

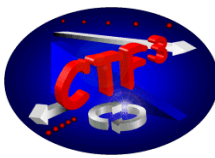


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- Feb-00: successful TDS high power tests,
- May-00: re-considering slotted iris structure,
- Jul-00: SI CA – combining slotted iris with constant aperture
- 22-Nov-00: Market Survey started (SI CA & TDS)
 - 30 European firms contacted, 6 interested and qualified to bid.
- 30-May-01: Invitation to Tender (SI CA & TDS)
 - 6 firms contacted, 4 positive answers
- 20-Aug-01: successful SI CA high power tests
- 23-Aug-01: Tender opening, structure type decided (SI CA)
- 19-Sep-01: Proposal through FC, letter of intent dispatched

- Apr-02: 1st full size prototype ready
- Apr-03: delivery of 18 SI CA structures

now



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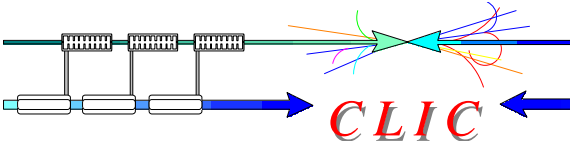
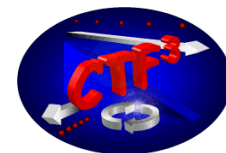
1. Full beam loading

allows for very high efficiency!

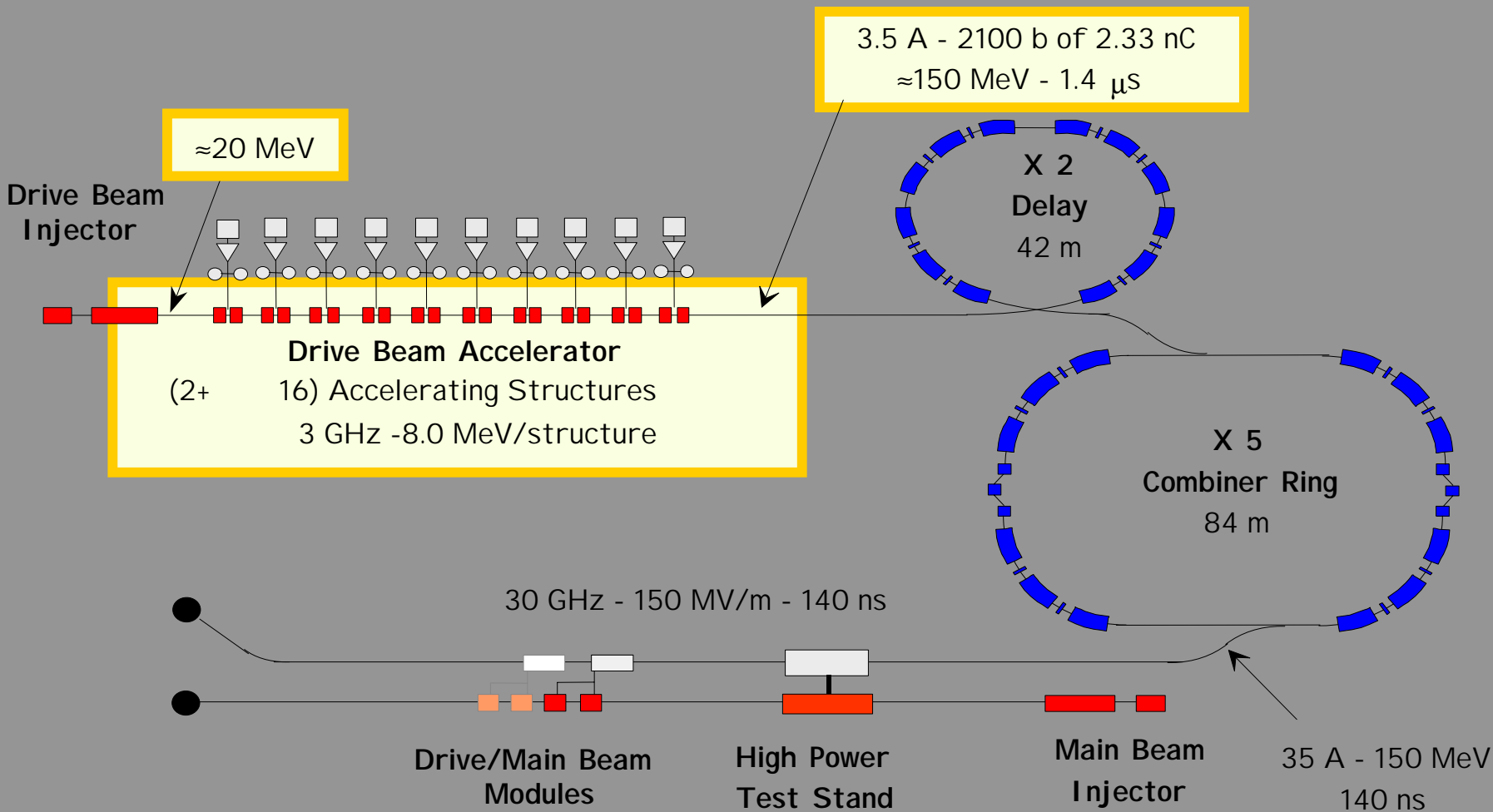
2. Transverse wakefields

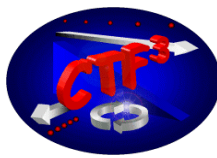
serious issue: beam current 3.5 A, 1.5 μ s!

CTF3 DBA

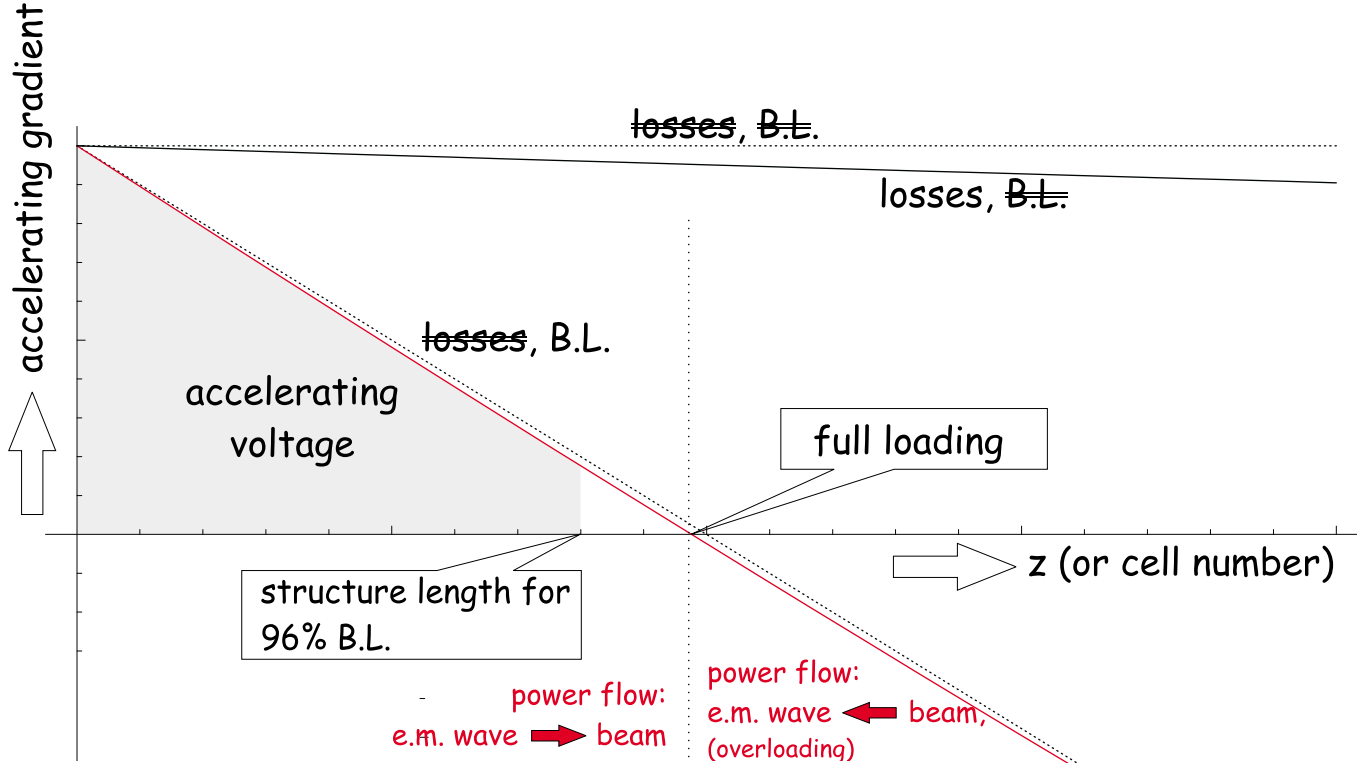


CTF3 - Test of Drive Beam Generation, Acceleration & RF Multiplication by a factor 10





Full beam loading



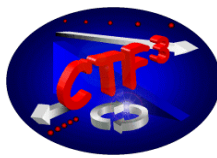
This illustration simplified for constant impedance

- initial gradient $\propto \sqrt{P_{in}}$
- overloading if
 - current too high, or
 - input power too small, or
 - structure too long.

