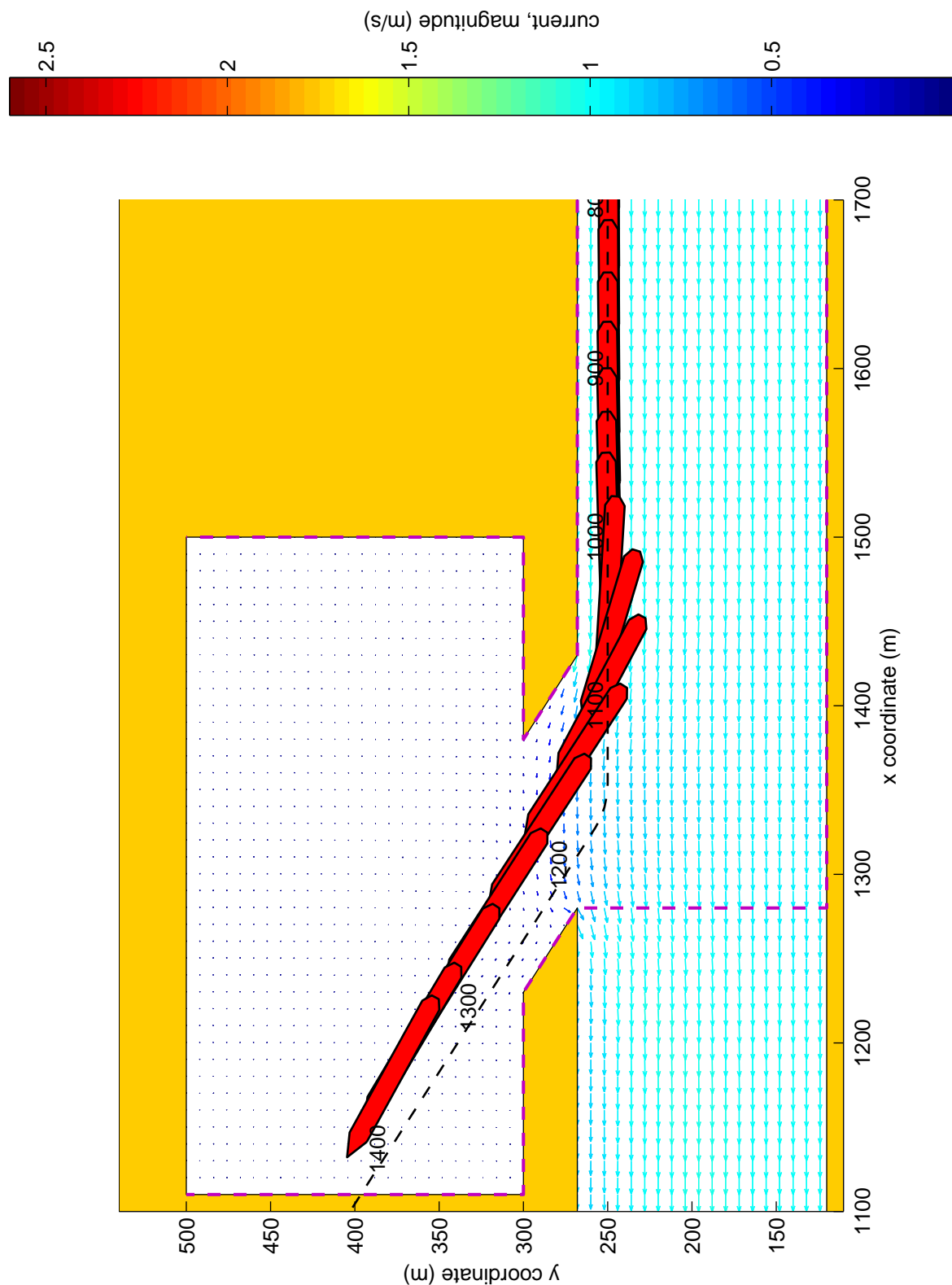
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 22

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 3

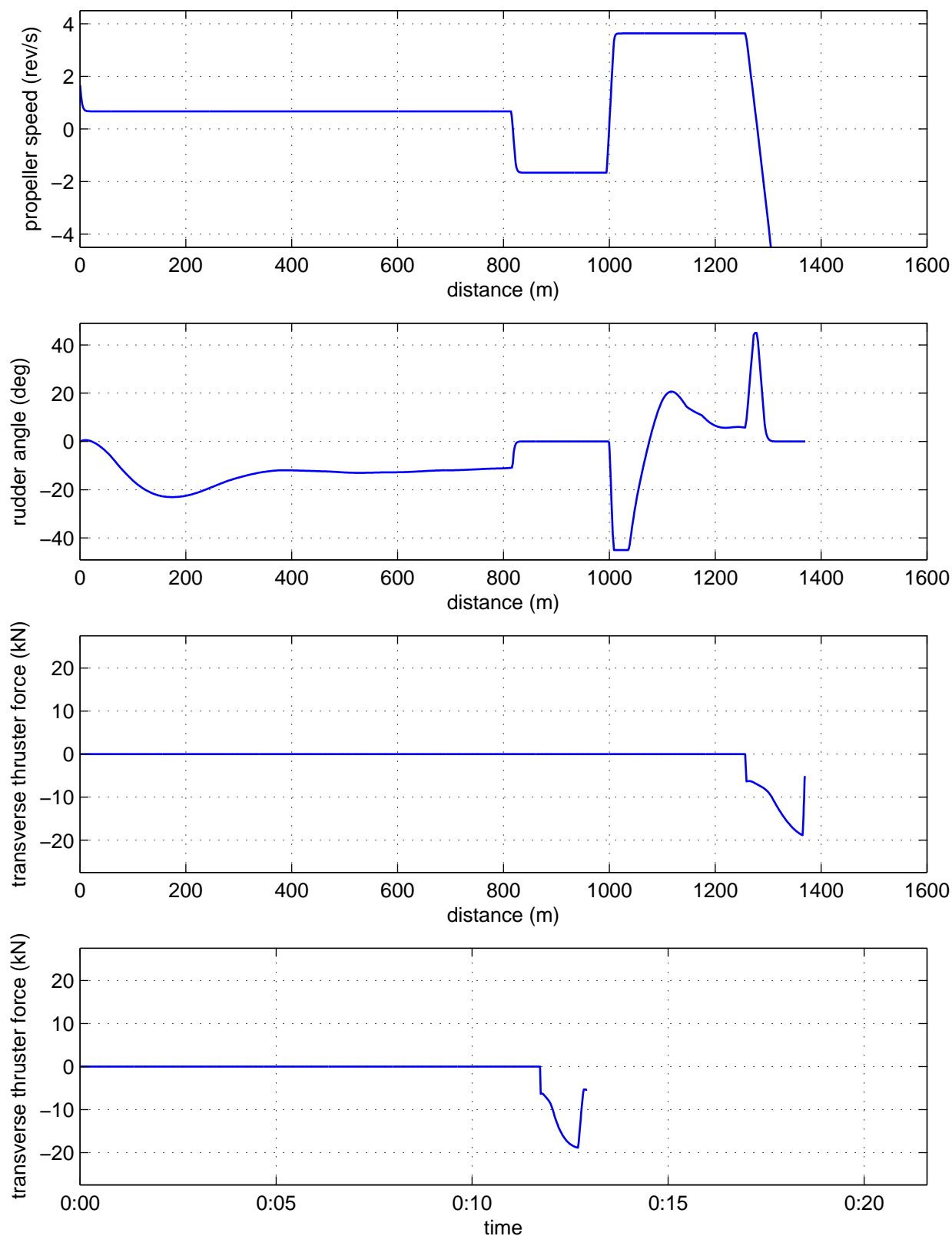
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 22

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 3

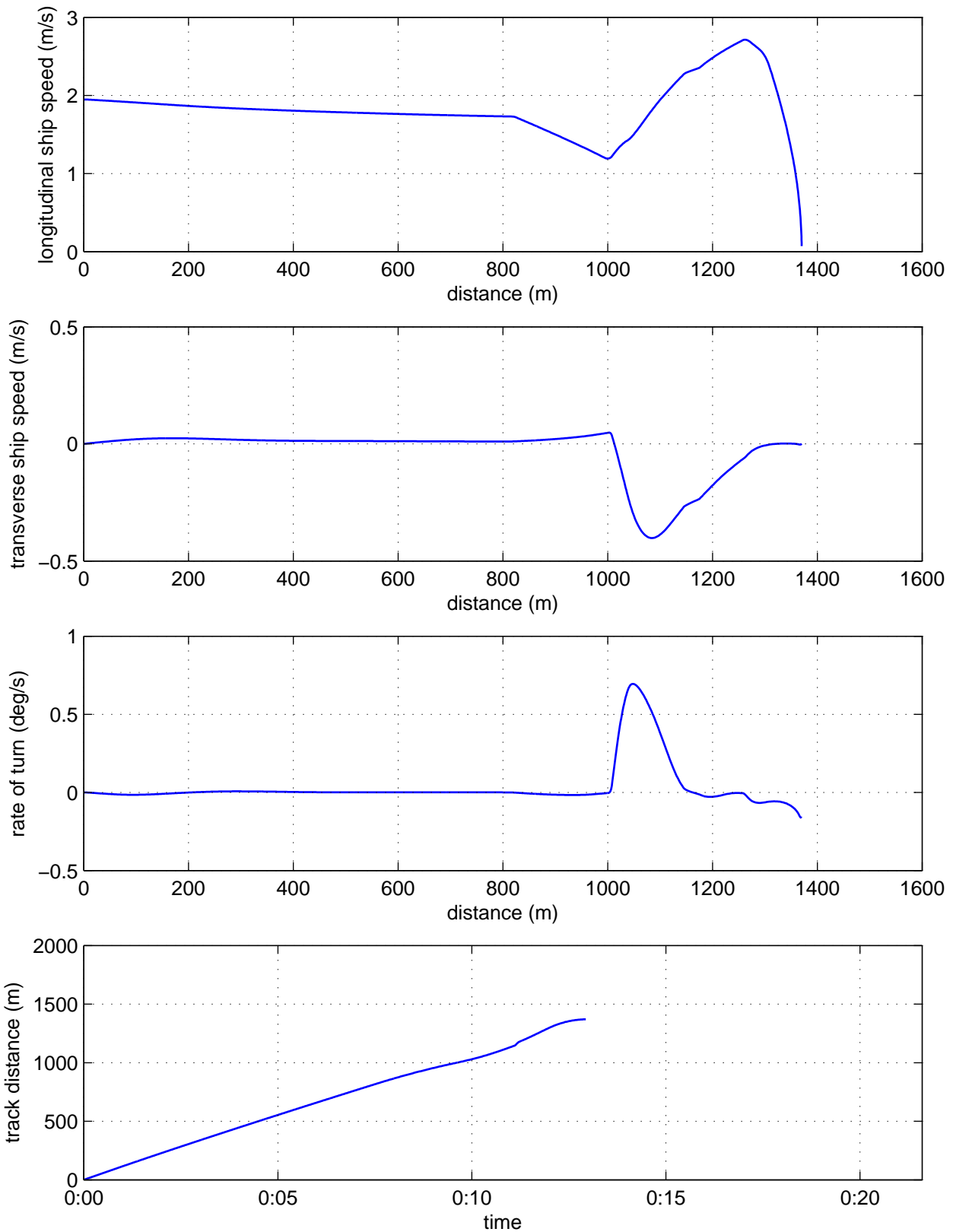
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 22

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 3

Current: 1.0 m/s

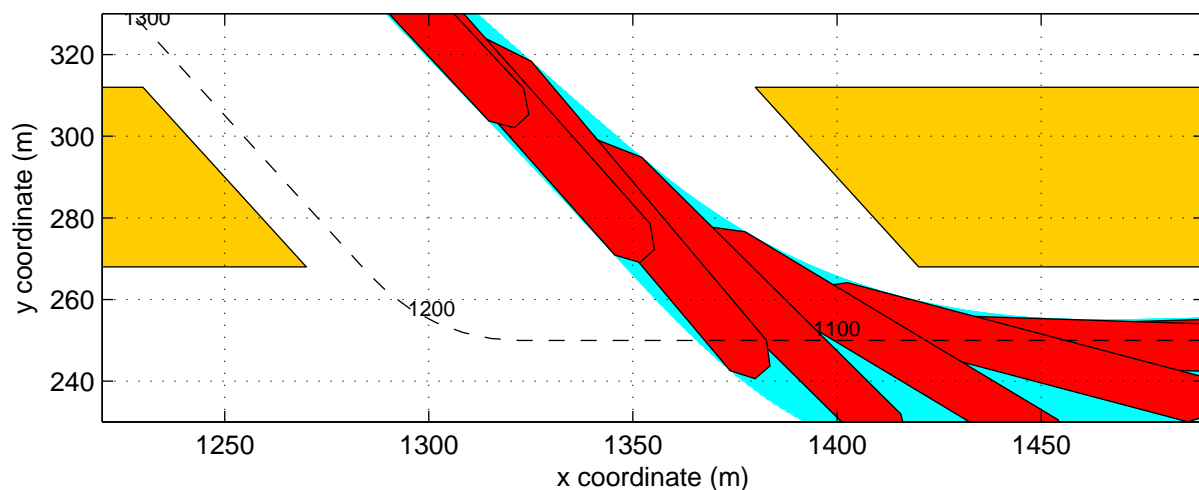
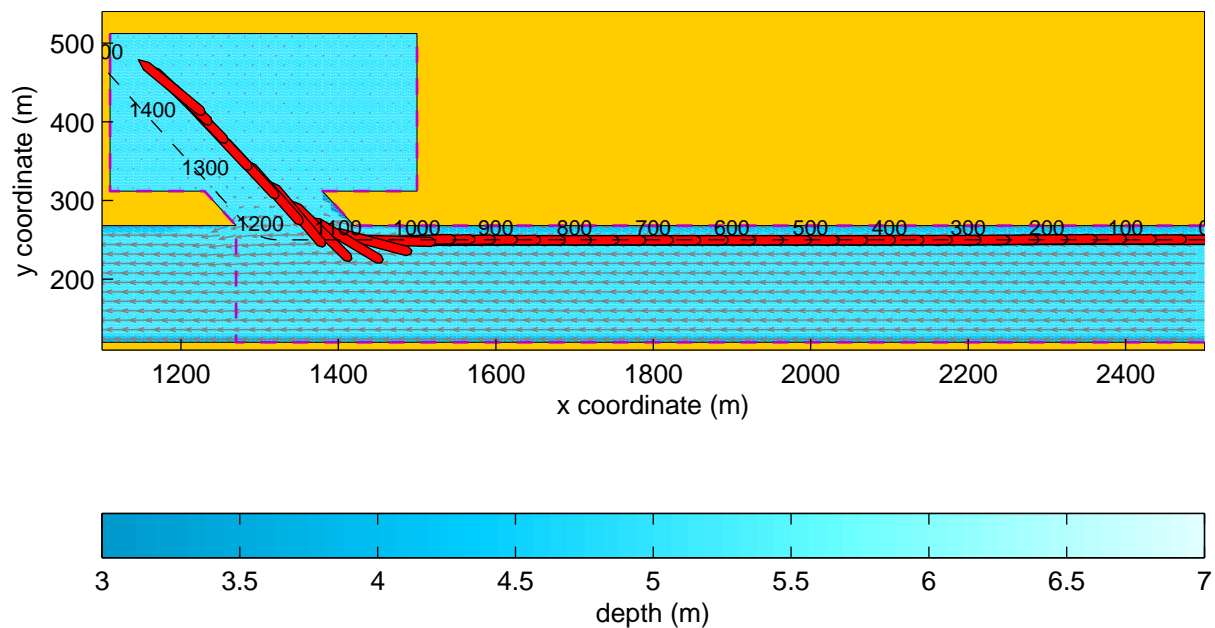
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 22

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 4

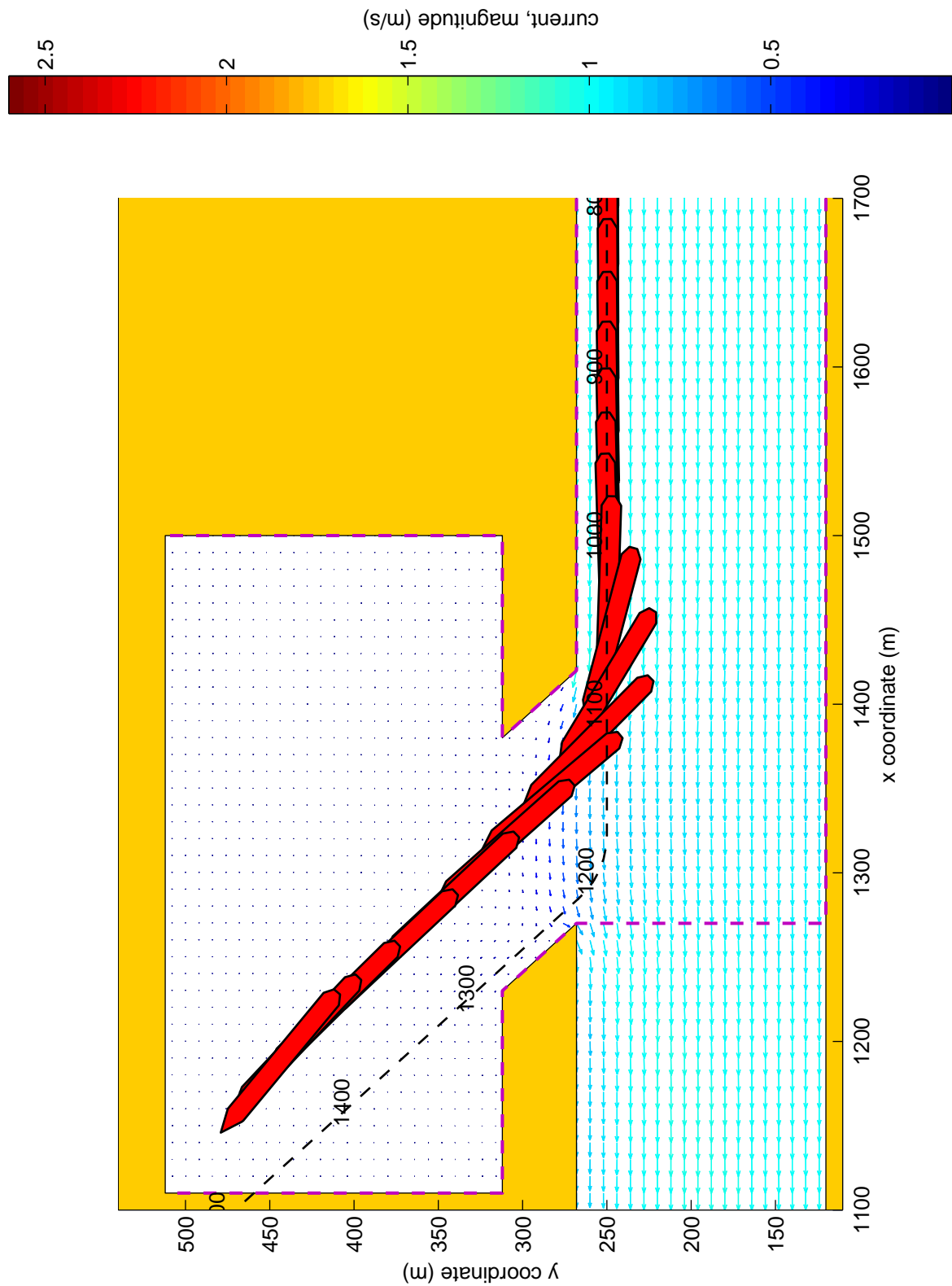
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 23

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 4

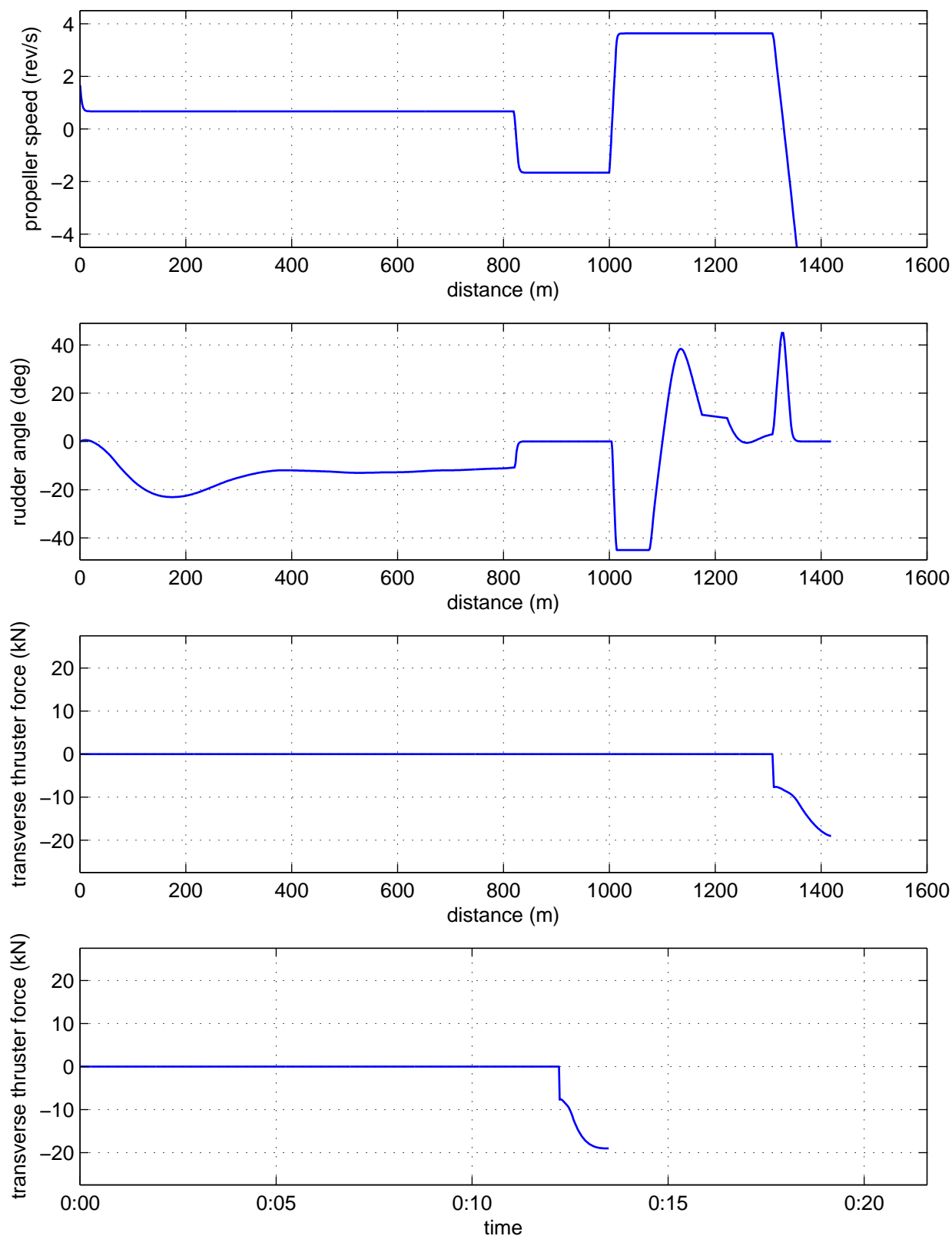
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 23

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 4

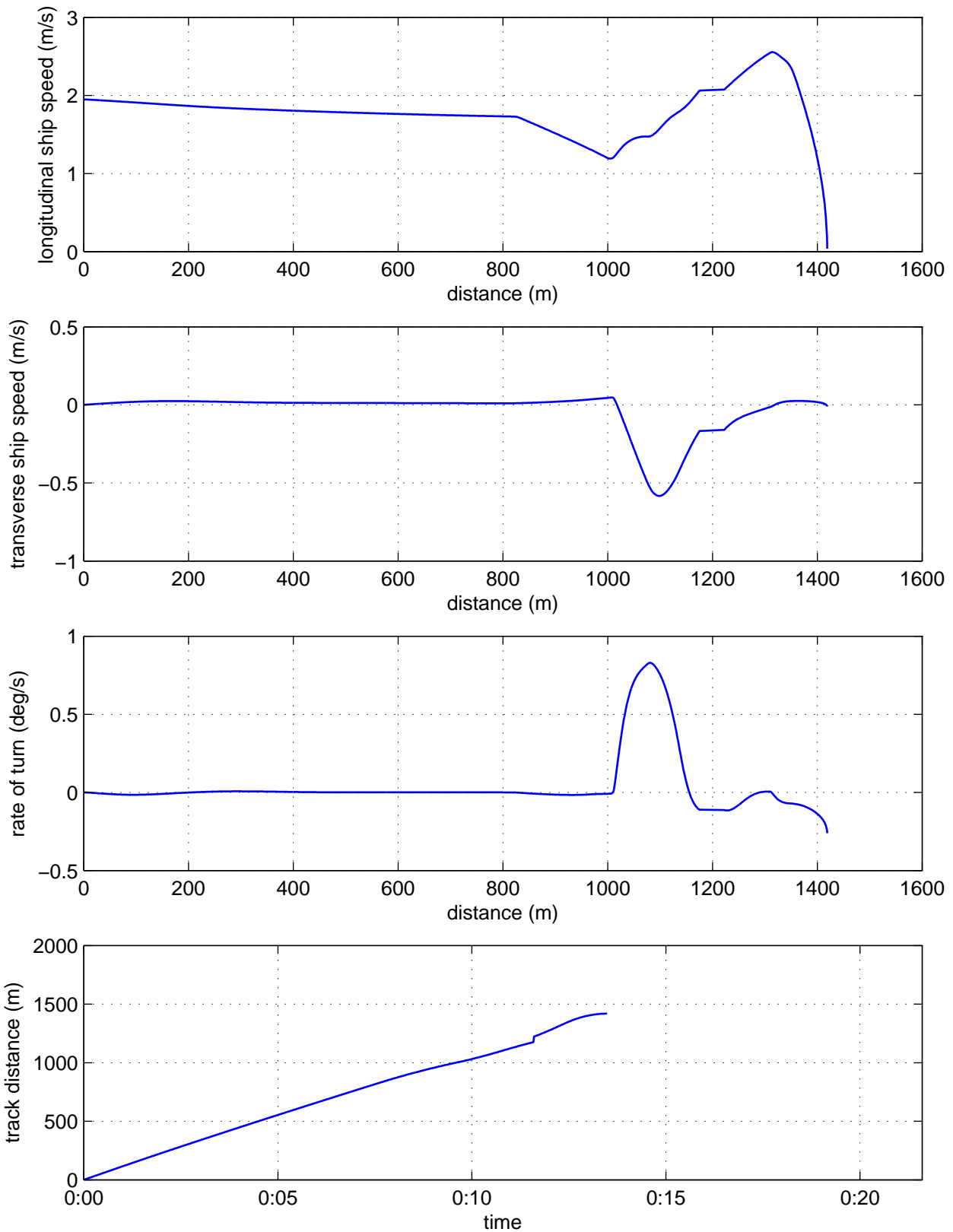
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 23

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 4

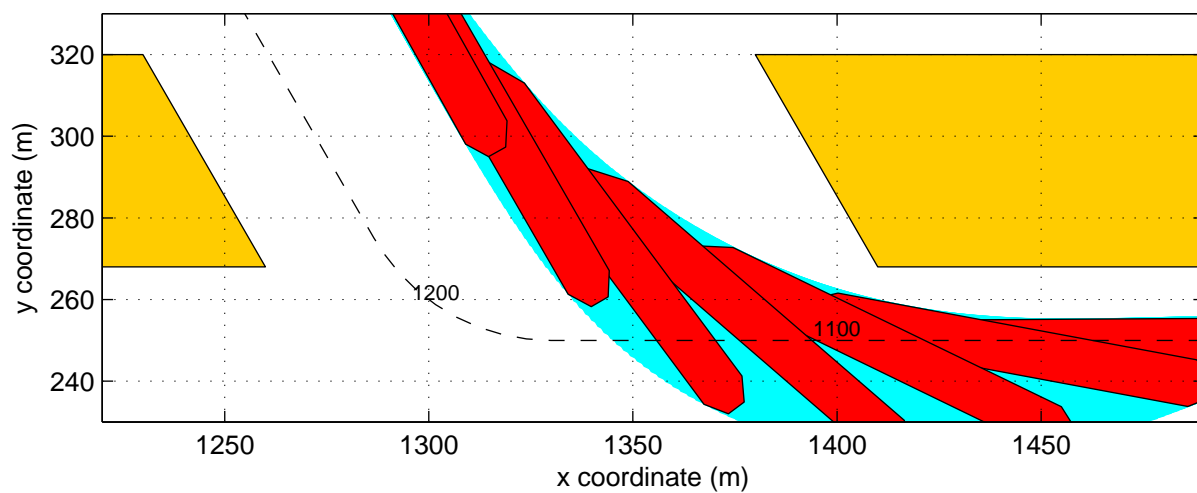
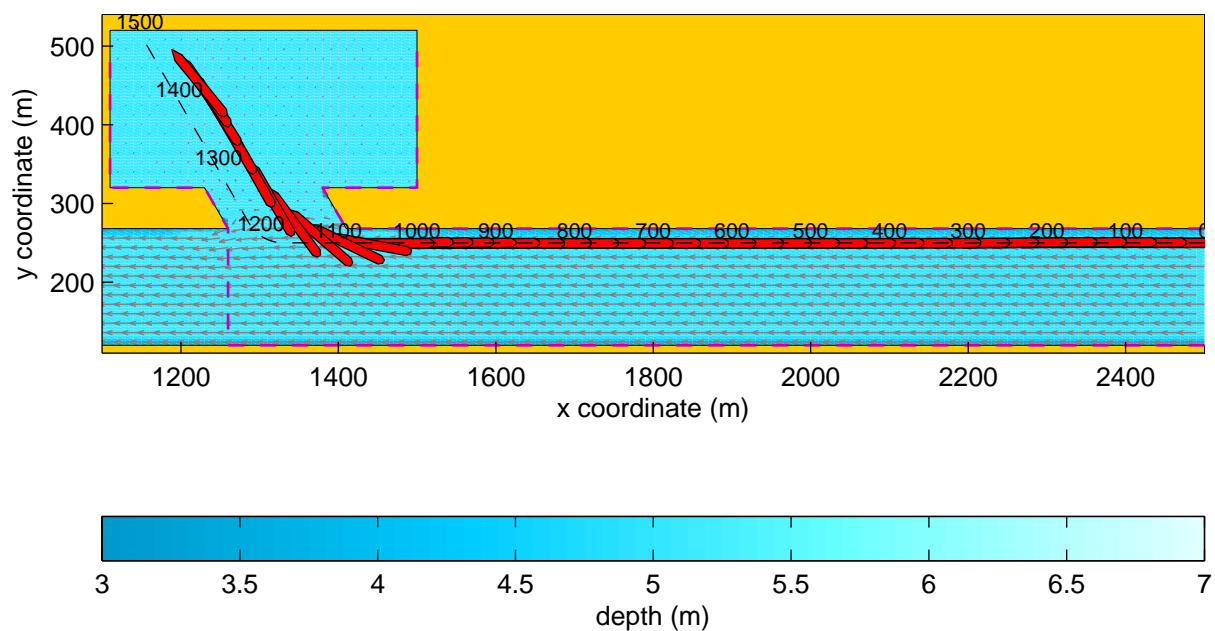
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 23

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 5

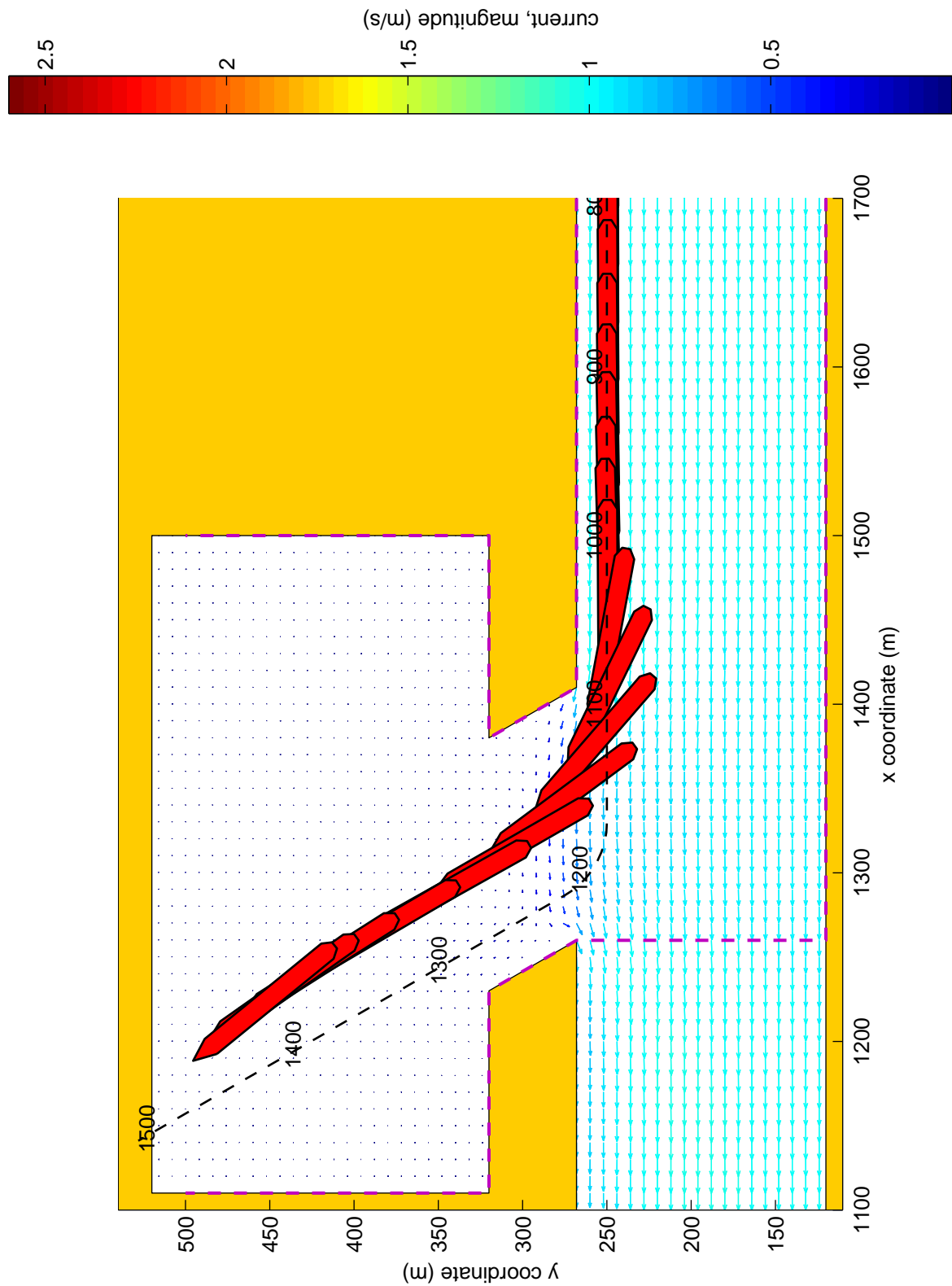
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 24

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 5

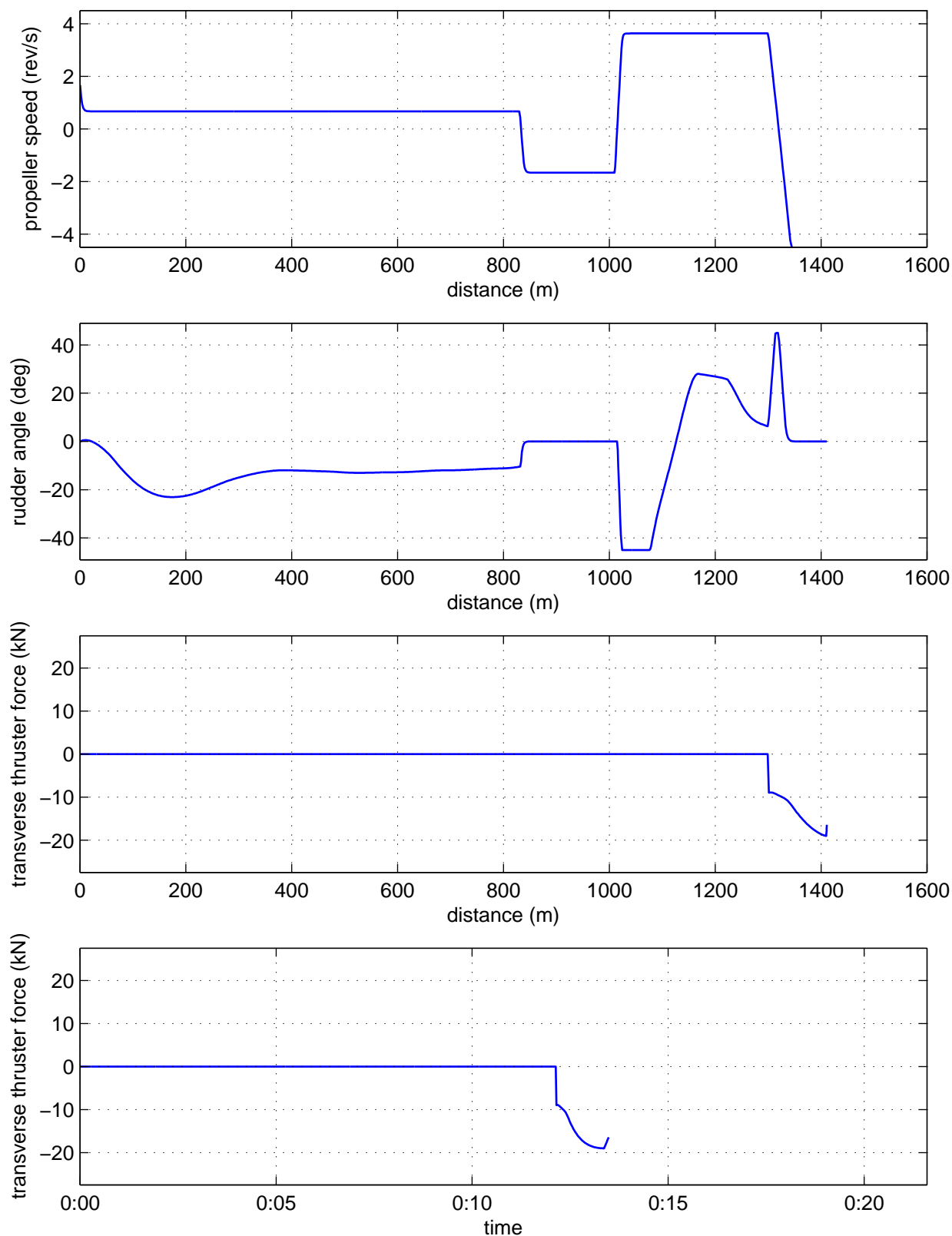
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 24

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 5

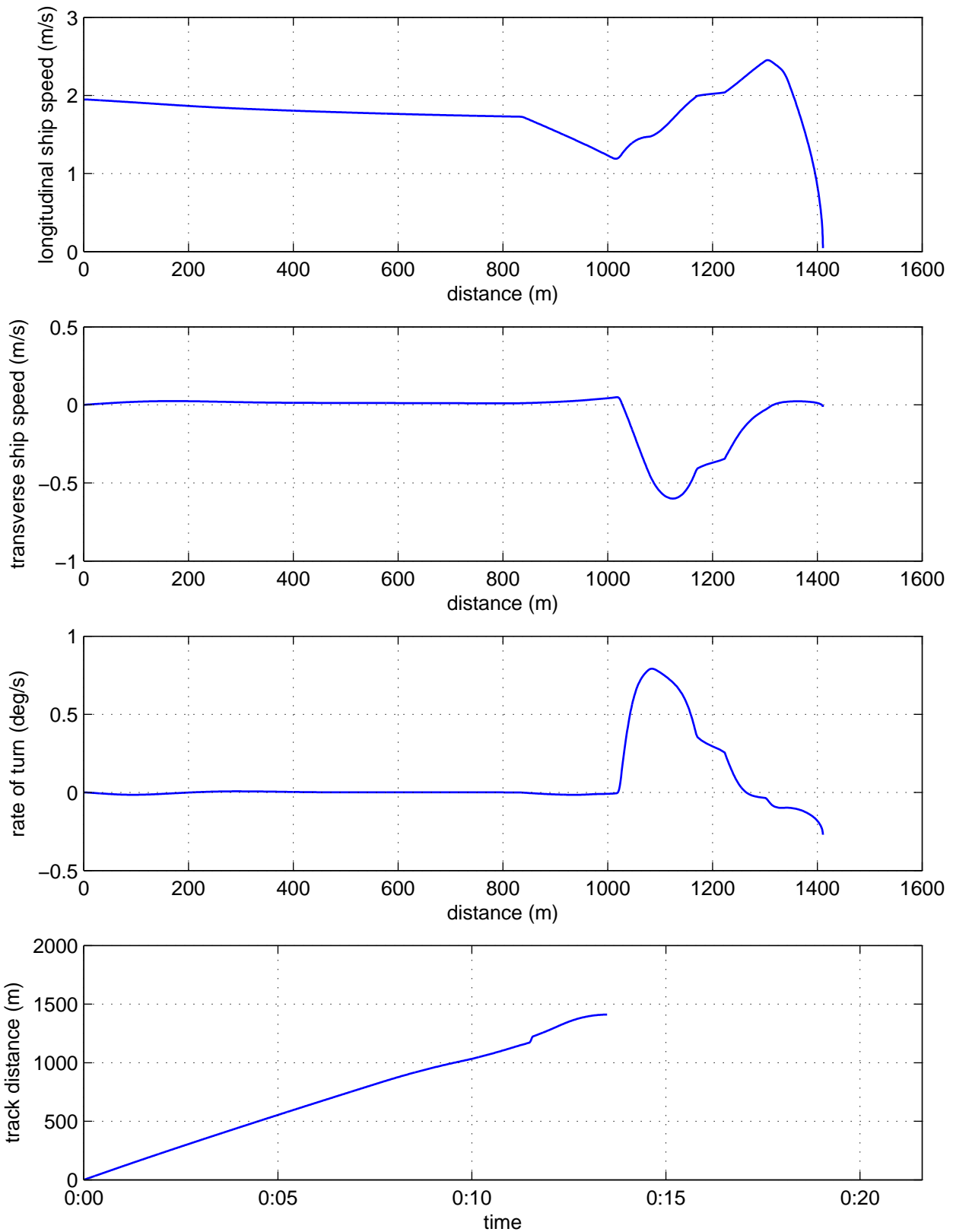
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 24

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 5

Current: 1.0 m/s

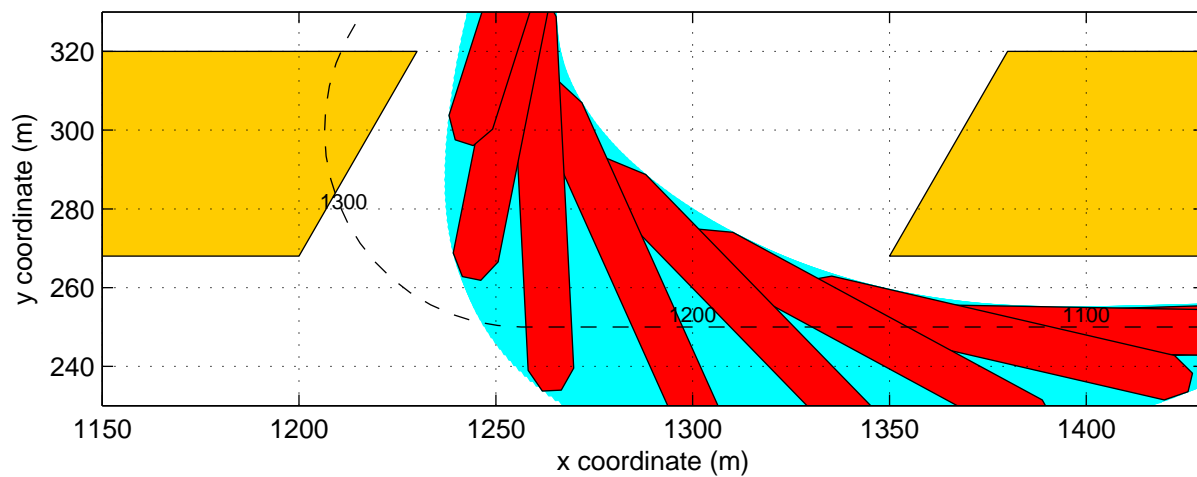
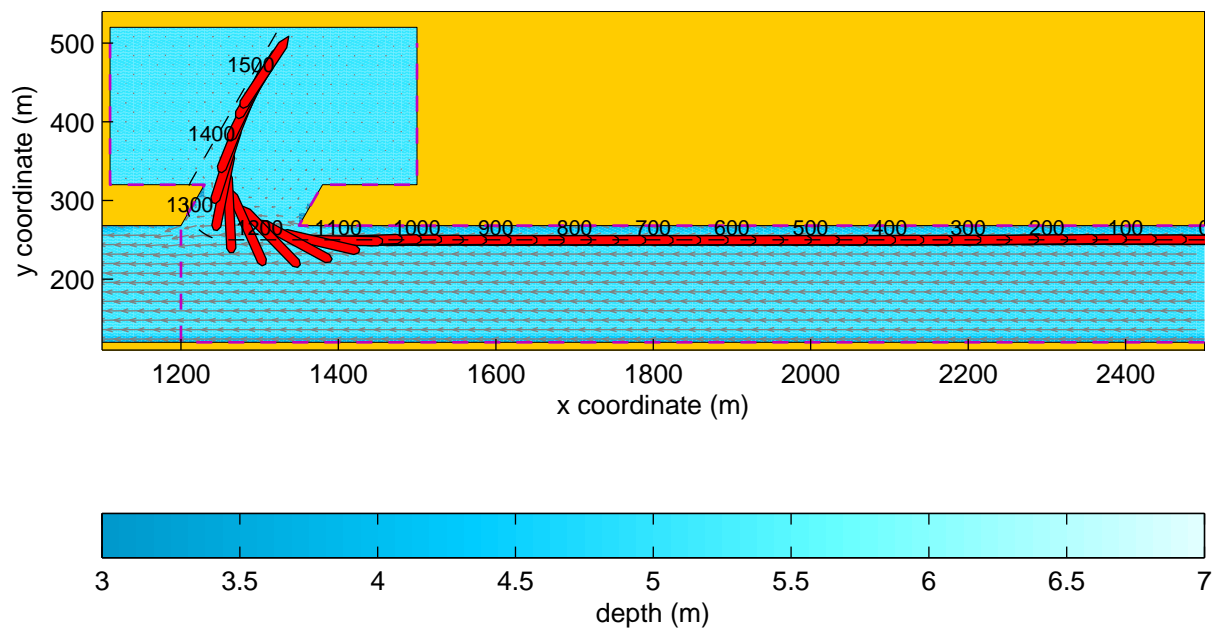
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 24

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

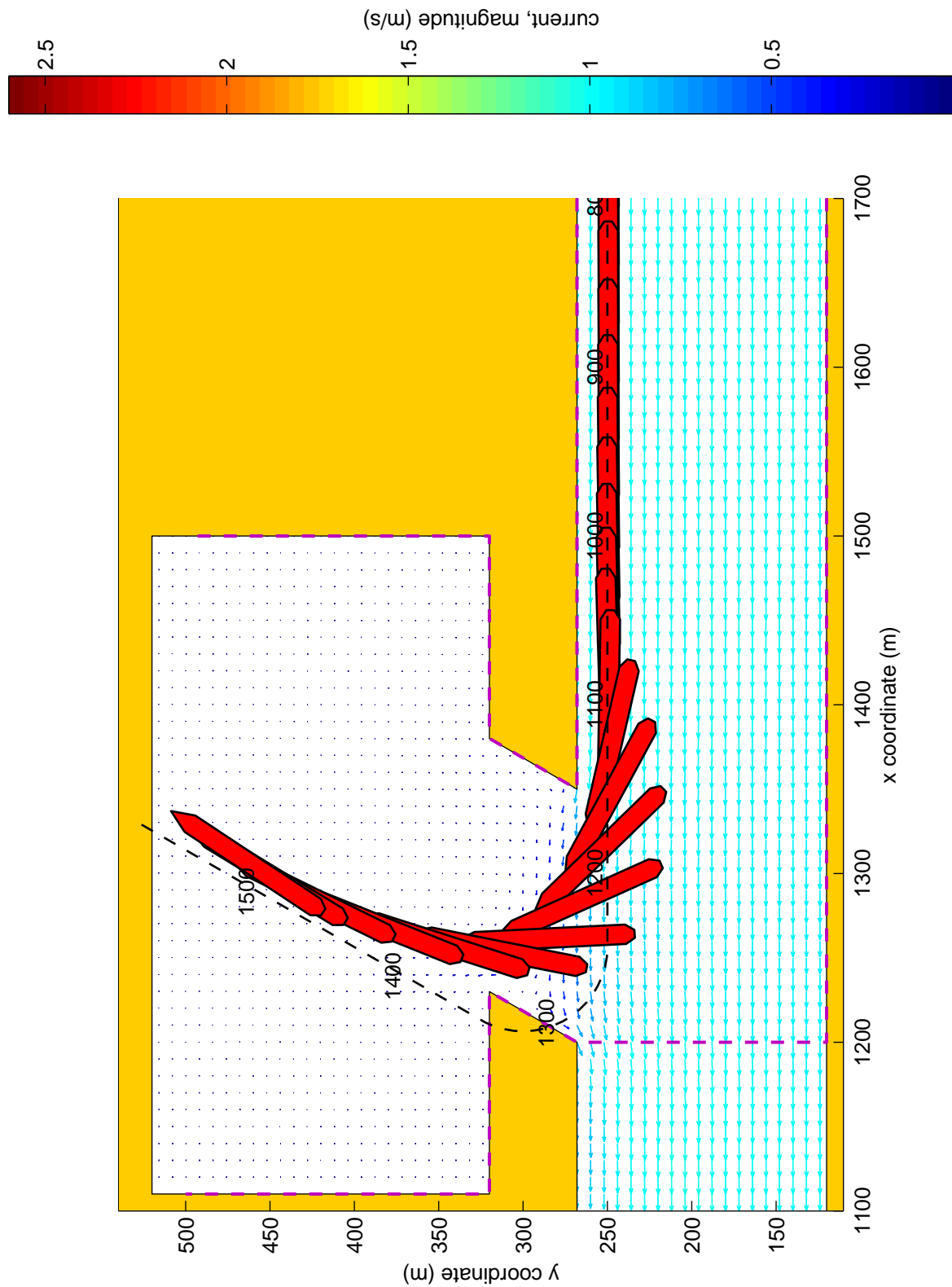
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 25

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

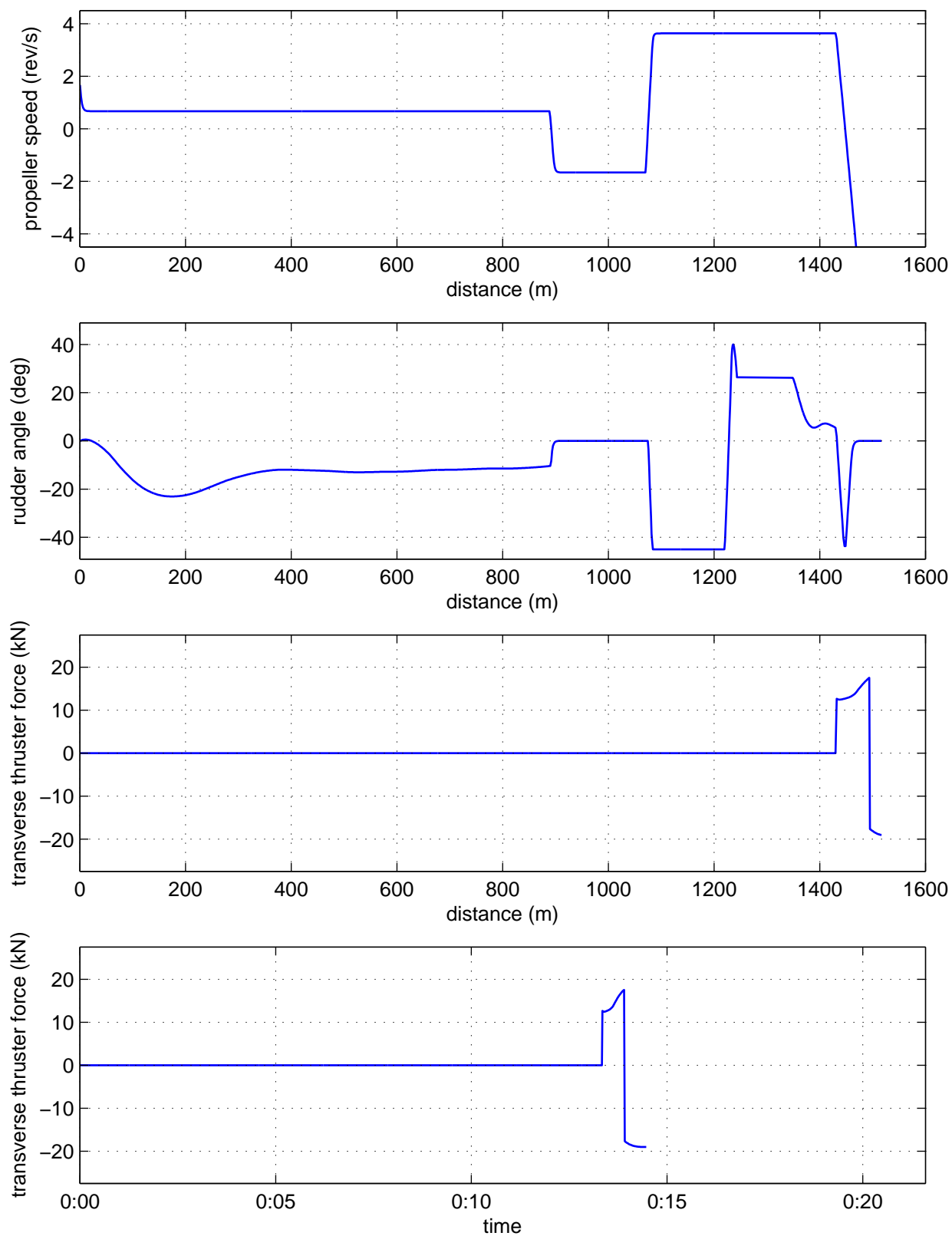
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 25

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

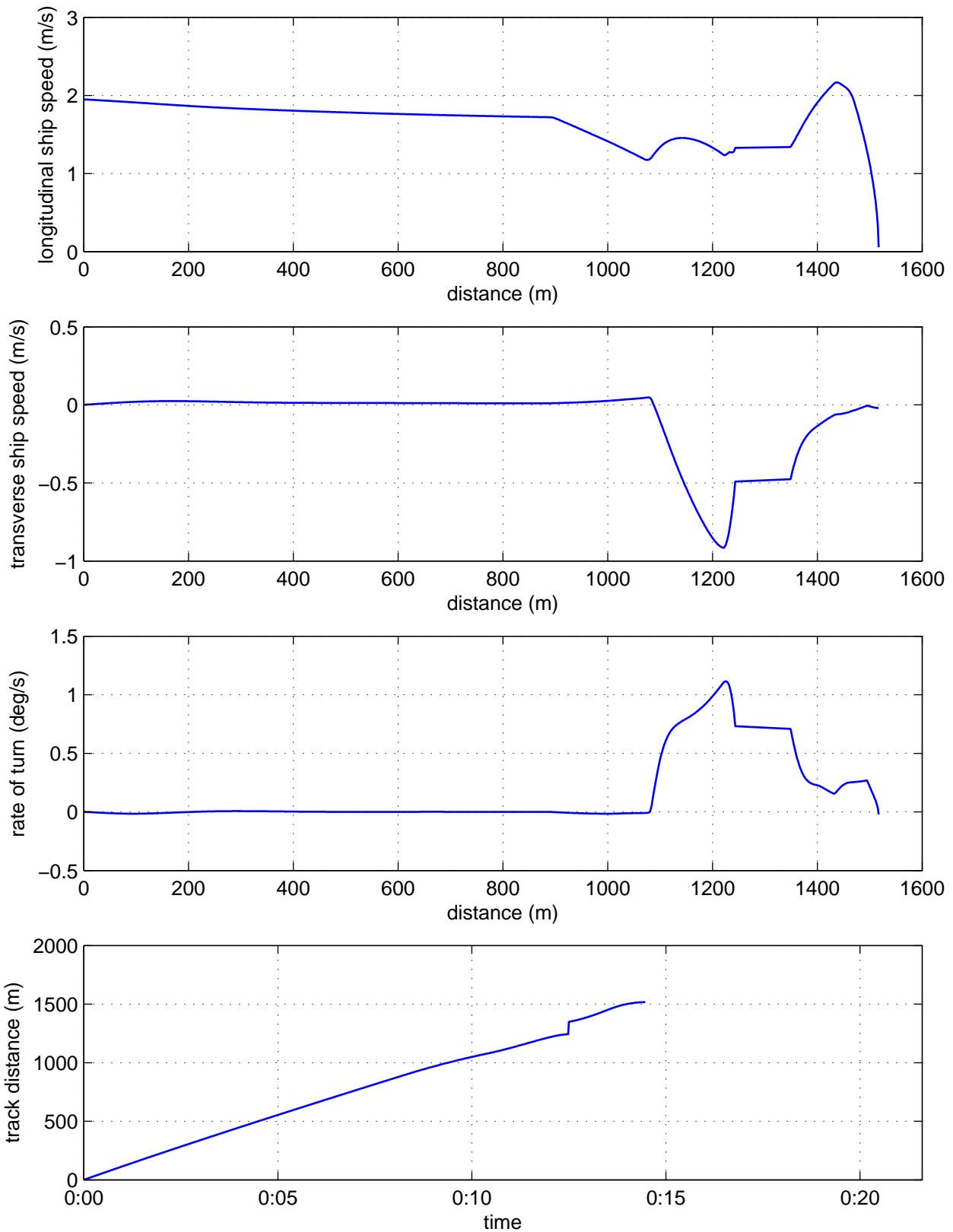
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 25

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

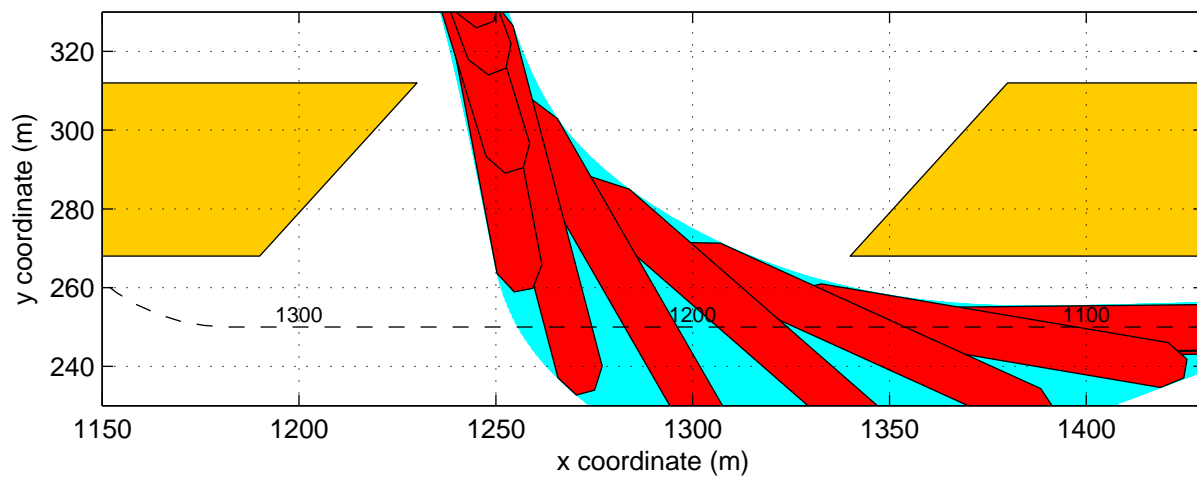
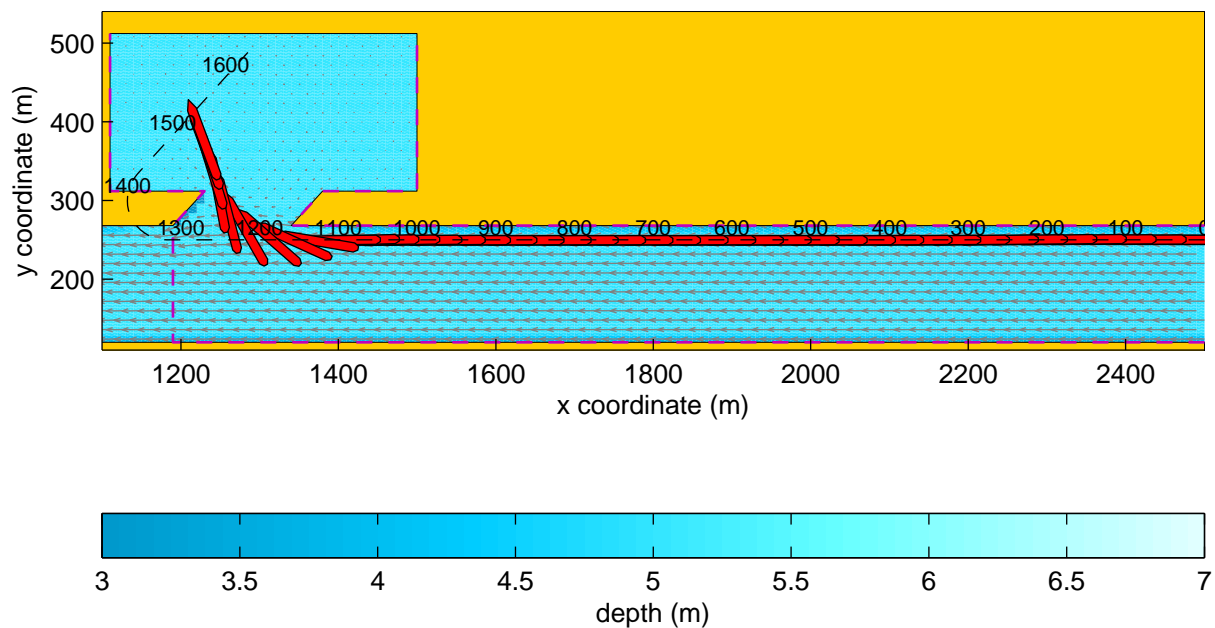
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 25

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 7

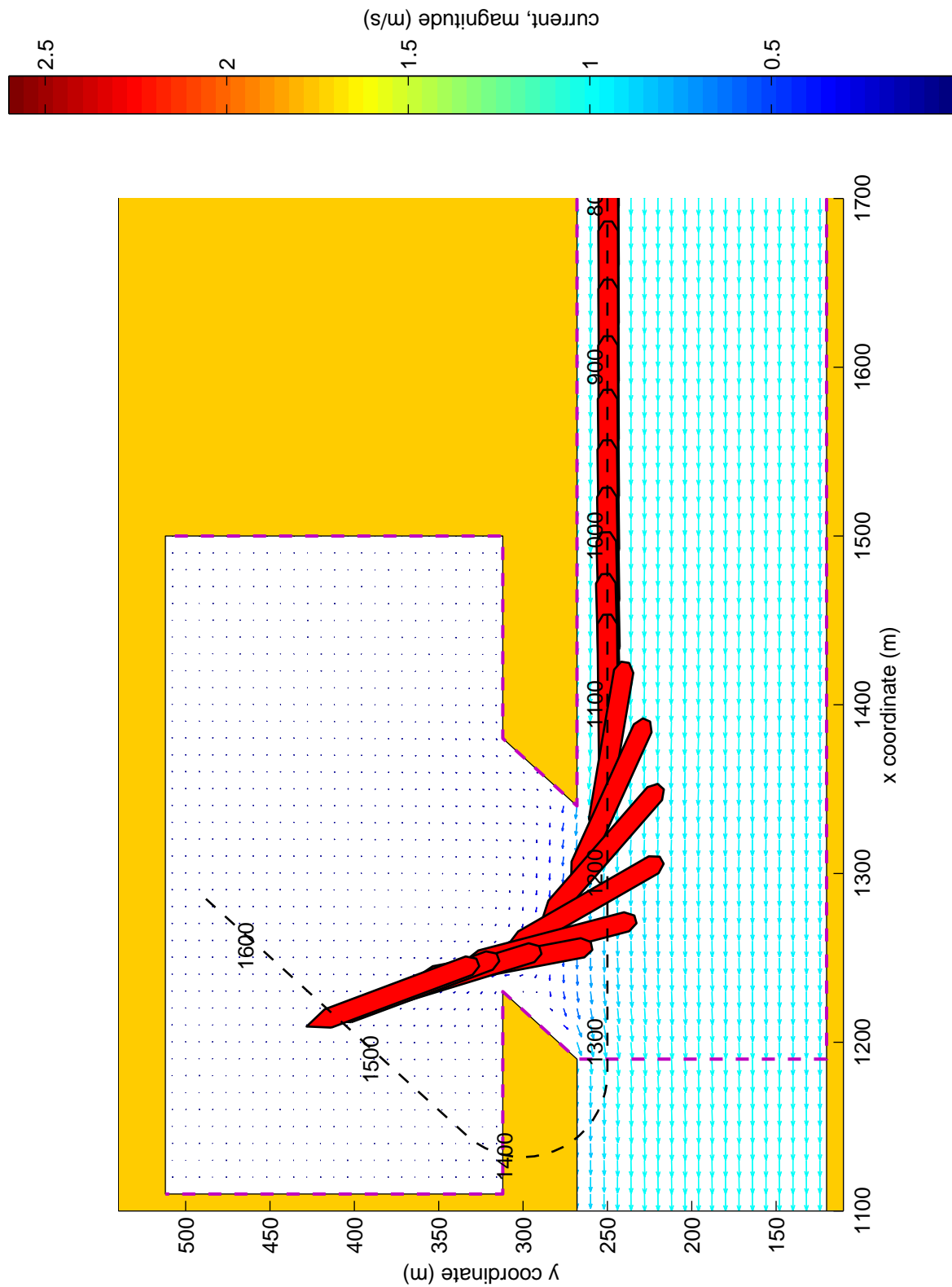
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 26

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 7

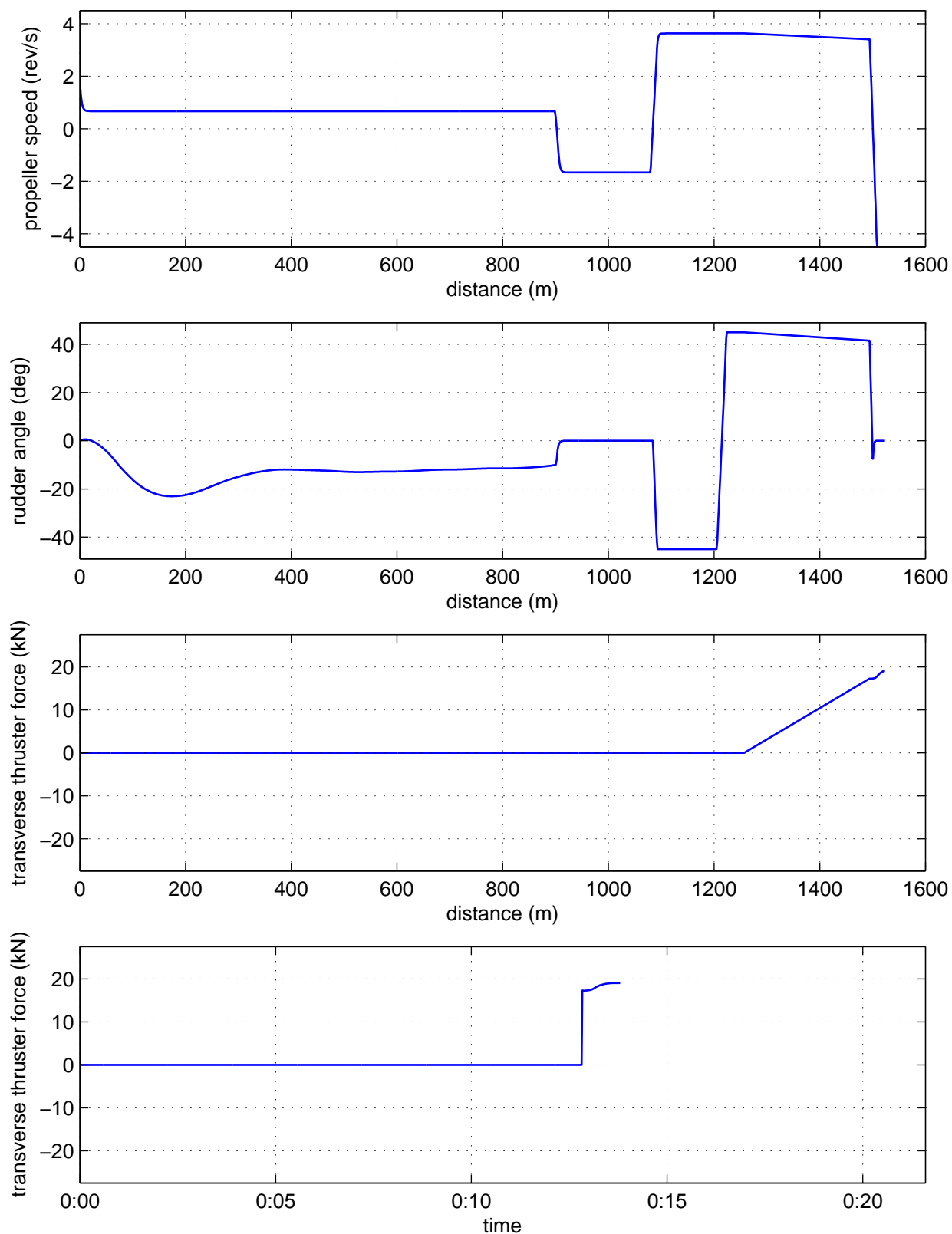
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 26

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

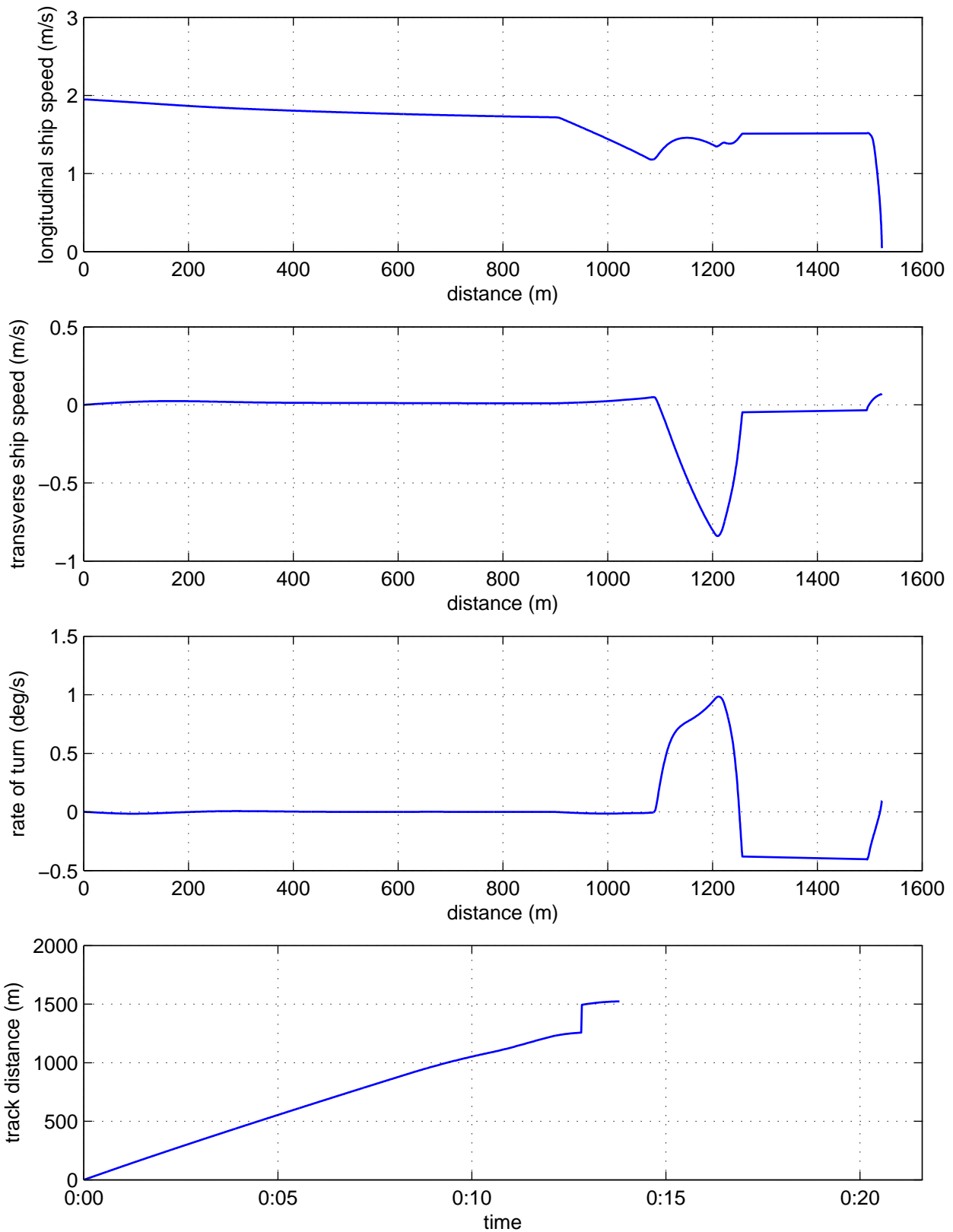
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 26

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

Current: 1.0 m/s

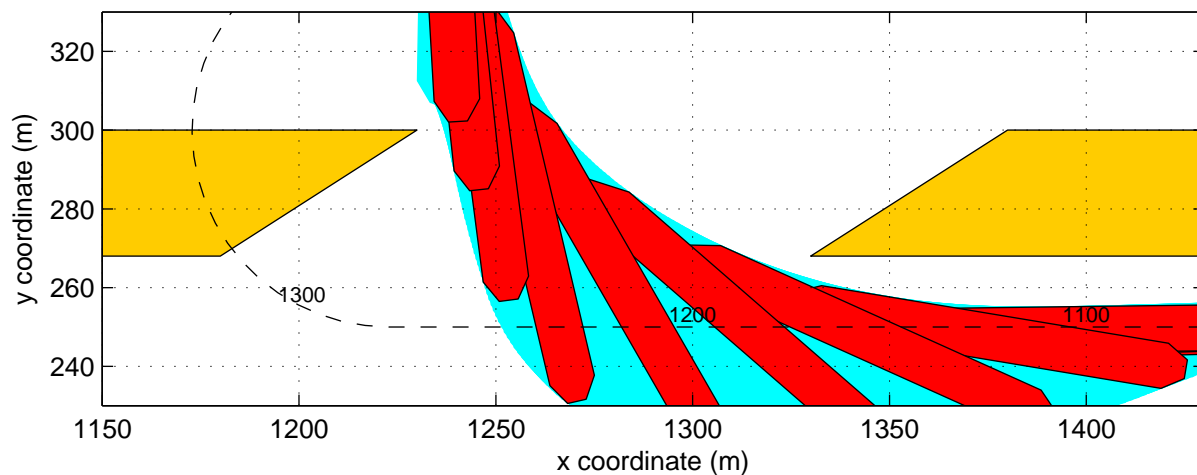
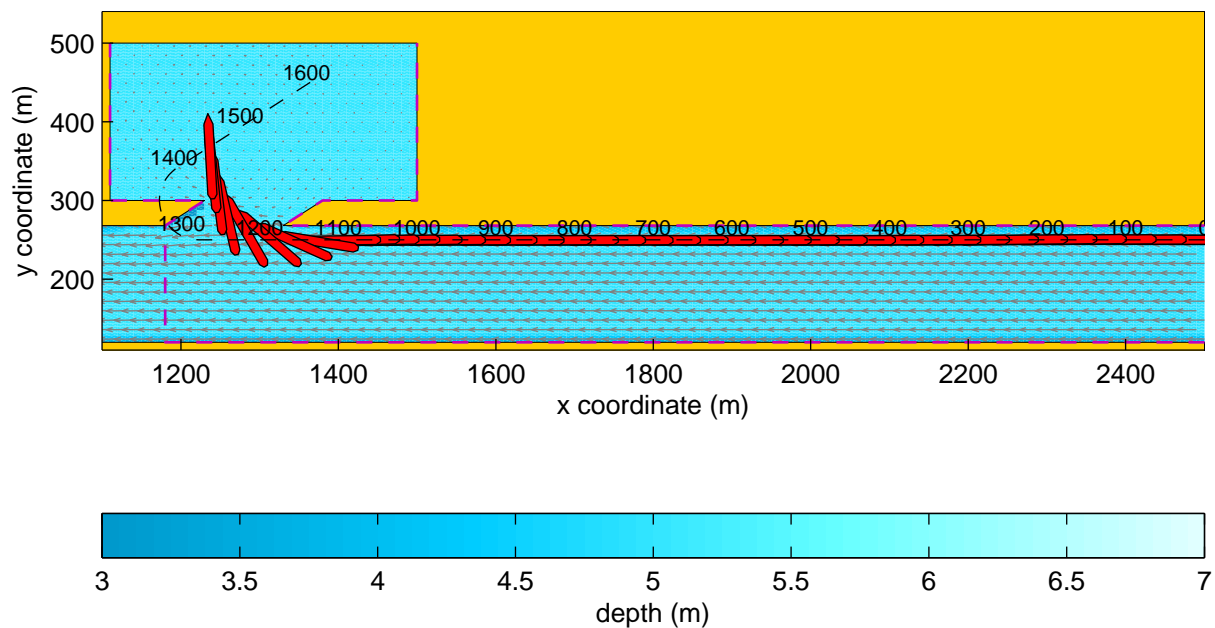
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 26

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 8

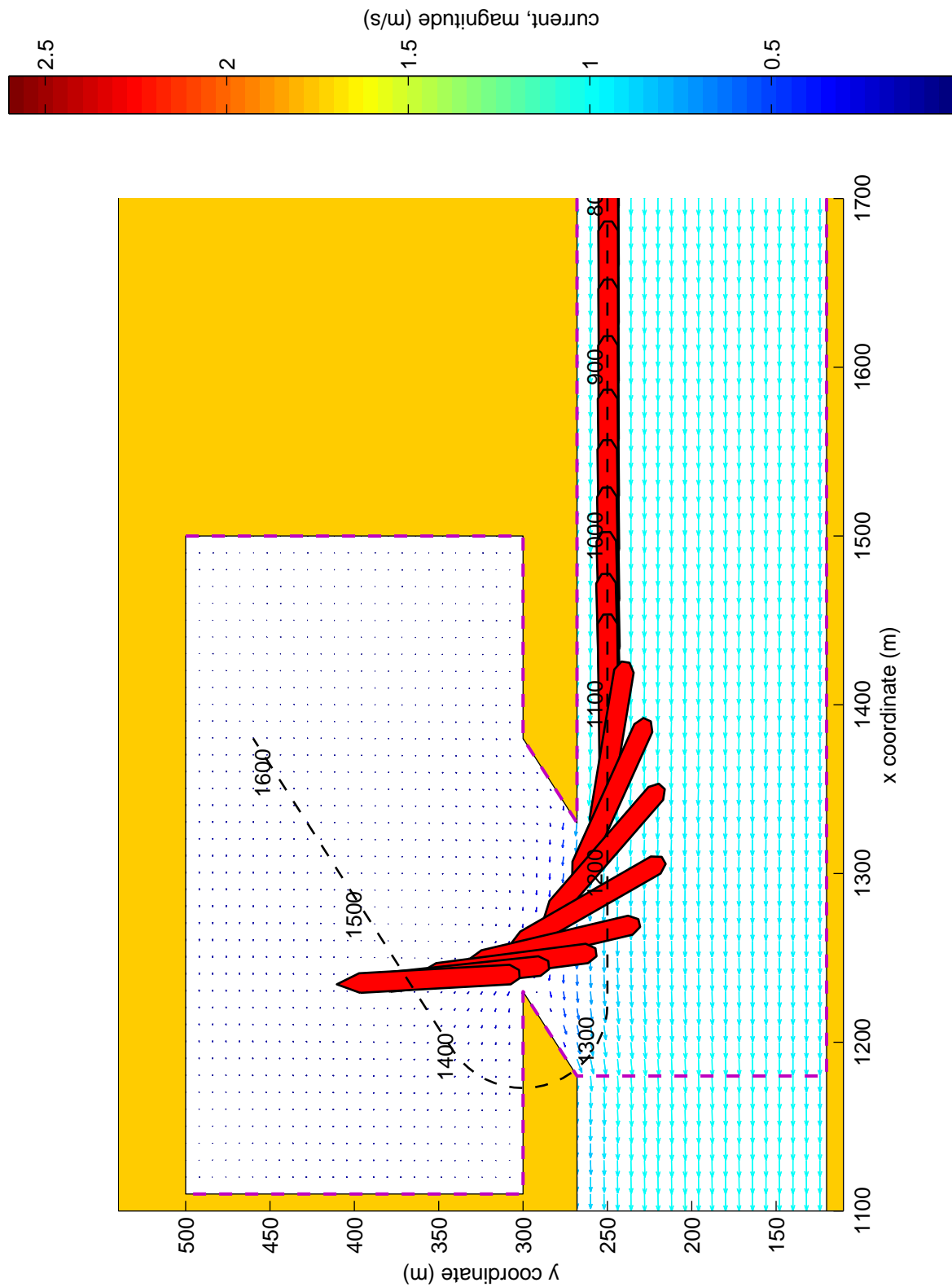
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 27

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 8

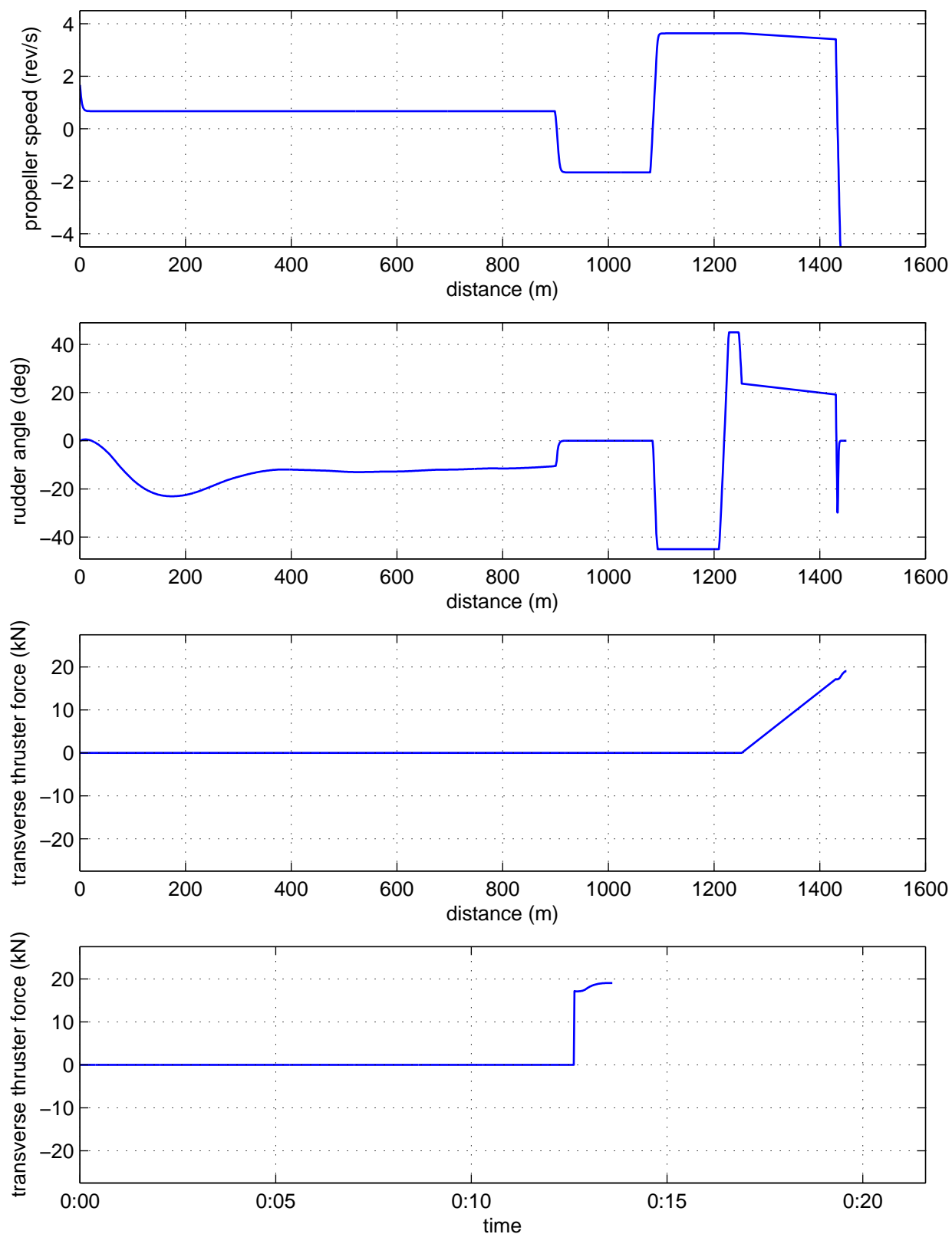
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 27

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

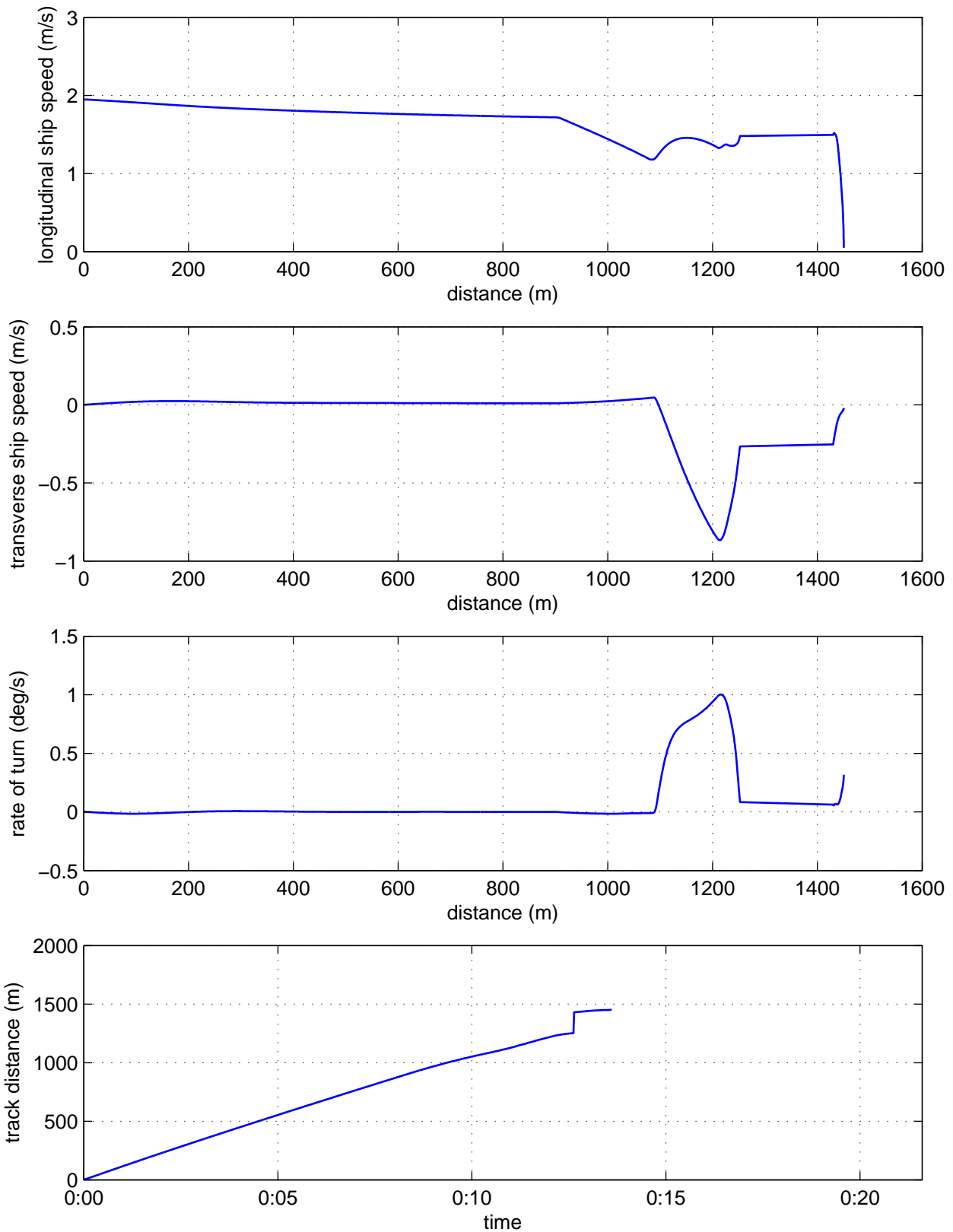
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 27

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

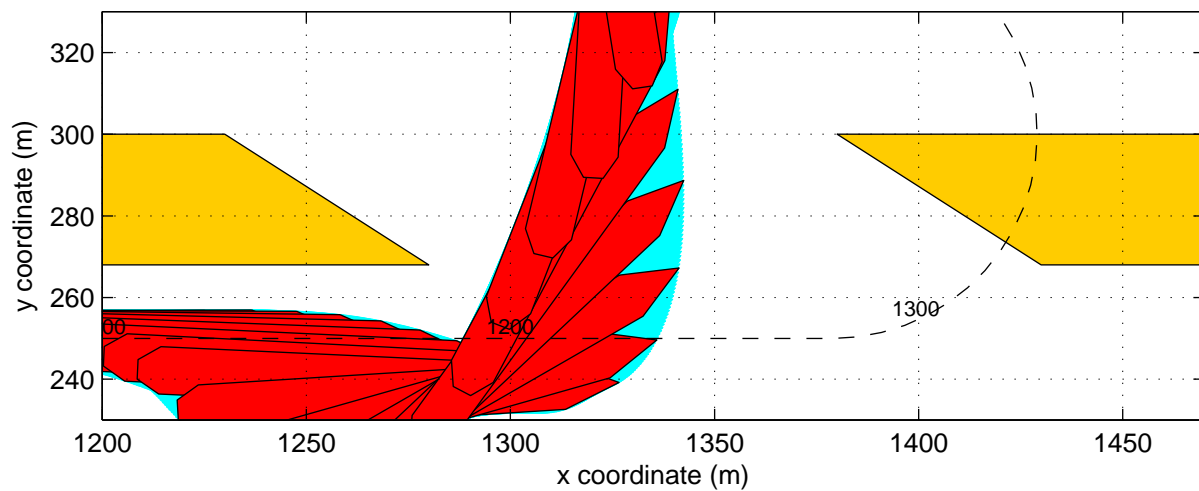
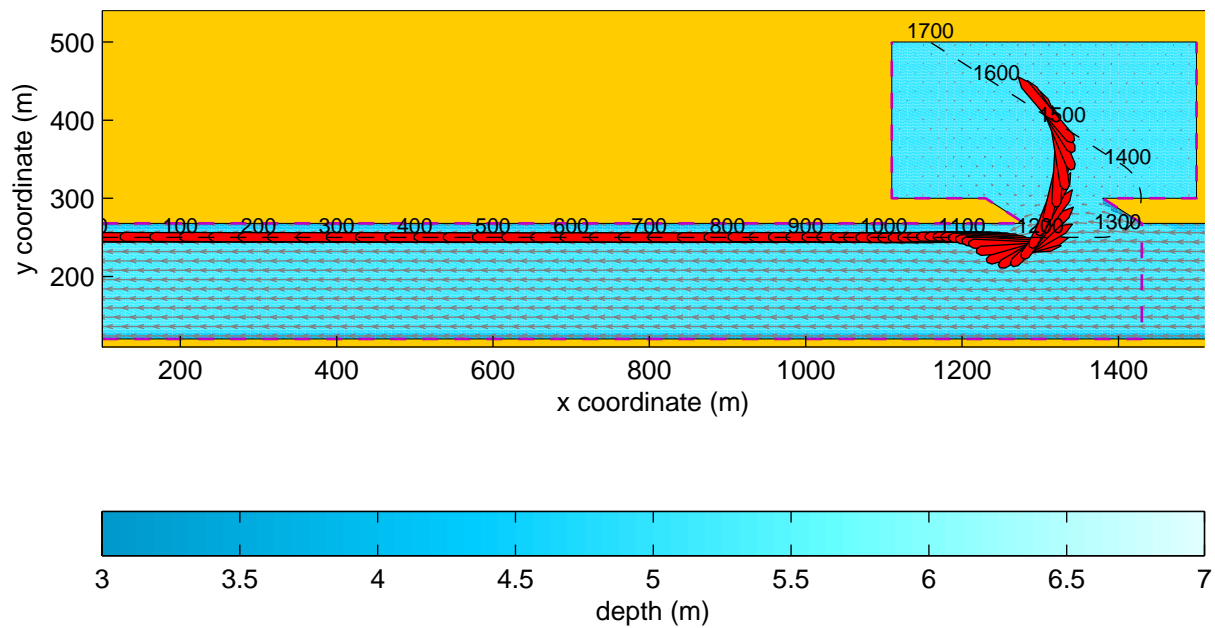
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 27

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 3

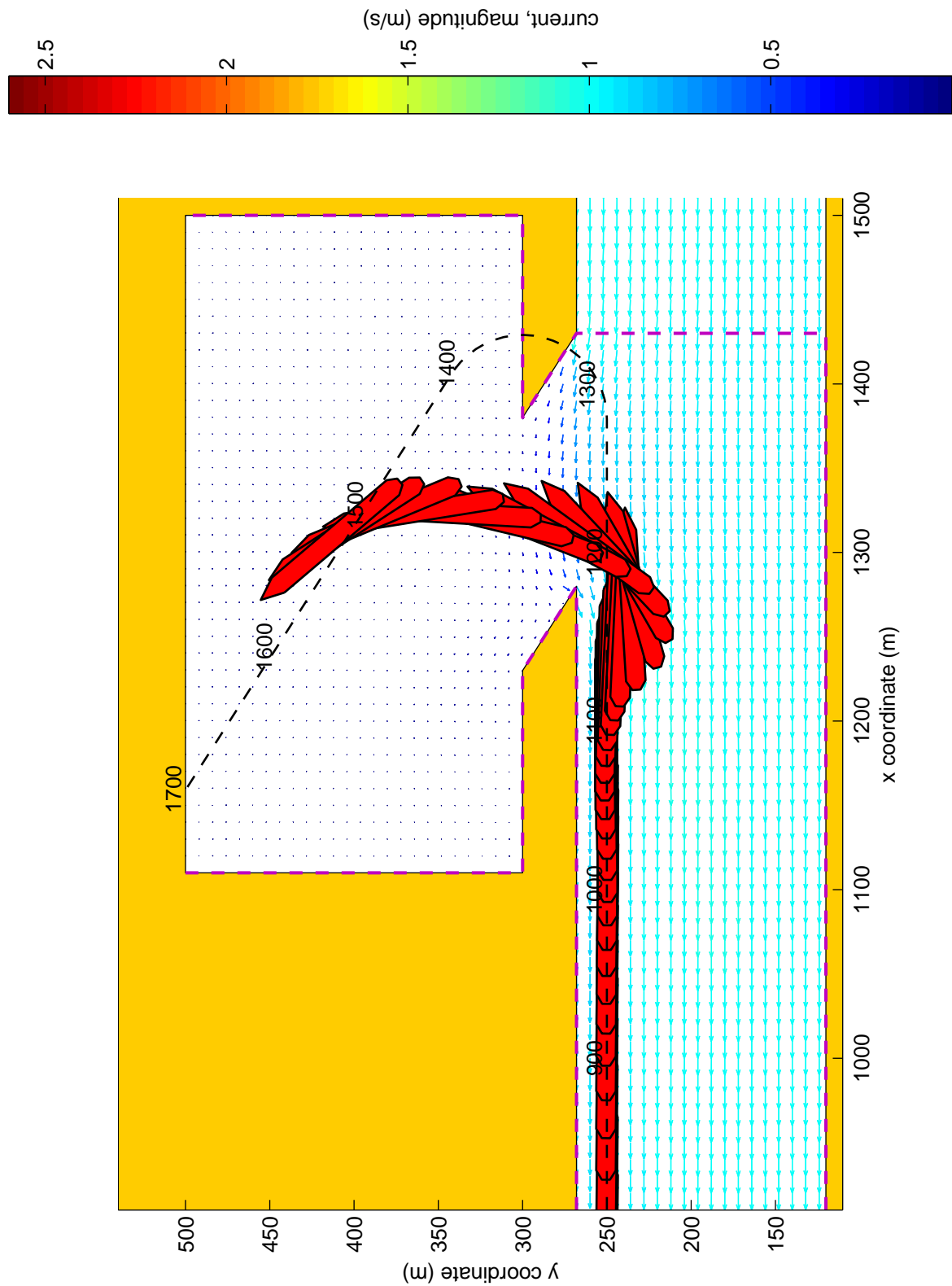
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 28

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 3

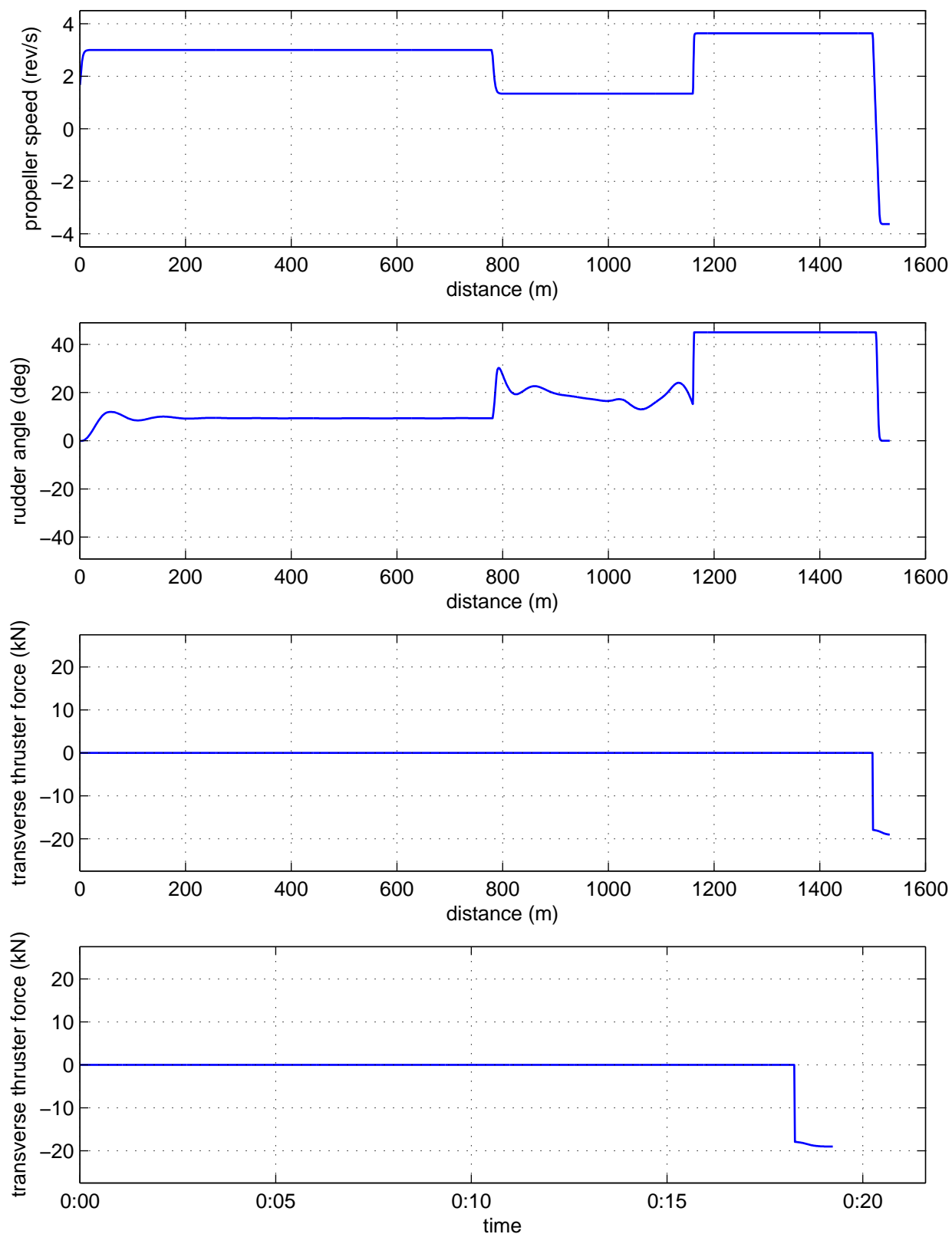
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 28

