Hans Weise / DESY
Frascati 5/11/01

# Results from TTF Linac Operation since Last Meeting

## Part 1

# TTF Linac Program May until October 2001

since the May 2001 shutdown...

FEL operation under optimized conditions

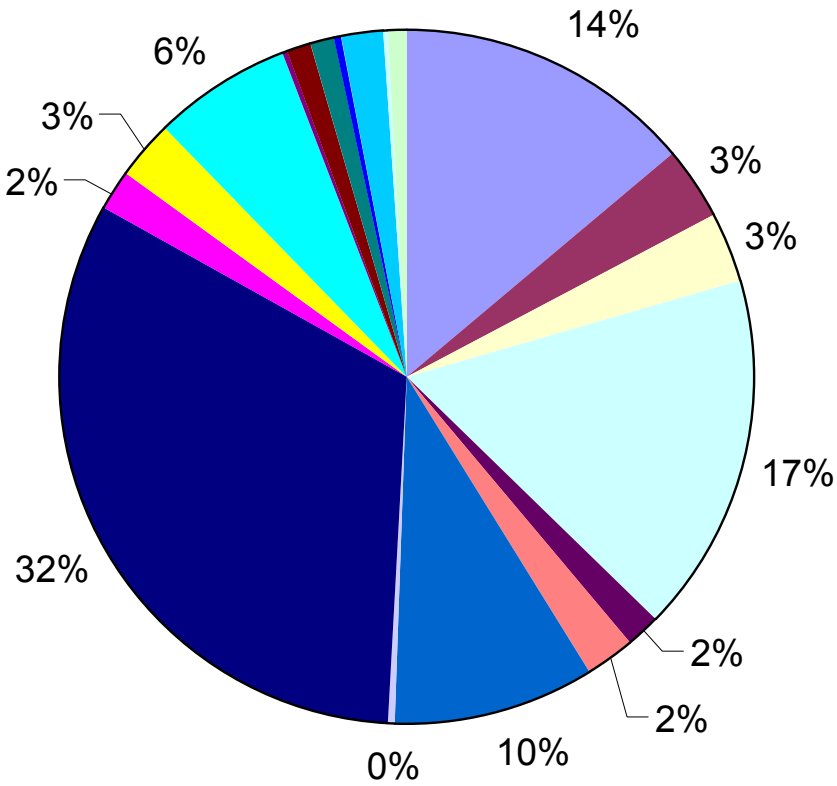
| | |
|---|---|
| FEL operation: | ablation & cluster experiments |
| FEL goal: | saturation |
| FEL studies: | RAFEL |

high gradient operation

CSR studies

dark current studies

# TTF operation between 27/08 and 28/10/01




| | | |
|---|---|---|
| 14% | LASER | |
| 3% | GUN | |
| 3% | GUN VAC | |
| 17% | CC | |
| 2% | KLYS3 | |
| 2% | CRYO | |
| 10% | GUN&KLYS2 | |
| 0% | MAGS | |
| 32% | KLYS2 | |
| 2% | MOD2 | |
| 3% | UNKNOWN | |
| 6% | TOURS | |
| 0% | PD | |
| 1% | DIAGS | |
| 1% | VACUUM | |
| 0% | INTERLOCKS | |
| 2% | SERVERS | |
| 0% | MISSPULSE | |
| 1% | OTHER | |

