Final Review

Gianmarco Ducci

09/23/2015

Mu2e experiment

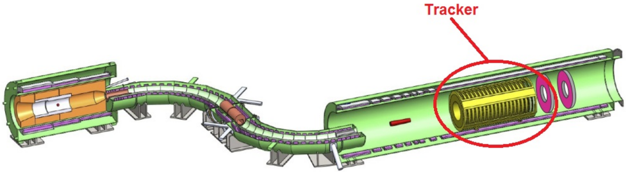
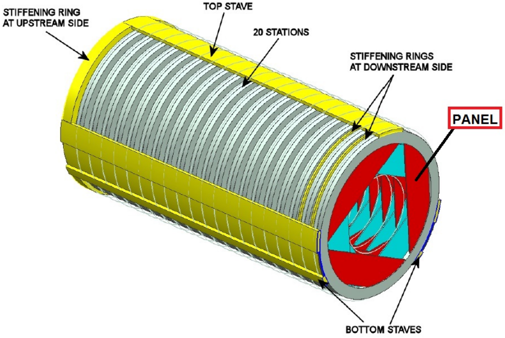


Figure: Sketch of the experimental area

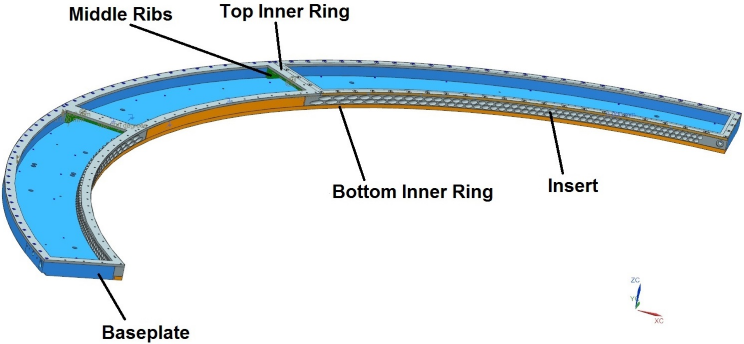
Tracker

The Tracker consists of 20 stations supported by a rigid frame. Each station consists of two planes, and each plane consists of six panels. Groups of straws are assembled into the panels, 2 layers in each panel.



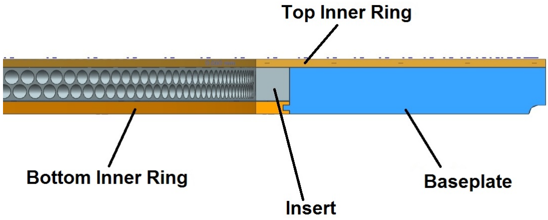
Panel

Panels are mechanical parts that are needed for includeing electronic components. We are developing panels layout to optimize space for electronic devices and manufacturing costs.



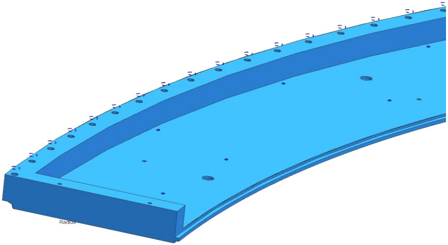
Baseplate

Baseplate height has been reduced to the insert height.
To take in consideration of manufacturing defect, between Bottom Inner Ring and Insert and between Bottom Inner Ring and Baseplate, there is a gap of 300 microns, where glue will be inserted.



