Crab Cavity

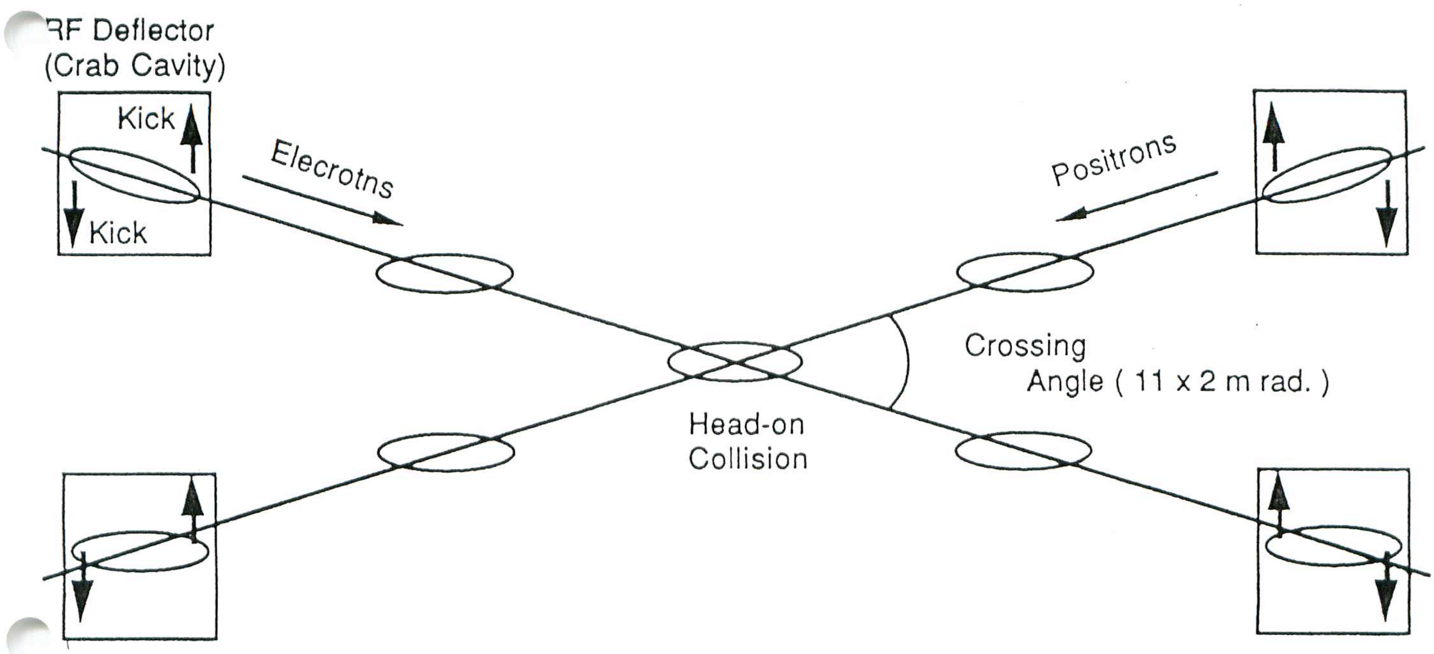
K. Hosoyama

Why crab crossing ?

The crab crossing scheme allows a large crossing angle collision without introducing any synchrotron-betatron coupling resonances. 2,3)

2) R. B. Palmer, SLAC-PUB-4707, 1988.
3) K. Oide and K. Yokoya, SLAC-PUB-4832,1989.

Crab crossing scheme



Non-Crab crossing scheme

Why superconducting cavity ?

	LER	HER	
Beam Energy	3.5	8.0	GeV
RF Frequency	508.887		MHz
Crossing Angle	± 11		mrad
βx *	0.33	0.33	m
$\beta crab$	20	100	m
Required kick	1.41	1.44	MV