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 3

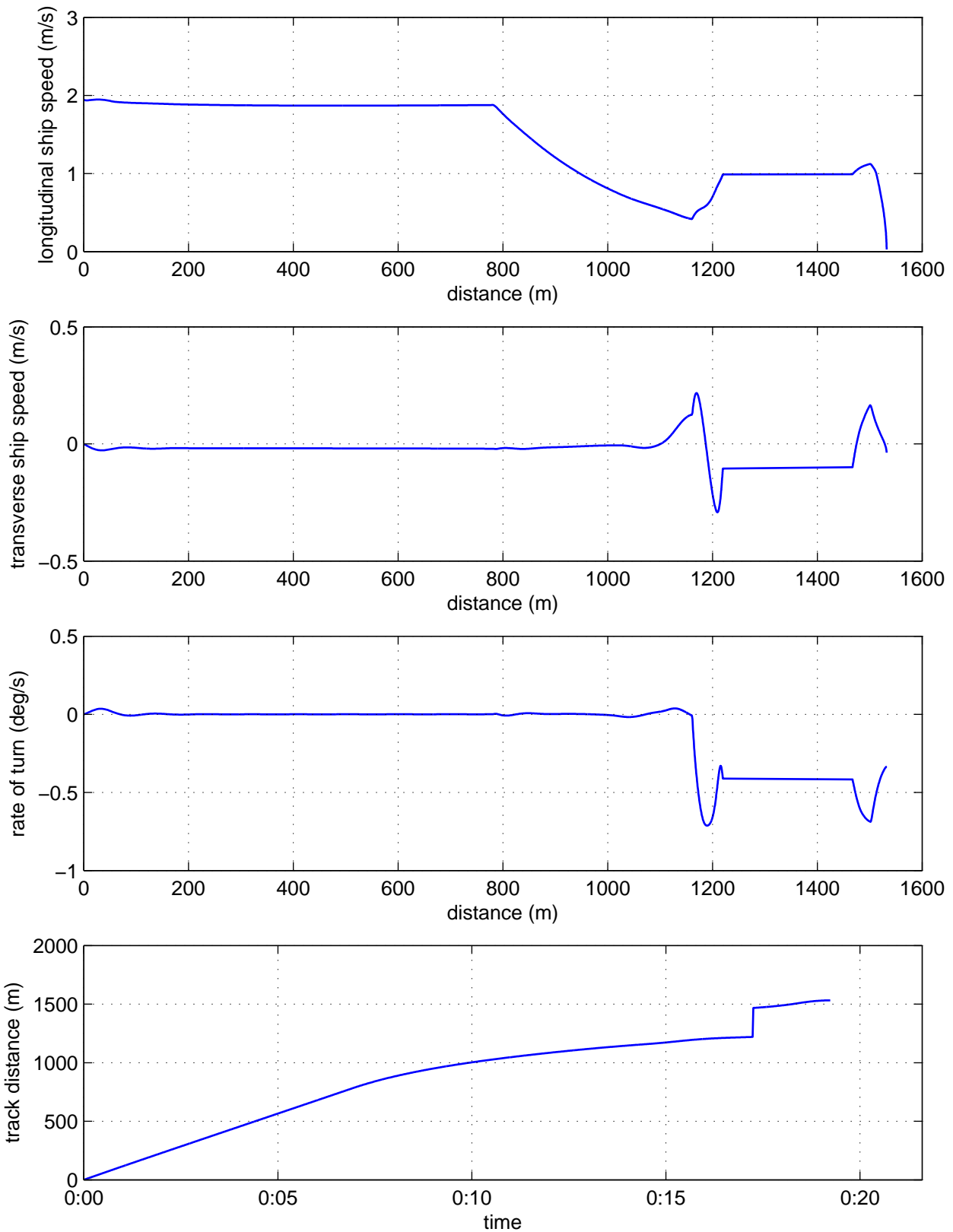
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 28

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 3

Current: 1.0 m/s

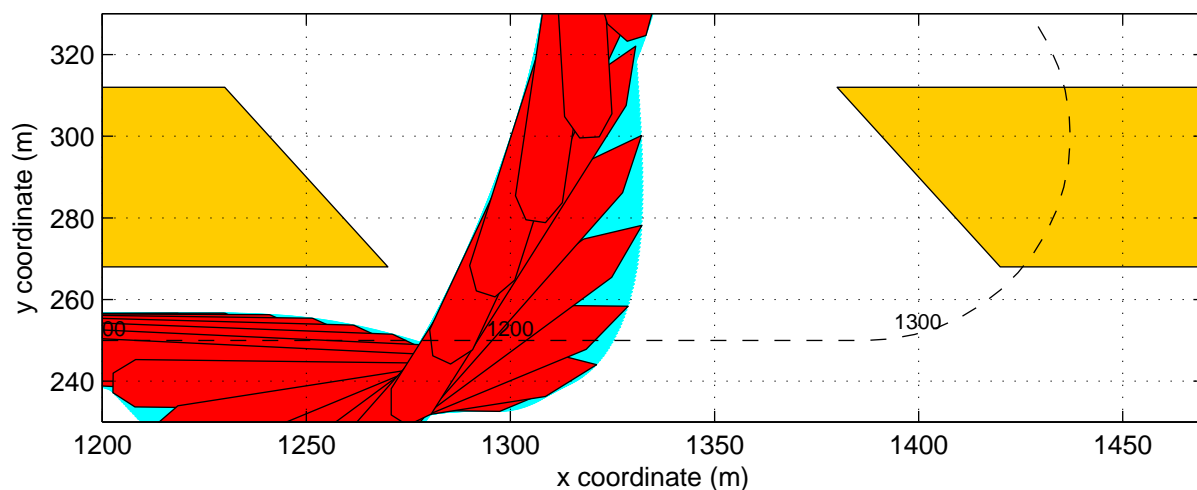
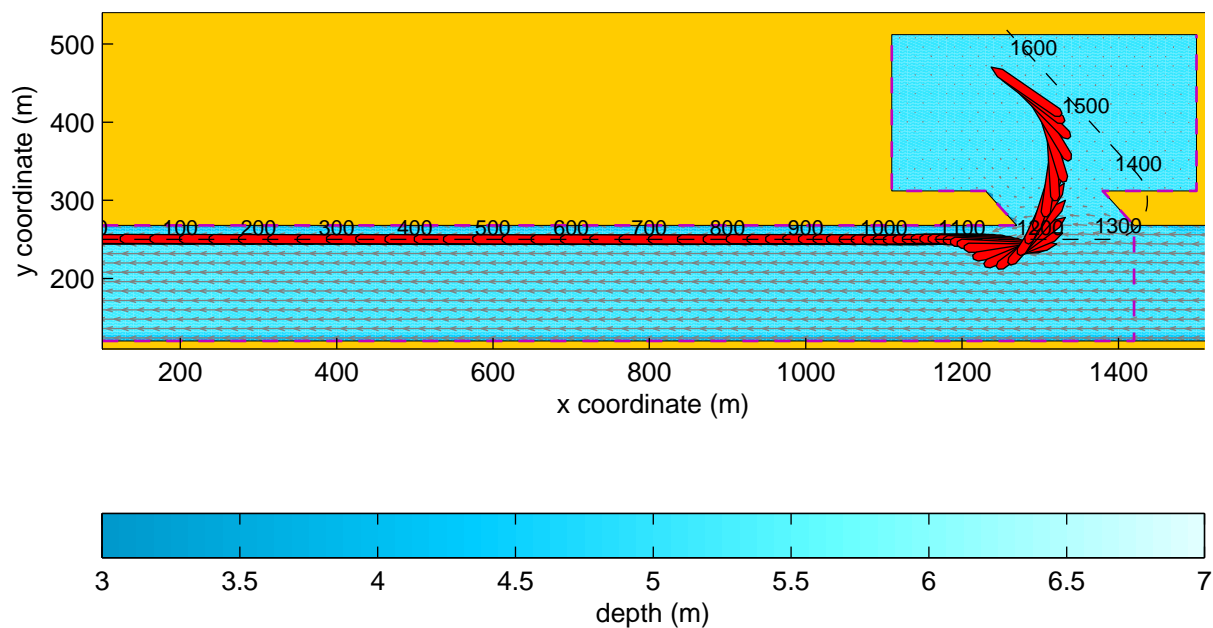
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 28

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 4

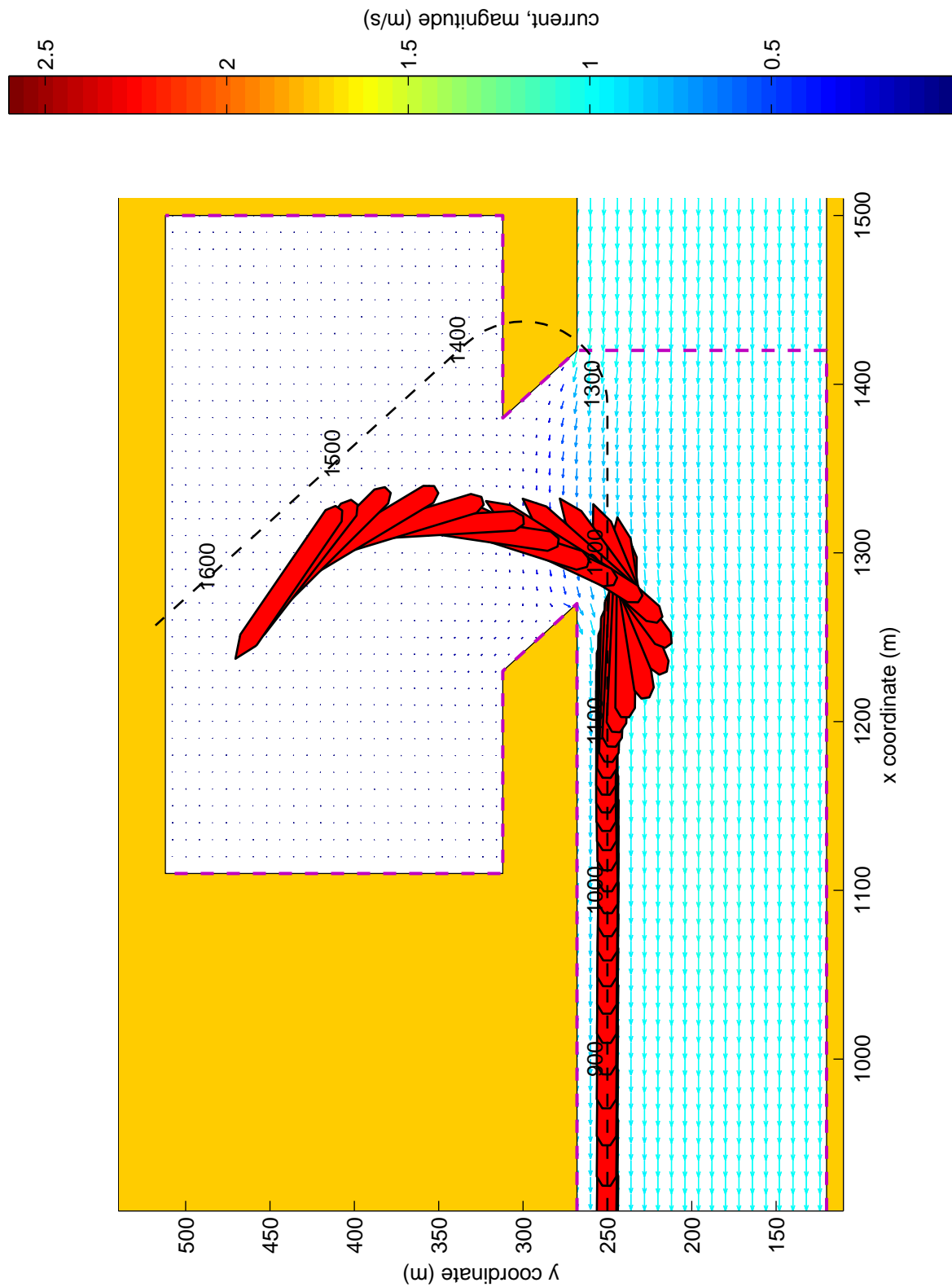
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 29

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 4

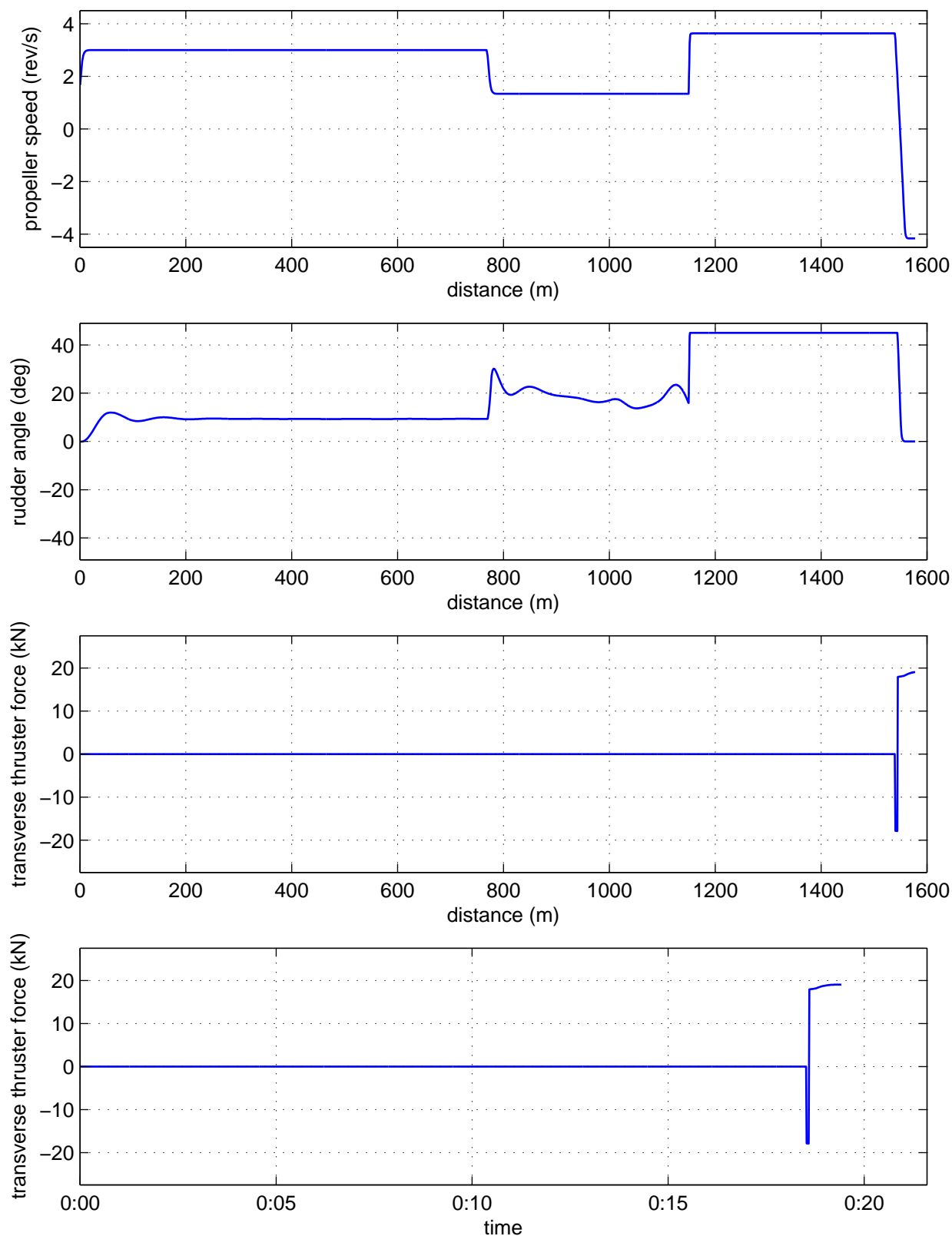
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 29

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 4

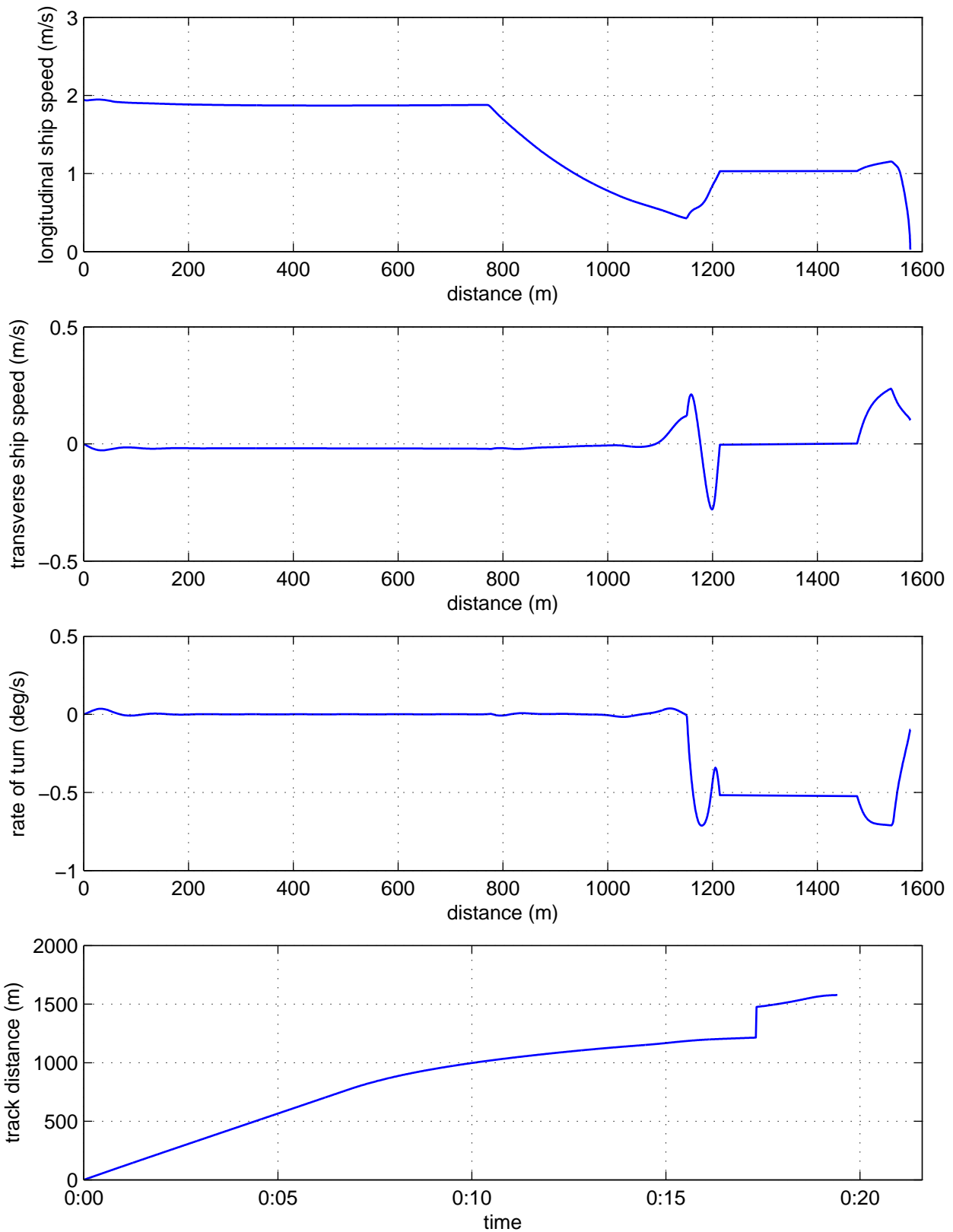
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 29

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 4

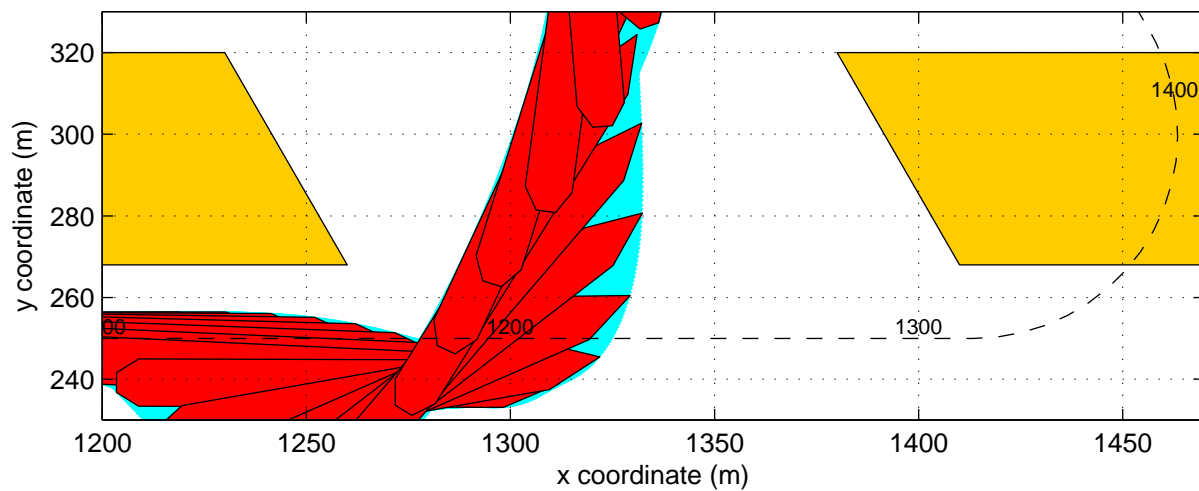
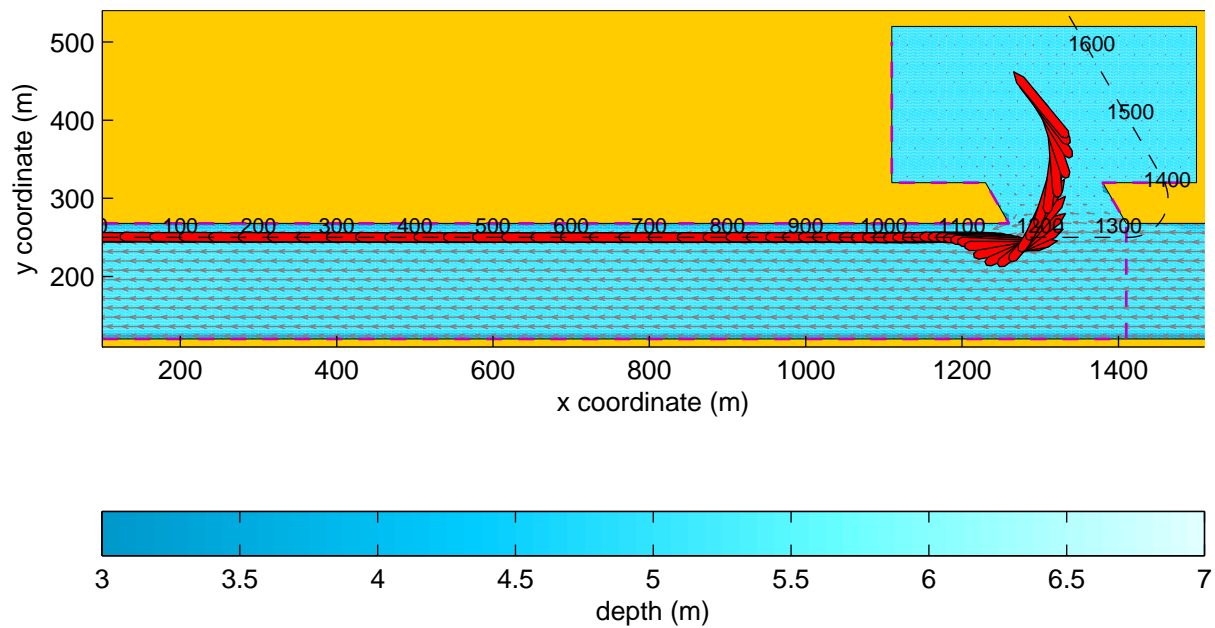
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 29

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 5

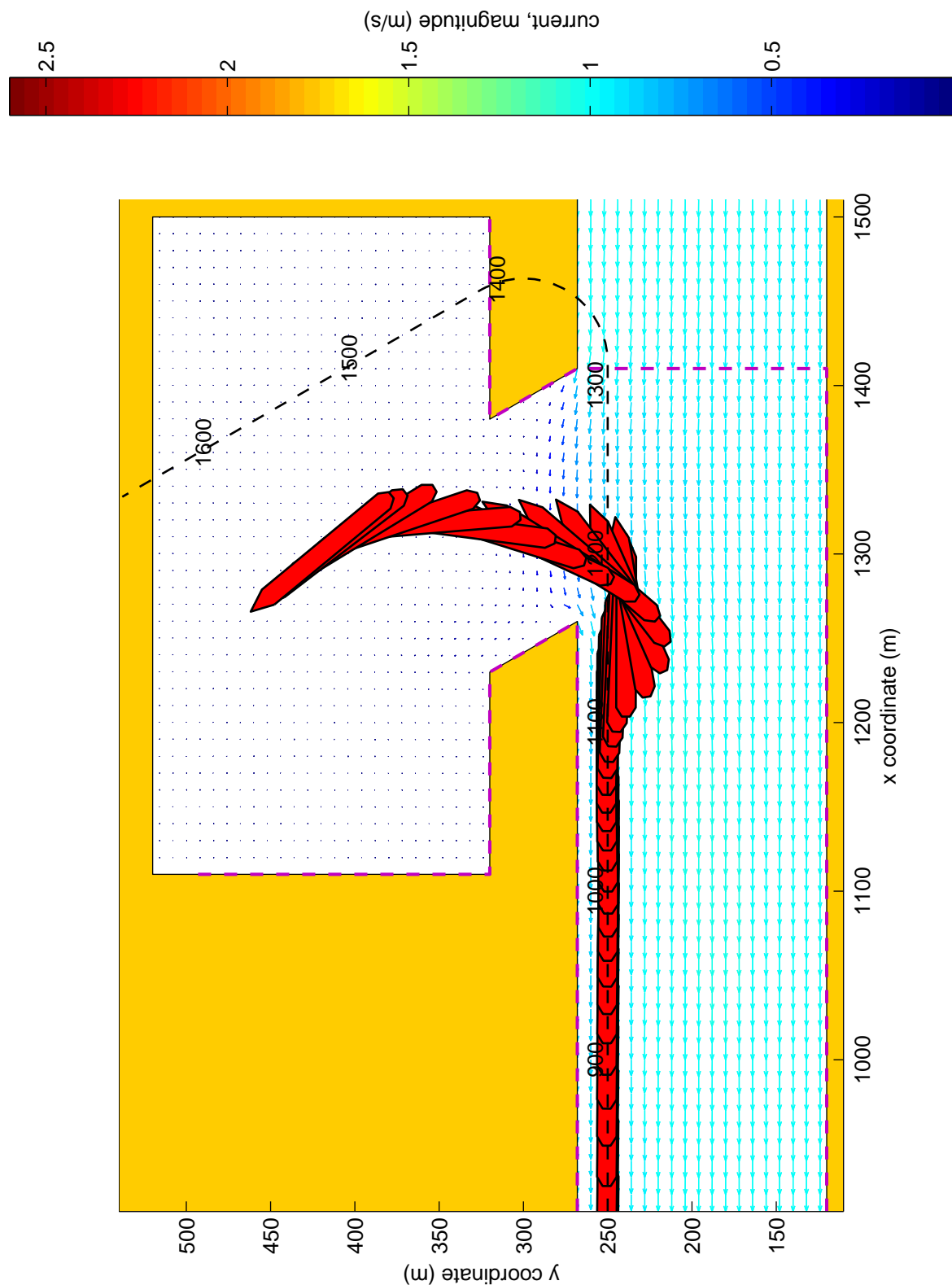
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 30

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 5

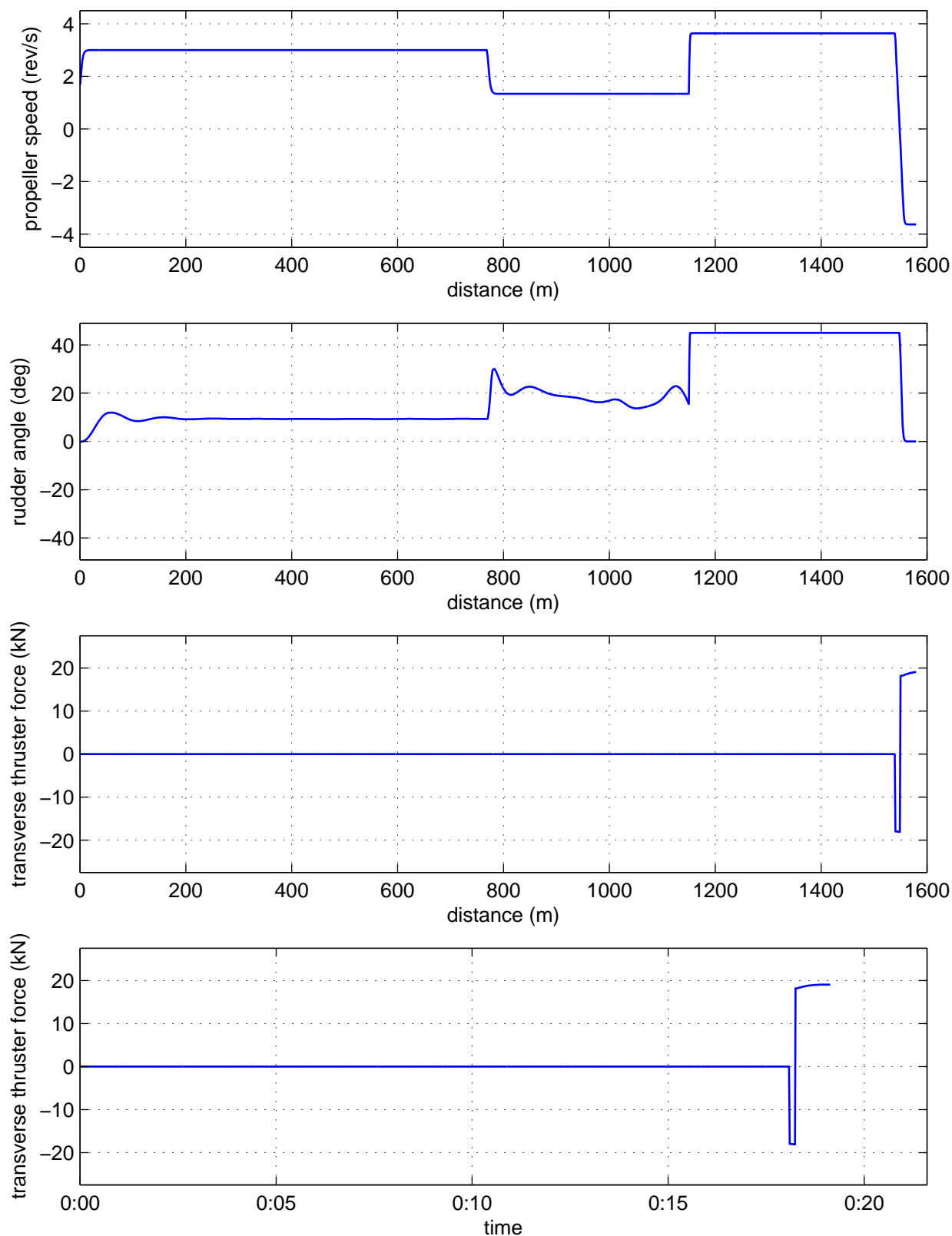
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 30

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 5

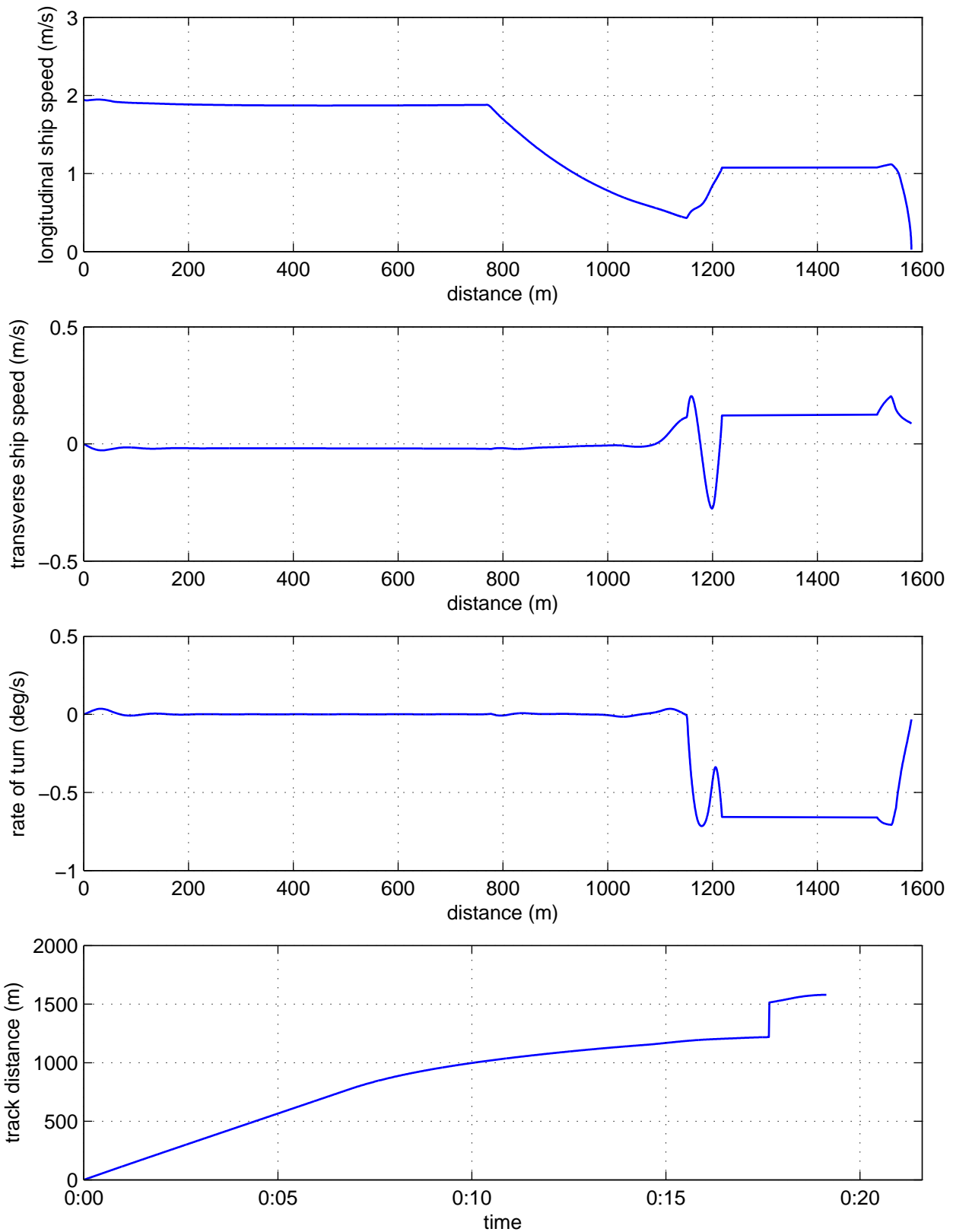
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 30

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 5

Current: 1.0 m/s

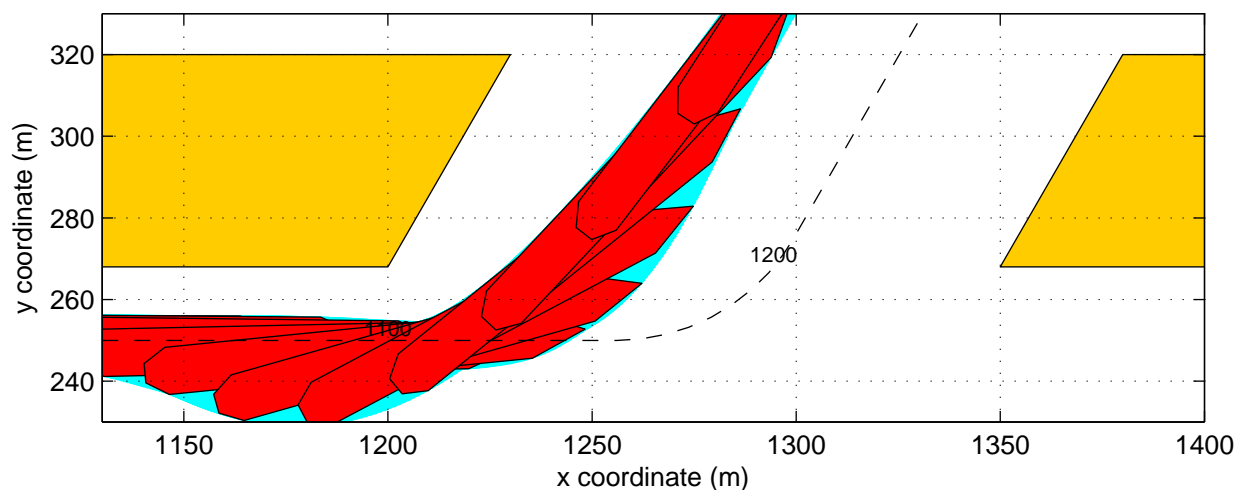
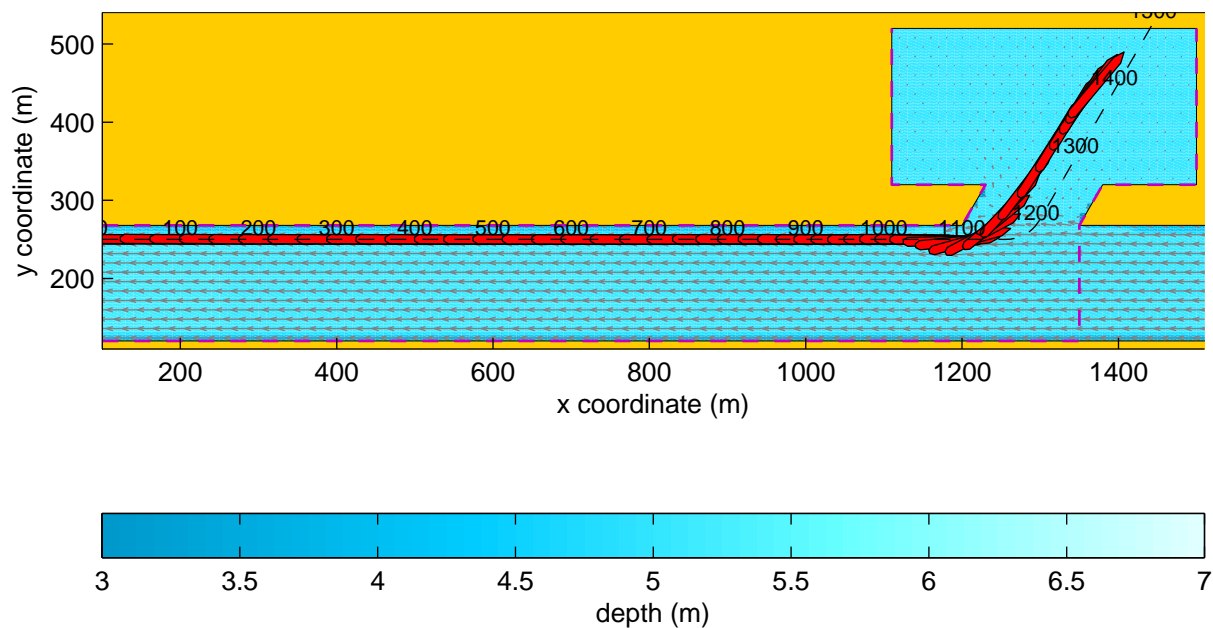
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 30

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

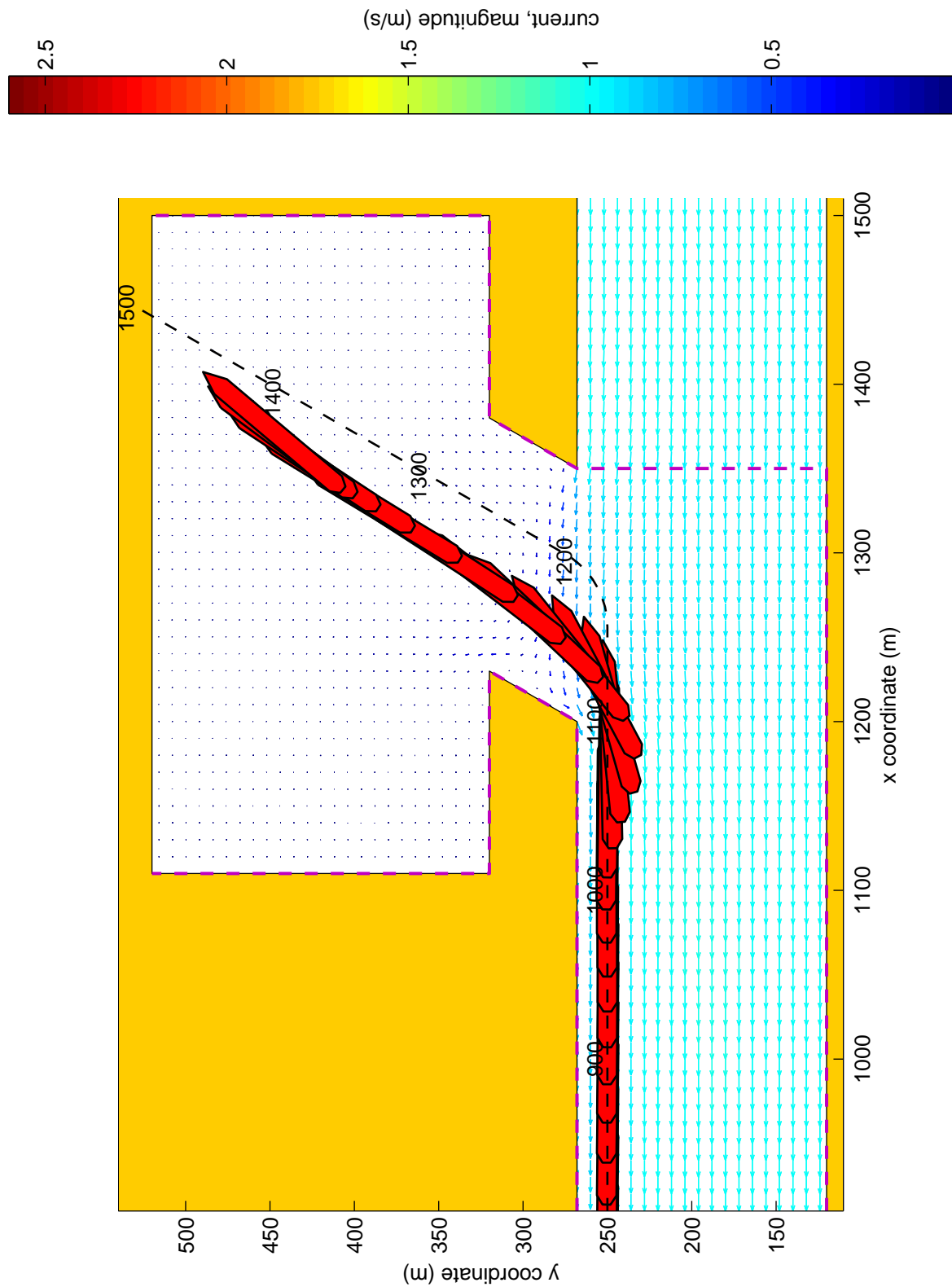
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 31

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

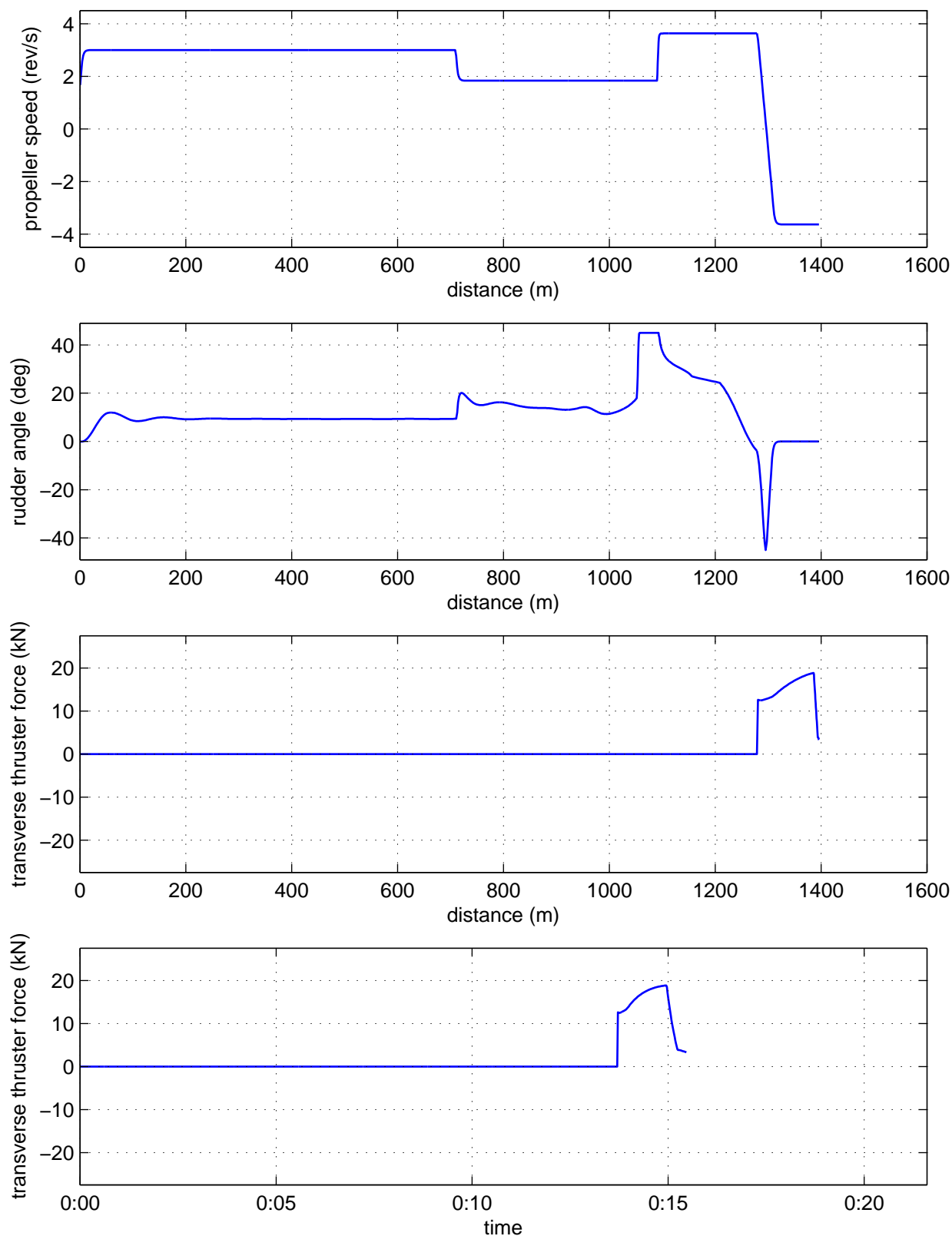
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 31

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

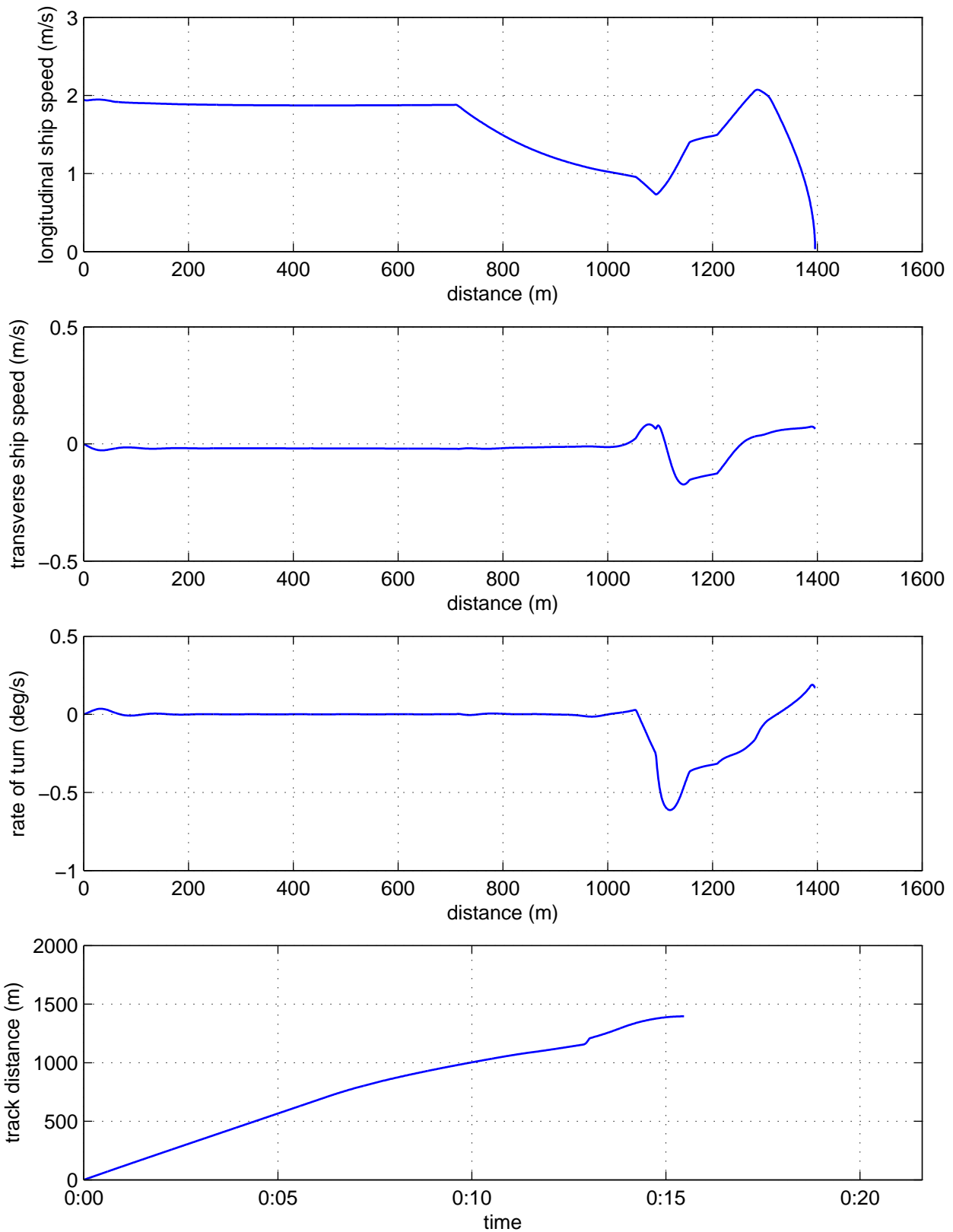
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 31

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

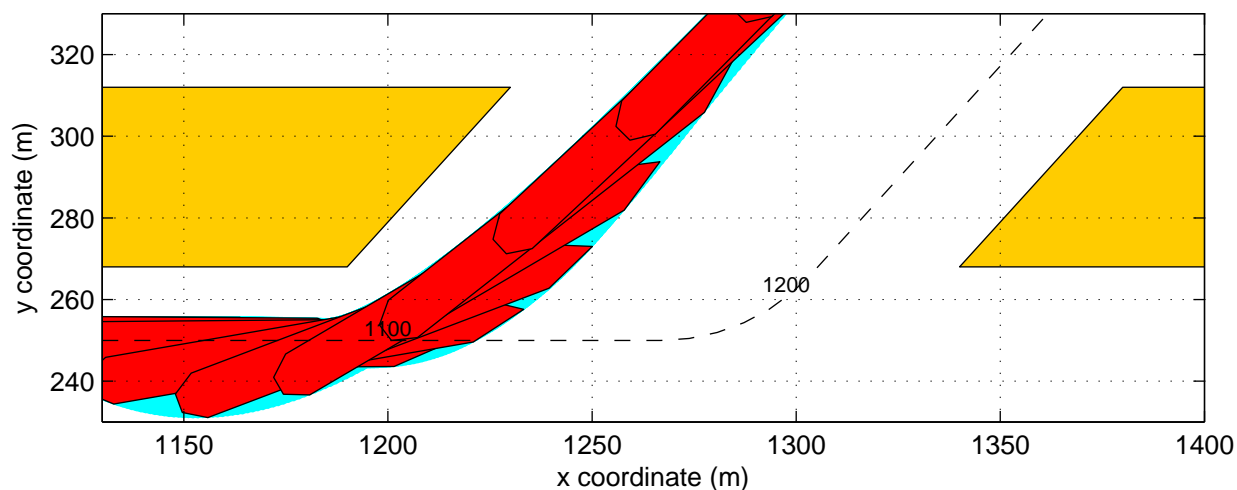
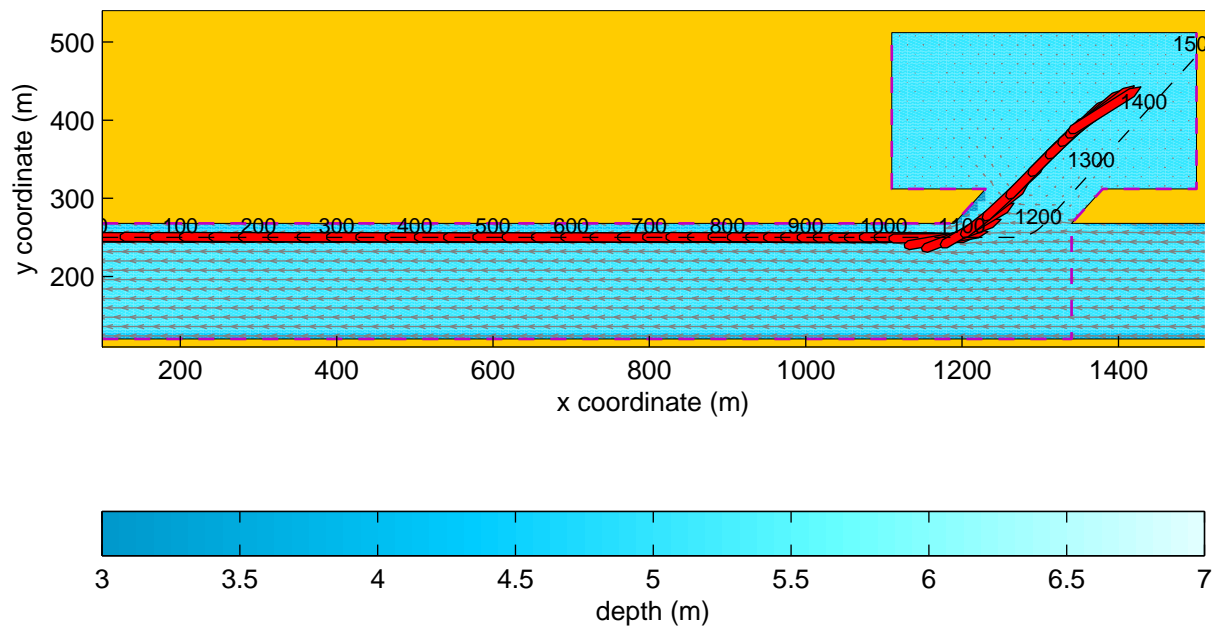
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 31

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 7

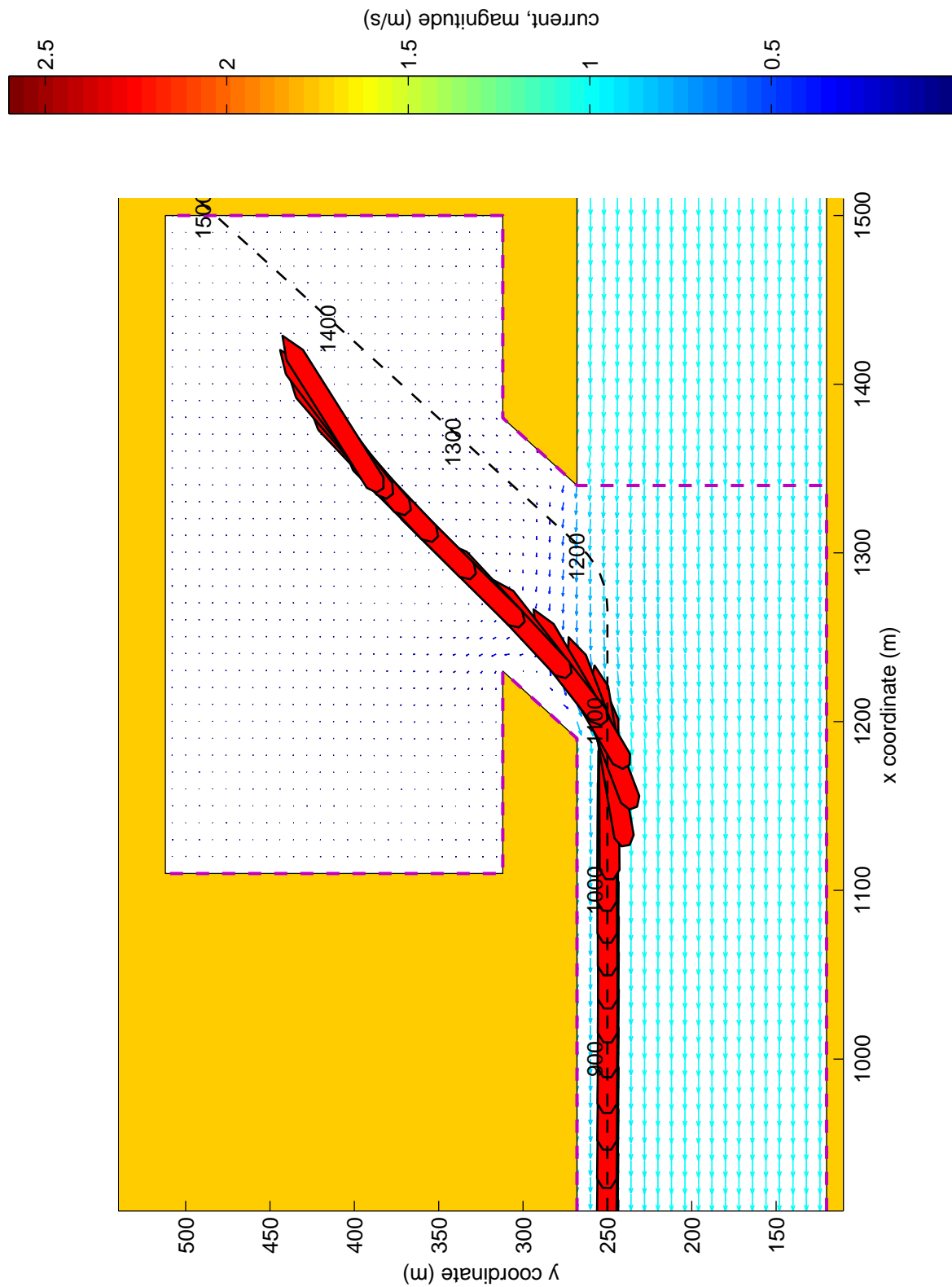
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 32

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 7

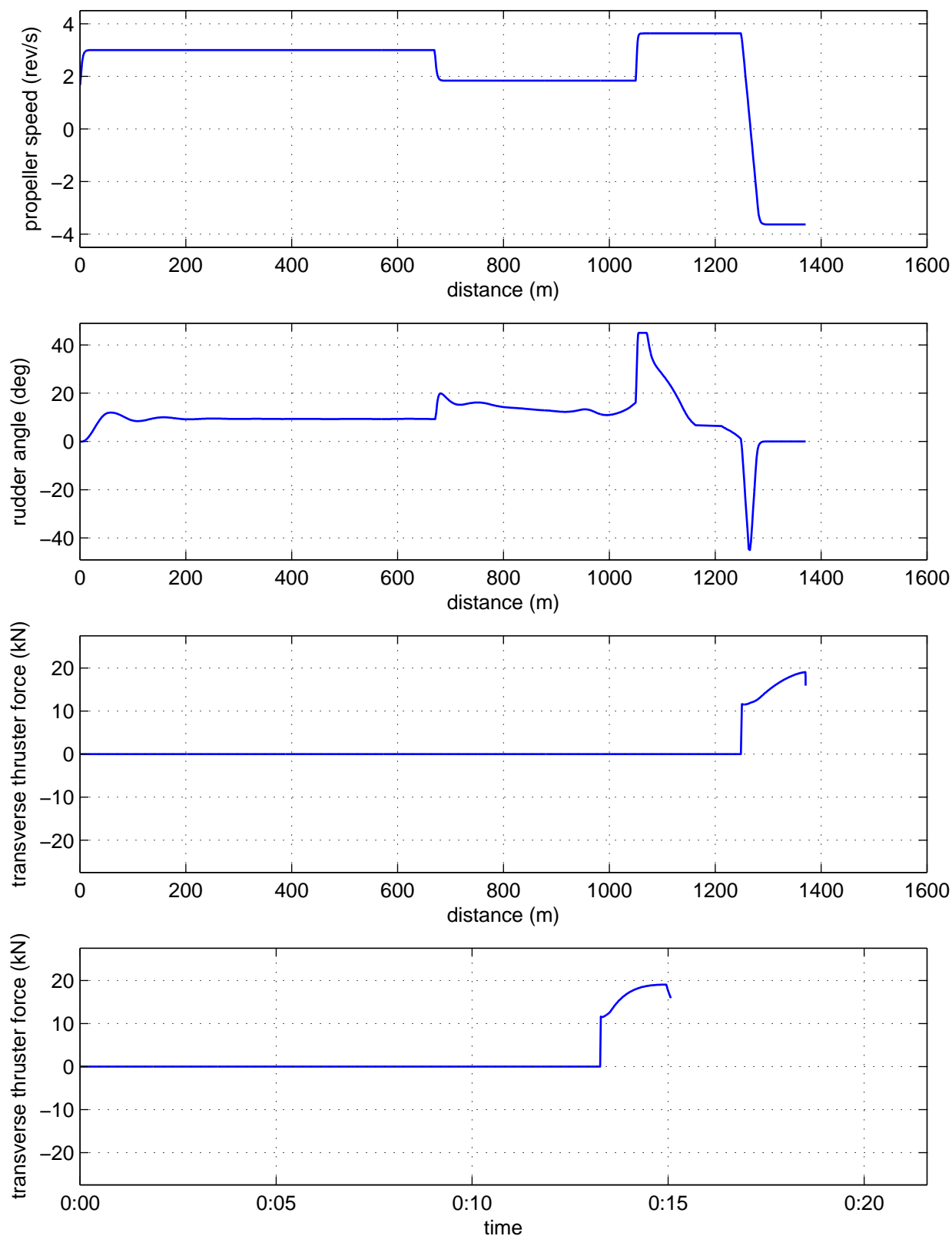
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 32

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

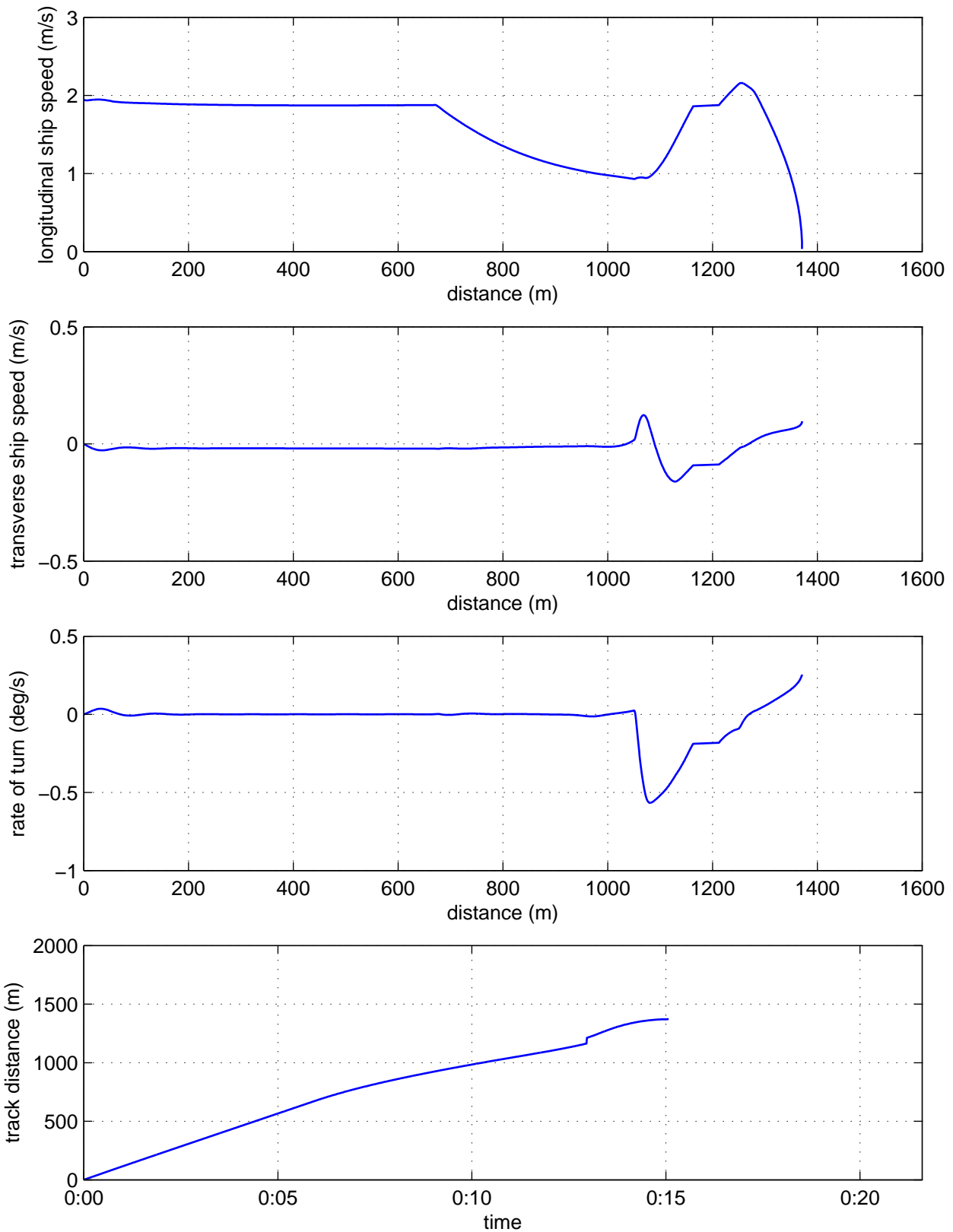
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 32

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

Current: 1.0 m/s

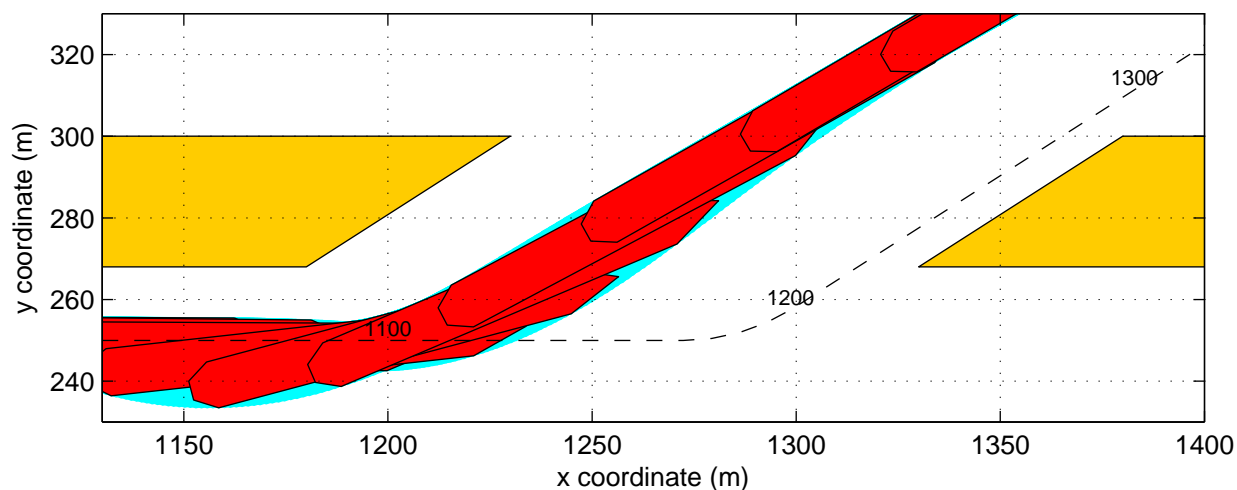
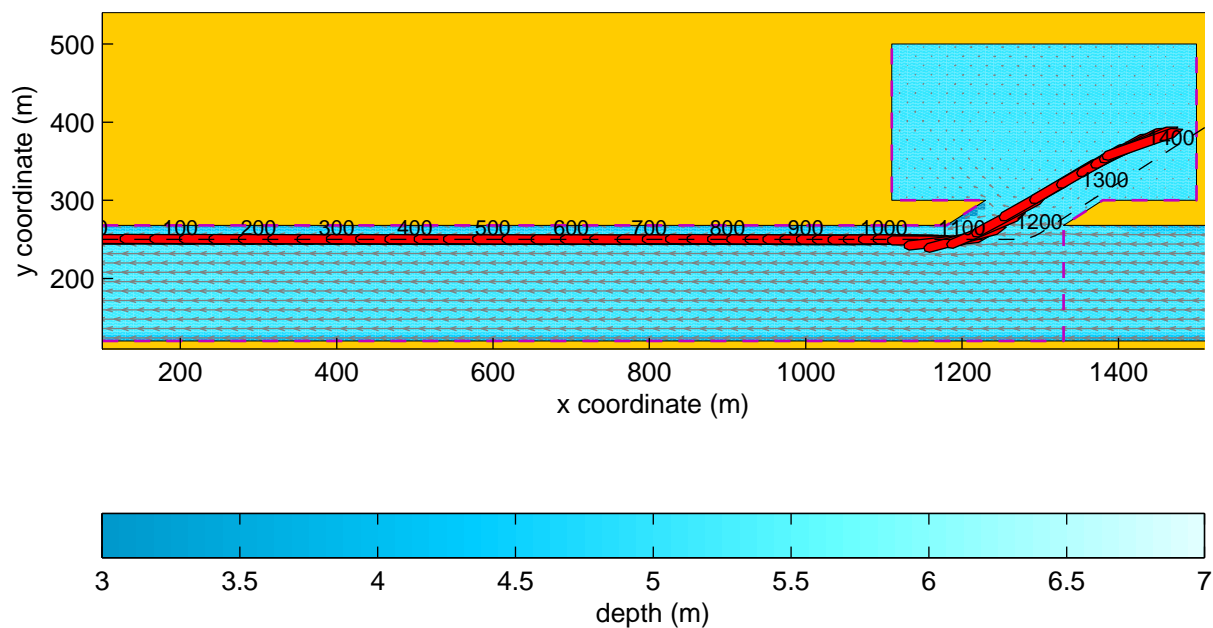
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 32

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 8

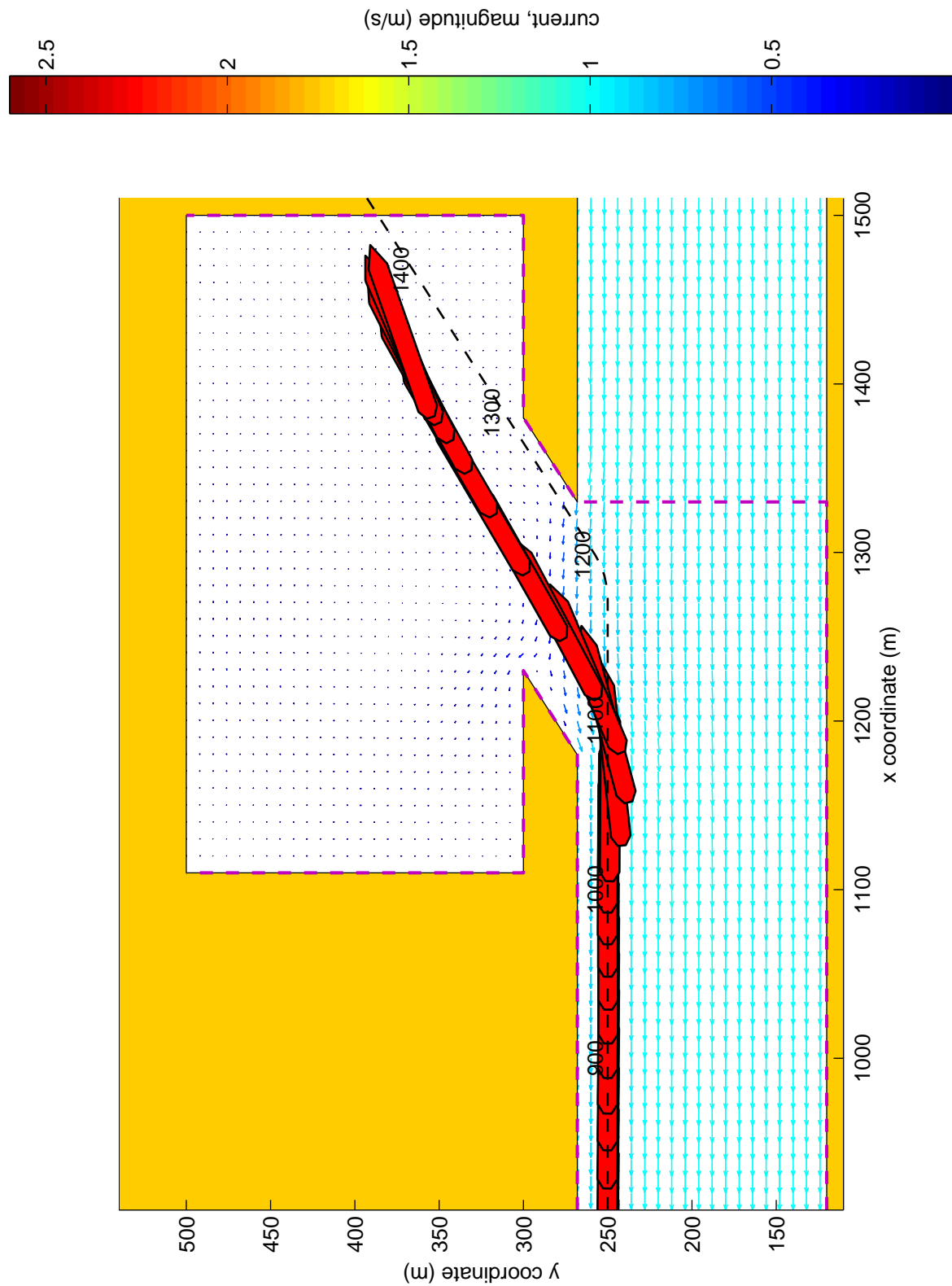
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 33

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 8

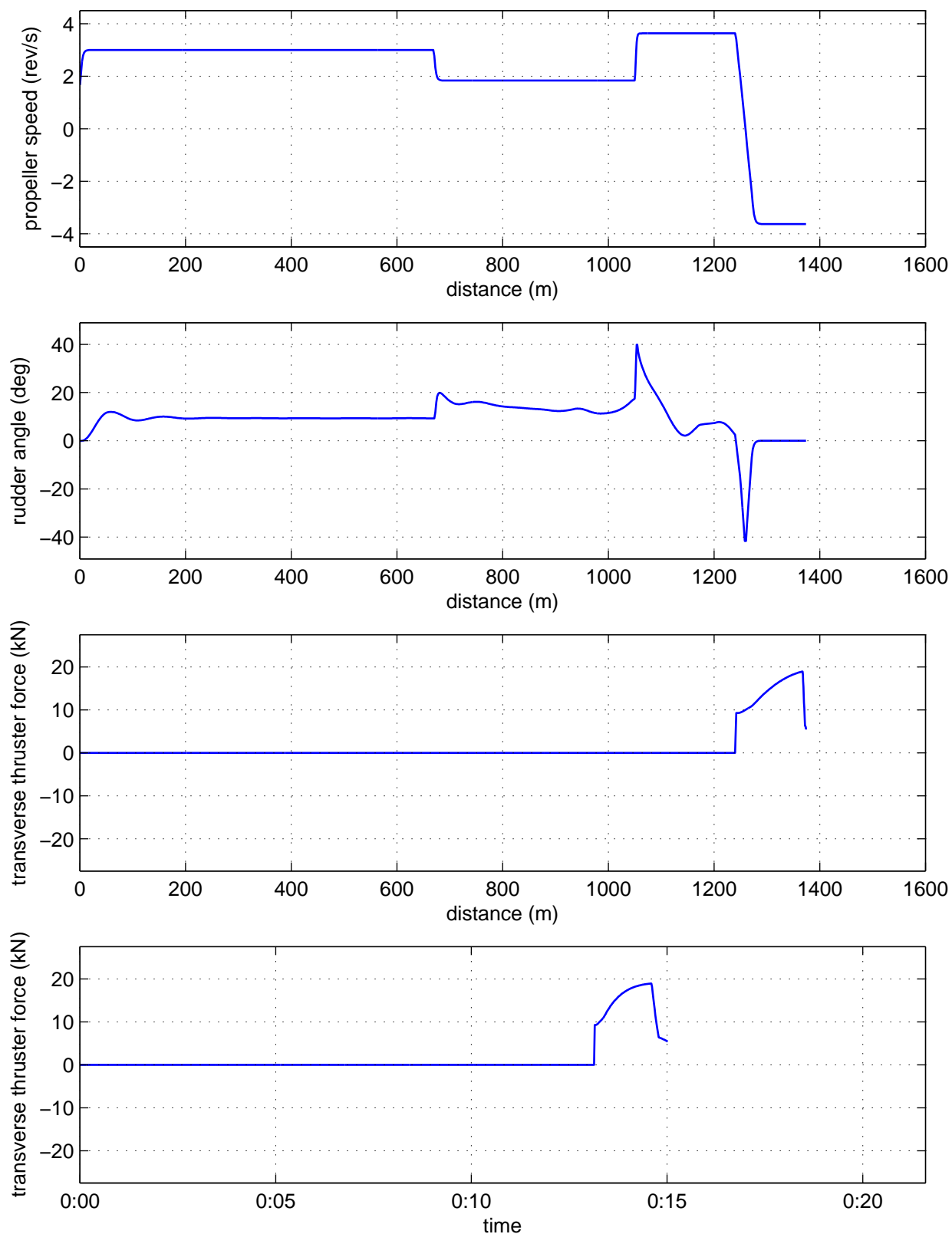
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 33

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

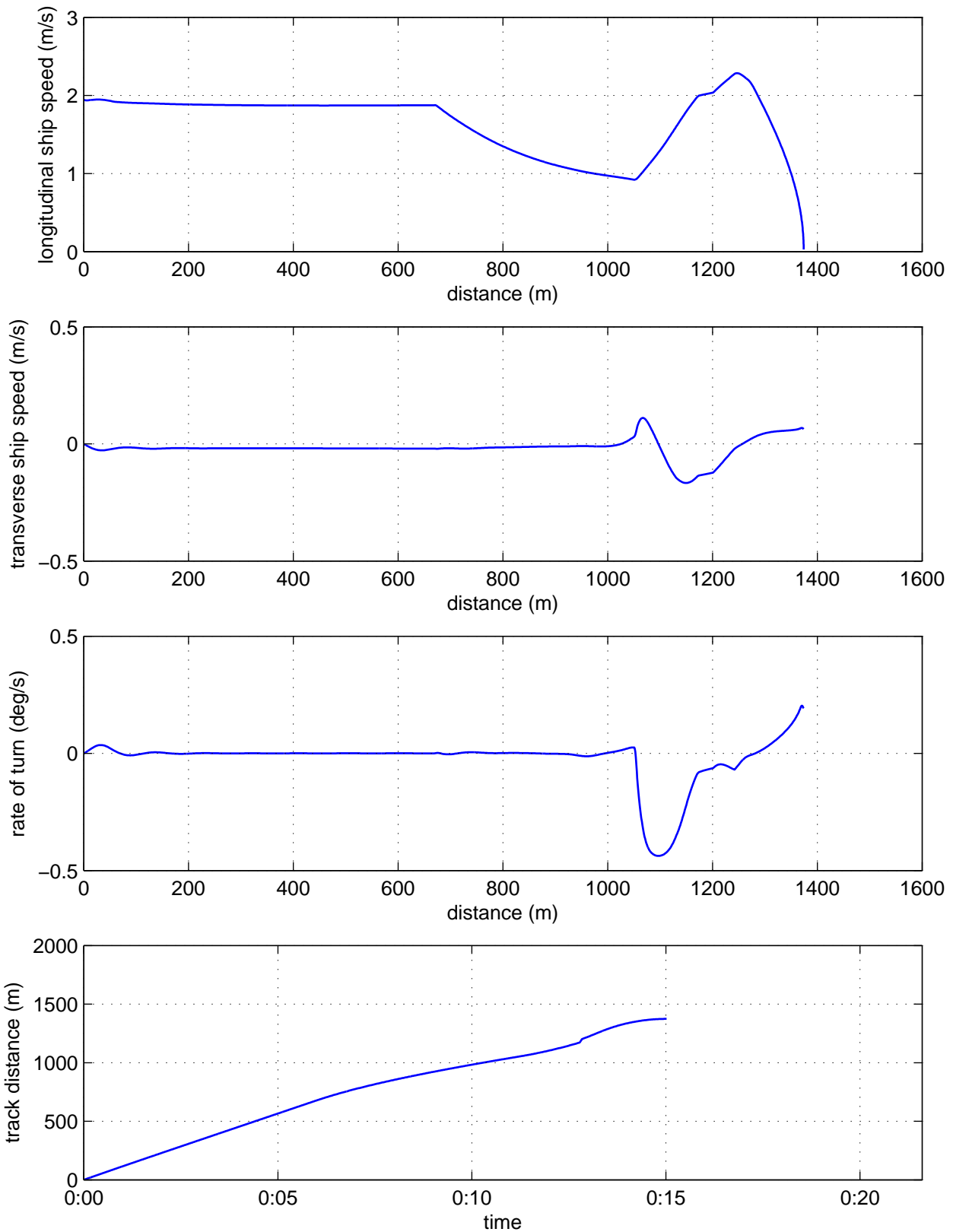
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 33

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

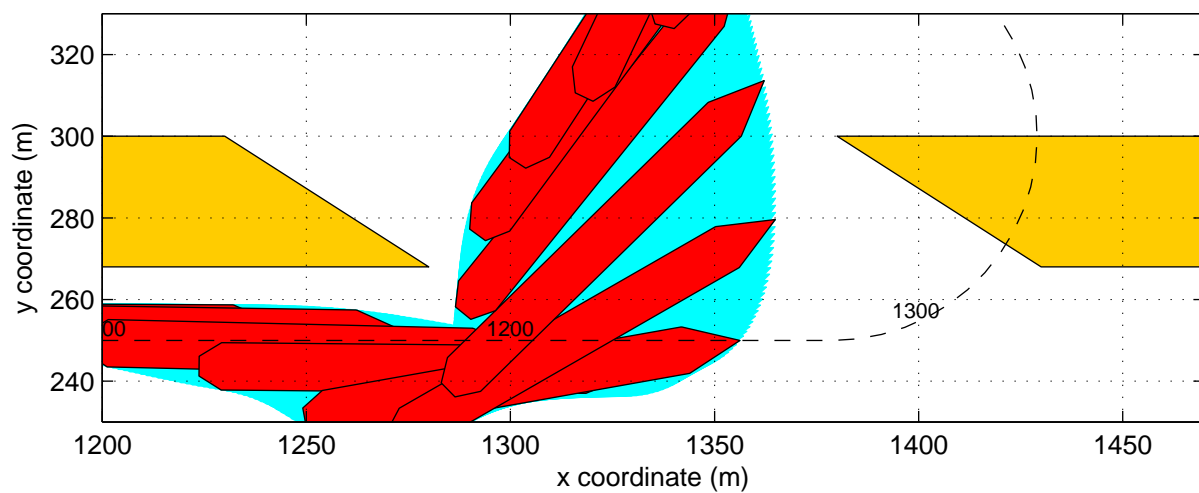
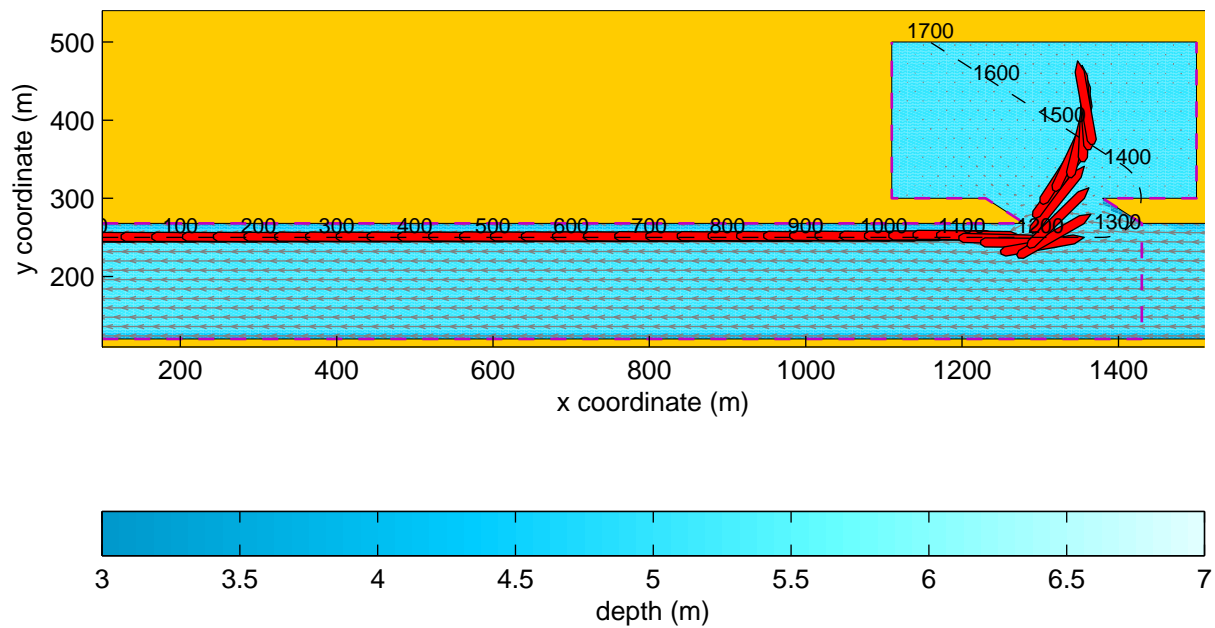
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 33

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 3

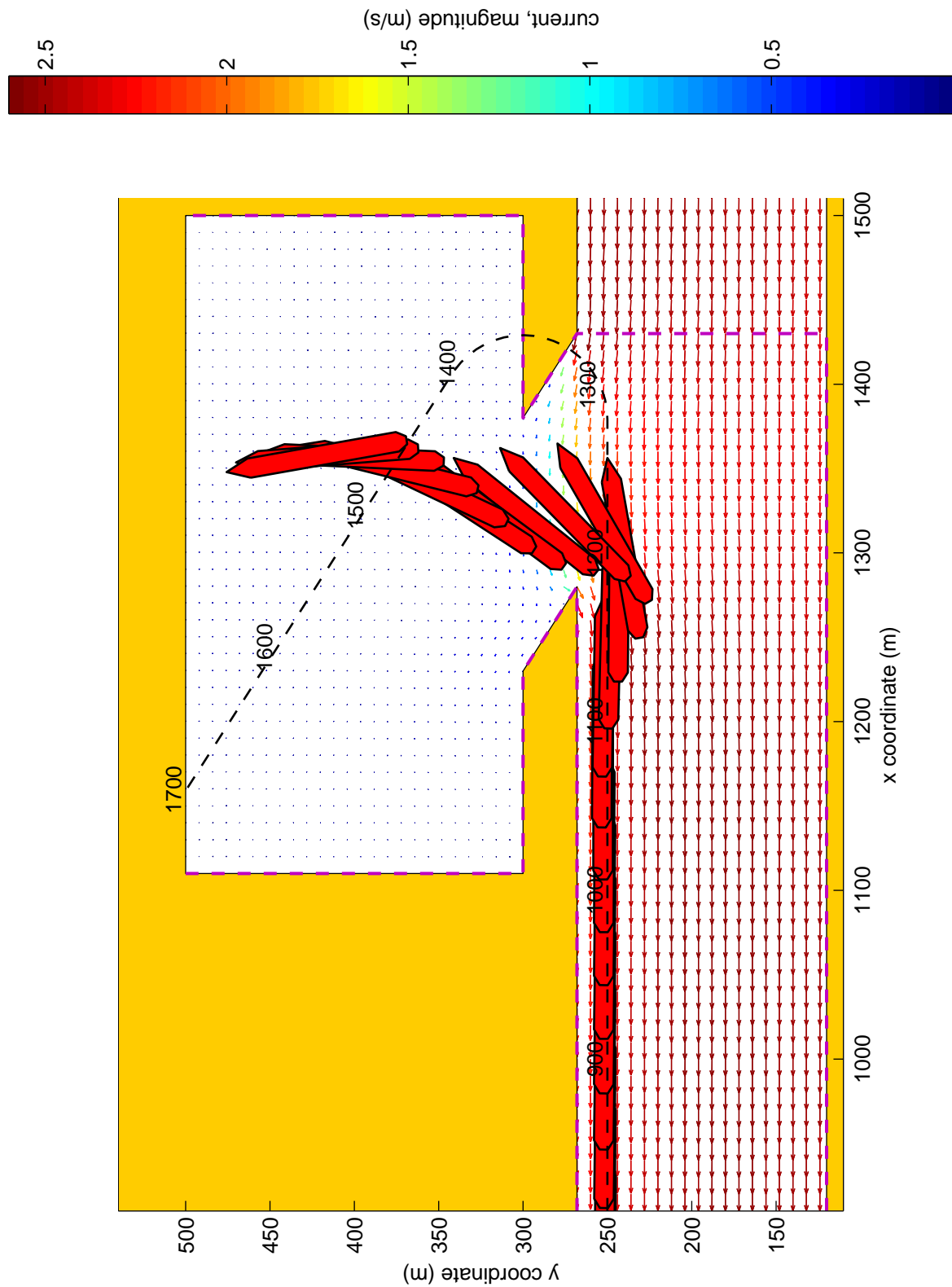
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 34

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 3

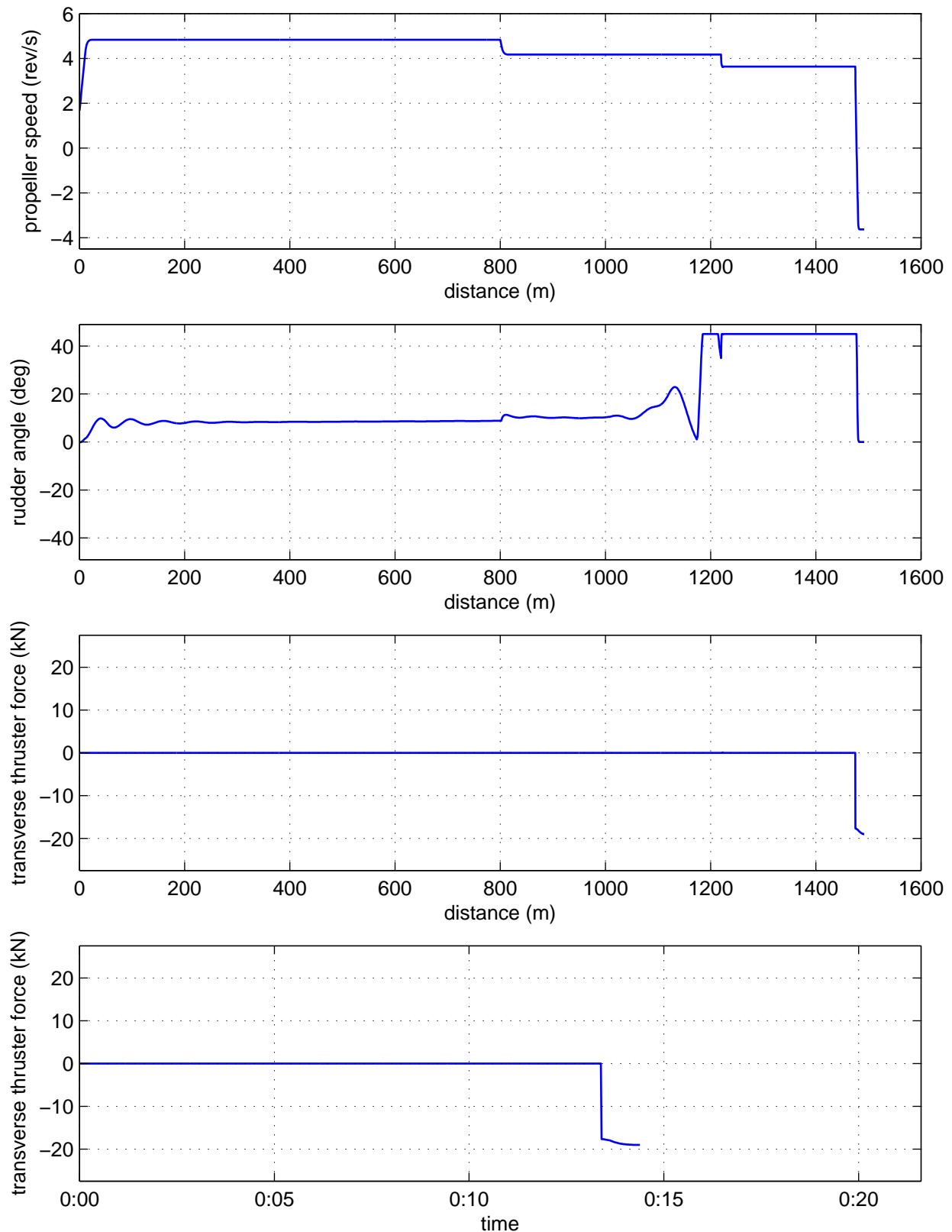
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 34

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 3

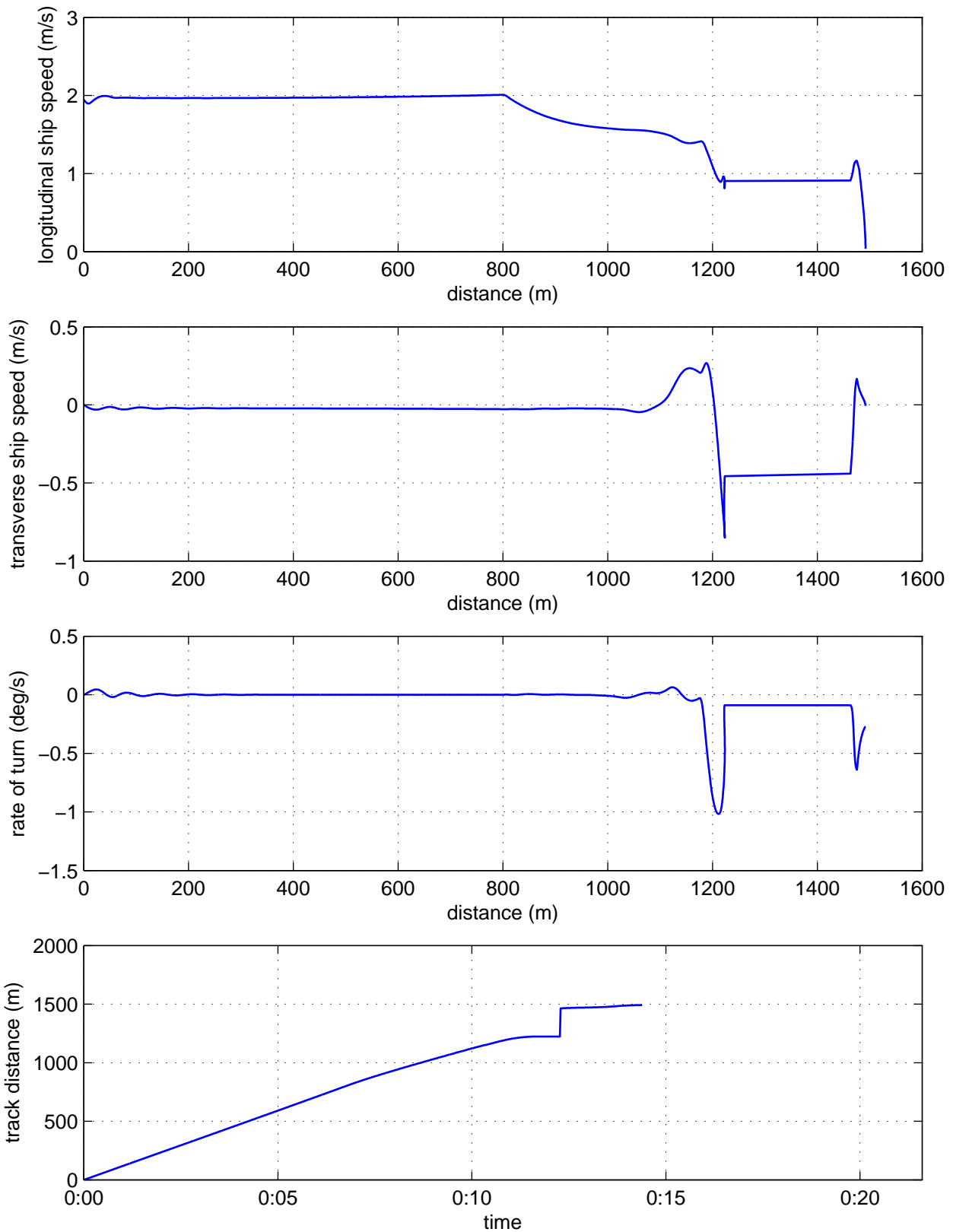
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 34

