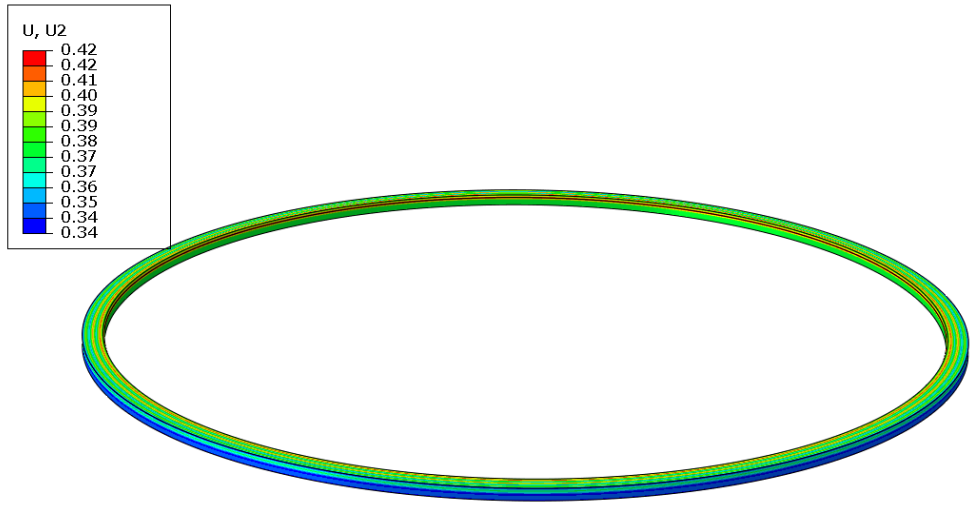
pfRICH End Ring Analysis for manufacturing

