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U.S. LARP

LHQ structure
Items for discussion

Collaboration Meeting 18

May 7th to 9th 2012, FNAL

Helene Felice

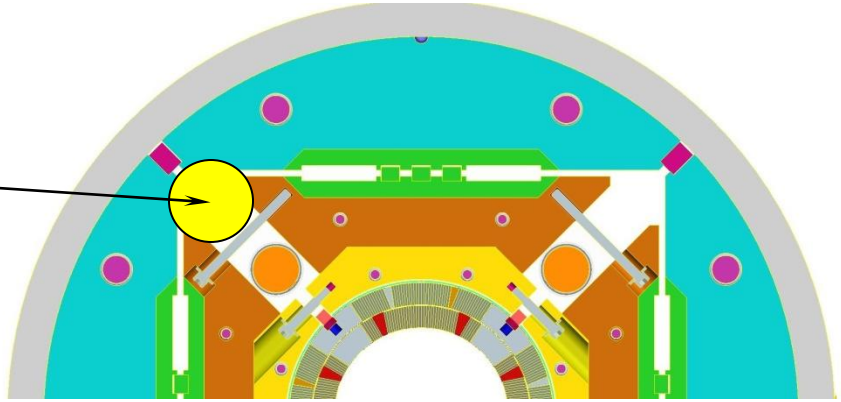
Topics for discussion

- **Cooling scheme in LHQ**
  - Holes in the structure
    - What are the expectations for LHQ?
  - Holes in the pole pieces
    - Impact on ground plane insulation
- **Assembly**
  - Key insertion in the key way: at what point of the assembly?
  - Collar type
  - Impact of the part tolerances on coil stress distribution

Cooling scheme in LHQ yoke

- Cooling channels in the structure
  - Requirements for prototype: 2 holes of 90 mm diameter => 63.6 cm^2 per hole => 127 cm^2 in total
  - Cannot be added in LHQ if we keep the same magnet OD
  - Need to maintain space for the rods and yoke keys
  - What do we want to demonstrate?

Nominal Diameter:
2.00" [50.8 mm]
(maximum per quadrant)
20.25 cm^2
=> 81 cm^2 for 4 holes



Ray Hafalia

LHQ structure cooling features

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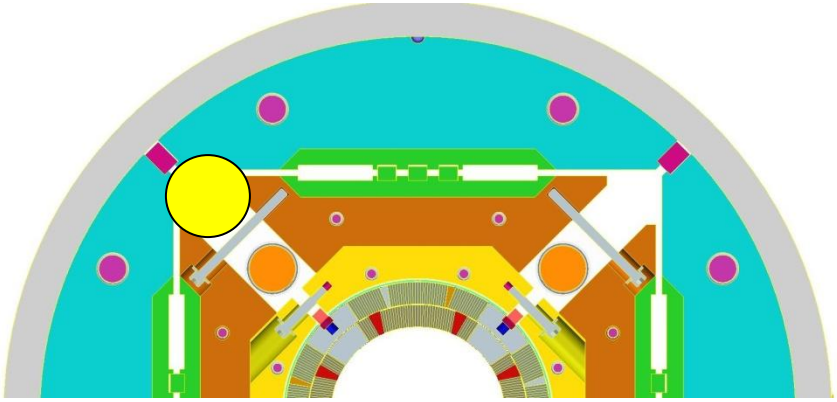
LHQ (120 mm – 15 mm)

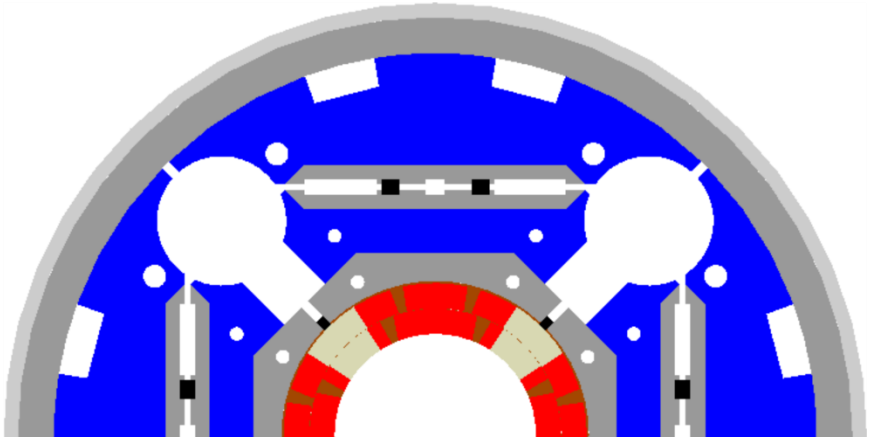


Ray Hafalia

- Preserve space for the rods
- Preserve gap keys
- Preserve magnet OD => important to allow testing at FNAL test facility

=> LHQ should provide holes demonstrating the principle but will not match the LHC requirements (?)