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 3

Current: 2.5 m/s

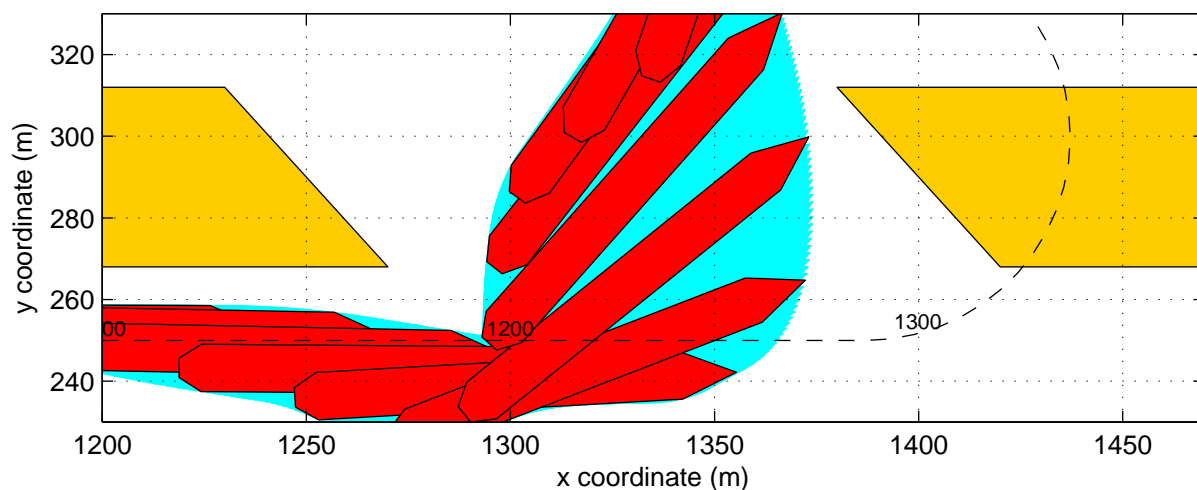
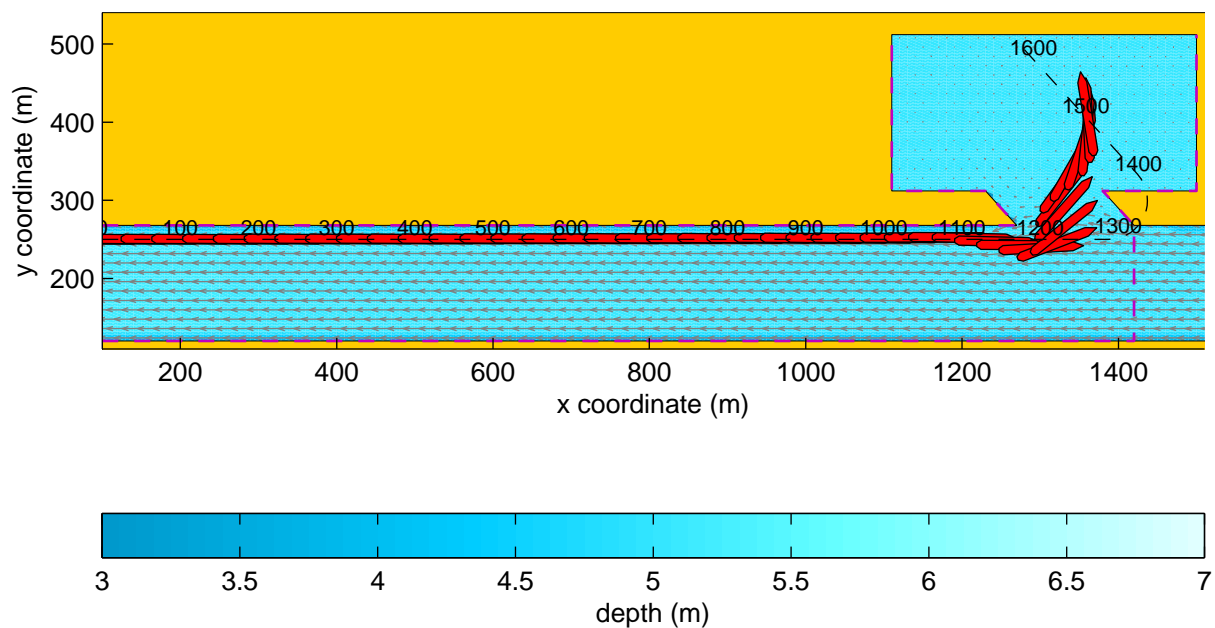
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 34

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 4

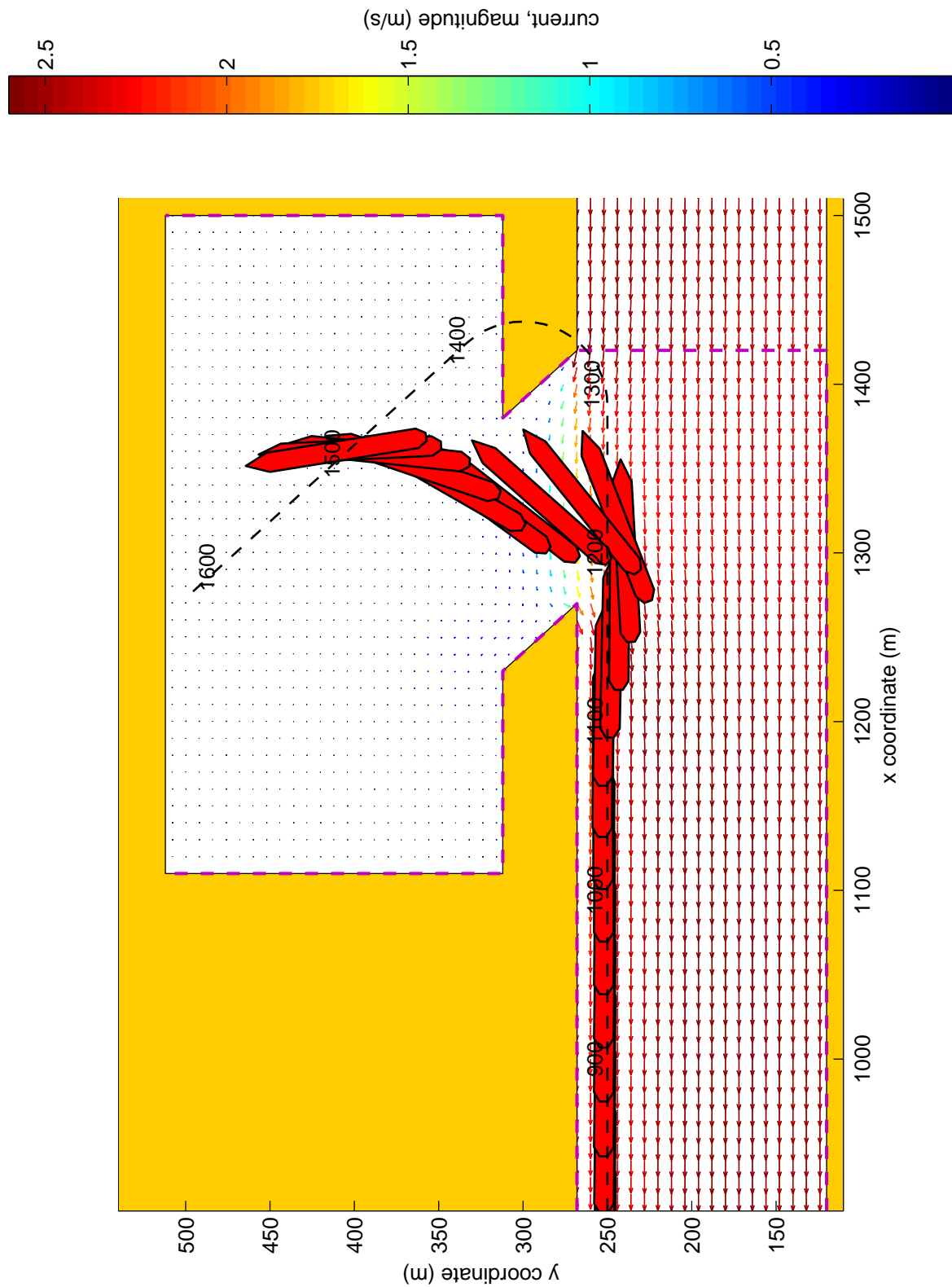
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 35

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 4

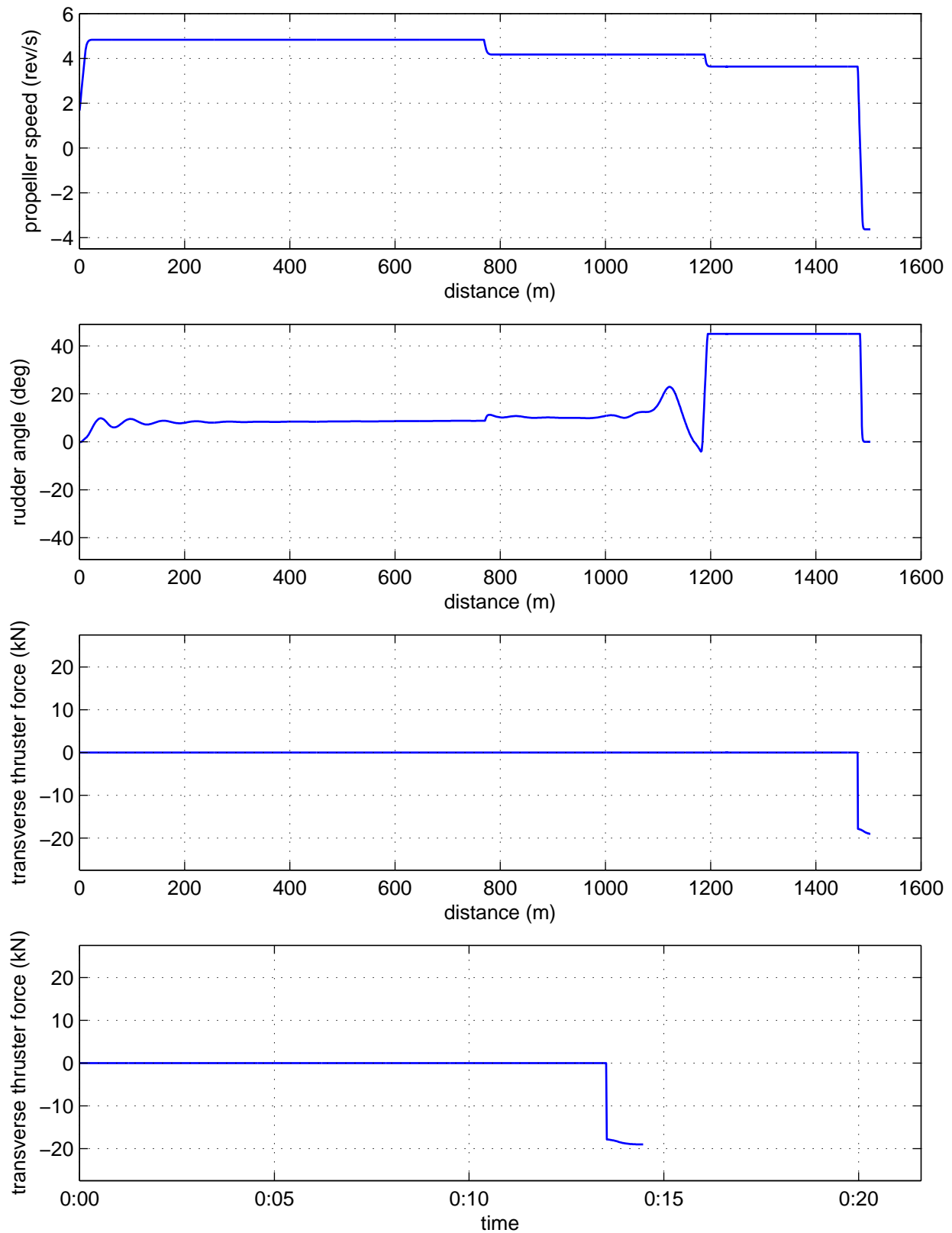
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 35

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 4

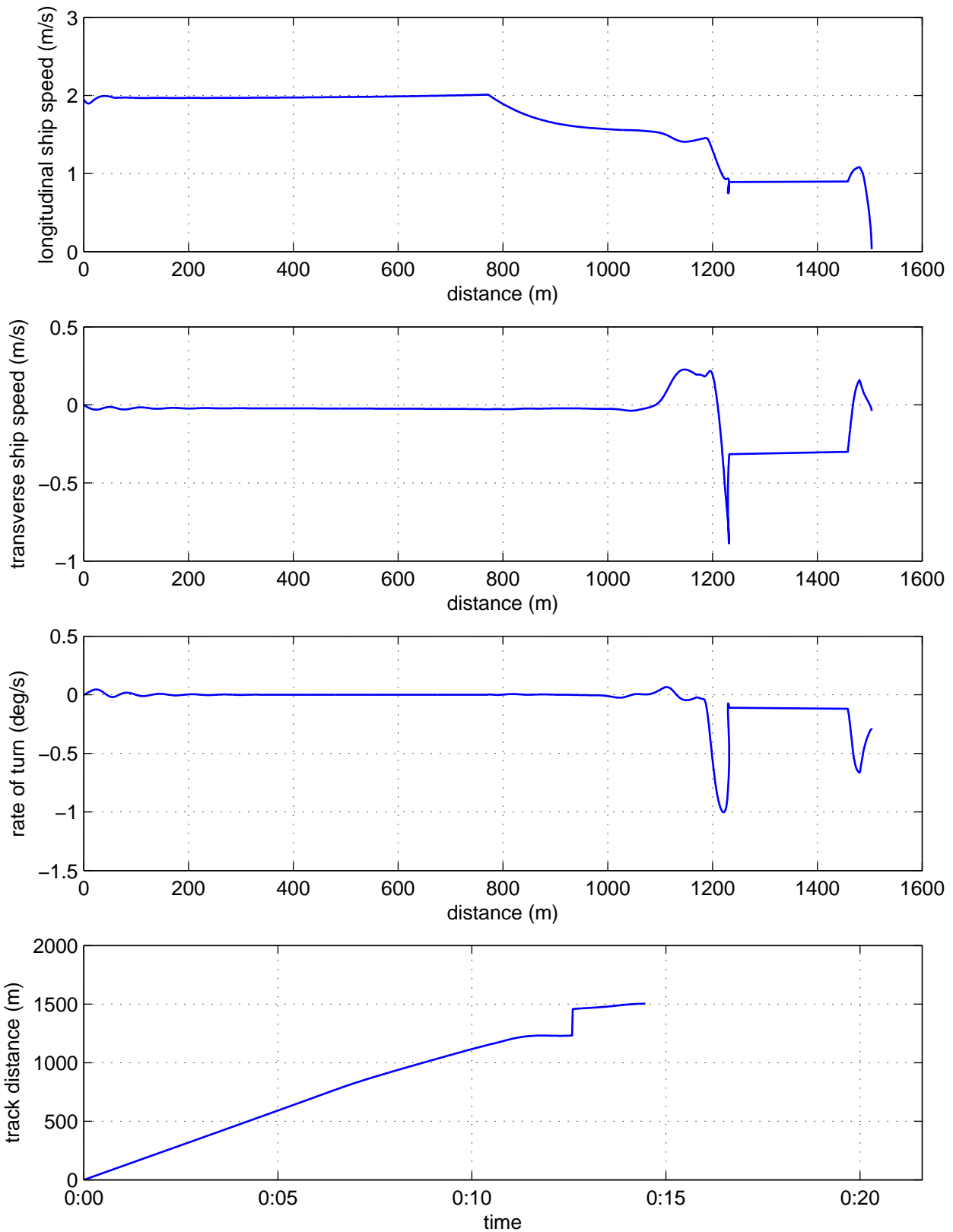
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 35

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 4

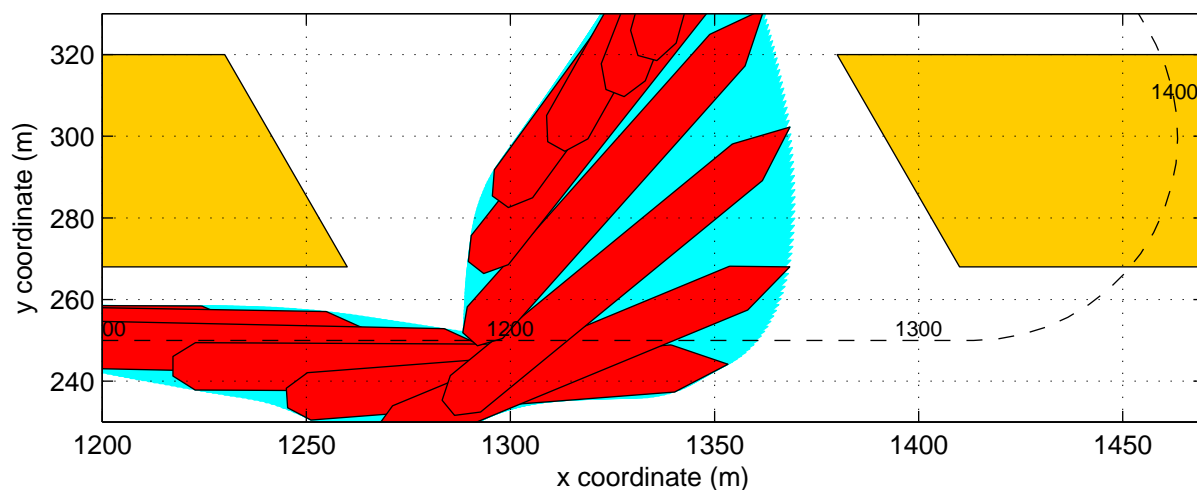
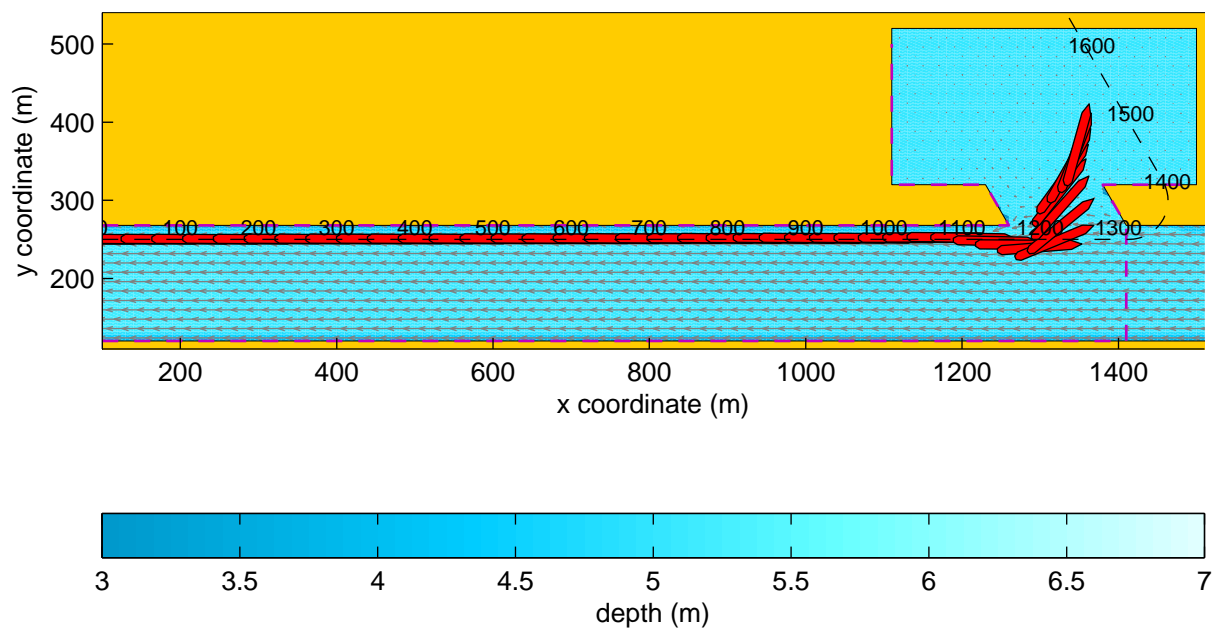
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 35

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 5

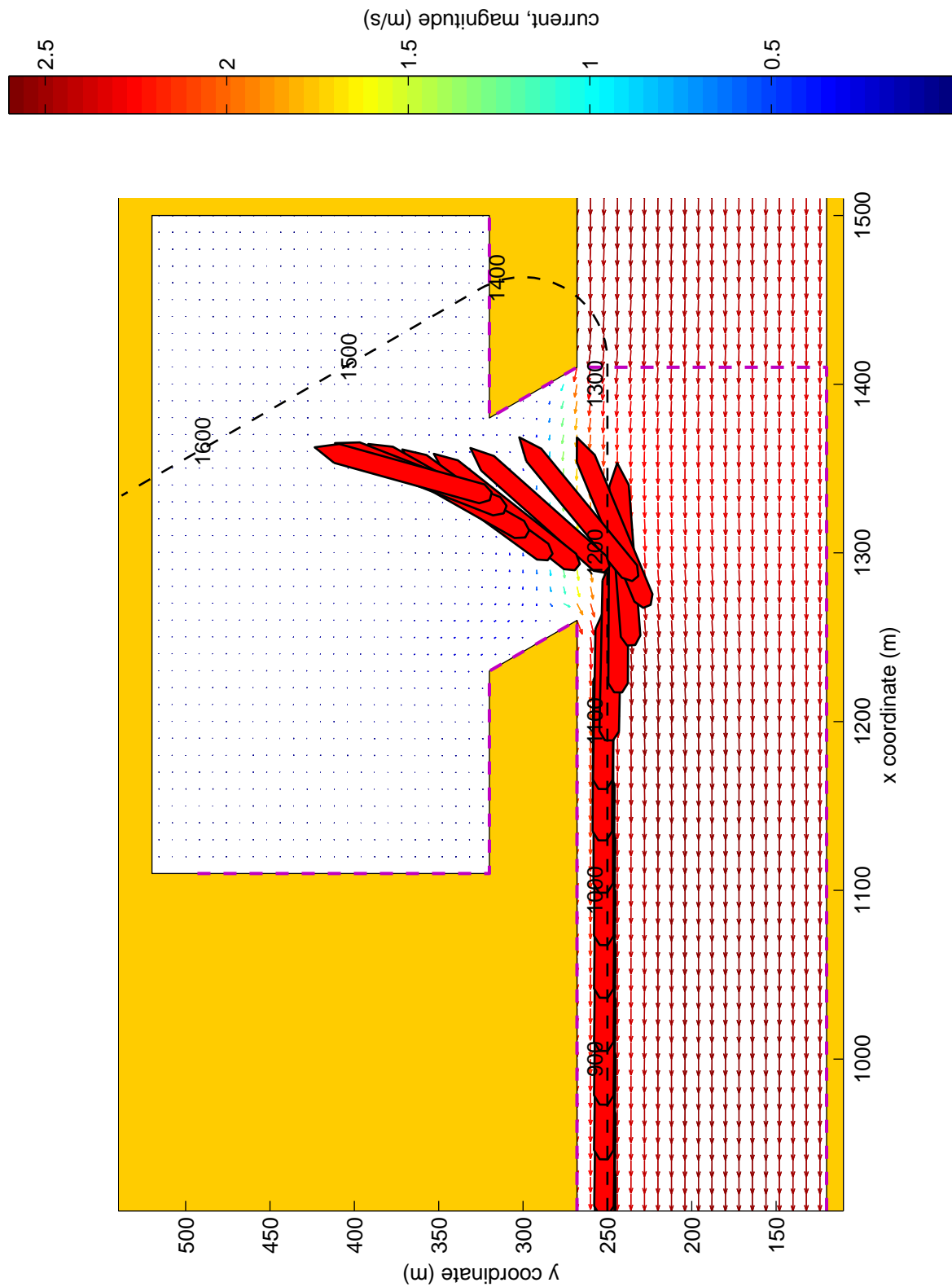
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 36

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 5

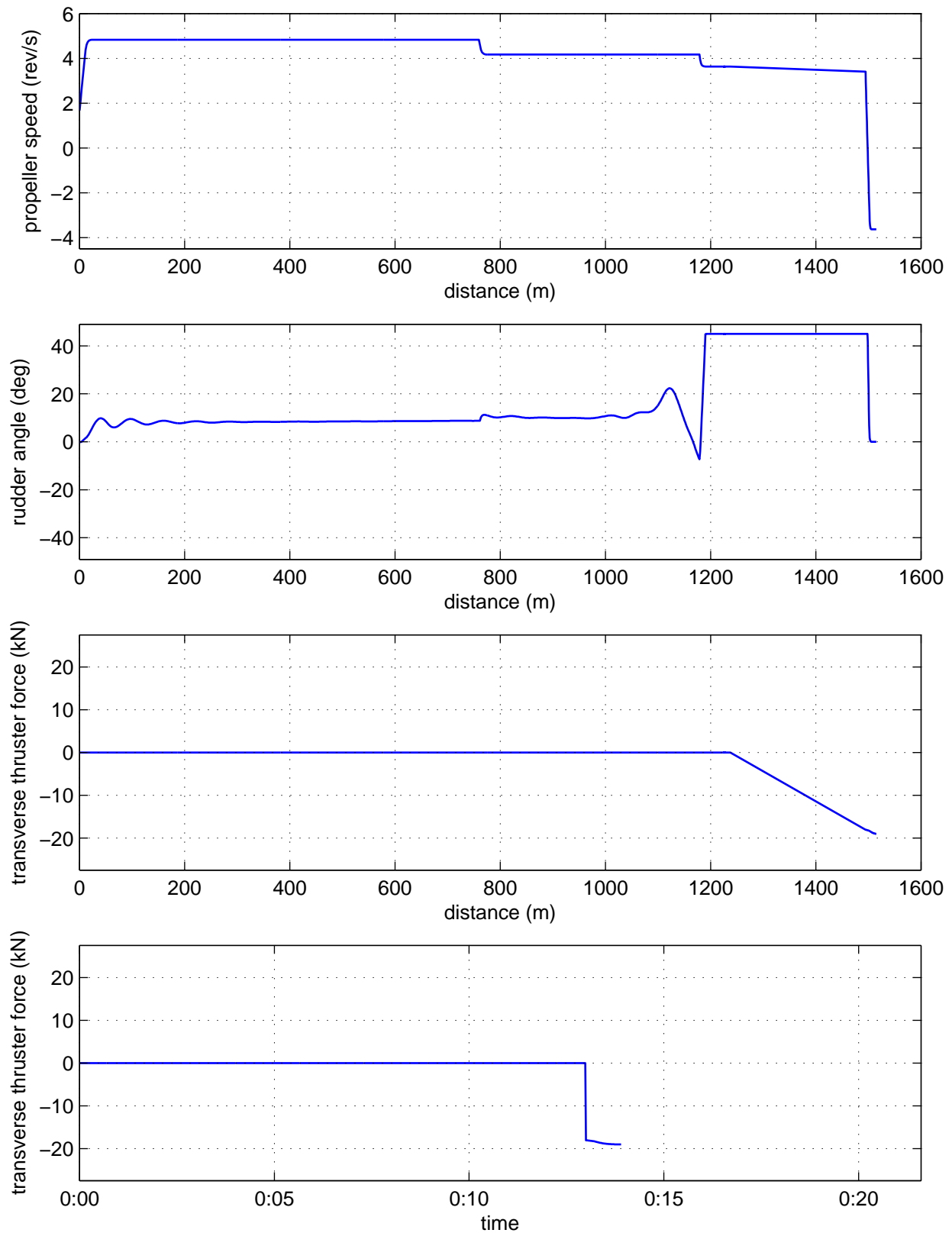
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 36

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 5

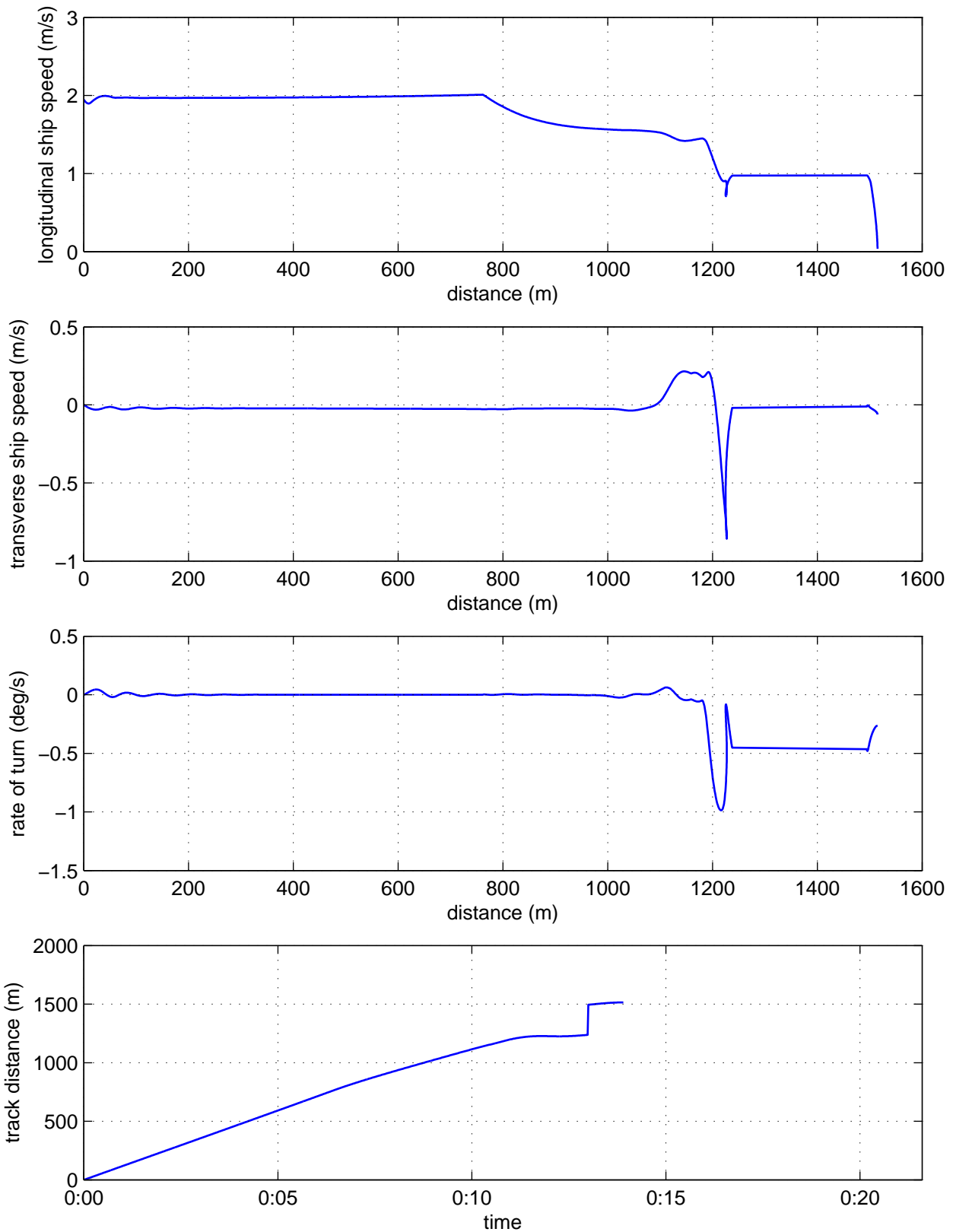
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 36

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 5

Current: 2.5 m/s

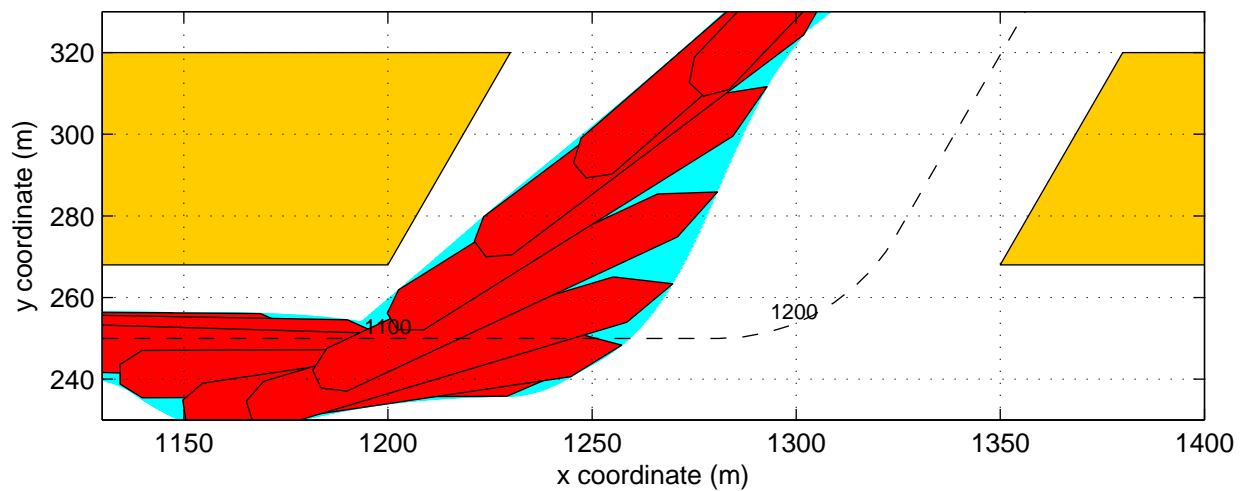
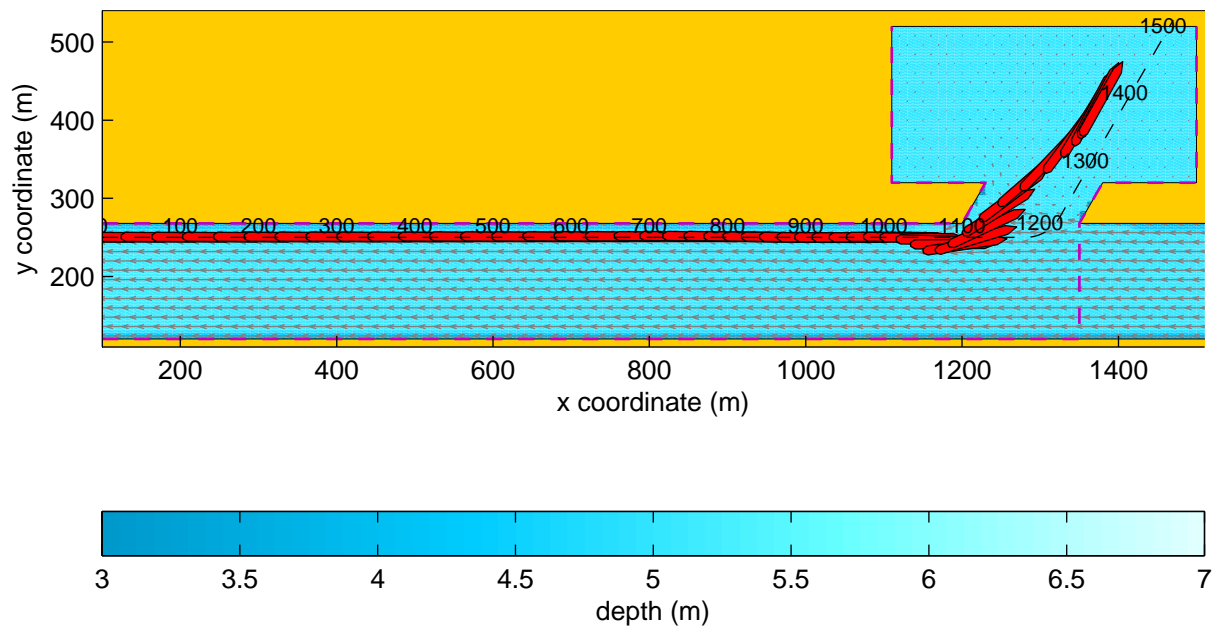
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 36

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

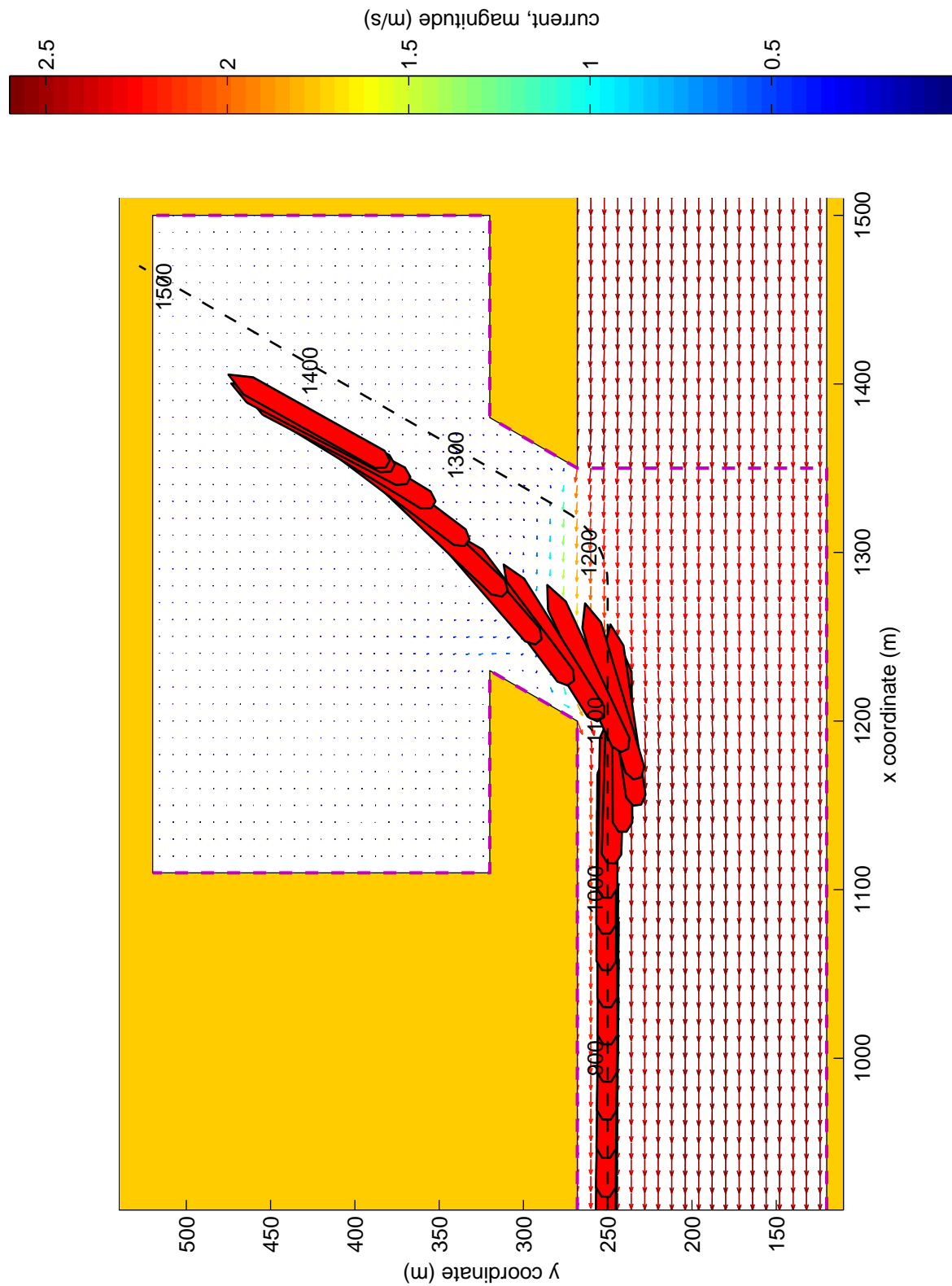
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 37

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

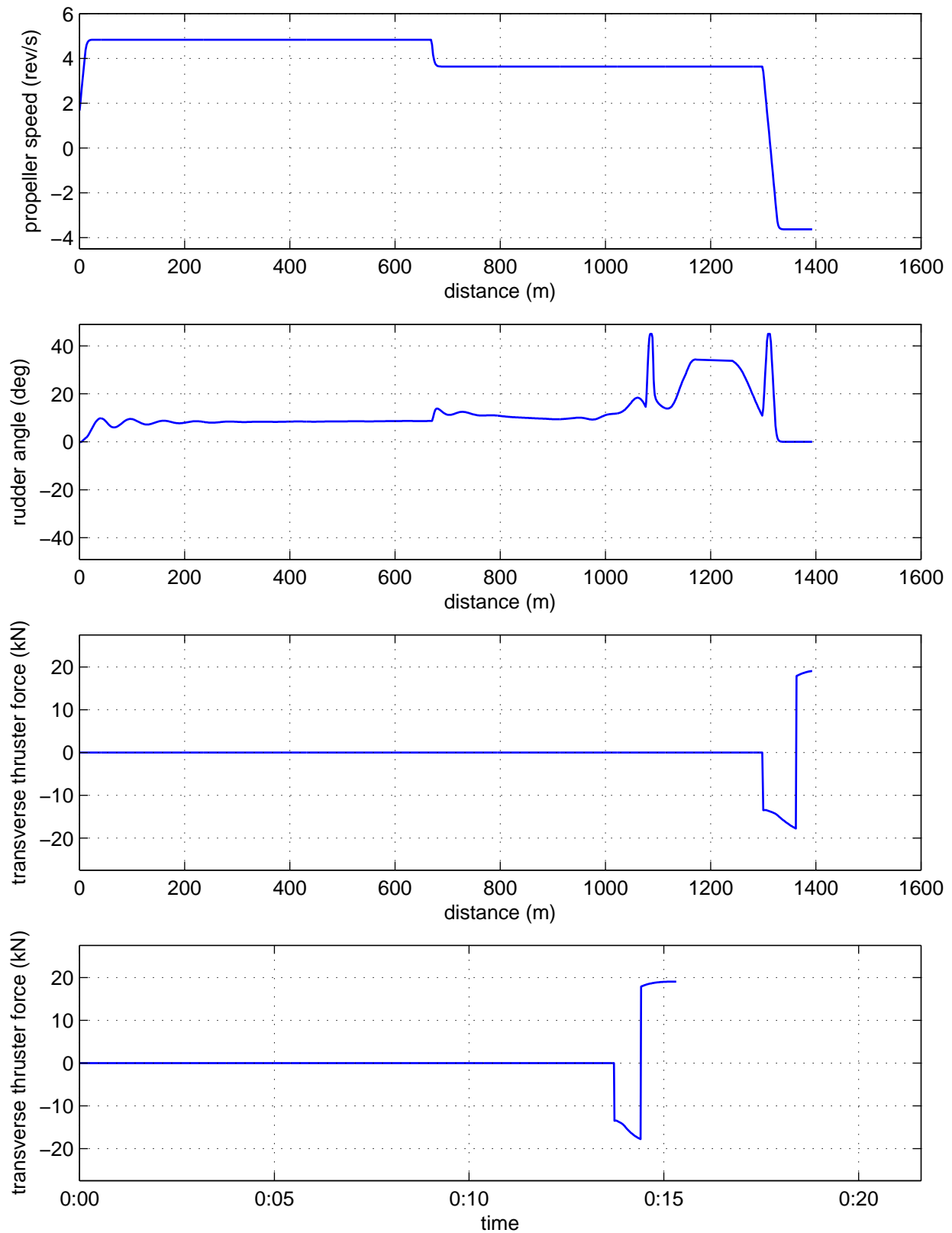
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 37

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

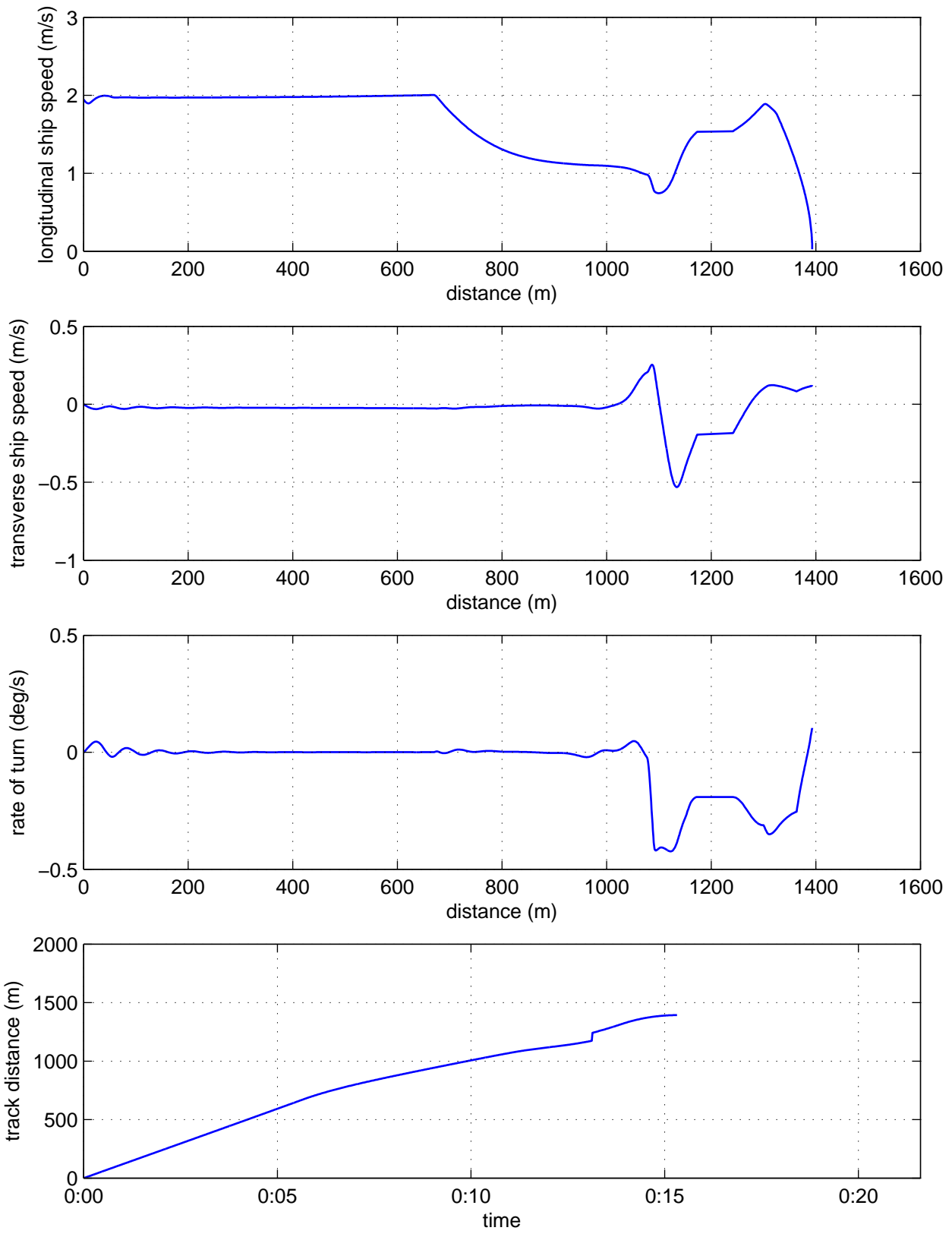
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 37

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

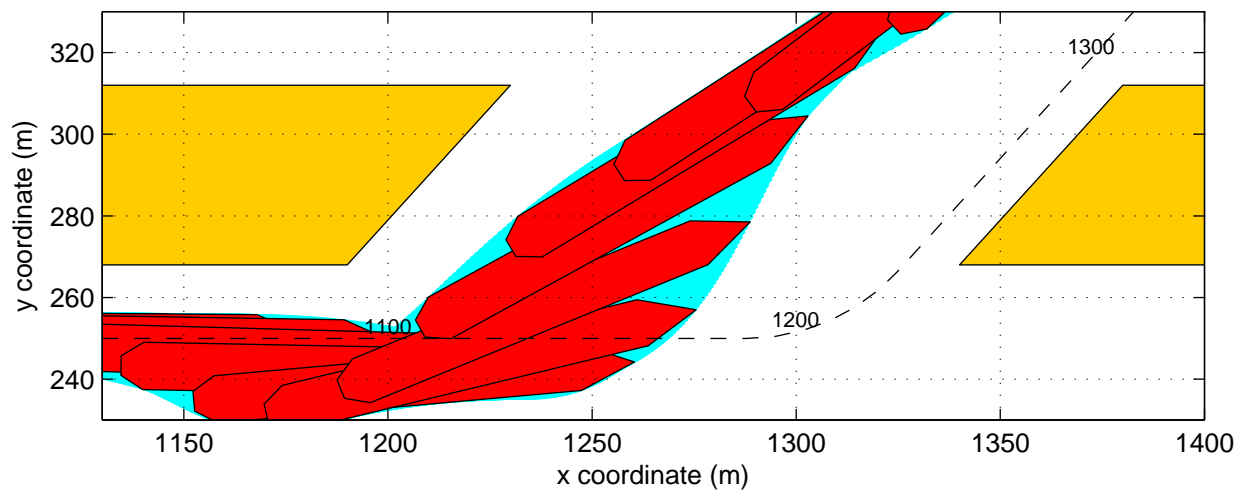
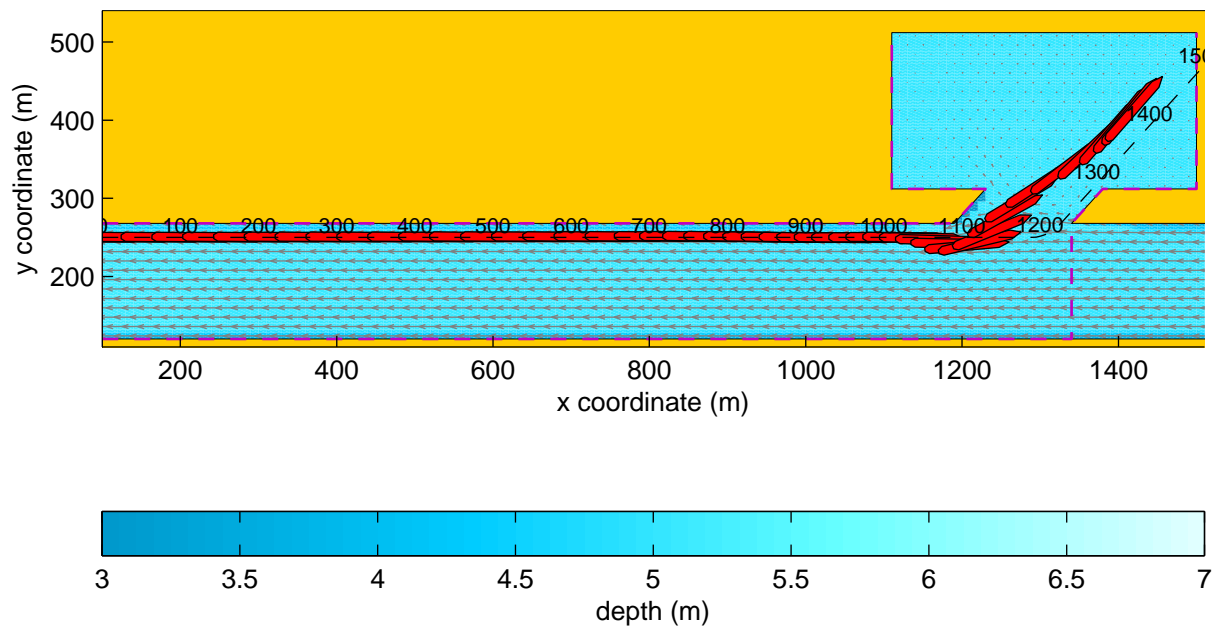
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 37

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 7

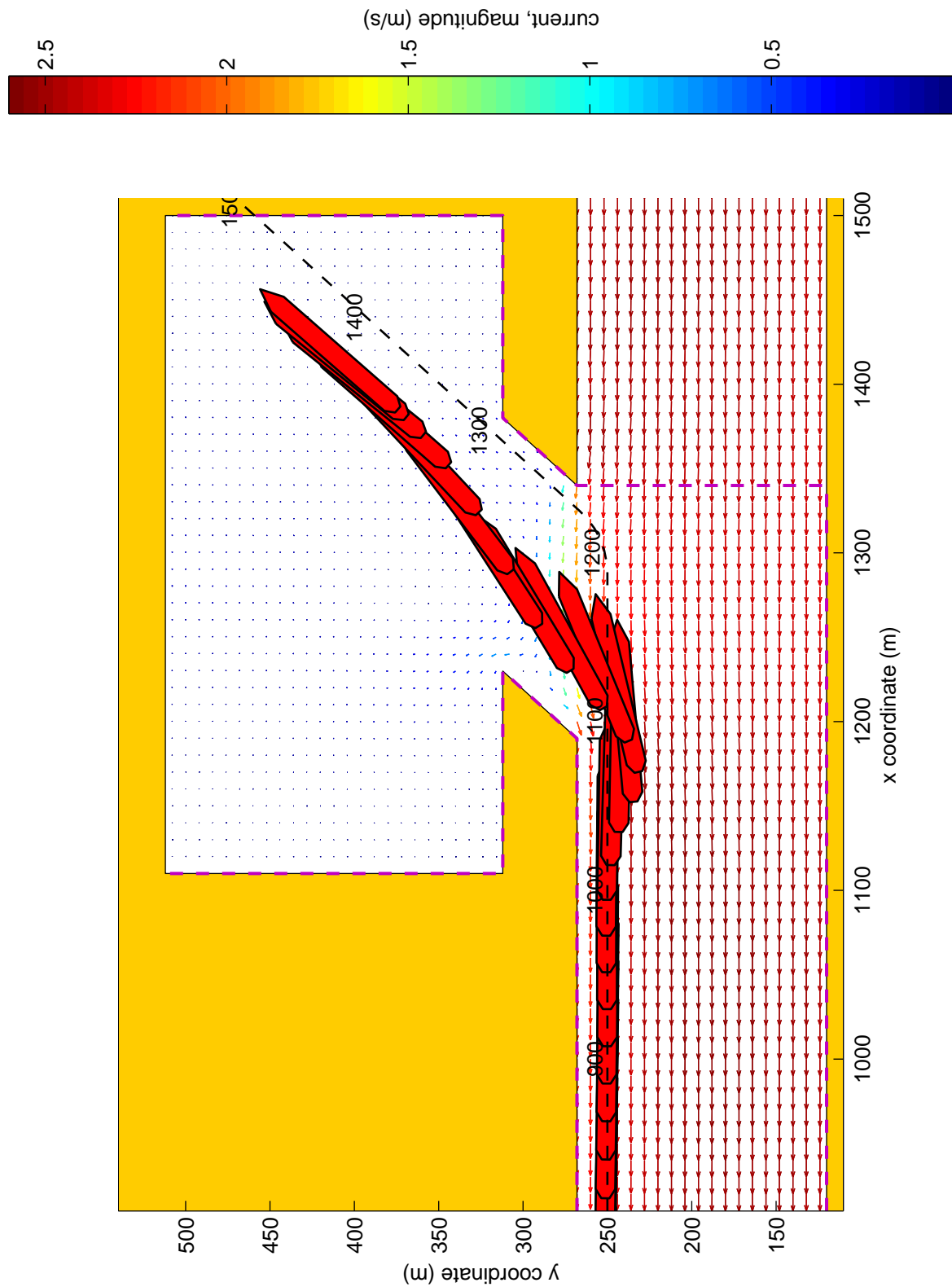
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 38

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 7

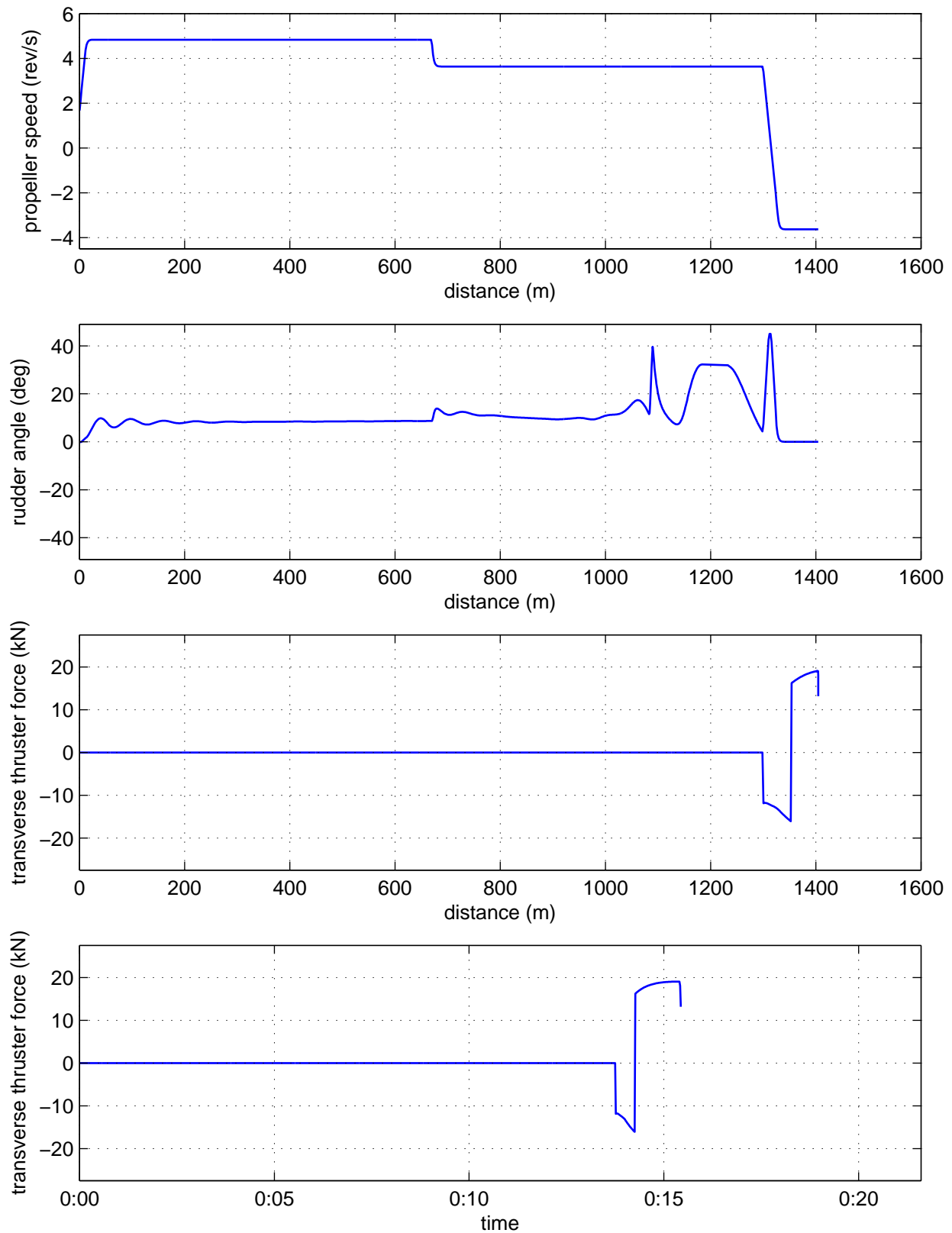
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 38

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

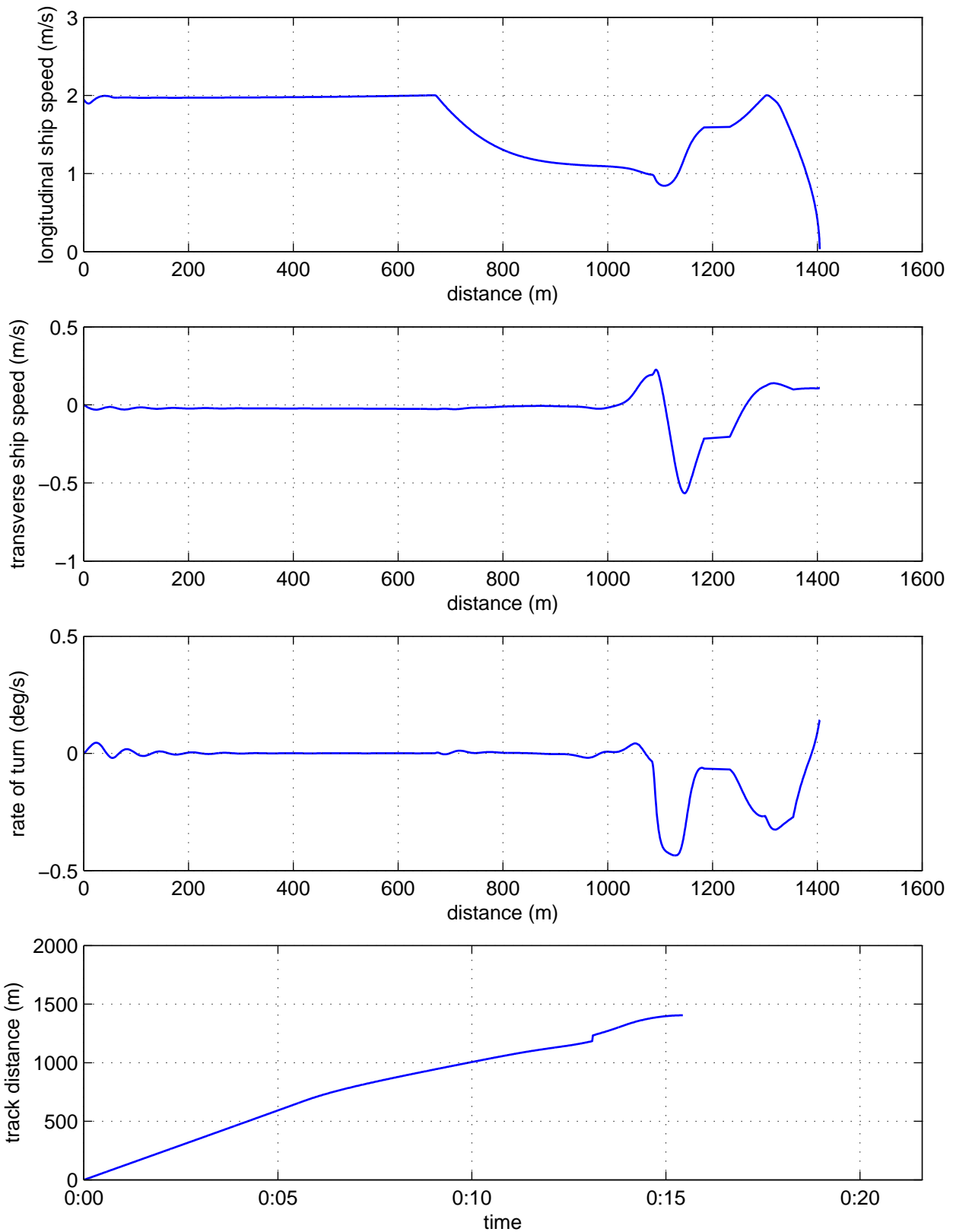
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 38

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

Current: 2.5 m/s

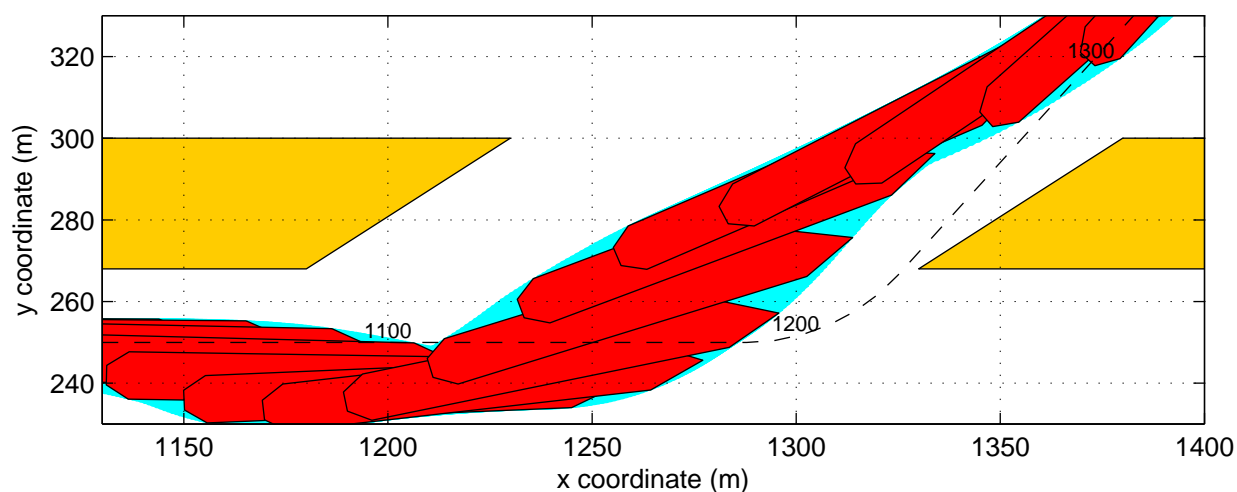
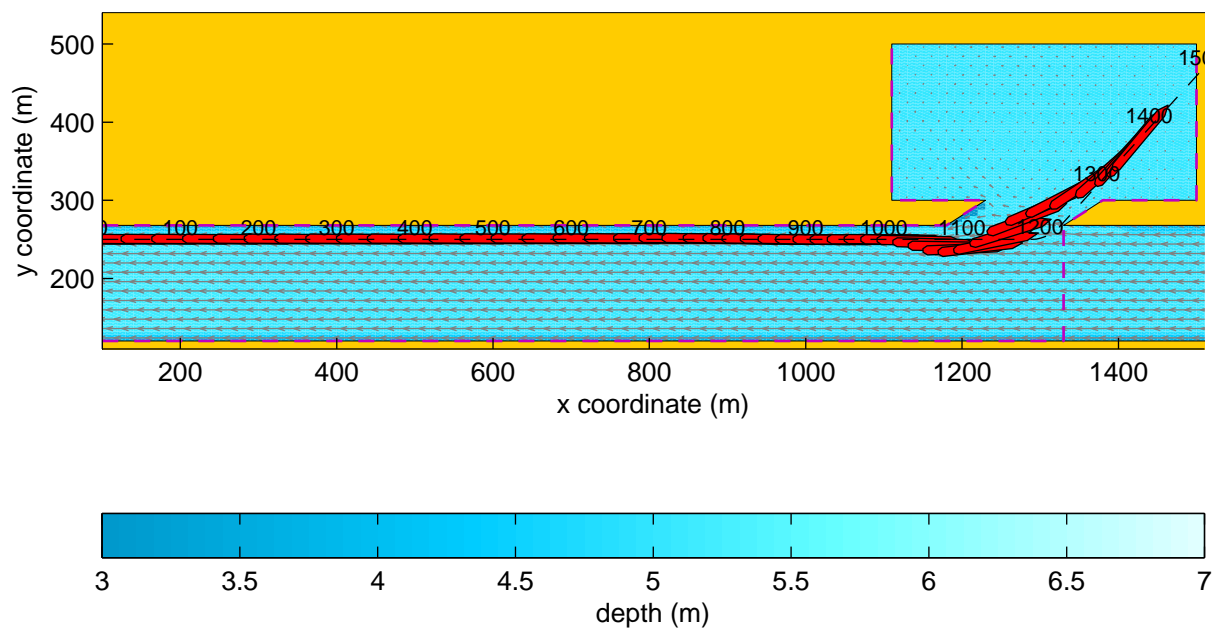
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 38

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 8

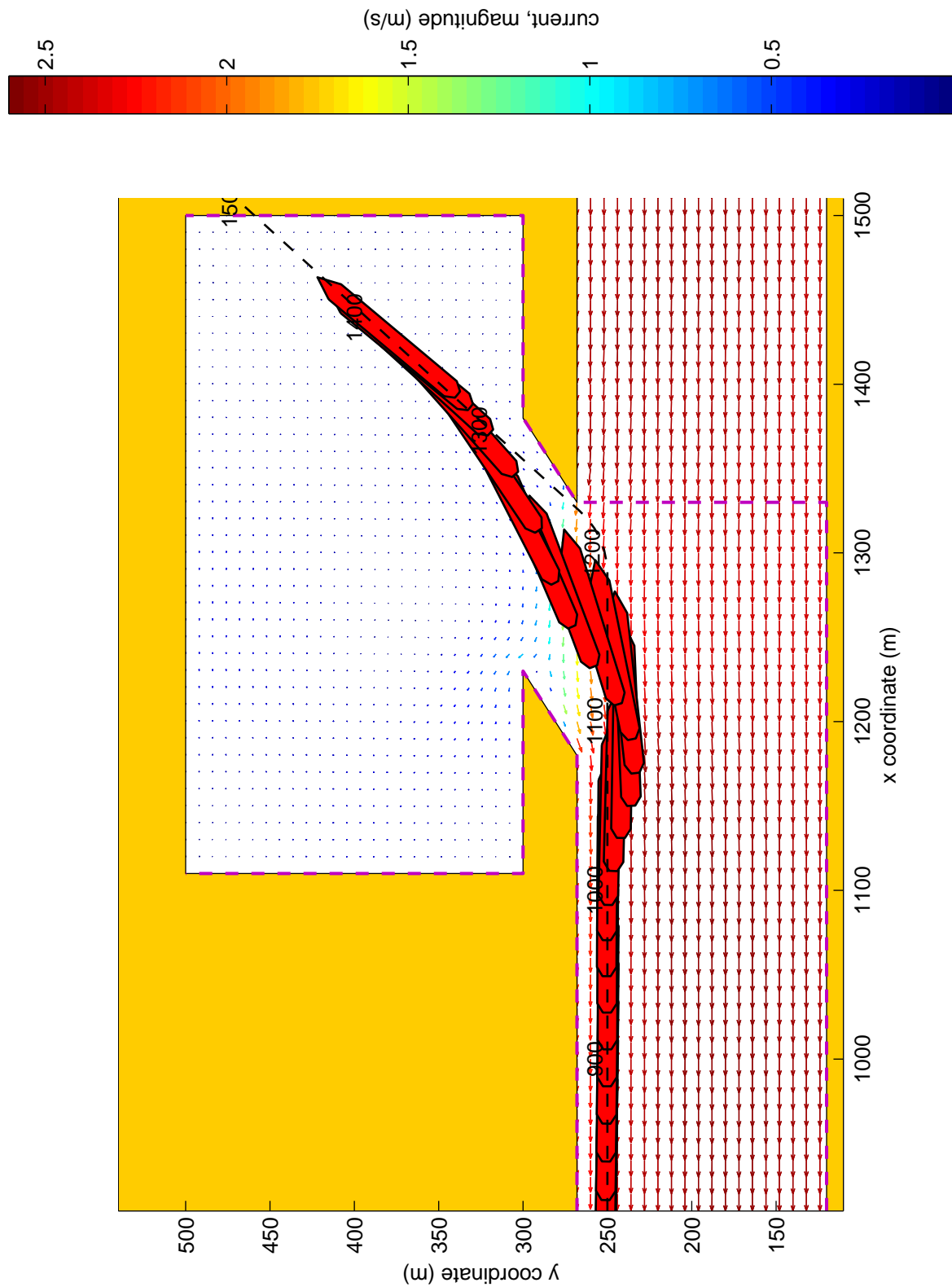
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 39

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 8

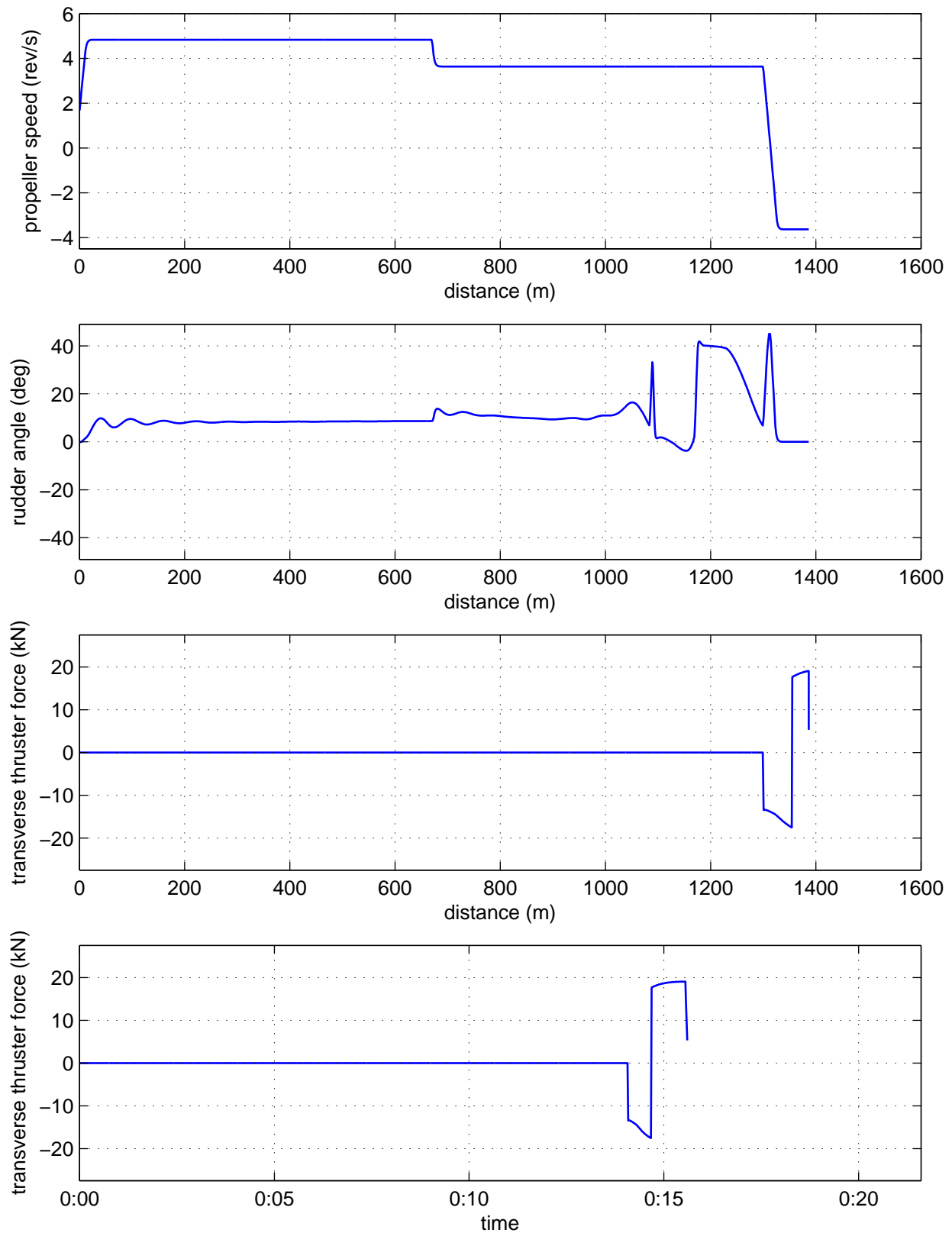
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 39

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

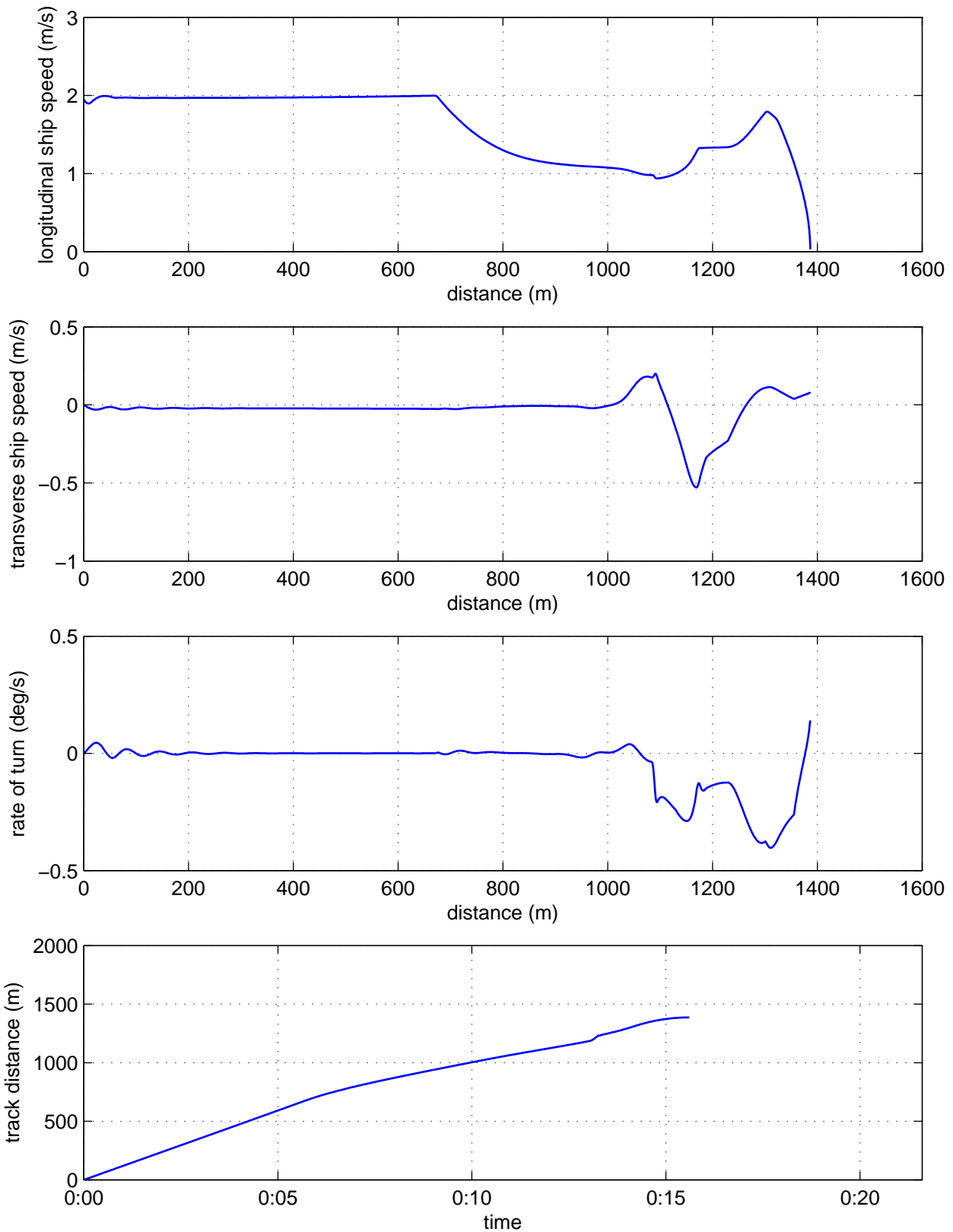
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 39

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

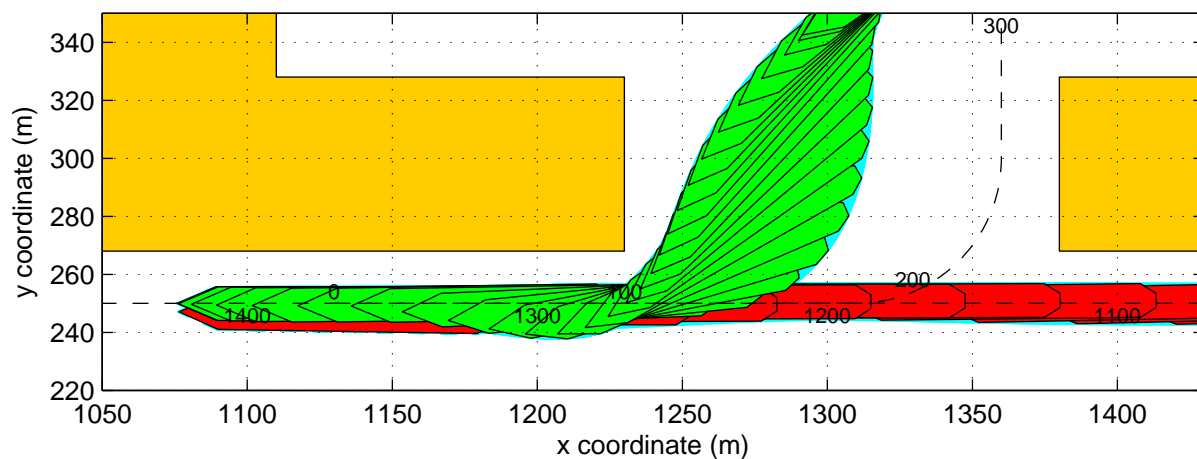
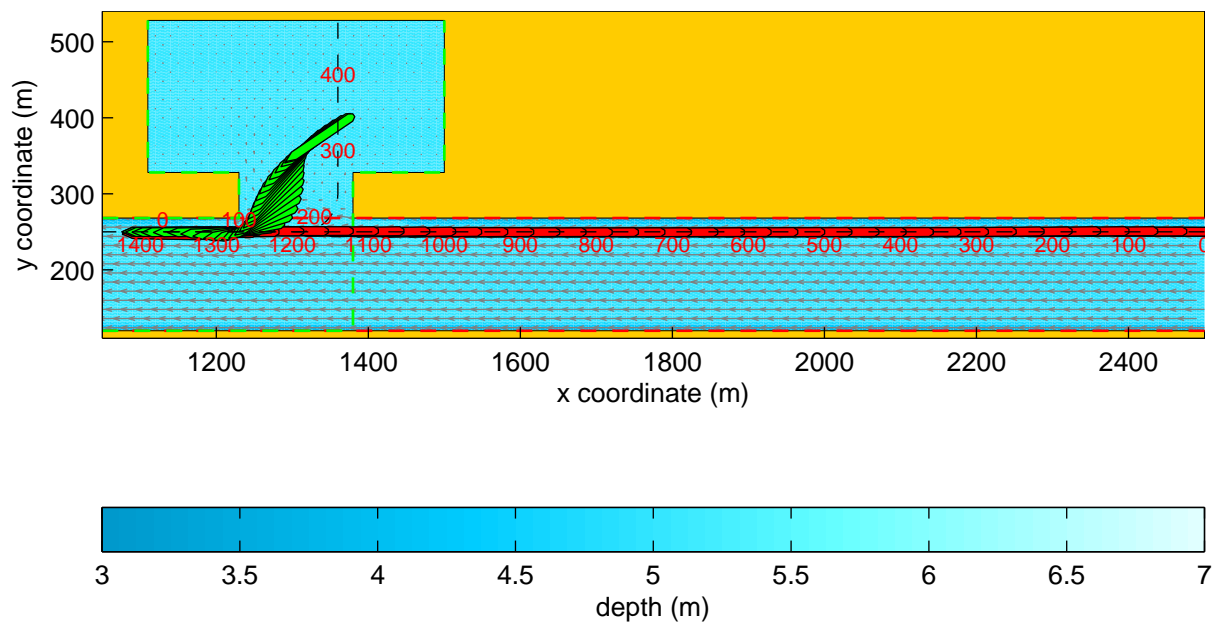
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 39

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 2

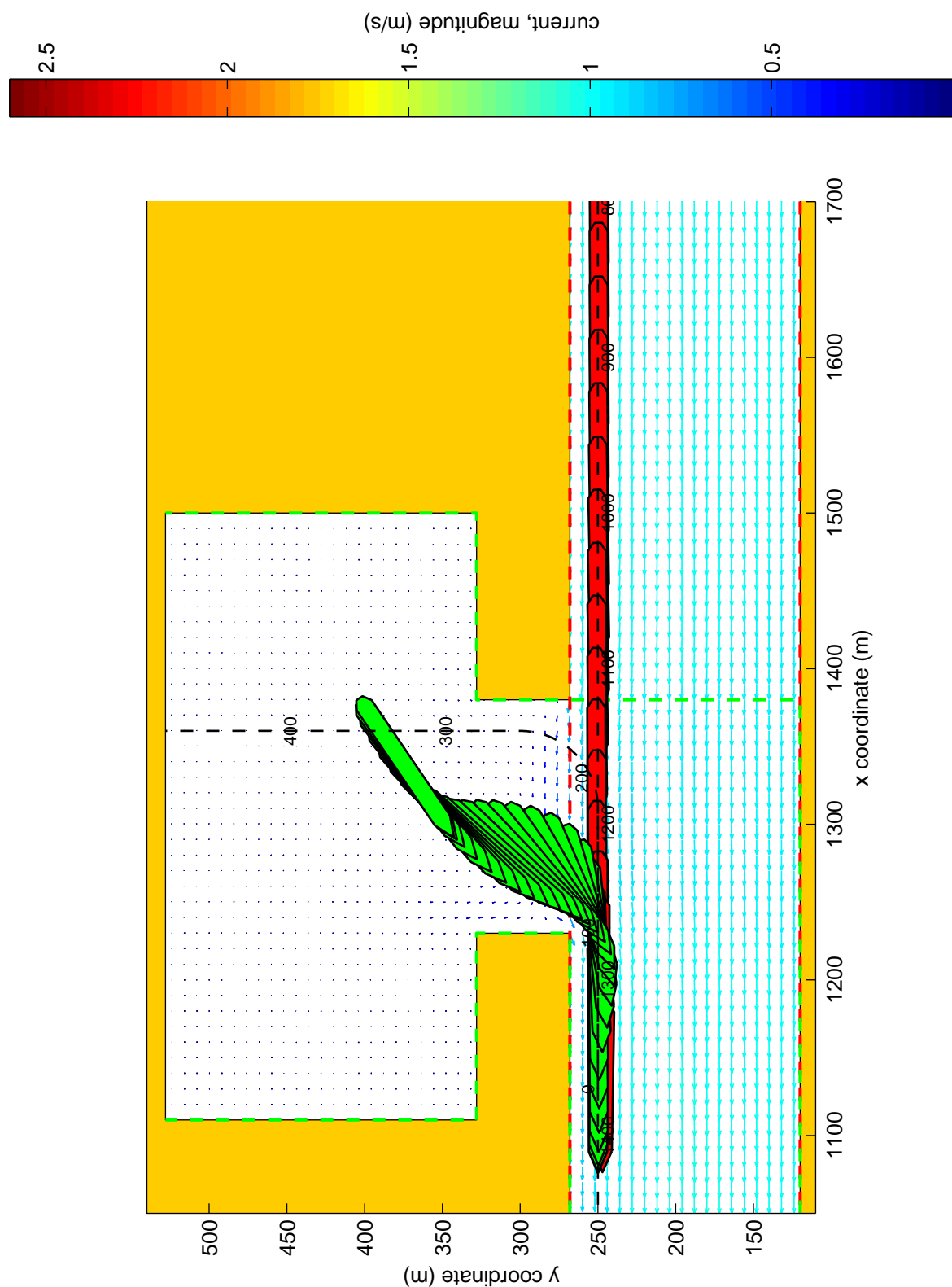
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 40

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 2

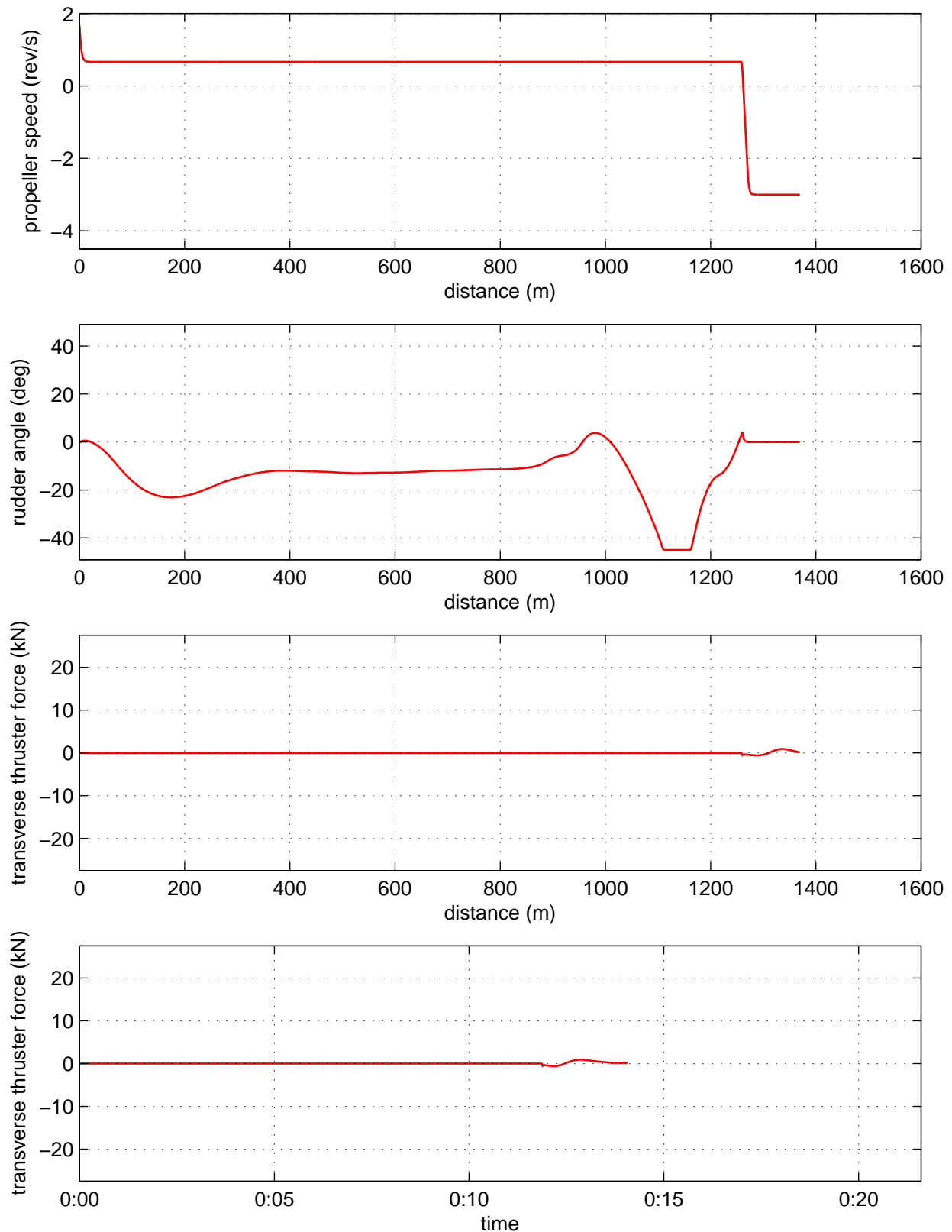
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 40

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

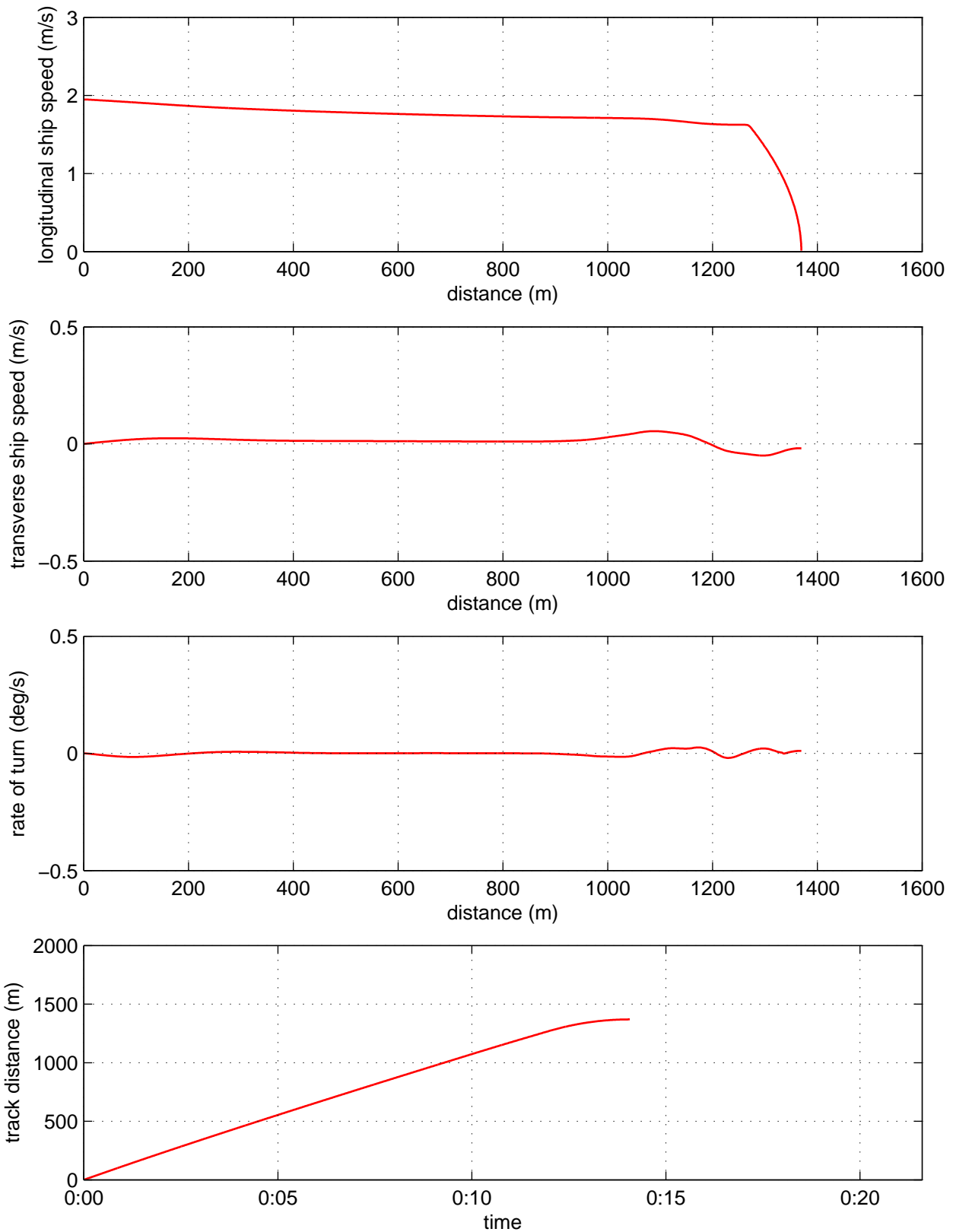
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 40a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 1.0 m/s

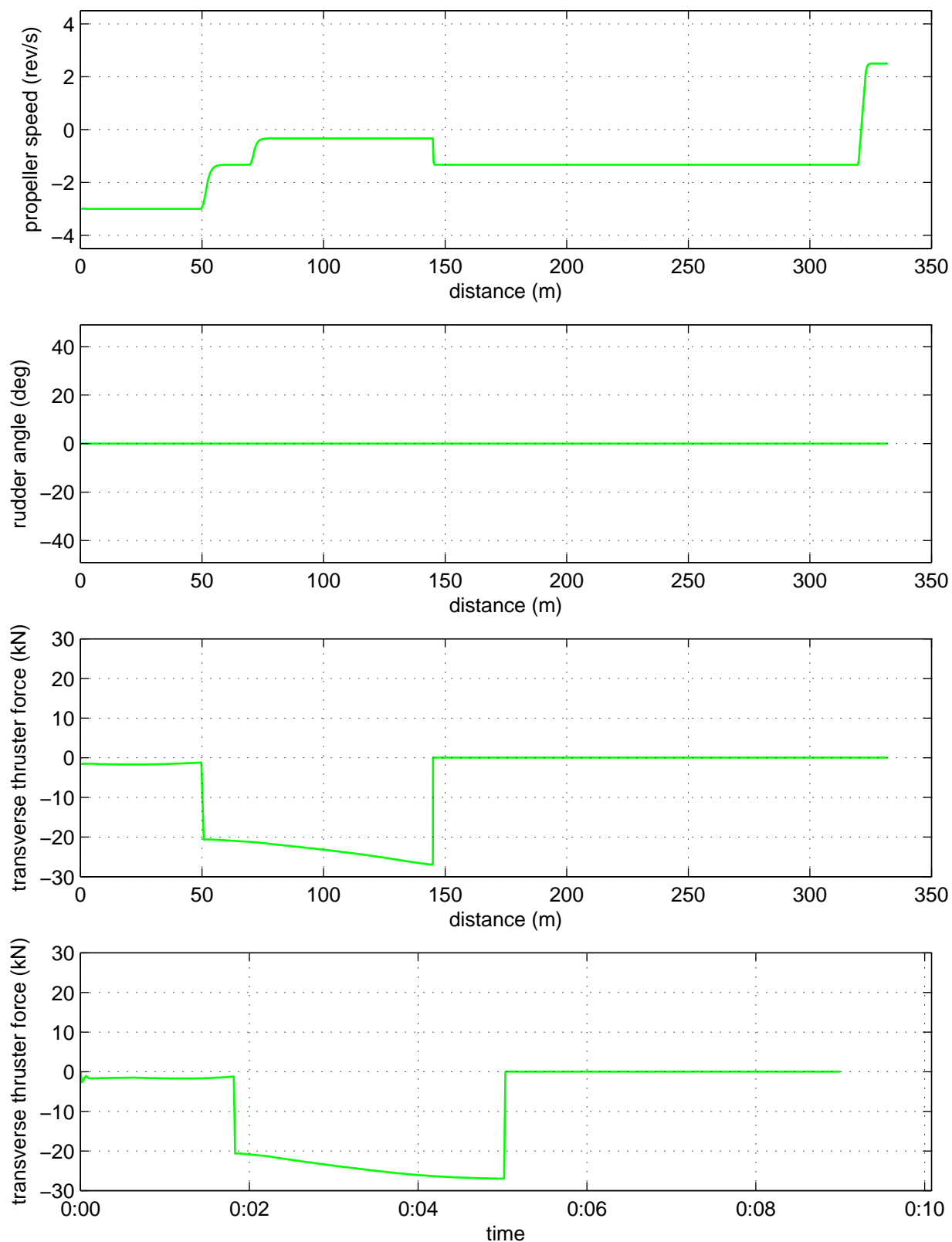
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 40a

Figure C





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

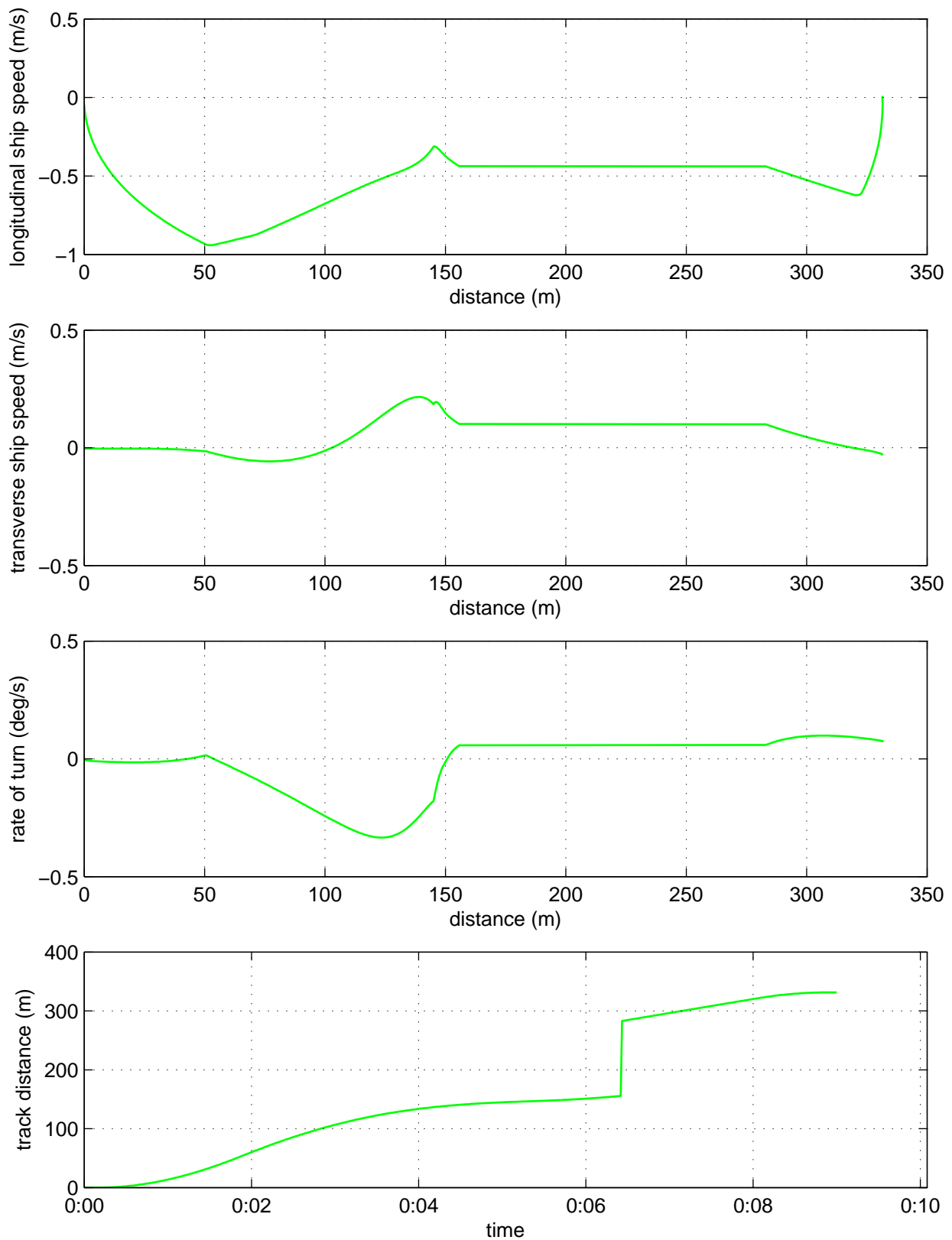
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 40b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

