Time-Of-Flight measurements at FLASH
- Status of the Setup -

Martin Kollewe

MVP/DESY

FLASH Meeting 25.Apr.2006

1) Motivation
2) Setup
3) Measurements
   - Sensitivity tests
   - Applications:
     - On Crest Phase, Dark Current (?), Compression Coefficients
4) Summary

Motivation

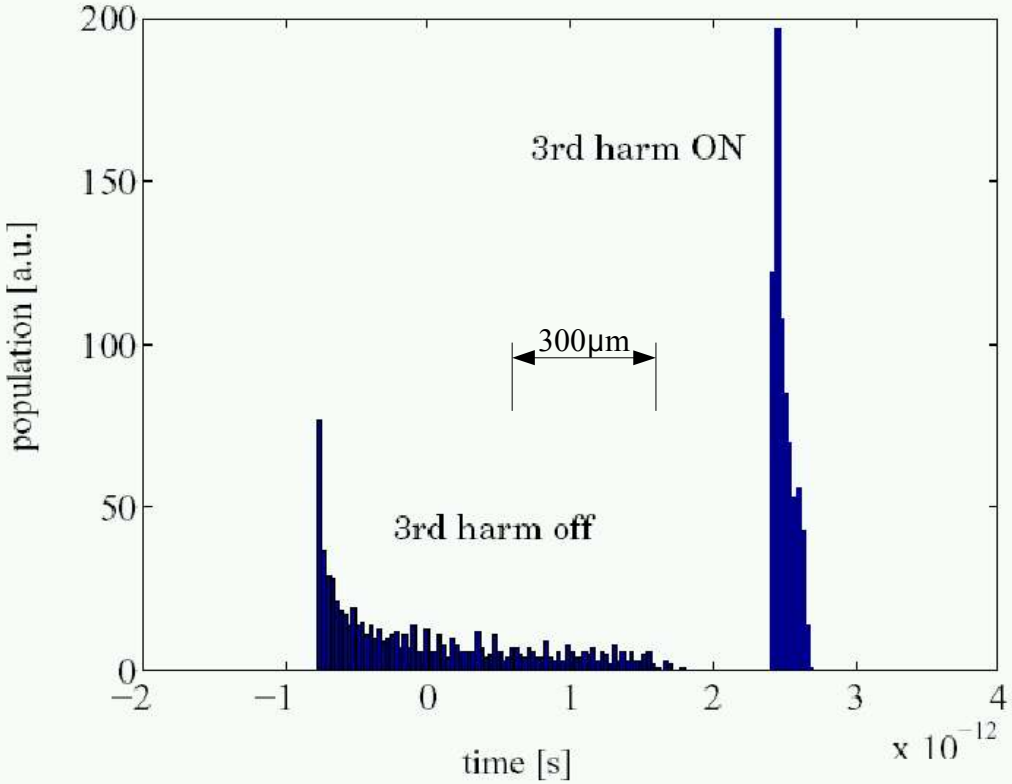


Figure 4: Comparison of the charge density profiles, downstream of the bunch compressor, when the 3rd harmonic section is or not operated.

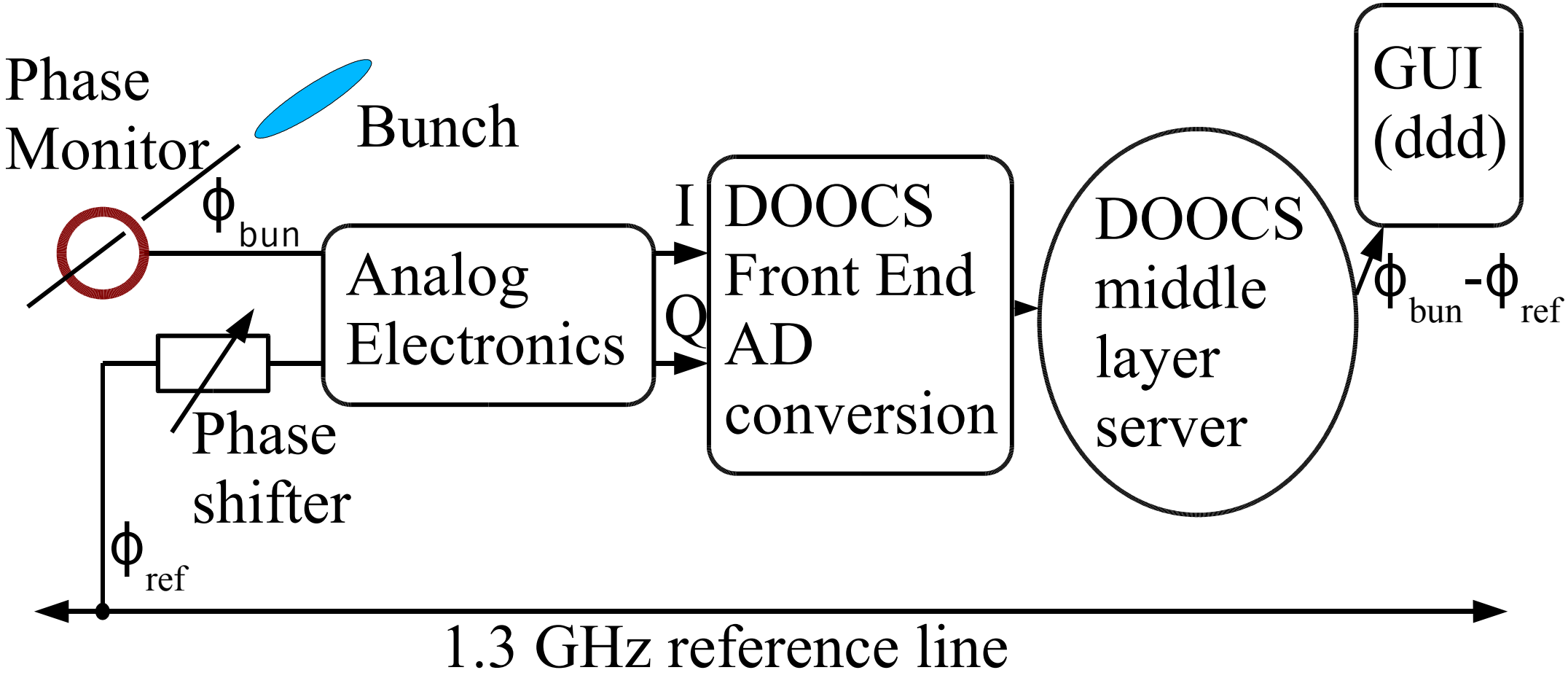
Floettmann et al. / FEL report 2001-06

3rd harm ON:

