HiLumi-LHC/LARP Crab Cavity System External Review 5-6 May 2014, BNL

SPS - RF Power and Coupler status

Erk Jensen, Eric Montesinos, CERN BE-RF

High Luminosity LHC

LARP

BROOKHAVEN NATIONAL LABORATORY

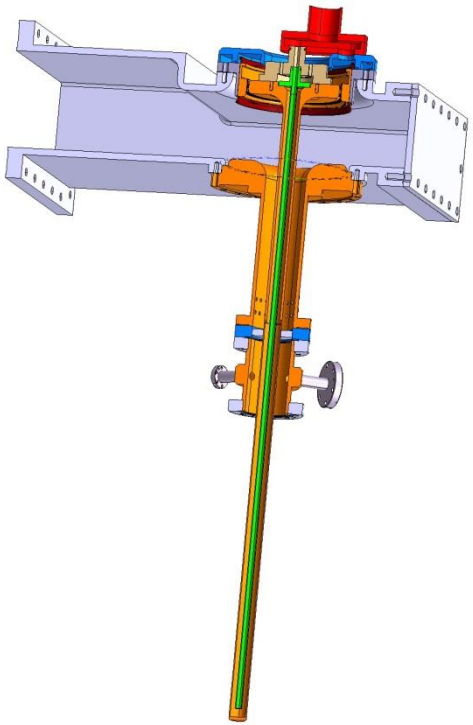
FPC – initial design

400 MHz 50 kW CW FPC
full reflection all phases

Agreed coaxial line
OD 62 mm - ID 27 mm

Coaxial disk window
- Outer titanium flange
- Al2O3 97.6% ceramic
- Inner copper tube

Coupler body
- Massive copper
- 316 LN Stainless Steel flanges on both sides



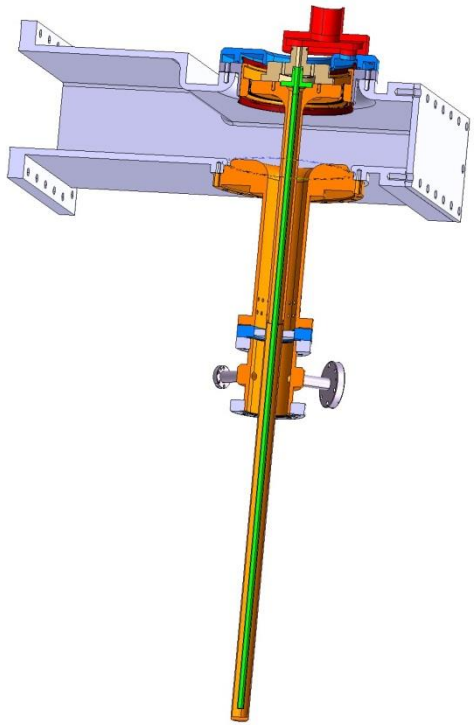
FPC – initial design

Monitoring ports

- 1 port for vacuum gauge
- 1 port for e- monitoring
- 1 port for arc detector

Coaxial to WG WR2300½H transition without doorknob

DC capacitor included for DC polarization



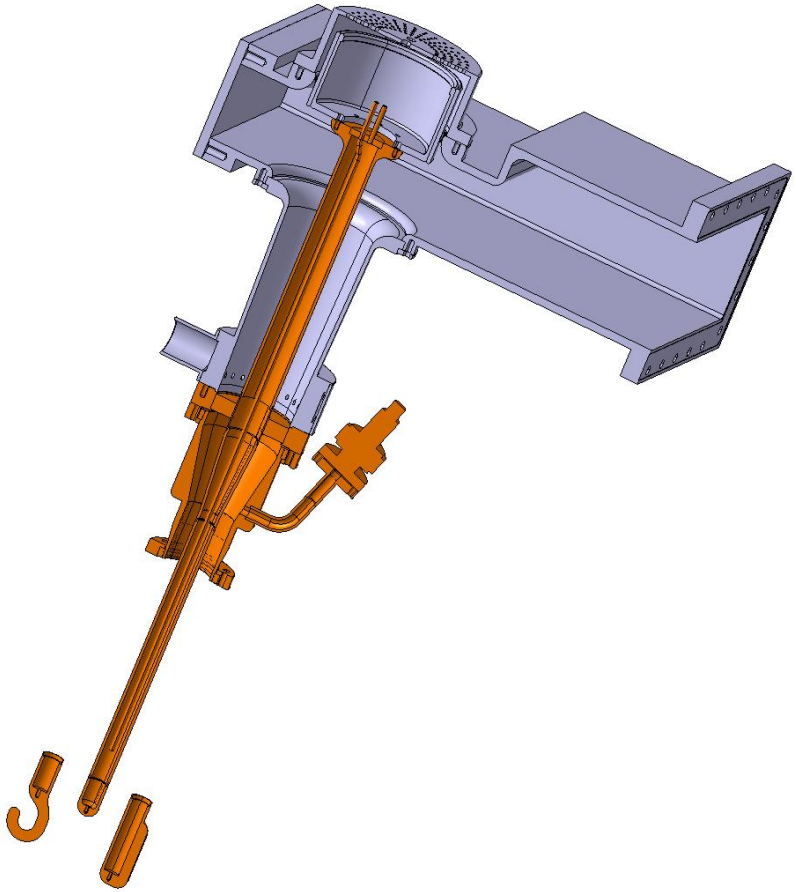
FPC – new design

Still agreed sizes on cavity side
OD 62 mm - ID 27 mm

Conical vacuum line to increase the diameter of the ceramic in order to avoid arcing on the air side

