

805 MHz Open Cell Cooling Channel Development

Tom Jurgens

Fermi National Accelerator Lab

November 9, 2000

Channel Research

- 805 MHz Cavity
- 5 Tesla SC Magnet

PROT stev.116 mu cavity 5 sigma; Resonant frequency= 804.999

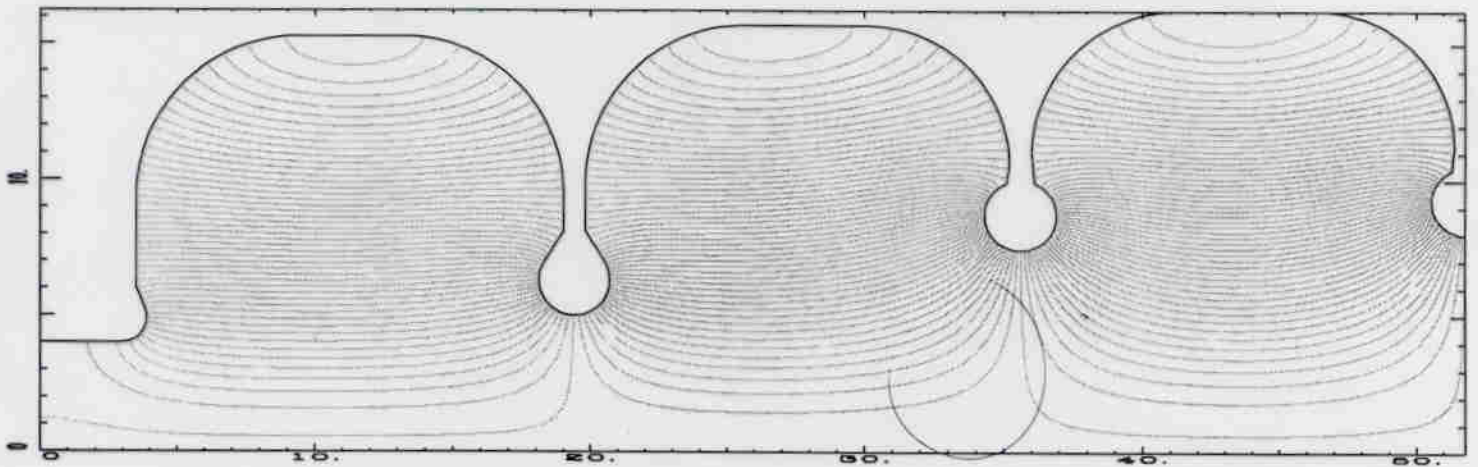
$$Q_0 = 35,637$$

$$\tau = 0.7252$$

$$Z_0 = 33.475 \text{ M}\Omega/\text{m}$$

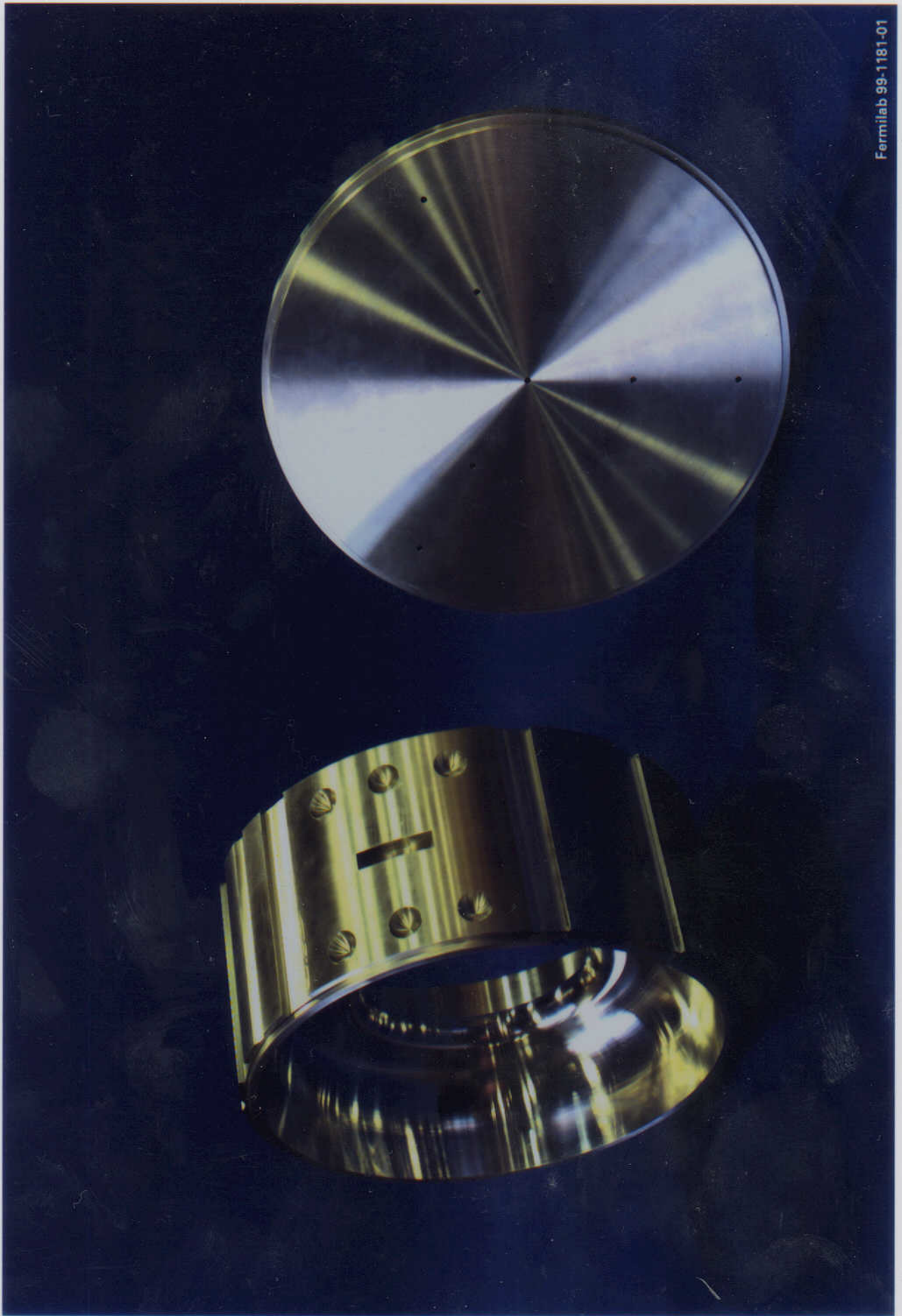
$$Z_{TT} = 17.60 \text{ M}\Omega/\text{m}$$

