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# Muon g-2 experiment hall design

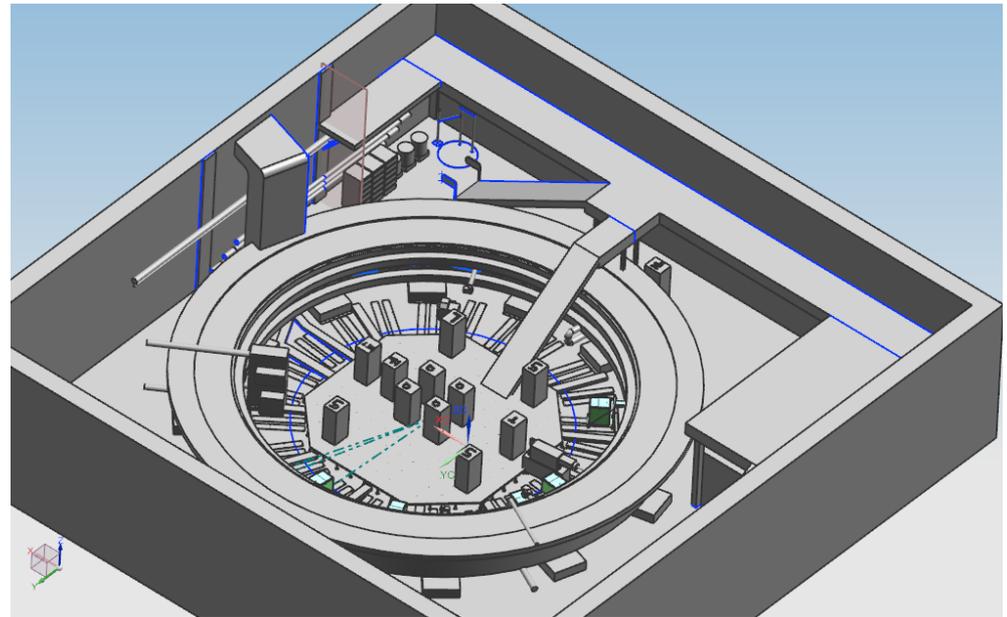
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Internship for Italian Students

23 September 2015

# Overview

- Intro – the muon g-2 experiment
- The experiment hall model
  - Constraints
  - Ring
  - Beam Chamber & related items
  - Floor and outside corner
- Conclusions

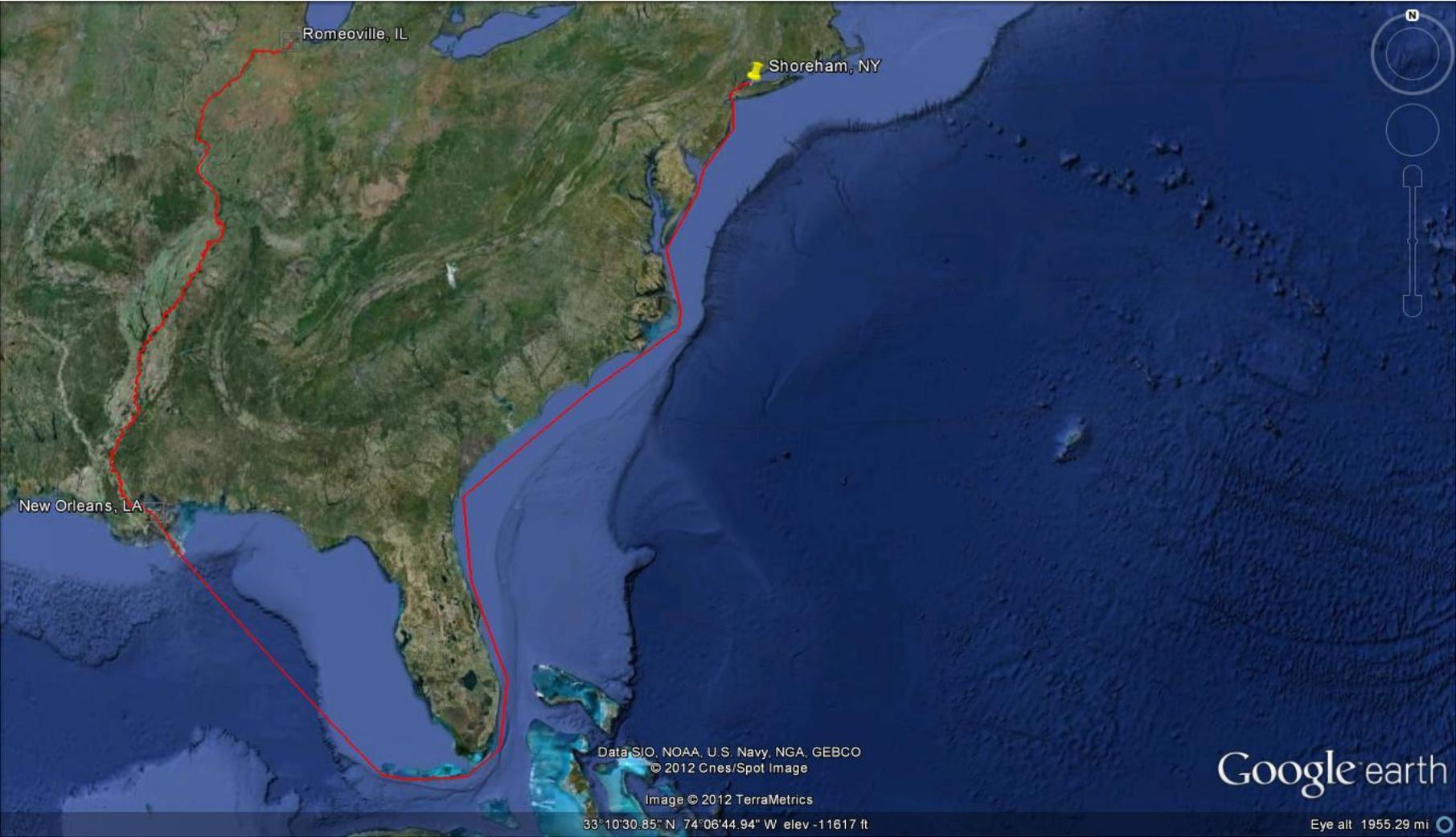


## Intro – The muon g-2 experiment

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- The experiment aims at measuring the anomalous magnetic moment of the muon
- It was already performed in Brookhaven National Laboratory
- The measured value is different from the theoretical one by more than 3 standard deviations
- Magnet was moved to Fermilab in summer 2013
- Fermilab muon production facility can deliver 21 times more muons to the magnetic ring, thus reaching 4 times higher precision
- Scheduled to start running in 2017