“smooth” approximation:

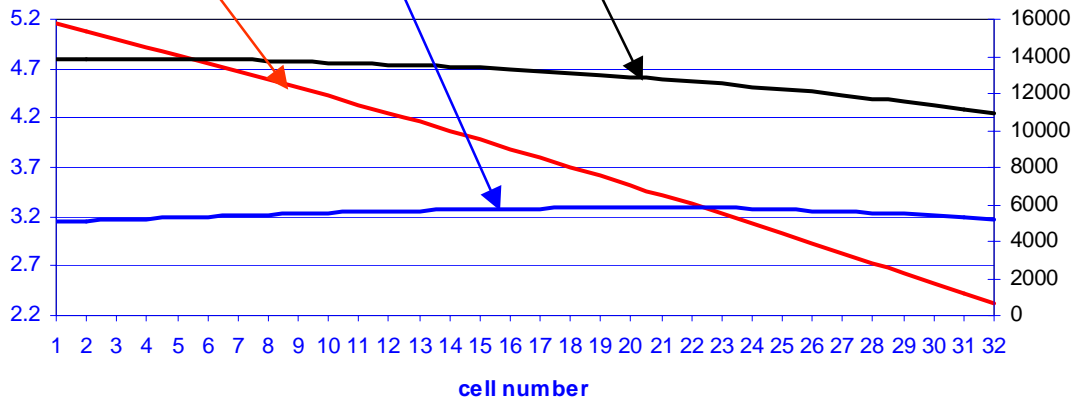
$$\frac{d}{dz} E_{acc} = -\frac{\omega}{2v_g} \frac{r}{Q} I_B - \frac{\omega}{2v_g} \frac{1}{Q} E_{acc}$$

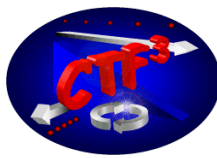
"nominal" case - 32 cells



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cell#	vg[% c]	R'/Q[kΩ/m] (Linac def.)	Q	P_{in} [MW]	P_{out} [MW]	P_{loss} [MW] accum.	P_B [MW] accum.	W[mJ]	V[kV]	V[MV] accum.
1	5.155	3.145	13868	30.00	28.68	0.09	1.24	63	353.39	0.353
4	4.918	3.176	13871	26.09	24.83	0.33	4.85	58	338.69	1.384
7	4.674	3.206	13874	22.36	21.16	0.55	8.29	52	322.72	2.369
10	4.421	3.235	13645	18.83	17.70	0.74	11.56	46	305.35	3.303
13	4.160	3.260	13488	15.51	14.45	0.92	14.63	40	286.16	4.181
16	3.891	3.279	13273	12.41	11.44	1.07	17.49	34	264.80	4.997
19	3.614	3.289	12994	9.58	8.69	1.20	20.10	28	240.85	5.744
22	3.328	3.288	12644	7.03	6.24	1.31	22.45	22	213.86	6.413
25	3.035	3.273	12220	4.79	4.13	1.39	24.48	16	183.19	6.995
29	2.632	3.225	11539	2.39	1.90	1.47	26.64	9	135.29	7.610
32	2.320	3.164	10941	1.07	0.74	1.50	27.76	4	92.81	7.933

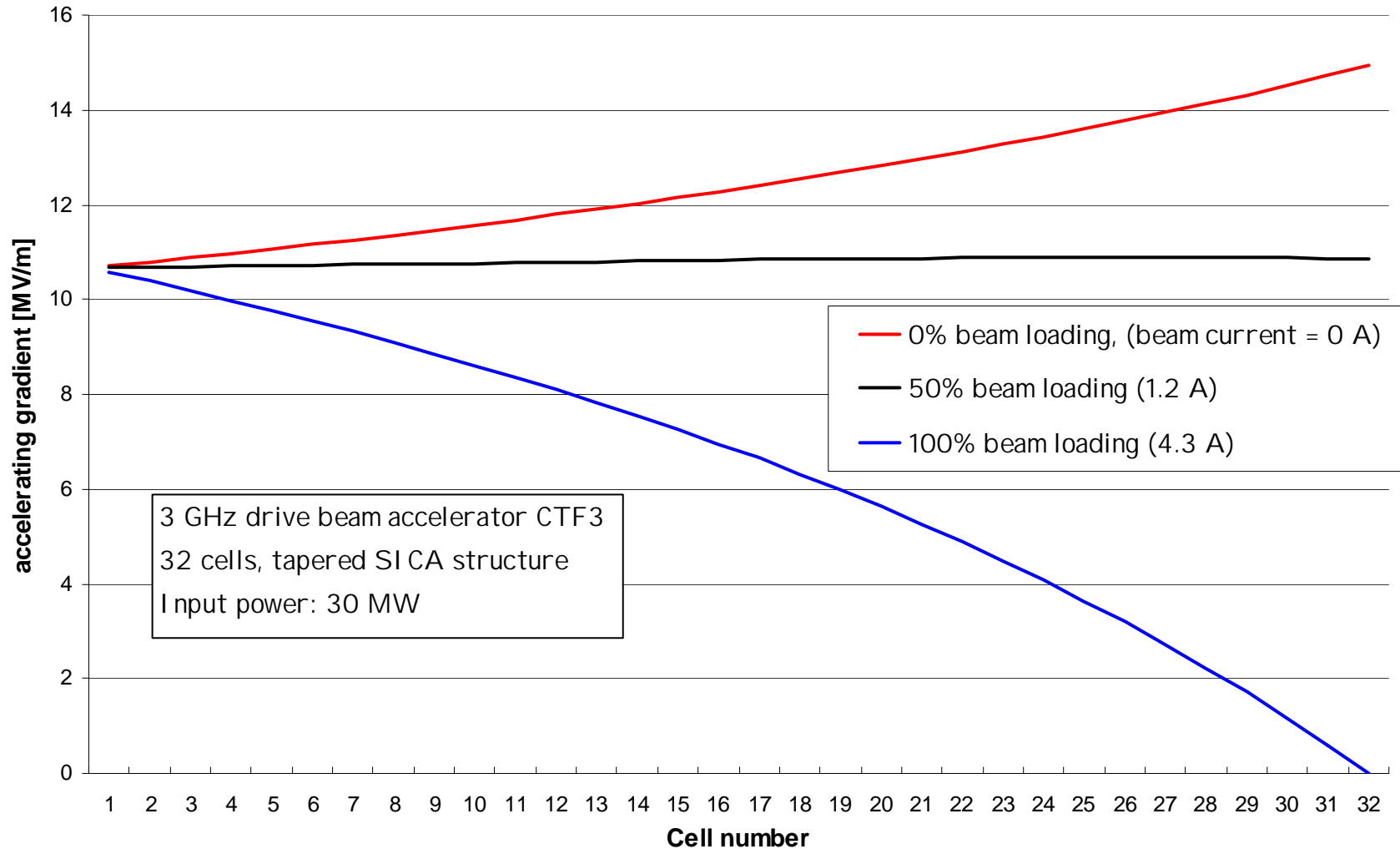




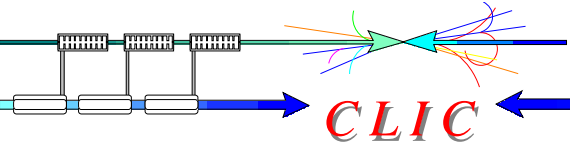
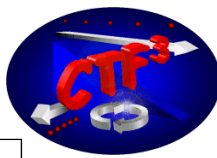
acc. gradient dependance on beam current

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Illustration of "full" beam loading



"nominal" case - 32 cells



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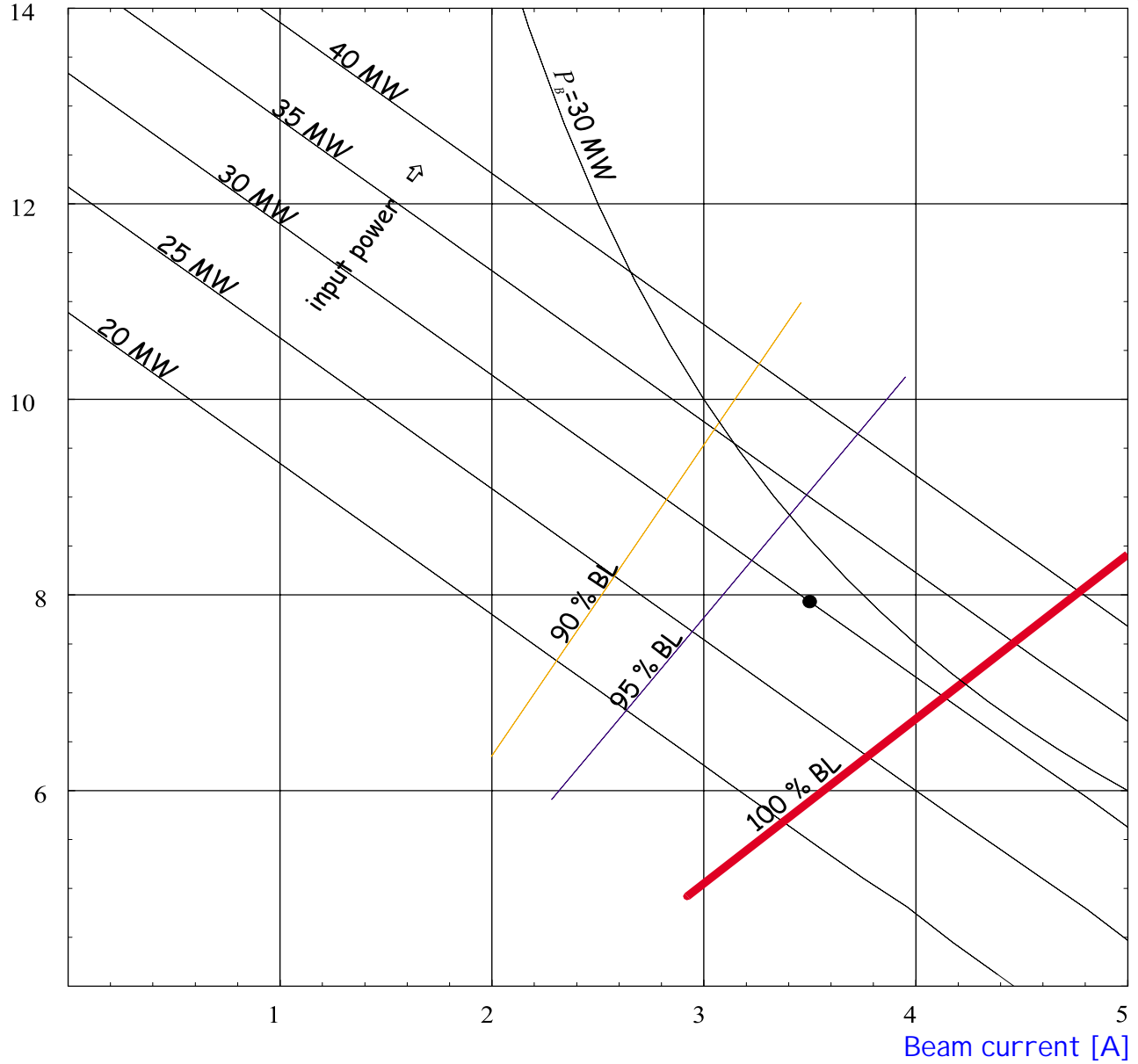
Acceleration
[MeV]