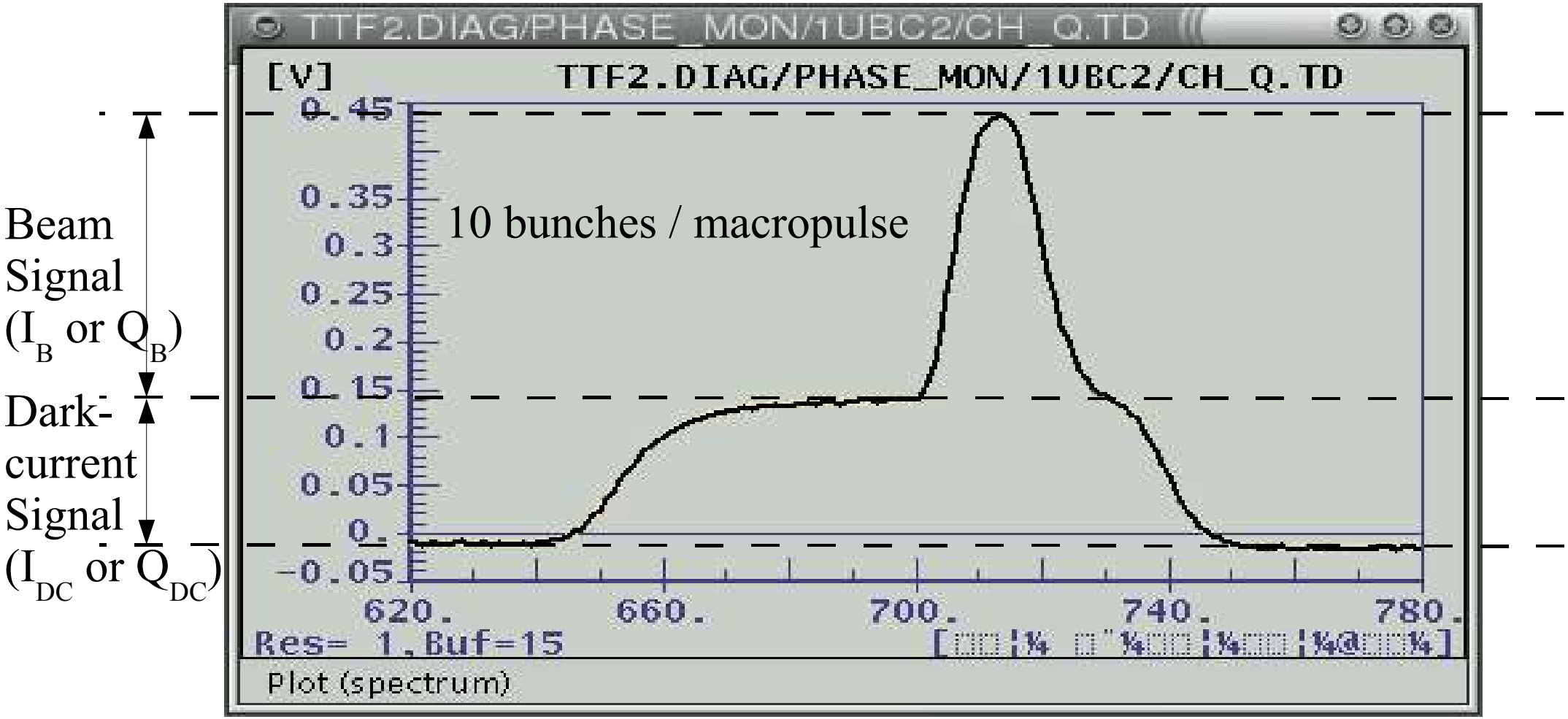
- z smaller
- q/z higher
- q/z smoother

To control the compression process:
1. Installation of third harmonic cavity
2. Time-Of-Flight Measurements

Principle


Phase
Monitor
Bunch
ϕ_{bun}
Analog
Electronics
I
Q
DOOCS
Front End
AD
conversion
DOOCS
middle
layer
server
GUI
(ddd)
$\phi_{bun}-\phi_{ref}$
Phase
shifter
ϕ_{ref}
1.3 GHz reference line

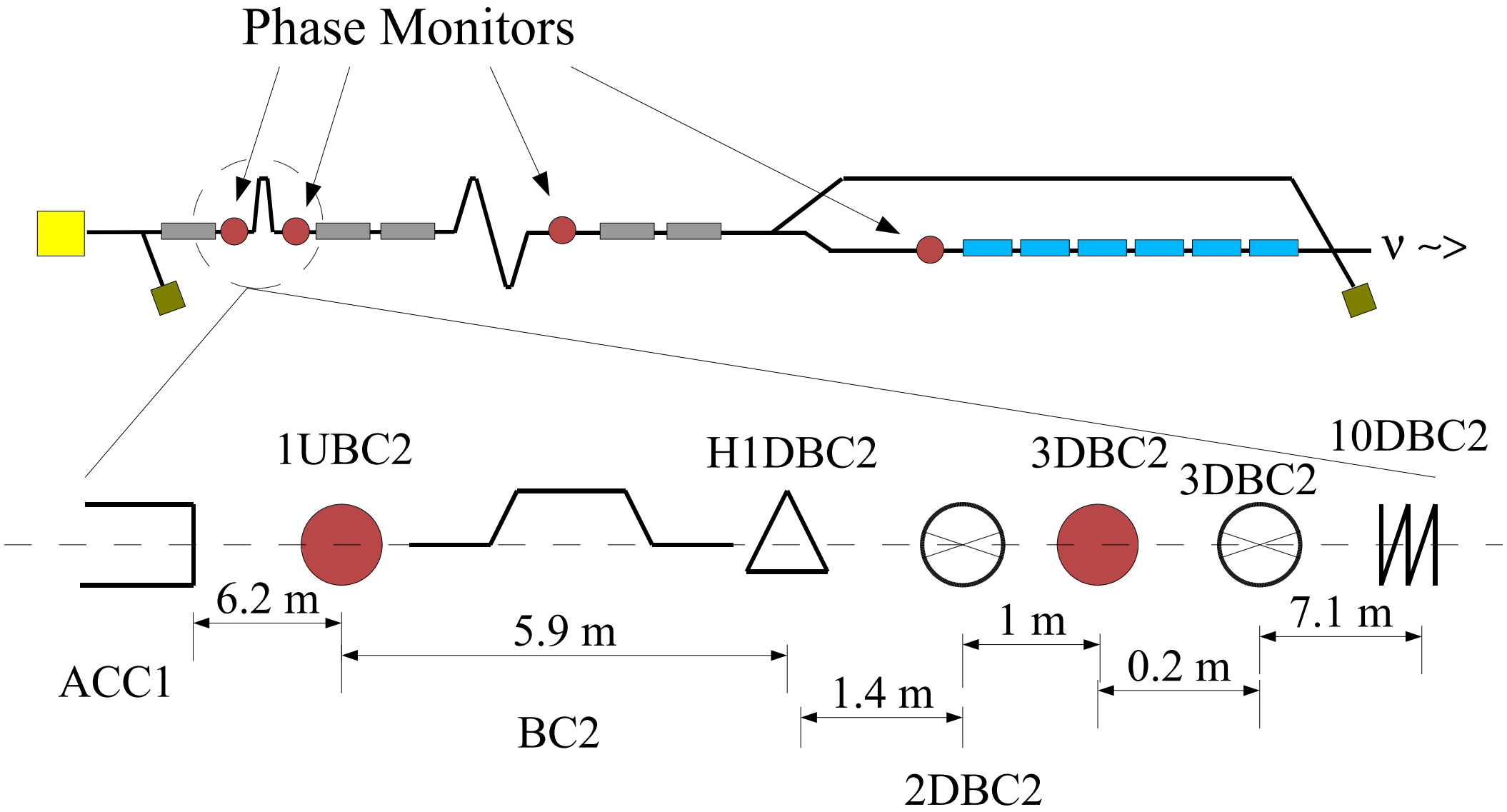
Example of analog signal



Phase of electron bunch passage w.r.t, reference: $\phi_x = \arctan(I_x/Q_x)$

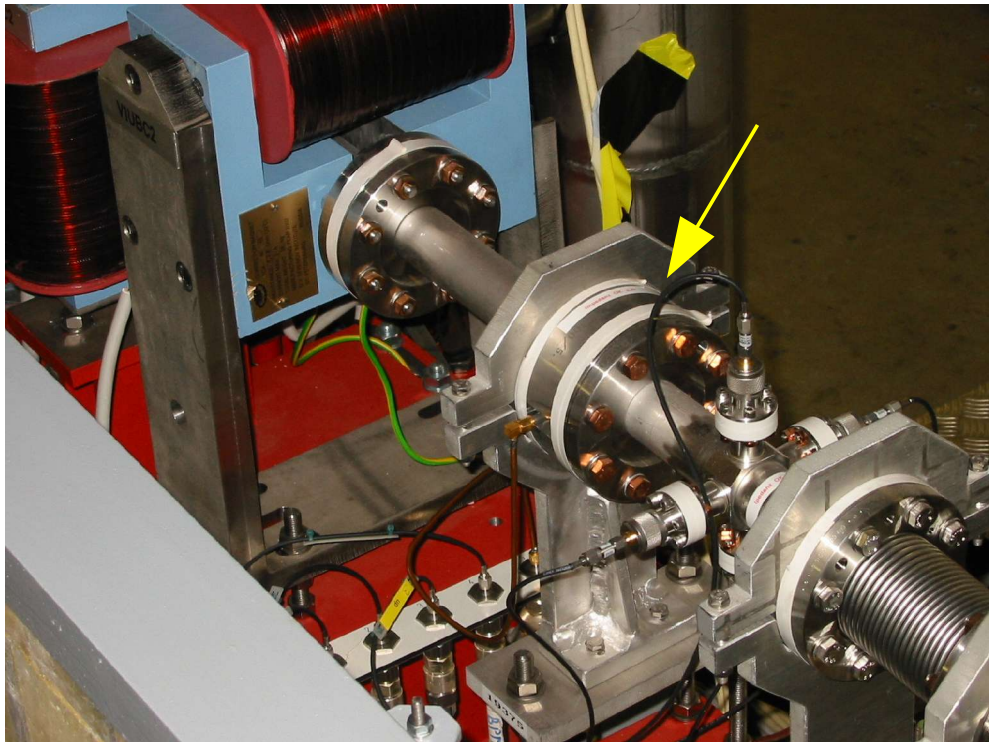
(x = 'B' or 'DC')

