LC Damping Rings: Engineering Model and Vacuum System Design

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Outline

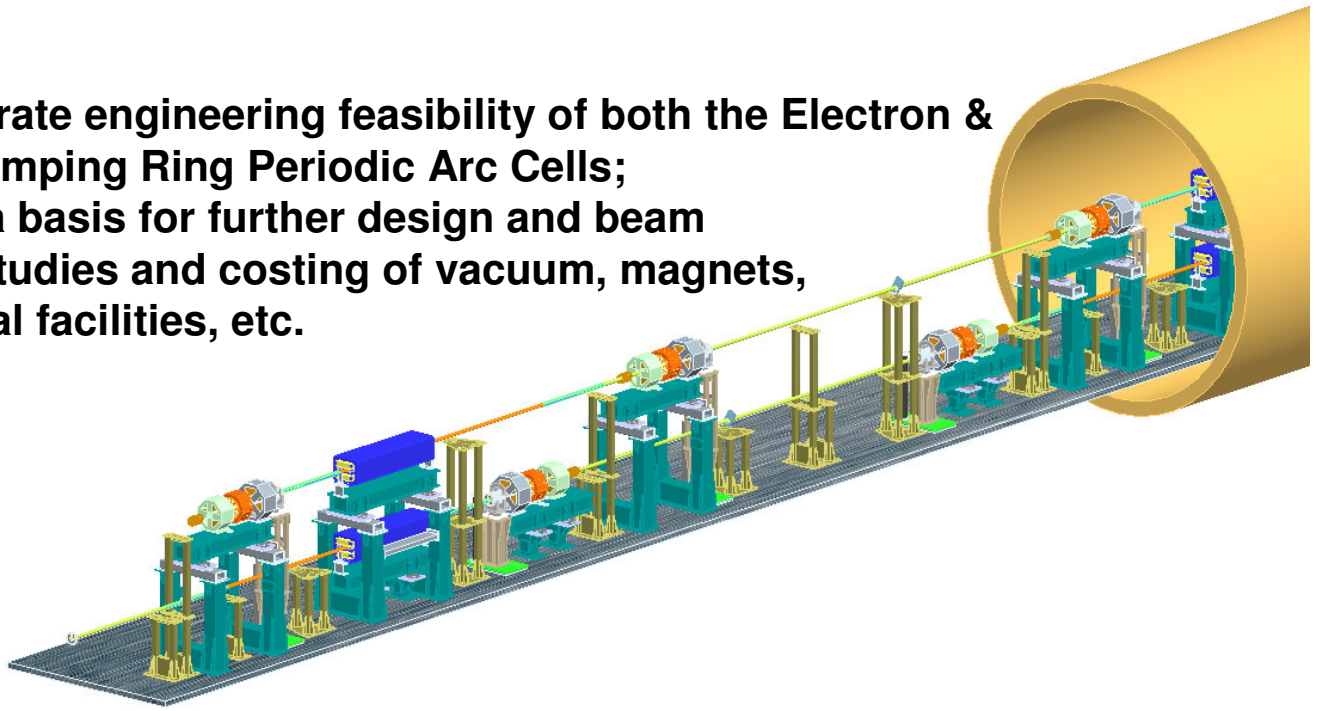
- In these slides, we describe progress with:
  - **the engineering model for the Electron and Positron Damping Ring Periodic Arc Cells;**
- The engineering design and vacuum studies will provide essential information for:
  - **developing an improved cost estimate, and identifying cost drivers and potential for cost savings;**
  - **progressing design work for a range of subsystems, including magnets, magnet supports, conventional facilities, alignment…**

Engineering model

- Work by John Lucas (STFC Technology)

- Developing a CAD model for mechanical integration of vacuum system, BPMs, magnets and supports.

