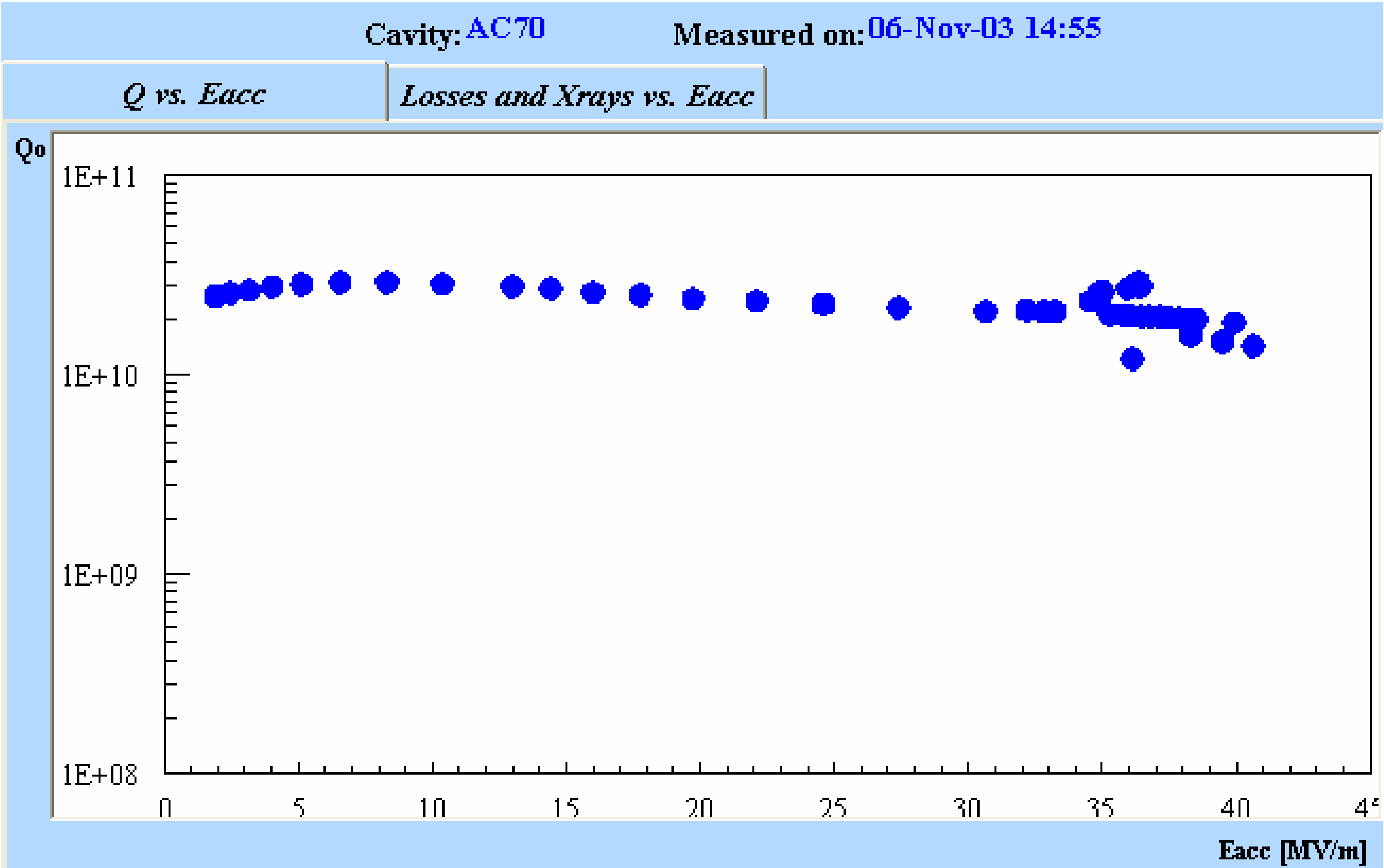
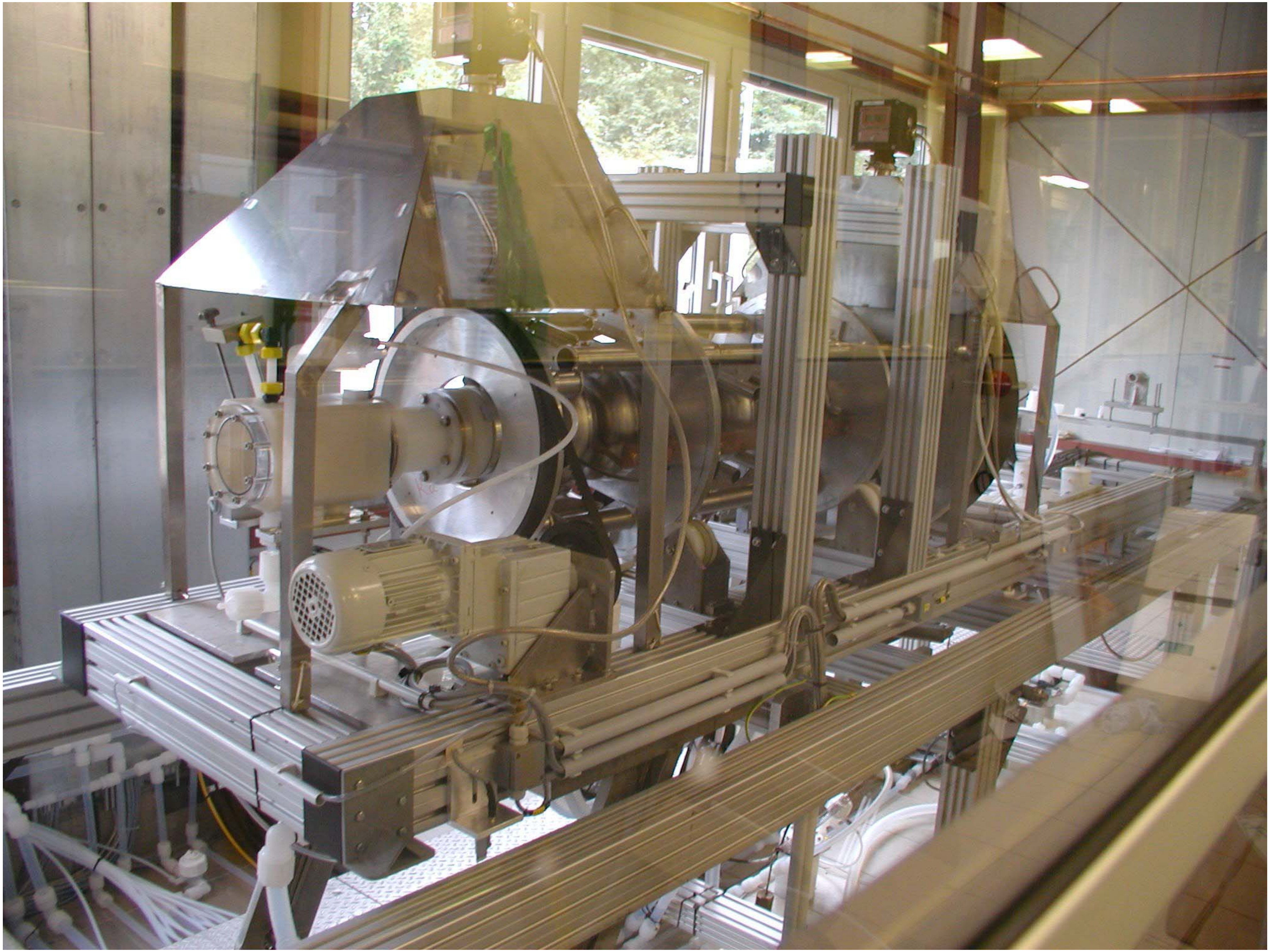
Technology Working Group #1

Test result of AC 70



AC 70 recovered from 19 MV/m to 39.5 MV/m after EP at DESY



Matheisen

Demounting sequence

BCP	
Rinse inside BCP stand	(40 Min)
Dismount from BCP stand	(5 Min)
Change flanges	(15 Min)
Rinse to 18Mohm cm	(30 Min)
Dismount flanges	(1 Min)
Total time	1h 31 Min
1st HP rinse	

EP	
Rinse inside Ep stand	(2 h)
Dismount from Ep stand	(1 h)
Clean outside by car wash / ultra sound	(1 h)
Demount EP head / driving ring	(30 Min)
change flanges	(15 Min)
Rinse to 18 Mohm cm	(30 Min)
Demount flanges	(1Min)
Total time	5h 16 Min
1st HR rinse	

