Conceptual Design of MICE RF Module (RFM) Vacuum System

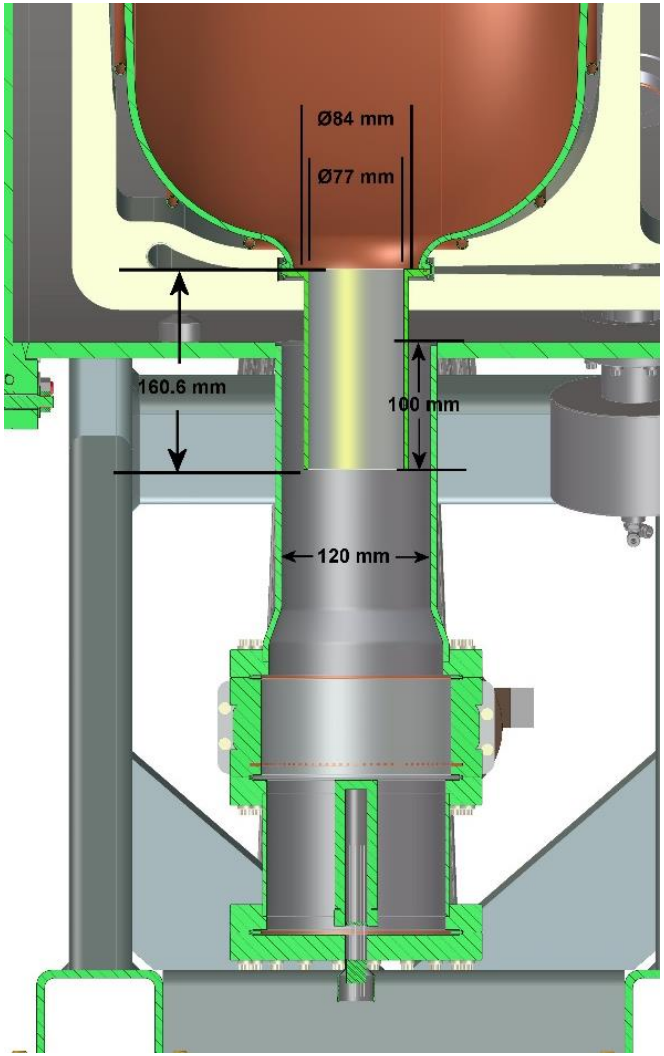
January 27th, 2015

Andrew Lambert

MICE Vacuum Vessel

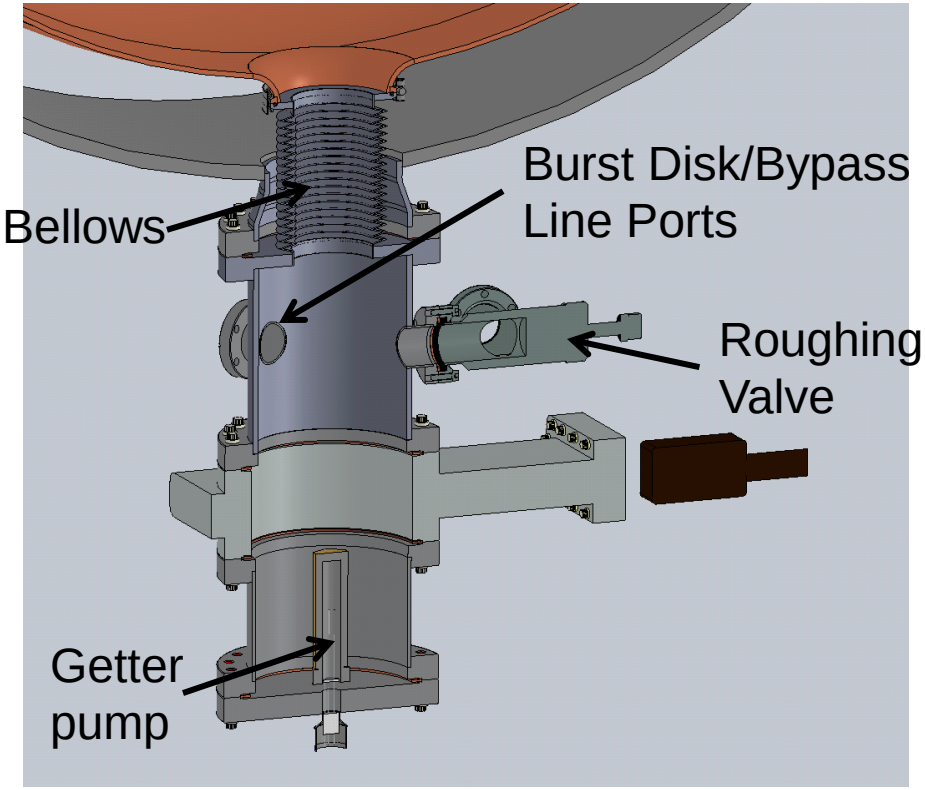
- Original vacuum vessel design proved unable to reach acceptable vacuum
  - Dual pumping on both interior and exterior vacuum with getter pump
  - Large conductance from exterior vacuum to interior vacuum
    - Causes two vacuum volumes to trend towards equalization – protection in cause of fault
    - Eliminate this feature to improve cavity vacuum, instead rely on burst disk line and bypass valve line for protection in failure scenario

