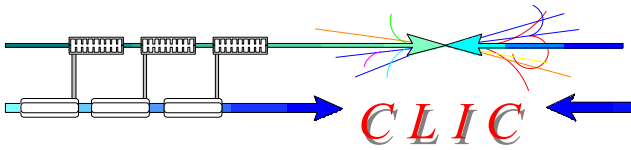
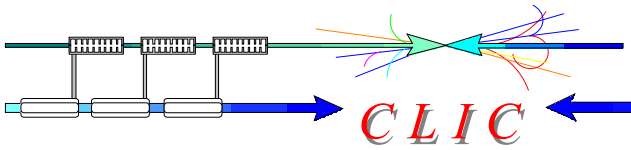


Status of Drive Beam Accelerating Structures & 3 GHz High Power loads

Erk Jensen
CERN

30 Septembre 2003



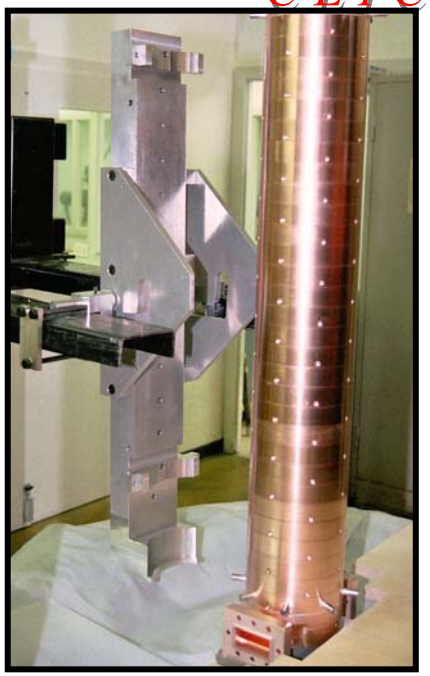
CERN Prototype: Status 11.6.02

Reminder:
Last Collaboration meeting, 12.6.02, status of CERN prototype was:

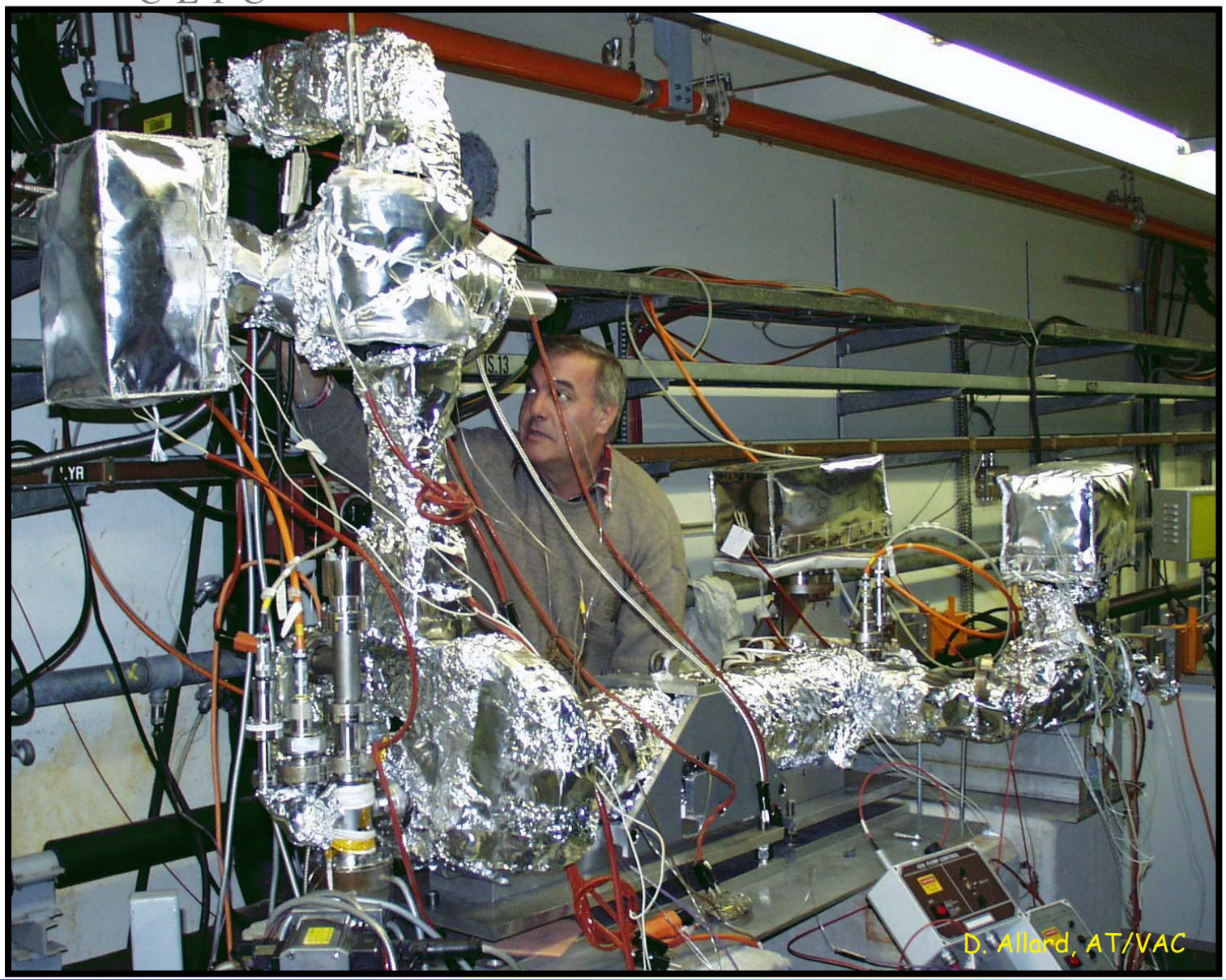
- All discs machined.
- All discs EDM'ed.
- 16 discs ready (rounding of edges, done outside CERN).
  …the others take 1 more week (come in 3 per day).
- 6 measured (OK, < 0.01 mm) now being cleaned,
- …the other 10 are waiting at quality control
- Both coupler cells and waveguides machined, being assembled for 1st brazing.
- First batch of SiC loads arrived today, next batch in 1 week.
- Fixtures for SiC loads ready.
- Assembly for complete structure 1st 2 weeks of July, brazing scheduled 2nd half of July.