Ceramic & Air coaxial line increased
OD 100 mm – ID 43.5 mm

Robust ceramic
Thickness 20 mm



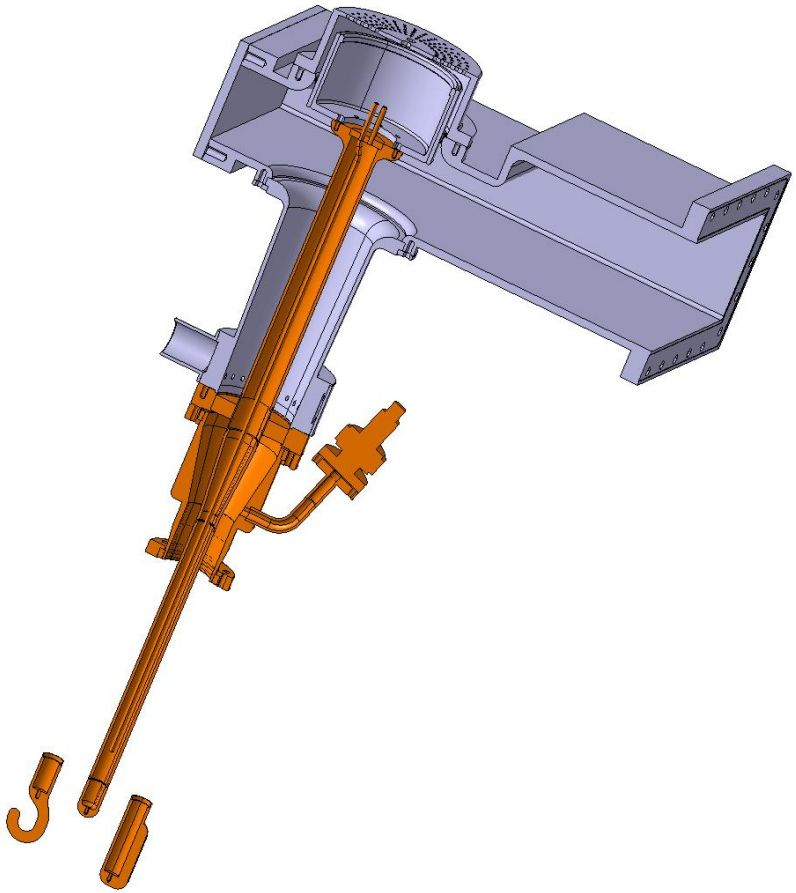
FPC – new design

Pseudo-conical air extension cooled with forced air

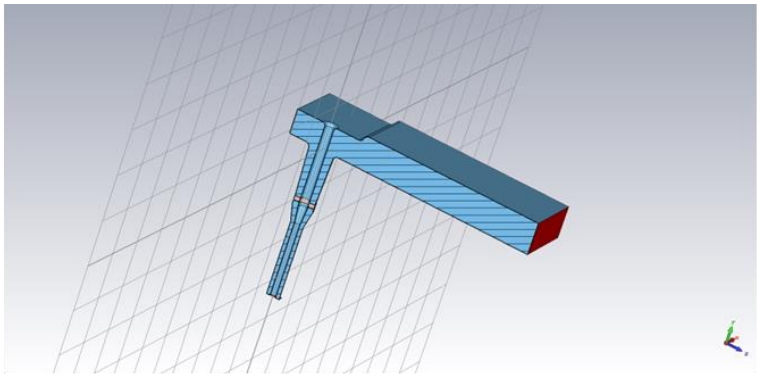
Even if against CERN's rules regarding joining, as no other way to do it, water cooled antenna

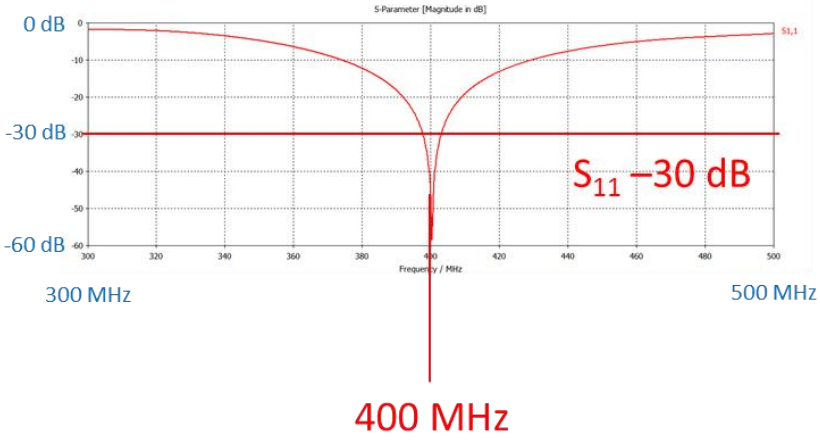
Mandatory vacuum gauge for coupler protection

