GlueX Two Magnet Tagger

G. Yang University of Glasgow

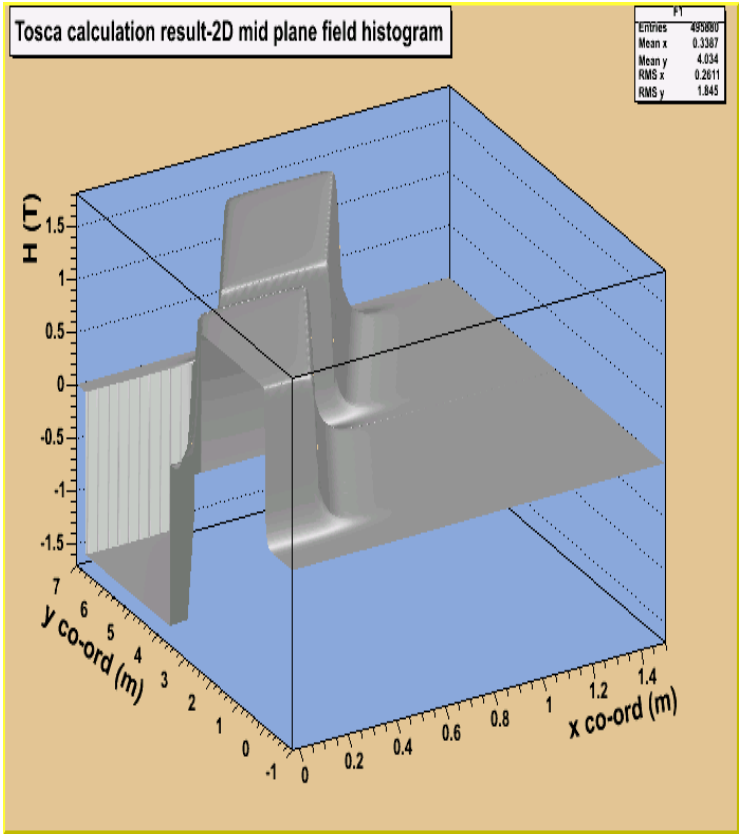
Part 1, 3 D Tosca analysis.
Part 2, Preliminary Drawings.
Part 3, Proposed Assembly Procedures
(i) Complete Tagger.
(ii) Vacuum Chamber Tests.

Part 1 3 D Tosca analysis

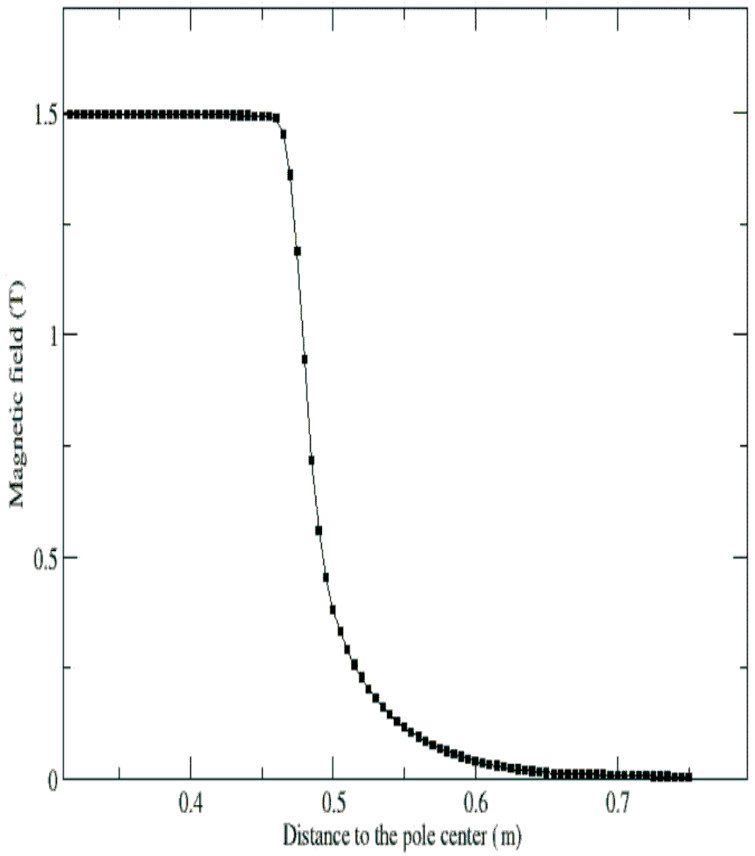
Software used : Opera 3D, version 8.010.

What we have calculated:

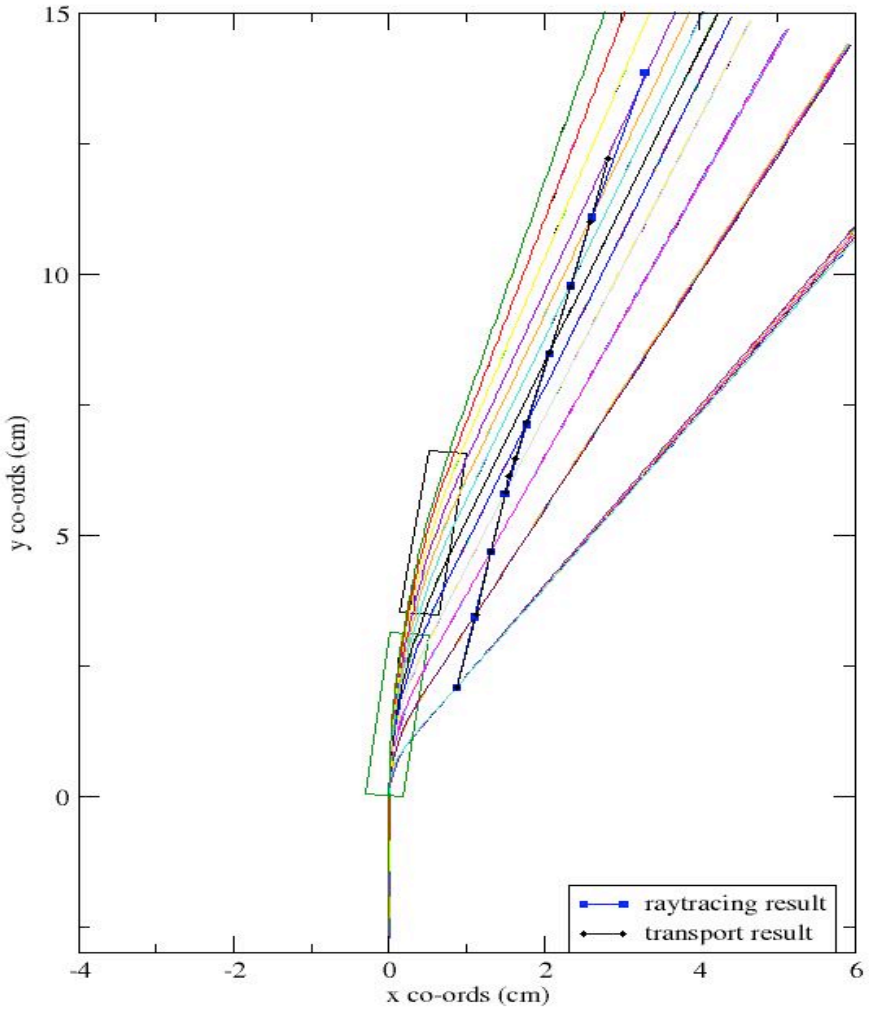
- 2 D, 3 D magnetic field distributions.
- The Effective field boundary along the magnet edge.
- Electron trajectories calculated by using Opera 3D, post processor.
- Optical properties using a grouping of 9 electrons trajectories.



2 D magnetic field histogram calculated by TOSCA.

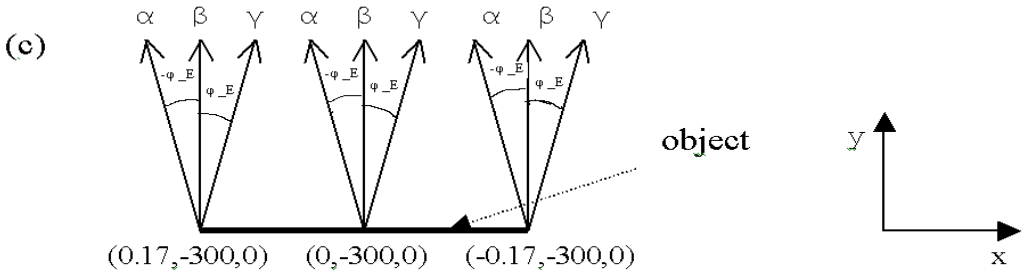


magnetic field along a line perpendicular to the magnet output edge.

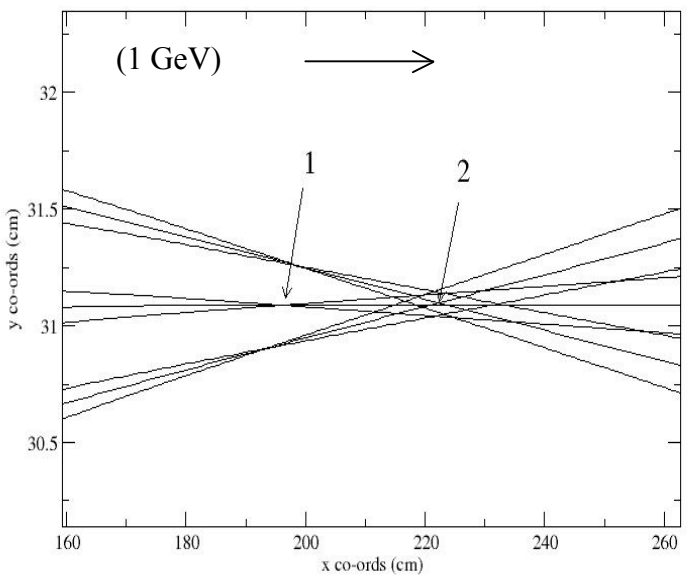


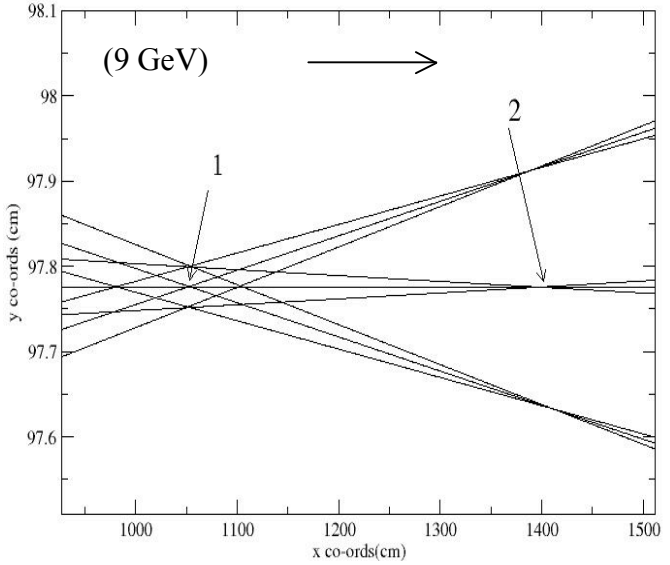
- Electron trajectories have been calculated using Opera 3 D post processor.
- By using the calculated electron trajectories, beam spot size, and focal plane position have been determined.

Calculated electron trajectories



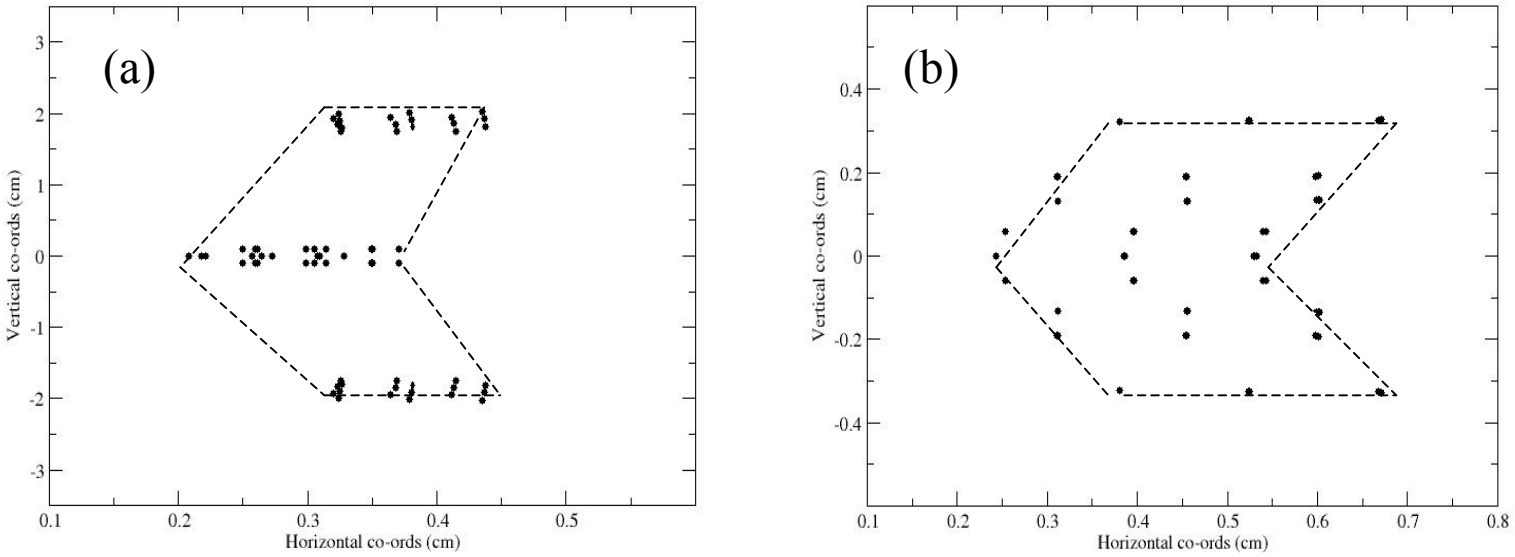
Electron trajectory bundles according to their directions at the object position.





Beam trajectories calculated from TOSCA in the mid plane for 1 GeV and 9 GeV. Those trajectories having the same direction focus on position 1, and those trajectories having the same starting position focus on position 2. (electrons travelling in the direction shown by the top arrow).