$$\frac{E_p}{E_0} = 2.58$$

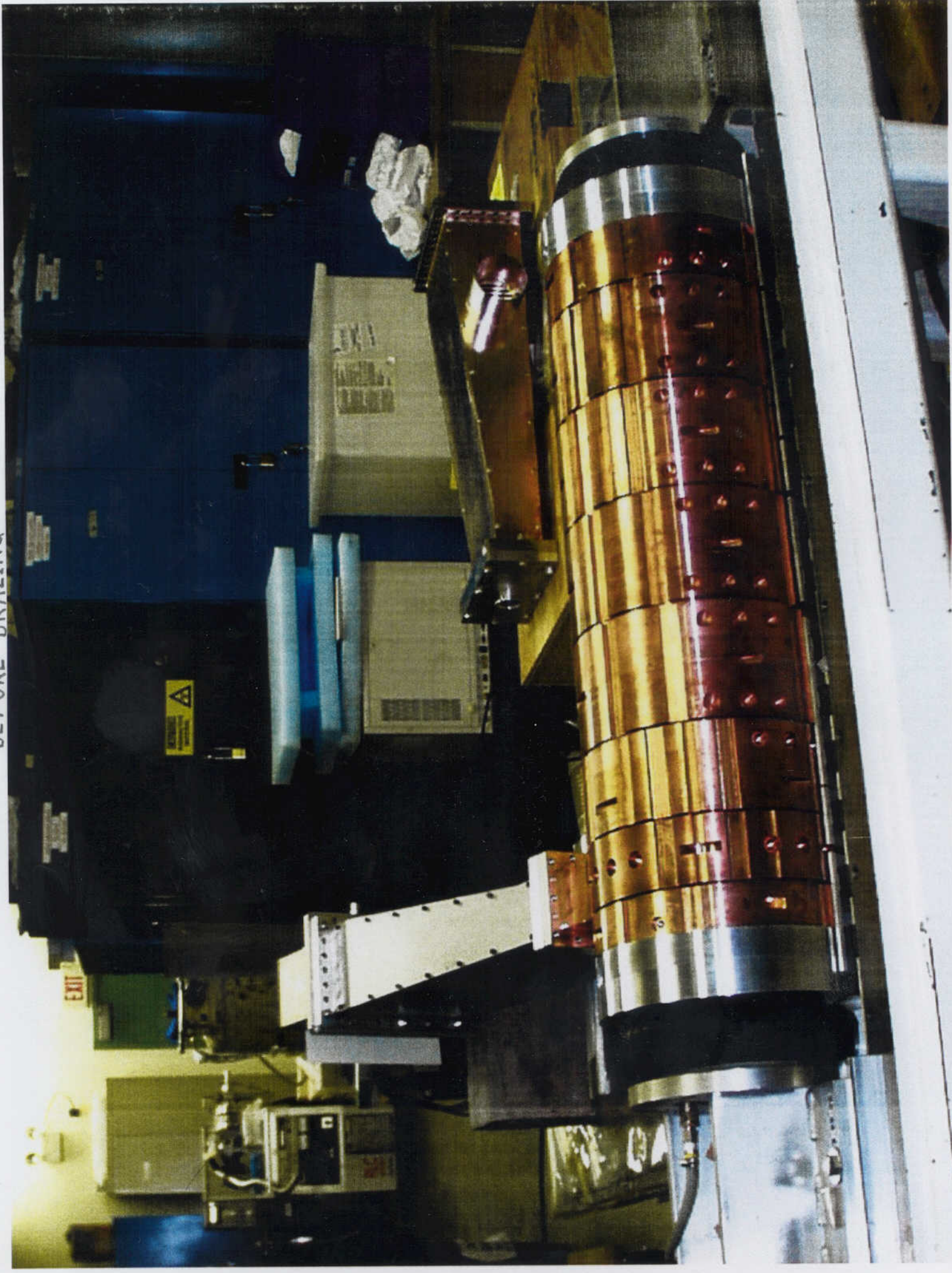


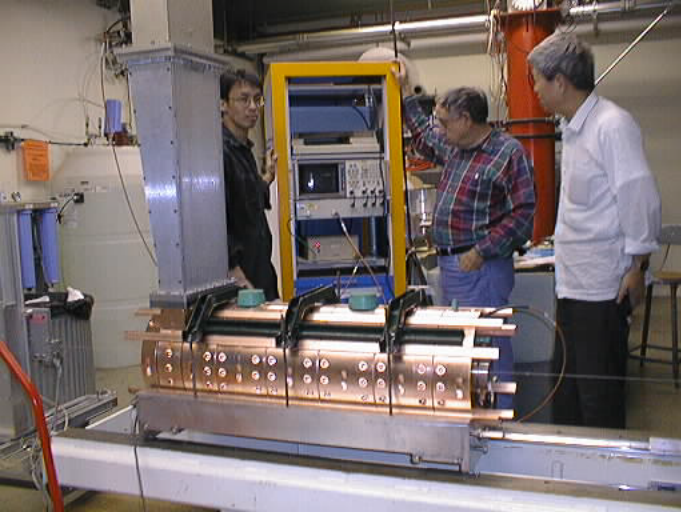
Super Fish
E Field
Cavity Design I

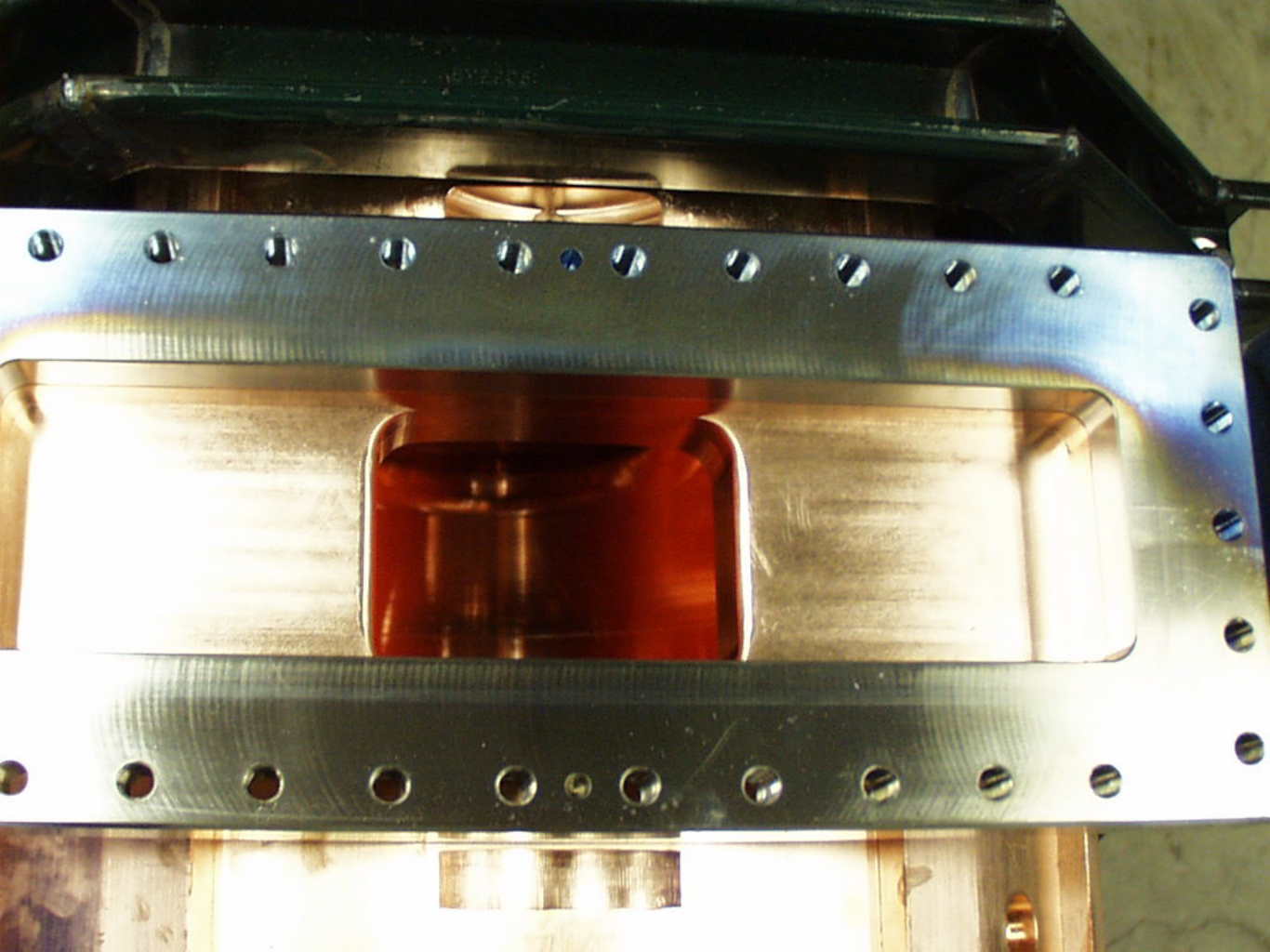
Al Prototype Cell



BEFORE BRAZING

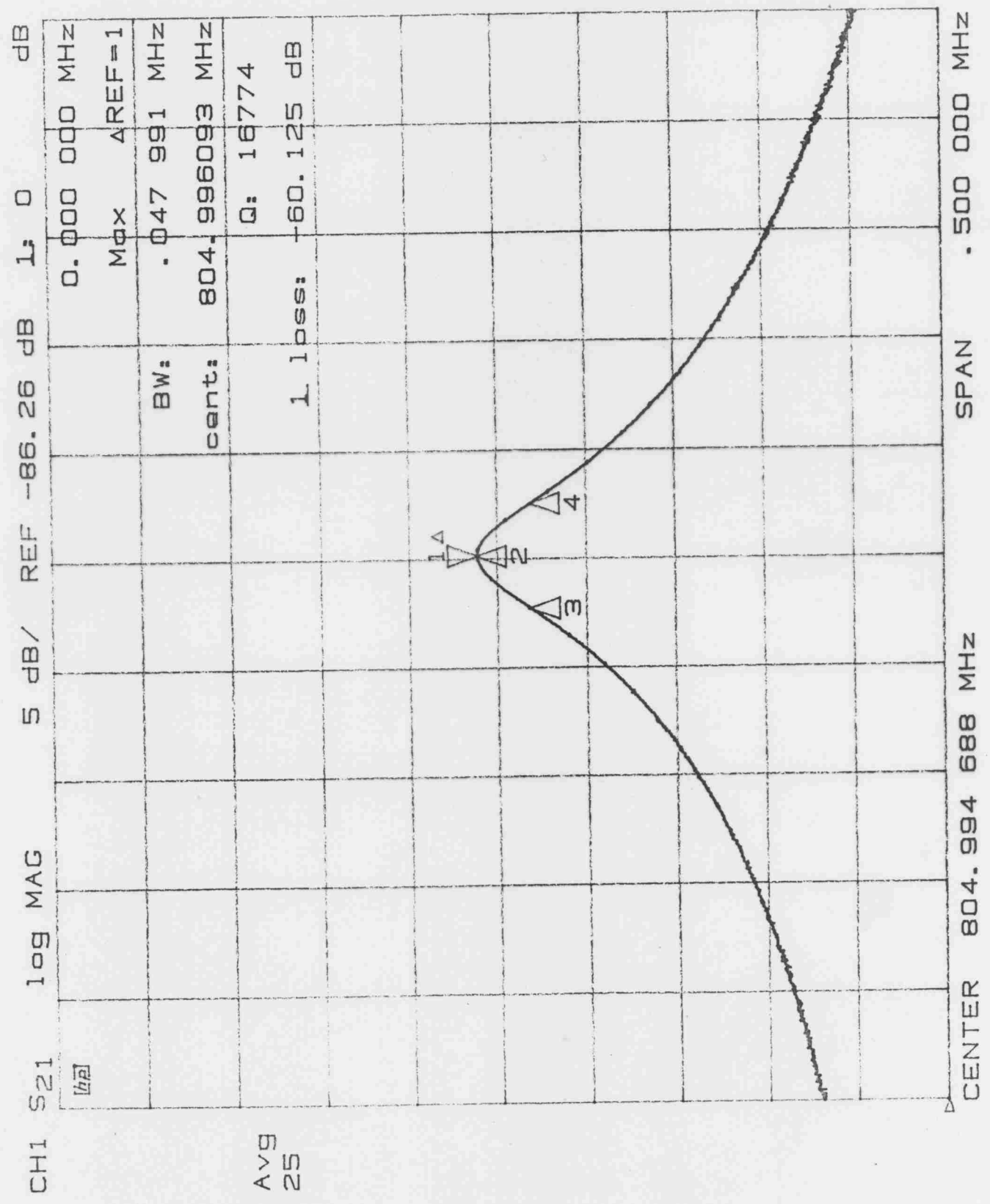






