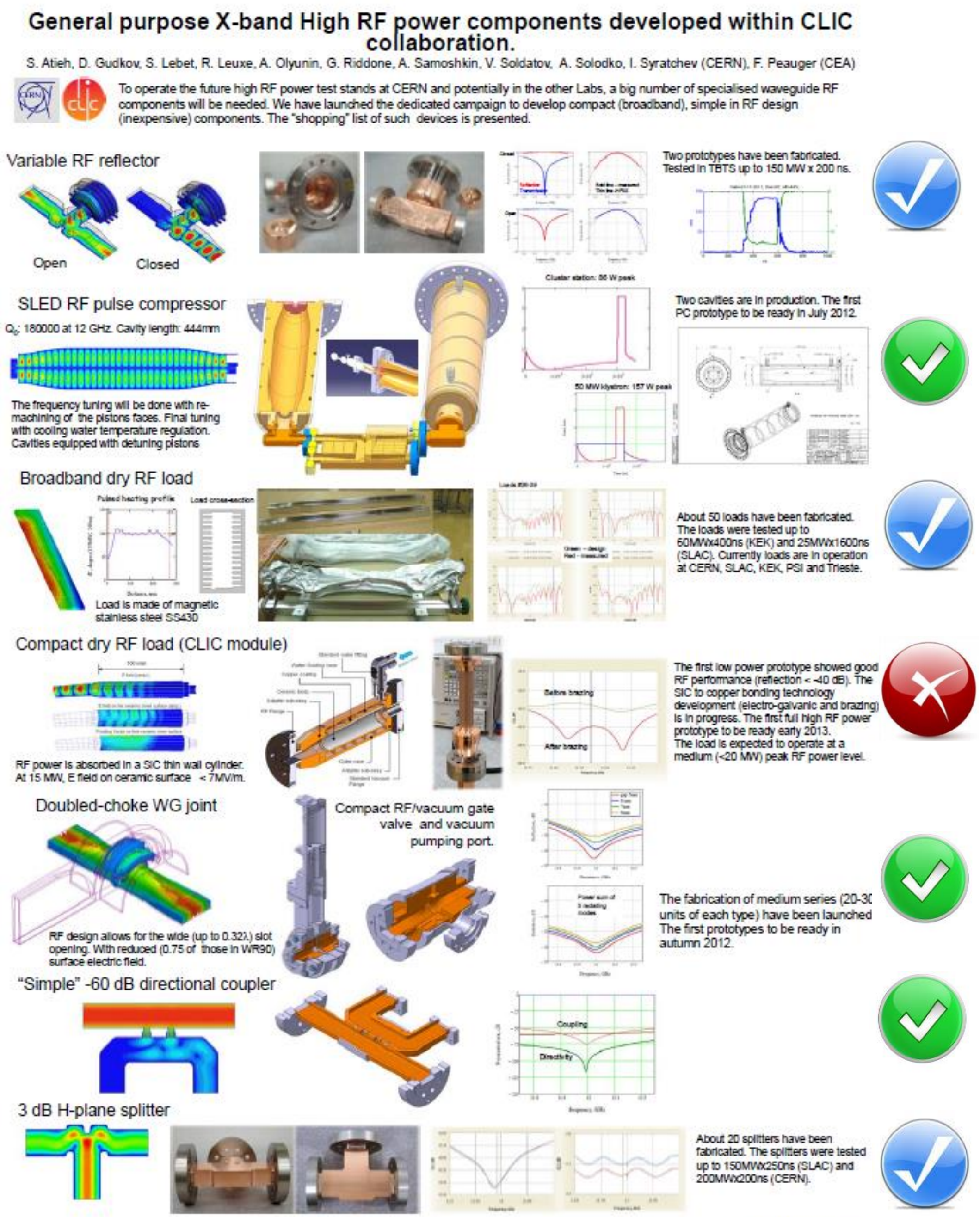
High power RF components developed at CERN

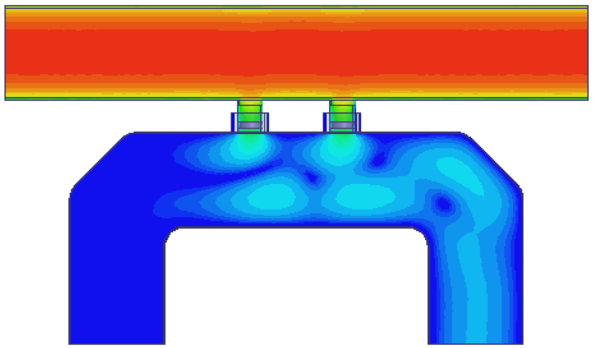
I. Syratchev, CERN

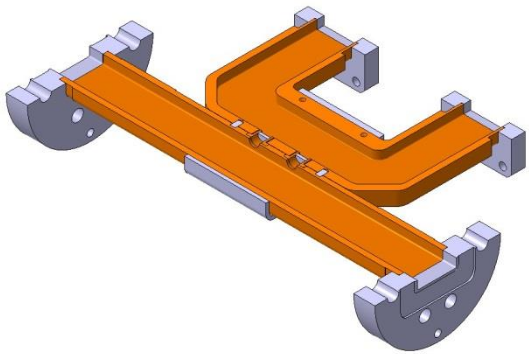


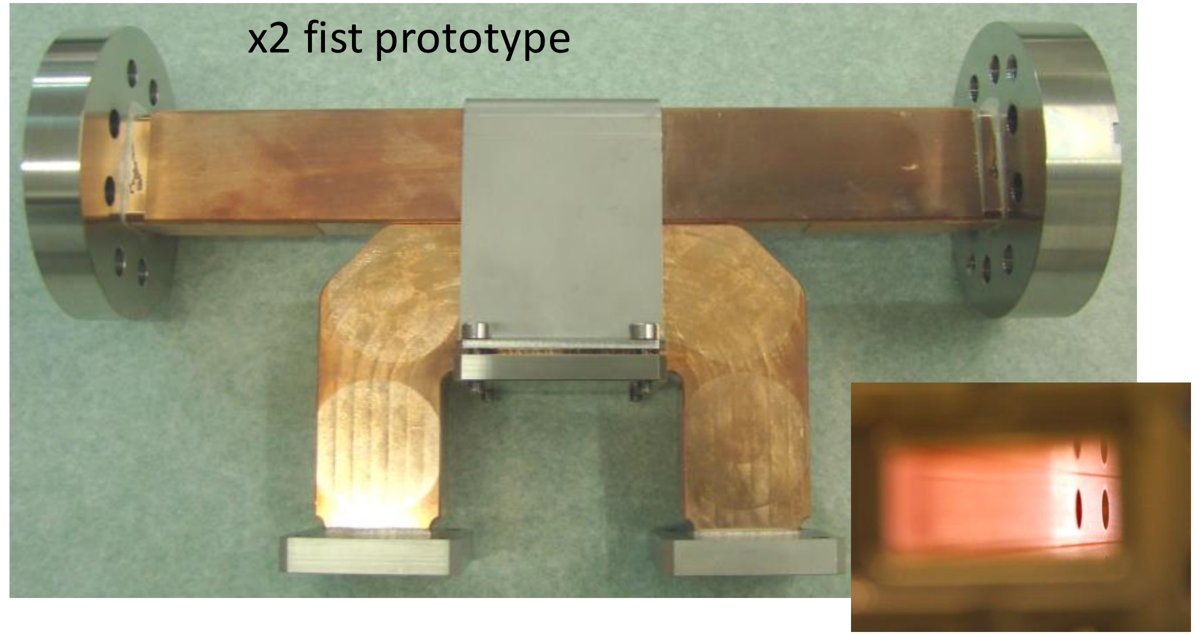
During last HG2012 workshop, we have presented our program of development of the new general purpose RF components.