| | | |
|---|---|---|
| 32% | KLYS2 | |
| 17% | CC | |
| 14% | LASER | |
| 10% | GUN&KLYS2 | |

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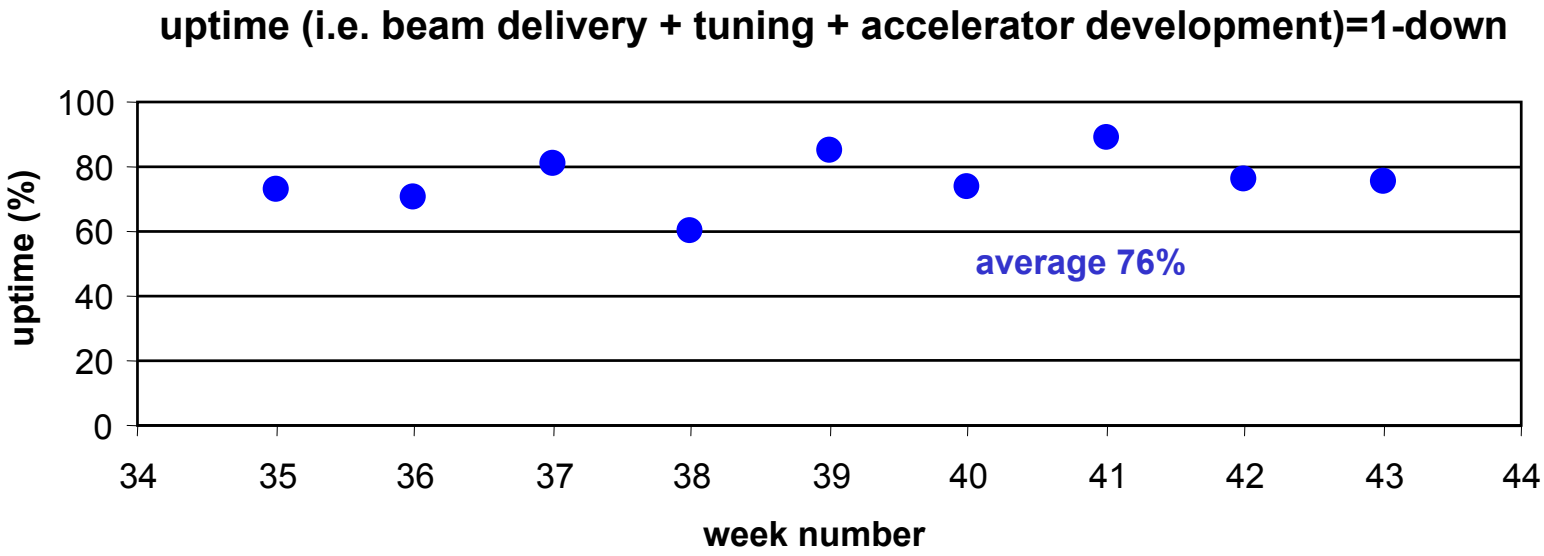
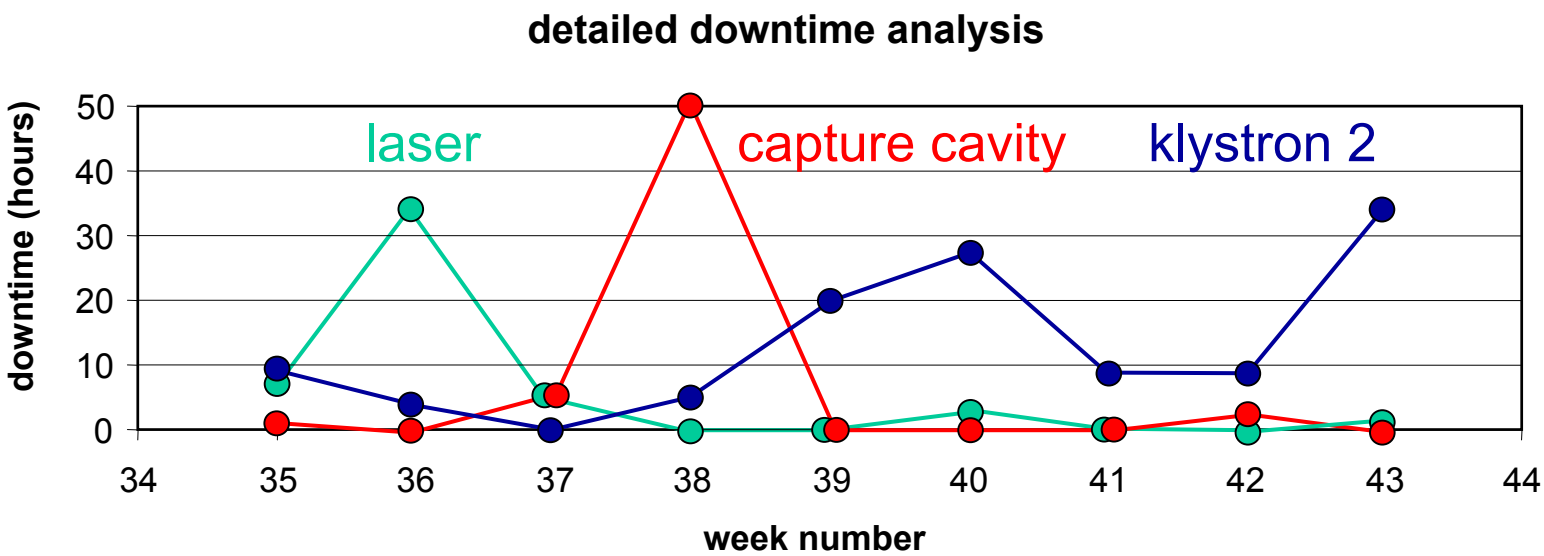
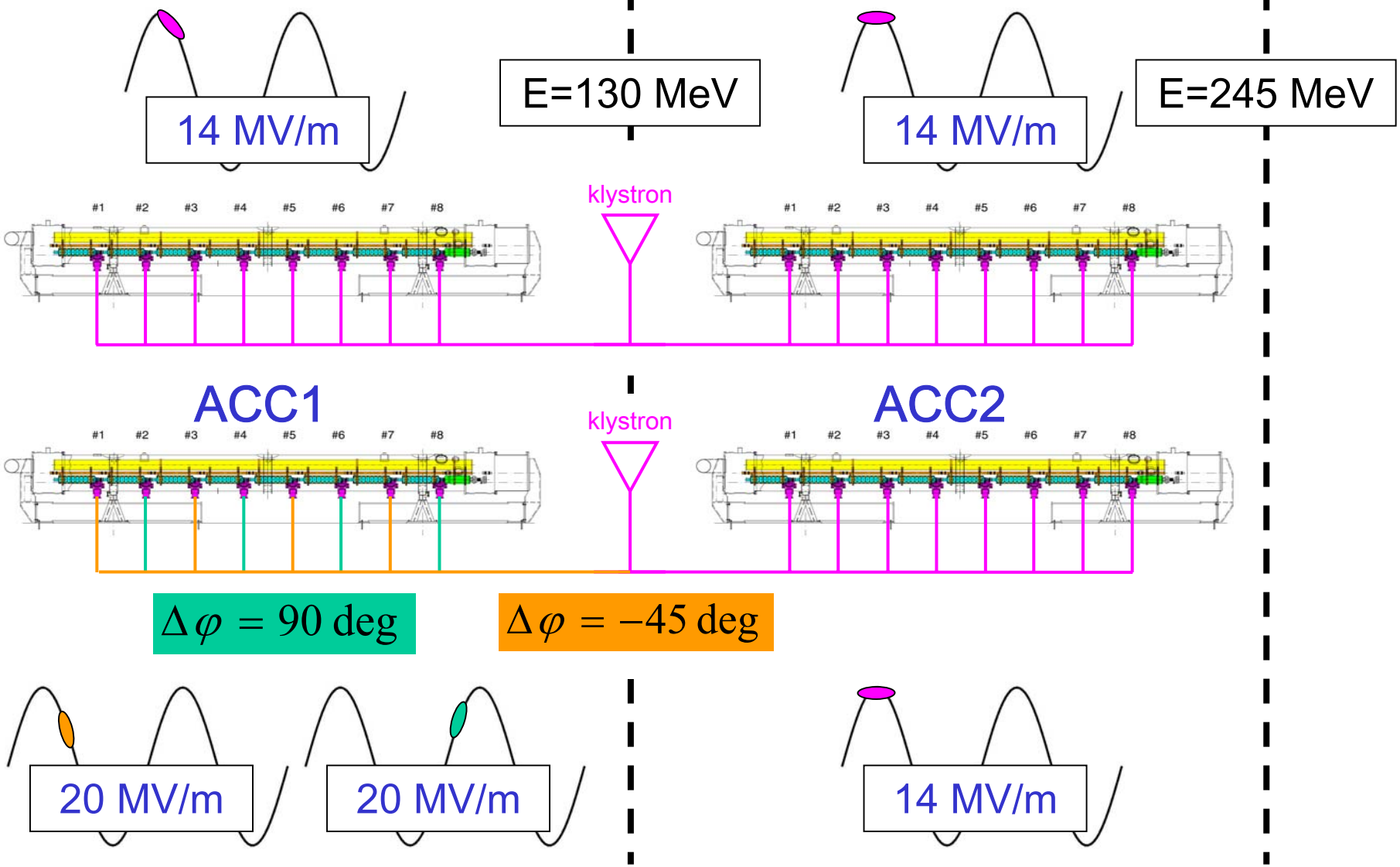
| | |
|---|---|
| Uptime | 1407 h (76%) total - off |
| Downtime | 337 h (24%) failure + tours |