# Intro – The big move



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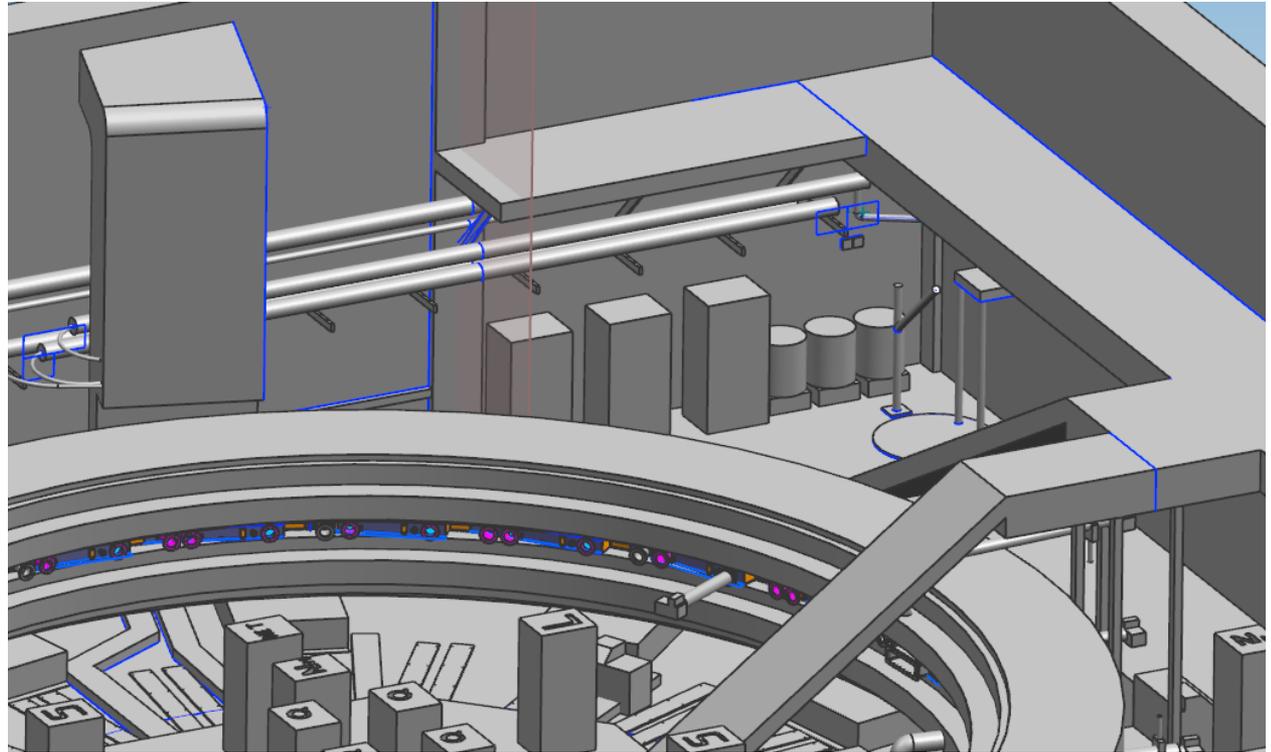
# Experiment hall model

## Goals:

- Check all instruments and equipments fit
- Assist with positioning

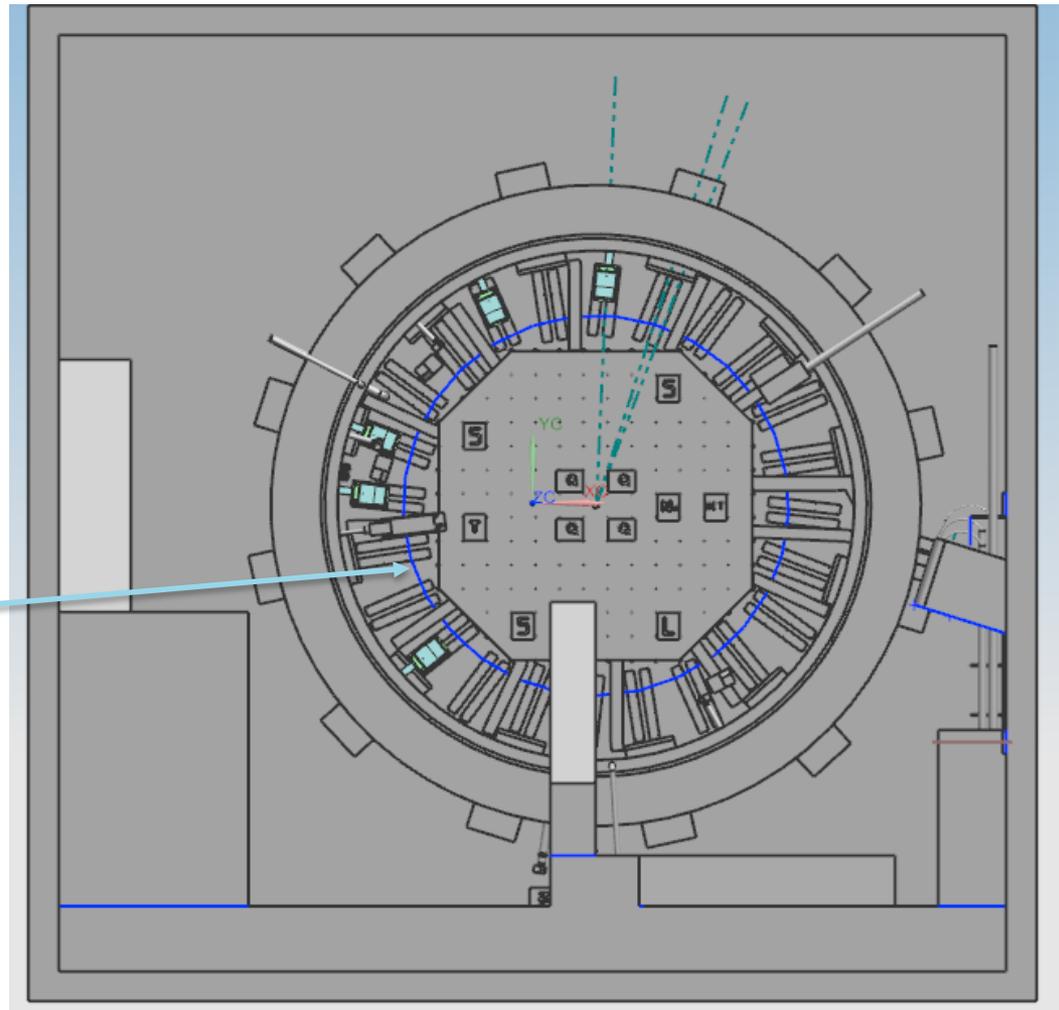
## Features:

- More than 100 elements
- Will be expanded in the coming months



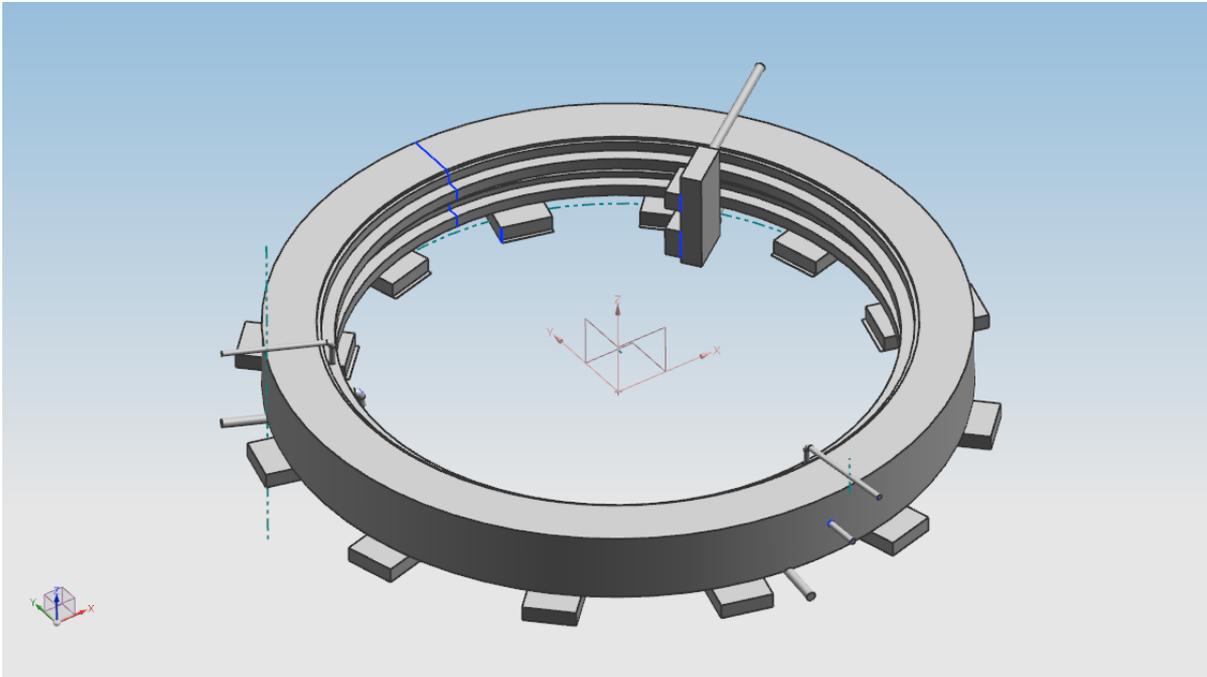
# Constraints

- Equipments have to fit inside the ring diameter
- Some equipments can't stand  $B > 20$  gauss
- From the magnetic flux density gradients map we defined a safe area
- Fixed ports and scallops on vacuum chambers
- Others specific for each item



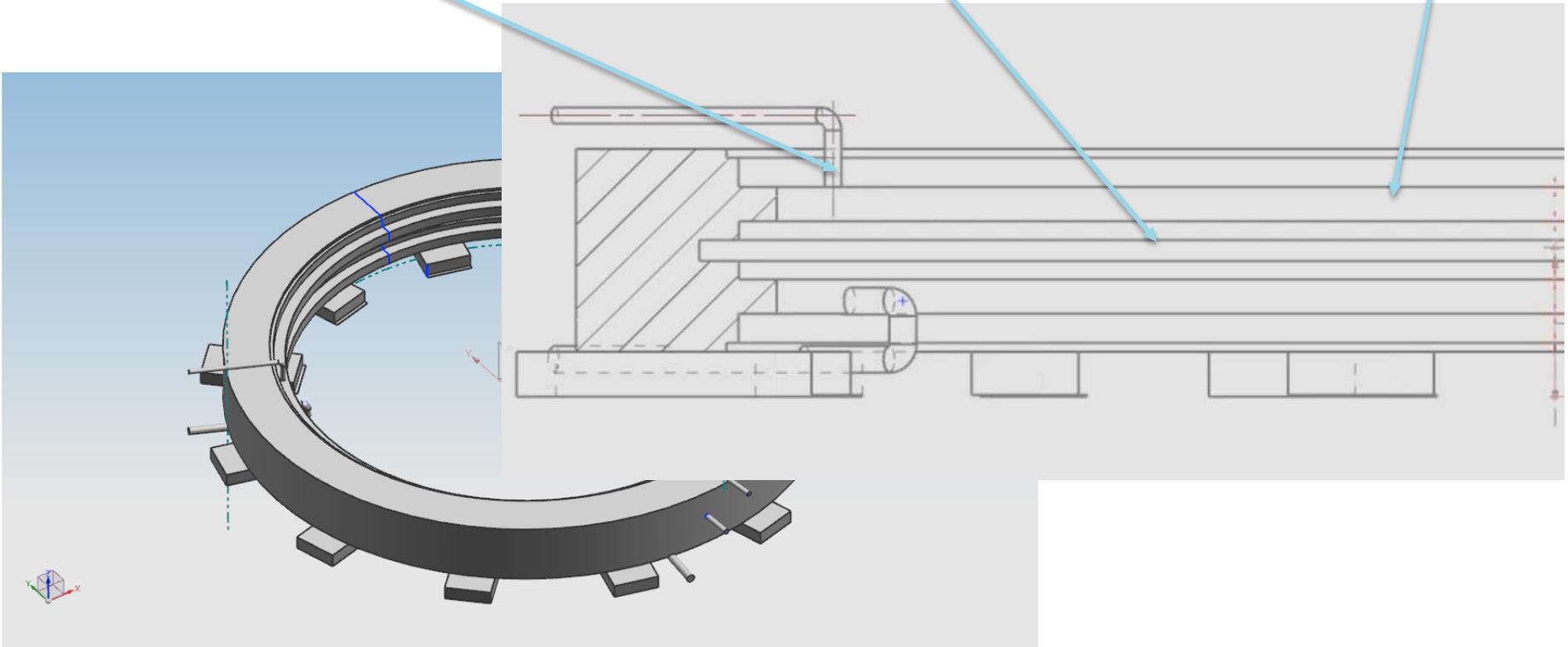
# Ring

- Accommodates beam chamber
- Tilted with respect to the room
- Insulating vacuum is pulled to insulate superconductors