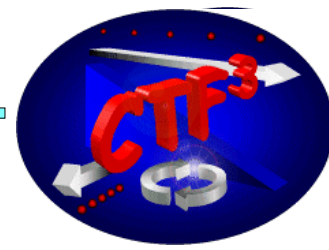
nominal w/o coupler cells:

- 7.93 MeV,
- $\eta = 92.5 \%$,
- $\kappa = 97.4 \%$,
- $\tau = 98.6 \text{ ns}$

with coupler cells:

- 7.97 MeV
- $\eta = 93 \%$,
- $\kappa = 97.9 \%$
- $\tau = 100.4 \text{ ns}$





Transverse wakefields - two solutions

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SICA (slotted iris - constant aperture)

TDS (tapered damped structure)

Detuning method:

varying nose cones ($a = 17$ mm, nose = 0 ... 4.66 mm),
constant (large) aperture \Rightarrow low short range wake

iris variation ($a = 17$... 13.3 mm), wide detuning

Mode selection (selectively damp HOM's, but not the fundamental !):

geometric type (uses field symmetry)

filter type

radial iris slots couple dipole modes to SiC loads
placed in corrugated waveguides.

waveguides with cutoff > 3 GHz to couple HOM's to
SiC loads.

Calculated damping of 1st dipole:

$$Q \approx 5$$

$$Q \approx 18$$

Construction:

external diameter 174 mm, compact, round.

larger external diameter 460 mm, possibility to
access SiC after brazing

Status (October 2001):

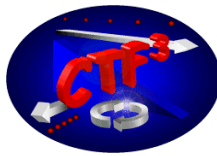
4 cell prototype tested (35 MW),
full size prototype being built

prototype ready, high power tested up to
40 MW.

Potential issues:

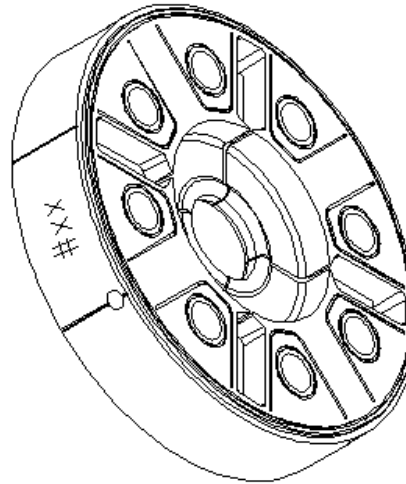
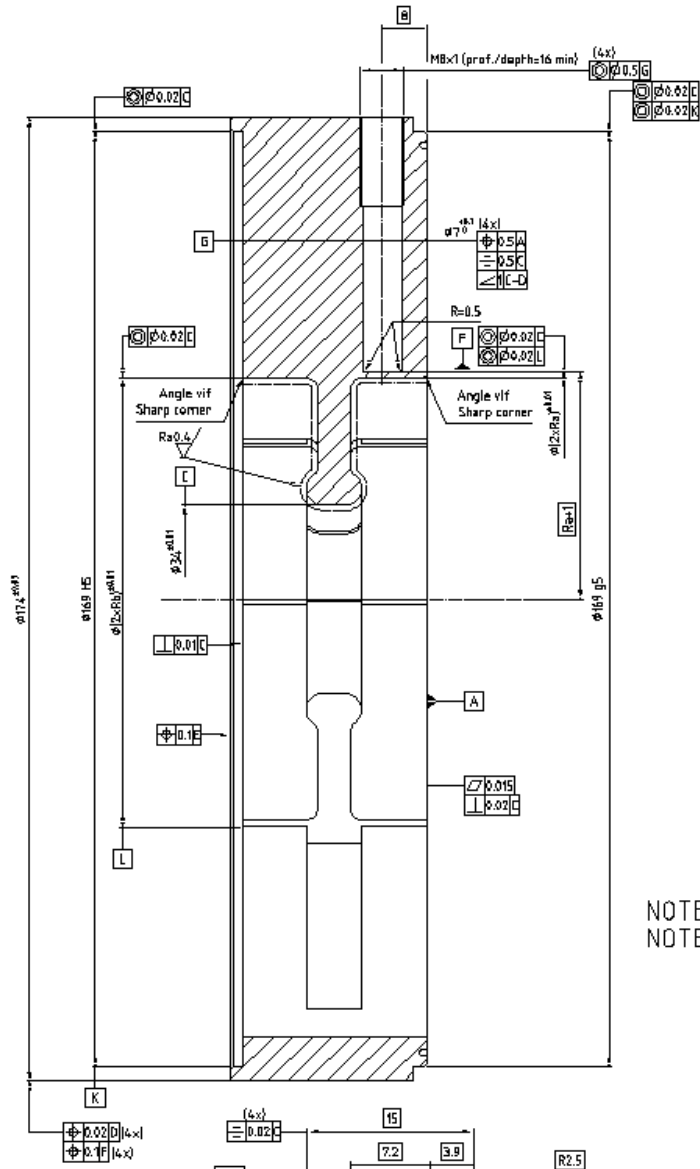
field enhancement (1.3) near slot

fabrication(?), handling(?)