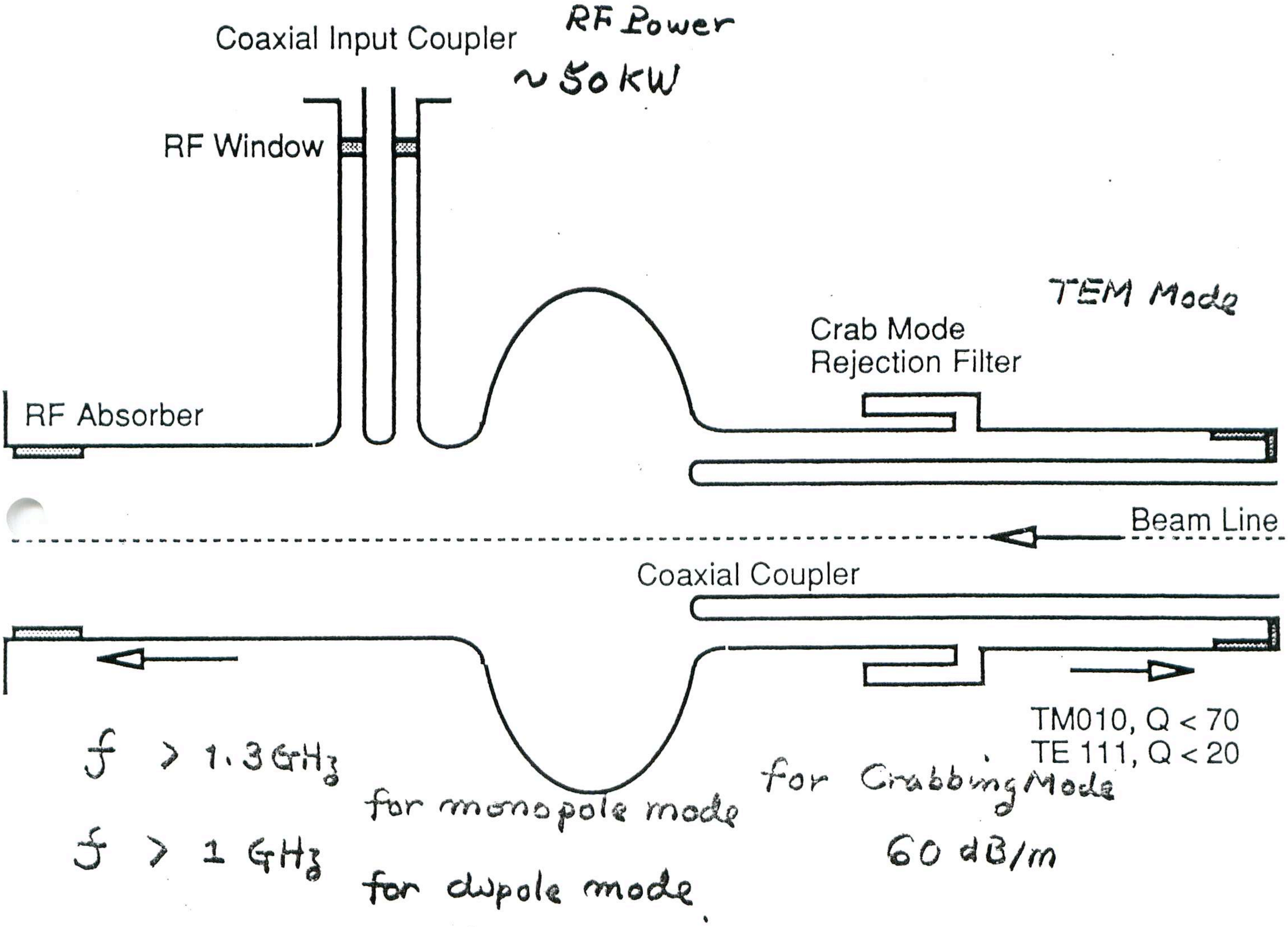
Base line design of KEK-B crab cavity

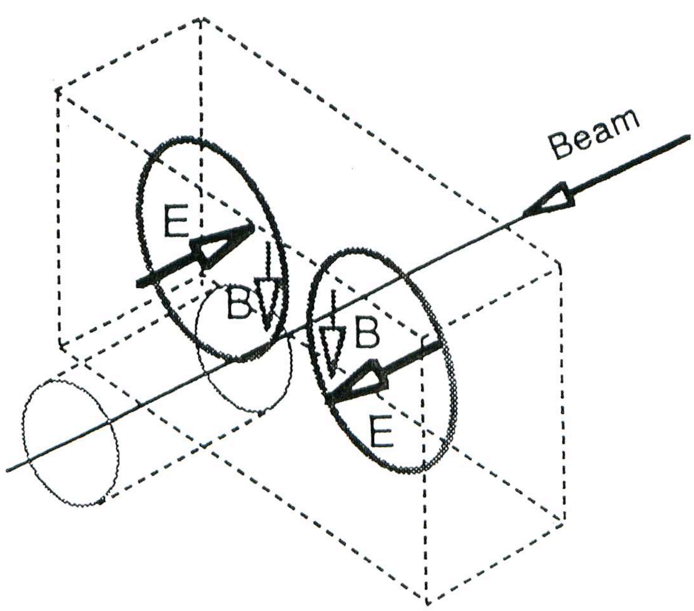
the "squashed" cell shape cavity scheme with a coaxial beam pipe and notch filter which was designed and extensively studied for CESR-B under KEK-Cornell collaboration