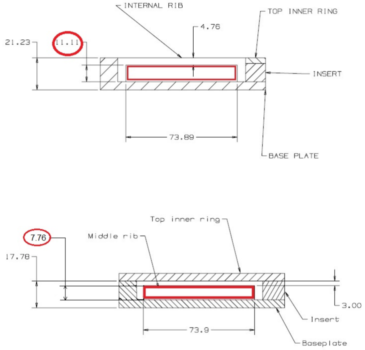
Baseplate

With respect to version 2.0, baseplate and external ribs are an unique part. This layout is designed with the intend to reduce the glue joint area which reduce the amount of the potential leakage area and increase the overall stiffness of the ring manifold



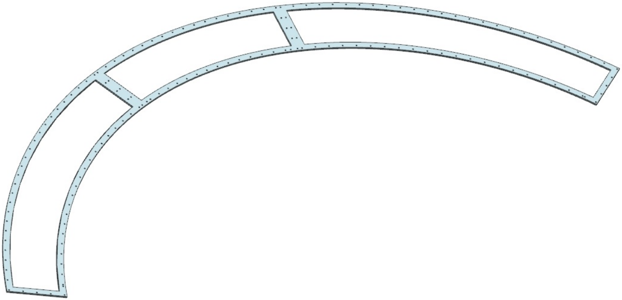
Middle ribs

The result is that the internal space has been reduced, as shown in the figure.



Top Inner ring

Top inner ring is an unique frame in Aluminum.



Baseplate stiffness

Baseplate is the most critical component as concerns installation of Ring Manifold 2.5. For this reason, a structural analysis of this part has been done.
Baseplate 2.5v and Baseplate 2.0v stiffnesses have been compared by a FEM Analysis.
Two different situations have been studied:

- Stiffness comparison before installation;
- Stiffness comparison during installation.

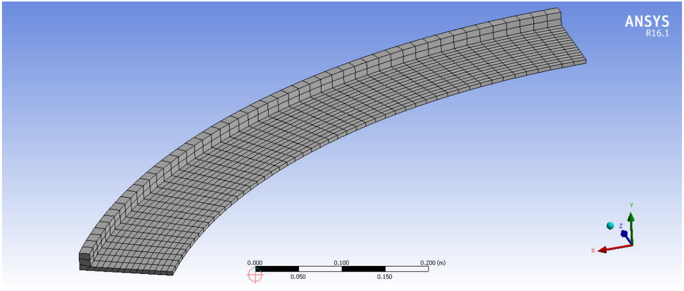
Model

In order to do the analysis described in the previous slide, semplified models of baseplate have been created.

- Holes and geometrical details have been excluded;
- For simmetry reasons, we'll study only the half part of baseplate.

Mesh Size

- Each simulation has been done with three different Mesh sizes: 16mm, 8mm, 4mm.
- The convergence value shown in the following slides, is evaluated with 4mm Mesh size.



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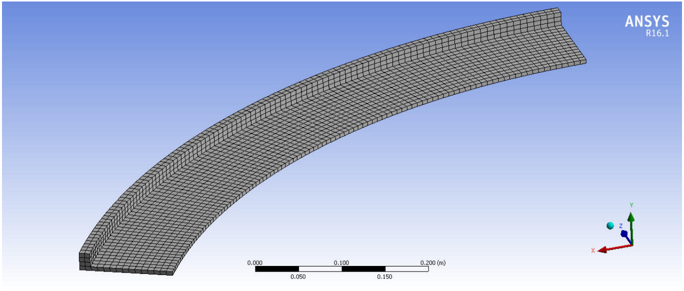

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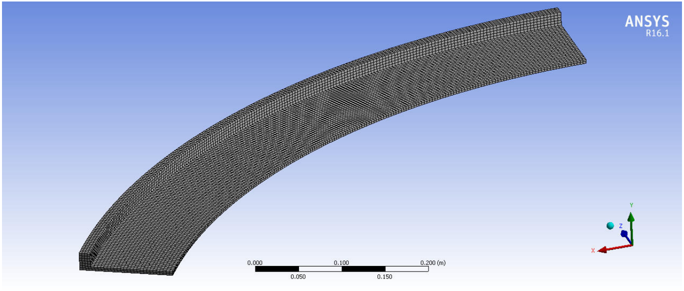


Baseplate stiffness before installation

Manufacturing defects will be simulated by a FEM analysis in order to evaluate the force reaction that an operator should apply to compensate flatness errors.

- Constraint: *Fixed Support* applied on the face indicated in the figure;
- Load condition: 3mm displacement have been imposed in order to evaluate the force reaction in a datum point.