# TTF operation between 27/08 and 28/10/01

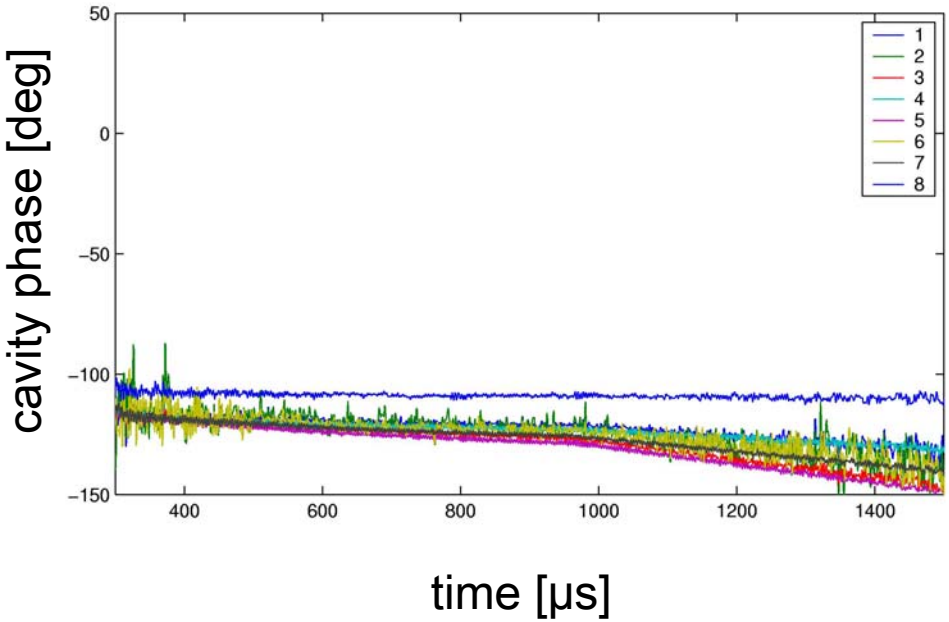


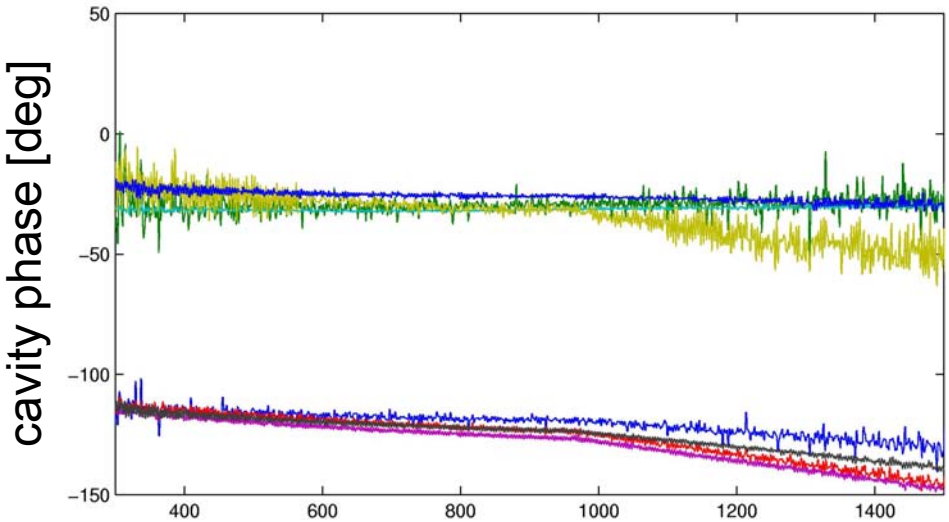
# High gradient operation of module ACC1



