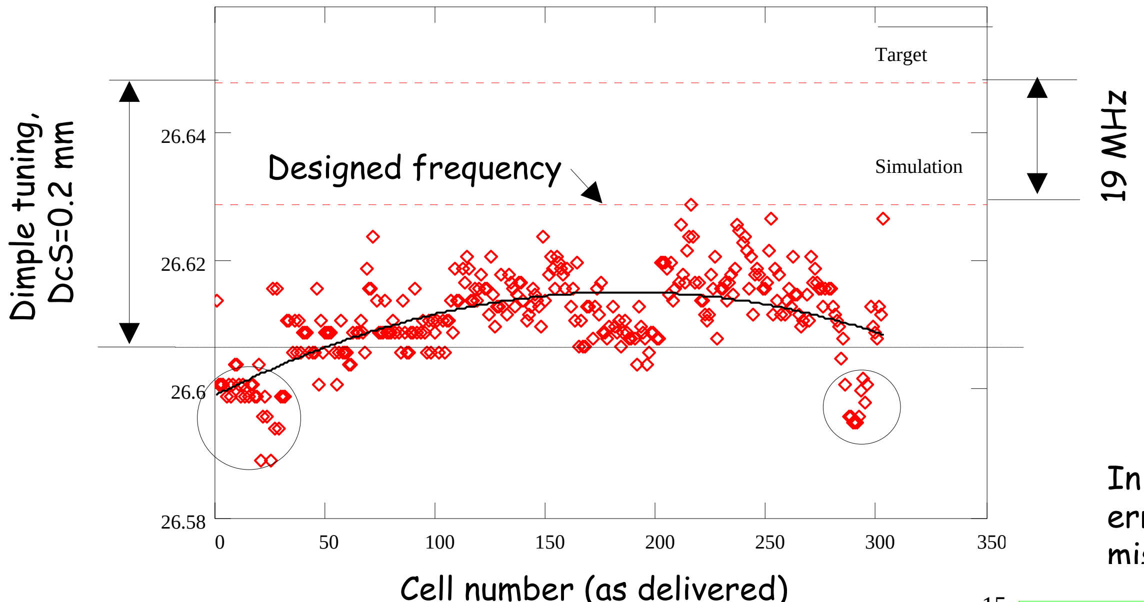
#1. 9 mm diameter PETS performance and high power test results

I.Syratchev

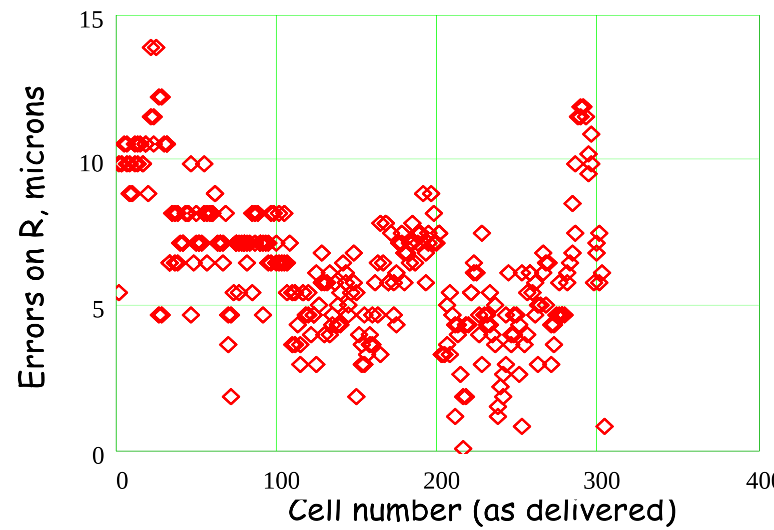
9.0 mm cells as received

Measured frequencies



Parameters	#9.0 mm
R/Q, kΩ/m	5.87
Beta (Vg/c),%	39.82
Q	5110
F_D, GHz	32.46
K_T, V/pC/mm/m	31.65
Q_D	5380
$Beta_D$, %	43.57

In assumption that frequency error came from outer radius (R) mismatch:



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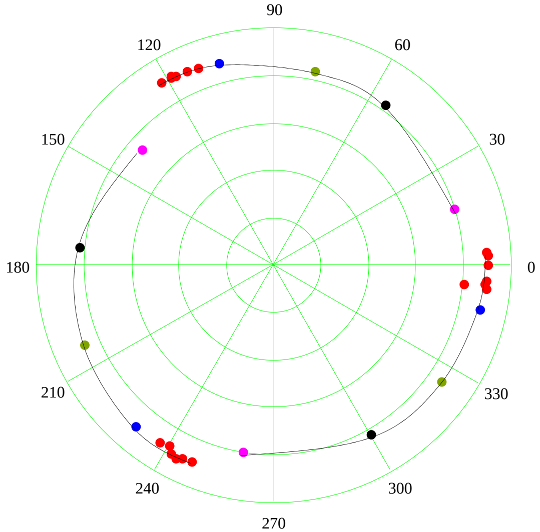
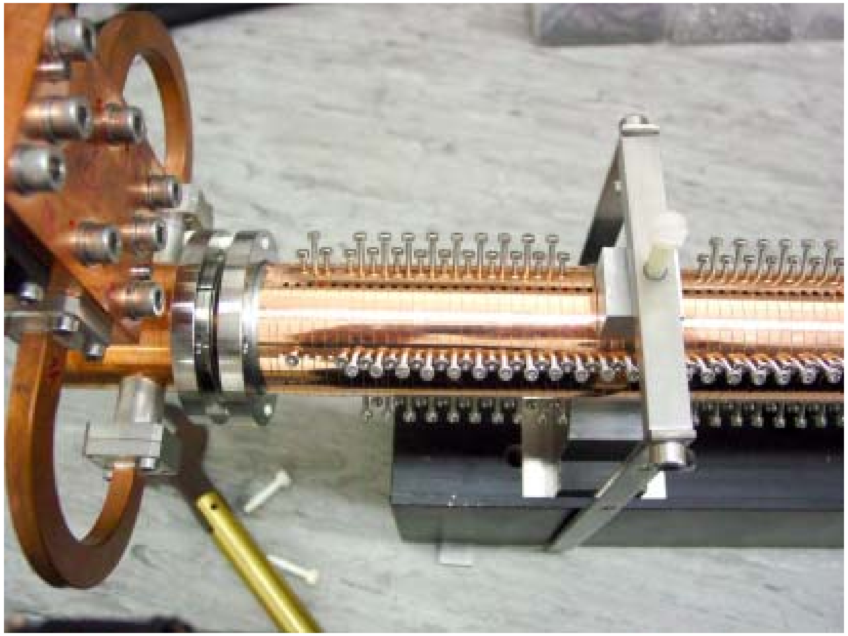
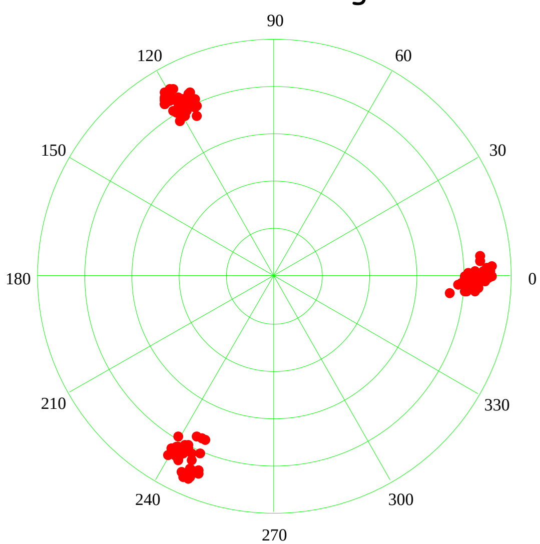
9.0 mm structure tuning (after brazing)