Matheisen

Conclusion after start up of the DESY Ep

INFRASTRUCTURE

Ep + 6 times HP rinse showed very low field emission at high gradients

Removal rate between 0.35 and 0.45 µm/min

2 times higher removal on iris than on equator ←

Field profile seems to be tilted by 0.5 to 0.6 % per 10 Minutes ←

Field profile tilt seems to have one major direction (cell 1) ←

EP shows strong dependency on current and acid temperature

Warm up of acid take 1 h (180 l) (bad for short treatments) ←

PROCESS

Ep process parameters seem to be in the right range for high gradients

It looks like a wide range of parameters are acceptable (15-18V)

Ep facility infrastructure seems to be reliable

Assembly of cavity to Ep stand very time consuming ←

Time between Ep and first HP rinse longer than after BCP ←

Up to 10gr Niobium /l acid no reduction of removal rate was seen

Situation in 2004

Matheisen

- TTFII conditioning start is scheduled for Mai
  (need of spare modules in case of trouble)
- 30 new cavities ordered delivery will start beginning of Mai
- Ep at DESY commissioned but statistic is low
  (Limited knowledge on EP multicells)
- XFEL needs study of new treatment
  (no 1400 C titanisation needed due to EP treatment??)
- Limited money and limited number of personal
- EP process more time consuming than BCP
  Removal rate 1/2 of BCP
  handling installation BCP ➔2h / EP ➔ 16h
  dismount BCP ➔1.5h EP ➔5.3h

Scenario 1

Matheisen

<u>Module 6</u>

2 cavities are on hand Ac 70 /Ac 73

7 AC cavities to be tested as fast as possible ➔3 may show 35

+ 3 have to be redone➔ 1 shows 35

<u>new cavity production</u>

4 cavities treated and tested ➔ 2 show 35

+ 2 retested ➔ 1 shows 35

SUMM 2+3+1+2+1= 9

➔Until mid of October 04 there is a chance
to have 8+x cavities qualified for the high gradient module