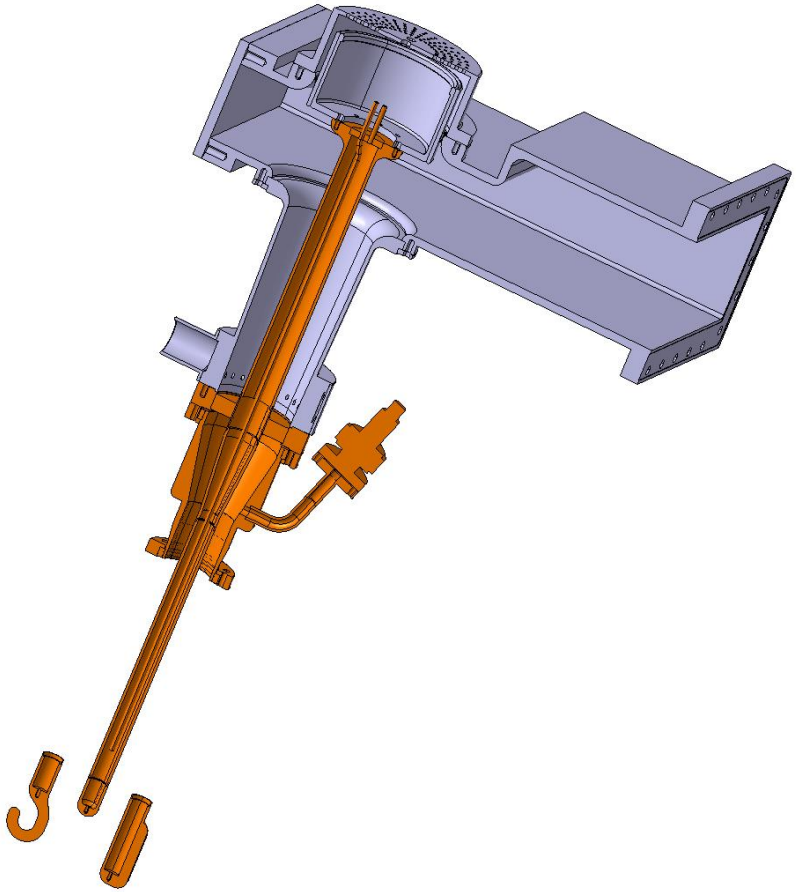
No more arc detector window neither e- antenna to ease integration



FPC – new design





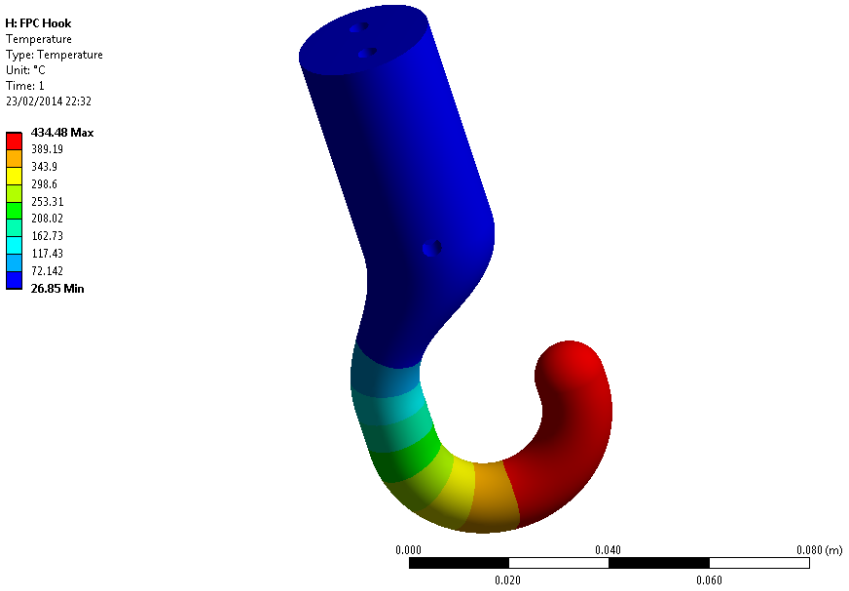


Antenna overheating

Looking at the size of the hook, no way to design a circuit which also cools down the curve part of the hook

Need to define the hook position along the FPC line, if not hook will overheat up to an unacceptable temperature