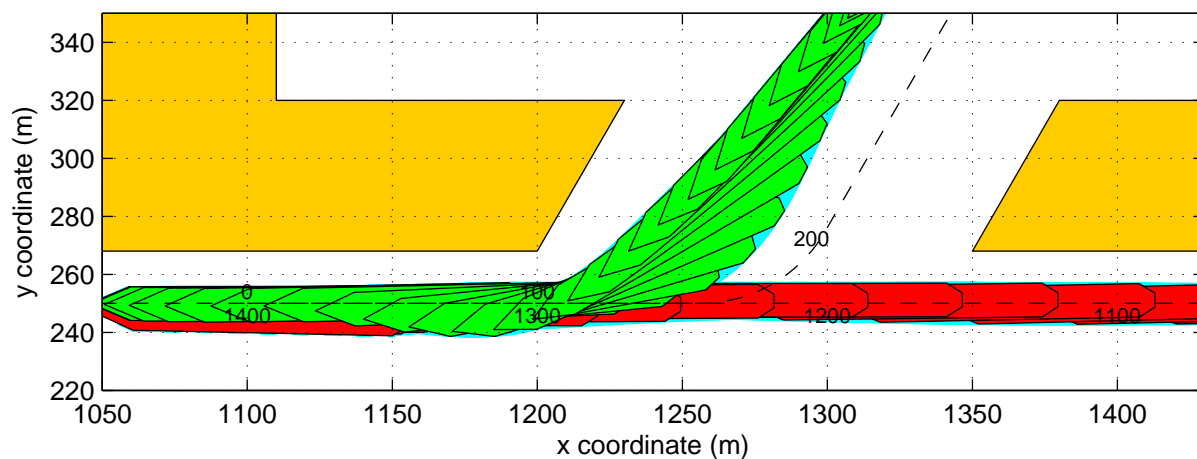
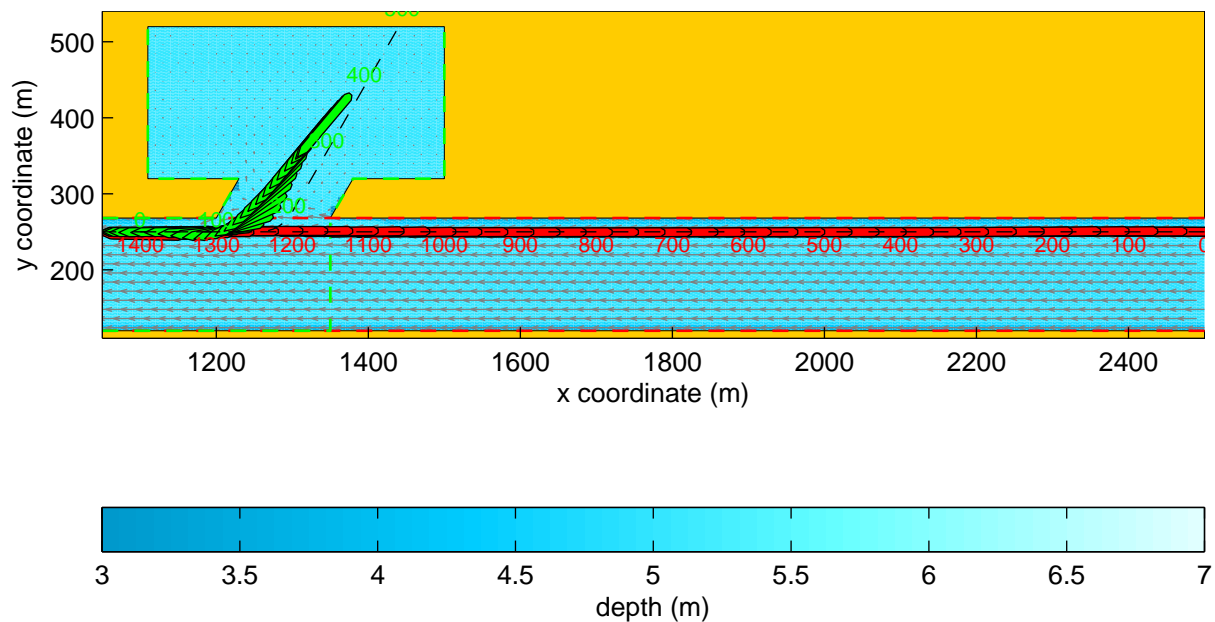
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 40b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 6

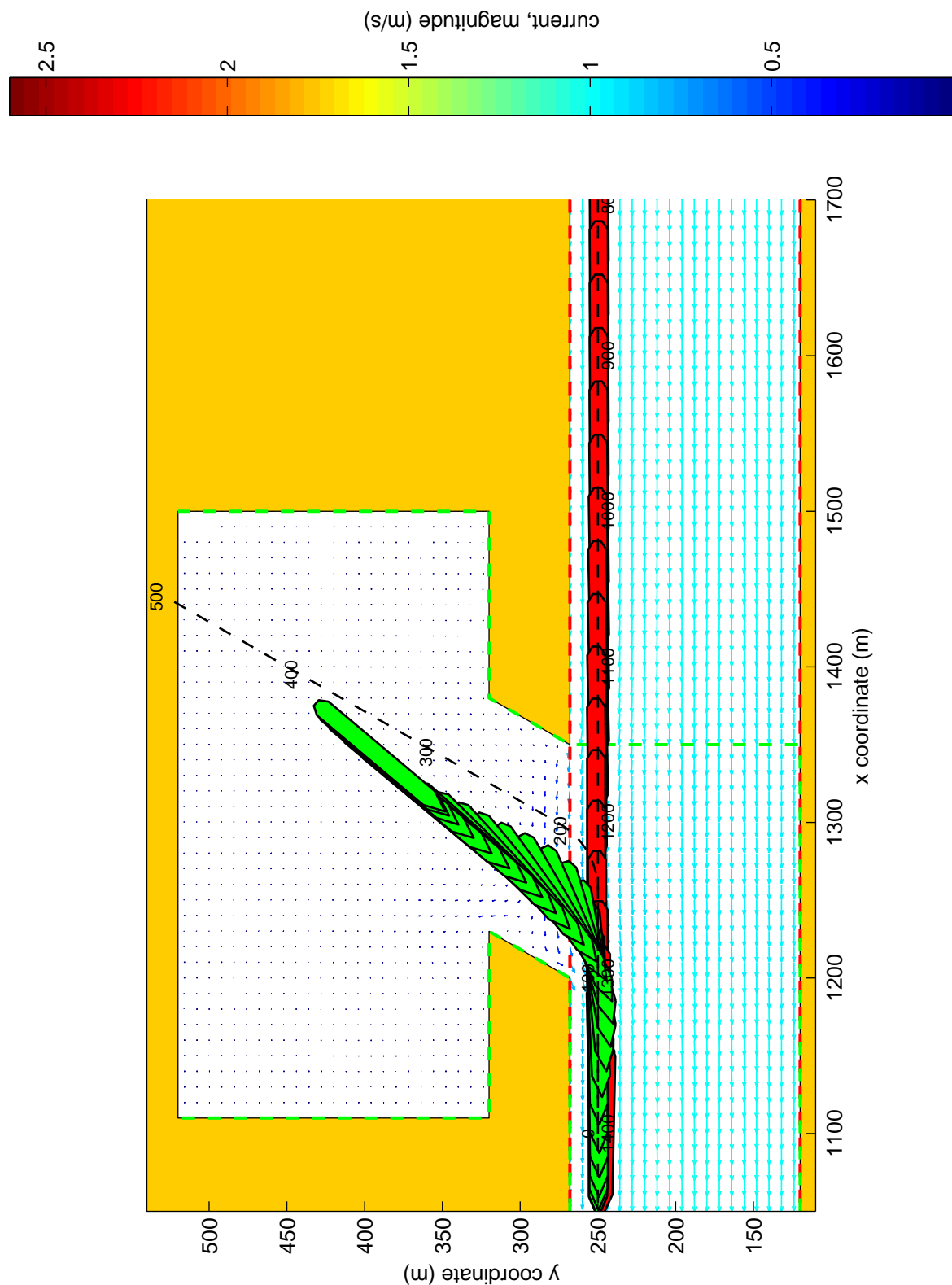
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 41

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 6

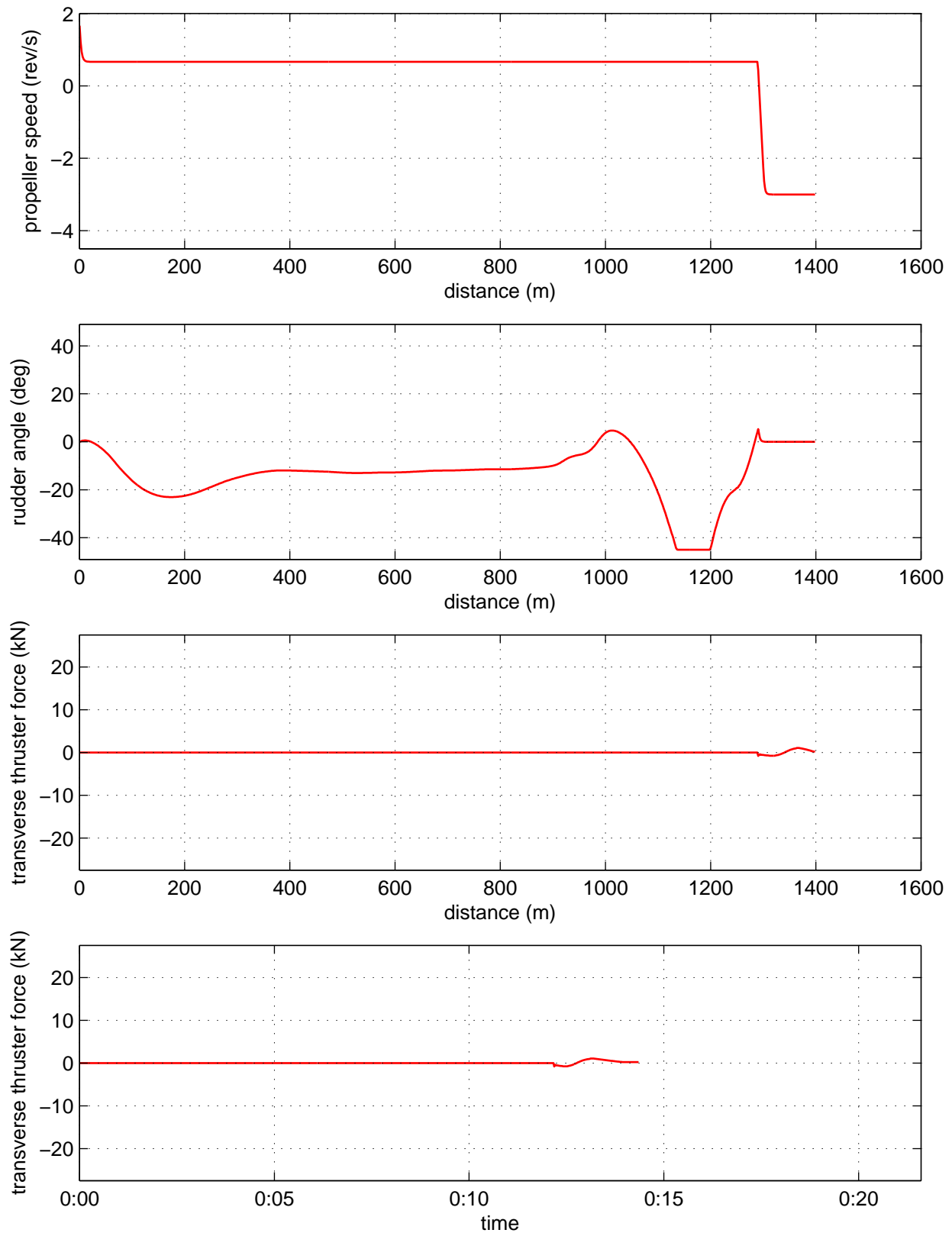
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 41

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

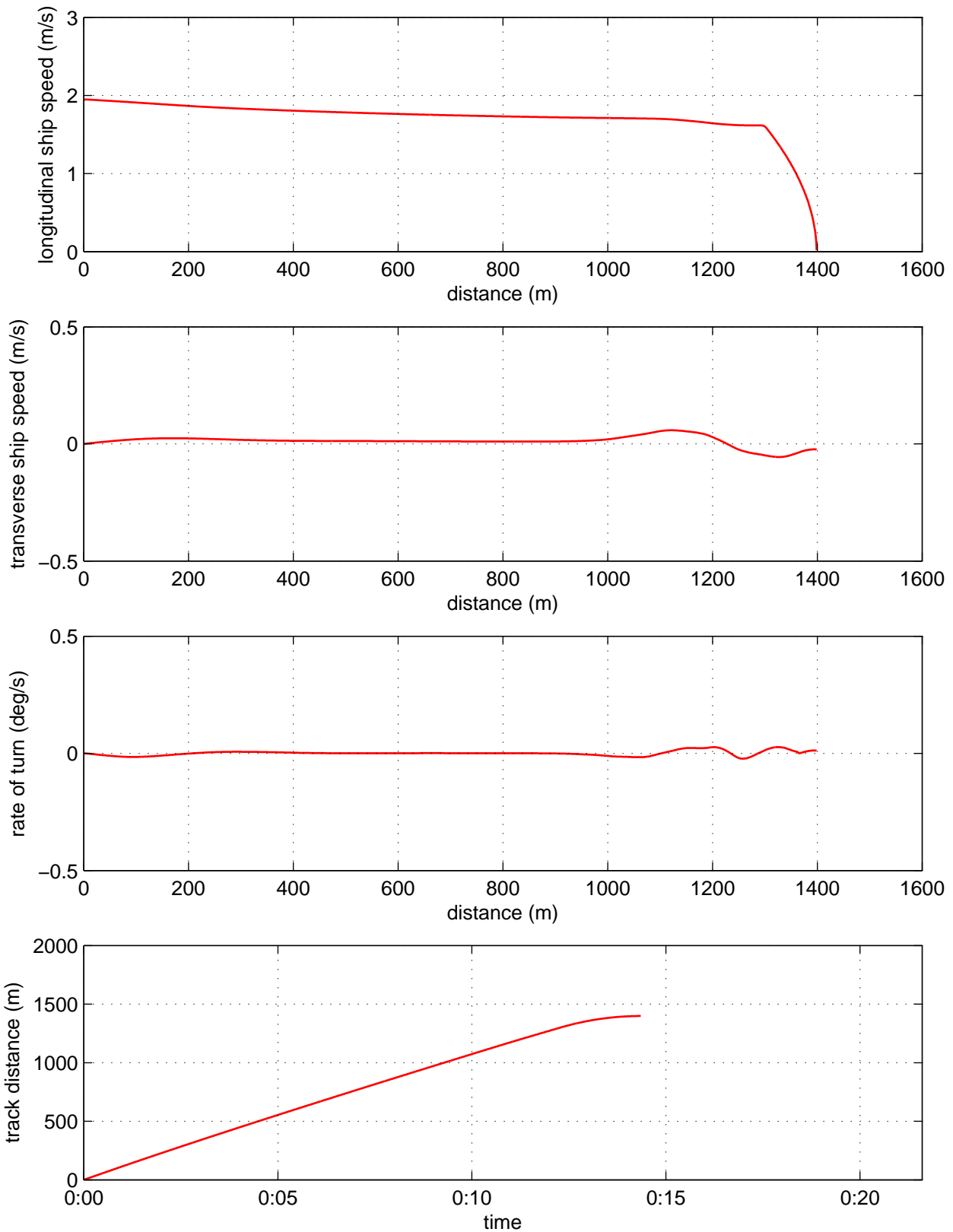
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 41a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

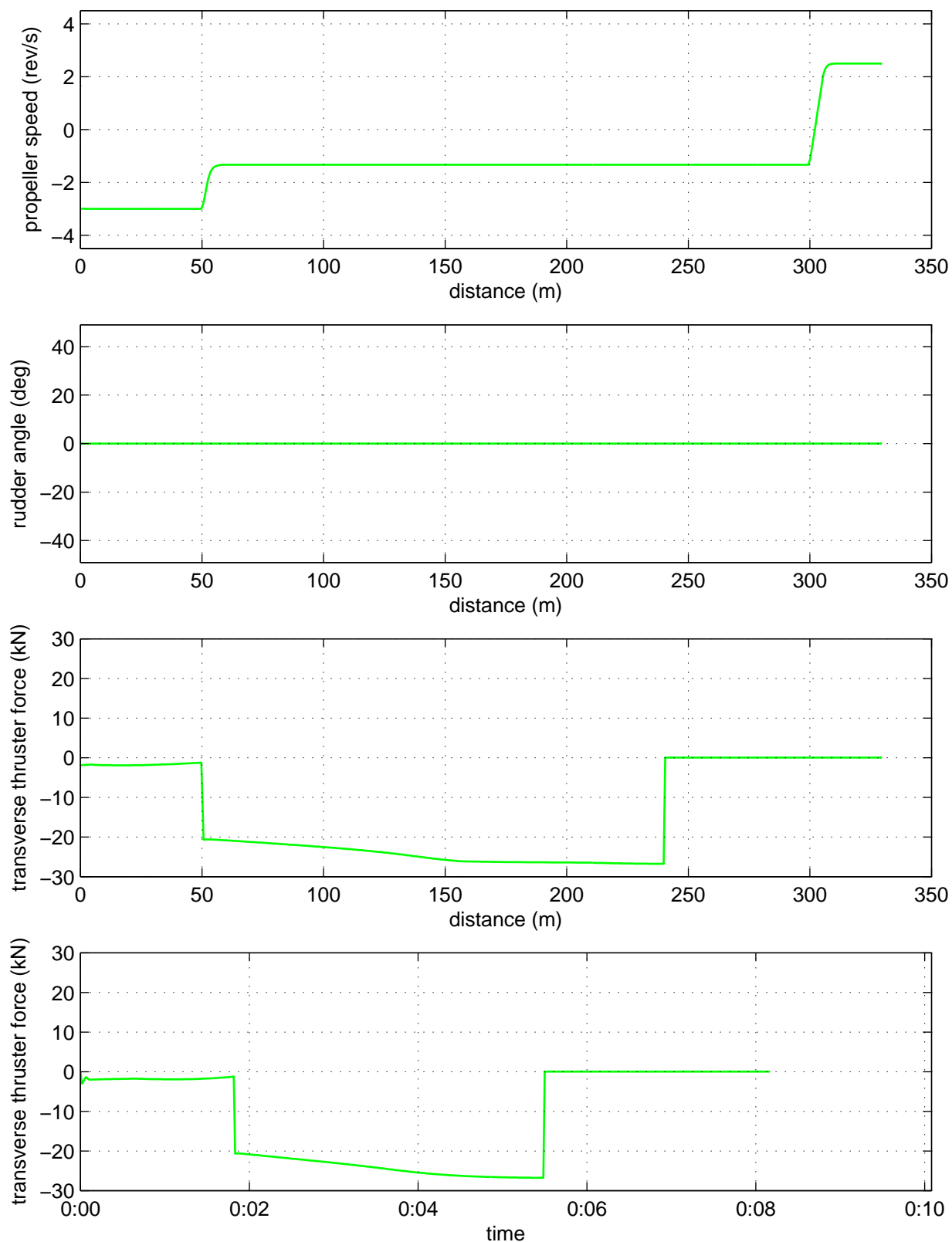
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 41a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

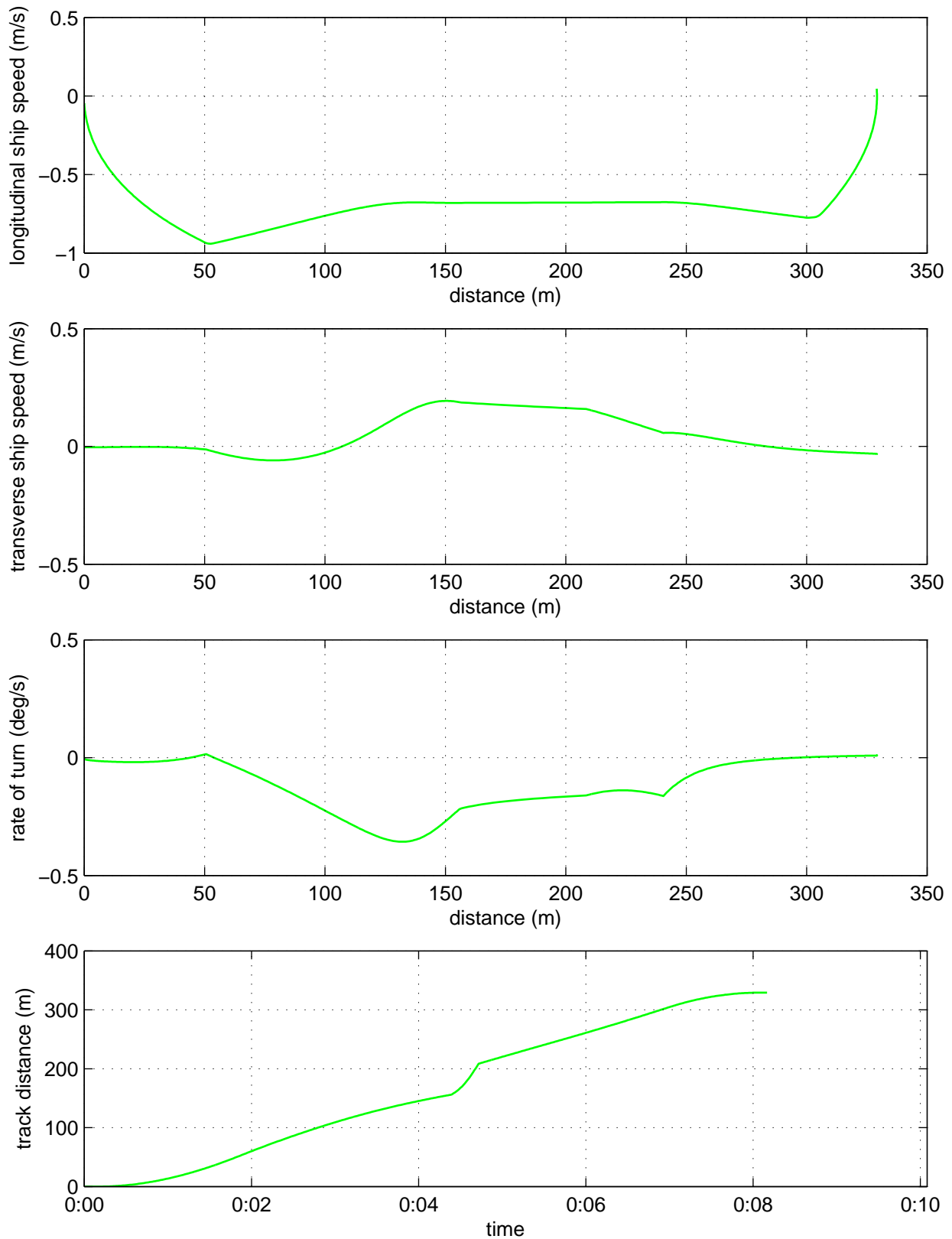
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 41b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

Current: 1.0 m/s

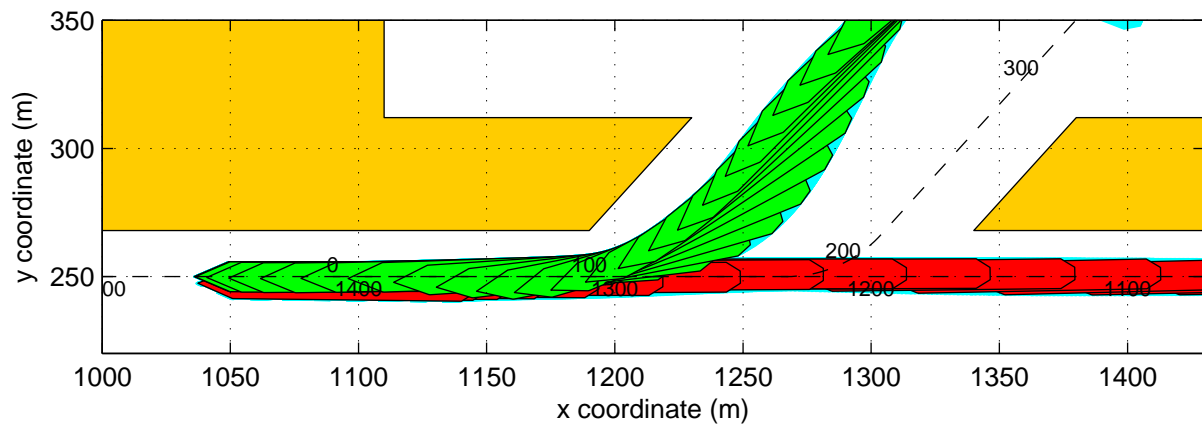
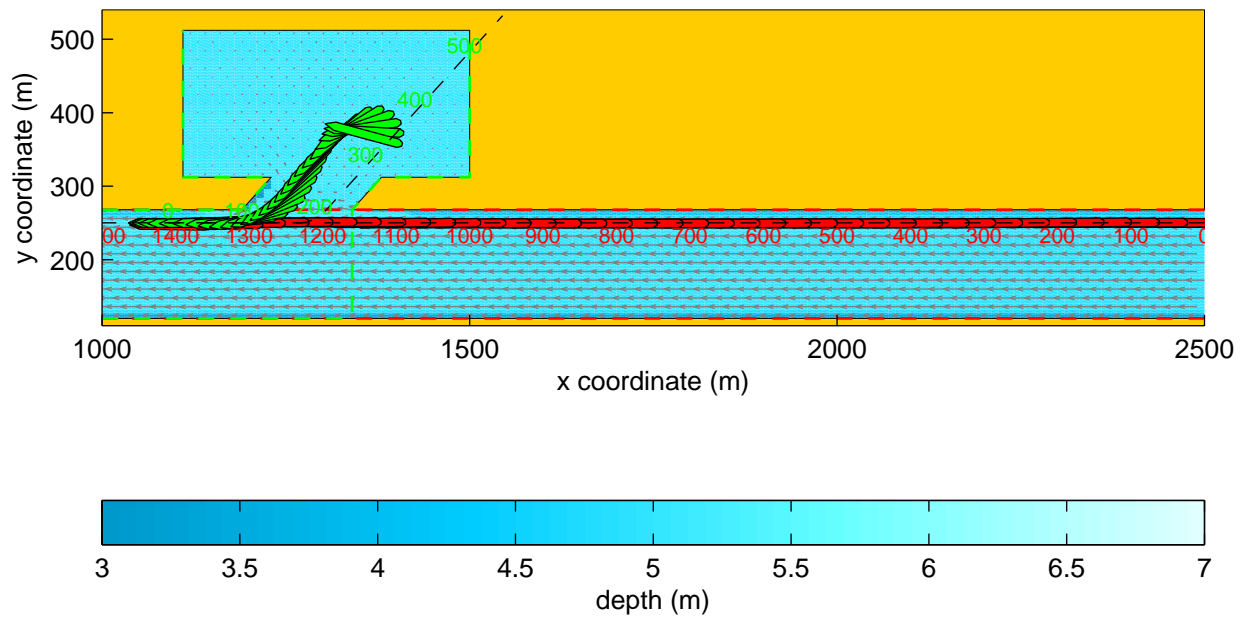
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 41b

Figure C





Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 7

Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 42

Figure A1

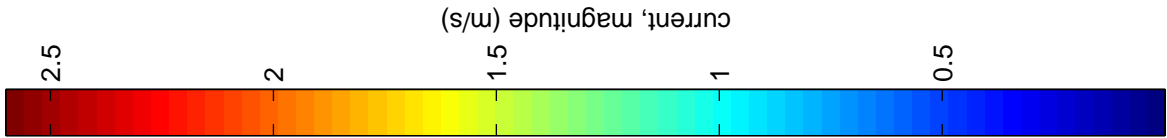
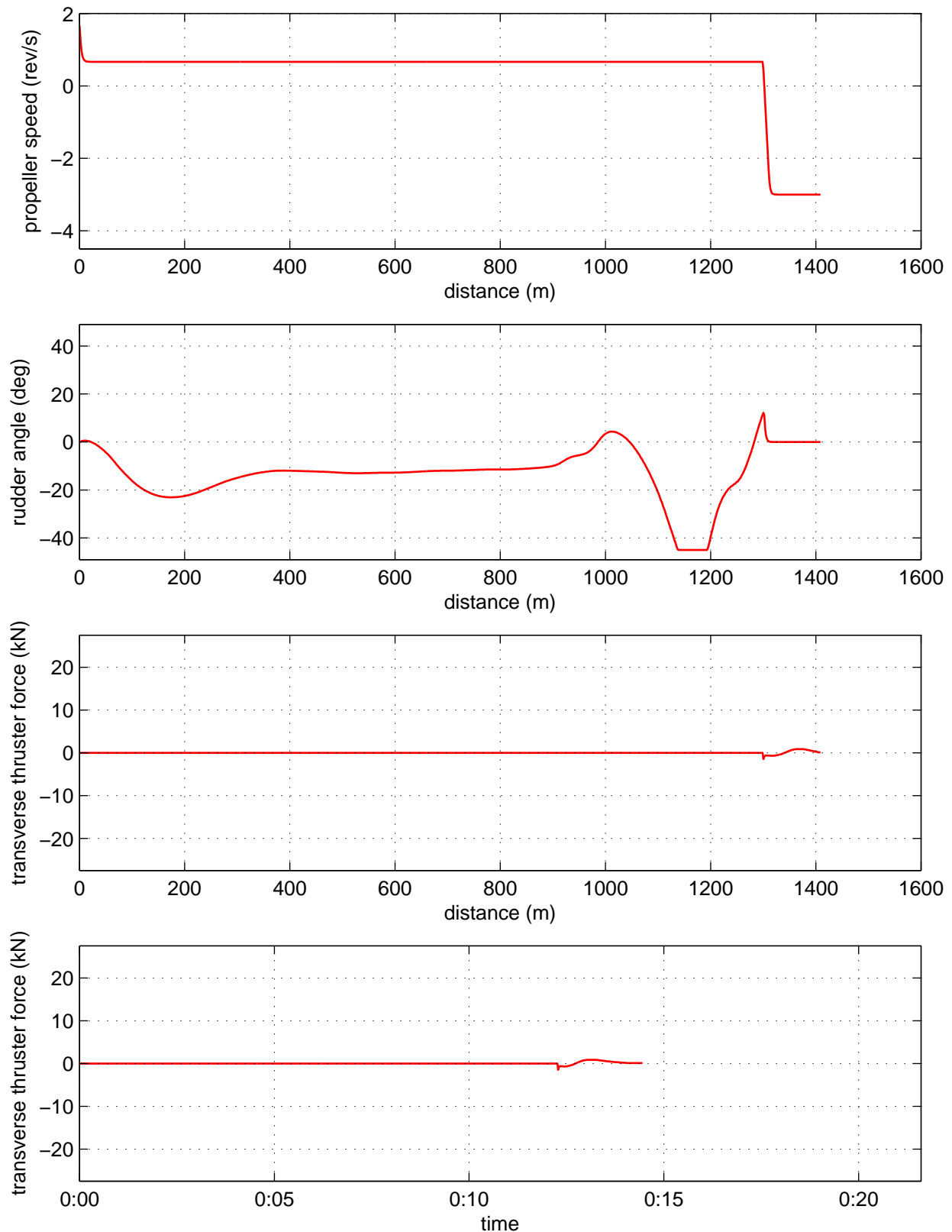


Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

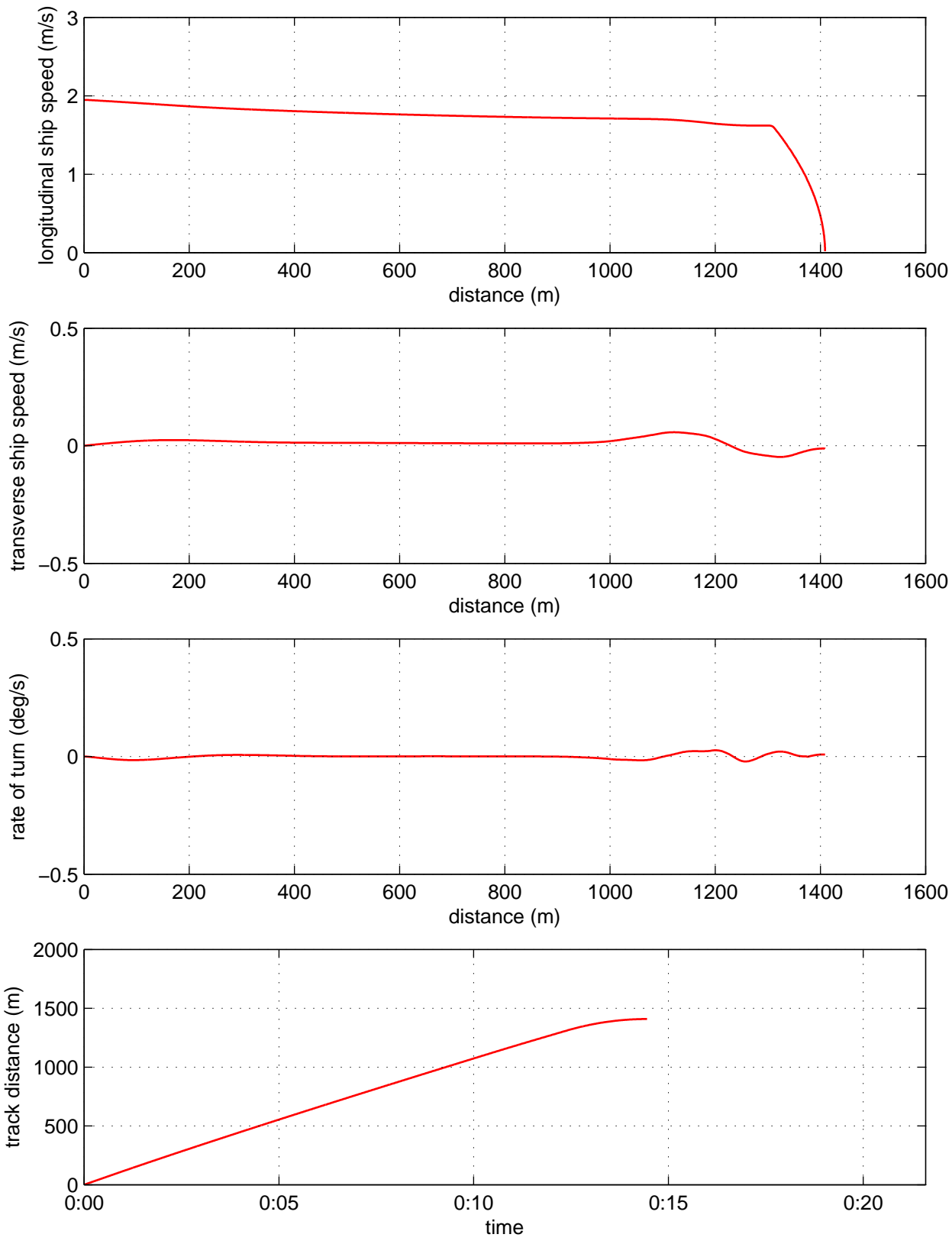
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 42a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

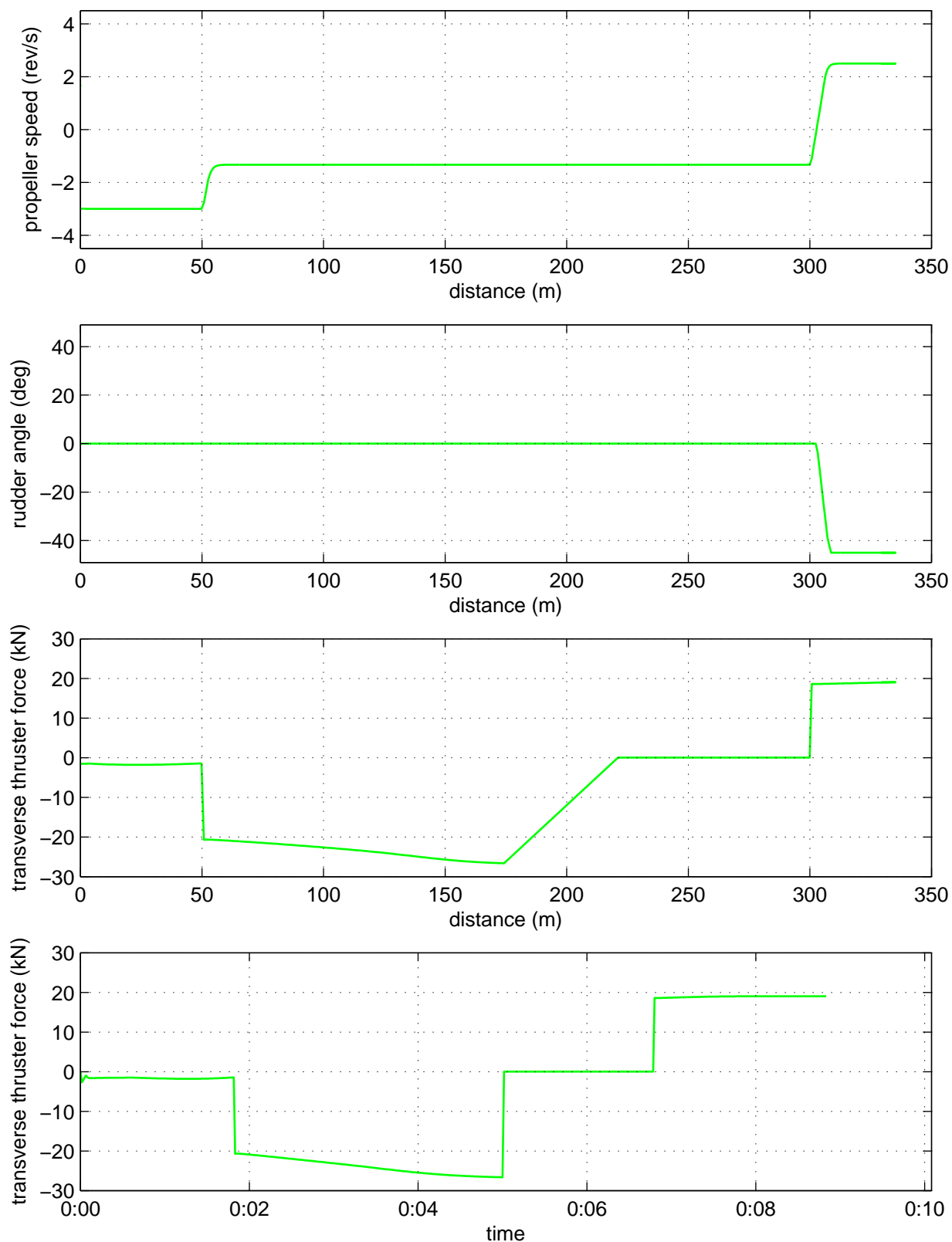
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 42a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

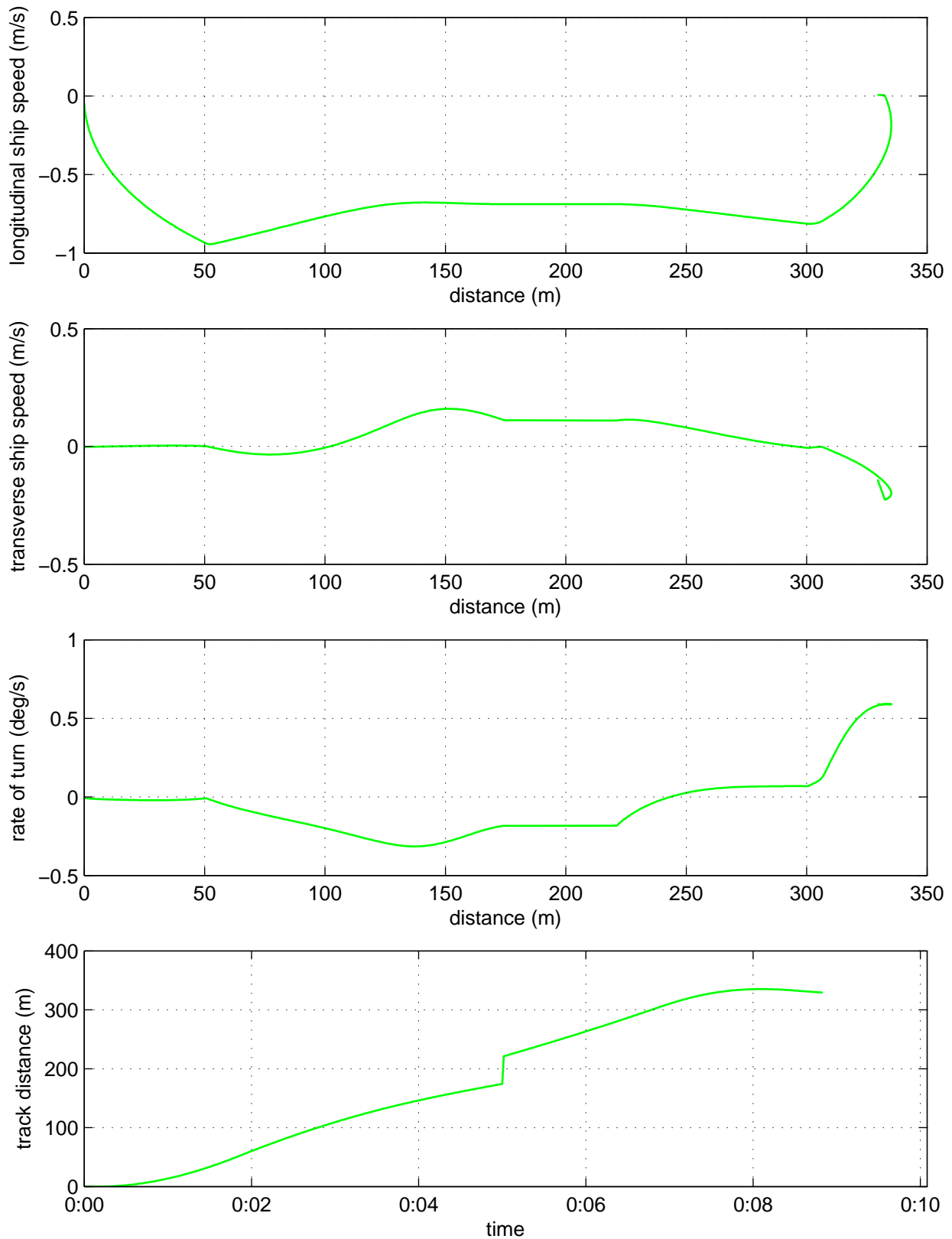
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 42b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

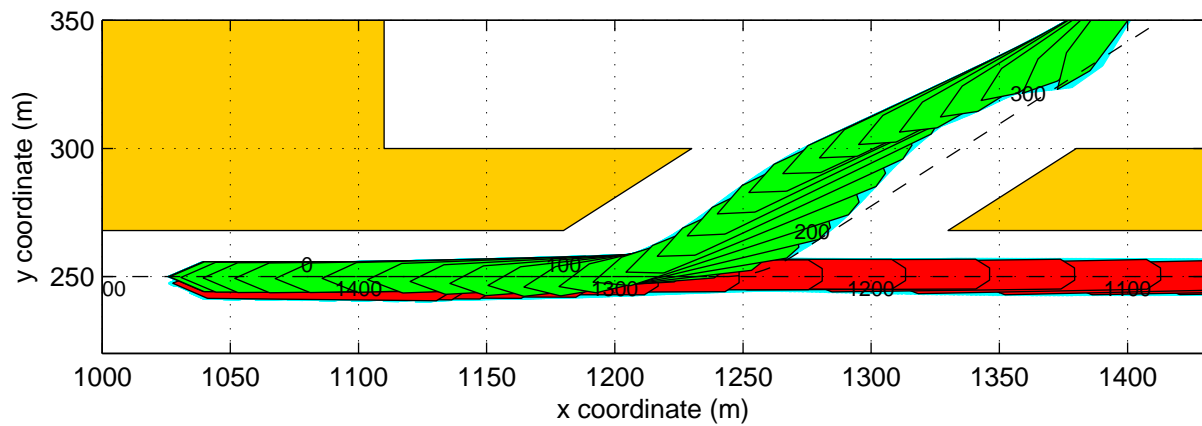
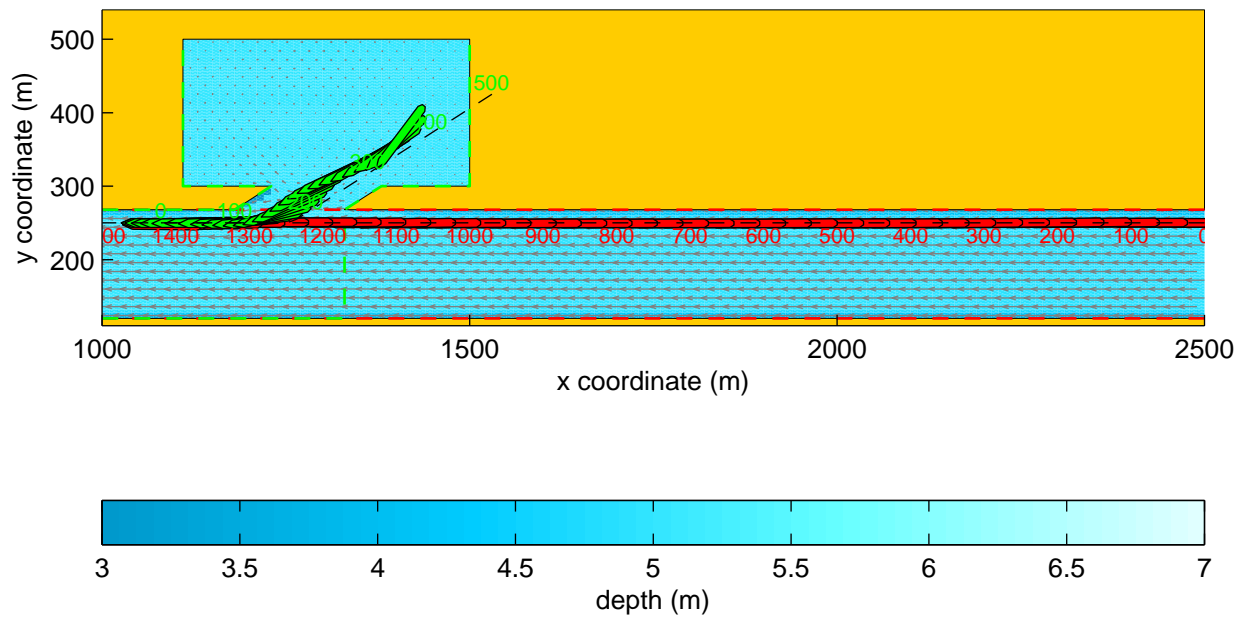
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 42b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 8

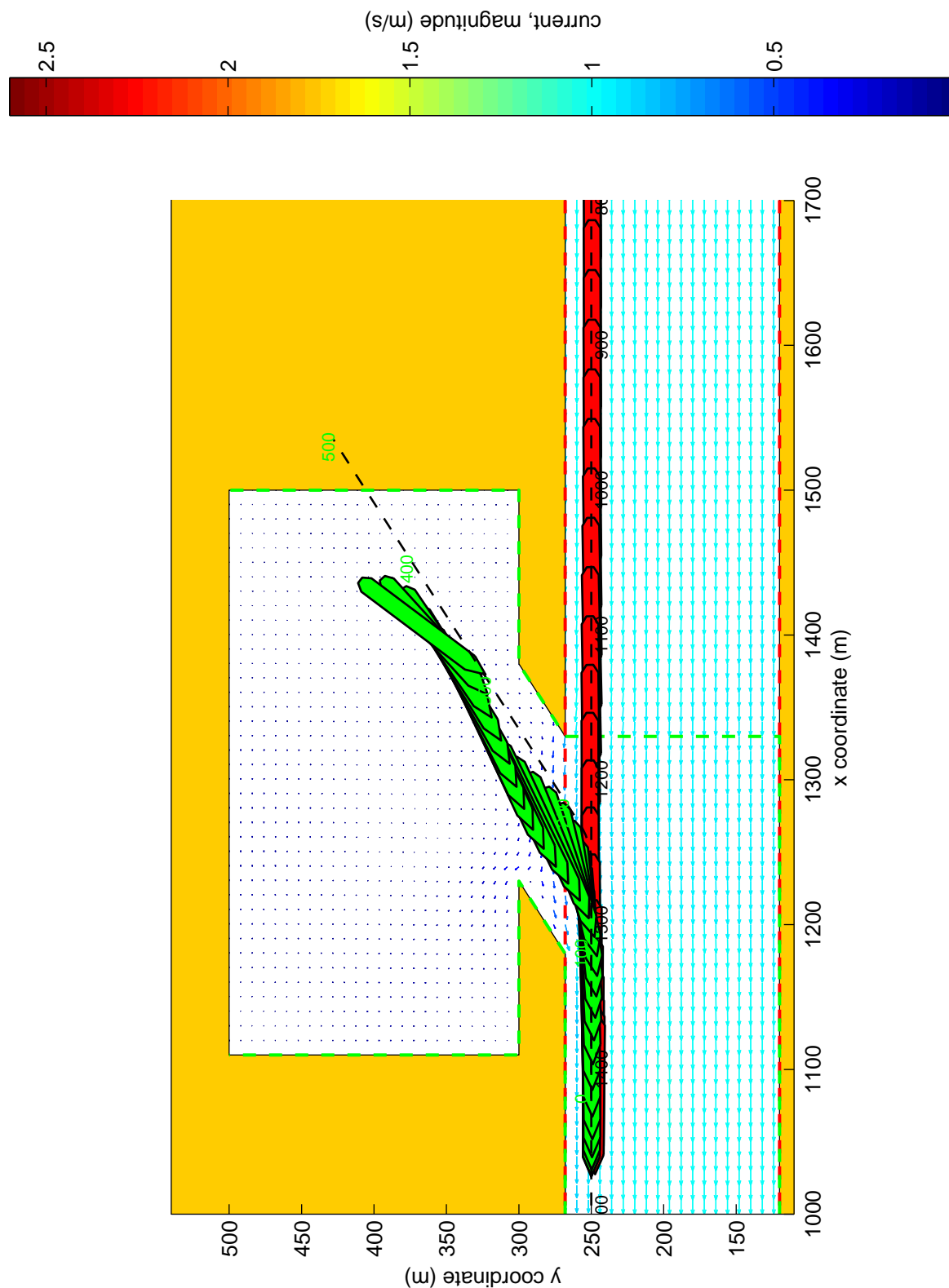
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 43

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 8

Current: 1.0 m/s

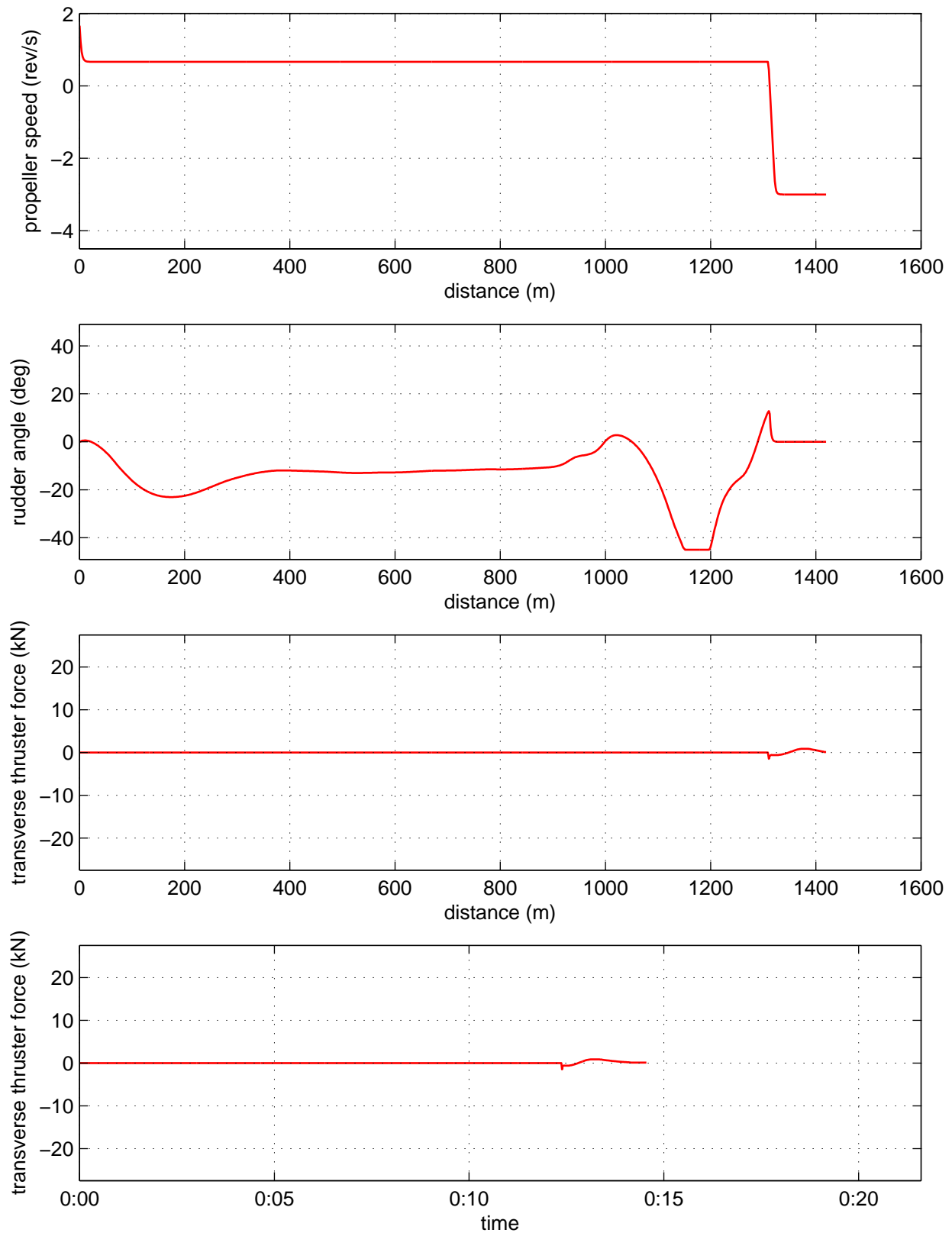
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 43

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

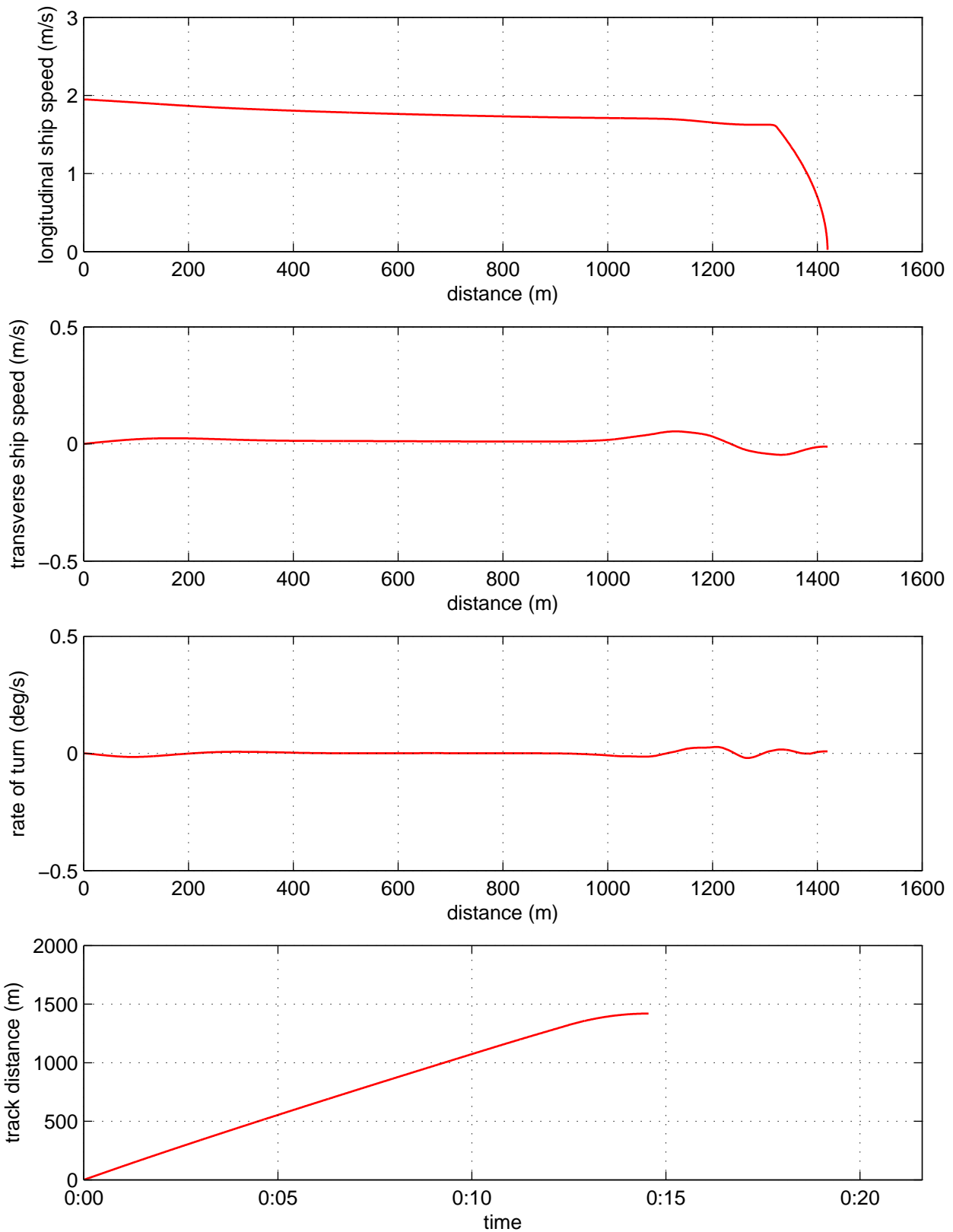
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 43a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

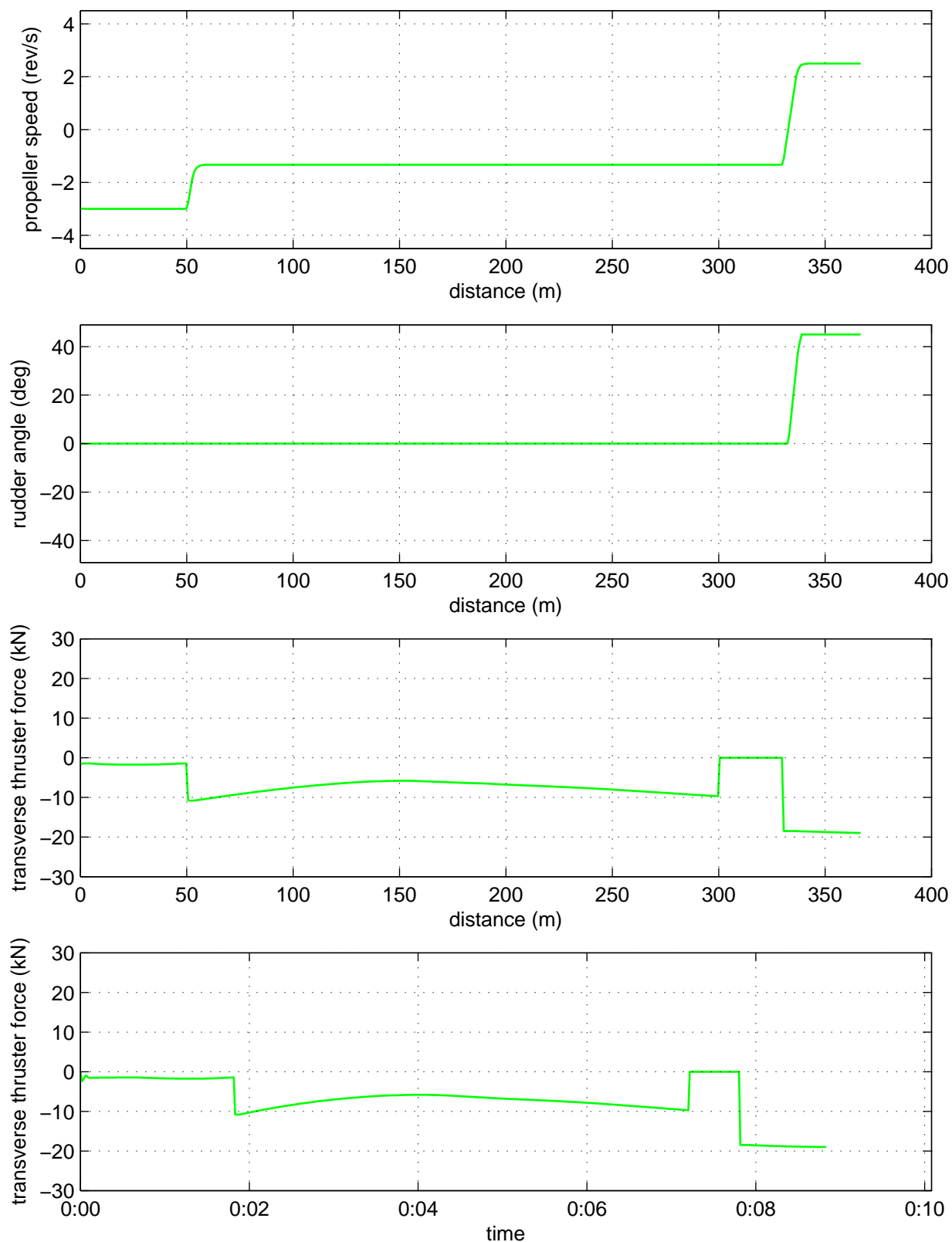
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 43a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

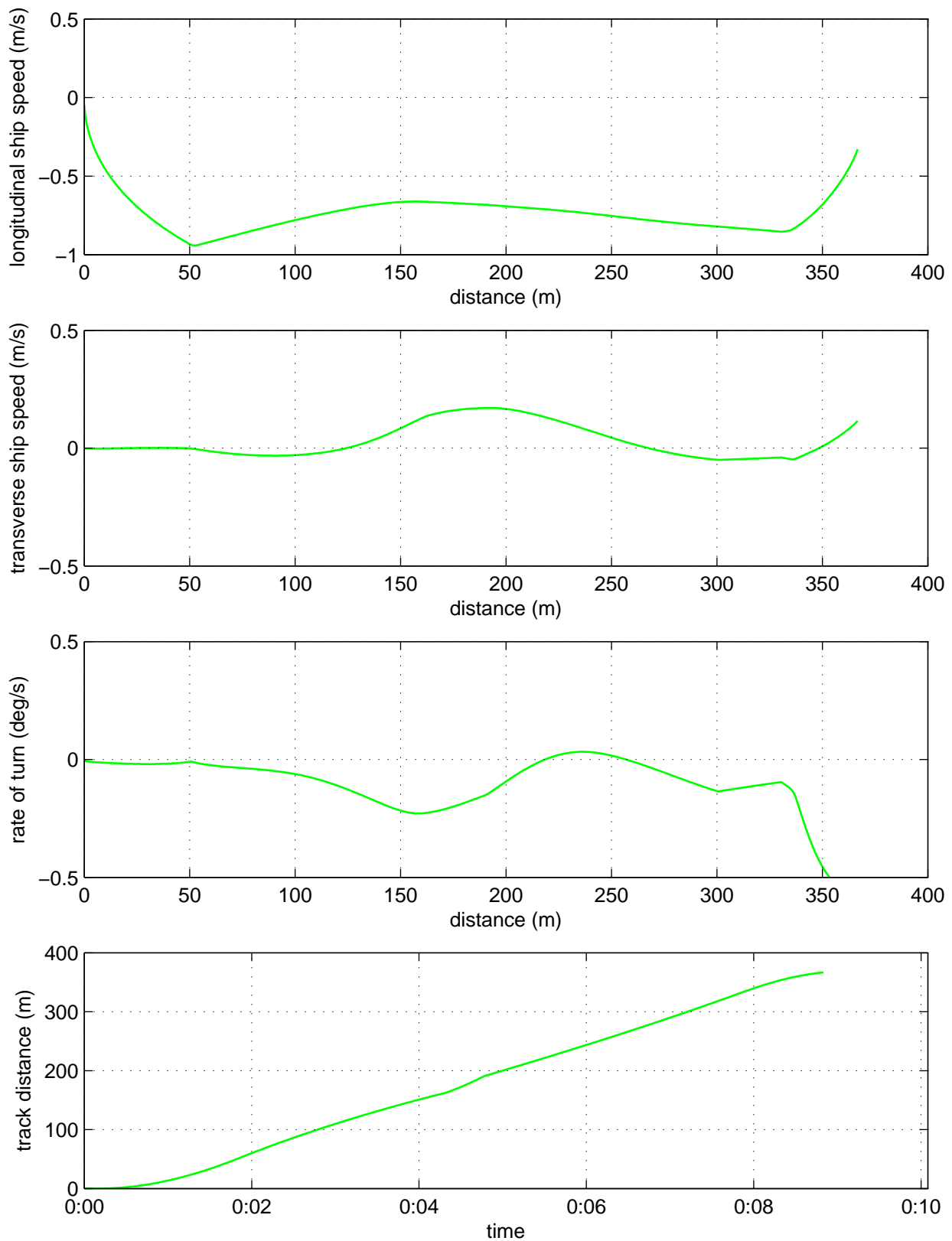
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 43b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

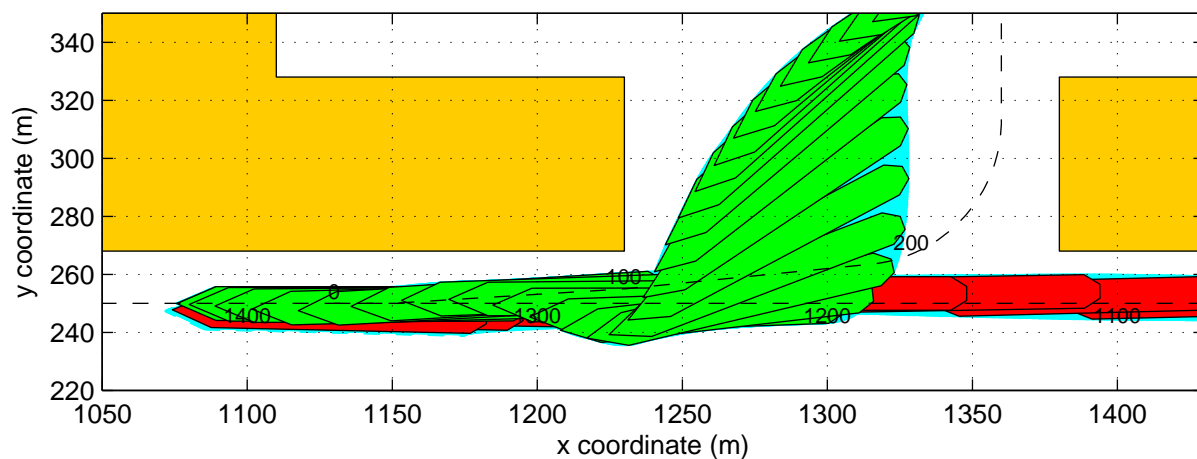
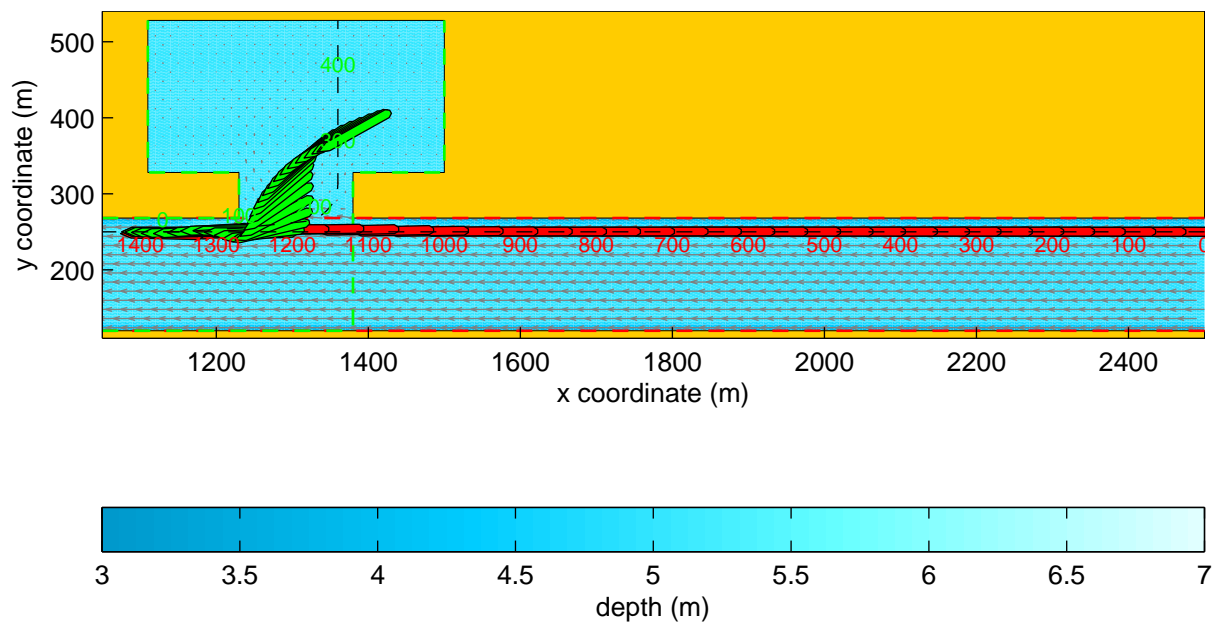
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 43b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 2

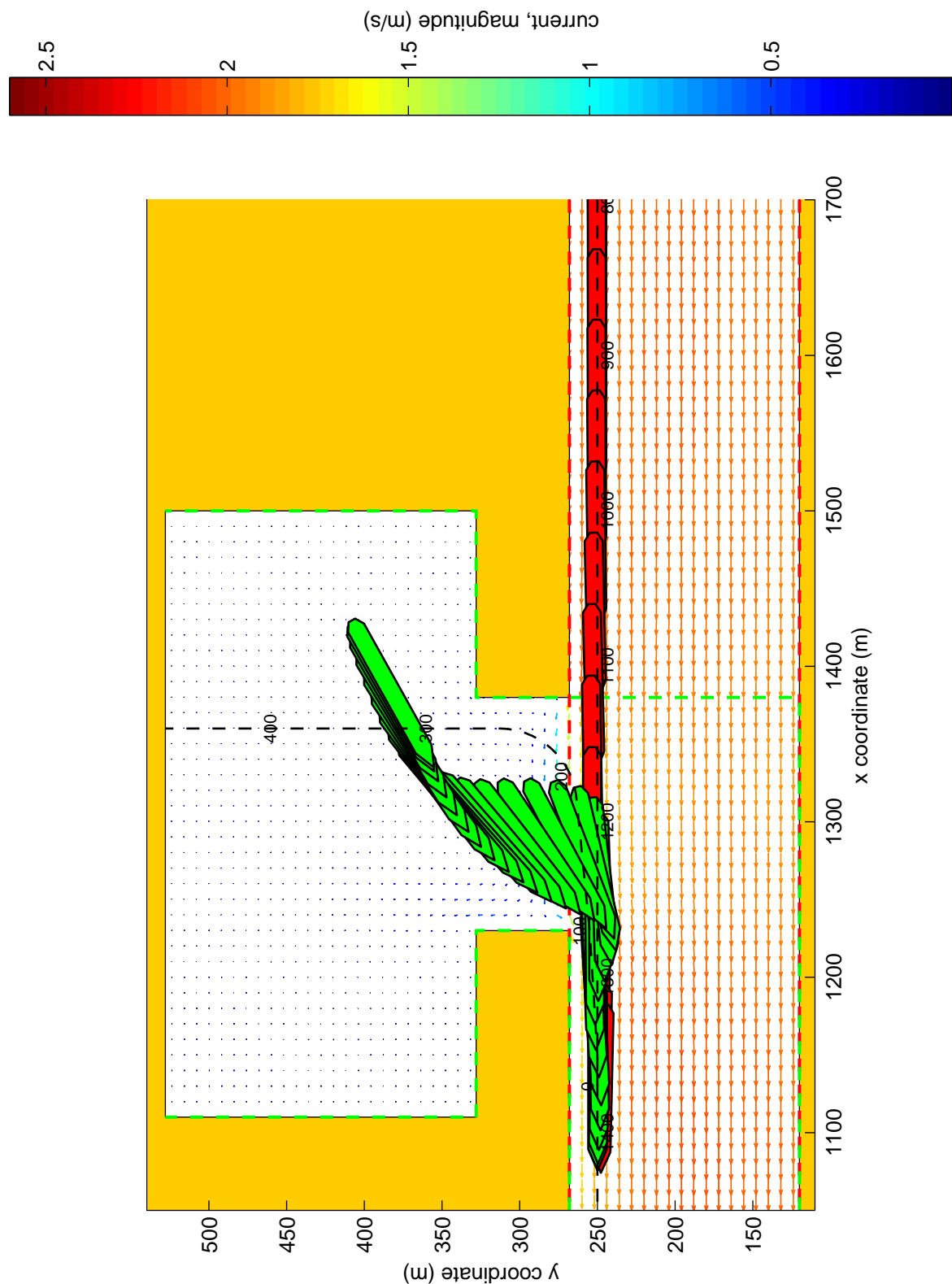
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 44

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 2

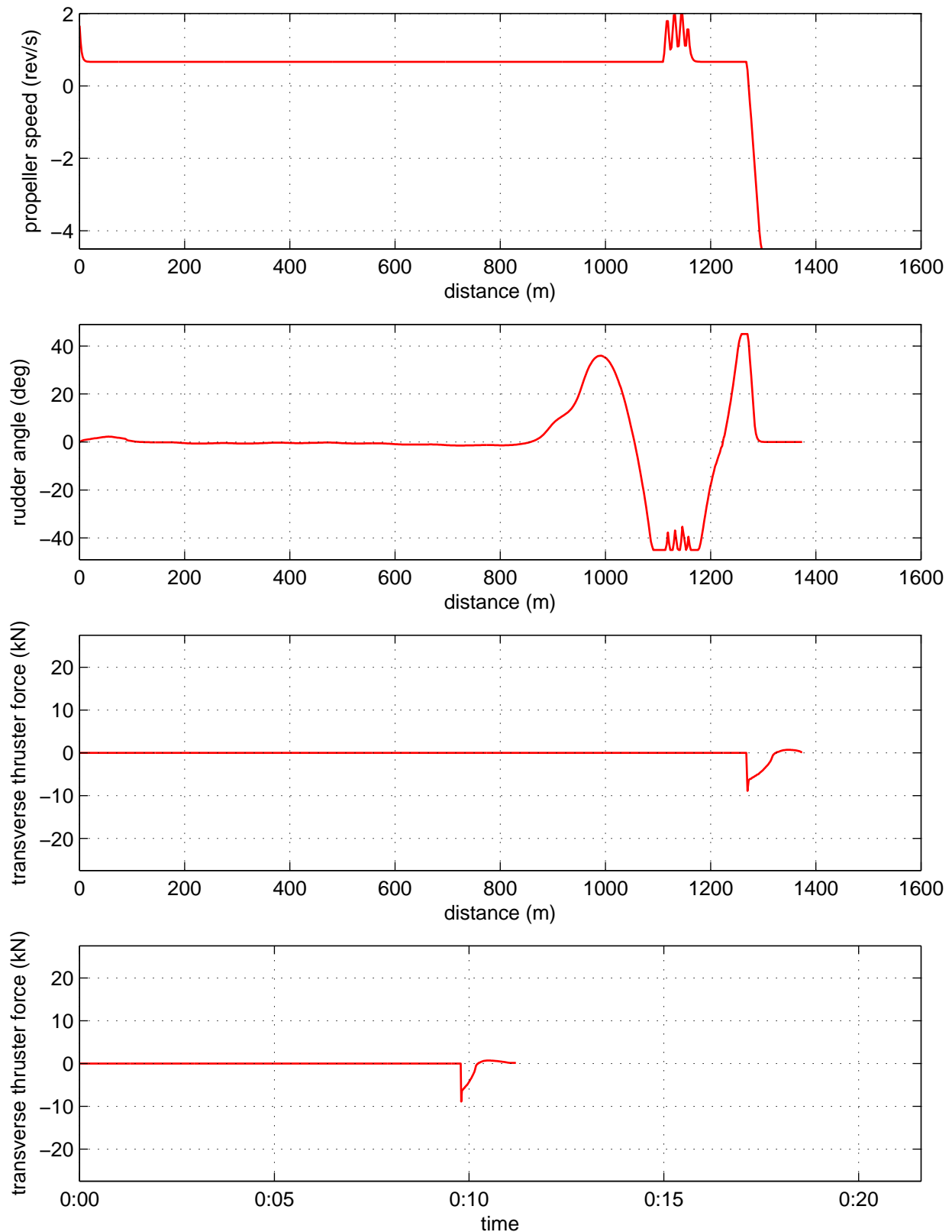
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 44

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

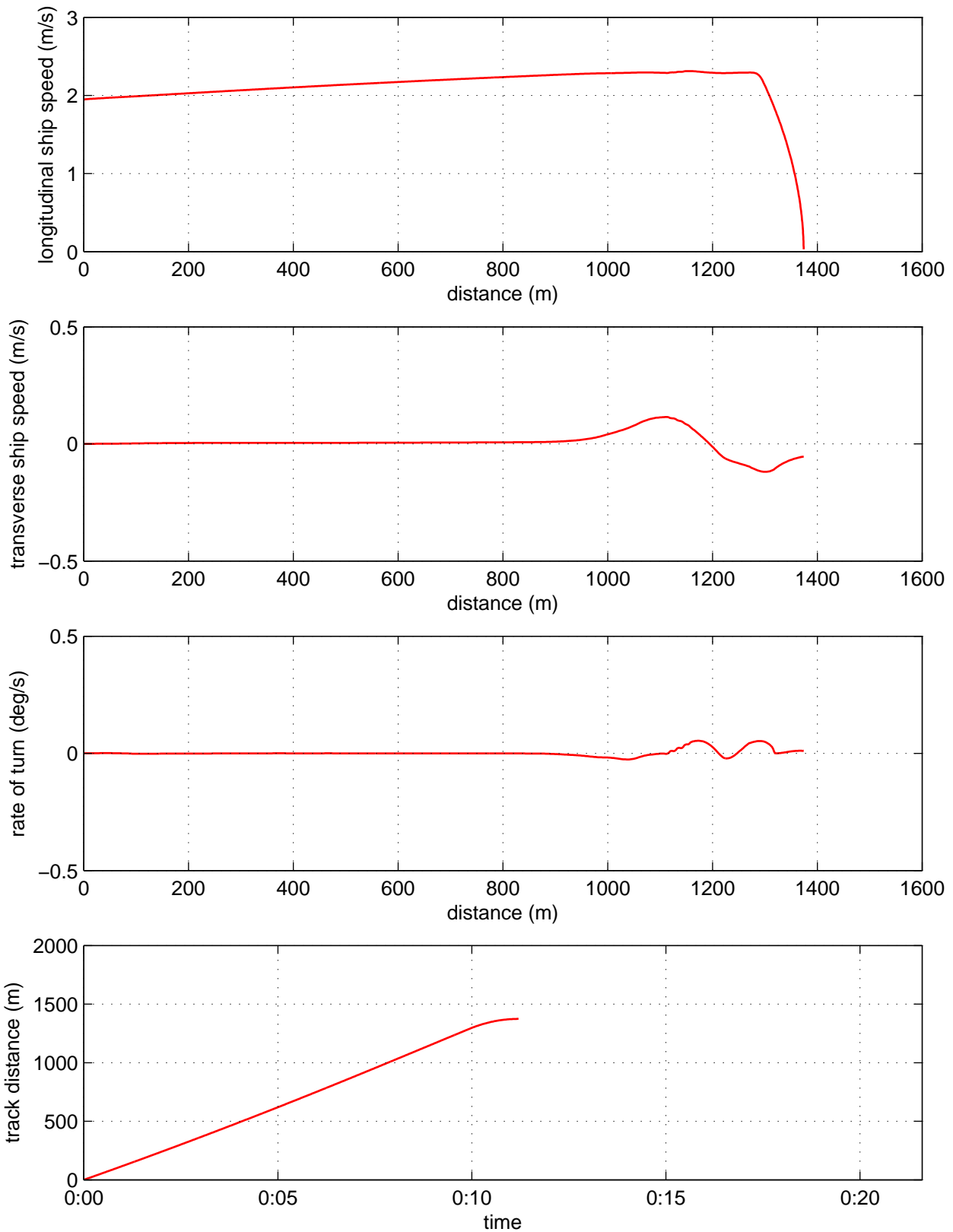
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 44a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

Current: 2.0 m/s

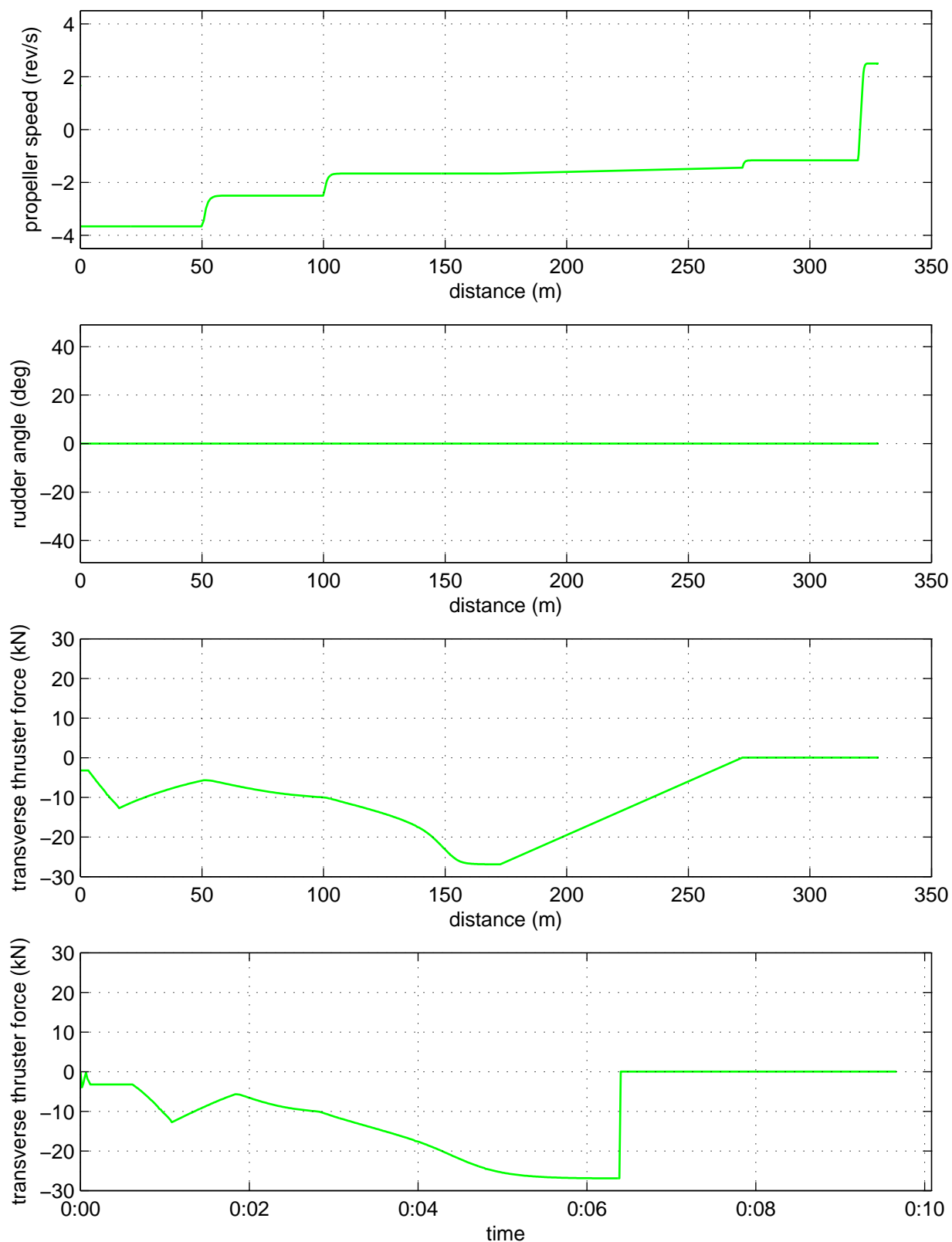
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 44a

Figure C





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 2

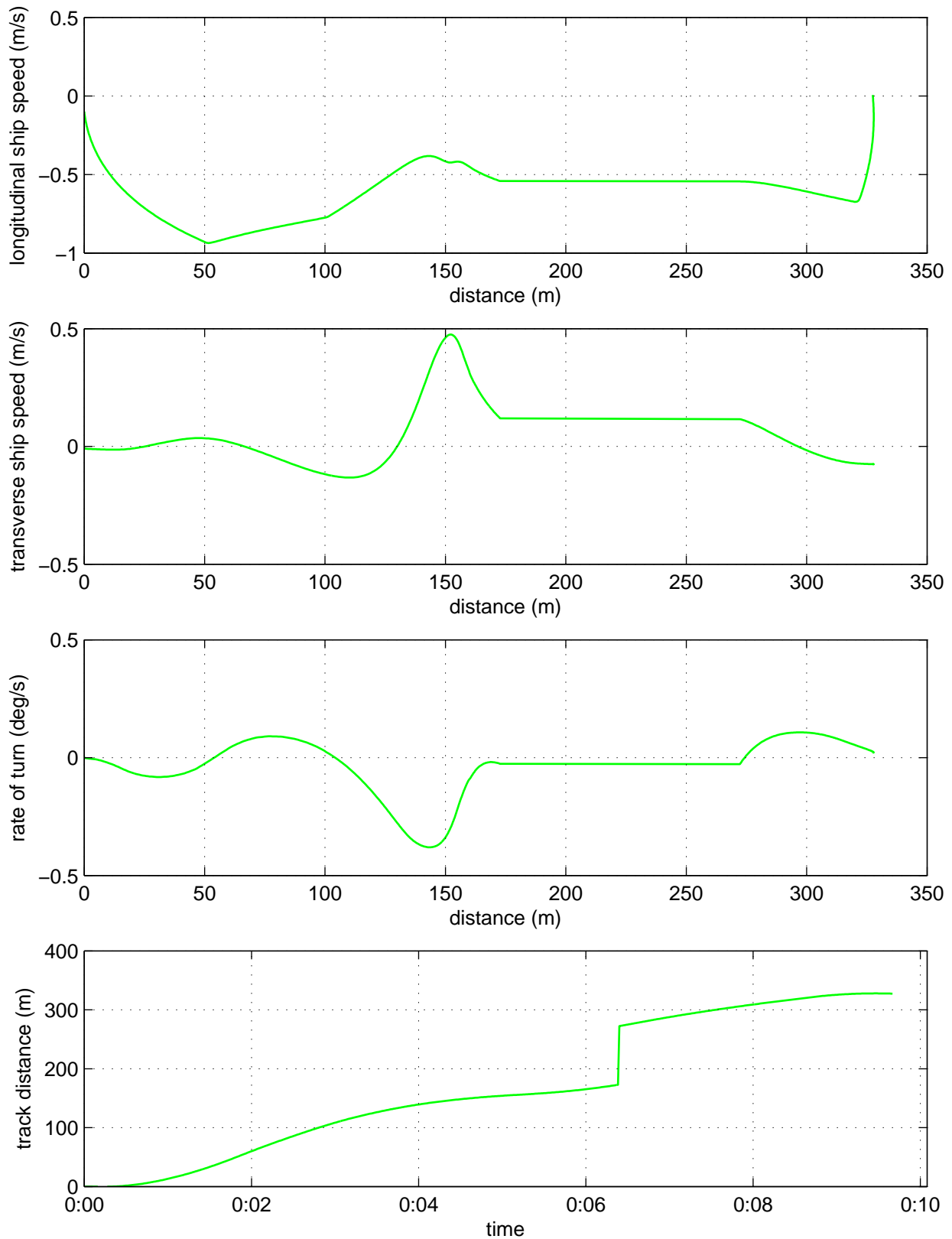
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 44b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 2

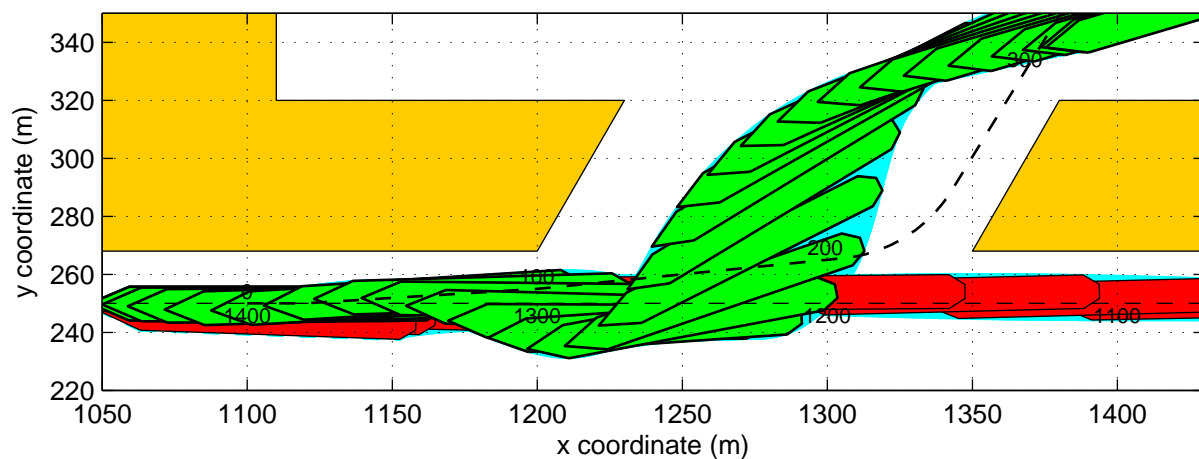
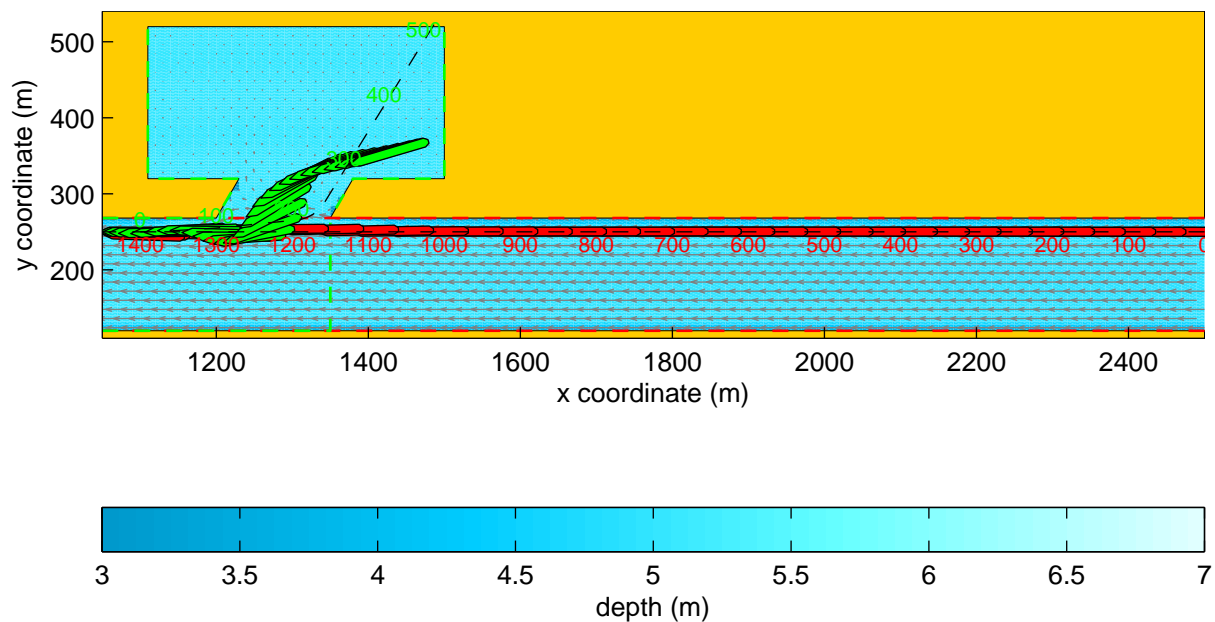
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 44b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 6

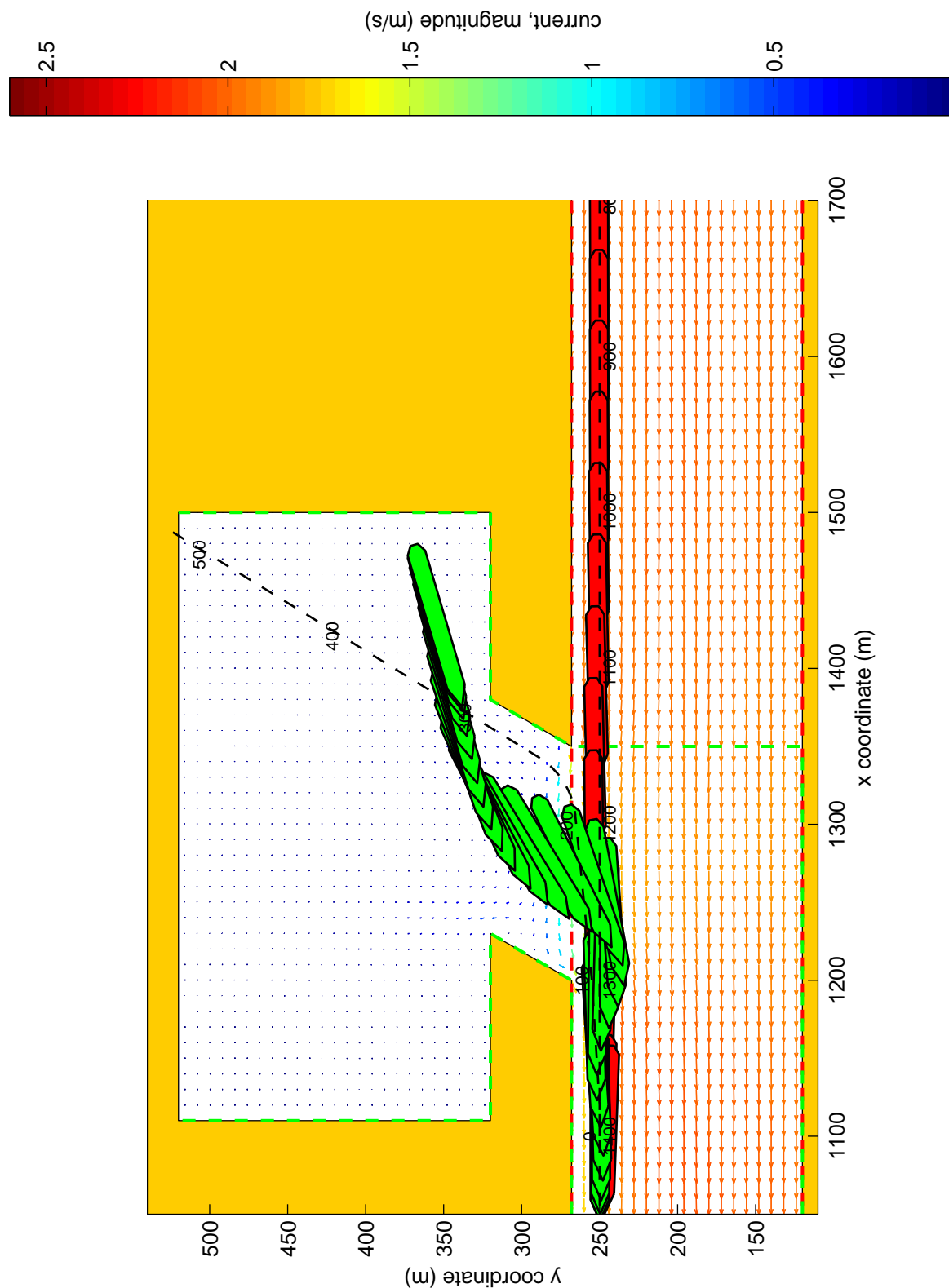
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 45

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 6

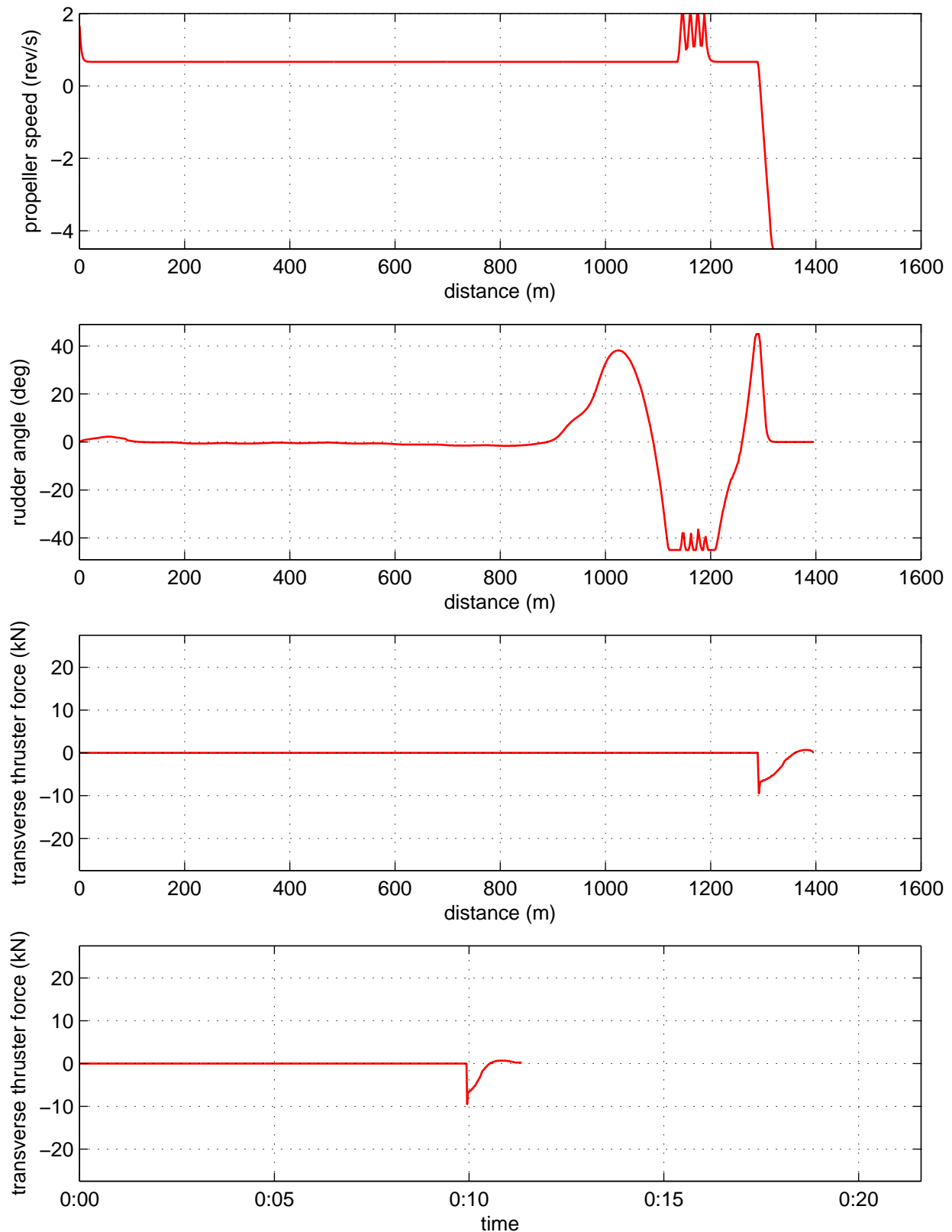
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 45