Other interesting results



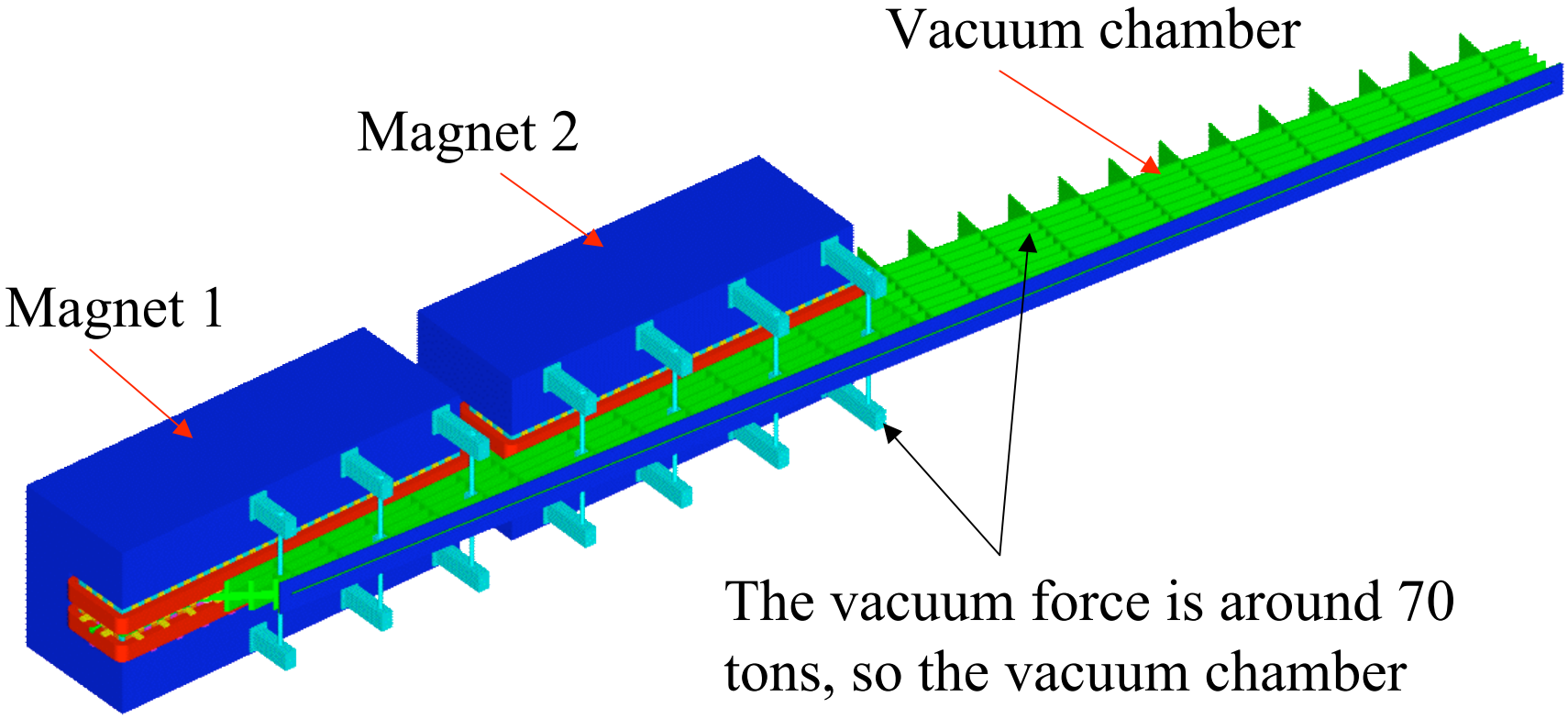
The intersections of the beam trajectories with the plane through the focusing point and perpendicular to the beam ((a):1 GeV, (b): 9 GeV), the dotted lines show the beam spot profile.

(We have used a rectangular object shape. So, ideally we expect to obtain a rectangular image at the focal plane.)

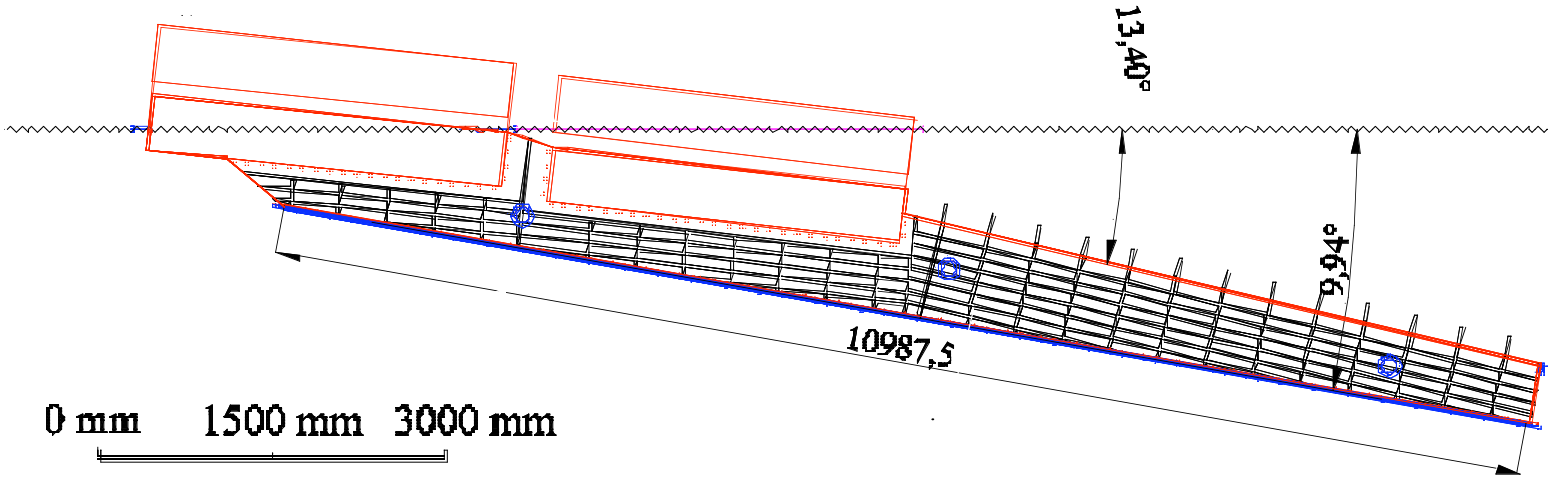
Part 2 Preliminary drawings

- Preliminary drawings of the two identical magnet tagger system are shown. The magnet dimension used here are the same as used in the Tosca analysis.
- The drawings include the two magnets, a vacuum chamber.
- Assembly procedure are proposed.

The two identical magnets tagger



The vacuum force is around 70 tons, so the vacuum chamber needs external support



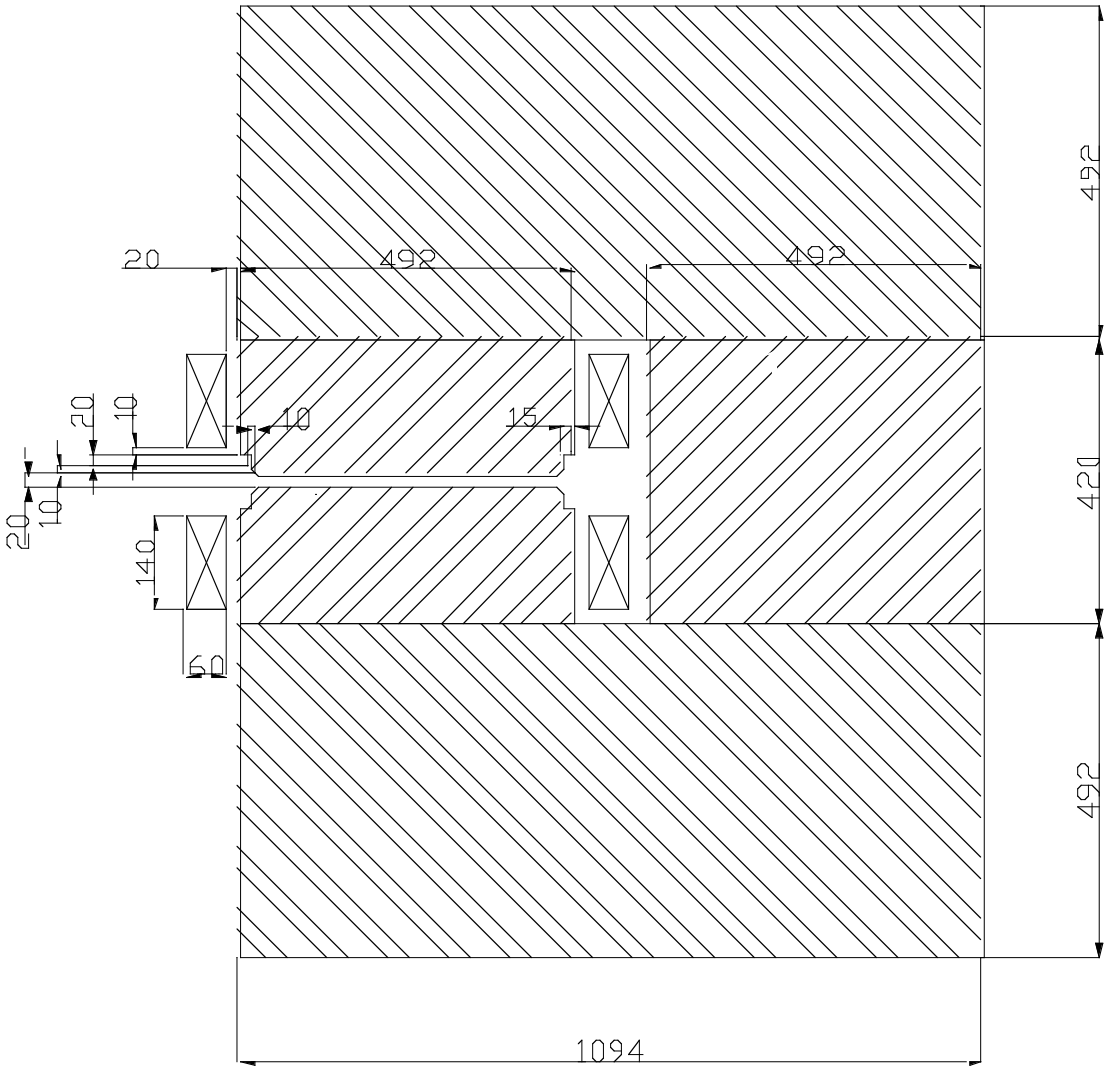
The electron entrance angle :5.9 degrees

Main beam exit angle: 6.6 degrees

Main beam bending angle 13.4 degrees

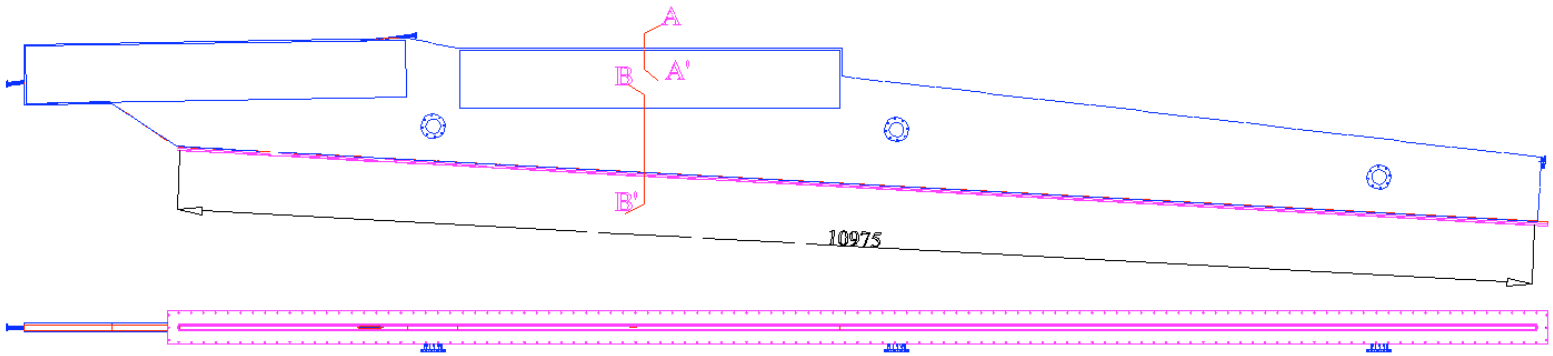
The angle between the photon exit beam and the focal plane: 9.94 degrees

Vertical section through one of the dipole magnets showing pole profile and coil geometry

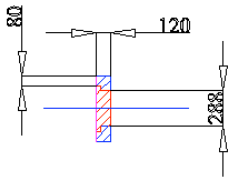


- Length: 3.11 m.
- Width: 1.09 m.
- Height:1.41m.
- Weight: ~38 Tonns for one magnet.
- Conductor area: 84 cm^2.
- Current: 154 A.
- Magnetic field: 1.5 T.
- Pole gap: 2 cm

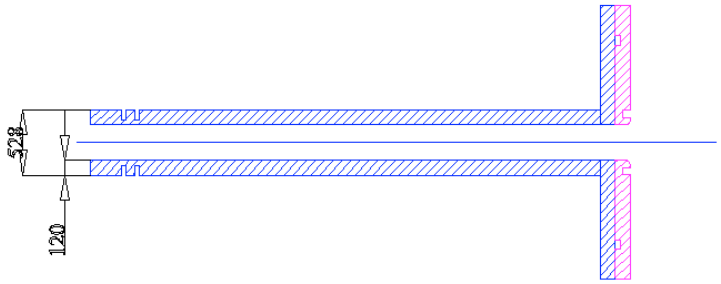
Vacuum chamber



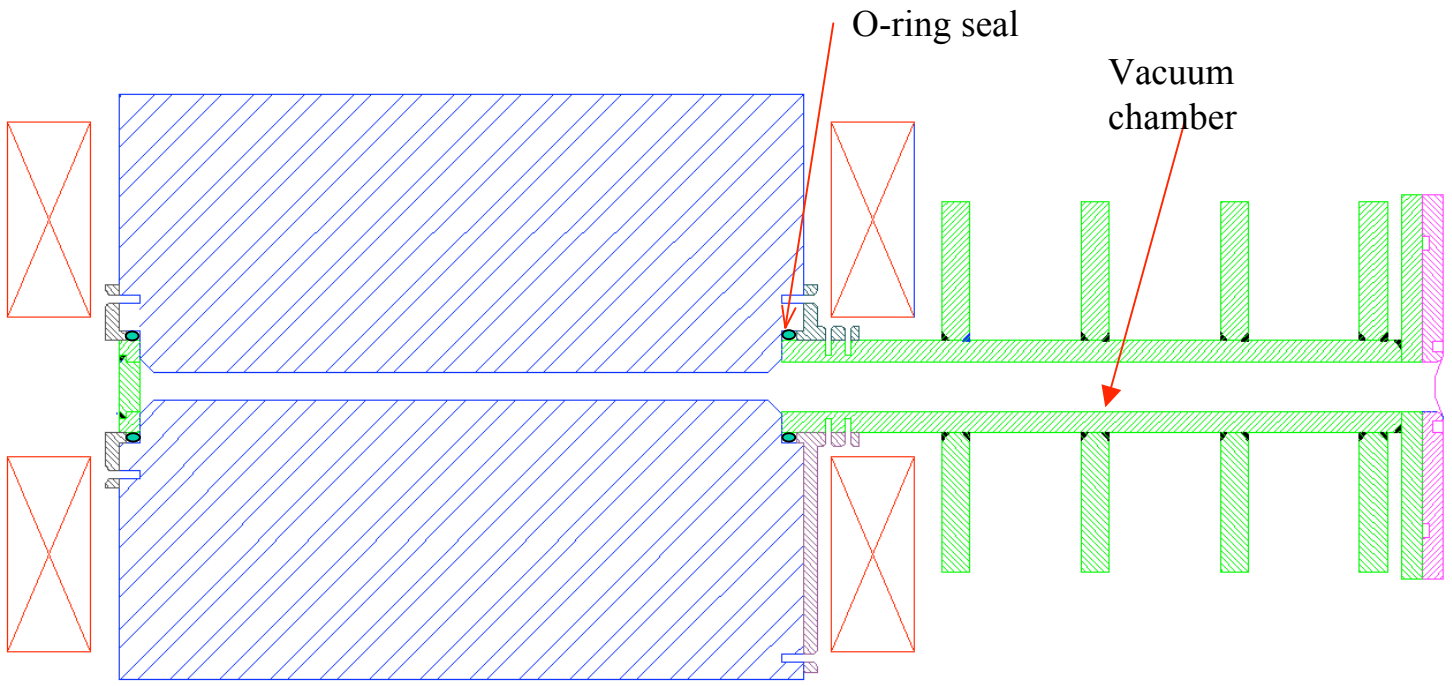
Section AA' (×8)



