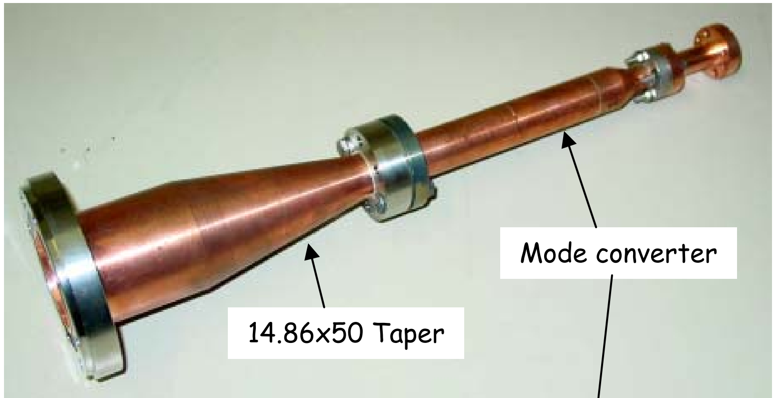
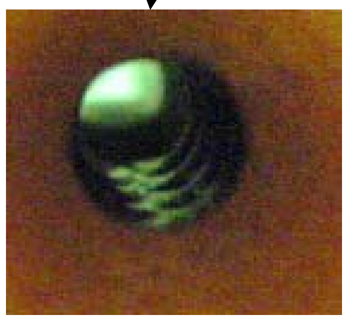
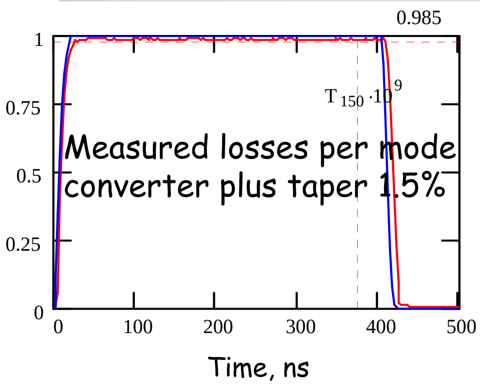
30 GHz rf components for CTF3 (and CLIC)
next part

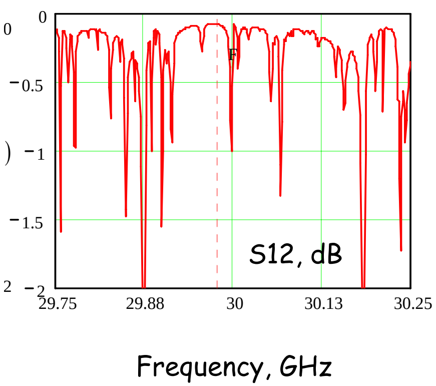
I. Syratchev

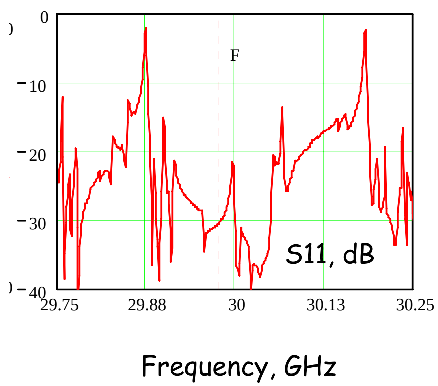
30 GHz overmoded waveguide components (GYCOM, Russia)

