AMS-100,
Axial aluminum

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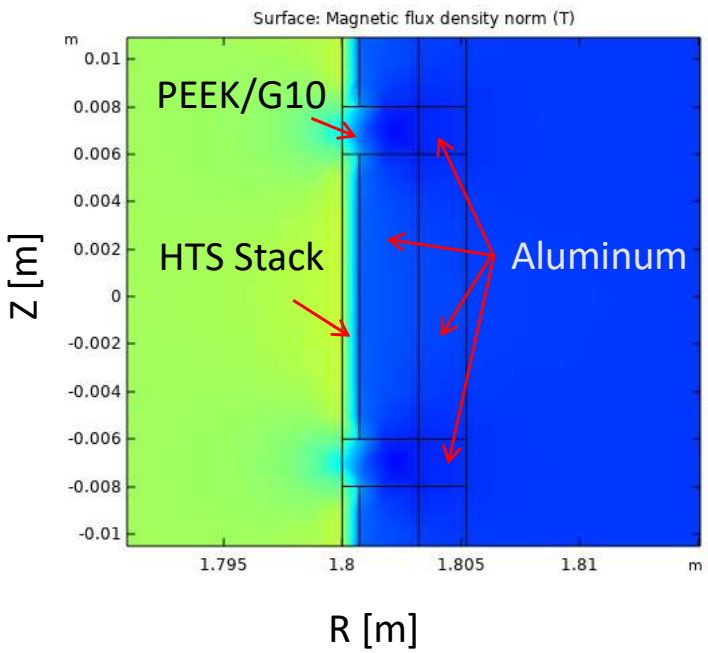
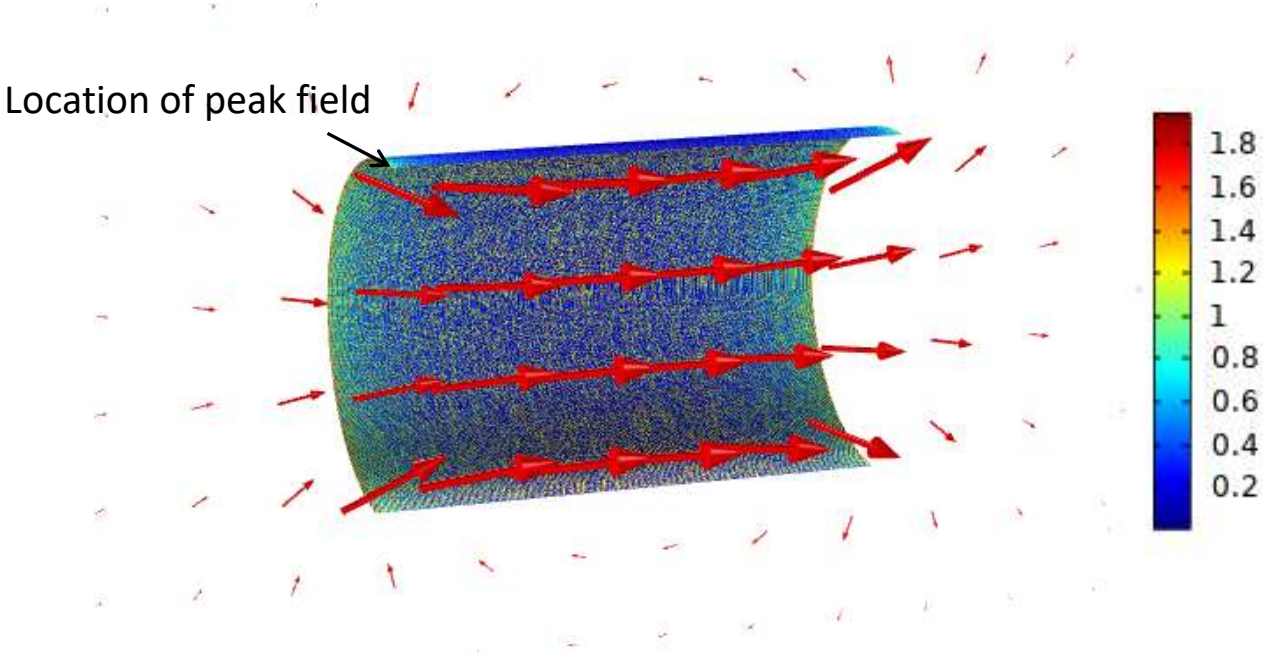
AMS-100 progress meeting, 21/8/20

OUTLINE

1. Axi-symmetric model of AMS-100, magnetic properties
2. Axi-symmetric model of AMS-100, stresses & strains
3. Methods for making an aluminum cylinder