Section BB' (×8)

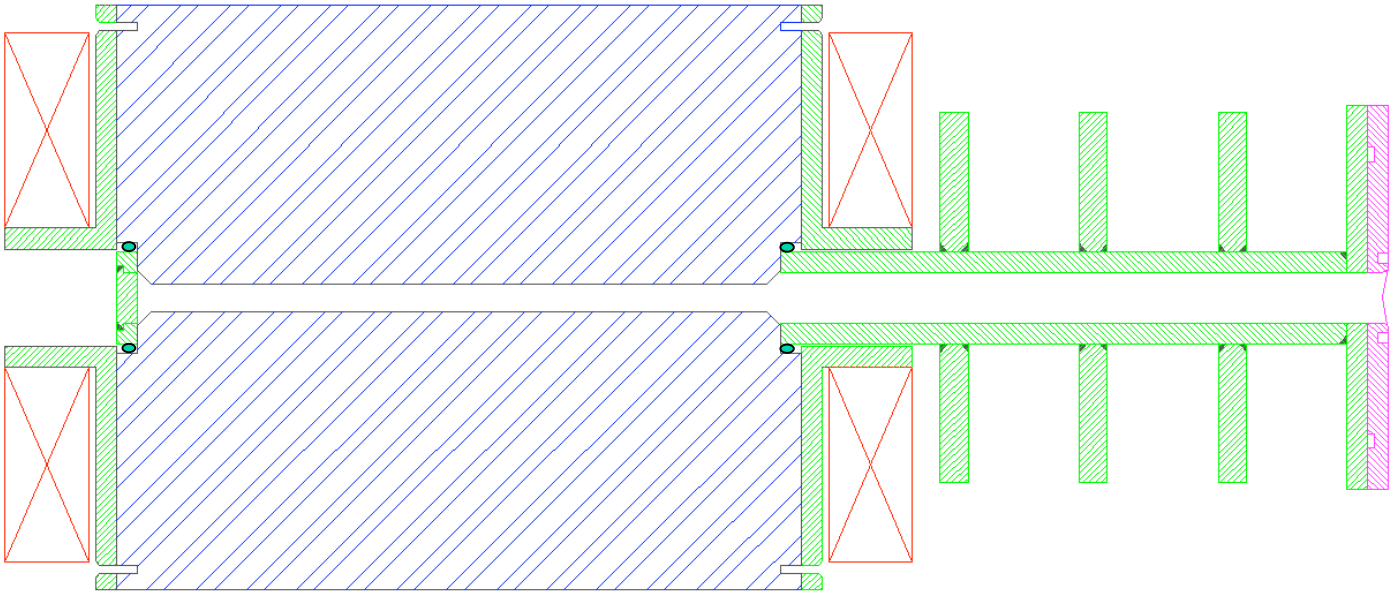


Vertical section showing how vacuum O-ring compression is determined

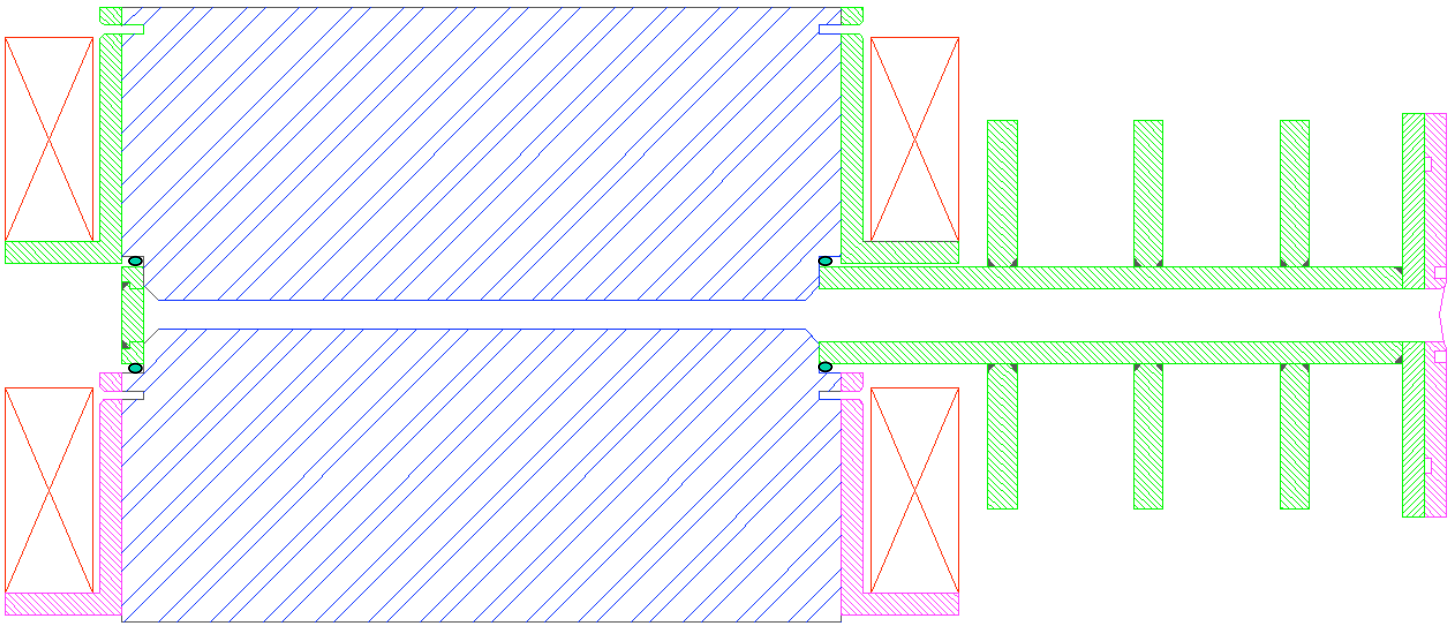


*

Vertical section showing how coils are supported against magnetic forces (0.5 ton)

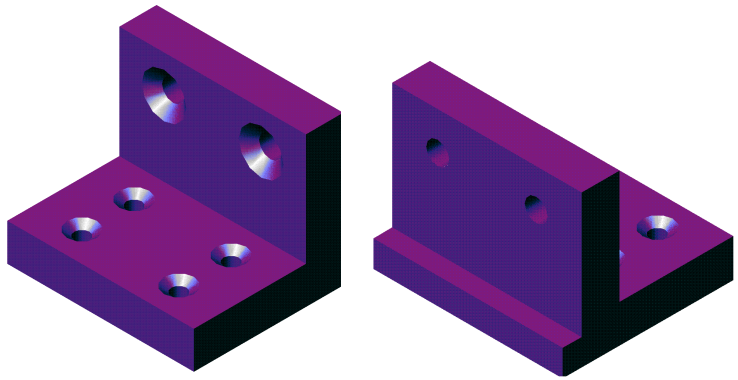


Vertical section showing how weight of coils are supported (each coil ~0.4 ton)



The brackets and spacers used in the tagger system

1



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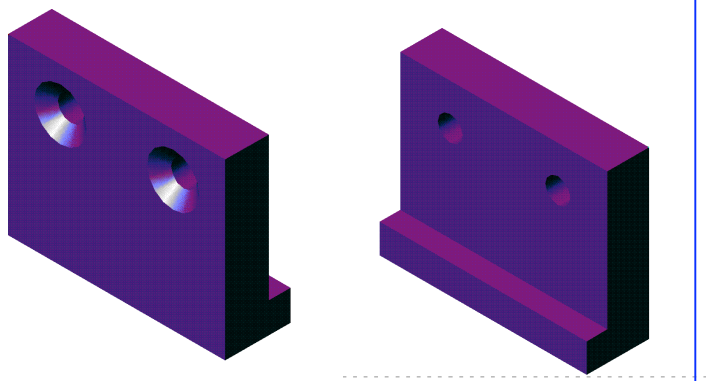