Before tuning





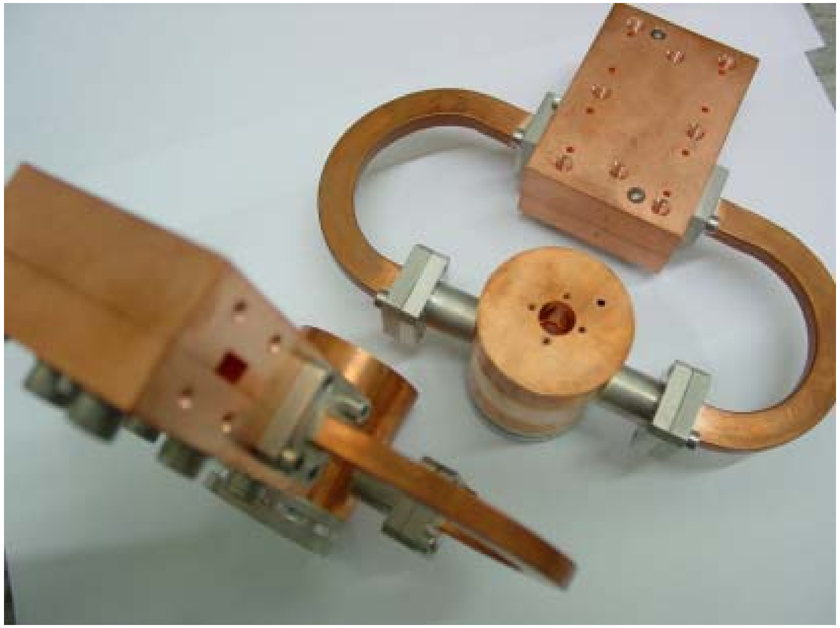
After tuning

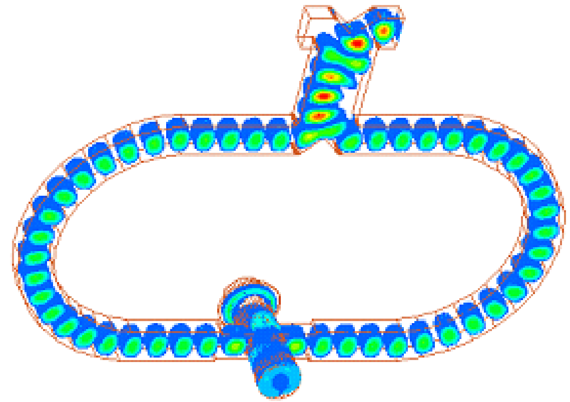


Because of specific (over-moded) nature of the 9.0 mm PETS, the special dimple tuning procedure was chosen. The cells were tuned in steps, and at each step the structure was dimpled as whole.

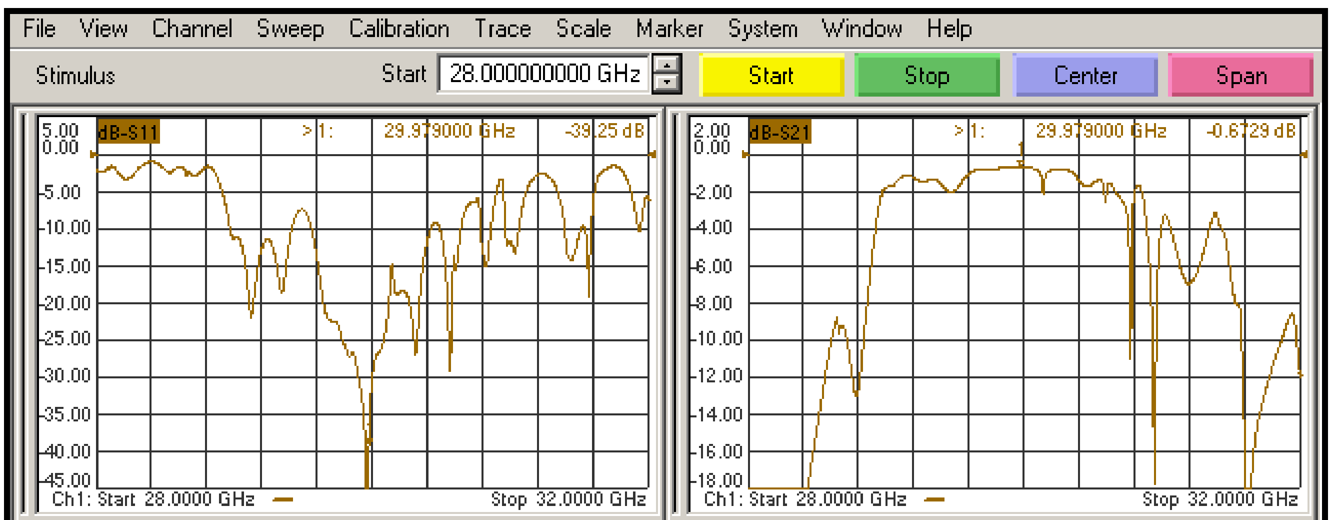
By chance, the 6.7 mm structure appeared to be manufactured just properly, so no tuning was needed!

