

Single Spoke Resonator SSR1 Construction Status

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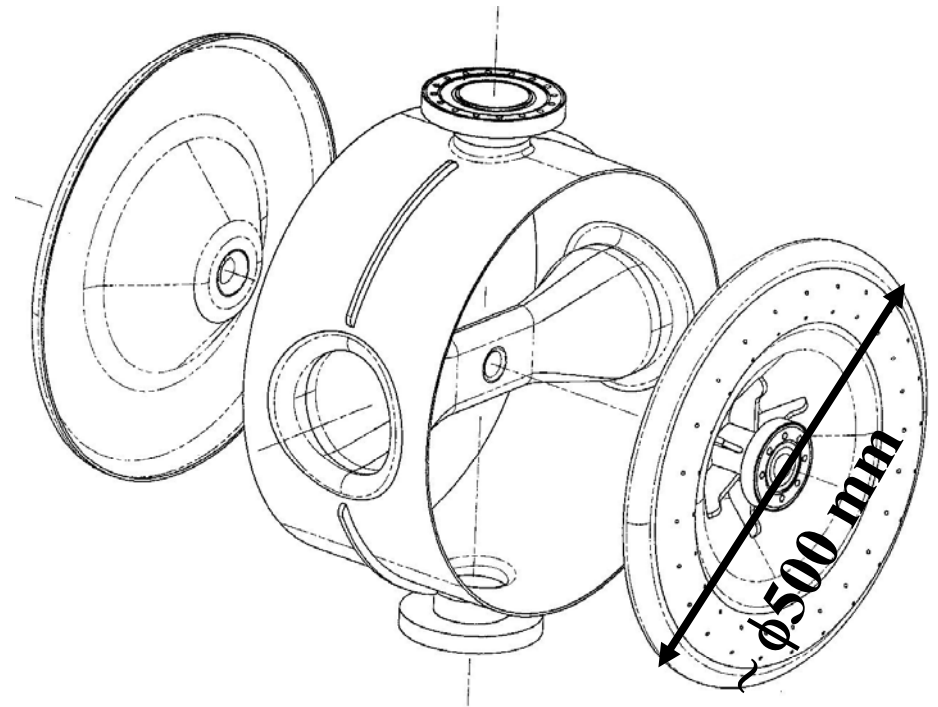
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Presentation Plan

- Introduction
- SSR1 - Dates
- What has been done
- Present Status
- Time Chart
- Conclusions

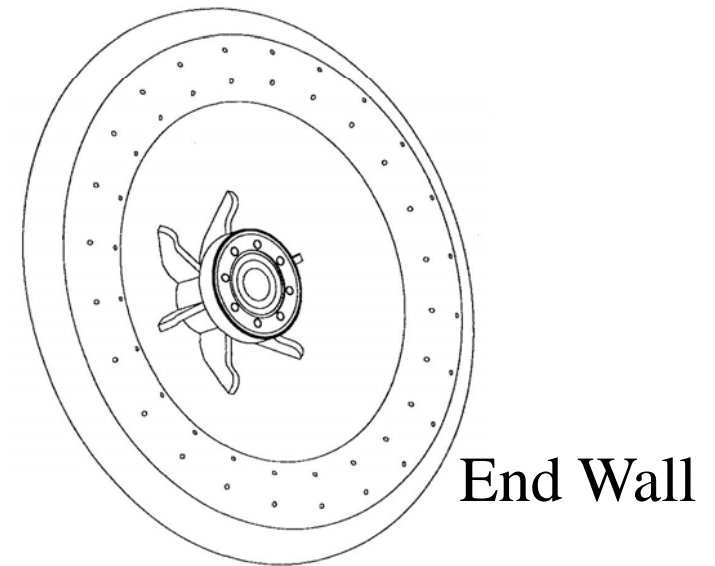
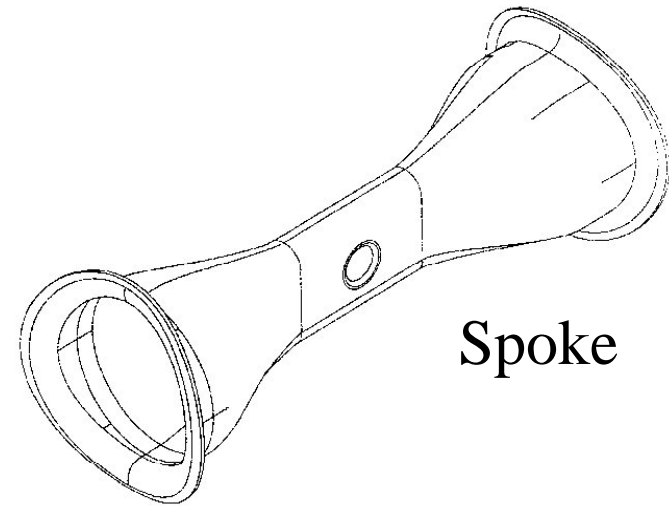
Introduction

- Under an MoU between IUAC and FNAL, two Niobium Single Spoke Resonators - SSR1 ($\beta=0.22$, $f=325\text{MHz}$) are being built by IUAC.
- The Outer SS vessel would be built and jacketed around the niobium resonators at FNAL.