module Nov 04

Repair of Module 2 cavities

8 (known) cavities treated and tested + 6 retests

8 out of 14 tests show gradients above 20 MV/m

➔Until end of march 8 cavities qualified for spare module

Spare module 1 ready for installation in May 05

Scenario 2 Test as many Ep cavities as possible Matheisen

Module 6

2 cavities are on hand Ac 70 /Ac 73

7 AC cavities to be tested as fast as possible ➔3 may show 35

+ 3 have to be redone➔ 1 shows 35

new cavity production

4 cavities treated and tested ➔ 2 show 35

+ 2 retested ➔ 1 shows 35

SUMM 2+3+1+2+1= 9

➔Finished until mid of October 04 there is a chance

Module Nov 04

Take the next new cavities and continue ep for the second spare module

12 cavity full treatments and test ➔ 6 show 35 MV/m

+ 6 2nd preparation and test ➔ 3 show 35 MV/m

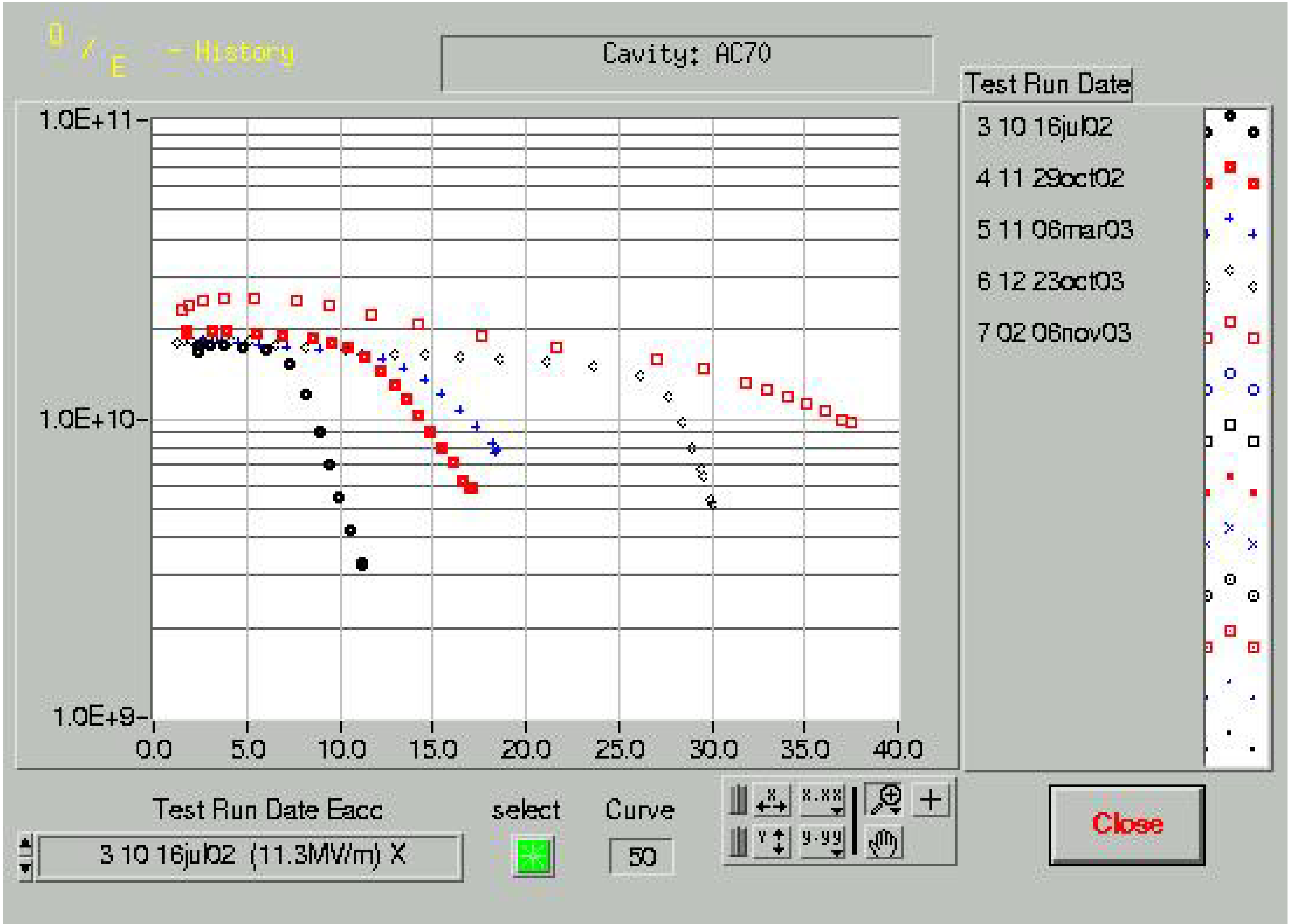
earliest to be finished until September

means spar module for installation not before end of 2005

Module Nov 05

Lilje

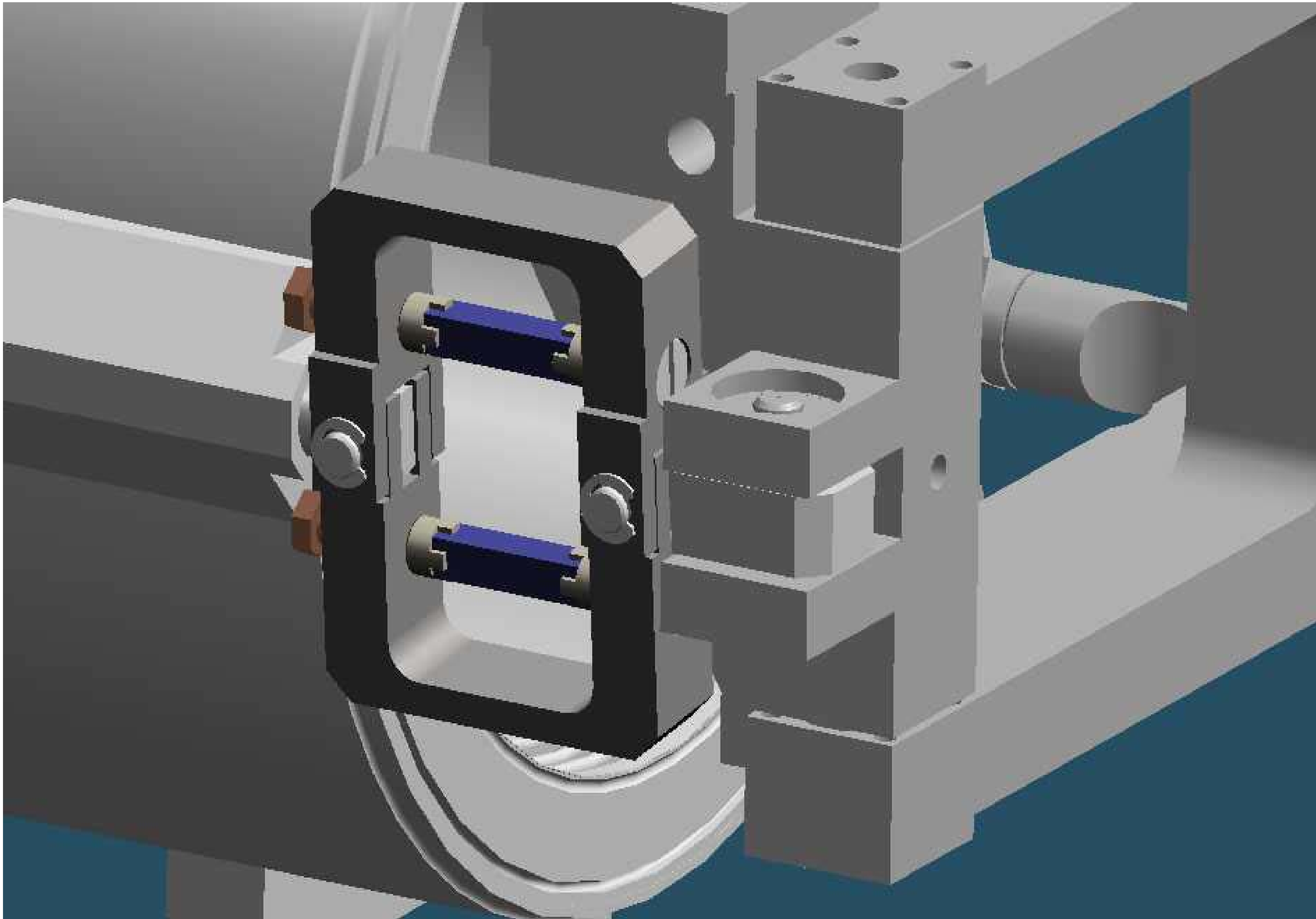
AC70: History



Some statistics on the test

- Test running 7.3.2003 – 14.8.2003
  - test took about 160 days (exact 3848 hours)
  - Scheduled cryo shutdown about 600 hours
  - warm-ups: 2x300 K, 4-5 times around 100 K
- Processing took about 165 hours
  - coupler 130 hours
  - cavity 35 hours
- RF operation of the coupler
  - cavity off-resonance and not at 2 K
  - power between 150 – 600 kW
  - 5 Hz operation very smooth
  - 10 Hz causes heating of the warm cer
  - **Total time RF on ~ 2400 hours**
- RF operation of the cavity
  - **1100 hours at around 35 +/-1 MV/m**
    - **~110 hours without interruption**
    - **57 hours at 36 MV/m +**
  - most of this is feed-forward operation
- Piezo compensation
  - **about 700 hours**

Drawing of current setup (H.-B. Peters)



Lilje

Problems with the active tuner

- Fundamental problem:
  - large tuning needed for AC72 (and AC73)
    - ´natural´ frequency after tank welding is 780 kHz above 1,3 GHz
    - Normally this is more like 200-300 kHz
  - this results in a very large force tearing on the piezo fixture
  - even the very rigid single piezo fixture cannot be used to operate at nominal frequency
- Single Piezo fixture
  - So far only 300-400 Hz compensated (no resonant excitation of the cavity)
  - Achieved compensation at 1,3 GHz
  - Alternative: Resonant mechanical excitation of the cavity
- Double Piezo fixture
  - Has only been operated at 1,3 GHz + 600kHz
  - Needs a stiffer design
  - Alternative: Put 2 single Piezo fixtures ?

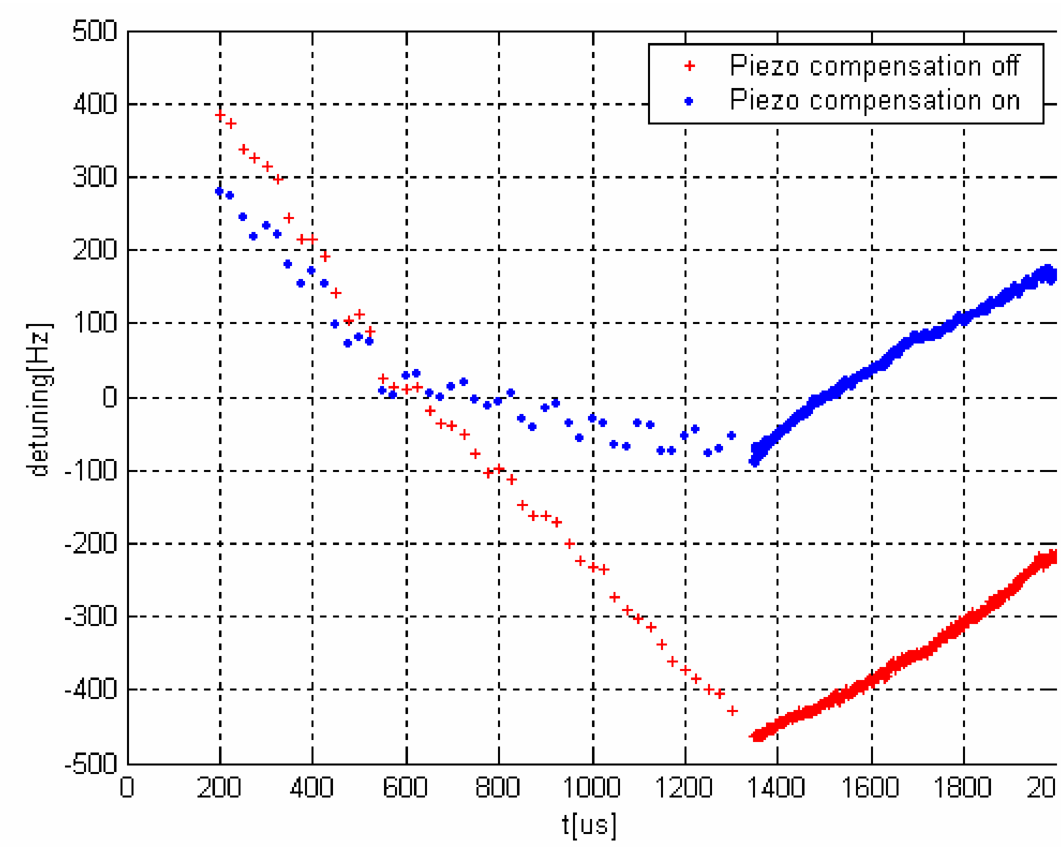
Lilje

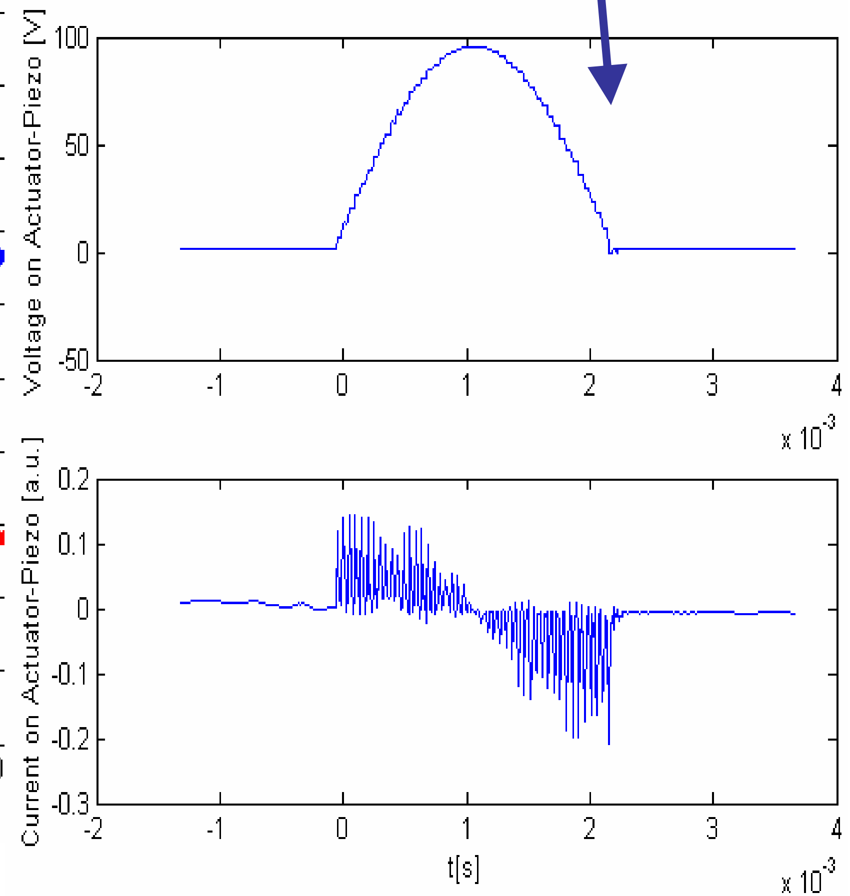
Frequency stabilization during RF pulse using a piezoelectric tuner