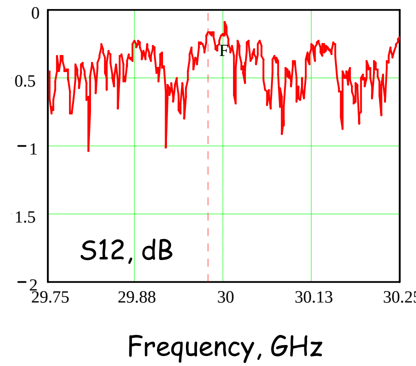


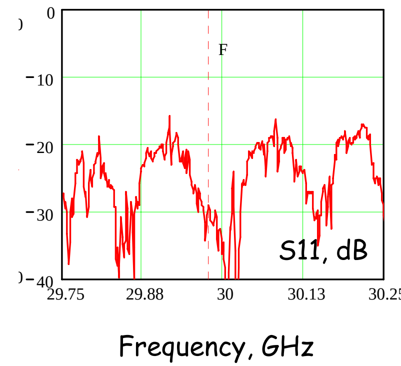


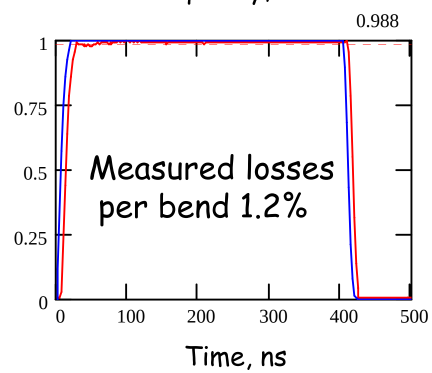


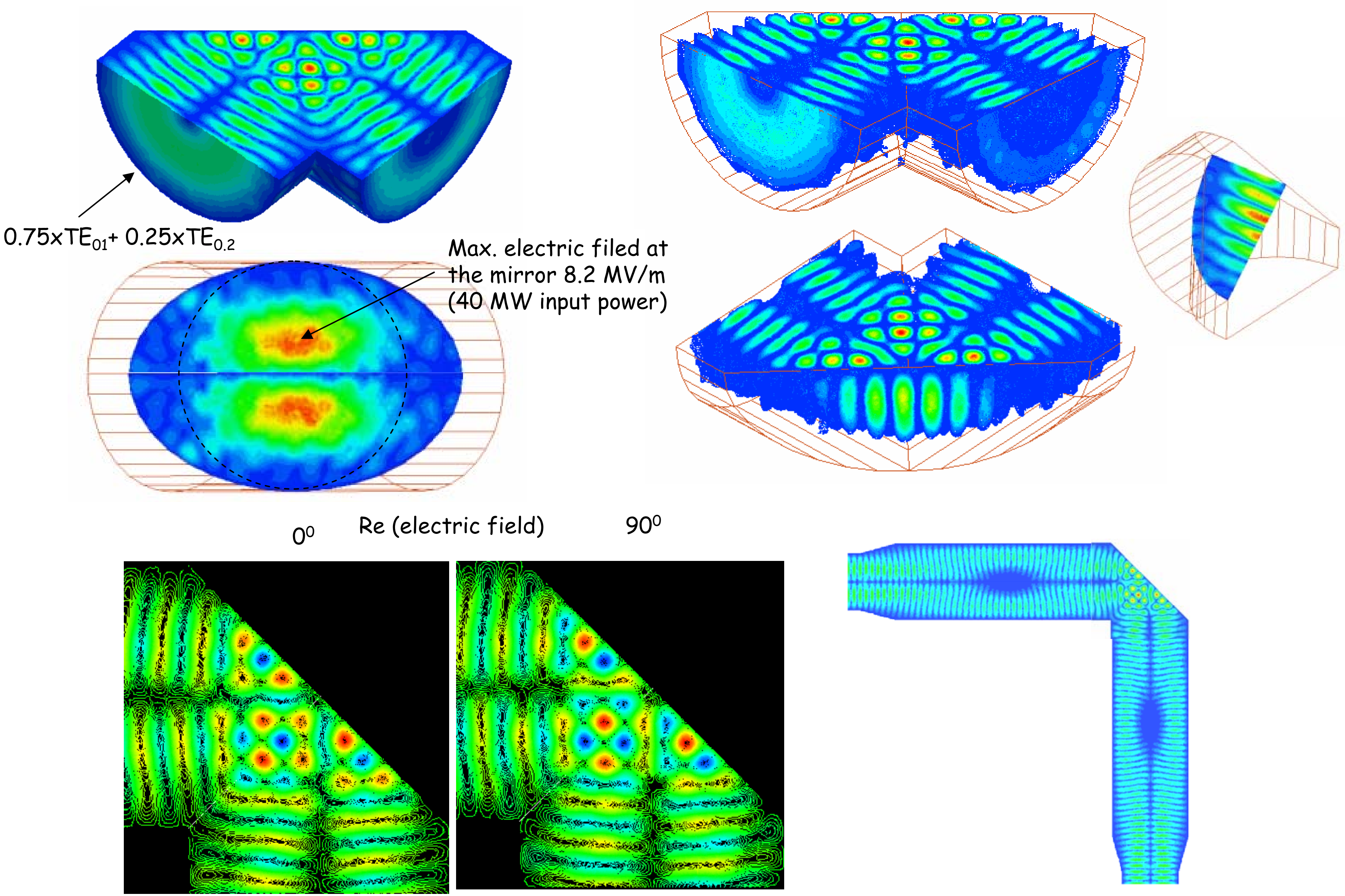




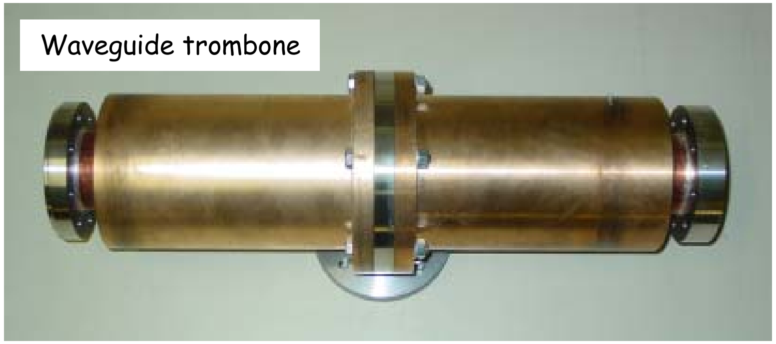


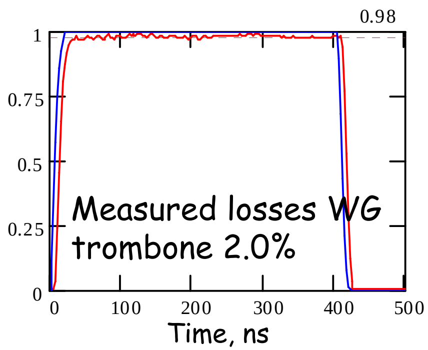


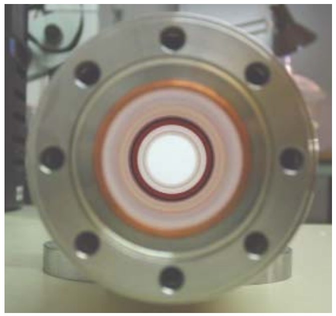


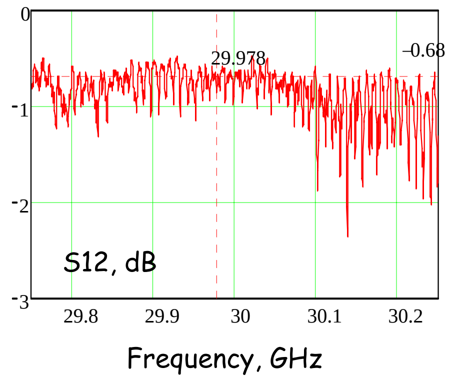

0.75xTE01+ 0.25xTE0.2
Max. electric filed at
the mirror 8.2 MV/m
(40 MW input power)
0⁰
Re (electric field)
90⁰

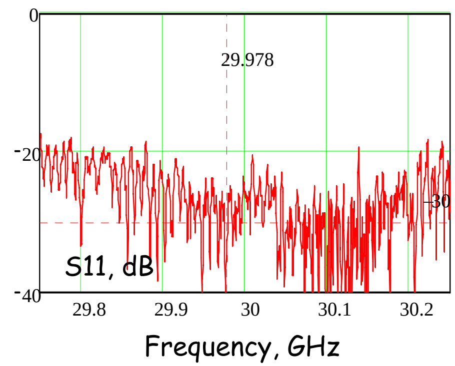
30 GHz overmoded waveguide components (GYCOM, Russia)