- RF issue
- Mechanical issue
- Cryostat and Cryogenics issue

Crab Cavity Design Concept

K. Hosoyama



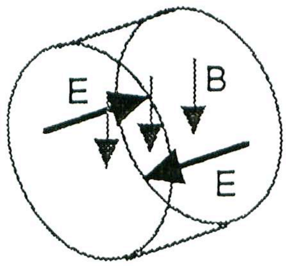


Round Cell Design

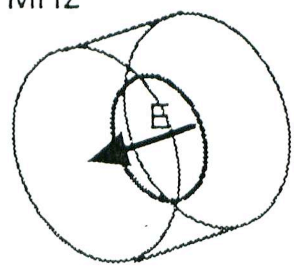
Unwanted Parasitic Mode

Crabbing Mode

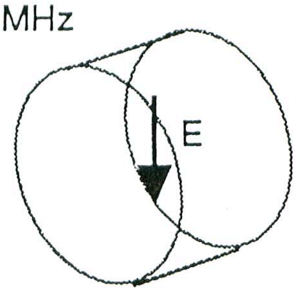
TM110
500 MHz



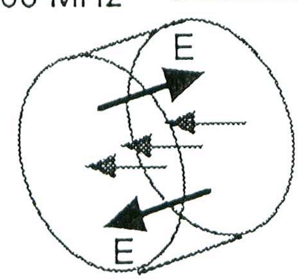