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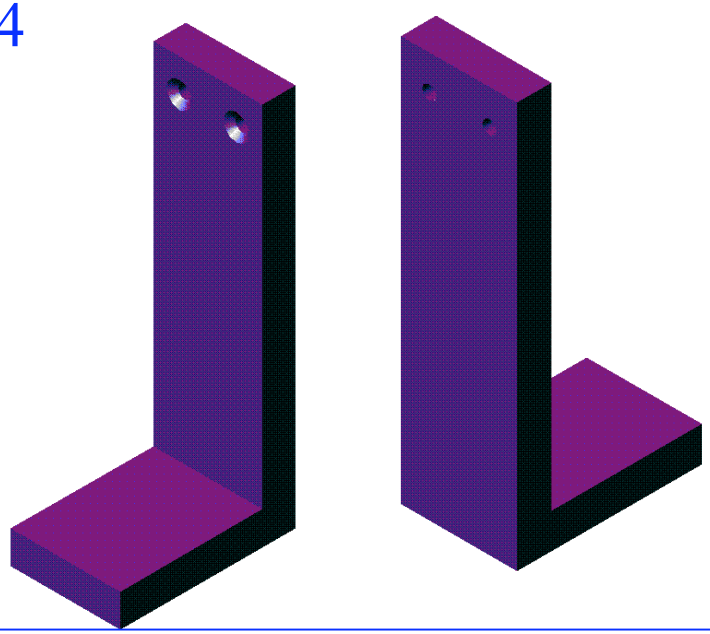
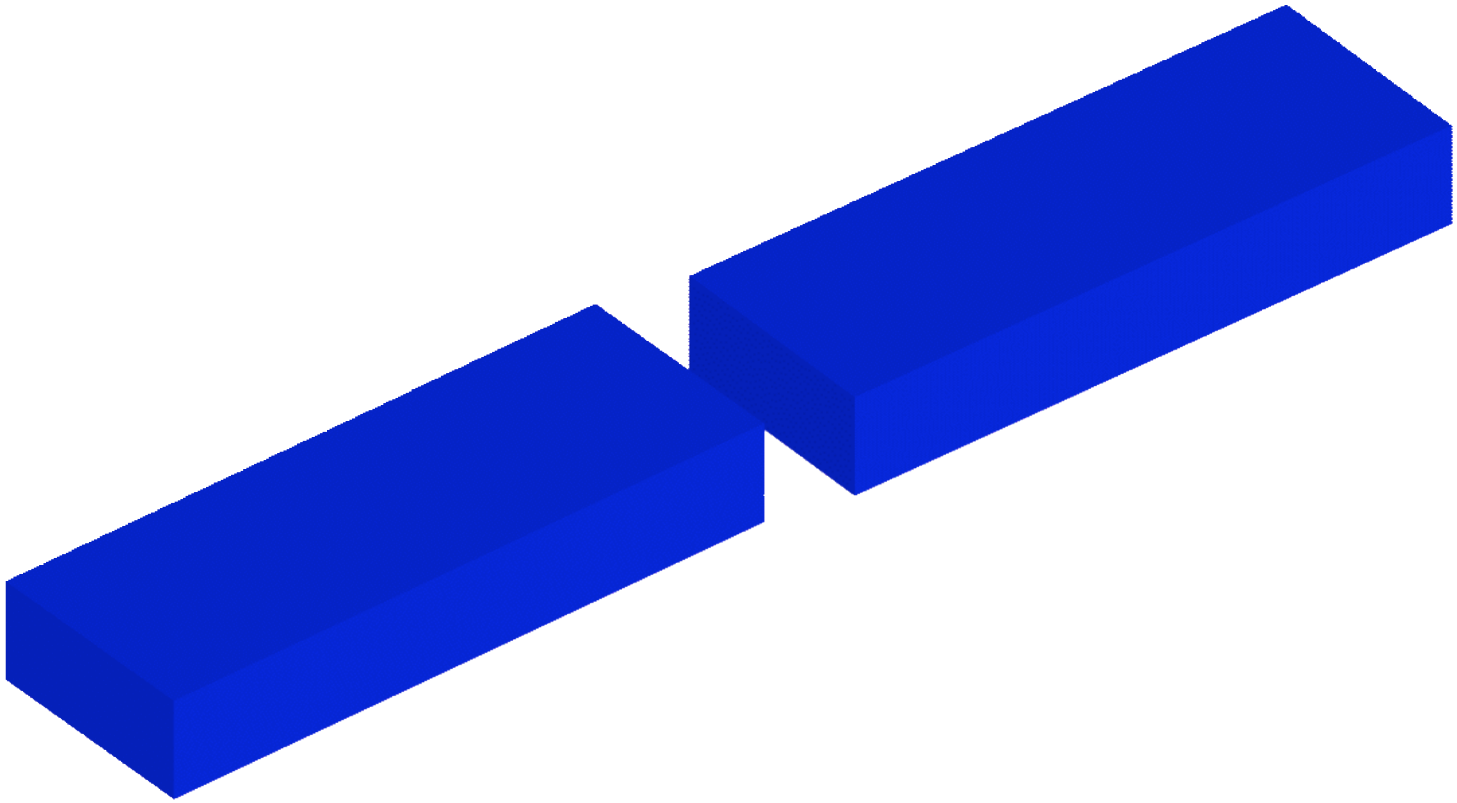
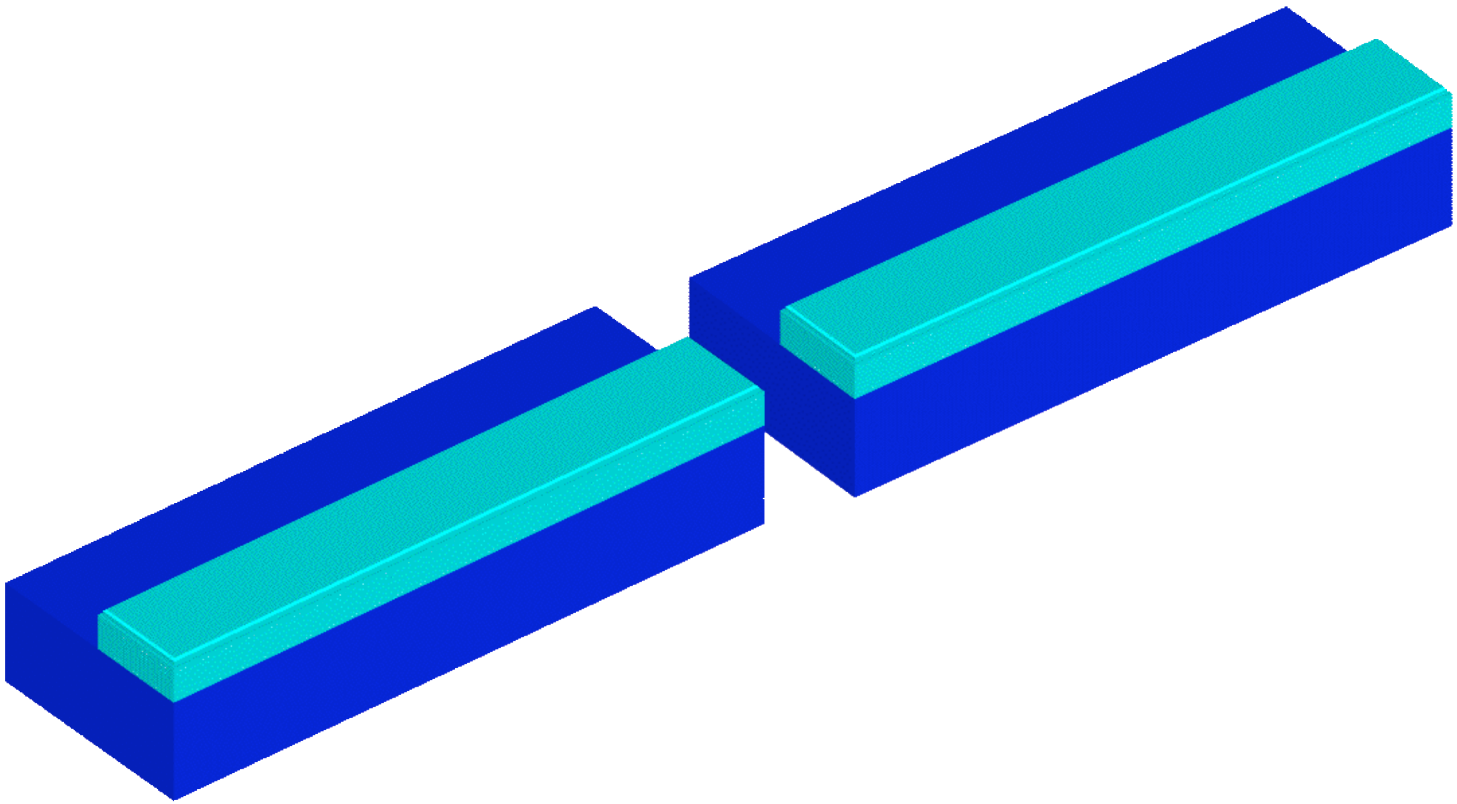
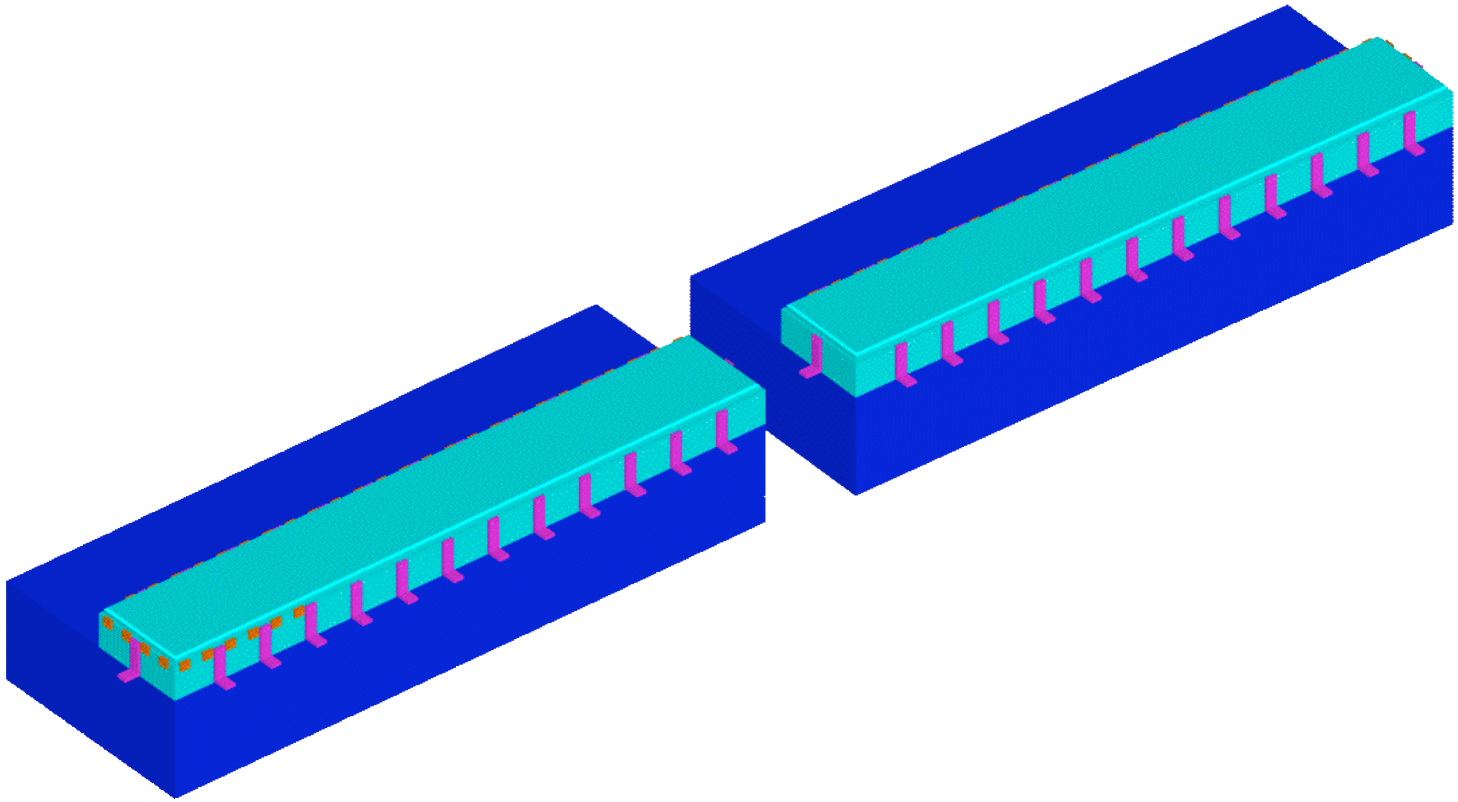
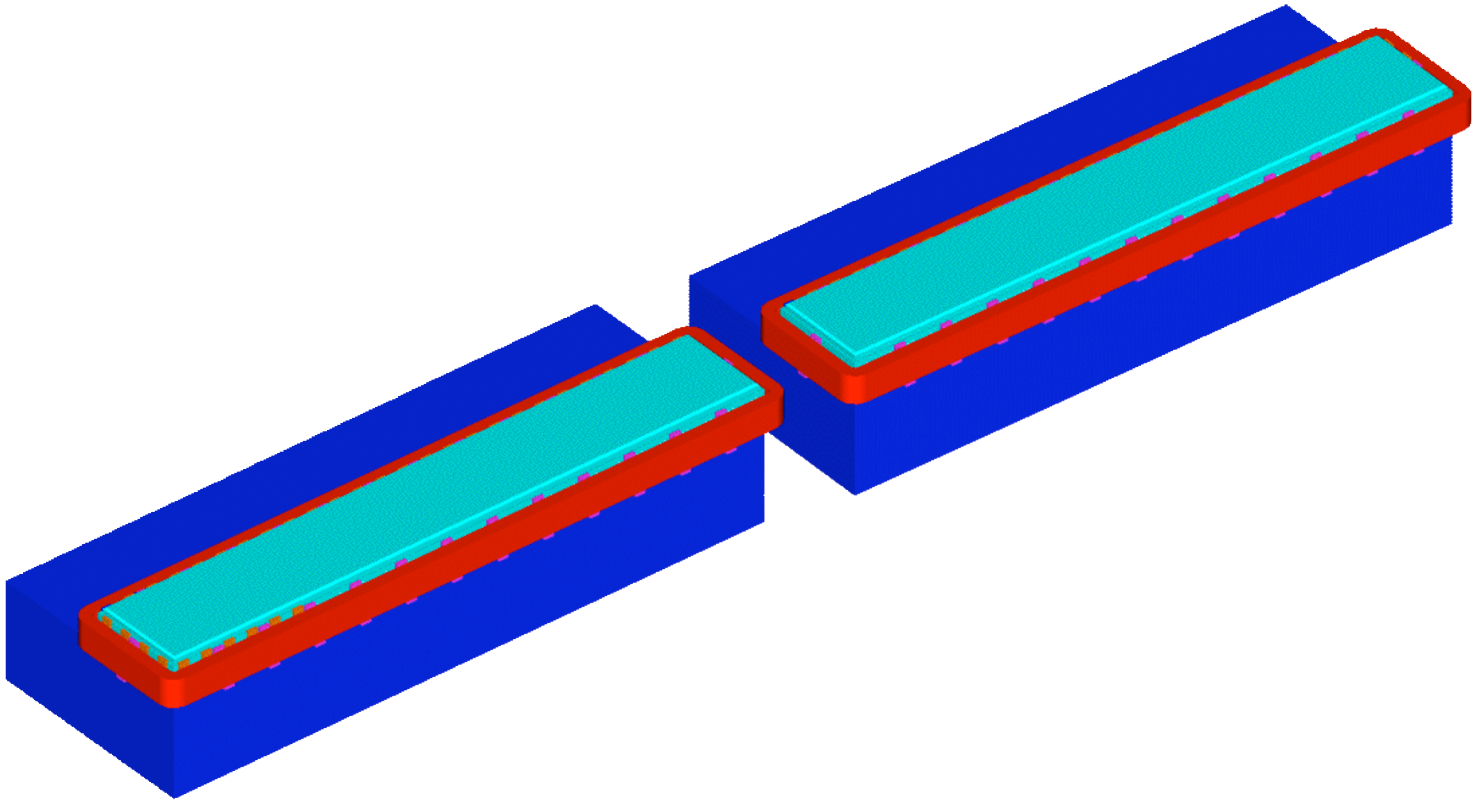


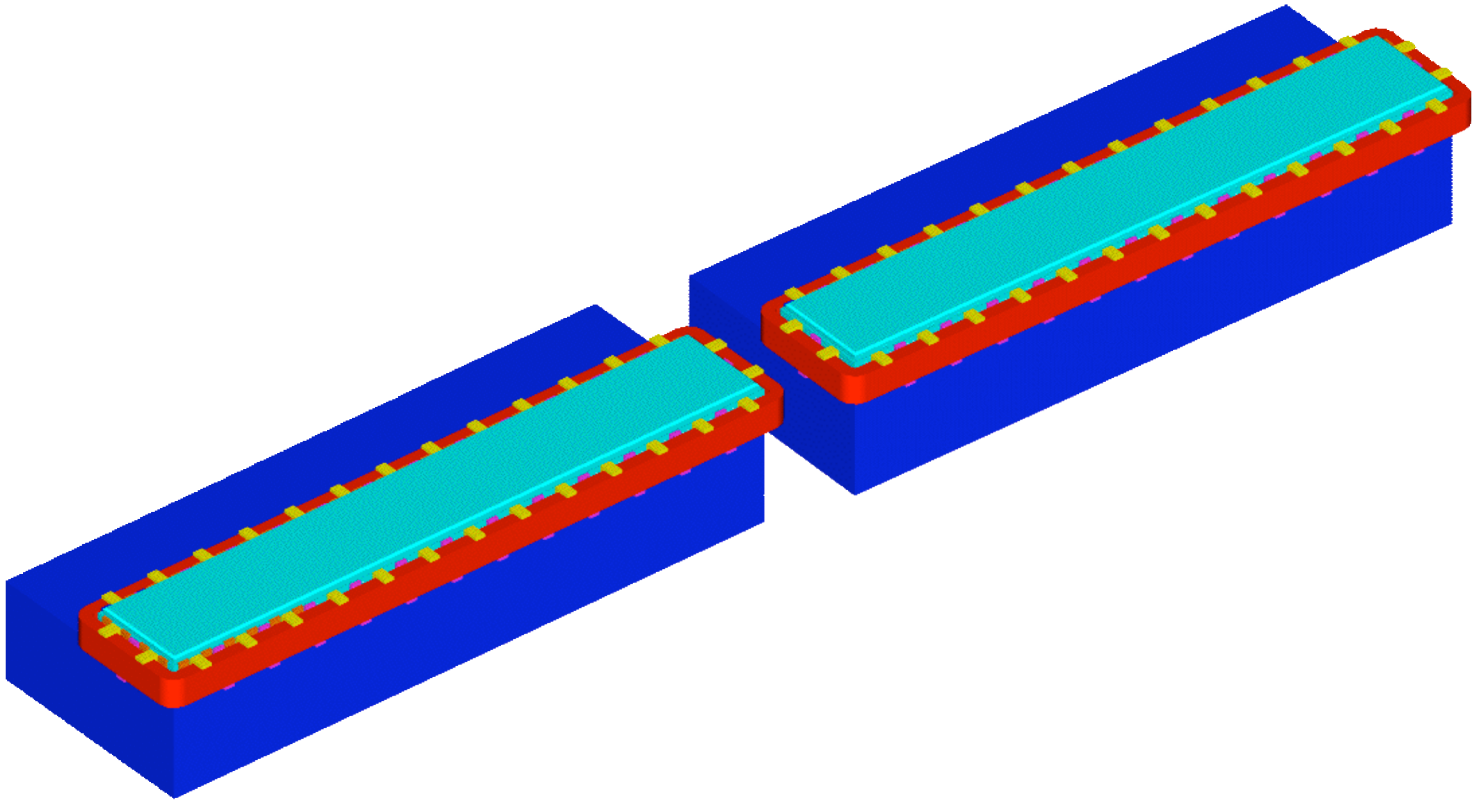
Part 3. (i) Proposed Assembly procedure for complete tagger