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

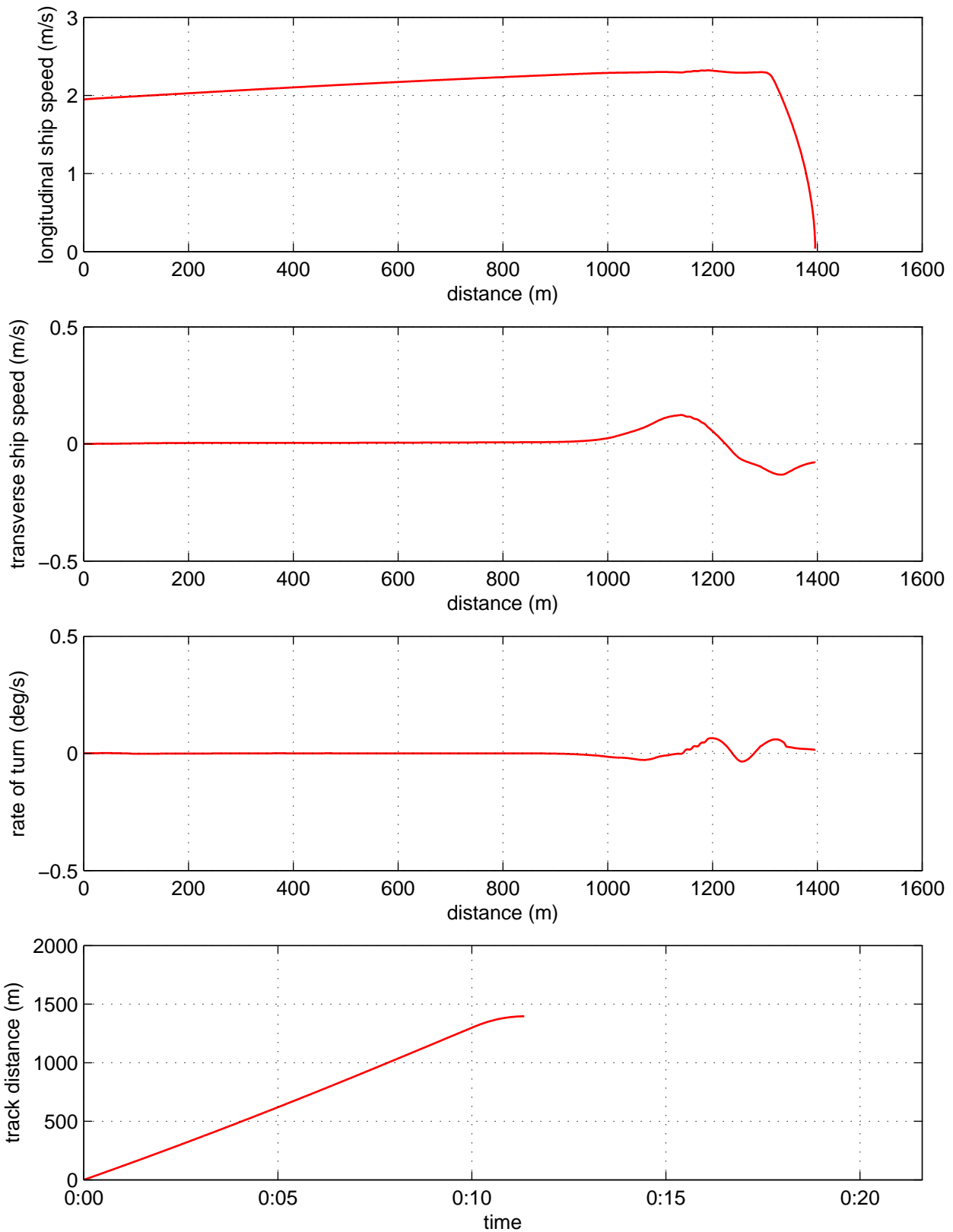
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 45a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

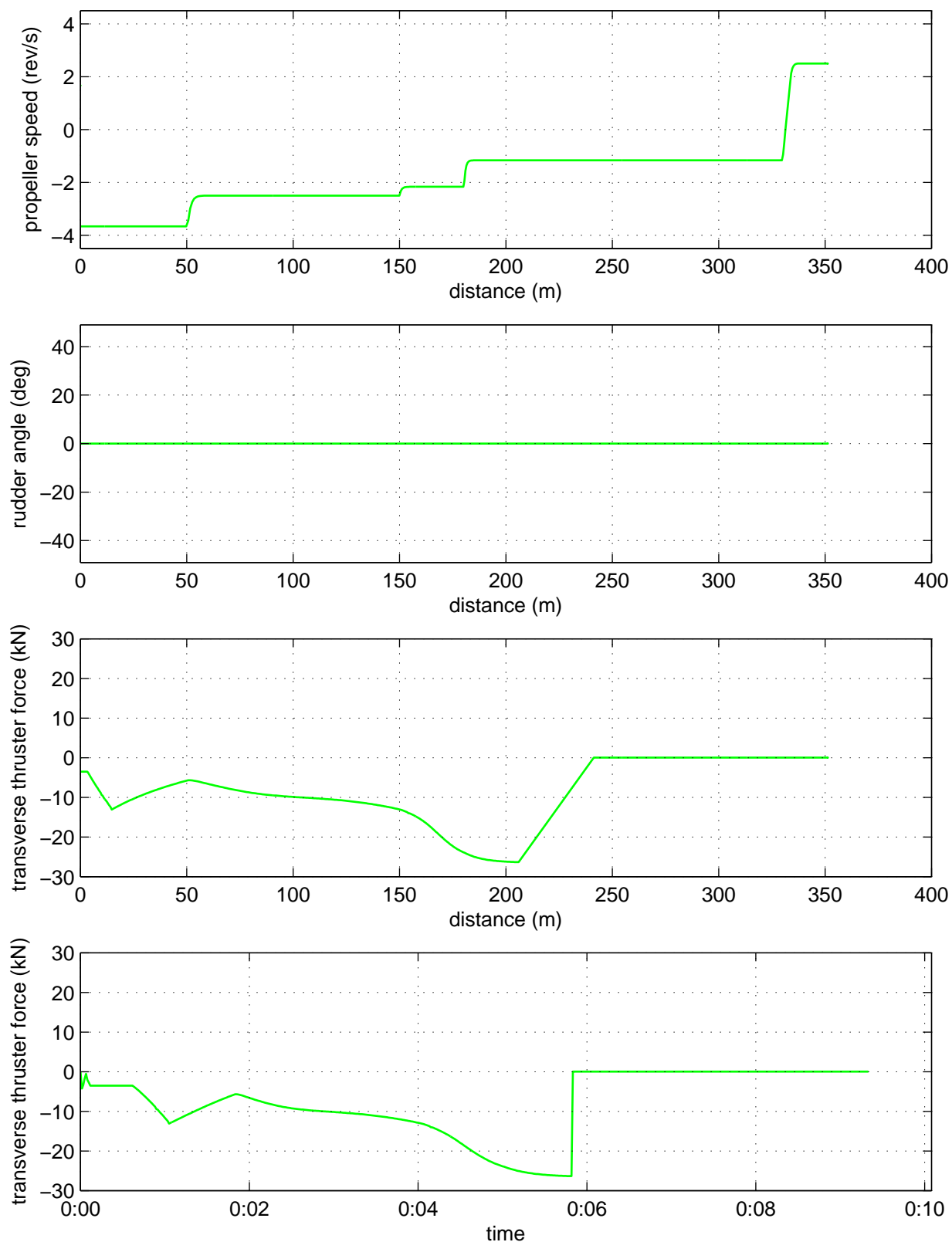
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 45a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

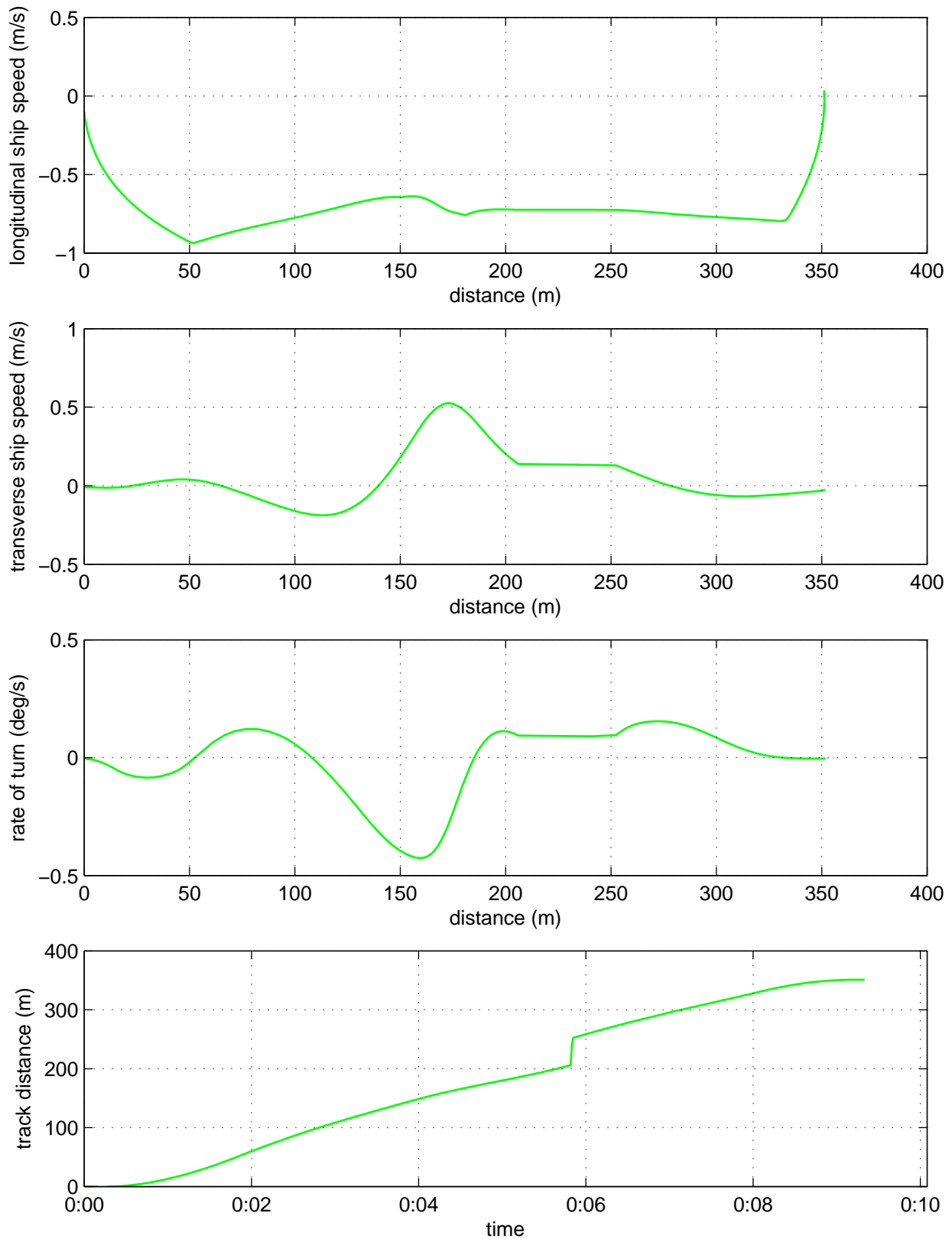
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 45b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

Current: 2.0 m/s

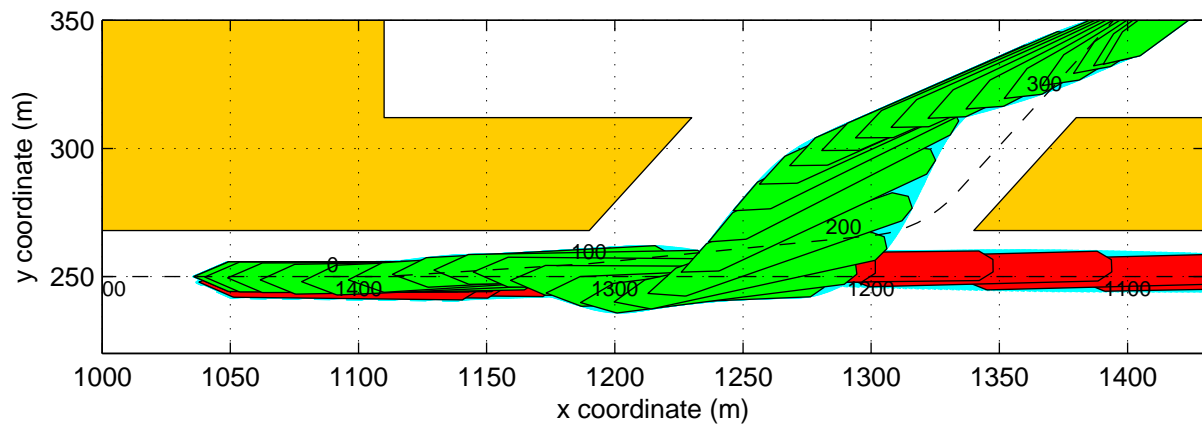
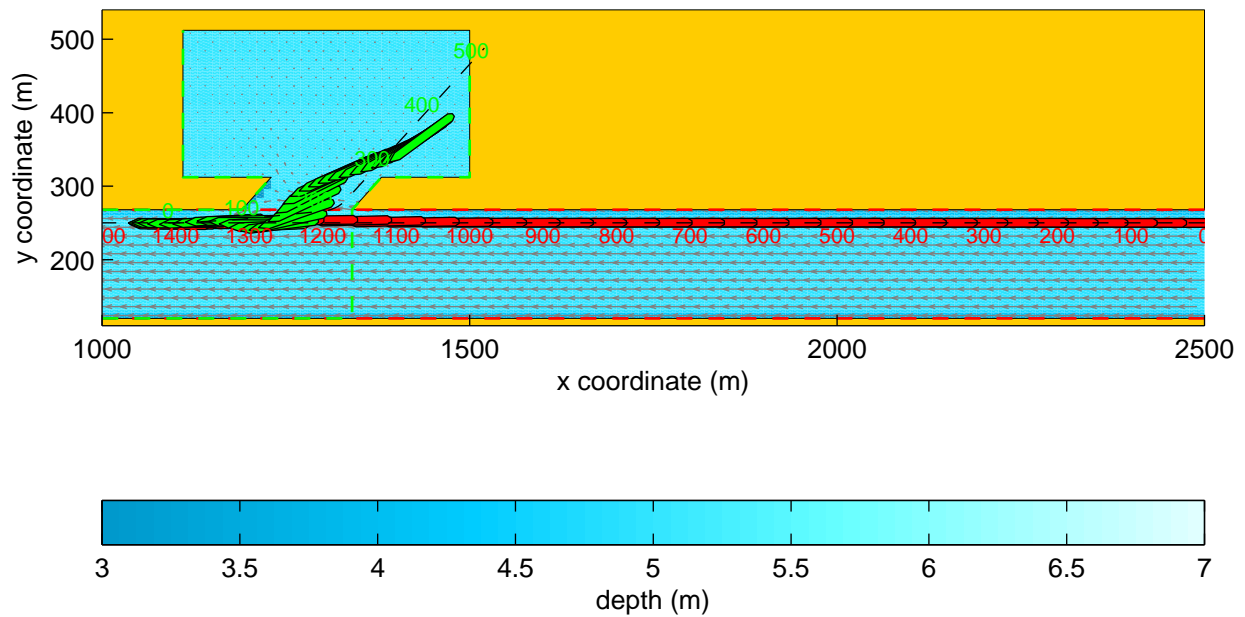
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 45b

Figure C





Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 7

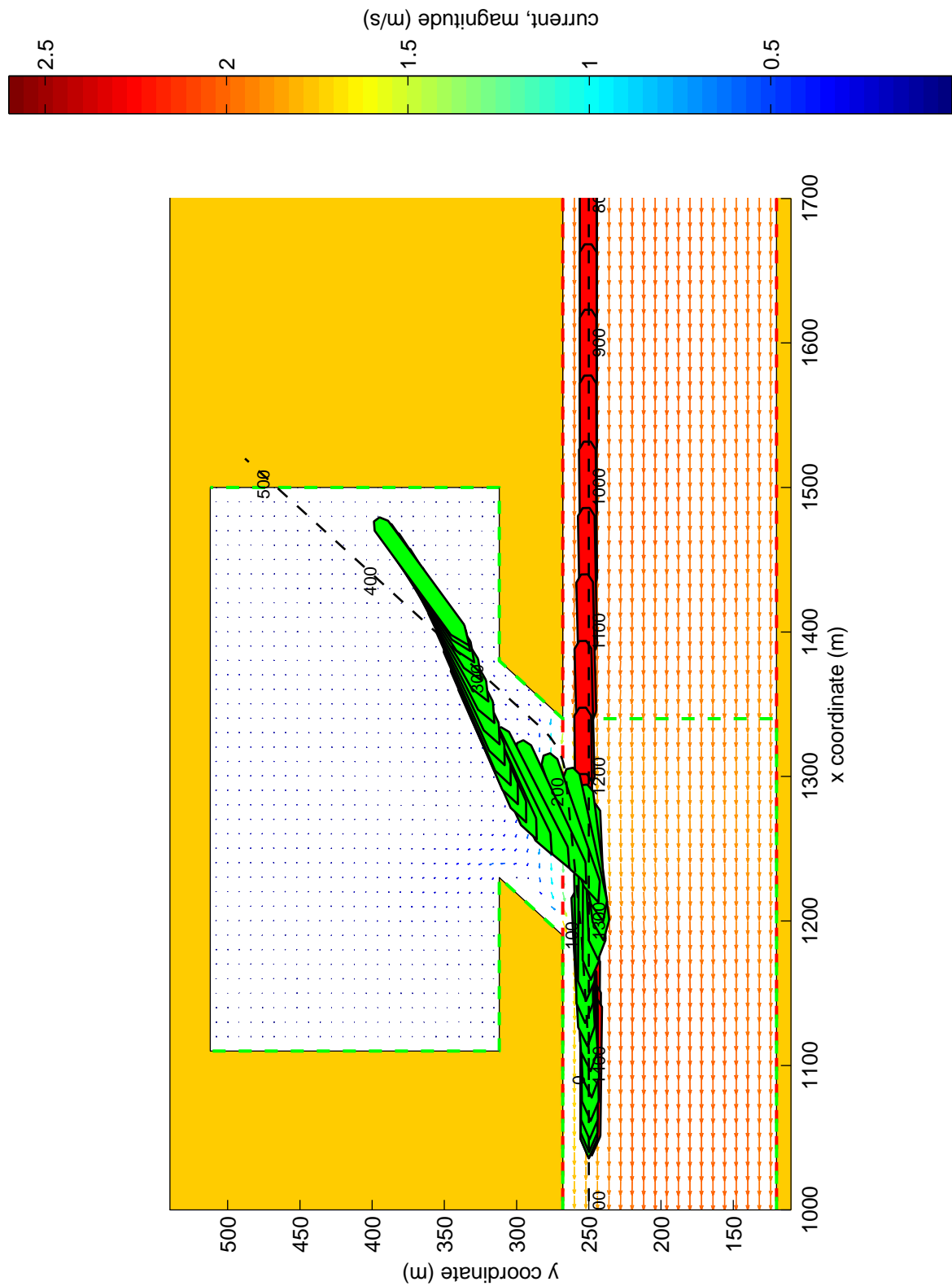
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 46

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 7

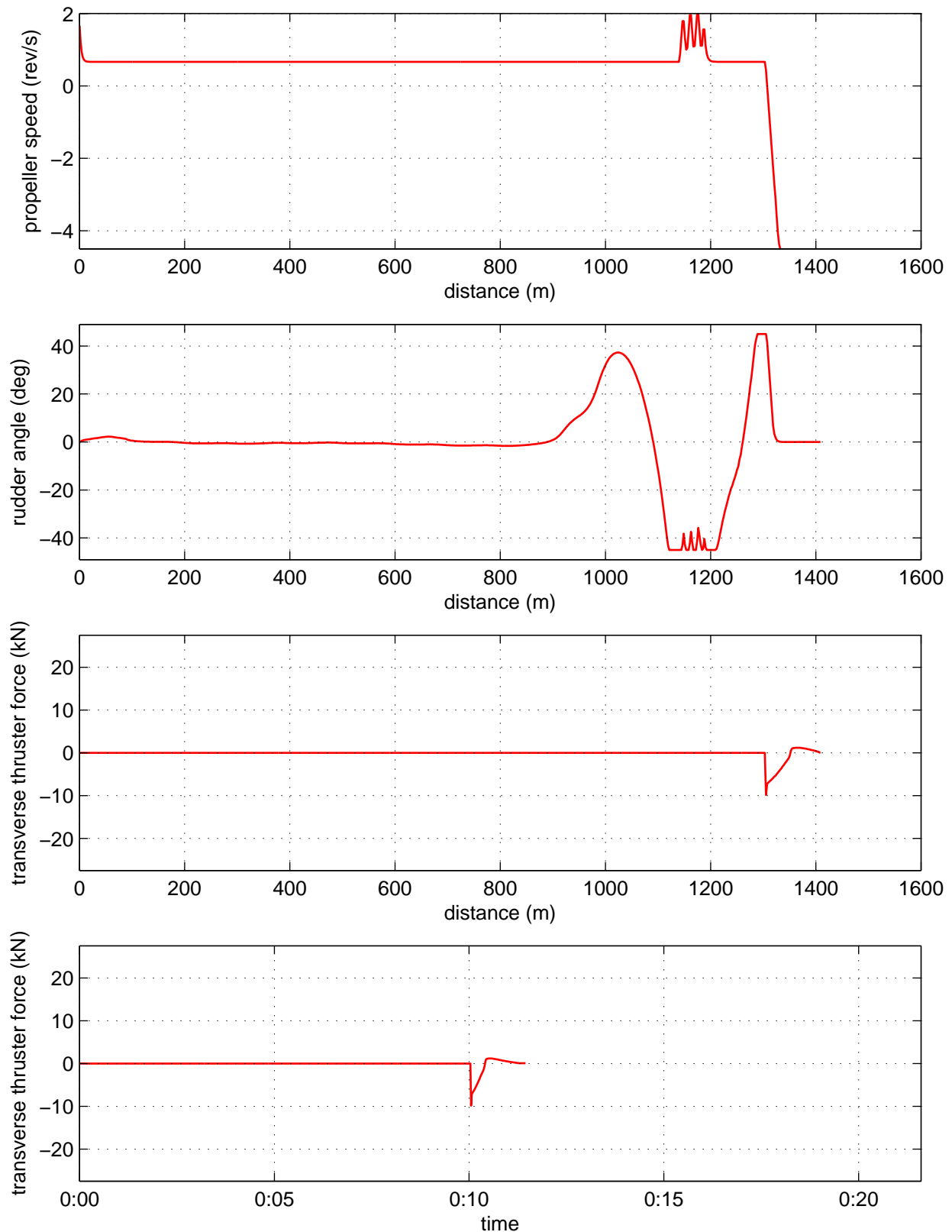
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 46

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

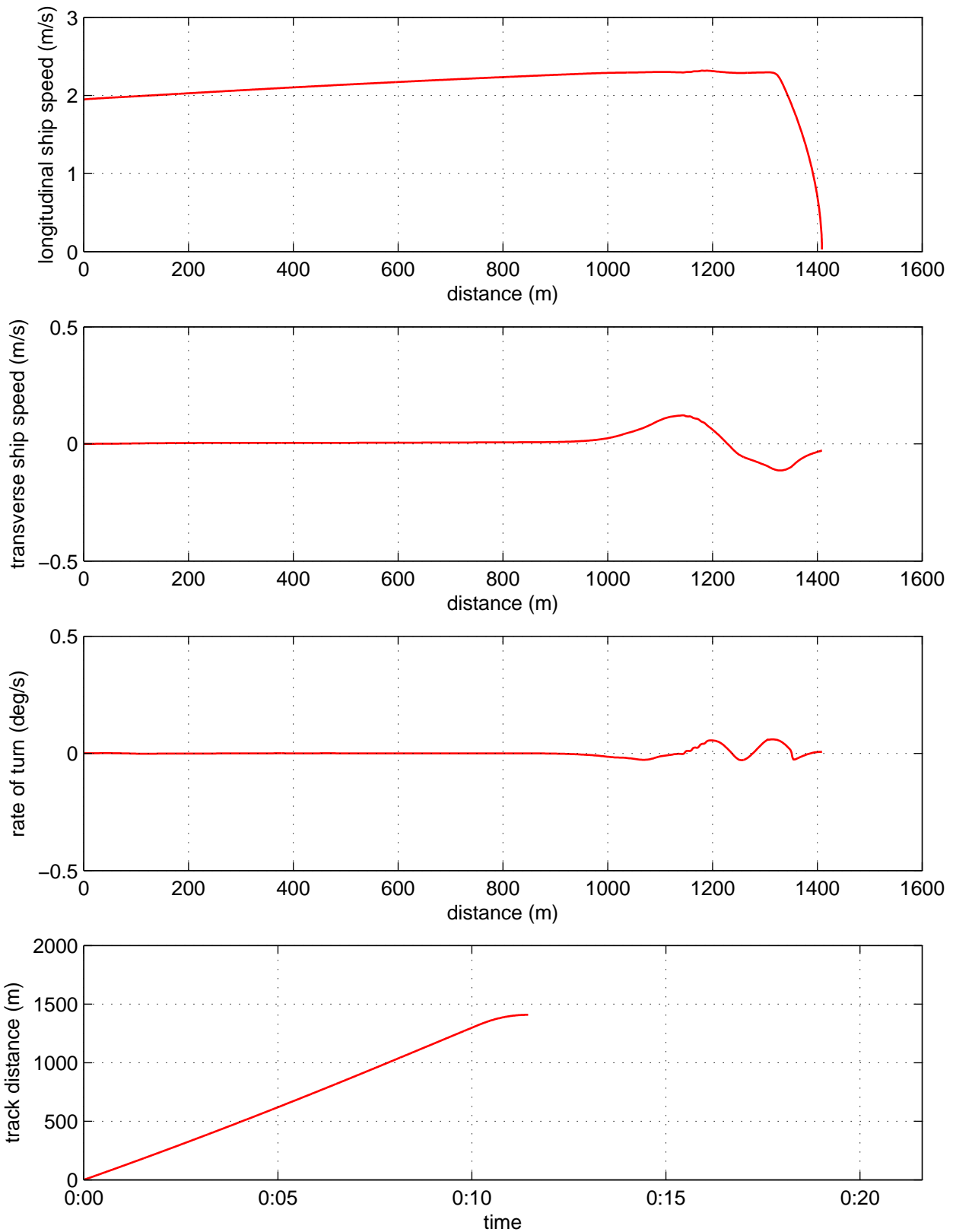
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 46a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

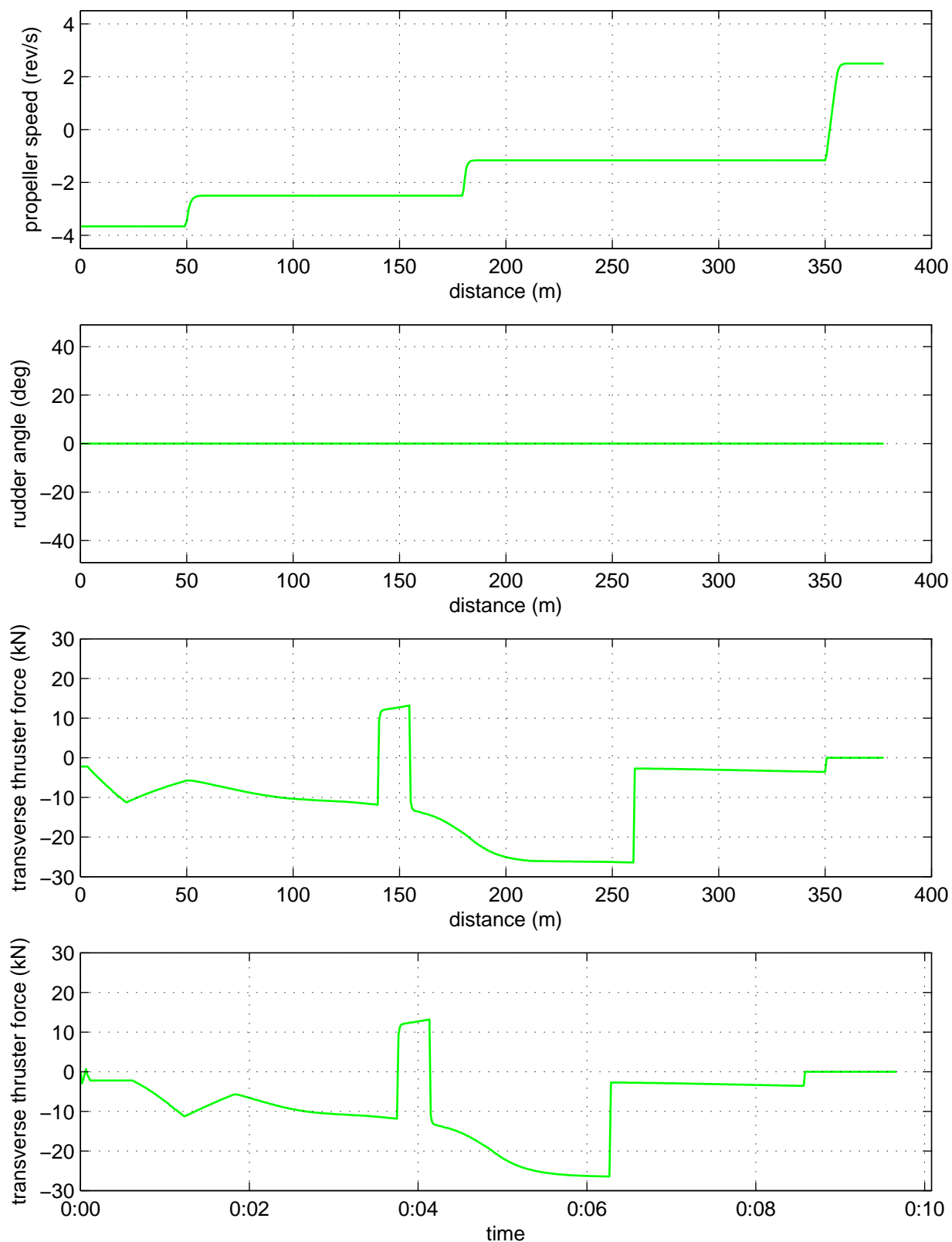
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 46a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 7

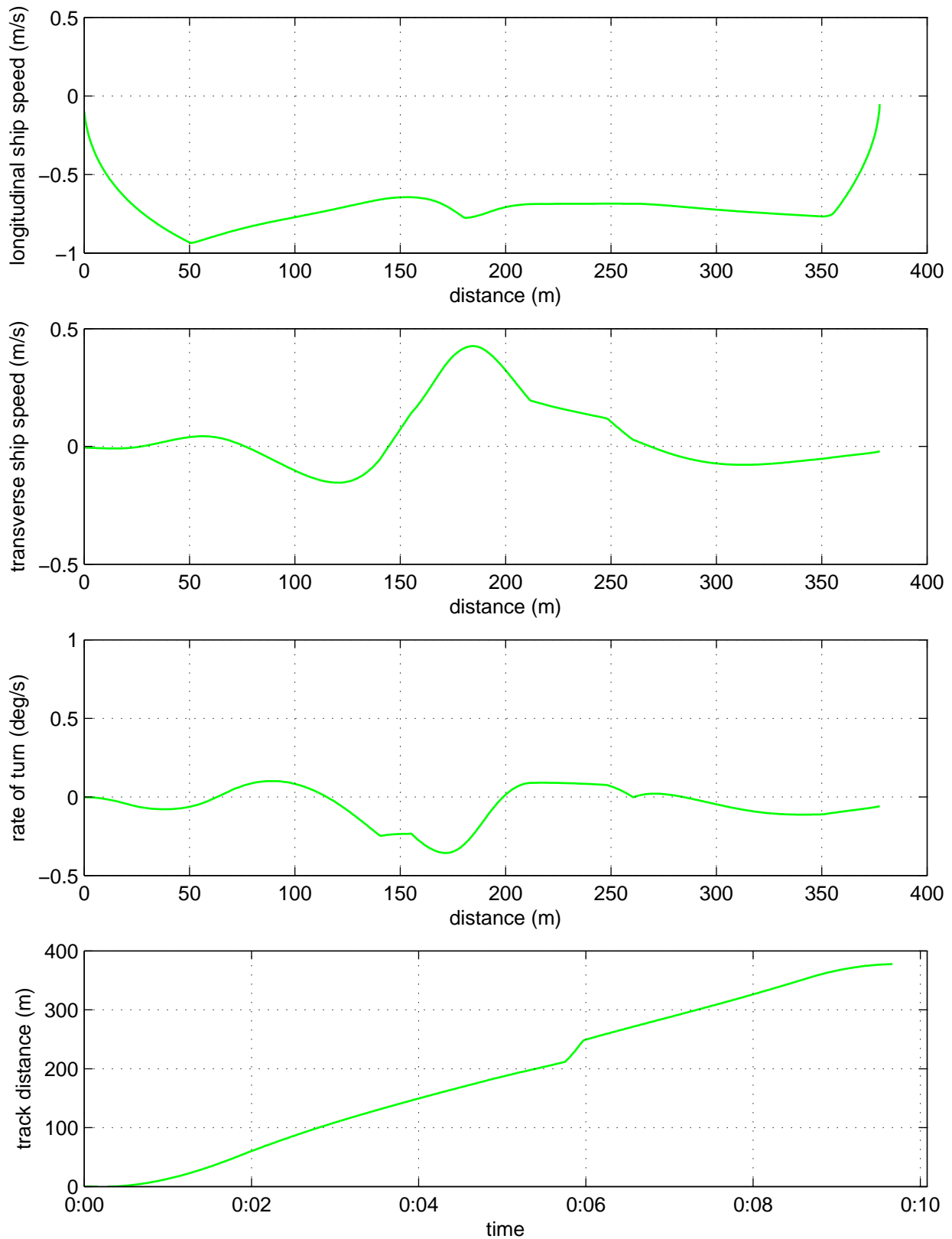
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 46b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 7

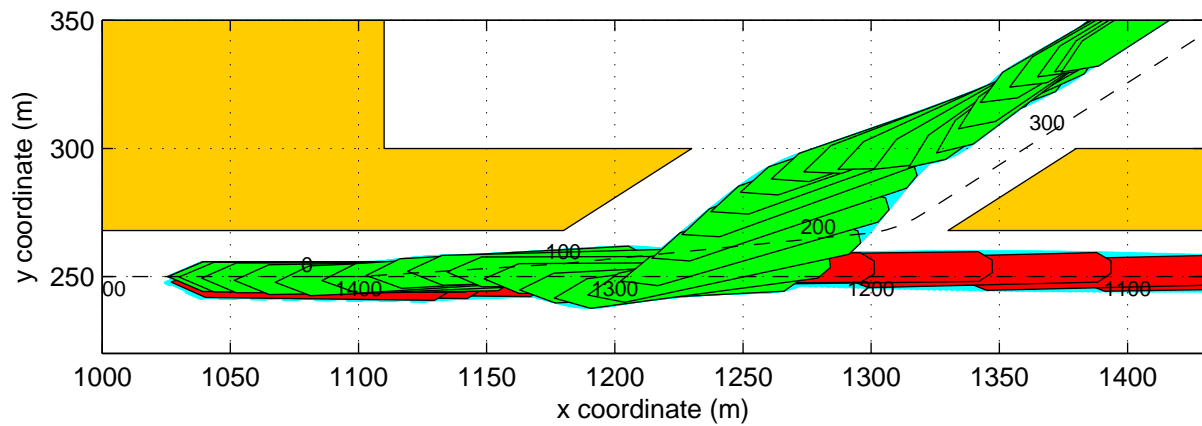
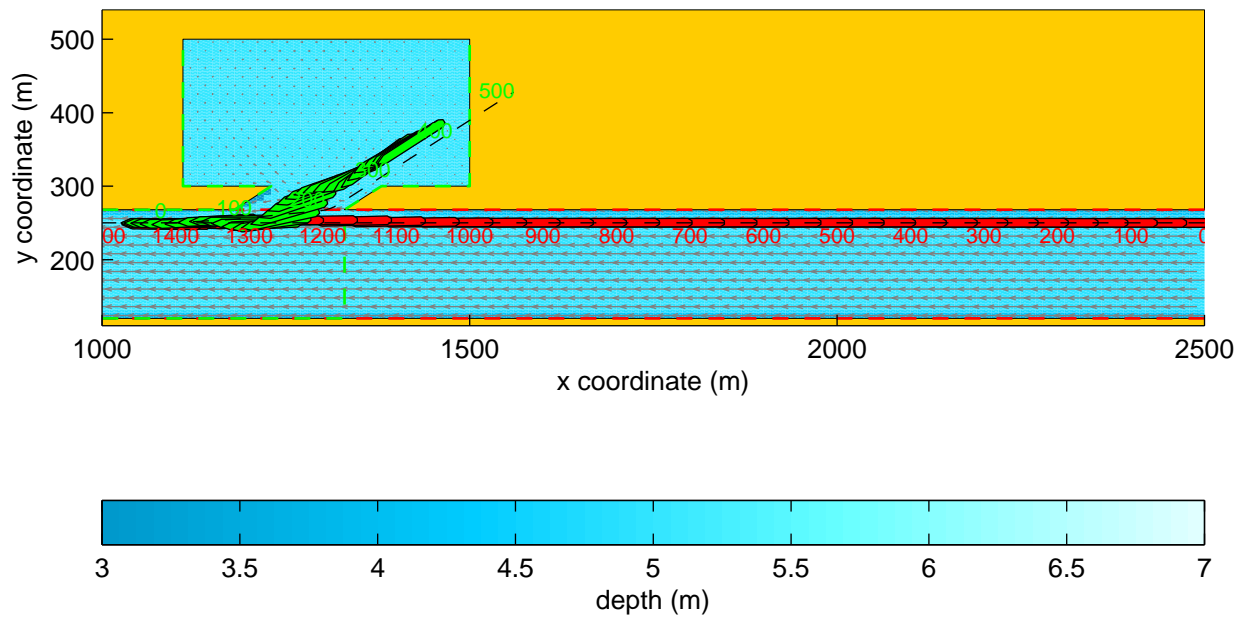
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 46b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 8

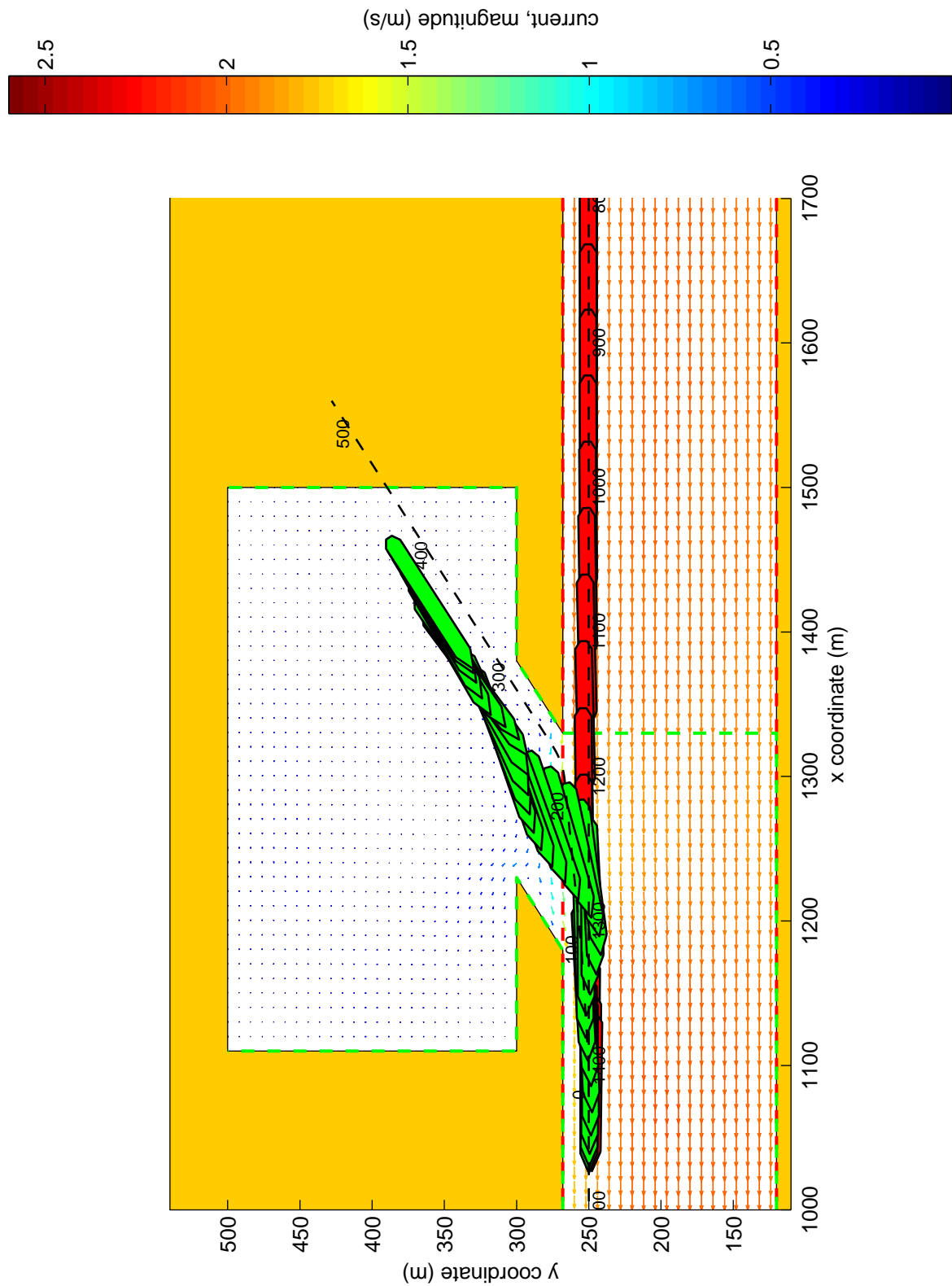
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 47

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 8

Current: 2.0 m/s

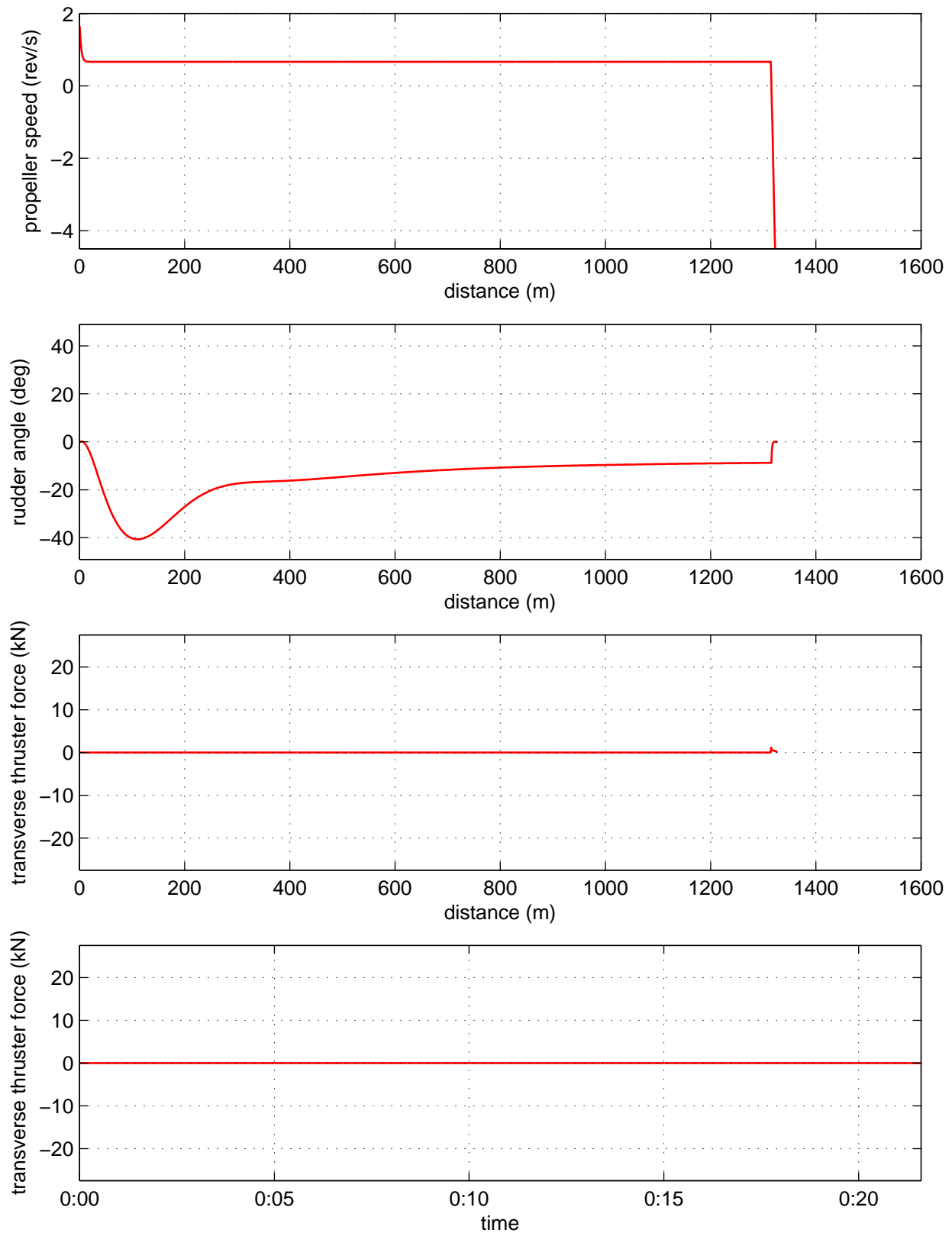
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 47

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

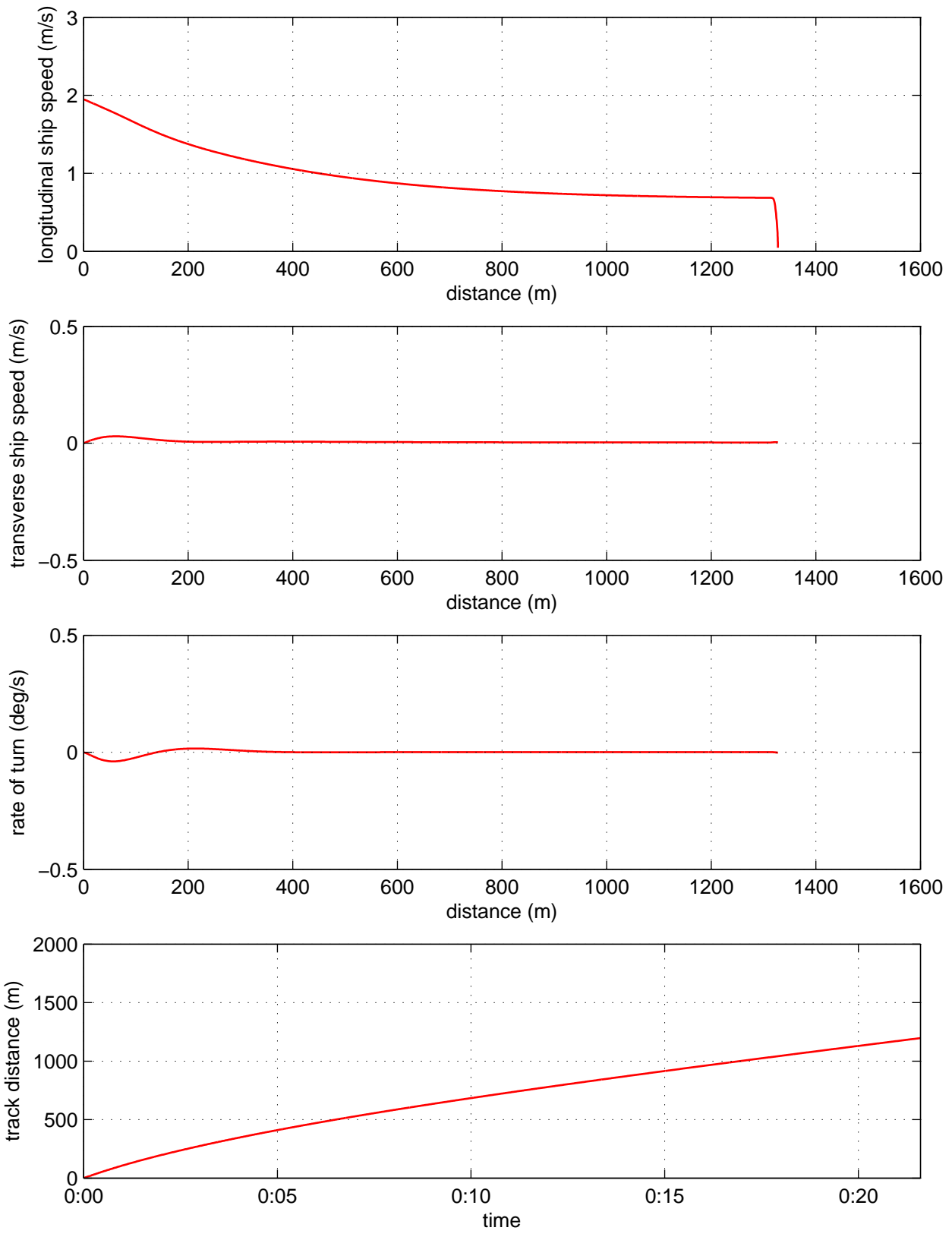
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 47a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

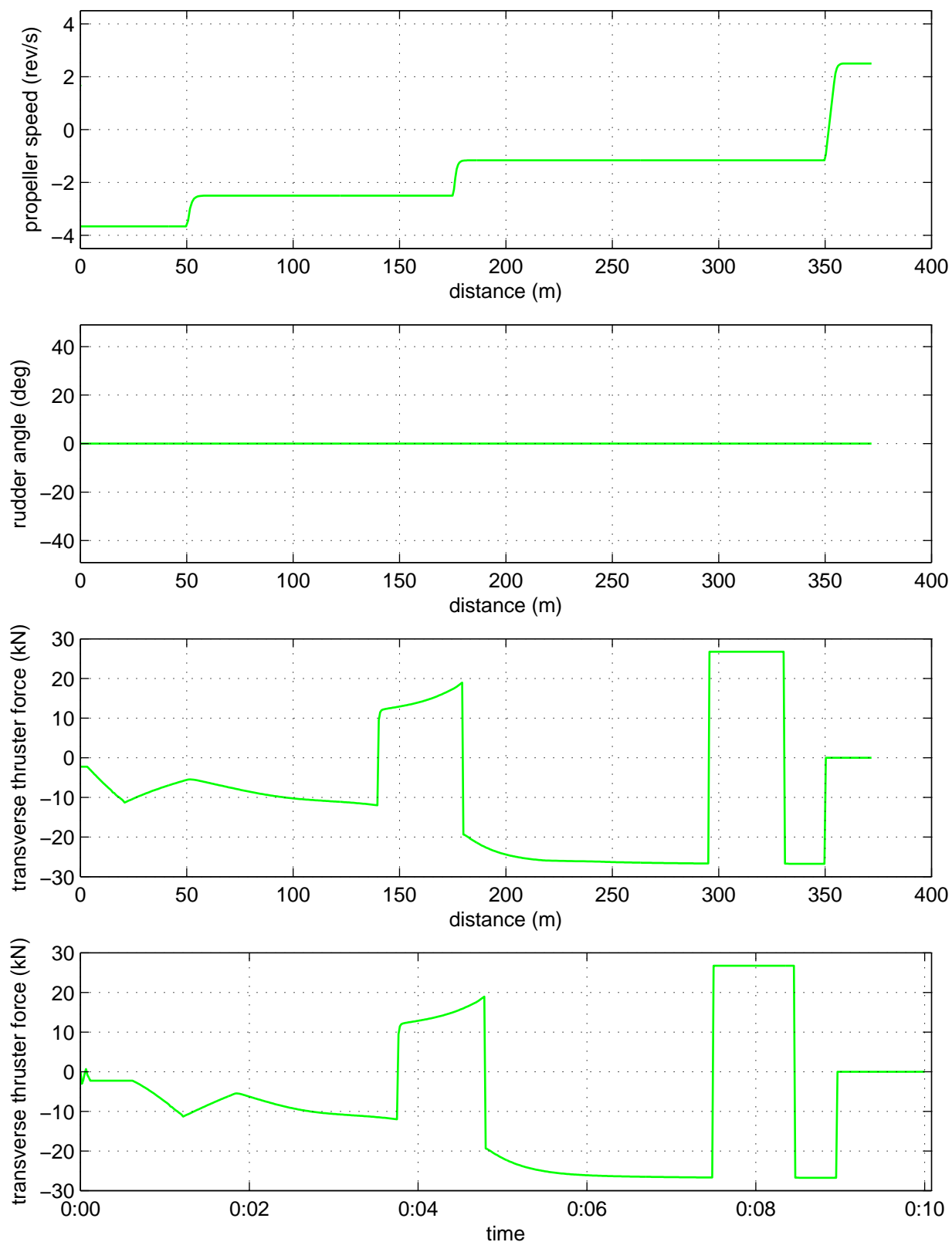
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 47a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 8

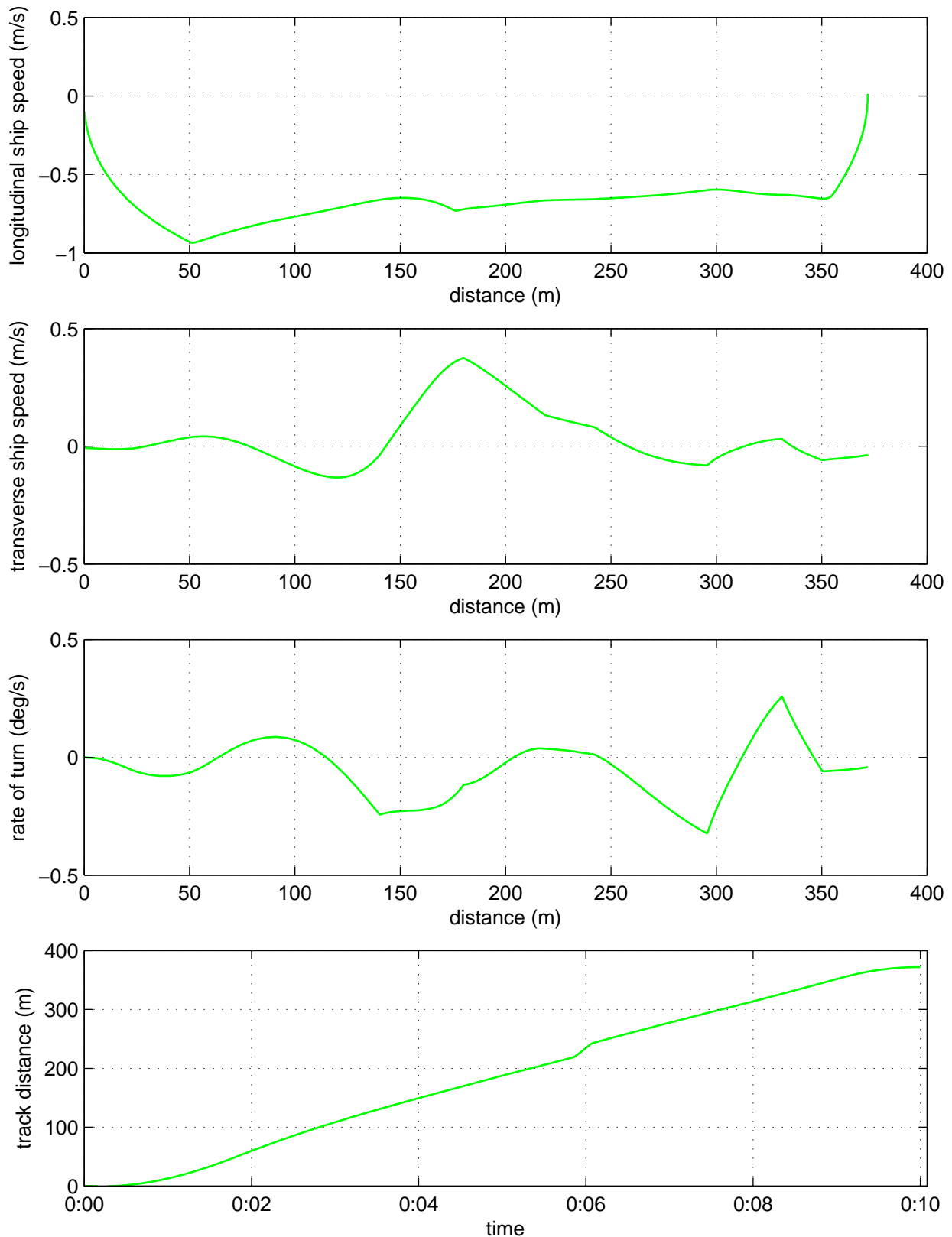
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 47b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 8

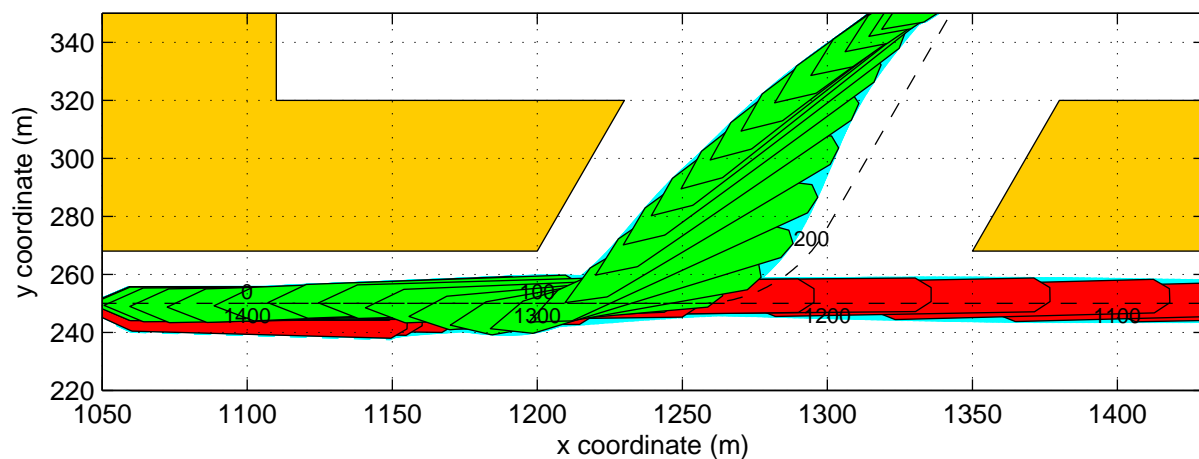
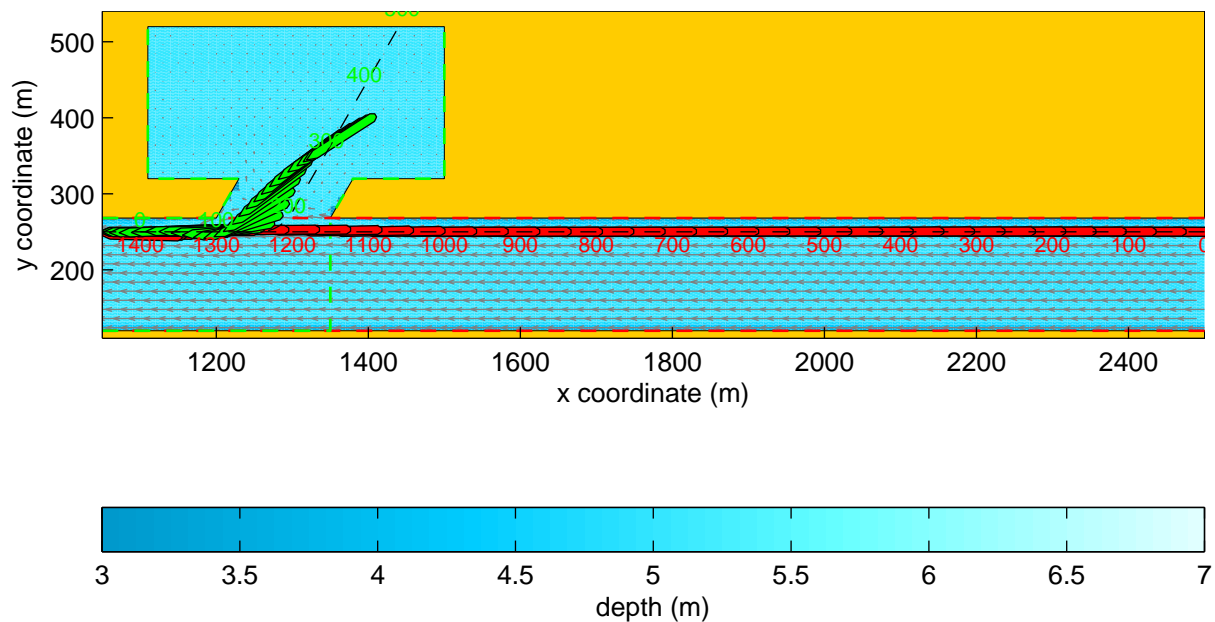
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 47b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 6

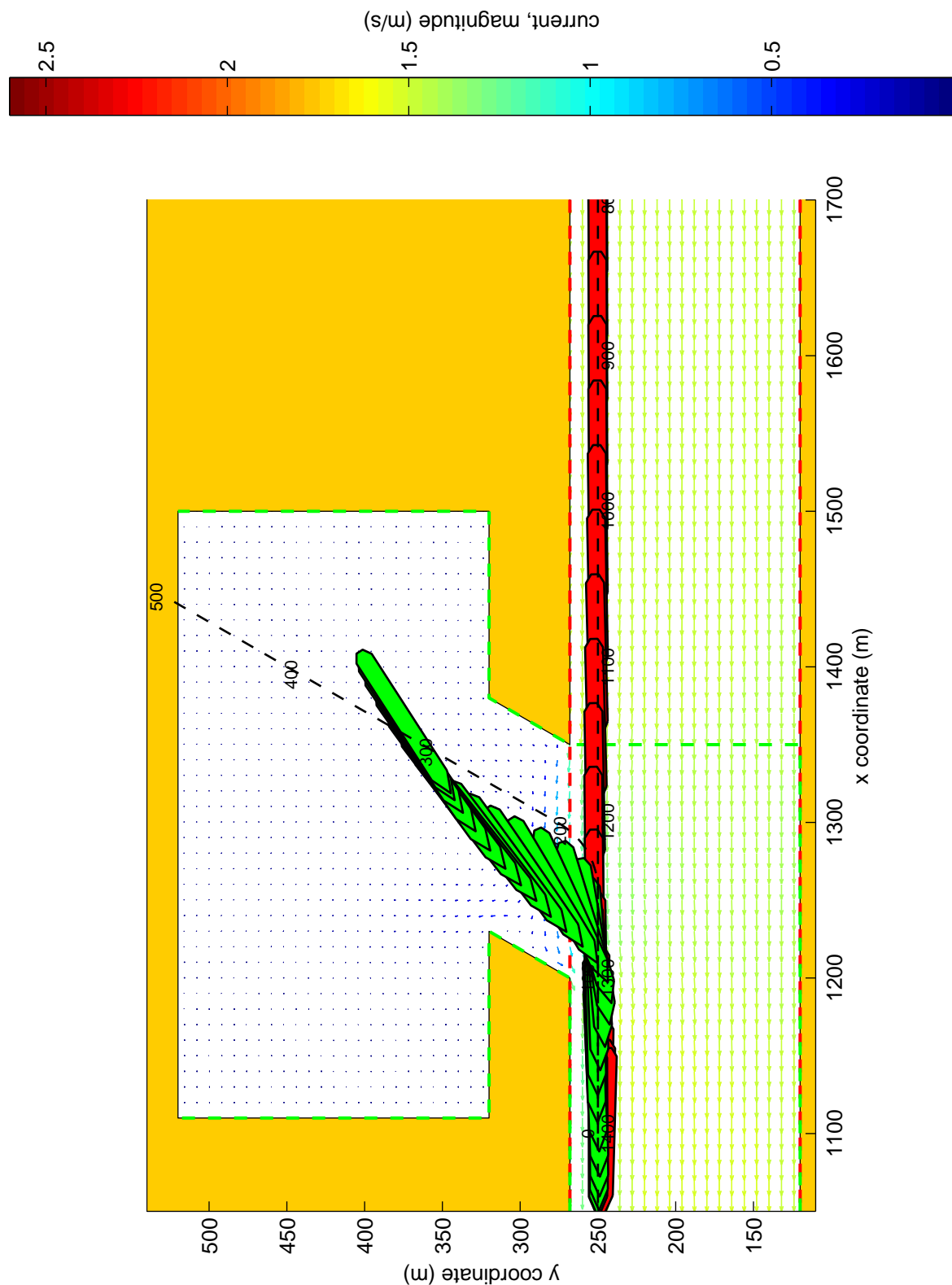
Current: 1.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 48

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 6

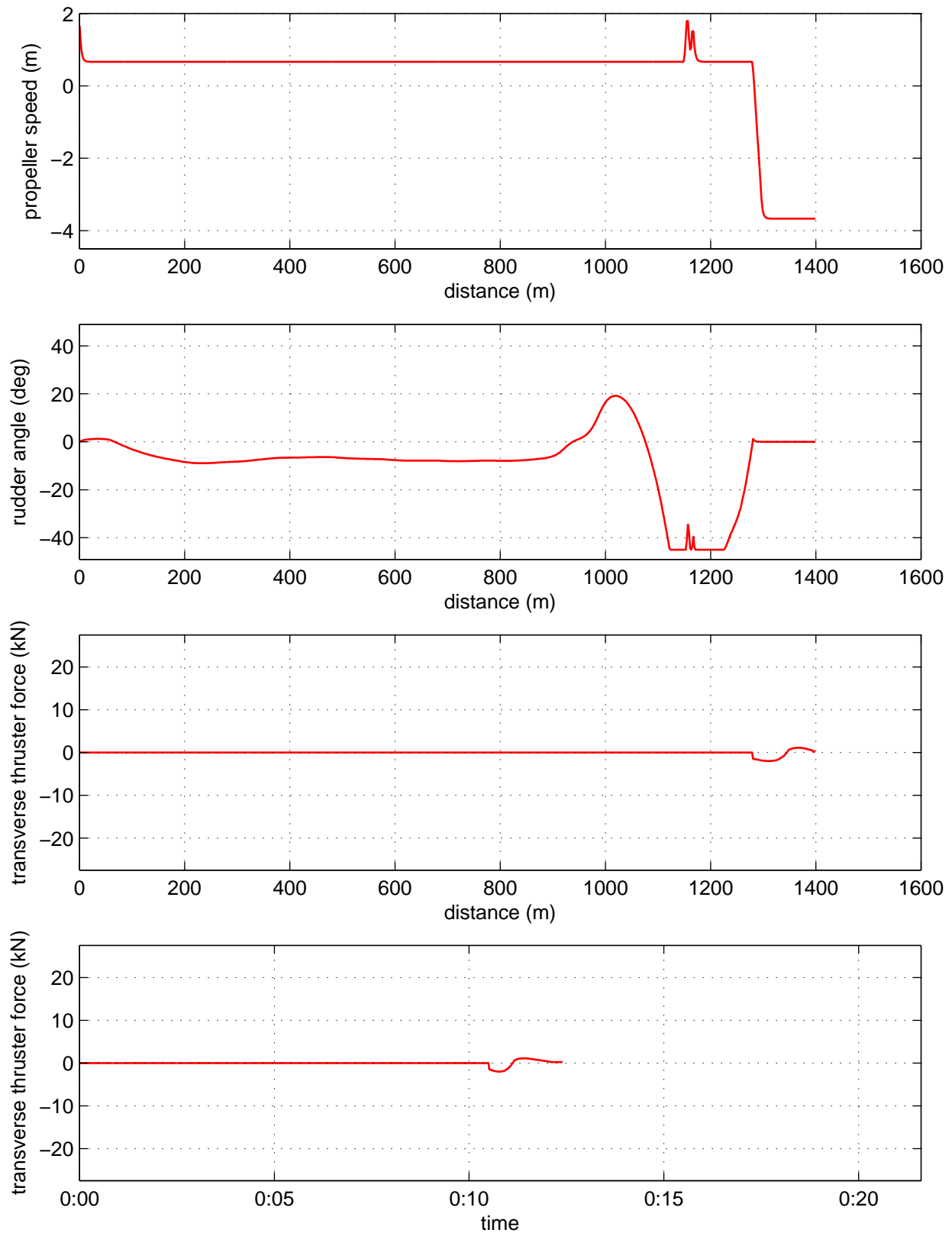
Current: 1.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 48

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

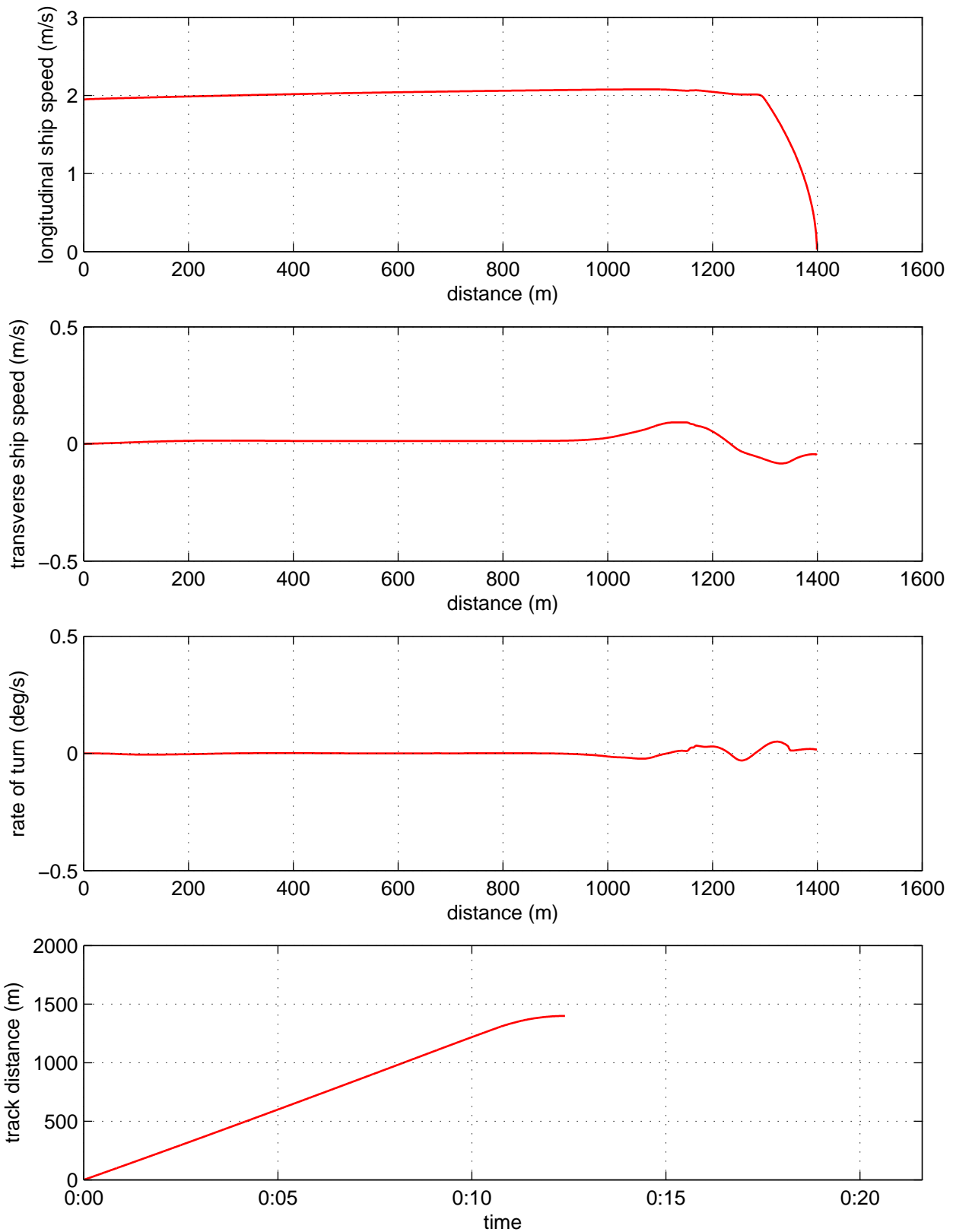
Current: 1.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 48a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

Current: 1.5 m/s

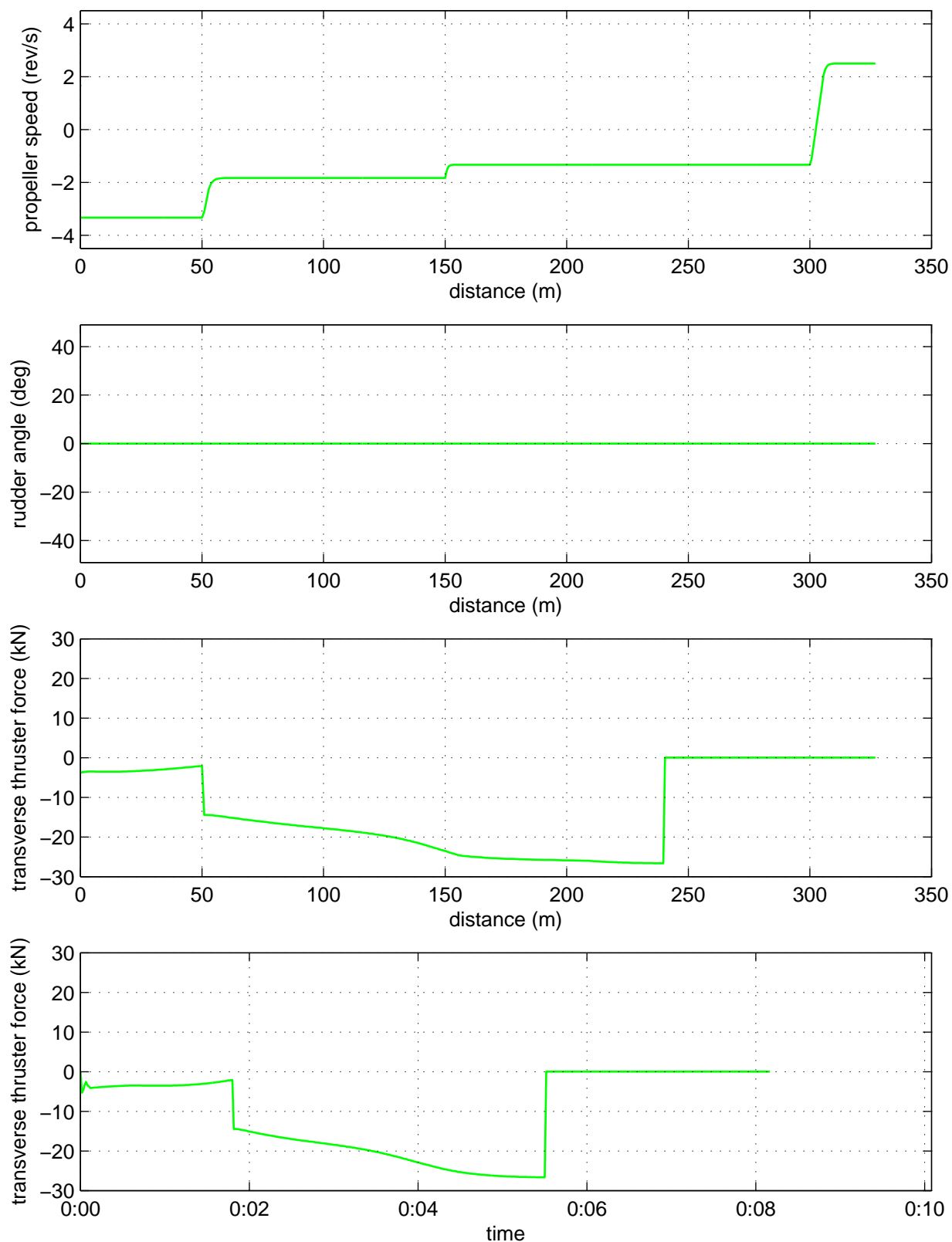
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 48a

Figure C





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

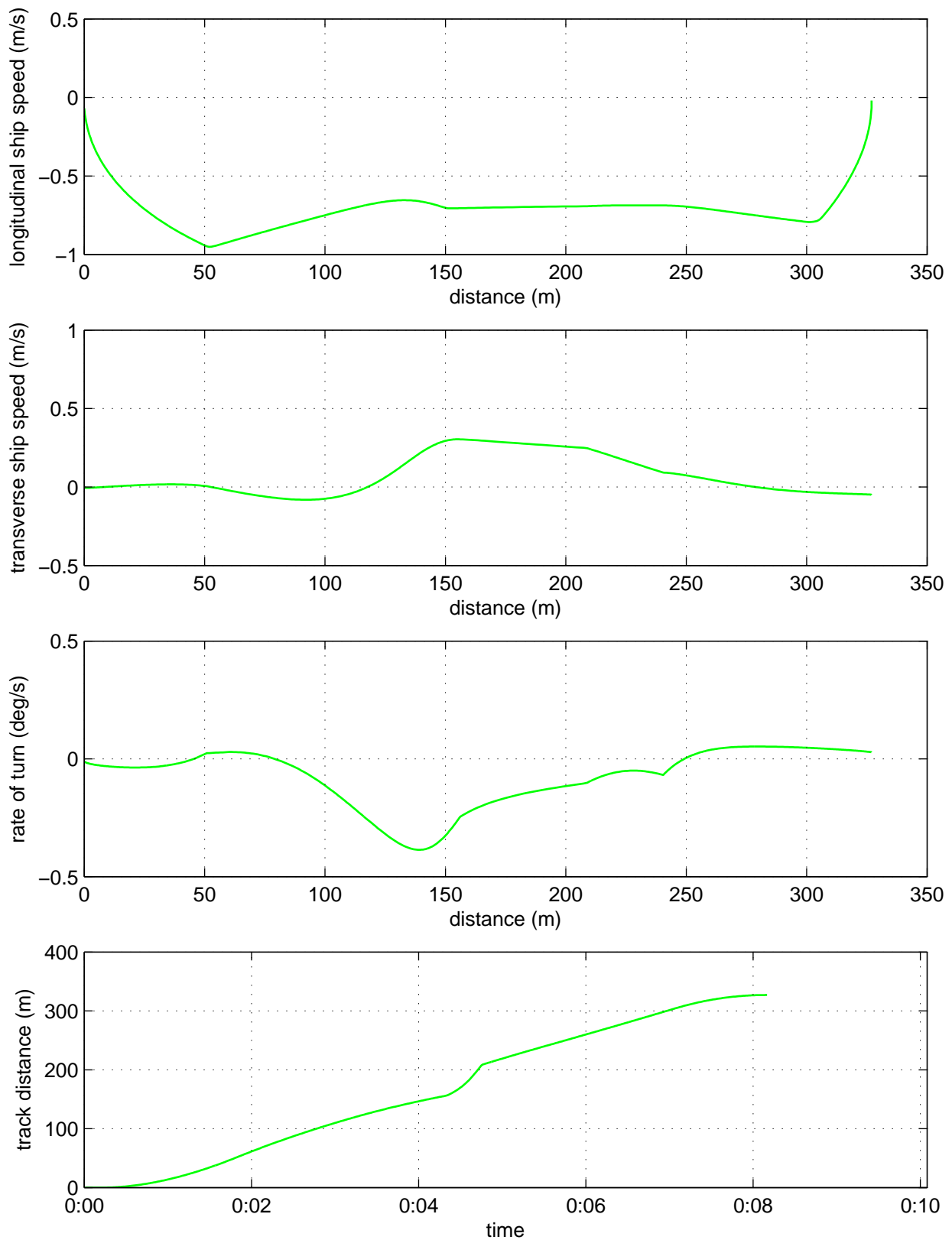
Current: 1.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 48b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

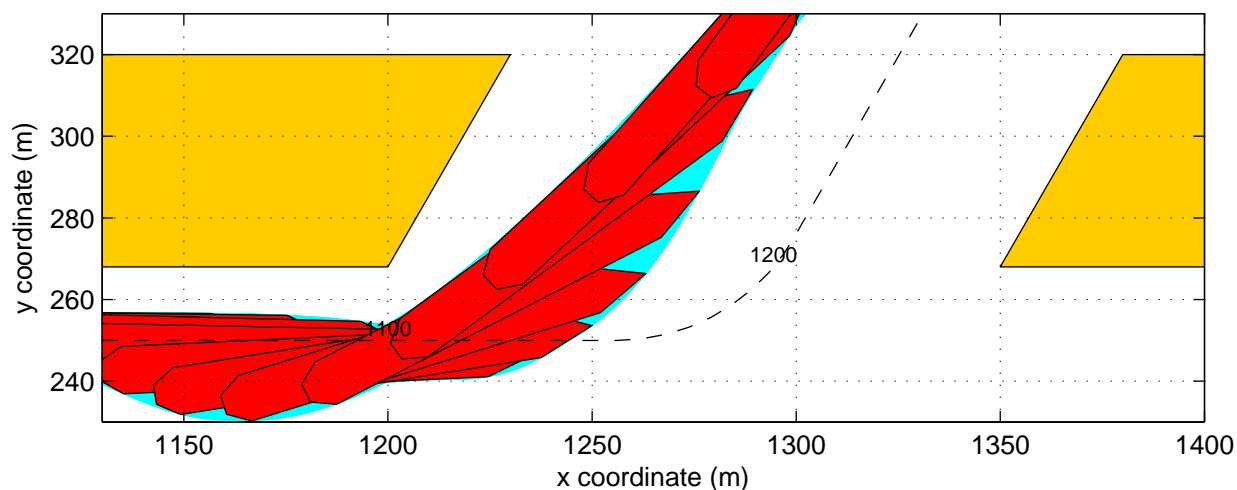
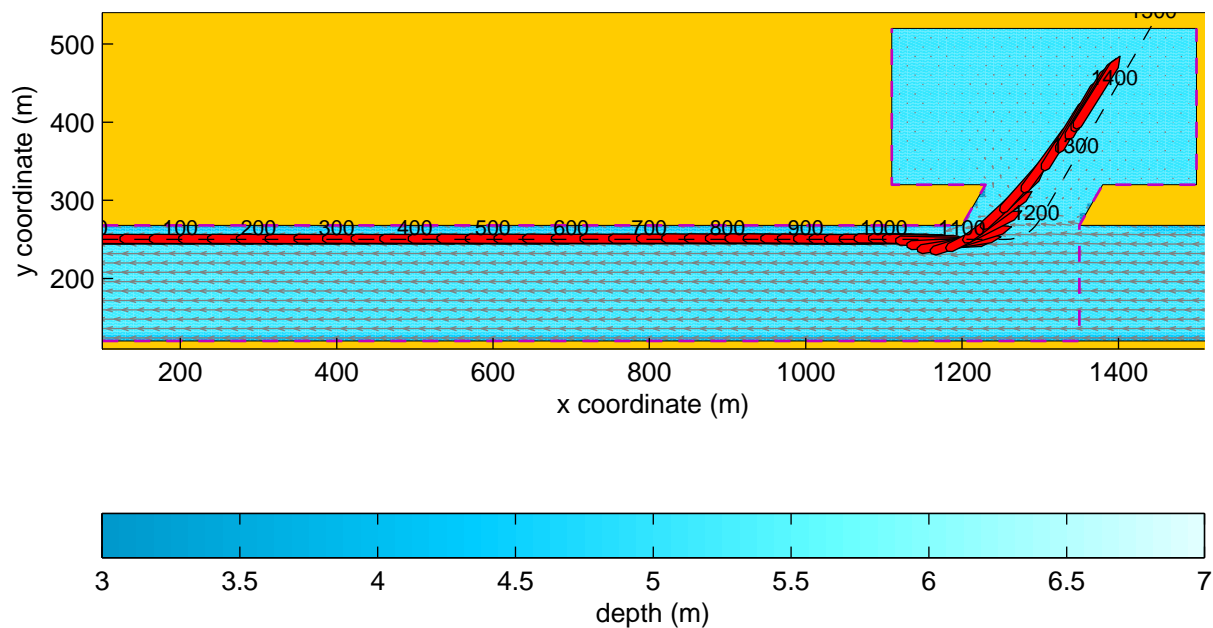
Current: 1.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 48b

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

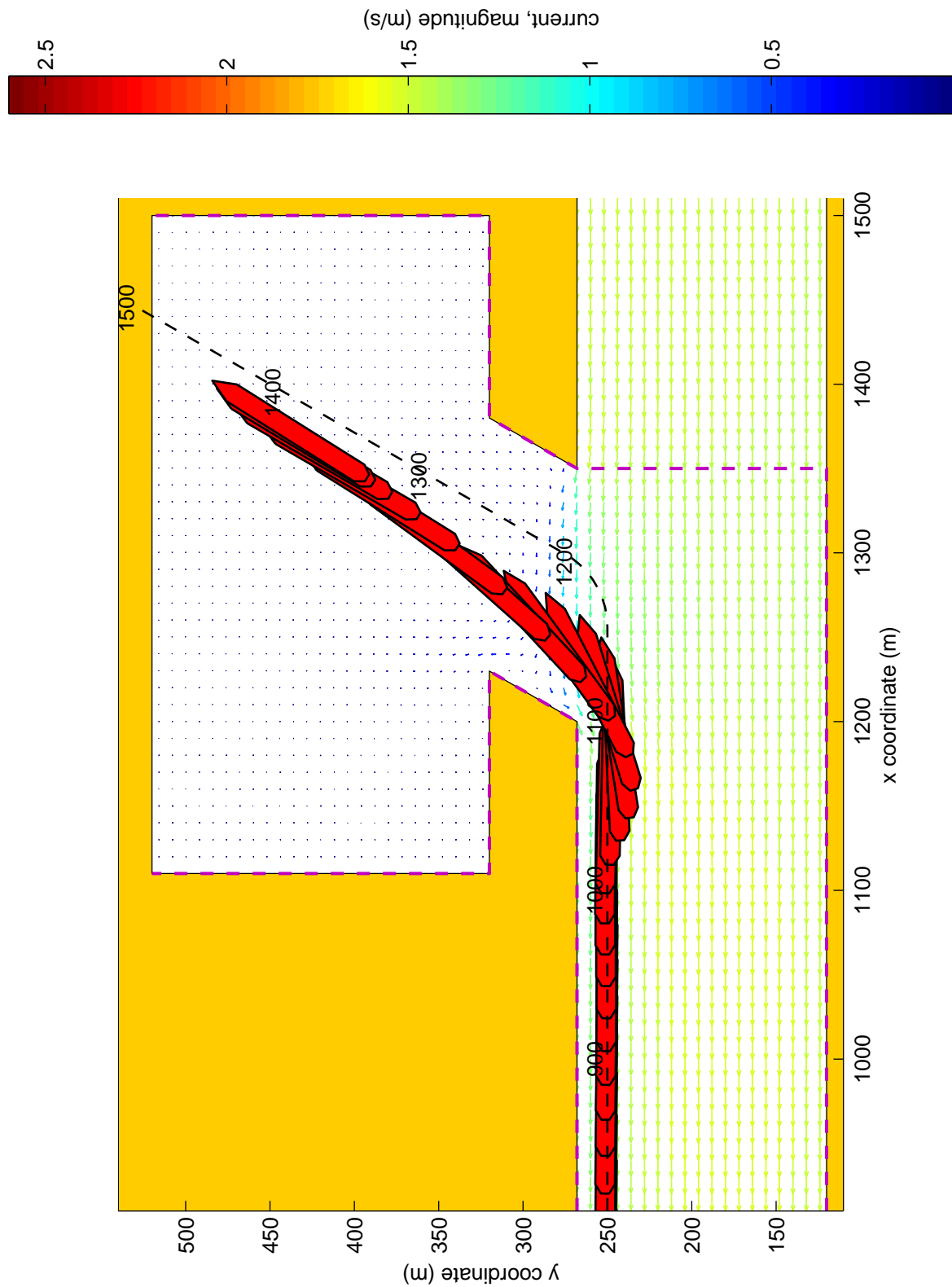
Current: 1.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Simulation 49

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

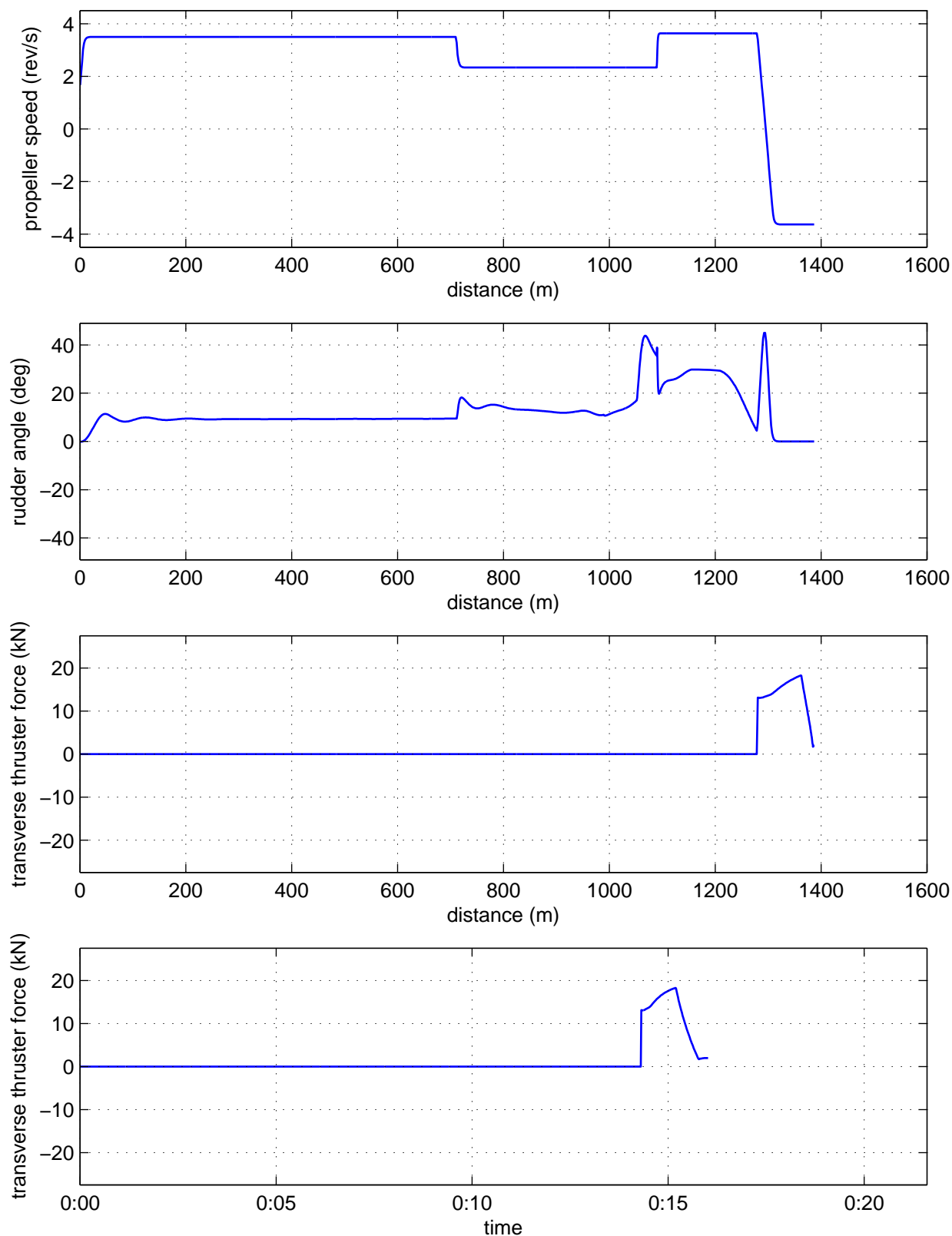
Current: 1.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Simulation 49

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

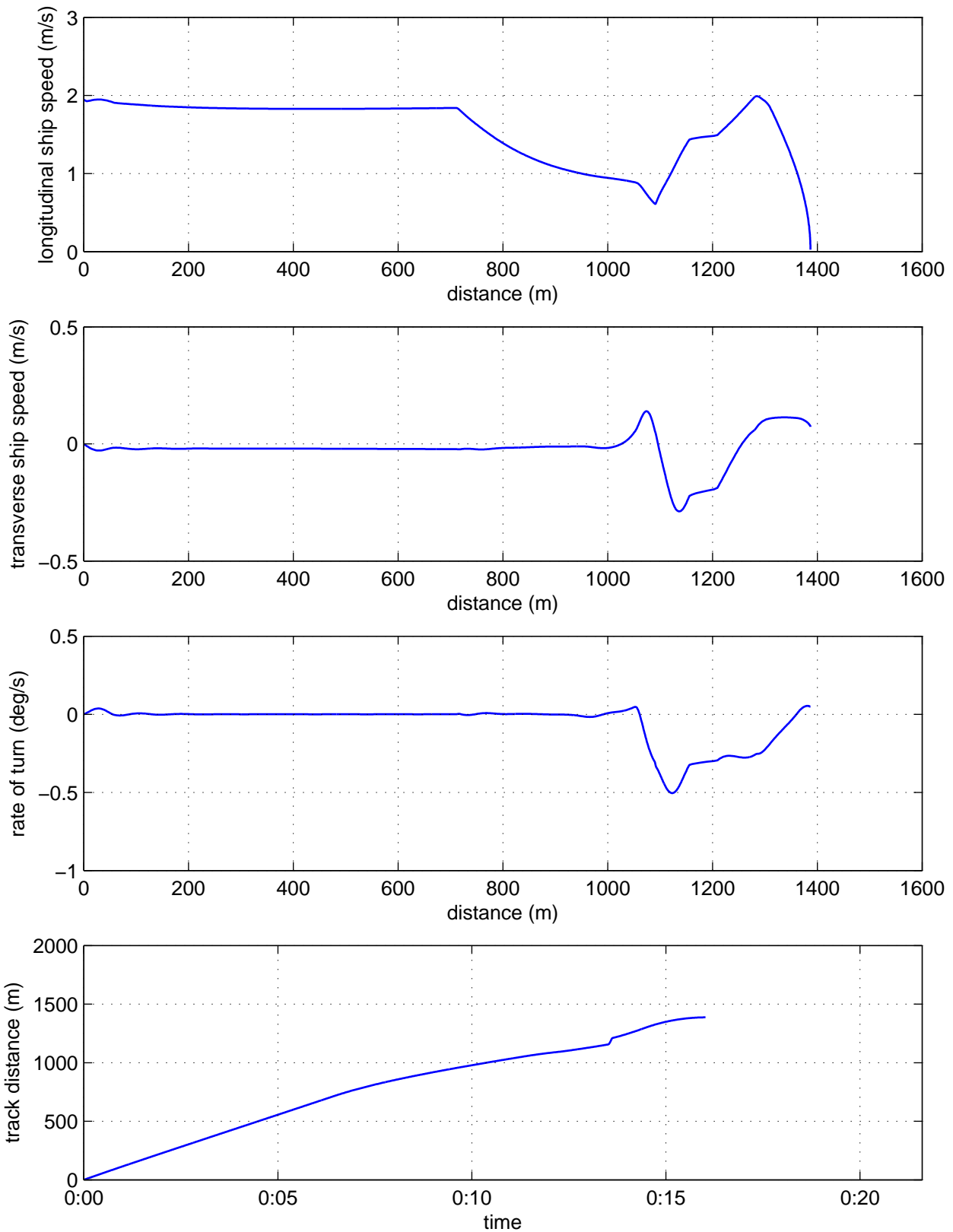
Current: 1.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Simulation 49

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

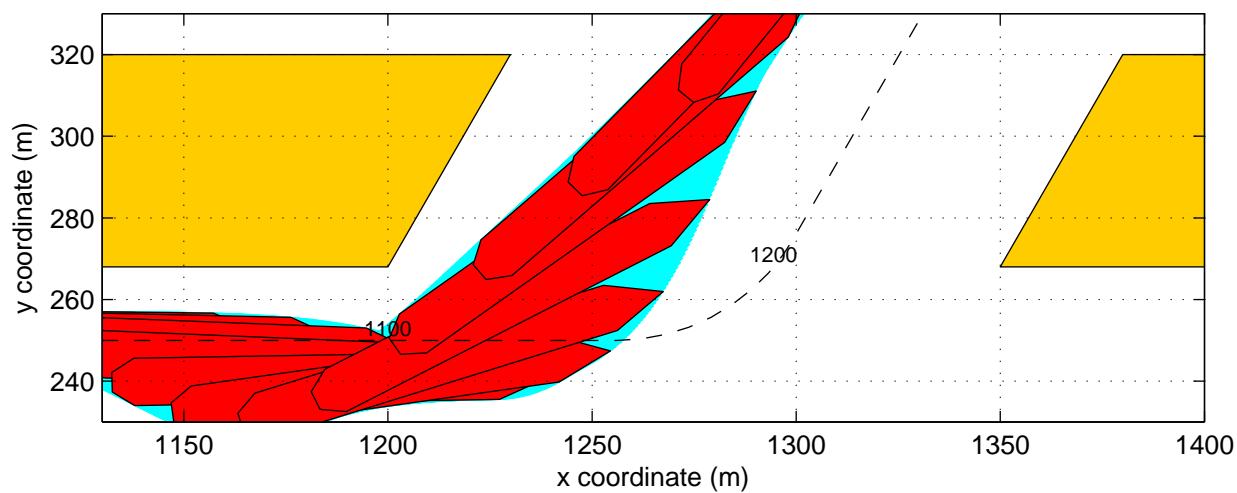
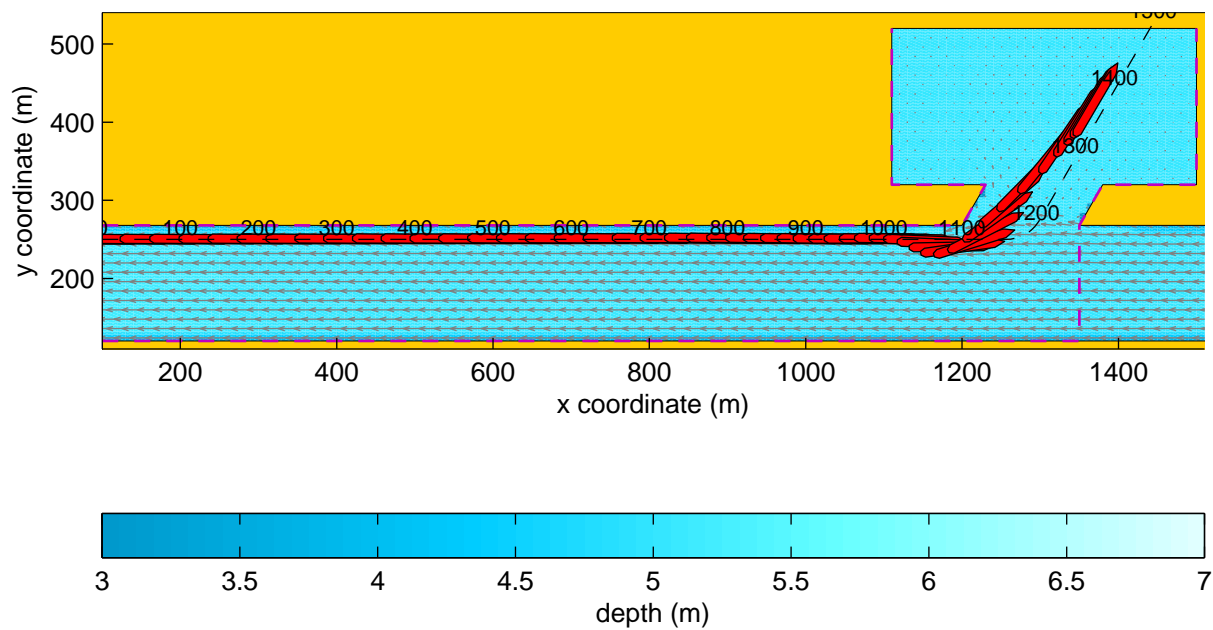
Current: 1.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Simulation 49