10/18/00

Before Tuning



loaded Q

AV9
25

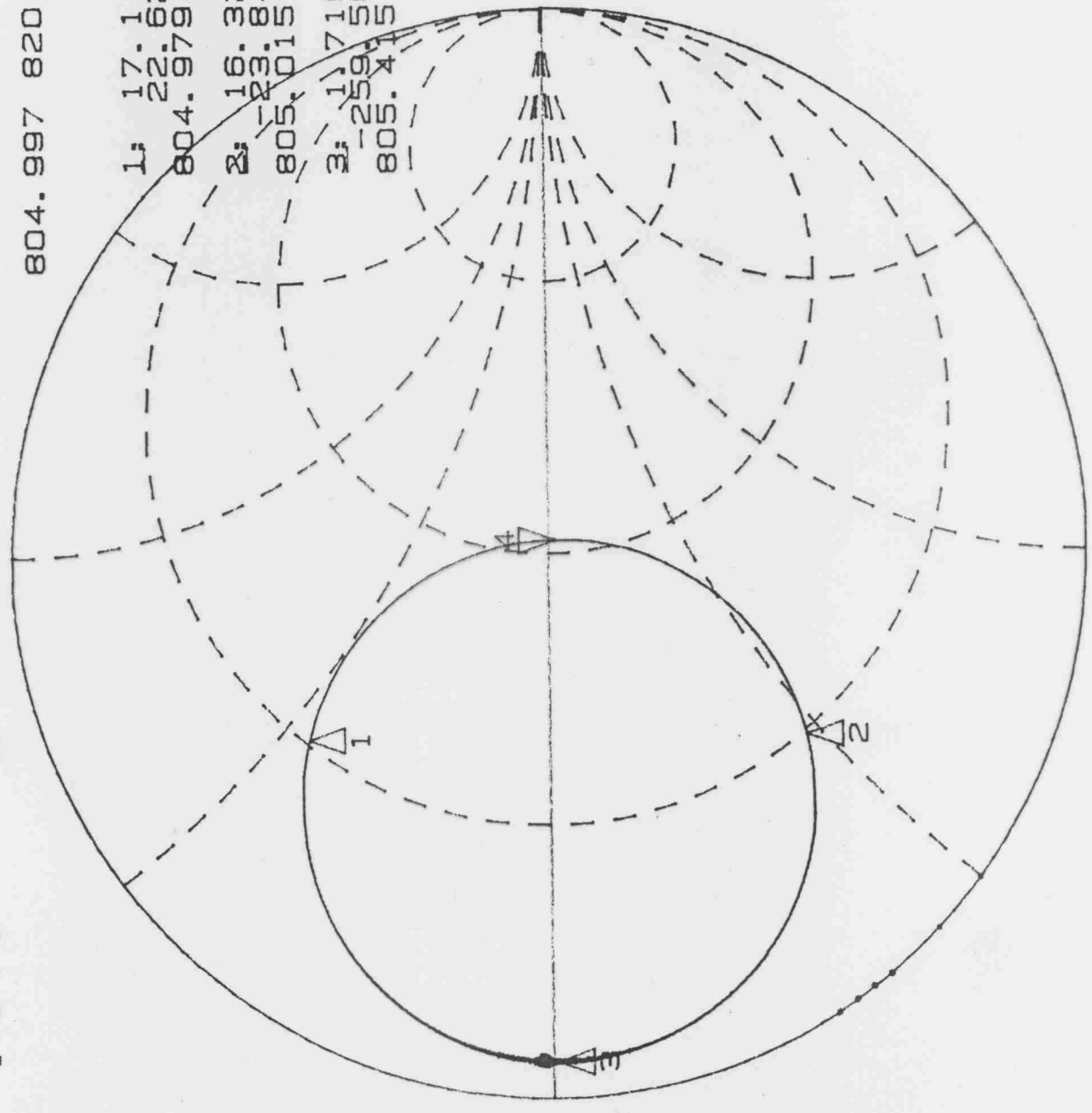
9/13/2000
4:55 pm

Before Tuning

CH1 S11 1 U FS 4: 52.643 Ω -1.334 Ω 148.21 PF
804.997 820 MHz

- 1: 17.111 Ω
22.62 MHz
- 2: 16.328 Ω
23.848 MHz
- 3: 11.7192 Ω
25.58 MHz
- 805.415 MHz