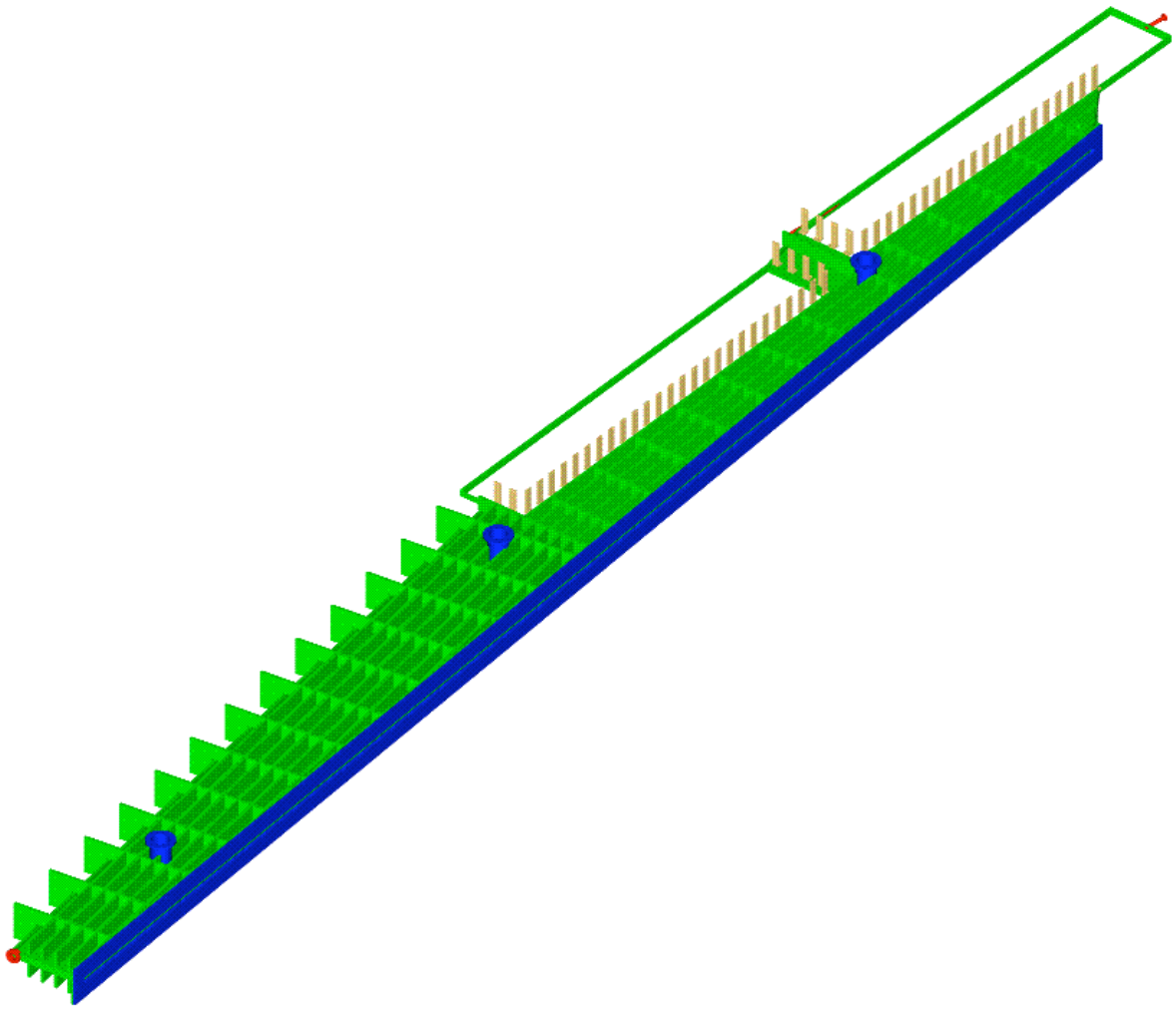


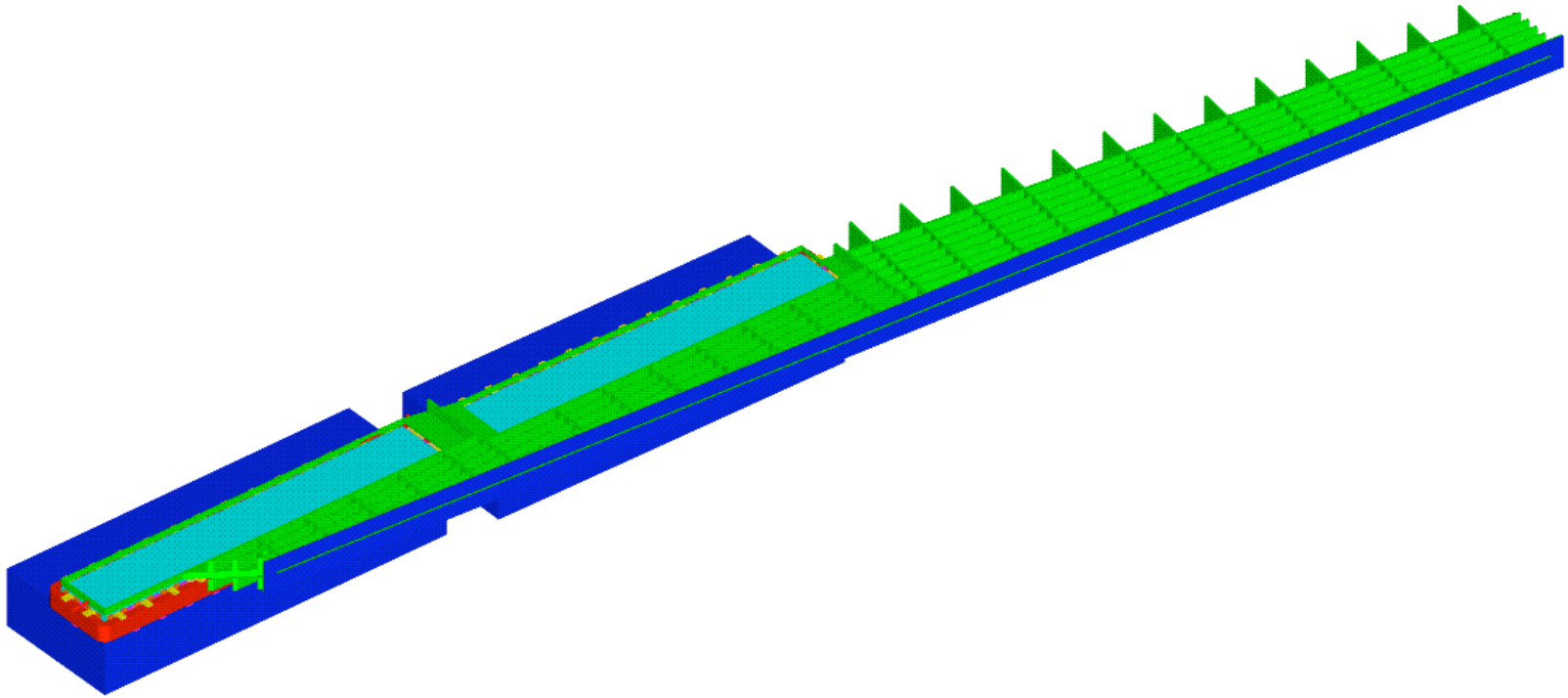


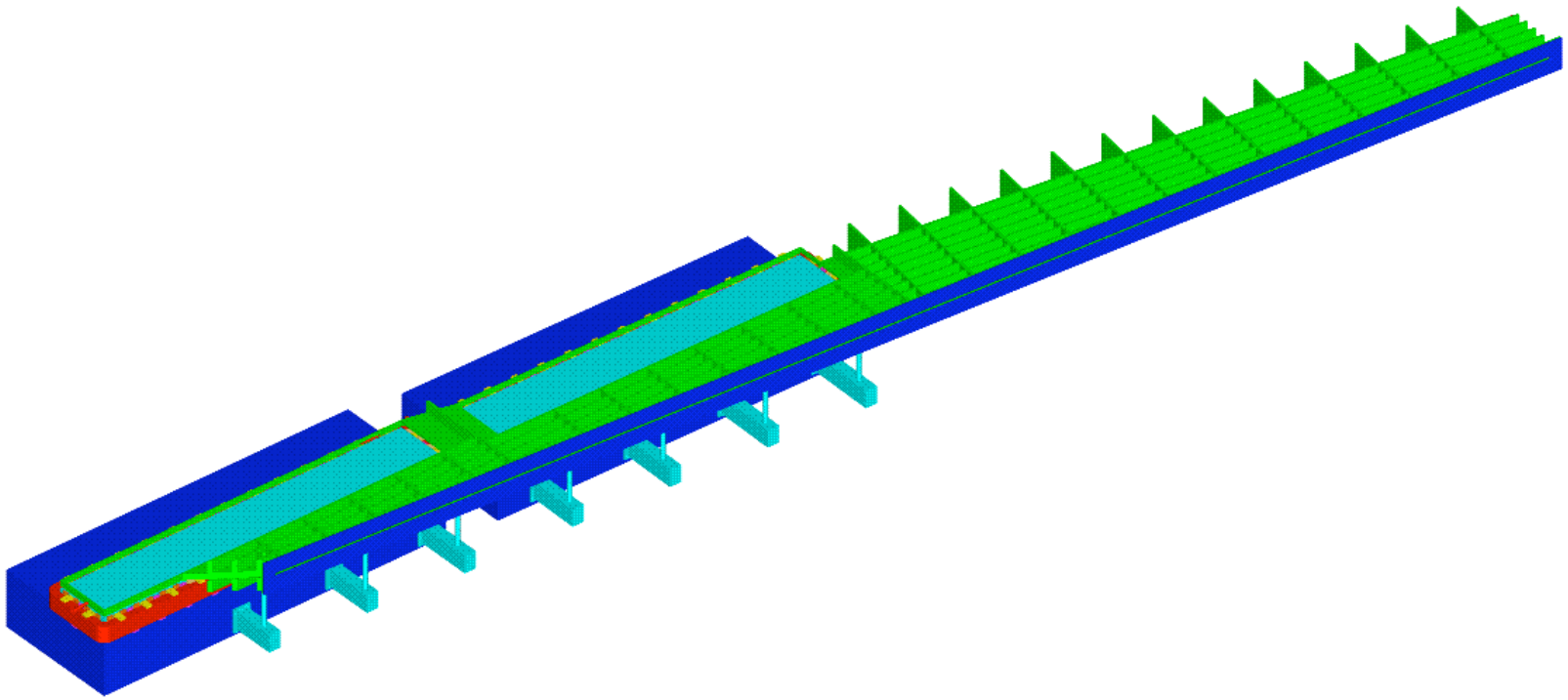


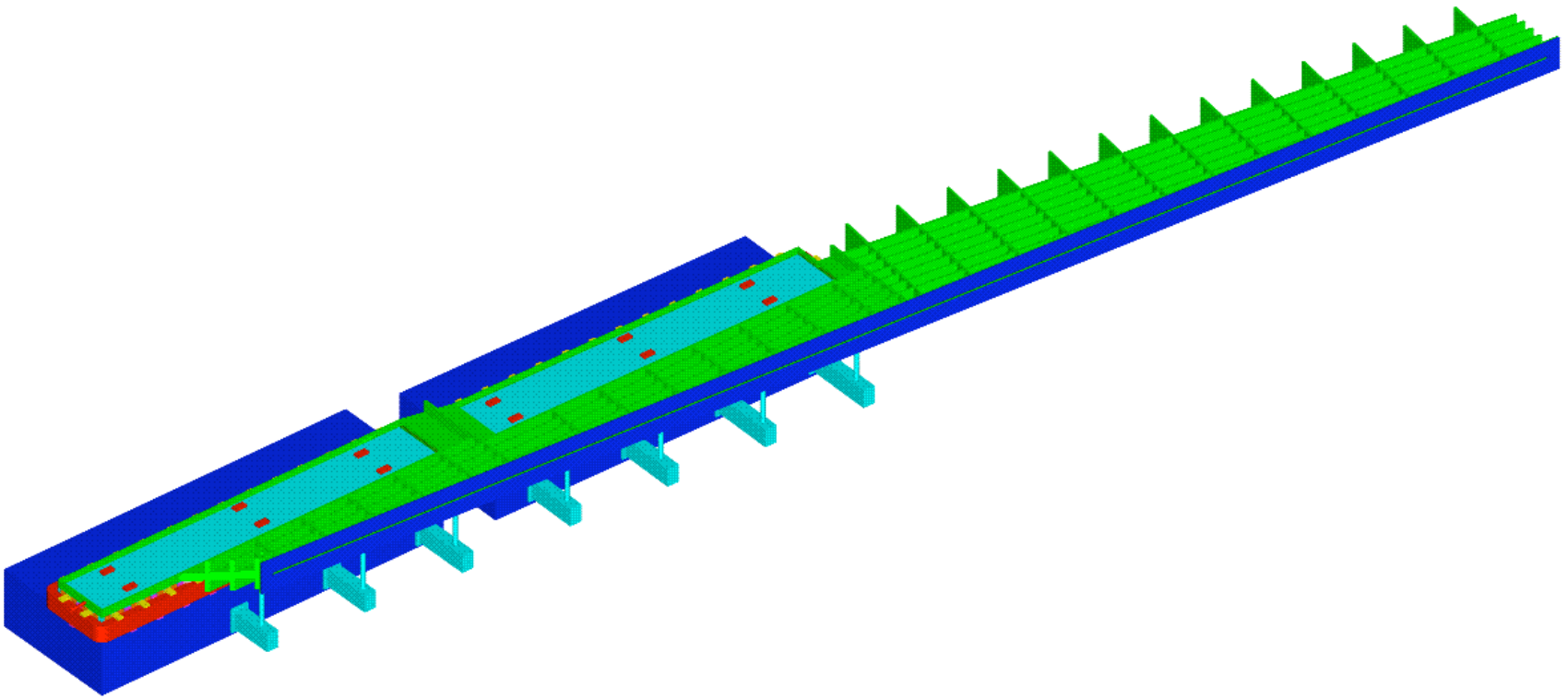


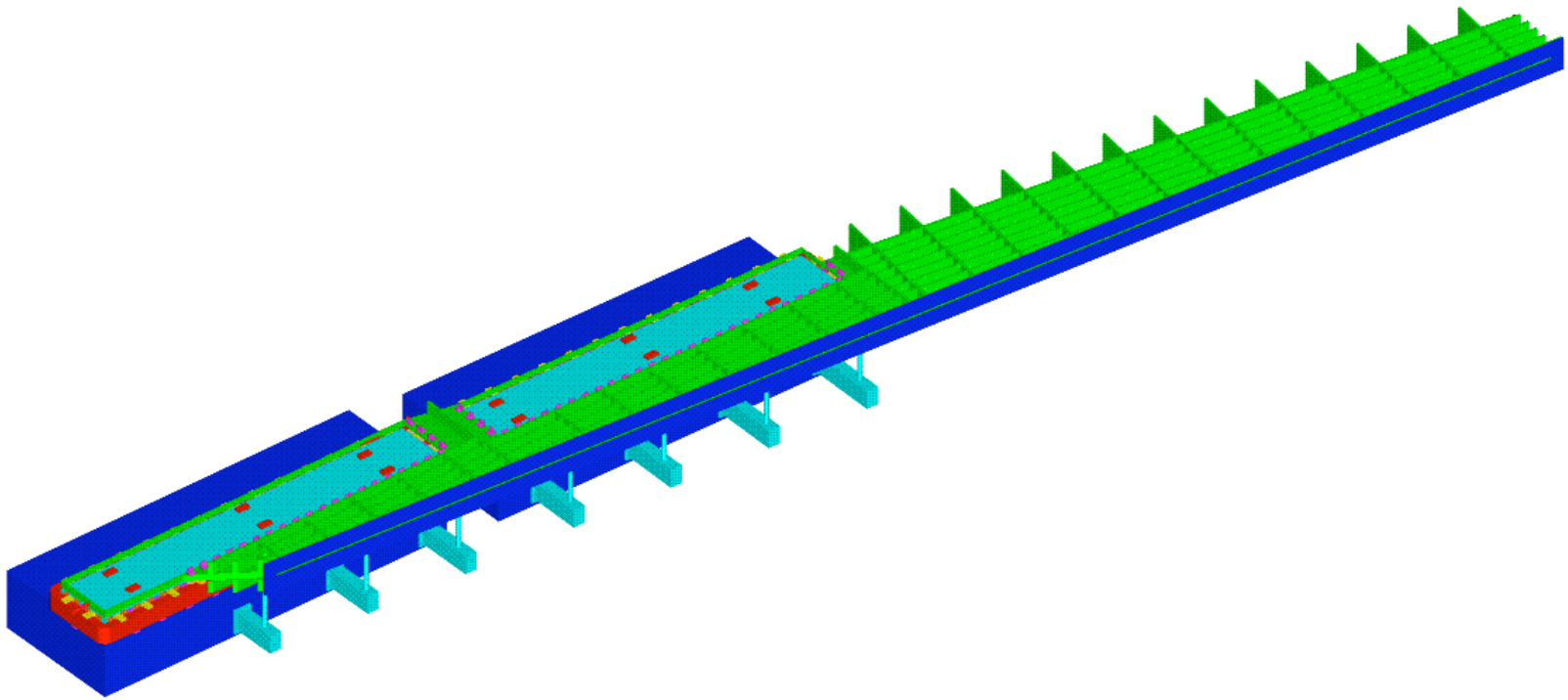


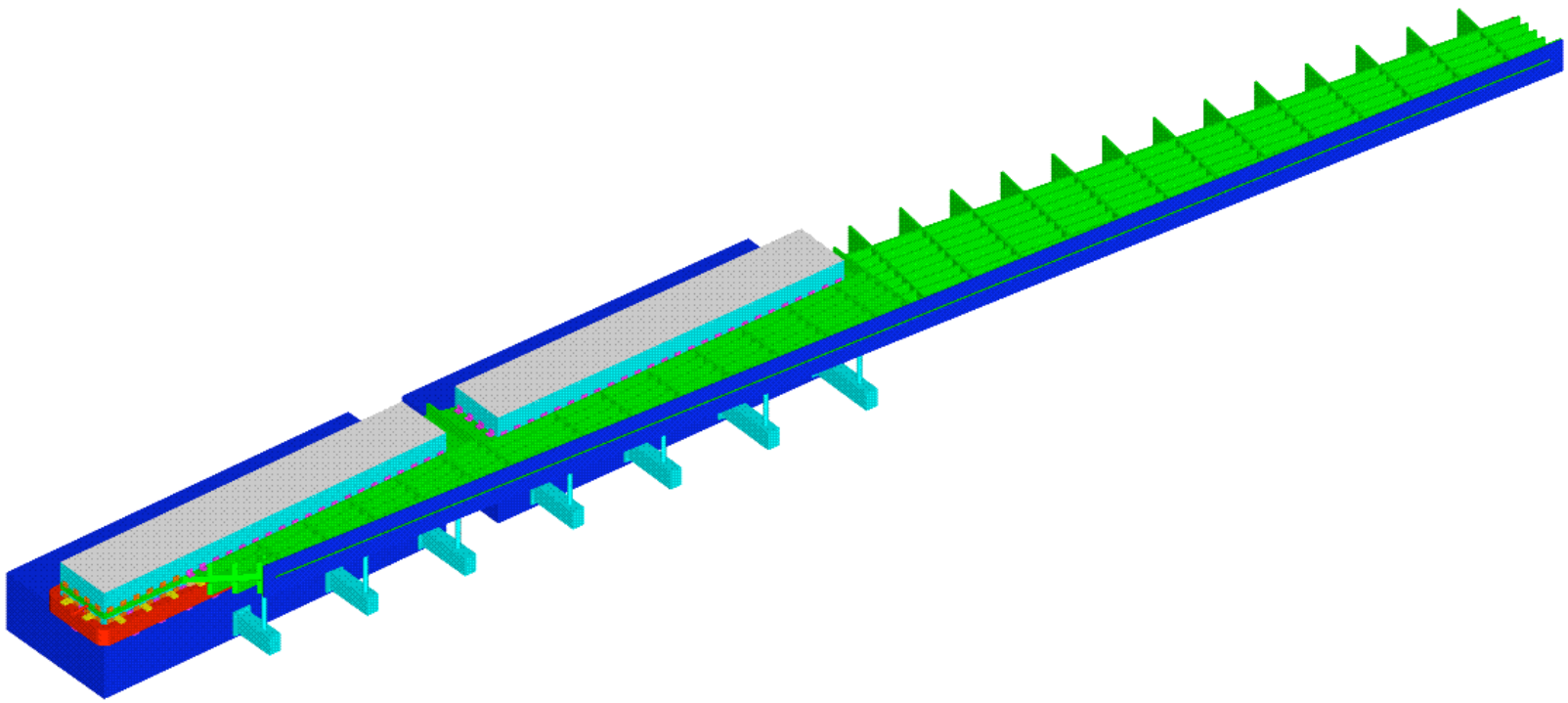