Blue: With piezo

Red: Without piezo

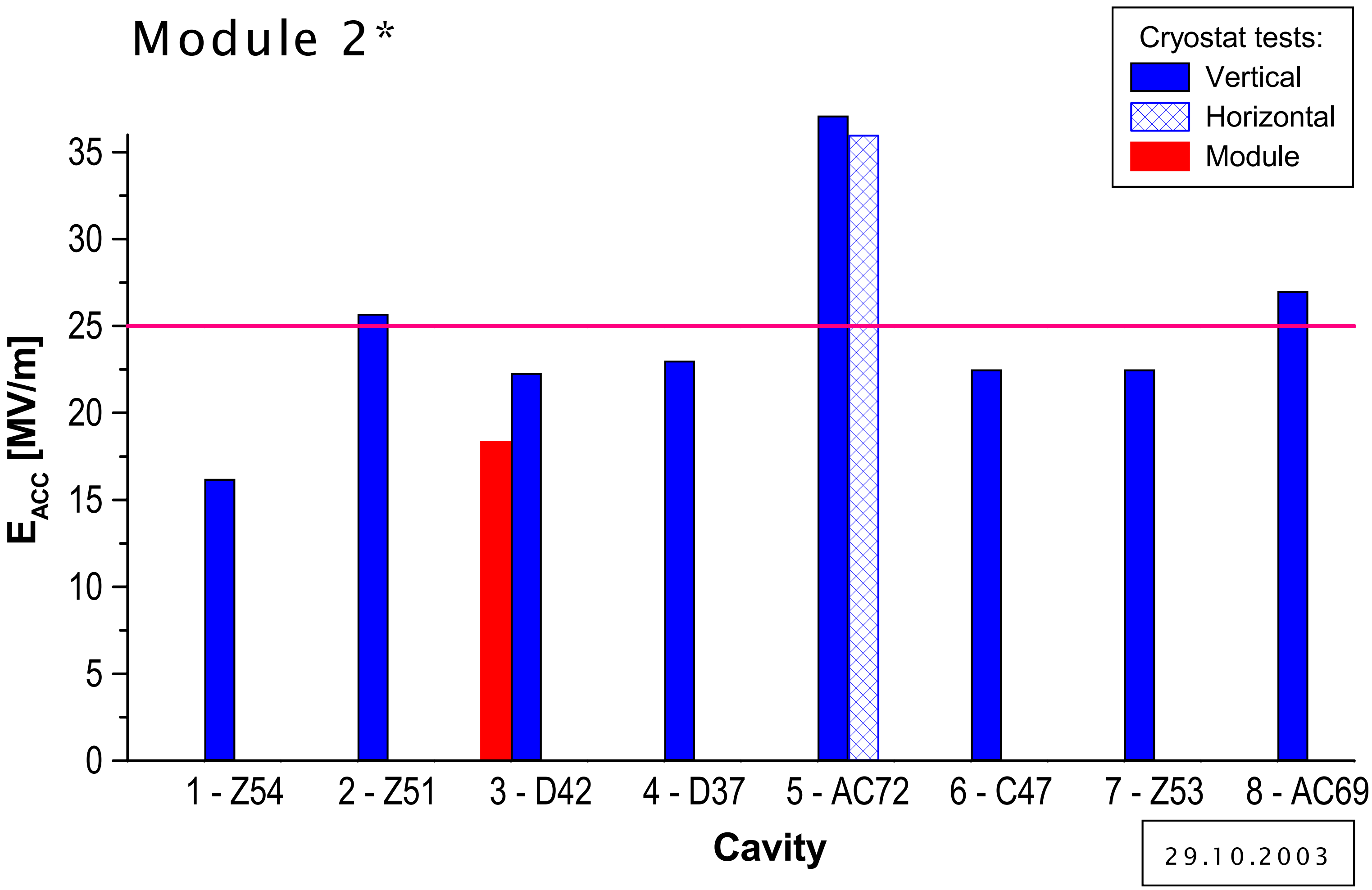
Frequency detuning of 500 Hz compen
voltage pulse (~100 V) on the piezo. N
compensation





Moeller

Module 2*



Moeller

Conclusion

- all parts needed for the high gradient module (new design spare) are available, the piezo design can be finished by Nov. 04
- the Superstructure has to be reassembled
- for a second high gradient module (old design spare) the cavity He-tanks have to be manufactured

monopole single passage losses
TESLA-TDR

$f_{rep} = 5$ Hz
$T_{HF} = 0.95$ ms

a) Collider (500GeV)

$\sigma_{bunch} = 400\ \mu m$
$N_{bunch} = 2820$
$q_{bunch} = 3.2$ nC (9.5 mA)

losses per module (12x9cells):

$P =$ 23.3 W
$P(f >\ 5$ GHz$) =$ 17.4 W
$P'(f > 10$ GHz$) =$ 12.7 W
$P'(f > 20$ GHz$) =$ 8.1 W
$P'(f > 50$ GHz$) =$ 3.0 W
$P'(f > 100$ GHz$) =$ 0 .7 W

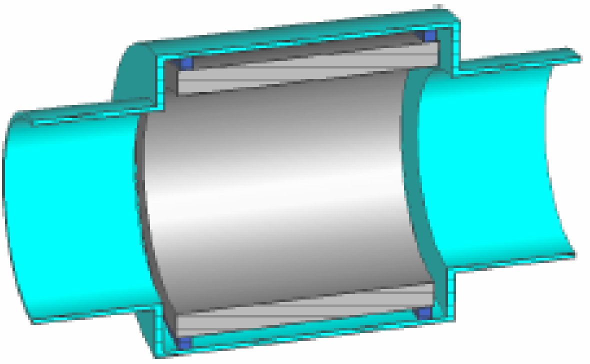
b) FEL

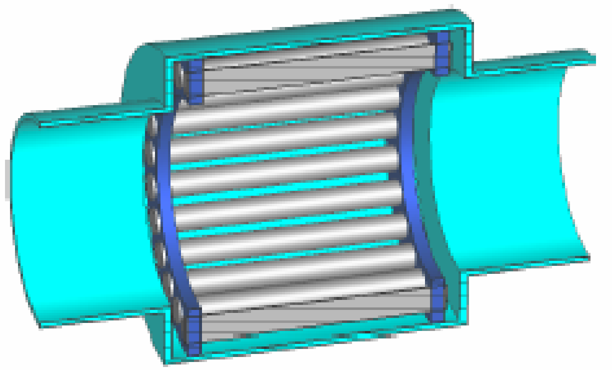
$\sigma_{bunch} = 25\ \mu m$
$N_{bunch} = 11315$
$q_{bunch} = 1.0$ nC (12 mA)

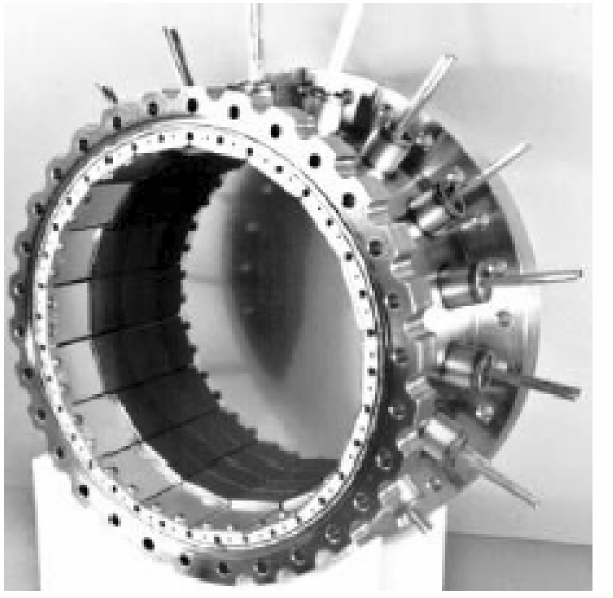
losses per module (12x9cells):