TM010
342 MHz



TE111
720 MHz



TM110
500 MHz



Squashed Cavity
700 MHz

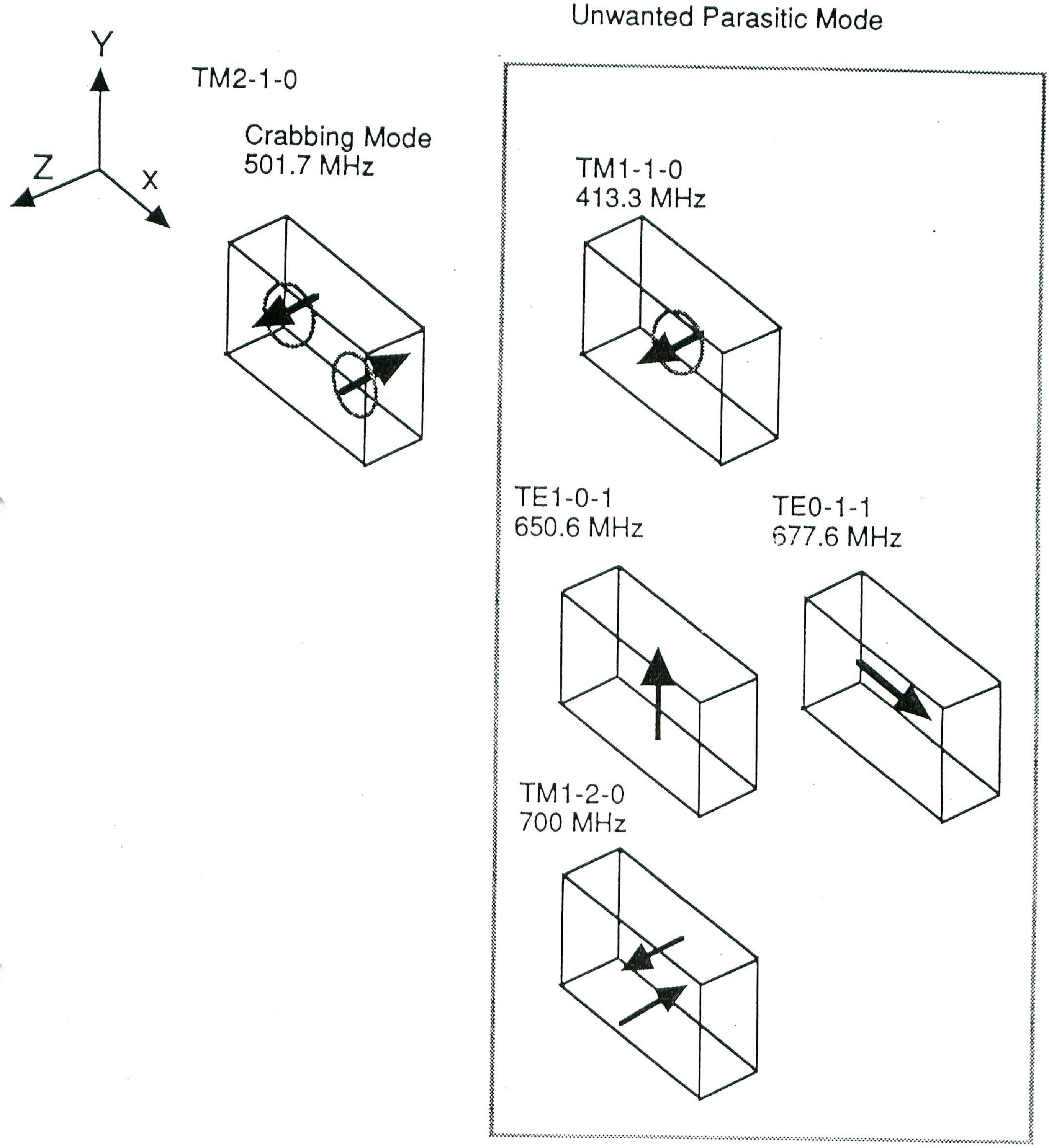
Coaxial Couper
TEM

Coaxial Coupler

f_c = 600MH

dipole like

Squashed Cell Design



K. AKAI et. al 1993 Particle Accelerator Conference

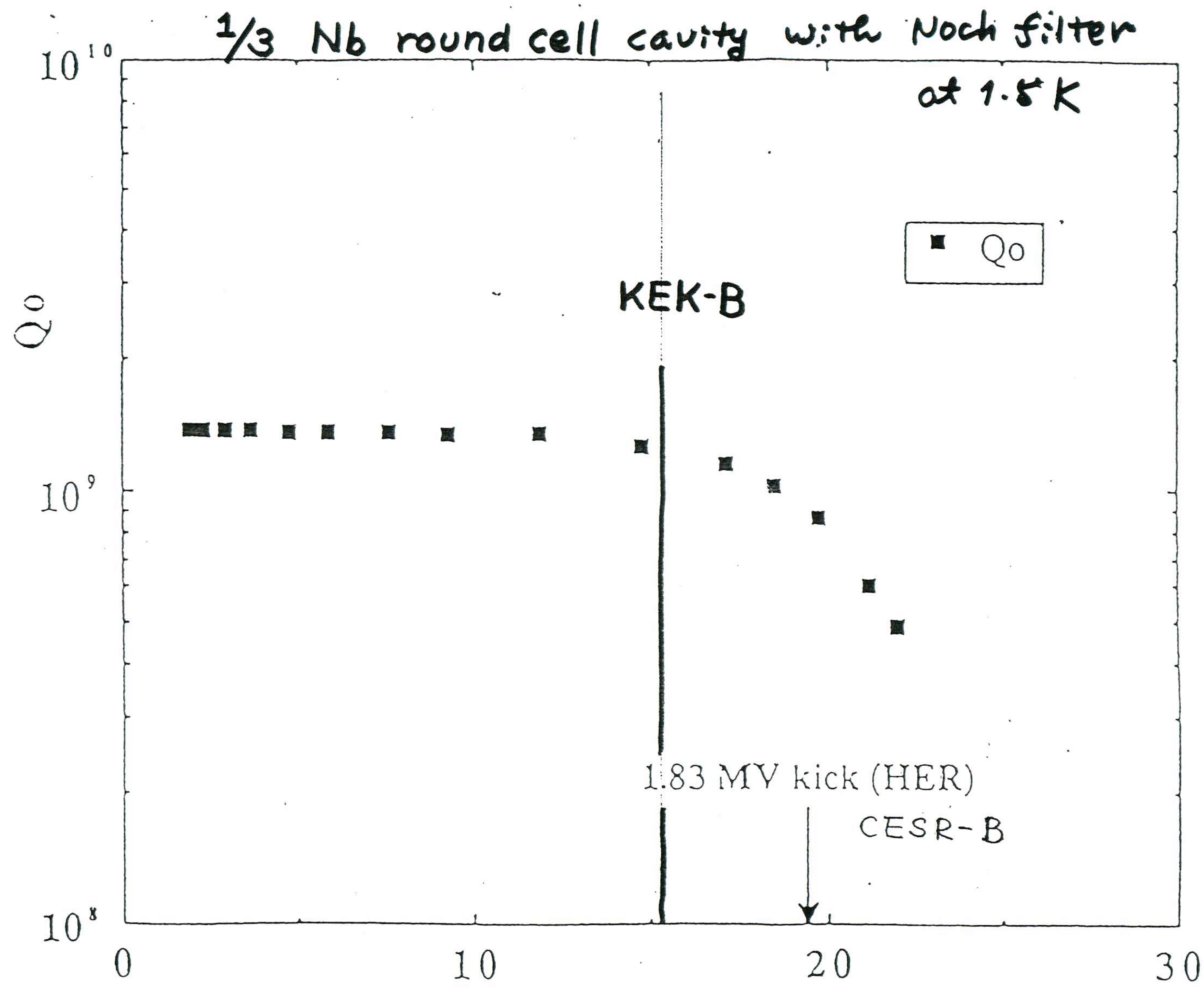
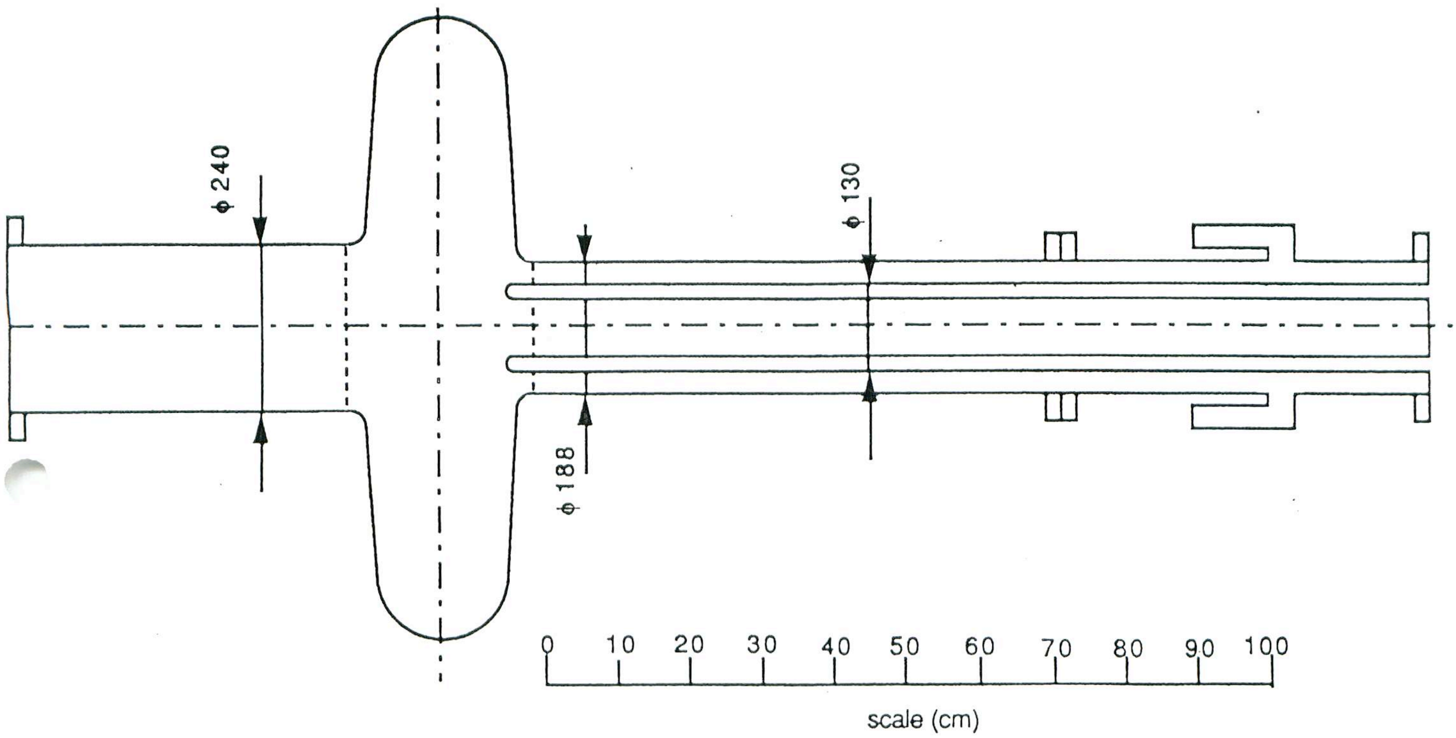