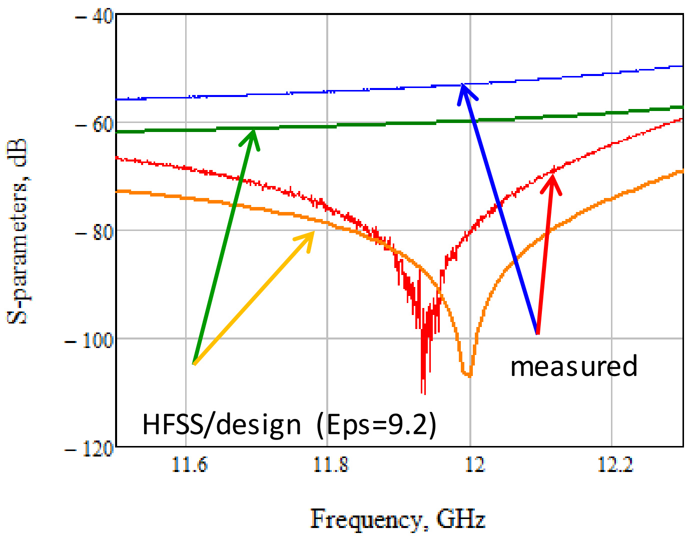
- In progress
- High RF power tested
- Prototypes received

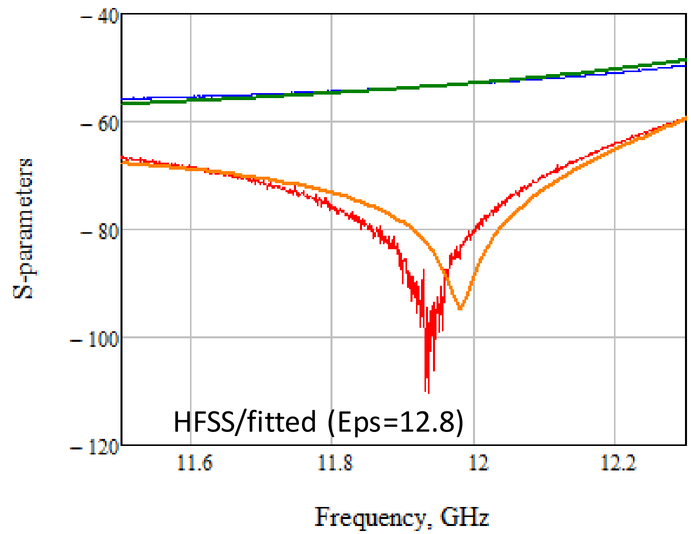
‘Simple’ -60 dB directional coupler







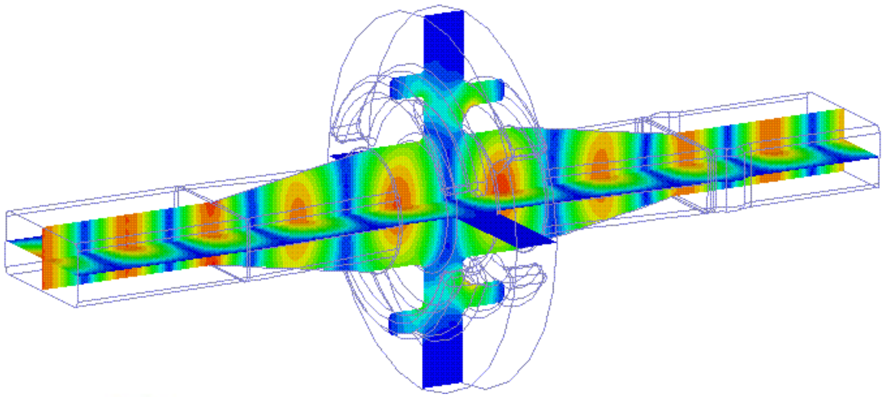


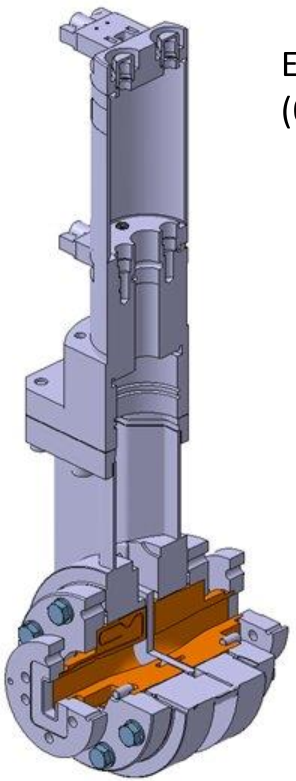


For the next generation, RF design was slightly modified, to bring coupling from -53dB down to -60 dB

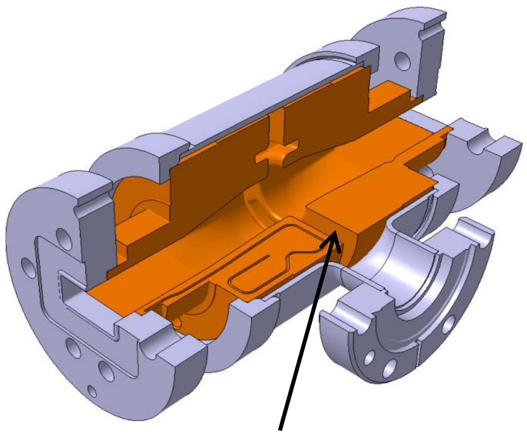
Compact RF/vacuum gate valve and vacuum pumping port