SICA excerpt tech. drawing

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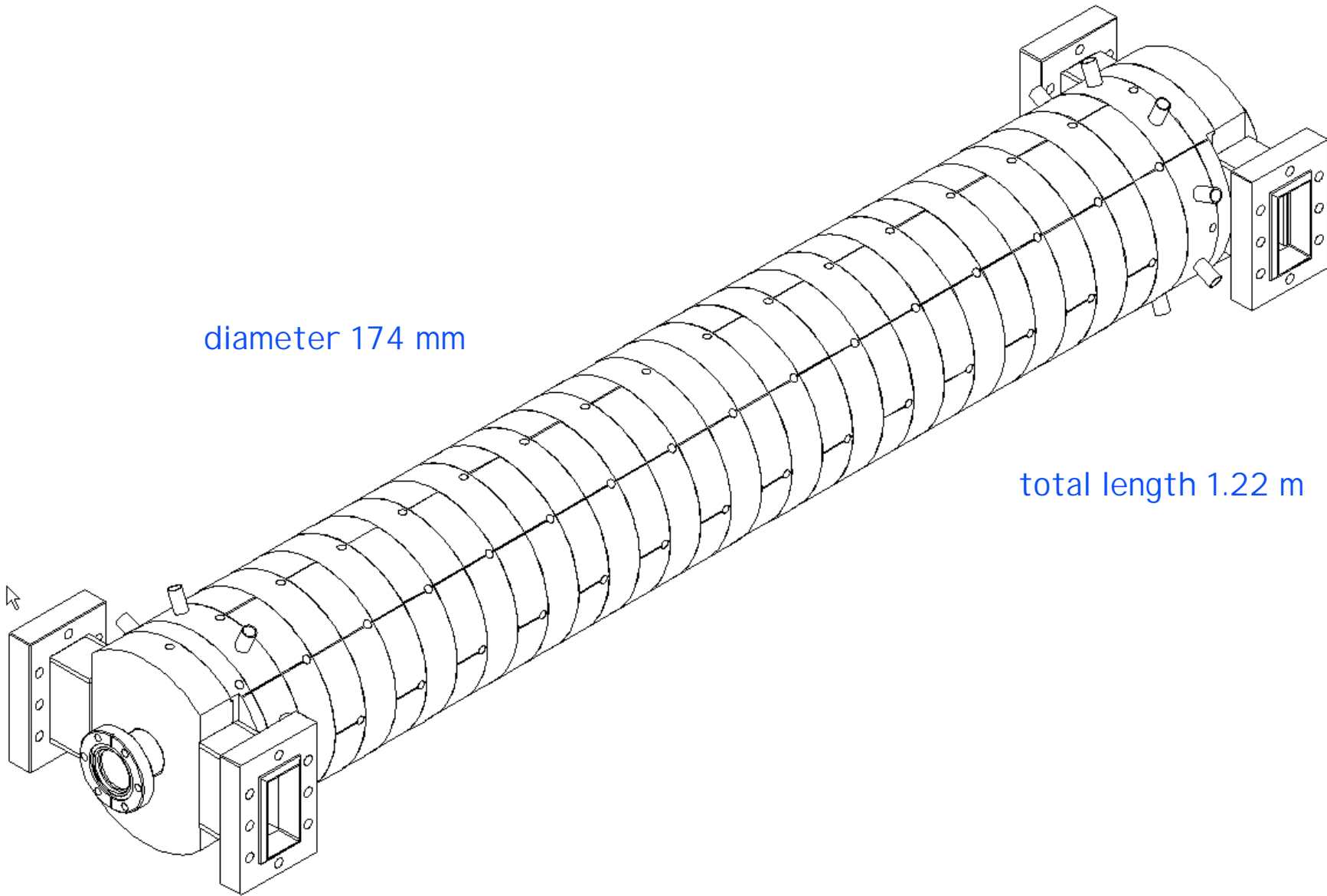
disc	Ra (mm)	La (mm)	Rb (mm)	Lb (mm)
#4	41.450	0.067	41.409	0.141
#5	41.409	0.141	41.362	0.222
#6	41.362	0.222	41.307	0.310
#7	41.307	0.310	41.246	0.406
#8	41.246	0.406	41.178	0.508
#9	41.178	0.508	41.105	0.616
#10	41.105	0.616	41.024	0.731
#11	41.024	0.731	40.936	0.852
#12	40.936	0.852	40.841	0.979
#13	40.841	0.979	40.740	1.112
#14	40.740	1.112	40.632	1.250
#15	40.632	1.250	40.517	1.393
#16	40.517	1.393	40.395	1.542
#17	40.395	1.542	40.267	1.695
////	////	////	////	////
#19	40.129	1.854	39.988	2.016
#20	39.988	2.016	39.836	2.184
#21	39.836	2.184	39.679	2.355
#22	39.679	2.355	39.515	2.530
#23	39.515	2.530	39.342	2.709
#24	39.342	2.709	39.162	2.891
#25	39.162	2.891	38.980	3.077
#26	38.980	3.077	38.787	3.266
#27	38.787	3.266	38.587	3.458
#28	38.587	3.458	38.381	3.653
#29	38.381	3.653	38.166	3.850
#30	38.166	3.850	37.949	4.049
#31	37.949	4.049	37.723	4.251
#32	37.723	4.251	37.489	4.455

NOTE : on the outside diameter of the disc (see #xx on the isometric view), engraved its number (NOTE : sur le côté diamètre extérieur (voir #xx sur la vue isométrique), graver son numéro (xx)