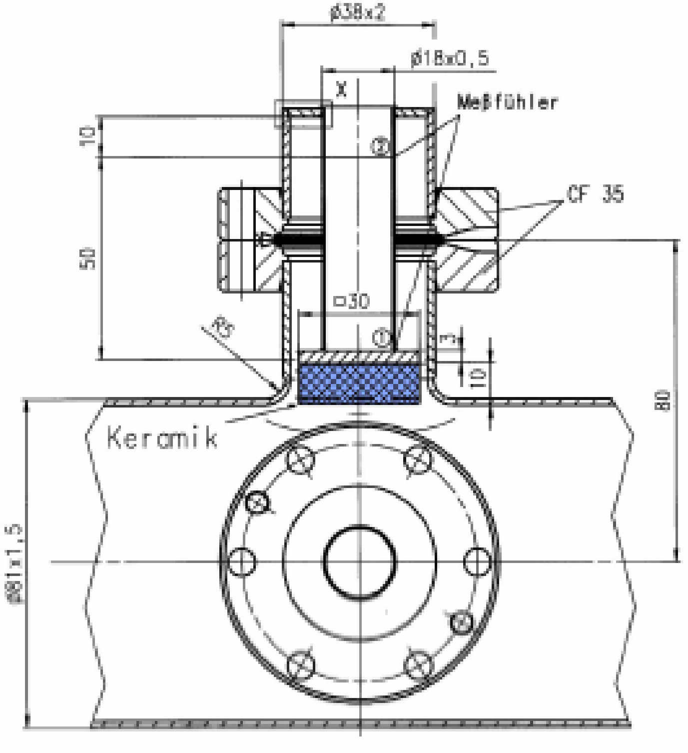
$P' =$ 14.2 W
$P'(f >\ 5$ GHz$) =$ 11.5 W
$P'(f > 10$ GHz$) =$ 9.3 W
$P'(f > 20$ GHz$) =$ 7.1 W
$P'(f > 50$ GHz$) =$ 4.7 W
$P'(f > 100$ GHz$) =$ 3.1 W

absorber design









- thermal isolation to T < 70K
- thermal contact (cooling) to T = 70K
- electrical contact
- mechanical contact
- protection ?

it is not possible to design an absorber without boundary conditions !!!
the material is probably not (the big) problem;

Quad from Spain Brueck

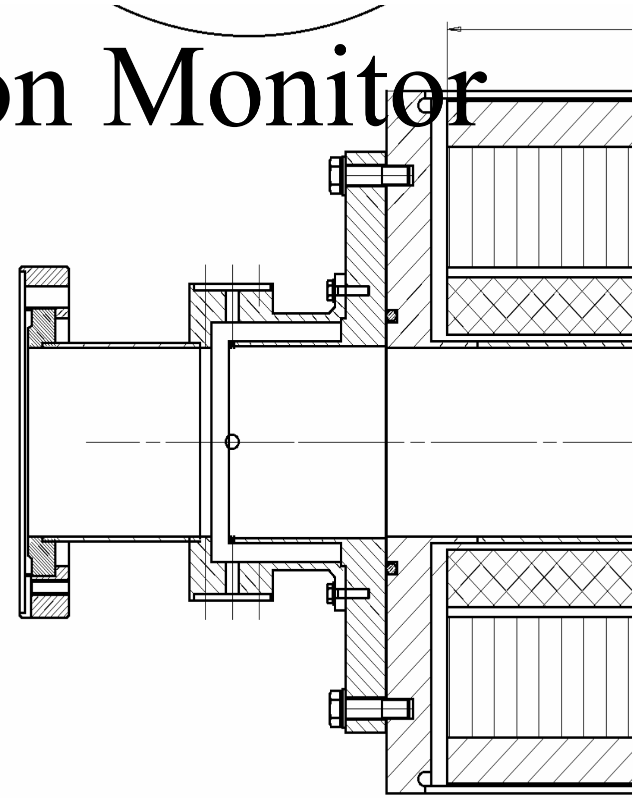
Status of the magnet fabrication

- Ribbon machine working, first ribbon produced
- Winding tooling is finished
- Vacuum impregnation chamber ready and tested
- All spacers ready, problems with the layer jump fixed
- First quadrupole coil next week
- Curing oven available
- Iron yoke an aluminum cylinder ready soon
- Complete magnet expected at DESY in April
- Ciemat/CEDEX needs input for the cryostat design

Brueck

Beam Position Monitor

- No final decision yet
  - Cavity type monitor not good
  - "Reentrant" monitor favored
  - Cleaning problem probably solved
- BPM test stand is being build
- Responsible Dirk Noelle



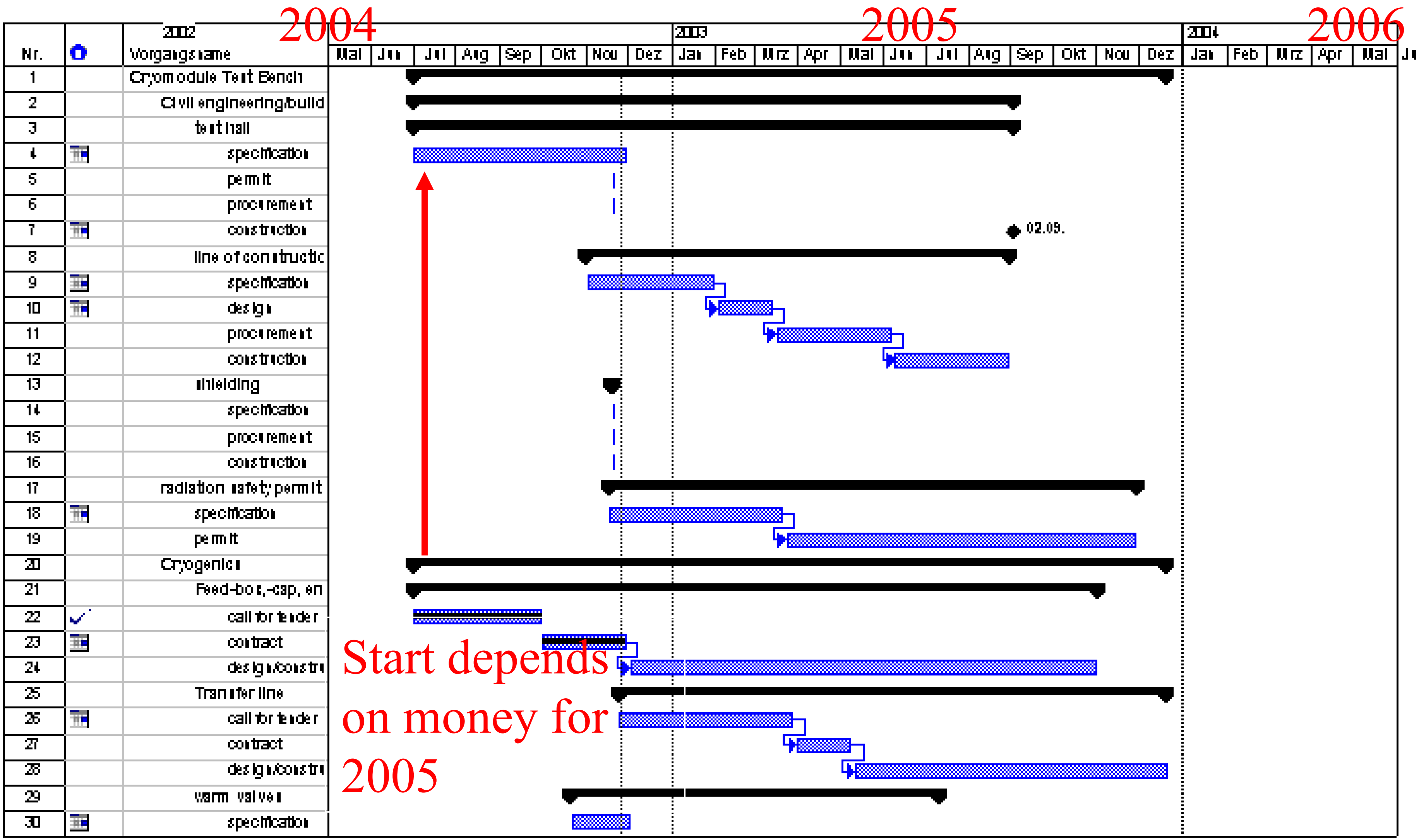
Reentrant Monitor

Entwurf
BPM ohne Faltenbalg,
angeflanscht an Quadrupol,
gedichtet durch Al-Kantendichtung.