Instrumentation



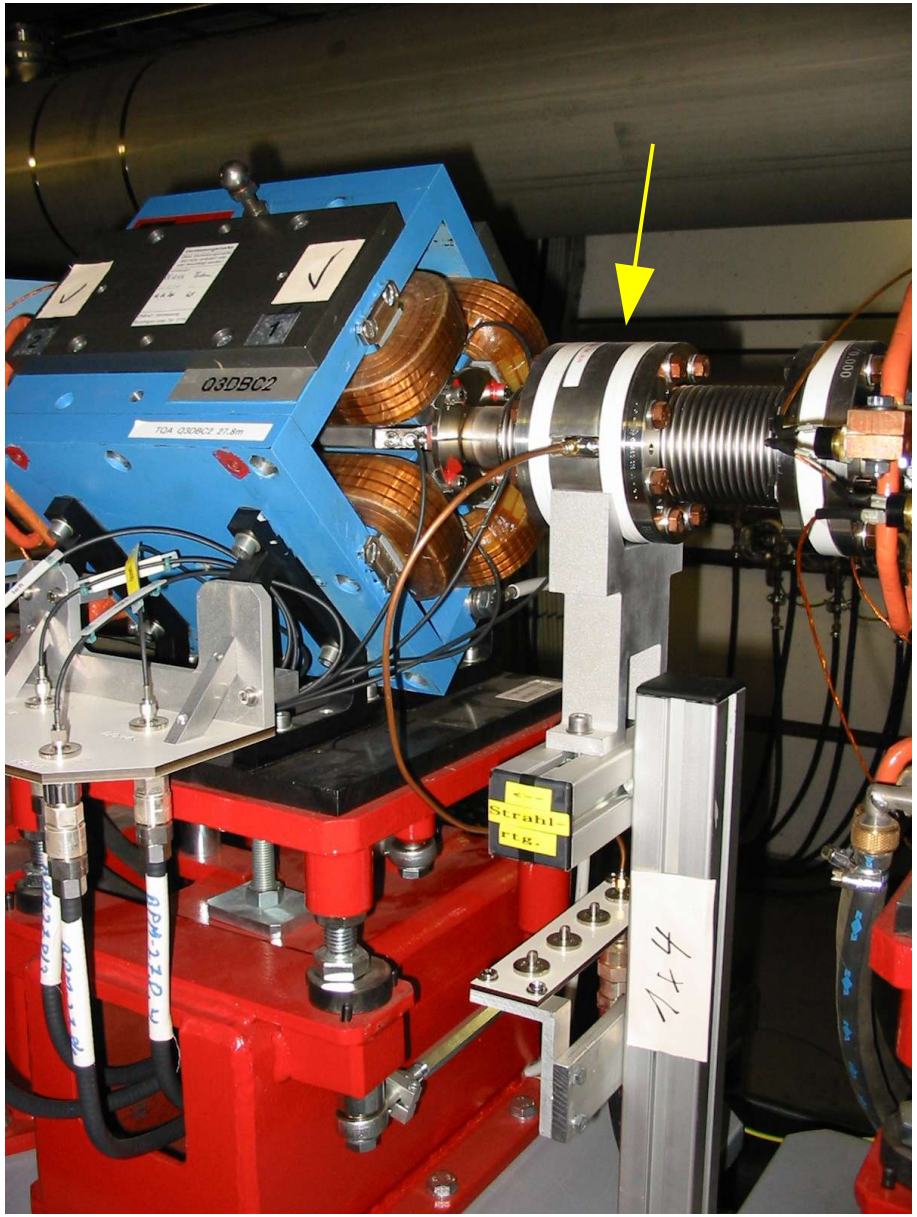
Instrumentation

Examples of devices
at FLASH



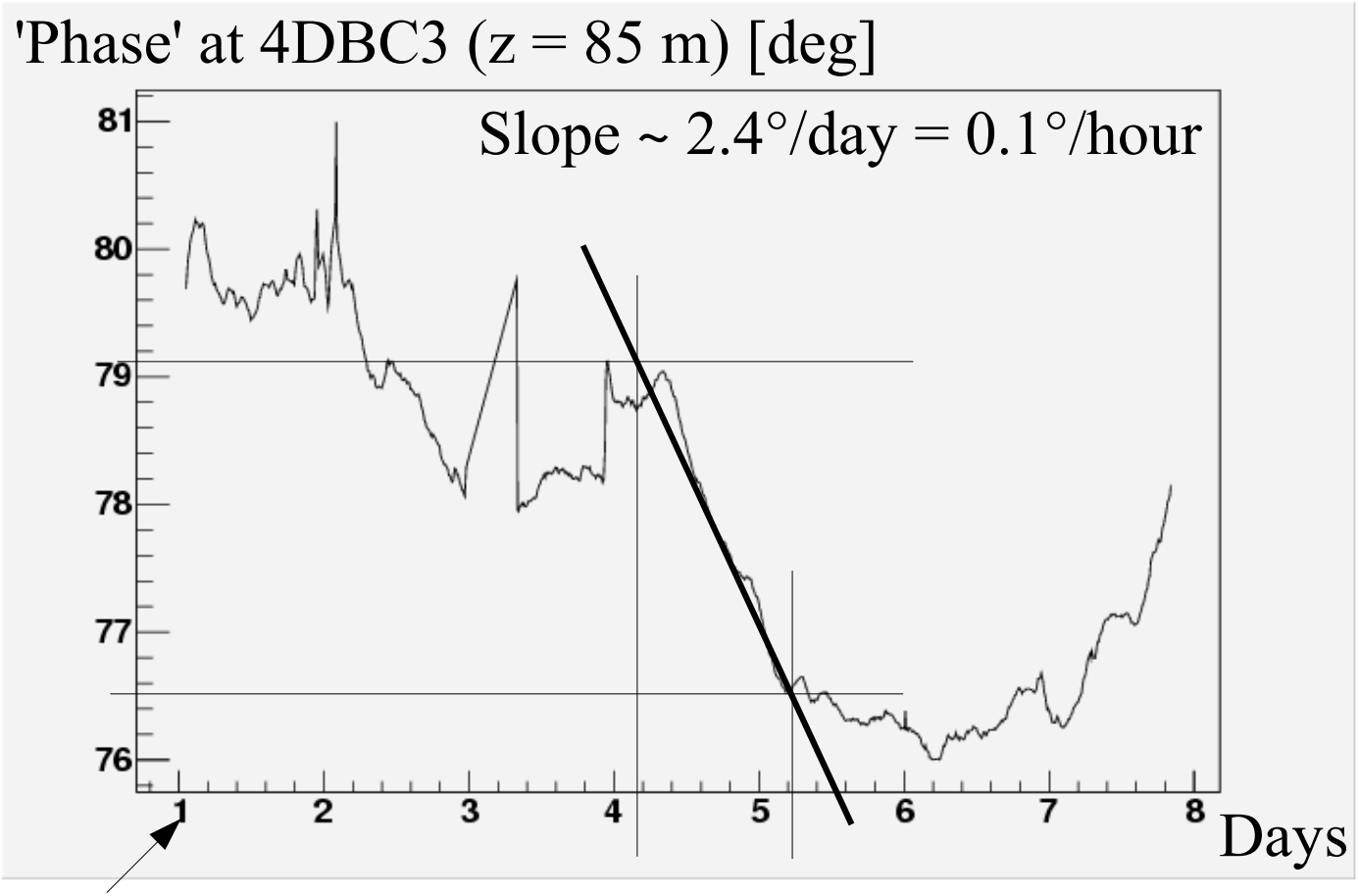
' 1UBC2 ' at z = 19 m

' 3DBC2 '
at z = 28 m



Long-term drift

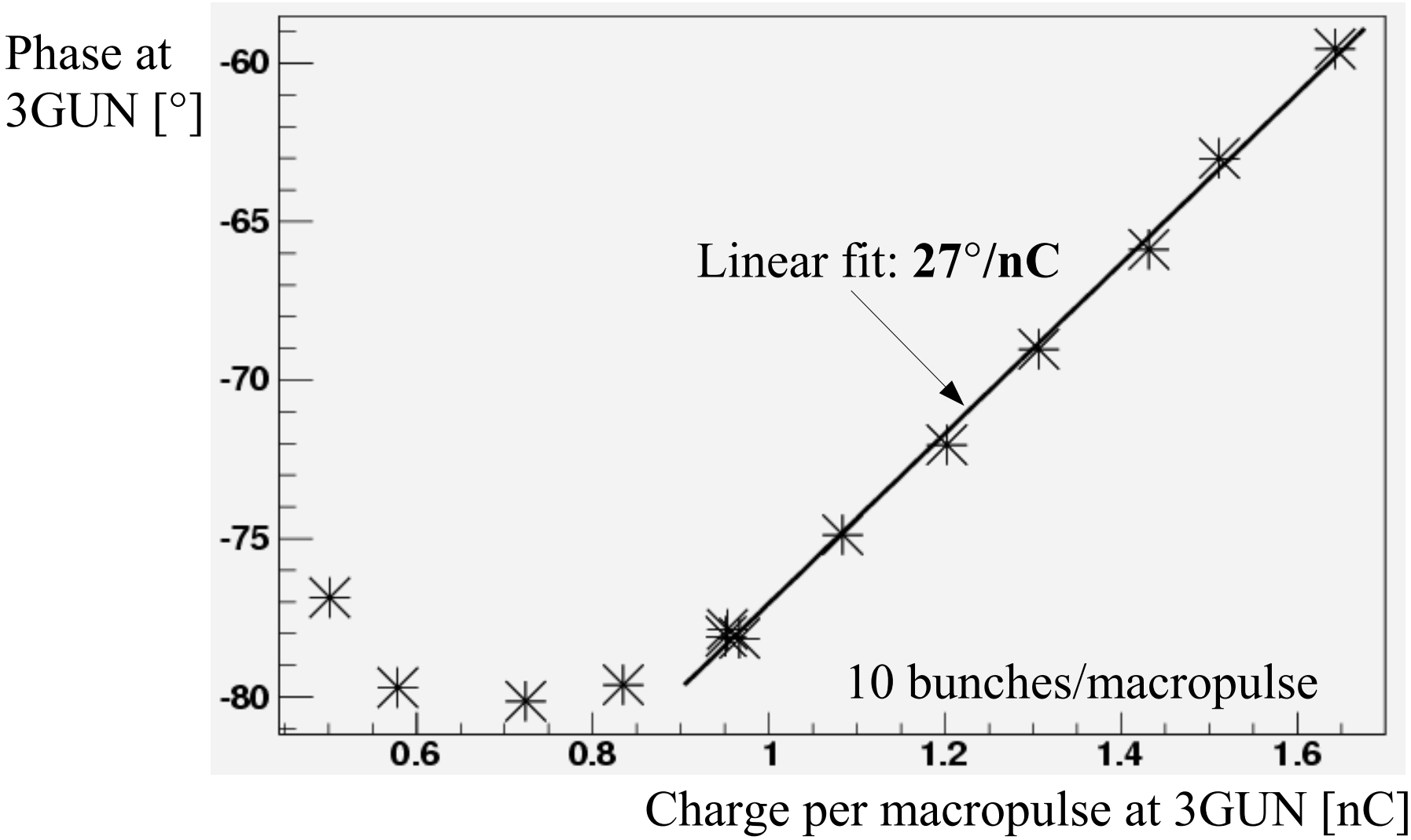