Same checks needed for all coupling element designs

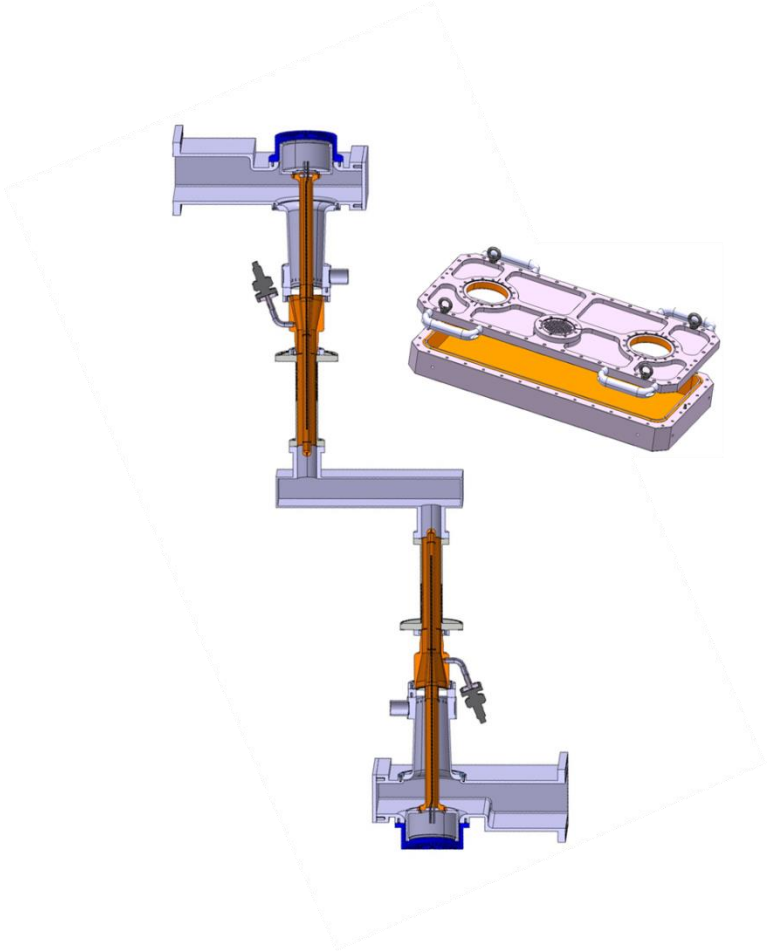


Test boxes

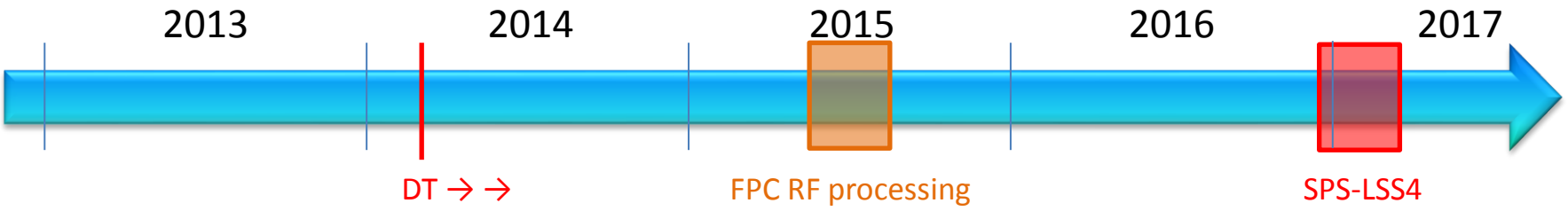
Three test boxes will be built allowing the preparation of pair of couplers

They will be made with two plates of Stainless Steel, not copper plated (easier and quicker), and will be water cooled

They will be customized regarding the coupling element for each cavity design



Schedule May 2014



- Cavities to be installed in the SPS in December 2016
- Couplers processed 50 kW SW CW all phases Q2-2015
- FPC design is missing **DT & coupling shape & position** (additional delay will impact FPC schedule)

Tetrode Amplifiers

No progress, still no water due to LS1 until May 2014

Was operated at 40 kW maximum in 1999

Should be able to provide 50 kW (not guaranteed)