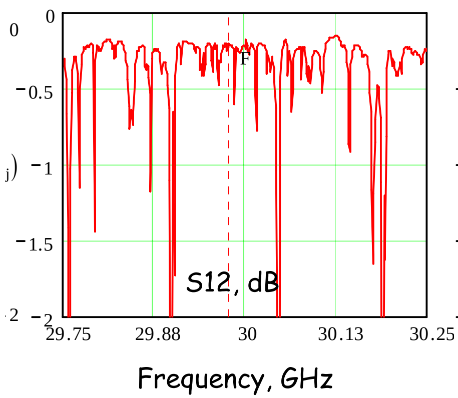


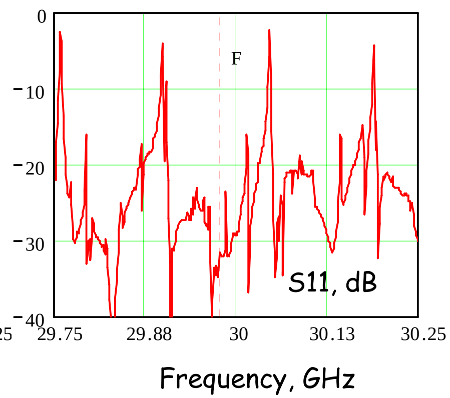




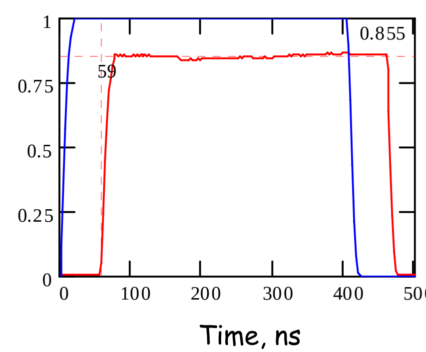


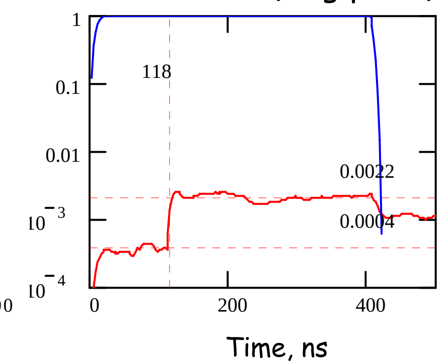




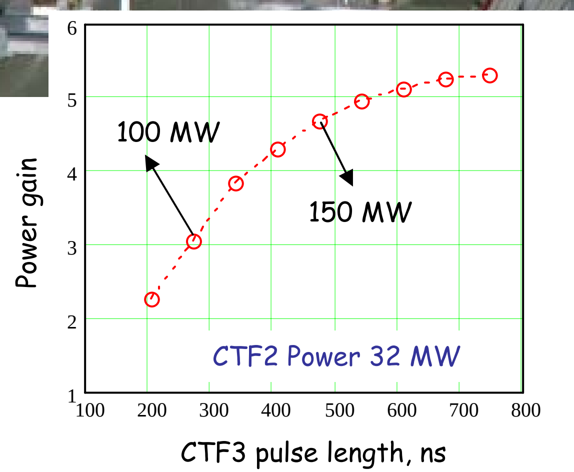


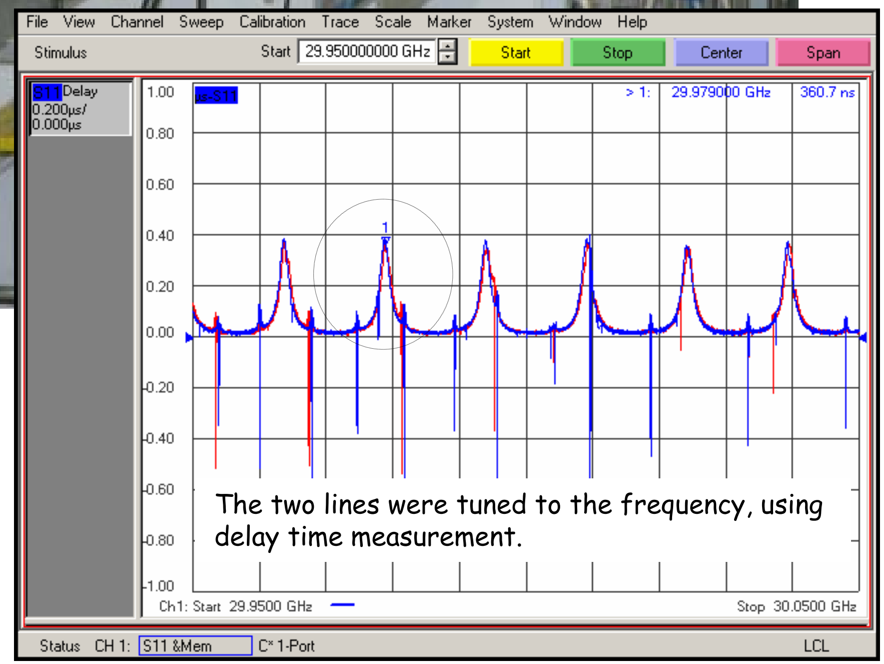
Measured losses 14.5.0%, reflection 0.22% (long pulse)





30 GHz resonant delay line pulse compressor (GYCOM, Russia)



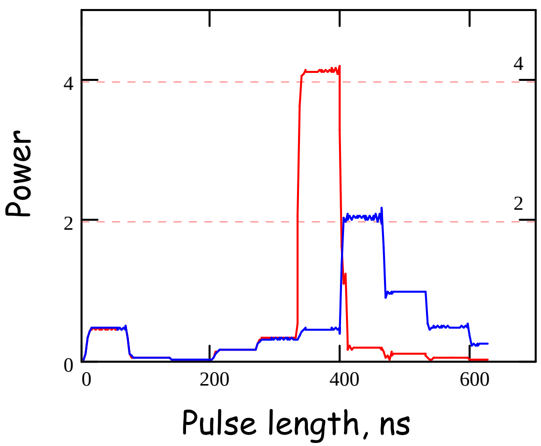


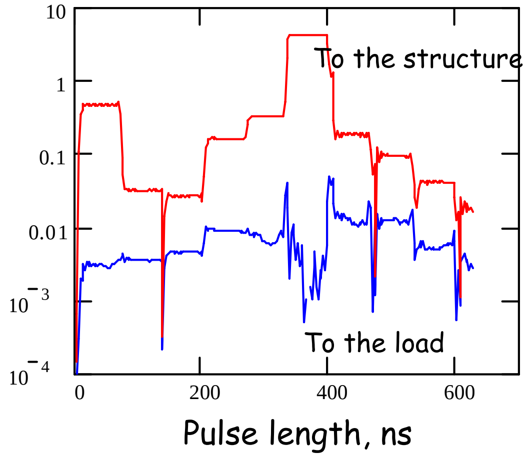
The two lines were tuned to the frequency, using delay time measurement.

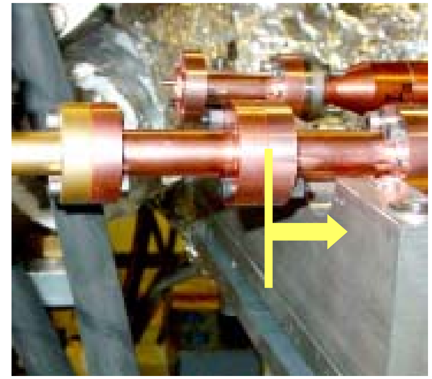
30 GHz resonant delay line pulse compressor (GYCOM, Russia)

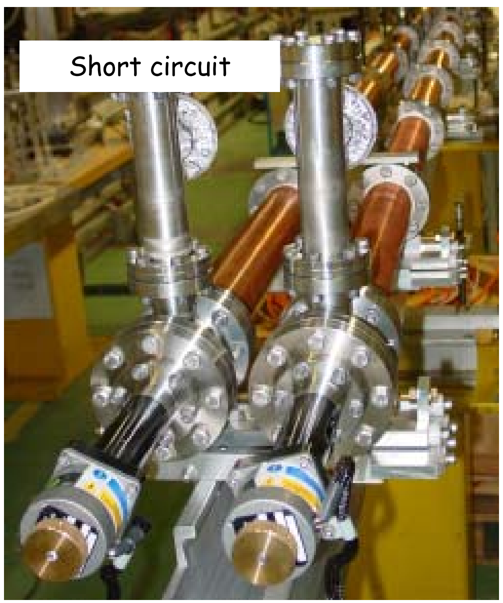
GYCOM Gyrotron complexes — development and application

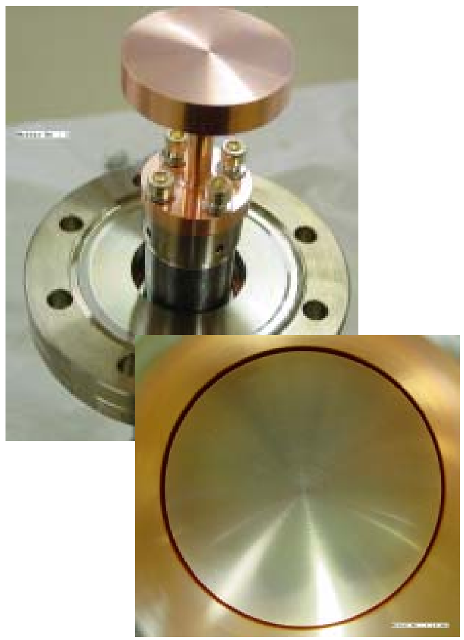
Reconstructed waveforms from the two lines measurements, losses were calibrated up to the yellow line