SICA - assembly

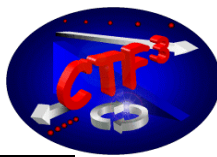


CLIC



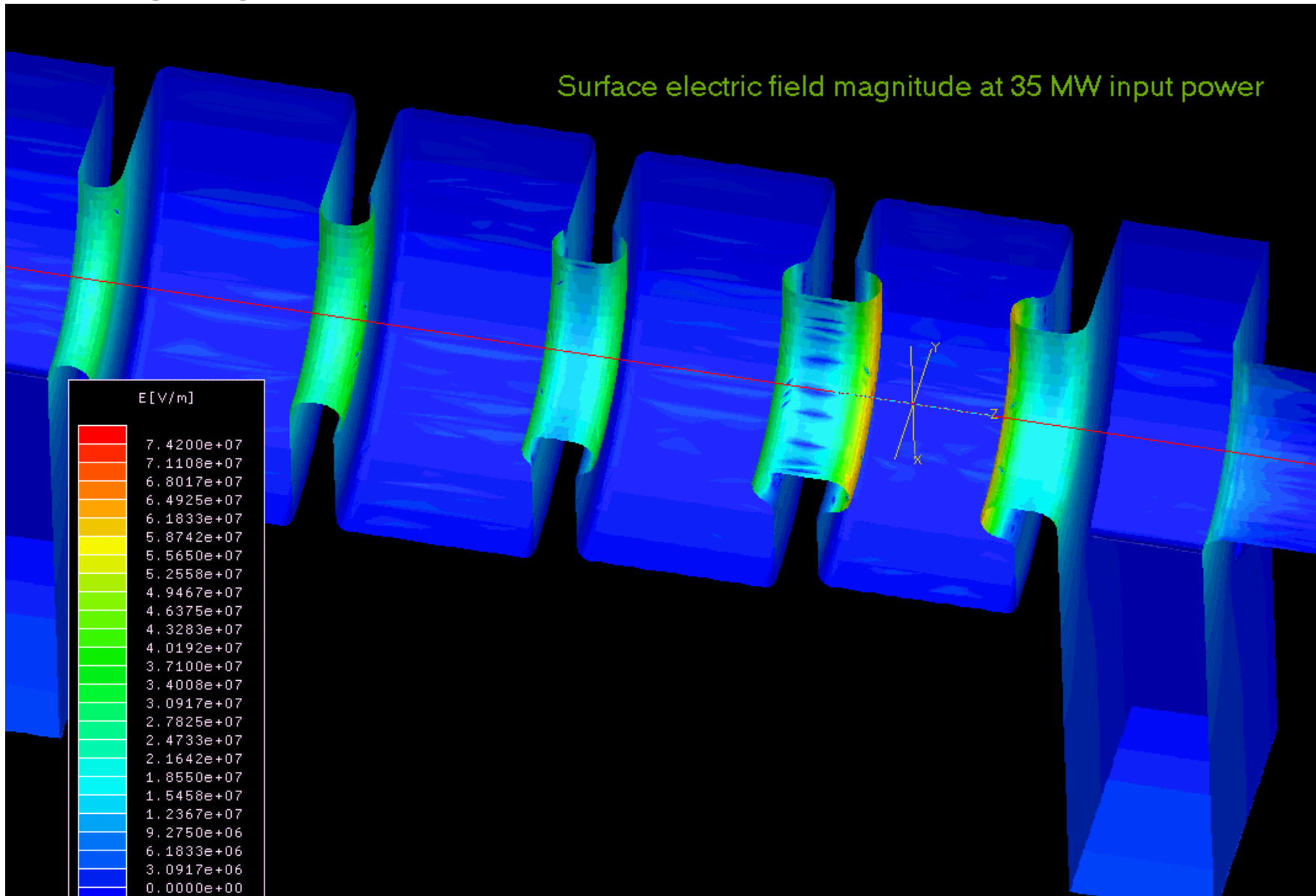
diameter 174 mm

total length 1.22 m

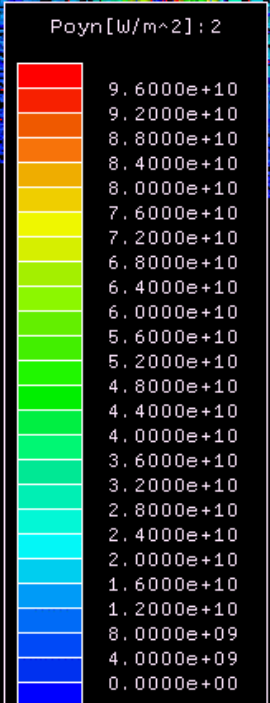
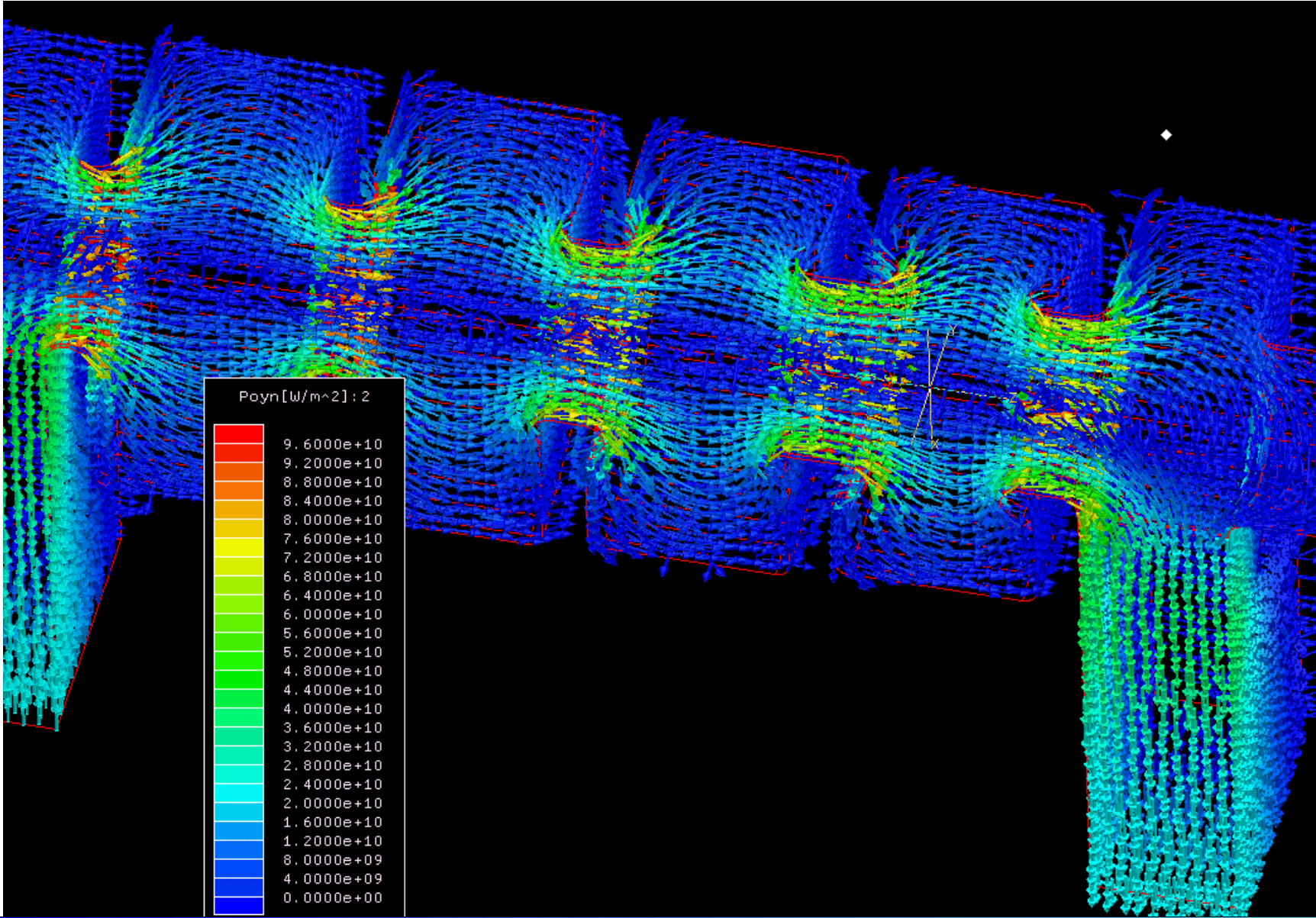
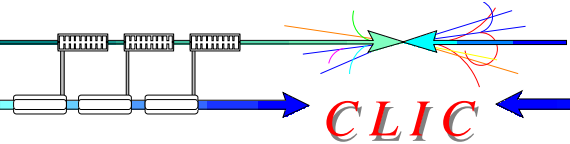
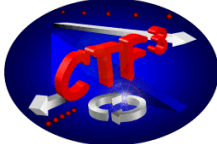