Mode launcher

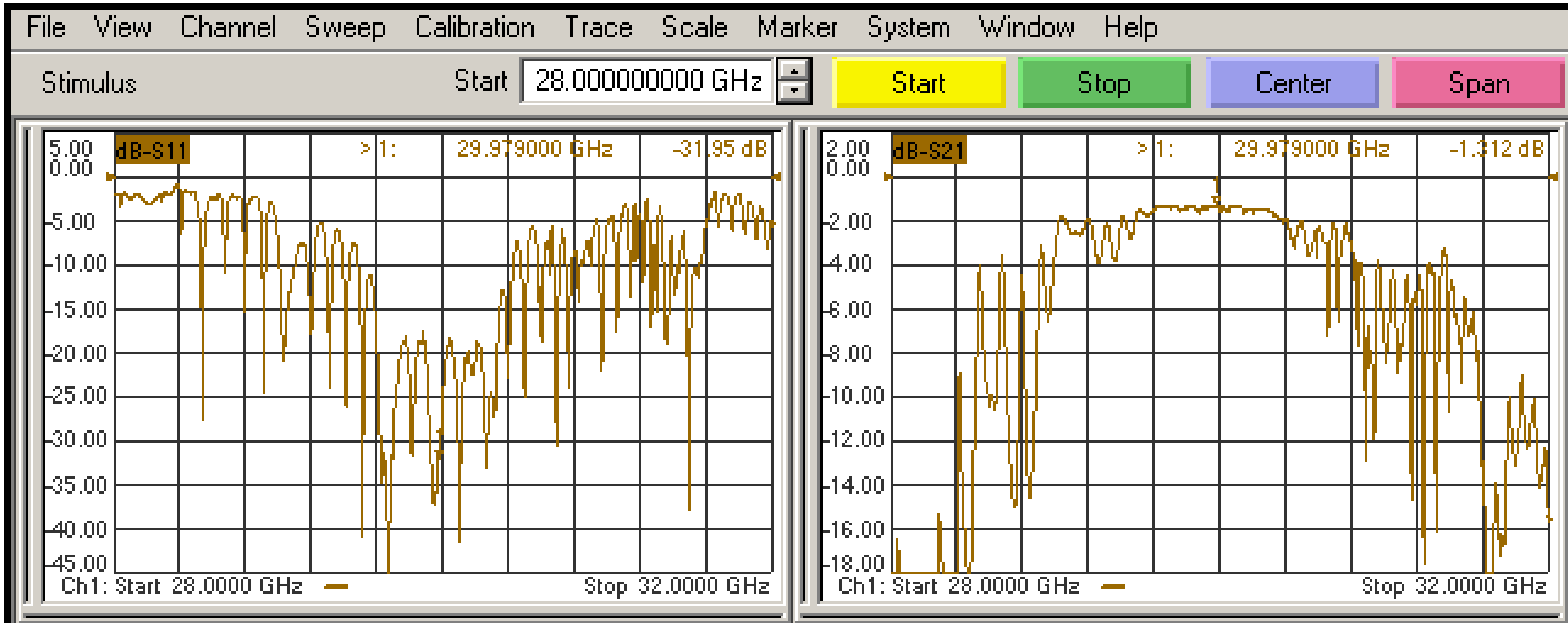




Measured parameters:
Extraction losses: 0.35 dB
Isolation and reflection < -30dB



9 mm structure

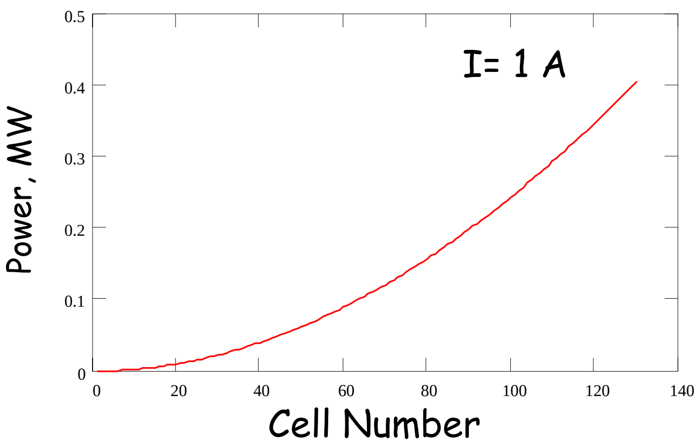


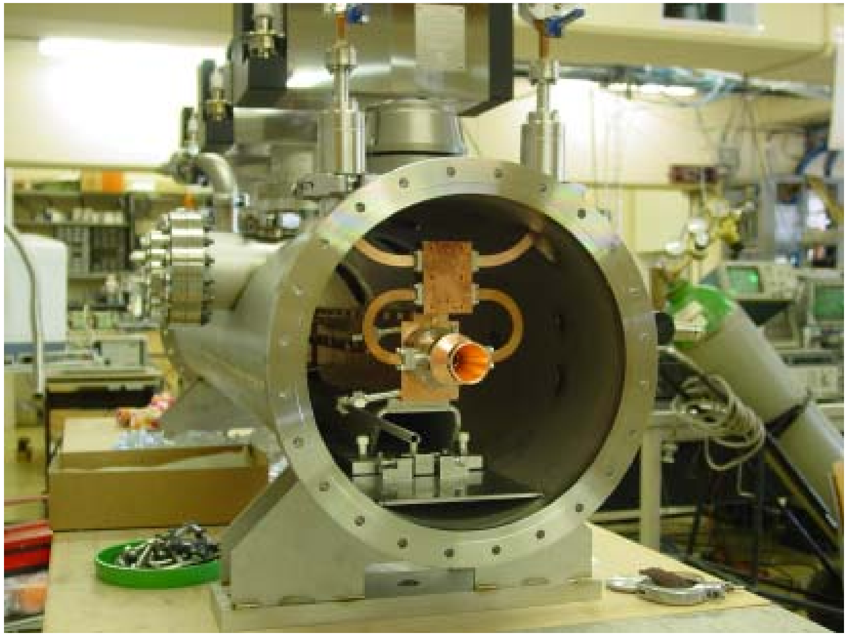
Measured losses (flange to flange): 1.312 dB
Losses per structure: 0.61 dB (0.56 dB theoretical)
Measured Q factor: 4860 (95% of theoretical value)

Power production in CTF3 (as expected)