Reference signal was put into both inputs of electronics



14.Feb.2005, 12.00h

MSK: 1°(Phase output)/1°C(Temperature)
Measured in laboratory

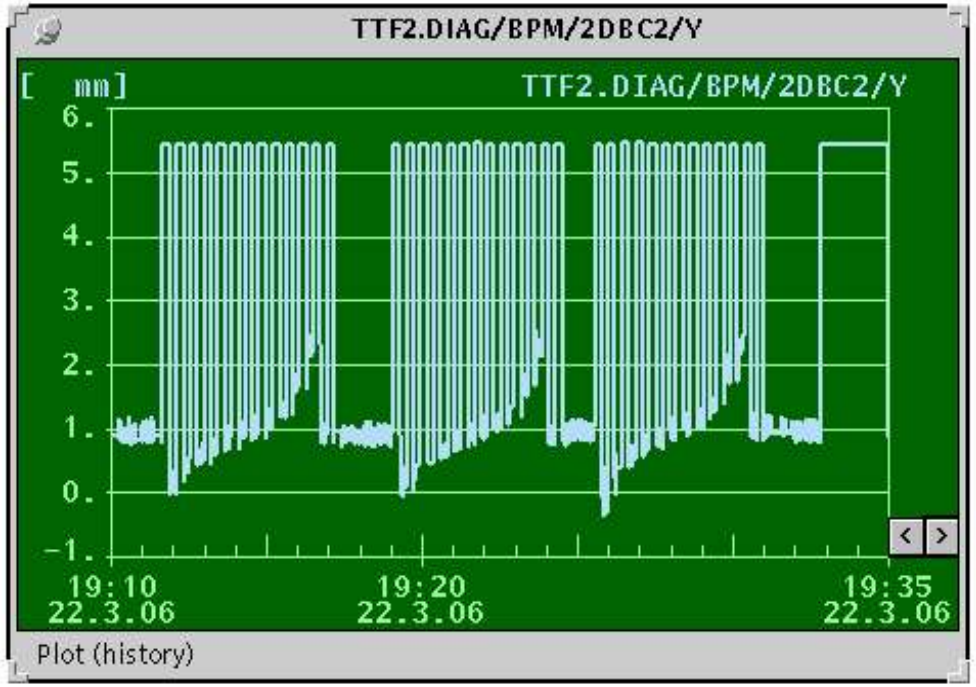
Dependence on charge per bunch



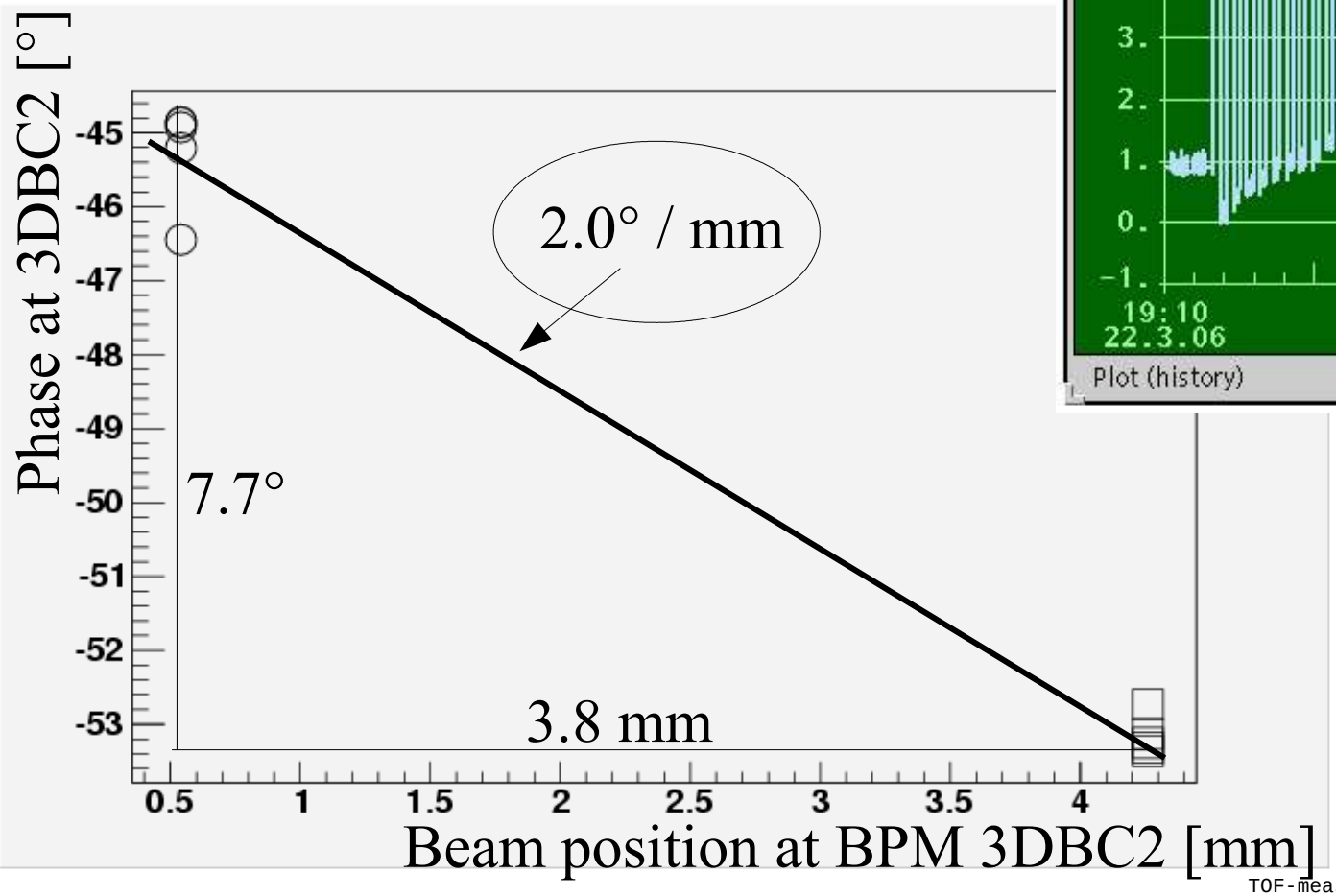
(17.Nov.2005)