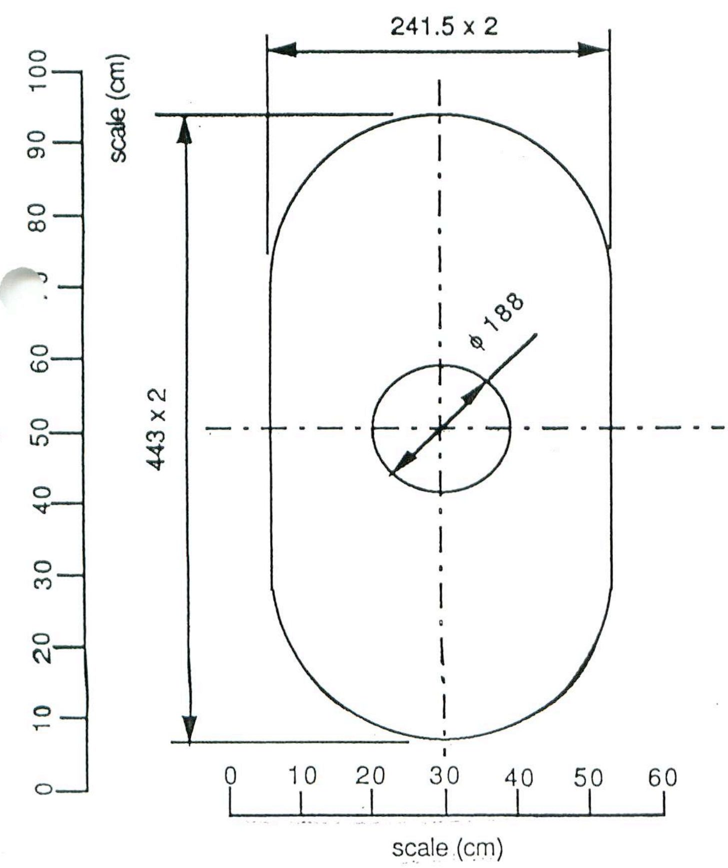
Figure 6. Surface peak field versus Q curve.

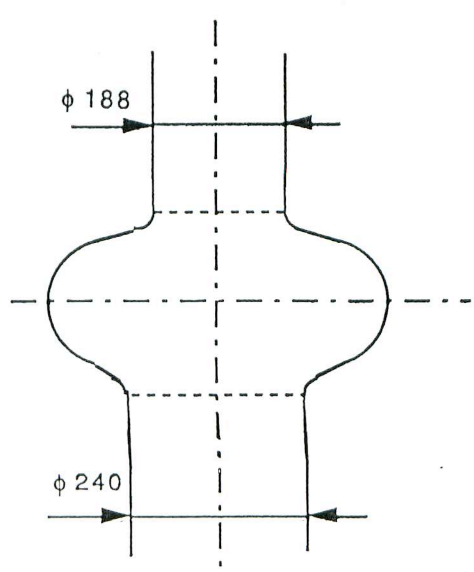
Crab Cavity Group

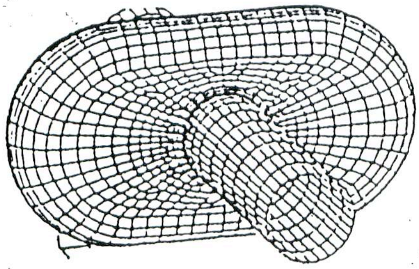
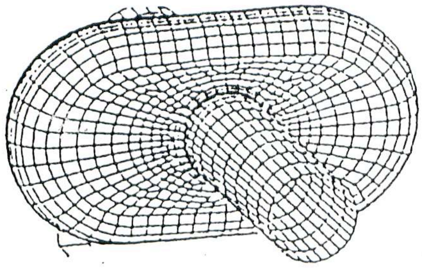
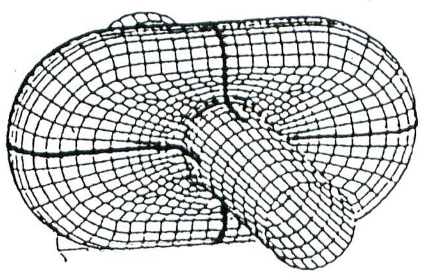
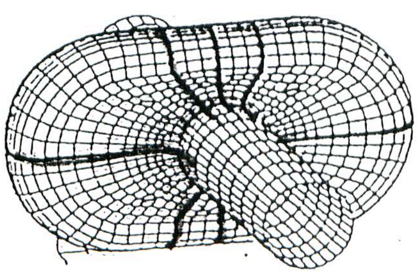
KEK-B Crab Cavity