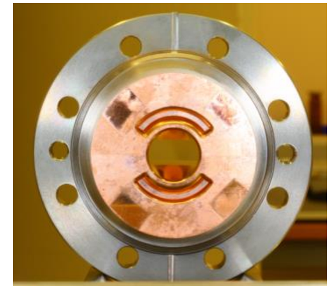
Doubled-choke WG joint

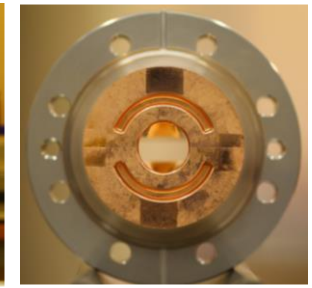


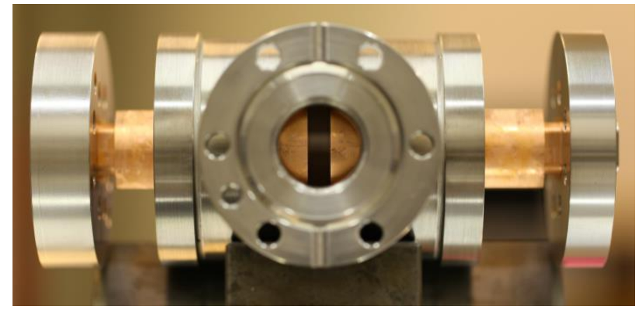


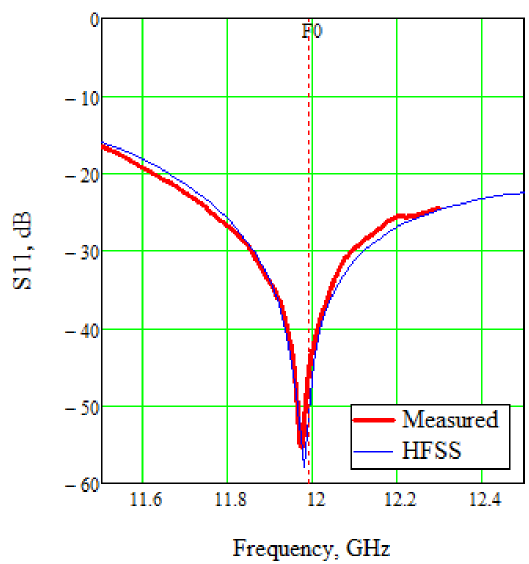
$E_{choke/max}$ (100 MW)=23.7 MV/m
($0.75 \times E_{max}$ in WR90)

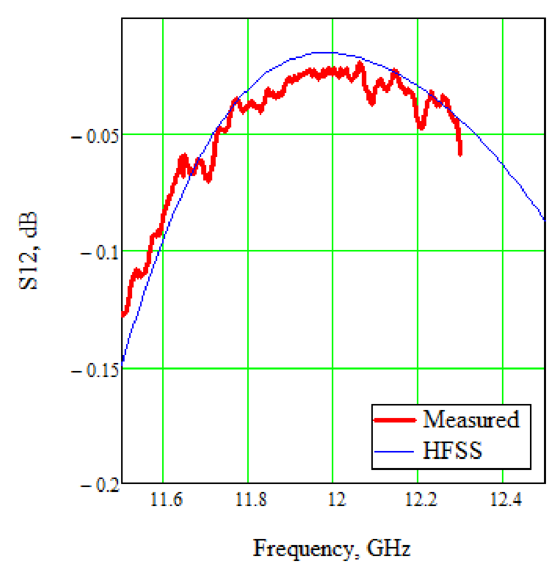




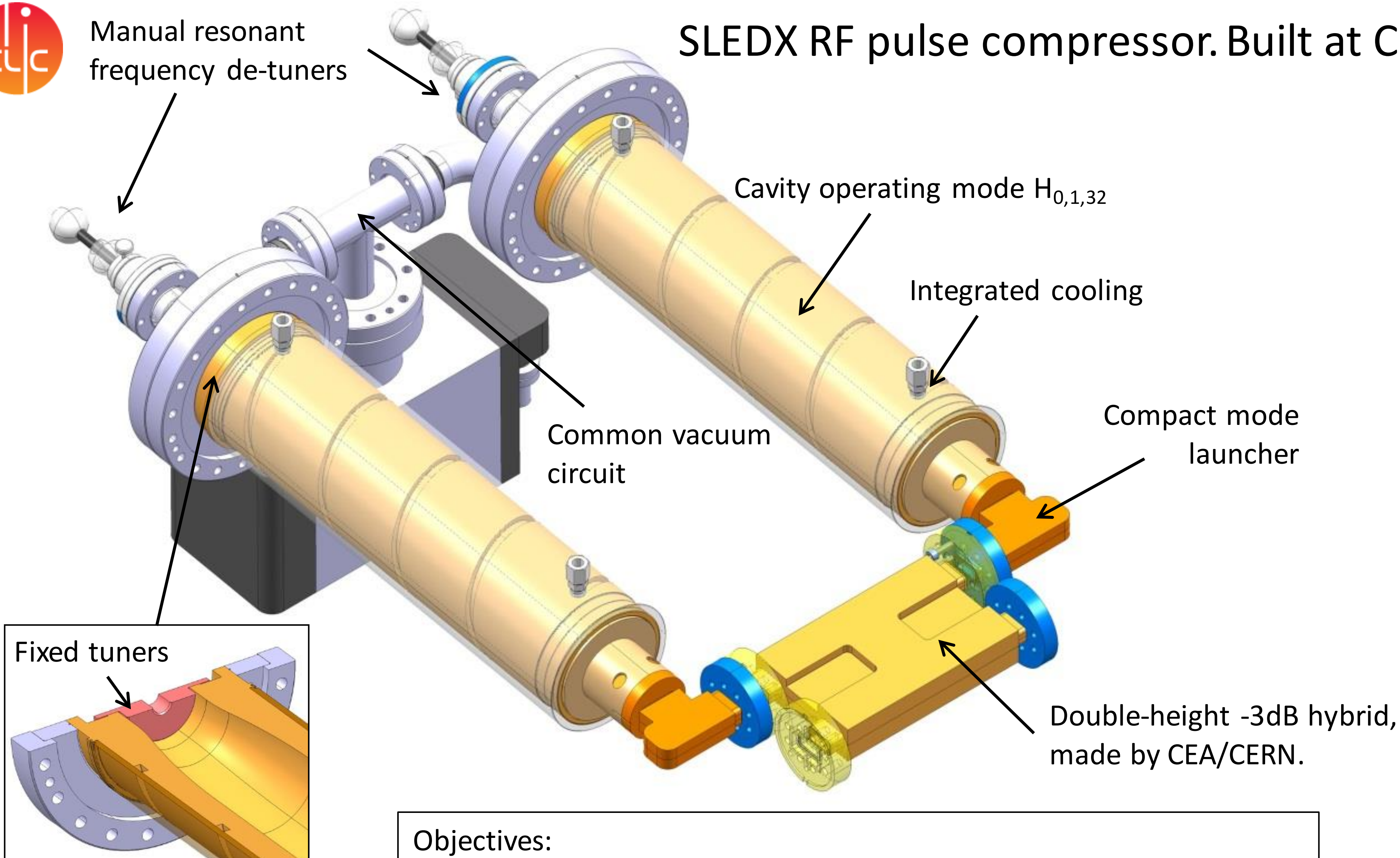








SLEDX RF pulse compressor. Built at CERN.