Sep. '02: brazing

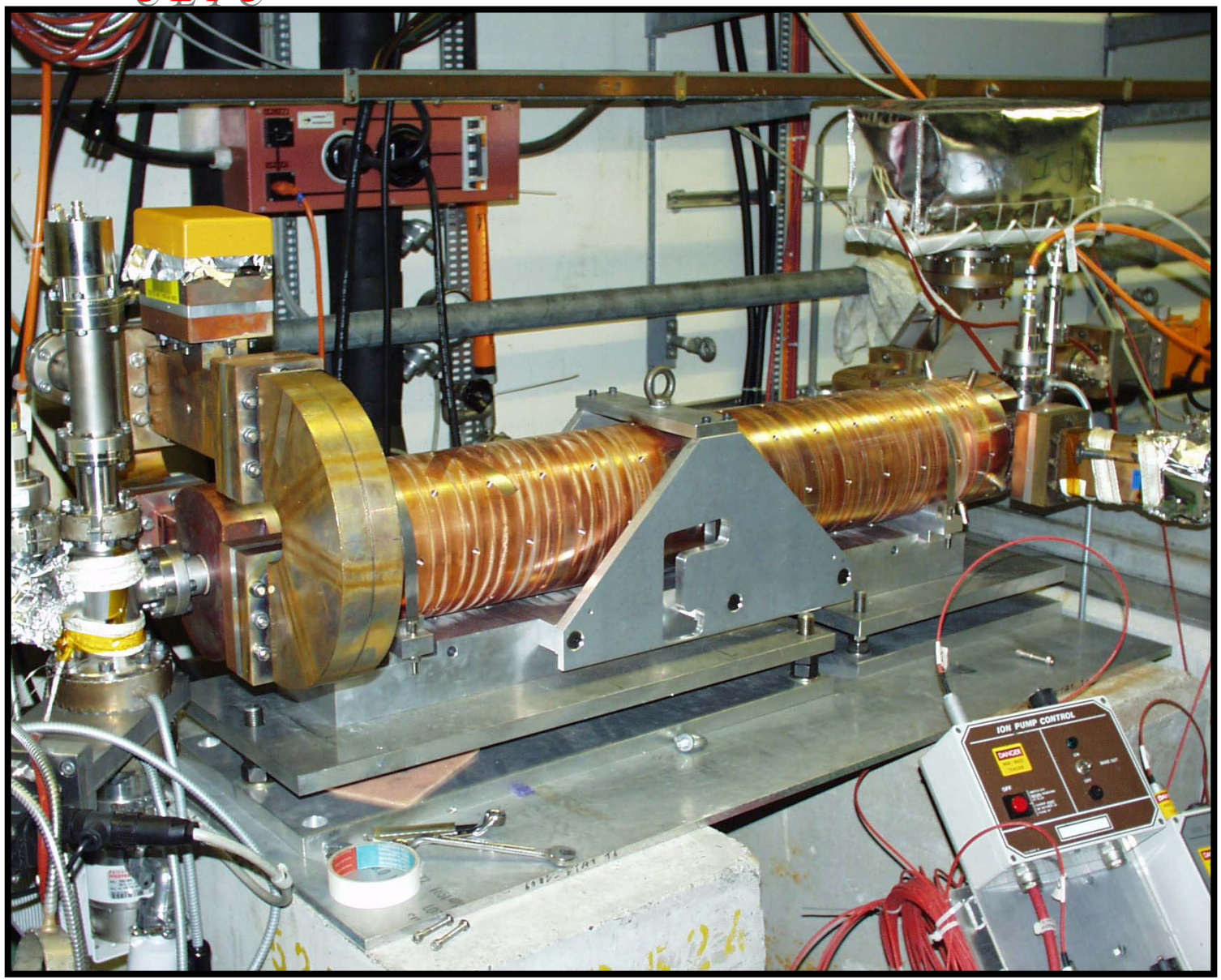
After brazing



Preparing bake-out



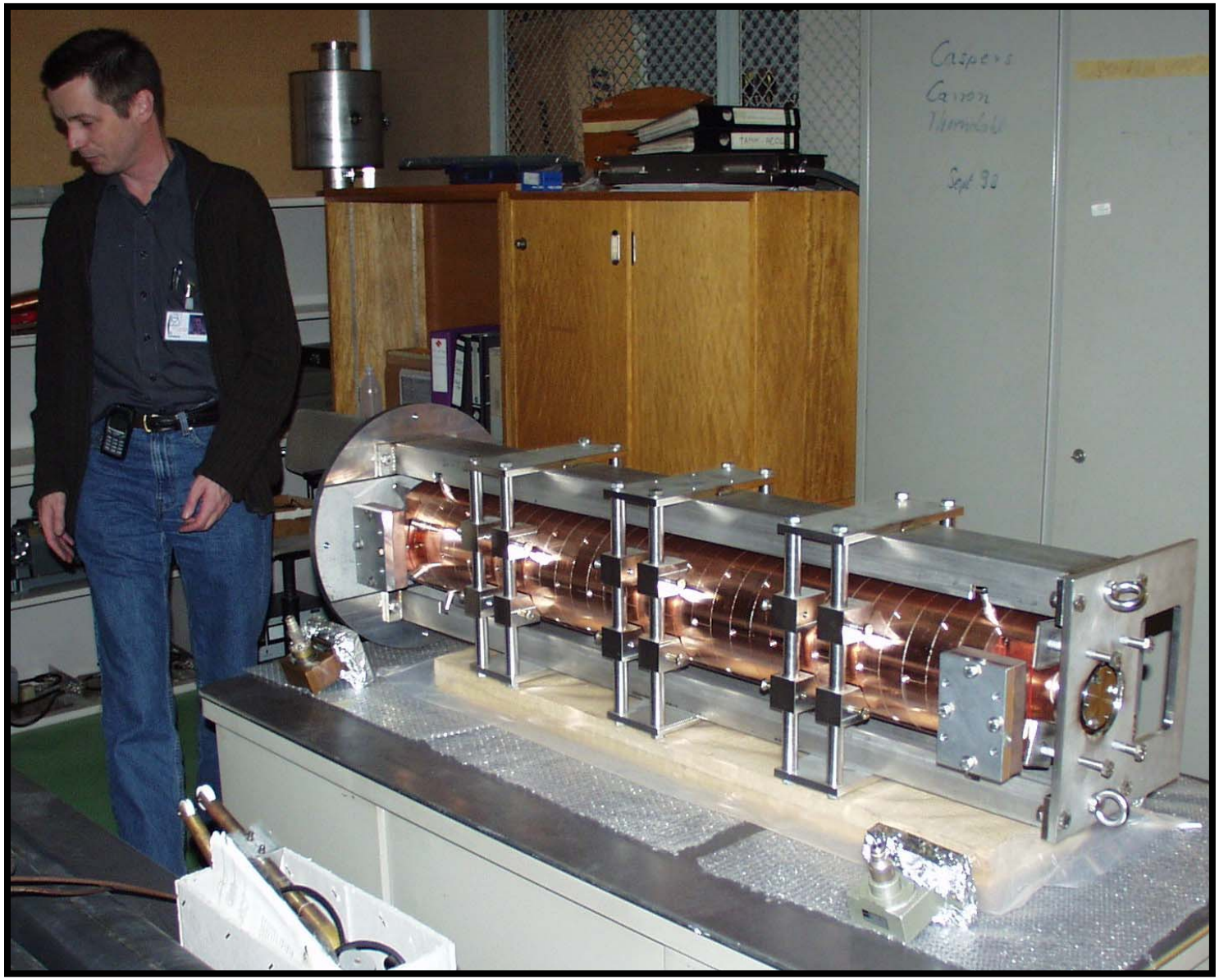
CERN prototype @ High Power Test



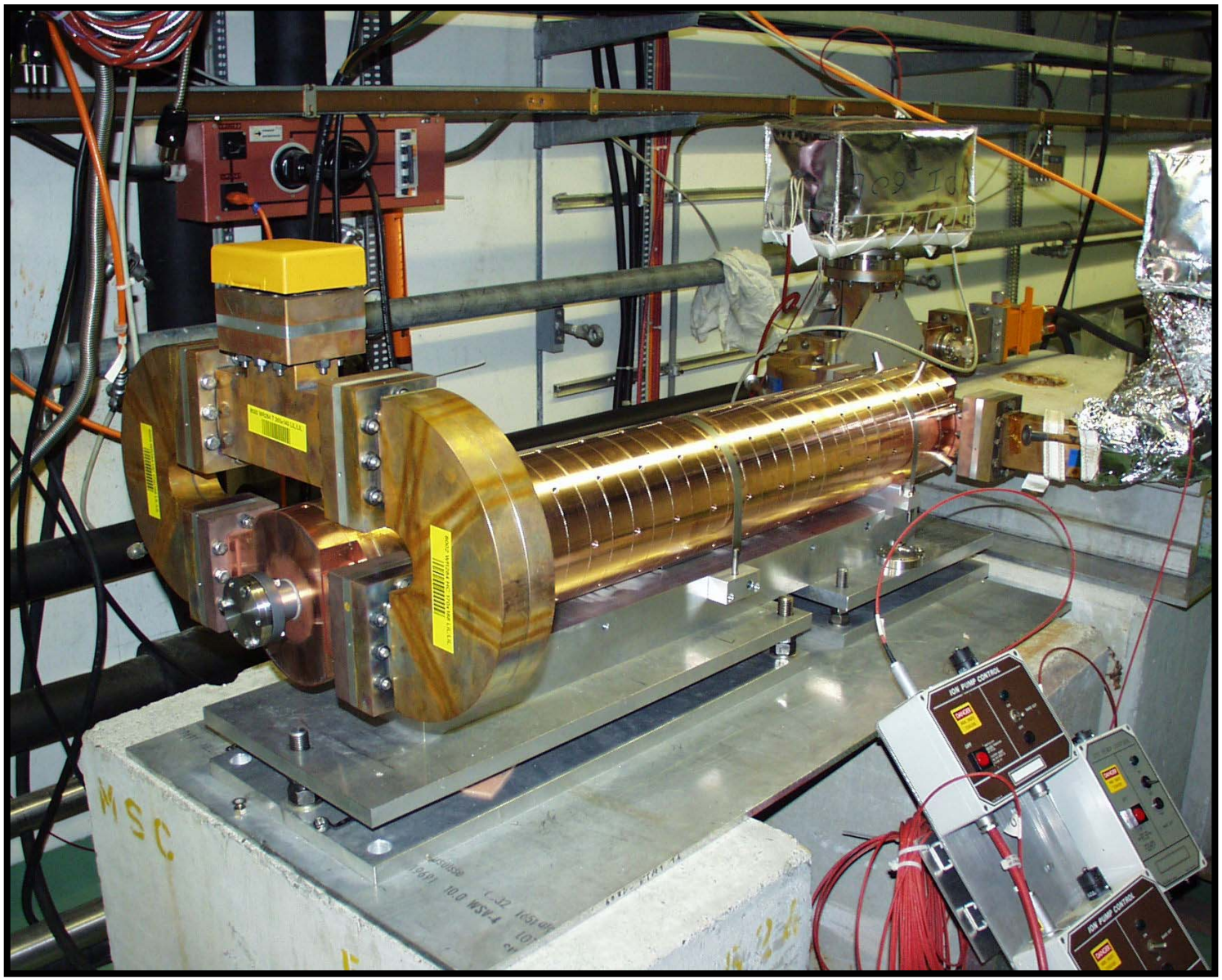
1st industrial prototype

ACCEL, Germany
10-Oct-02:
Assembly before brazing.