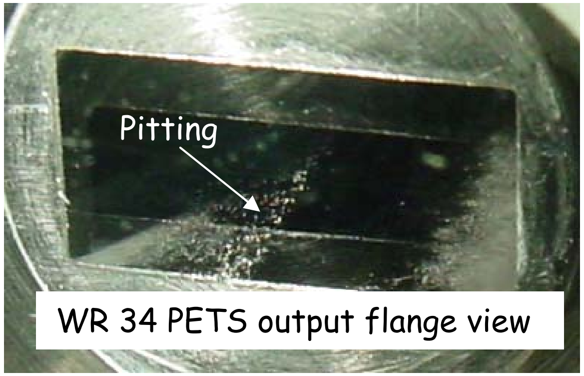






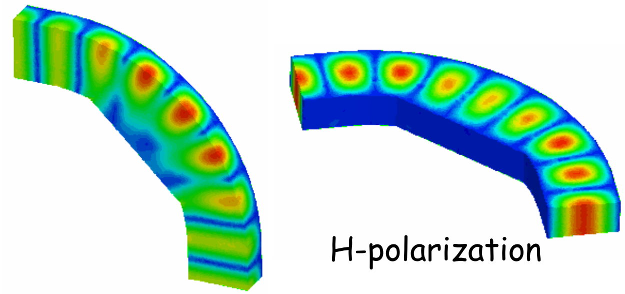


New 30 GHz waveguide standard for CTF3/CLIC – square 8.64x8.64



The picture of the PETS output waveguide have been made last year, when the best RF performance was 73 MW at 55 ns.
Now we are about 90 MW and 80 ns. To reduce the surface field and to increase the vacuum conductivity, the new waveguide standard with square crass section was introduced.

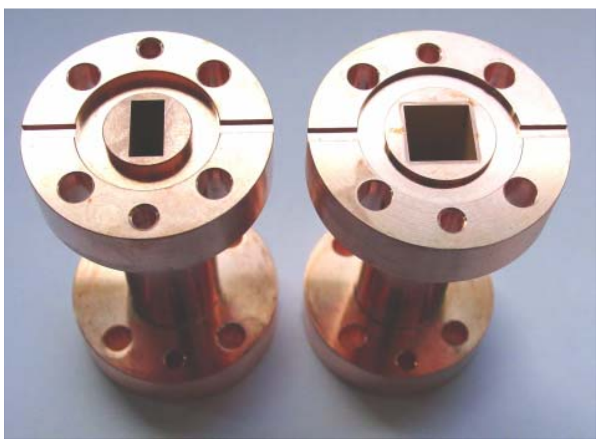
Special multipurpose 90^0 square waveguide bend

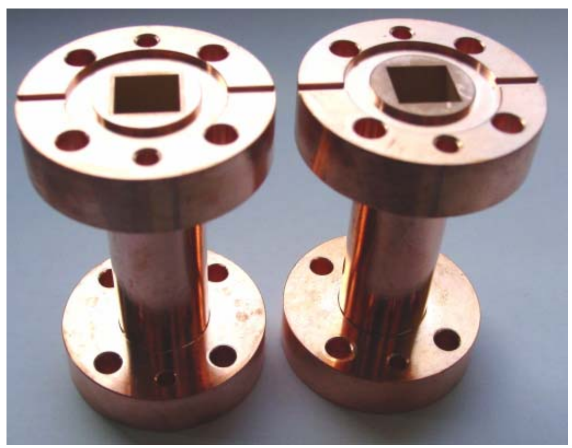


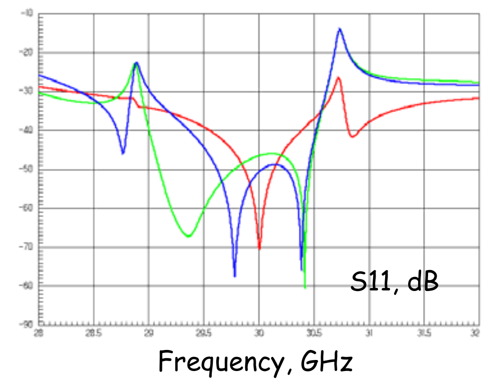
The number of waveguide components was designed and fabricated:

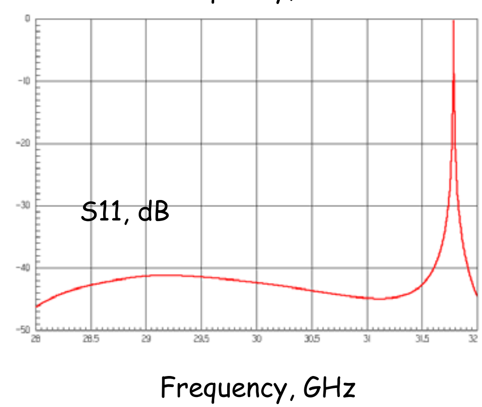
- ✓ 3dB hybrids
- ✓ Special multipurpose (E,H) 90^0 waveguide bends
- ✓ Directional couplers (see Alexej presentation)
- ✓ adapters and straight sections
- ✓ H10 -> H01 mode converters (ordered from GYCOM)