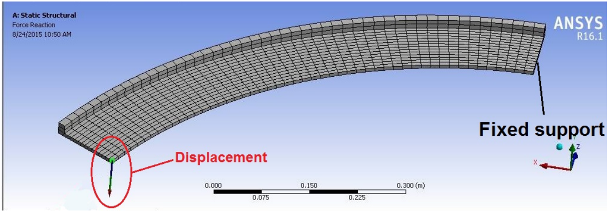
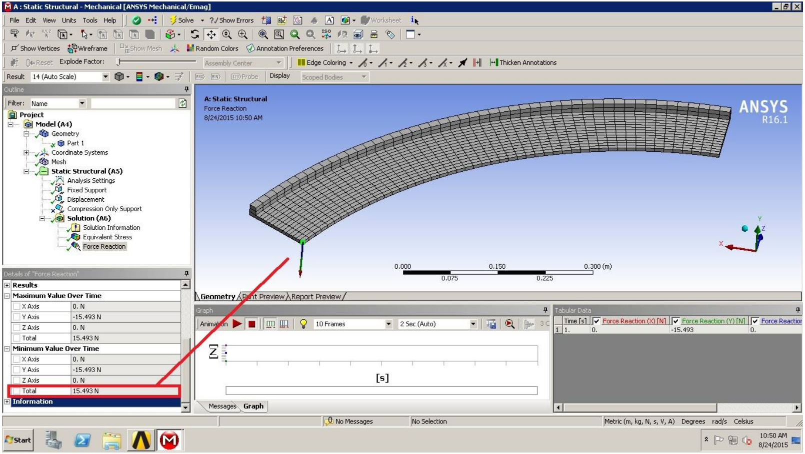


Figure: Simplified model

Force reaction v2.0

The maximum value of the force is ∼15.3N.



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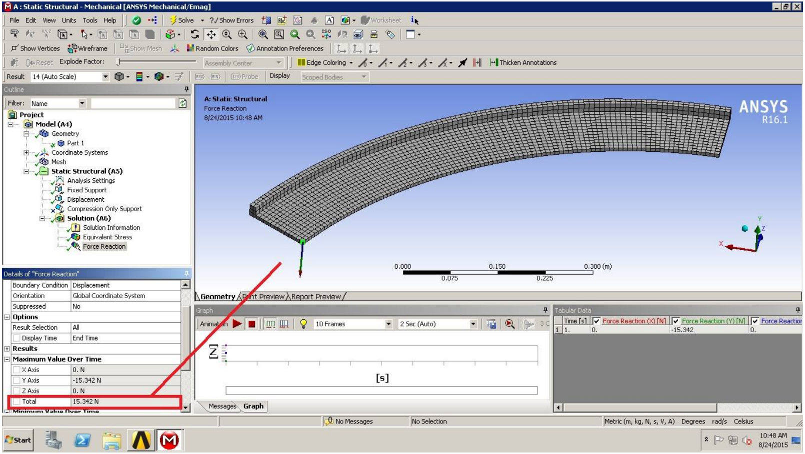