Power supplies

Existing one will be for the test stand

Two new systems will be bought for SM18 & BA4

Will be one HV power converter for two amplifiers to reduce the cost

Driver amplifiers, Circulators & Power Loads

Offers received from 10 companies, off the shelves SSA

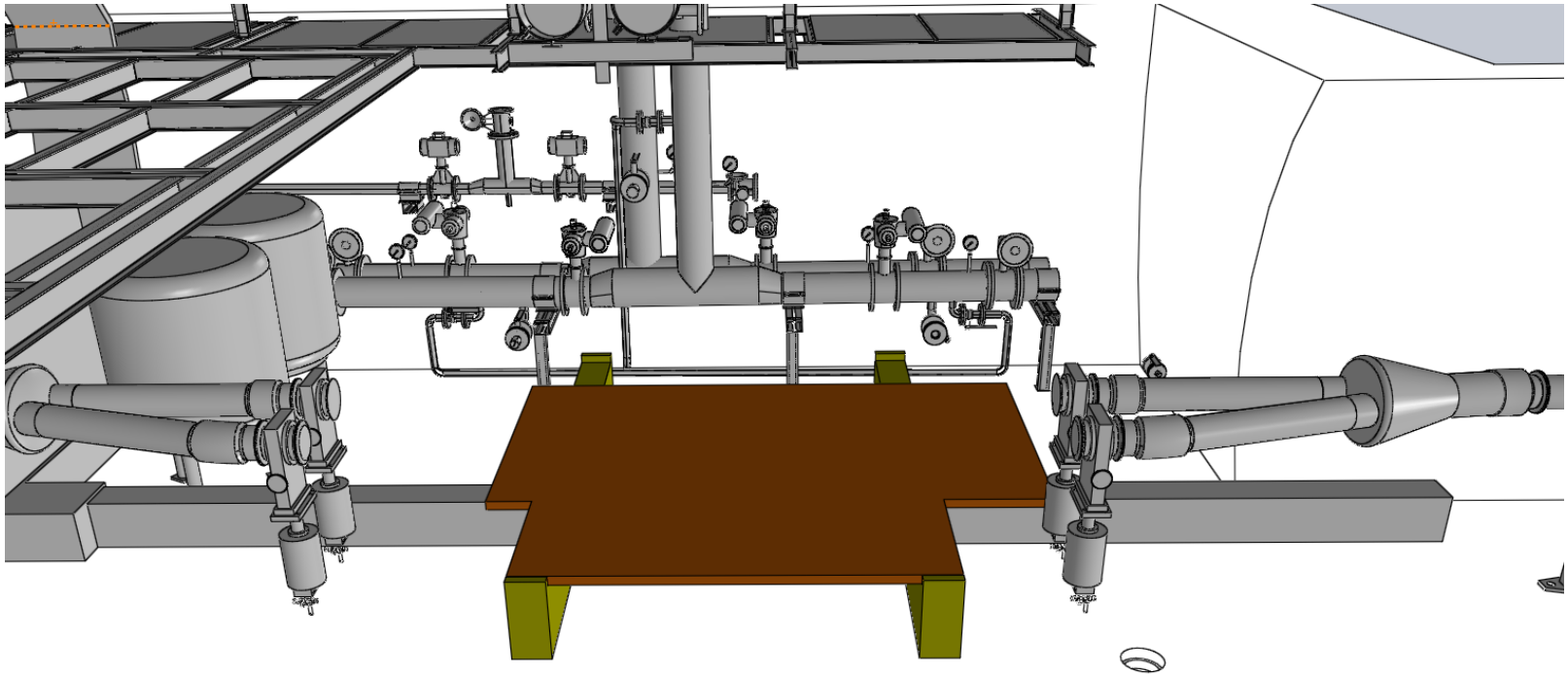
On-hold awaiting Tetrode amplifier test results in order to correctly define the output power level regarding tetrode amplifier gain

They will be close to the LLRF racks in ECX4

Three sets of LHC 400 MHz 330 kW circulators & LHC loads have been ordered

Loads will be shorten to allow integration onto the table

Movable table



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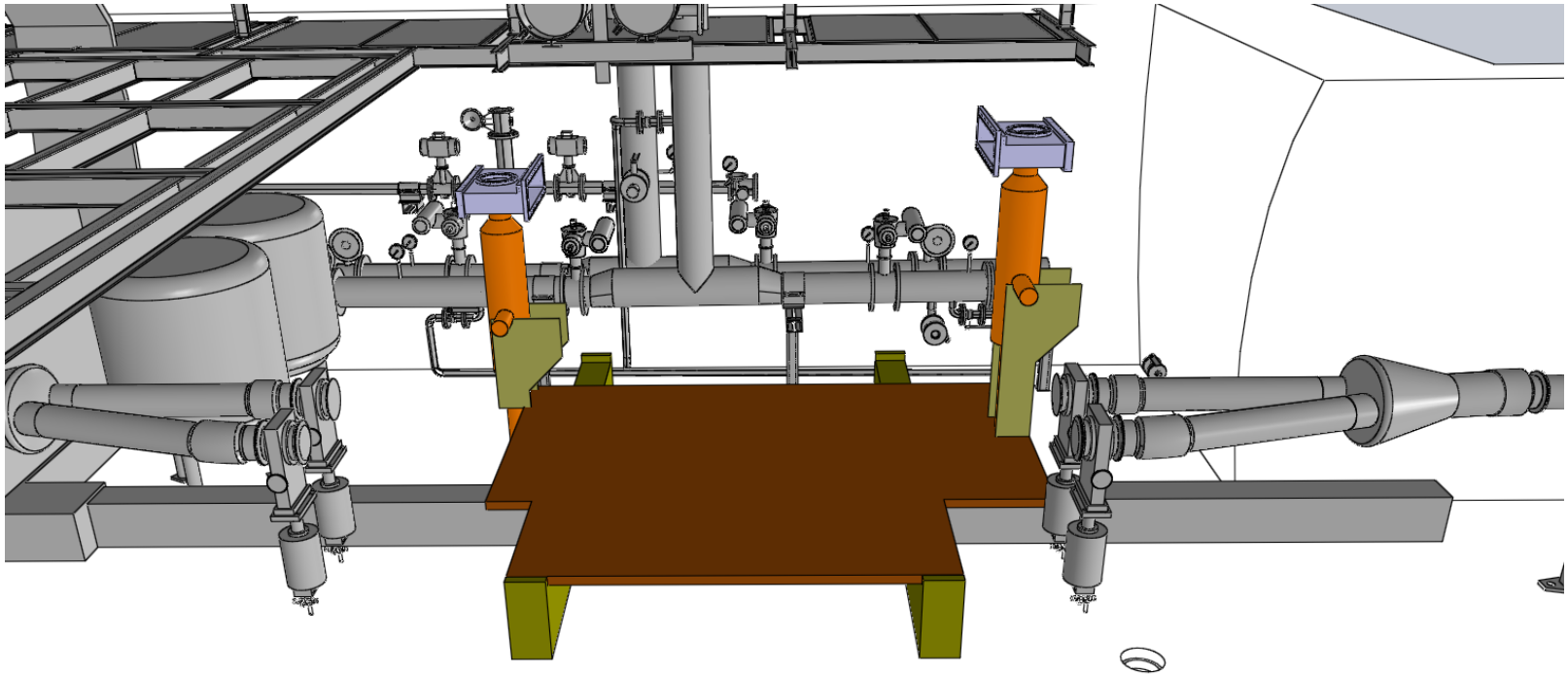
Tetrodes Amplifiers onto the table