Waveguide components: adapter and straight section fully made of CuZr

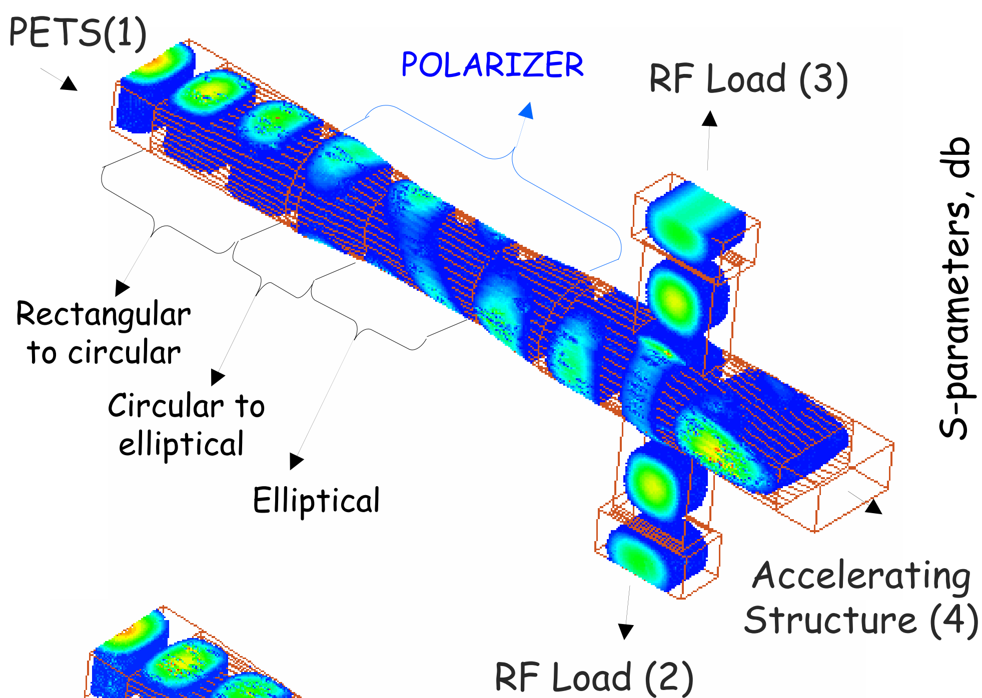


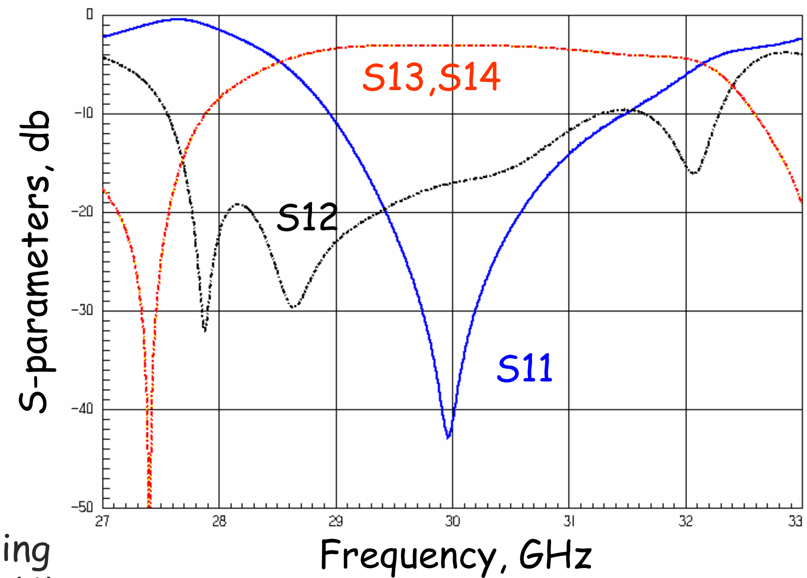


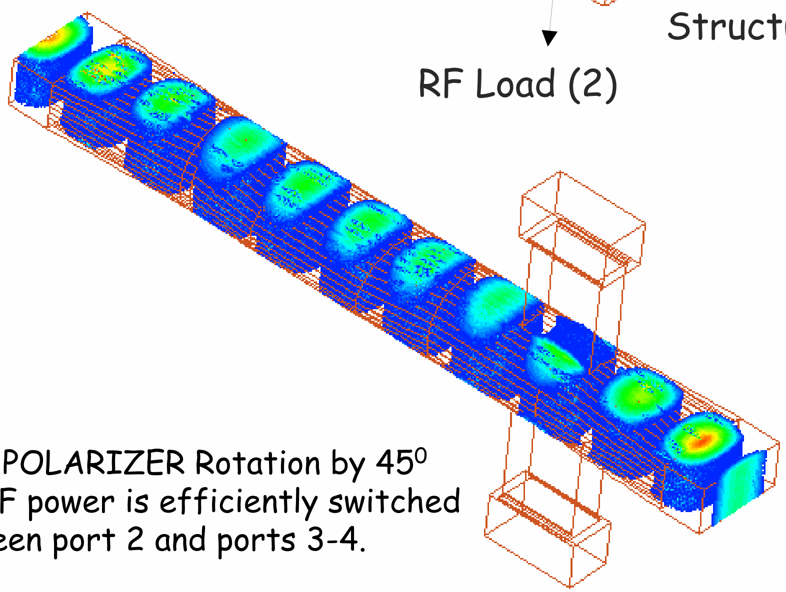


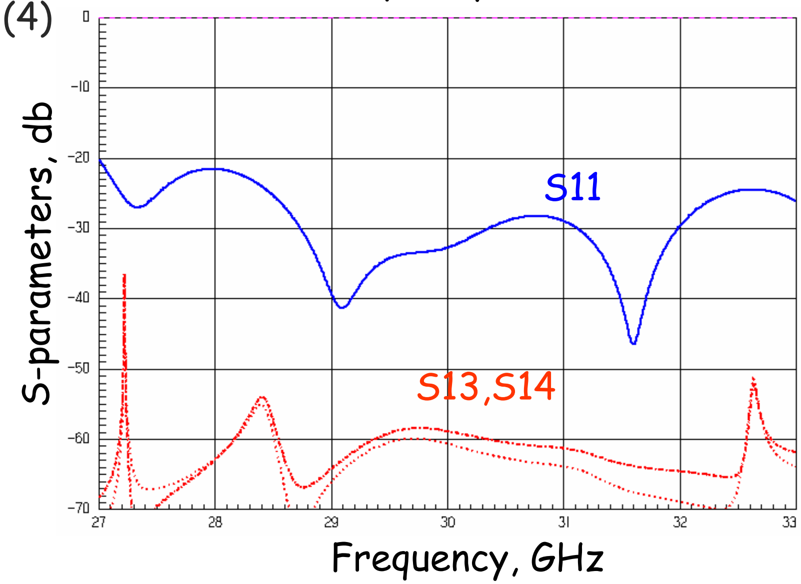


30 GHz High power attenuator (splitter). CLIC design.



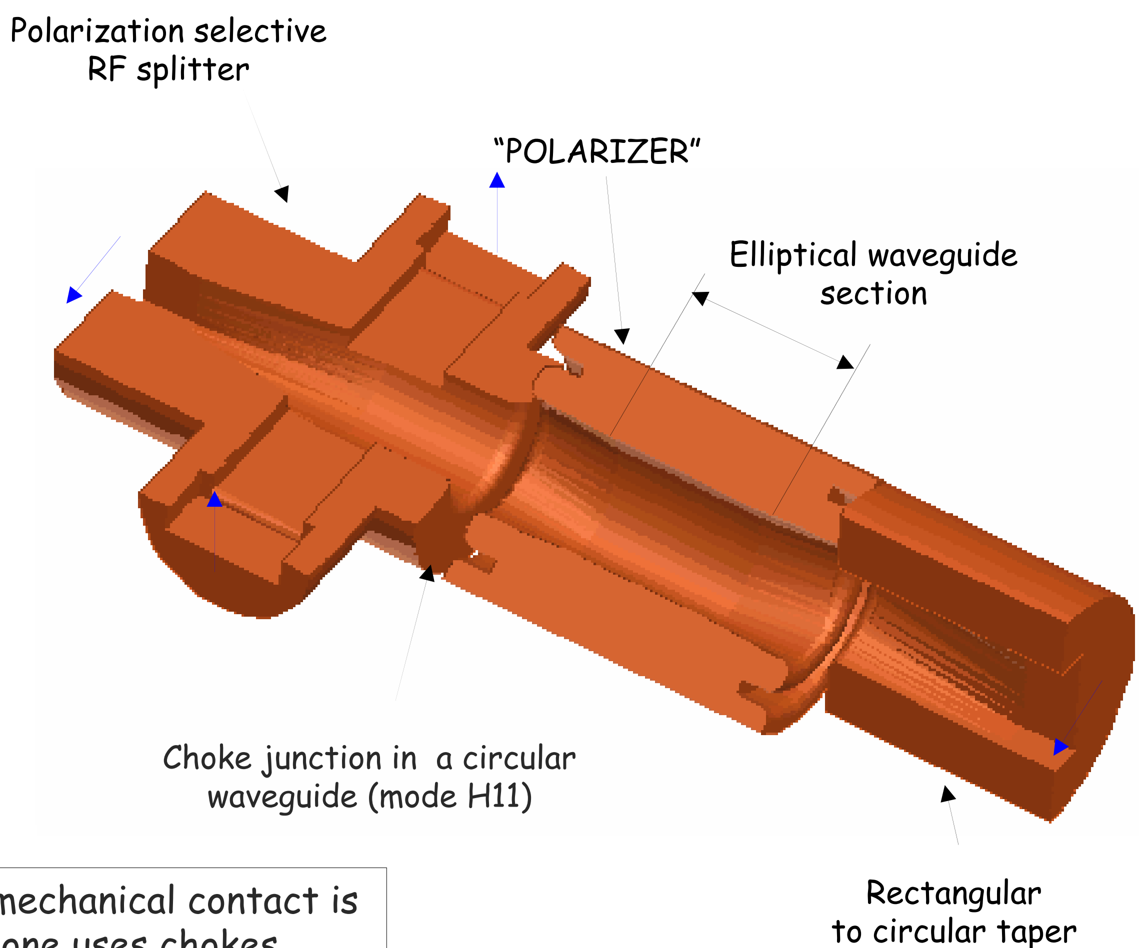






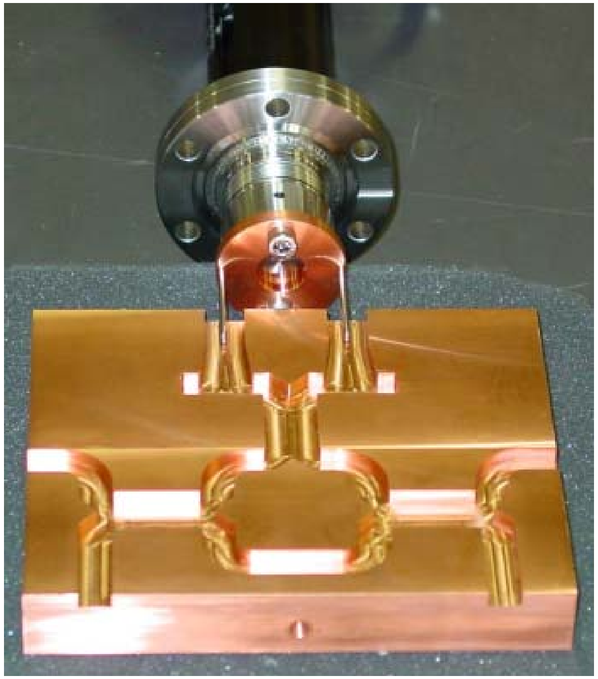
With POLARIZER Rotation by 45^0
the RF power is efficiently switched