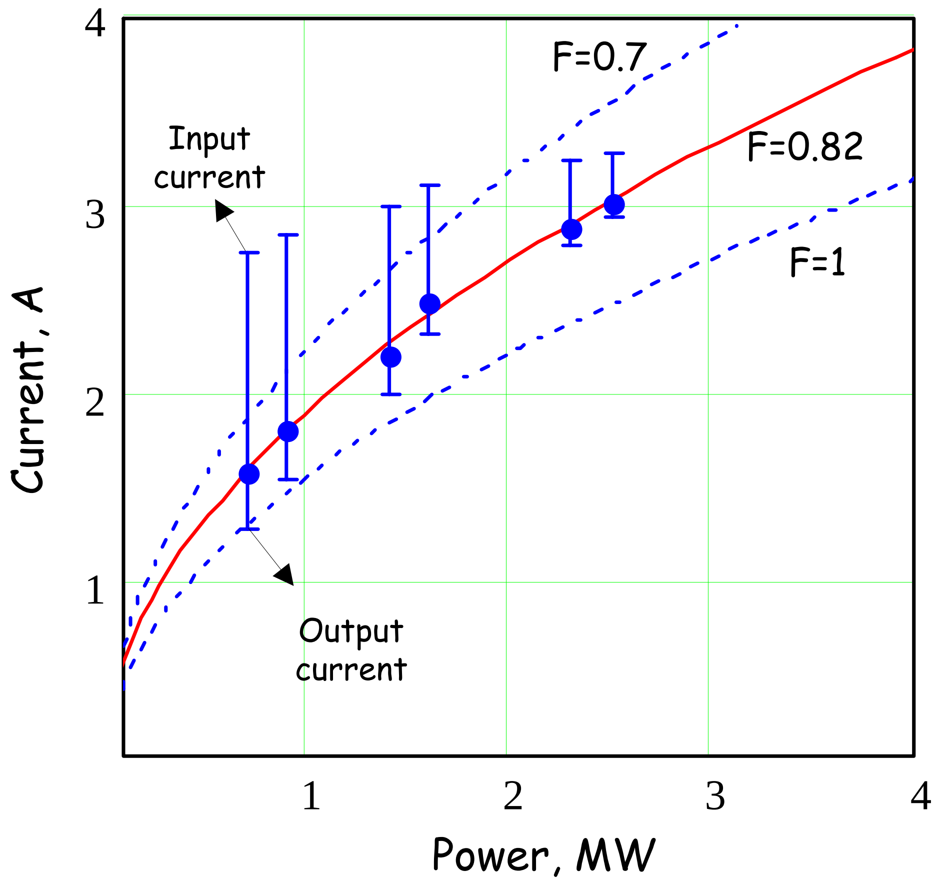
Parameters	#9.0 mm
R/Q, kΩ/m	5.87
Beta (Vg/c),%	39.82
Q	**4860**(5110)
F_D, GHz	32.46
K_T, V/pC/mm/m	31.65
Q_D	5380
$Beta_D$, %	43.57

$$Power[MW] = 0.4047x(I[A])^2xF^2$$





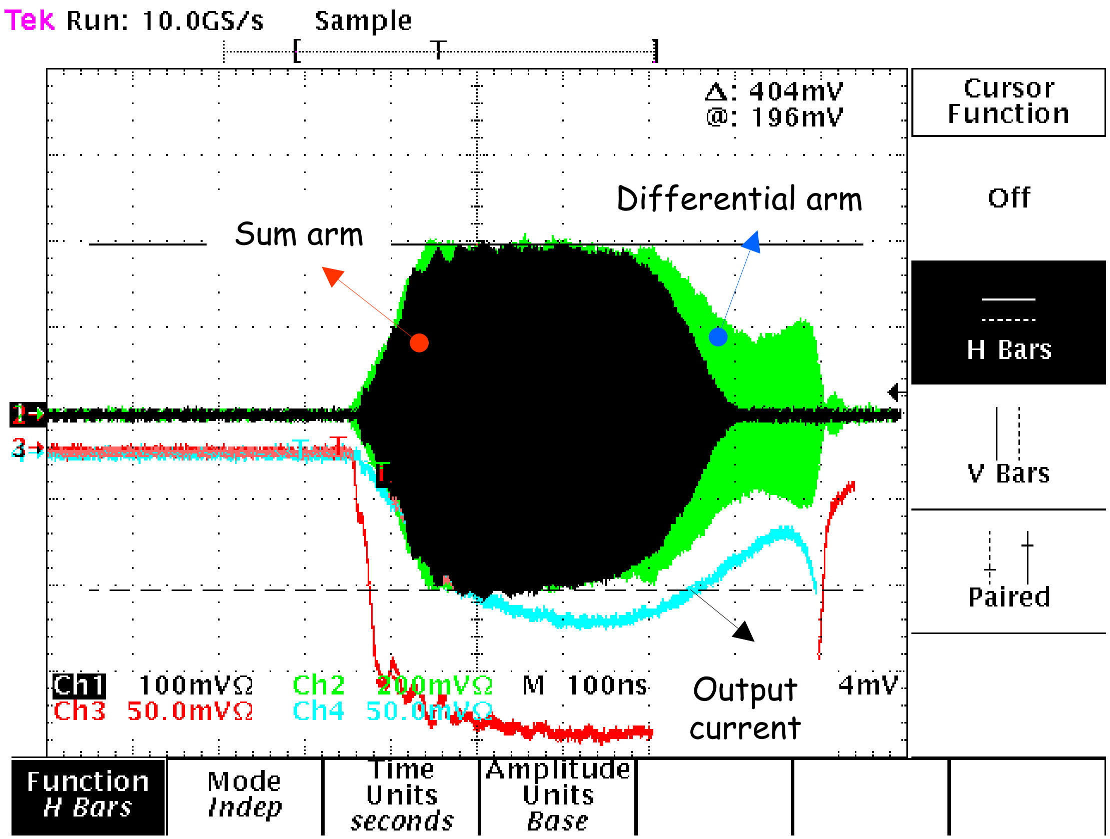
Summary of the high power 30 GHz production runs in CTF3 (R.Corsini)



Blue dots on a picture represent the guess current which best fits the $P=I^2$ dependence for the given single bunch form-factor:

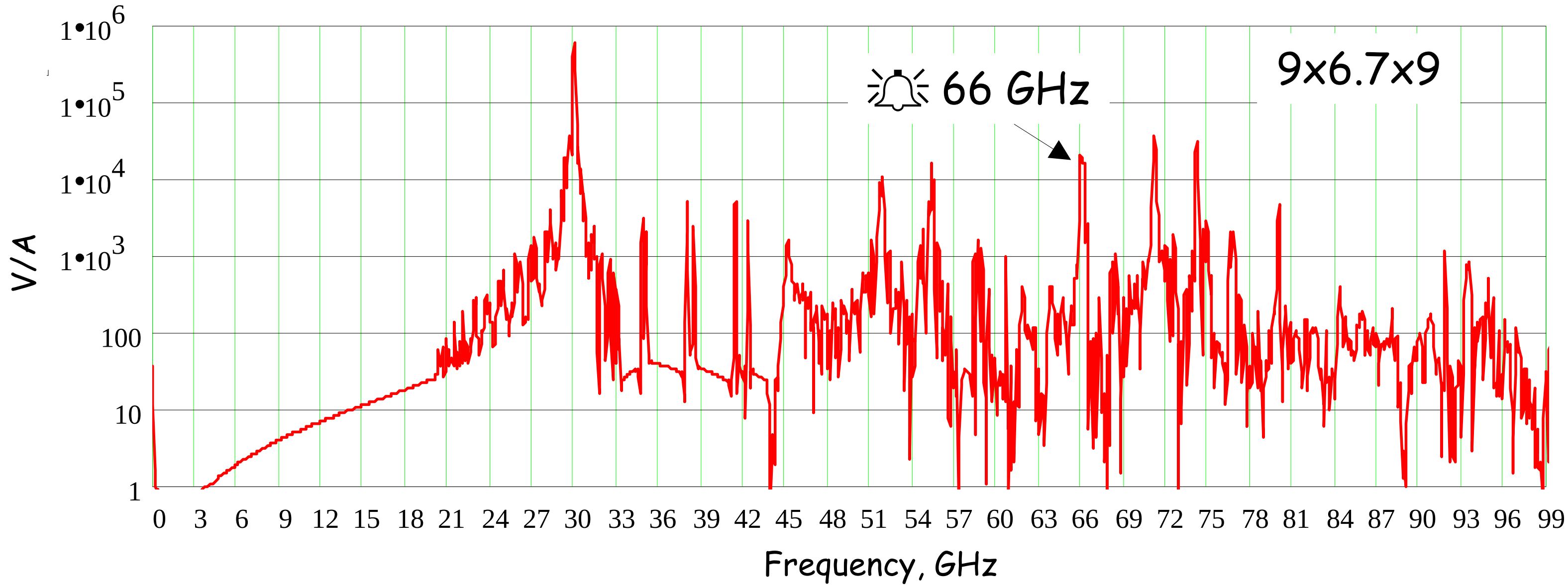
$$I_G = \frac{I_{input} \times 4 + I_{output}}{5}$$

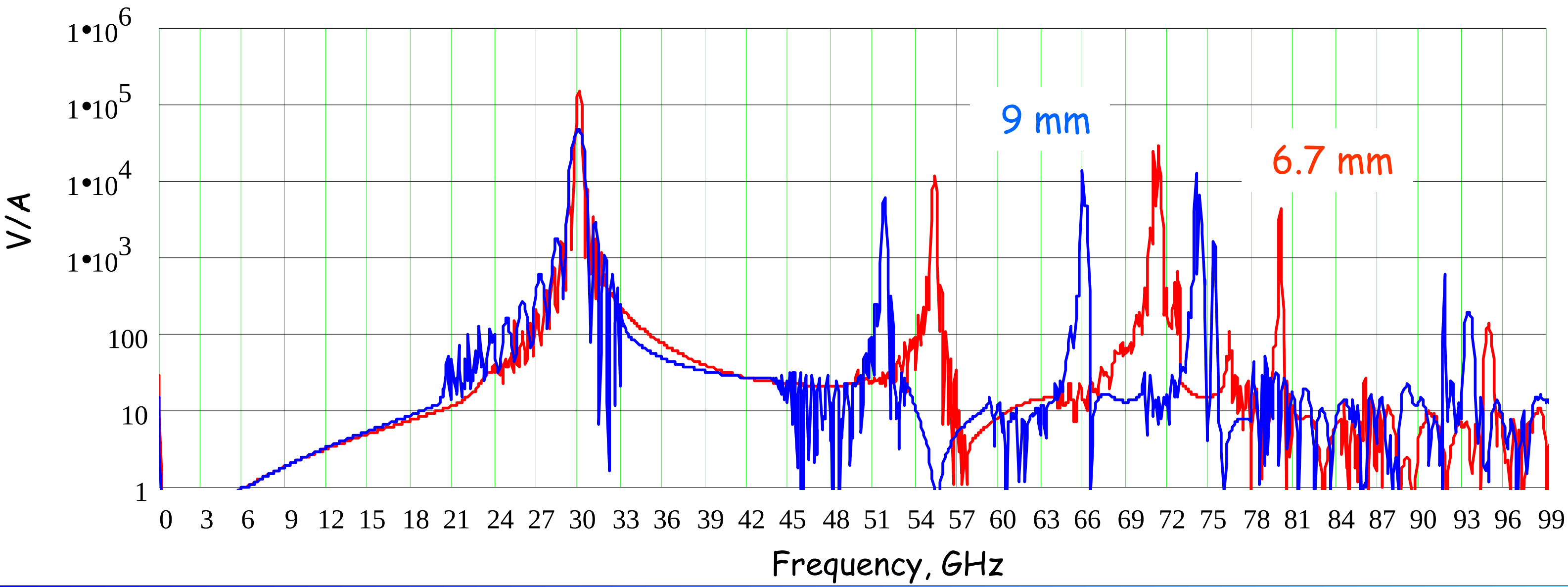
66 GHz venture



Following the fact that there was no any dependence of the detected signal amplitude in the differential arm on the 30 GHz attenuator settings, it was discovered that 66 GHz frequency was dominating there.