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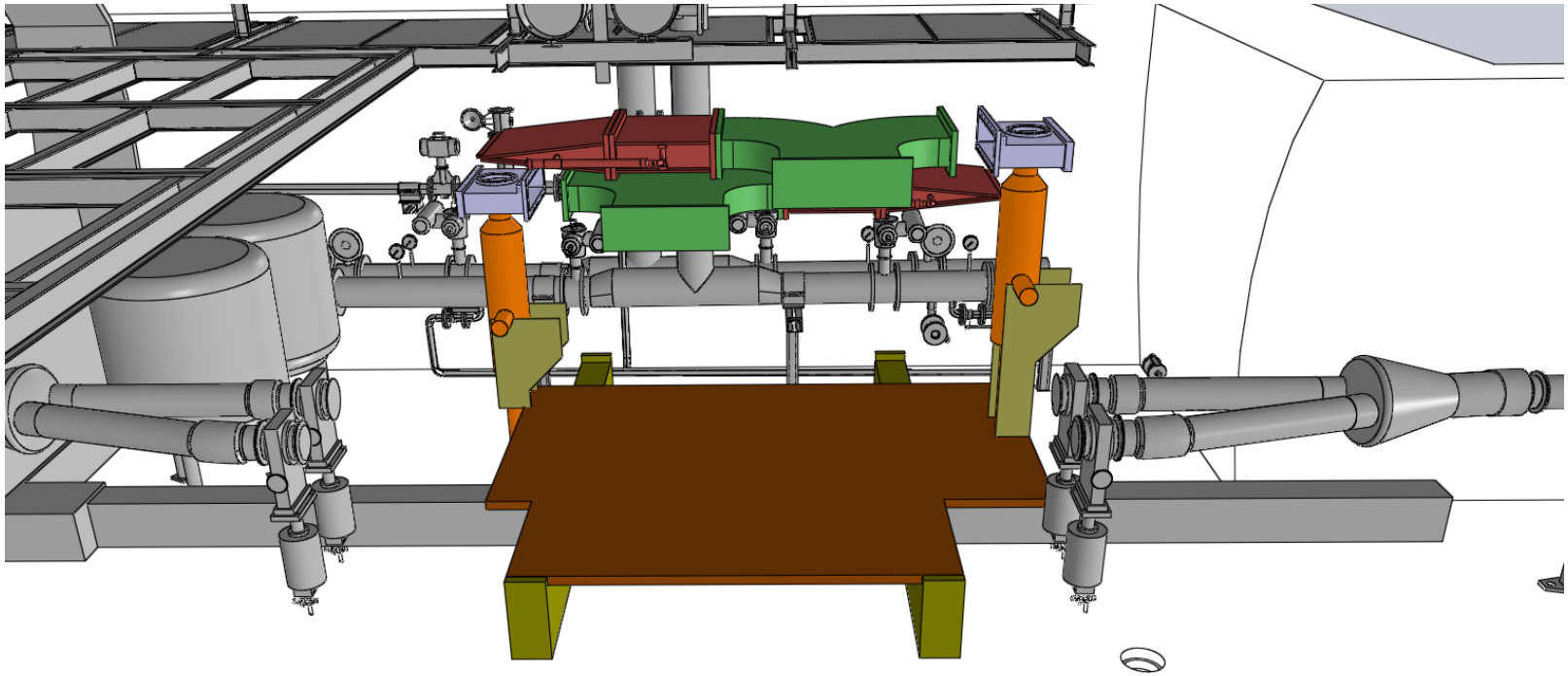
Circulators & power Loads