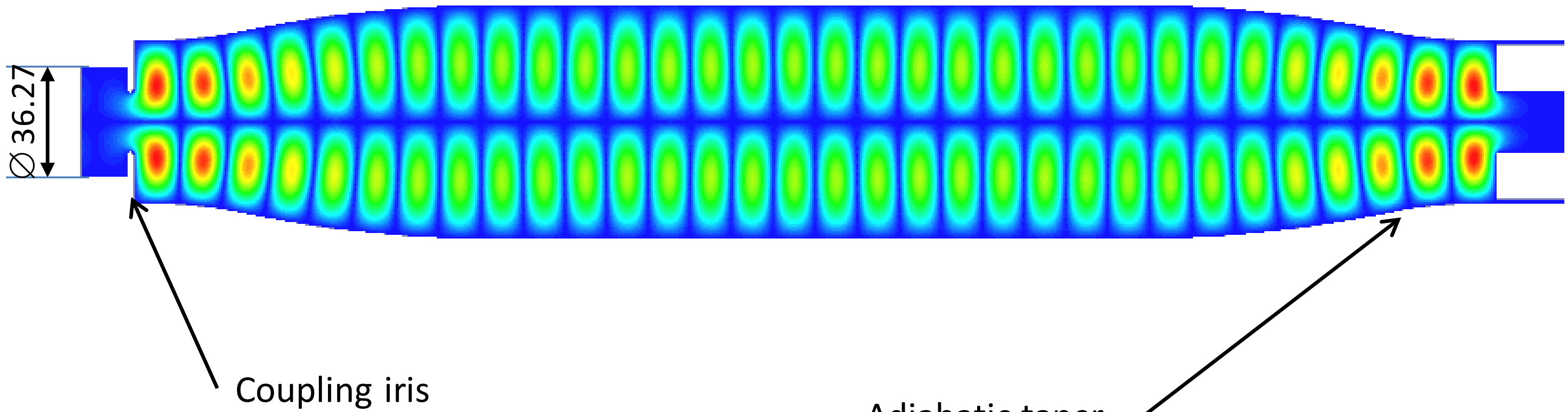


Objectives:

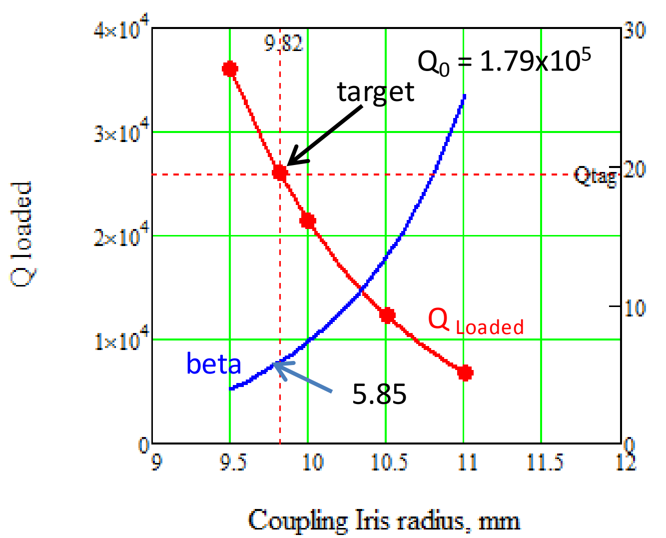
1. Compact (inexpensive).
2. Relaxed fabrication tolerances.
3. Fixed frequency tuners (frequency control by temperature).
4. Detuning option.