SICA - geometry and field distribution

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SICA - Poynting vector

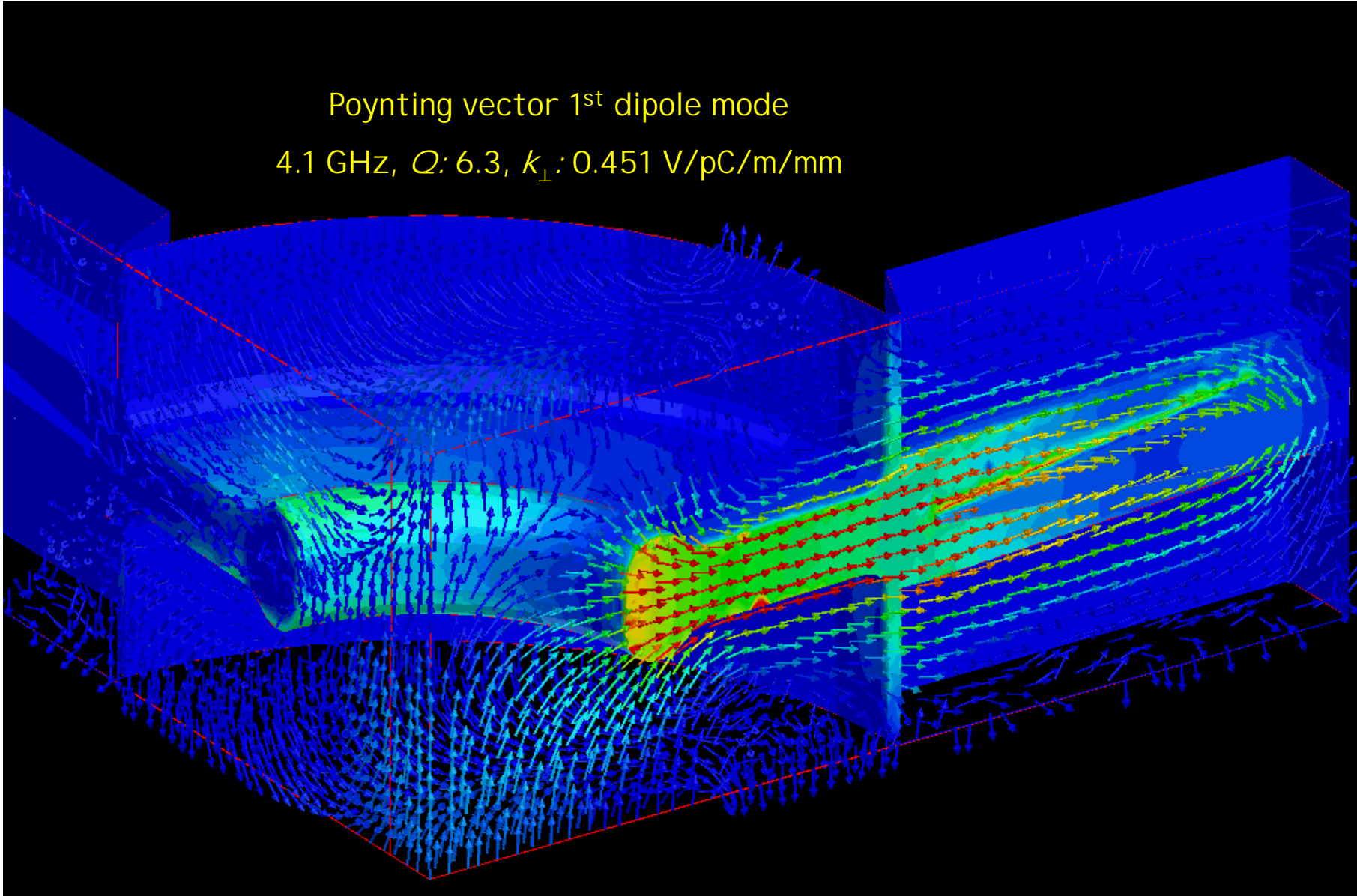




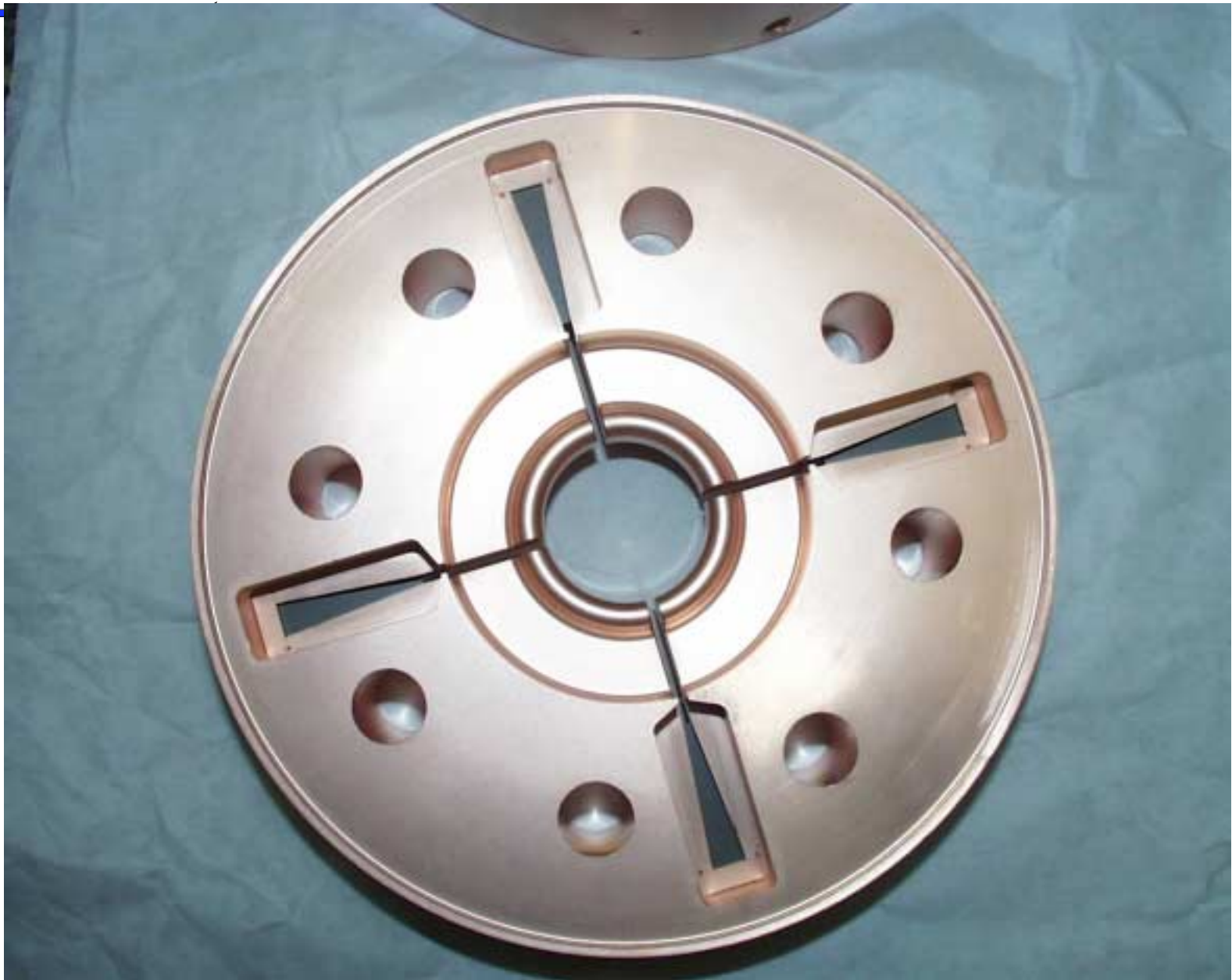
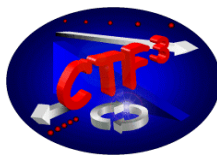
SICA - 1st dipole mode damping