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

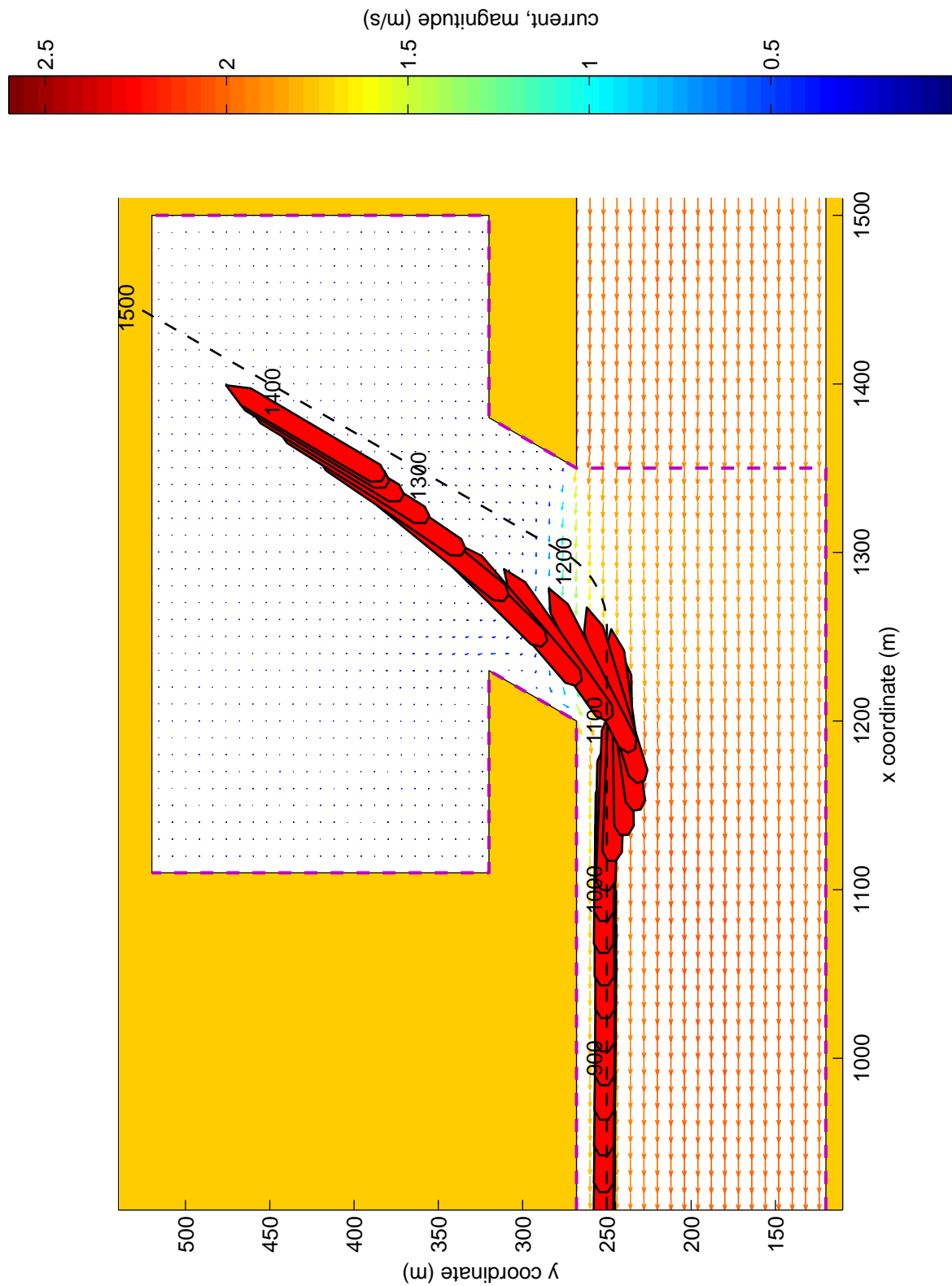
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 50

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

Current: 2.0 m/s

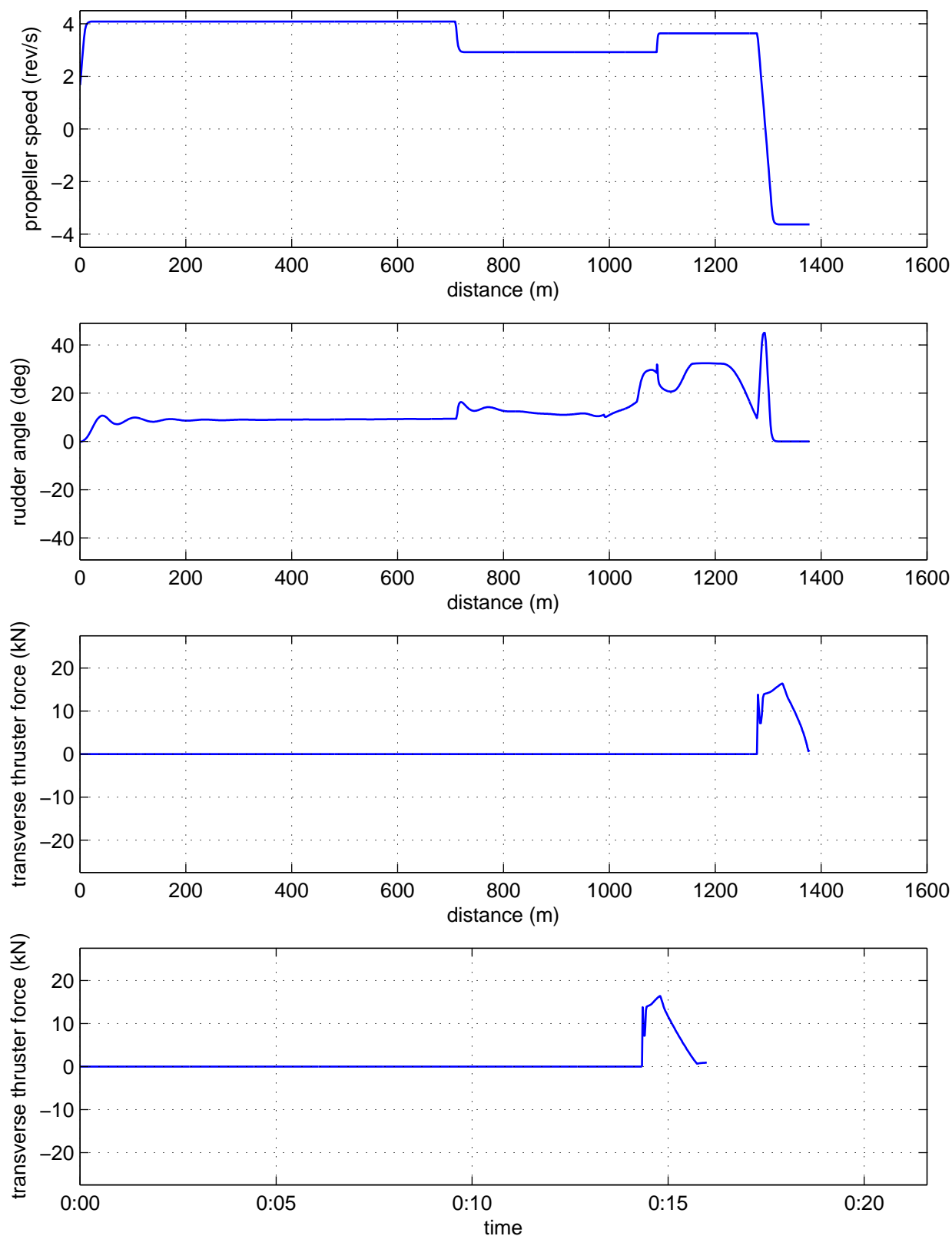
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 50

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

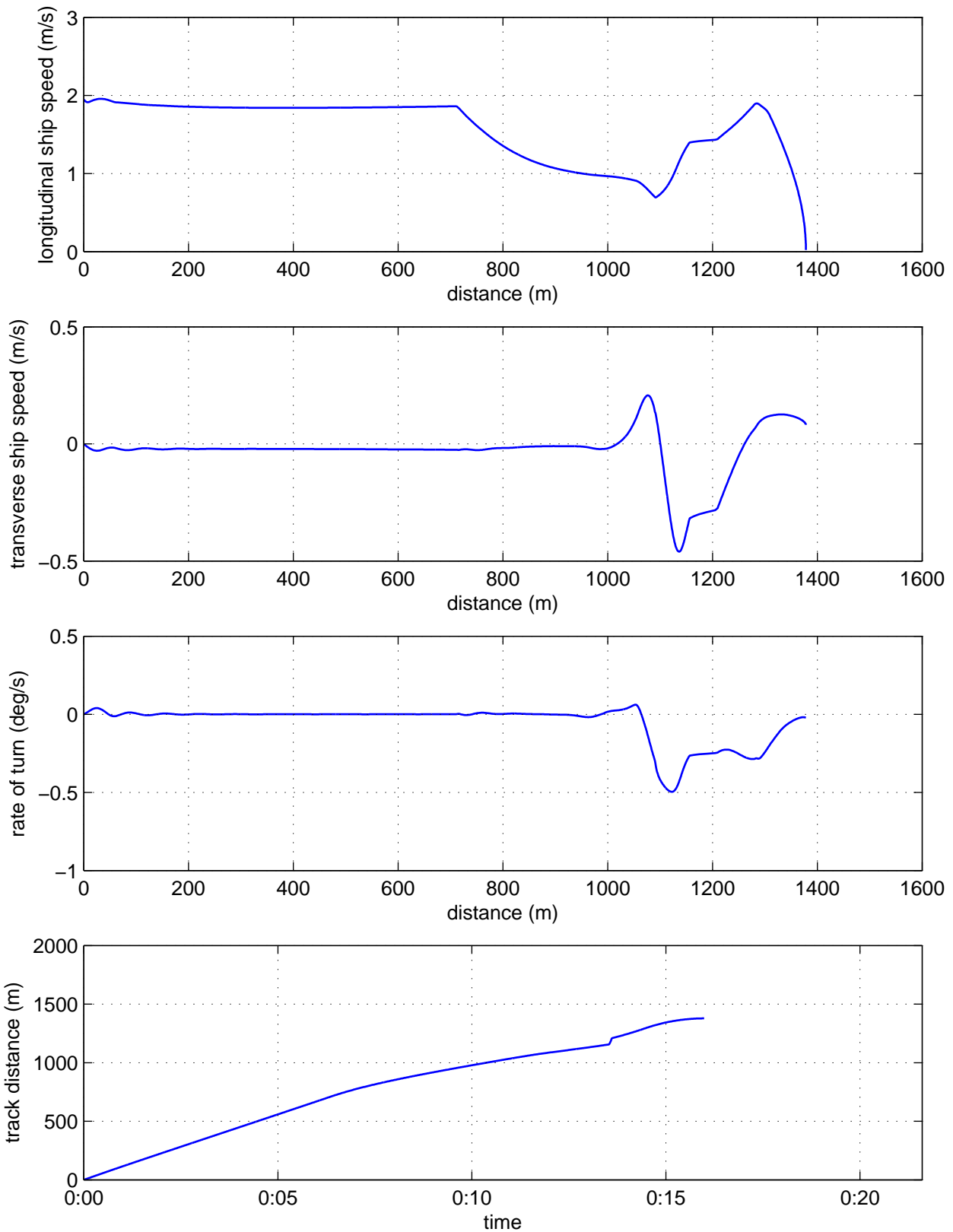
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 50

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

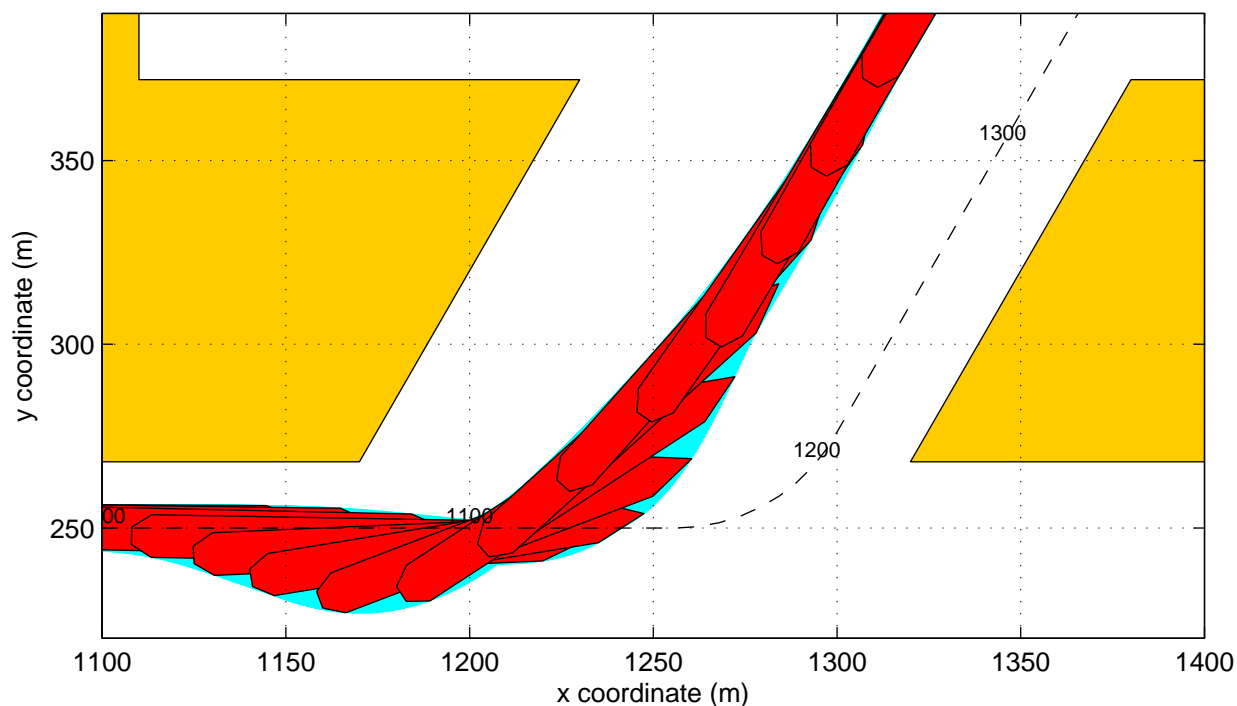
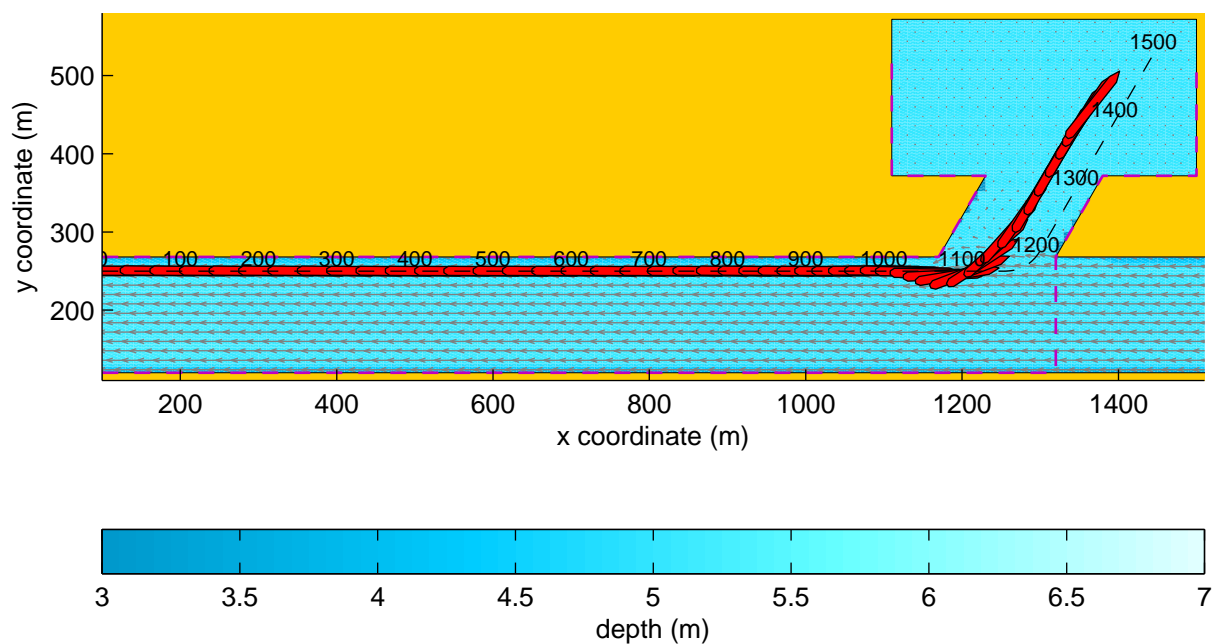
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 50

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 9

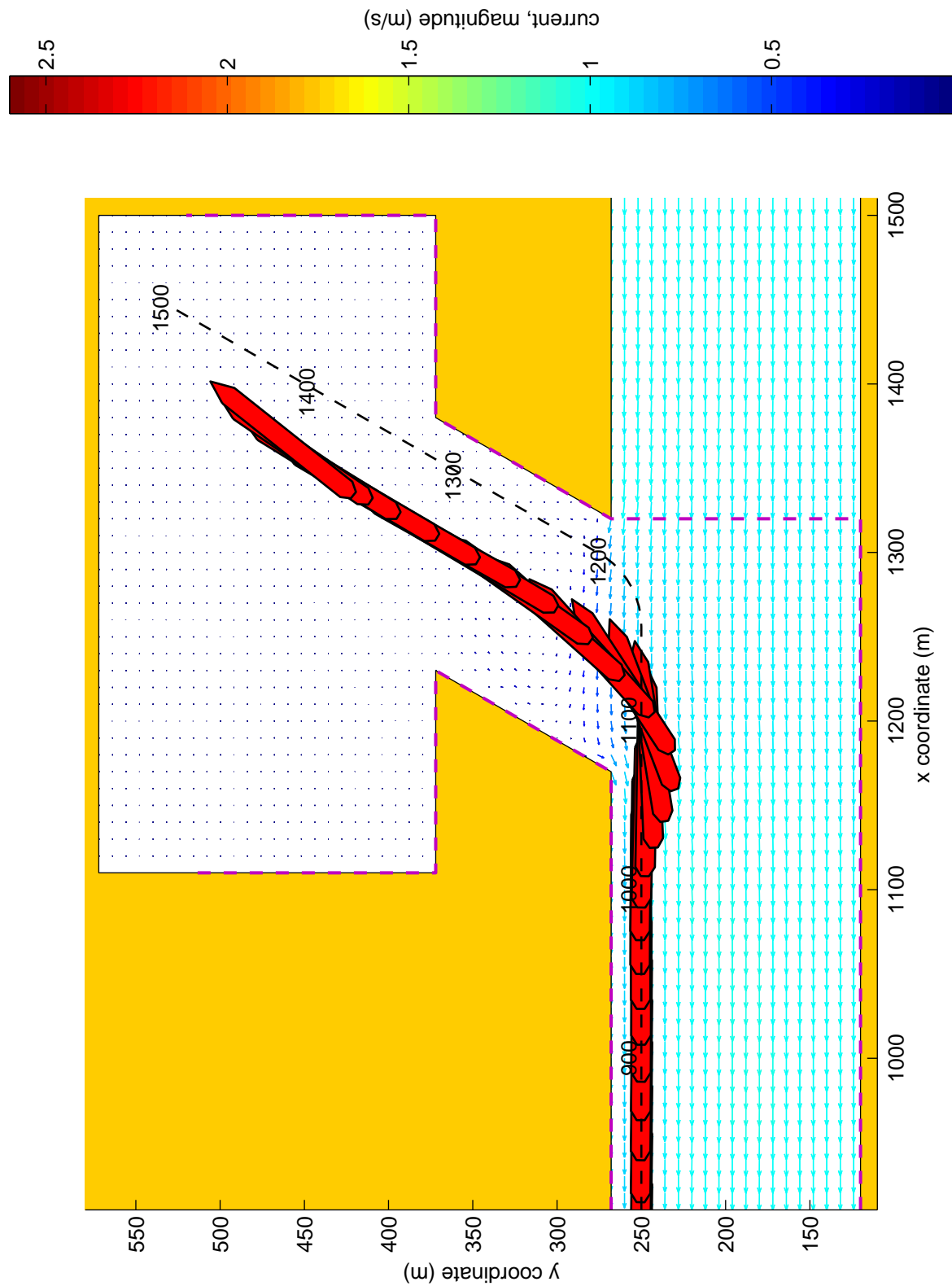
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 51

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 9

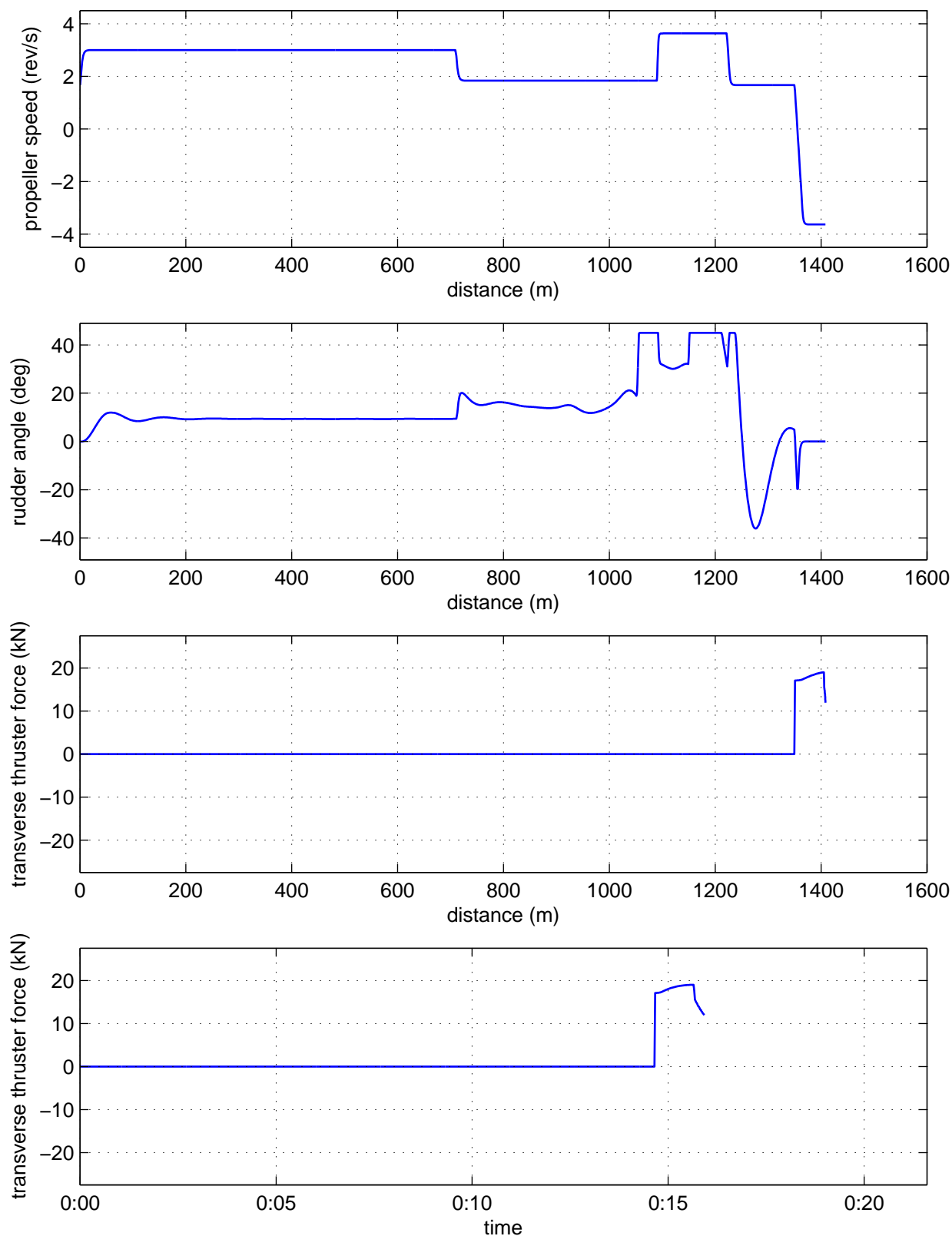
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 51

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

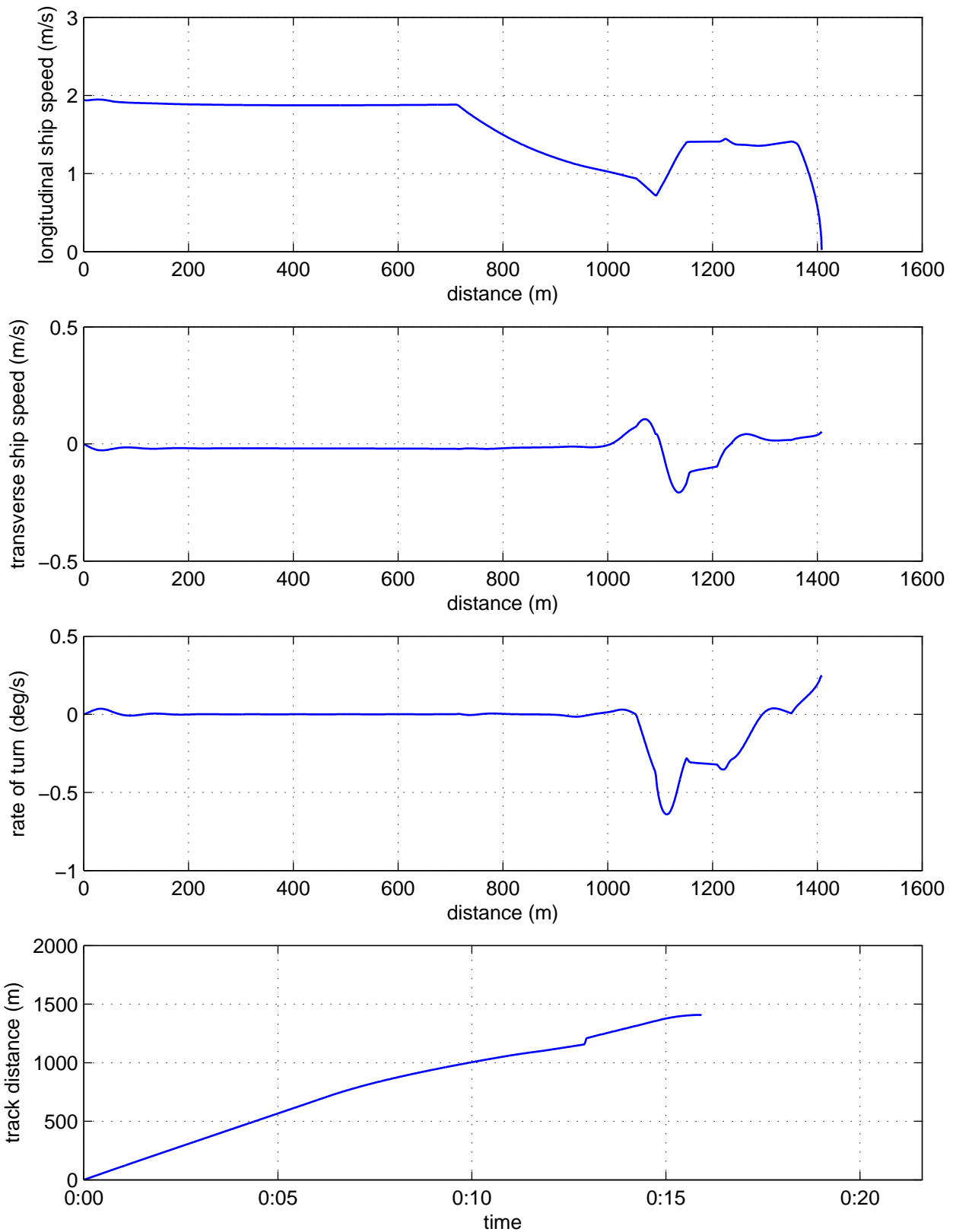
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 51

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

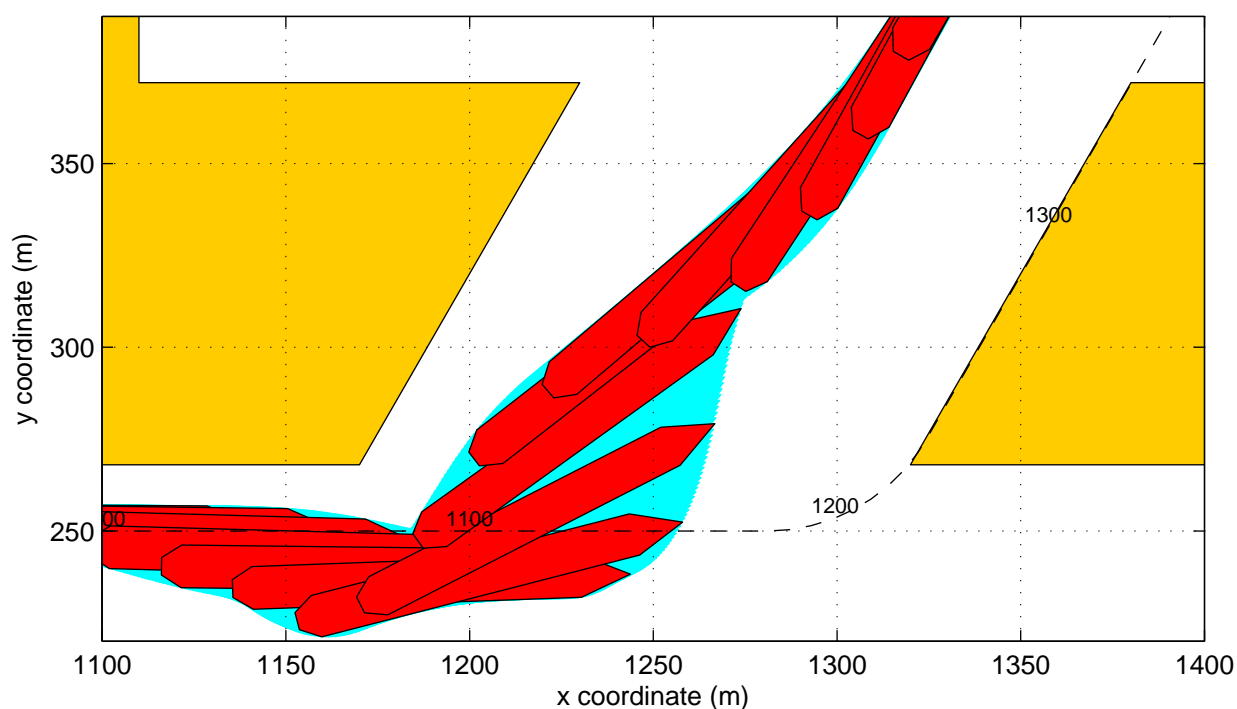
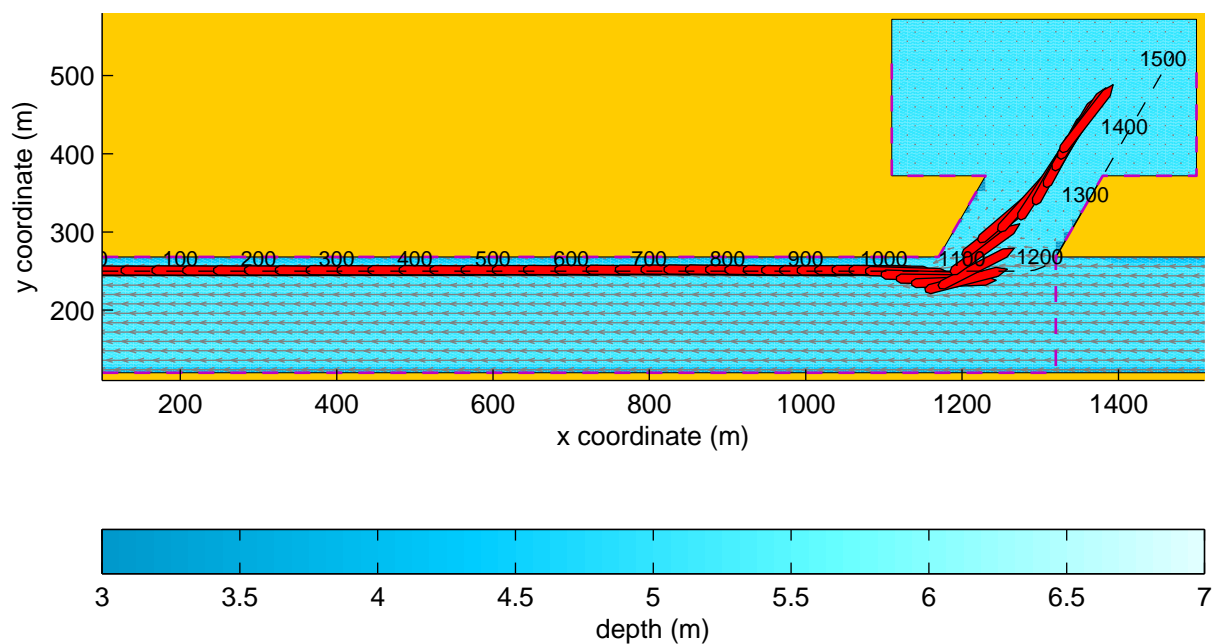
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 51

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 9

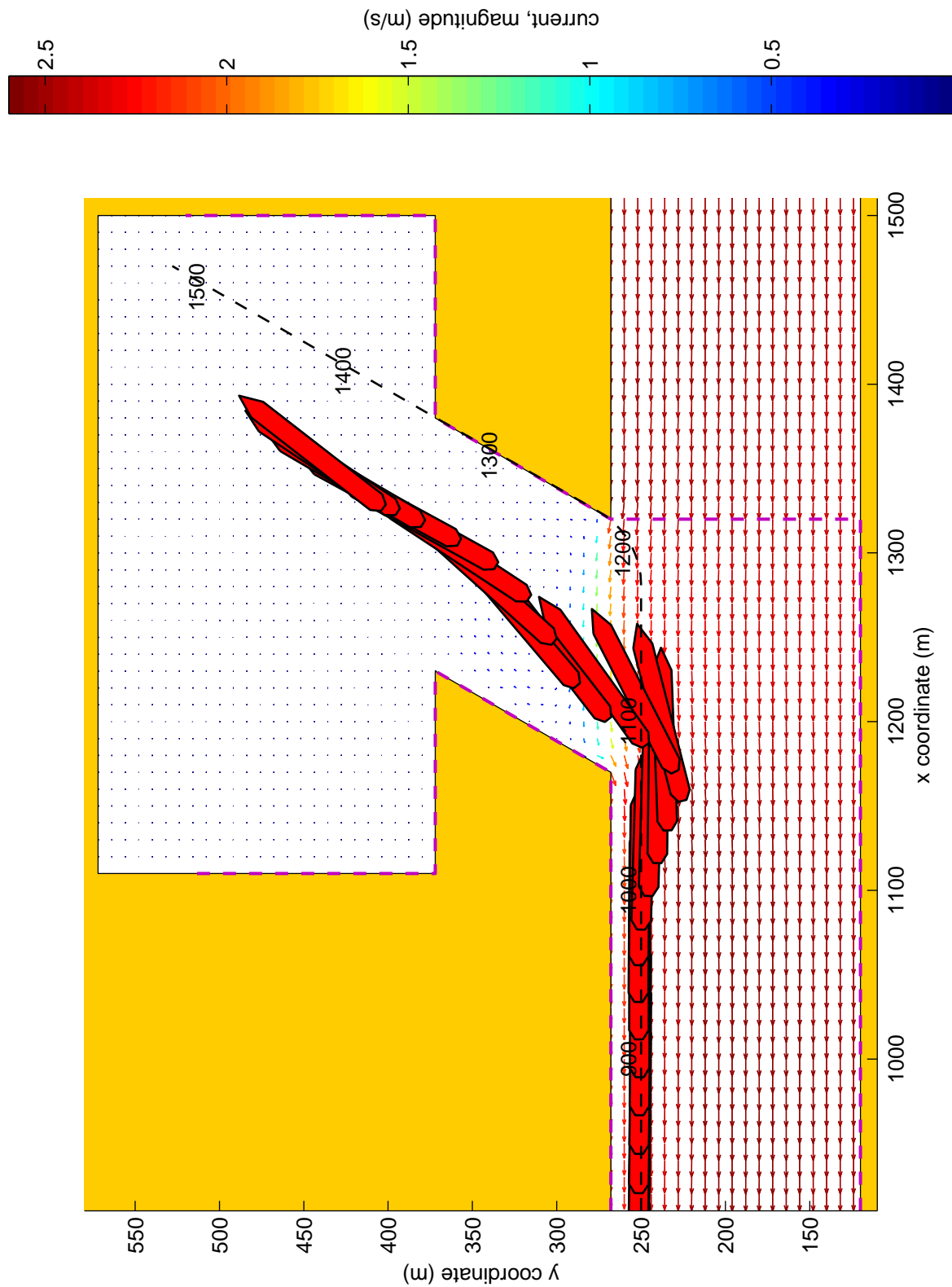
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 52

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 9

Current: 2.5 m/s

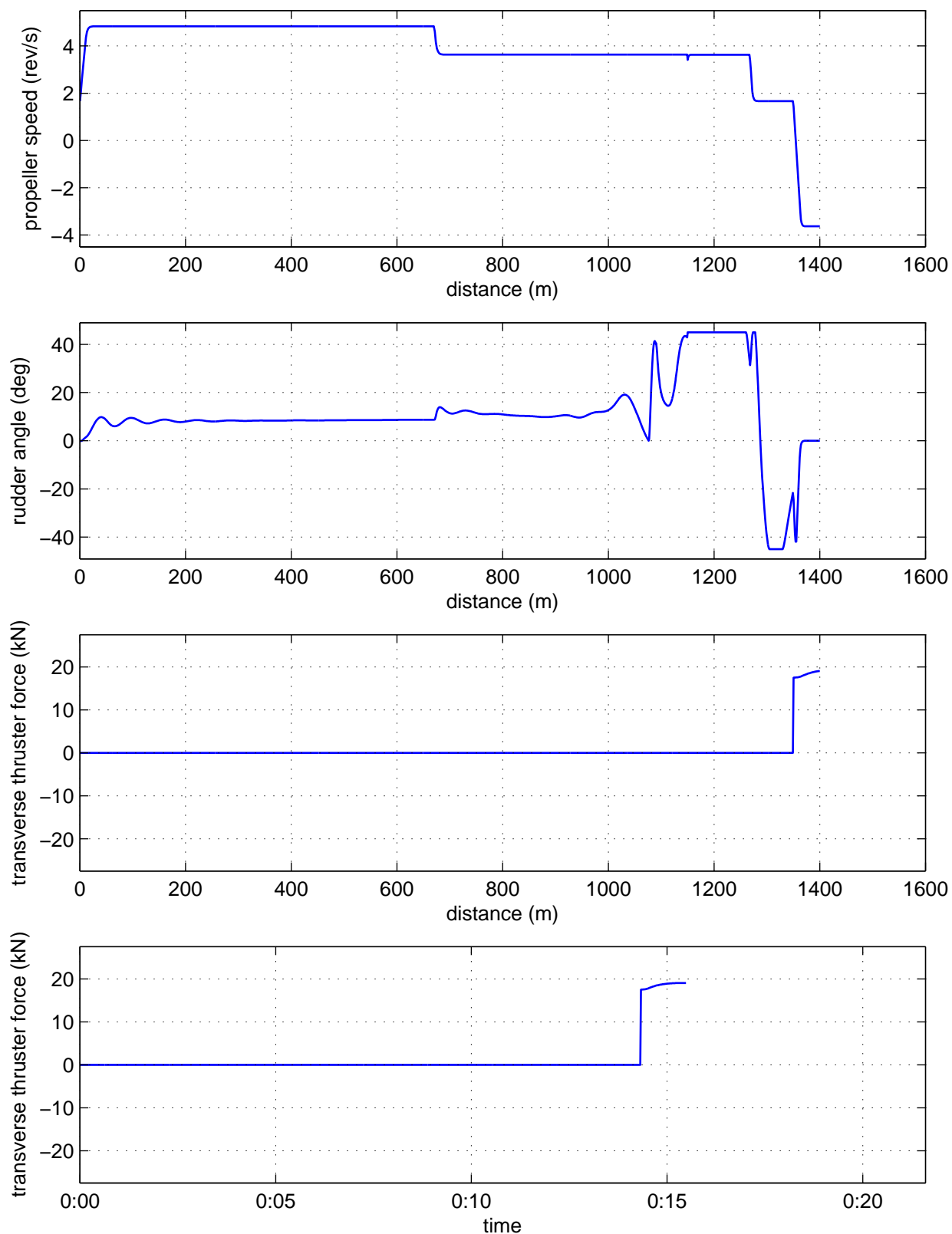
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 52

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

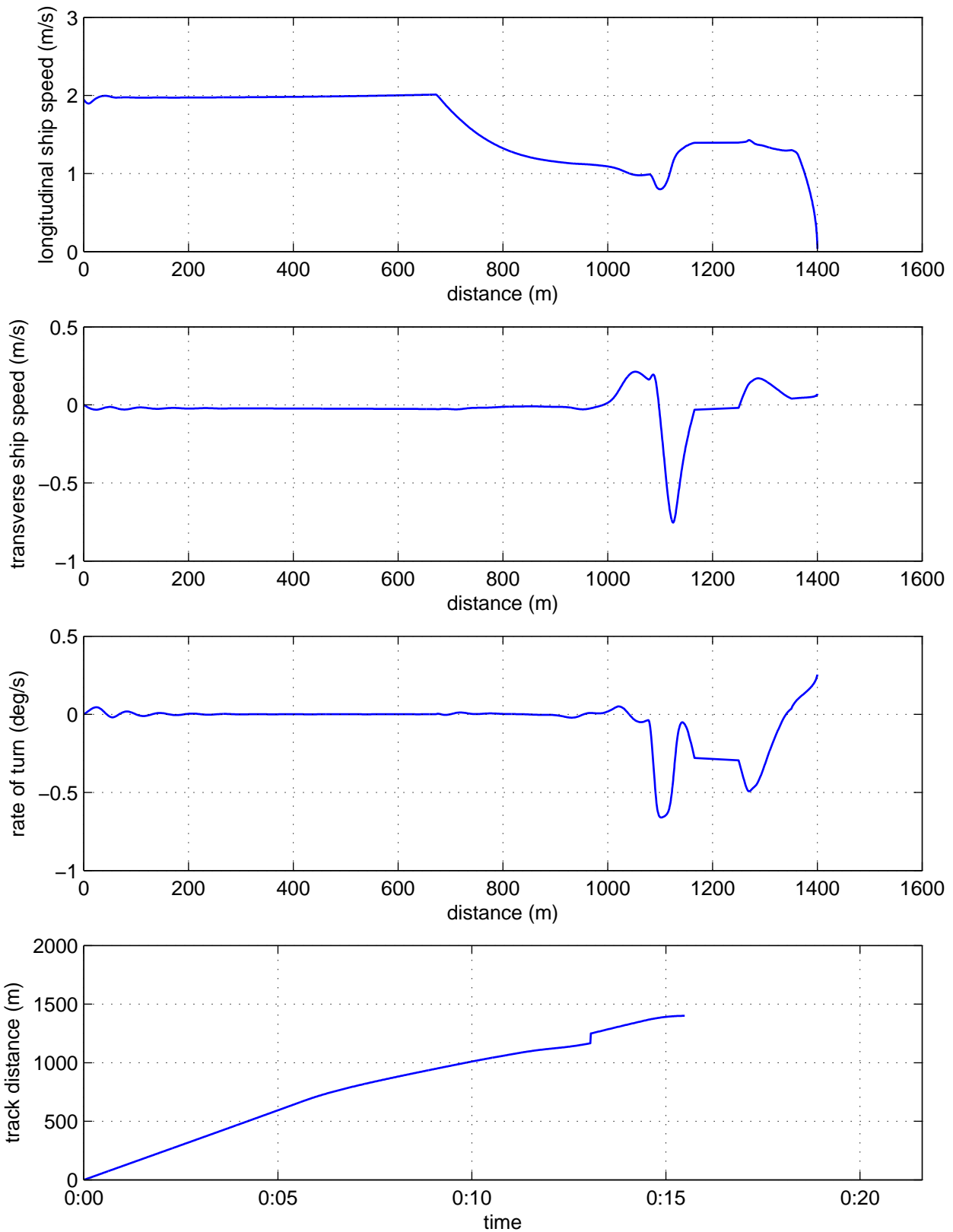
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 52

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

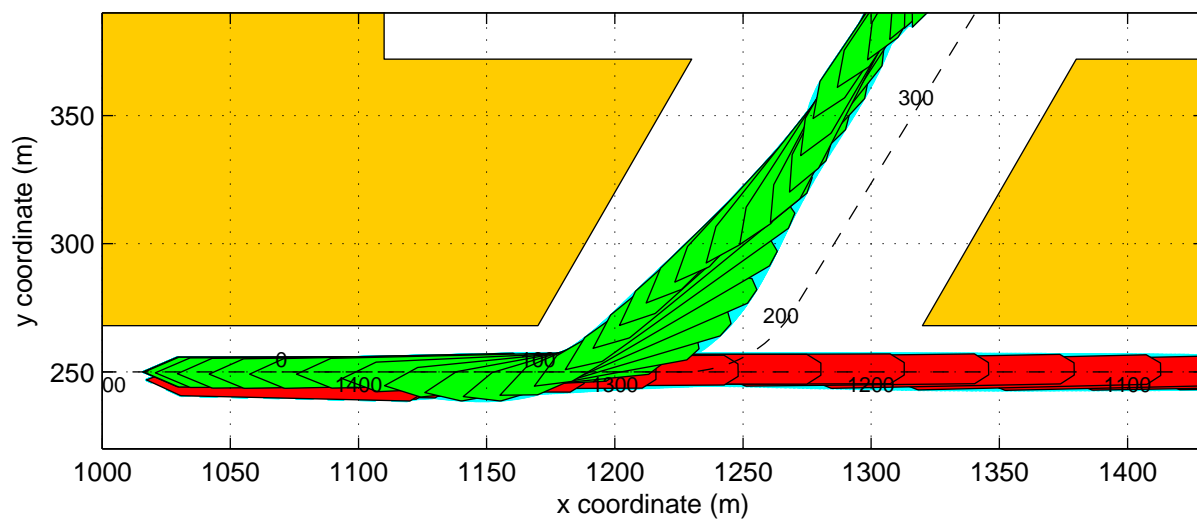
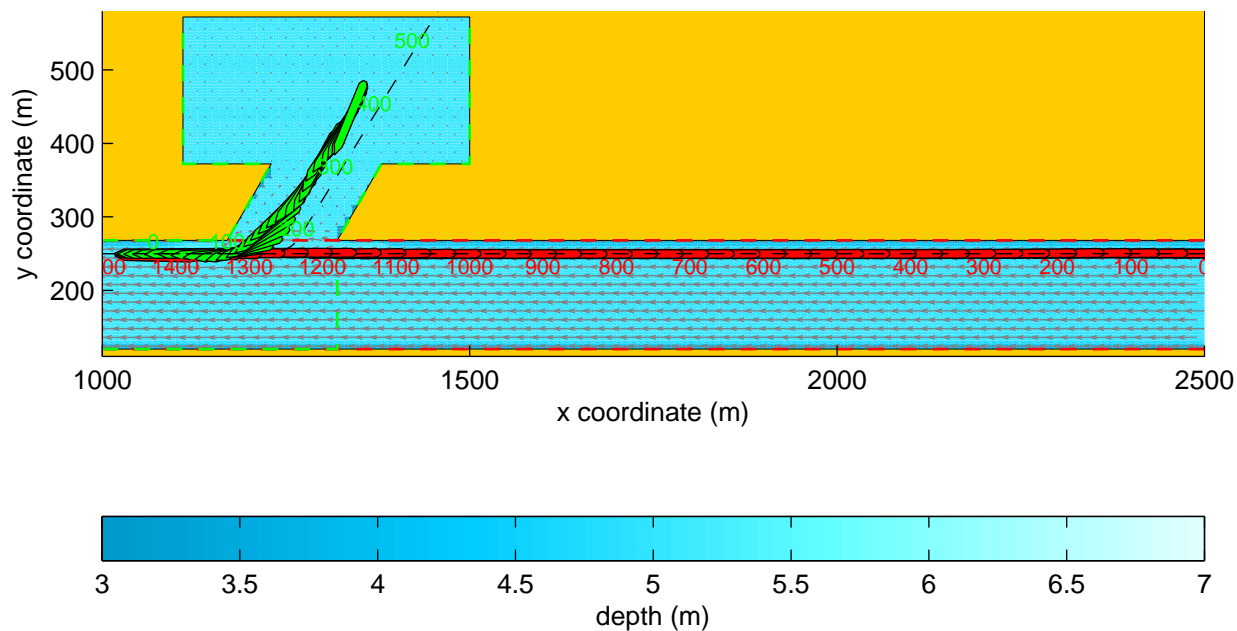
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 52

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 9

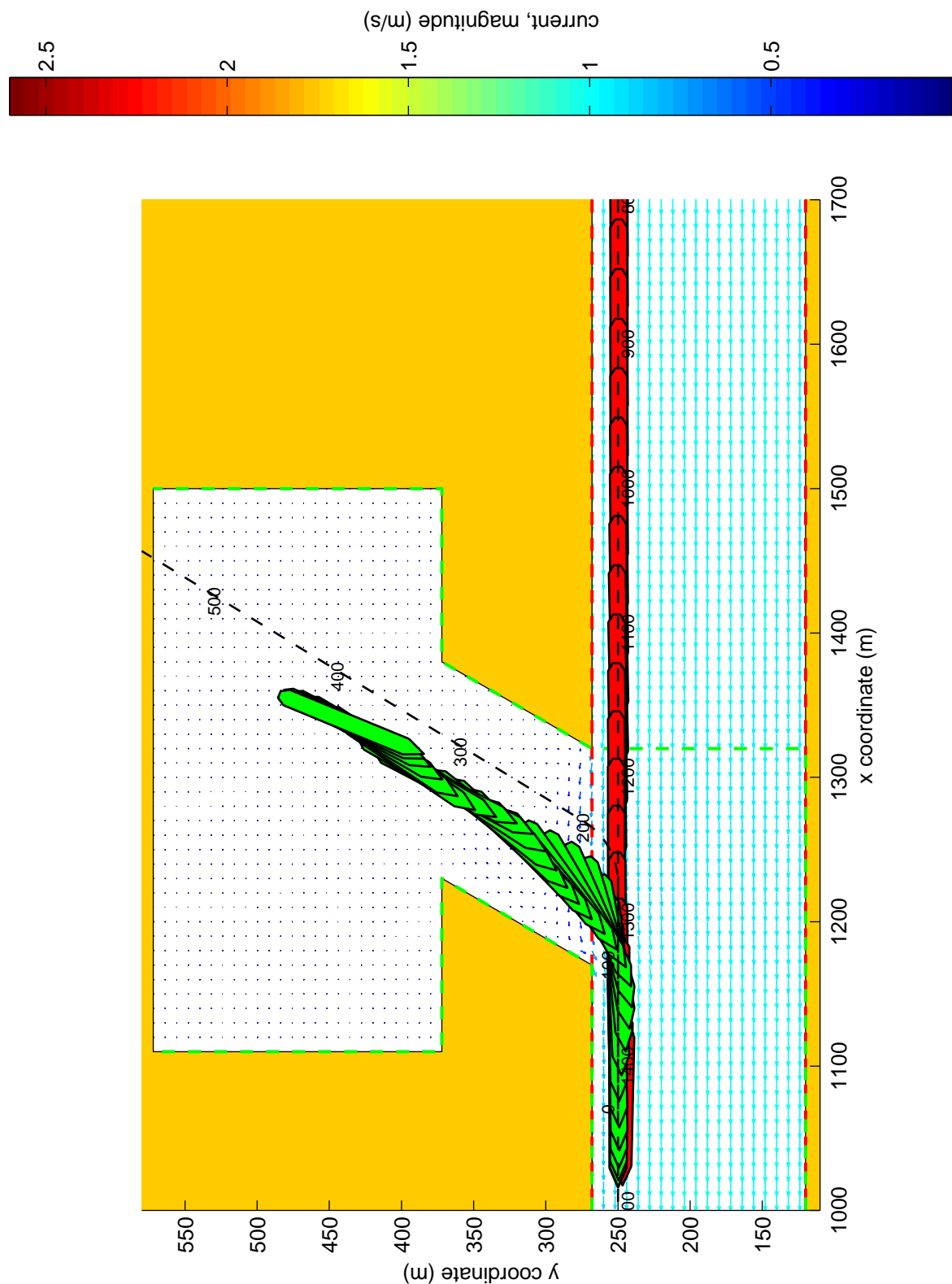
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 53

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 9

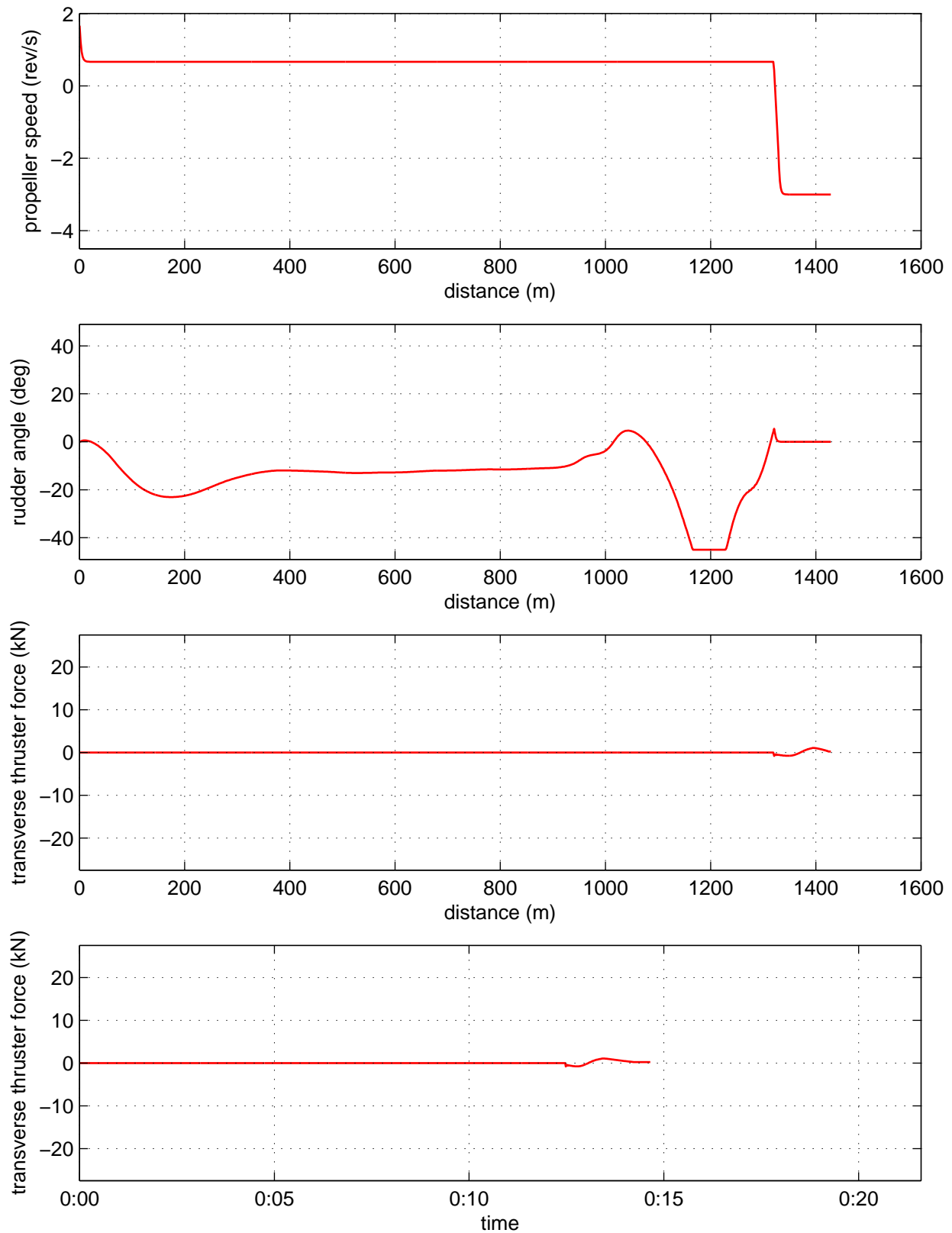
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 53

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

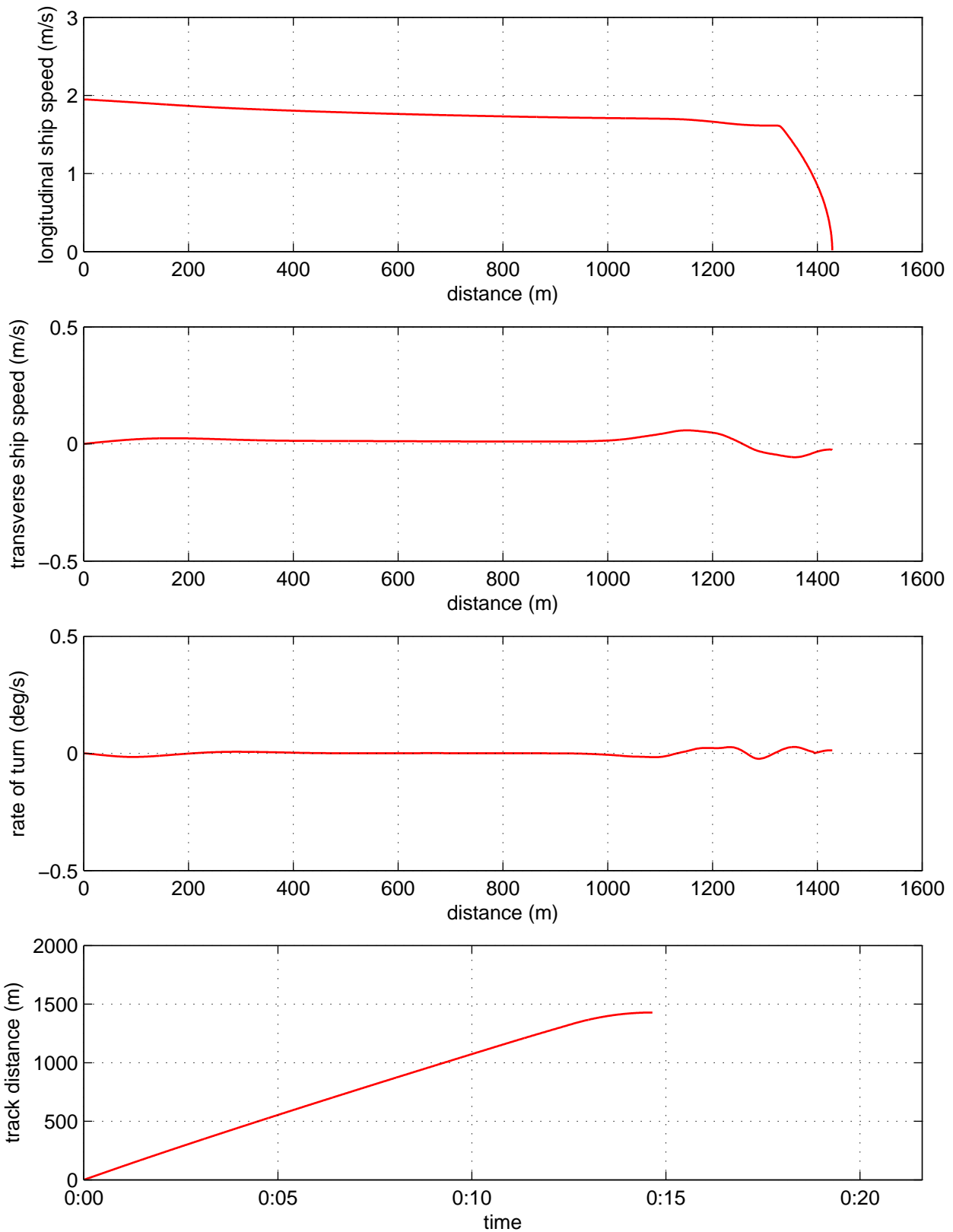
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 53a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

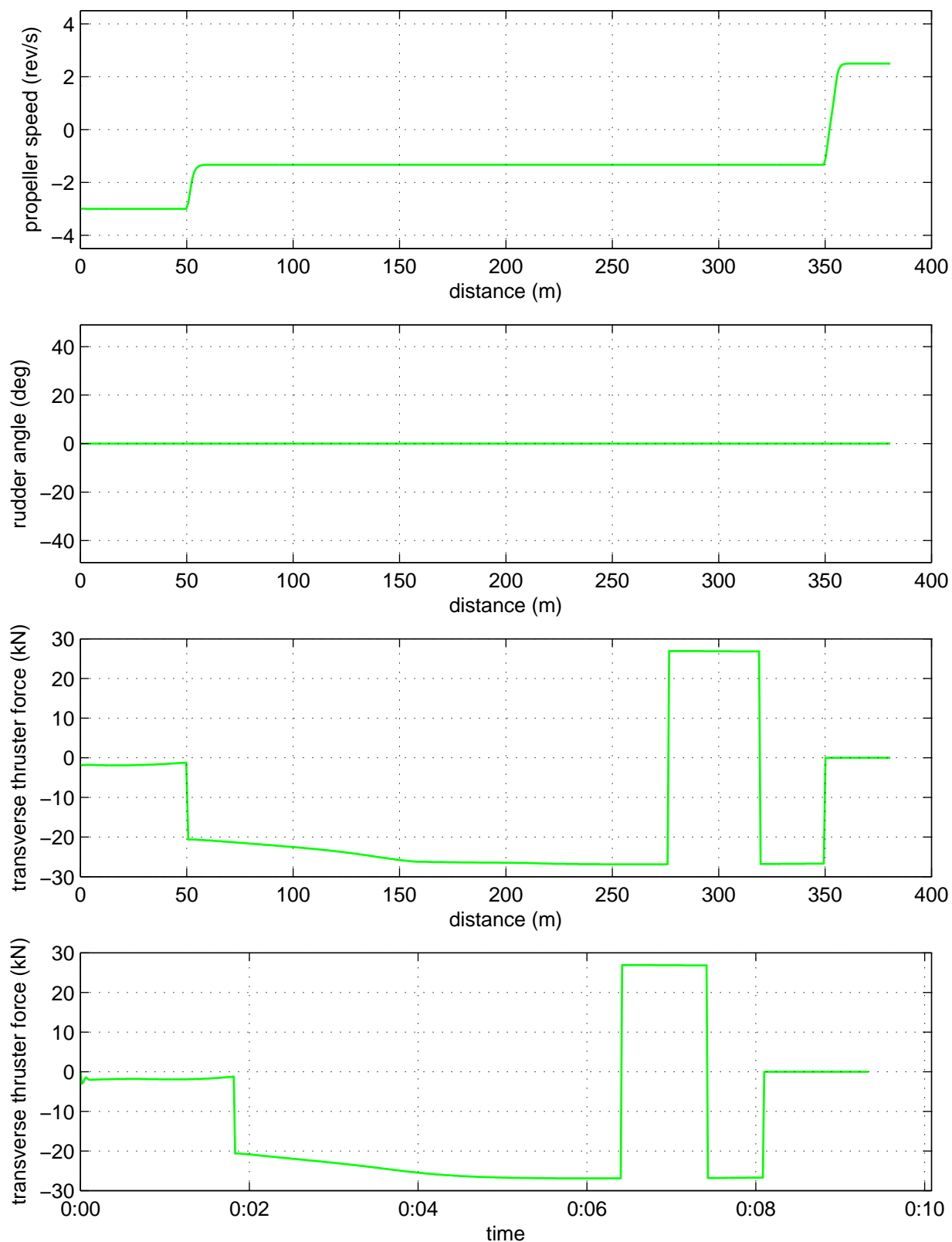
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 53a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

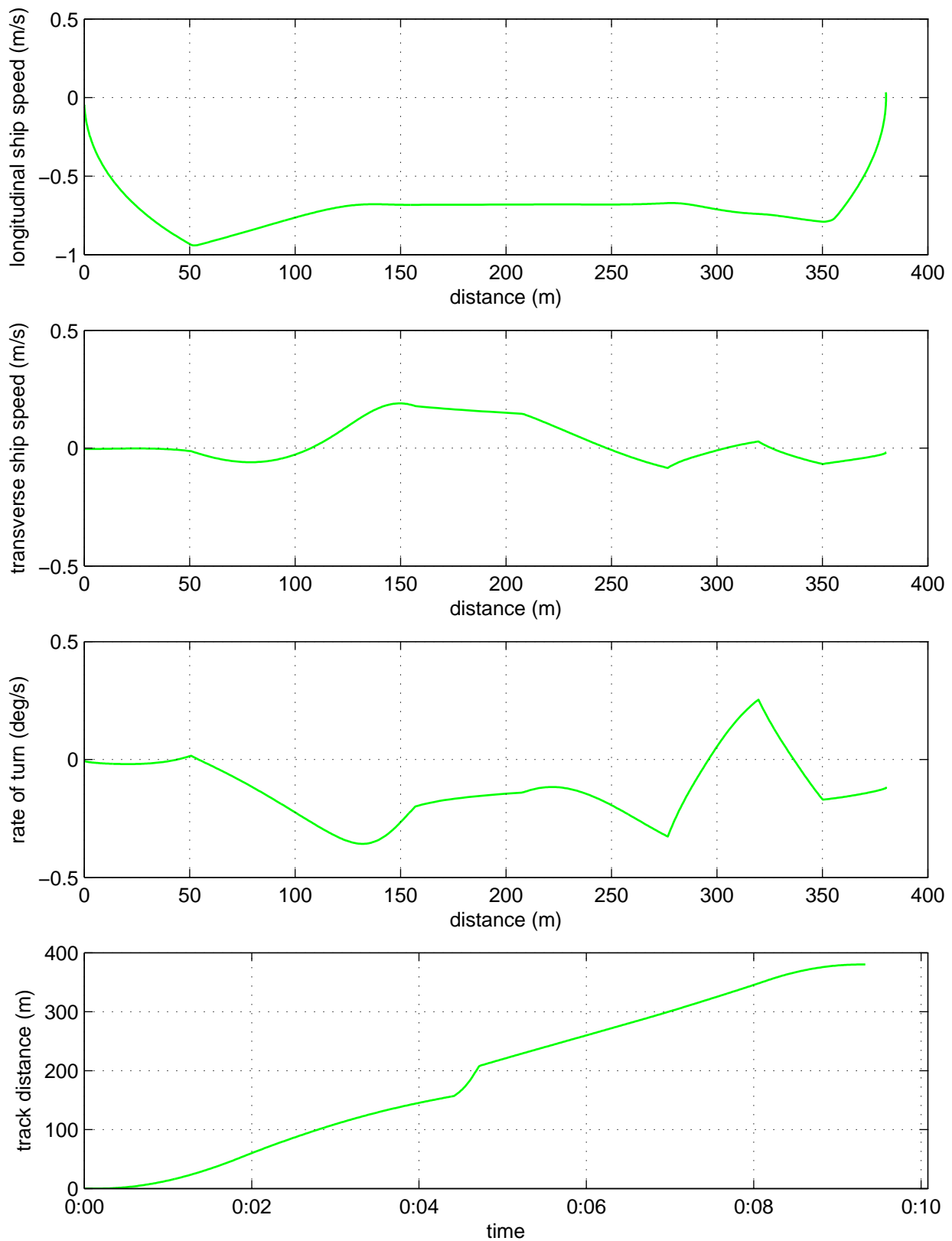
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 53b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

Current: 1.0 m/s

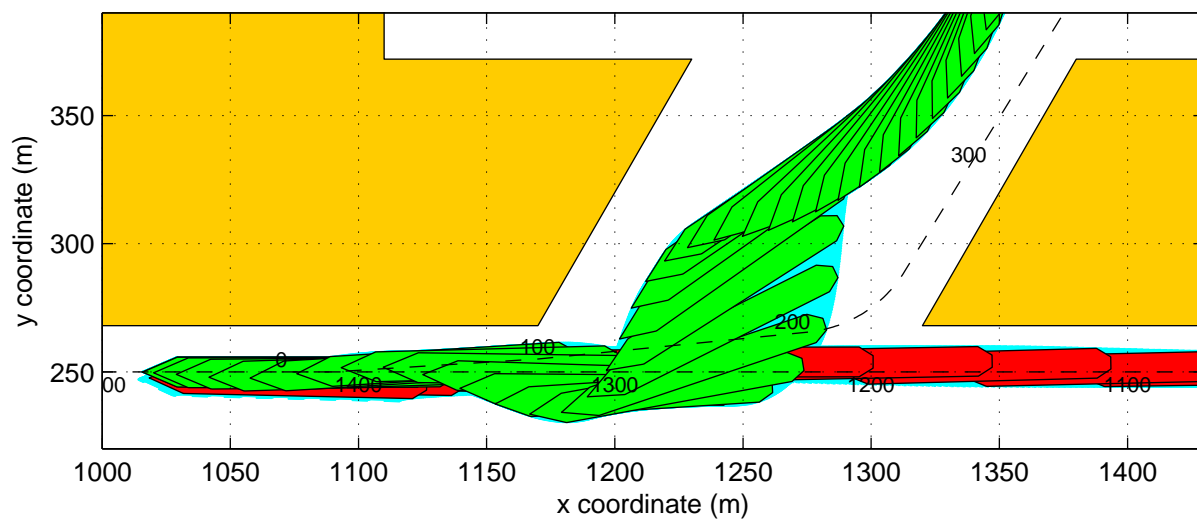
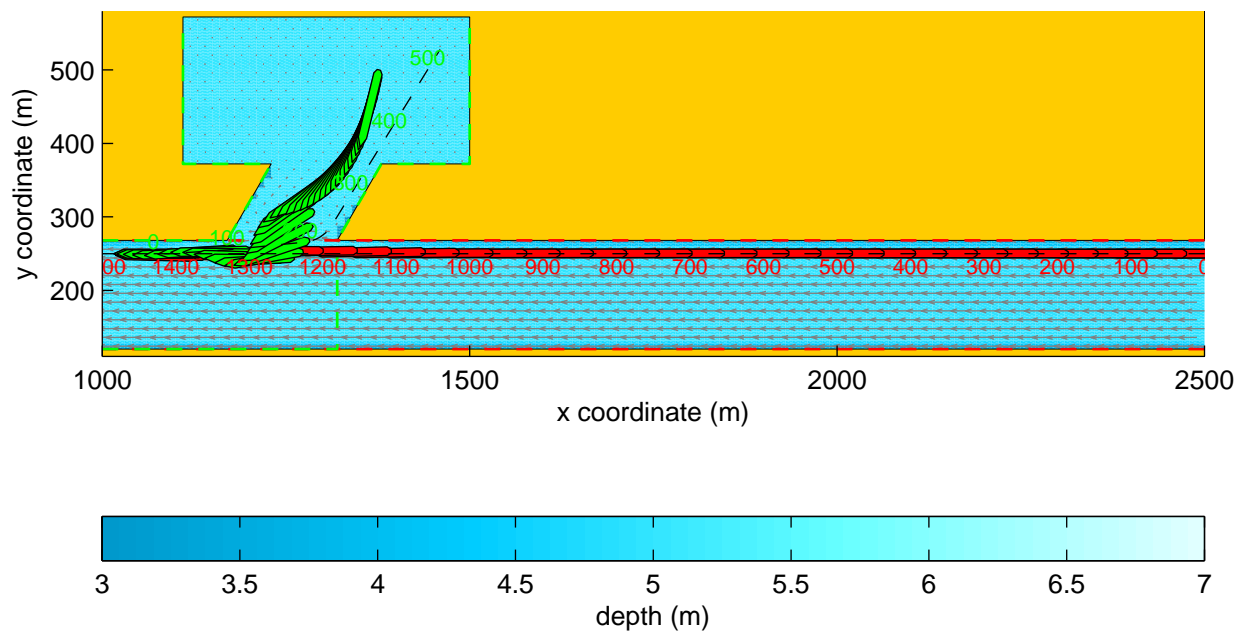
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 53b

Figure C





Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 9

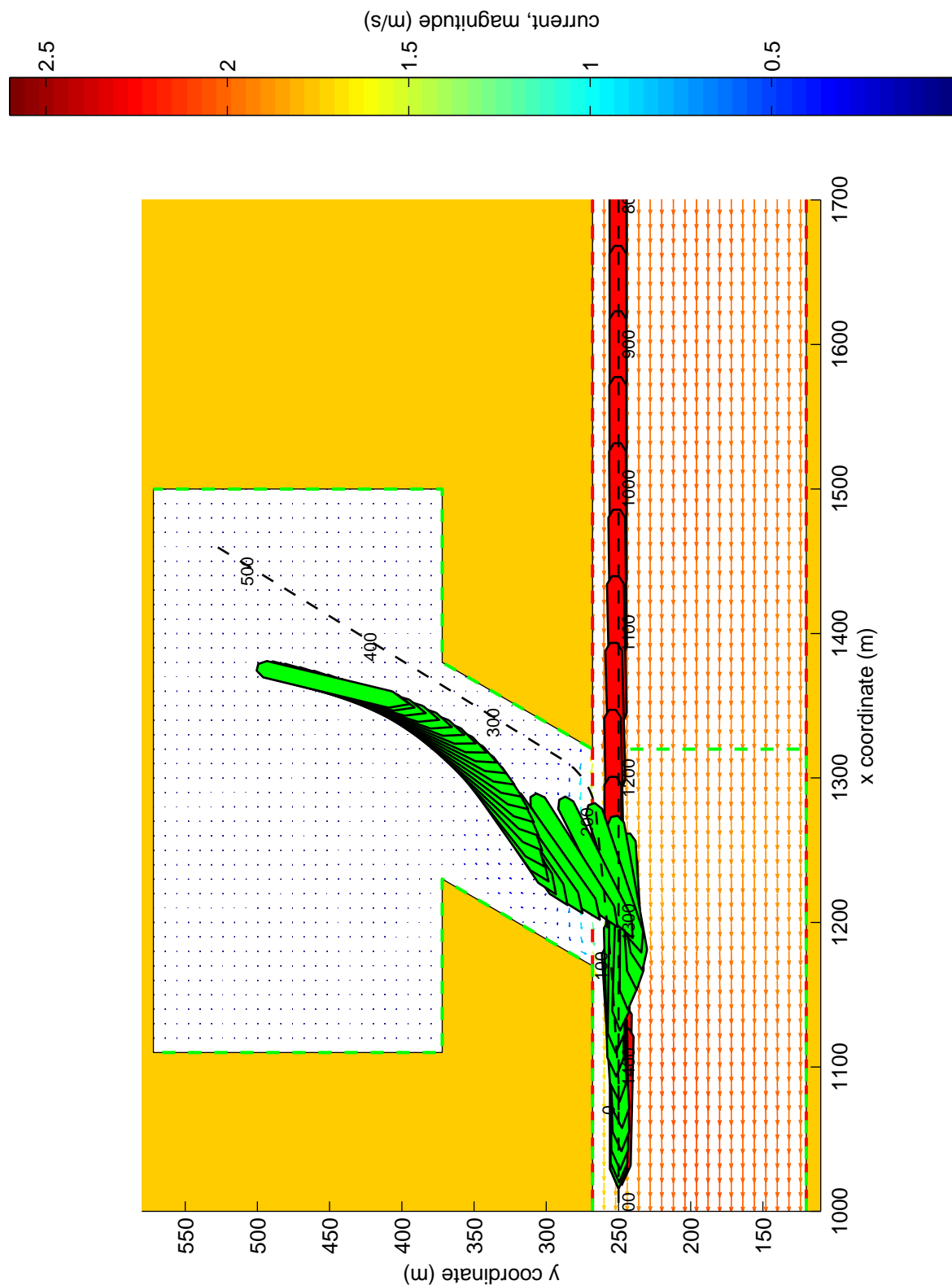
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 54

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 9

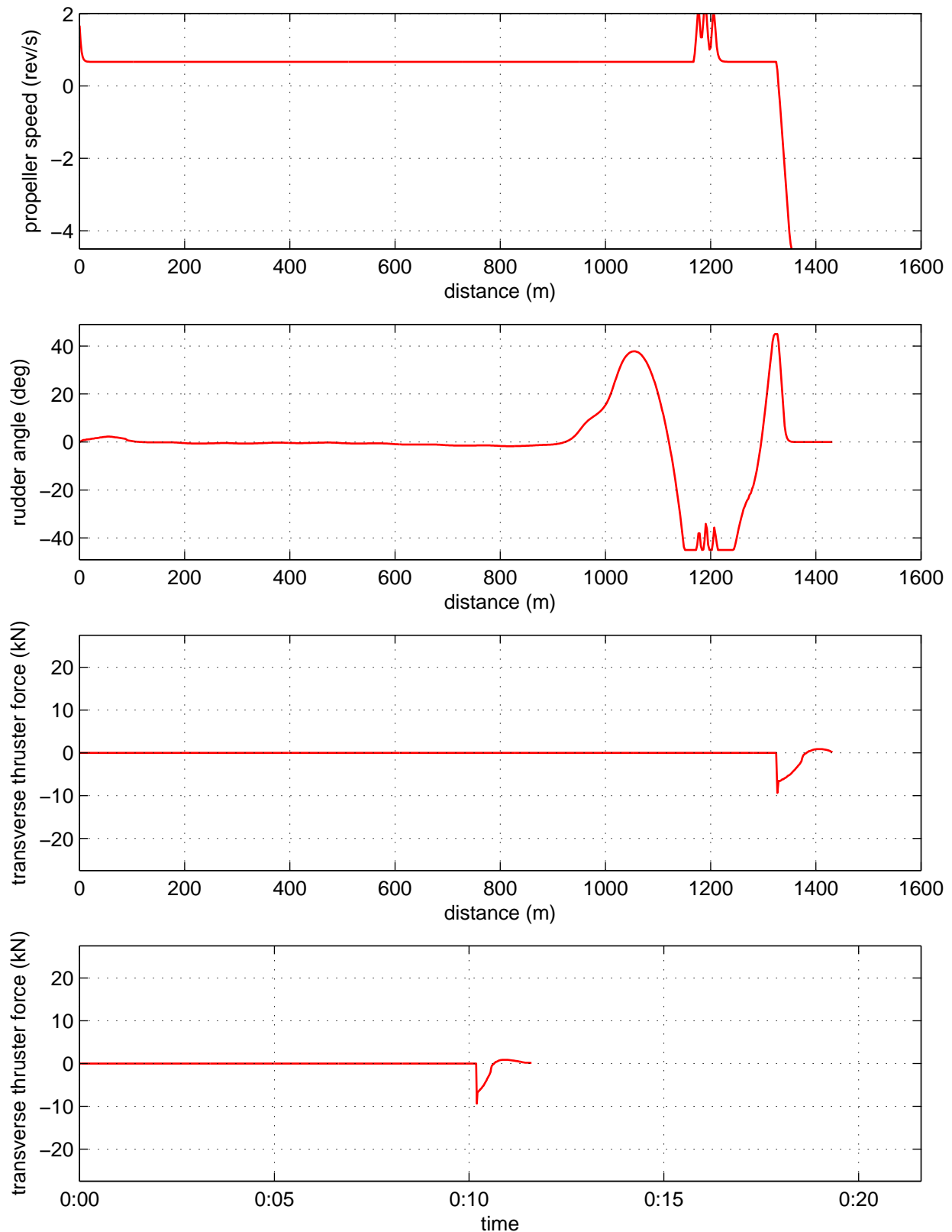
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 54

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

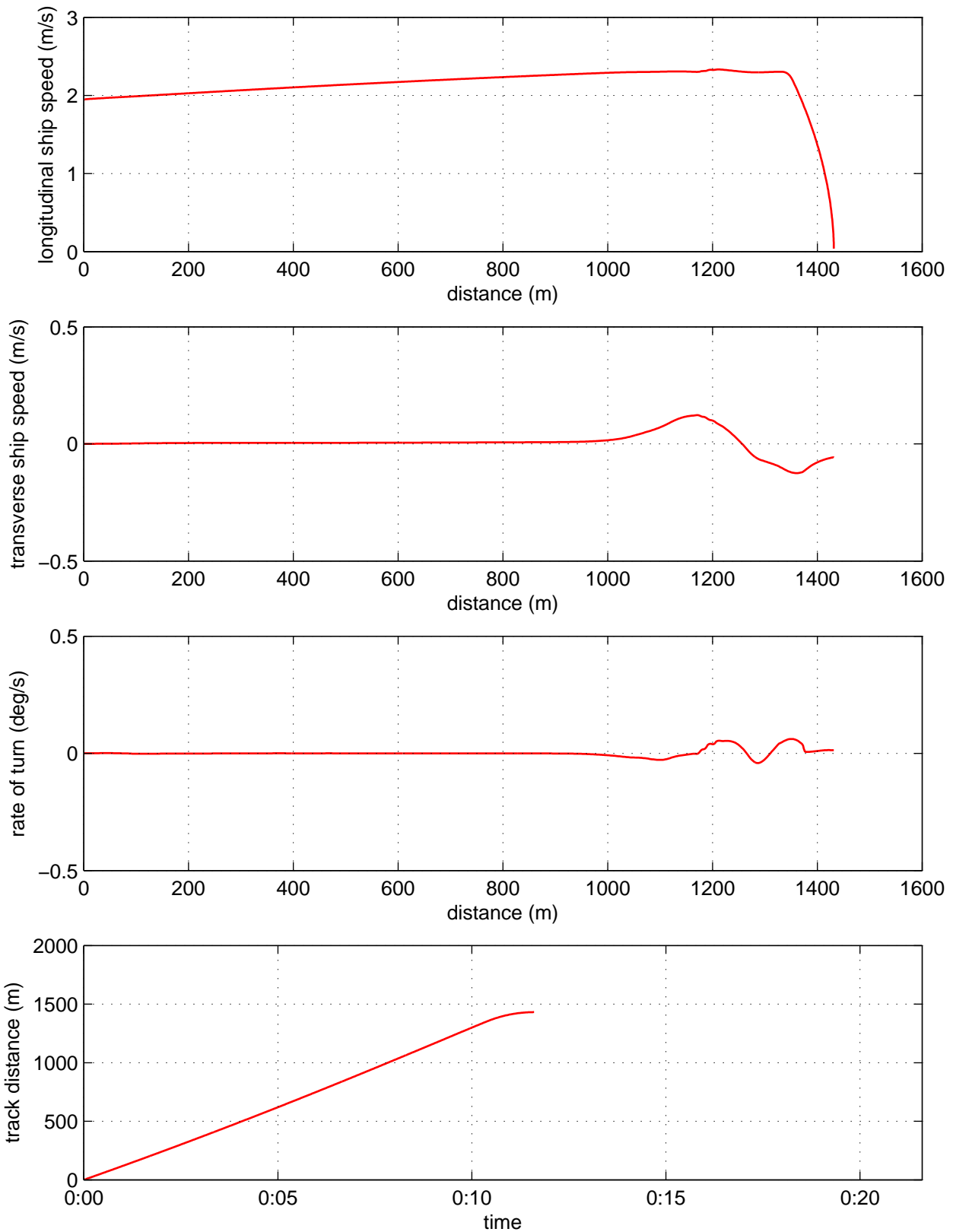
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 54a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

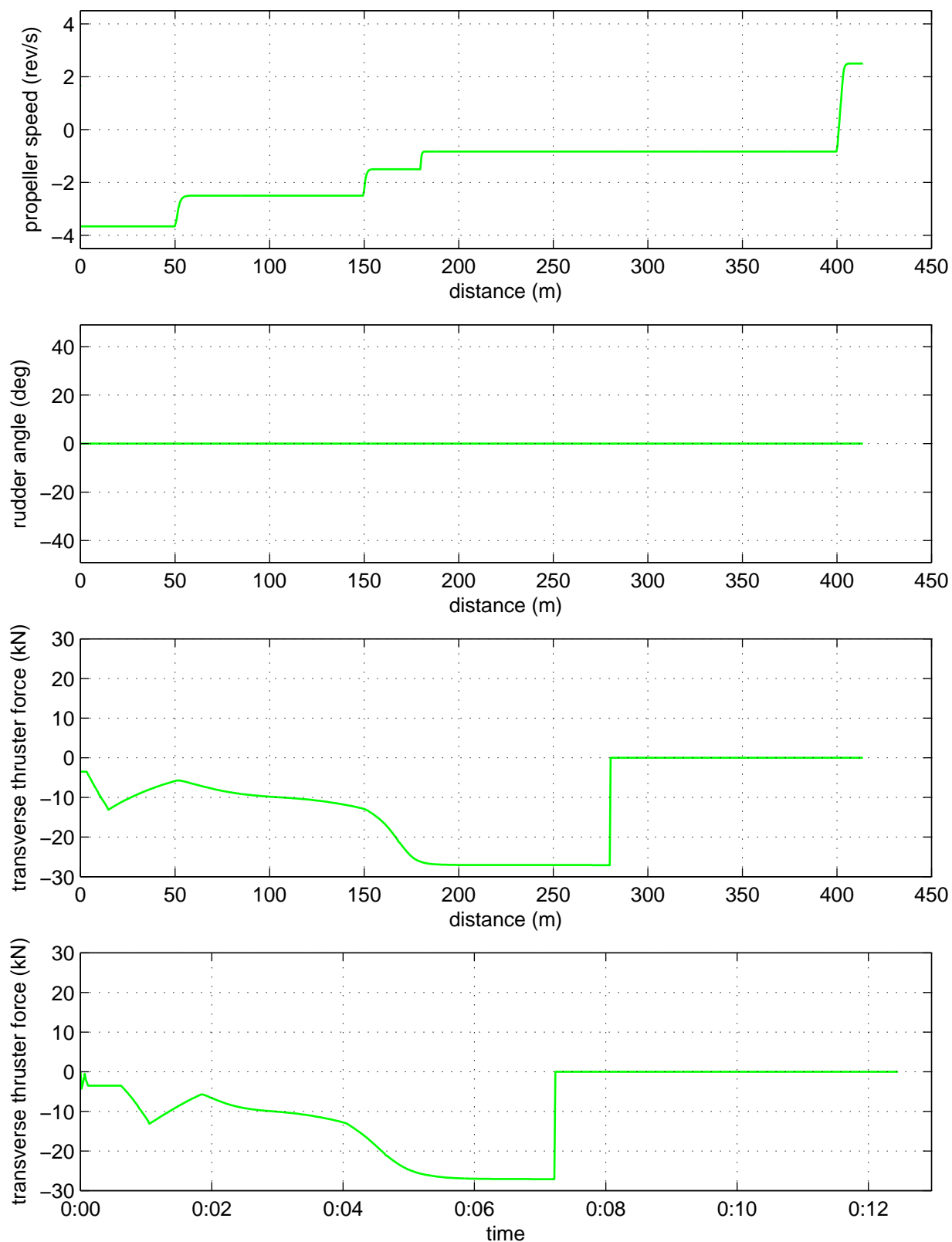
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 54a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 9

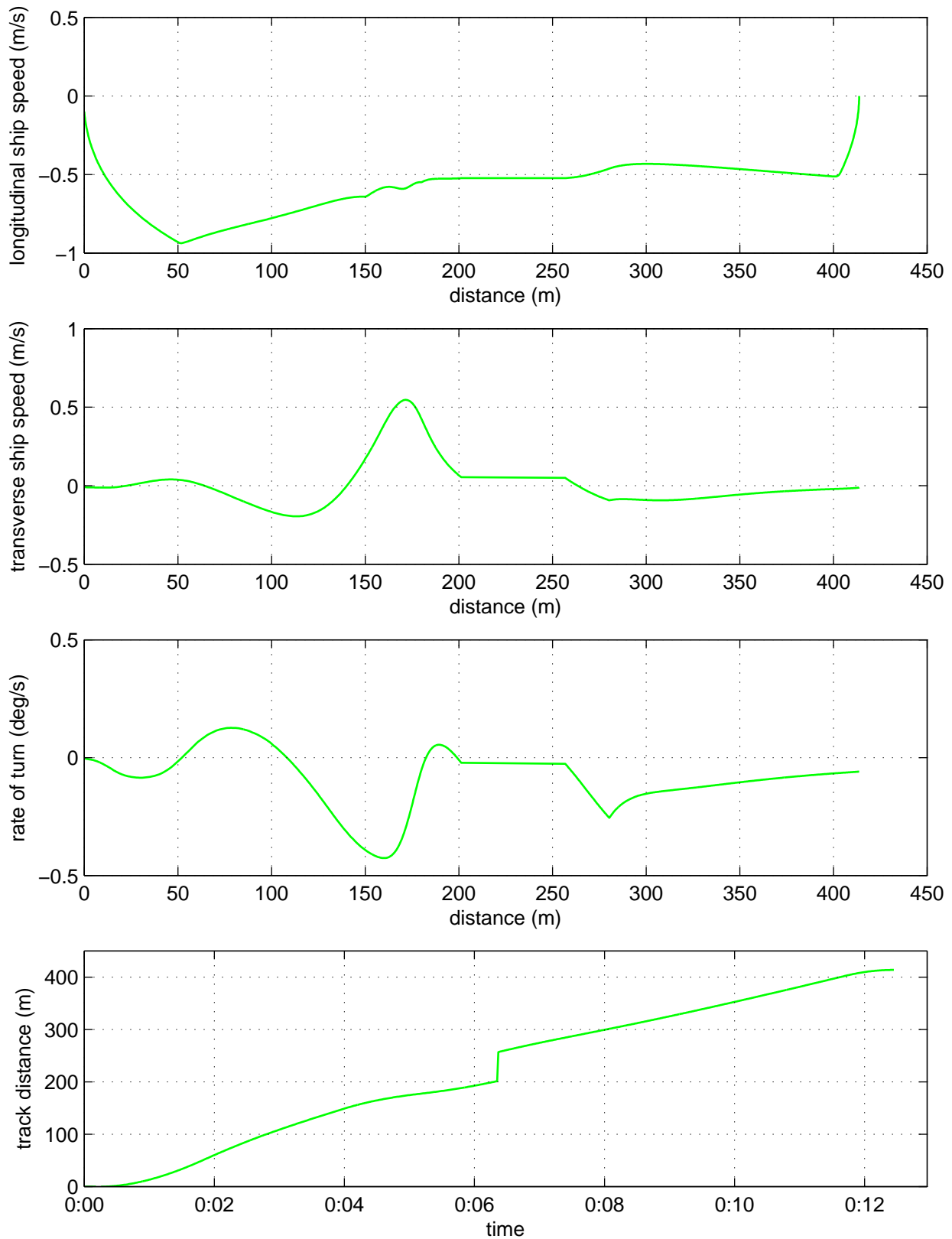
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 54b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 9

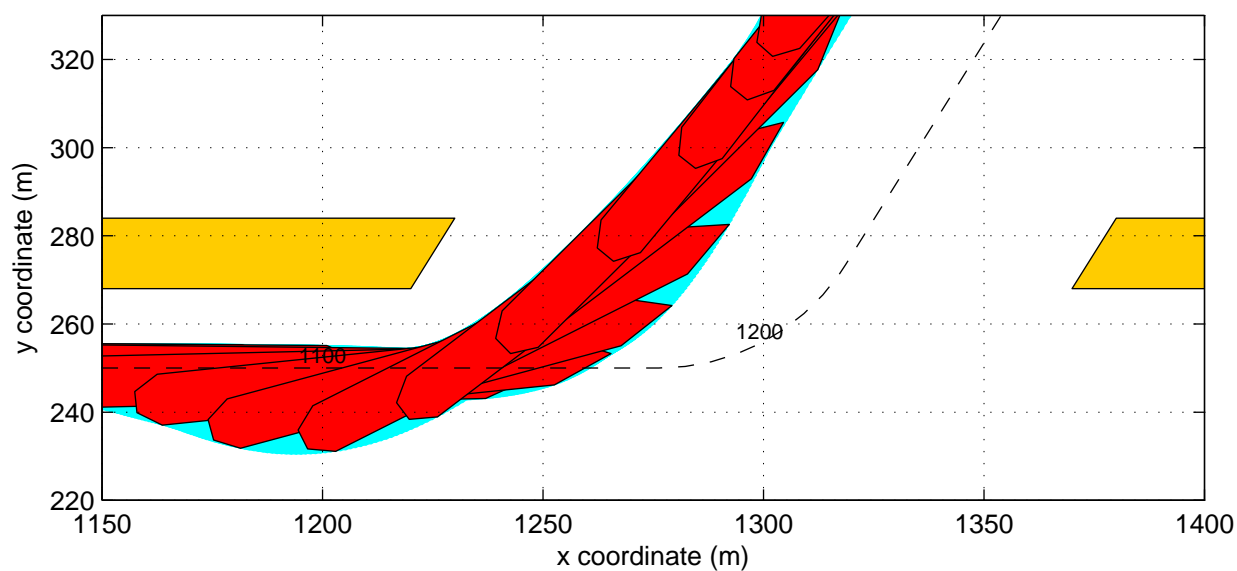
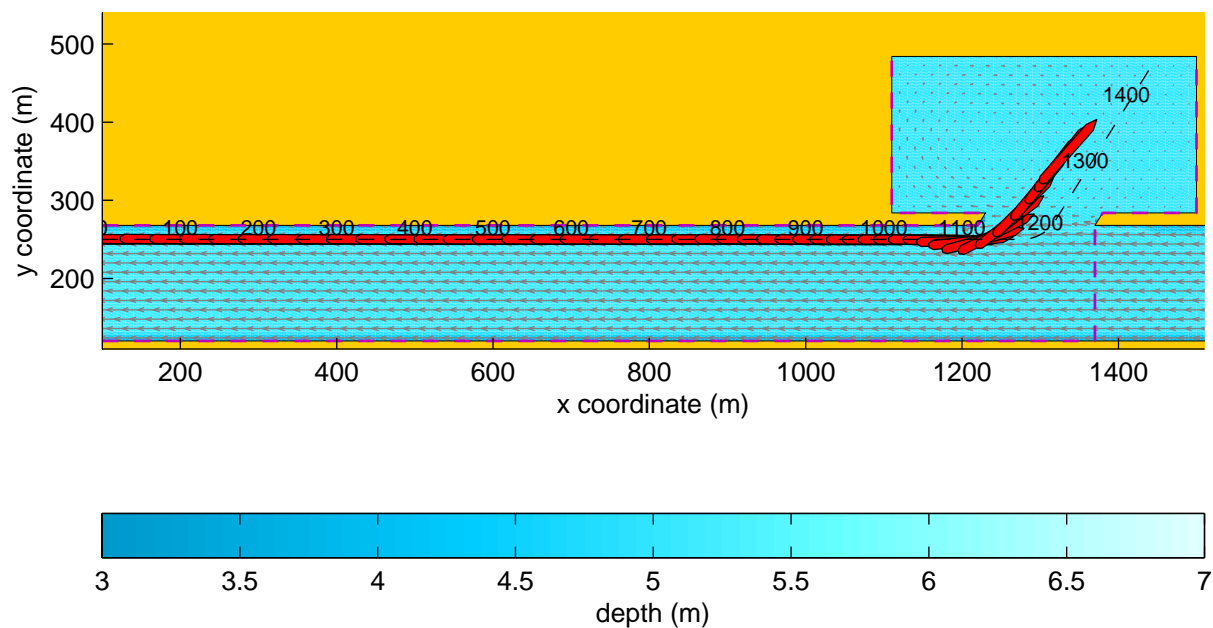
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 54b

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 10

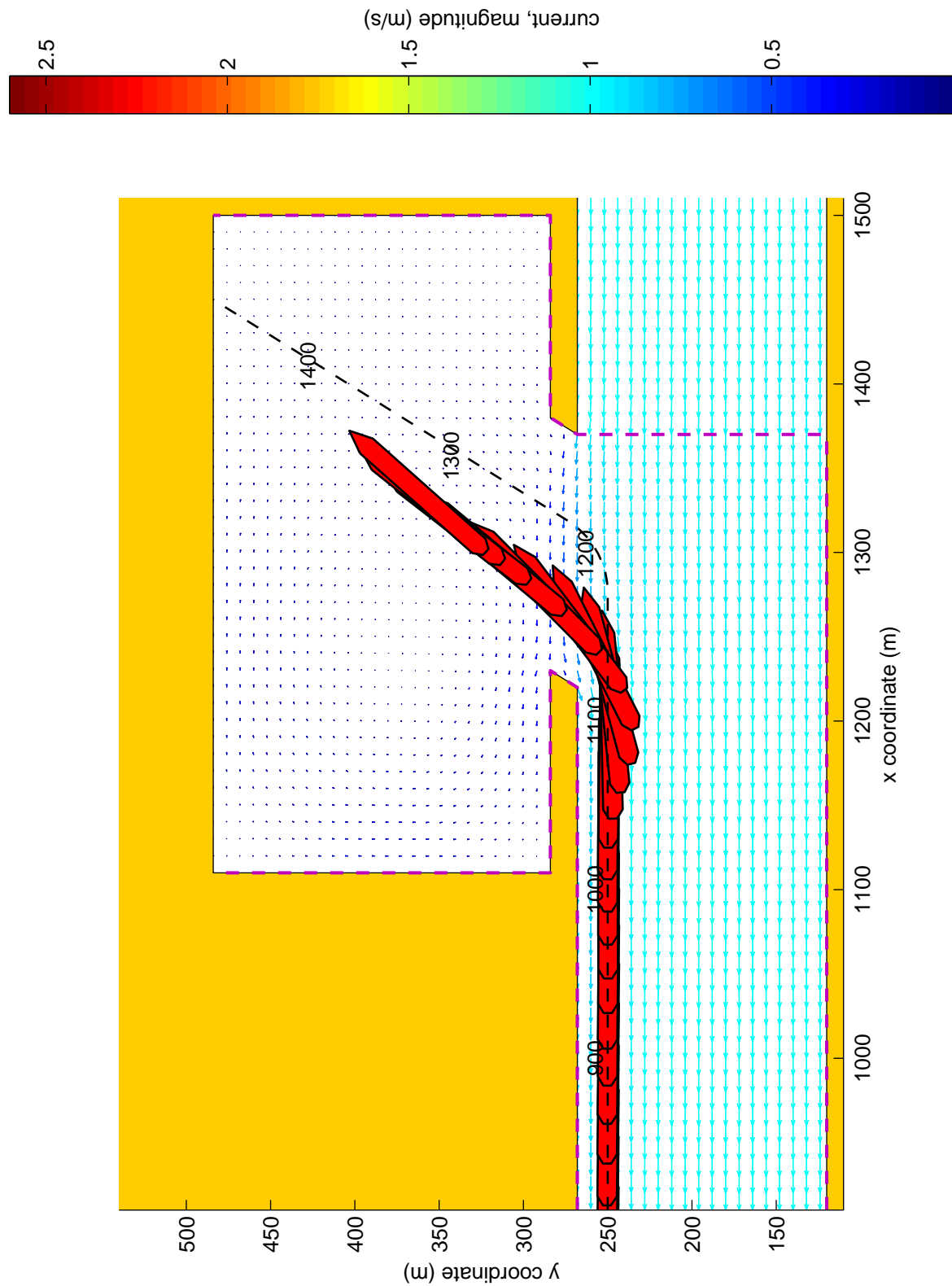
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 55

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 10

Current: 1.0 m/s

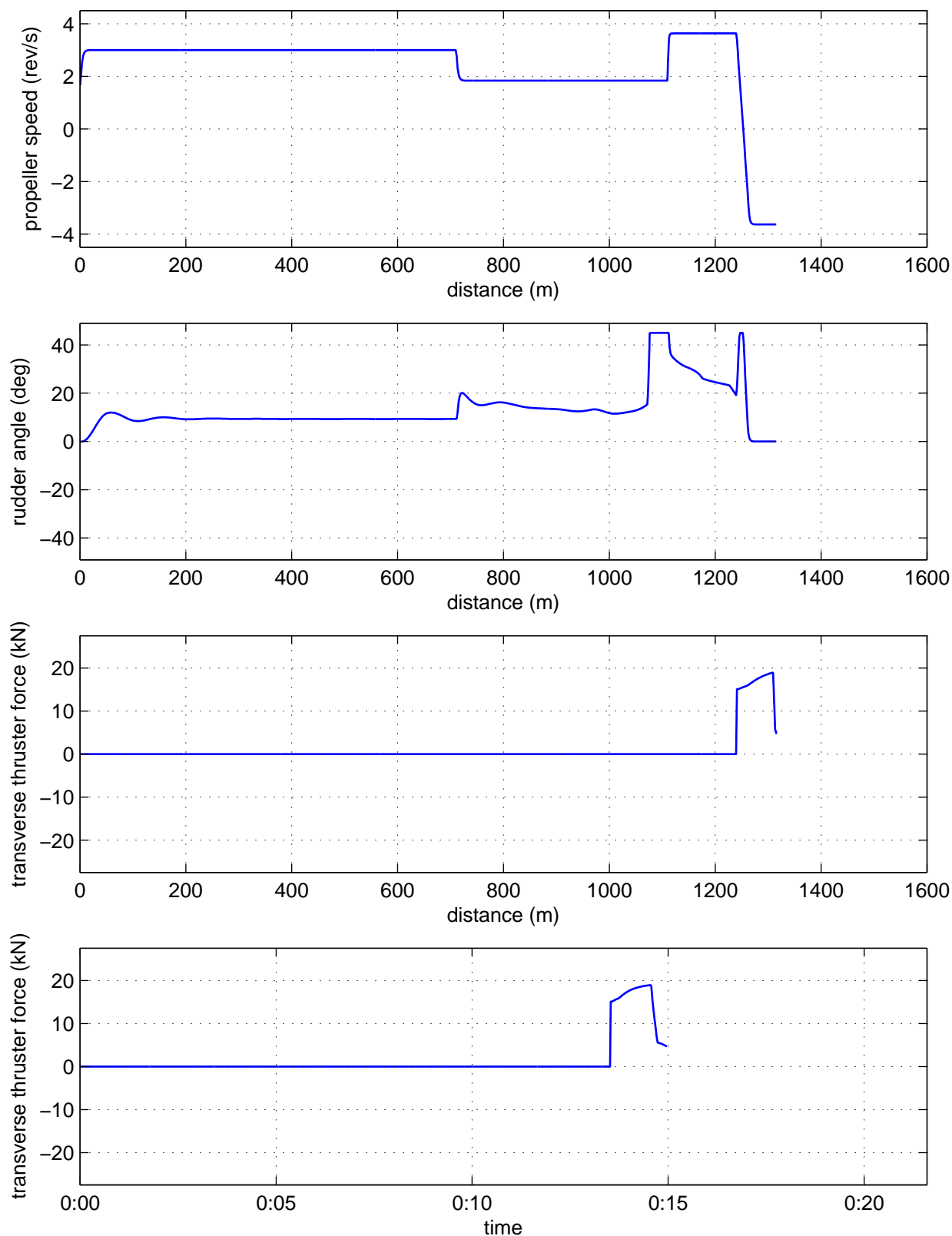
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 55