- Goals:
- - **to demonstrate engineering feasibility of both the Electron & Positron Damping Ring Periodic Arc Cells;**
  - **to provide a basis for further design and beam dynamics studies and costing of vacuum, magnets, conventional facilities, etc.**



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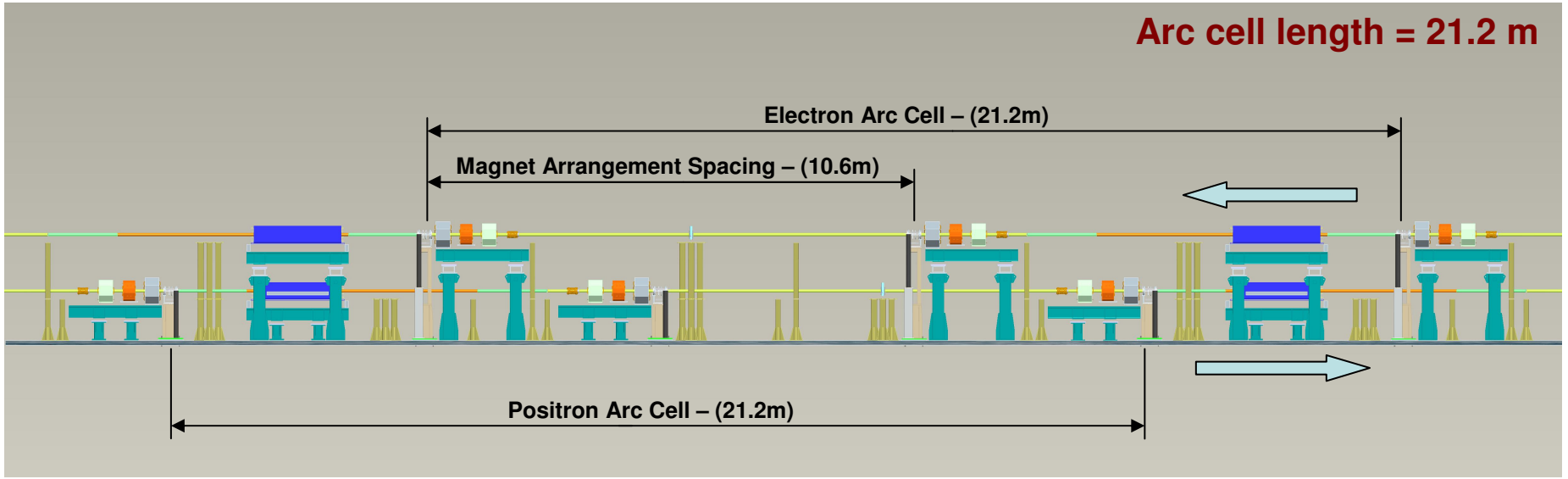
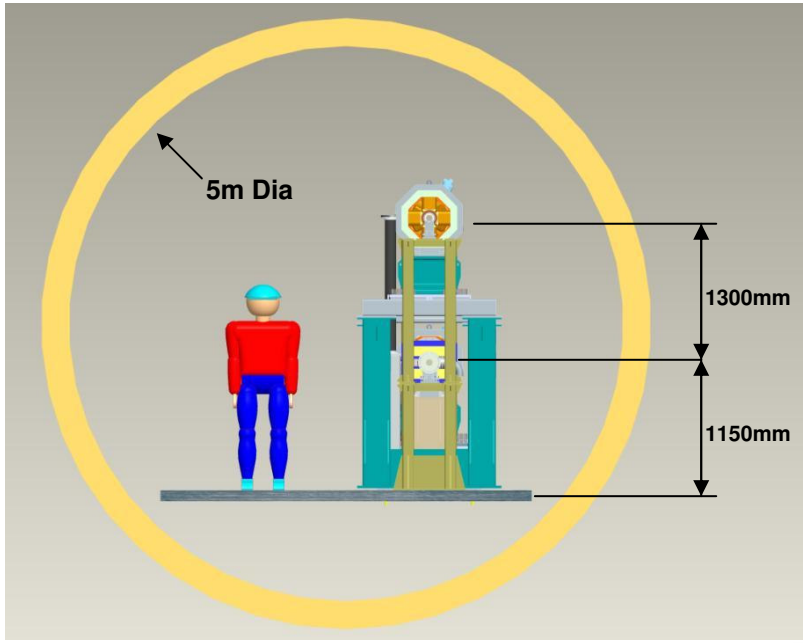
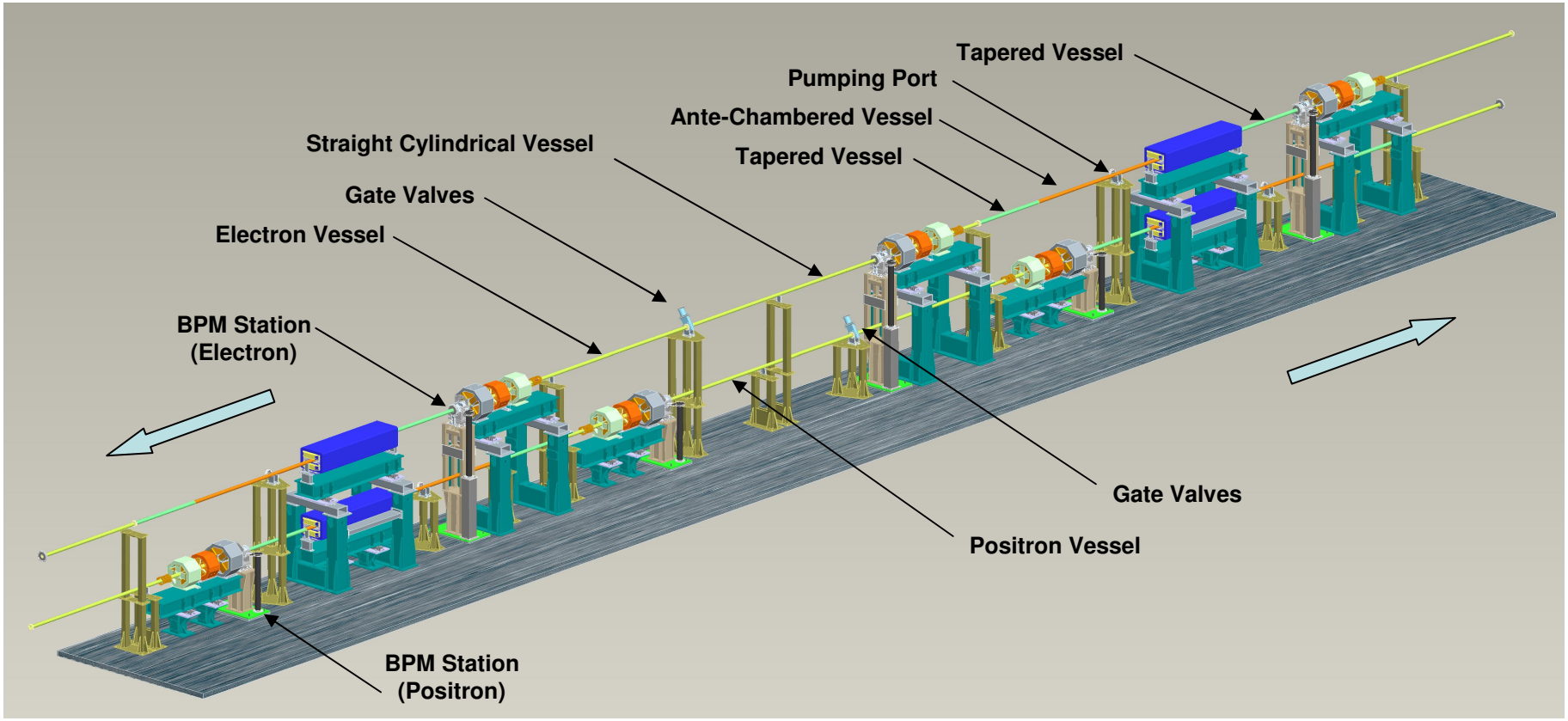
Periodic Arc Cells

