Discussion on "RIA Cryomodule Design Work" by Joel Fuerst

The first discussion focused on the integrated stainless/niobium helium vessel concept. Fuerst answered to a question that no bellows is incorporated into the vessel. The differential contraction for the 2-spoke case is acceptable. The resulting compression during cool-down is a small fraction of the slow tuner range. For the 3-spoke case this might have to be revisited.

The discussion elaborated on the concept of the integrated cavity/vessel design. The concept strives to balance the forces so that the vessel is stiff against helium pressure fluctuation but still has a low tuning force. This is not achieved by making the vessel inherently stiff against helium pressure, but by a design that is flexible and has a net cancellation of pressure deformation effects. This flexibility then allows low tuning forces. It was reiterated that this concept only compensates the helium pressure effect, any differential shrinkage effects due to cool-down still need to be taken care of by the slow tuner.

While there are no bellows in the helium vessels, there are bellows between cavities that allow an independent tuning of each cavity in a cryomodule. Related to this the cryomodule layout presented triggered questions about the assembly. The space between cavities is very tight. To study the feasibility it was suggested to build a mock-up for developing assembly procedures.

Pagani reported that for the present tuner in the TESLA design the Lorentz Force coefficient (LFC) is dominated by the "weak" tuner. This indicates that all auxiliaries to a cavity need to be considered when the dynamics of mechanical behavior is determined. Shepard answered that this is not an issue for RIA. Their design does not expect any additional stiffening from the tuning system itself at this time. The LFC results presented for the RIA cavities are for unconstrained cavities. These do not show any LF detuning issues. Any additional constraint will make the situation only better. He also added that LF detuning is less of an issue for the cw operation in RIA than it is for SNS, which is a pulsed machine.

The tuner discussion was closed by some remarks on the implications of a weak tuner. The use of such a tuner limits its use to very slow tuning, which is compatible with the concept of the RIA design.

Next the static losses of the RIA cryomodule were discussed. The dynamic losses per cavity are expected to be around 10 W. The static losses are expected to be around 1-2 W. Vogel commented that this sounds extremely good and asked if these could really be achieved. Also Kelley estimated that for the number of penetrations and details of their fixtures he would expect a higher number (around 30% of the dynamic losses). Shepard explained that these numbers are based on their operation experience with ATLAS. He conceded however that the final determination of this number can only be done when the system components are finalized.

Differential contraction behavior was the last topic discussed. Shepard explained that everything will be installed onto 2x12 aluminum strongback beams. This will drive all differential contraction. The cryo-connections will not be a problem, as they will all be flexible hosing.