# Cavity phases of module ACC1




before phasing

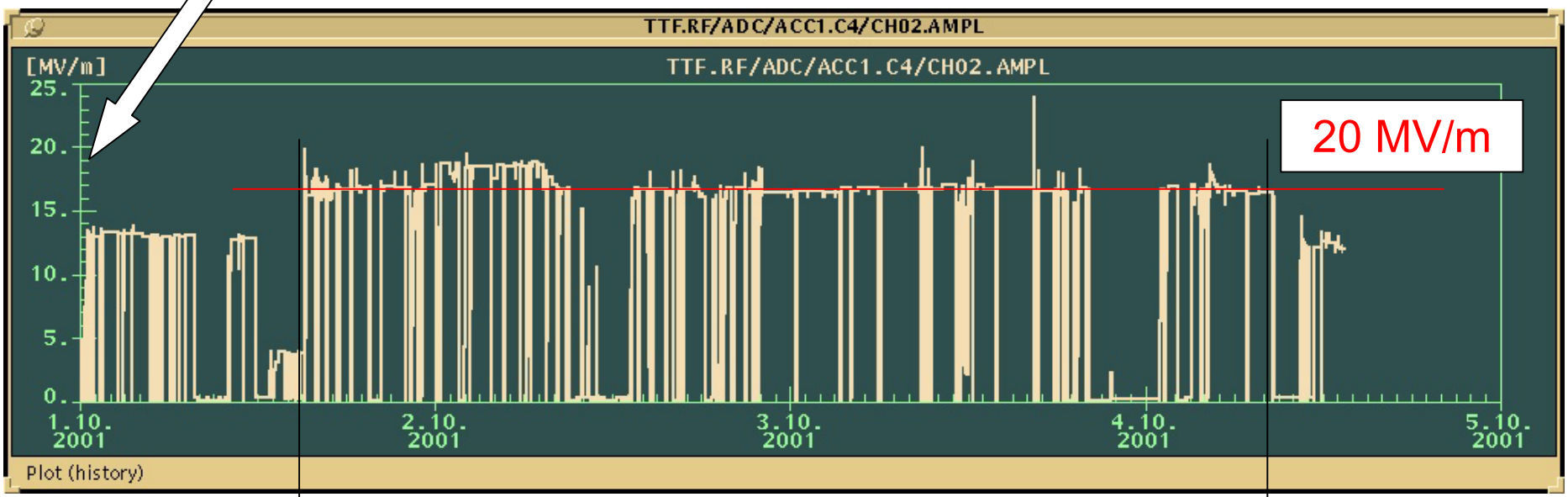



after re-phasing

cavities 2,4,6,8

cavities 1,3,5,7

# Gradient history of module ACC1

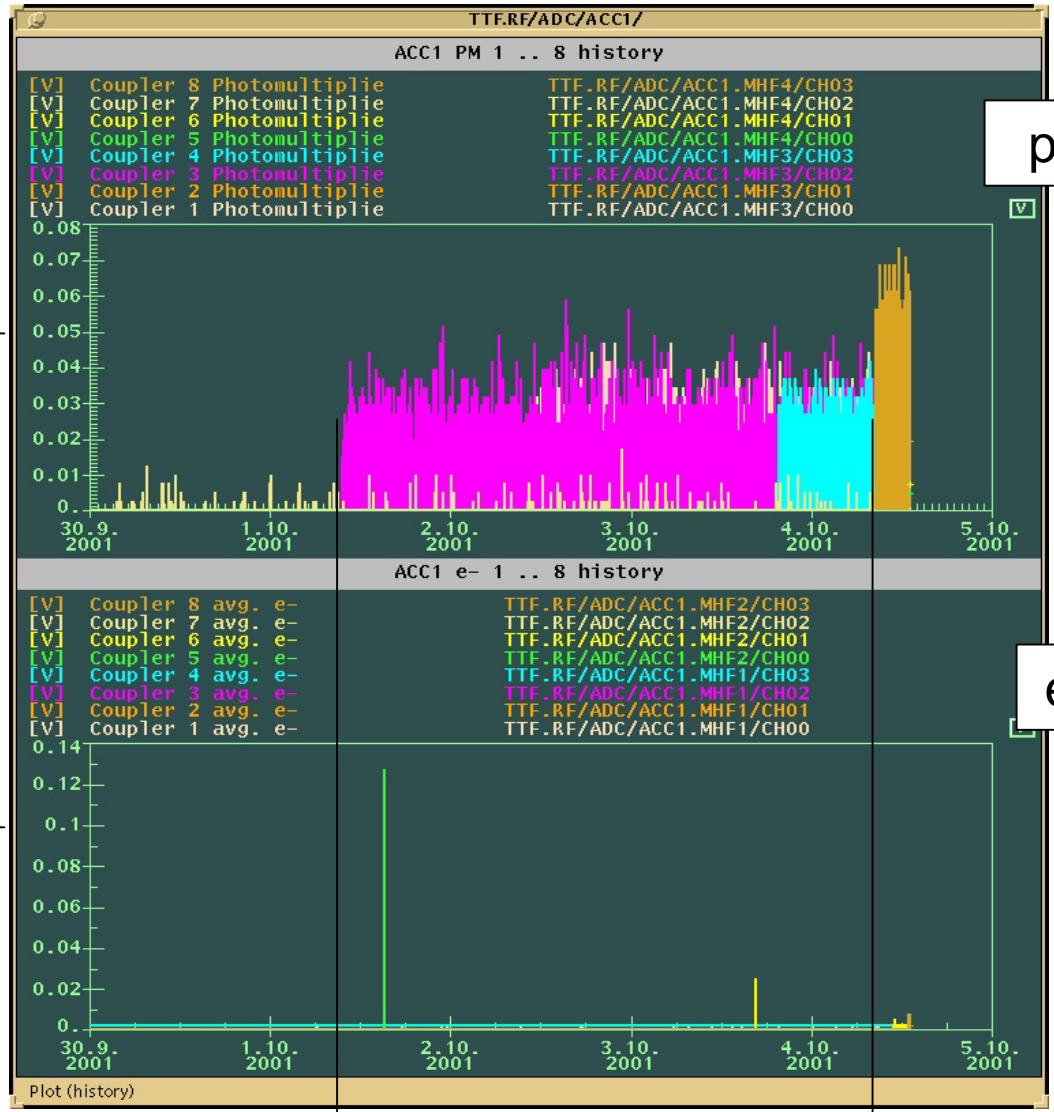



approx. 40 hours uptime

1 Hz rep.rate, 800 µs flat top

20 MV/m

# Coupler history of module ACC1 at 20 MV/m




0.05 V