# Ring

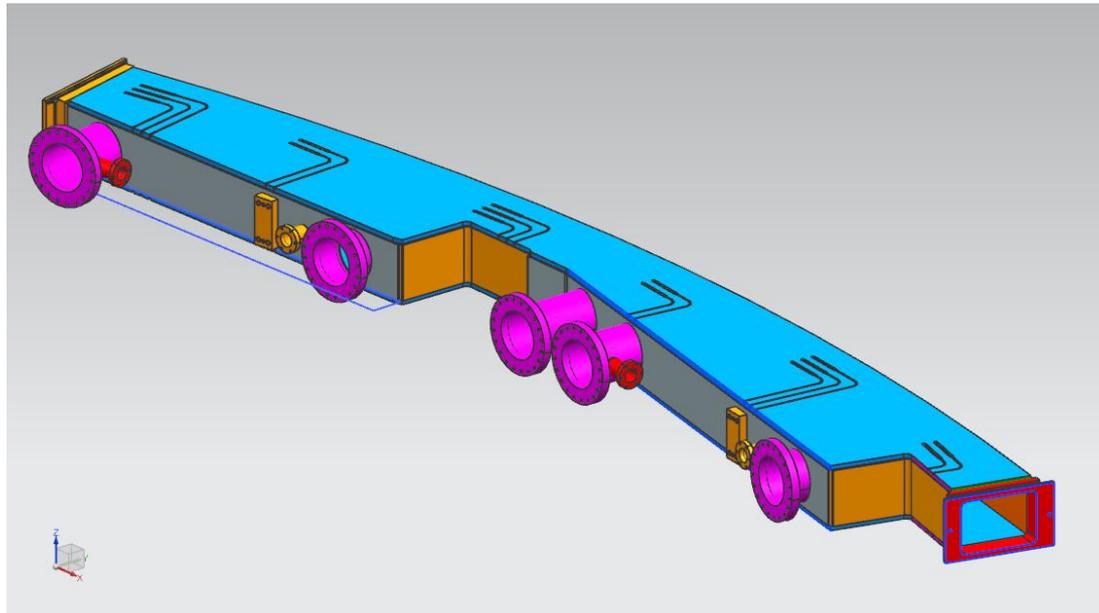
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# Vacuum chamber

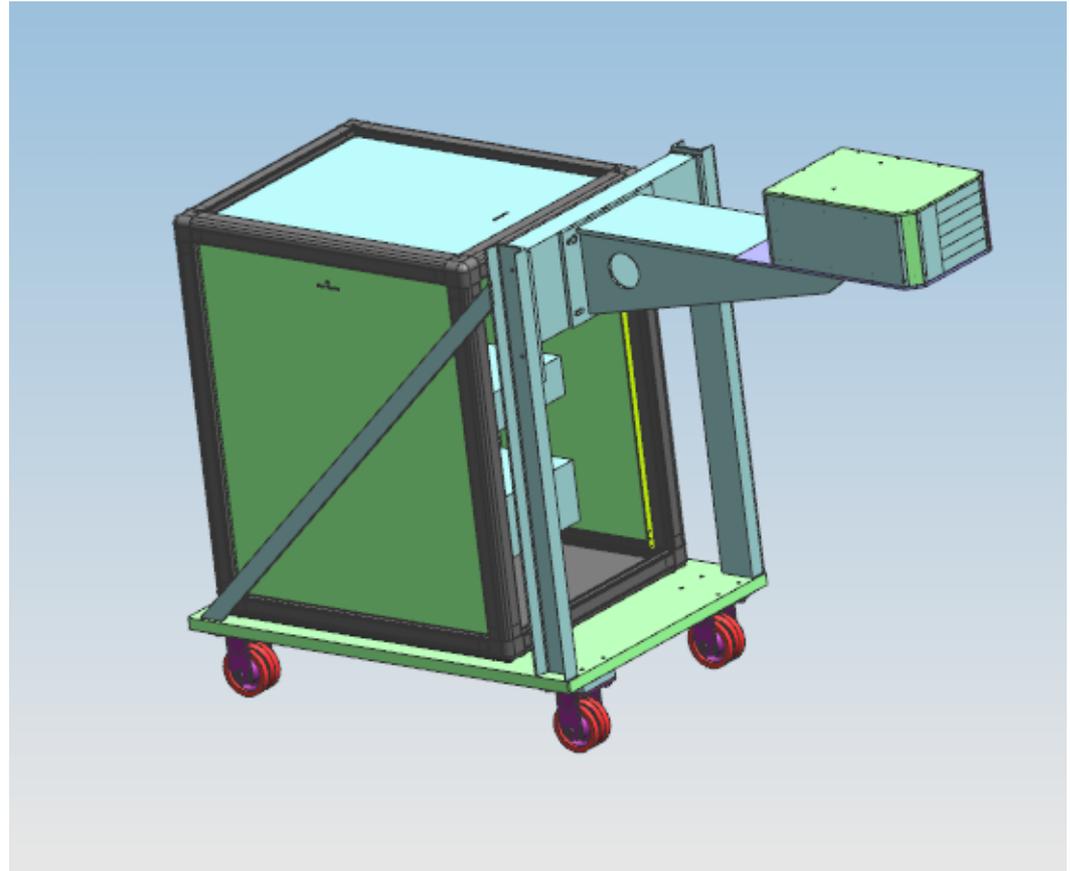
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- 12 of them form the beam chamber ring
- Modified chambers accommodate straw detectors, to measure muon spatial distribution and momentum spread
- Contains rail for calibration trolley
- Coupled with calorimeters