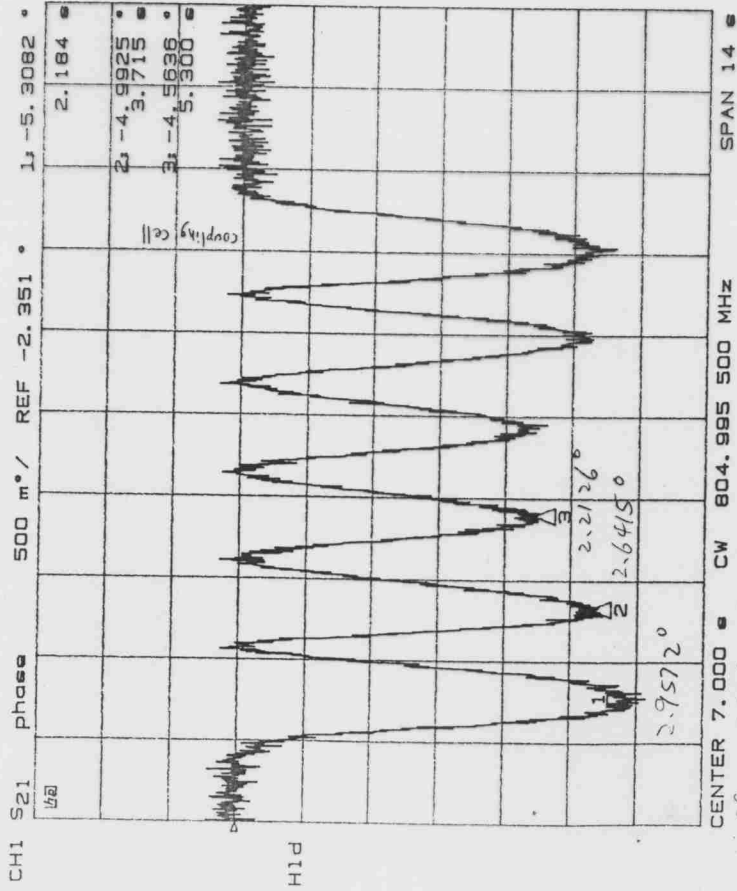
Cor
Del



CENTER 804.996 000 MHz SPAN 1.400 000 MHz

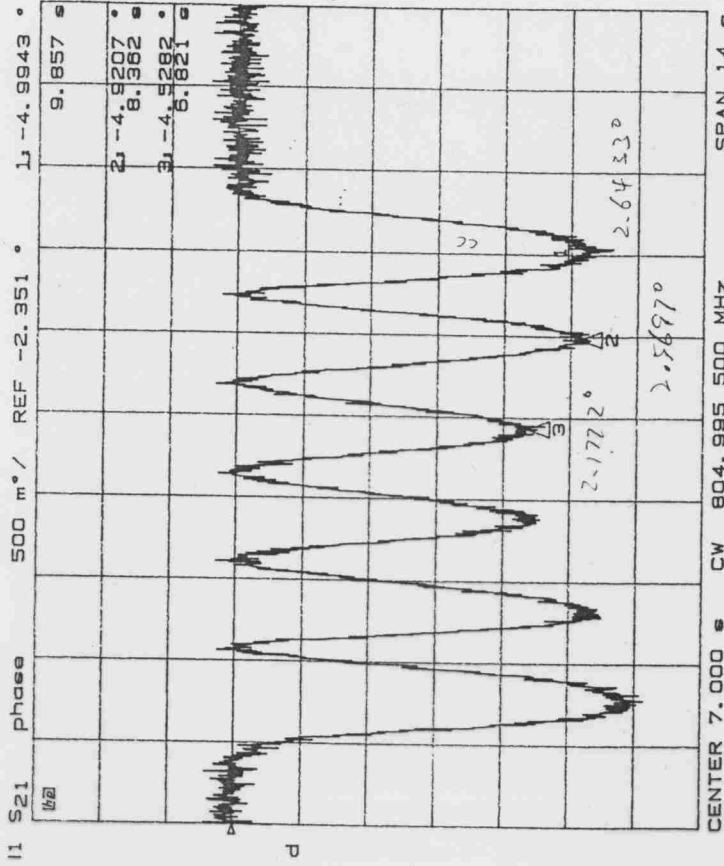
Before Tuning

Oct 18 4:10 PM
before tuning,

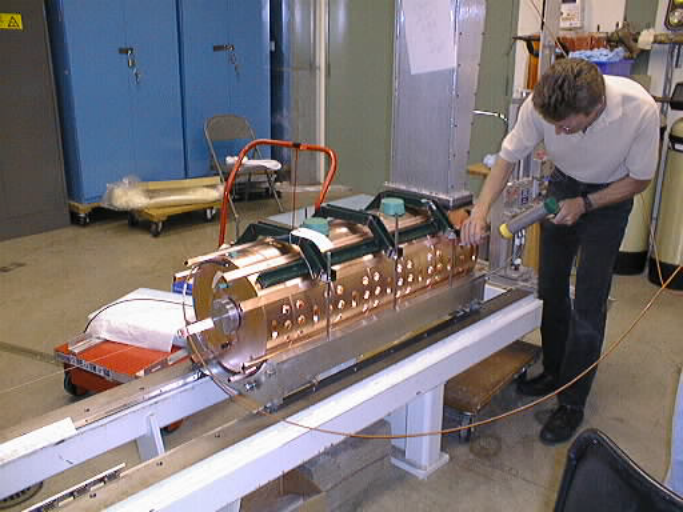


fields → 1.156, 1.093, 1

10/18/02
4:10 PM

