



# Design of Production PIP-II SSR1 Cavities

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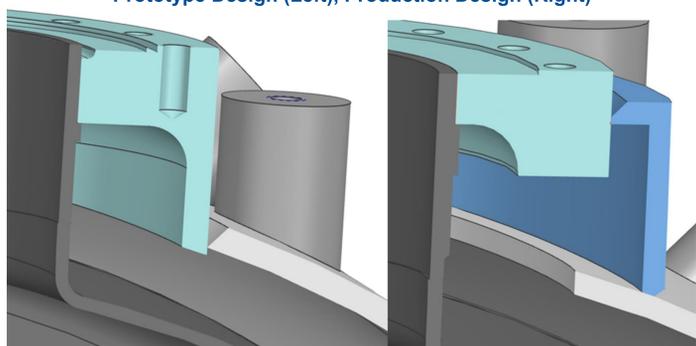
## ABSTRACT

The testing and manufacturing process of the PIP-II Single Spoke Resonators Type 1 (SSR1) prototype jacketed cavity presented opportunities for refinement of the production series. Experience from the prototype cavity and the design of other cavities at Fermilab were used. The mechanical design of the production jacketed cavity has been modified from the prototype design to allow for improvements in overall performance, structural behavior, and manufacturability of the weld joints.

### SIDE PORT ADAPTOR

The attachment of the side port adaptor has been updated to weld an adaptor ring to a flange instead of directly welding a flange to the helium vessel. TIG welding the adaptor piece to the external helium vessel removes the chance of weld spatter through the joint while simplifying the alignment process.

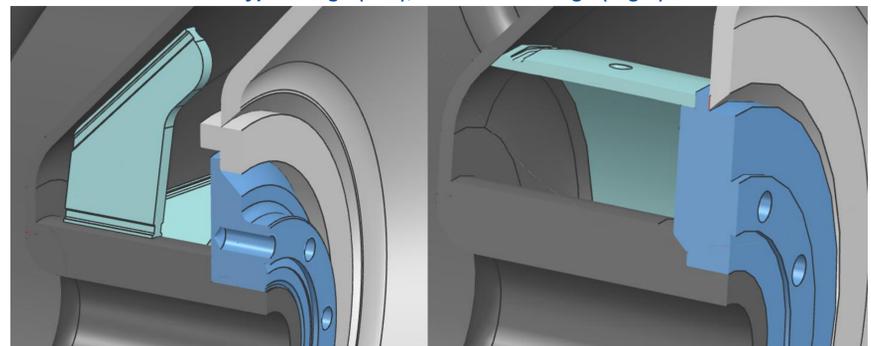
Prototype Design (Left), Production Design (Right)



### IRIS STIFFENER

Using lessons learned from the SSR2 Cavities, the iris stiffener of the cavities were modified to improve the strength and reliability of the assembly. By shifting to a ring stiffener design from a rib stiffener, the pressure and tuning loads are better distributed throughout the cavity.

Prototype Design (Left), Production Design (Right)



### DESIGN VERIFICATION

All changes to the design of the SSR1 Cavities have been verified using the design by analysis methods of the 2021 version of the ASME Boiler and Pressure Vessel Code and Fermilab's Environmental Safety and Health Manual.

Analysis accounted for following loads:

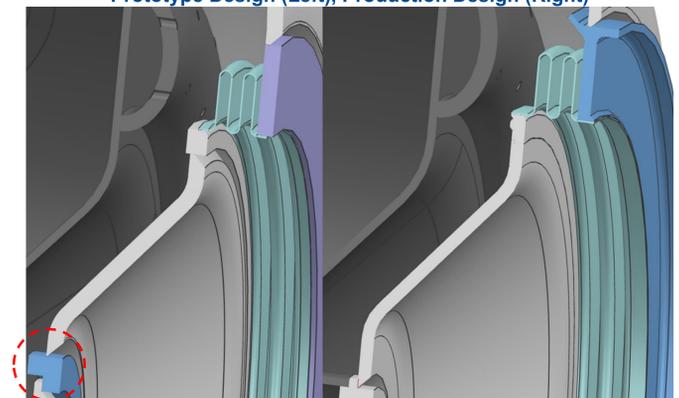
- 0.205 MPa in helium volume at Room Temperature
- 0.41 MPa at 2K
- Tuning Range of 0.26 mm
- Transportation shock of up to 3g
- Helium leaks into internal cavity volume up to 0.205 MPa
- External atm. pressure on helium vessel

### SLIP JOINT

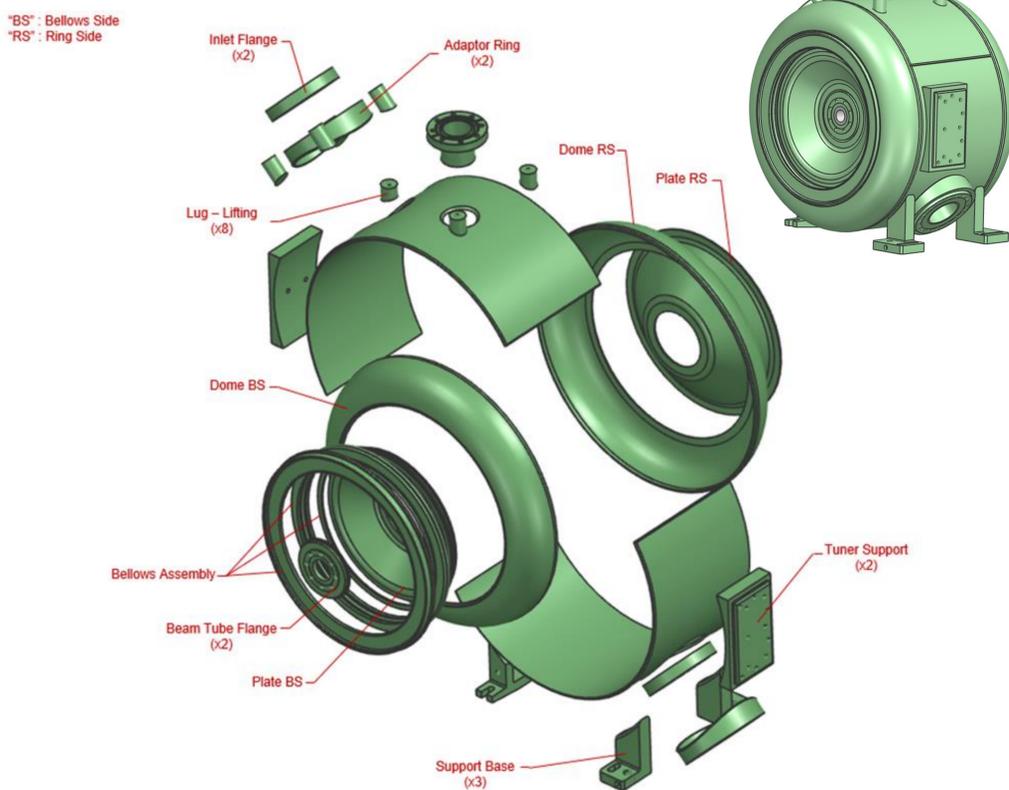
To reduce the amount of alignment needed during assembly, the slip joints of the head of the cavity were moved from the iris of the cavity to closer to the expansion bellows. This change reduces the number of parts in the assembly that require precise alignment to be attached.

Assembly of joints also provide backing for weld joint preventing sputtering of weld material onto cavity

Prototype Design (Left), Production Design (Right)



### HELIUM VESSEL COMPONENTS



### CAVITY COMPONENTS