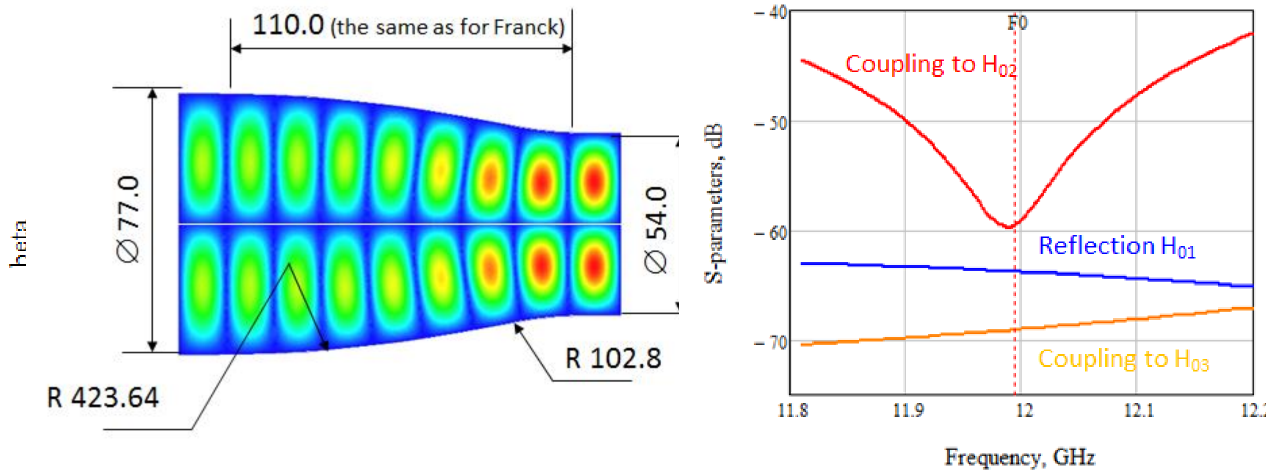
Storage cavity design

Cavity operating mode $H_{0,1,32}$, length 0.444 m, Q_0 (HFSS) = 1.79×10^5

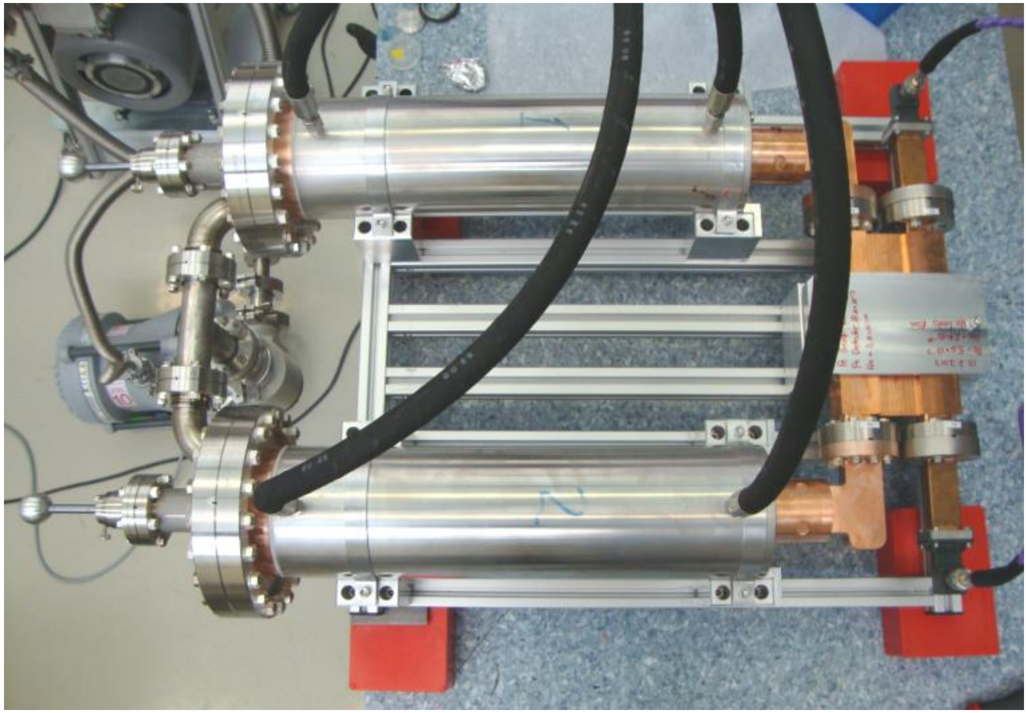


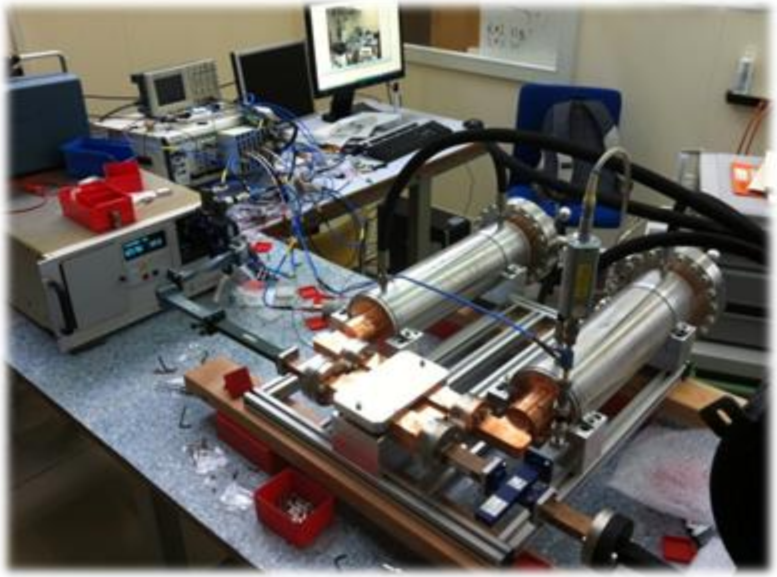
Iris thickness 2 mm with inner filler radius 1 mm