Ba.
15.01.04

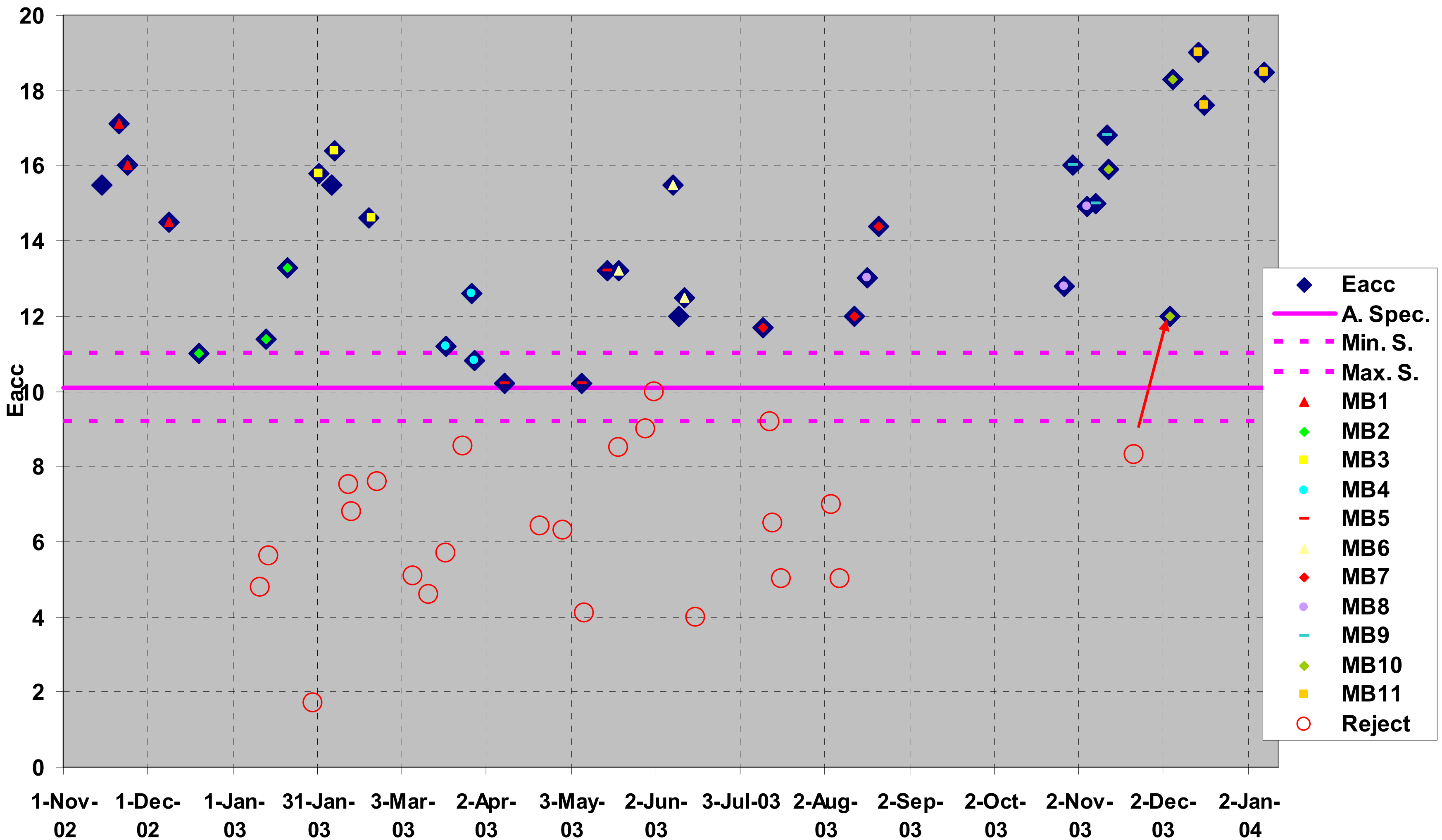
Petersen

Time schedule



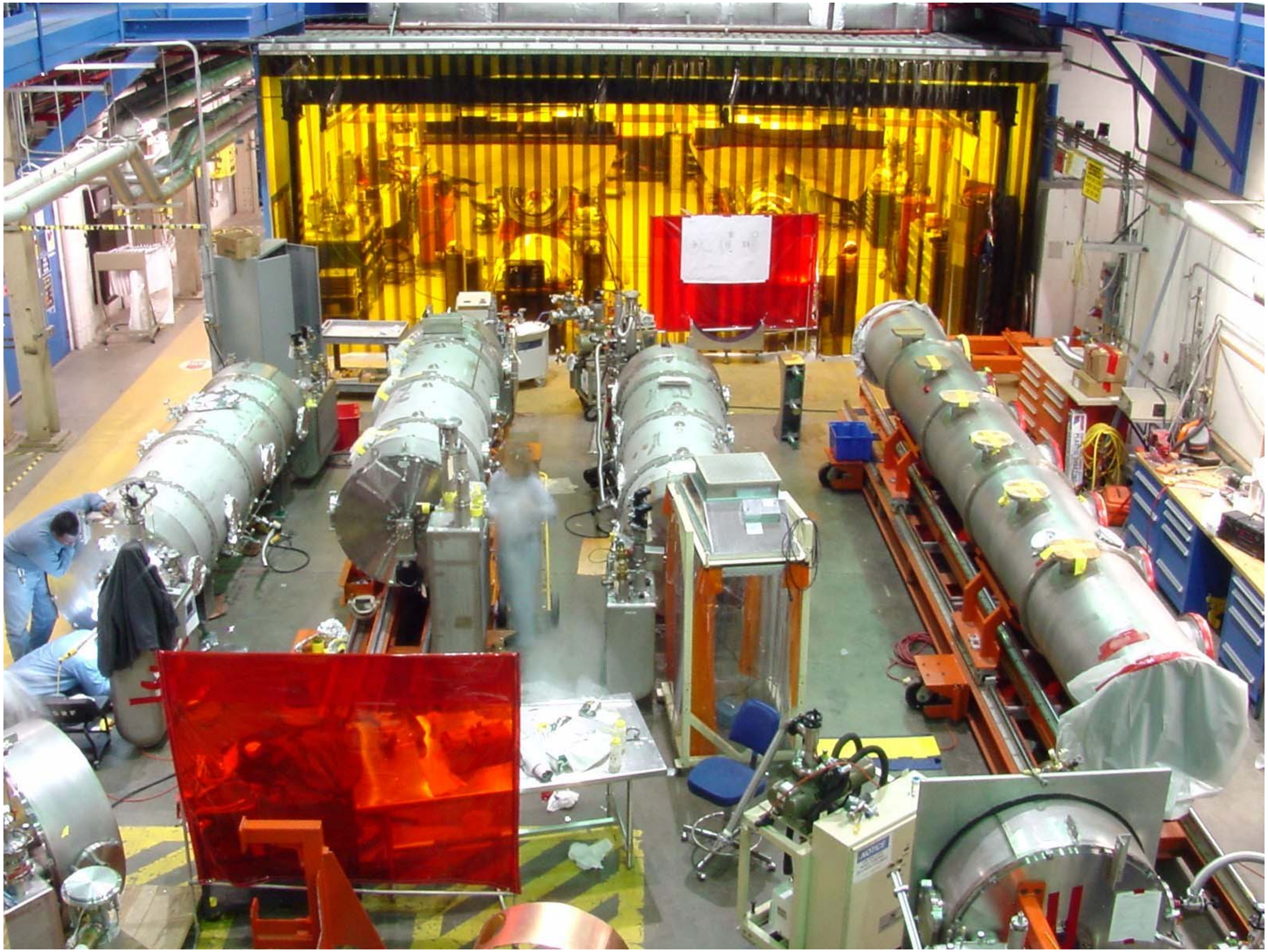
Vertical Test History

Mammosser SNS

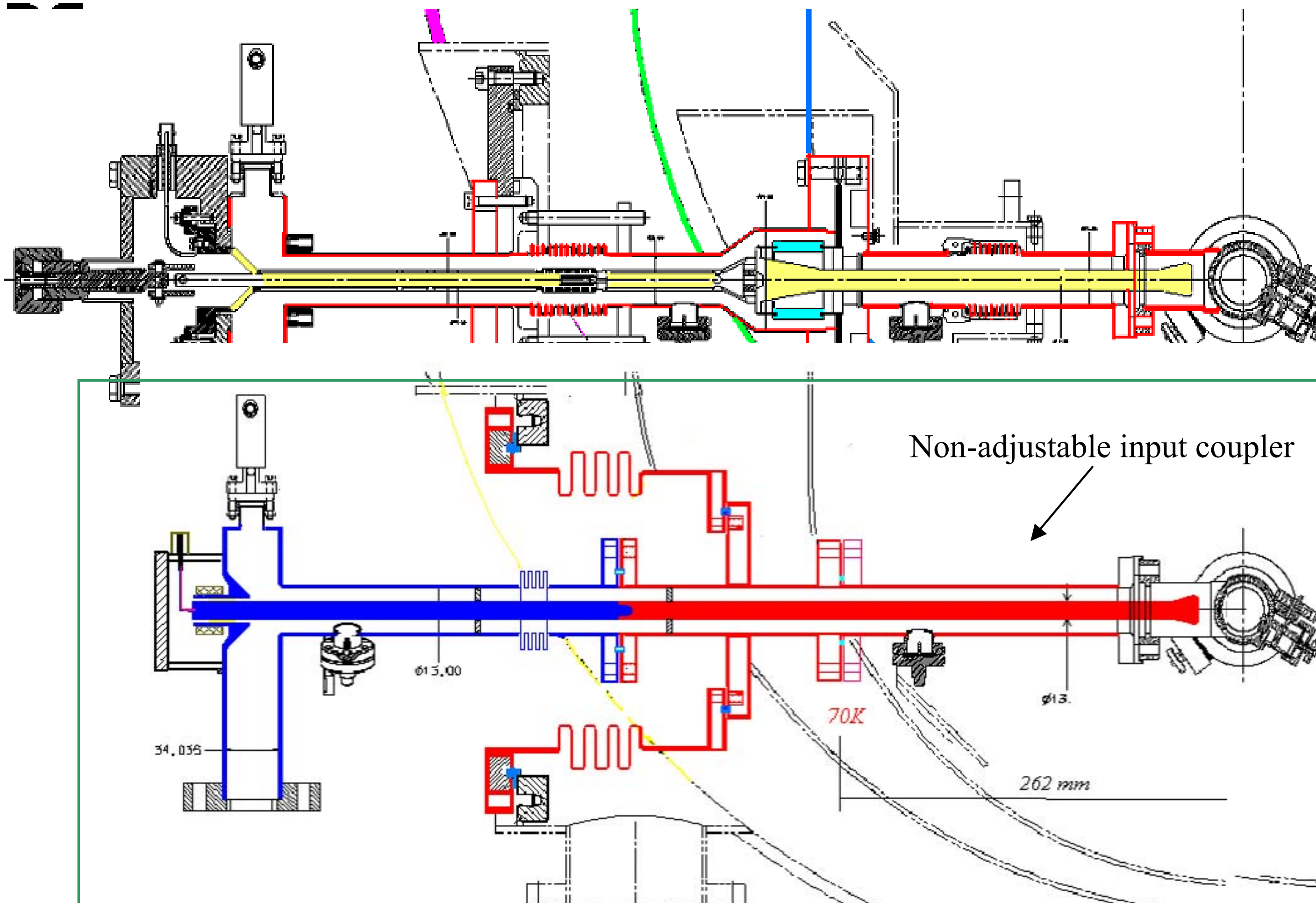


Cryomodules M4, thru M8 & FEL3

Rode JLab



Adjustable vs. simple non-adjustable coupler



Toshiba Kly Status and Schedule Y H Chin

- About 60% of brazing was already finished.
- The baking of the tube will start in early February.
- So, by the end of February, the Prototype-0 will be ready for testing at Toshiba, as scheduled.
- The delivery of waveguide components has been a bit slow.
- If the delivery of the waveguide system can meet the schedule, the testing of Prototype-0 will start in March.

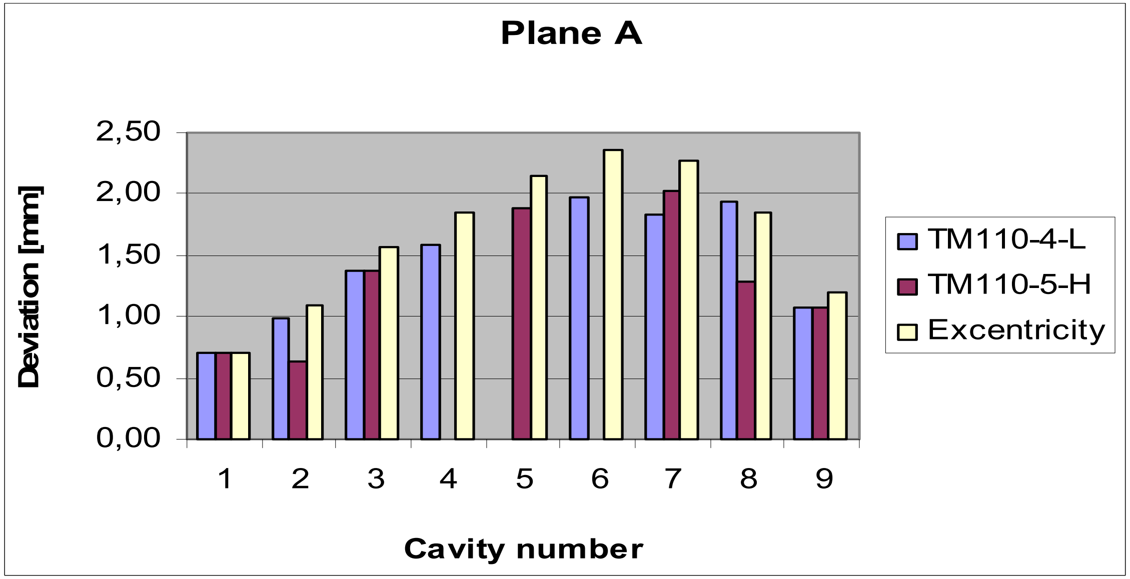
