eRD111: Report & Plans

FY22 & 23 institutes listed in proposals: Jlab, INFN, LANL, LBNL, ORNL, UK institutes

eRD111 in 3 parts

- FY23 proposal, DAC presentation
- Forming modules from stitched sensors
- Barrel & discs
  - Inner Barrel (L0 – 2)
  - Outer Barrel staves (L3 & 4)
  - Discs (5 each in electron & hadron going directions)
- Mechanics, integration, & cooling
  - Air/liquid/other cooling
  - CAD model
  - Global support structures

Modules

- **Deliverable**: Optimization of the stitched sensor dimensions based on ER1 yield. Explore integration options for sensor in module unit
- **Milestone**: Written report on optimized sensor dimensions based on yield and outcome of bending & interconnection studies

Barrel & discs

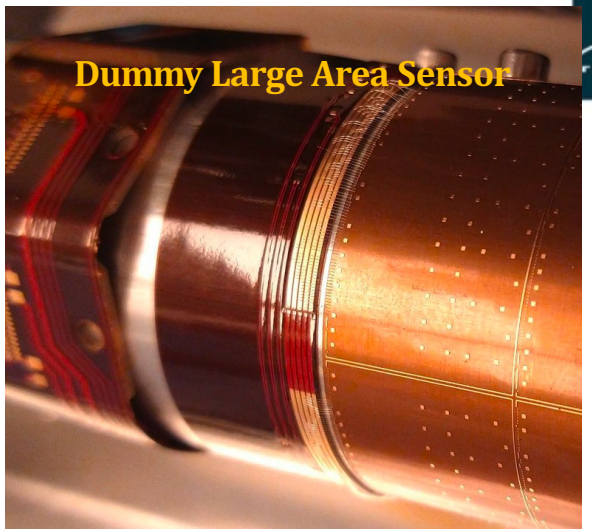
- **Deliverable:** Conceptual design of the vertexing layers including support structures. Focus on additional needs based on expanded radii of ePIC in comparison to ITS3. **Milestone:** Written report
- **Deliverable & Milestone:** Prototype pieces specific to vertexing layers
- **Deliverable:** Advanced stave & disc conceptual designs. **Milestone:** Written report
- **Deliverable & Milestone:** Prototype pieces for mechanical & thermal tests

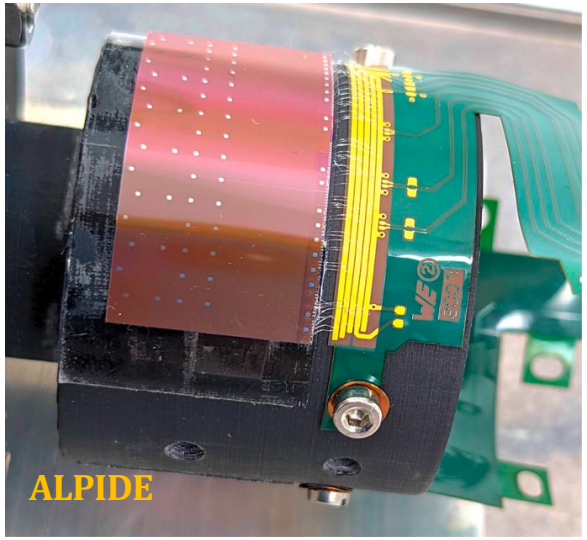
Mechanics, integration, & cooling

- **Deliverable & Milestone:** CAD model of silicon tracker, including interface with other detectors, beam pipe, etc.
- **Deliverable:** Analysis of cooling options for SVT, emphasizing air cooling. **Milestone:** Written report
- **Deliverable:** Conceptual designs for full set of detector support structures (cones, cylinders, etc.) and how they connect to the global support. **Milestone:** Written report
- **Deliverable & Milestone:** Prototype pieces of support structures for mechanical and thermal tests

Modules/Connections

- INFN: Previous EICSC presentation
- Single-reticle sensors & large-size MAPS
  - Bending, thinning, interconnection
- Bending & wire-bonding have been successfully exercised at vertex radii
- First electrical tests of ITS3 FPC in Bari