Original RFM Vacuum Design



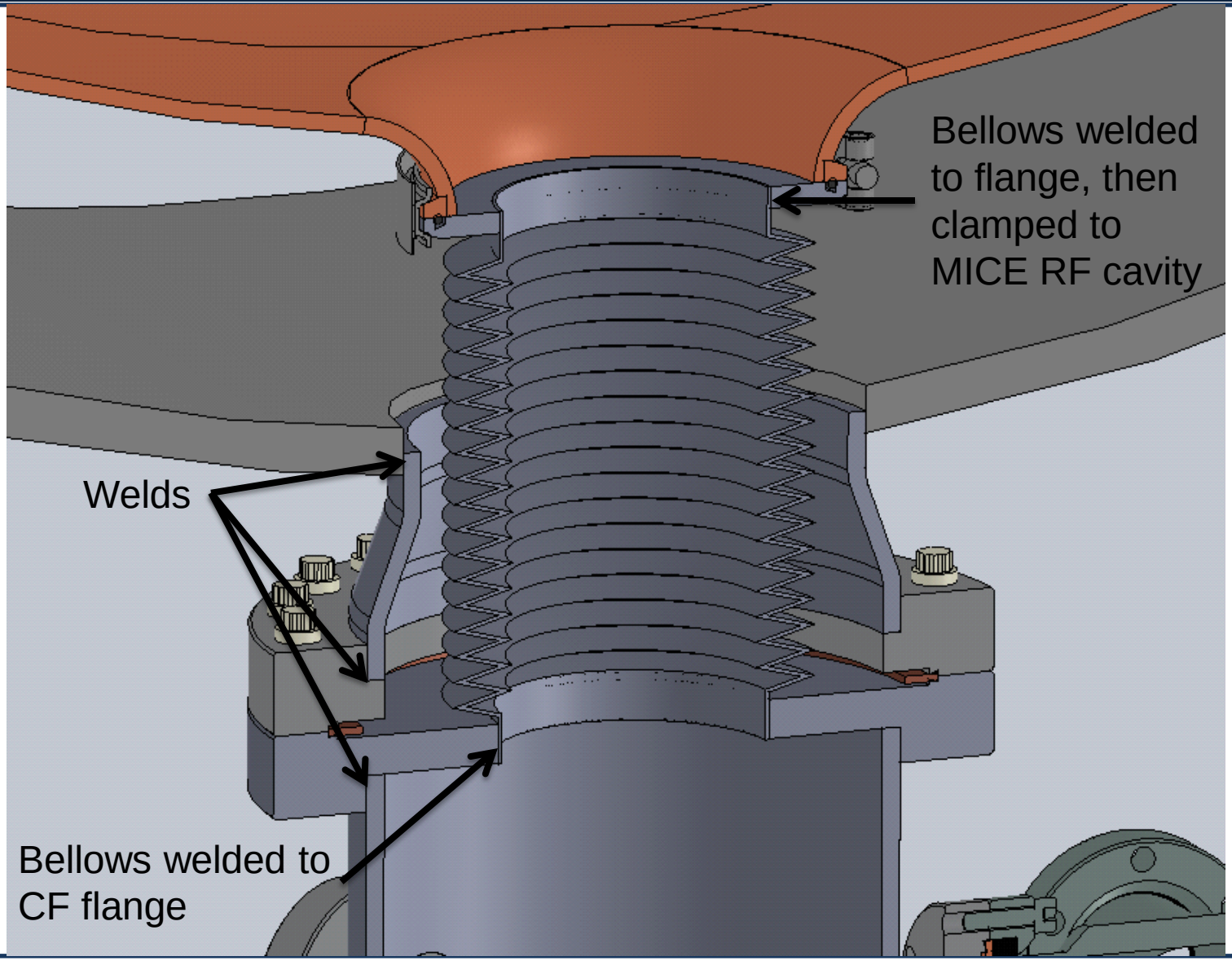
- Conductance between the two vacuum volumes
  - Exterior vacuum spoils the interior vacuum
  - Annular clearance has very large conductance
  - Instead pump on only the cavity with getter pump, use roughing system for exterior vacuum