MQXF (140 mm – 17 mm)



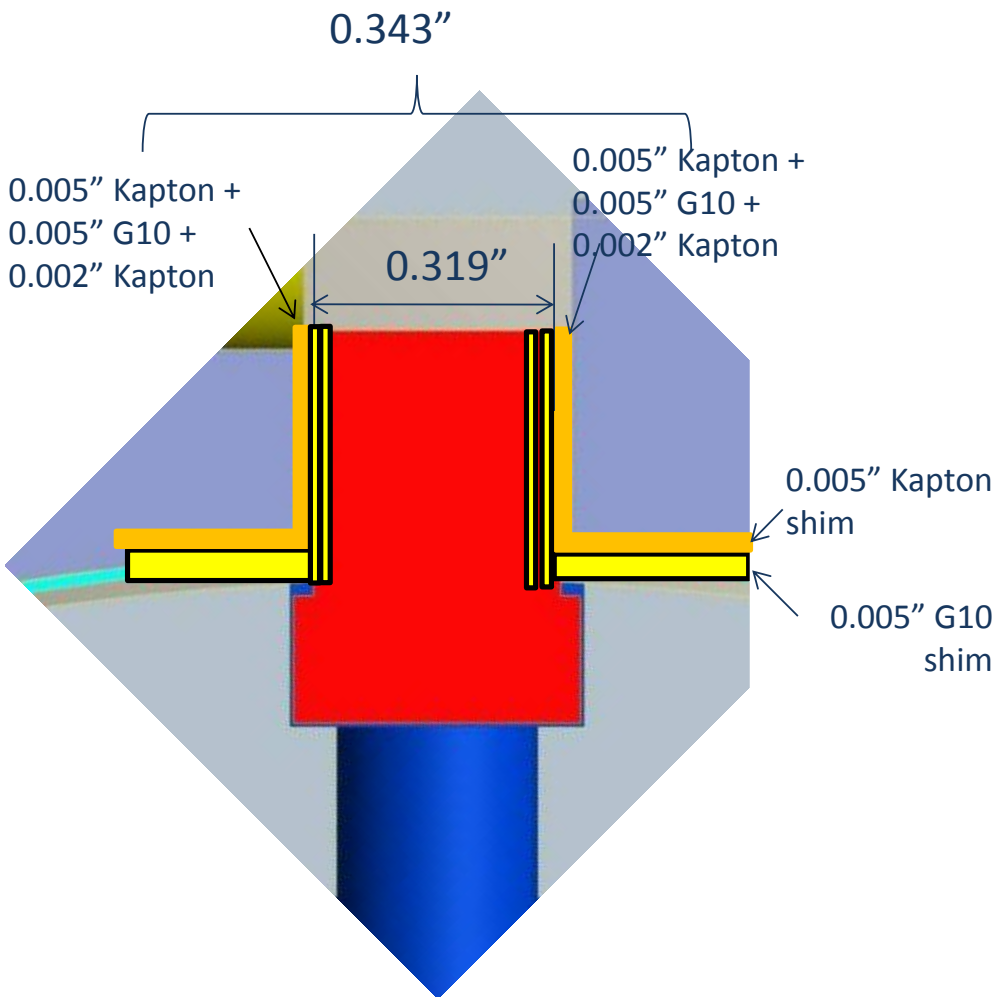
Paolo Ferracin

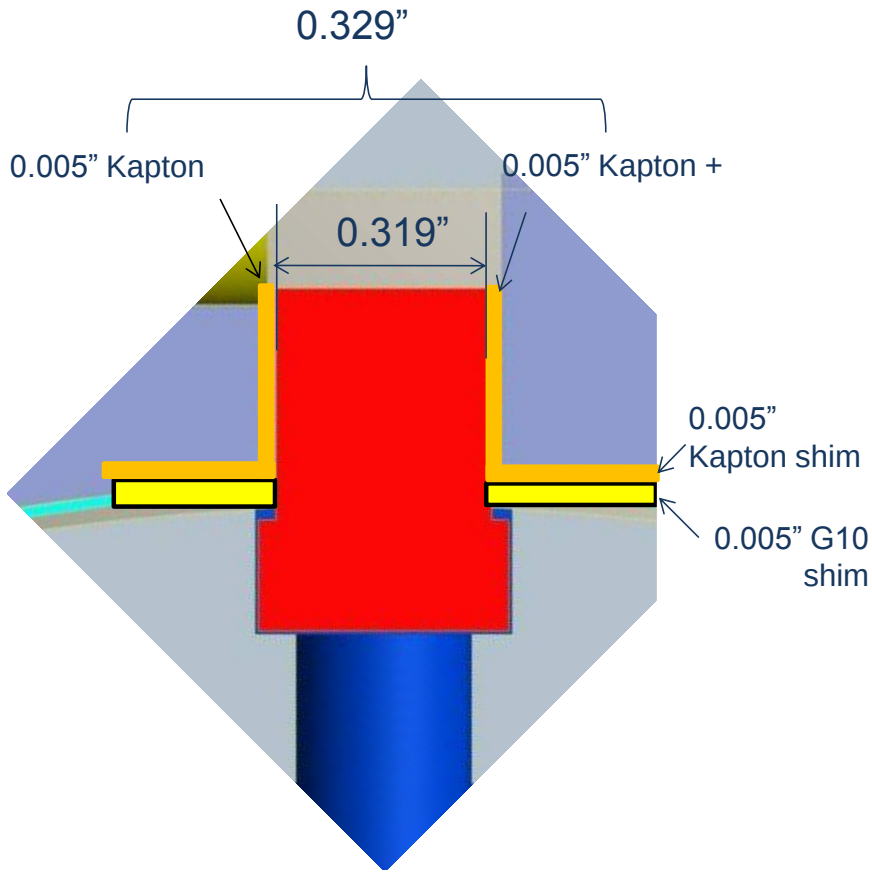
- Does NOT preserve space for the rods
- Preserve gap keys
- Increases magnet OD

Cooling scheme in LHQ pole pieces

- Holes in the pole
  - Require key segmentation or holes in the key
  - Possibly affecting size of each coil's outer layer keyway width and depth (impacting pole segment profile, alignment key design & collar profile)
  - Impact on Ground plane insulation