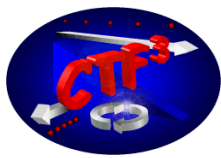
CLIC

Poynting vector 1st dipole mode
4.1 GHz, $Q: 6.3$, $k_{\perp}: 0.451$ V/pC/m/mm



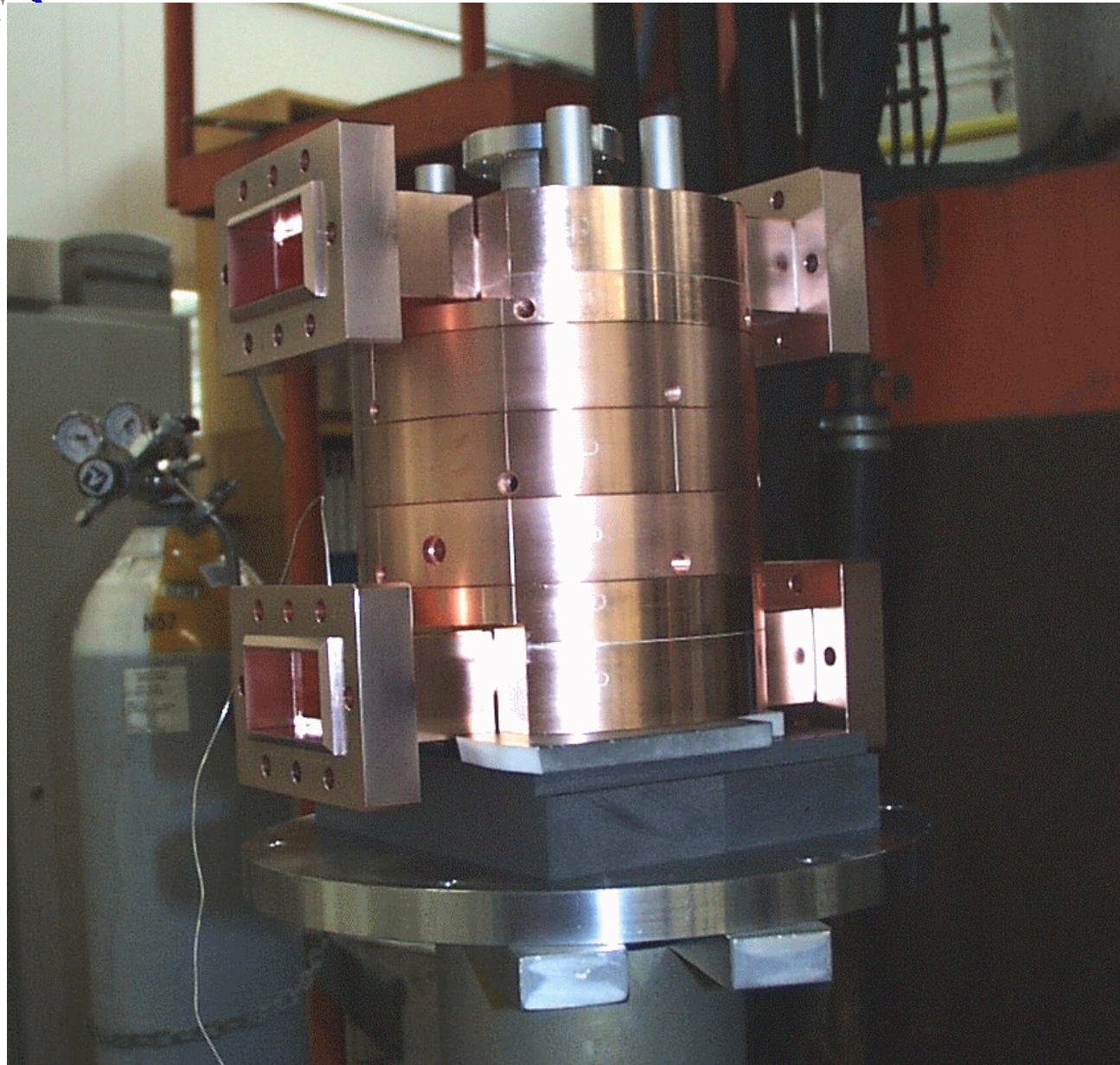
SICA - disc with SiC loads

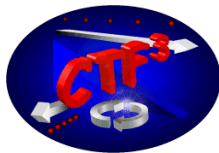




SICA - 4 cell prototype, brazing

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Bead-pull SICA

CLIC

CH1 S₁₁-M 30 mU FS

12

1: 50

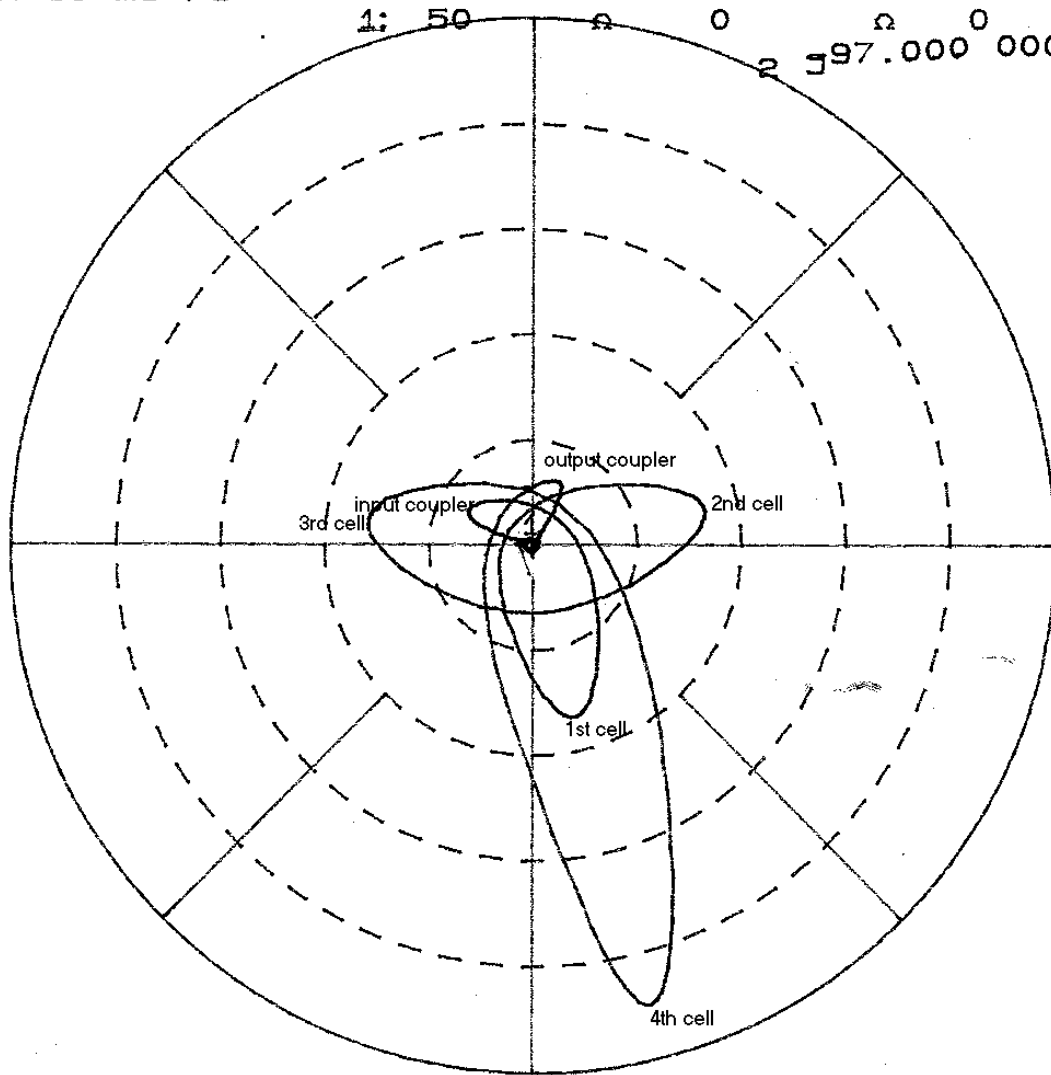
0

0

2

997.000 000 MHz

H1d

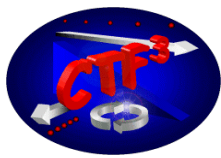


x2

CENTER 2 997.000 000 MHz

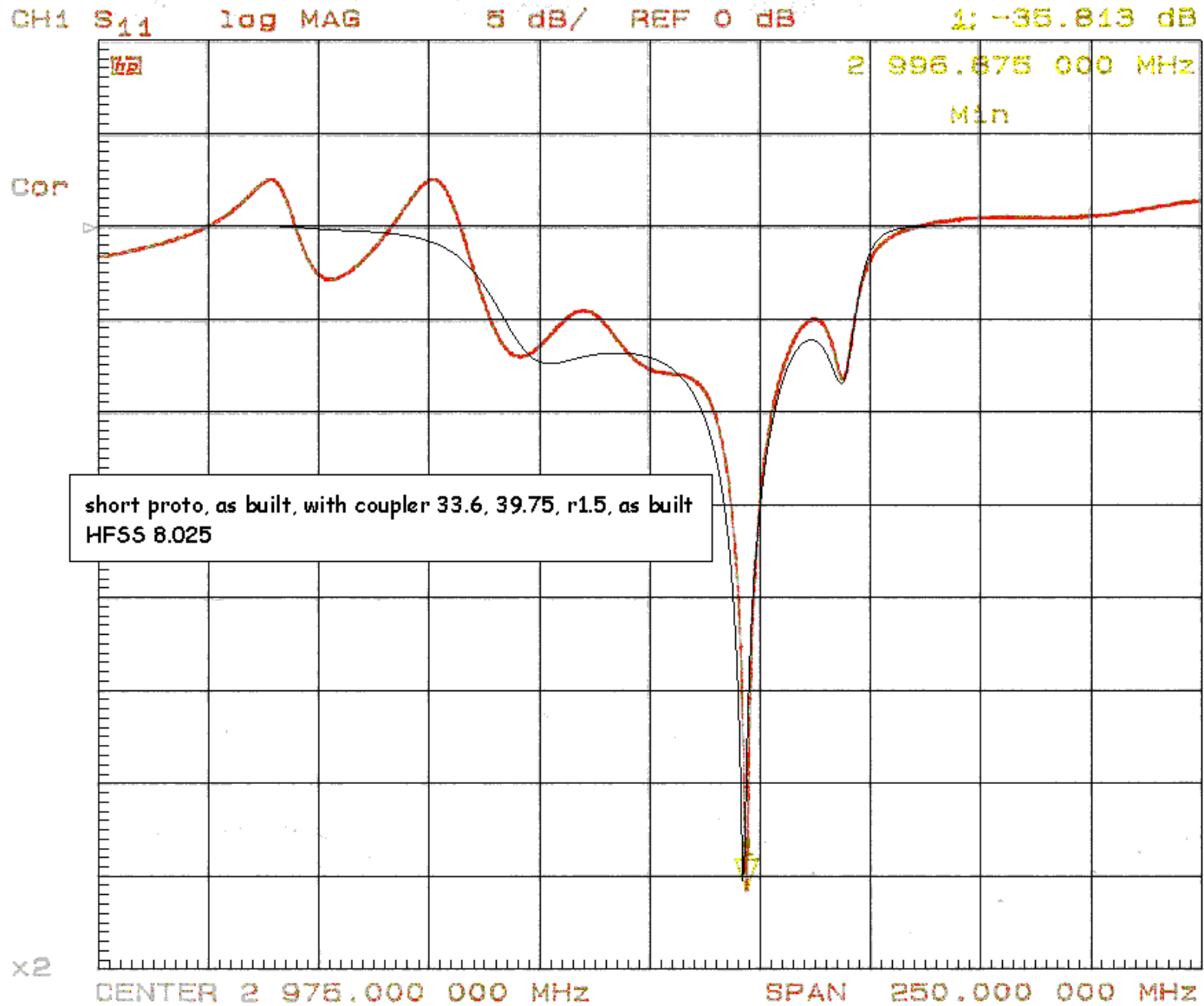
SPAN

0.000 000 MHz

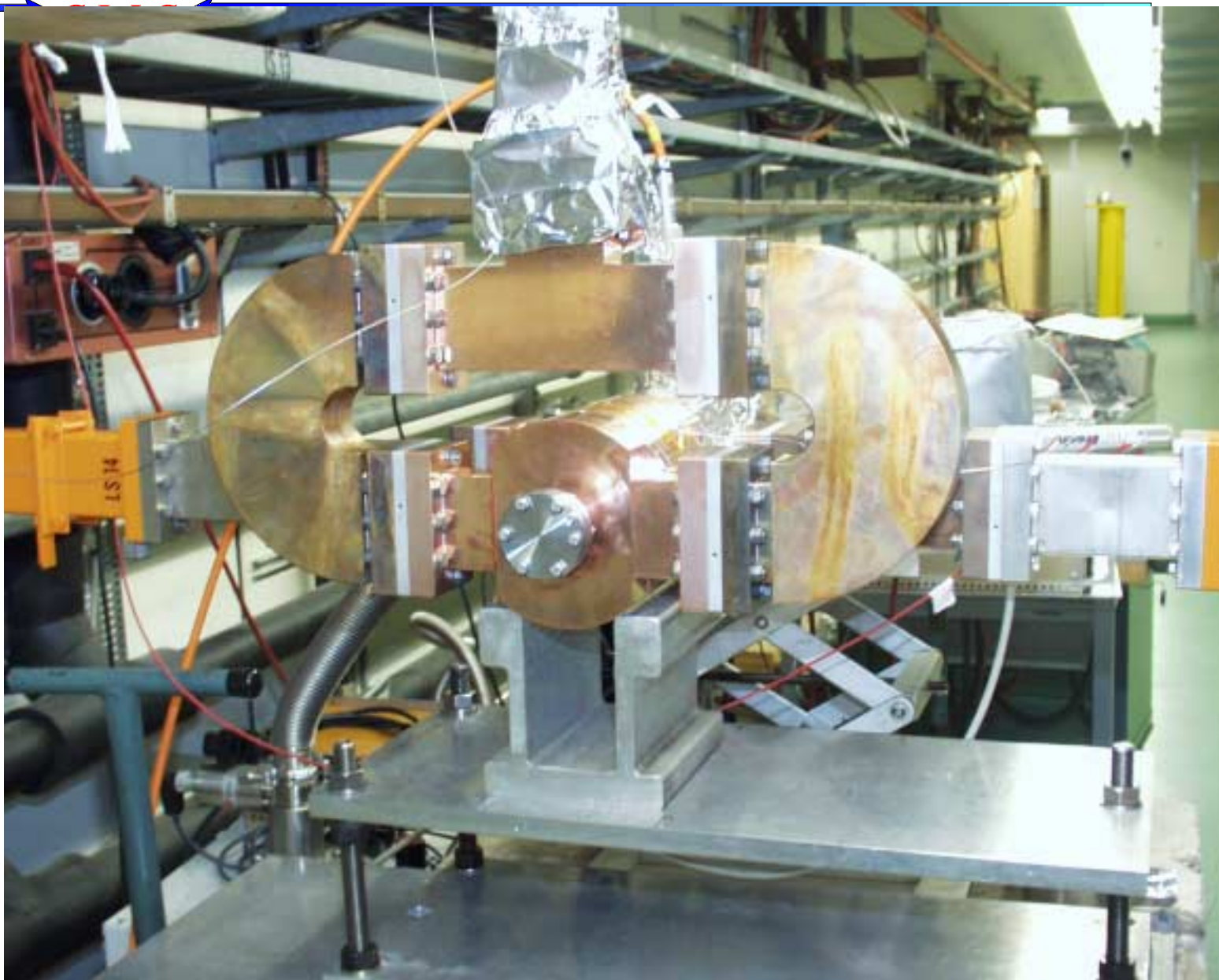
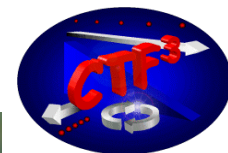