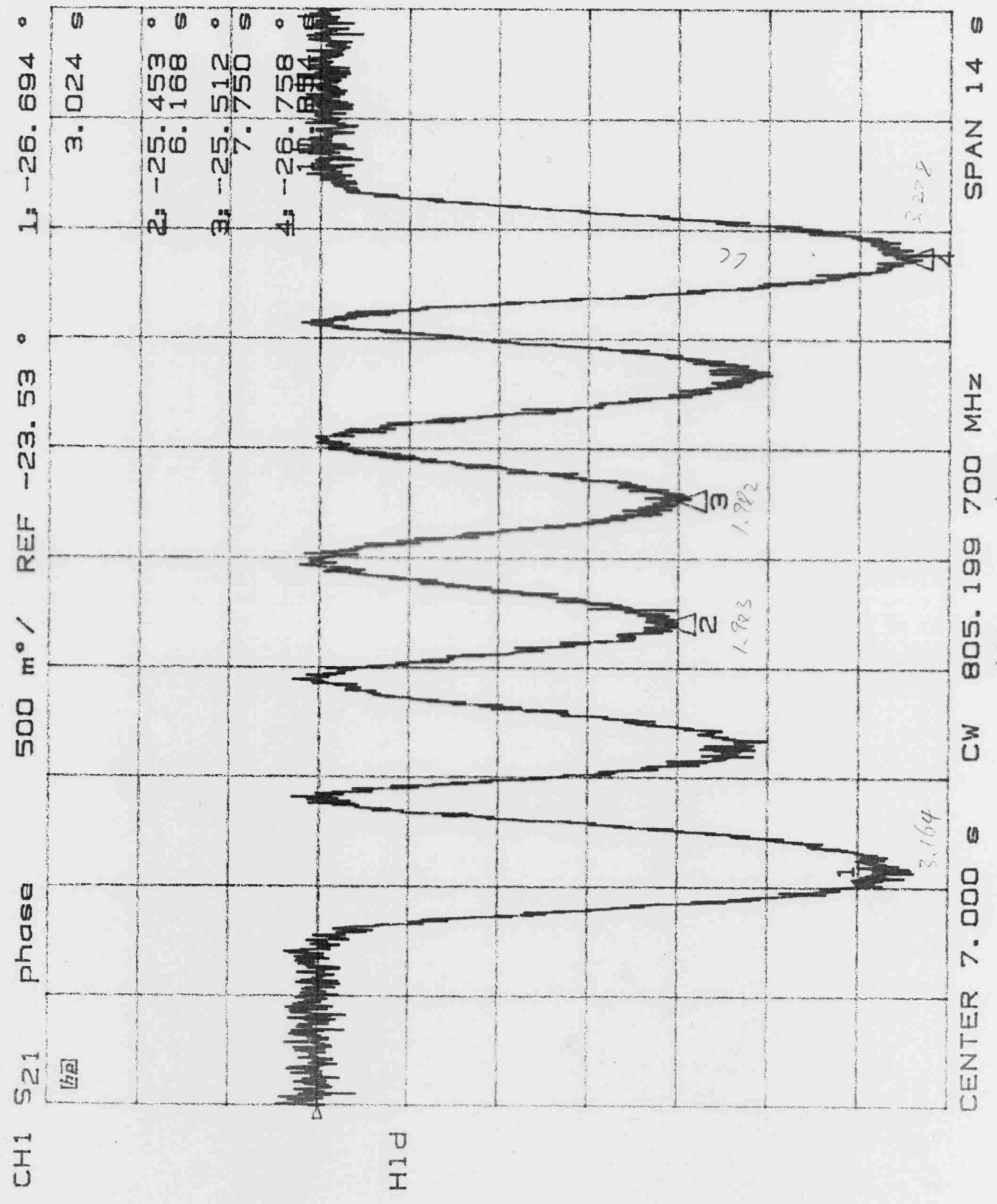


fields → 1, 1.086, 1.102



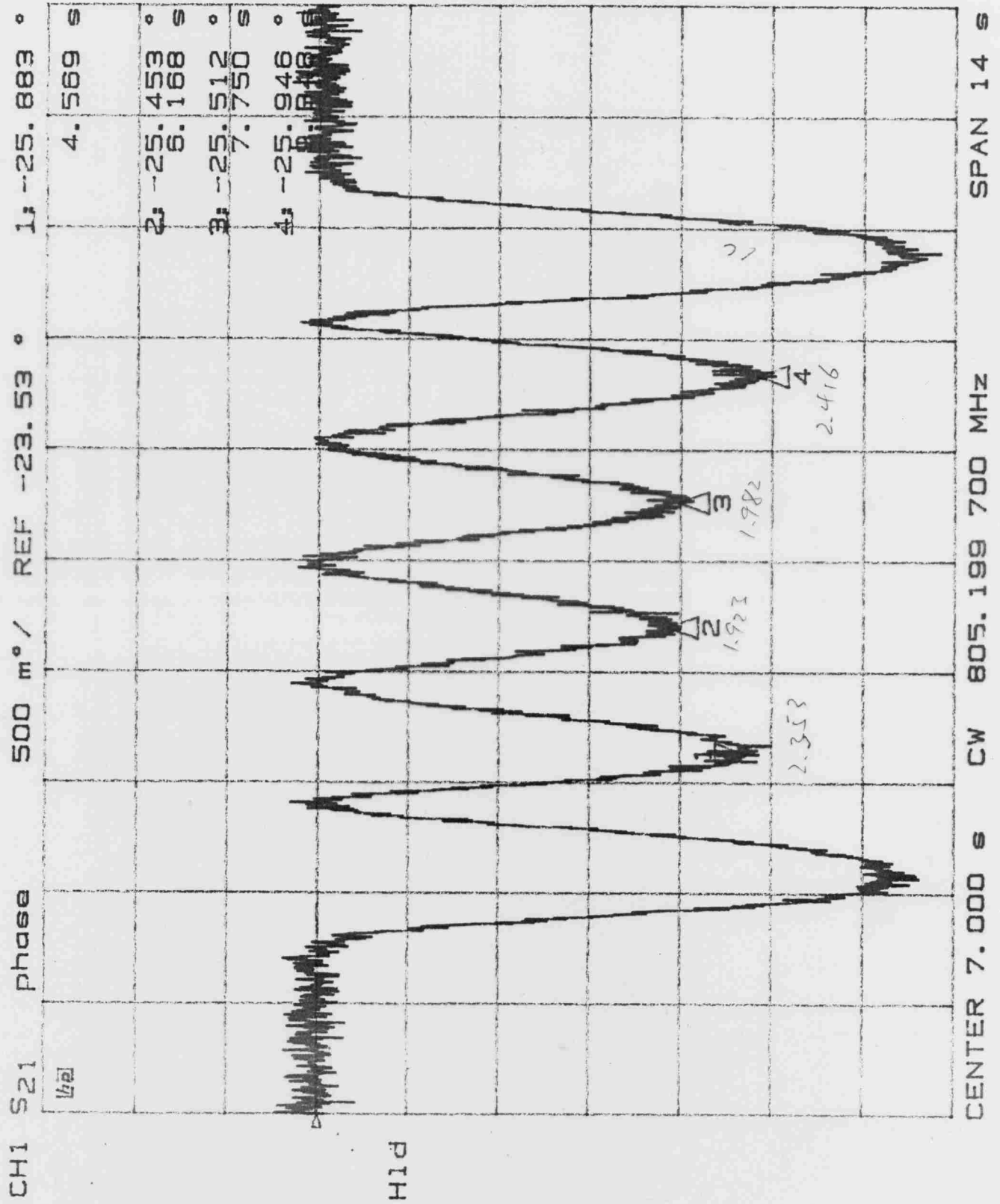
10/19/2000
3:30 PM

6 kHz at opposite ends cell



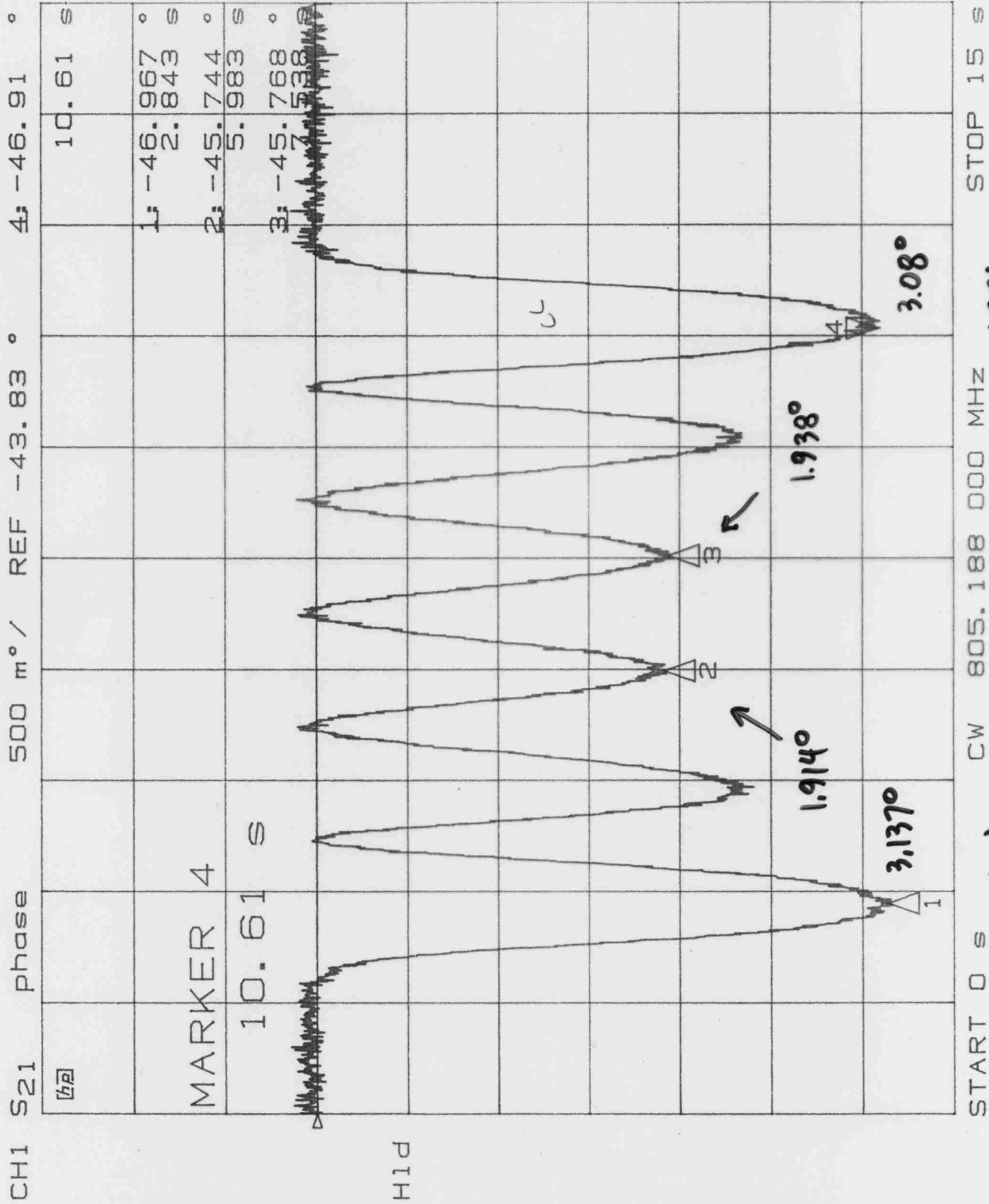
10/10/2000
3:30pm

6 kHz at opposite end cell



Oct 20, 2000
9:30 am

(with semi-rigid loop probes in first