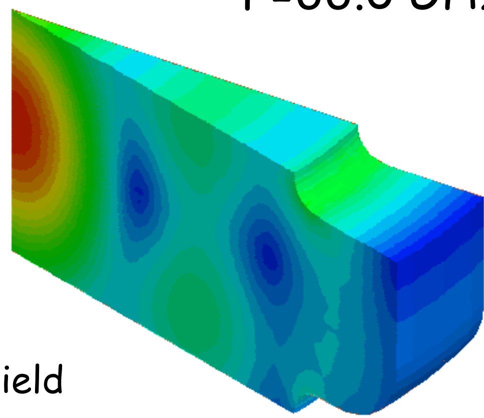
GDFIDL results





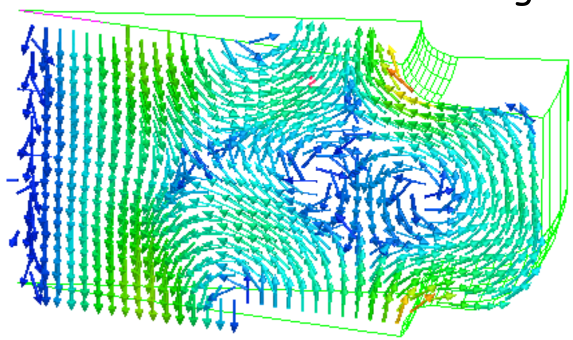
HFSS results

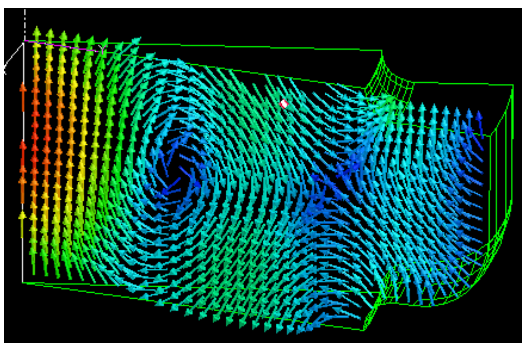
F=66.0 GHz ‘complex’ mode



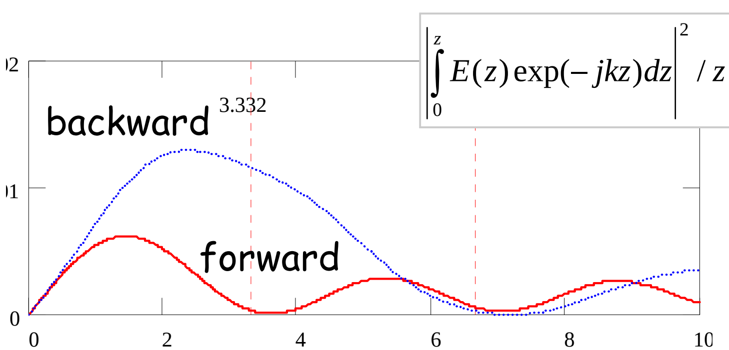
E-field

Pointing vector





F	66 GHz	30 GHZ
R/Q	356 Ohm	5870 Ohm
Vg	**0.12 C**	0.398 C
Ph/cell	264	120



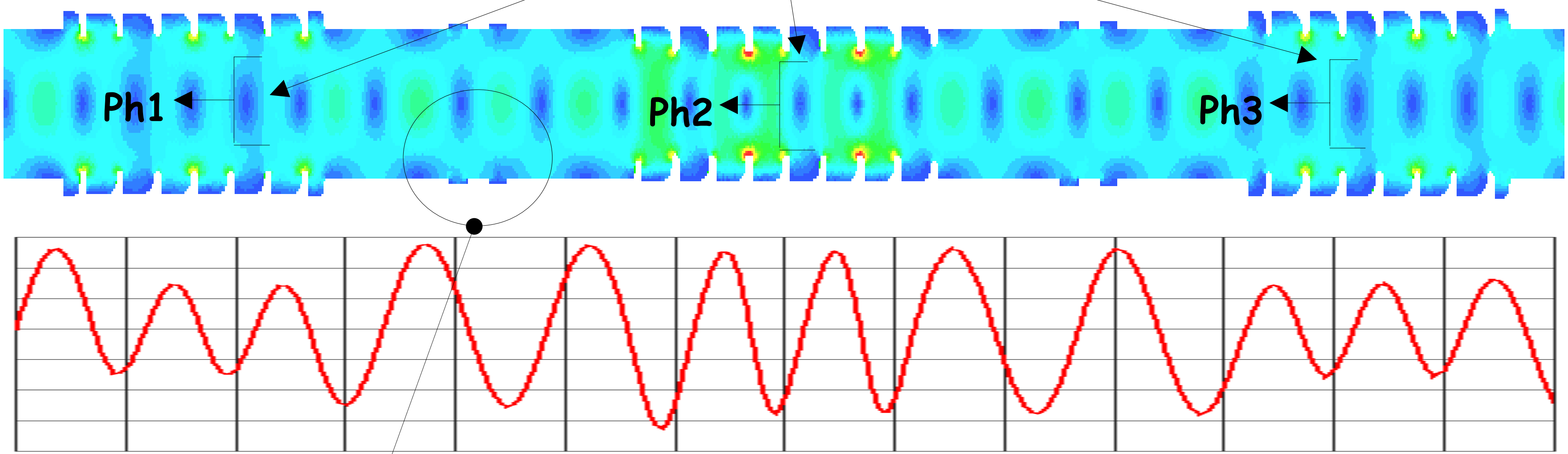
Power produced ($F^2 = 1$) ~ R/(QxVg)
Compared to 30 GHz this gives 4.9 times less power at the PETS output !!!!
Form factor gives another 3 times, so finally 66 GHz power is about ~ 16 time lower compared to 30 GHz.

I. Syratchev, CERN, AB/RF

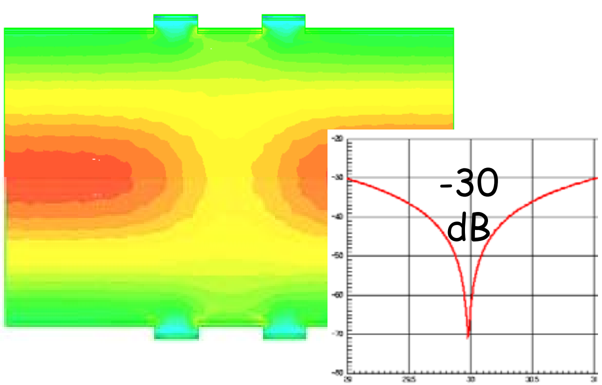
#2. Next run. Status up to date

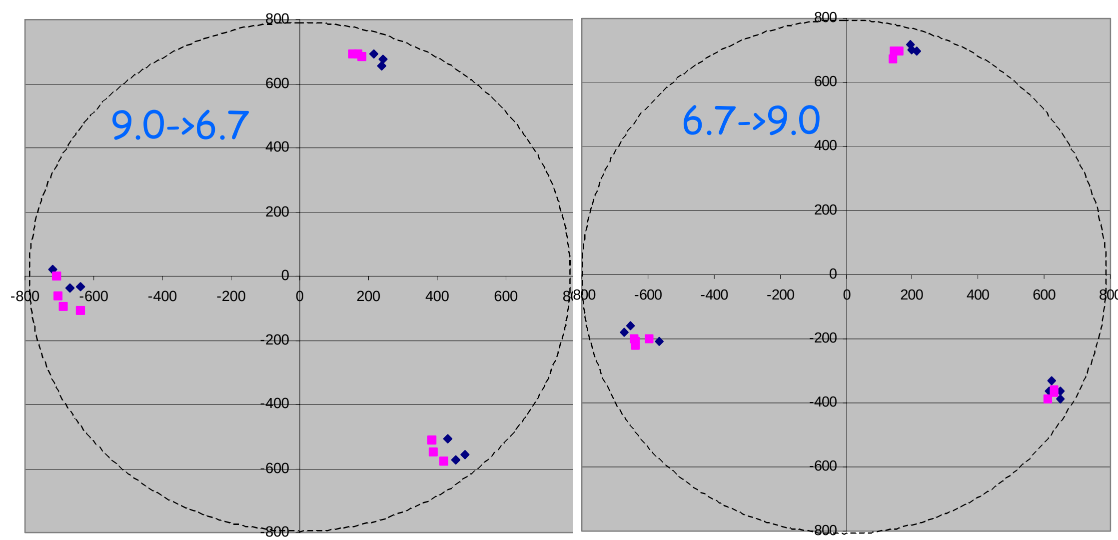
3 structures phasing (HFSS results)