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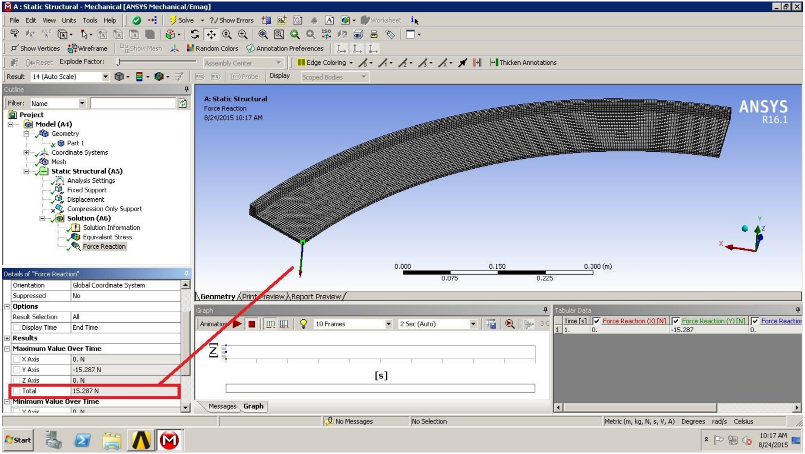
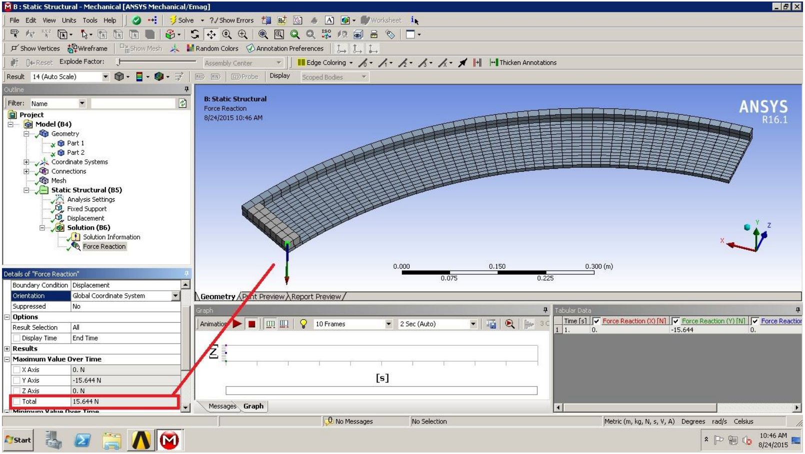


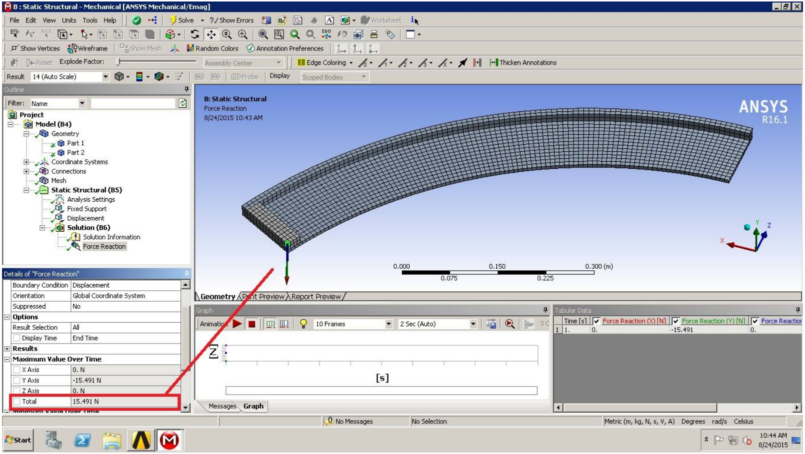
Force Reaction v2.5

The maximum value of the force is ∼15.5N.



Force Reaction v2.5

The maximum value of the force is ∼15.5N.