Dependence on beam position

2. Beam position while ACC1 phase scans (chopped beam)

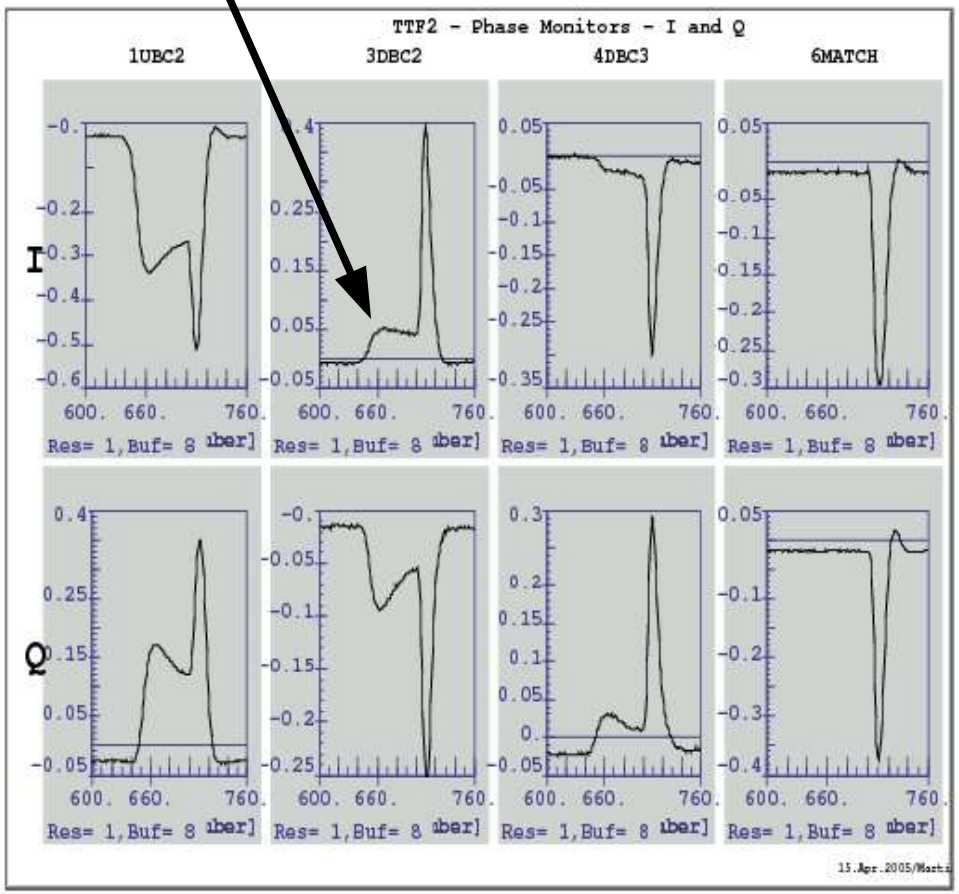


1. Beam steered with steerer H1DBC2



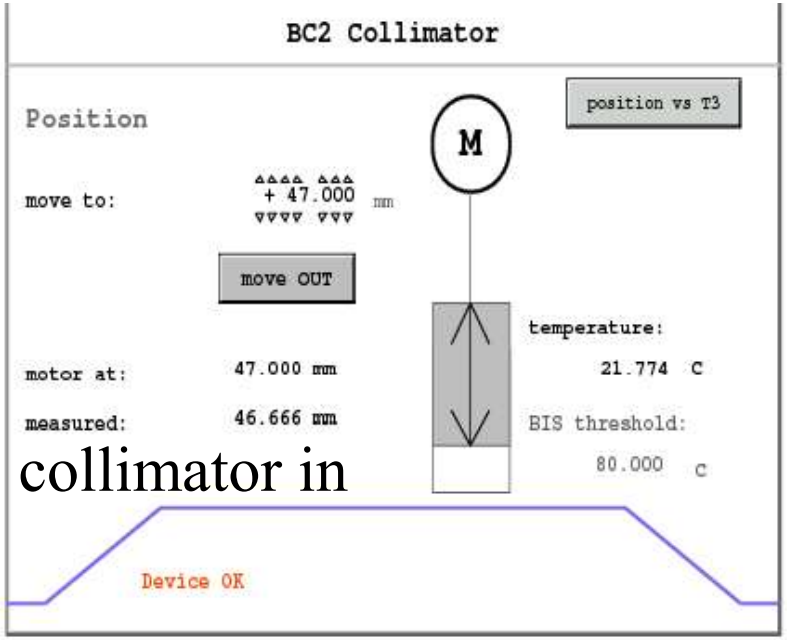
Dark current signal

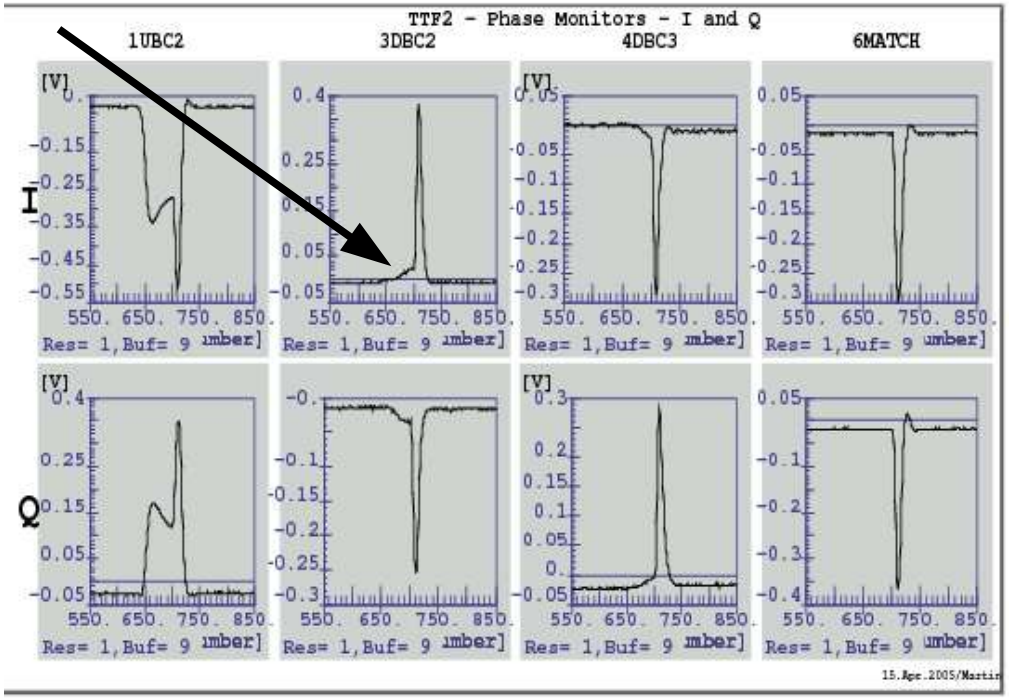
BC2 collimator out



12.May.05 16:45.25

BC2 collimator in