between port 2 and ports 3-4.

30 GHz High power attenuator (splitter).

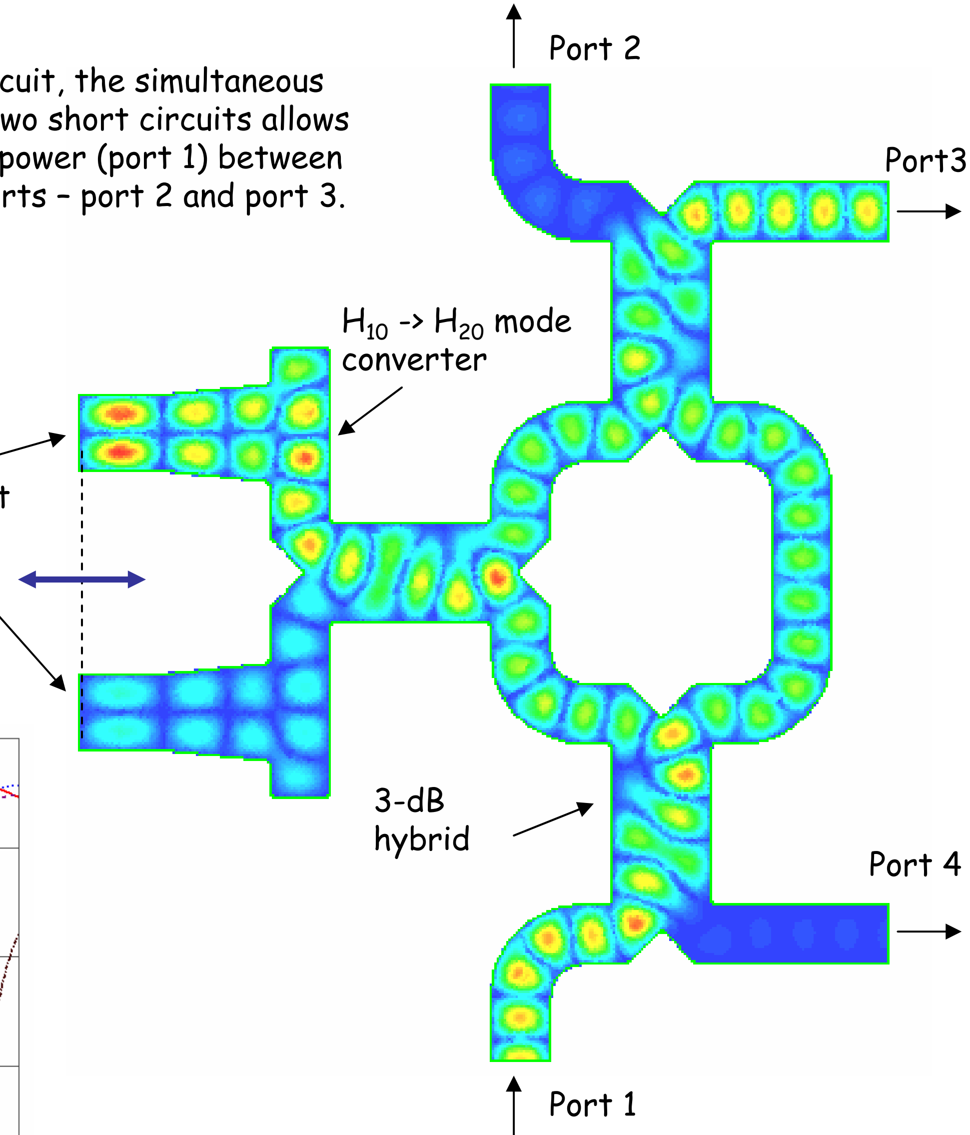


No electrical/mechanical contact is needed, if one uses chokes.

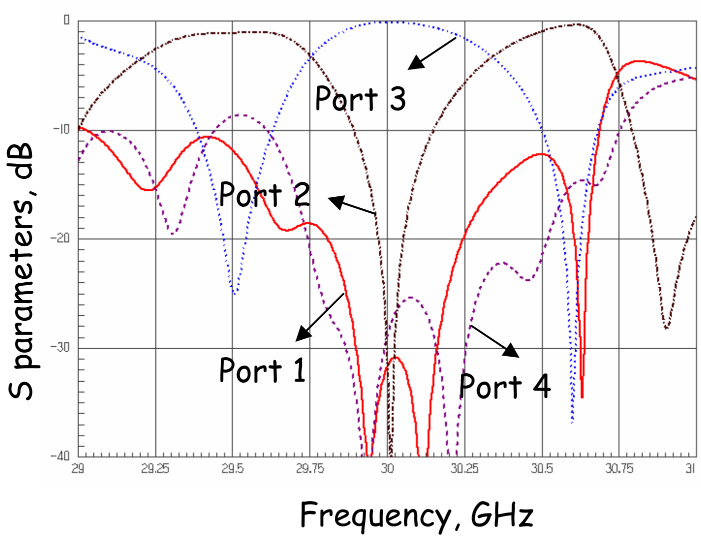
30 GHz High power attenuator (splitter). Scaled SLAC X-band version.



In this RF circuit, the simultaneous shift of the two short circuits allows to split input power (port 1) between two output ports – port 2 and port 3.