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

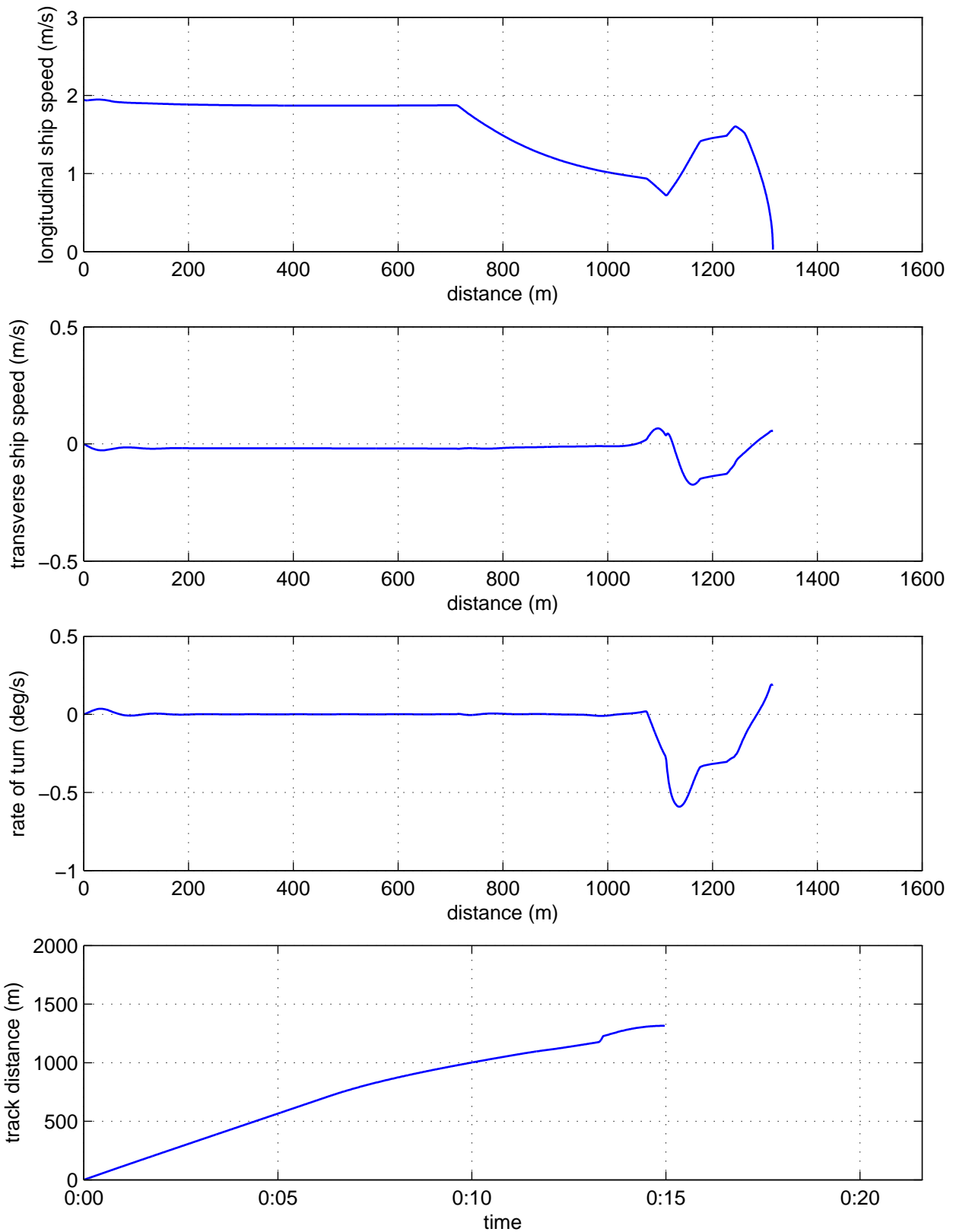
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 55

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

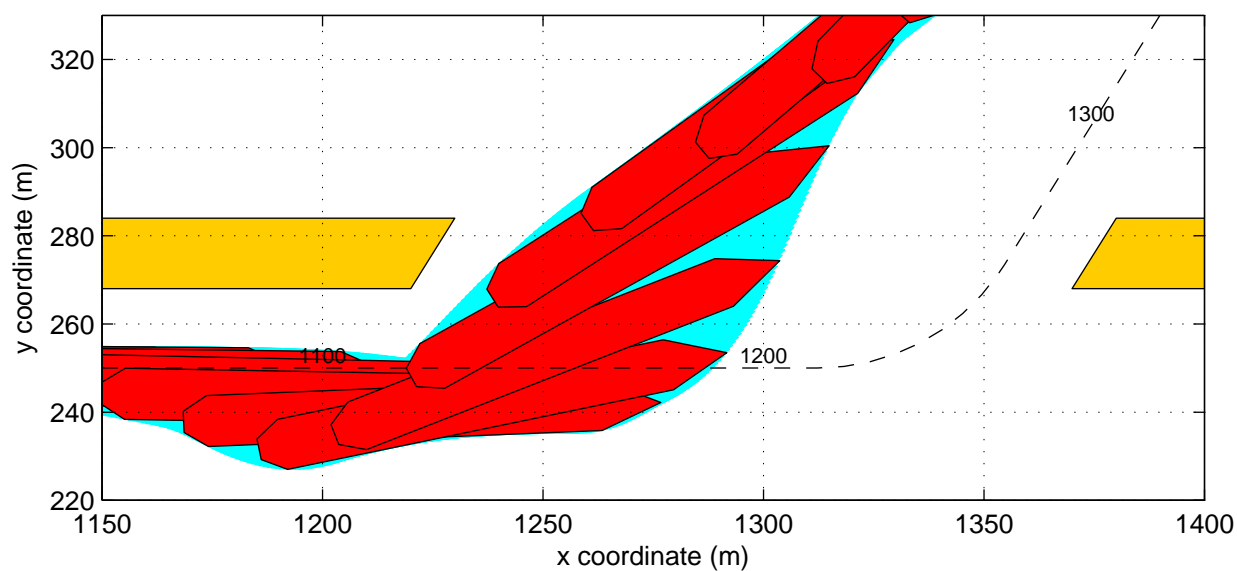
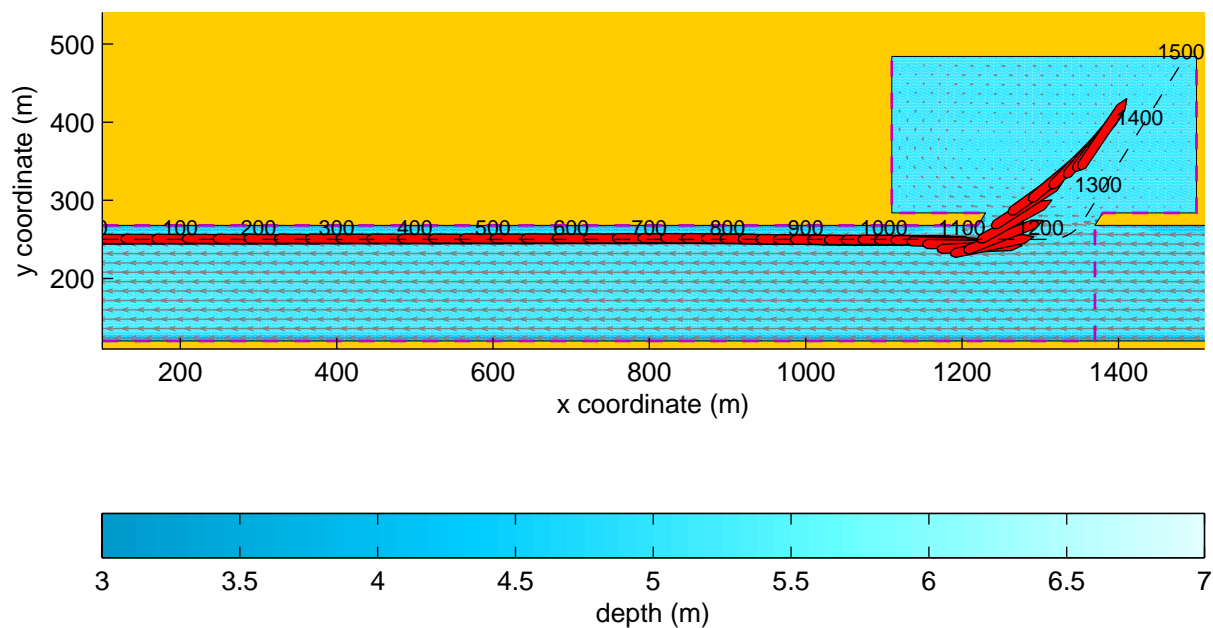
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 55

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 10

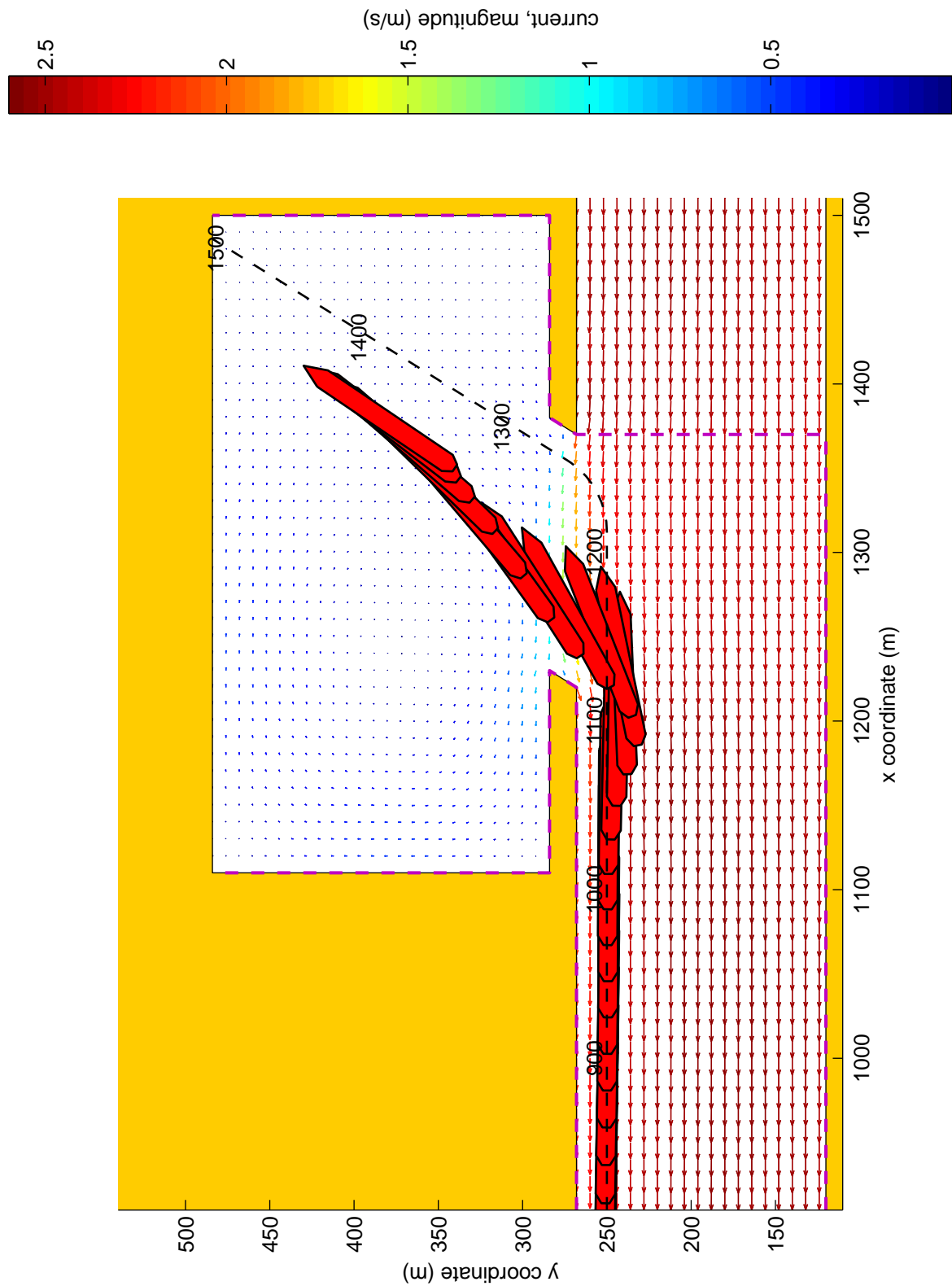
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 56

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 10

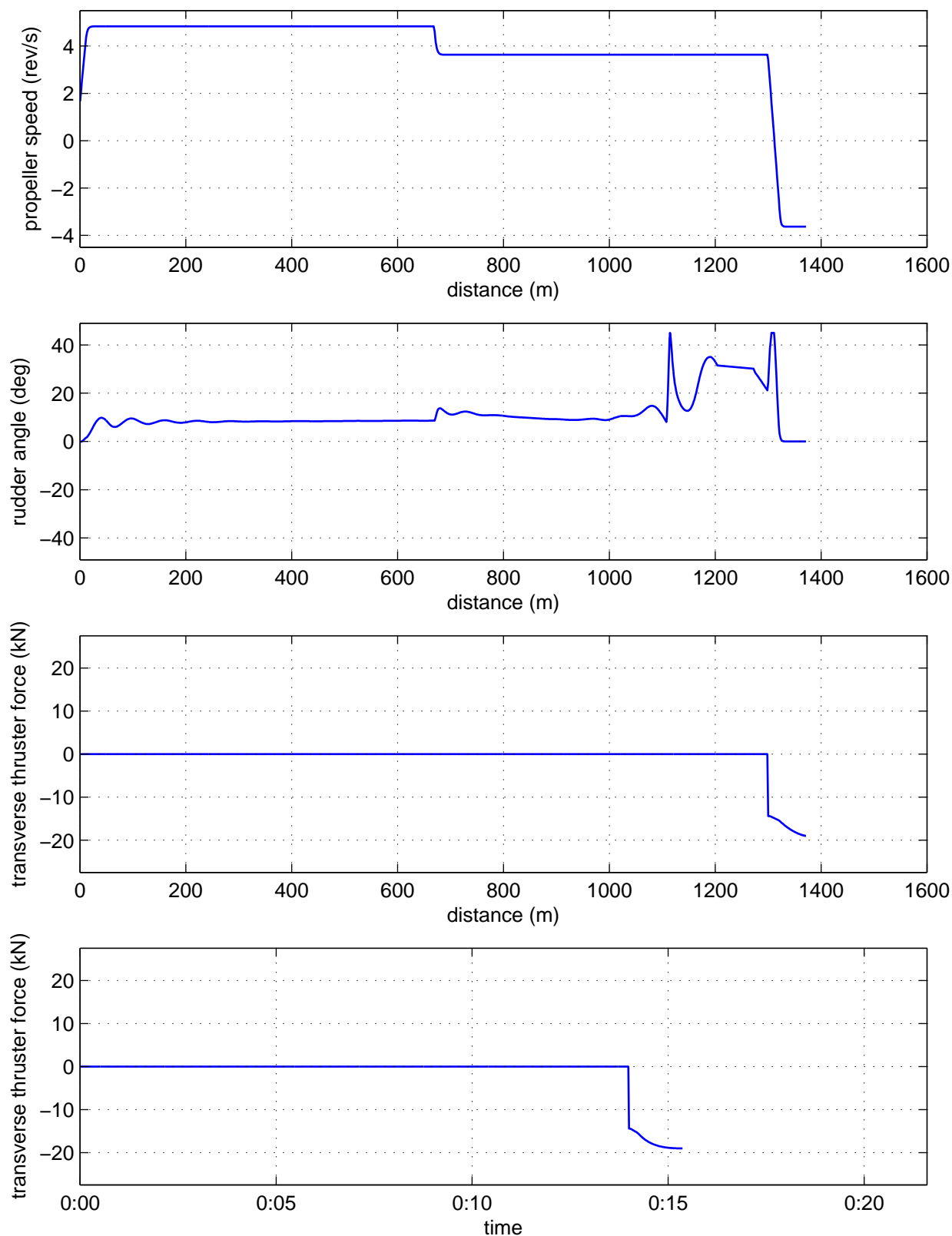
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 56

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

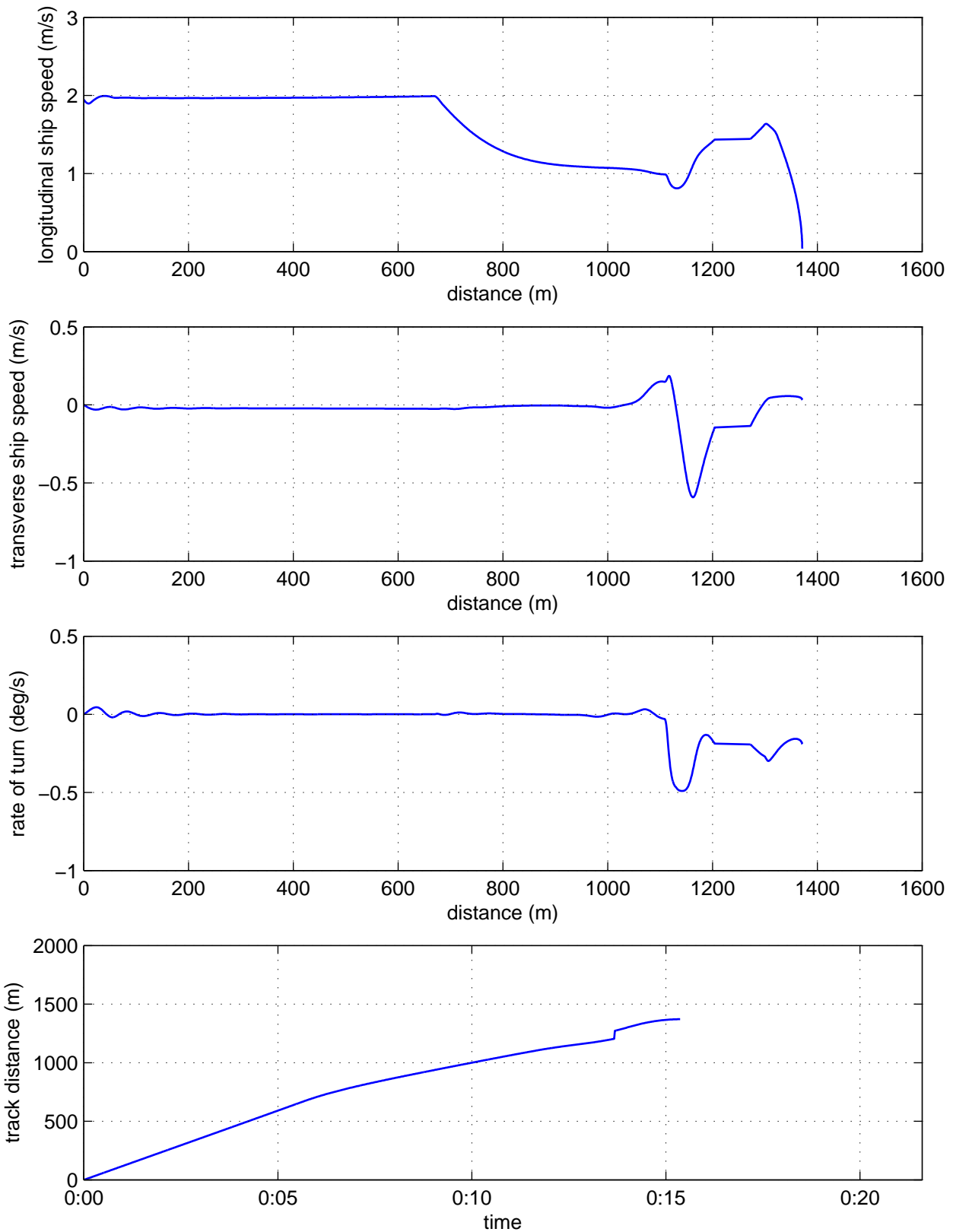
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 56

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

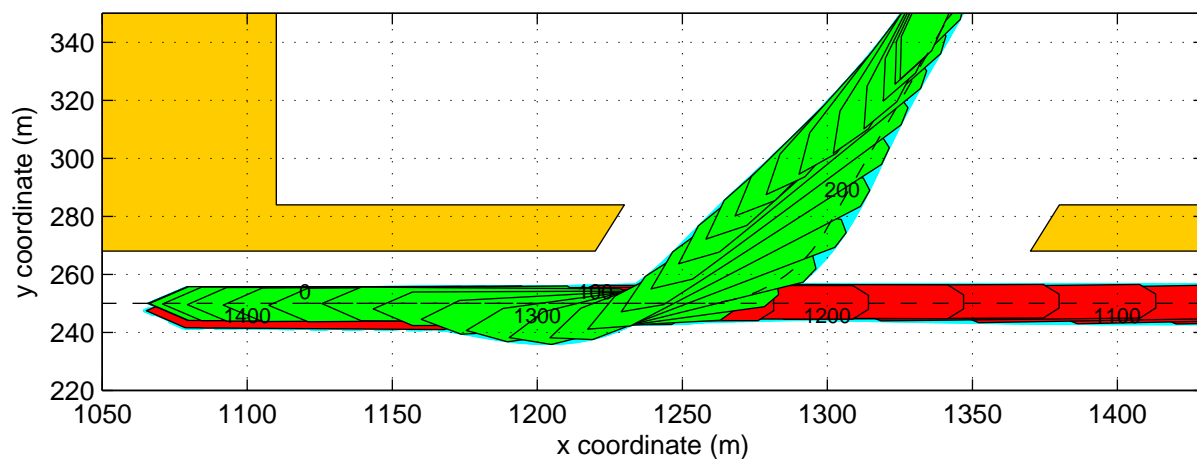
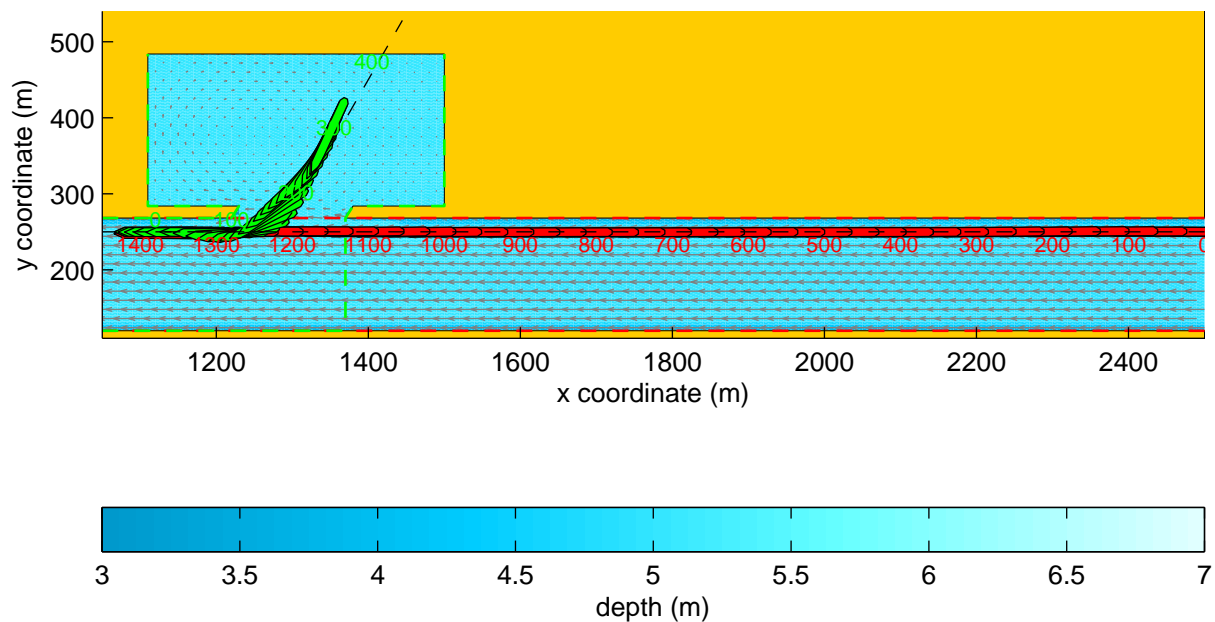
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 56

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 10

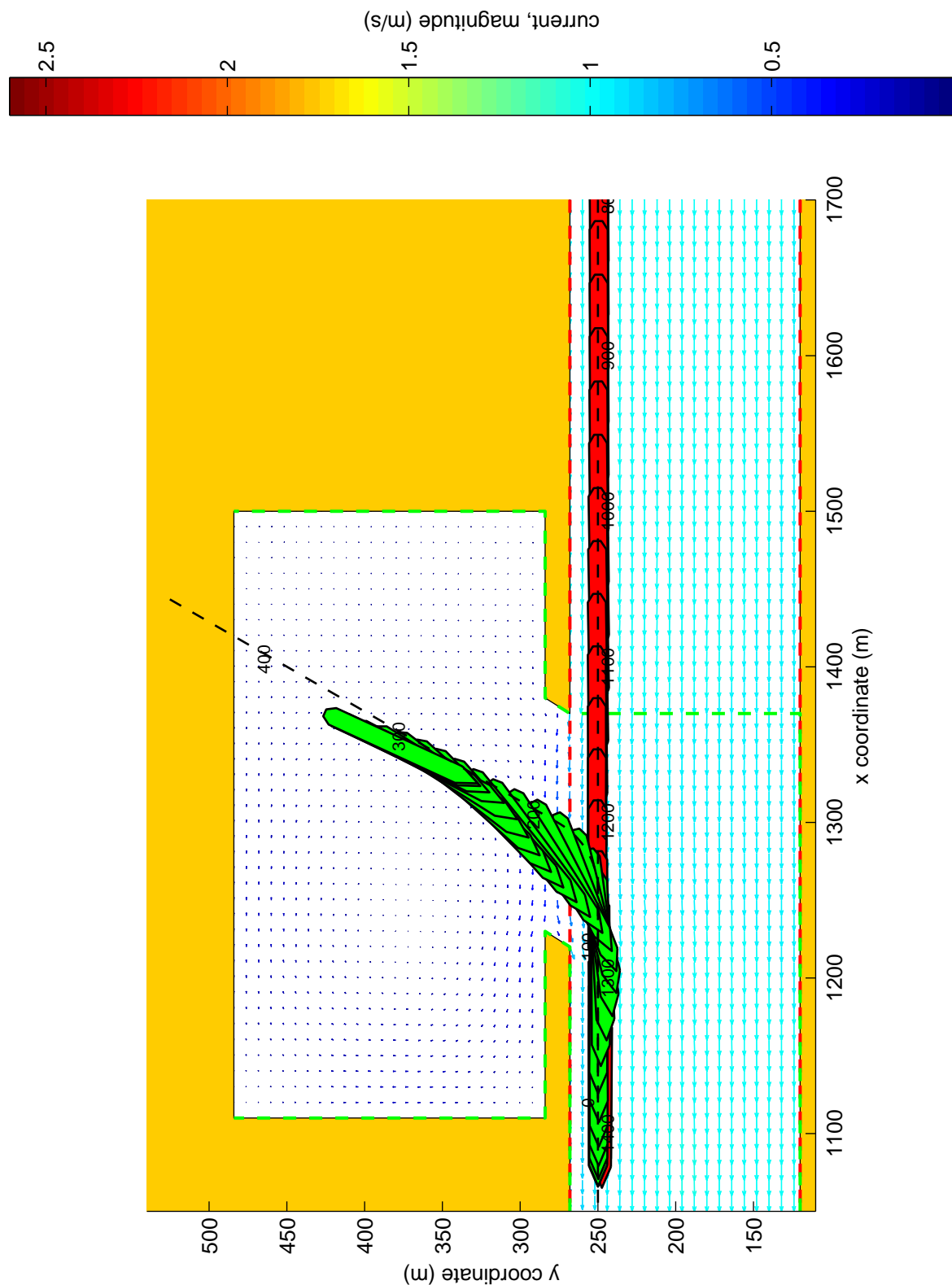
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 57

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 10

Current: 1.0 m/s

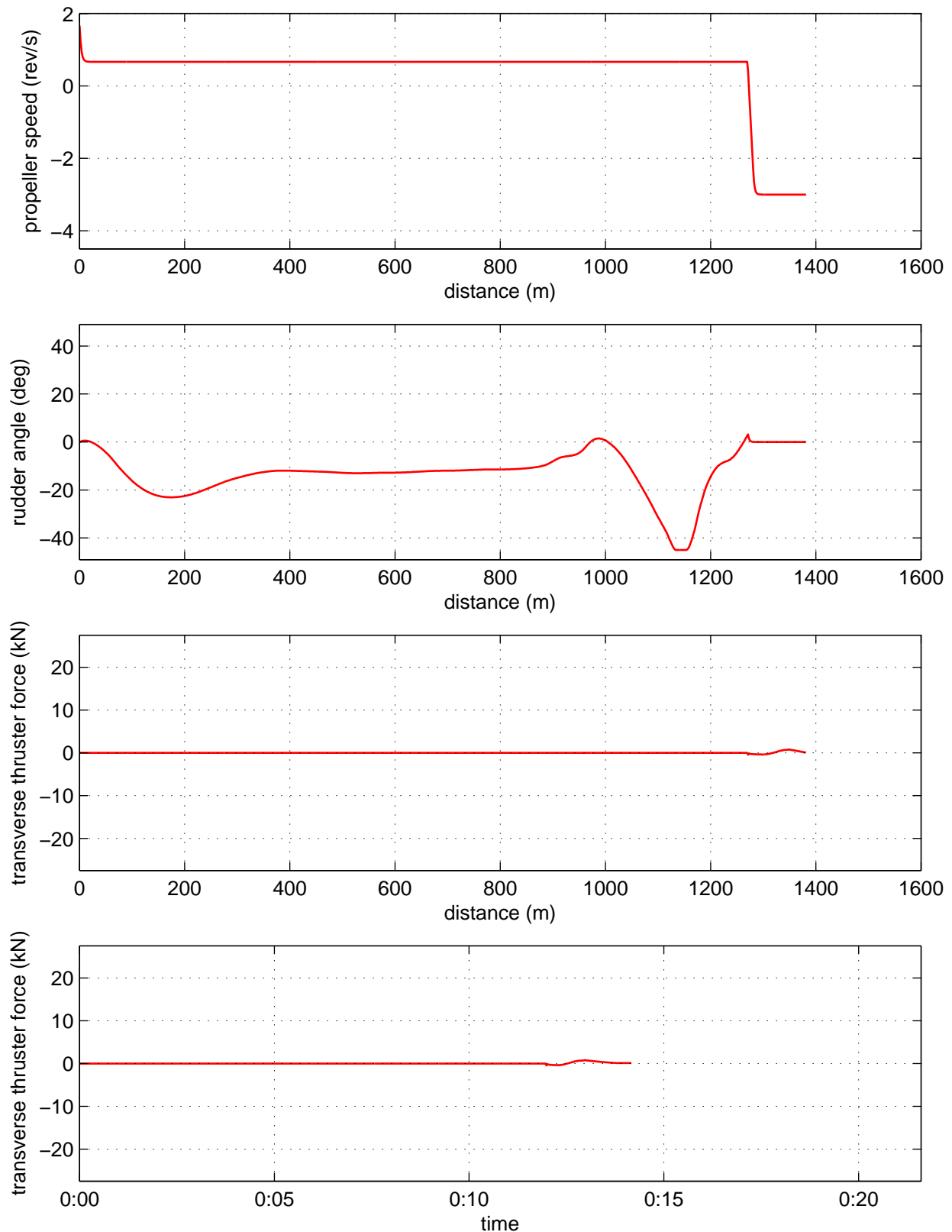
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 57

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

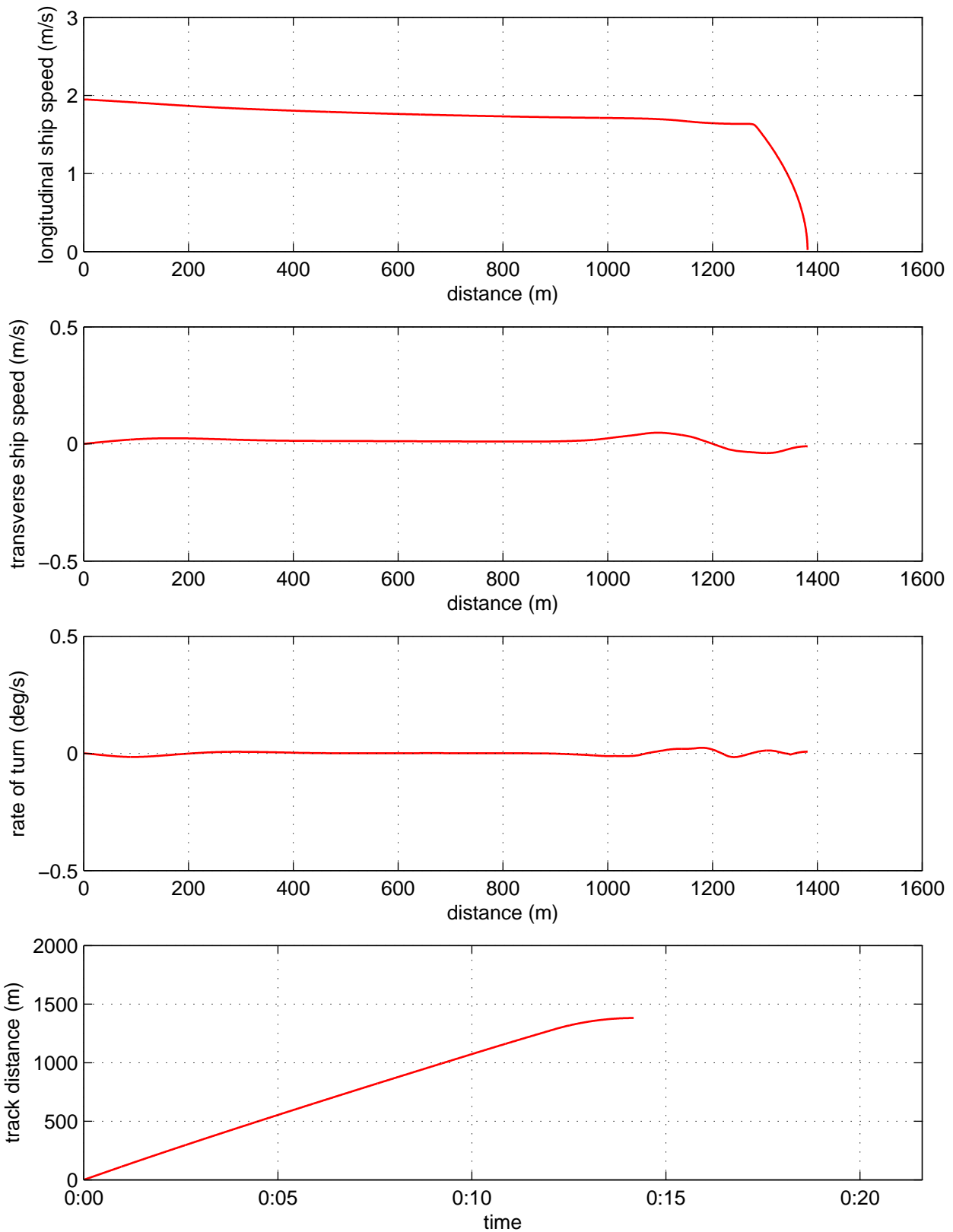
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 57a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

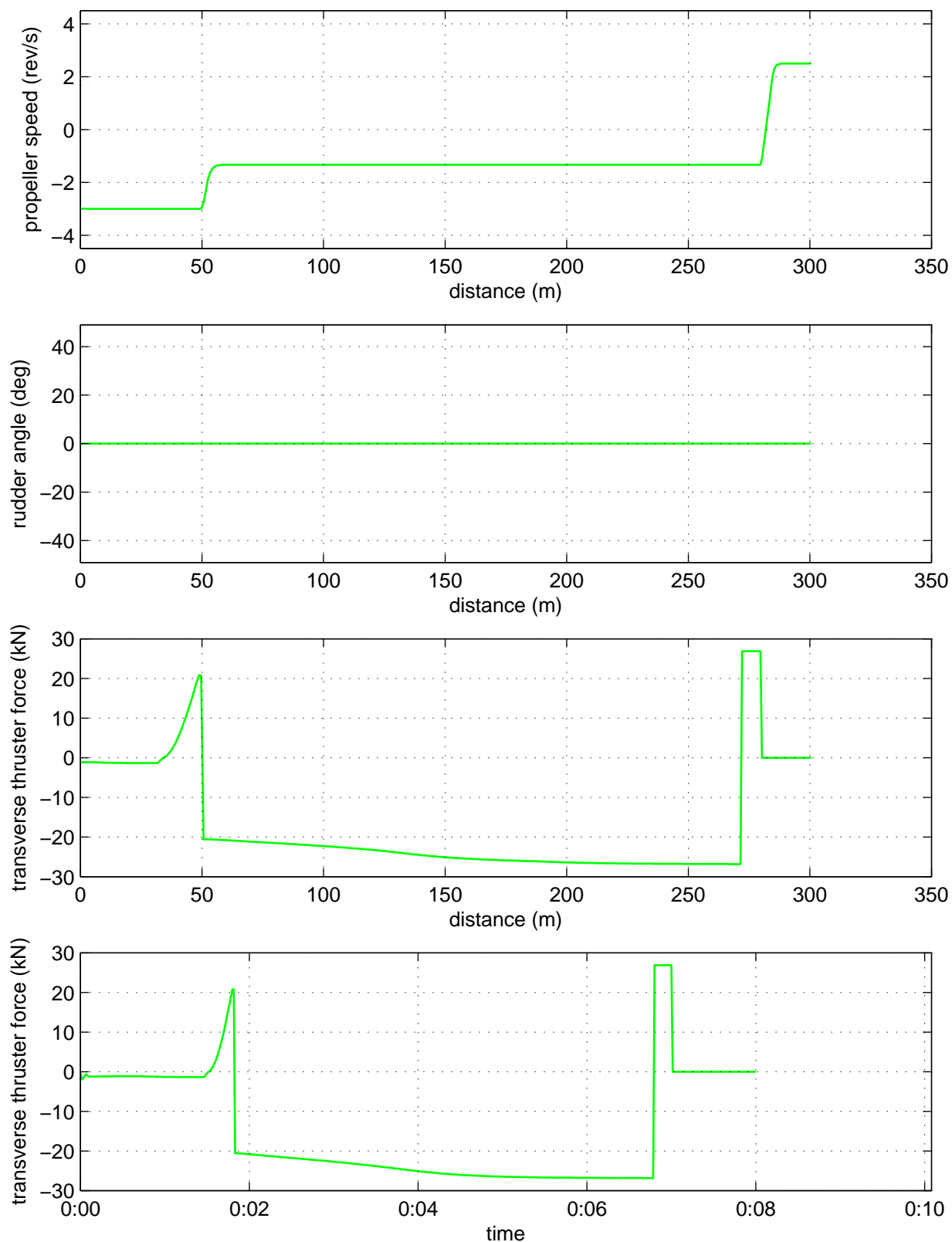
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 57a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

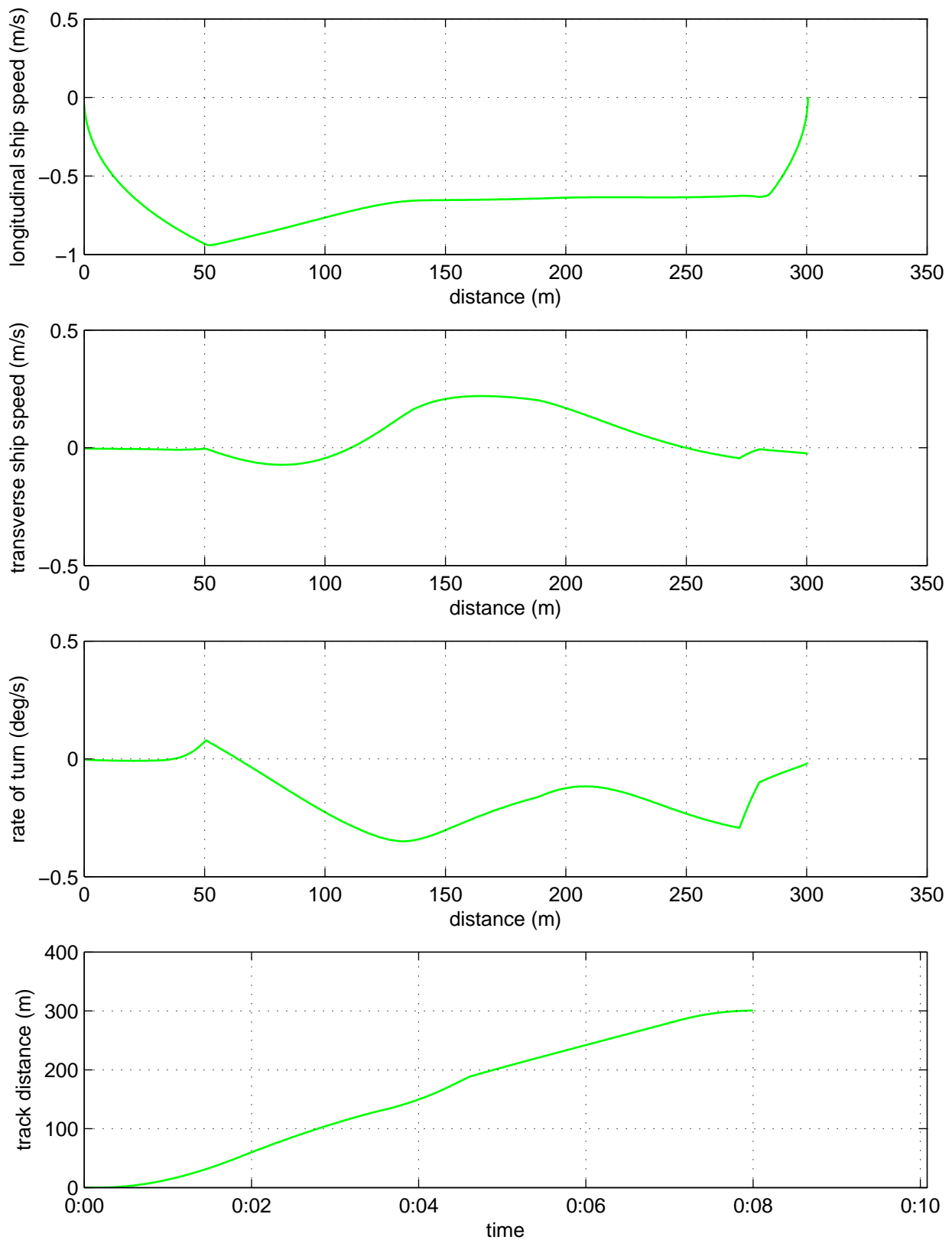
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 57b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

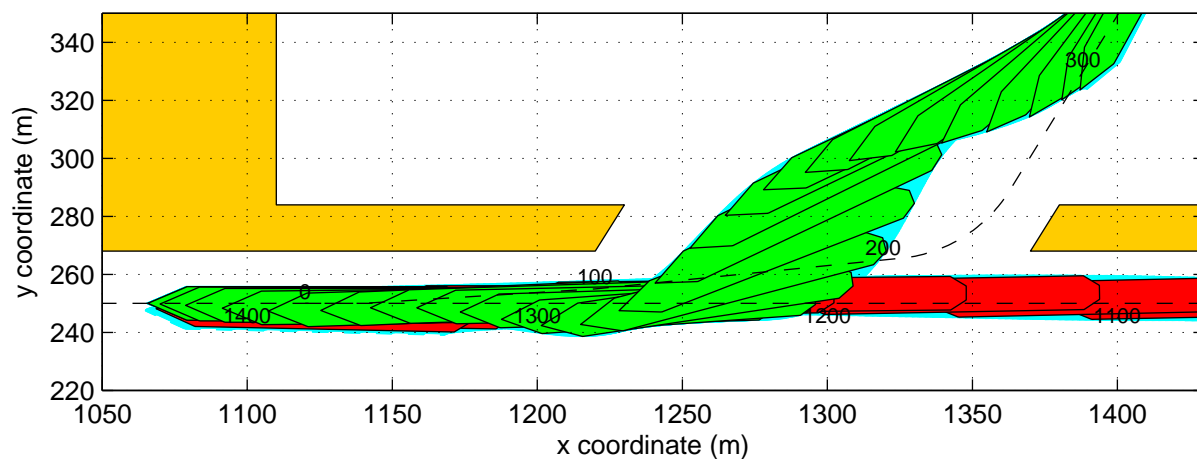
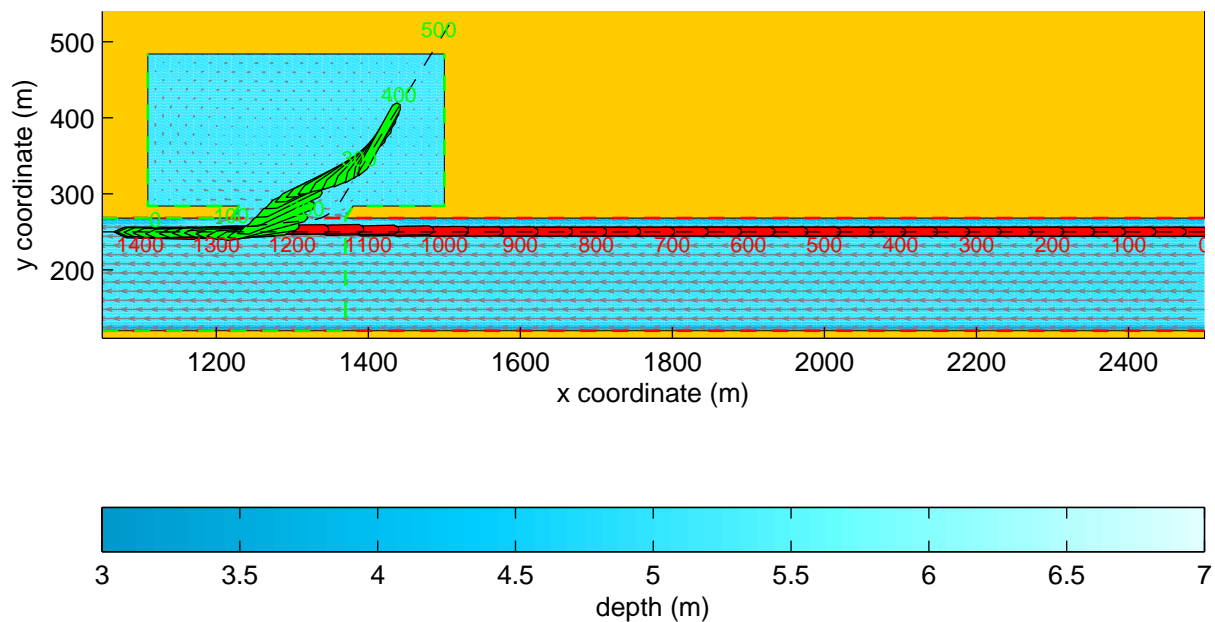
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 57b

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 10

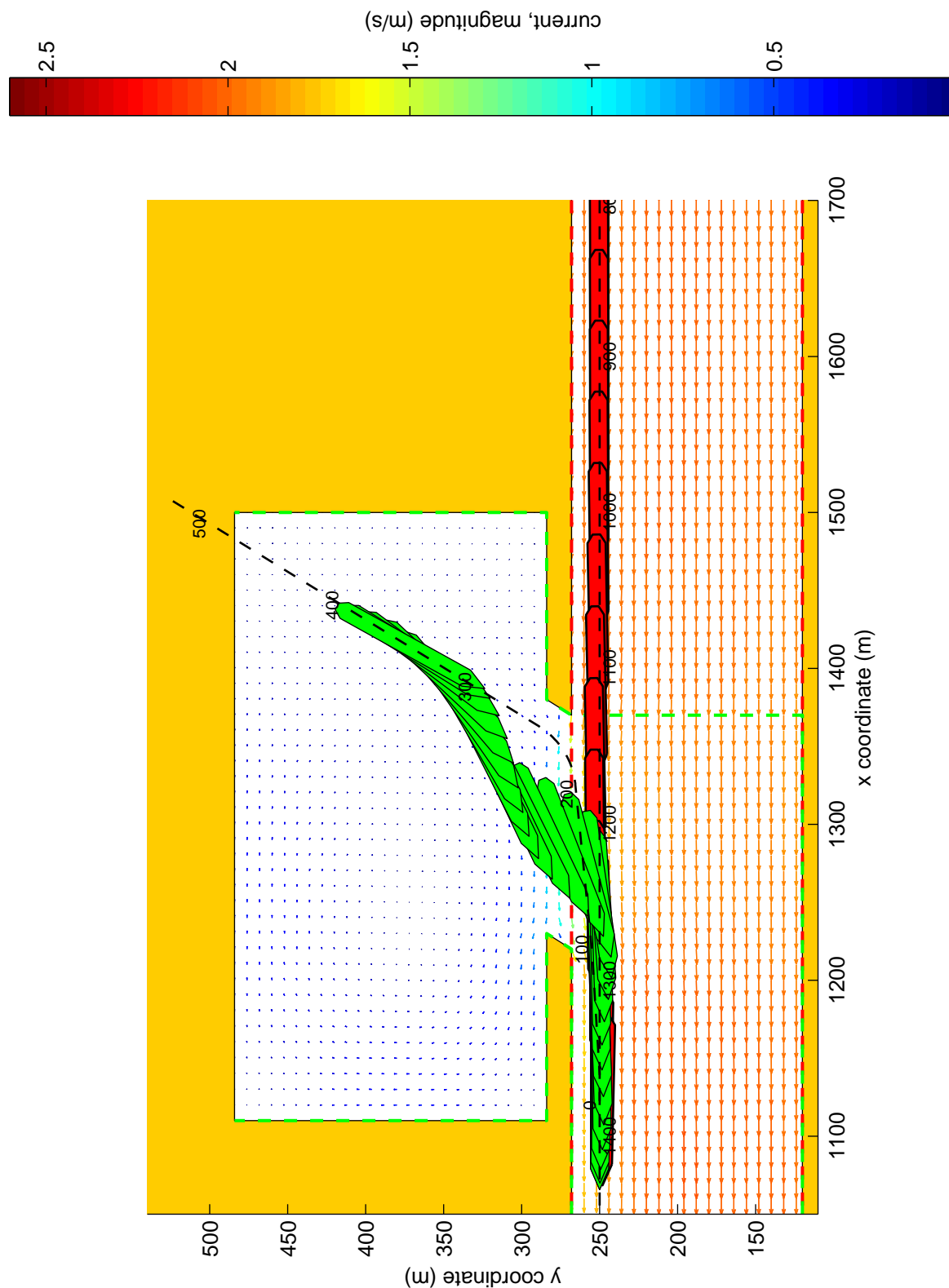
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 58

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 10

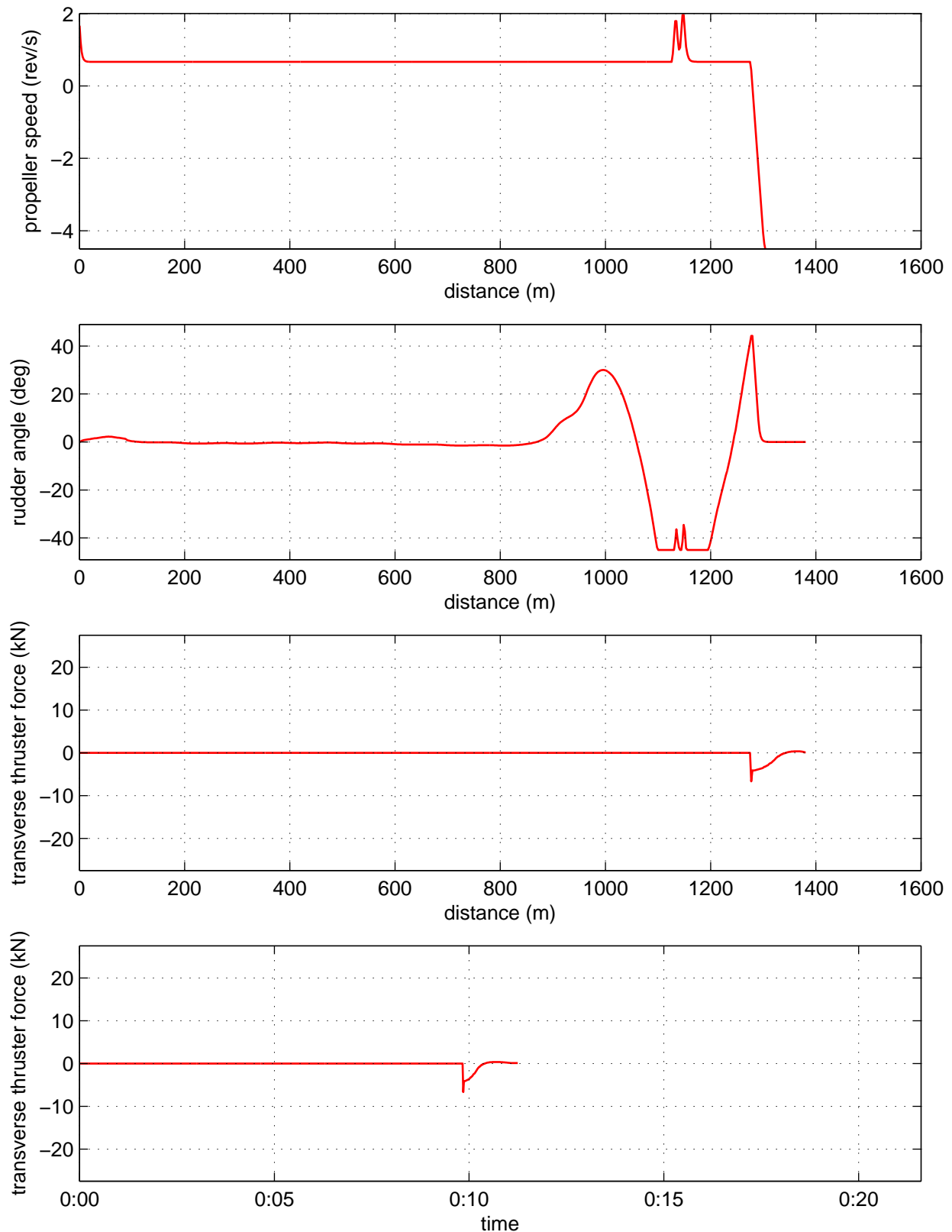
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 58

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

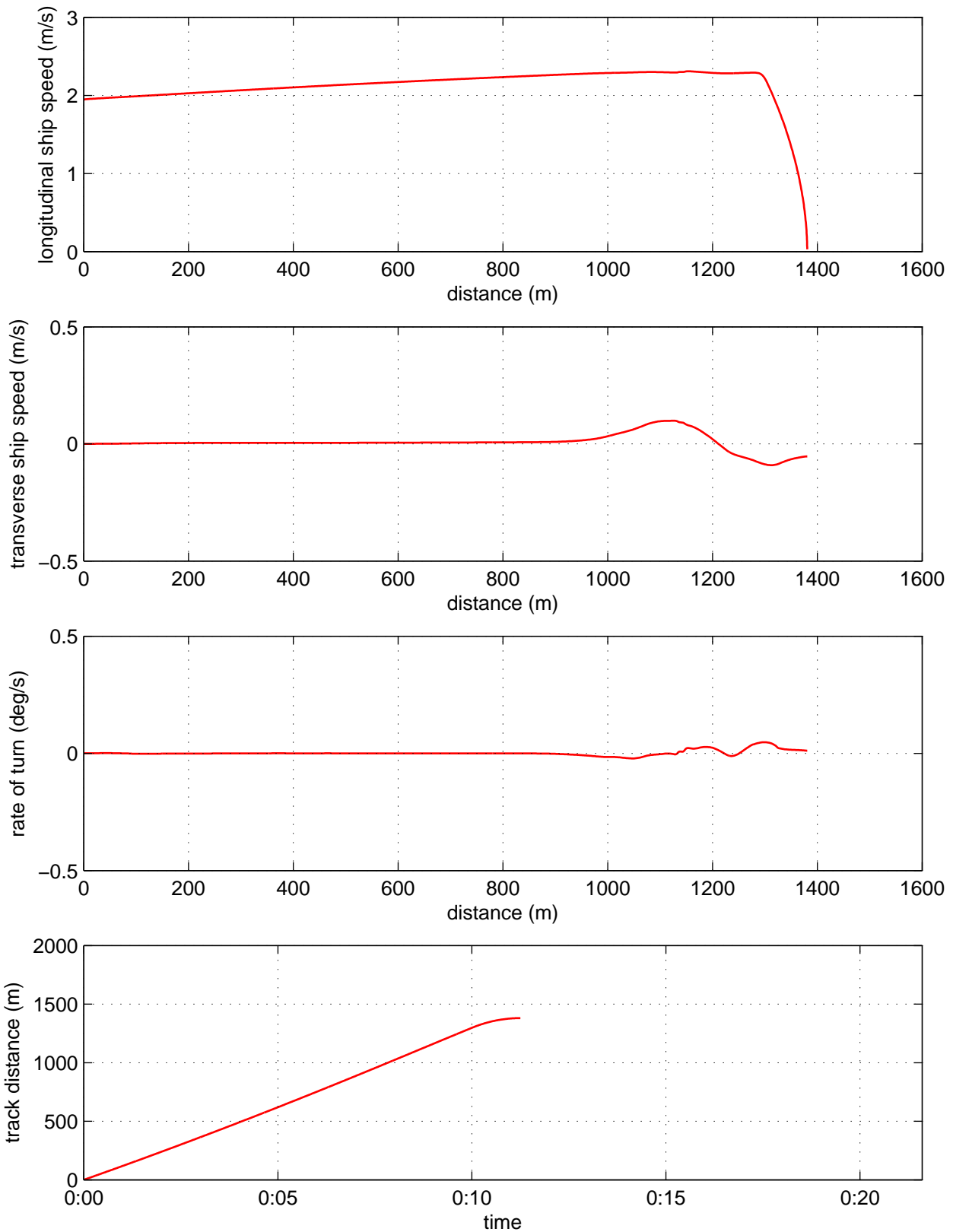
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 58a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

Current: 2.0 m/s

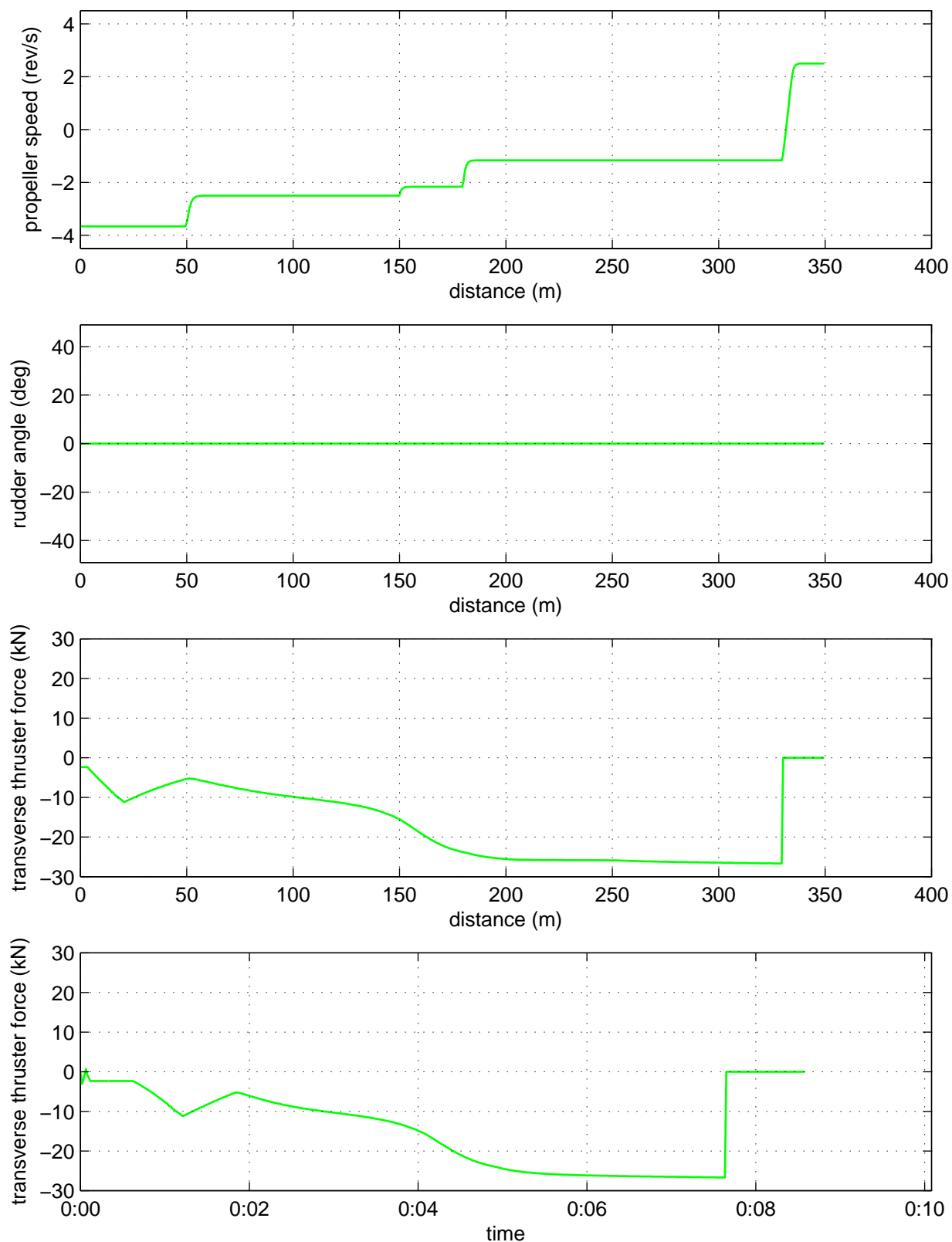
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 58a

Figure C





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 10

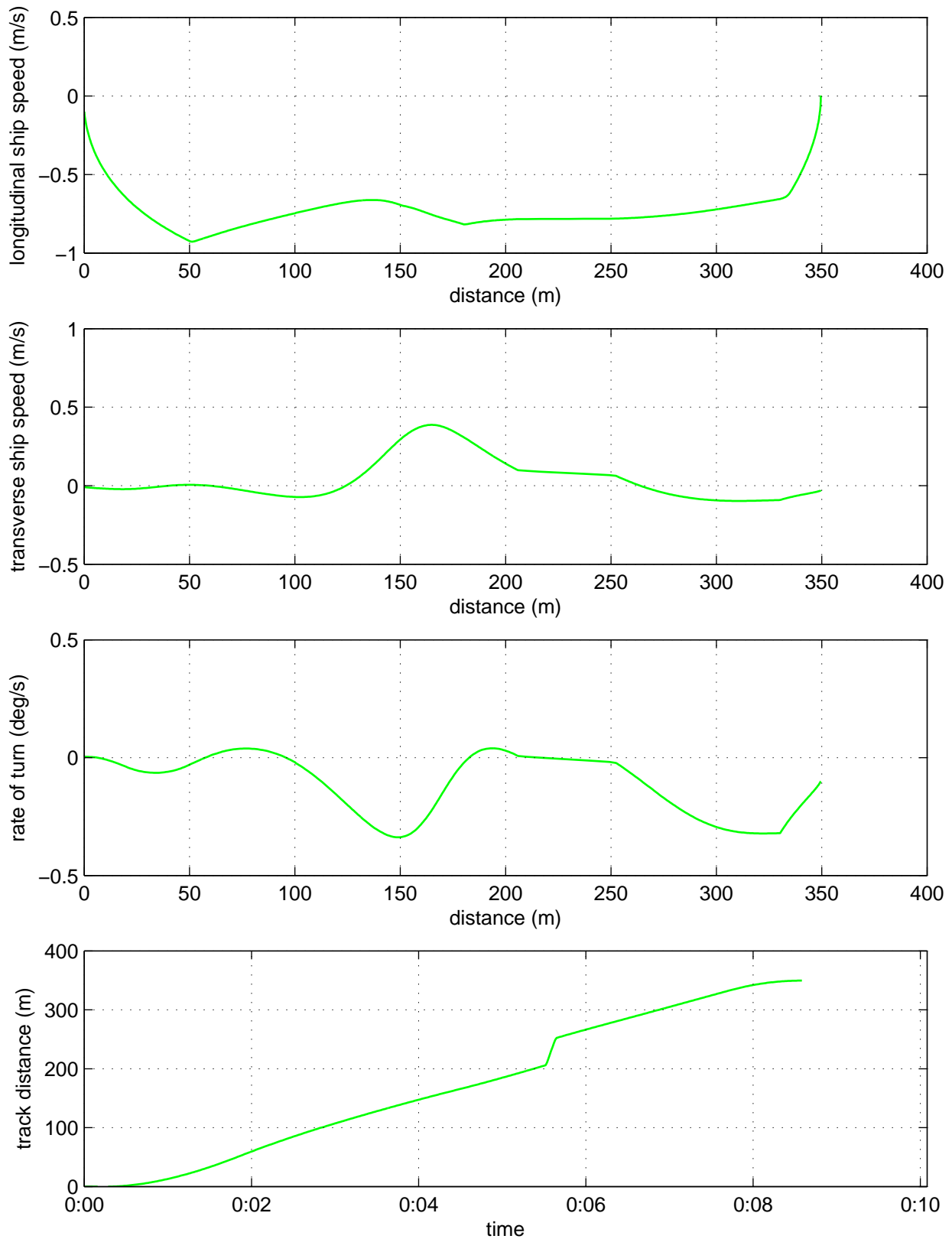
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 58b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 10

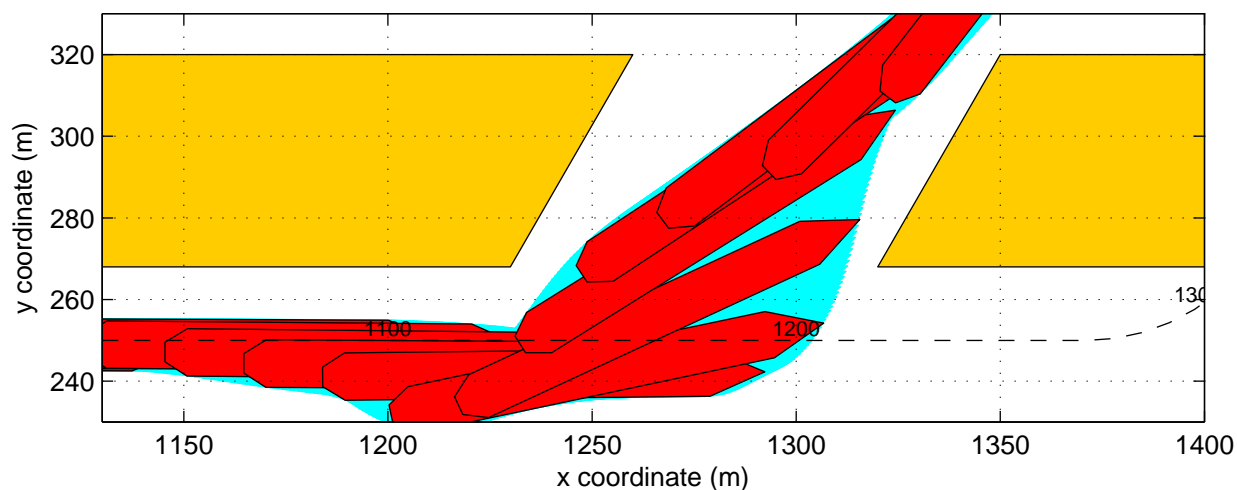
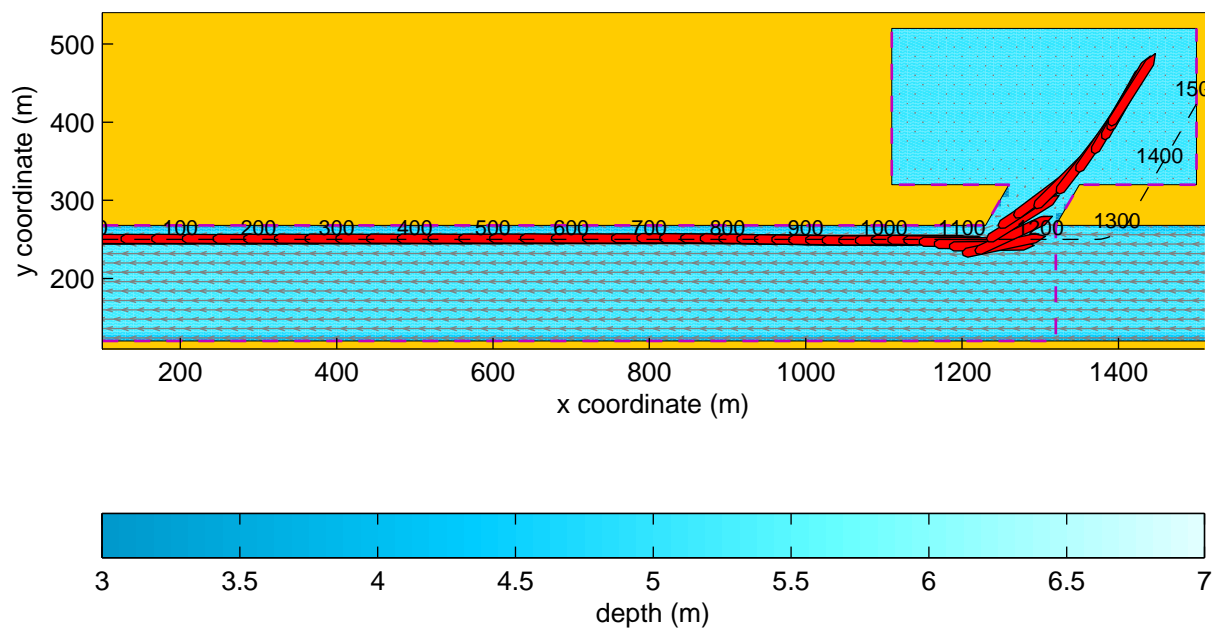
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 58b

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 11

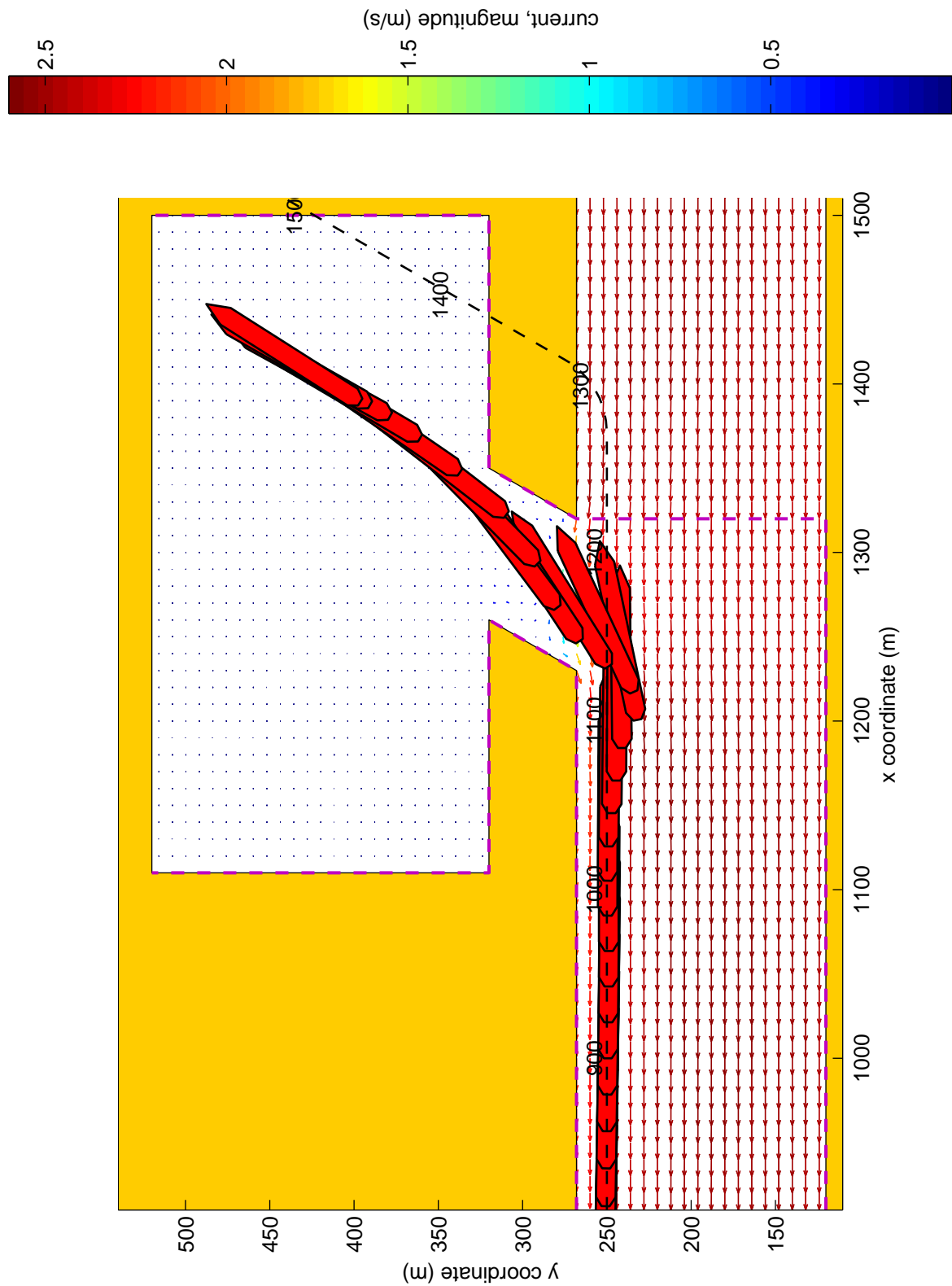
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 59

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 11

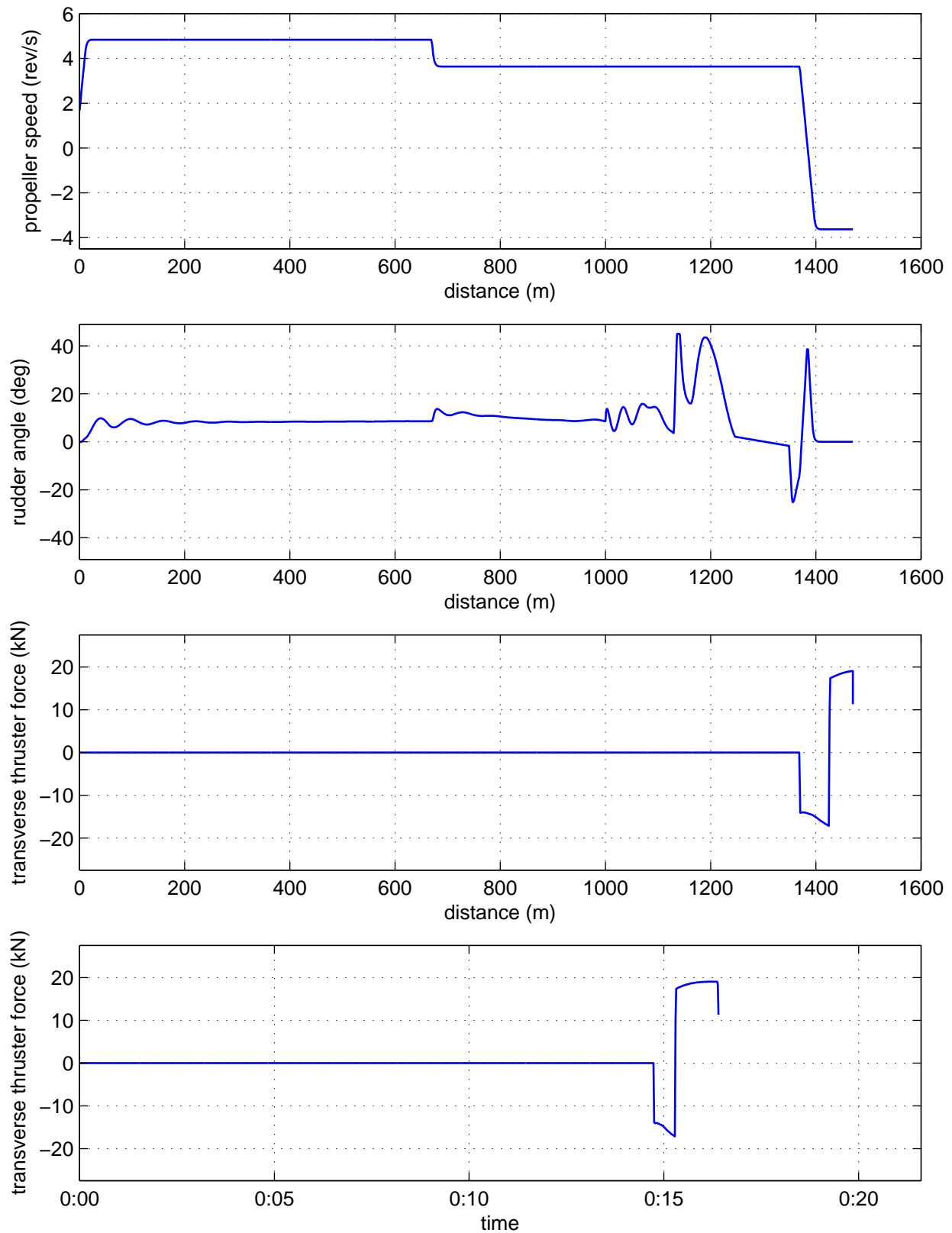
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 59

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 11

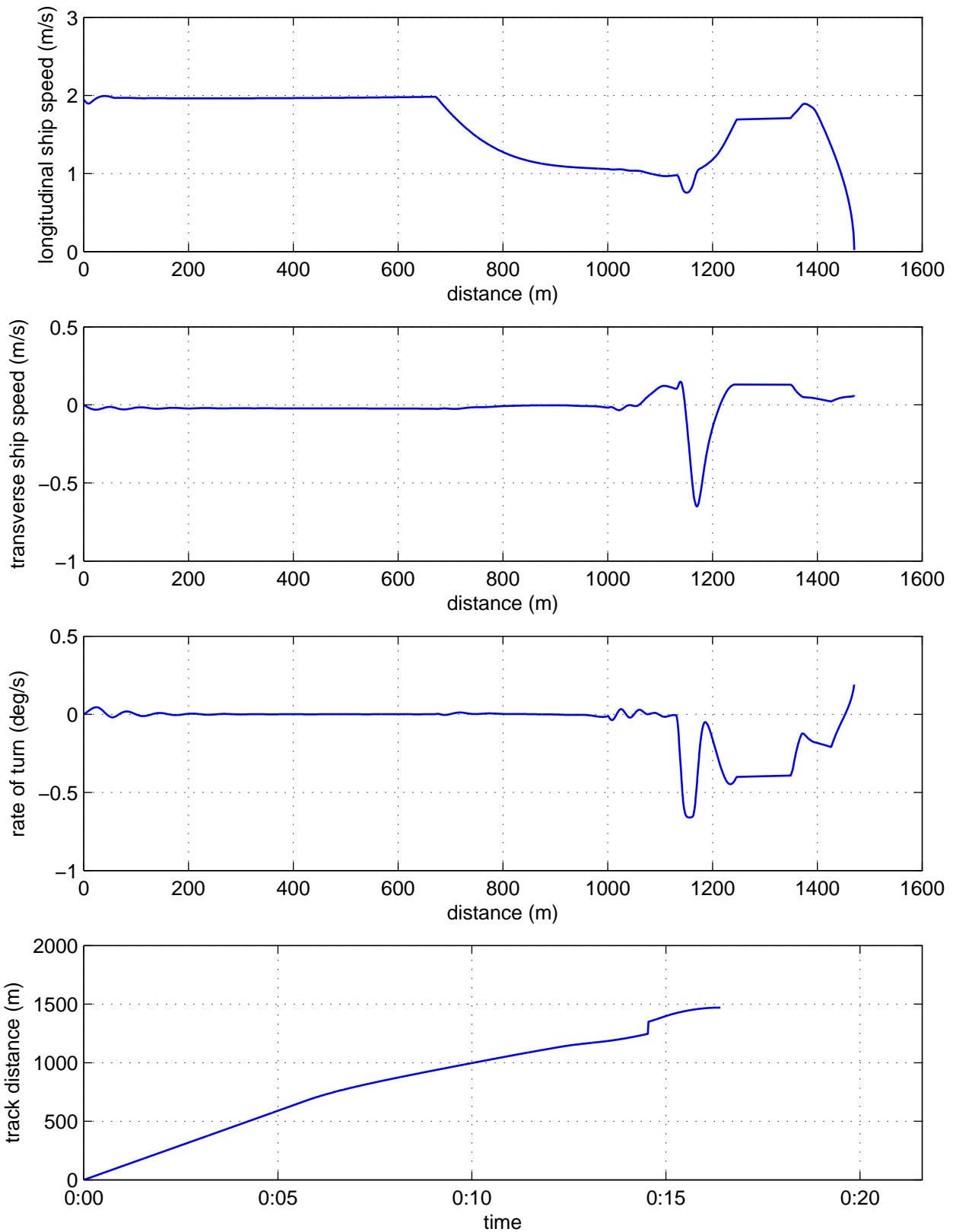
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 59

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 11

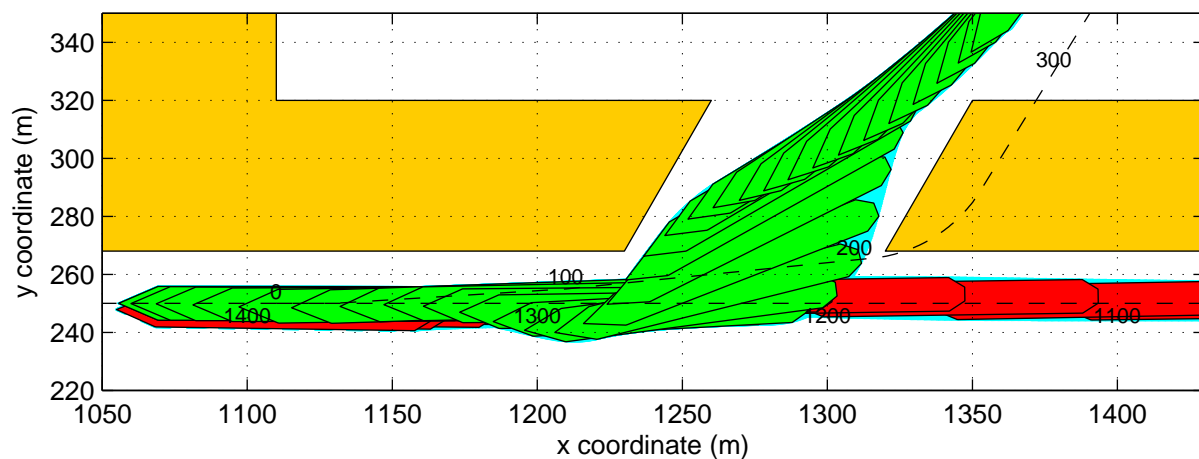
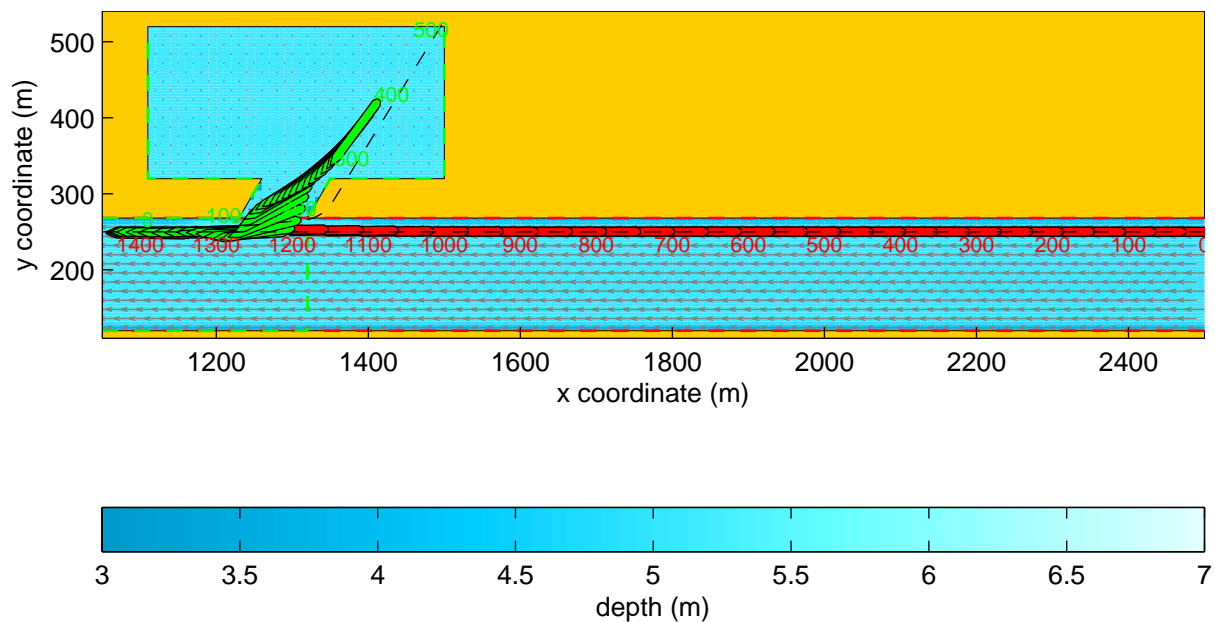
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 59

Figure C



Overview plot: Implemented tracks (dashed black lines), bank suction lines (dashed lines), ship snapshots, water depth and current.

Close-up plot of port entrance: Implemented tracks (dashed black lines) swept path (blue area) and ship snapshots.

Layout nr. 11

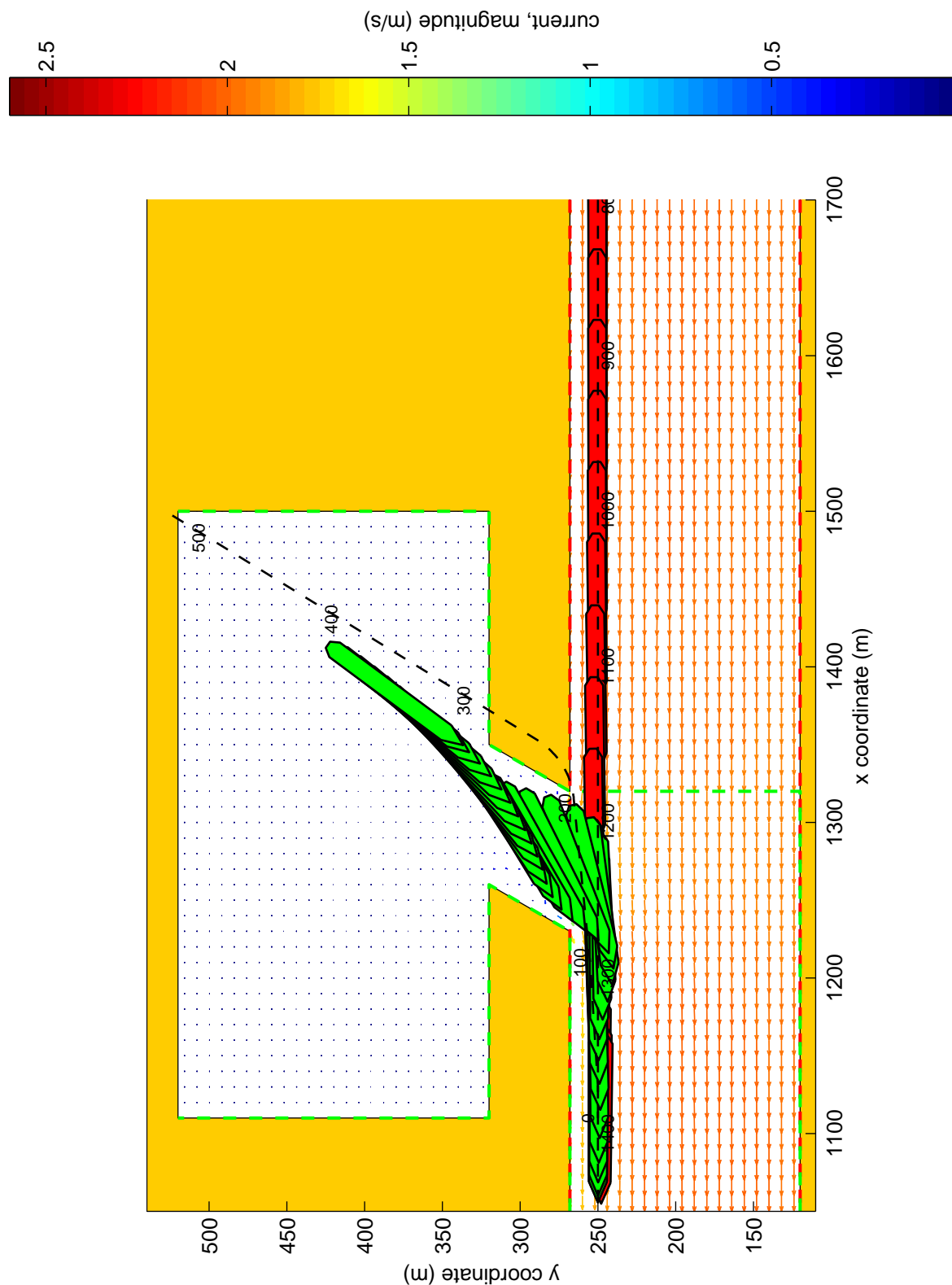
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 60

Figure A1



Close-up plot around port: Implemented tracks (dashed black lines), bank suction lines (dashed lines), current and ship snapshots.