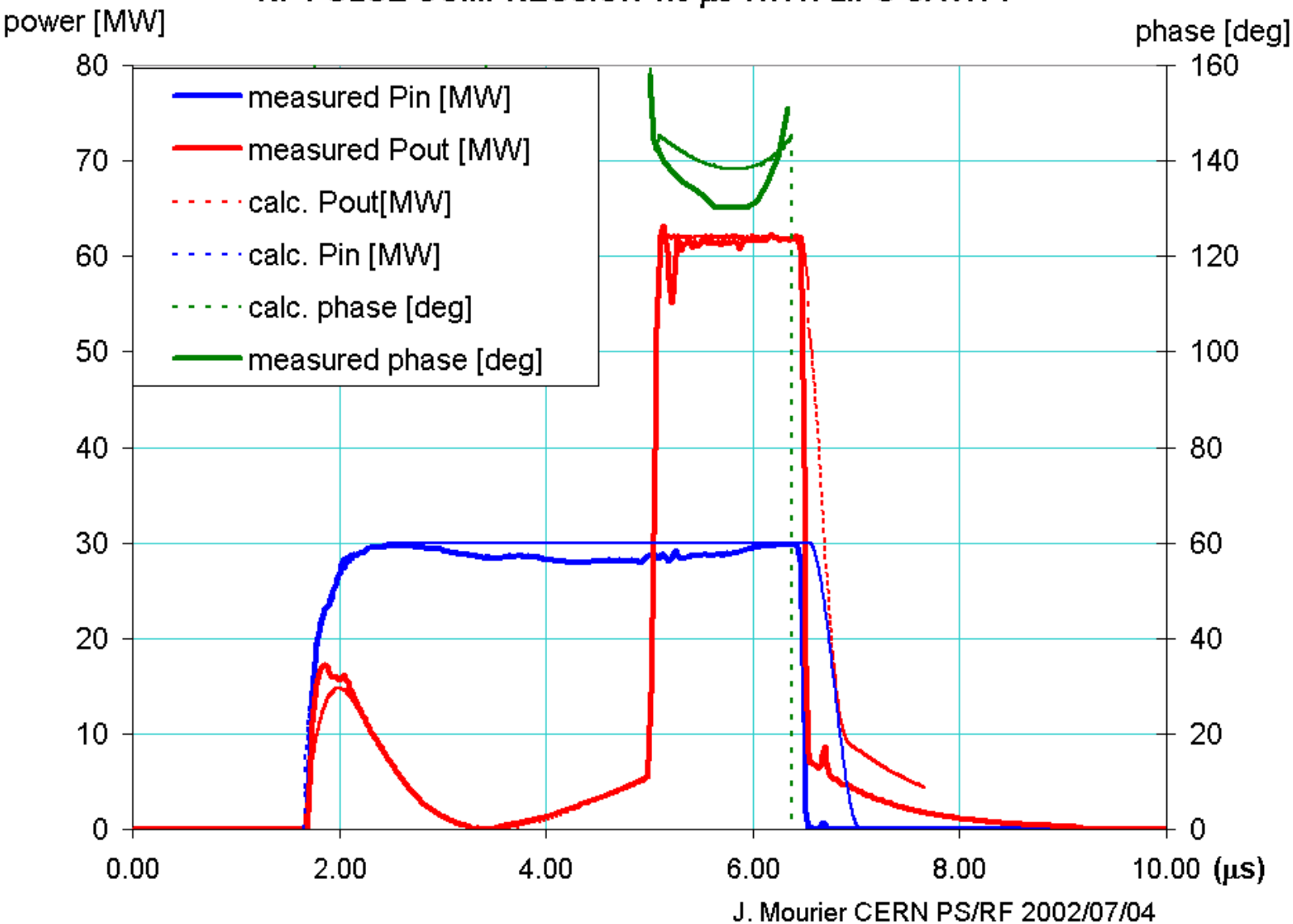
Nov.-02: Arrival of 1st ACCEL structure

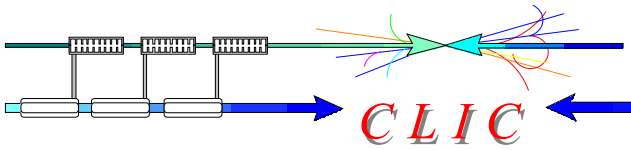


ACCEL prototype @ High Power Test



Pulse compression





High power tests

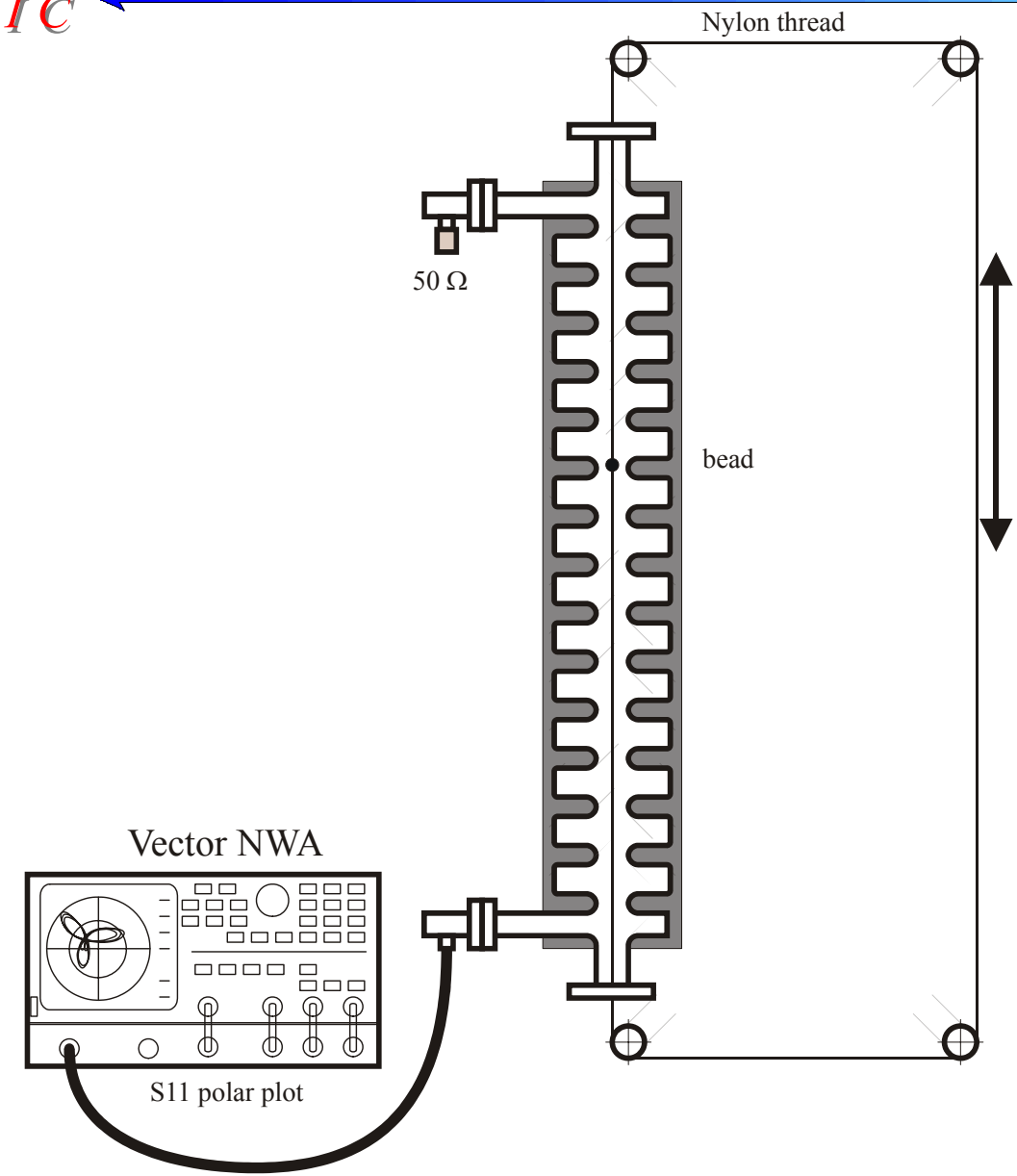
- Nominal parameters: 30 MW, 1.6 μs, 5 Hz.
- Both structures, the CERN prototype and "ACCEL01" were successfully tested with up to
  - 35 MW with 2 μs pulse length (w/o LIPS),
  - 60 MW with nominal pulse length,
  - 70 MW with short pulses (500 ns).
- Processing took typically 2 days (@ 10 Hz rep. rate)

Dimple Tuning!

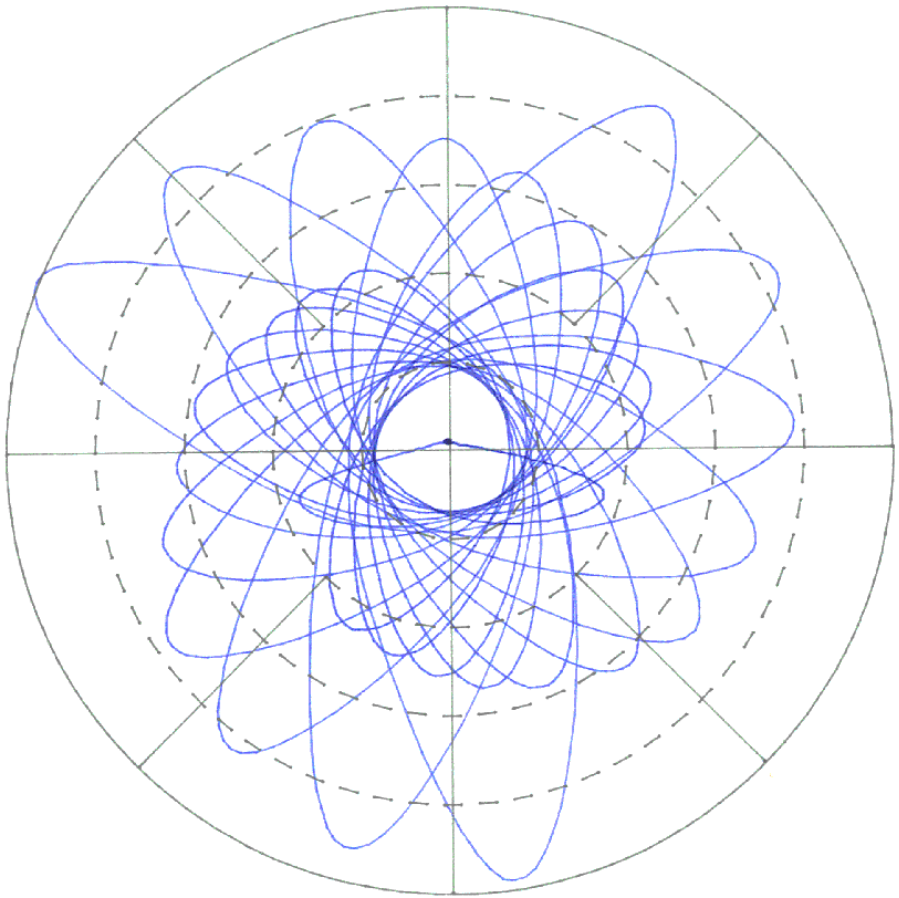
- Nominal frequency before tuning: (2997.55±1) MHz.
- Dimpling allows to tune *up* by max. 2 MHz.
- But: ACCEL prototype was 2995.6 MHz, i.e. out of nominal tuning range! Could we tune?
- So we did some tests (with the old "short" prototype) to see whether we could tune more.
- Result: see animation on the right!
- Conclusion:

  up to 3 mm deformation seemed OK – and that worked!

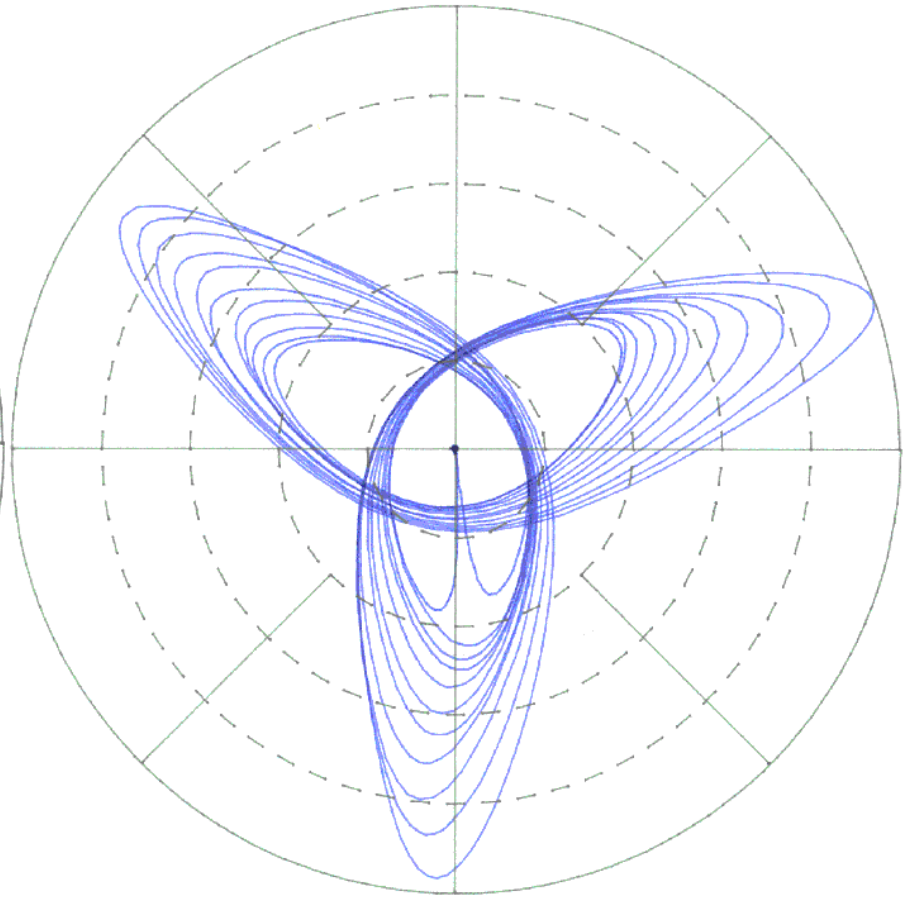
Reminder: Bead Pull Measurement



Dimple tuning "ACCEL01"

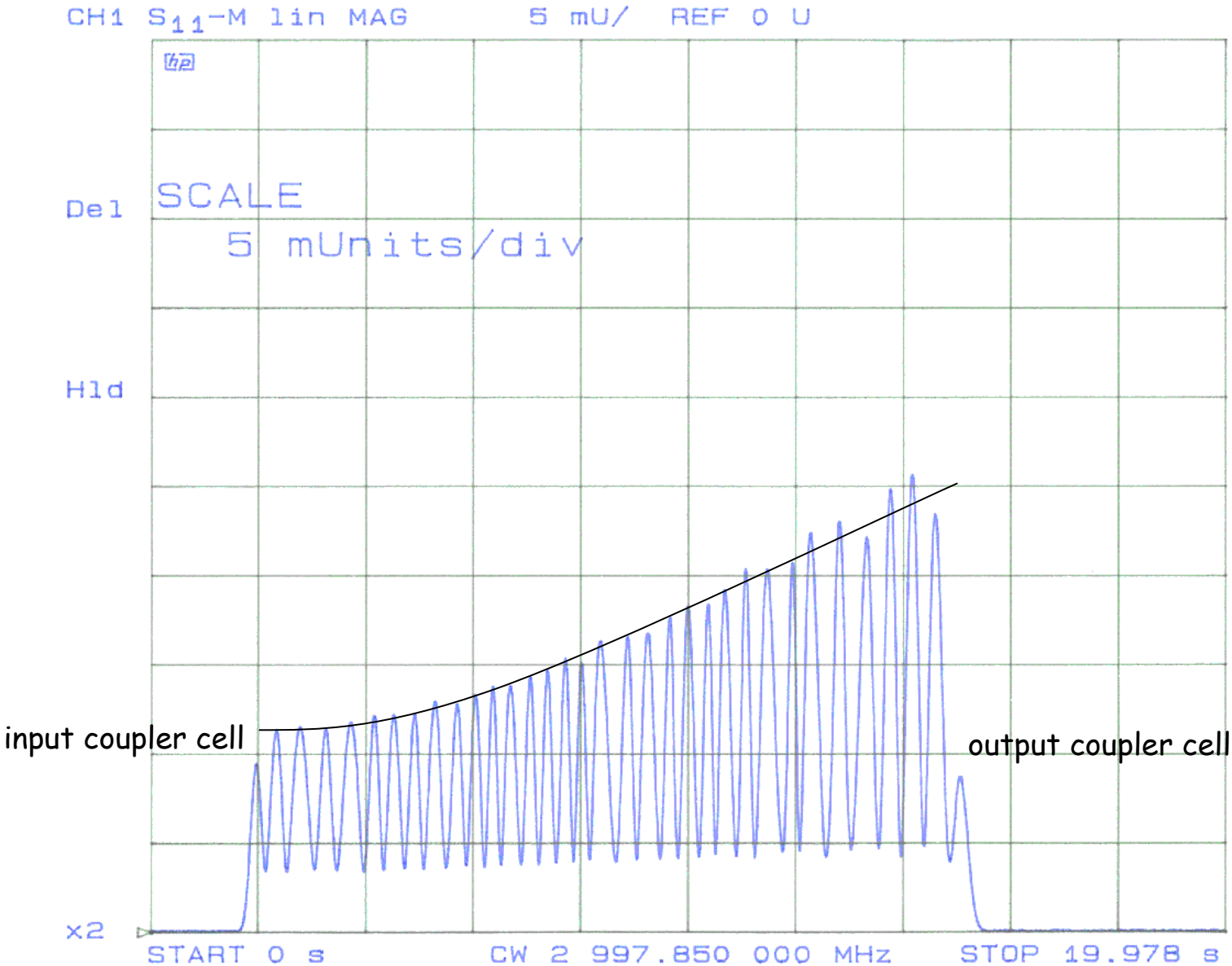


before (off by 3 MHz)