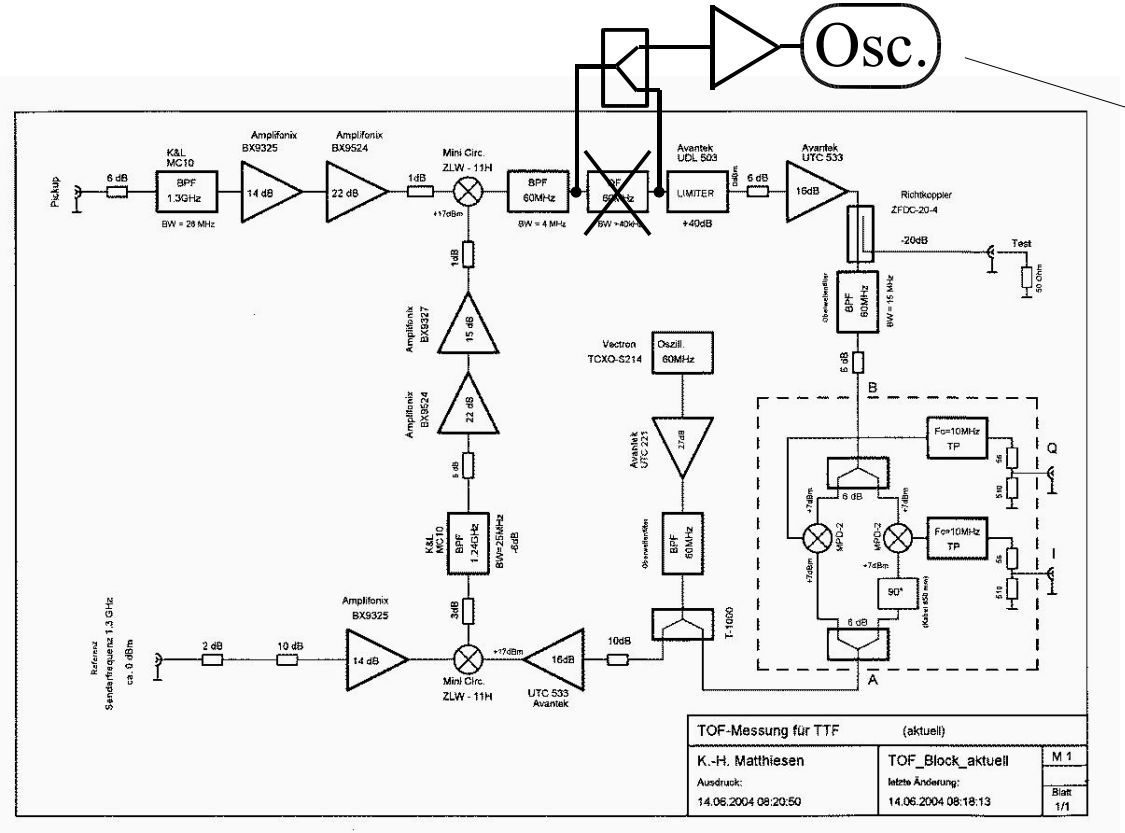


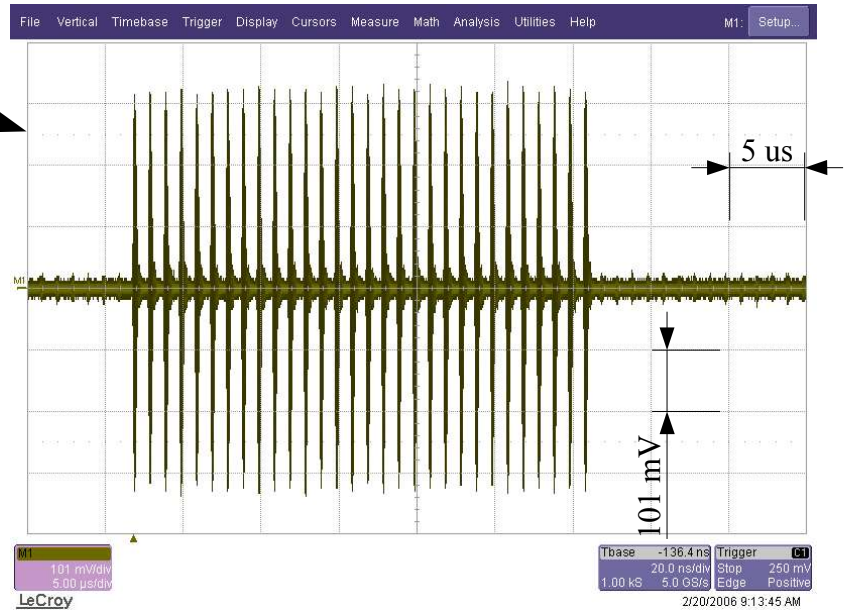


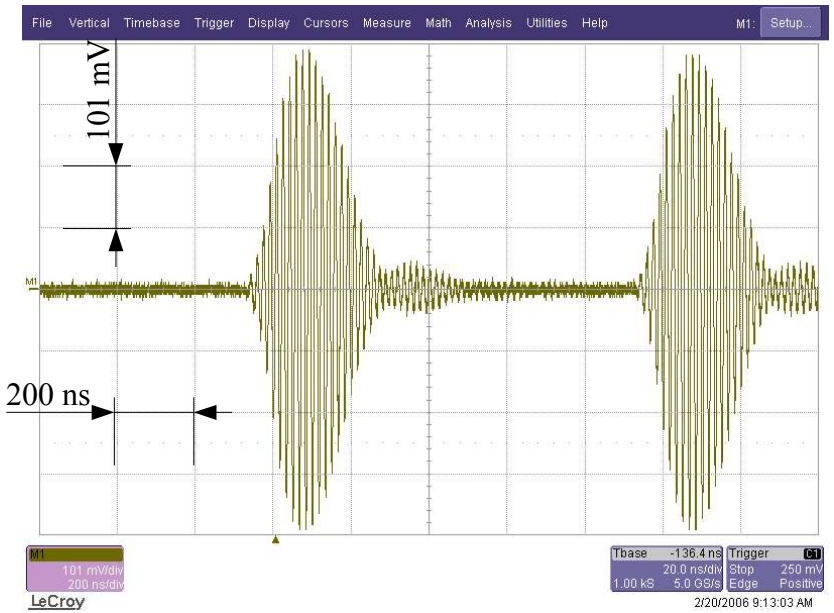
12.May.05 16:50.02

(12.May.2005)

Dark current signal



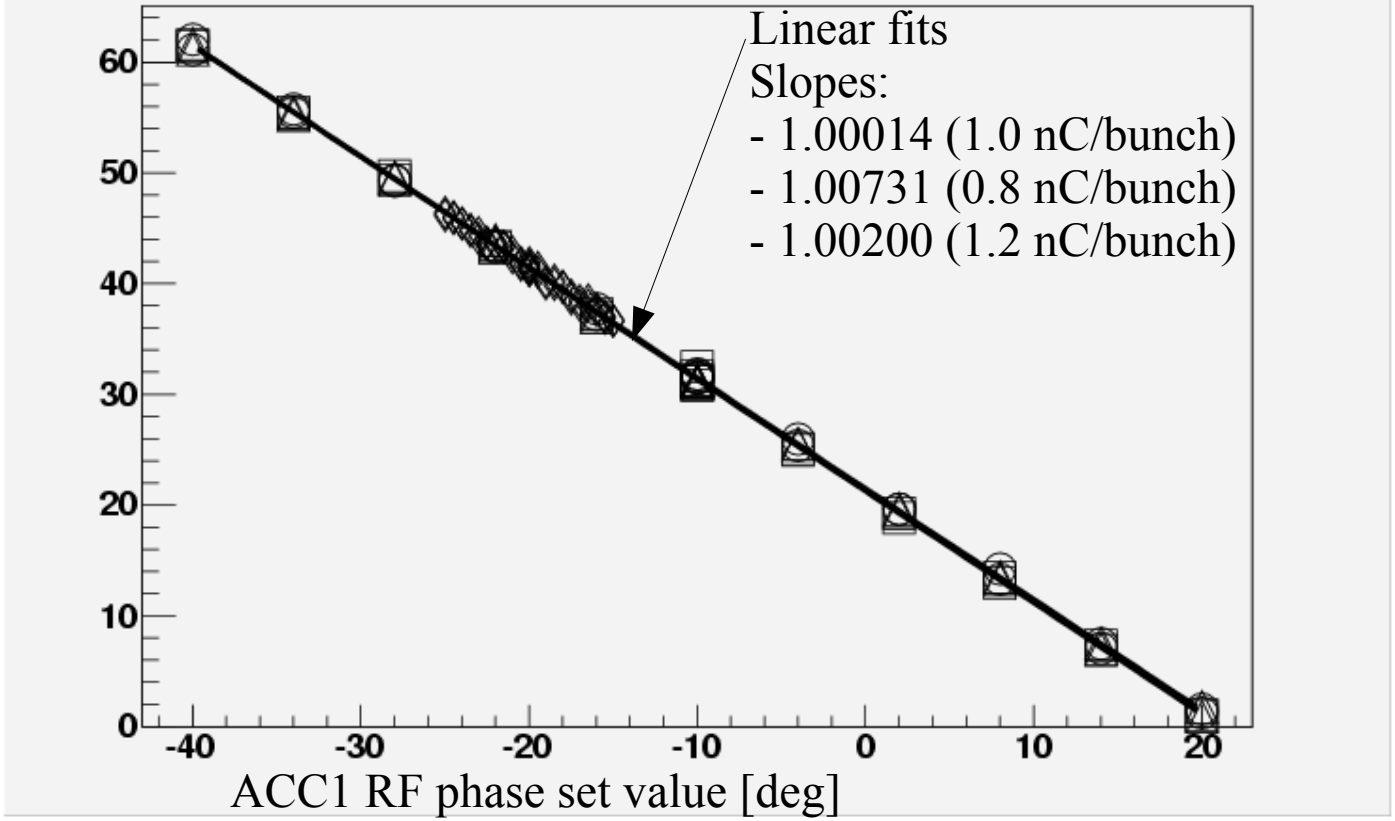




Modification of electronics '6MATCH'
Dark current kicker varied
BC2 collimator varied
-> no effect in interval between 'bursts'
(28.Feb.2006)