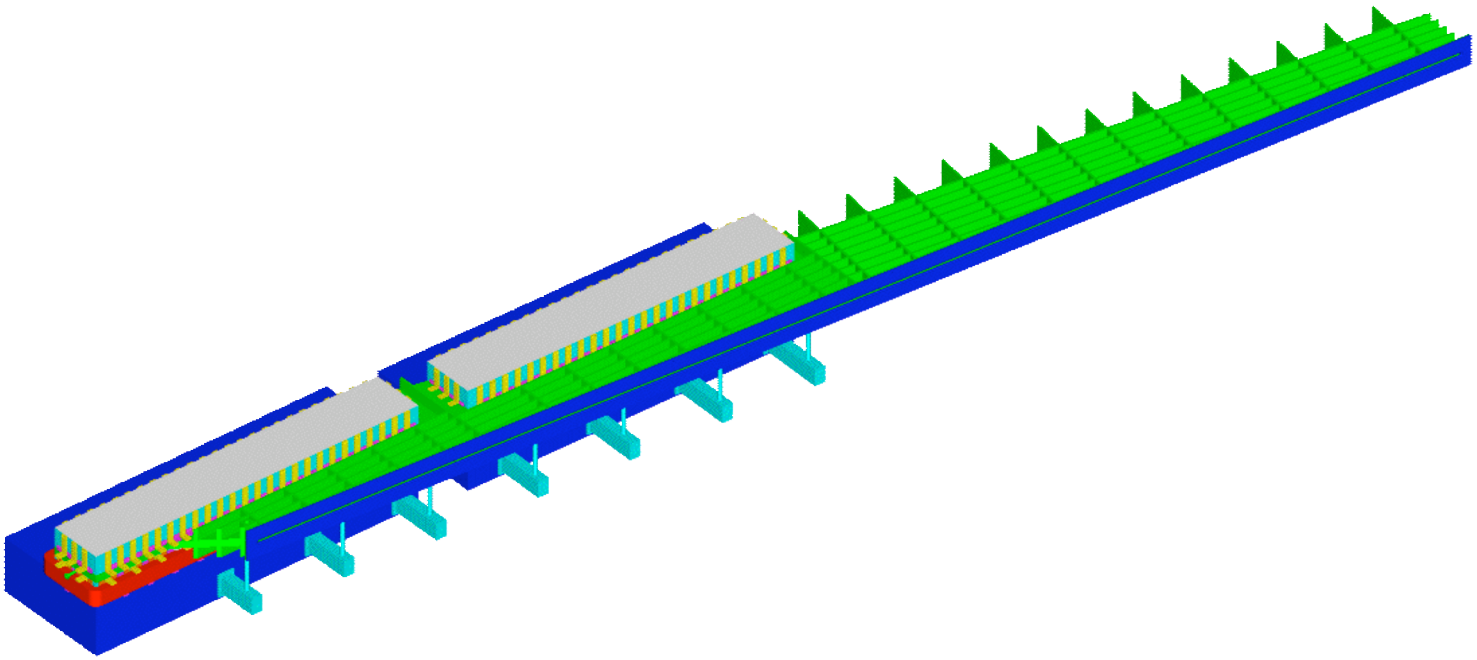


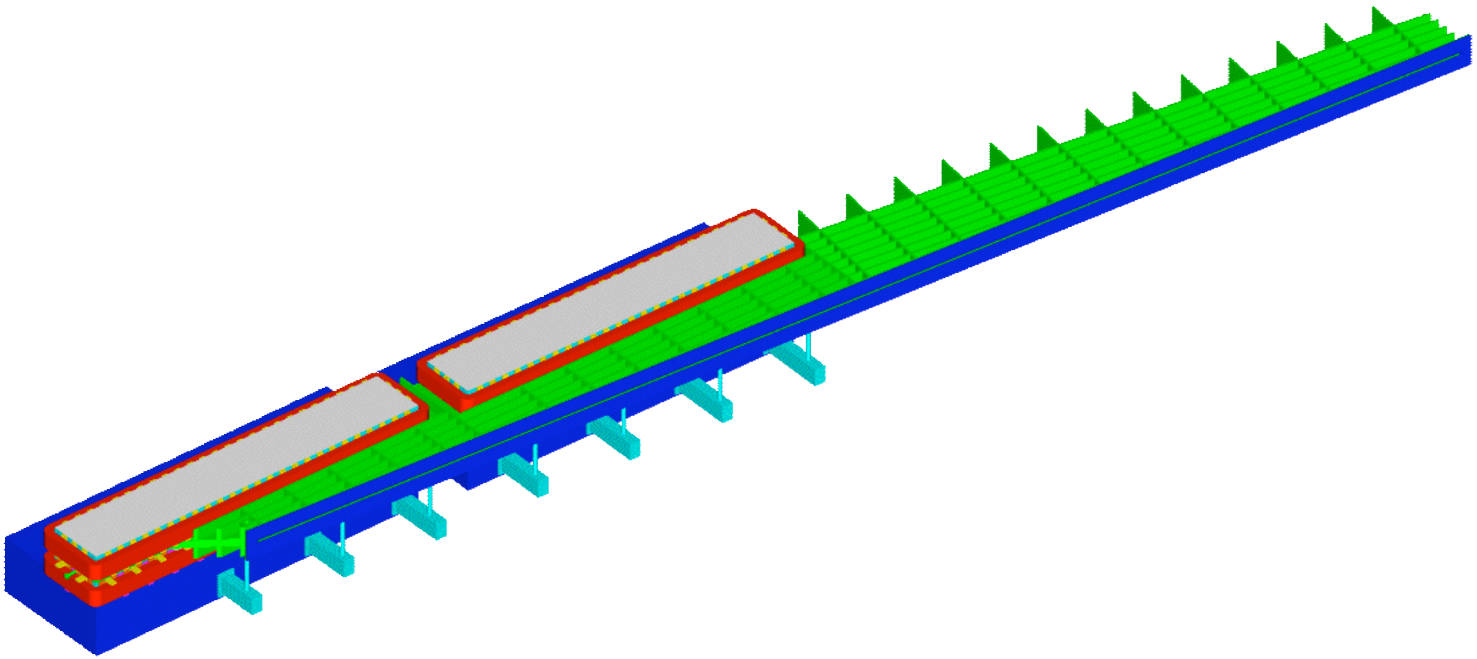


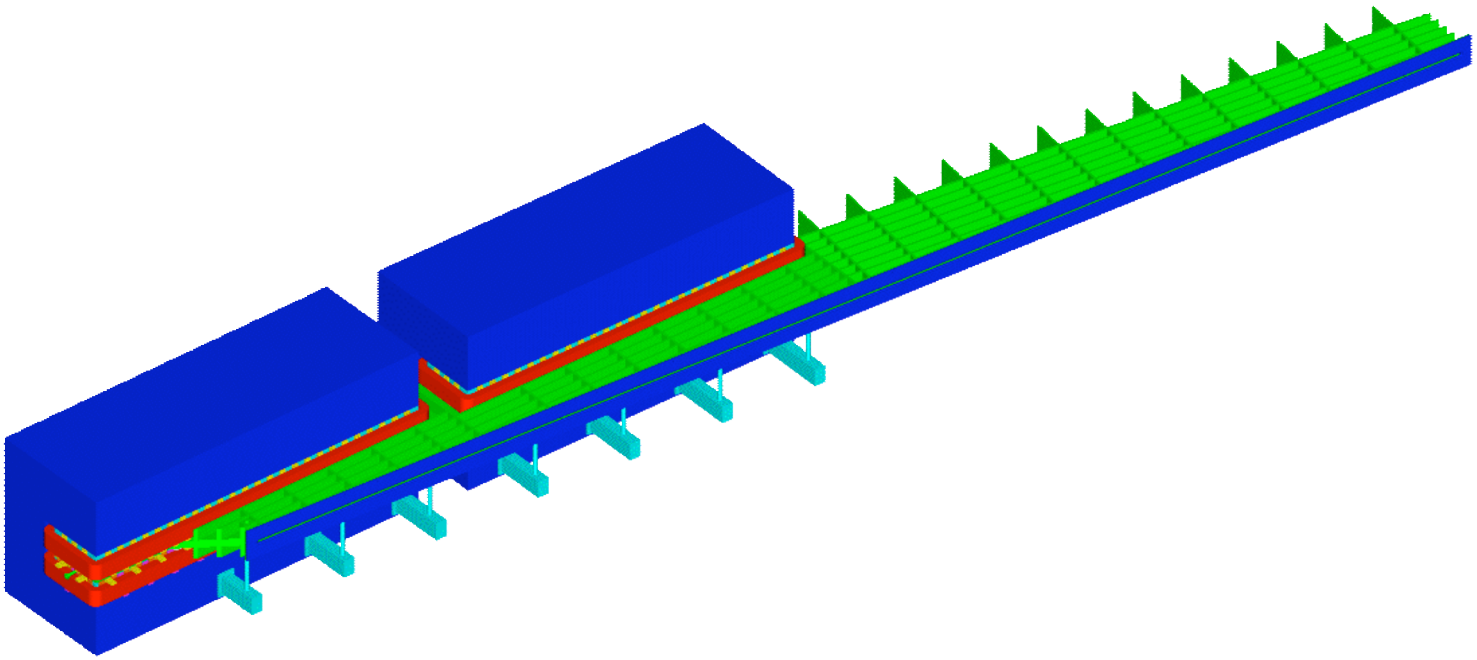


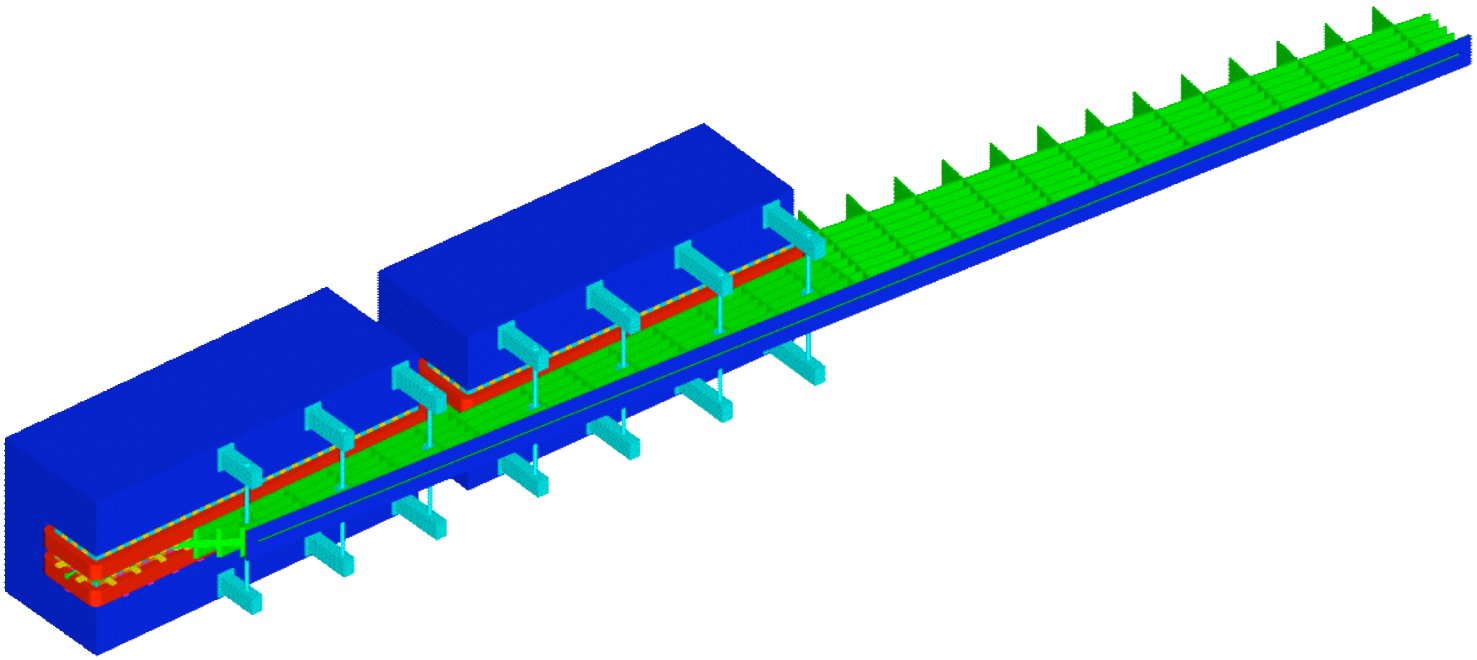




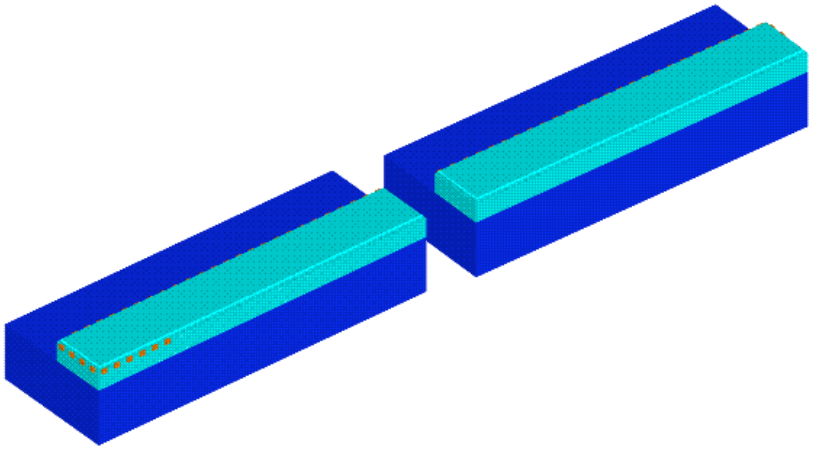


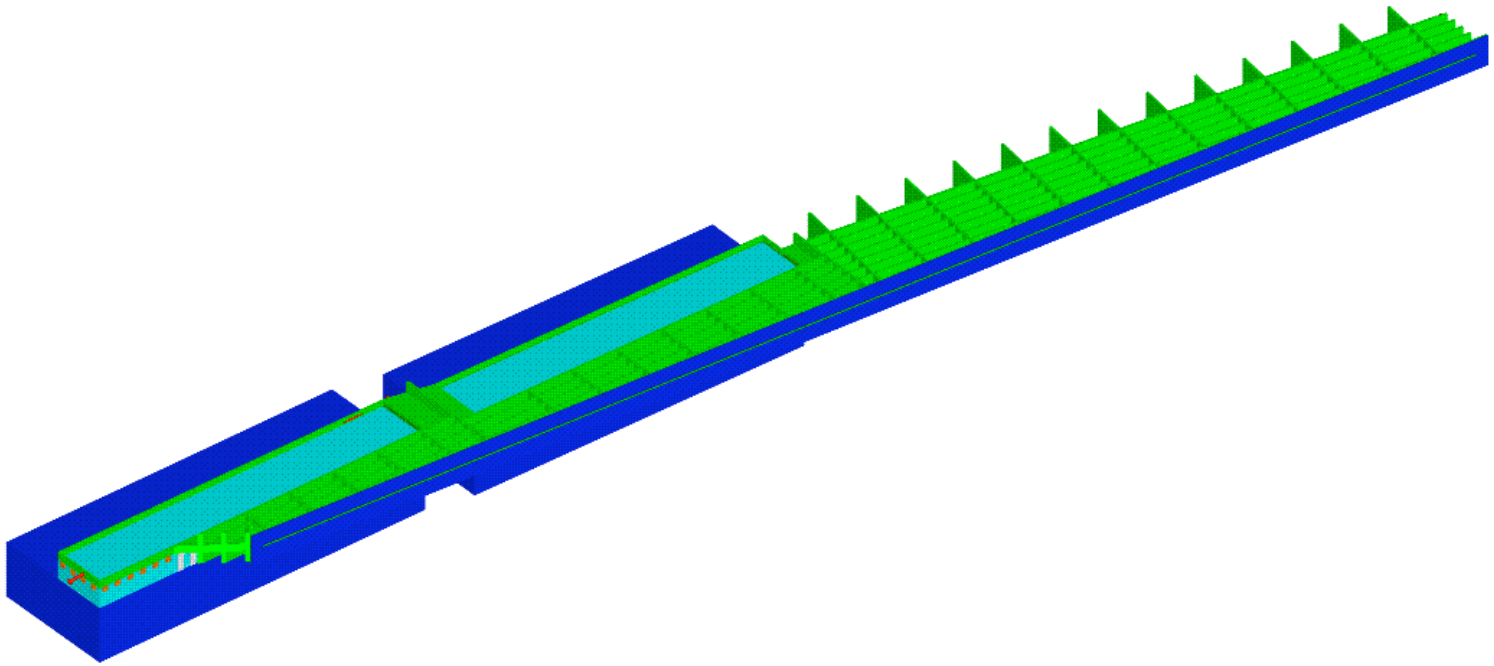