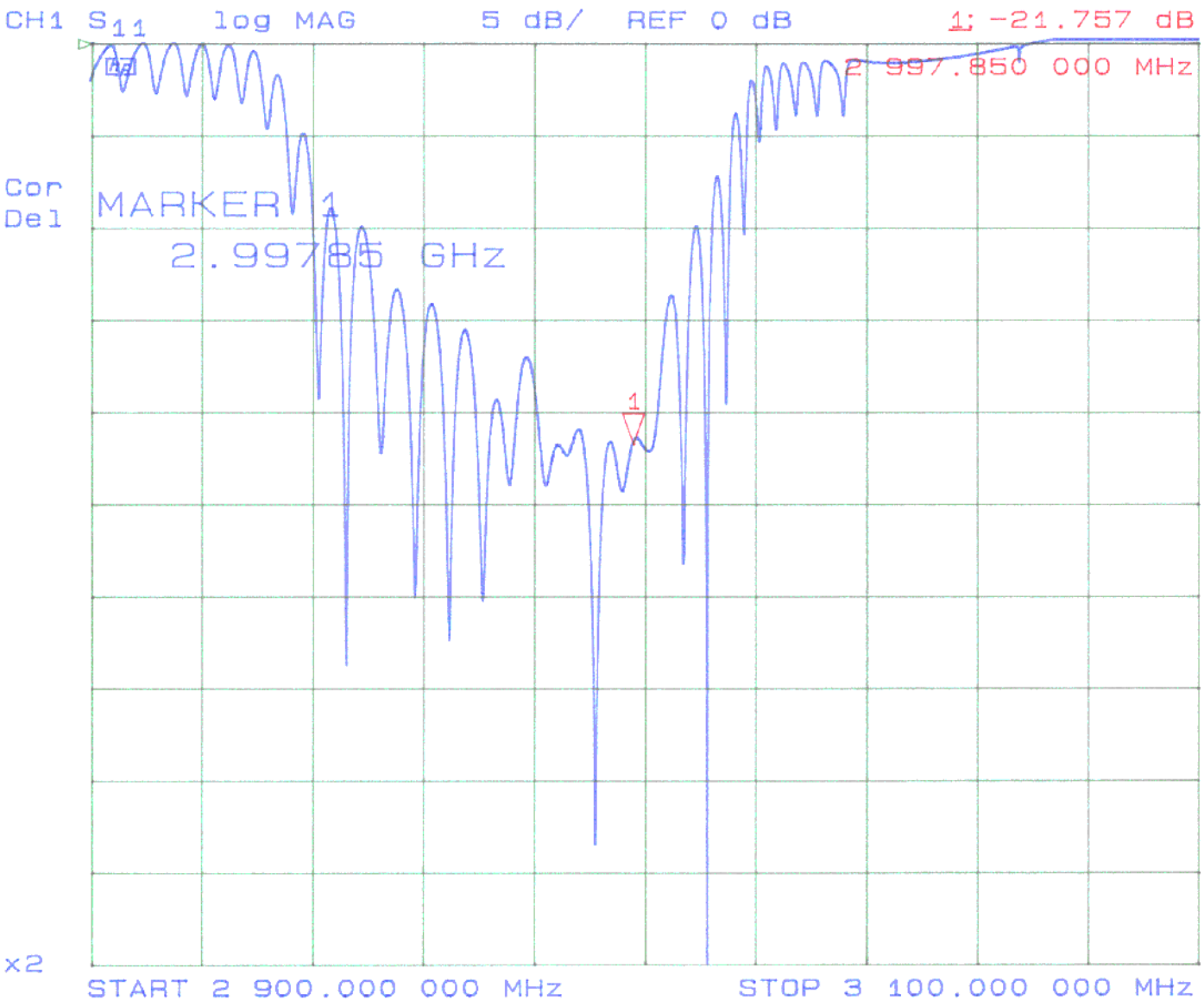


after

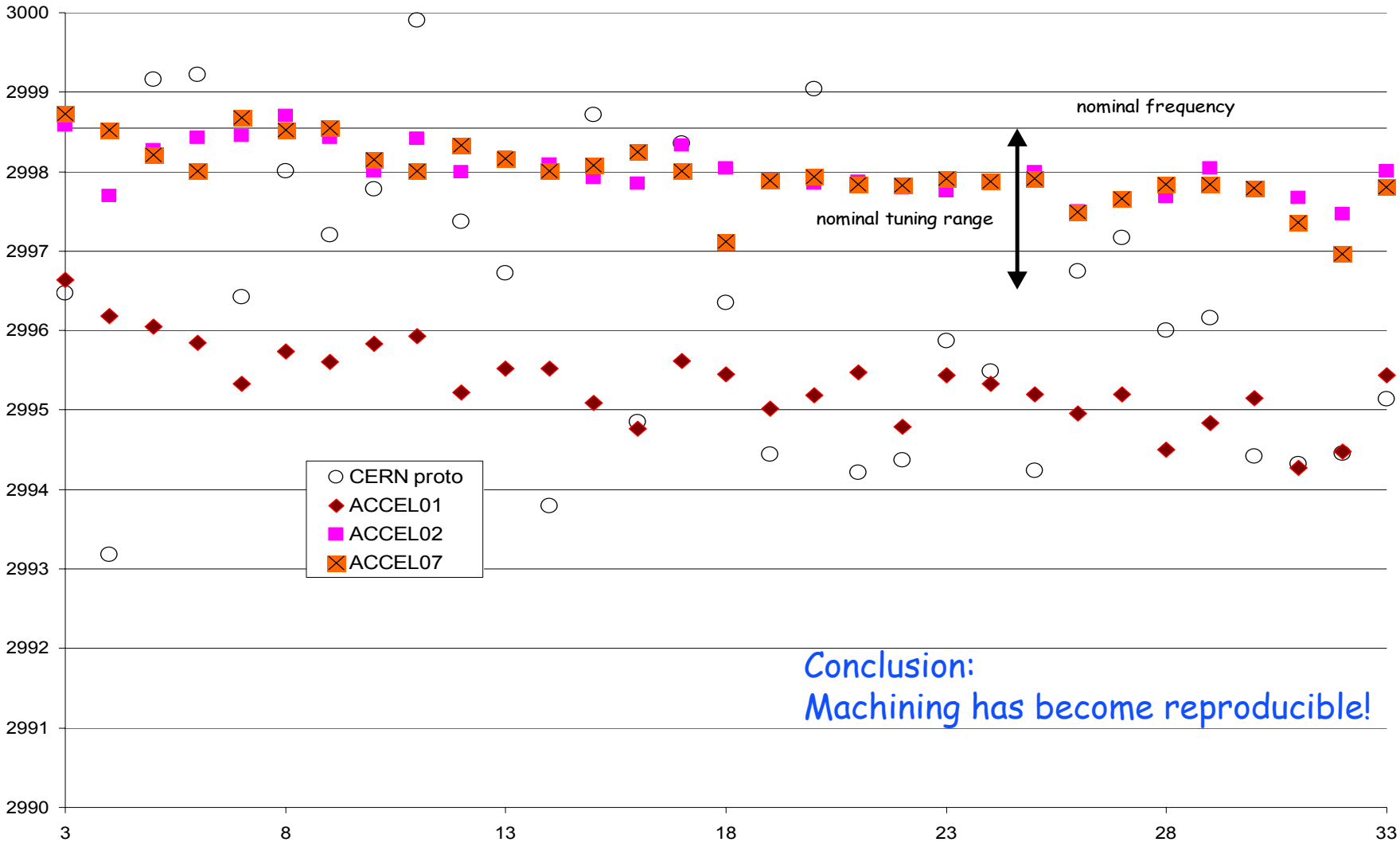
Field distribution inside the structure



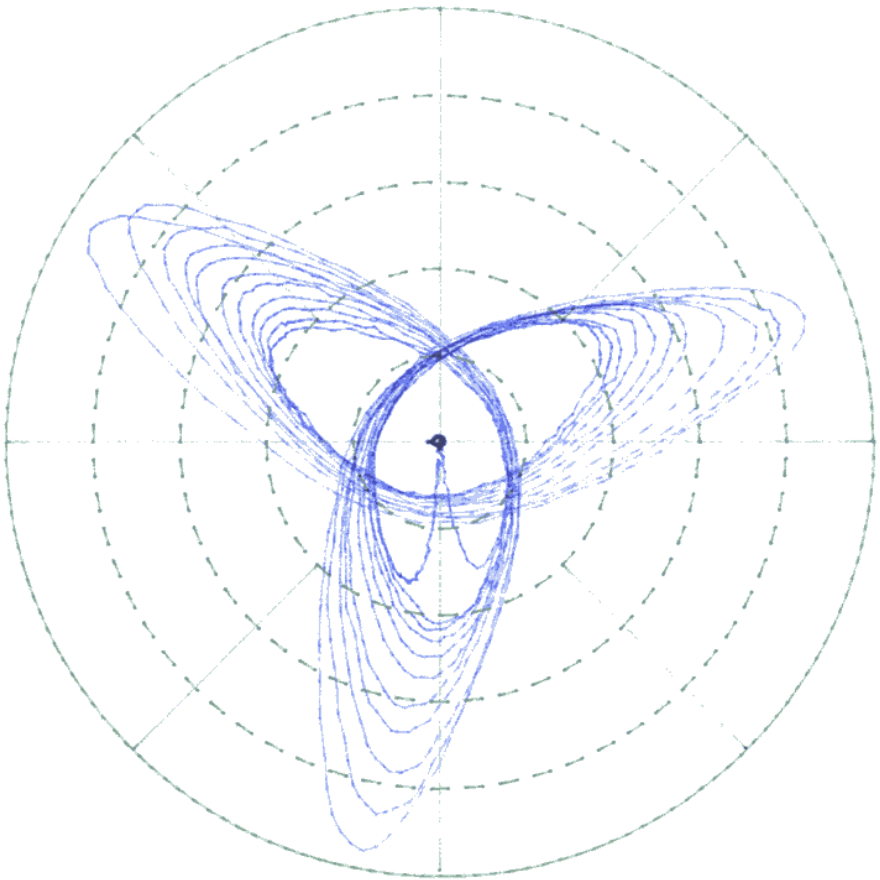
Input match

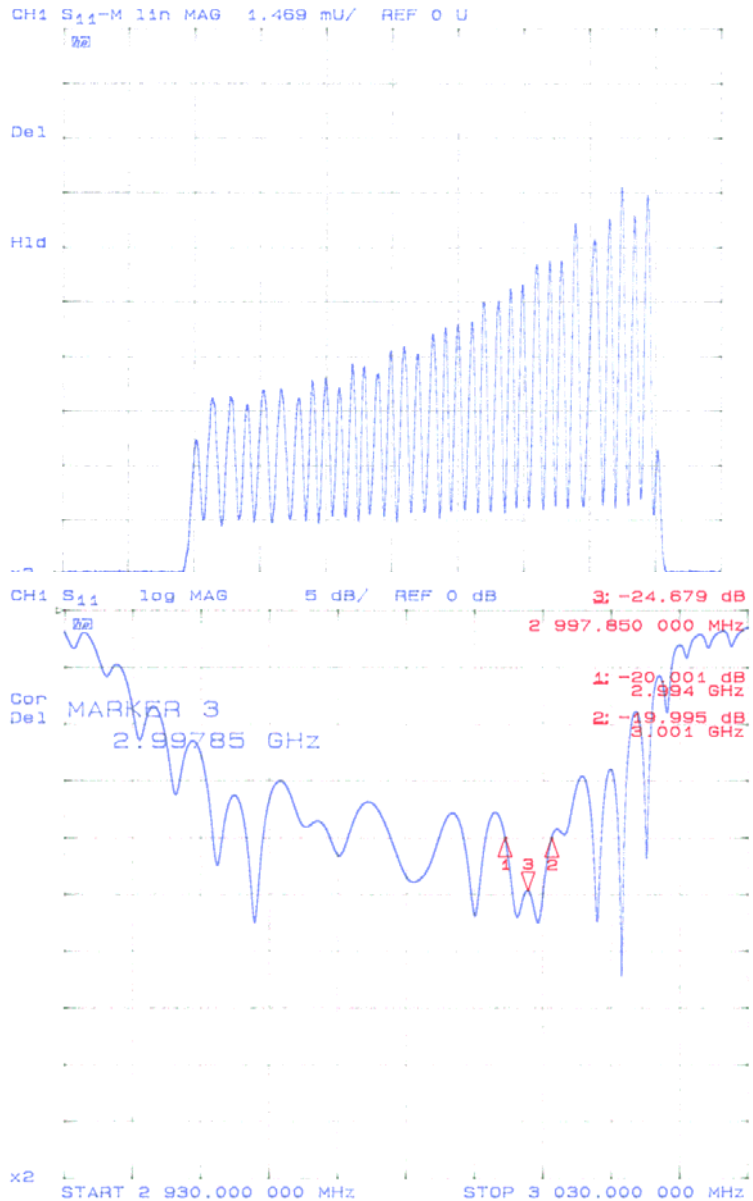

CH1 S11 log MAG 5 dB/ REF 0 dB
1: -21.757 dB
2 997.850 000 MHz
Cor
Del
MARKER 1
2.99785 GHz
x2
START 2 900.000 000 MHz
STOP 3 100.000 000 MHz

Single disc f-measurements