Mar.24, 1995
K. Hosoyama
(revised from Mar. 16)







Case 1		thickness t = 4 mm	σ_{max} 17.6 kgf/mm^2
Case 2		thickness t = 7 mm	7.15
Case3		thickness t = 4 mm 4 ribs (10 mm x 20 mm)	7.41
Case 4		thickness t = 4 mm 8 ribs (10 mm x 20 mm)	6.86

$\sigma_a = 8.1$ kgf/mm^2

Case 1

$t = 4\,mm$

$\sigma_{max} = 17.6 \; kgf/mm^2$

$\sigma_a = 8.1$

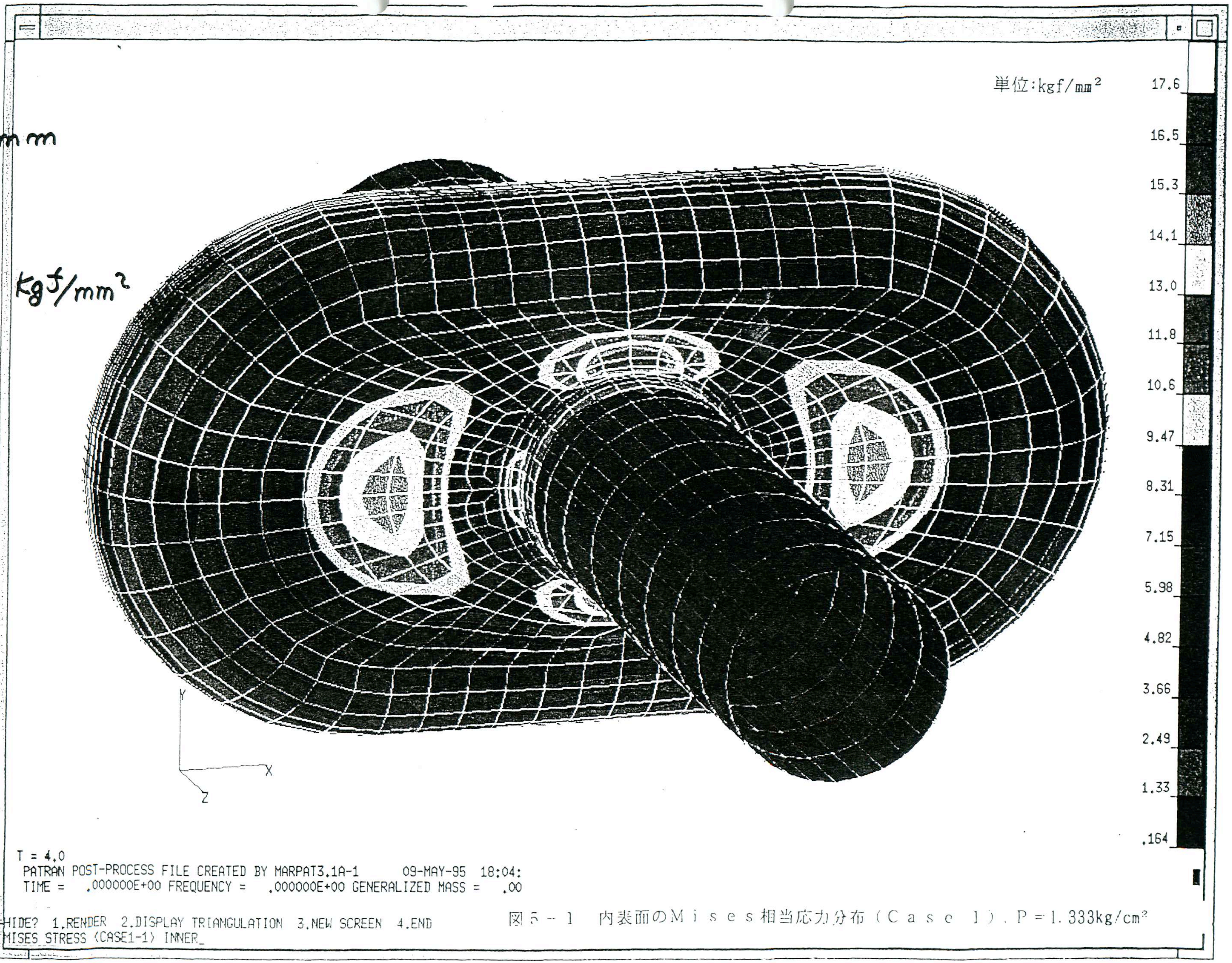
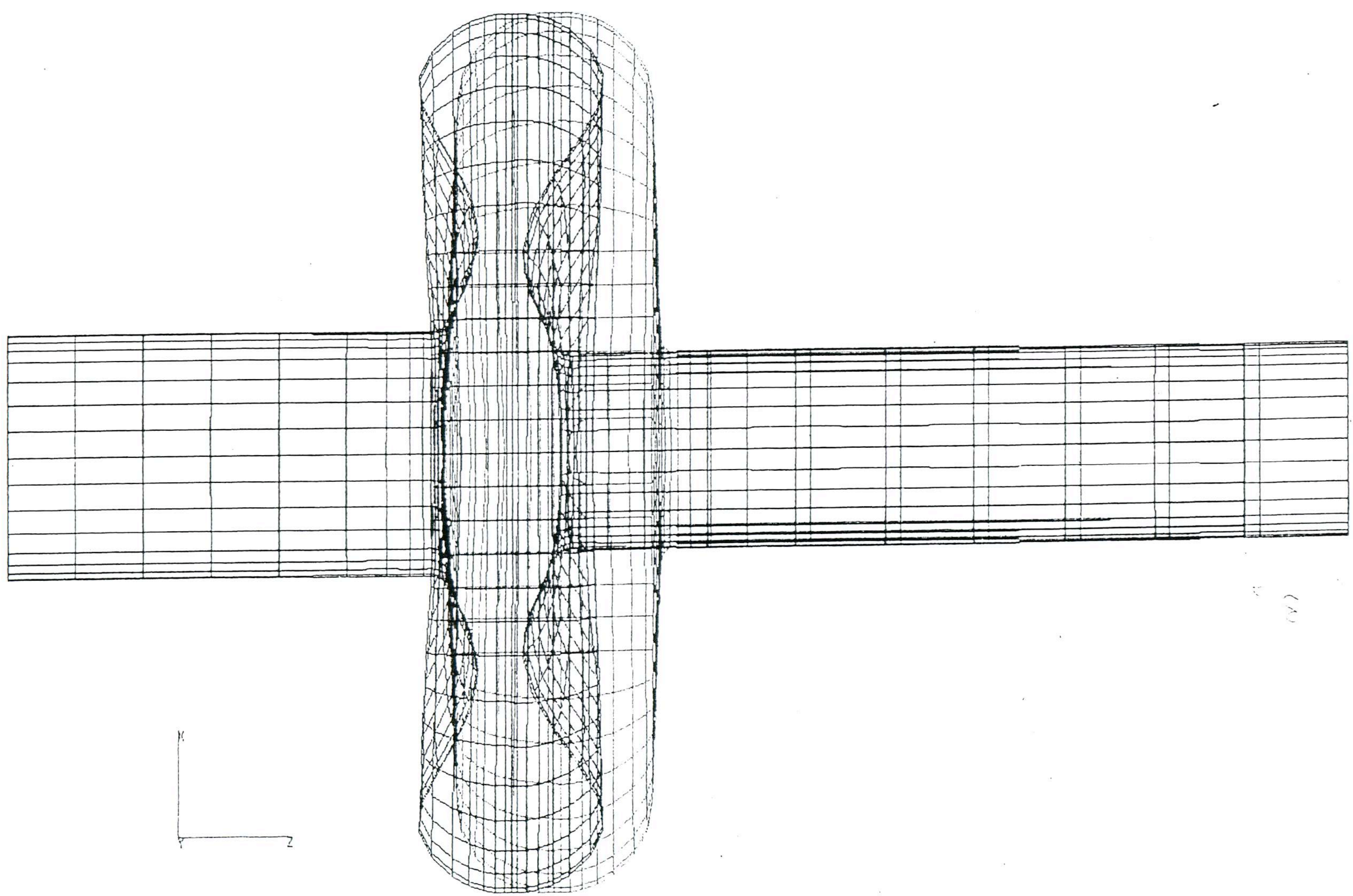