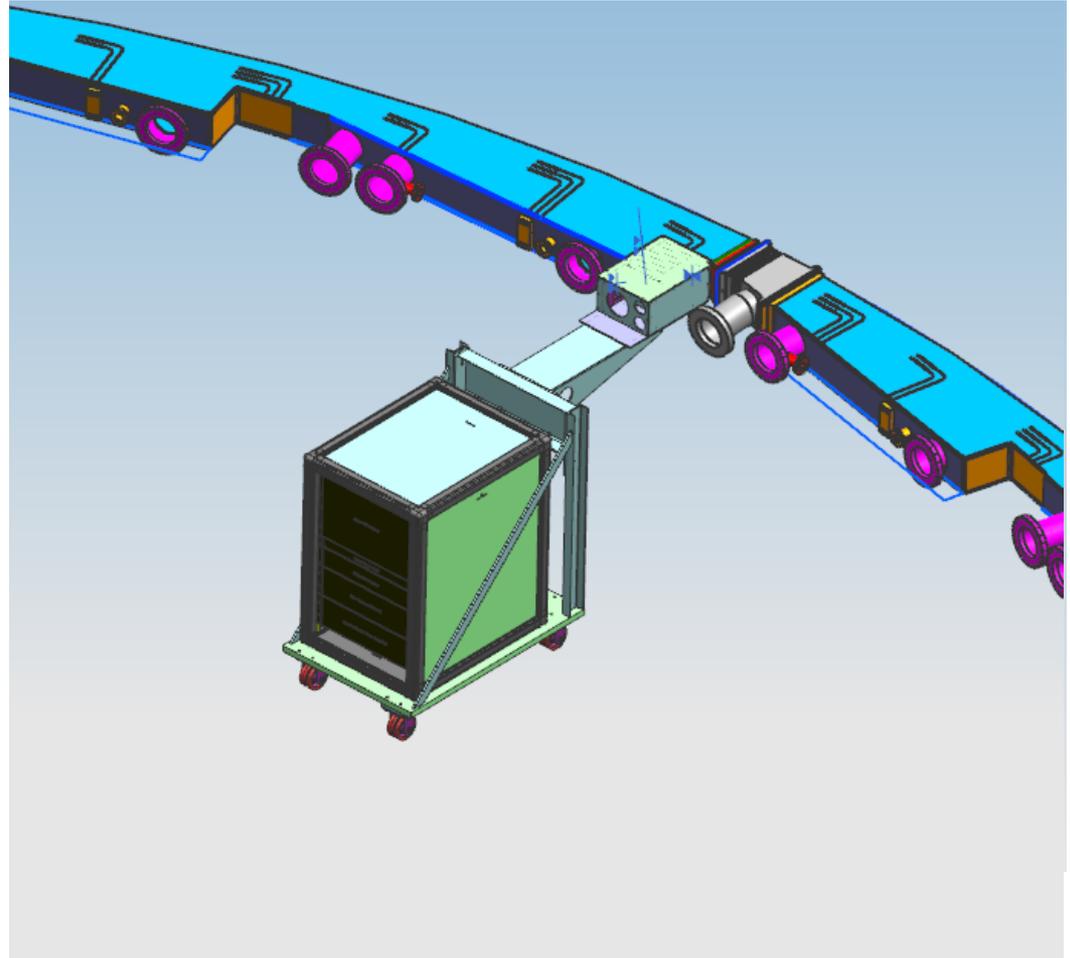
# Calorimeters

- Muons decay into a positron and a neutrino
- Positrons don't have enough energy to stay on its orbit
- Measure hit times and energies of positrons
- Reconstruct trajectory and there measure B
- Sitting on rails
- 24 along the ring



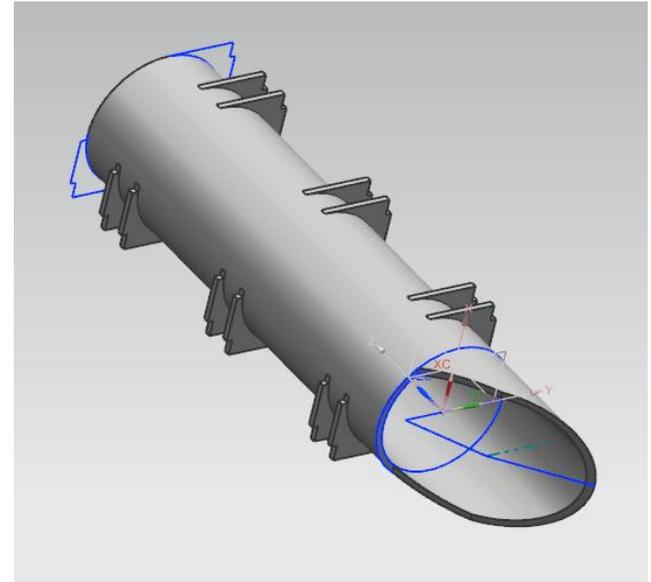
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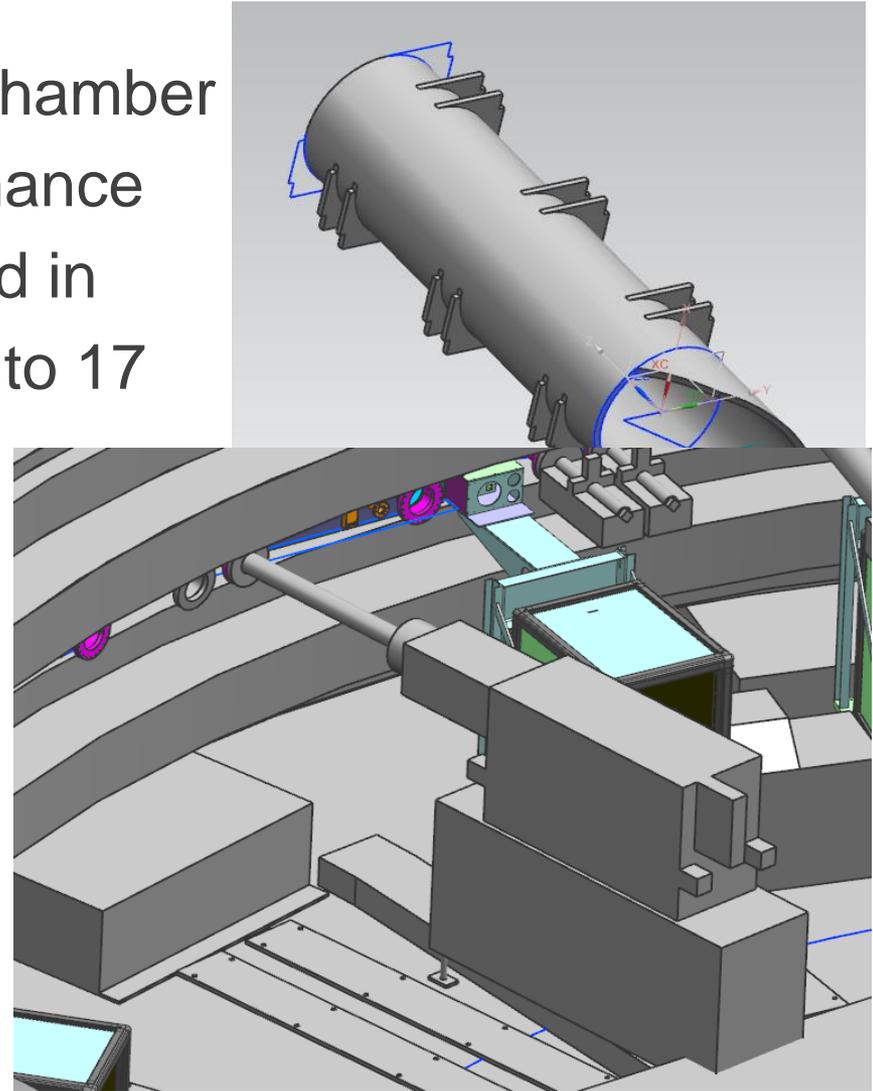
# Trolley Drive & Garage

- 2 trolleys will run inside beam chamber
- One for calibration and maintenance
- The other to measure the B-field in approx. 6000 locations thanks to 17 NMR sensors
- Drive developed by Argonne National Laboratory
- Drive will pull the trolleys by wire