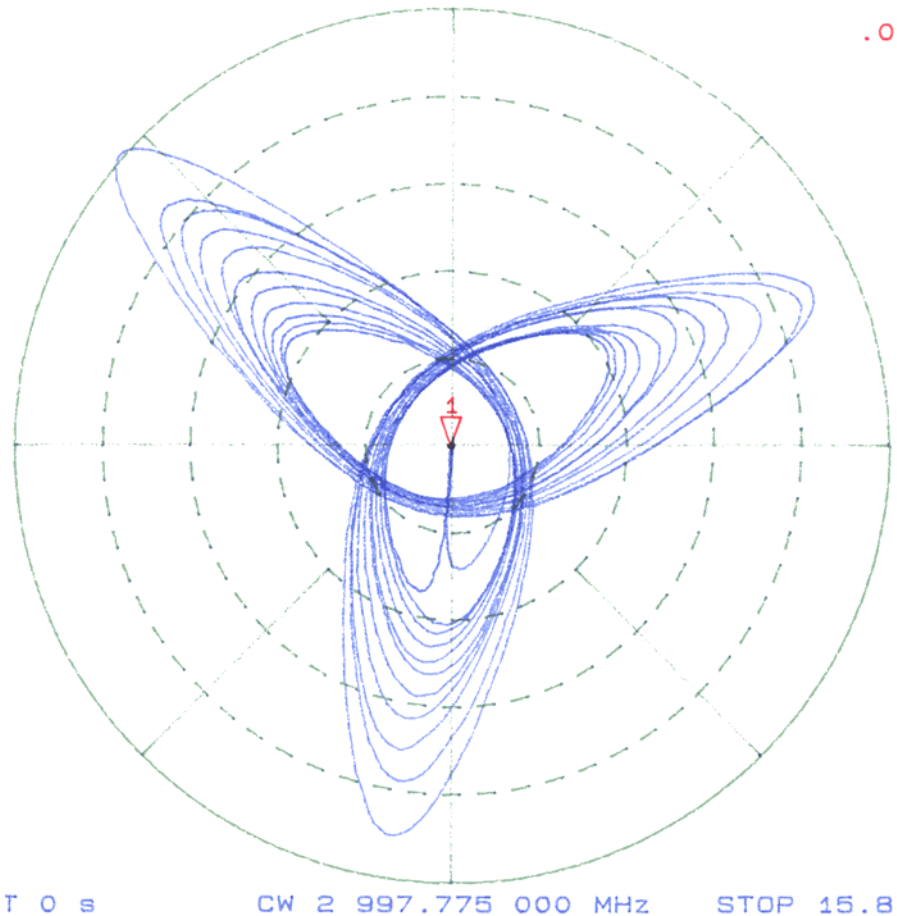


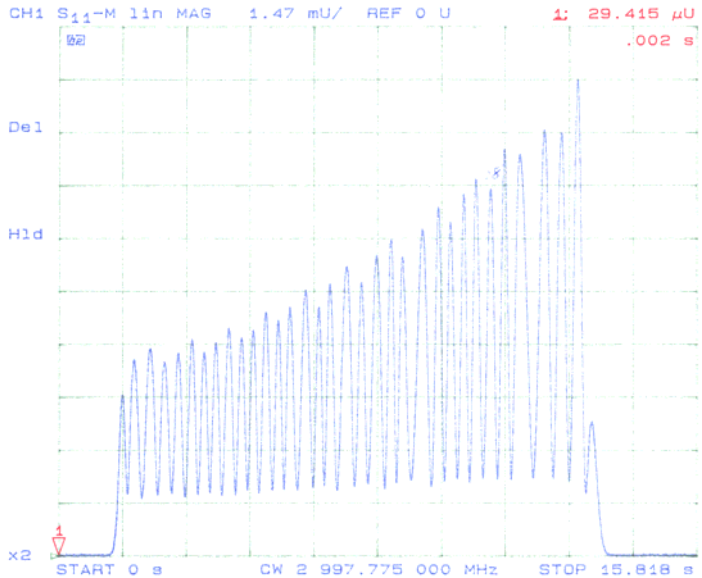
ACCEL07 (first of series) after tuning

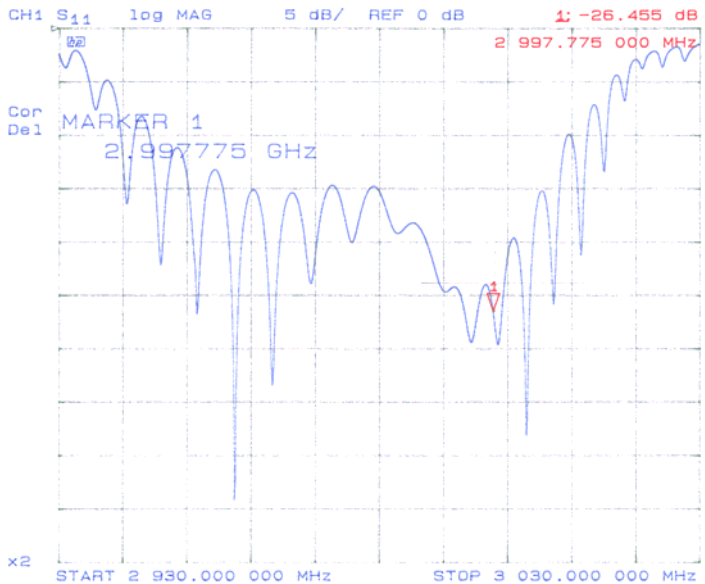




CERN proto after tuning

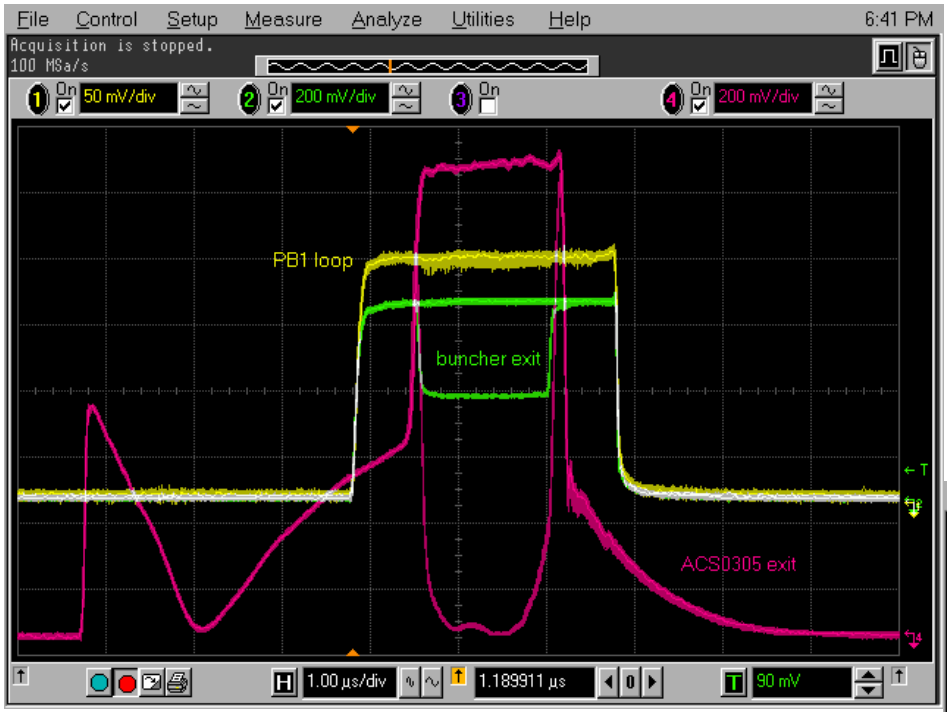






CTF3 in June-03

Aug-03: Tests with beam



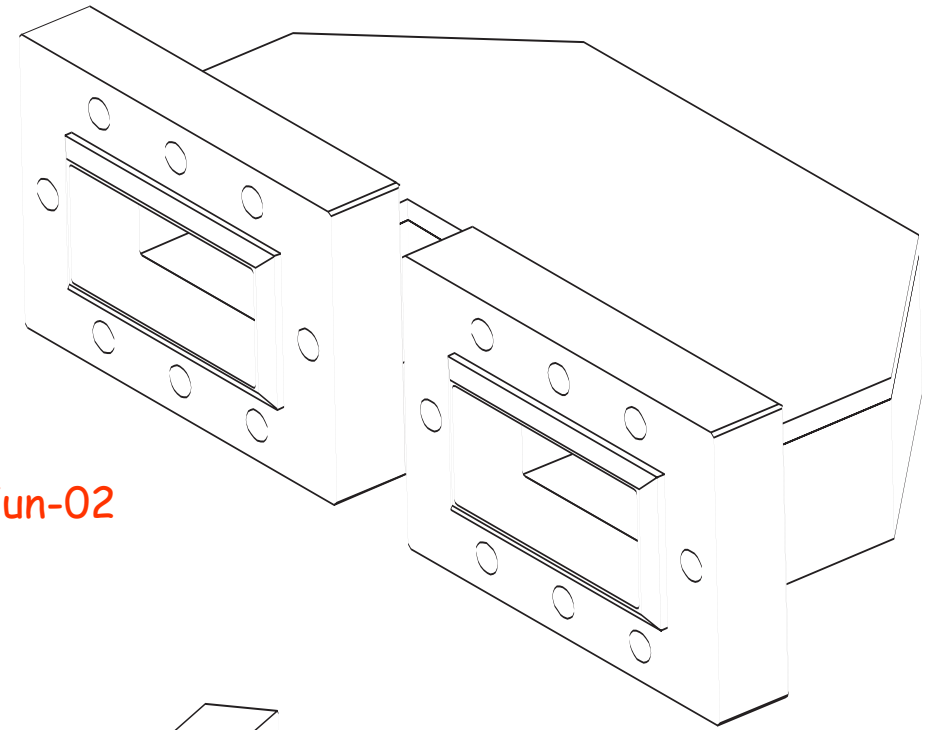
Full loading demonstrated with nominal parameters!