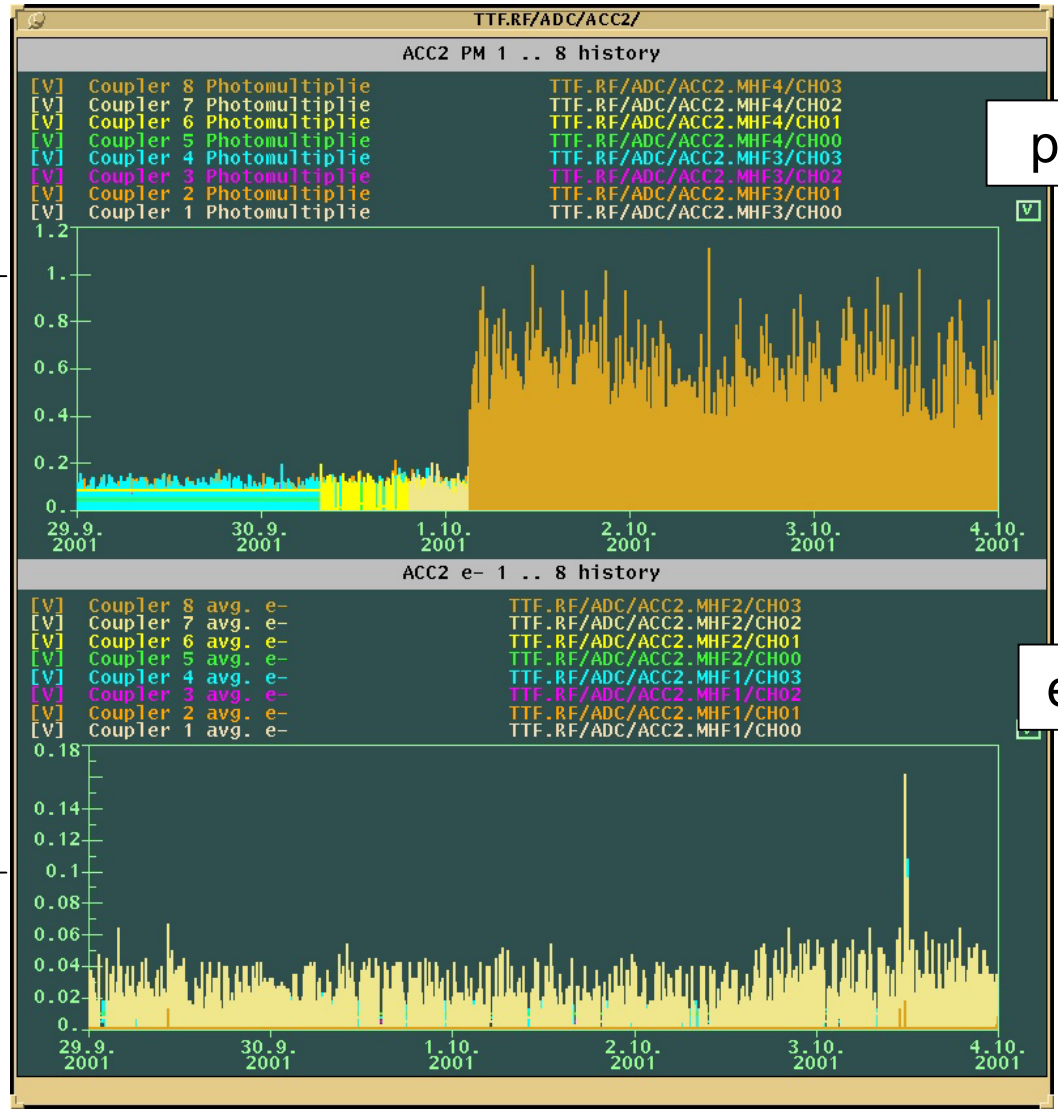
0.1 V

photo multiplier

electrons

20 MV/m

# Coupler history of module ACC2 at 14 MV/m




1.0 V

0.1 V

photo multiplier

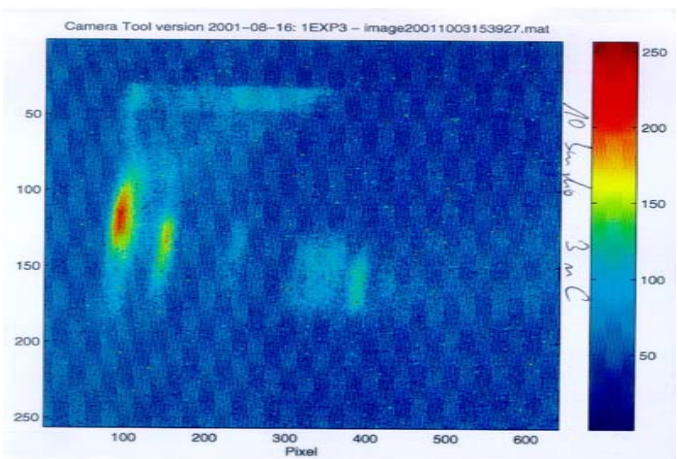
electrons

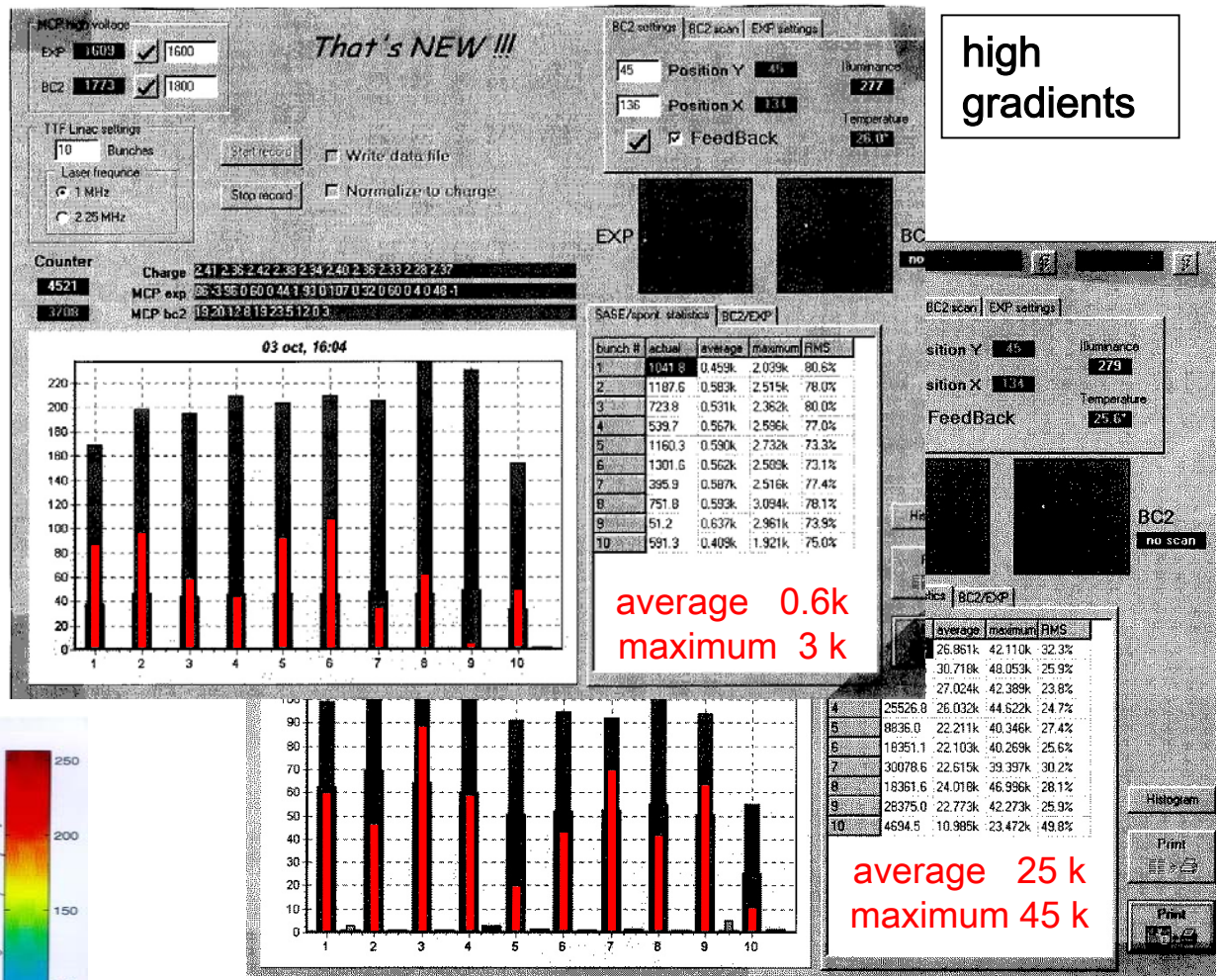
# SASE with high gradient operation of module ACC1