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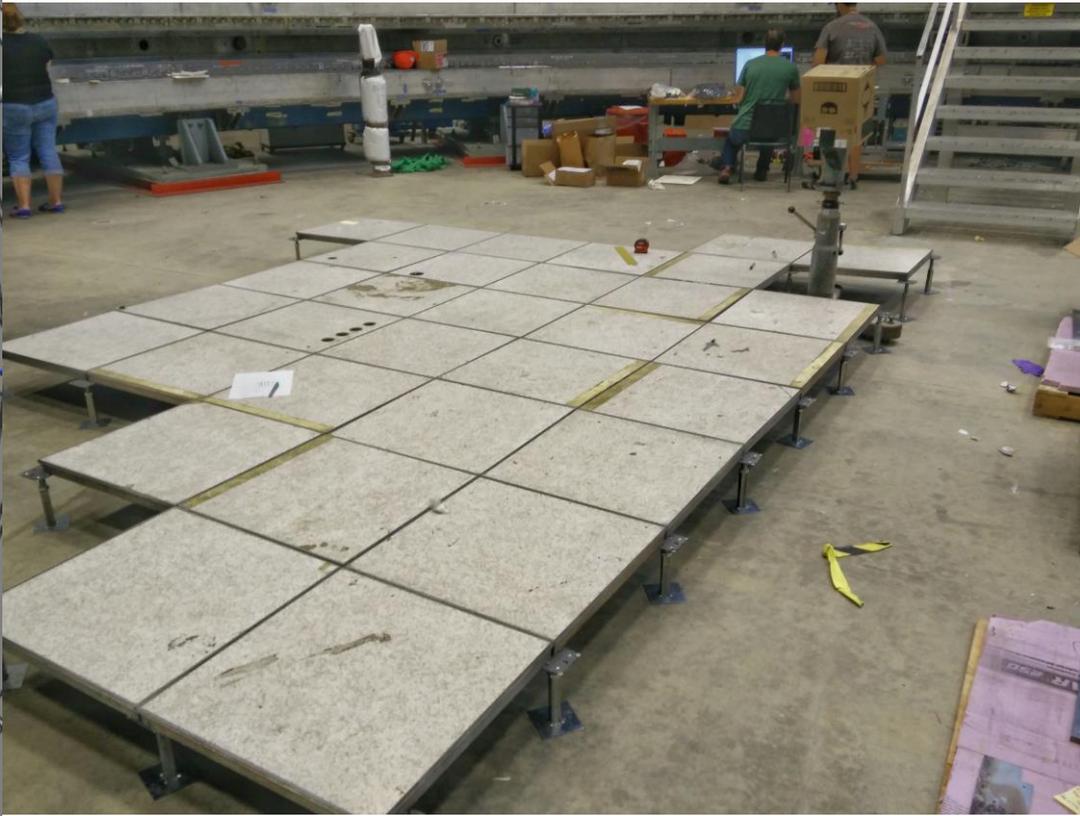
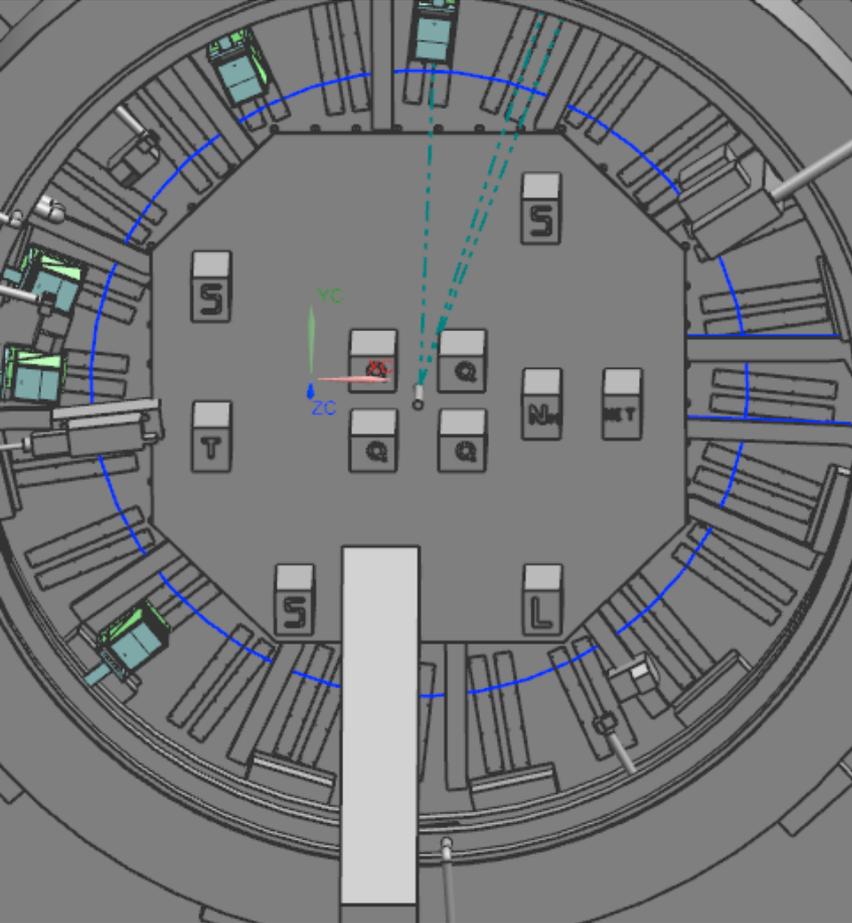


# Fake Floor

- Not in place yet
- Will cover wirings and cable trays
- Centered on the alignment monument
- Will be crowded with racks holding the electronics for the various instruments