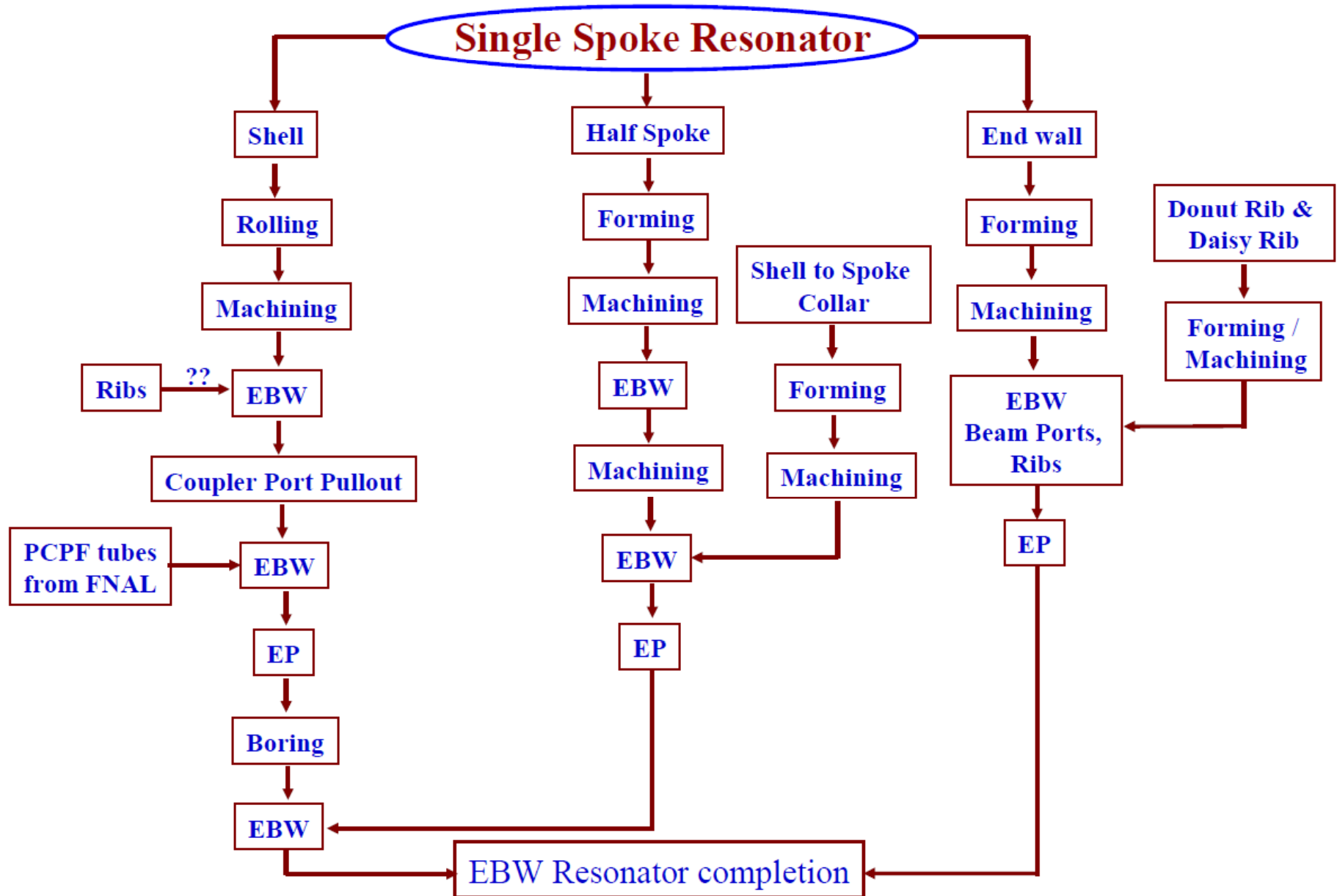


Introduction

- The major components of SSR1 are:
 - Shell
 - Spoke
 - End Walls
 - Coupler Ports
- The niobium material for the fabrication has been supplied by FNAL.



Fabrication Flow Chart



SSR1 - Dates

- Niobium material received from FNAL ~ Sept. 2007
- Technical discussions with the outside vendor started in January '2008 for the development of the dies and other niobium fabrication work.
- All technical & commercial negotiations were completed with the vendor by the end of March 2008.
- Placement of PO was delayed by about 6 months.
- Work eventually started by the vendor in October 2008.
- Our estimate is that the fabrication would take 12-14 months from this date.

What has been done

- After the PO was placed fabrication of the dies (using mild steel) for the following components was taken up immediately:
 - Half Spoke
 - End Wall
 - Spoke to Shell Collar
 - Donut Rib
- Meanwhile copper material of the required thickness was procured for the trial forming.