Piston positions

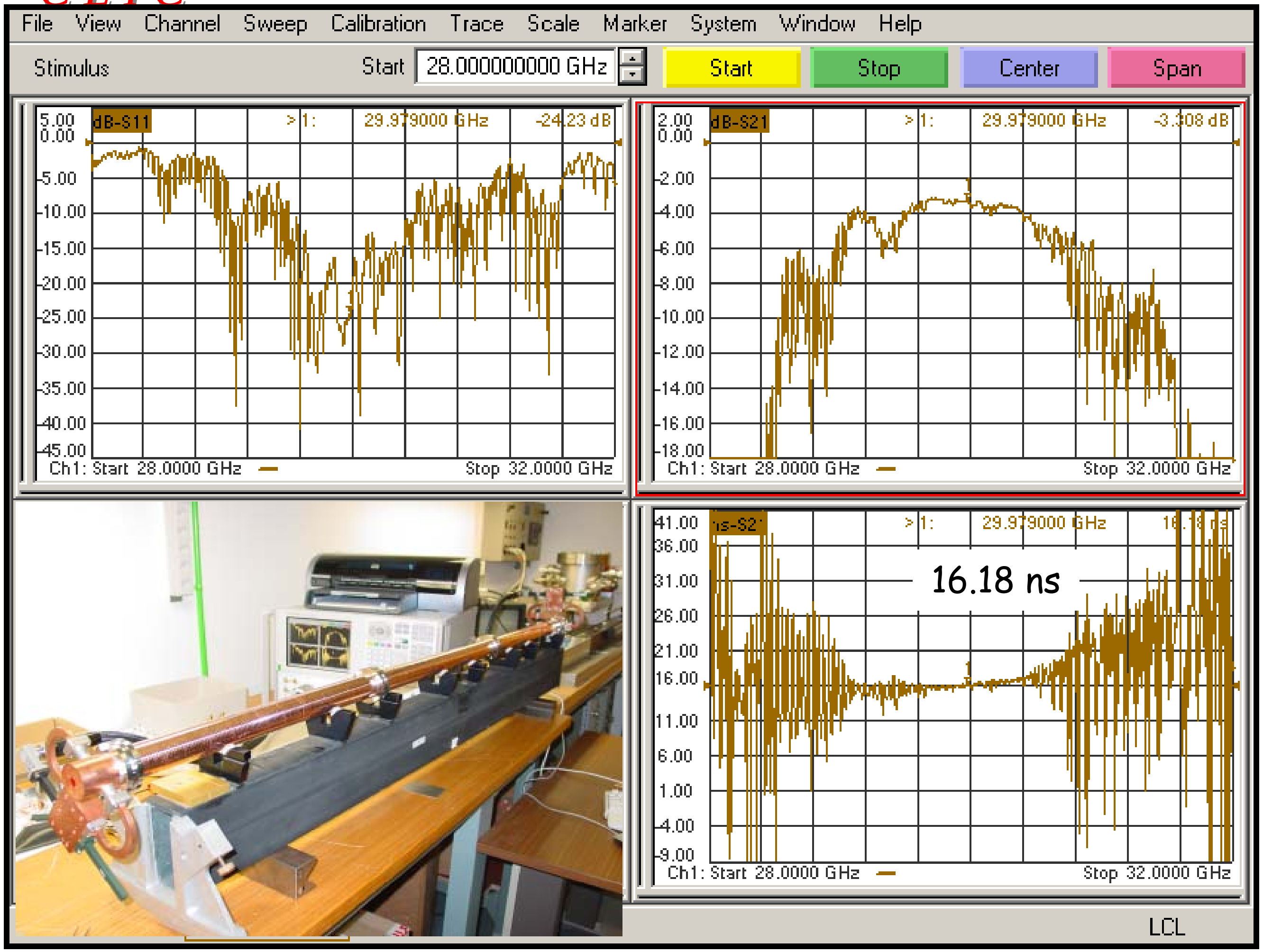


Special RF phase spacer





9x6.7x9 PETS



Delay time budget: 1.233x2(ML) + 3.63x2(9.0) + 5.93(6.7) + 0.58(PhS) = 16.23 ns

Power production in CTF3 (as expected)

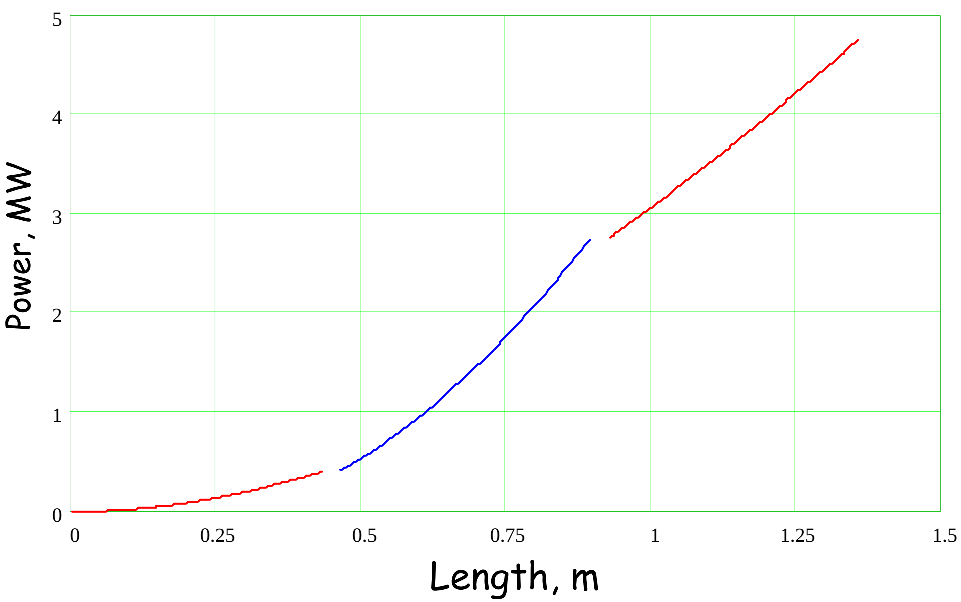
Parameters	#6.7 mm	#9.0 mm
R/Q, kΩ/m	11.26	5.87
Beta (Vg/c),%	24.35	39.82
Q	**4150**	**4900**
F_D, GHz	34.01	32.46
K_T, V/pC/mm/m	105.0	31.65
Q_D	4420	5380
$Beta_D$, %	23.68	43.57

