TOPIC 3: SPOKE VS. ELLIPTICAL CAVITIES FOR β = 0.5

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Elliptical and spoke resonators originally have been developed for particle acceleration at different ends of the beam velocity spectrum. While elliptical resonators have been developed for the acceleration of electrons at the speed of light, spoke resonators are a variant of a half-wave resonator that have their origin in the acceleration of protons or ions at low to moderate energies and velocities ($0.15 < \beta < 0.4$).

In the last 10 years we saw an extension of the proposed use of elliptical resonators towards the acceleration of higher energy protons ($0.5 < \beta < 1.0$) (e.g. APT, ADS, RIA and SNS). This was achieved by longitudinally compressing the dimensions of standard elliptical resonator geometries. Due to the mechanical problems resulting from this compression, there is a certain limit on the velocity of particles that the elliptical cavities can accelerate. The SRF community agrees that the lower limit is around a beta of 0.4 - 0.5.

Spoke resonators, in comparison, do not have any geometric limitation to the range of velocities they could be designed for. The limits for their range of application are on historic grounds. This created the idea of extending their application to beam velocities beyond their standard range of application. This can be seen in the proposals for new proton linacs that often use spoke resonators in the range of $\beta > 0.2$ and in some cases up to betas around 0.6 (e.g. ADS, ESS, RIA, ...).

The goal of this discussion is to find out which of the two technologies is more advantageous than the other in the transition region around $\beta = 0.5$. As there is no operational experience of any of those structures the evaluation of the properties of each technology will have to be based on simulations and low power tests that have been done in the past.

Criteria will include RF-performance, fabrication, surface treatment/cleaning, mechanical properties, choice of frequency, choice of operation temperature, beam-cavity interaction and cost. It might also turn out that there is no distinct advantage for one of the technologies and that the best choice is related to the specific application.