HQ01d – full length G10 key



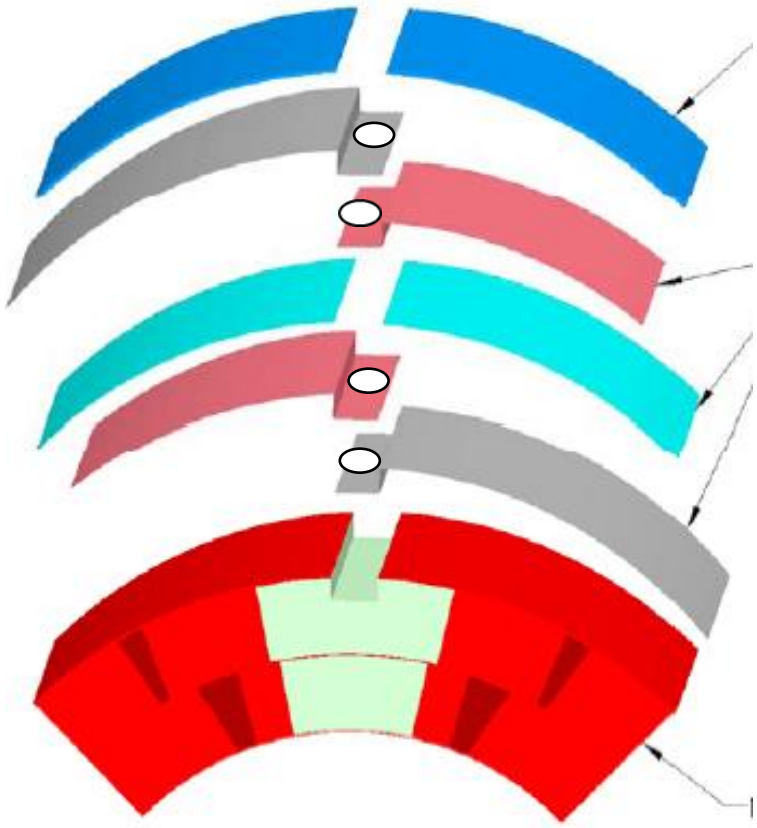


Slide from Giorgio

LHQ cooling Holes and Ground Insulation

Jesse Schmalzle
Giorgio Ambrosio

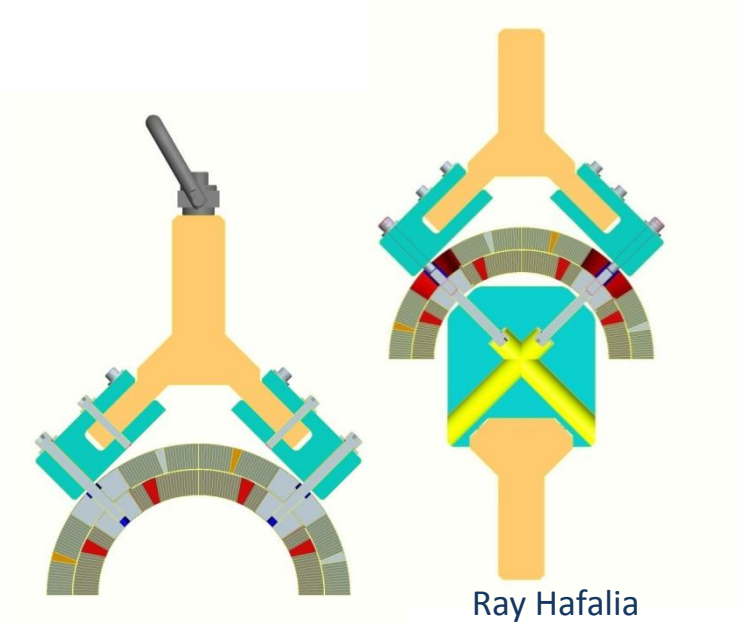
- Possible solutions:
  - Segmented key with hollowed insulating spacers around the cooling holes
  - Some insulation on collars close to the holes?
  - Better ideas ???



Assembly

- In HQ:
  - Key inserted in the key way before assembly

- In LHQ due to handling tooling
  - Key will have to be inserted
    - when the coils are in position for the top coils