$$Power_{PETS}\,[MW] = 4.762 \times (I[A])^2 \times F^2$$

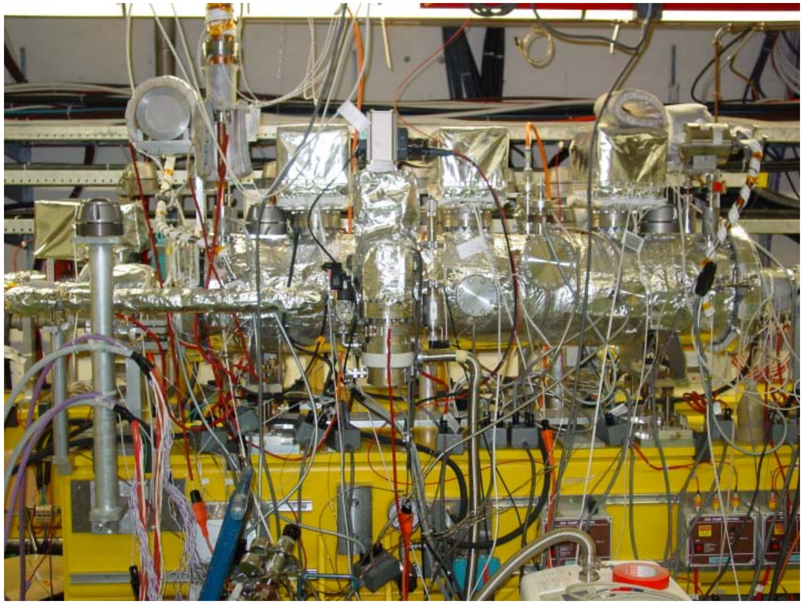
$$Power_{Load}\,[MW] = Power_{PETS} \times \eta_T$$

$$\eta_T = 0.86 \times 0.85 = 0.73$$

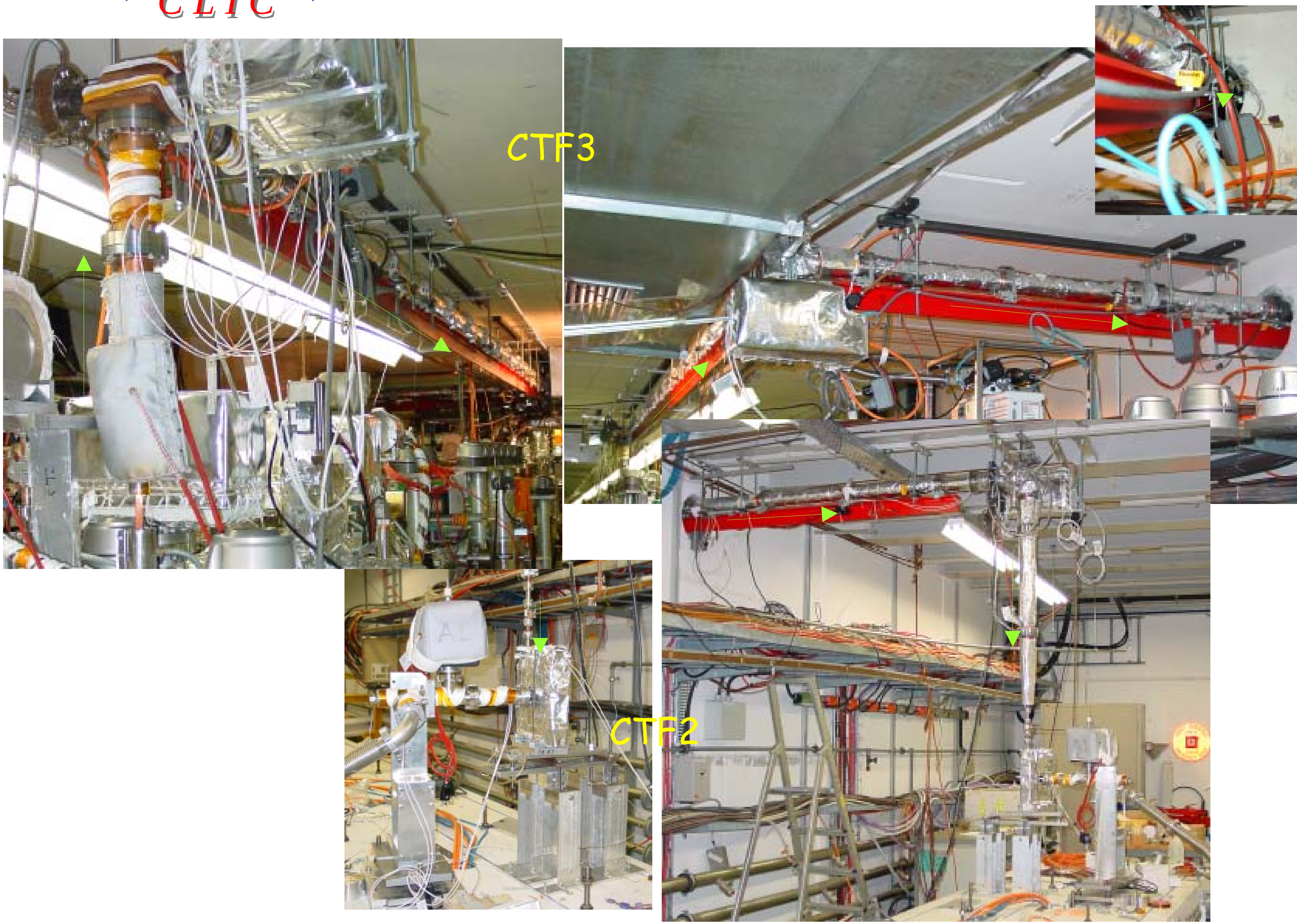
WG components (0.86) — Power line (0.85)



9x6.7x9 PETS tank in CTF3



30 GHZ power line (85% efficiency)



I. Syratchev, CERN, AB/RF