ACC1 RF phase
Comparison Set Values <-> Measured Values

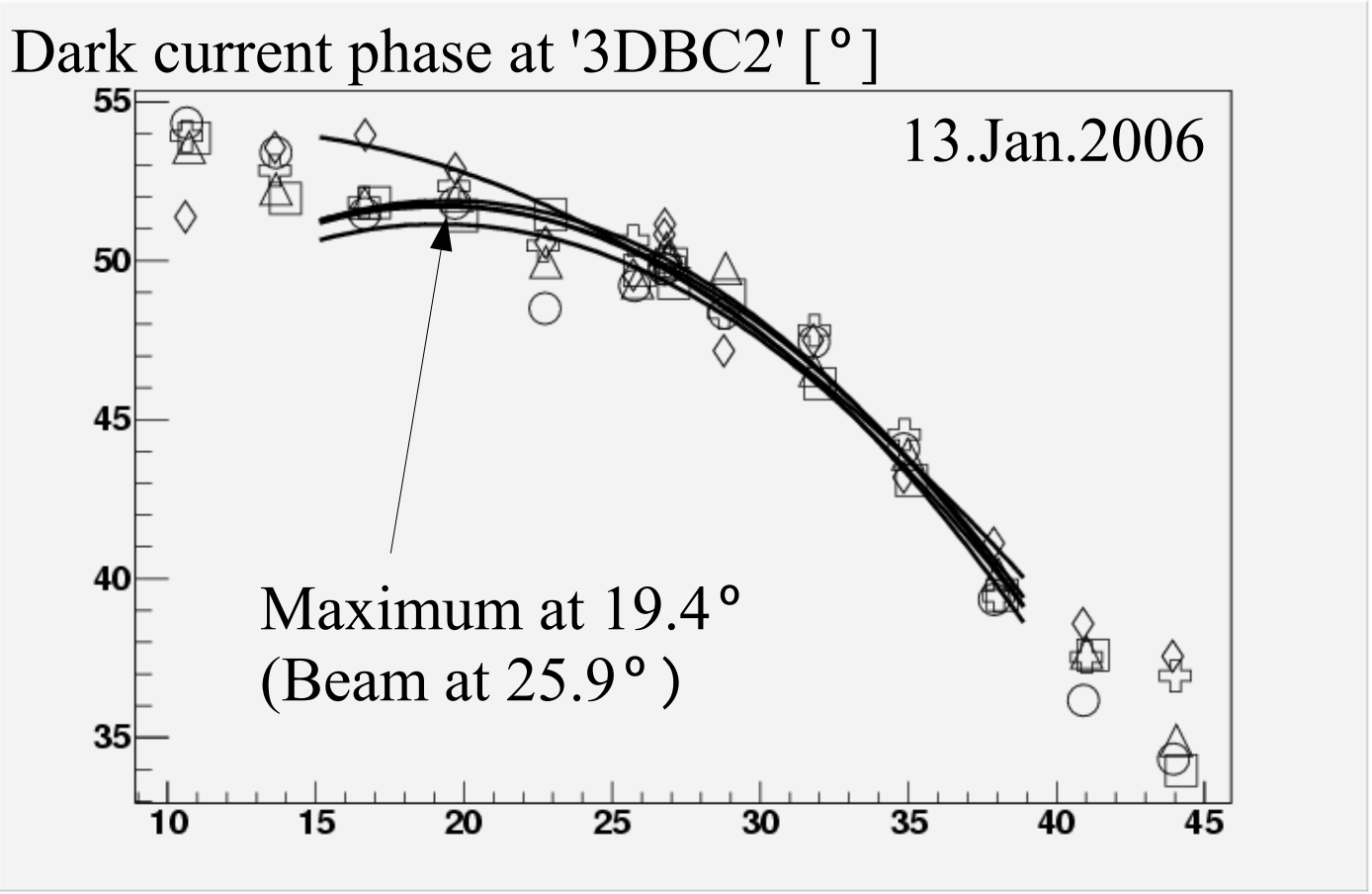
ACC1 RF phase measured value [deg]
"TTF2.RF/ADC/Cx.ACC1.PROBE/PHASE.TD"



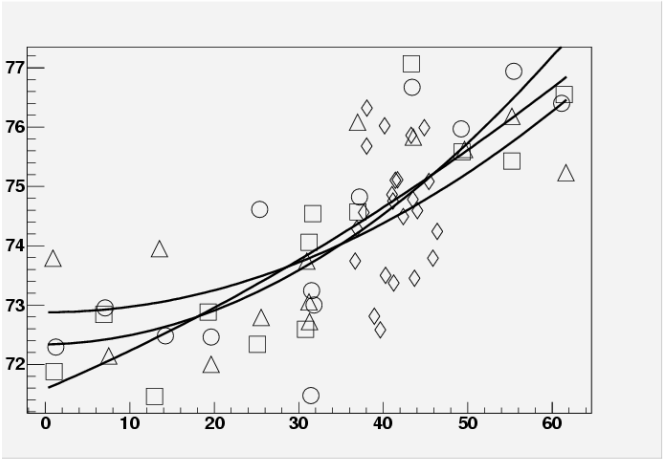
- Each symbol: Average of 10 measurements
- Measurements done within 34 min.