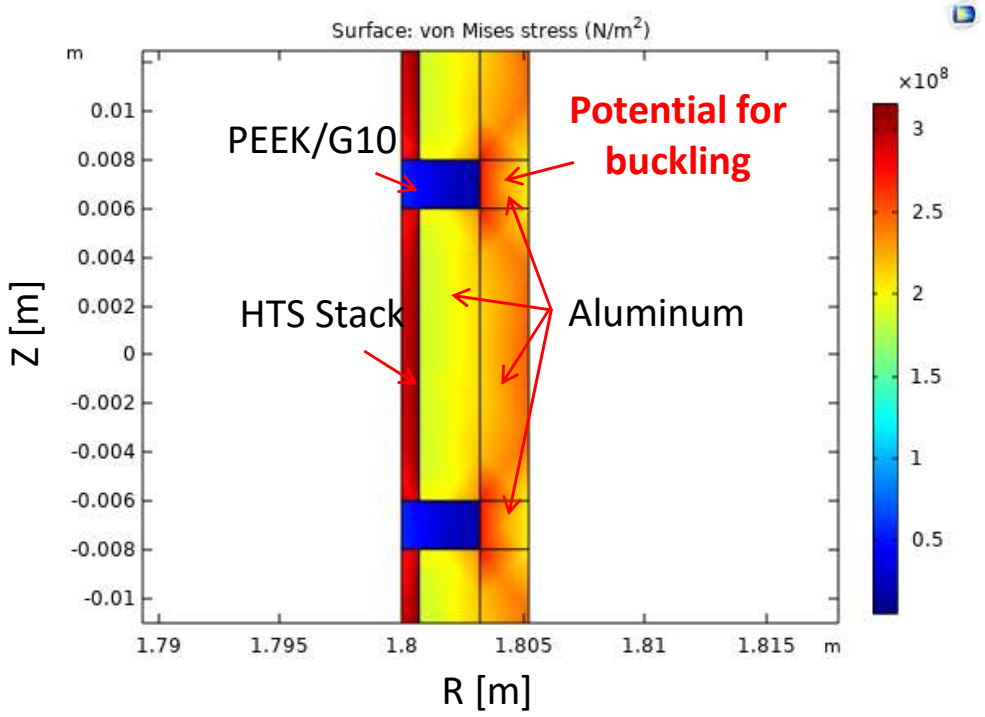
1. AXI-SYMMETRIC MODEL OF AMS-100



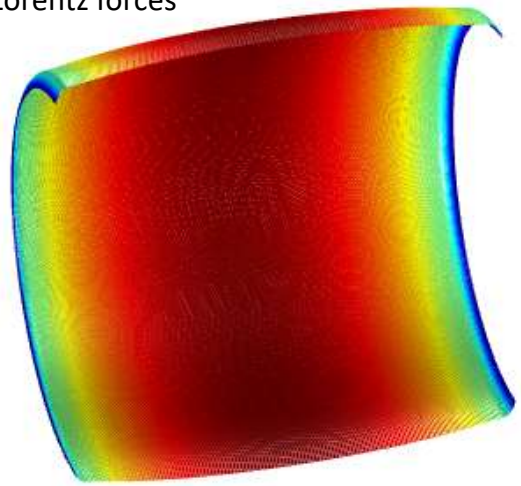


- 13.5 kA operating current gives 1 T in center
- For outermost HTS stack, average field is 1.2 T and peak field is 2.0 T (in the corner)
- Stored magnetic energy: 24.6 MJ
- Inductance: 0.27 H

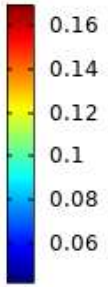
2. Axi-symmetric model of AMS-100, stresses & strains