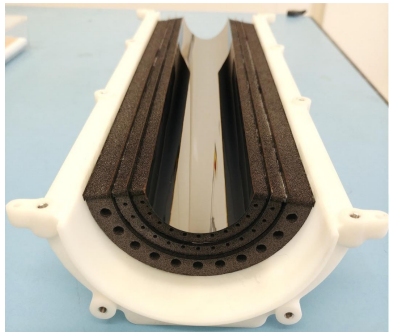


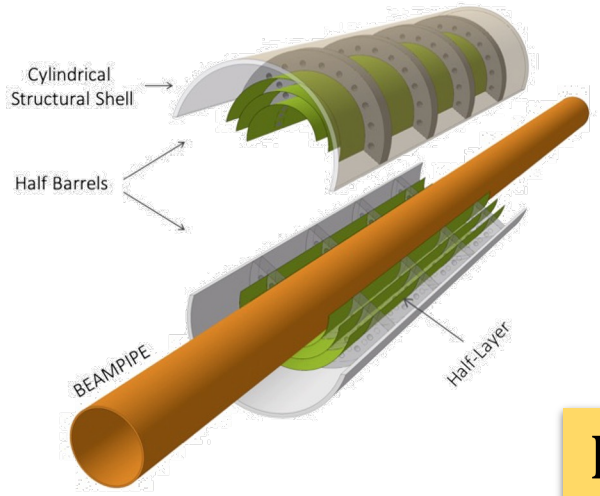


https://doi.org/10.1016/j.nima.2021.166280

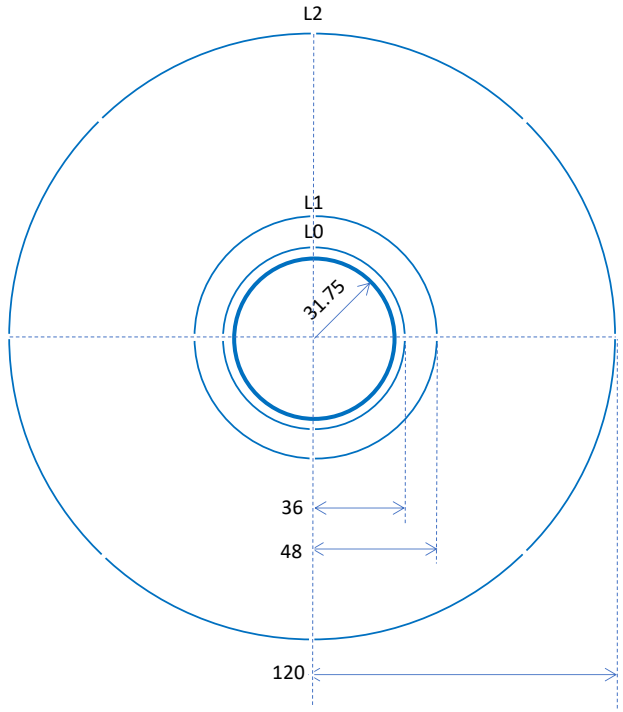
Inner barrel

- Some mechanical challenges still to be thought out
  - Additional support?
  - How to bring in air?