    - Bottom coils ?



Ray Hafalia

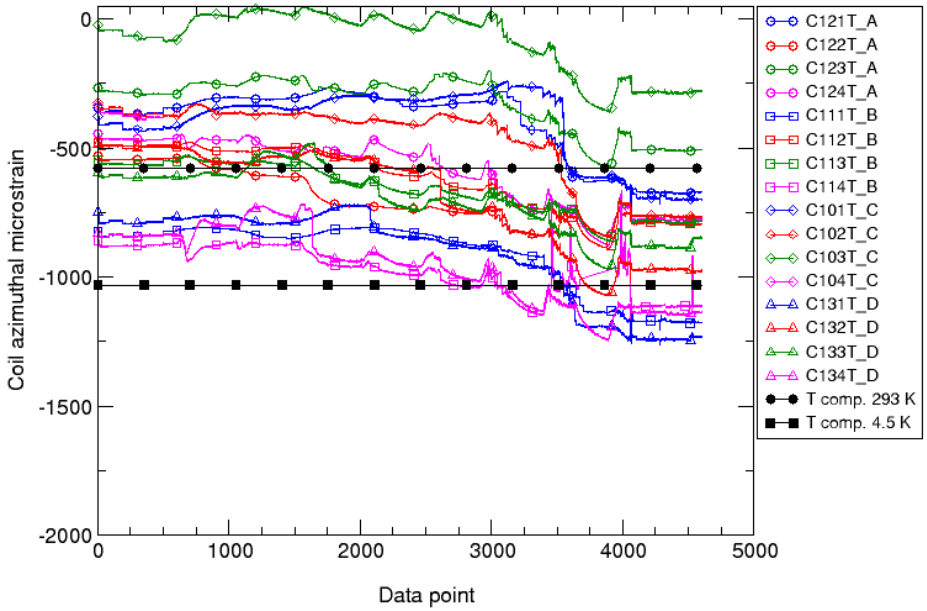
Alignment and collars

- Presently HQ relies on 50 mm thick bolted collars
  - Baseline for LHQ?

- Should we consider laminated collars?
  - round collars with alignment keys on the midplane
  - Quadrupole-type collars => complexity in the assembly
  - Dipole-type collars

Next steps: Impact of tolerances

- Quite a large spread on LQ strain gauges



- Need to determine the possible impact of the part tolerance on this spread
- Analysis should be supported by FEM analysis