New RFM Vacuum Design

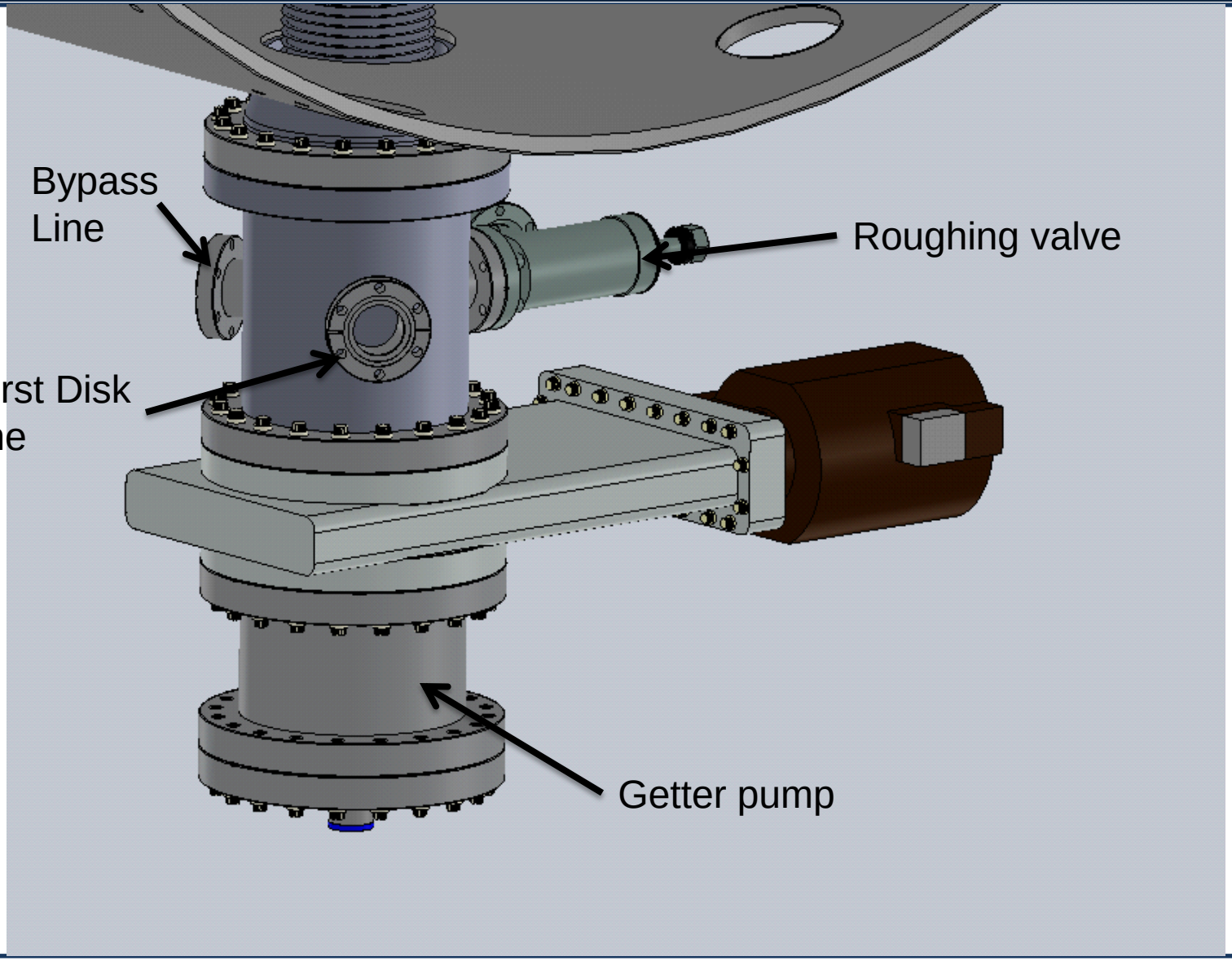


- Bellows connects the getter pump directly to the cavity
  - Getter only pumps on the cavity
  - Improve vacuum in the cavity
- Burst disk line will connect the two vacuum volumes
  - Protection in case of fault scenario
  - Burst disk should be sized to rupture at 0.5 psi
- Bypass line
  - Coat bypass line with getter material
  - Throttle valve allows for manipulation of the conductance from exterior vacuum to interior vacuum

New RFM Vacuum Design



New RFM Vacuum Design



Summary

- The MICE RF module vacuum design has changed in three essential ways
  - Connection of the getter to the cavity via the bellows isolates the cavity vacuum and ensures that the getter only pumps on the cavity volume
  - Instead of an annular bypass region, the system will now use a bypass line coated with getter material and regulated with a throttle valve
  - 0.5 psi burst disk will provide protection of the Be windows in a fault situation
- These changes to the vacuum system should ensure that we can pump the interior cavity down to operating vacuum while minimizing leakage from the exterior vacuum