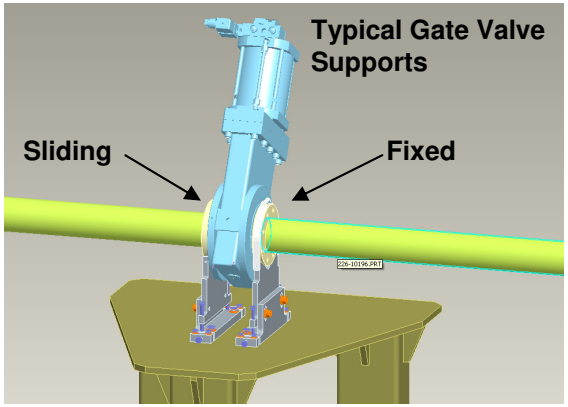




- Work has focused on developing the model for a Single Arc Cell (linear).
- Tunnel Internal Diameter is 5 m.

Arc Cell Components





- Possibly one Gate Valve per 5 Arc Cells.
- Gate Valve supports consist of one fixed and one sliding support.
- Bellows allow for 4.5 mm/meter thermal expansion (NEG activation at 180℃).

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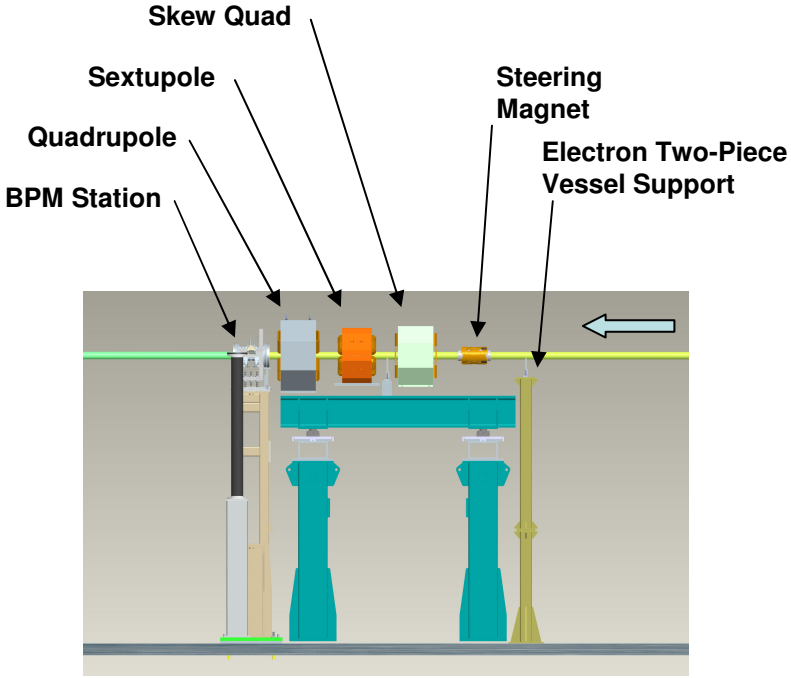
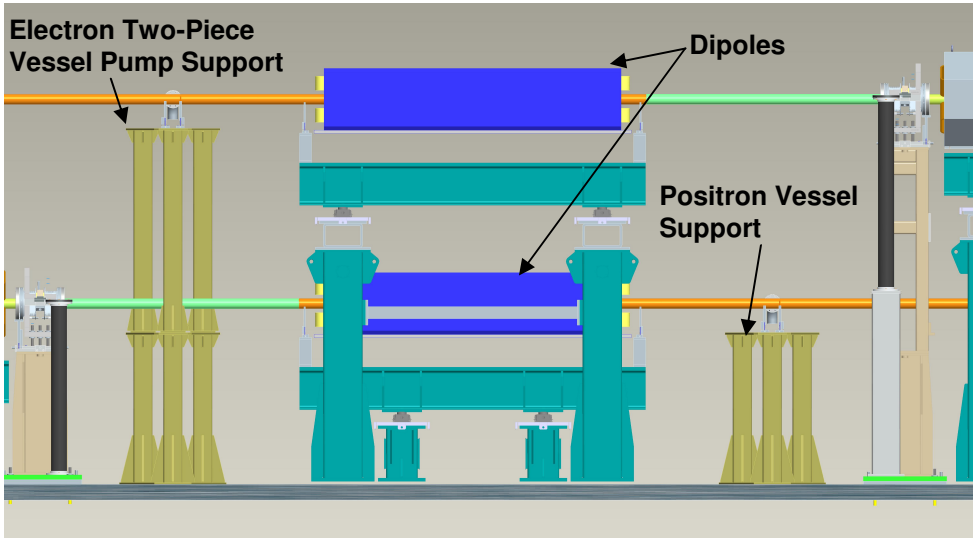
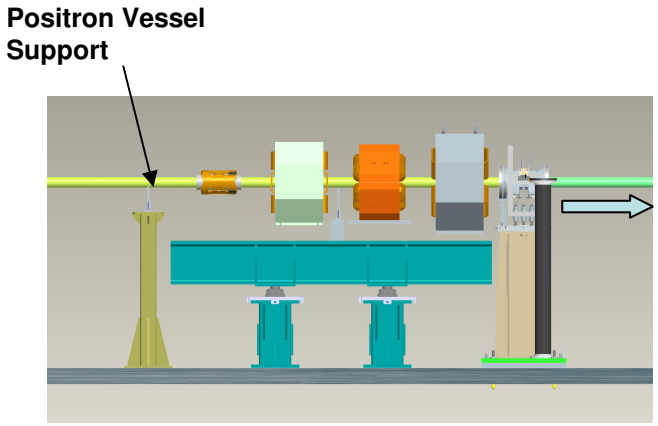
Arc Cell Components Cont'd