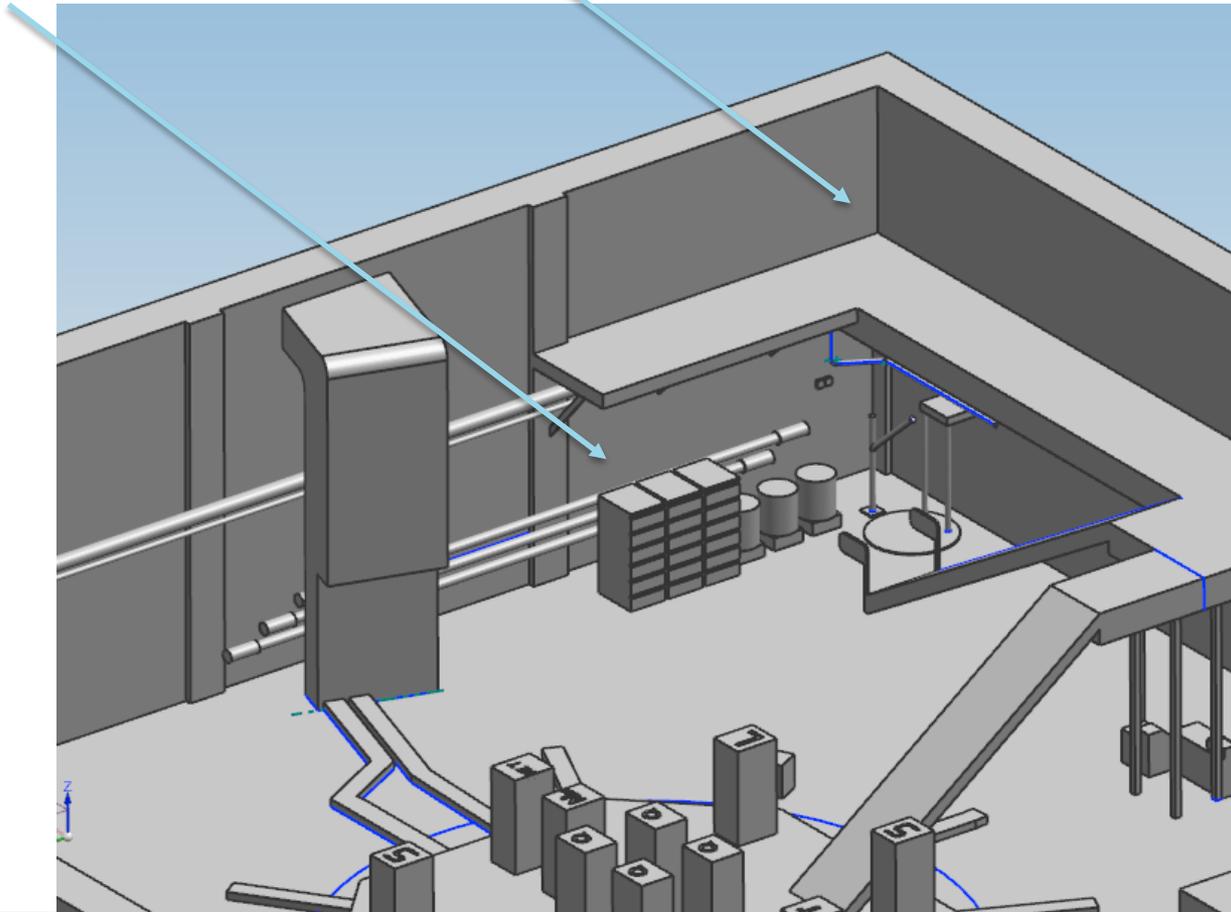


# Floor



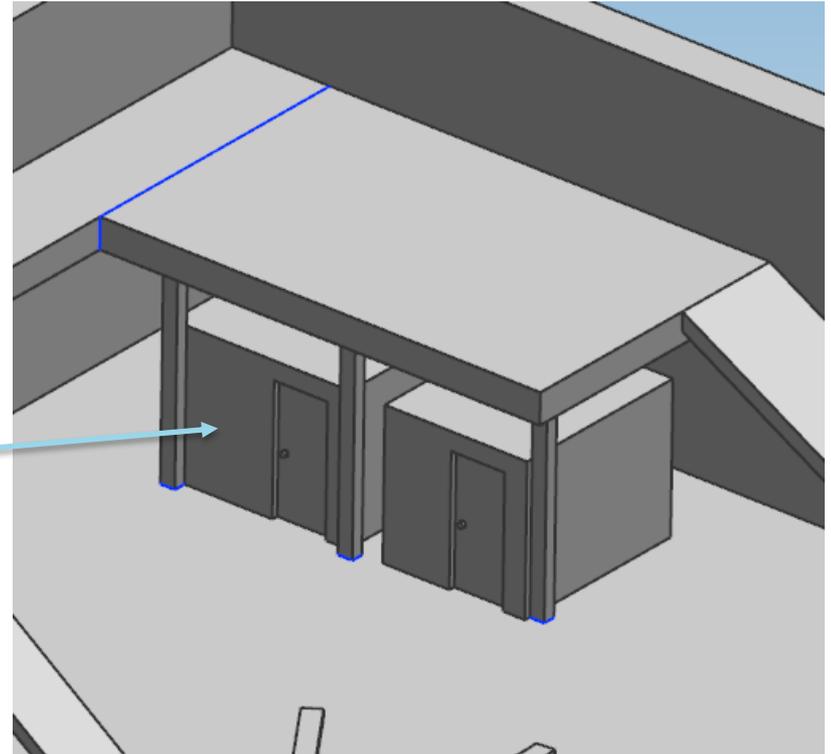
# Outside the ring

- Entrance to the hall
- 5 o'clock corner, the most critical area outside the ring



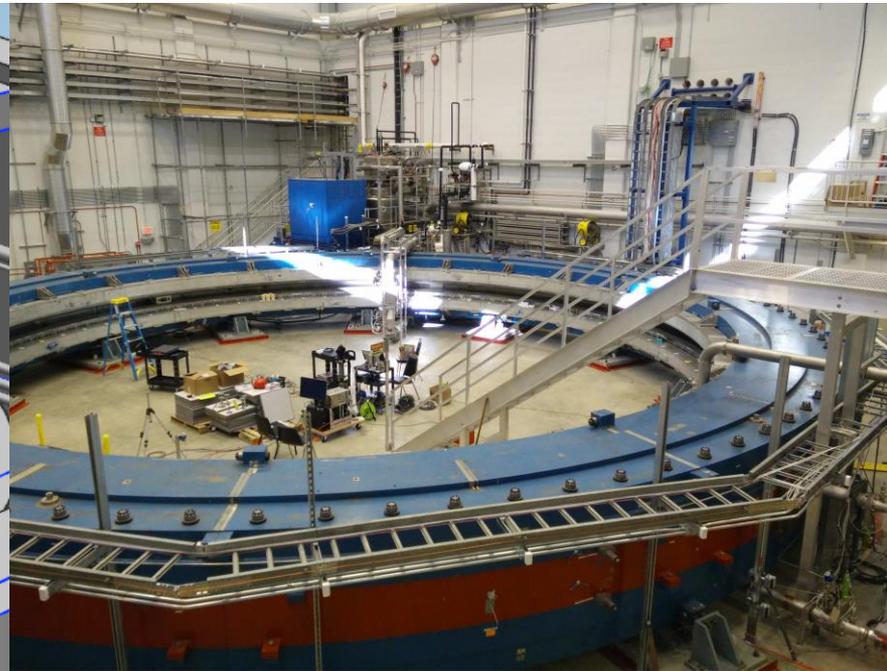
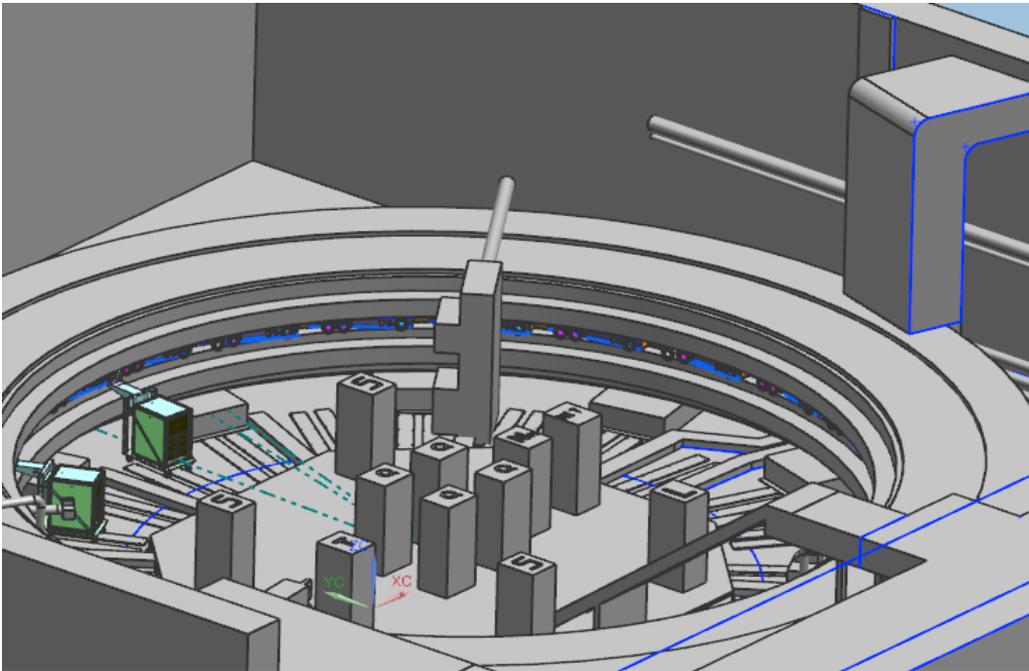
# Outside the ring