図5－1　内表面のＭｉｓｅｓ相当応力分布（Ｃａｓｅ　１），Ｐ＝1.333kg/cm²

Case1

$t = 4\,mm$

$\delta = 0.362\,mm$



CLUB KUDOU 1/3 SCALE MODEL (CONTROL)
PATRAN POST-PROCESS FILE CREATED BY MARPAT3.1A-1 13-APR-95 10:59:
TIME = .000000E+00 FREQUENCY = .000000E+00 GENERALIZED MASS = .00

5.ANIMATE 6.ANIMATE (HIDDEN) 7.NEW CASE 8.END

図 5-3 変形状況 (Case 1) $P=1.333kgf/cm^2$

Case 2

t = 7 mm

σ_{max} = 7.15 kgf/mm²

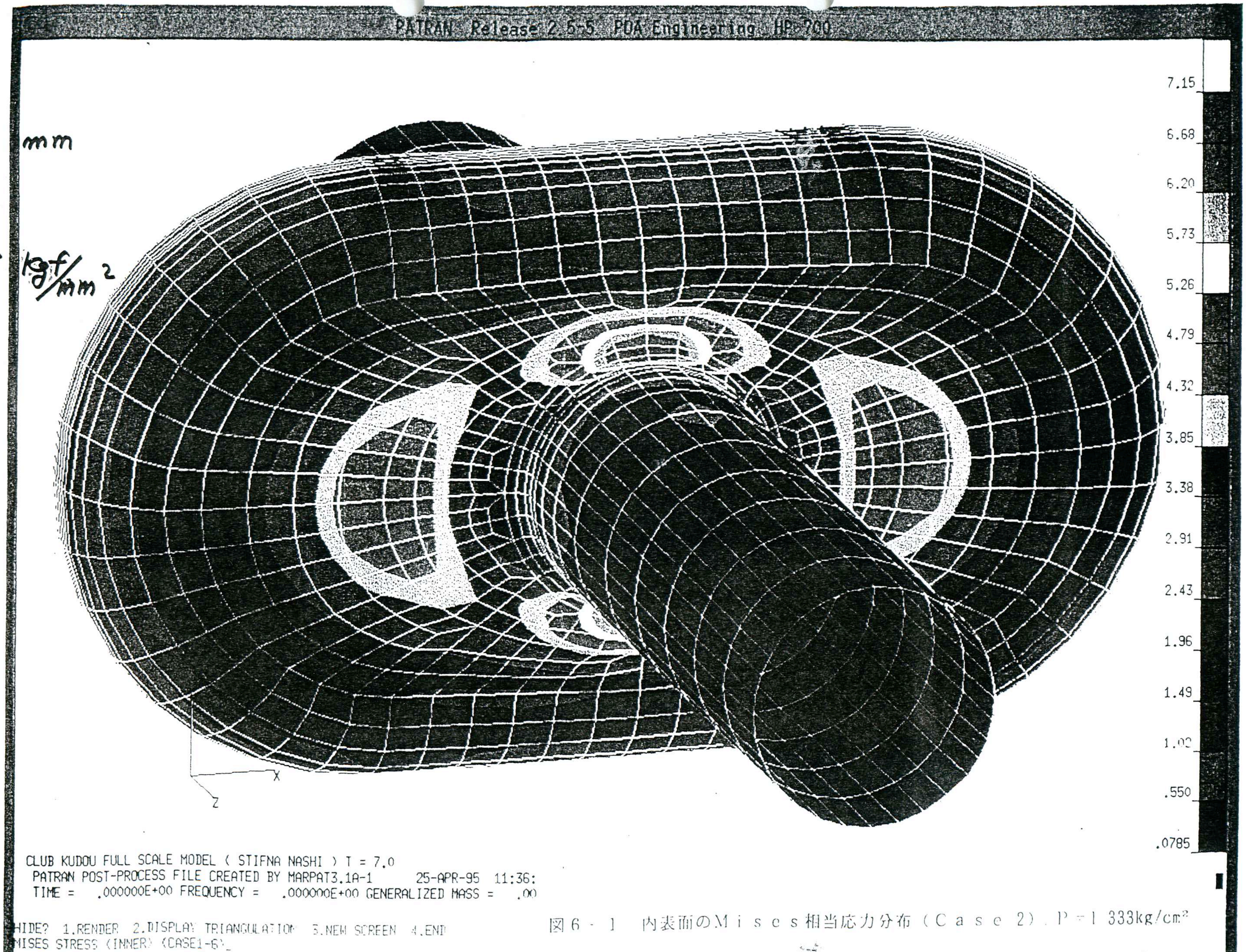


図６－１　内表面のＭｉｓｅｓ相当応力分布（Ｃａｓｅ２）．Ｐ＝１ 333kg/cm²

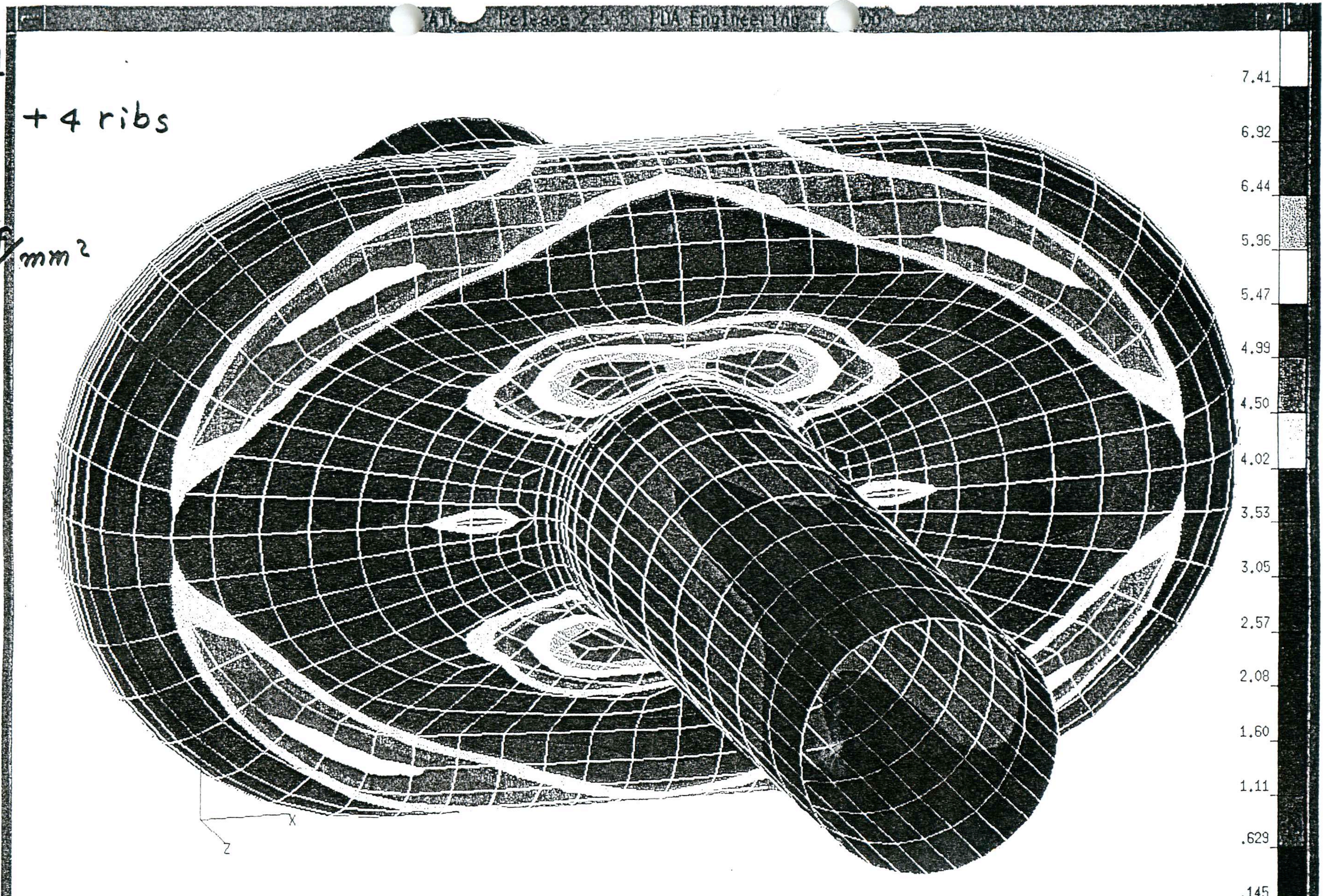
Case 3-1

t = 4mm + 4 ribs

σ_{max}

7.41 kgf/mm²

$\sigma_a = 8.1$



(STIFNA = 10*20)
PATRAN POST-PROCESS FILE CREATED BY MARPAT3.1A-1   20-APR-95 14:15:
TIME = .000000E+00 FREQUENCY = .000000E+00 GENERALIZED MASS = .00