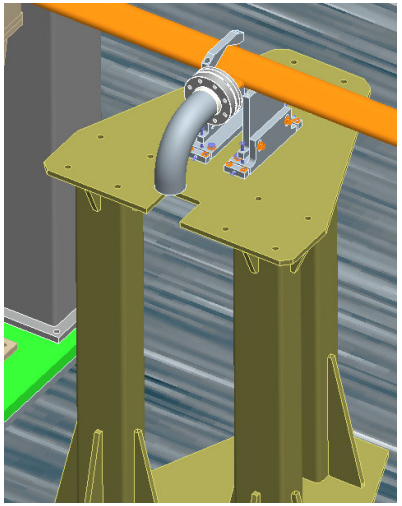
Magnet & Supports – (Electron)

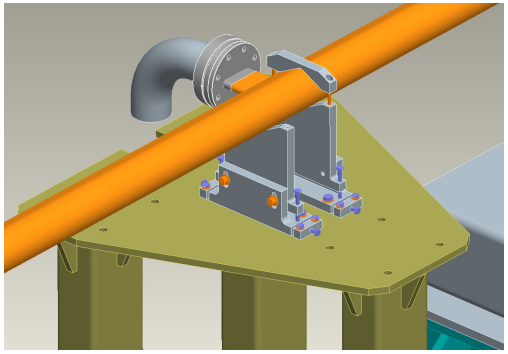


Dipoles & Supports



Magnet & Supports – (Positron)





Vessel Pumping Supports

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Vacuum system: key features

- Vacuum chamber mostly consists of straight cylindrical tube.

  - Internal diameter 60mm, wall thickness 2mm.

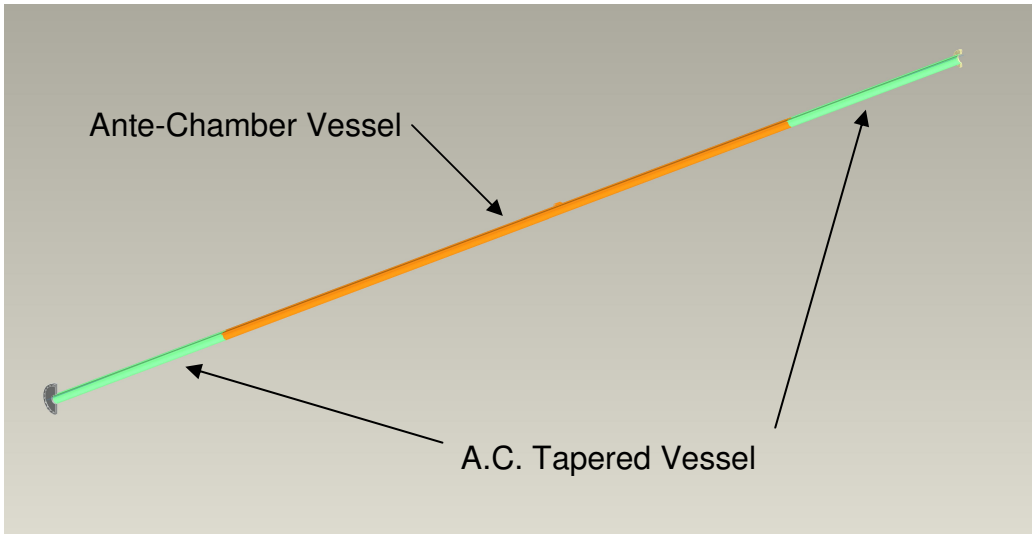
  Antechamber and cooling provided in dipoles.

  - Intended to reduce build-up of electron cloud by reducing the number of photons in the main chamber.

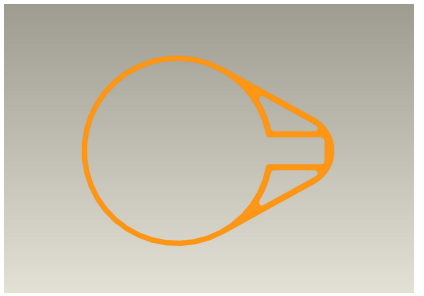
  - Dipole chamber will consist of extruded vessel with antechamber, welded to machined "taper" sections.