1 nC : $\phi_{set} = (21.505^\circ - \phi_{meas}) / 1.00014$

On crest phase determination
- Dark current -

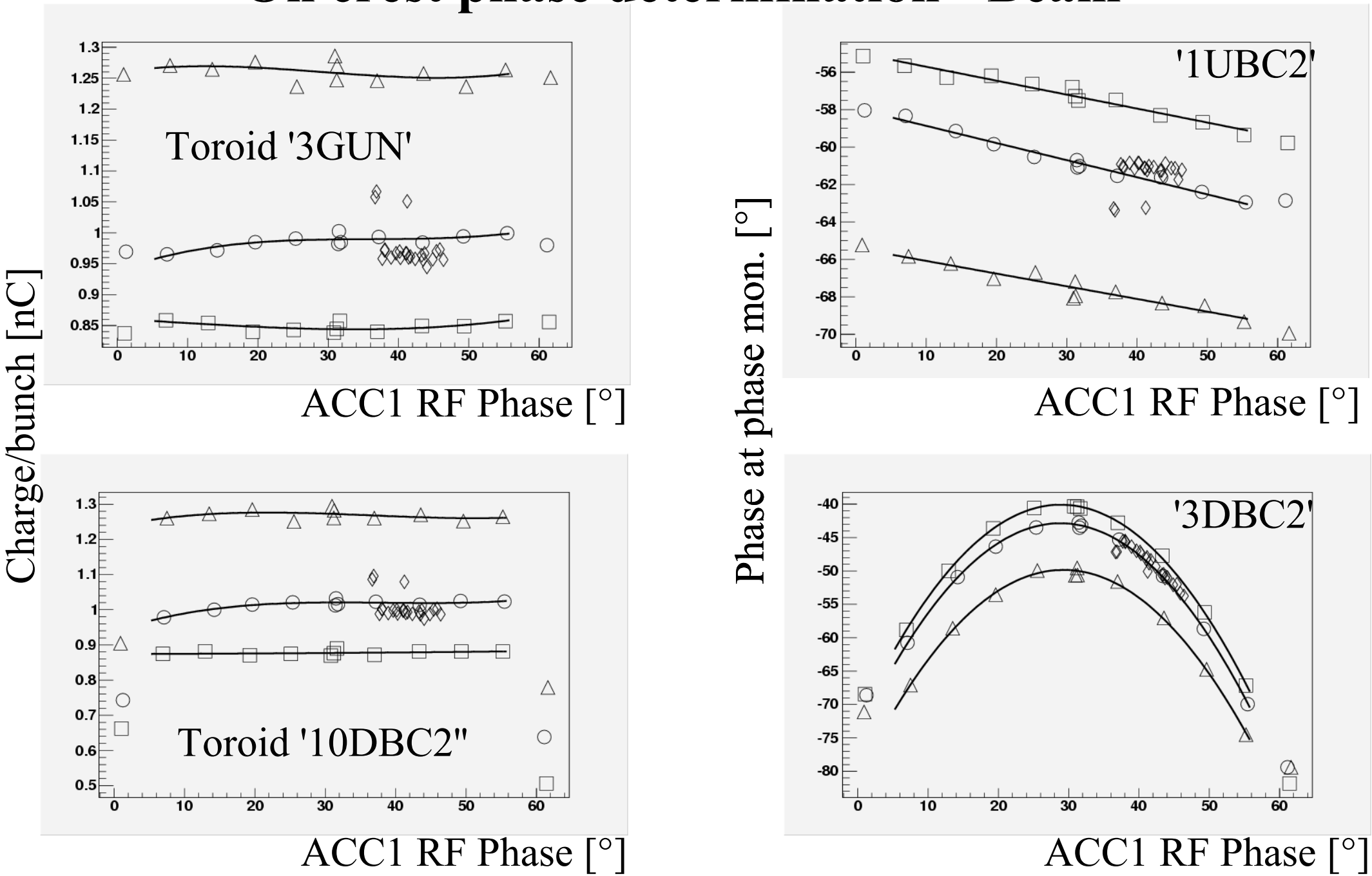


22.Mar.2006:
Very little
dark current signal



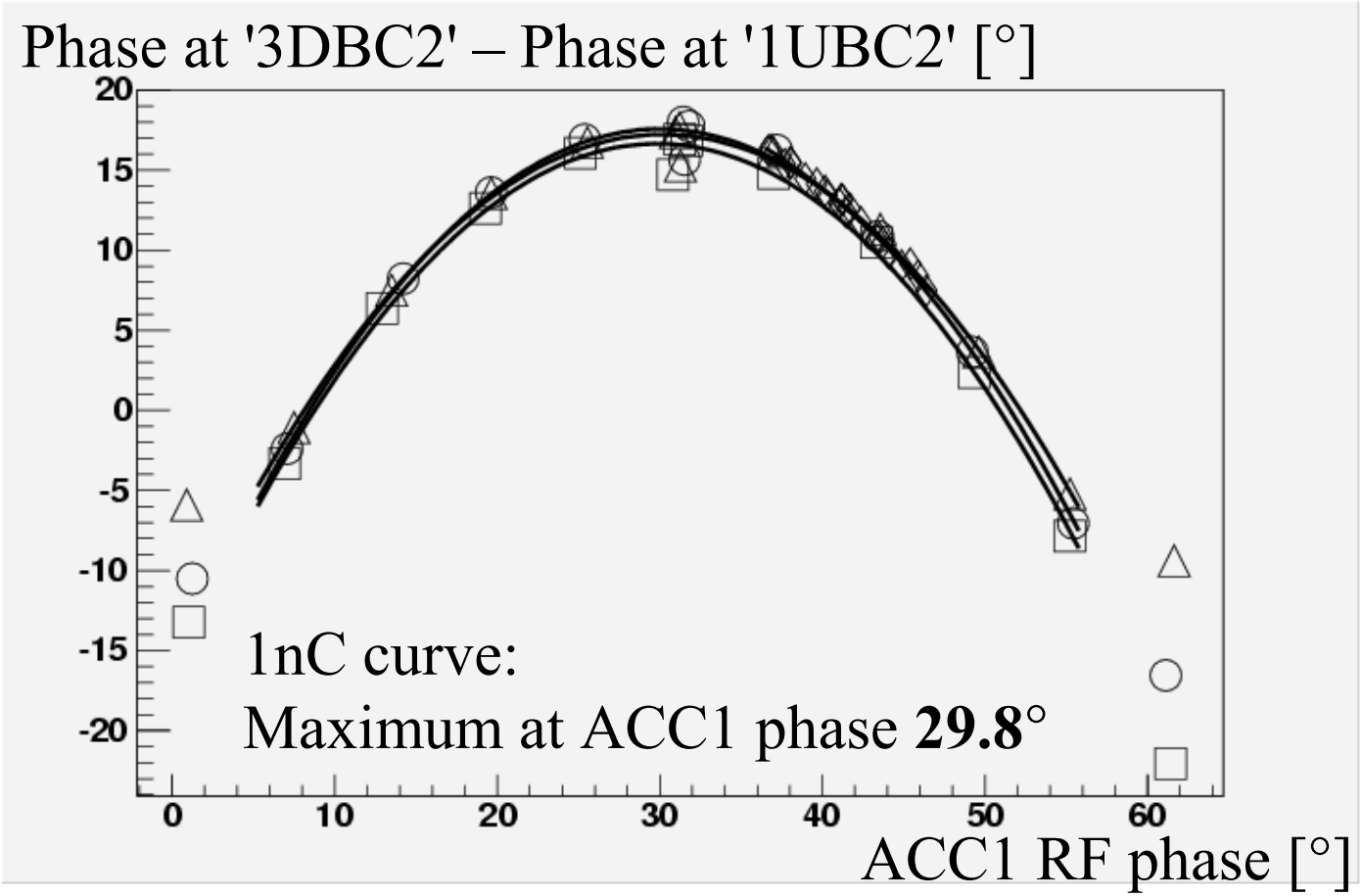
ACC1 RF phase [°]

On crest phase determination - Beam -



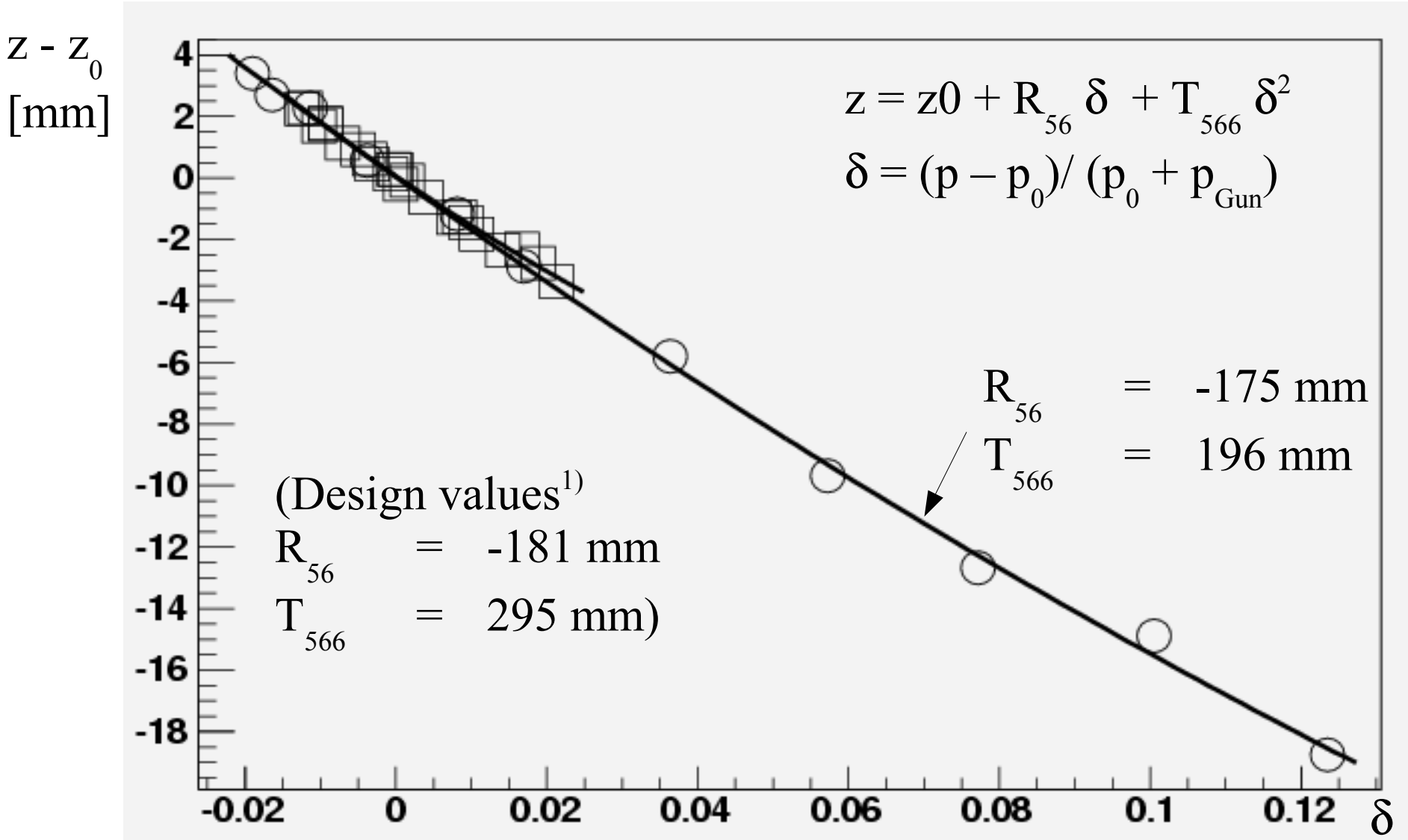
(22.Mar.2006)

On crest phase determination - Beam -



- On-crest phase by eye
  (minimum energy spread on screen 3DBC2): **31.5**°
- Pyro-detector maximum signal ('maximum compression') at **42.5**°

Compression coefficients measurement



[1)]TESLA-FEL 2002-01

Time-Of-Flight measurements at FLASH
- Status of the Setup -

Summary

Purpose, principle and installation reviewed
Influence of different (side-)parameters discussed
Measurements
- On crest determination (beam, dark current)
- Compression coefficients of BC2 measured
- Dark current amount measurements?

Plans

Measurement of accuracy
Improvements (Hardware, DOOCS mid. layer server)
Discussion: what is required?