Both for TDS and SICA!

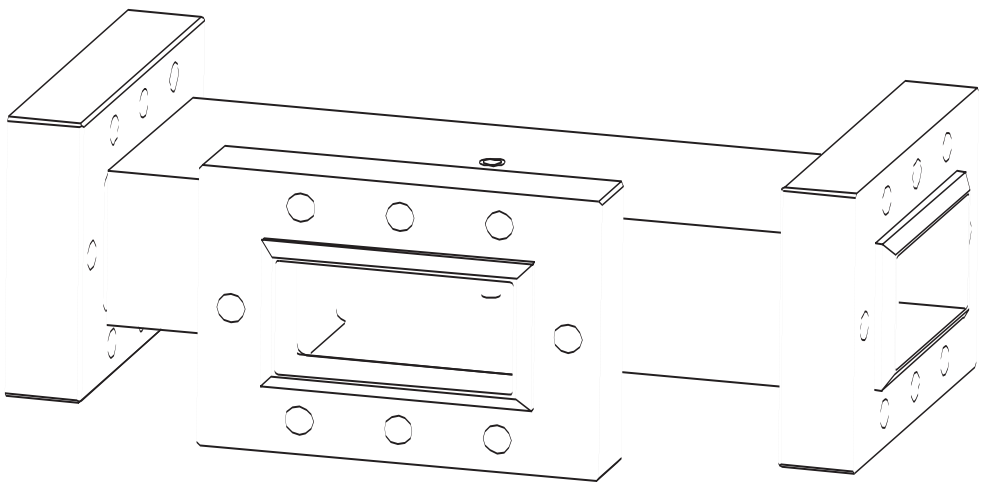
(more: R. Corsinis talk)

Required waveguide components

H-plane 180 deg bends
(2 needed per acc. section)

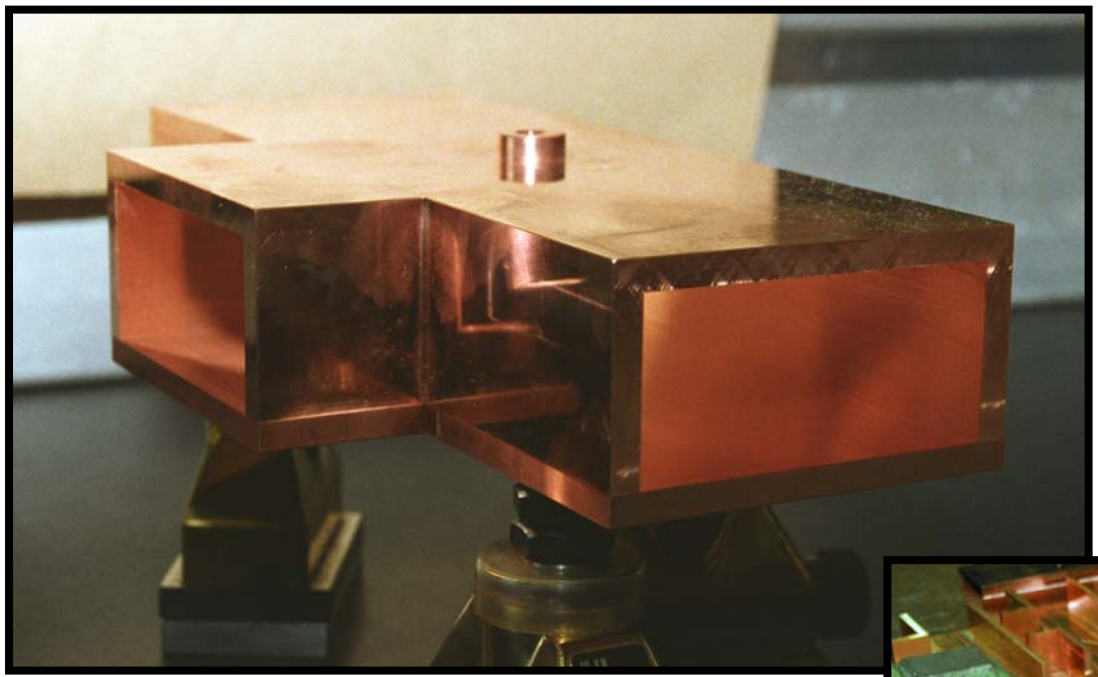


From last collaboration meeting, 12-Jun-02

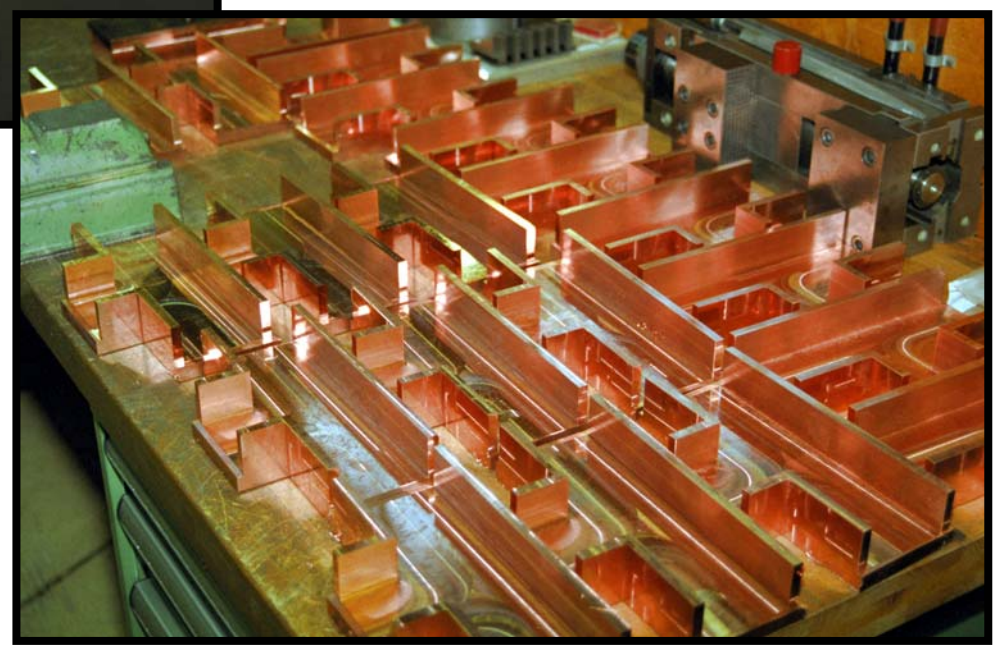


H-plane power splitters
(1 needed per acc. section)

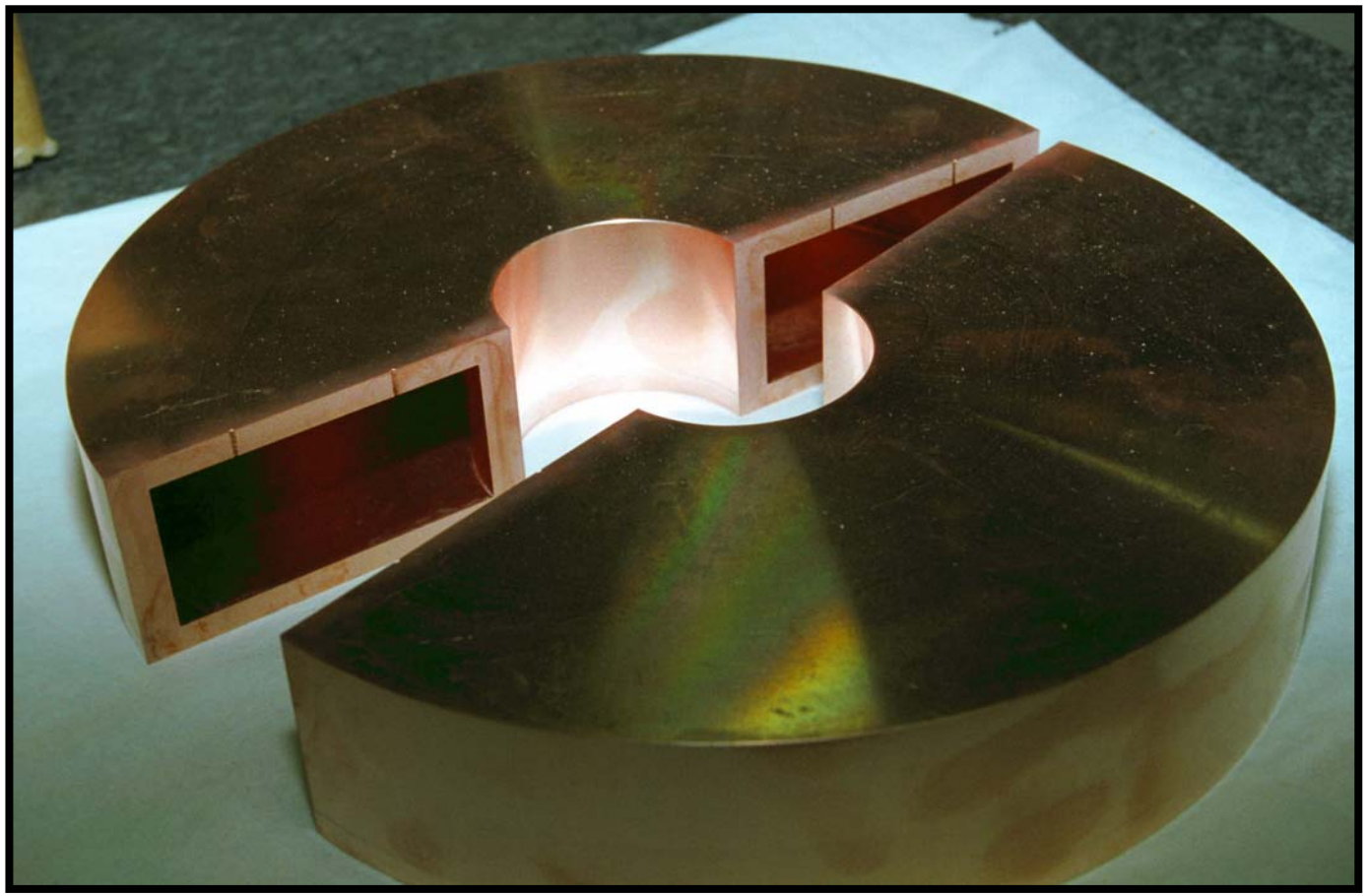
20 H-plane Splitters



- In fabrication @ CERN
- On schedule!