Brief Report on Where X-Band Stands Now: R1/R2 Prospects

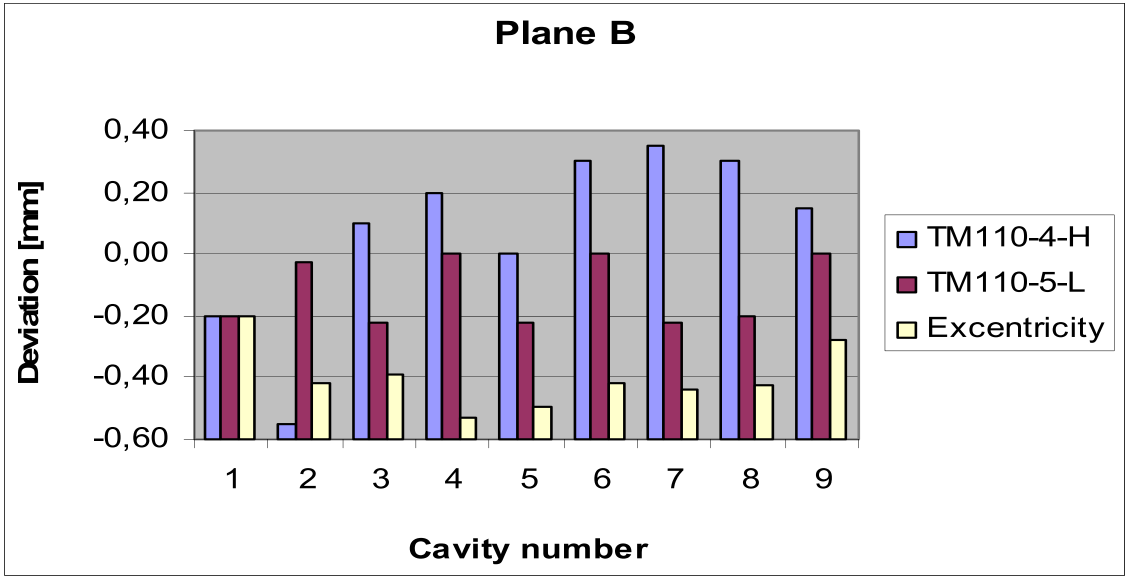
Yong Ho Chin
KEK
TESLA Collaboration Meeting
DESY, Zeuthen

K Saito- report on EP and various procedures that reduce emitter size and beta (field enhancement)

Lebanc- Experiments with 9-cell copper cavity Initial measurements of cavity electrical center

- As was mentioned before, there was a problem with fixation of starting point of the bead on the iris, so the absolute values are loaded by additive error. To compare the cell to cell displacement, the values on graphs are corrected (first cell is equaled to the mechanical eccentricity)
- Missing bars mean insufficient field in cells to make a measurement

