Commissioning of TTF2

P.Castro

COMMISSIONING

hardware + sub-systems ⟨
- cryogenics + vacuum + klystrons + interlocks + …
- RF cavities: gun + cold modules + LOLA
- collimators + wirescanners + cameras + …
- laser …

3 weeks **1st beam (bypass)** ⟨
- re-commissioning of gun + injector
- setup cavity phases ACC2-5 → beam energy
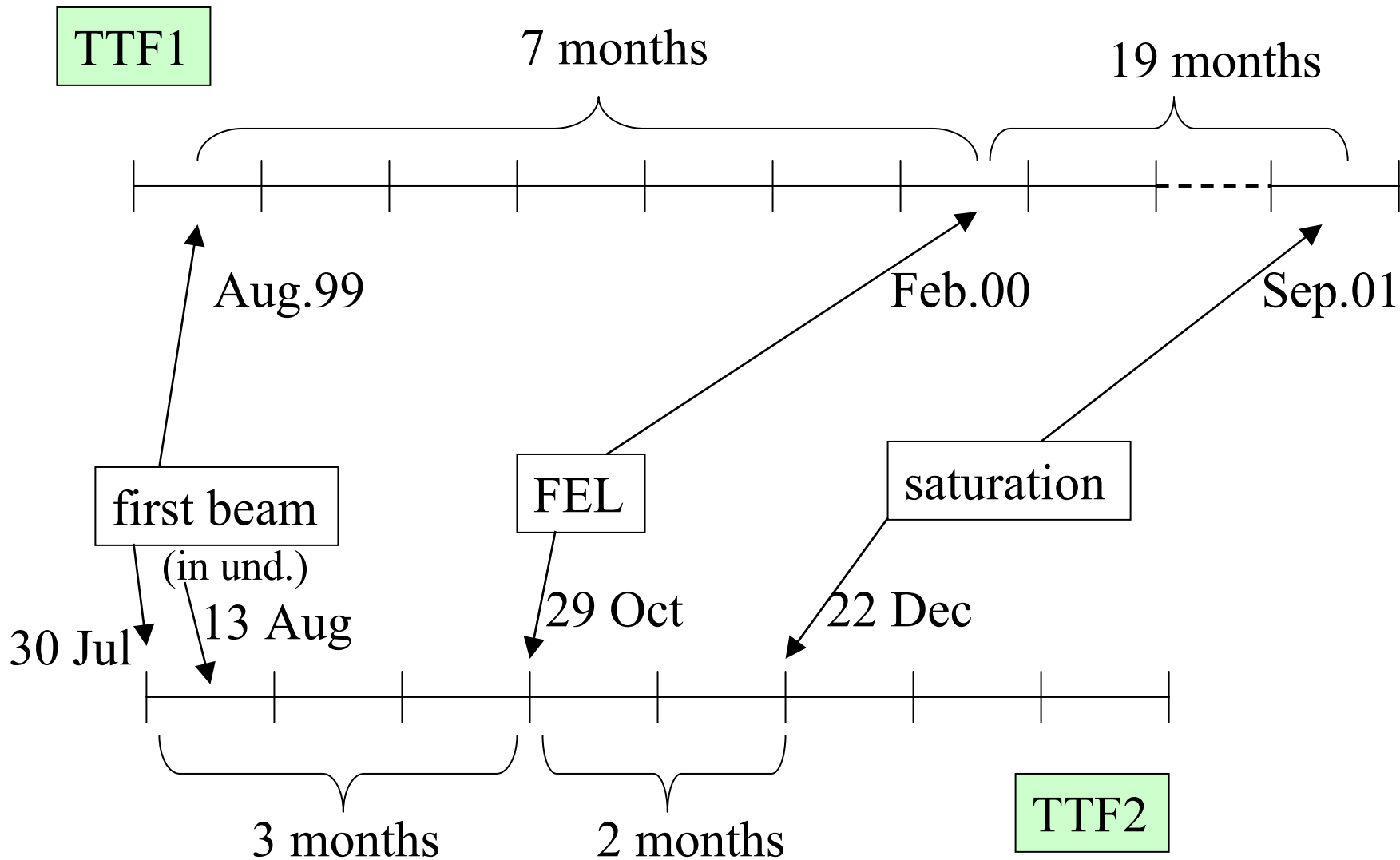- commissioning of diagnostics