Layout nr. 11

Current: 2.0 m/s

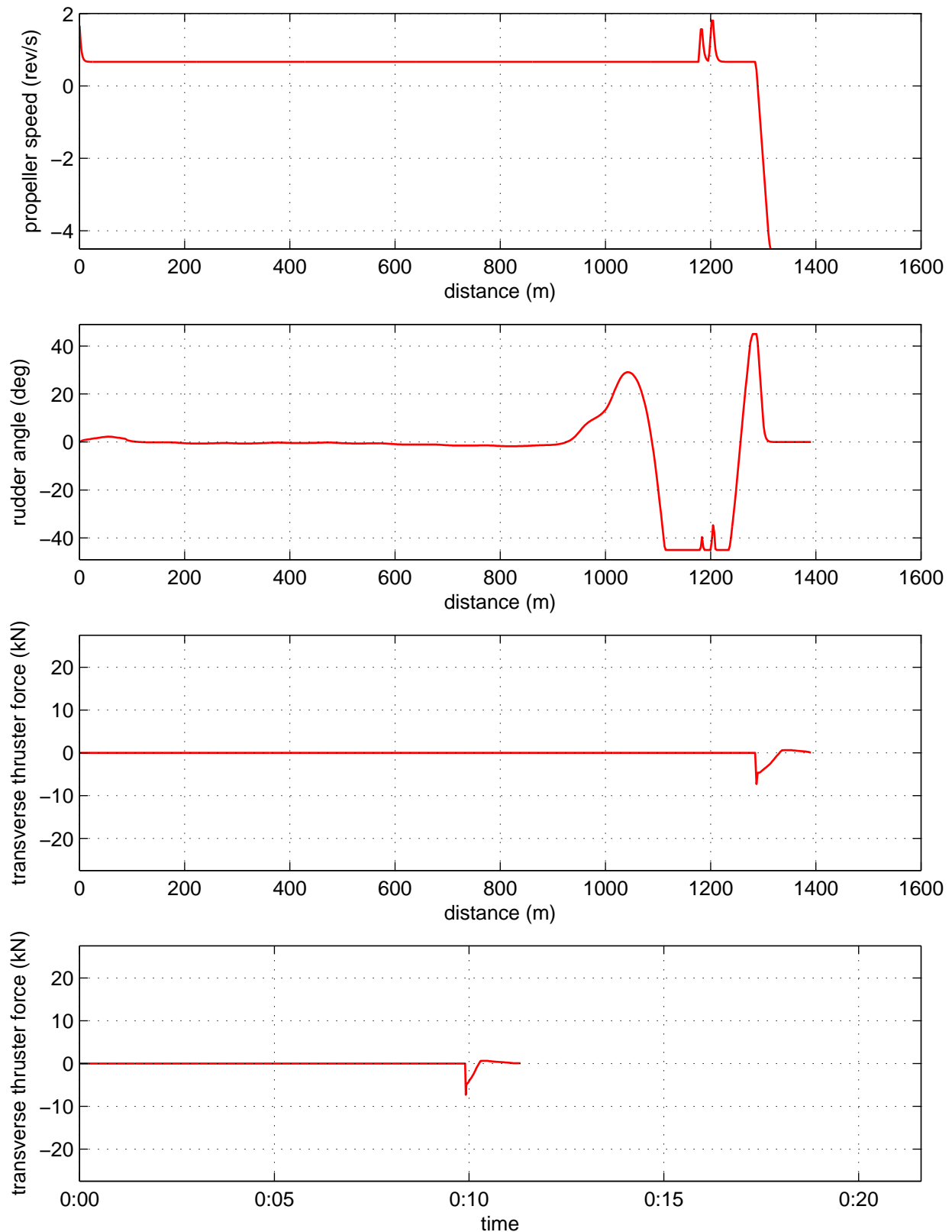
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 60

Figure A2





Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 11

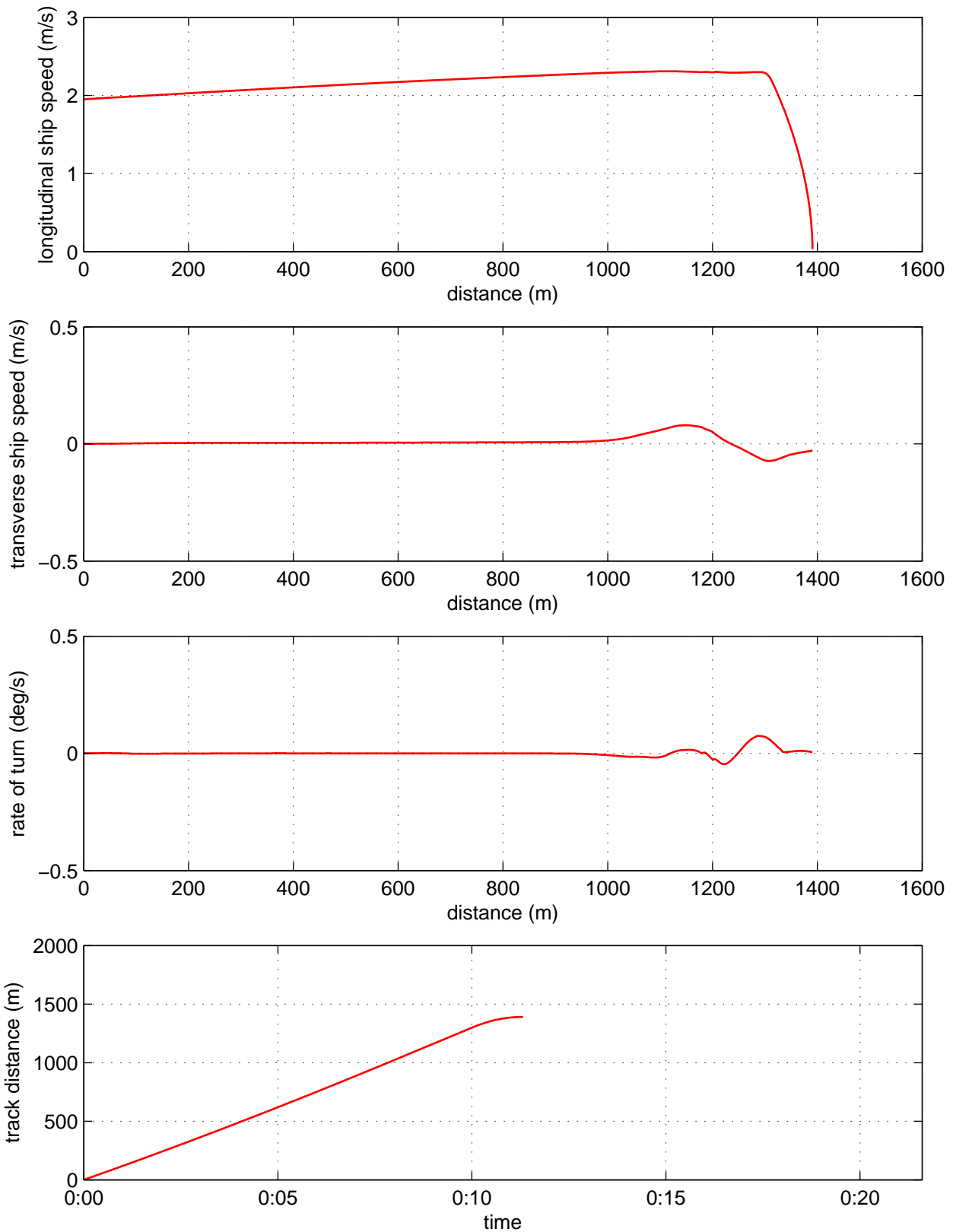
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 60a

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 11

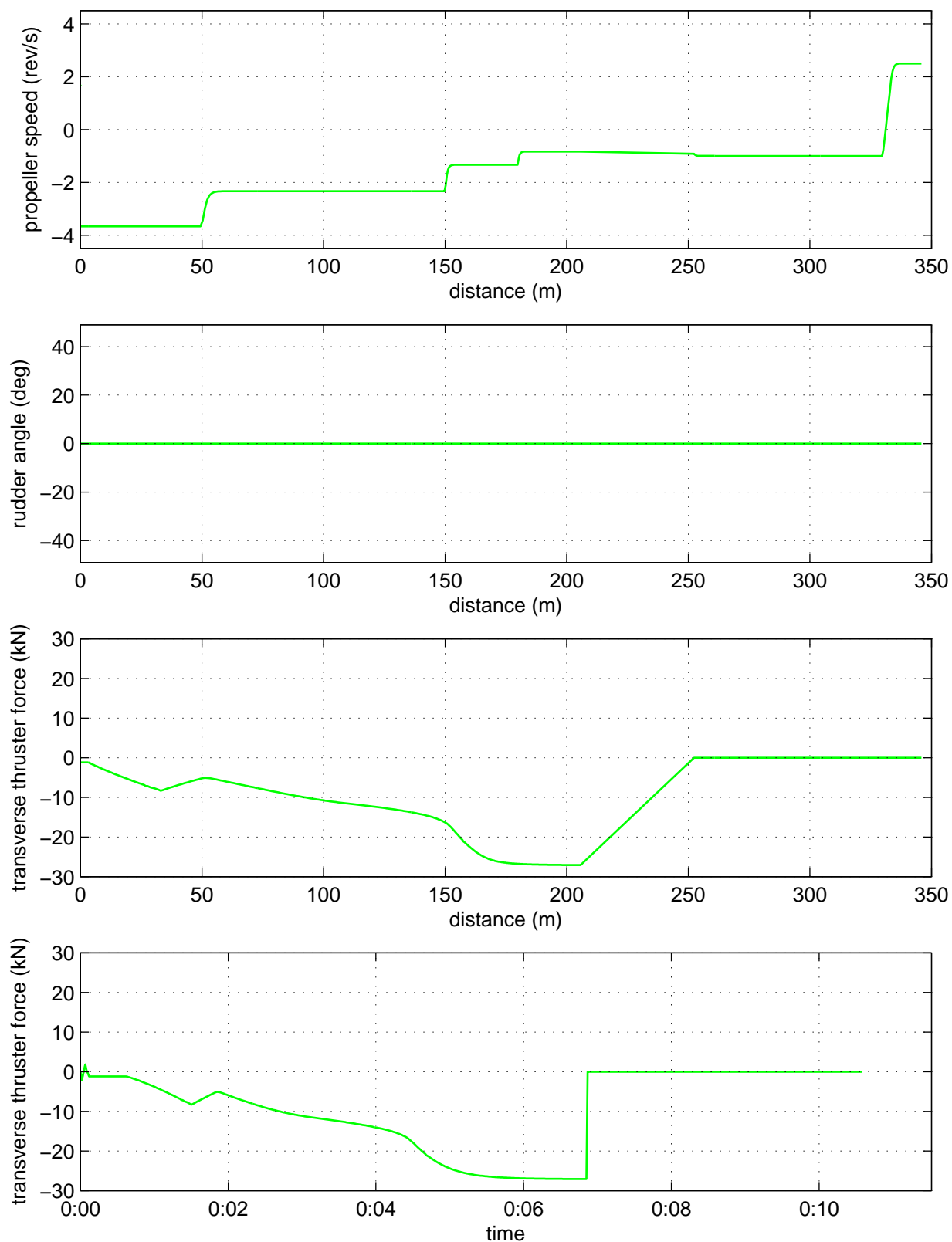
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 60a

Figure C



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 11

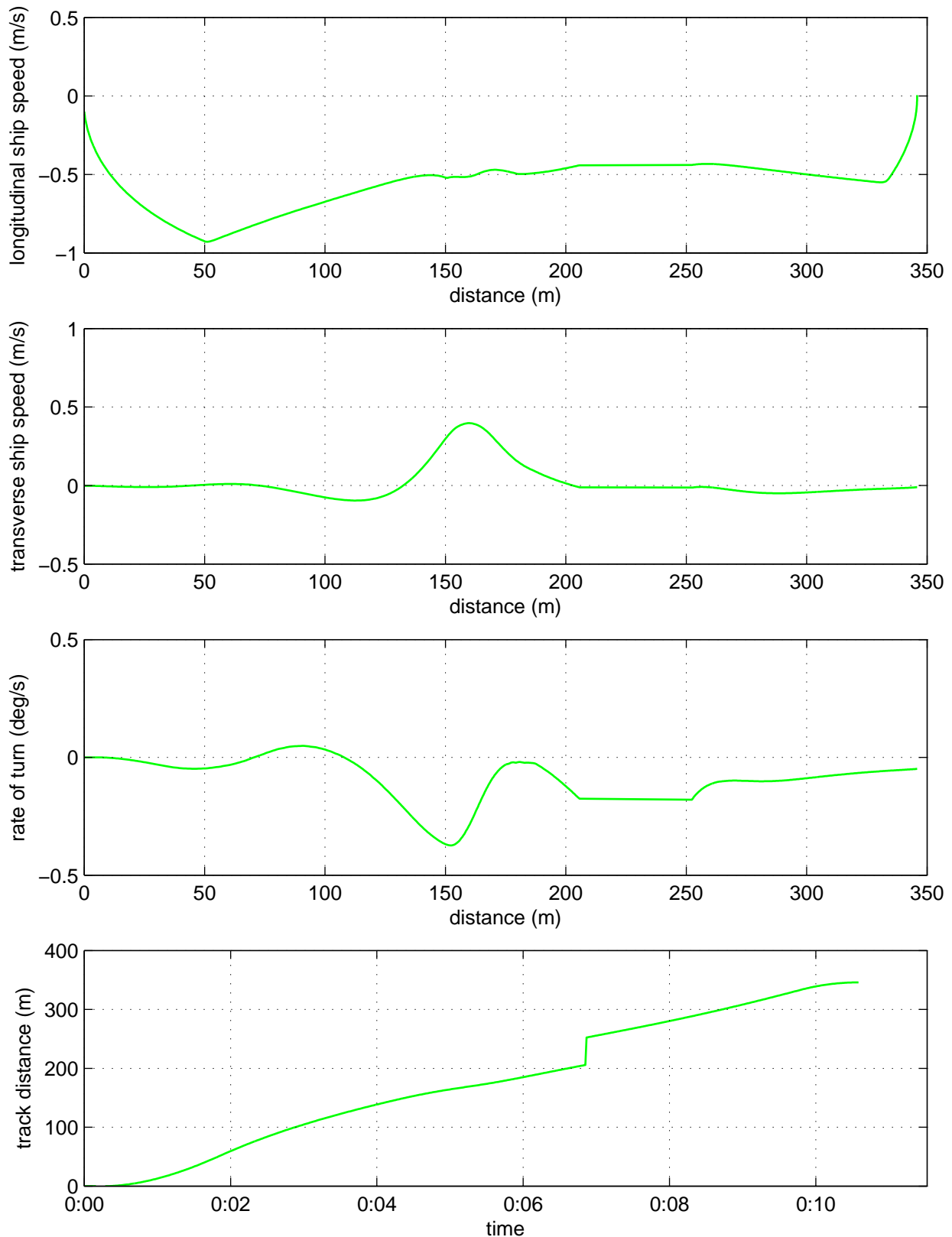
Current: 2.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 60b

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 11

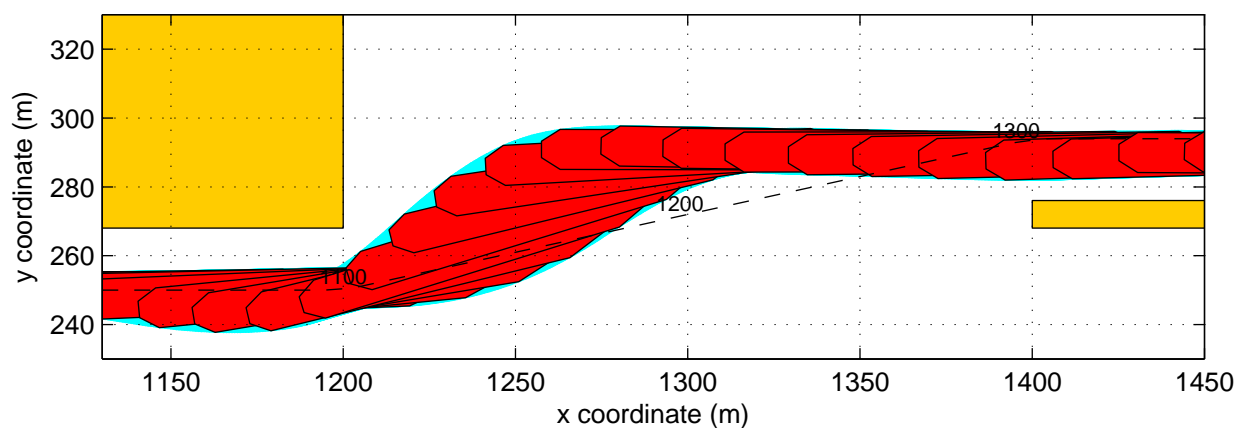
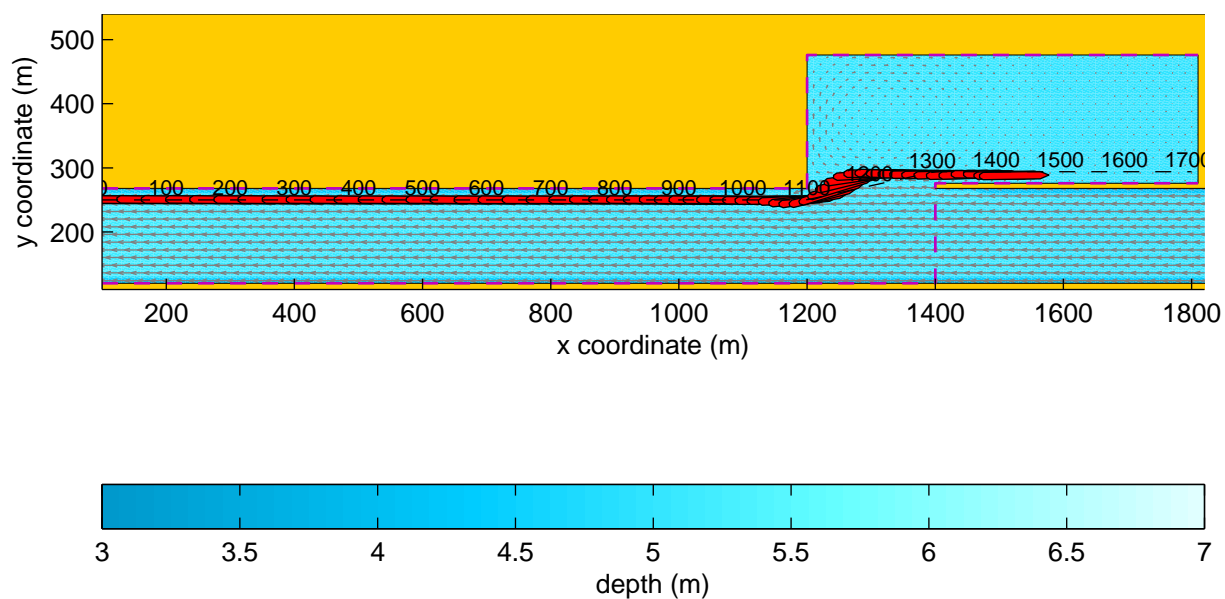
Current: 2.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 60b

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 12

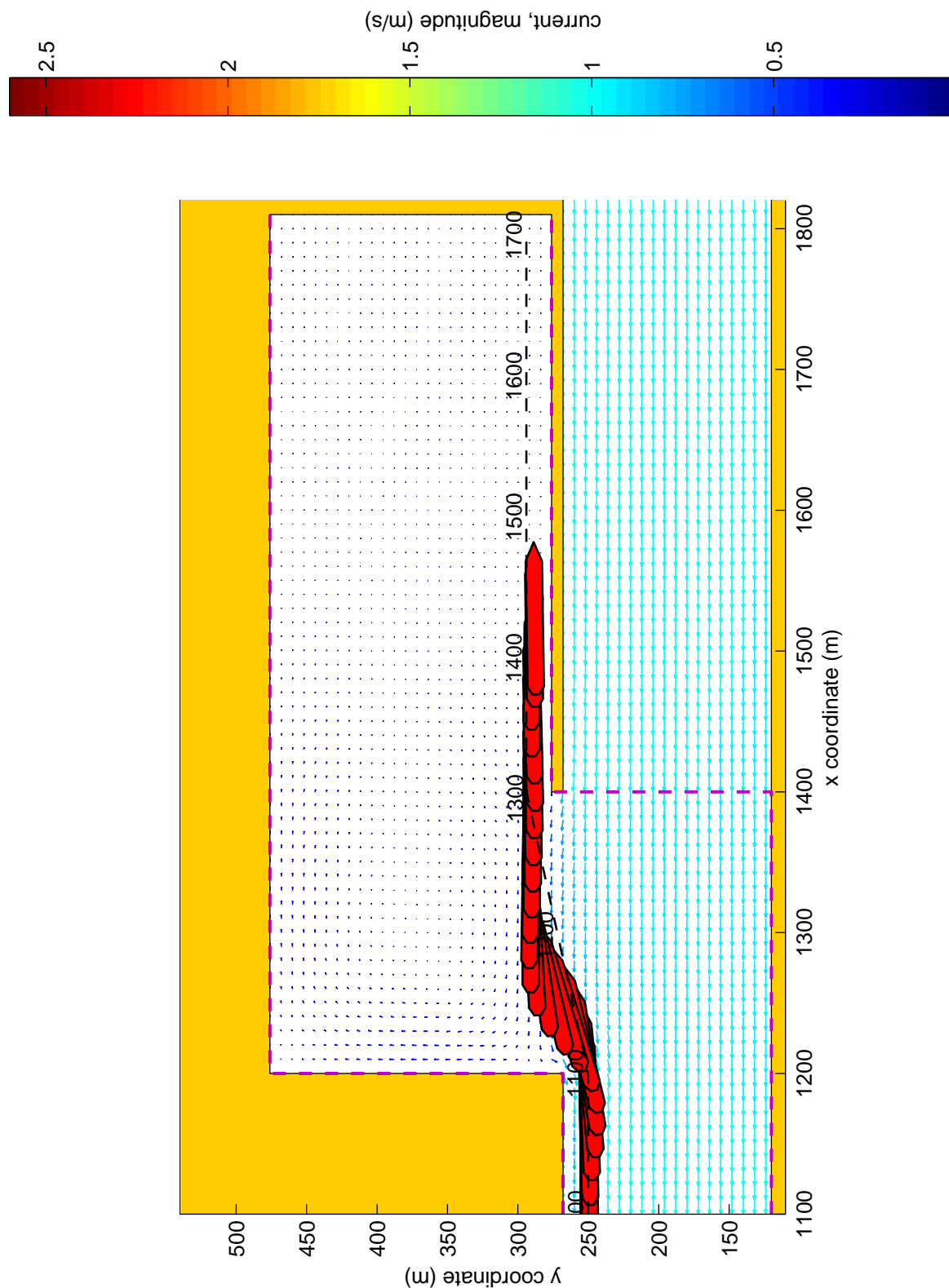
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 61

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 12

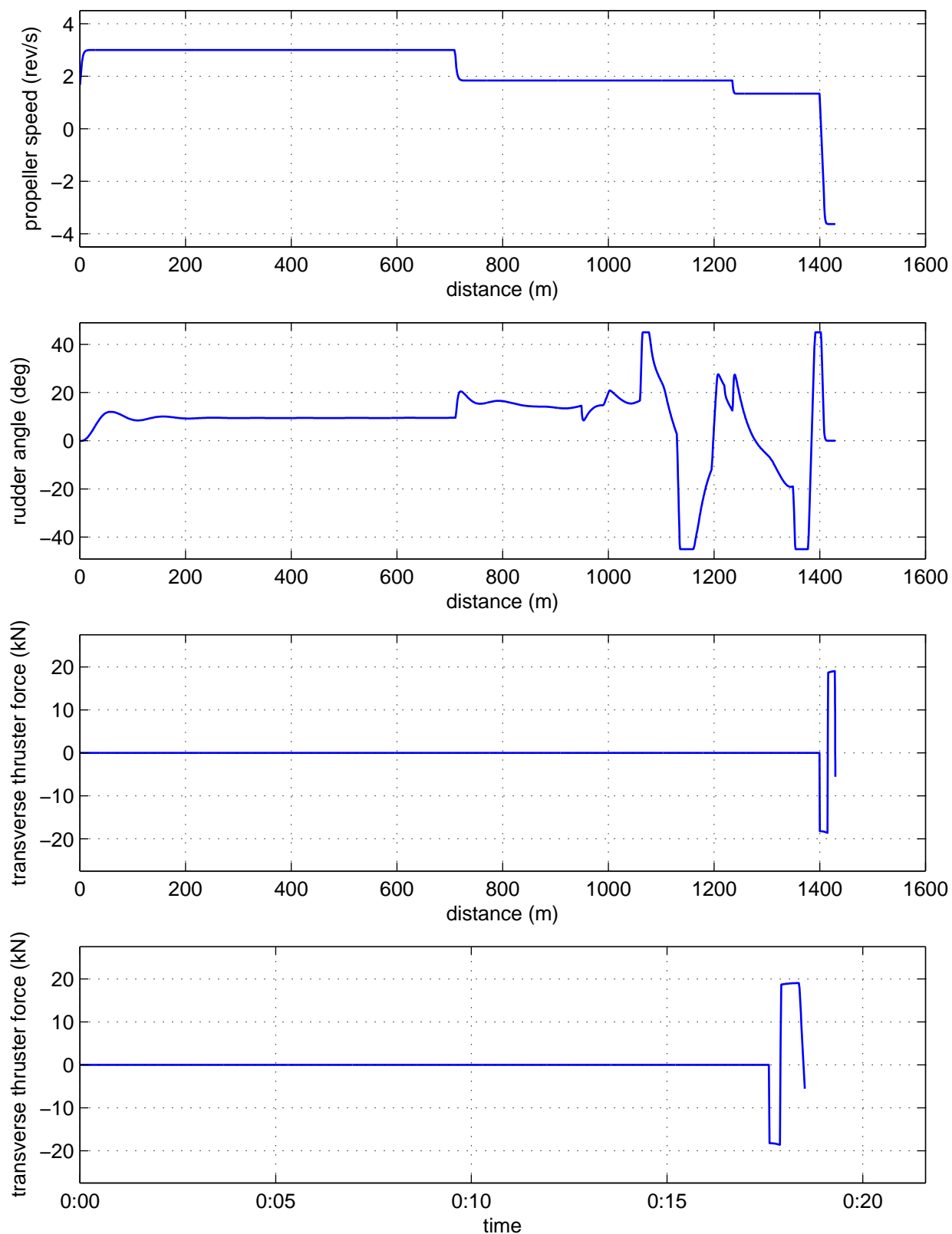
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 61

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 12

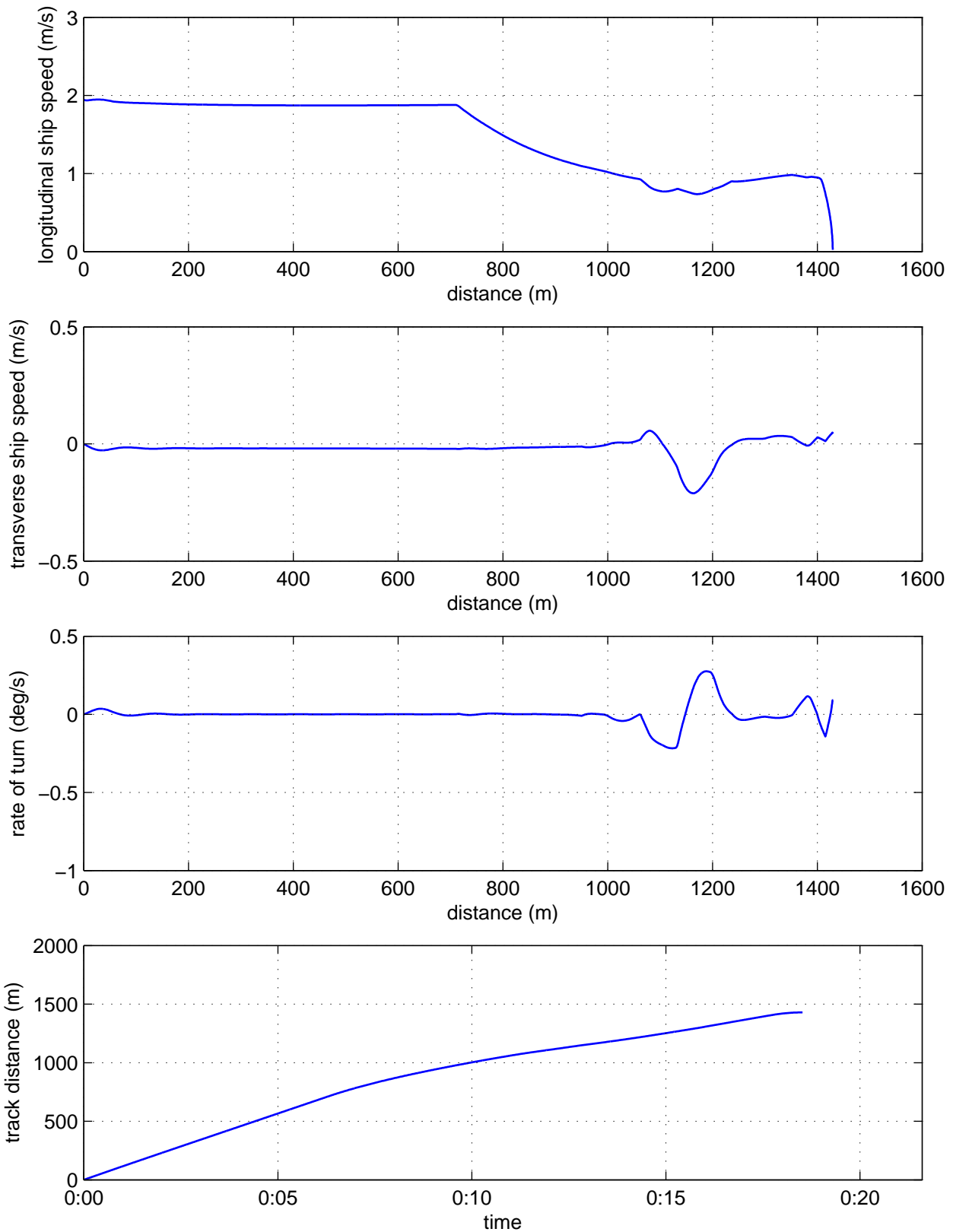
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 61

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 12

Current: 1.0 m/s

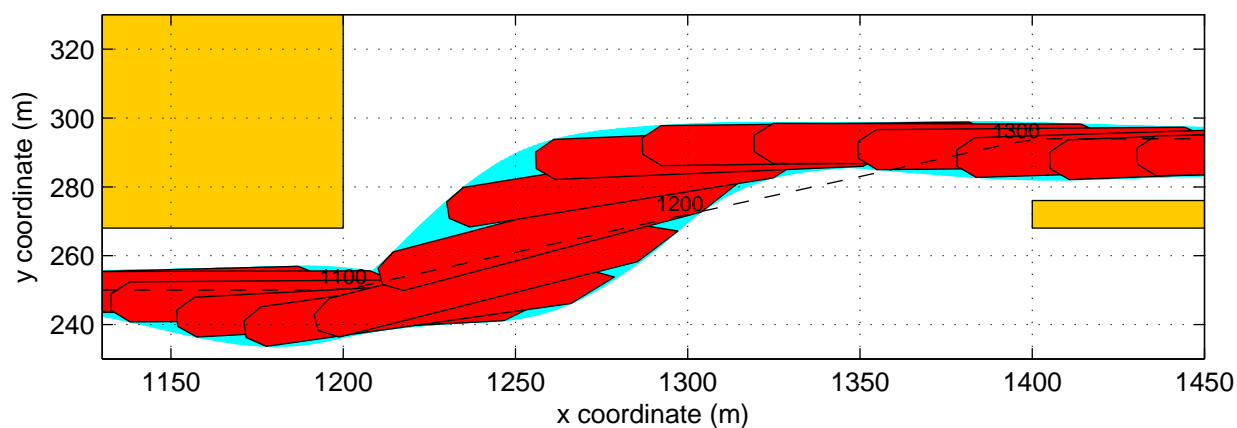
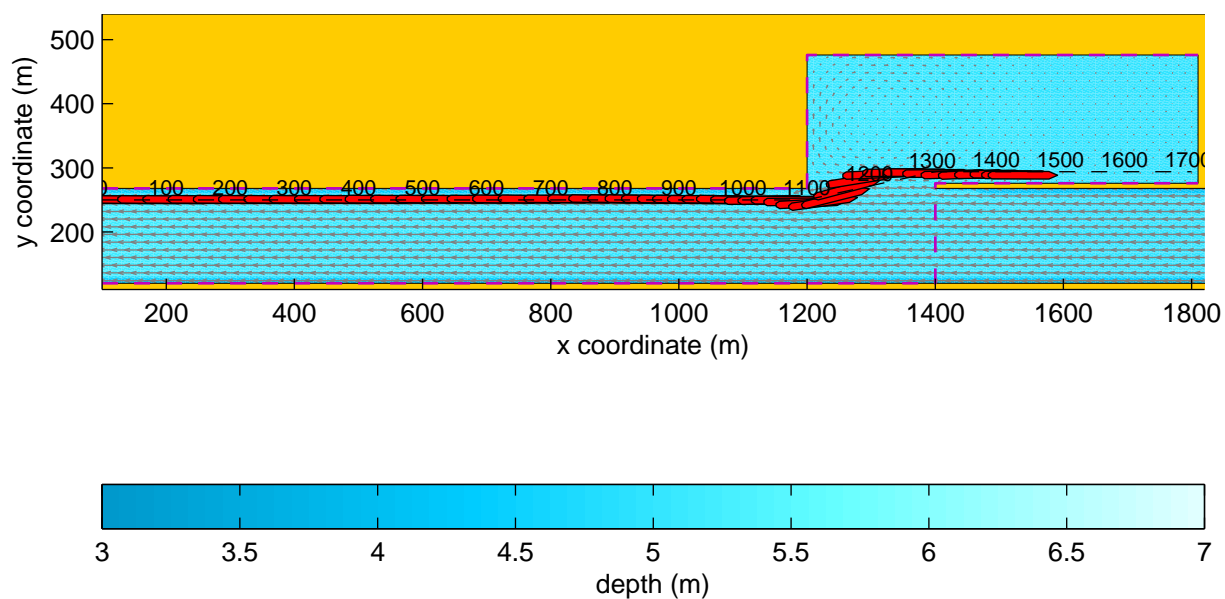
SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 61

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 12

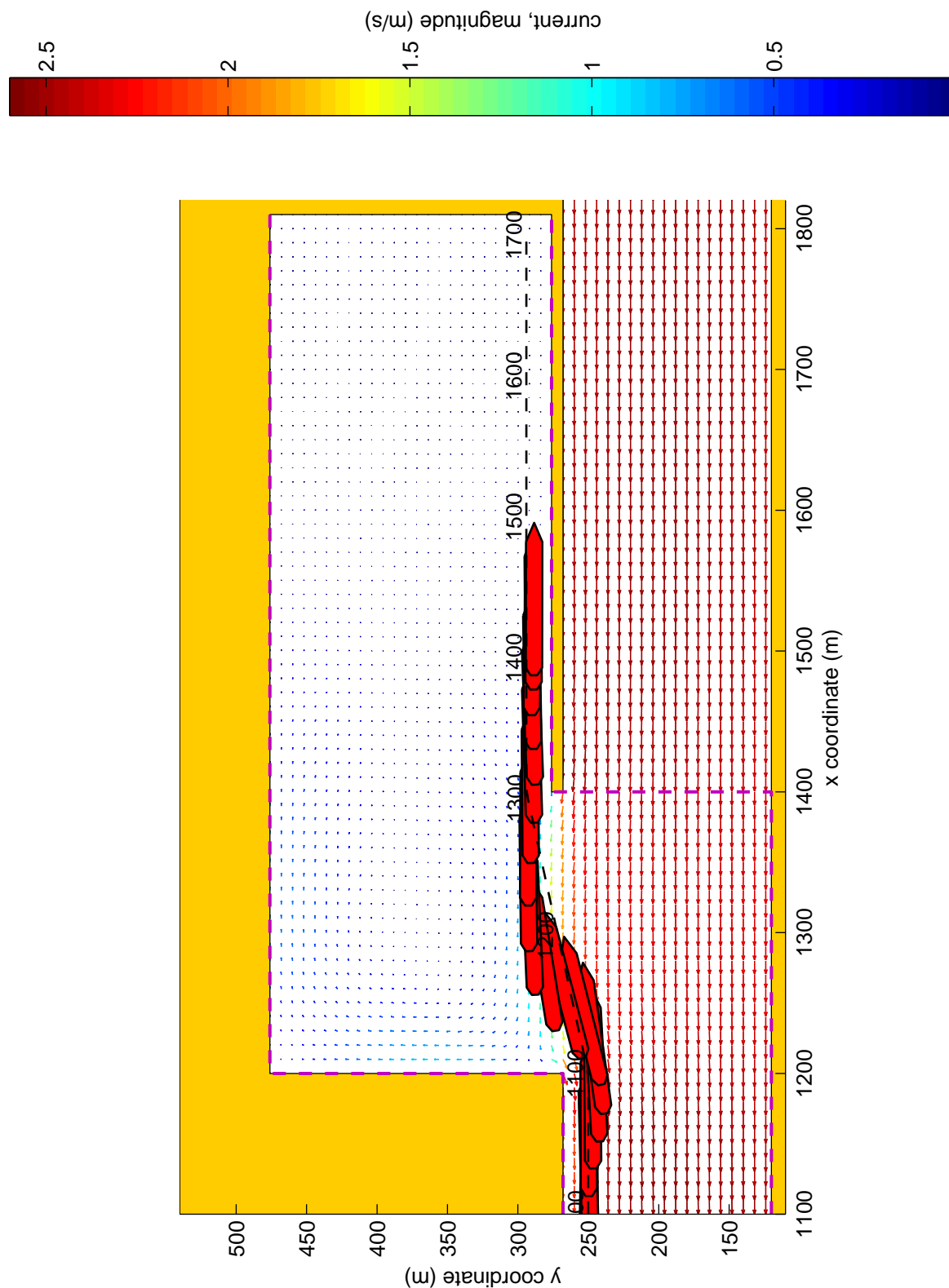
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 62

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 12

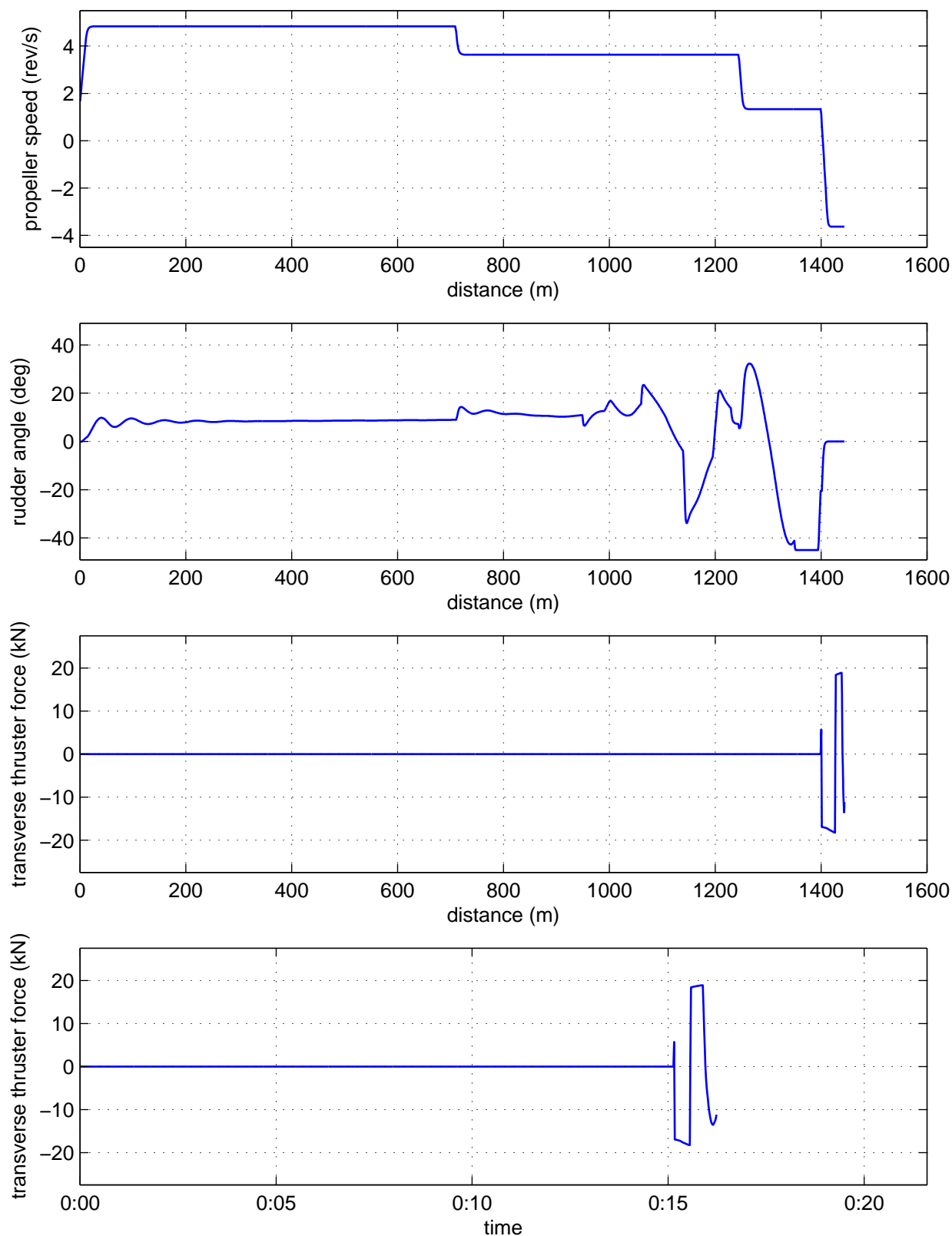
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 62

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 12

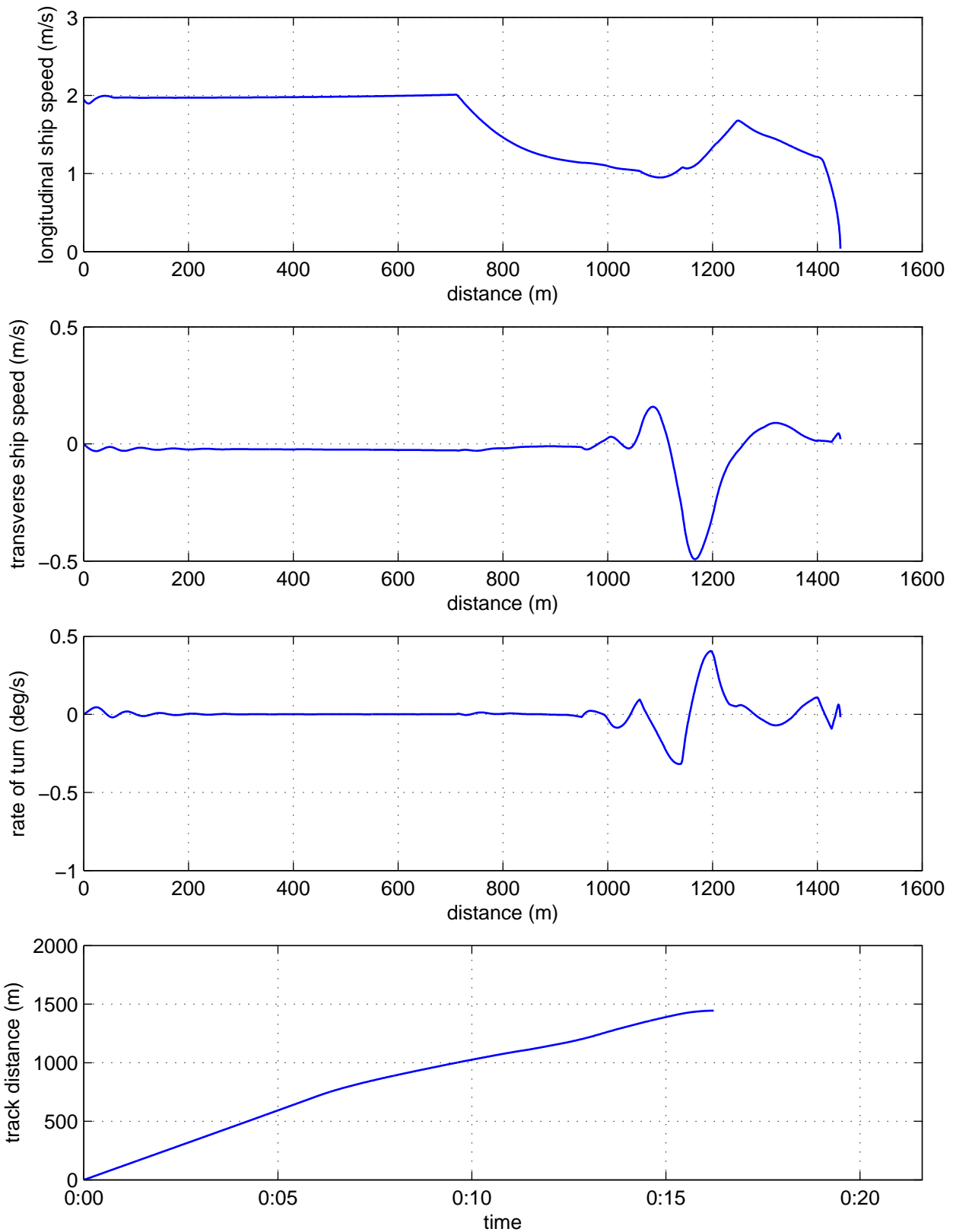
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 62

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 12

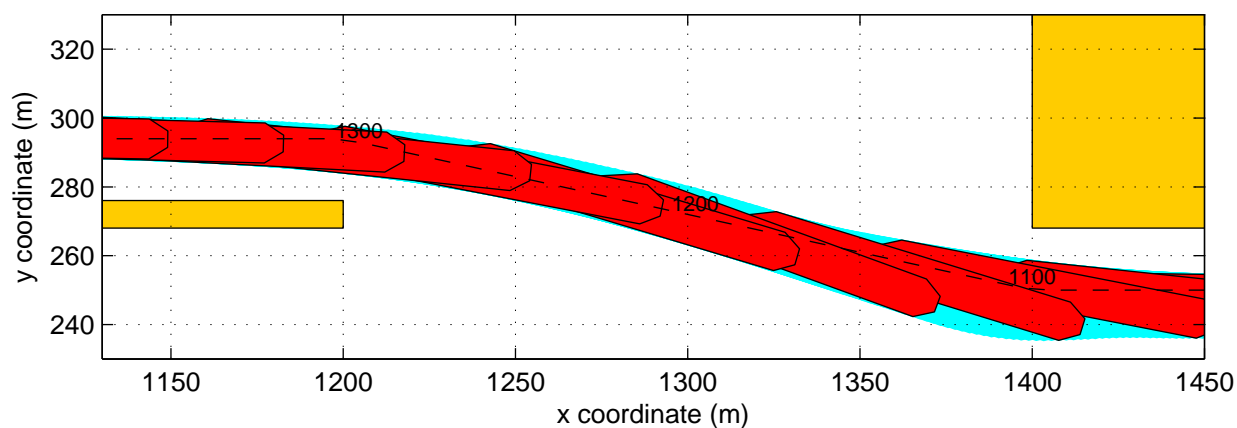
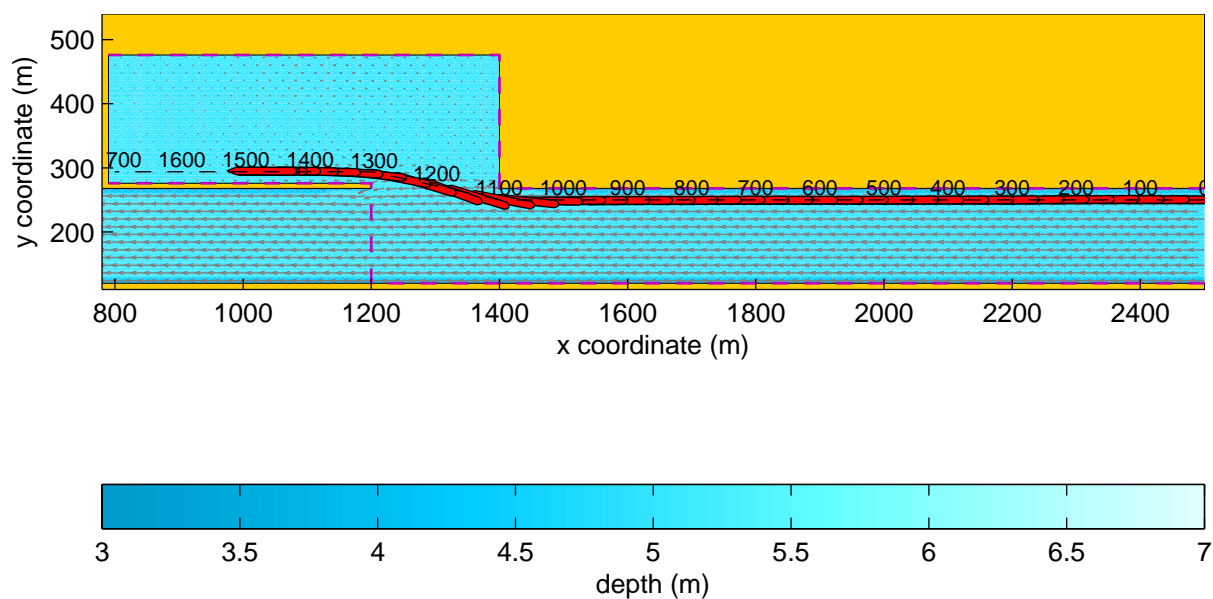
Current: 2.5 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 62

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 13

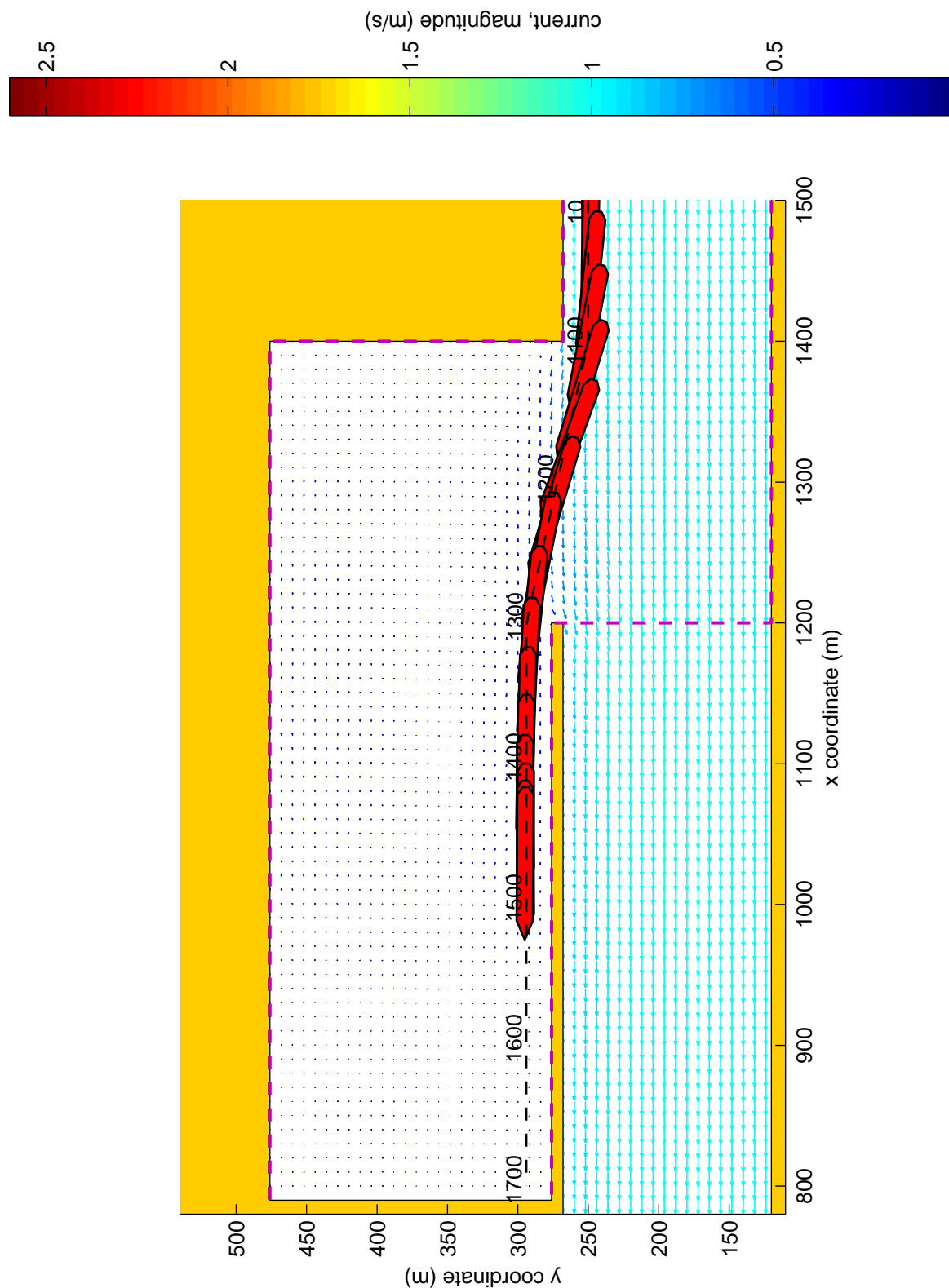
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 63

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 13

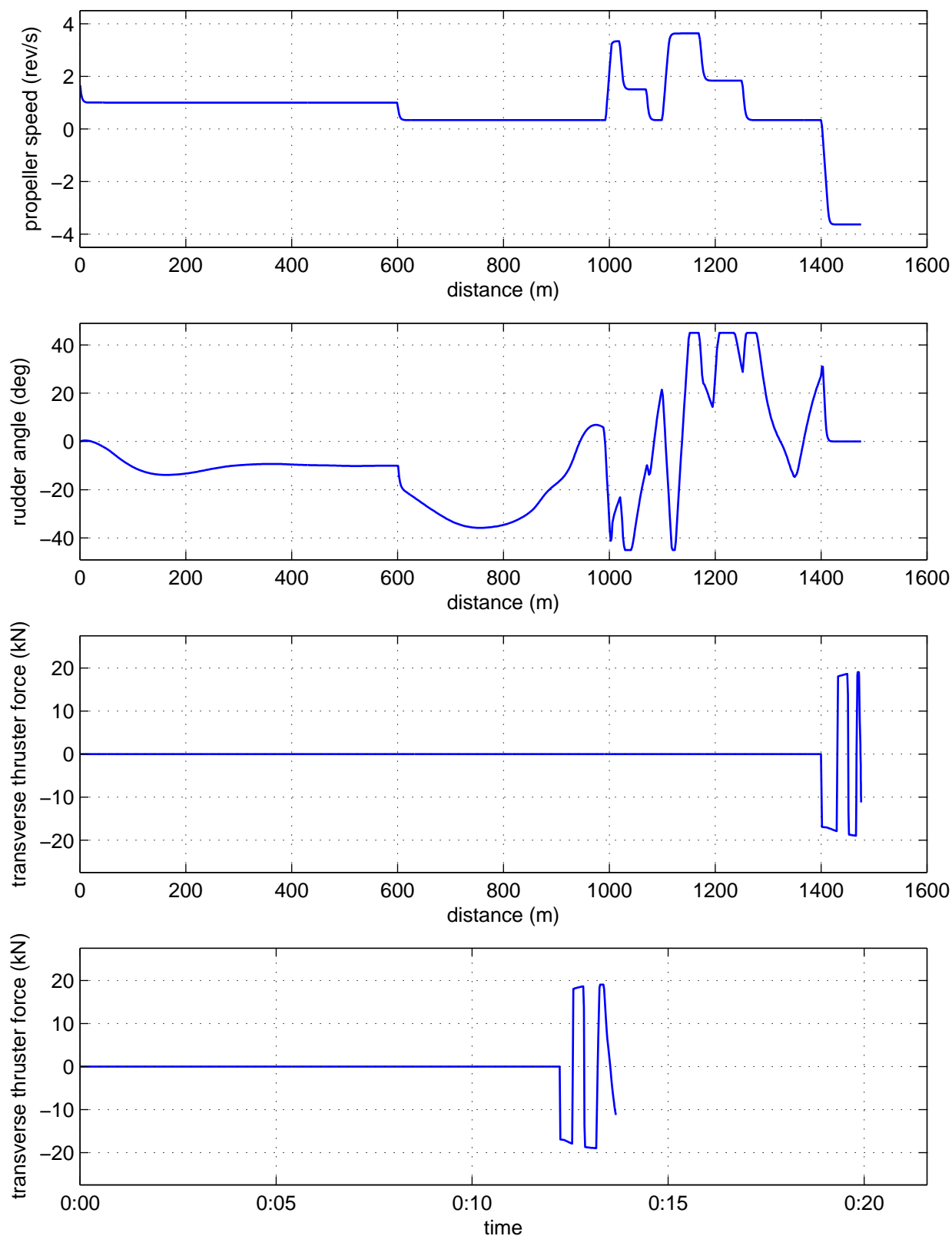
Current: 1.0 m/s

SHIPMA 7.4.2

Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.

Run 63

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 13

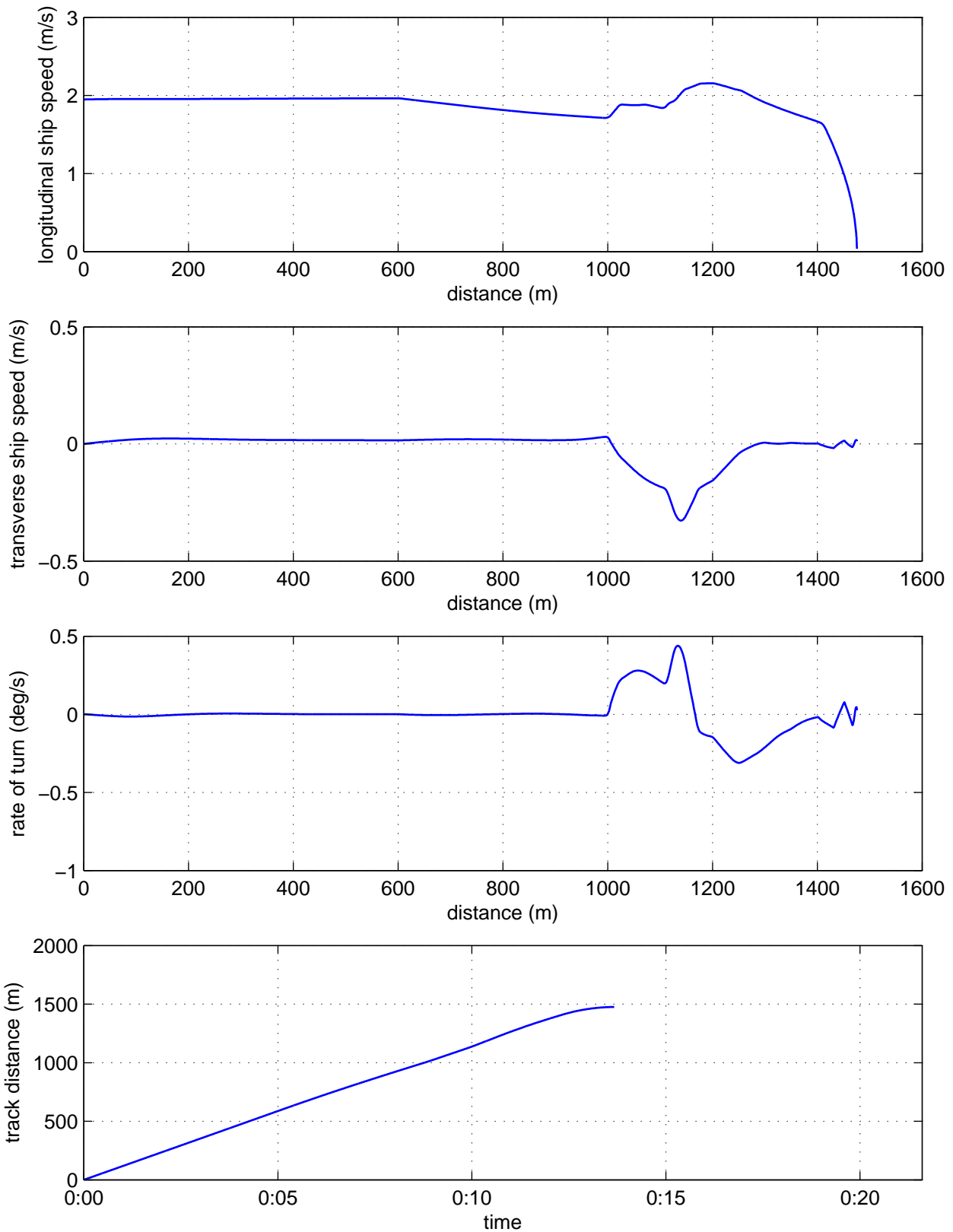
Current: 1.0 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 63

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 13

Current: 1.0 m/s

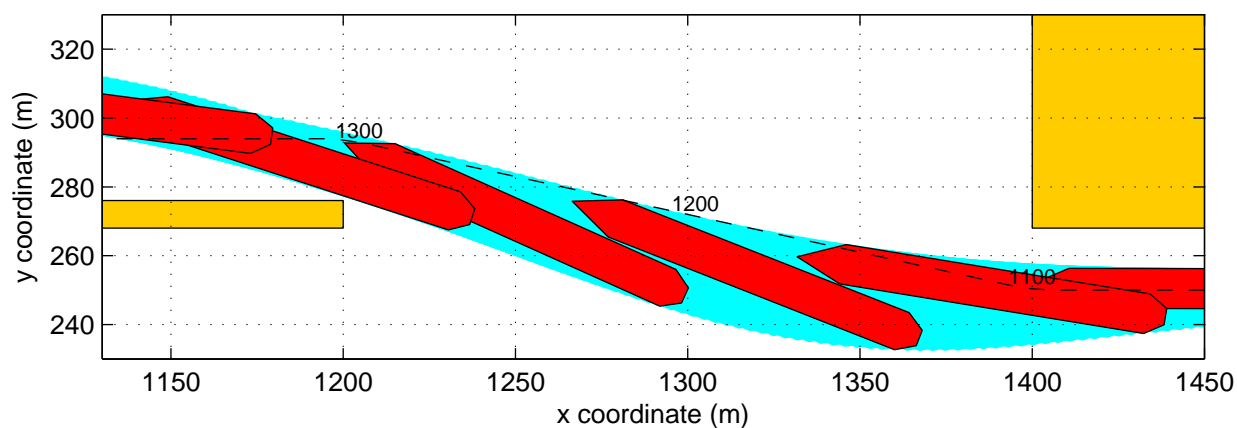
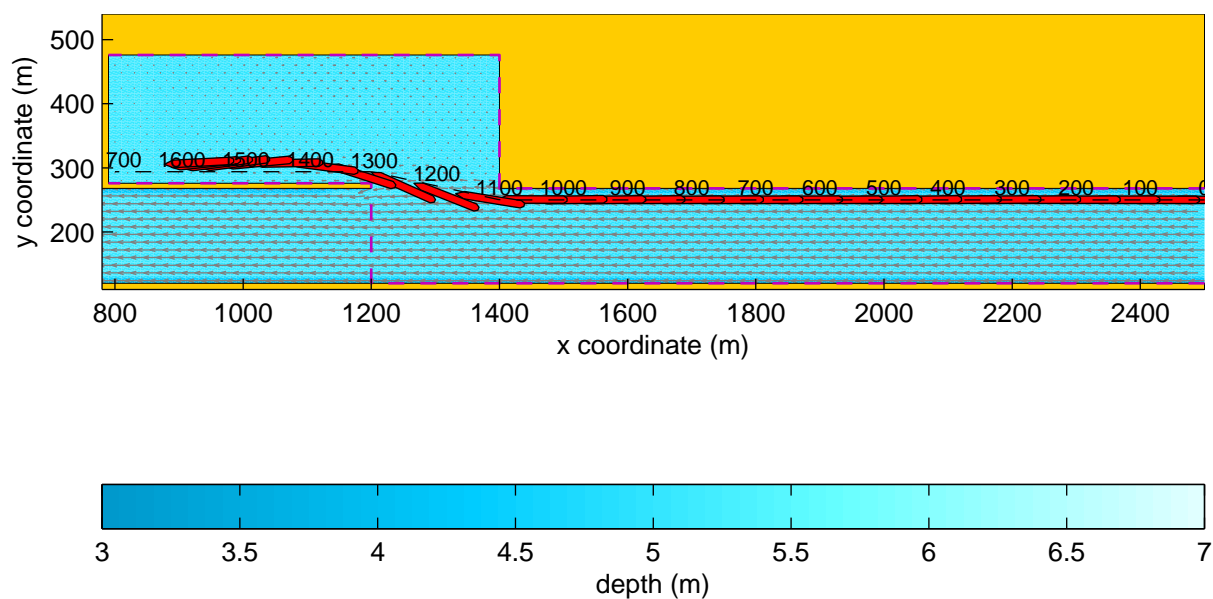
SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 63

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 13

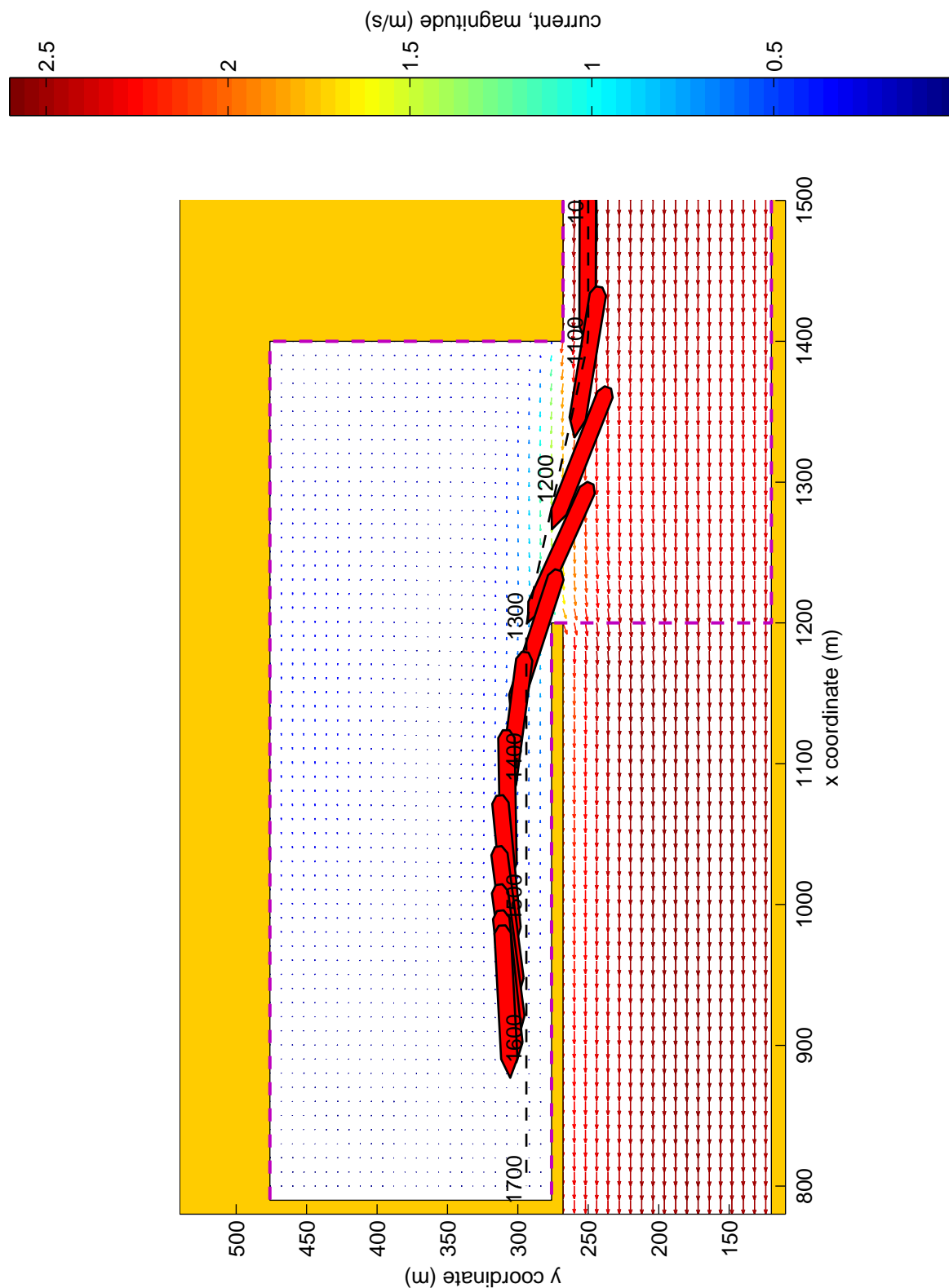
Current: 2.5 m/s

SHIPMA 7.4.2

**Buckers, M.D. (2017). TU Delft MSc Thesis in cooperation with MARIN.**

Run 64

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 13

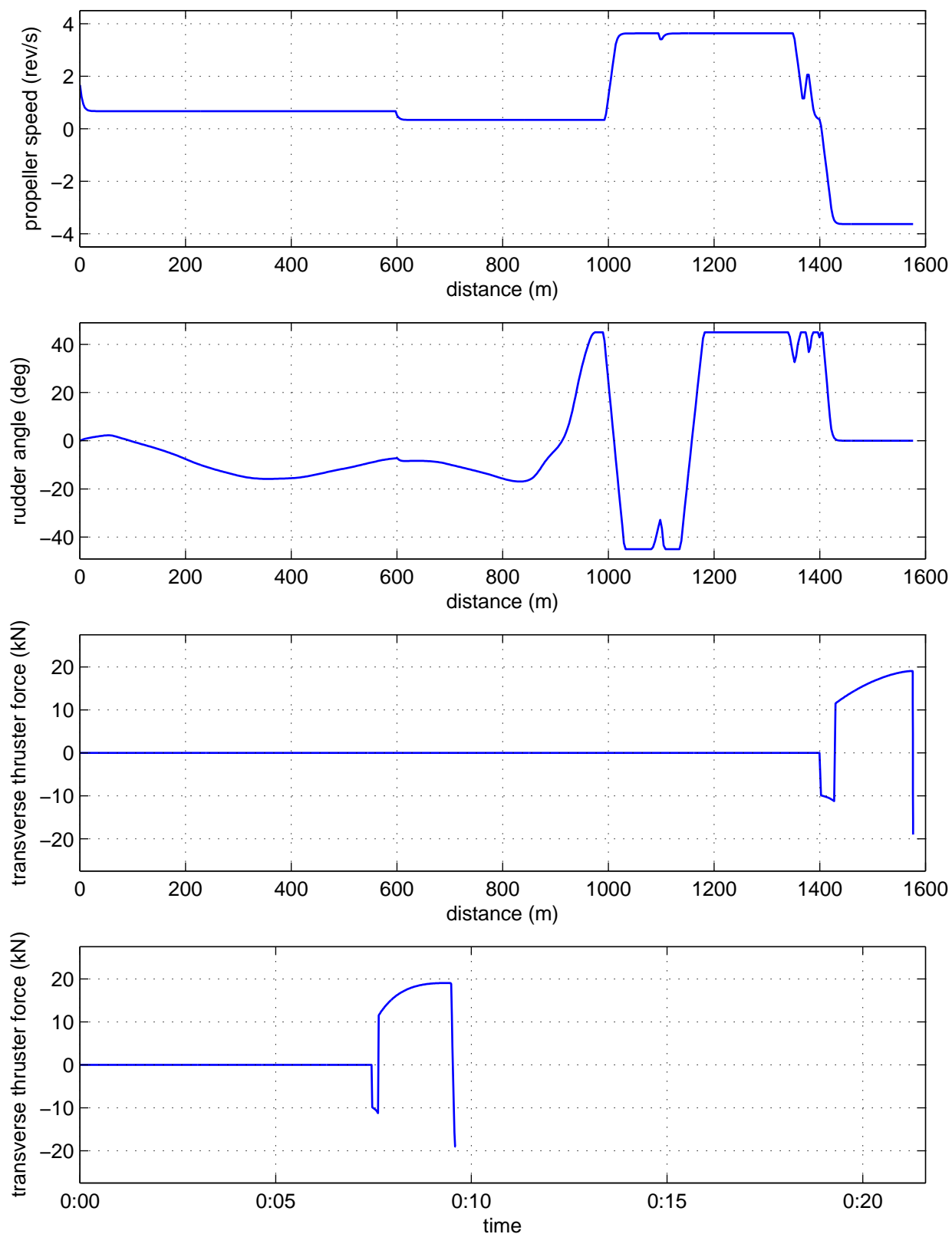
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 64

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 13

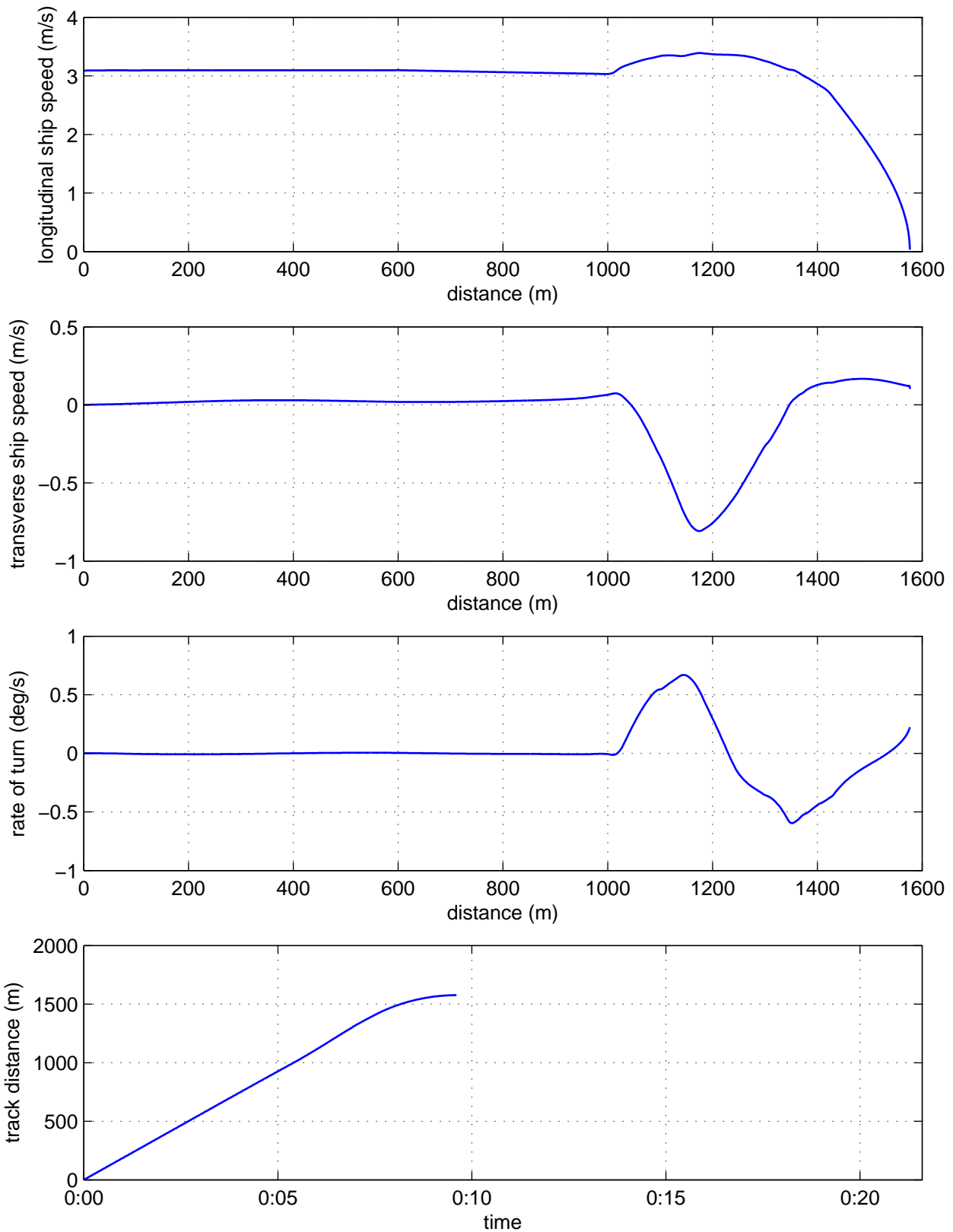
Current: 2.5 m/s

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Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 13

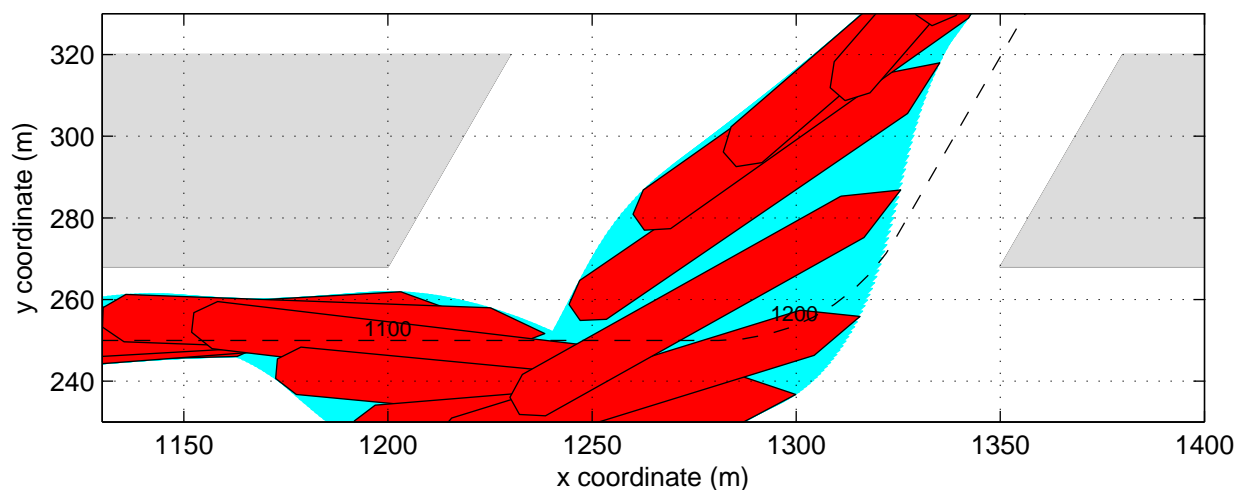
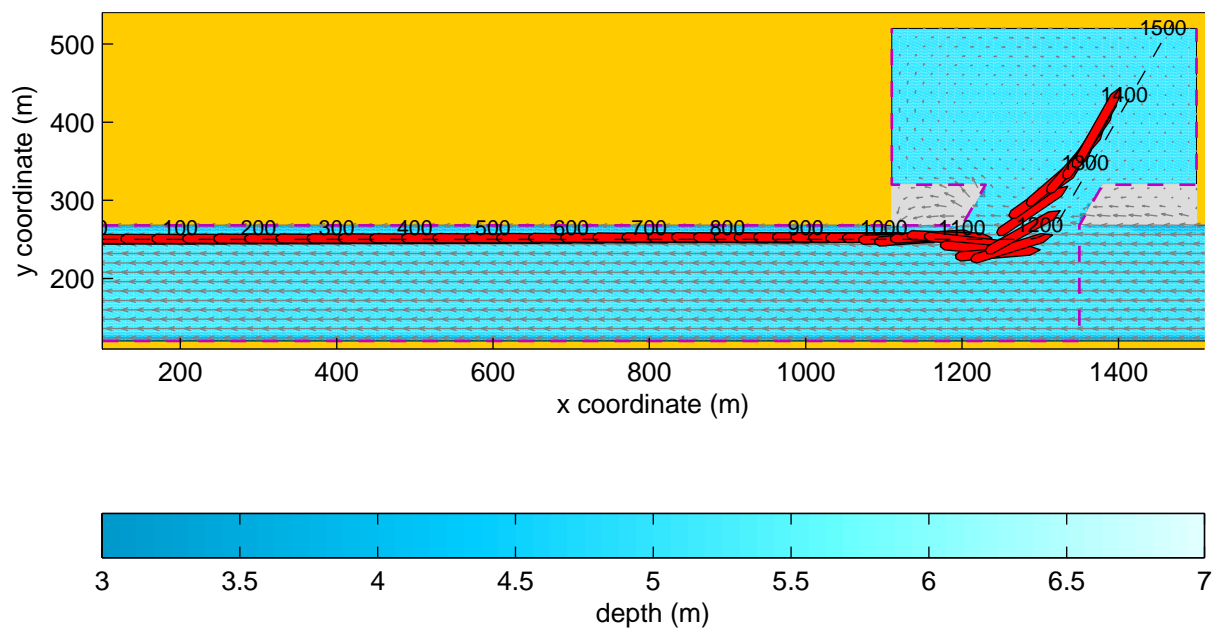
Current: 2.5 m/s

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Run 64

Figure C



Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 14

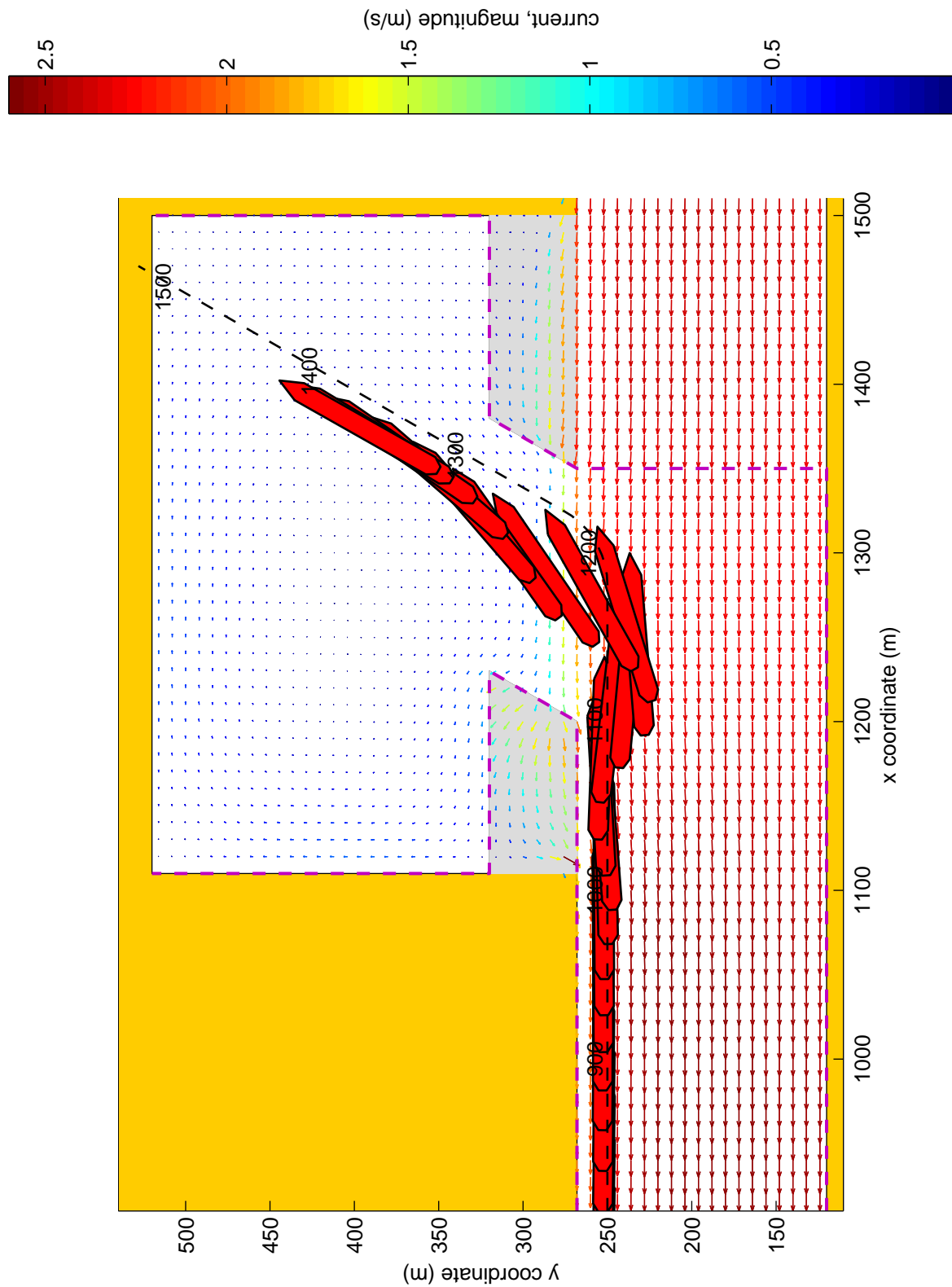
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 65

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 14

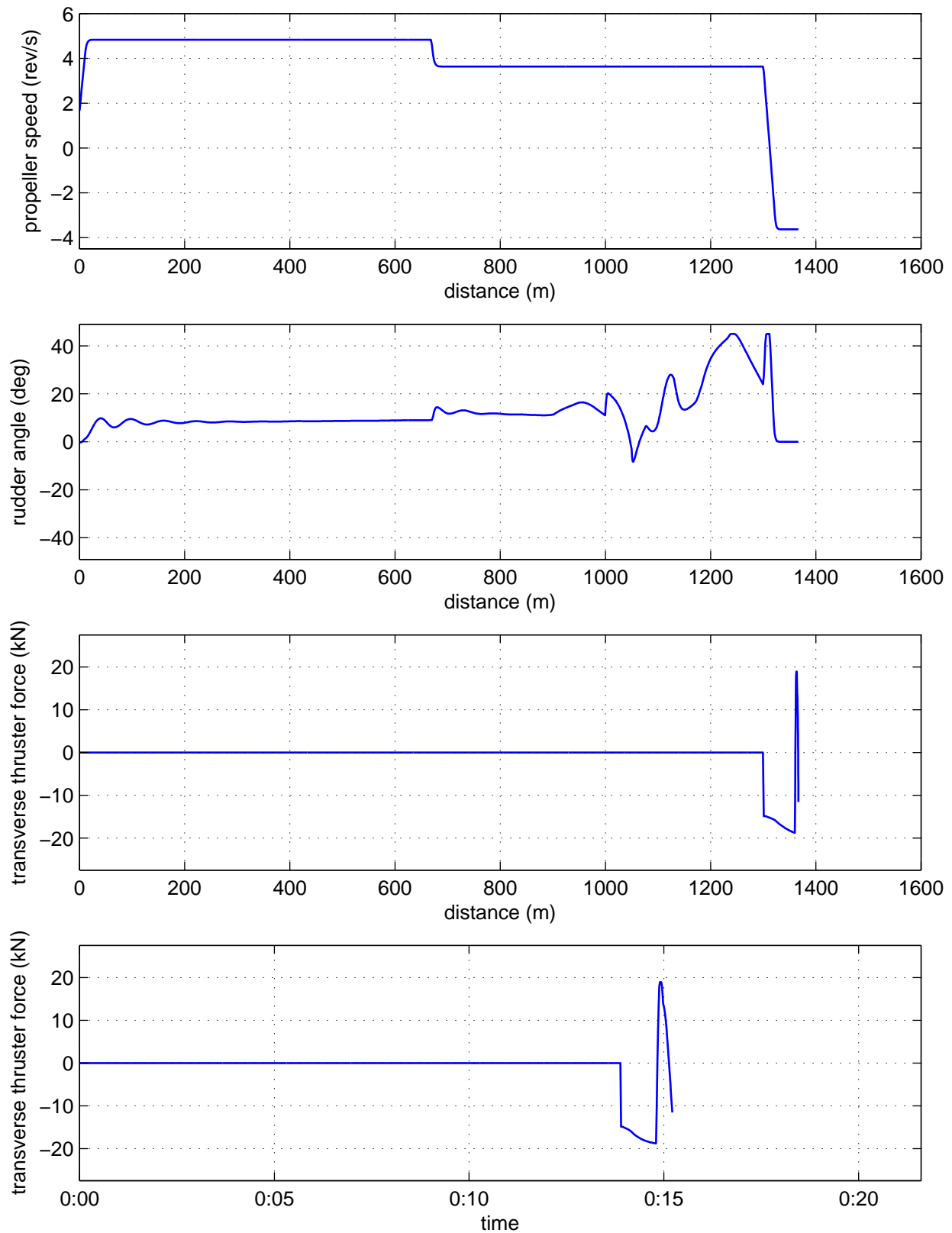
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 65

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 14

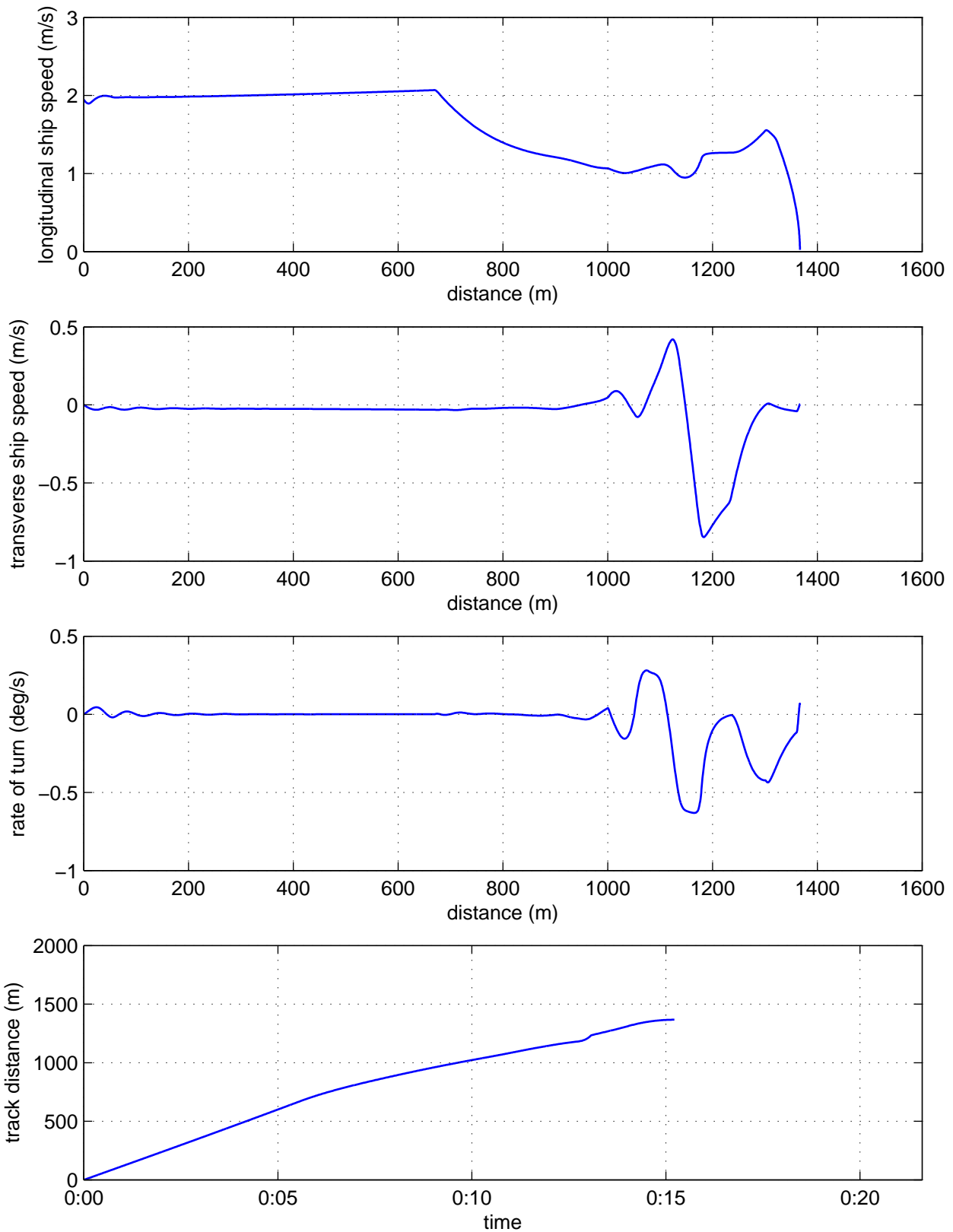
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 65

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 14

Current: 2.5 m/s

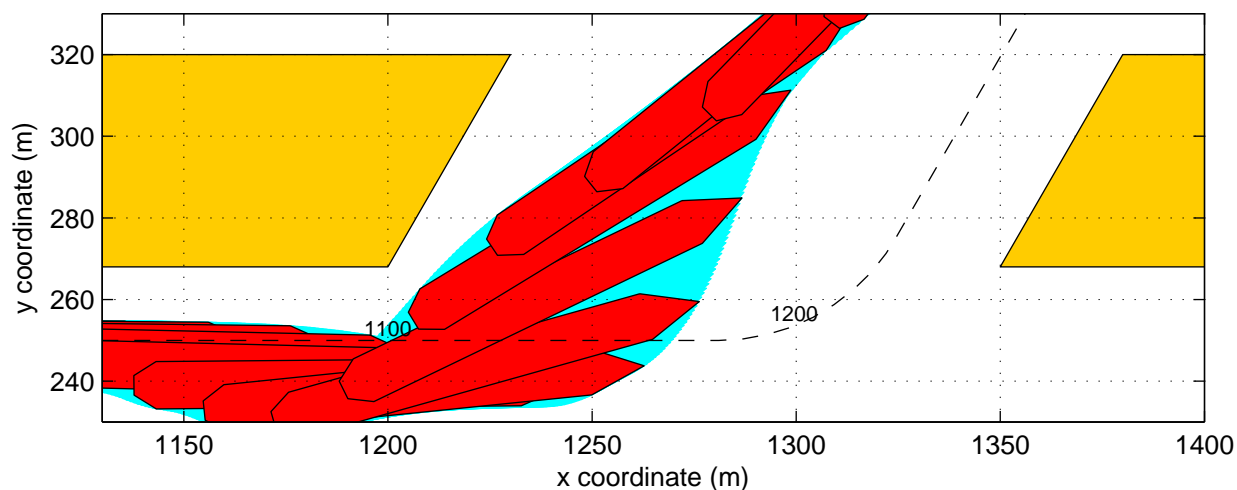
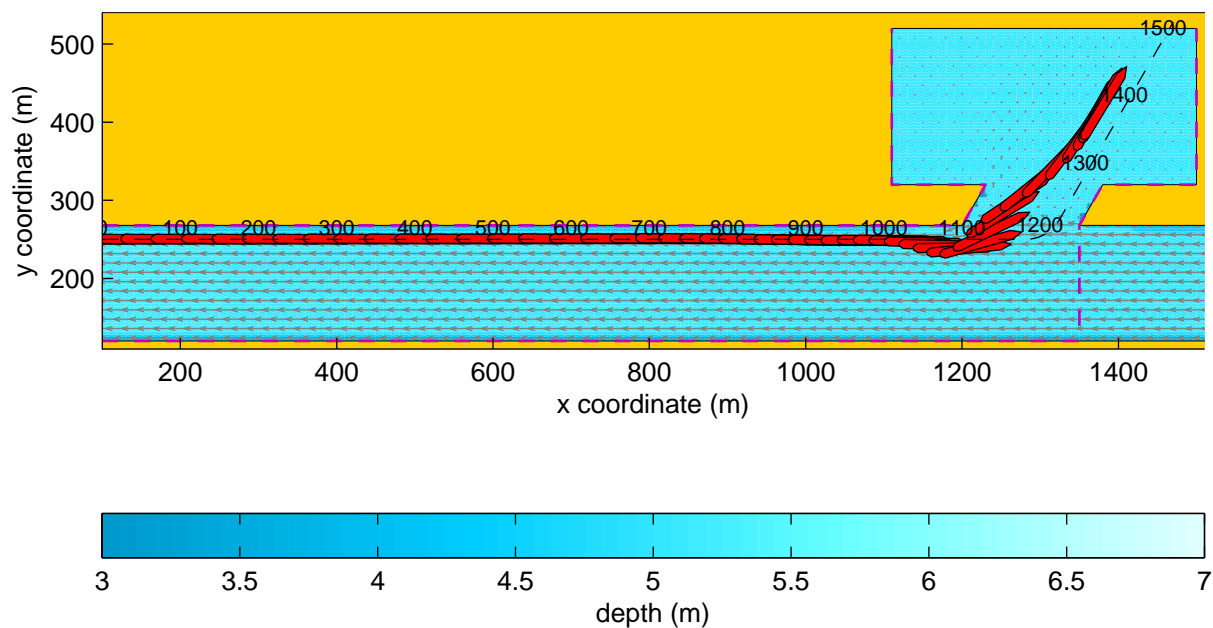
SHIPMA 7.4.2

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Run 65

Figure C





Overview plot: Implemented track (dashed black line), bank suction lines (dashed purple lines), ship snapshots, water depth and current.  
 Close-up plot of port entrance: Implemented track (dashed black line) swept path (blue area) and ship snapshots.

Layout nr. 6

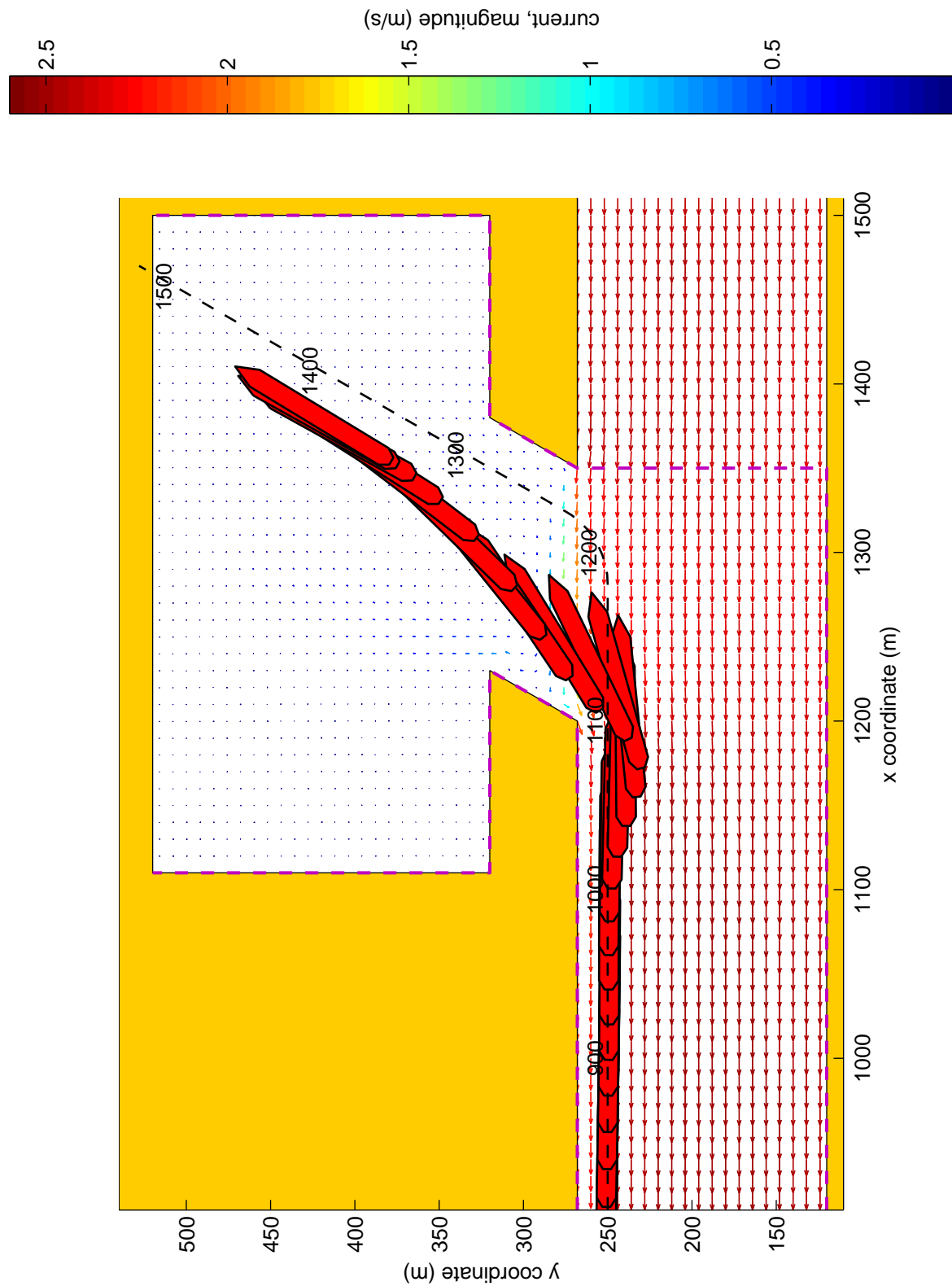
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 66

Figure A1



Close-up plot around port: Implemented track (dashed black line), bank suction lines (dashed purple lines), current and ship snapshots.

Layout nr. 6

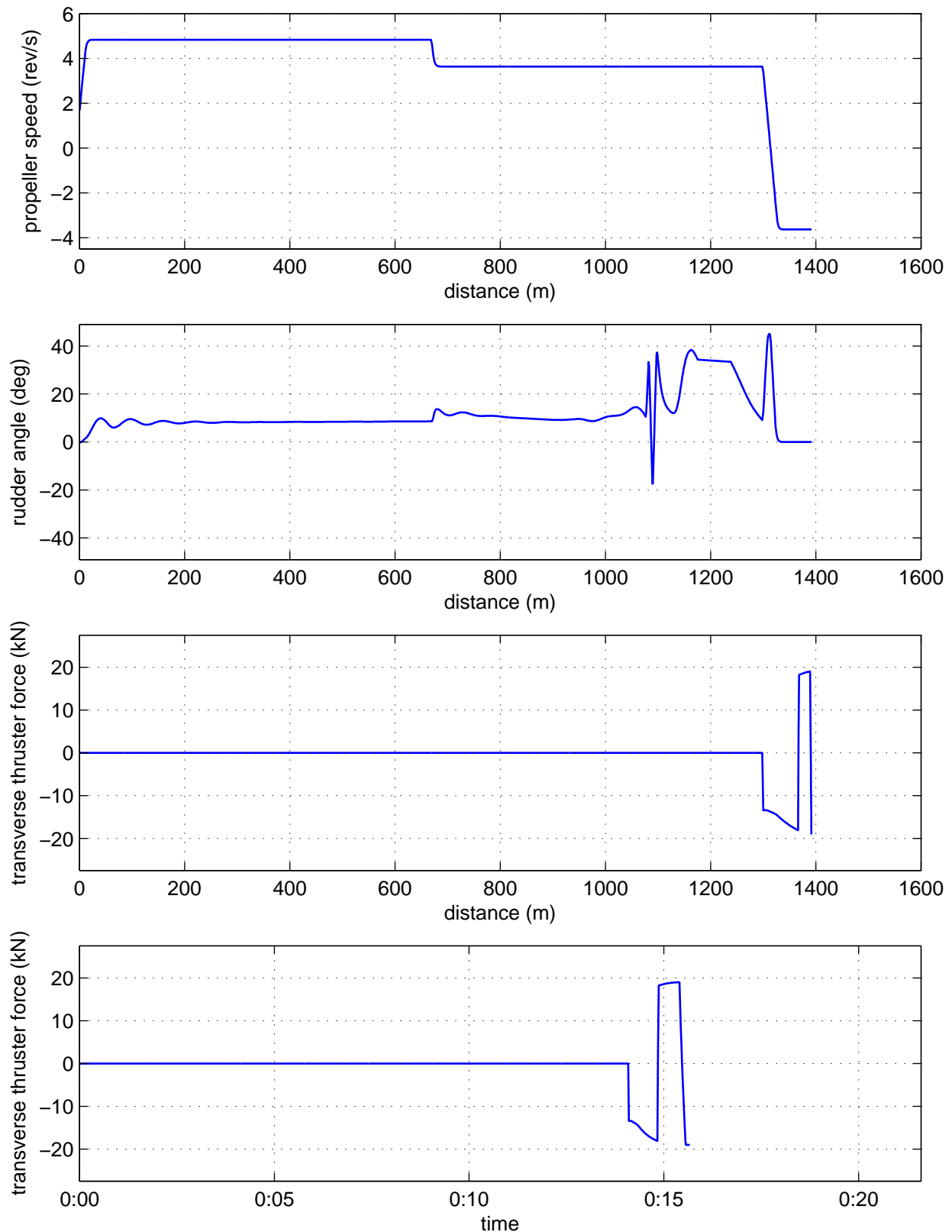
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 66

Figure A2



Data plots: Propeller speed, rudder angle, transverse thruster force plotted against the distance and transverse thruster force plotted against the time.

Layout nr. 6

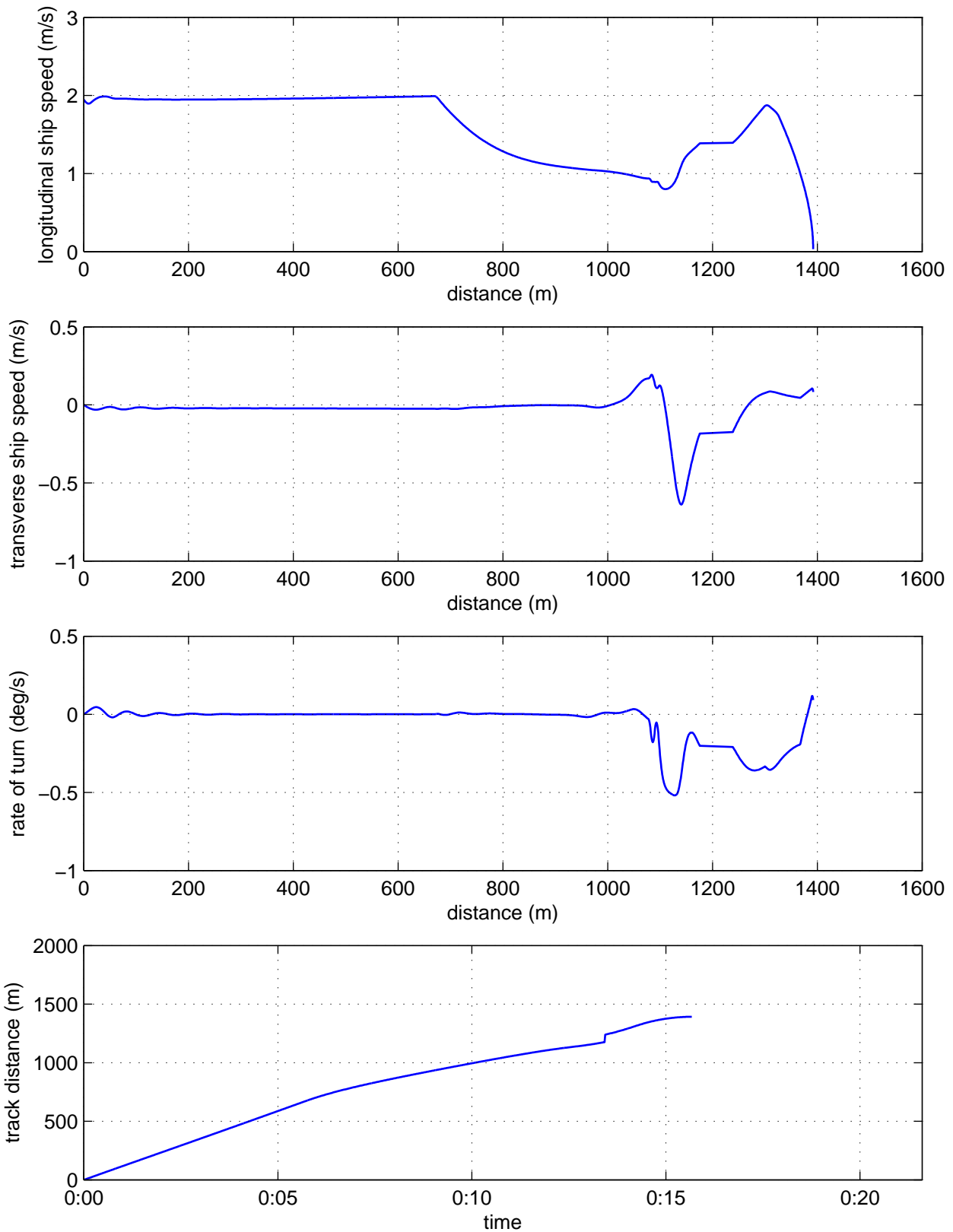
Current: 2.5 m/s

SHIPMA 7.4.2

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Run 66

Figure B



Data plots: Longitudinal ship speed, transverse ship speed, rate of turn plotted against the distance and the track distance plotted against the time.

Layout nr. 6

Current: 2.5 m/s

SHIPMA 7.4.2

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Figure C