Deformation due to Lorentz forces

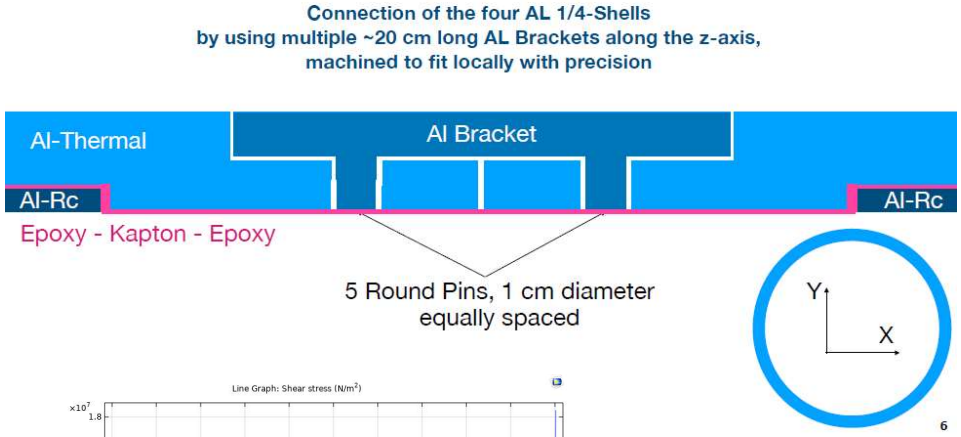


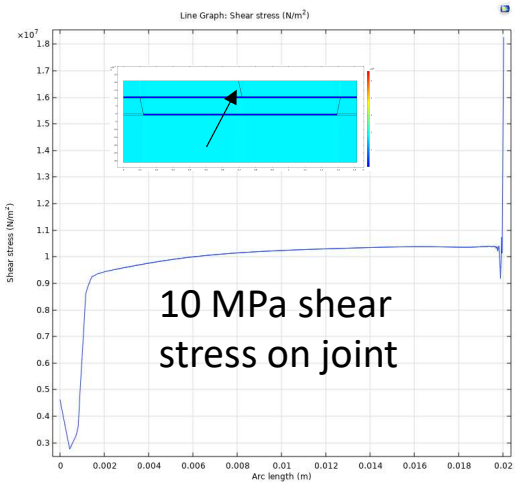
Radial strain with respect to strain-free state of HTS stack after cooldown



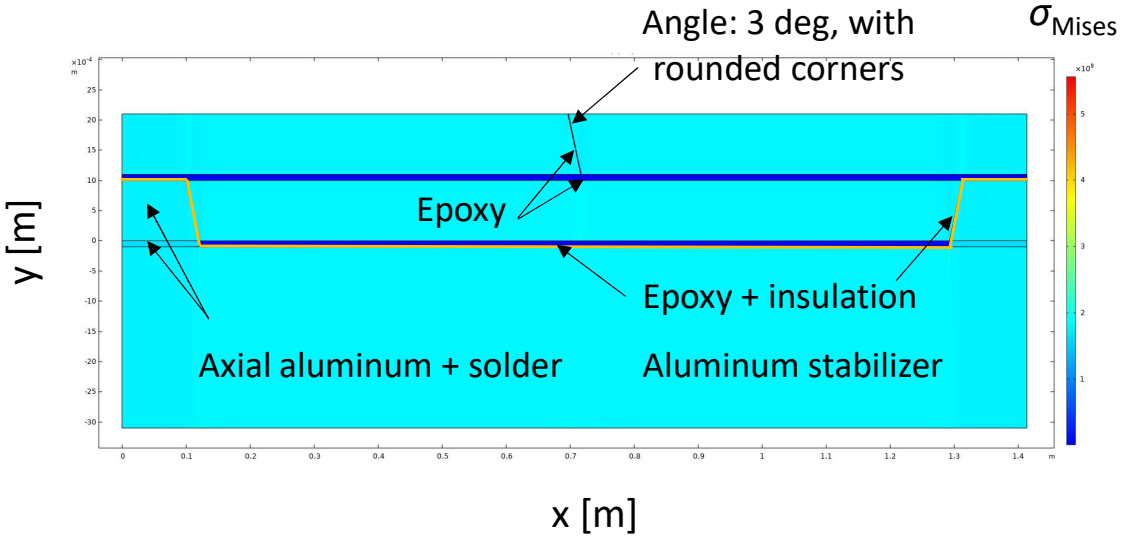
- Assumptions
  - Neglecting presence of carbon and inner PEEK/G10 layer (Pre-tensioning of outer carbon layer will be needed to compress HTS stack against inner PEEK & carbon layer)
  - E_{Al} = 70 GPa, E_{PEEK} = 3.6 GPa, E_{HTS} = 150 GPa
  - **Assuming that axial aluminum acts as a cylinder**
- Results: 0.16% radial strain in HTS, 0.26% radial strain in aluminum, aluminum PEEK stresses in bridges over PEEK

3. How to get axial aluminum to behave like cylinder?





Sheer stress at center glue joint



- Problem:
  - Initial idea (Glued axial strips) does not give reasonable azimuthal strength
  - Potential solution: brackets (see top left
  - Variation of bracket solution:
    - Staggered aluminum layers
    - Angled glue joints with rounded corners