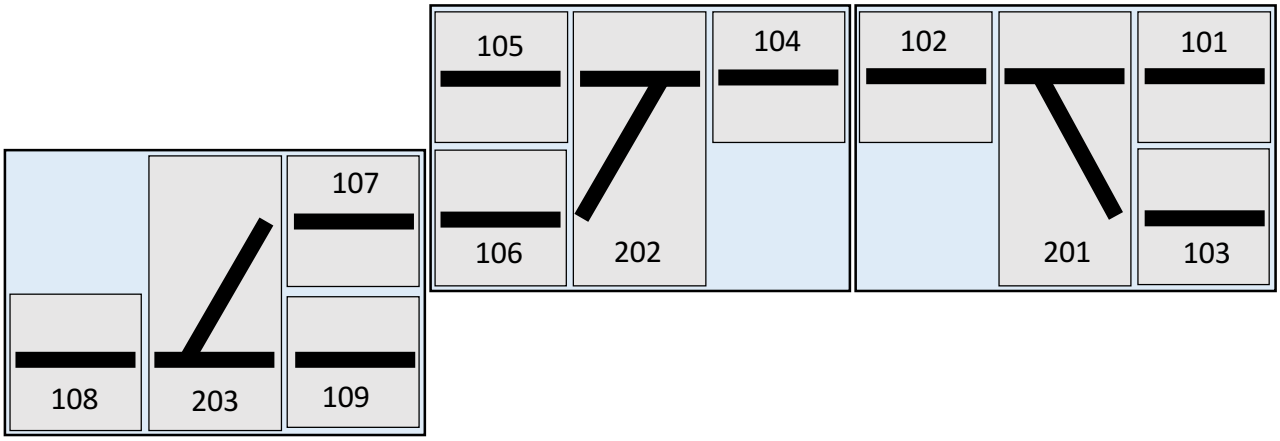
Turnout Safety Module test scenarios

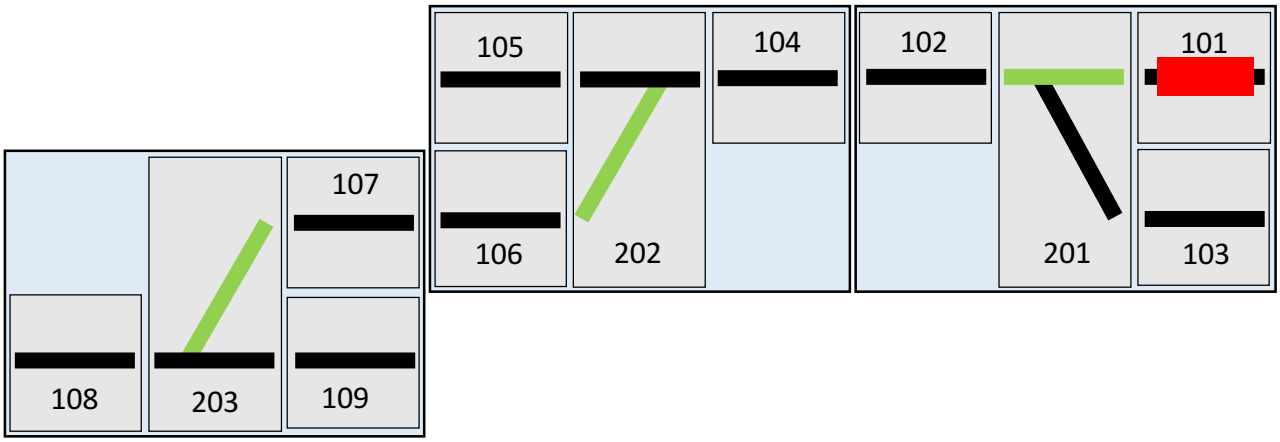
We defined 5 different scenarios. The track layout is the same by each one except the last one, the others only differ in the situation (state of the turnouts, location of the trains). The default track layout and notation is the following:



We numbered the turnouts and sections from right to left and counter clockwise. All in all 3 turnouts and 9 section took part as a system in the tests.