What has been done

- Several components in copper have been formed, which include:
 - Half Spokes
 - Shell
 - End Walls
 - Spoke to Shell Collar
- Dimensions were measured on the formed components to fine tune the dies and the process.
- Thickness, especially along the EBW welding edges, was measured so that the dies could be corrected to reduce variations.

What has been done

- Based on the trial forming in copper, all the dies were suitably modified to address the various issues.
- A Shell in copper material was initially rolled as a trial piece.
- Based on the experience we have rolled both the Shells in niobium. They have been machined at the edges in preparation for the beam welding.
- Acids for performing the electropolishing of the various sub-assemblies have been procured.

What has been done

- Four niobium tubes of OD $\phi 82.7$ mm \times 45 mm (L) \times 3.15 mm (WT) for the Power Coupler Port have been sent to FNAL. For this a single tube was rolled, machined at the edge, e-beam welded, saw cut and machined to size.
- Fixtures for electropolishing of the various sub-assemblies have been designed and are presently being made. Viton sheets for making the gaskets are also being procured.

Half Spoke



Die & Punch for forming the Half Spoke. The forming is actually done in two stages. In the first stage the central flat portion is formed (the die set for that is not shown here) followed by the full Half Spoke.

Half Spoke



Half Spoke in copper after forming (left) and after machining it (right).

End Wall



End Wall Die and one piece formed in copper (left) and first punch (on the right, in the foreground)

End Wall



Second punch for forming the nose (on the left) and closer view of the End Wall formed in copper (right). A separate attachment for forming the End Radius (where the End Wall meets the Shell) has also been made.

Spoke to Shell Collar



The Die & Punch for forming the Spoke to Shell Collar has been made. The trial copper piece formed has come out well. Measurements on the thickness at the EBW edge will be made shortly after it has been machined.

Shell



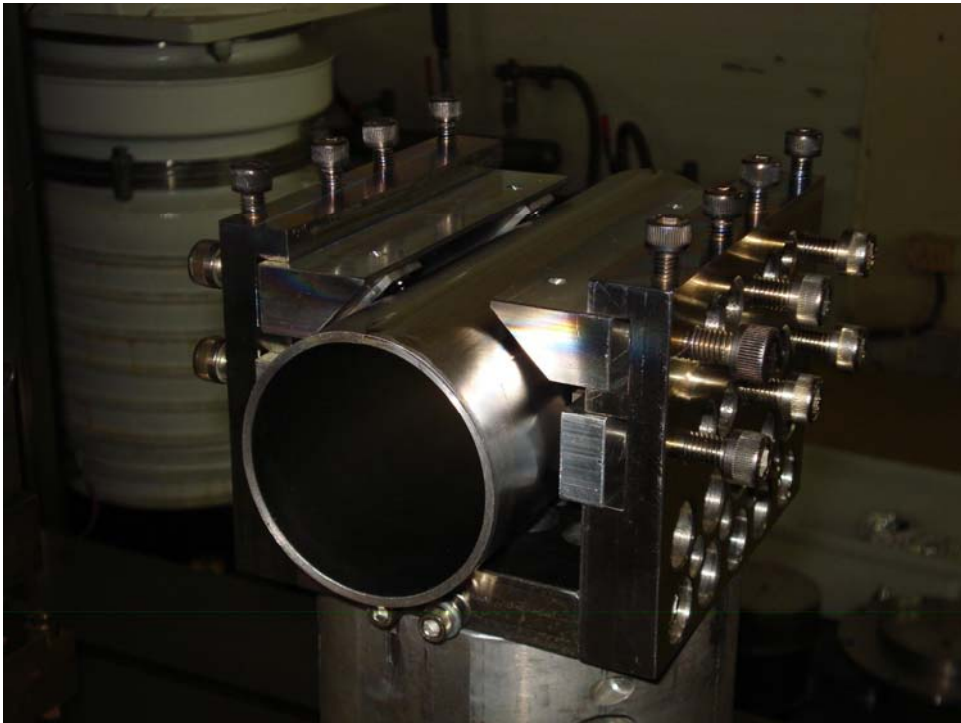
The Niobium Shell being rolled (left). The photograph on the right shows the two Shells.

Shell



Left: The Shell being machined. Right: Machining of the Aluminium Fixture for holding the Shell.

Power Coupler Port Flange Tube



Left: PCPF Tube setup for electron beam welding.
Right: Four tubes (which were cut from the single tube) that were sent to FNAL.

Donut Rib



Die & Punch for forming the Donut Rib.

Coupler Port Pullout

- The Coupler Port Pullout Die has been designed and drawings have been made in Solidworks.
- The Die will attach to the Shell holding fixture.
- Machining of the die will begin shortly.
- We will try out the die on the copper shell first.
- After that the die may be tried on small niobium pieces.
- Finally we will pull out the Ports on the actual Shells.

Thank you