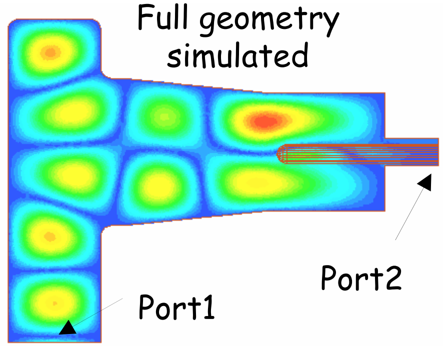
HFSS data



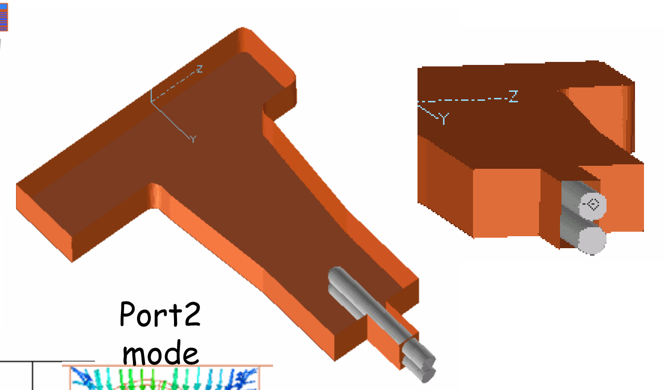
30 GHz High power attenuator (splitter).

#0. Ideal case

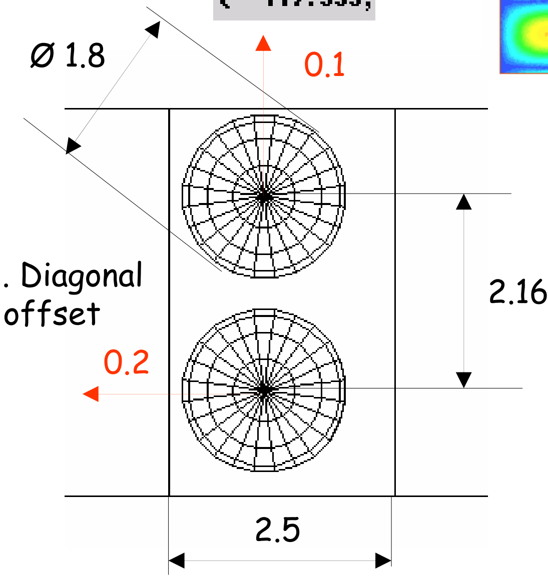
port1:m1
(-0.000,
(-69.761,
(-61.600,
(-76.308,
(-68.254,
(-117.933,



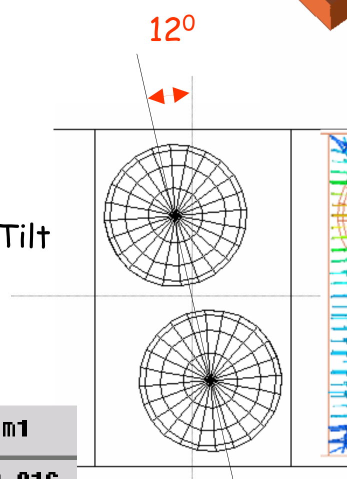
H10->H20 mode converter and tunable double piston short circuit. Position sensitivity analysis



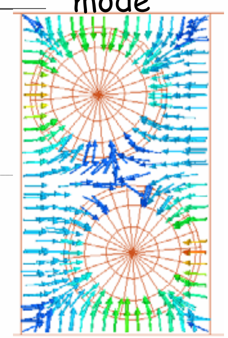
#1. Diagonal offset



#2. Tilt



Port2 mode

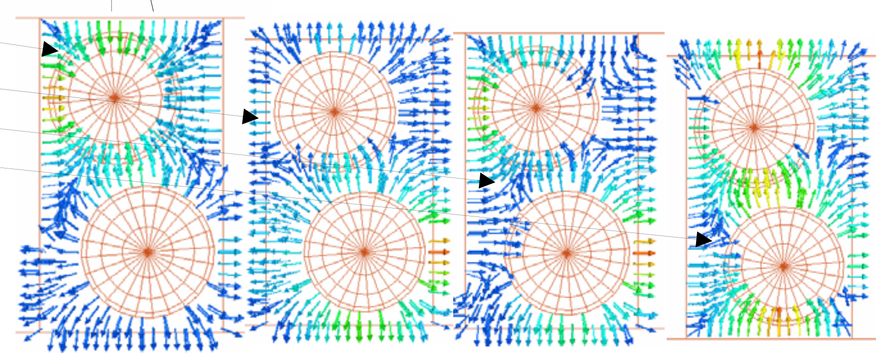


Refl. Port1

port1:m1
(-0.002,
(-40.364,
(-35.768,
(-38.891,
(-40.597,
(-85.251,

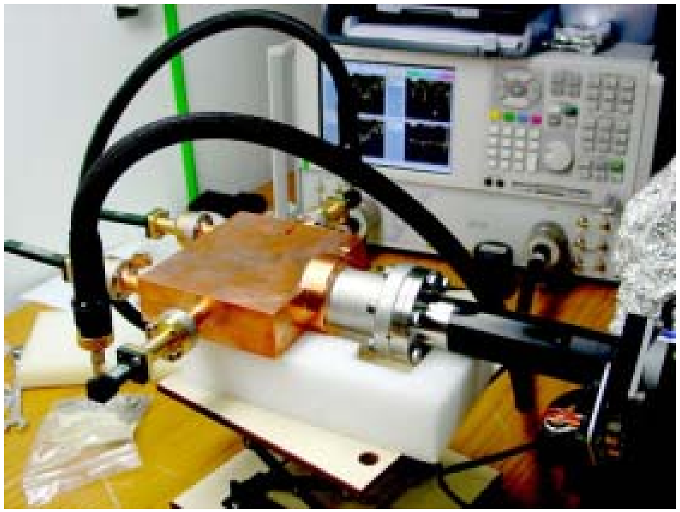
Transm. Port2(5 modes)