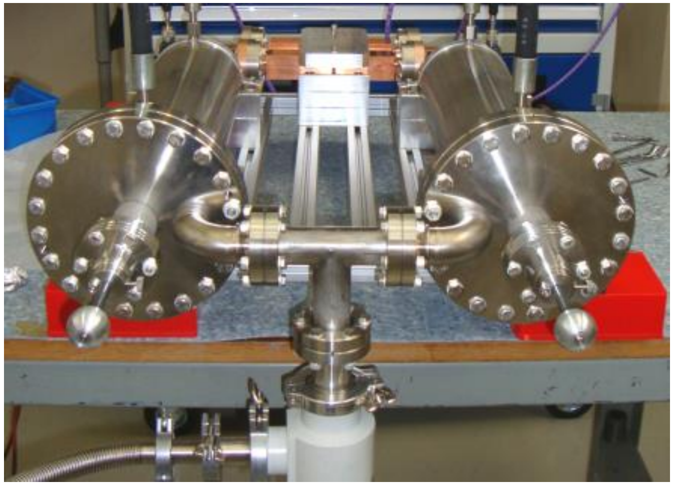




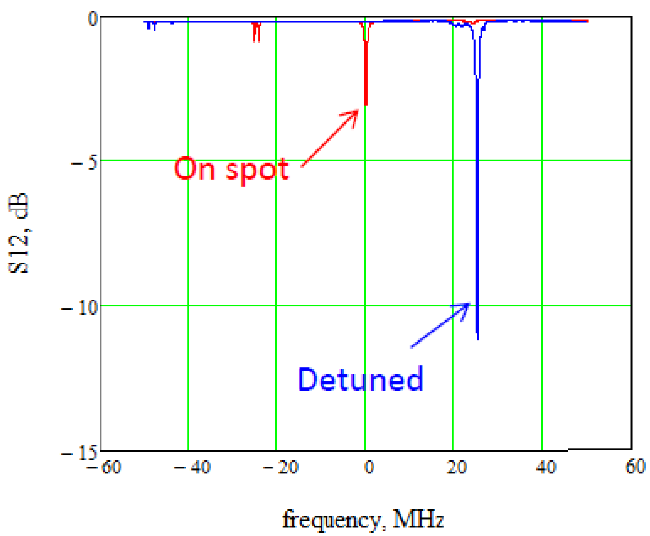
SLEDX under RF tests

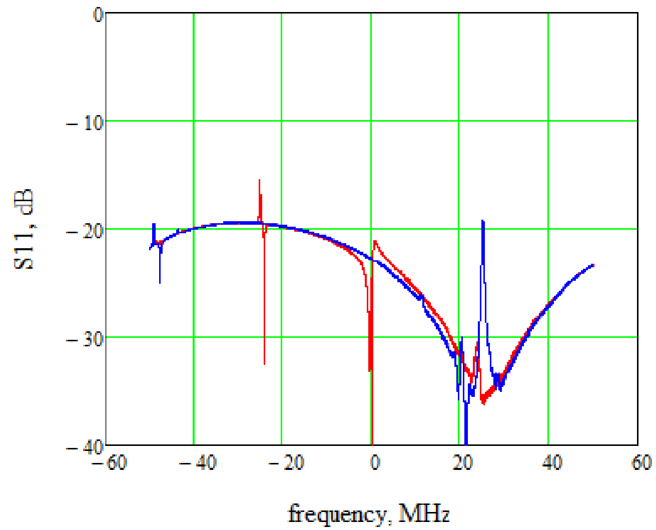




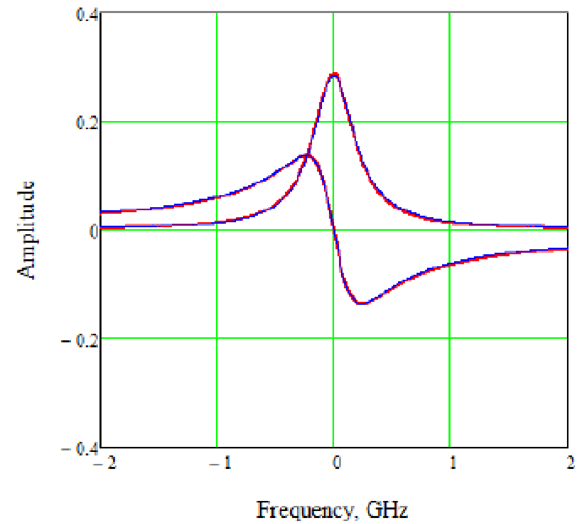


Central frequency: 11.99424 GHz. Measured at vacuum and 27.7 ^{0}C

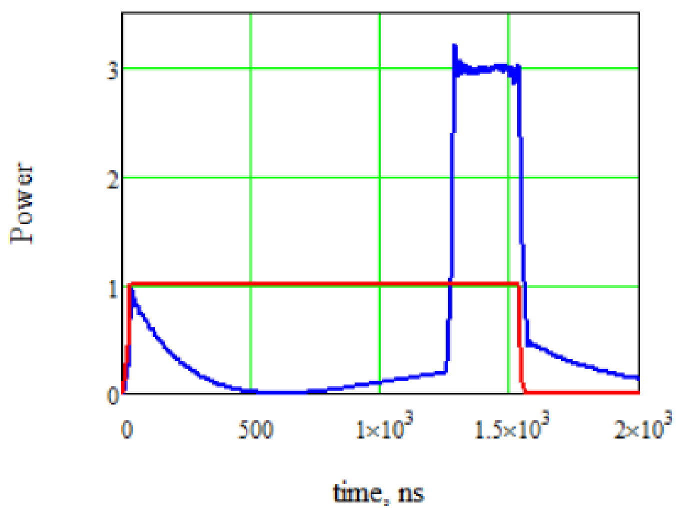




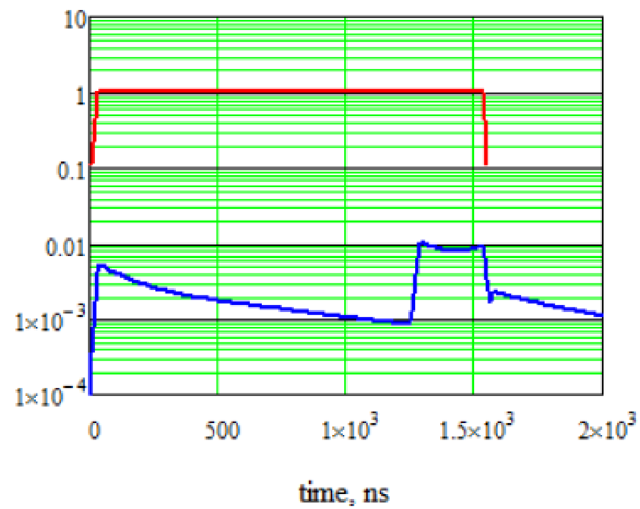
Cavities impedance



Compression (simulation)



Reflection

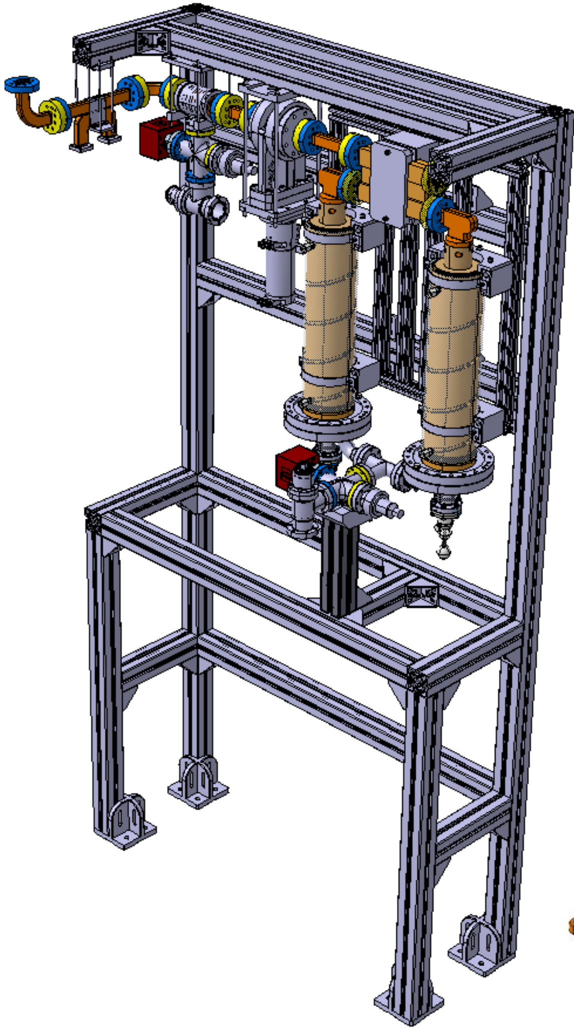


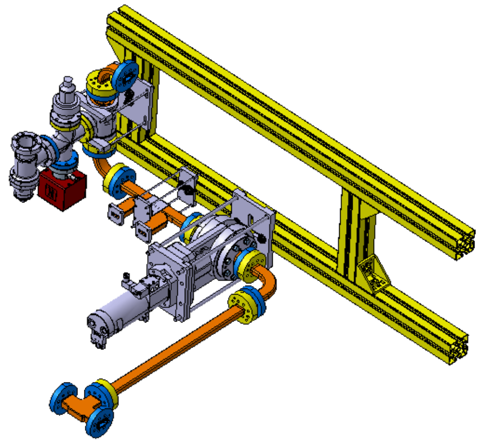
Cavities parameters

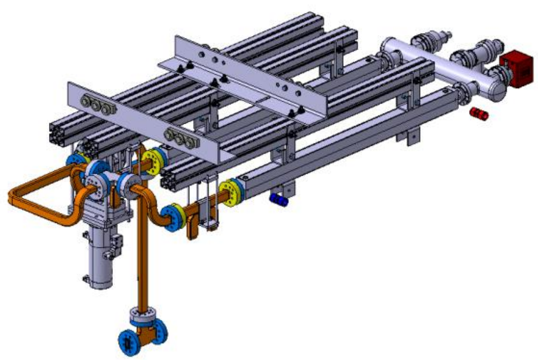
	By design	Measured
Q_0	1.79×10^5	1.77×10^5
β	5.85	5.98