the operator‘s SASE display

high gradients

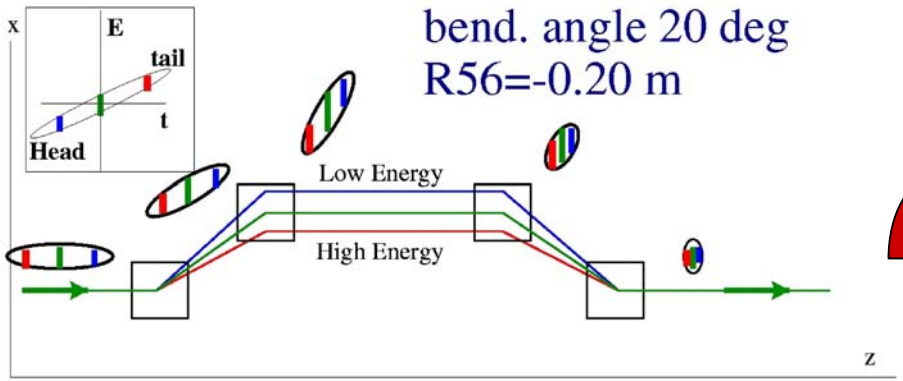
10 bunches @ 3 nC seen of view screen 1EXP3 in the dispersive section




standard operation

# The need for CSR measurements




$\Delta E, \varepsilon_n, \sigma_z$

needs to be measured as
f (phase(ACC1))

Bunch compression in BC2 causes
short bunches to radiate coherently

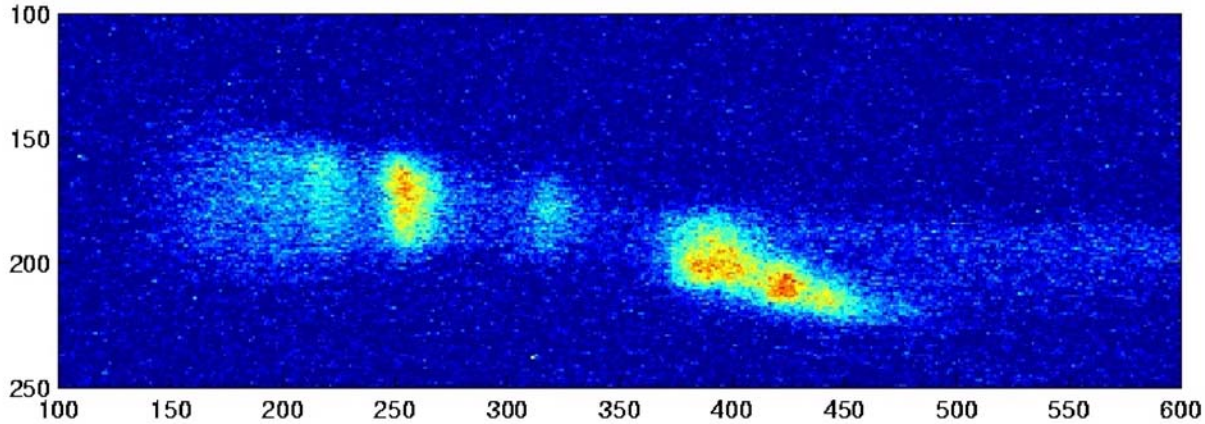
This requires ...
- a stable and reproducible run over many shifts
- precise bunch length measurement