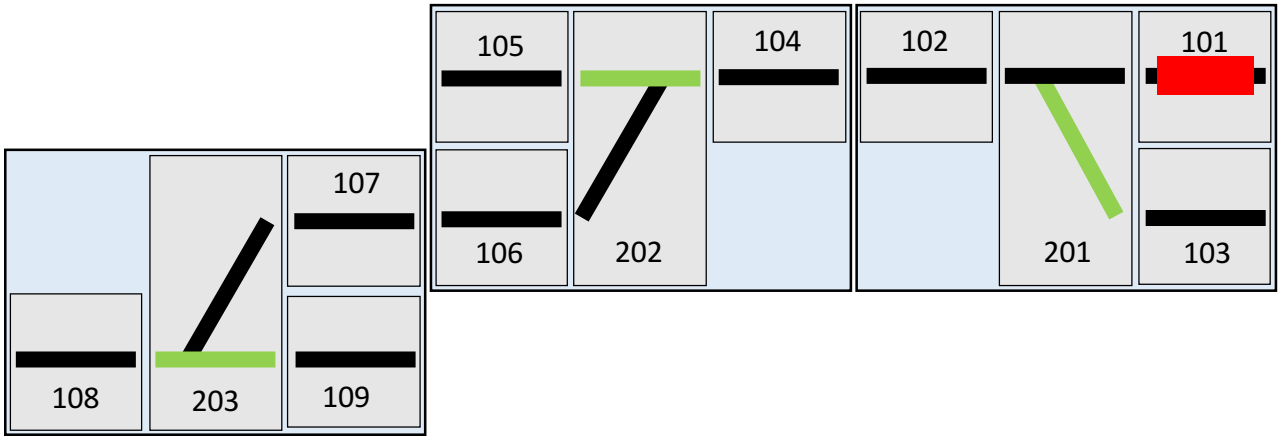
Case 1

This scenario is the simplest. Only one train is present here: it appears at section 101 and goes from there to 108. We merely want to test if the modules transmit their signals correctly and the train is able to go through the defined track. It does not meet any other train; the turnouts' default states are appropriate in respect of the movement of the train so they are not expected to switch in this case. These states are colored green and the red rectangle shows the starting position of the train:



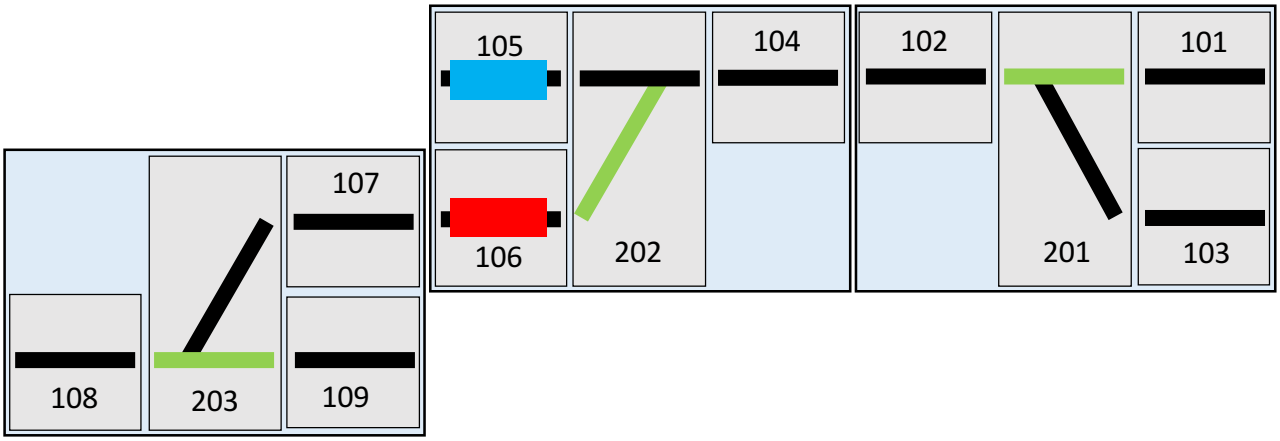
Case 2

This case is similar to the first one except the default states of the turnouts: they are not always in the appropriate position so they need to switch. Turnout 201 switches from straight to divergent then back to straight, 202 and 203 from straight to divergent and the train goes from 101 to 108 again. The turnouts switch right after the train arrives to them.