Force Reaction v2.5

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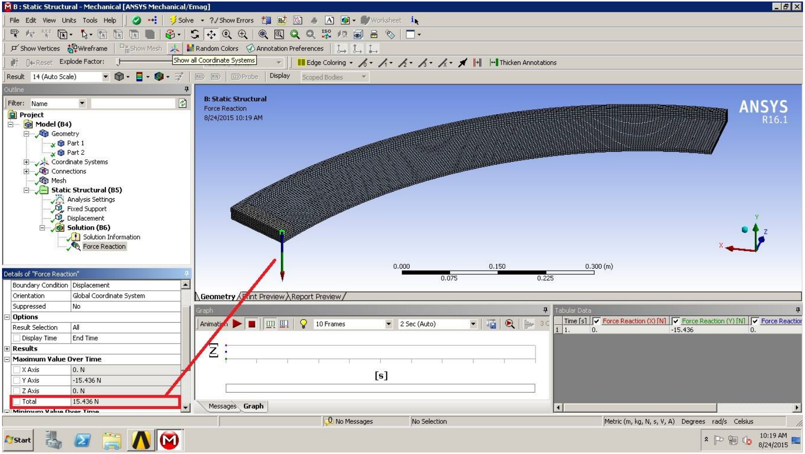
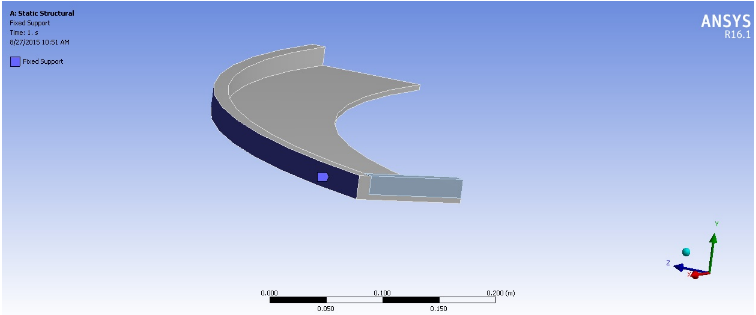


Baseplate stiffness during installation

In order to evaluate the baseplate stiffness during installation, a FEM Analysis has been done with the following criteria:

- Constrain: Fixed support on the middle face. Because of symmetry condition, displacements and rotations are not allowed on this face;
- Constrain: No displacement along outer lower edge.



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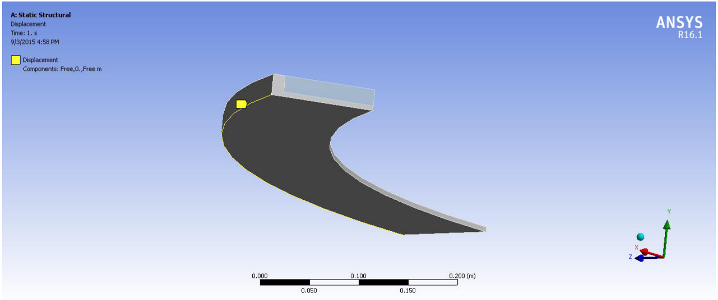
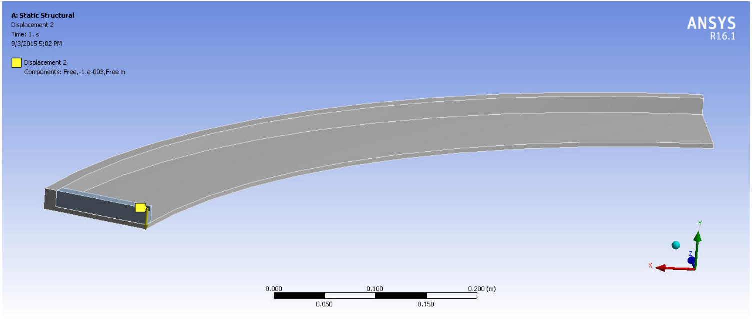


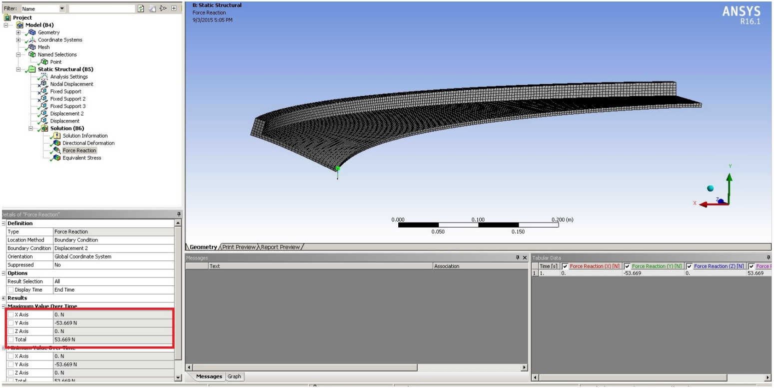
Load condition

In order to evaluate the baseplate stiffness during installation, it has been supposed that the maximum deflection due to imperfection during manufacturing processes is 1mm displacement in the vertex.