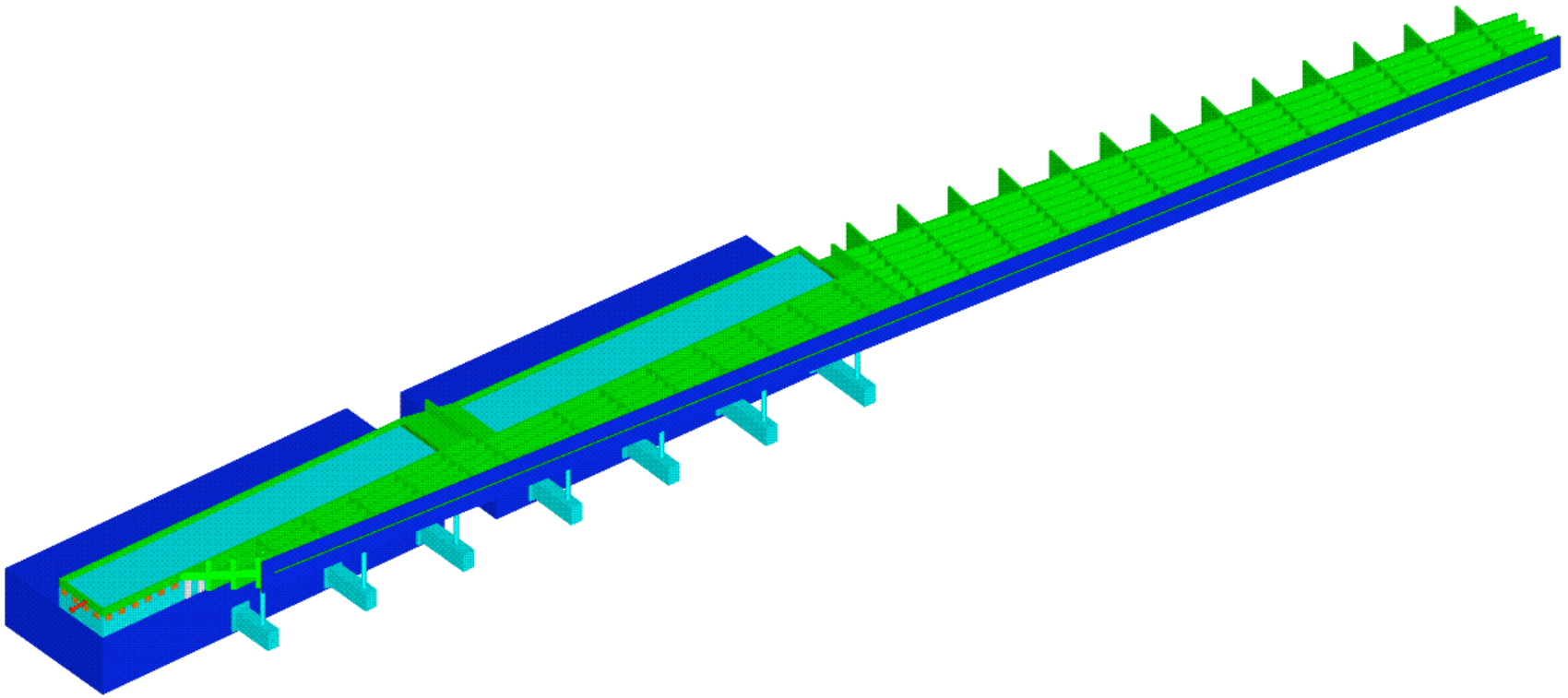


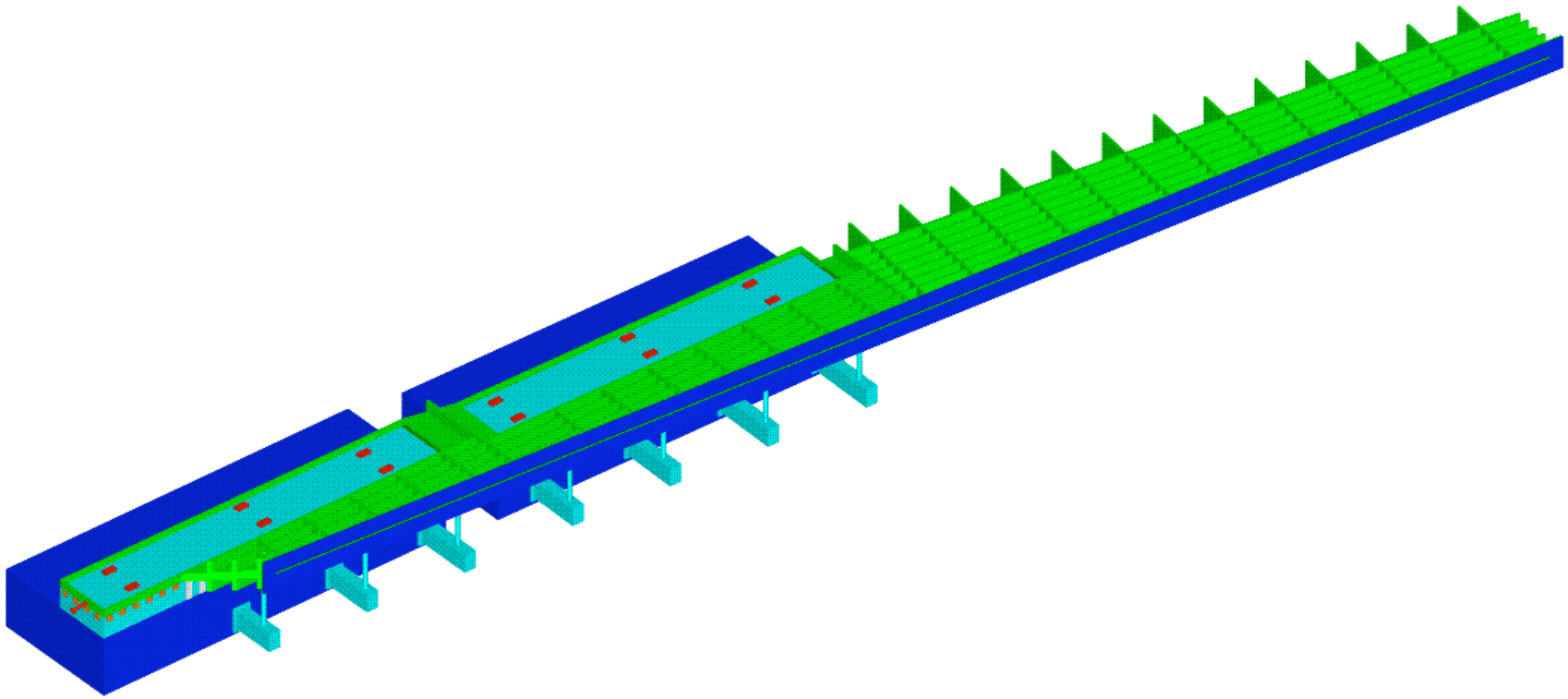


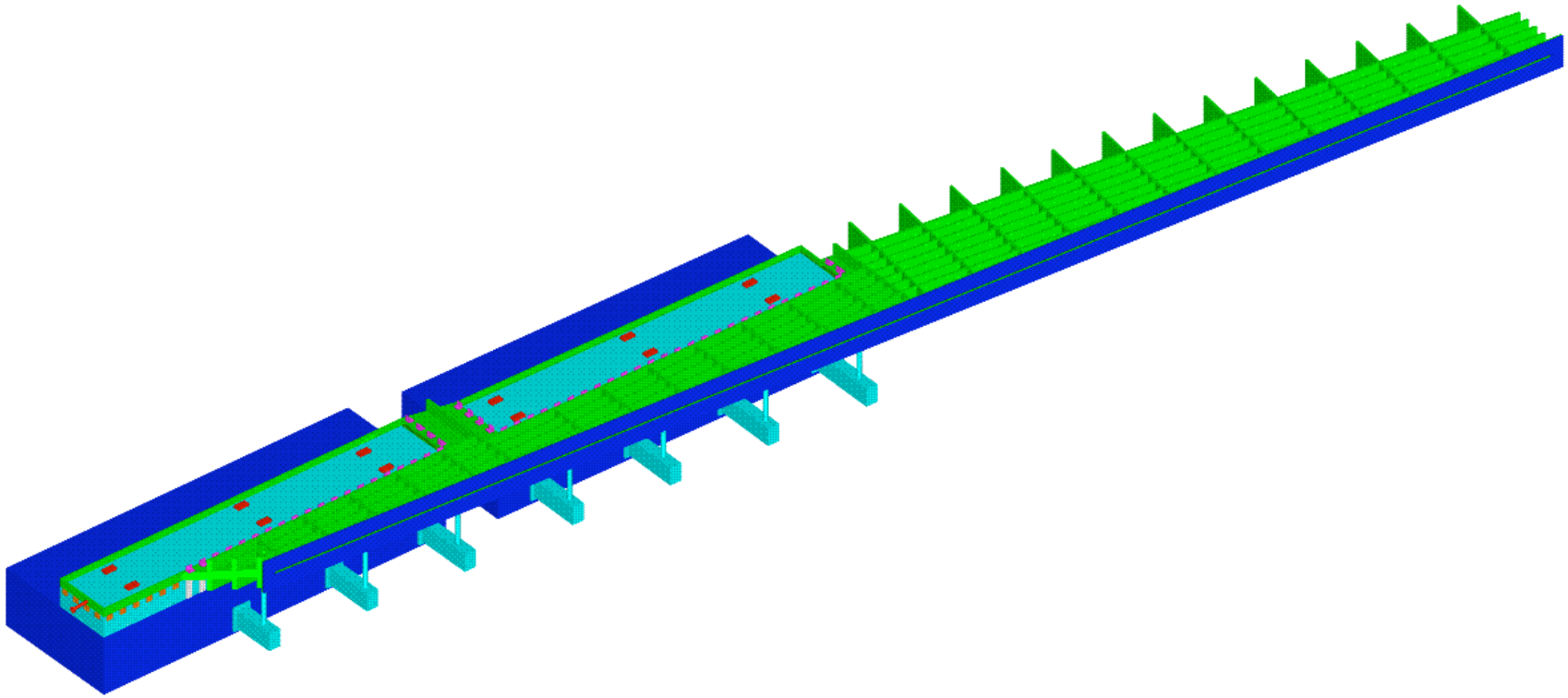
Part 3. (ii) Proposed Assembly procedure for vacuum chamber testing

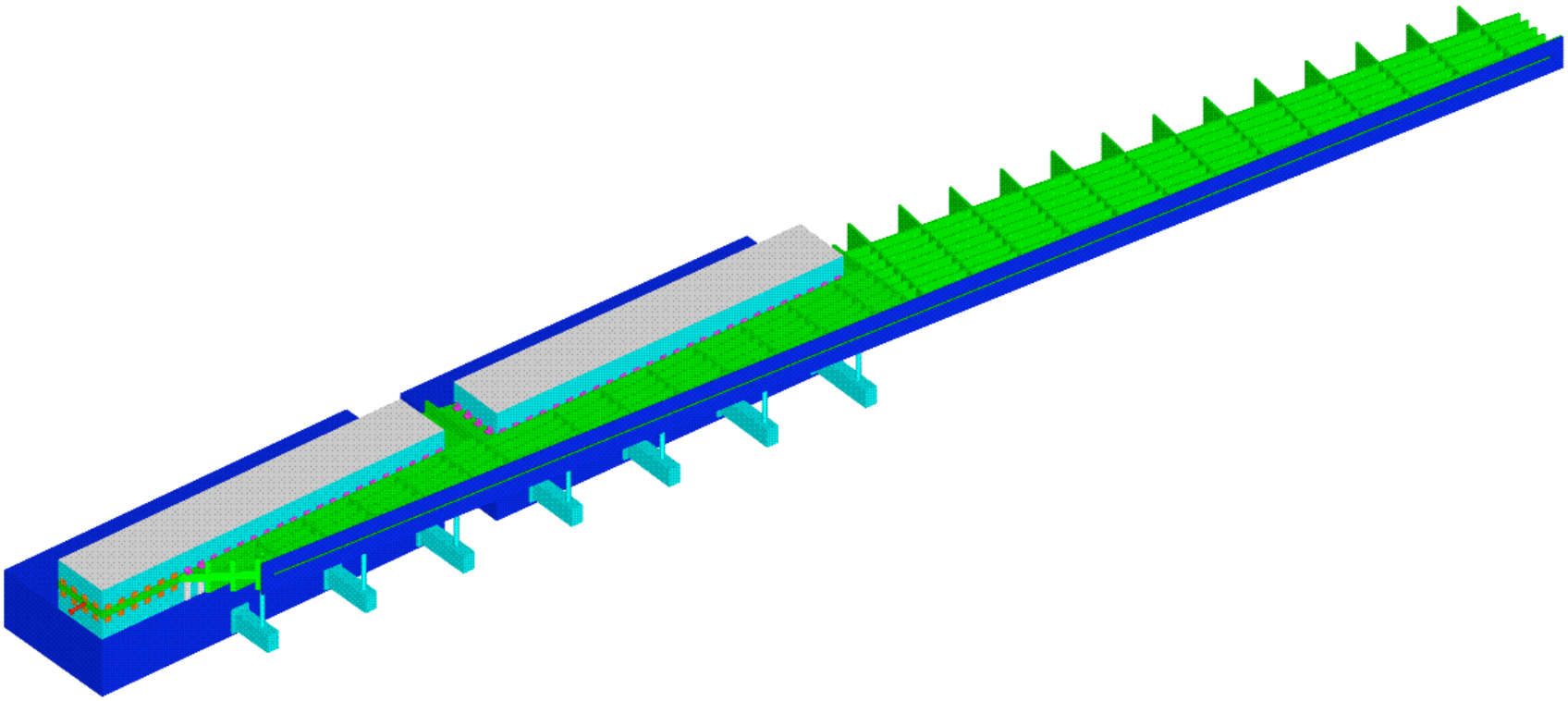


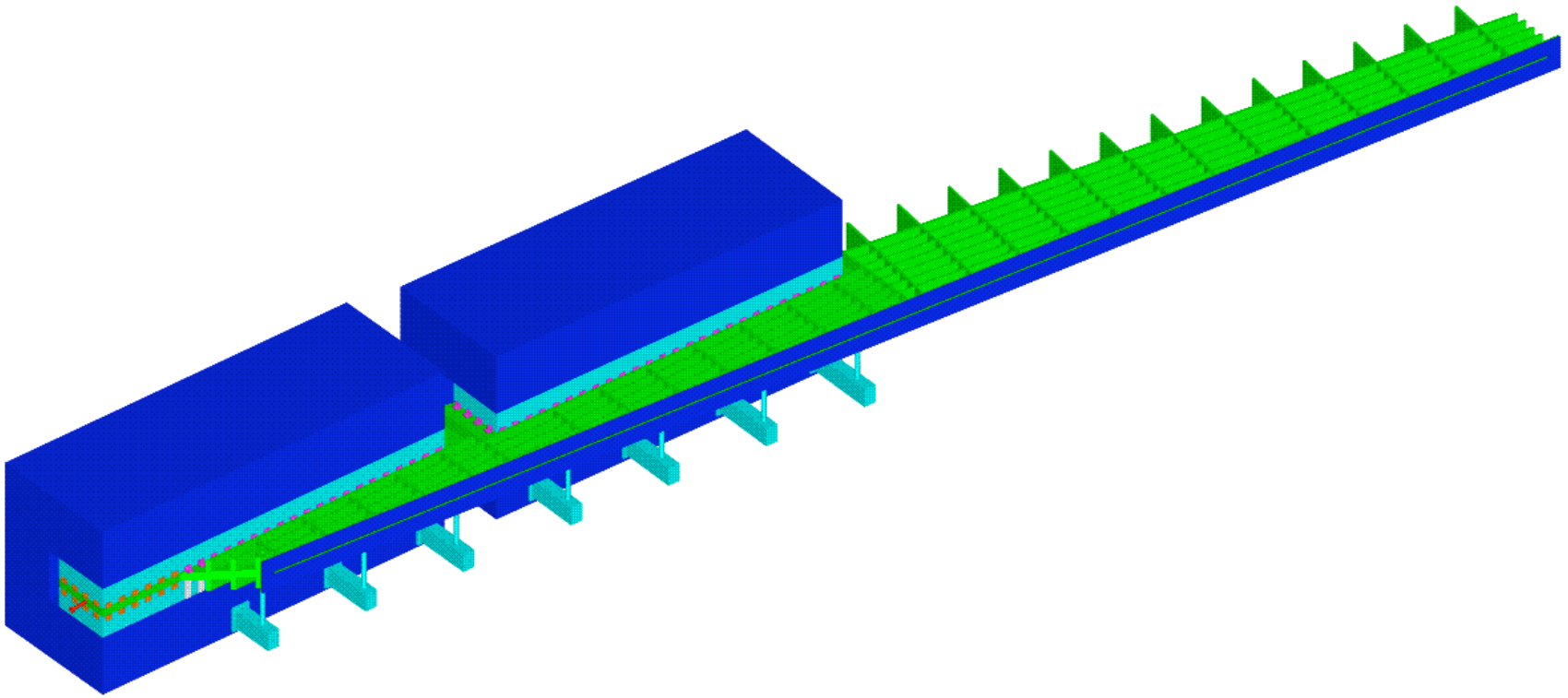