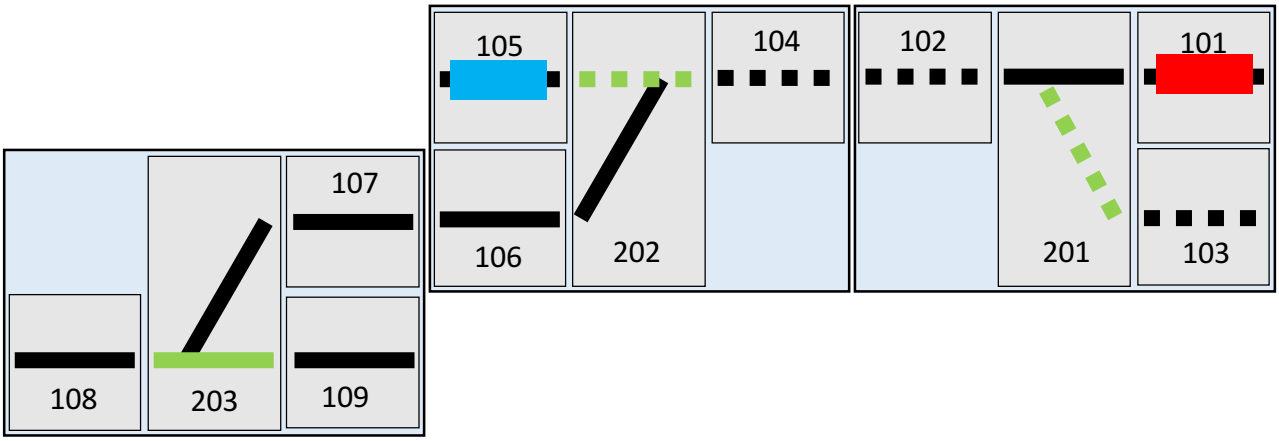
Case 3

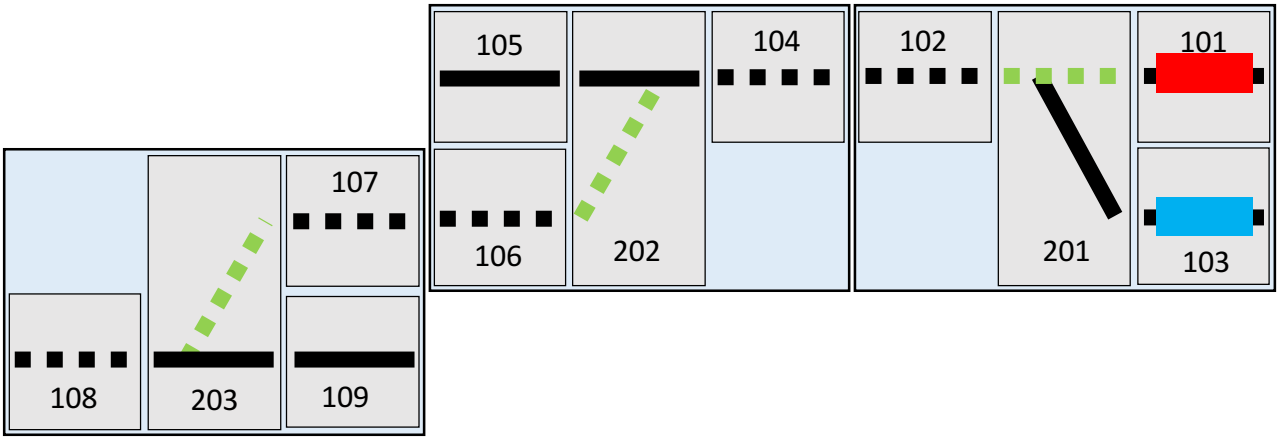
This case is different from the previous ones: this time we have two trains but they appear in different times so they should not disturb each other while moving from start to end point. The red train's course is unchanged; it goes first as seen before. The blue train appears later on section 105 but this time the red one is already on section 106 so they will not meet. The blue train's destination is section 103.
The expected behavior: turnouts switch accordingly and the two trains will not conflict.