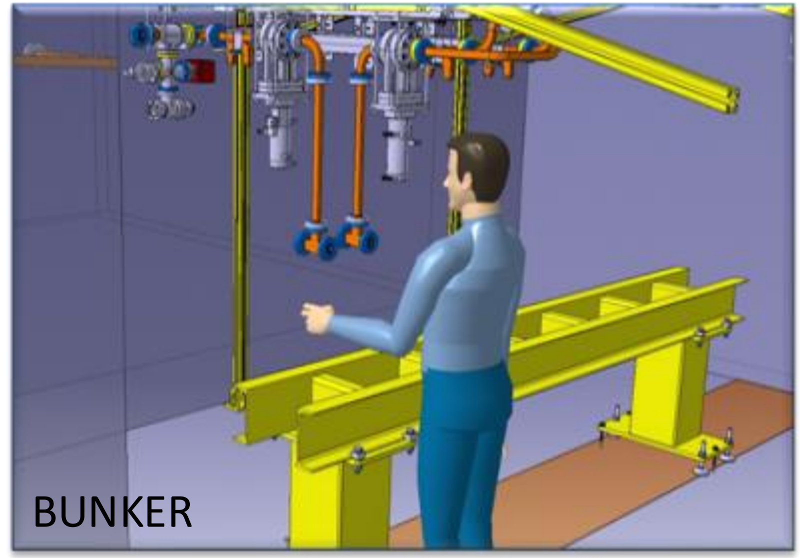
3dB hybrid is slightly (+25 MHz) detuned.

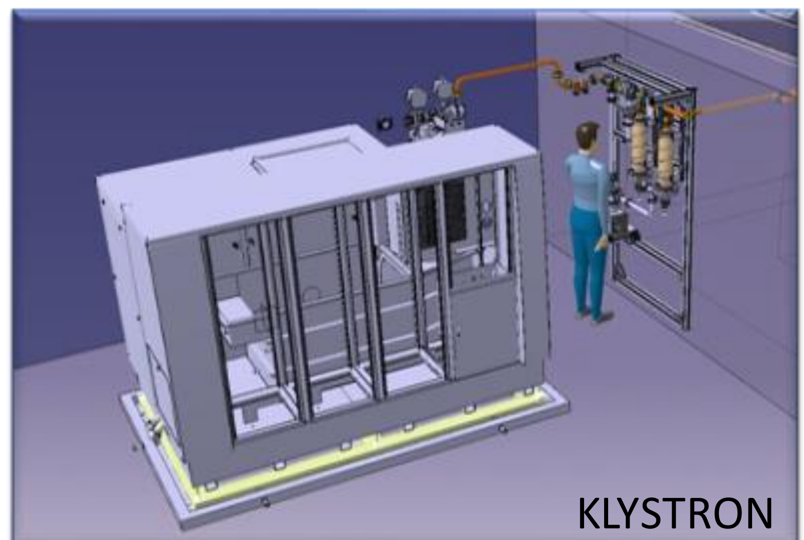
All these components will be used in XBOX2/3 new RF network