  - A pumping port is included in antechamber downstream of dipole.

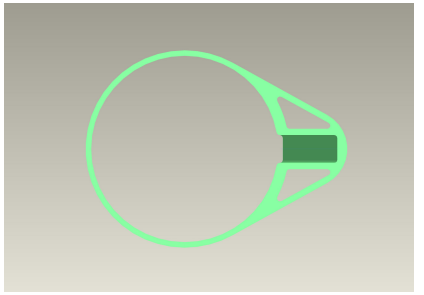
Vacuum Vessel Profiles



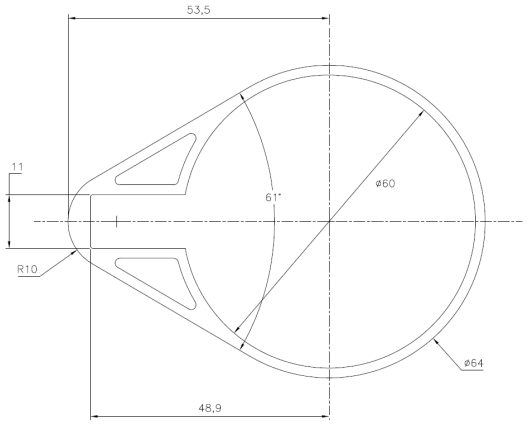
Ante-Chamber Vessel Fabrication

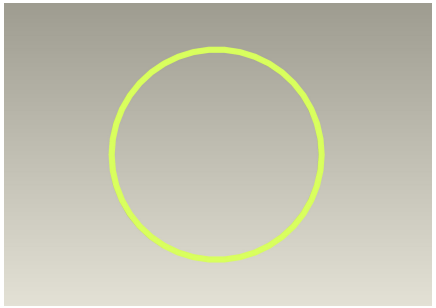


Ante-Chamber Vessel

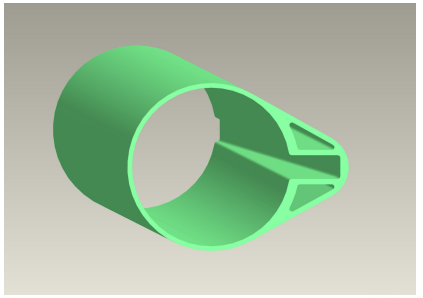


A.C. Tapered Vessel





Cylindrical Vessel



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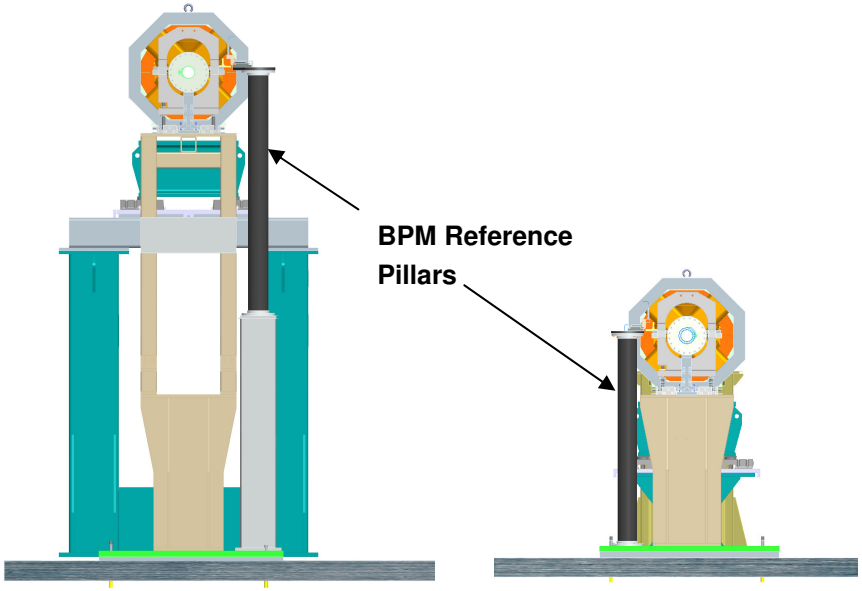
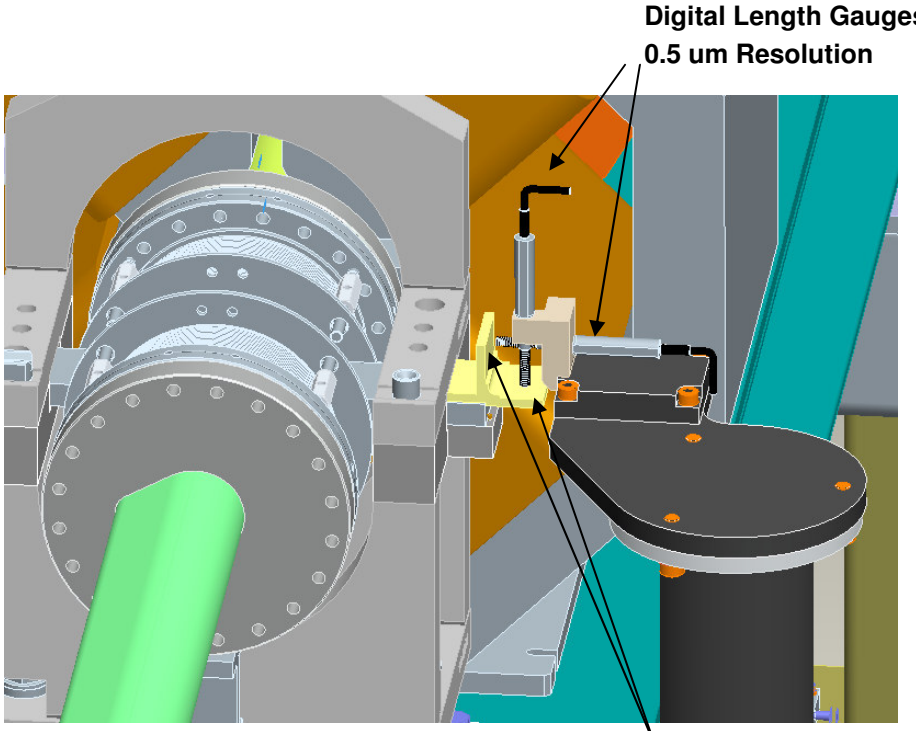
Vacuum Vessel BPM Stations

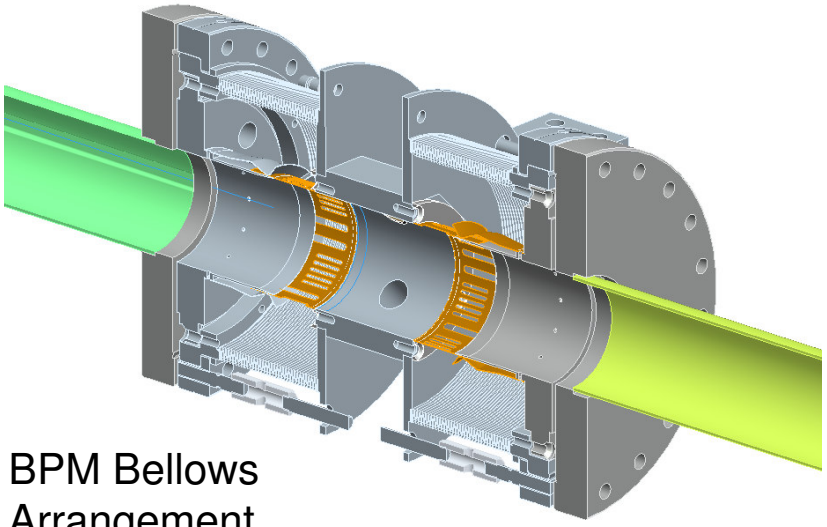


Electron End View

Positron End View



Position Encoders



BPM Bellows
Arrangement

- **Fitted on all BPM Blocks.**
- **Reference Pillar provides reference points for the beam orbit.**
- **Position Encoders monitor any motion of BPMs from thermal or mech effects.**

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Summary: engineering model and vacuum design

- **Significant progress has been made with the vacuum system design and engineering model for the arc cells.**
- **The model will provide essential information required for further design work (magnets, conventional facilities...) and beam dynamics studies (including electron cloud and ion effects).**
- **The next steps are clearly defined in the present plan:**
  1. **Complete the present engineering model for the arc cell.**
  2. **Provide technical designs of vacuum system components for beam dynamics studies.**
  3. **Make preliminary cost estimate of vacuum system, to identify cost drivers and to highlight areas for potential cost savings.**
  4. **Commence design work for long straight sections.**