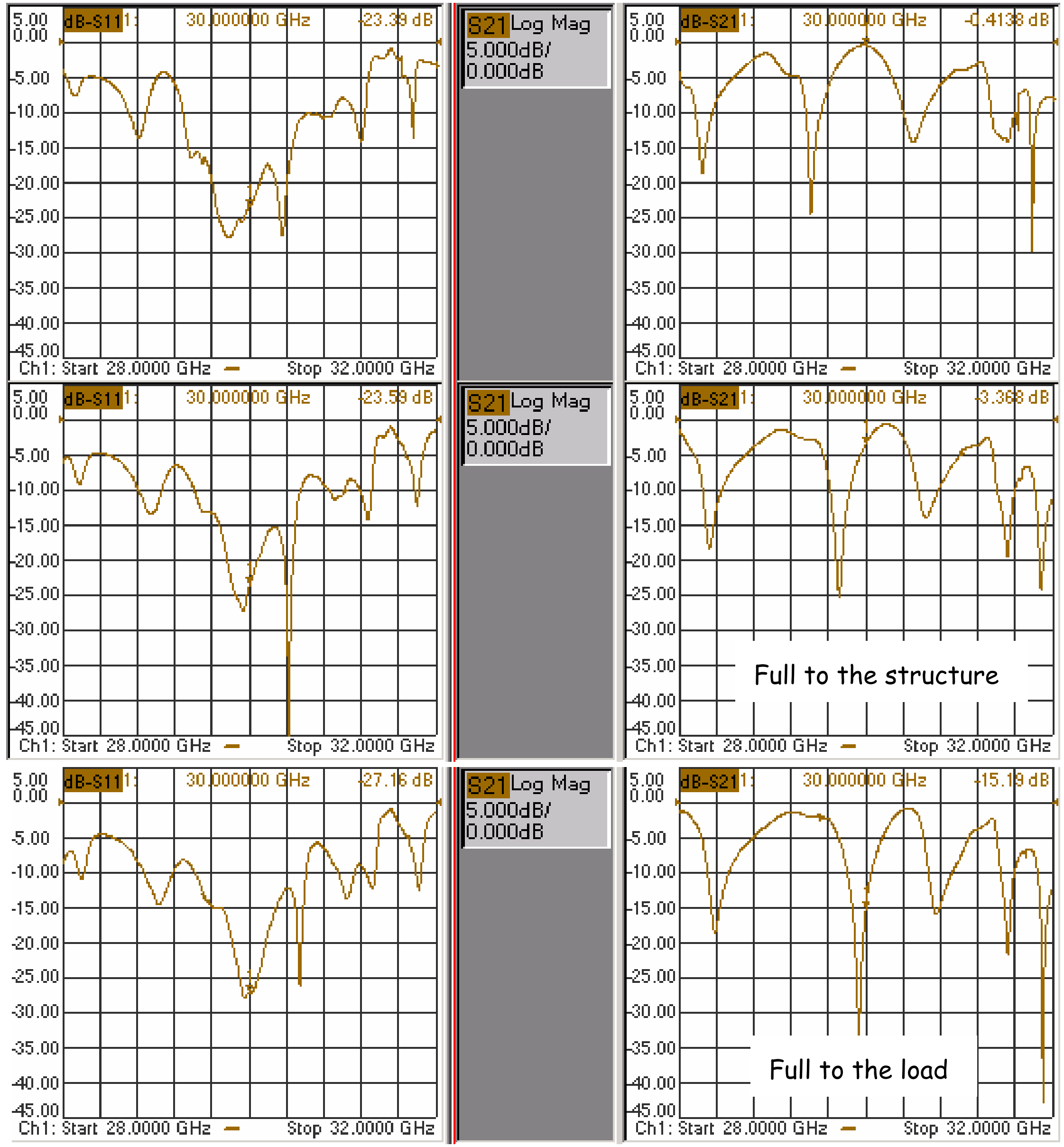
port1:m1
(-0.016,
(-29.111,
(-26.003,
(-64.271,
(-89.177,
(-62.624,



30 GHz High power attenuator (splitter).

Low power test
Measured losses 3.5%



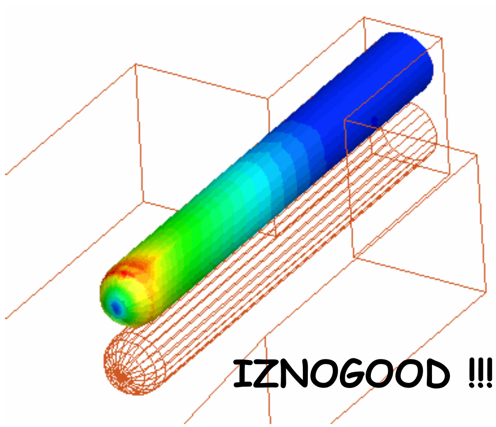


30 GHz High power attenuator (splitter).

What have we learned during the high power operation:

1. A lot of vacuum activities associated with attenuator location have been observed. The certain processing period was needed at every new power level or the position of attenuator's pins.
2. For the first run, attenuation was limited to about – 3dB due to the control settings.
3. It was changed to high values for the current run, but can be limited by vacuum activity.

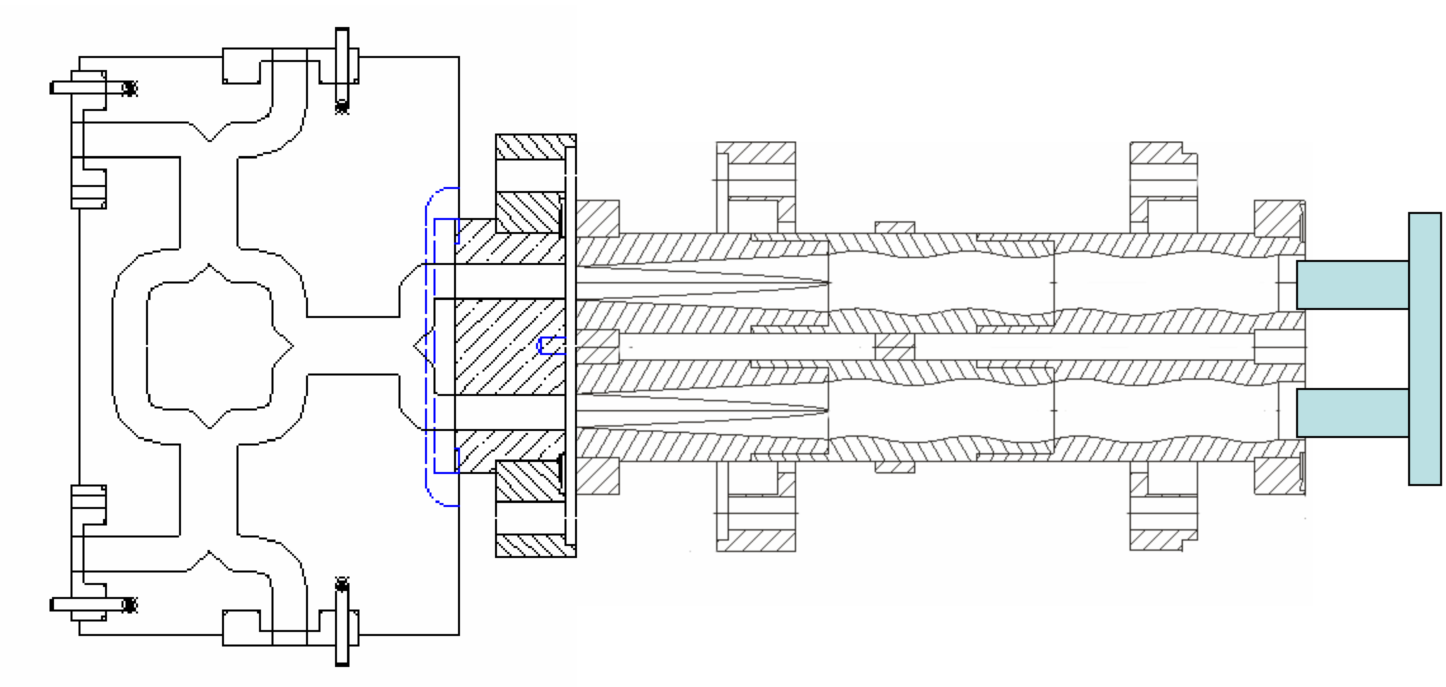
Temperature map on the pin surface for 100 ns and 60 MW RF power, at the position of maximal attenuation. Pulsed heating $\Delta T_{max} \sim 30\ ^0C$



In general, the attenuator was very useful and made it possible the routine operation. However it was decided to built modified version, which is free now from the observed problems.

30 GHz High power attenuator (splitter). Modified.

Modifications: new square waveguide standard, doubled H10 -> H01 mode converter, two ∅ 14 mm pistons, vacuum port close to short circuit



To be ready in march 2006

Waveguide network in CTF2 test area as foreseen for the next run in 2006.