SICA: Input matching

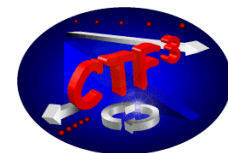
CLIC



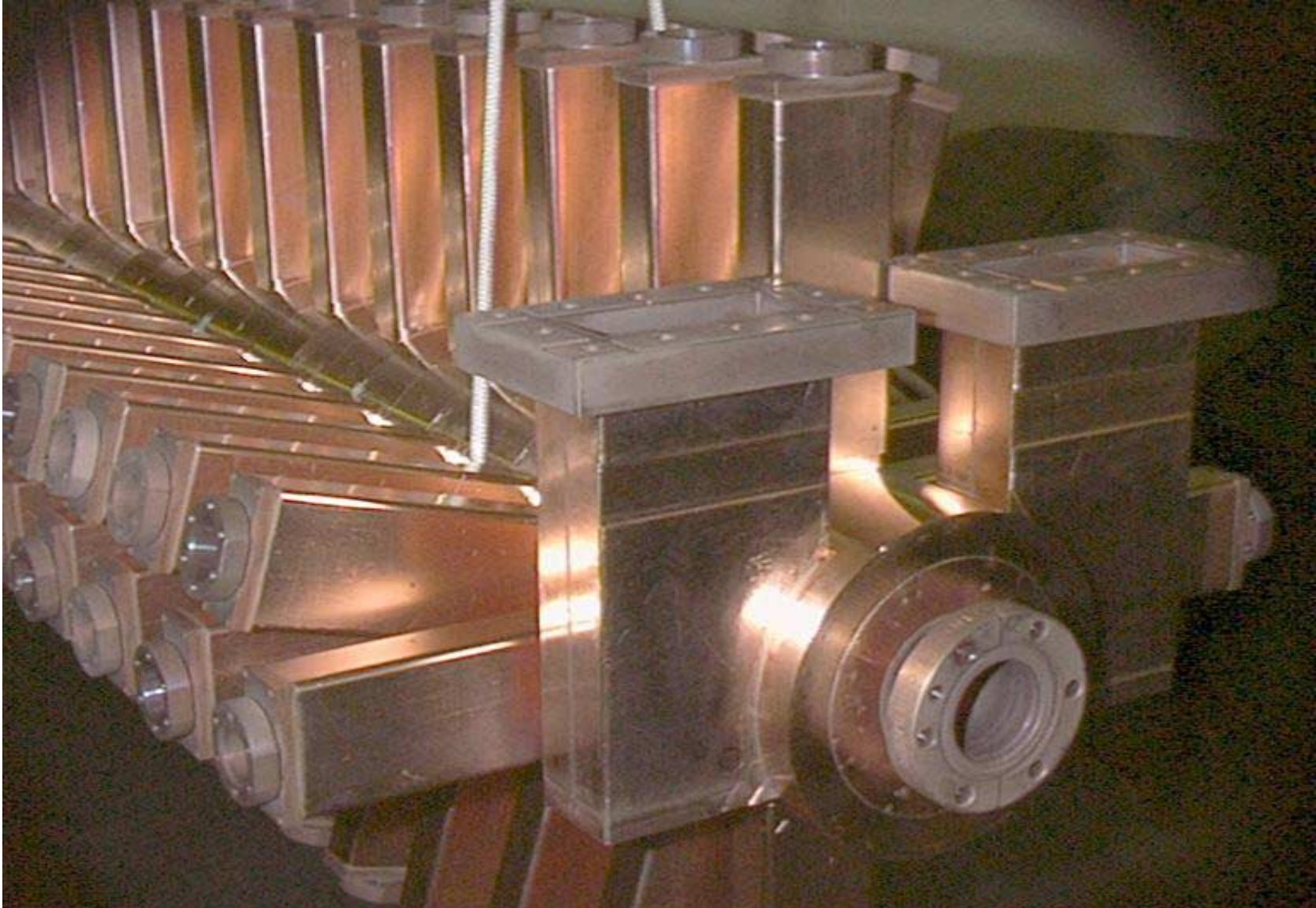
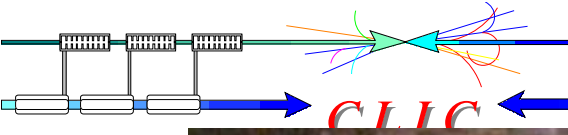
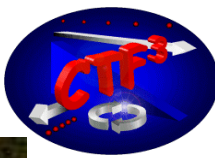
SICA high power test, 17-Aug-01

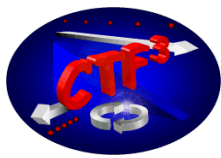


SICA high power test, 17-Aug-01

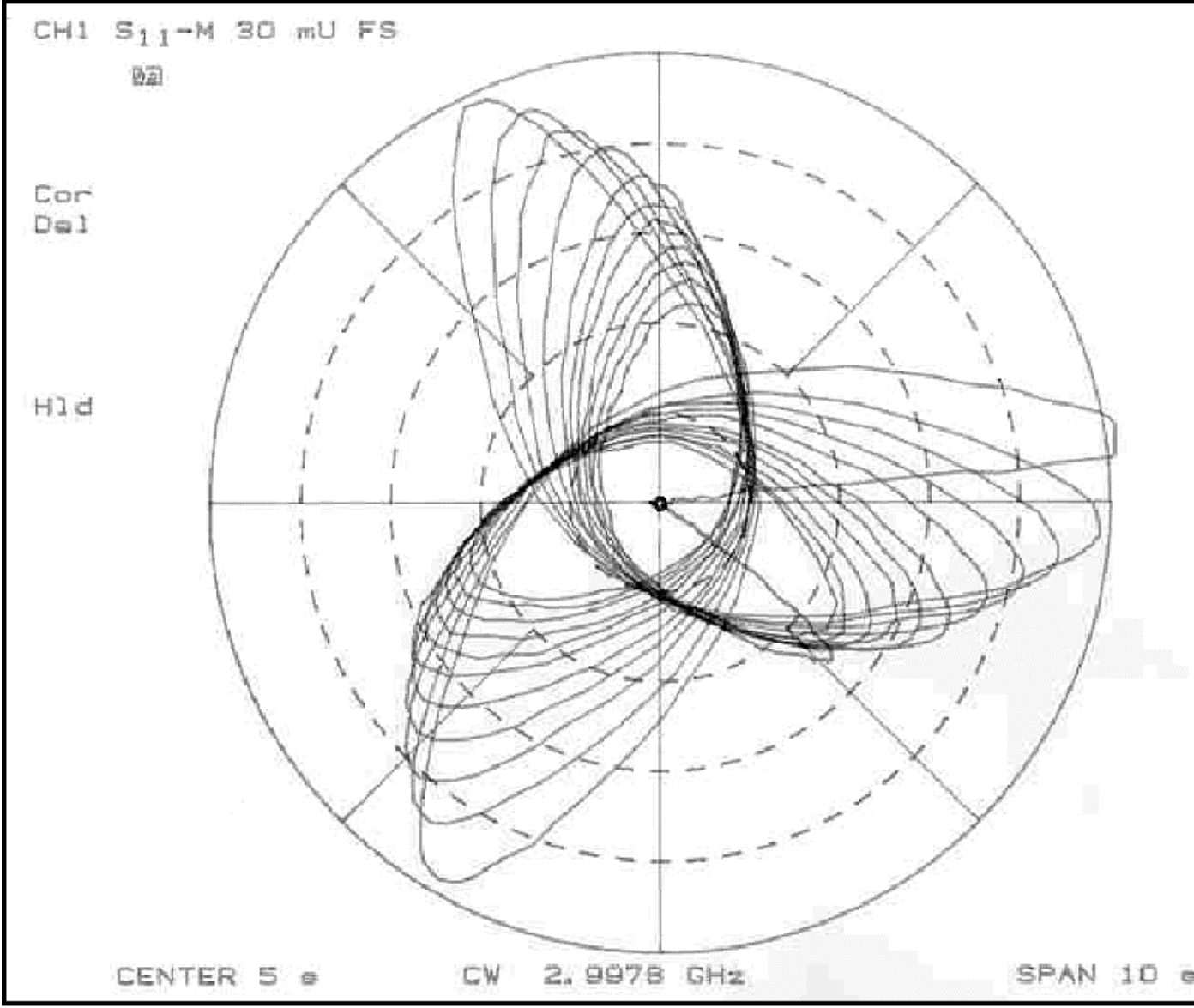
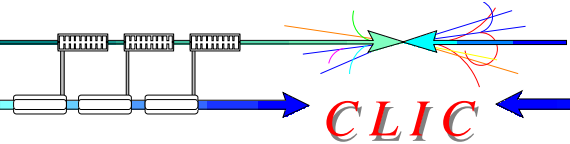


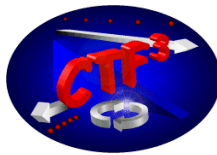
TDS prototype





Bead-pull measurement TDS

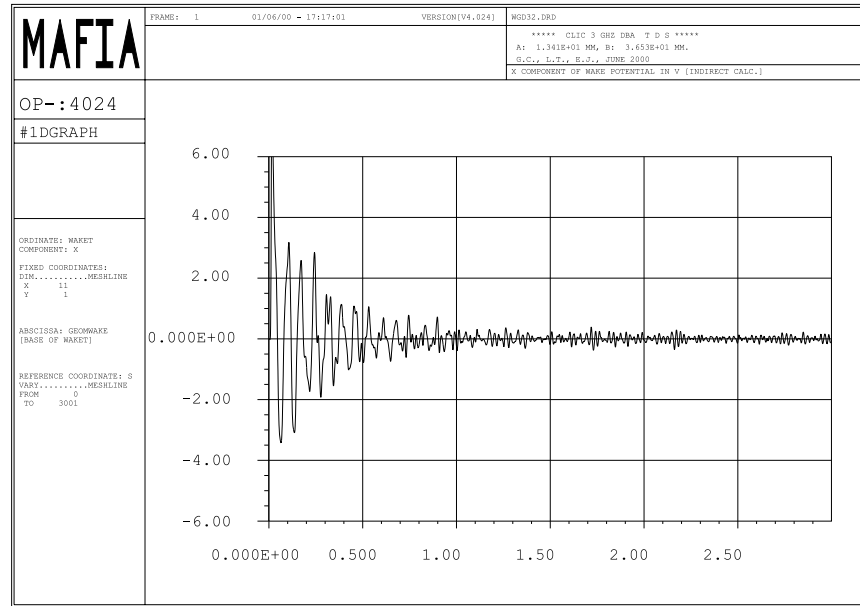




HOM damping performance:

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TDS, cell 32
⊥ wake, $\sigma: 2.5$ mm



SICA, cell 32
⊥ wake, $\sigma: 2.5$ mm