and last cell)



Cavity Field Profile

Cell	1	2	3	4	5	6
Ideal	1.279	1.126	1.000	1.000	1.126	1.279
Actual	1.283	1.106	1.000	1.000	1.104	1.276

Oct 20, 2000

9:45 am

CH1 S11

1 UFS

4:

68.074 Ω

-1.543 Ω

128.1 PF

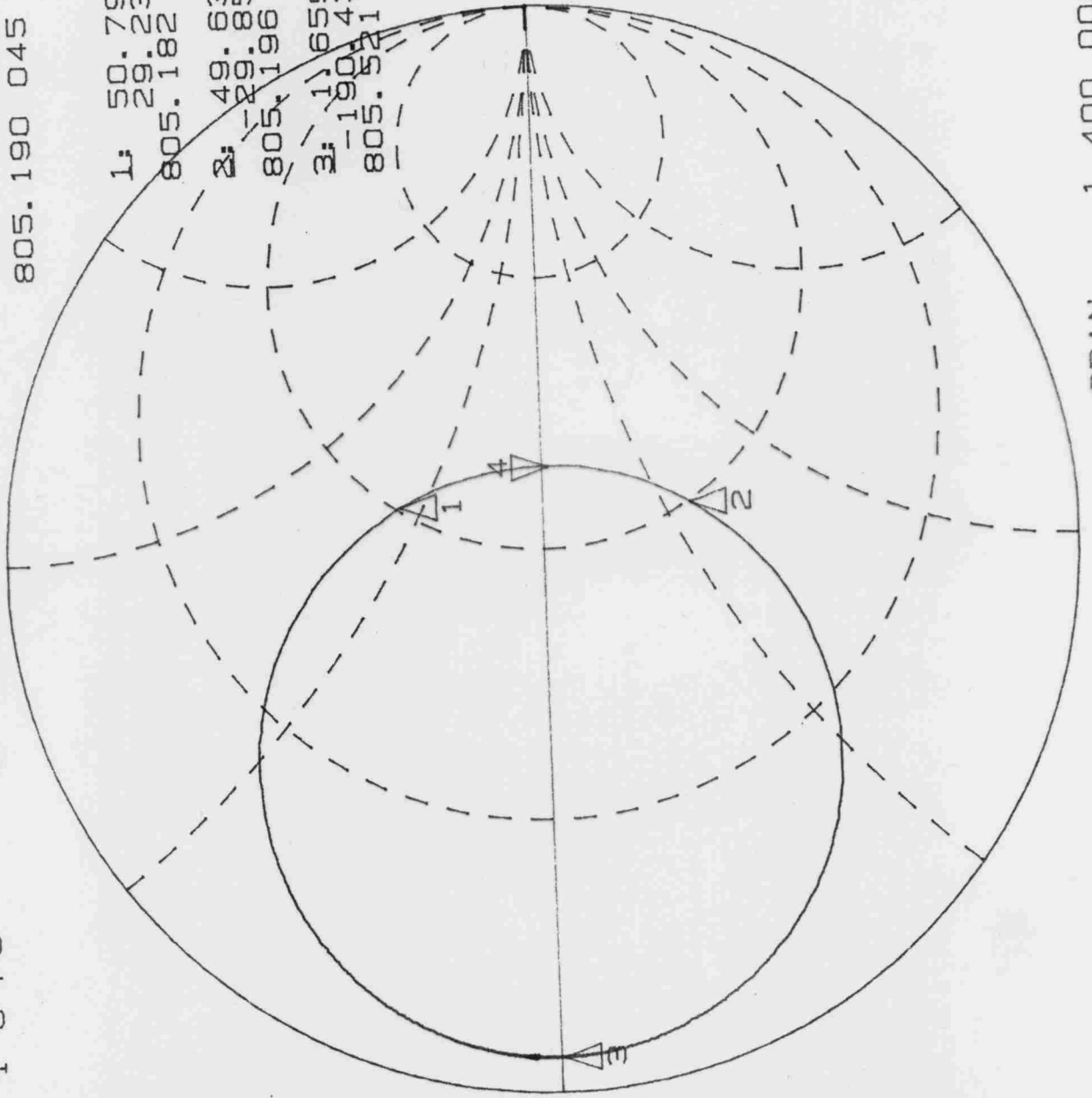
805.190 045 MHZ

[2]