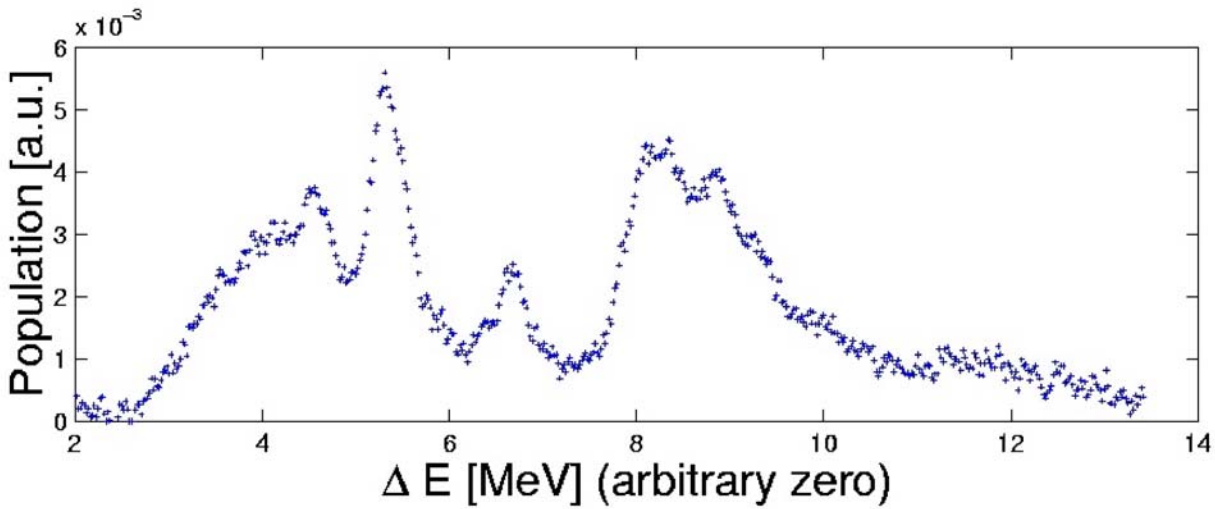
Currently observed ...
- charge dependent energy spread blow-up @ minimum bunch length
- transverse emittance increases with bunch charge, horizontal one dilutes when ACC1 is operated for max.compression

# CSR measurements

Example for energy spread blow-up seen at maximum compression;

the picture was taken in the dispersive section downstream of the undulator



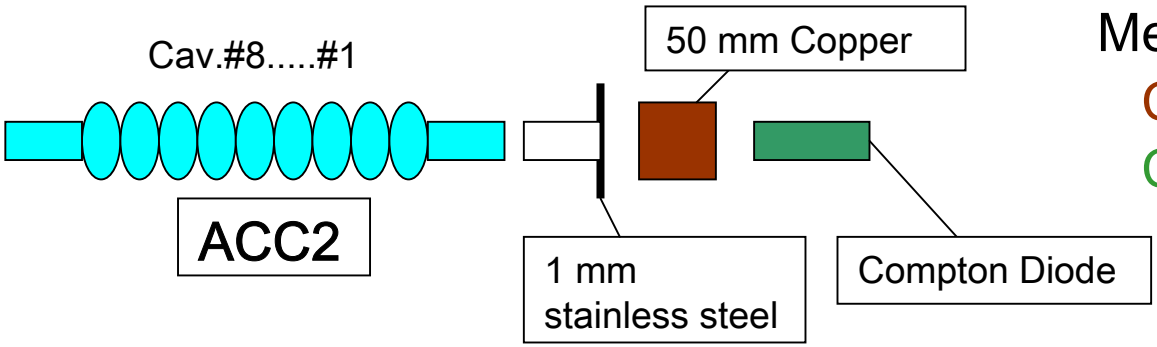



# CSR measurements

## open questions & next steps

- the vertical emittance dependence on the charge is suspicious and not understood
- some strange vertical tail downstream of BC2
- x-y coupling depending on ACC1 phase and on injection into ACC1
- improve the machine stability
- new emittance / bunch length meas. station at the end of BC2 and a high dynamical range (12 bit) CCD camera
- installation of flat BC2 vac.chamber and check for drastic effects
- gain experience with the flat chamber since it‘s going to be used for TTF Phase 2 (with additional copper plating)

# Dark current measurements at ACC2




Measured signals:

Current on copper

Current in Compton Diode

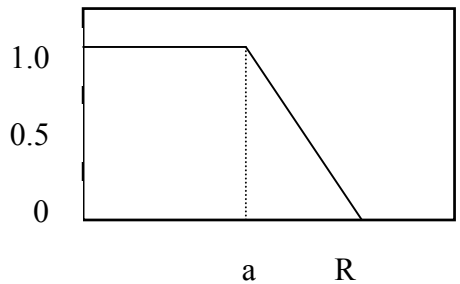
Why 50 mm Copper?

$R \approx 0.55\ E\ [g/cm^2]$ $a \approx 0.238\ E\ [g/cm^2]$ $\rho_{Cu} = 8.9\ g/cm^3$