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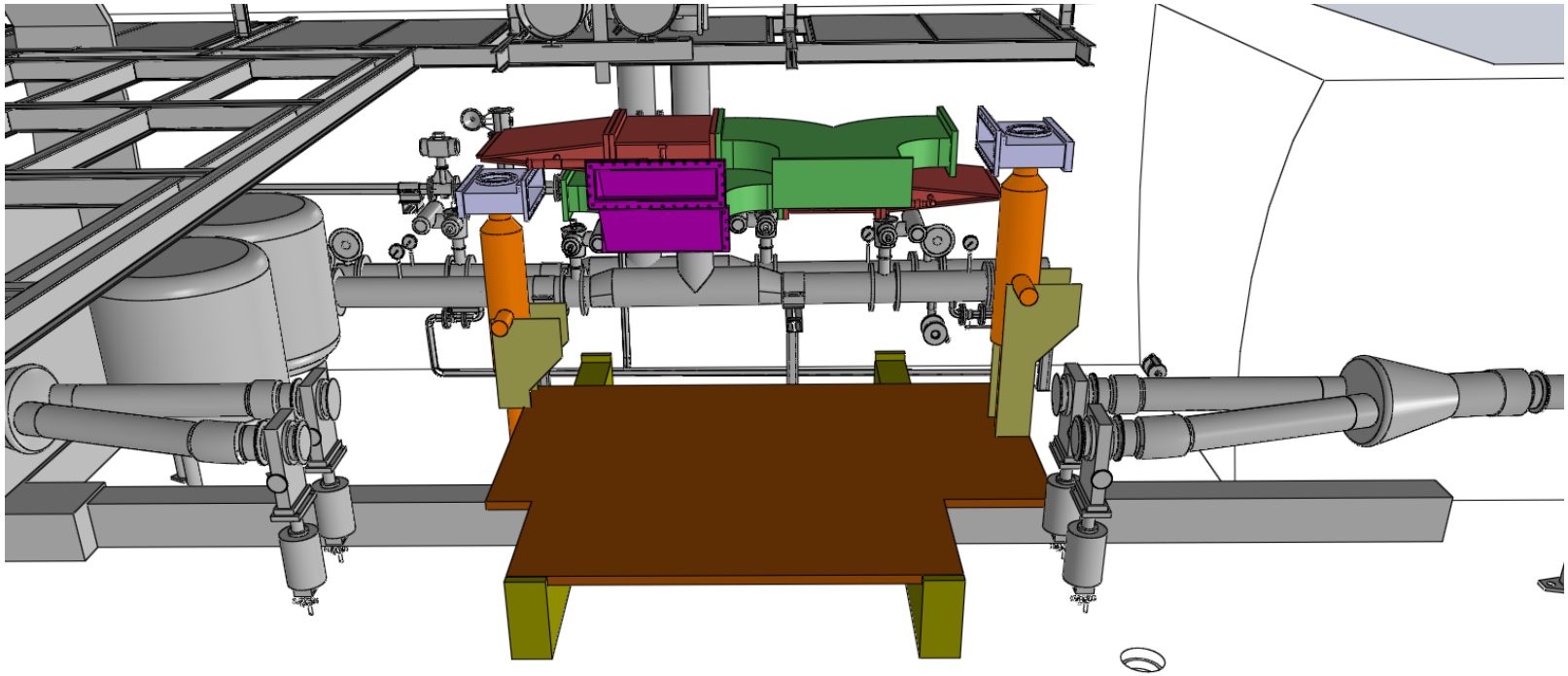
Waveguides to FPC



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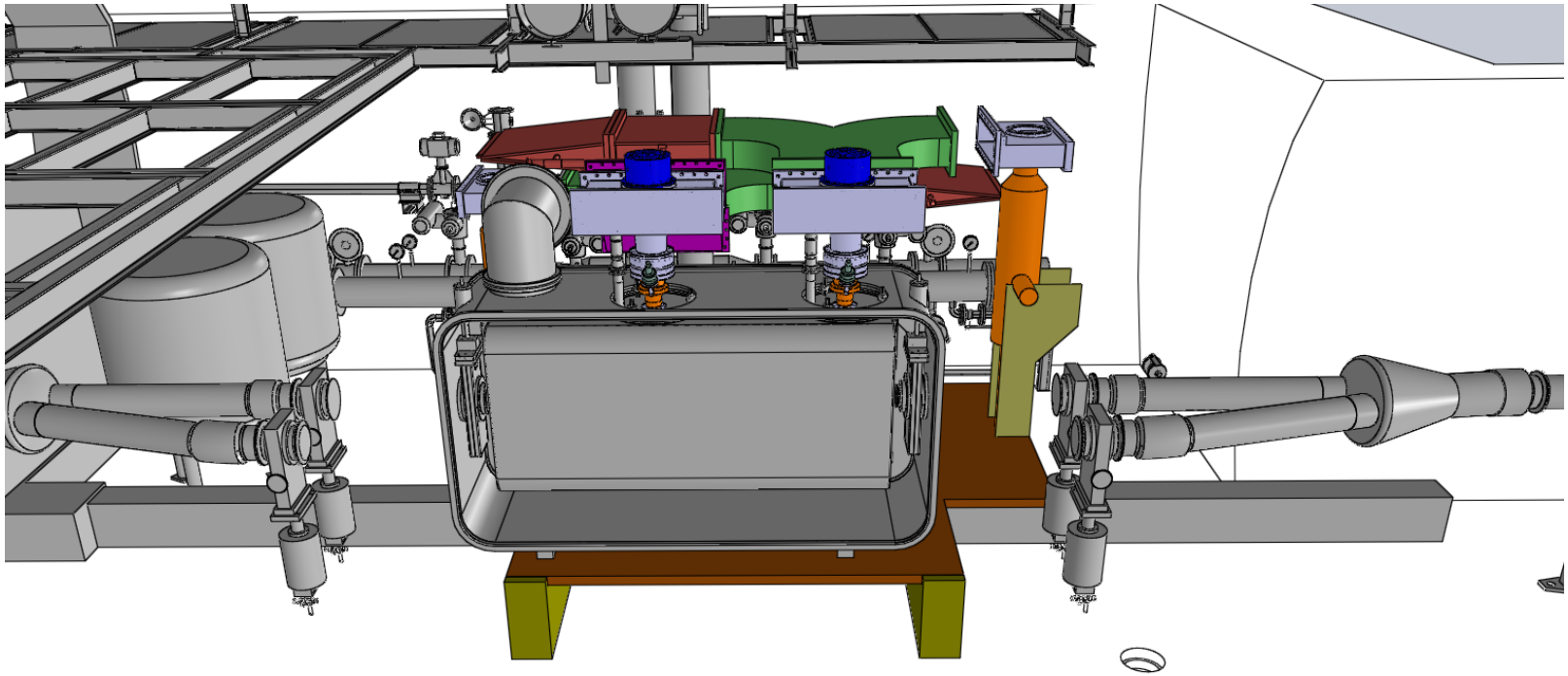
Cryomodule with FPC