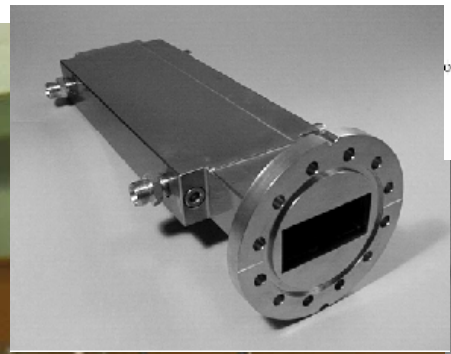


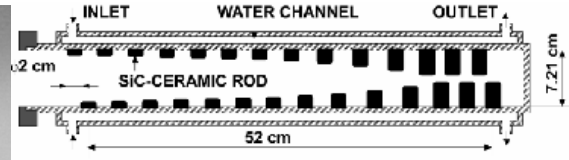
40 H-plane 180° bends

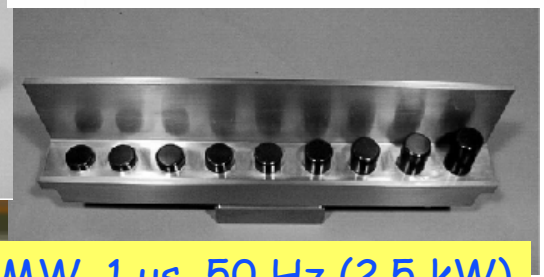


- The Series is in fabrication @ CERN
- On schedule!

Inspiration: "Matsumoto"-Load (PAC '99)





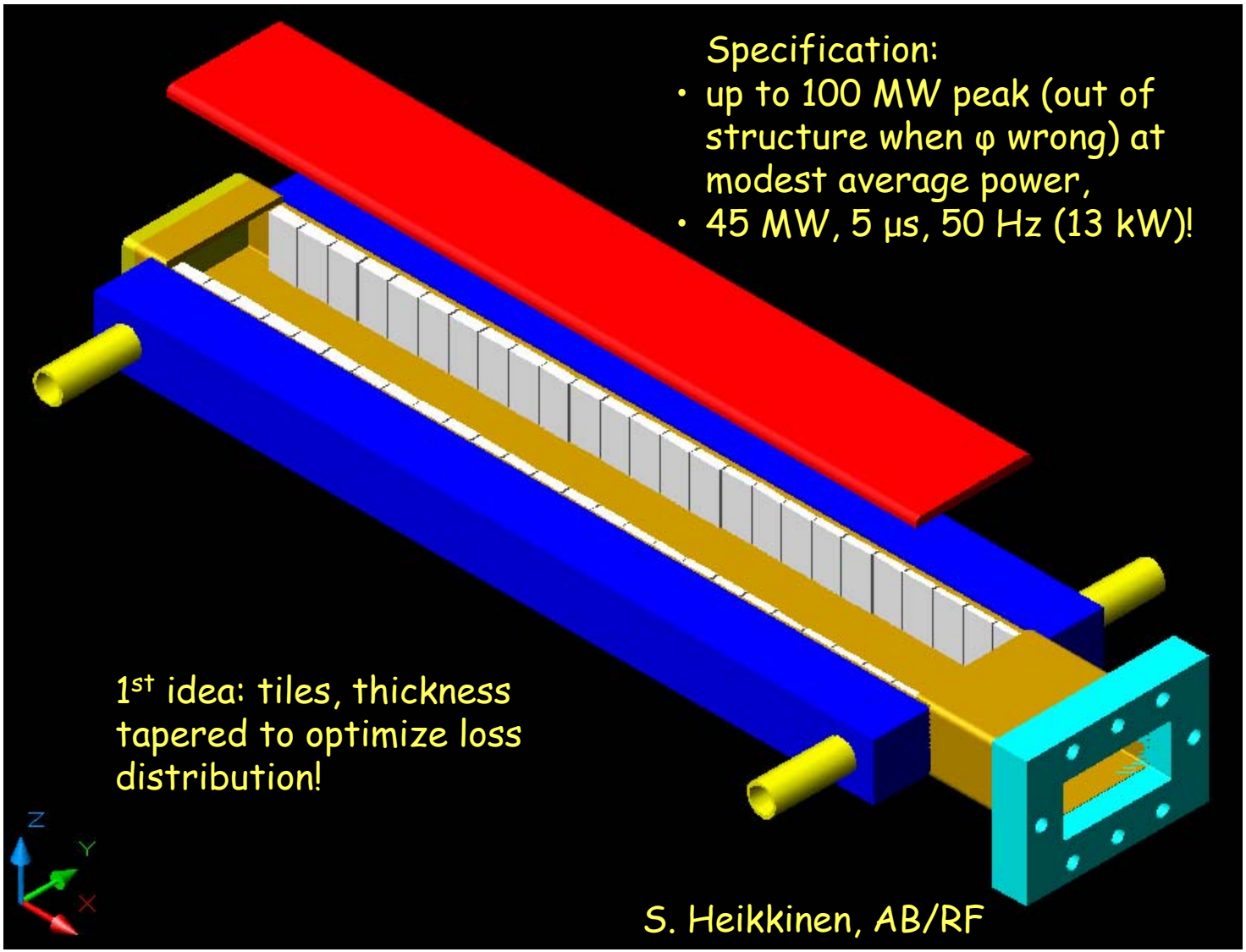


tested at 50 MW, 1 µs, 50 Hz (2.5 kW)

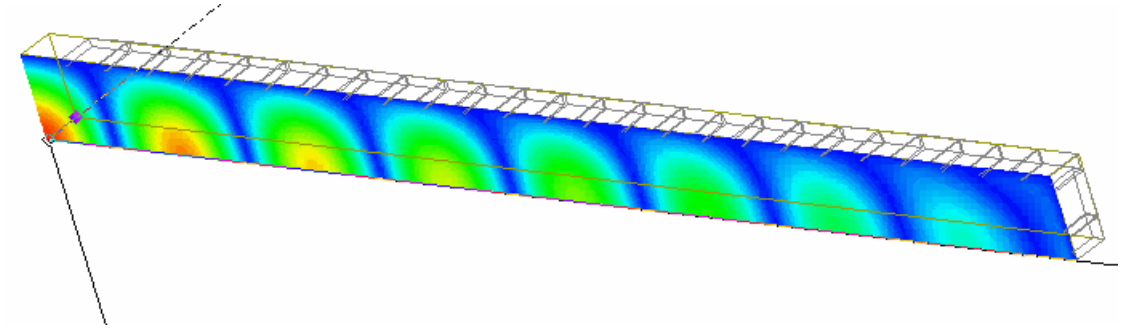
seen at Postech, Pohang, S.-Korea

S. Döbert, now SLAC

High Power Load: SiC tiles

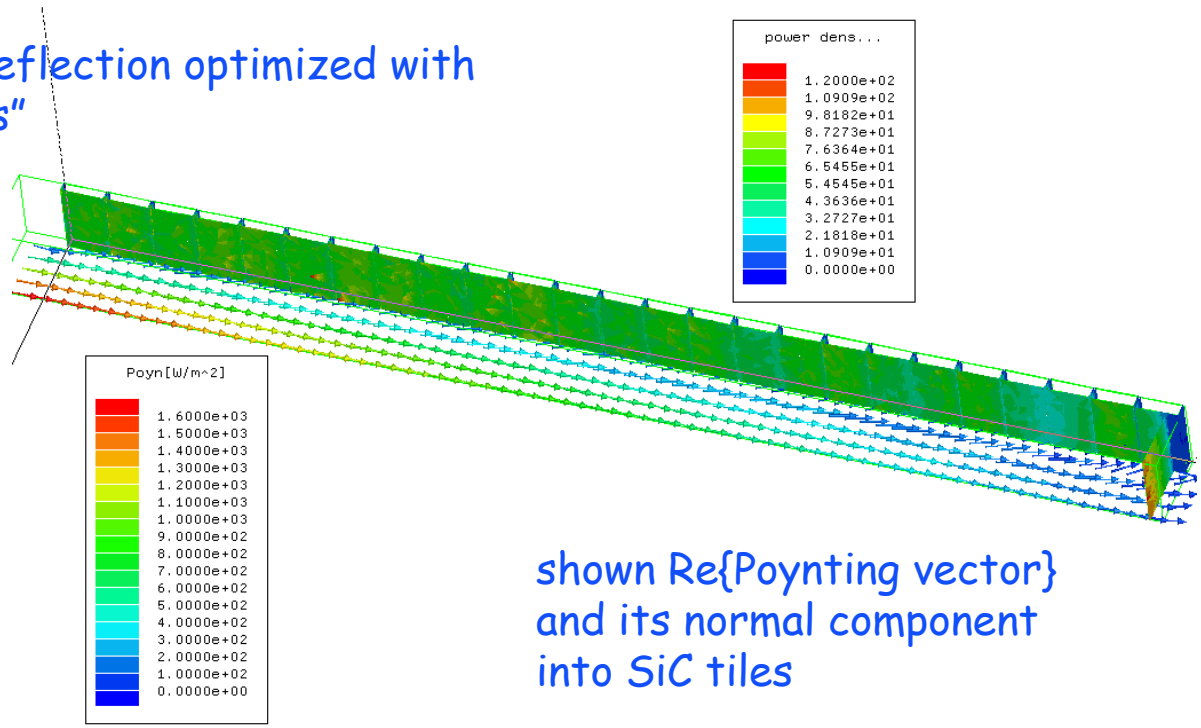


Power distribution



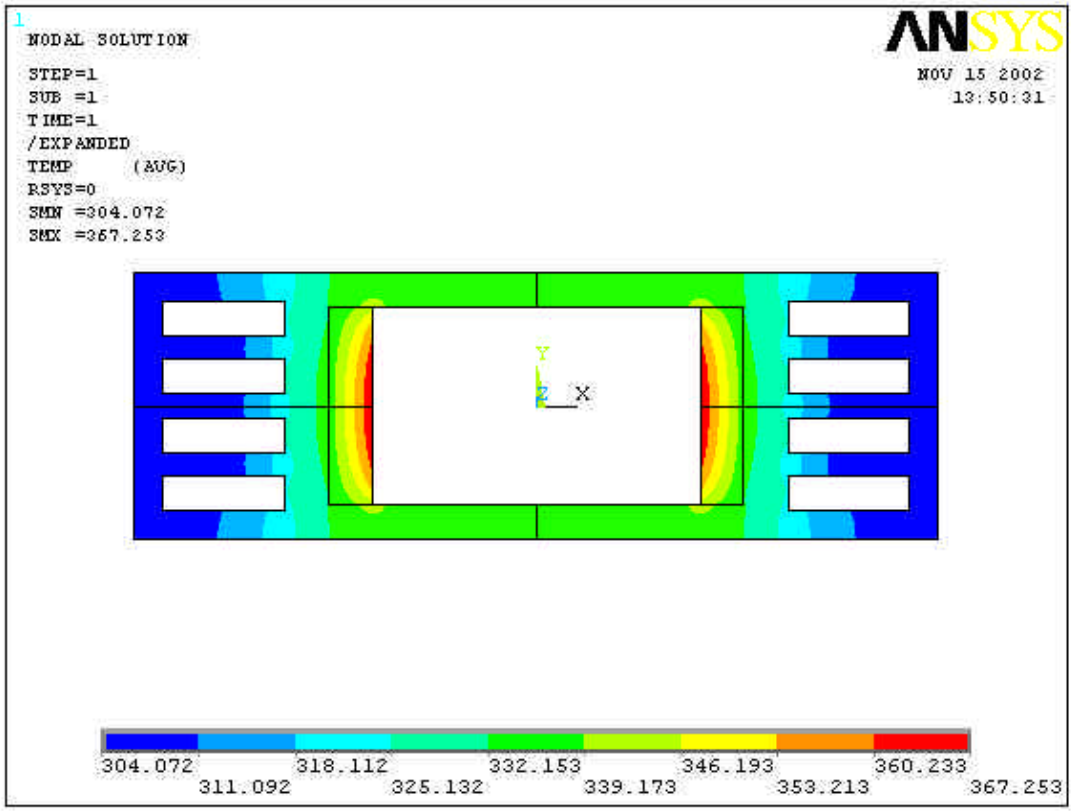
shown: E-field amplitude

Loss distribution and input reflection optimized with Ansoft HFSS & "Optimetrics"



shown Re{Poynting vector} and its normal component into SiC tiles

Heat transfer from tiles to cooling water



Assumptions:

Constant heat flux into SiC tiles, 445 W/tile (70 W/cm^2).