HIDE? 1.RENDER 2.DISPLAY TRIANGULATION 3.NEW SCREEN 4.END
MISES STRESS (OUTER)_

図 -1 外表面のＭｉｓｅｓ相当応力分布（Ｃａｓｅ 3-1） P＝1.333kg/cm²

Case 3-2

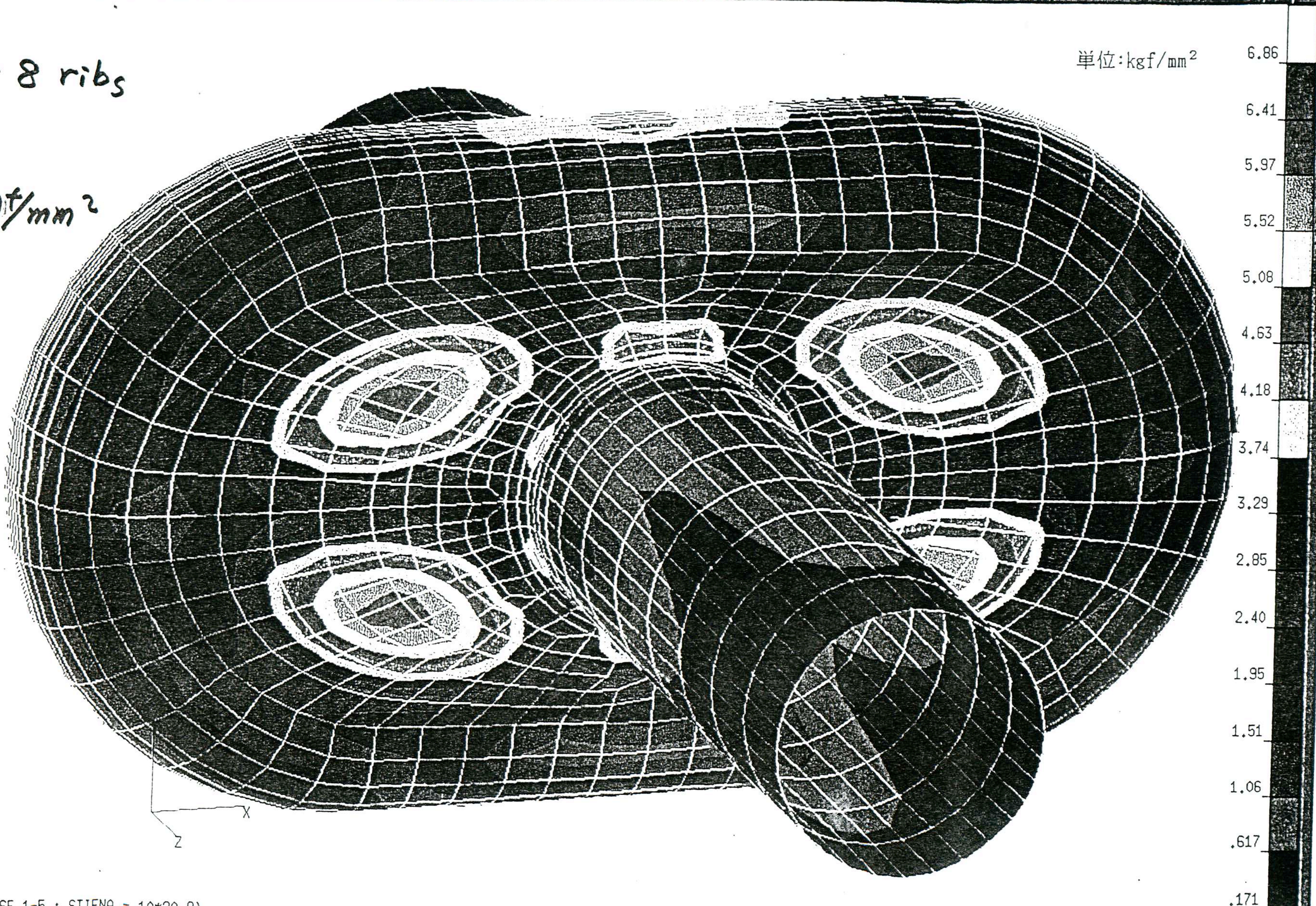
$t = 4mm + 8$ ribs

σ_{max}

6.86 kgf/mm²

$\sigma_a = 8.$

PATRAN Release 2.5-5 PDA Engineering HP 700



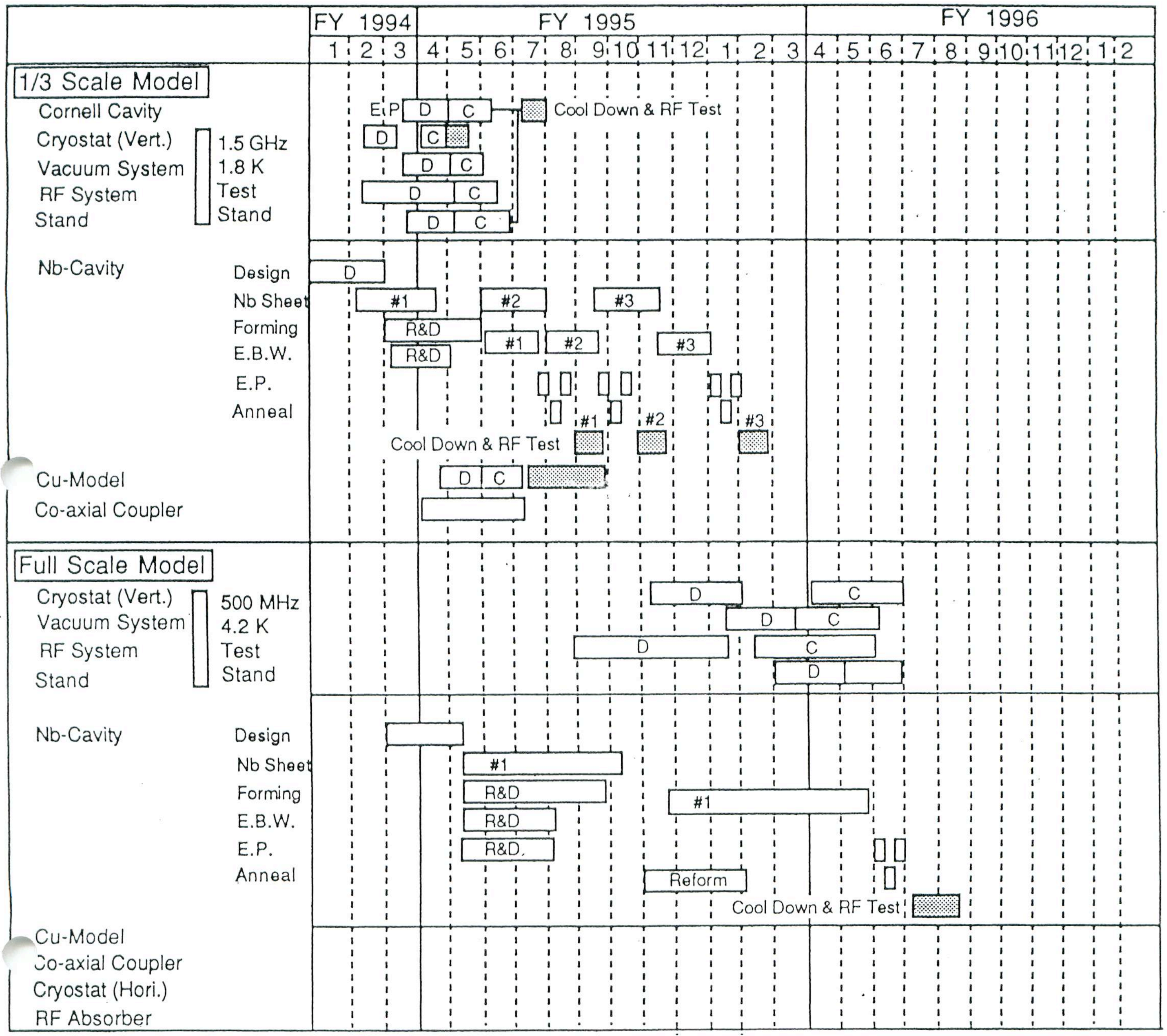

```
( CASE 1-5 : STIFNA = 10*20,8)
PATRAN POST-PROCESS FILE CREATED BY MARPAT3.1A-1        25-APR-95  10:43:
TIME =    .000000E+00 FREQUENCY =    .000000E+00 GENERALIZED MASS =    .00

HIDE?  1.RENDER  2.DISPLAY TRIANGULATION  3.NEW SCREEN  4.END
MISES STRESS (INNER)  (CASE1-5)_
```

図　内表面のMises相当応力分布 (Case 3-2)　P=1.333kgf/cm²

Crab Cavity Group

CRAB - CAVITY R&D SCHEDULE (1995)

Mar. 1995
K.Hosoyama



C : Construction
D : Design