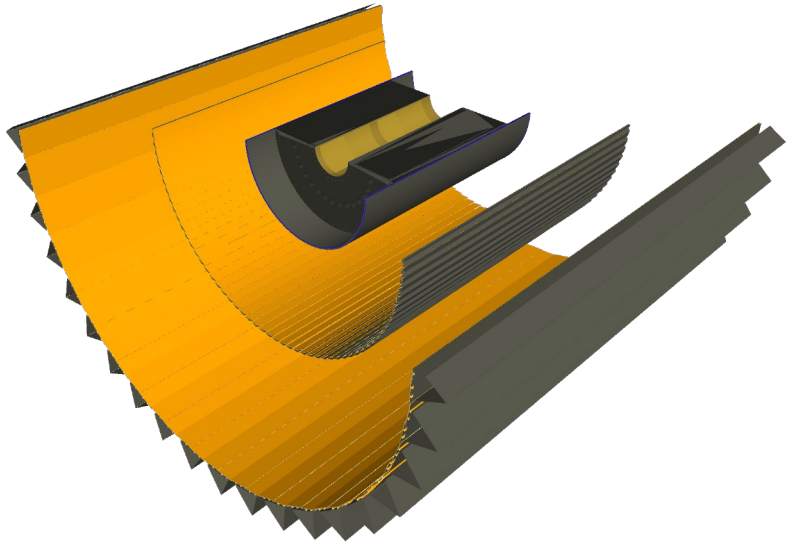


Option for ePIC layers 0-2

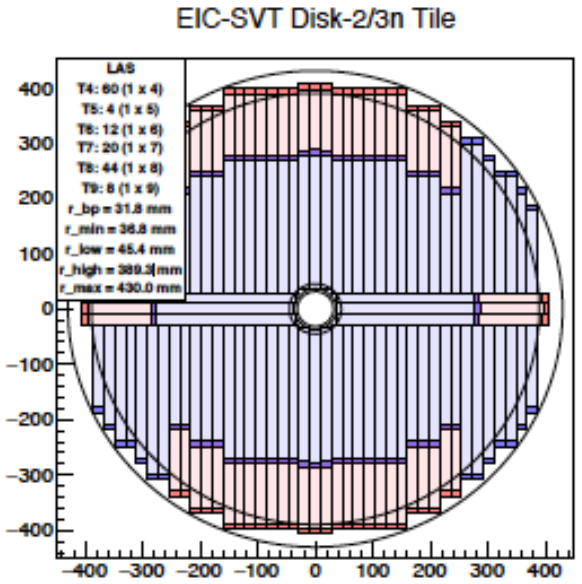


From ALICE ITS to ePIC

Staves & discs

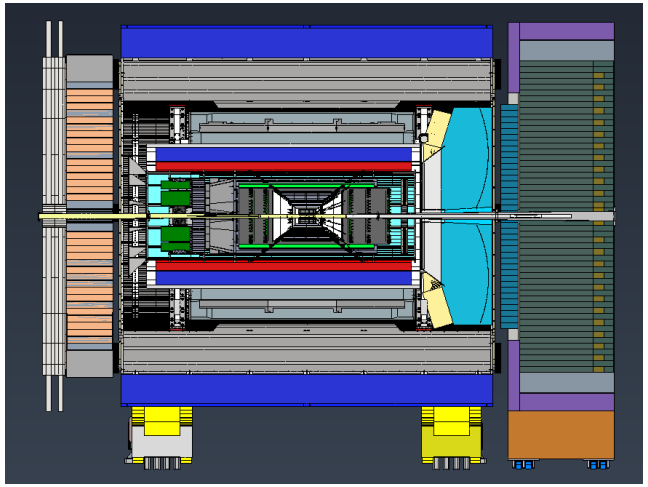


- Possible stave/disc configurations
- Some engineering challenges
- Stitched sensor sizes limited to 2-3 variations
  - Stave & discs layouts need to be re-thought
  - Disc tiling studies: UK Peter Jones