- Waterfall & cable trays
- Blumleins
- Other pipes
- Racks & oil tanks
- Sump pump
- Vacuum pumps & controls
- Catwalk & stairs
- Operators rooms



# Situation on 09/21/2015

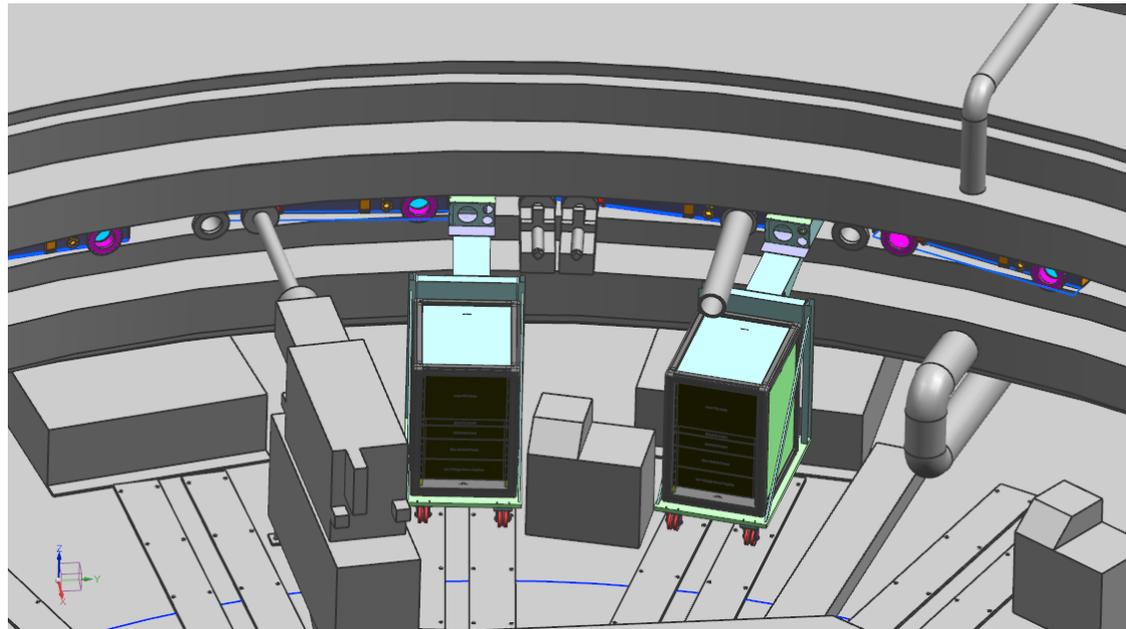
- Cooling system is being tested



# Conclusions

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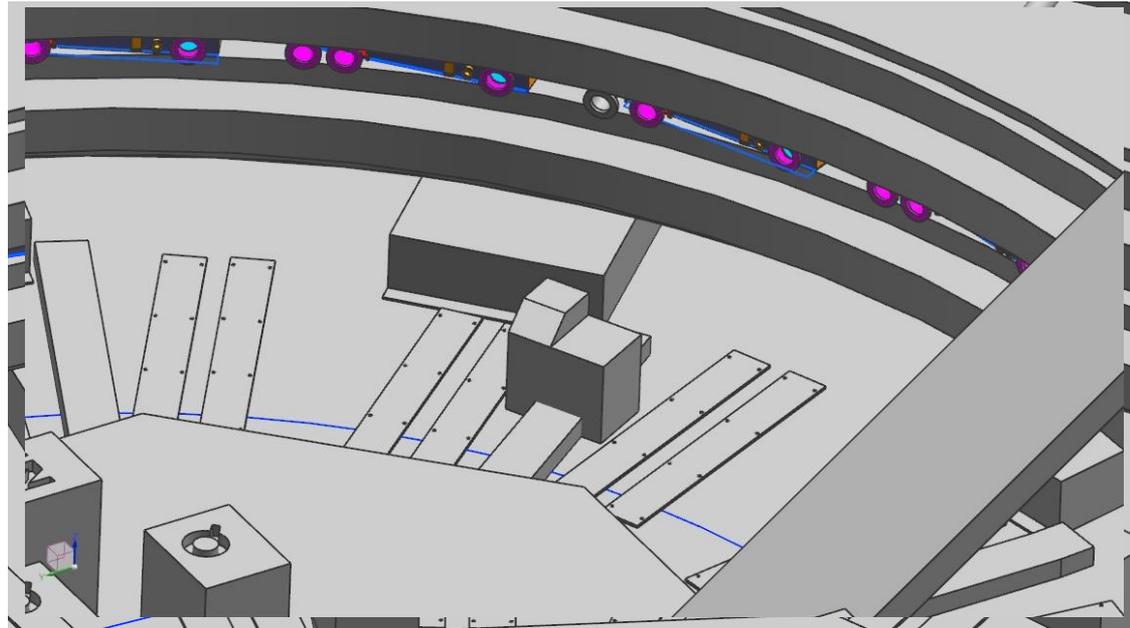
- Model has good level of detail and completeness
- Model has good precision (less 1-2 inch difference between model and real hall)
- Main components fit without interference (calorimeters, rails..)
- Model can be updated if needed



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Thanks for your attention!  
Any questions?