Cor
Del

- 1: 50.793 Ω
- 29.236 Ω
- 805.182 MHZ
- 2: 49.637 Ω
- 29.85 Ω
- 805.196 MHZ
- 3: 11.6594 Ω
- 190.43 m Ω
- 805.521 MHZ

$\beta = 1.36$



CENTER 805.188 000 MHZ

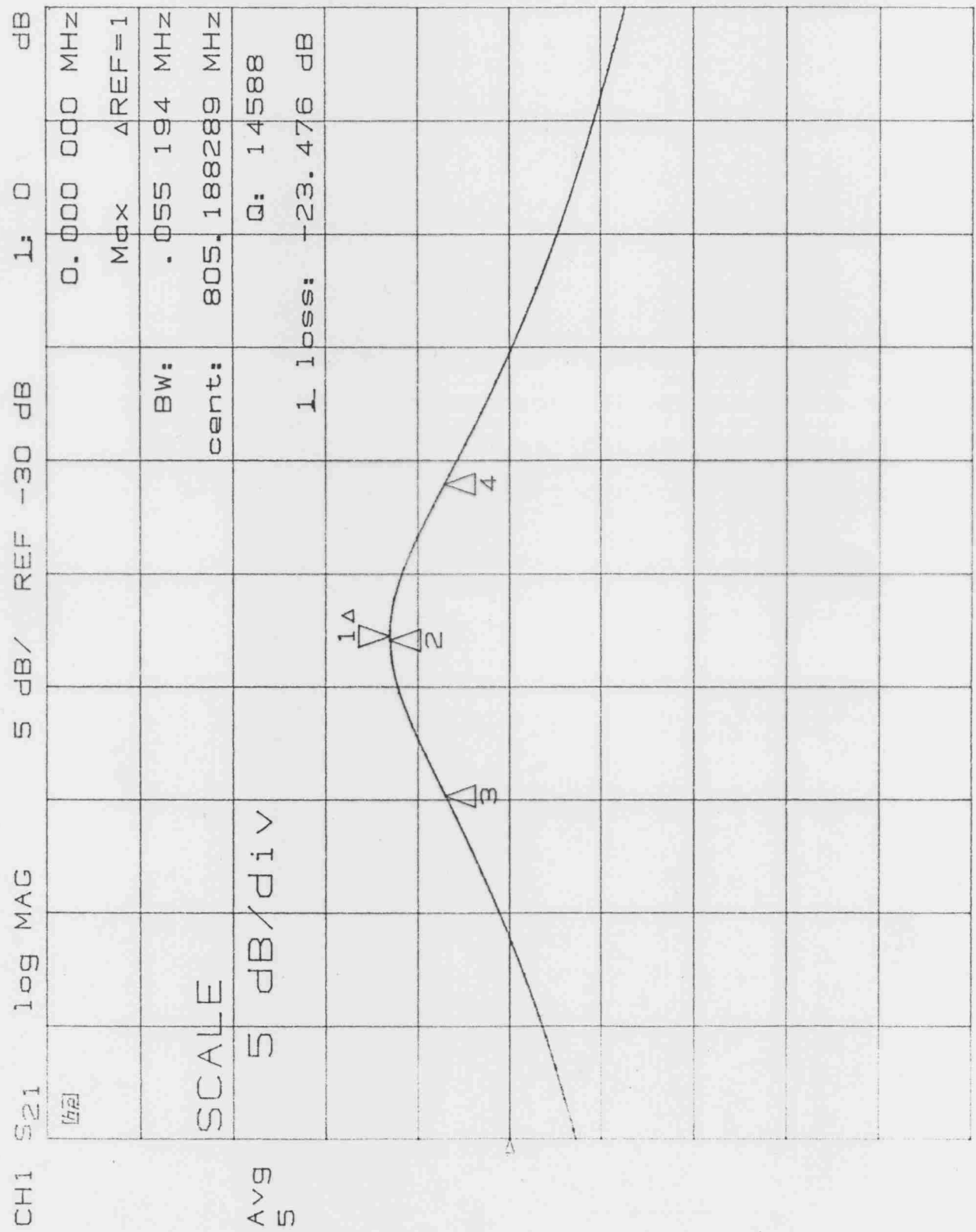
SPAN 1.400 000 MHZ

Oct 20, 2000

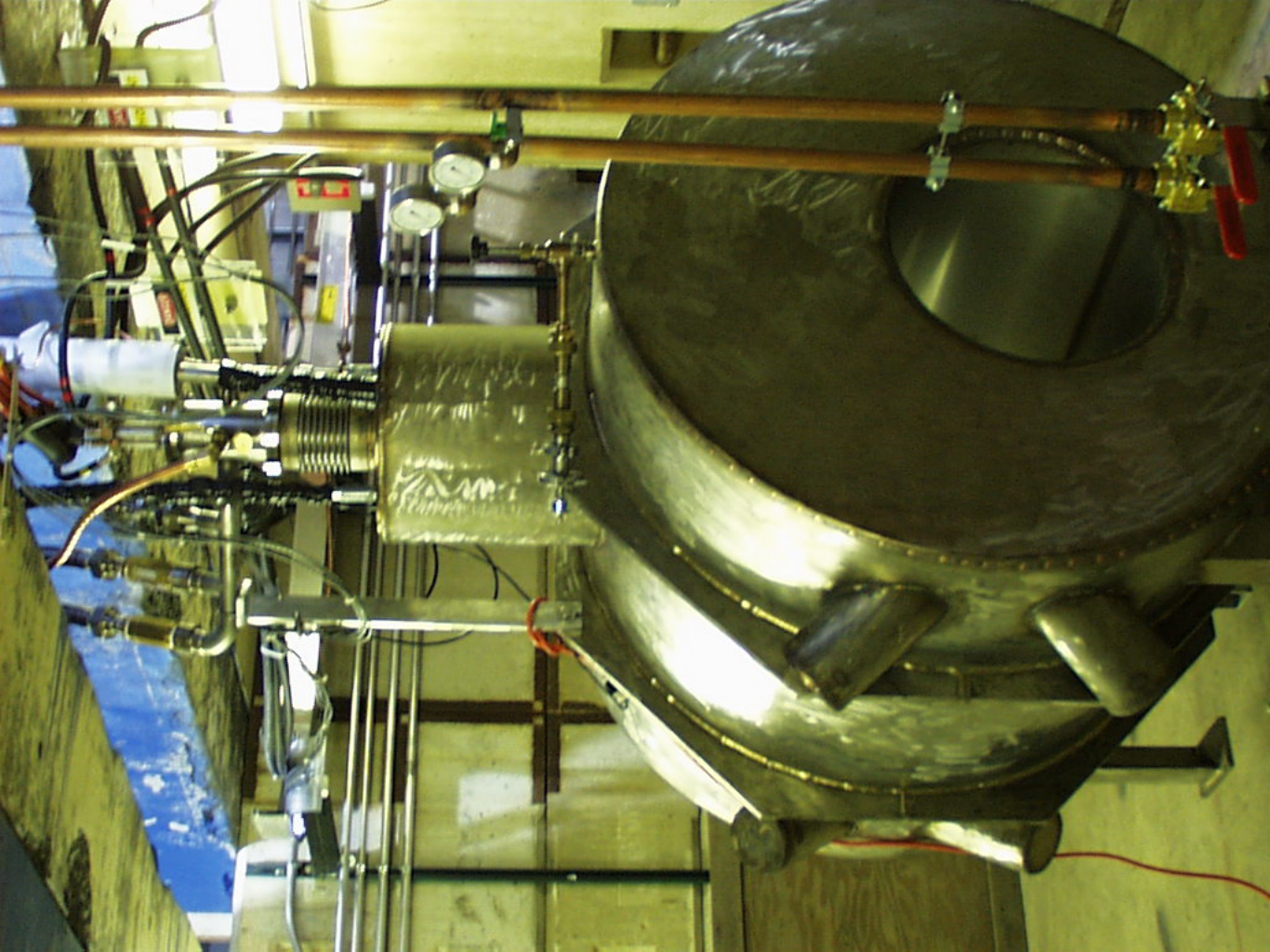
998.5mB

20°C

9135 am



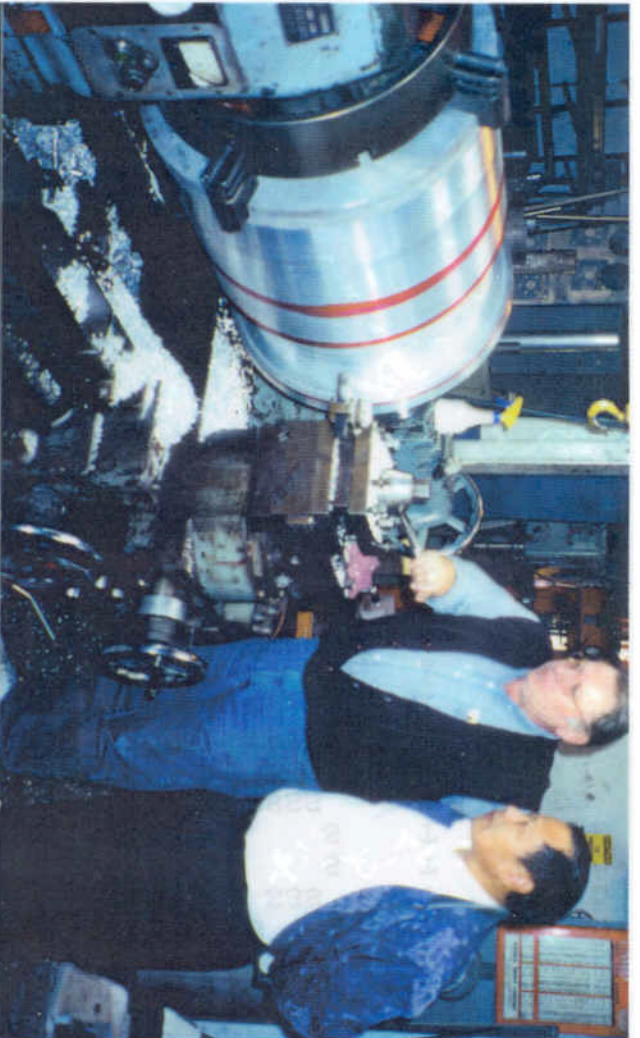
loaded Q



Machining

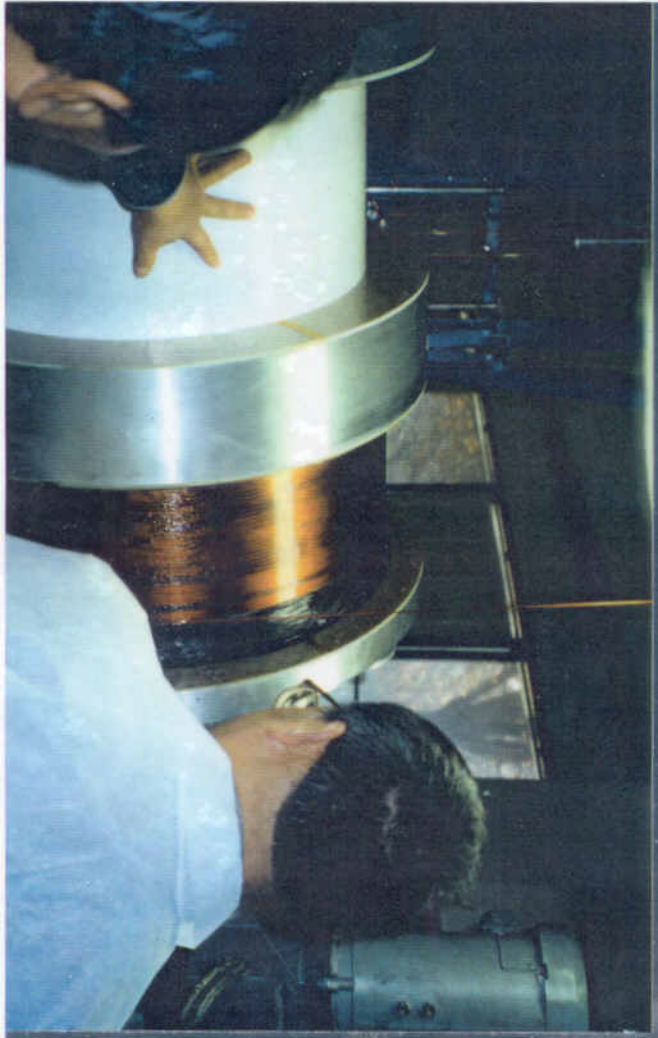
the coi

bobbim



32 000

Winding
the
first coil



Summary of Magnet Runs

Run	Mode	Max I (A)	Quench	Energy (MJ)	Remarks
1	Solenoid	115	Yes	0.65	virgin magnet
2	Solenoid	130	Yes	0.87	
3	Solenoid	137	Yes	0.92	
4	Coil #1	167	Yes	0.58	magnet warmed to 270 K
5	Coil #2	199	Yes	0.83	
6	Gradient	228	Yes	1.78	
7	Coil #1	270	No	1.52	
8	Coil #2	266	Yes	1.47	
9	Solenoid	214	Yes	2.25	93% of design current
10	Solenoid	192	Yes	1.81	magnet warmed to 170 K
11	Gradient	240	Yes	1.97	liquid He level was very low
12	Gradient	276	No	2.61	104% design current
13	Solenoid	199	Yes	1.94	87% of design current
14	Solenoid	207	Yes	2.10	90% of design current
15	Gradient	183	Yes	1.15	magnet warmed to 283 K
16	Gradient	238	Yes	1.94	90% of design current
17	Gradient	265	No	2.20	100% of design current
18	Solenoid	188	Yes	1.74	82% of design current
19	Solenoid	192	Yes	1.81	83% of design current
20	Solenoid	203	Yes	2.02	88% of design current



Magnet Runs at Lab G

Run	Mode	Max I (A)	Quench	Energy(MJ)	Remarks
21	Coil #1	271	Yes	1.54	
22	Coil #2	270	No	1.52	
23	Gradient	274	No	2.62	
24	Soleniod	253	Yes	3.15	110 % of design current
25	Soleniod	234	No	2.65	7.5v charge
26	Gradient	270	No	2.45	
27	Gradient	294	Yes	3.00	from 270 A; 110% design cur.

*-quenches mostlikely
due to low He level*