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CEA COUPLER ACTIVITY UPDATE

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PIP-II Coupler collaboration meeting

Status of studies on the 650 MHz couplers presented in June

Study	Status	Main results	Comments
RF Conditioning: 50 KW with full reflection RF study for complete geometry with the doorknob: S11, surface fields and losses	Done. Agreement between Comsol, Ansys and Fermilab results	-30 dB bandwith around 8 MHz. Max surface electric field 1.6 MV/m (at antenna disk.)	
RF Conditioning: 50 KW with full reflection Thermal studies	Done. Agreement between Comsol, Ansys and Fermilab results. Higher ceramic Max T° for CEA simulation (fine phase variation)	Max internal conductor temperature = 126 - 133 C. Max T° Ceramic (4g/s cooling air rate) CEA/Fermilab = 83°C/68°C	High temperatures on HB coupler ceramic can enhance degassing during RF tests
RF Conditioning: 35 KW with full reflection Thermal studies	Done. Comsol simulation using the same model as previously.	Max T° Ceramic CEA (4g/s) = 65°C Max T° Ceramic CEA (6g/s) = 54°C	Increase of cooling air rate is recommended during RF conditioning
Cryomodule operation: Thermal studies – cryogenic static	Verification ongoing – **to be discussed at dedicated meeting** **Today**	How to ensure ceramic temperature > 0 C? Heat flux to cavity and 5K strap = ?	Current and short term studies
Cryomodule operation: Thermal studies – cryogenic with RF	Verification ongoing **– to be discussed at dedicated meeting**	How to avoid excessive loss on the coupler to cavity interface?	Current and short term studies

Advances

Preparation of the calculation model

- Discussion between CEA and Fermilab about the coupler model was very interesting and allowed to understand the differences between the two ways of modeling in addition to the confirmation of some data inputs. This allowed to finalize the CEA coupler model for the Cryomodel operation.
- Last versions of drawings were checked in order to consider the last updates in the Coupler calculation model.
- First results were obtained using a **coupled RF and Thermal calculation for RF input power of 50 kW with 20% reflection**.

How did we proceed for our calculation?

- The calculation is performed with a 2D coupler model to have less time consuming calculations for parametrical studies.
- The cooling air temperatures increases are calculated using RF losses computed using a complete 3D coupler structure which takes in account the waveguide RF losses. We considered the maximum temperature increase for all phases for the 2D calculation.

What did we calculate?

- Heat flow to 2K interface for reflection phases from 0 to 2*pi [rad] with steps of pi/8 [rad]
- Heat flow to 2K interface for T° on the coupler to cavity interface from 2 to 10 K
- Influence of the copper plating thickness on cold outer conductor
- Influence of the RRR=100
- Influence of plating on the coupler to cavity flange

We need to consolidate the results internally than we can discuss them. **Radiation effect is not considered yet**.