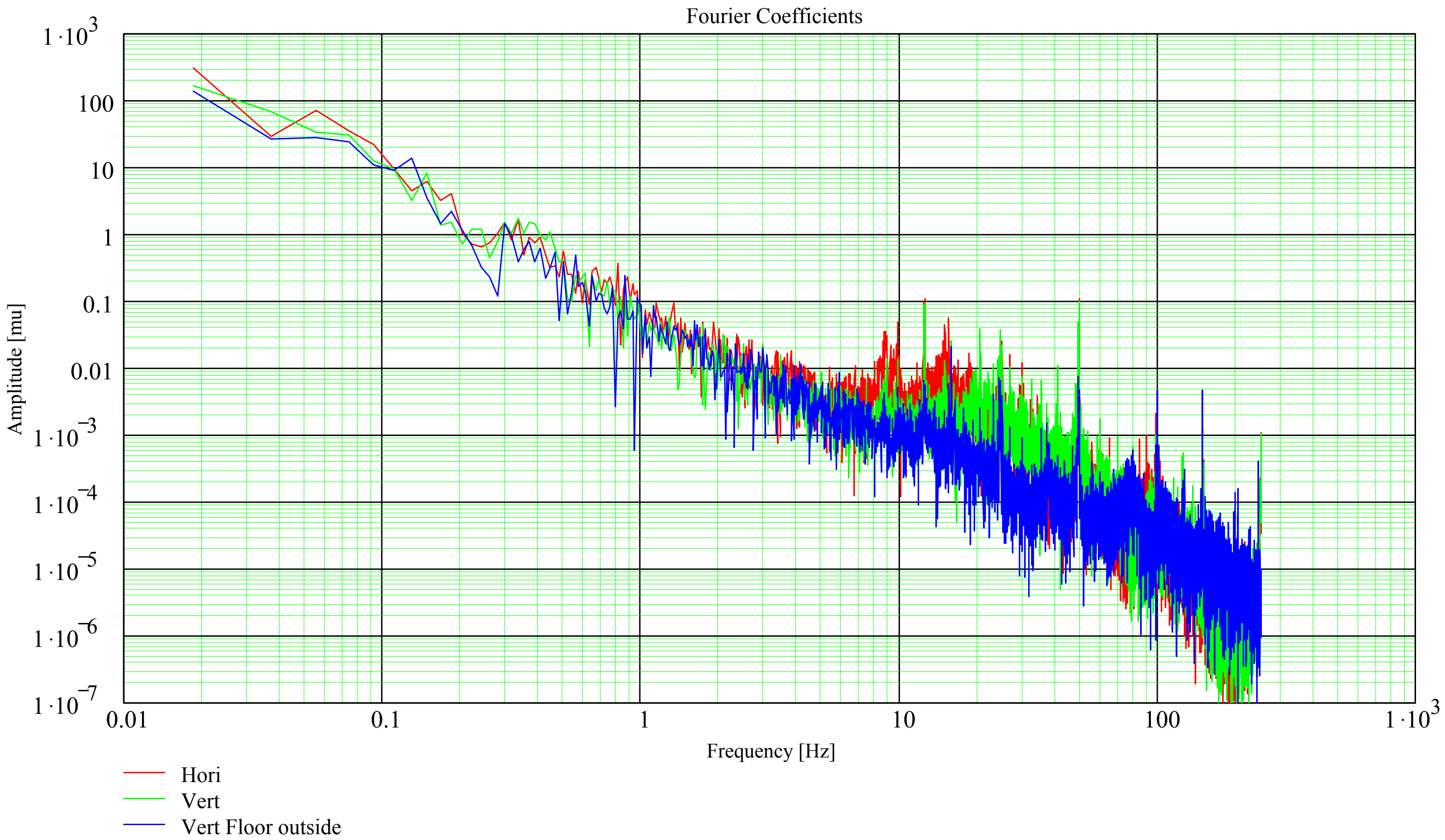




ACC2 horizontal, vertical
Vertical outside TTF Tunnel on floor

Brueck Initial Measurements Fourier Spectrum

Preliminary!



Bositti-Module 1 1st & 2nd complete thermal cycles

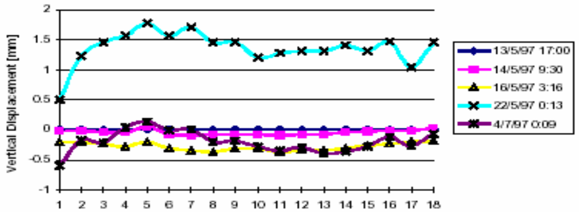


FIG. 20: Vertical displacements related to stable positions during the first complete thermal cycle.

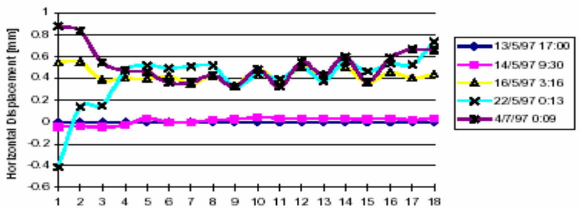


FIG. 21: Horizontal displacements related to stable positions during the first complete thermal cycle.

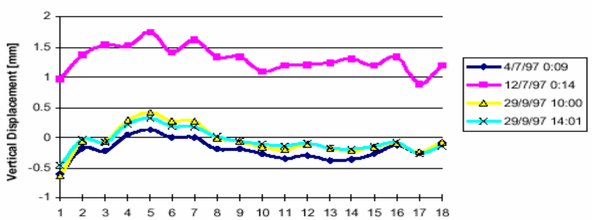


FIG. 22: Vertical displacements related to stable positions during the second complete thermal cycle.

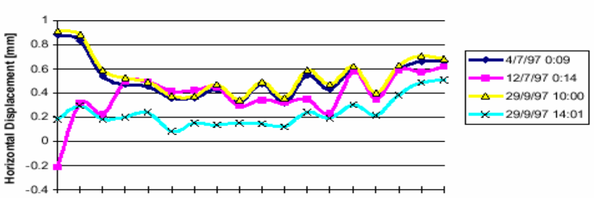


FIG. 23: Horizontal displacements related to stable positions during the second complete thermal cycle.

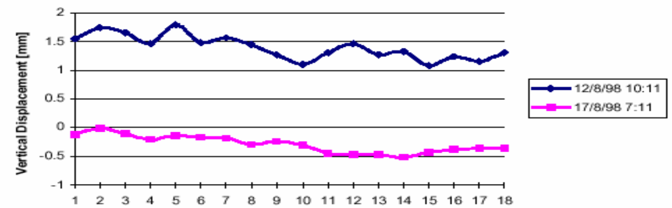


FIG. 24: Vertical displacements related to stable positions 23/11/98 during the third complete thermal cycle.

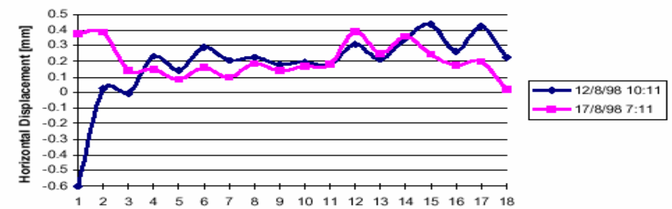


FIG. 25: Horizontal displacements related to stable positions 23/11/98 during the third complete thermal cycle.

- 14/5/97 h 9:30 Starting of the vacuum pumping.
- 16/5/97 3:16 Pressure = 0.1 mb; T = 300K.
- 22/5/97 0:13 Stable cold position after first cooldown operation.
- 4/7/97 0:09 Stable position after warm up; pressure = 0.1 mb.
- 12/7/97 0:14 Stable position after second cooldown.
- 29/9/97 10:00 Stable position after second warm up; pressure = 0.1mb.
- 29/9/97 14:01 Stable position after second warm up; pressure = 1000 mb.

Cold Results #2, 2 tunnel, und e+, 3% energy overhead

Edwards Reliability

region	% downtime incl forced MD
sitewide	4.614
e- injector	1.322
e- DR	1.767
e- compressor	0.9338
e- linac	1.288
e- BDS	0.6625
e+ source	0.9052
e+ PDR	0
e+ DR	1.347
e+ compressor	0.5155
e+ linac	1.103
e+ BDS	0.4971
IP	0.5185
% time down incl forced MD	15.5

% time down incl forced MD	15.5
% time fully up integrating lum or sched MD	84.5
% time integrating lum	74.3
% time scheduled MD	10.2
% time actual opportunistic MD	1.78
% time useless down	13.7
number of accesses per month	3.79

Note: linacs are 2.4%
DR's 3.1%
other regions 5.4%
site wide 4.6%
cryo plant 2.6%
power 1.4%
controls global 0.6%