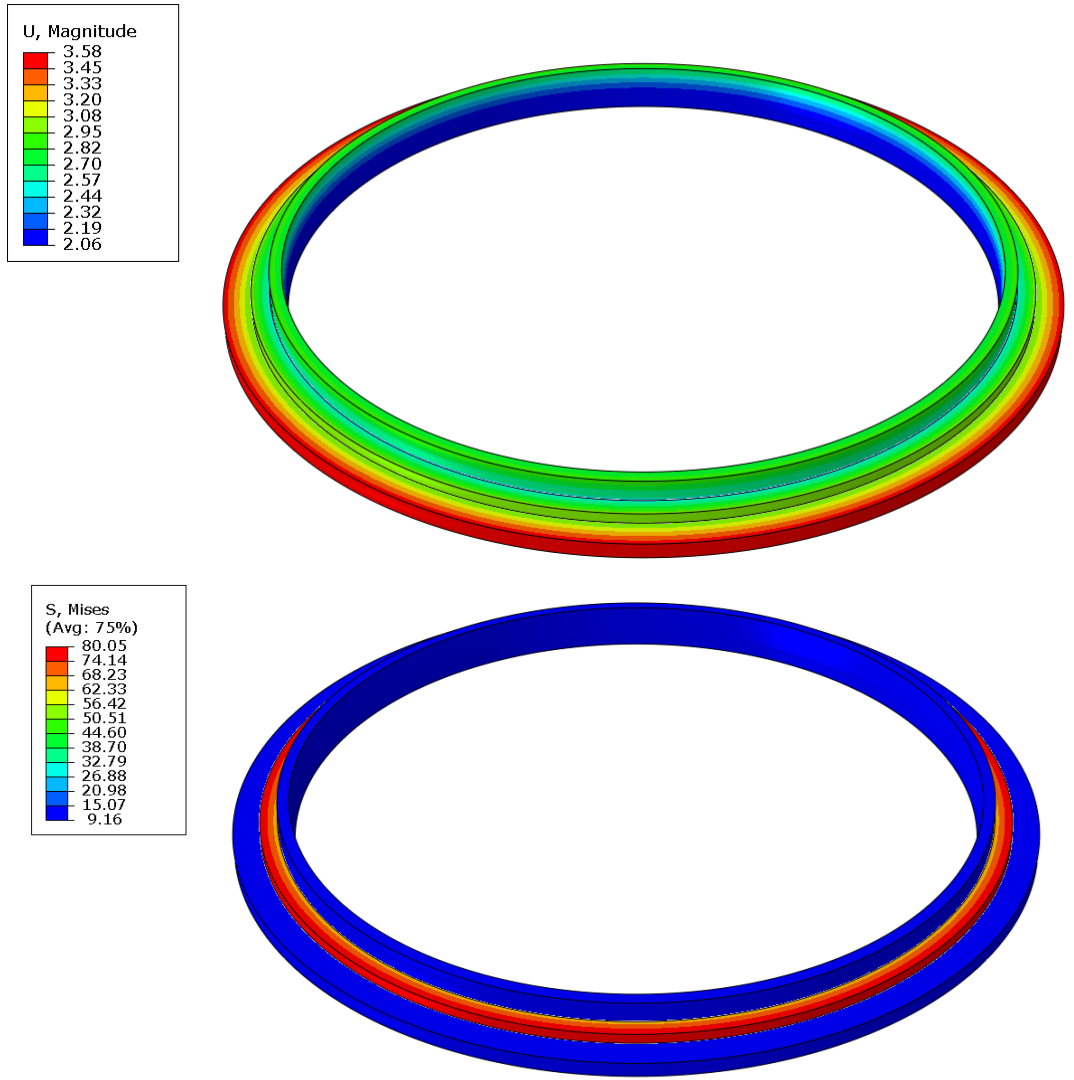
Sushrut Karmarkar, Andy Jung

29 January 2024

End Ring as a single part

- Can be manufactured as a single part.
- The stress in the ring is mid-level – not too bad
- There is a 300 – 400 micron out of plane deformation – the part is designed to have a 5 mm excess on all sides that will be CNC machined – hence this will not affect the planarity of the part





Material Selection

1. Carbon Composite for the prototype –

   Proof Research AS4 plain weave with p2si 250p epoxy resin pre-preg; Ply thickness of 230 micron – available in stock at Purdue U.

2. Tooling material –

   A. Renshape 5065 polyurethane tooling block : 2 boards needed for full ring – available in stock at Purdue U.

   B. 3DPrinted tooling with LSAM process – PESU 25% CF wt. thermoplastic from Thermwood – material available at Purdue U. : More efficient use of material/less wastage : but longer lead time for making the part.

3. Other consumables needed –

   i. Release film; Vacuum Bag; Breather; Sealant Tape; Teflon and chemical release for tools -- All of this is in stock from CMS, CERN project. Lead times for this vary from 1 week to 3 weeks. Vendor – AirTech Advanced Materials

   ii. Inserts – adhesive with self tap – McMaster Carr order – lead time 2 – 3 days

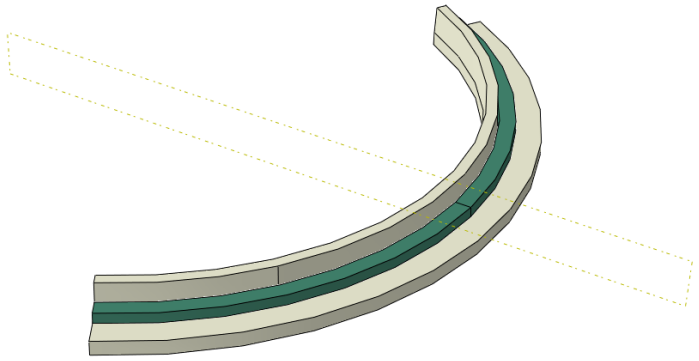
   iii. Adhesive – Araldite 2011 epoxy adhesive – lead time 2 – 3 days

The modus operandi will be we use the materials that are in stock here at Purdue U. from the other project and place an order from Airtech for EIC in the meantime. When the materials arrive, we will replenish the materials from other projects.

On-Going Steps

- Analysis for a quarter section End Ring to see if there is lesser spring-in
  - Advantages –
    1. Lower cost on tooling material (significantly)
    2. Faster production time for mold (longer for making 4 parts)
    3. Easier to remove the stock from the mold. We will not need ejector pins and mechanical release design for a ring
    4. Needs assembly jig for assembling the 4 parts together – easy to build with aluminum 80-20s
    5. Higher planarity will be achieved with this
  - Disadvantages –
    1. 4 joints in the End Ring
    2. Needs an additional bonding step (~ 1 week time)

Sushrut can machine this on CNC he knows how to operate; the single part needs to be sent to the machinist at the center and machined from the larger CNC – scheduling is possible but one variable outside Sushrut's control



Back up Slides

- Over all deflection of the part only for single piece end ring