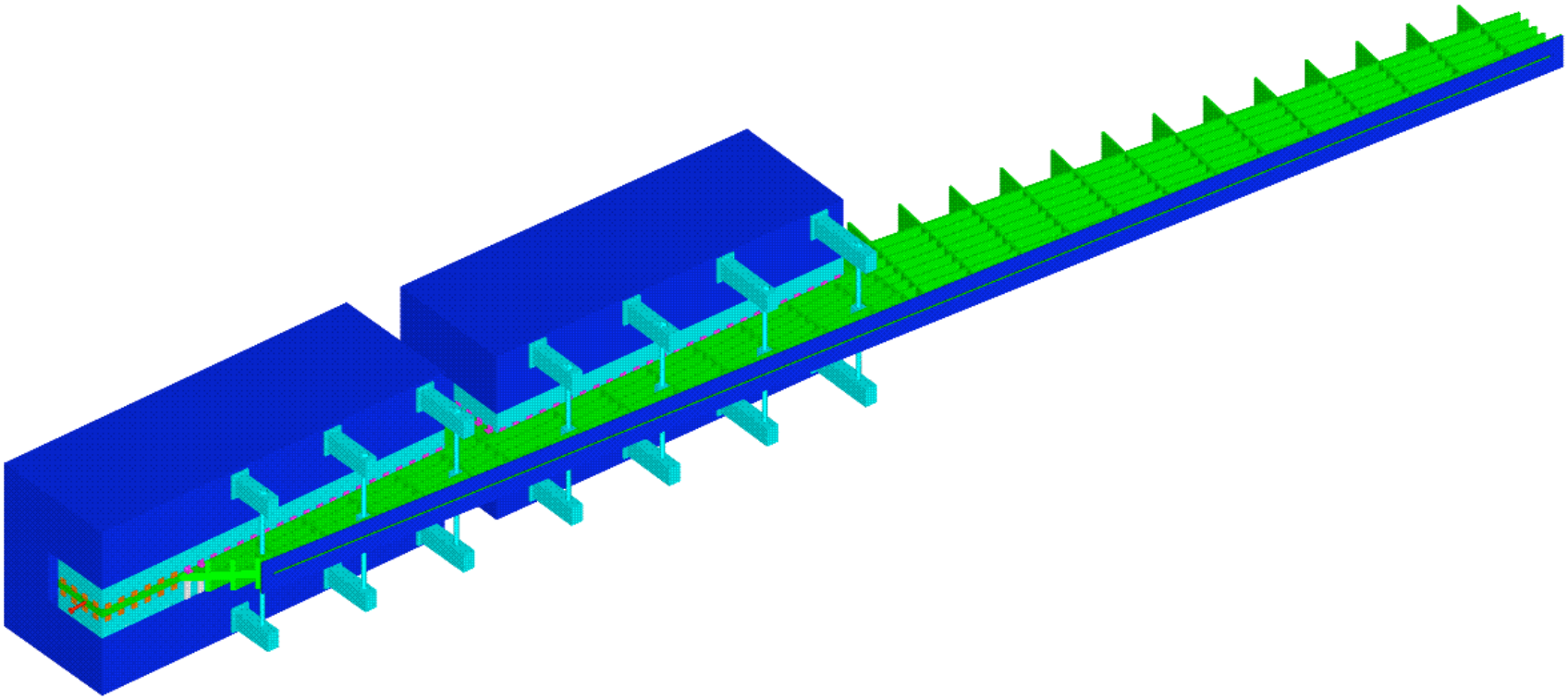












Conclusions

1. Optical properties meet design specification

2. Sufficient details is provided so that a realistic cost estimate of the tagger magnets and vacuum chamber can be obtained from potential manufactures.