Case 4

This time the two trains arrive at the same time to their starting location so they will share the same part of the track, we created a conflict that is needed to be avoided.
The expected behavior: the trains will not collide, the turnout module disables the sections so one of the two trains will be able to move first, after it when this part of the track is free the second train can move on.
A possible acceptable scenario (the dashed line means the route of the train which is free to move):

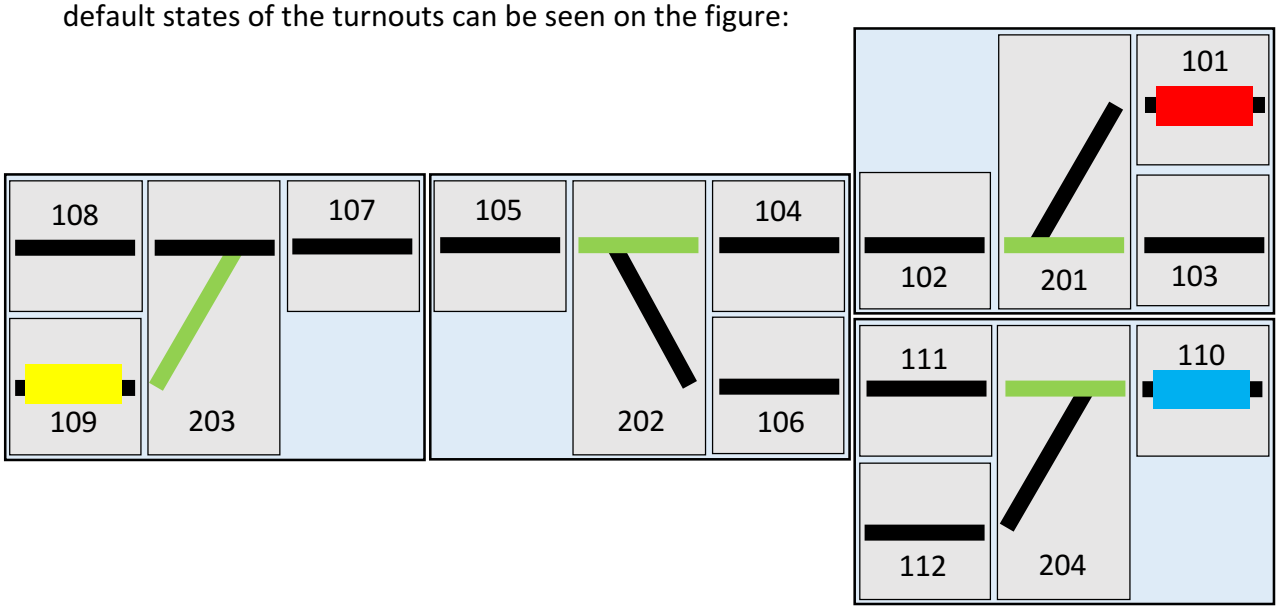




Case 5

In this case we created a completely different track layout in order to test another situation. This time we have 3 trains so things become a bit more complicated.

The red and blue trains appear first at the same time and they move parallel. The default states of the turnouts can be seen on the figure:



Both trains move from their starting position to section 108. Turnout 201 has to switch which means the blue train comes faster to their crossing (turnout 202). This turnout also has to switch.

The time when the blue train arrives onto section 105, a yellow train appears on section 109 and its destination is section 103. In this case turnout 203 has to switch and let the blue train and red train to pass. When they are gone, the yellow can continue its route.