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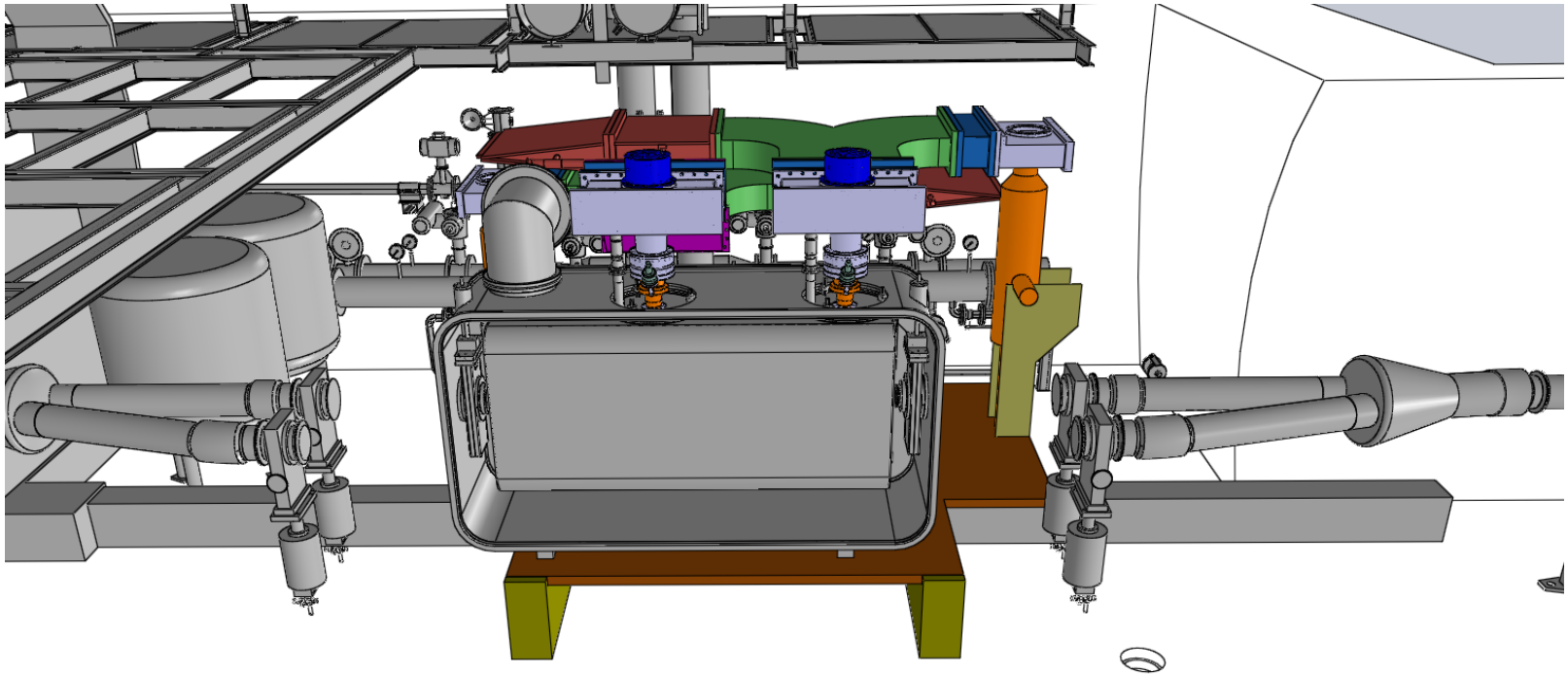
Flexible WG



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Conclusion

Coupler designs almost completed & test boxes simulations to be completed

- Hook position to be defined
- DT length still to be defined

Tetrode amplifier still to be tested

Integration pre-study of power system completed → ok

Schedule … more and more optimistic if no decisions are taken regarding DT & Antennas !

Thank you