Convective heat transfer on the cooling channel surface.

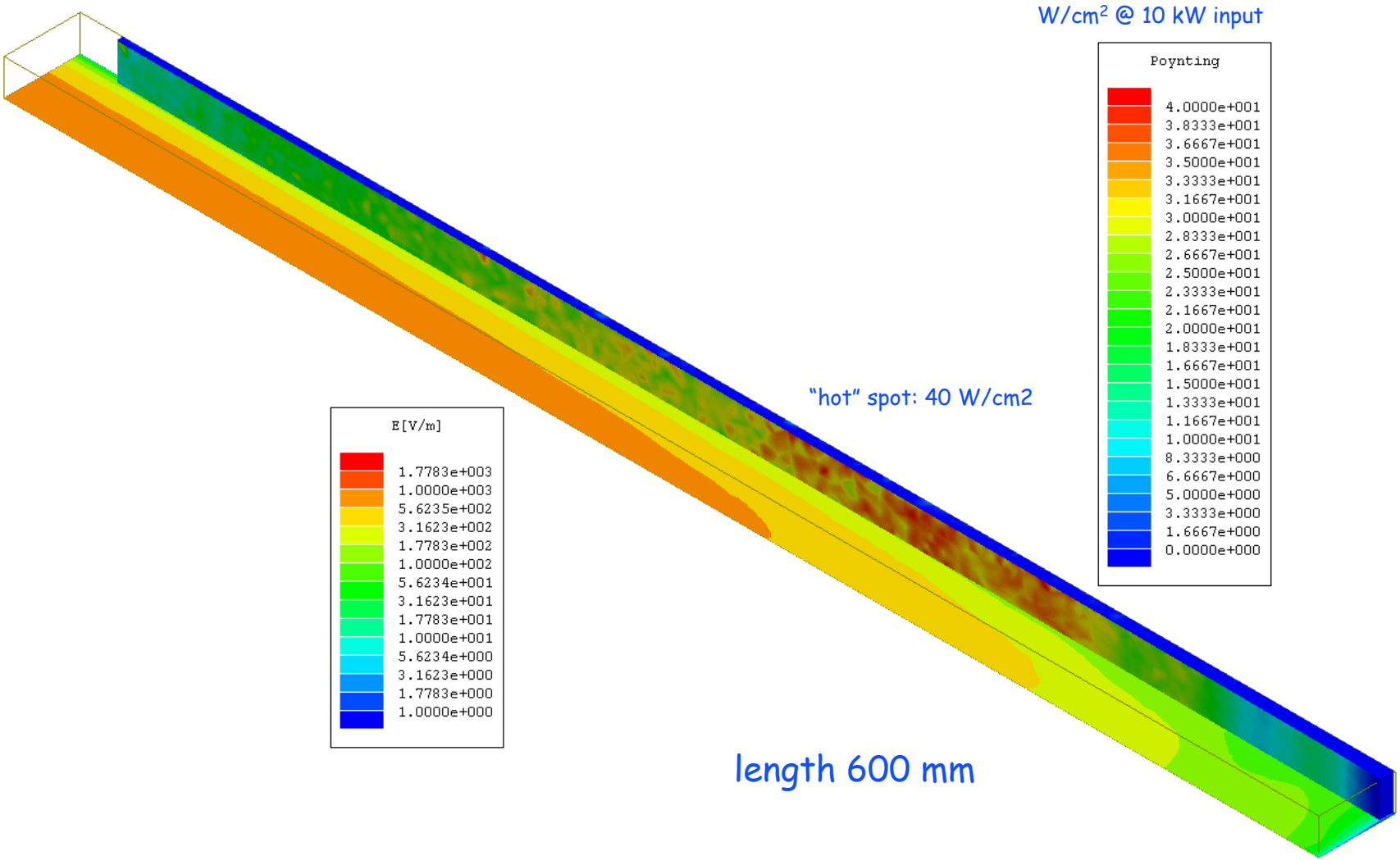
Water temperature:
300 K.

Water flow:
8 x 0.252 l/s.

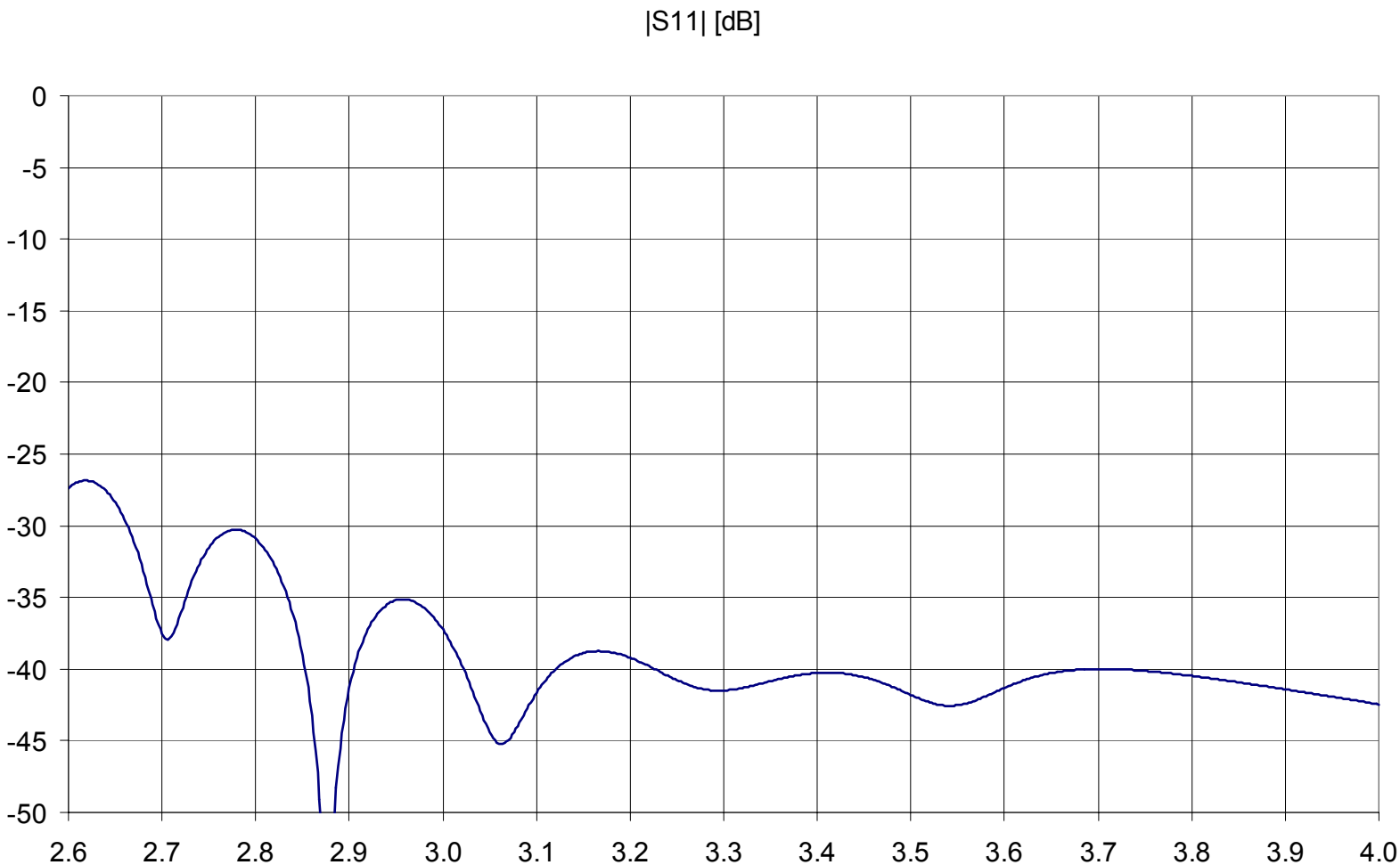
Heat transfer coefficient:
9.7 10^{-3} W/(mm^2 K).

S. Heikkinen, AB/RF

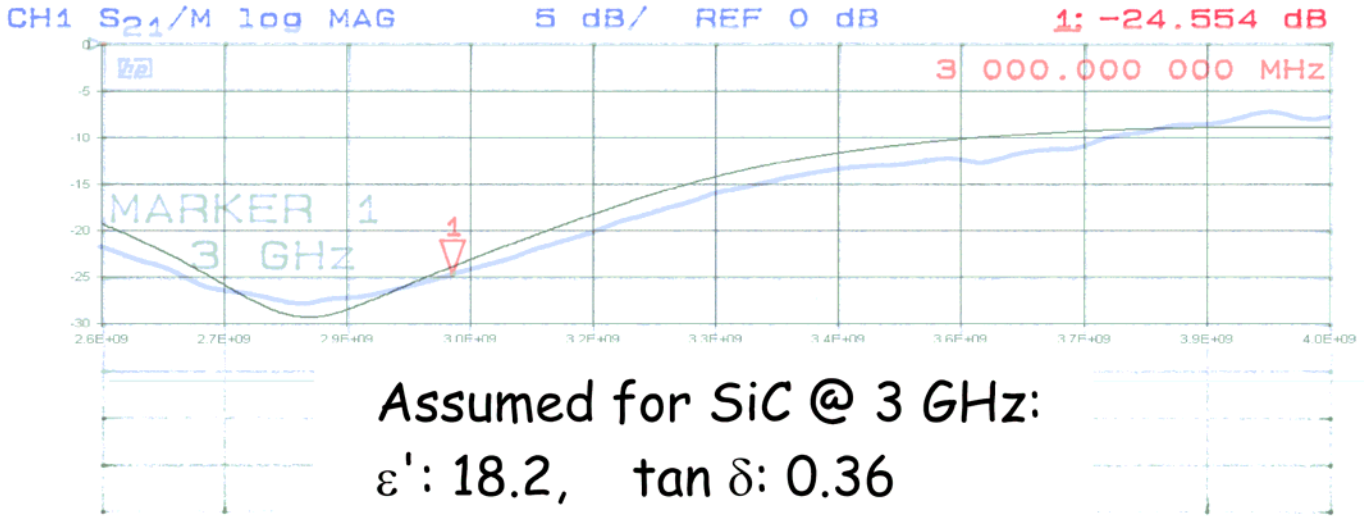
SiC slab (can be brazed at 220 °C)



Input reflection



"Measurement" of ε and tan δ



Assumed for SiC @ 3 GHz:

ε': 18.2, tan δ: 0.36