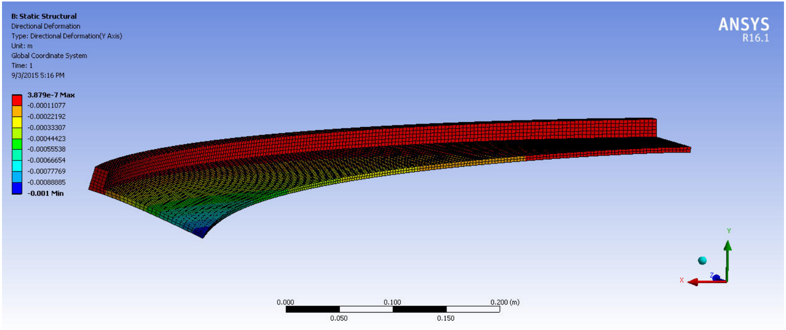
Results for Baseplate v2.0

Using the model described in the previous slides, a force reaction of ∼54N has been found.



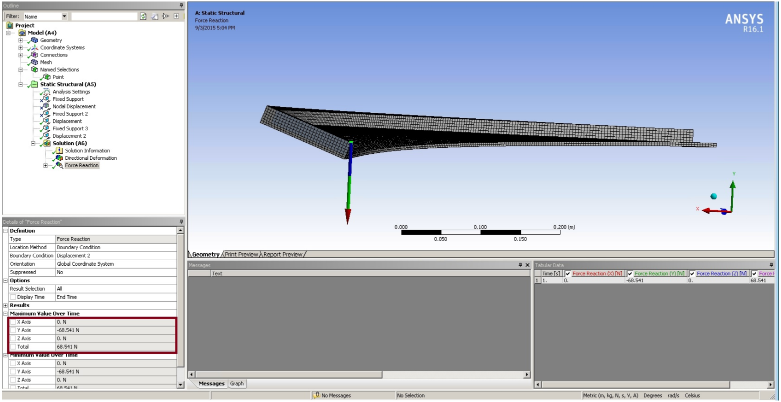
Results for Baseplate v2.0

The displacements along Y-axis are shown in the following figure.



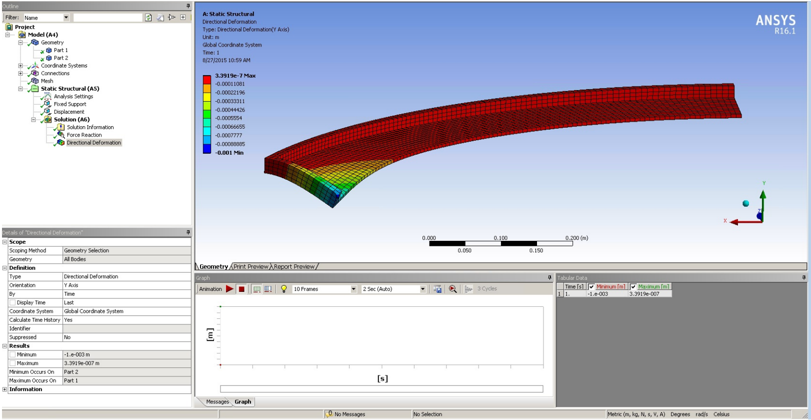
Results for Baseplate v2.5

Using the same model also for Baseplate v2.5, a force reaction of ∼69N has been found.



Results for Baseplate v2.5

The displacements along Y-axis are shown in the following figure.



Conclusion

As shown in the analysis, the difference between baseplate 2.0 and baseplate 2.5 version is not significative as far as the installation is concerned.
Comparing the force reactions found, they have the same order of magnitude and the value of them is acceptable for the purpose required.

Goals achieved

- The new layout of Ring Manifold has been verified and approved;
- Components of Ring Manifold 2.5 have been drawn and drawings have been sent to machine shops in order to evaluate manufacturing costs.

Thank you for the attention