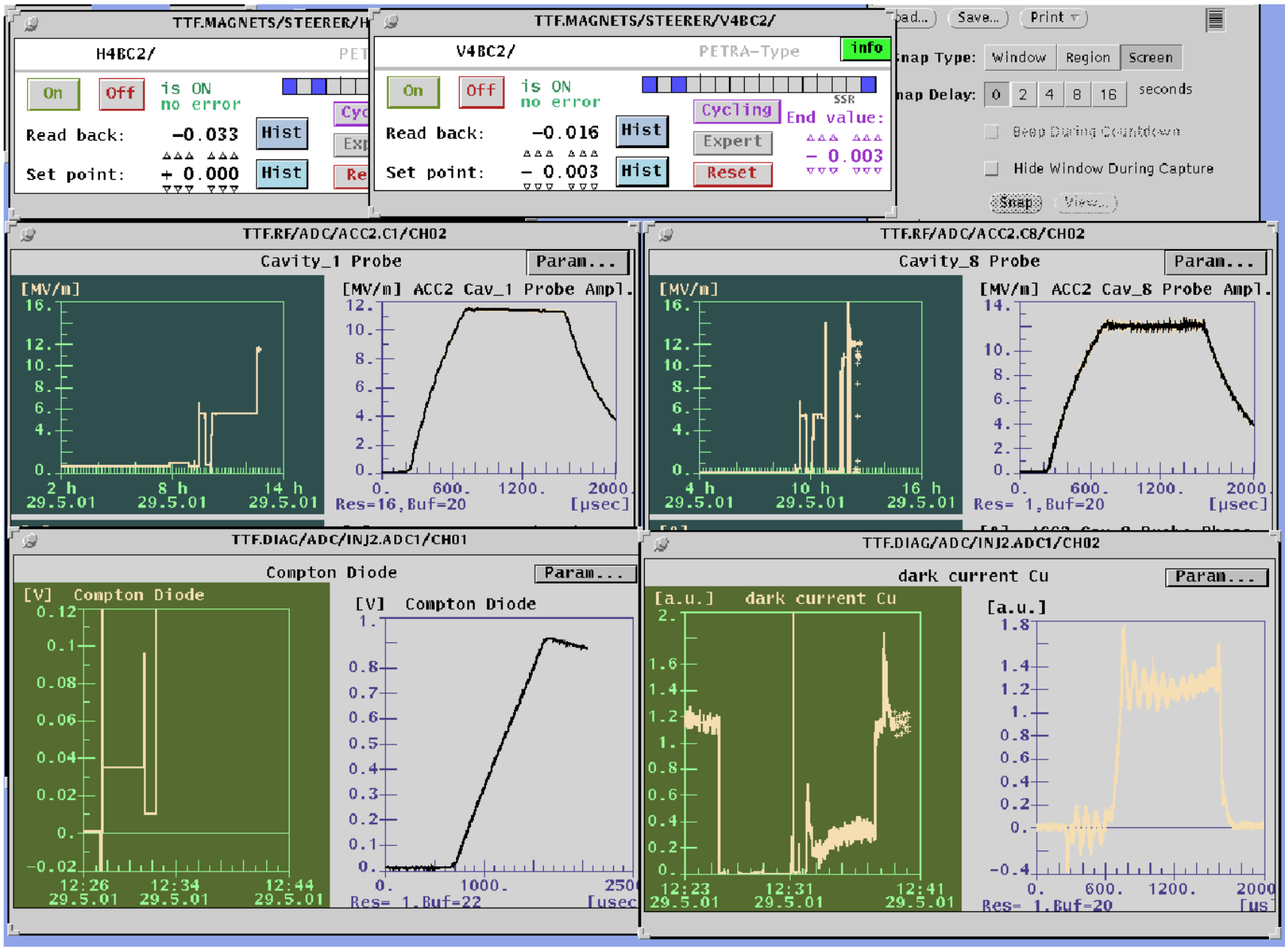
At 100 MeV

R = 62 mm

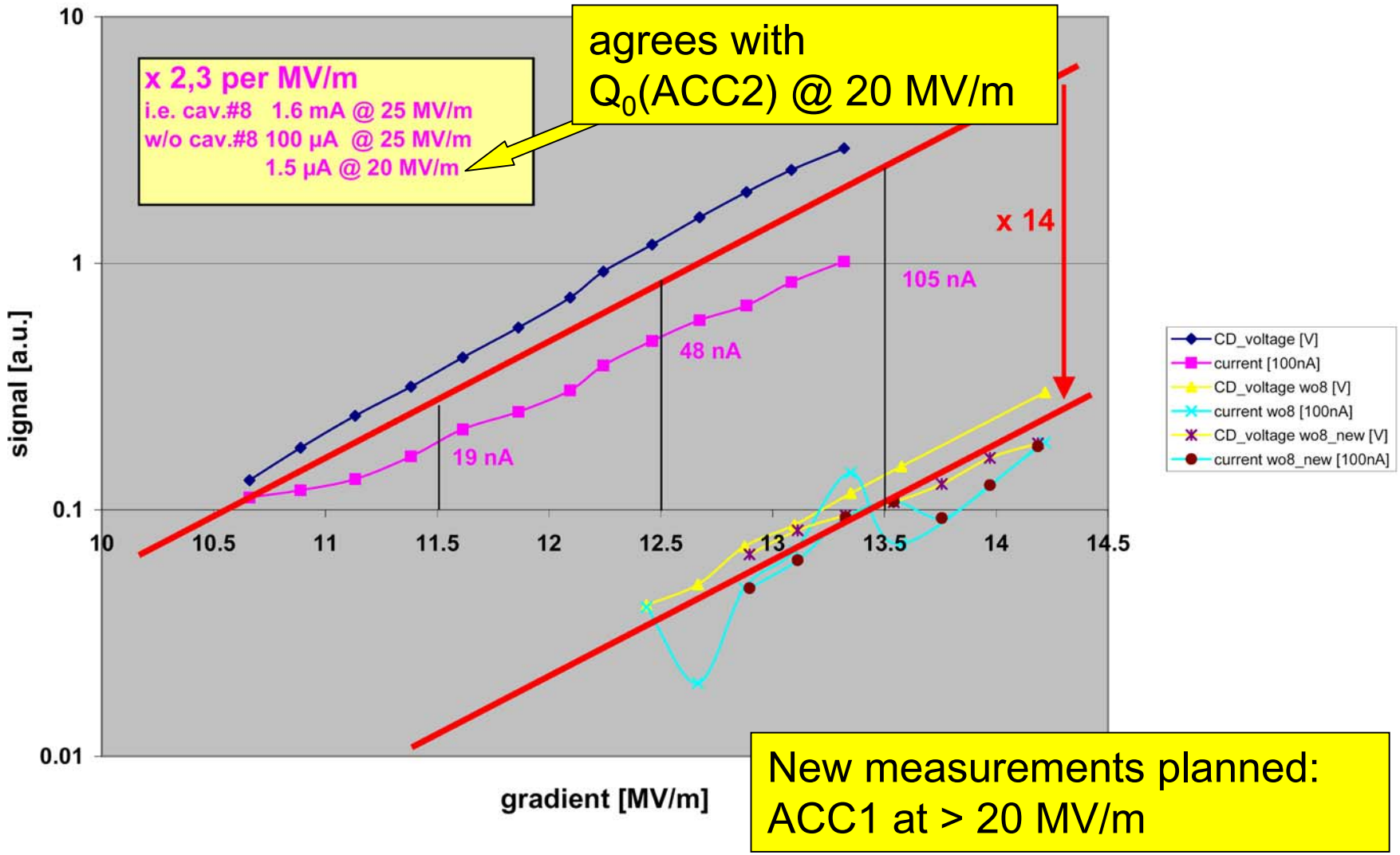
a = 27 mm



# Dark current measurements at ACC2



# Dark current measurements at ACC2
## ... first measurements ...




New measurements planned:
ACC1 at > 20 MV/m