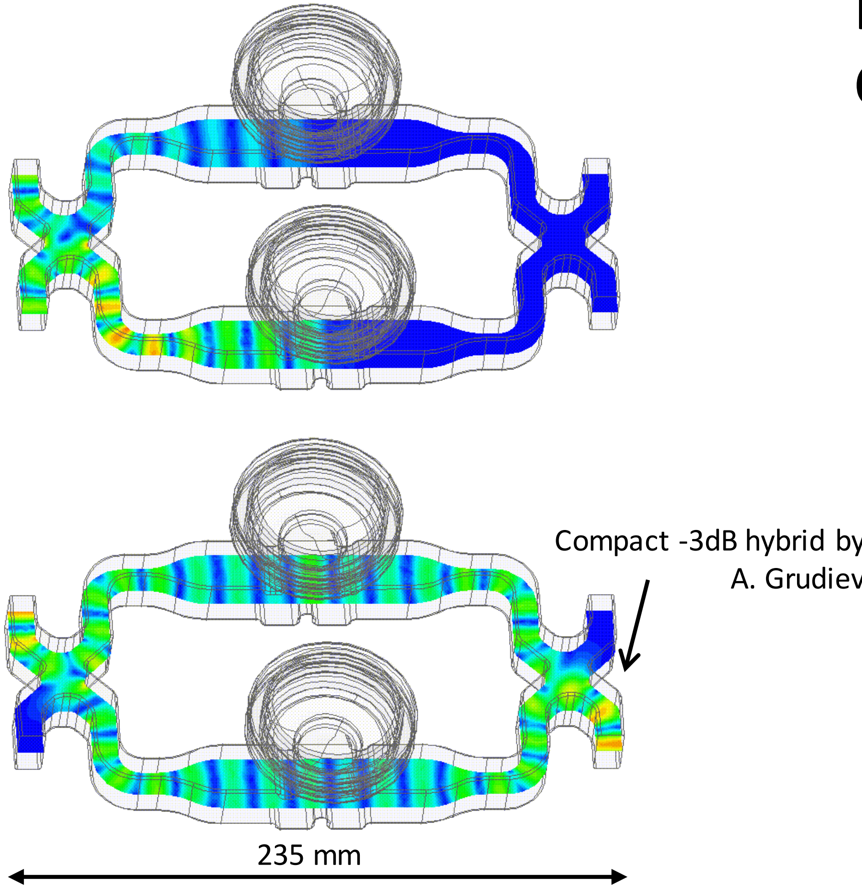


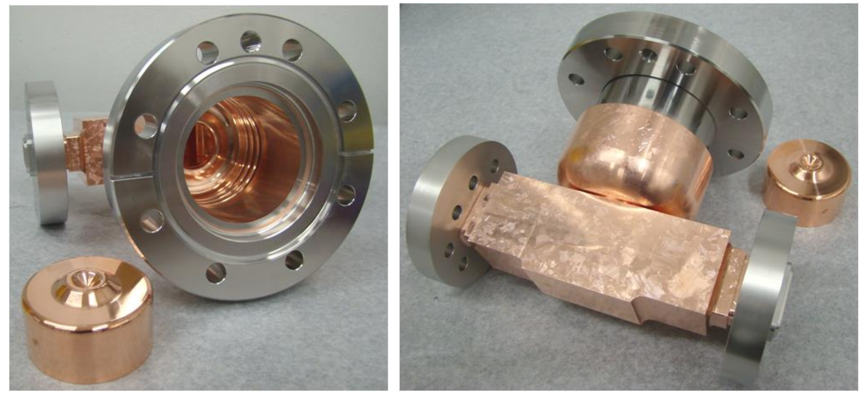


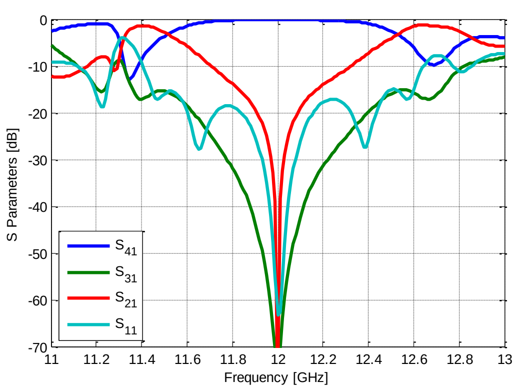


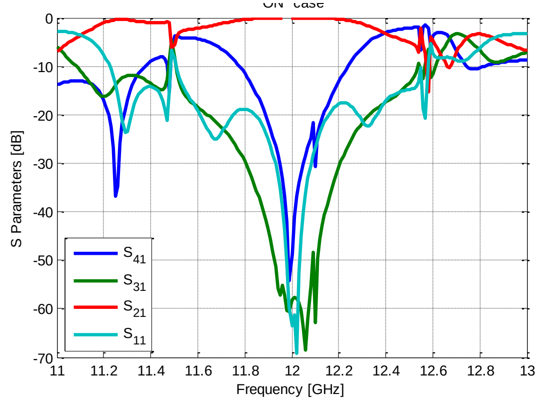


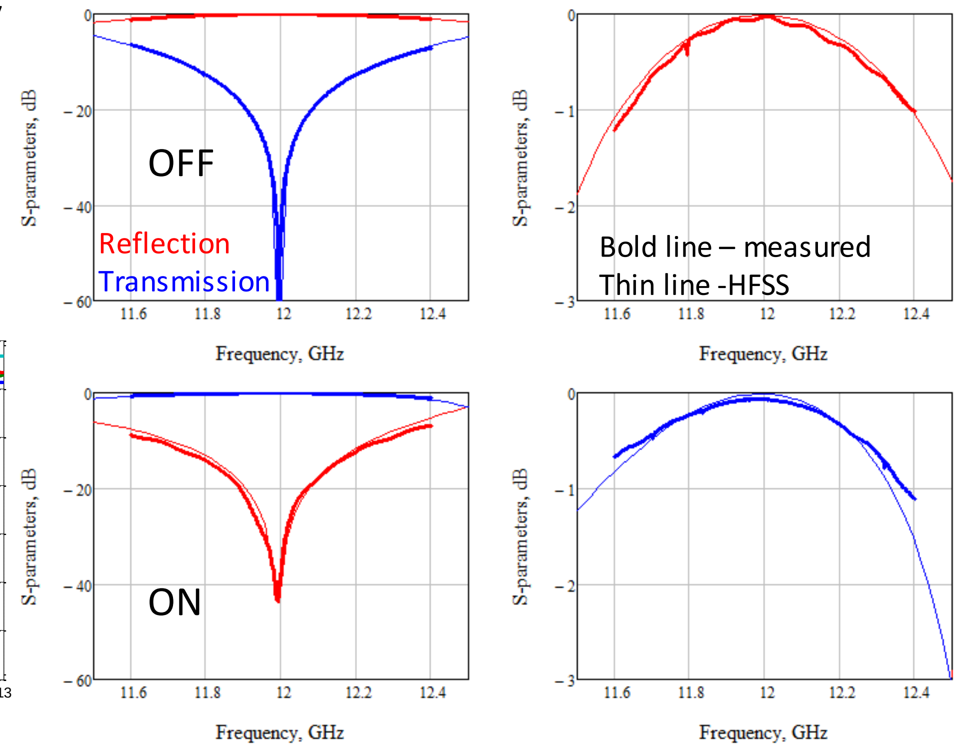
New RF component in development. Compact variable RF power divider.







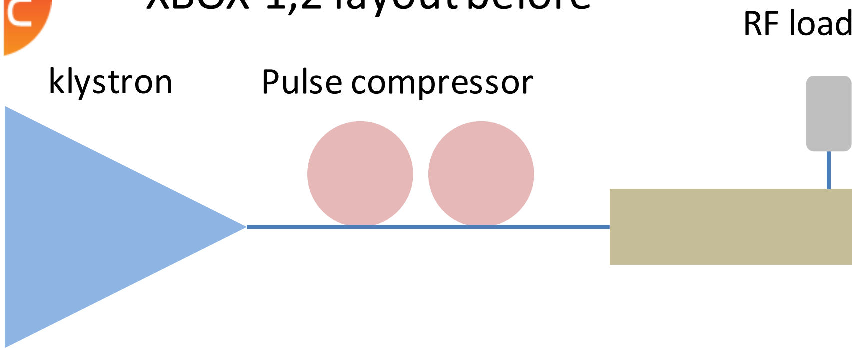




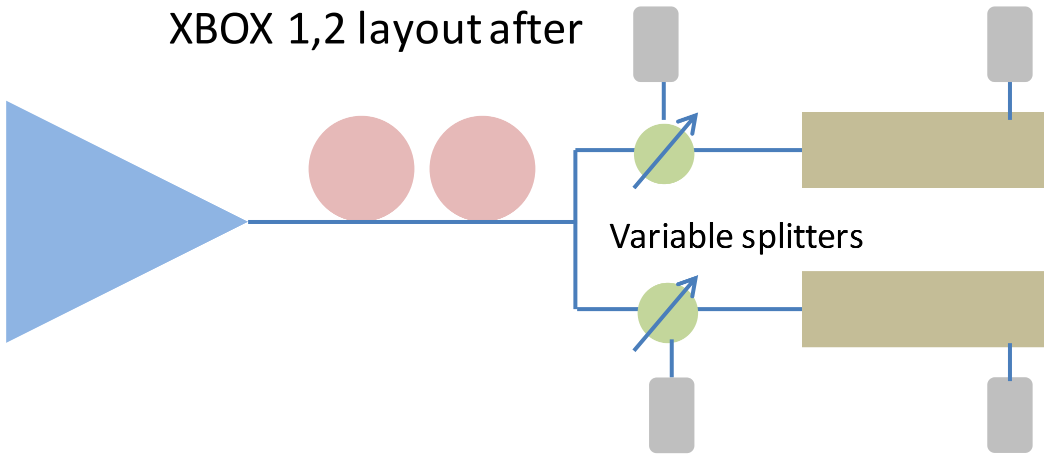
HG2013, 3-6 June, 2013, ICTP Trieste, Italy.

Where would we need them?

XBOX 1,2 layout before



XBOX 1,2 layout after



1. They will allow to process two structure in parallel in the most convenient way, when each of the structure will receive personal RF power handling.
2. They could operate as a part of processing procedure (in the case of the structure breakdown), thus minimising transient thermal load in the pulse compressor.

- Anticipating final testing capability of 8 structures (XBOX #1,2,3), 8 power splitters will be needed
- It will be also useful to replace the old GYCOM devices in CLEX, then 2 more splitters are needed.
- With 1-2 spare, we should plan to fabricate ~ 12 such device.