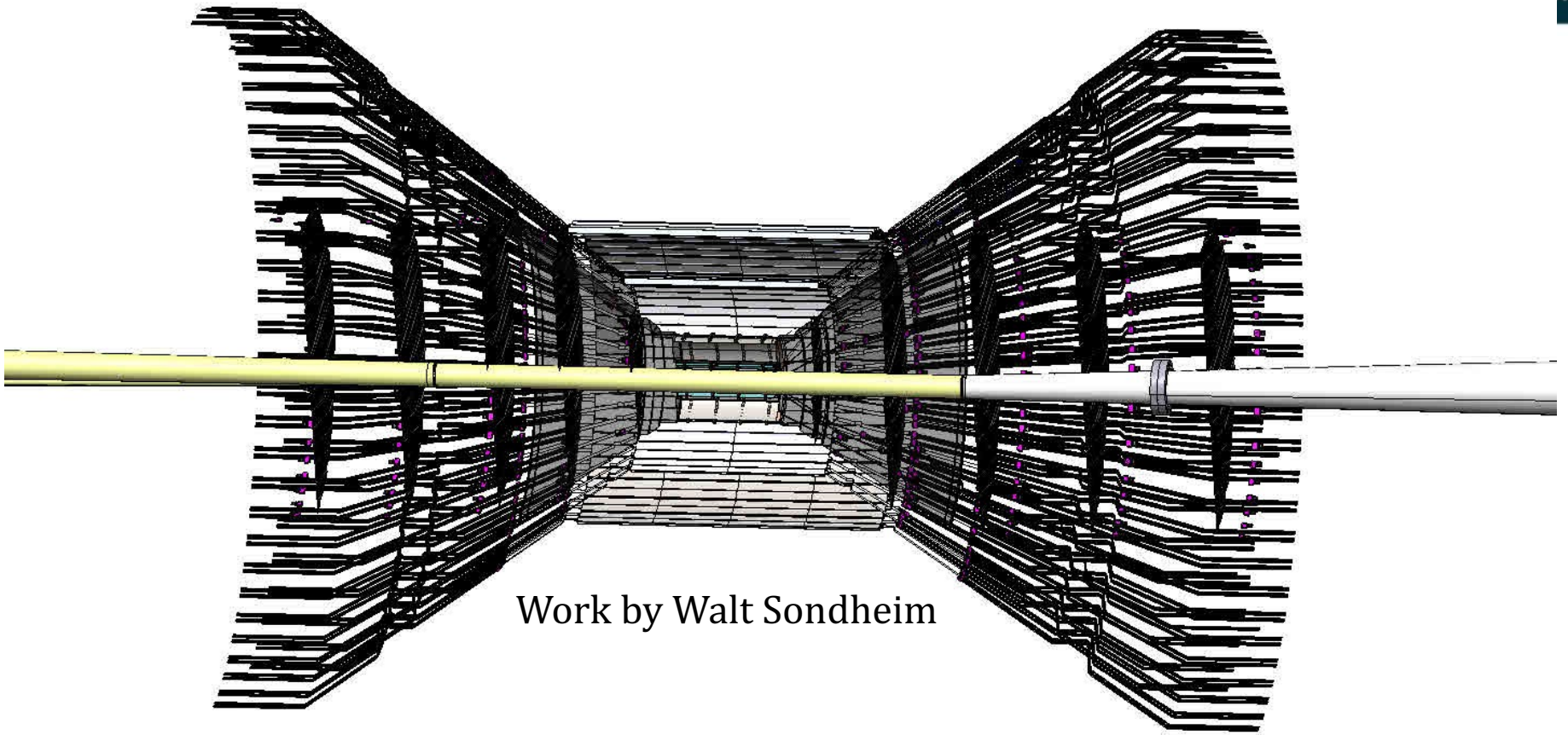


Global mechanics/support

- SVT mechanics meeting 3/29/23
  - Initial discussion with interested groups & project engineers
- ePIC engineering workshop 5/10 – 5/12/23
  - 3 day workshop at BNL
  - Brainstorming/conversation about assembly sequence, conceptual support design, & more
  - Participants from LBNL, UK, BNL, Jlab



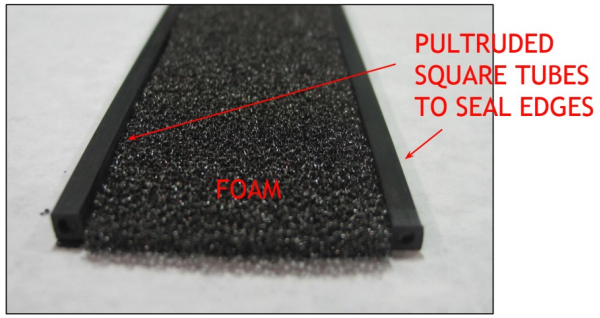
CAD Model



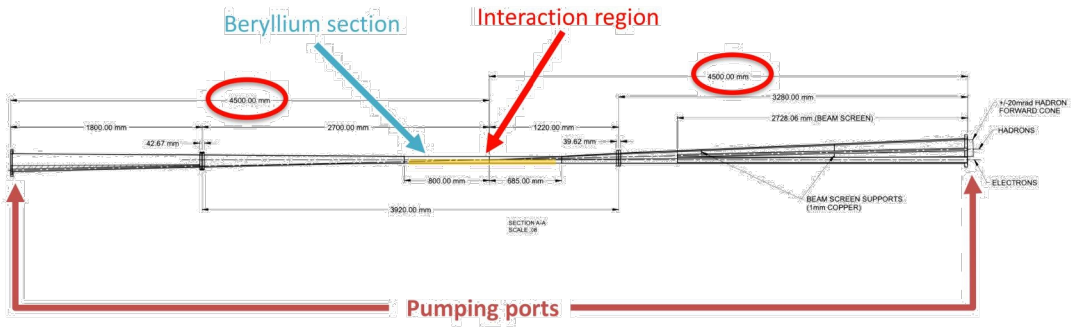
Work by Walt Sondheim

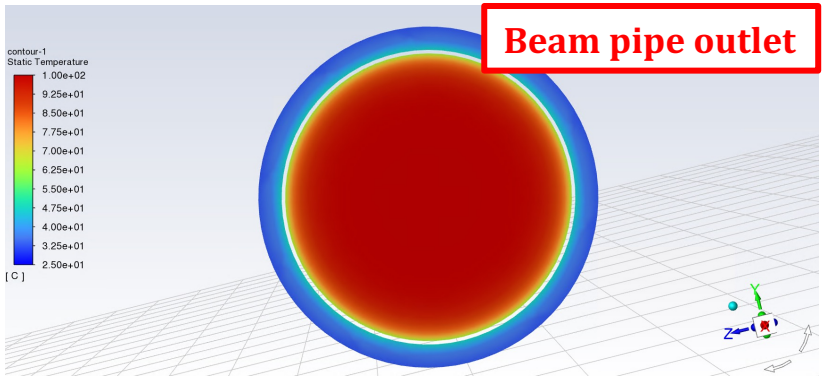
- EICSC 1/30/23
- SVT mechanics meeting

Cooling



- Internal air cooling project (LBNL)
  - Previous talks: EICSC Meeting 10/10/22, 2/28/23
- Beam pipe bake-out studies (Jlab, LBNL)
  - Previous talks: EICSC Meeting 6/6/22, 2/28/23
    - 5 mm gap between beam pipe and 1st silicon layer





Thoughts for FY24

- Modules/Sensor Interconnections
  - Investigate FPC & connections to end of sensor
- Barrel & discs
  - Advance designs, scale up prototypes
  - Inner barrel is NOT a copy of ITS3, needs significant effort
  - Disc & stave design should take into account the 2-3 sensor size variations
- Mechanics, integration, cooling
  - Advance designs, scale up prototypes
  - Converge on cooling, how to integrate into local structure