10 weeks **FEL 30 nm 1 bunch** ⟨
- setup collimation
- emittance measurements and optics matching
- beam-based alignment in undulator section
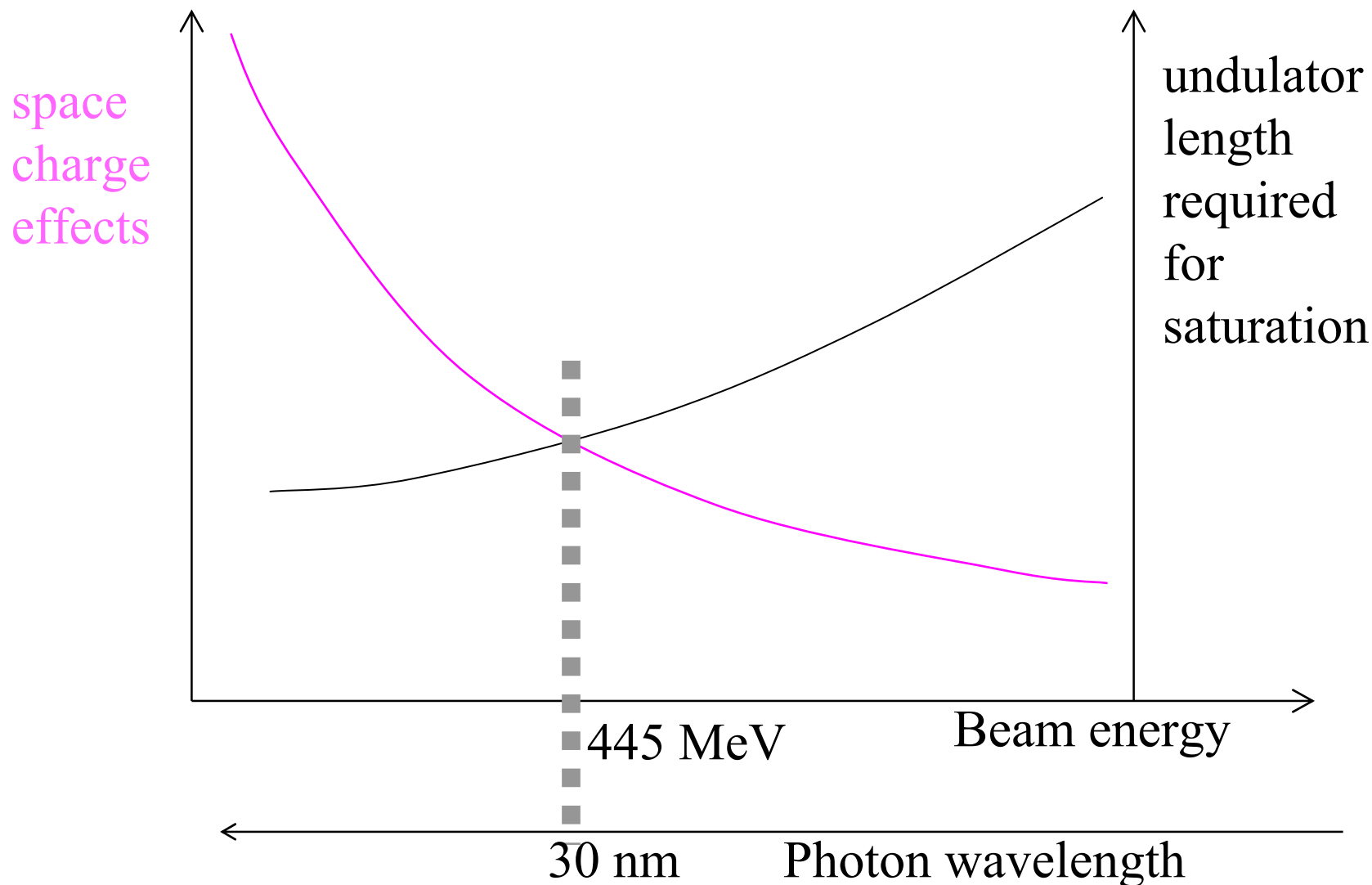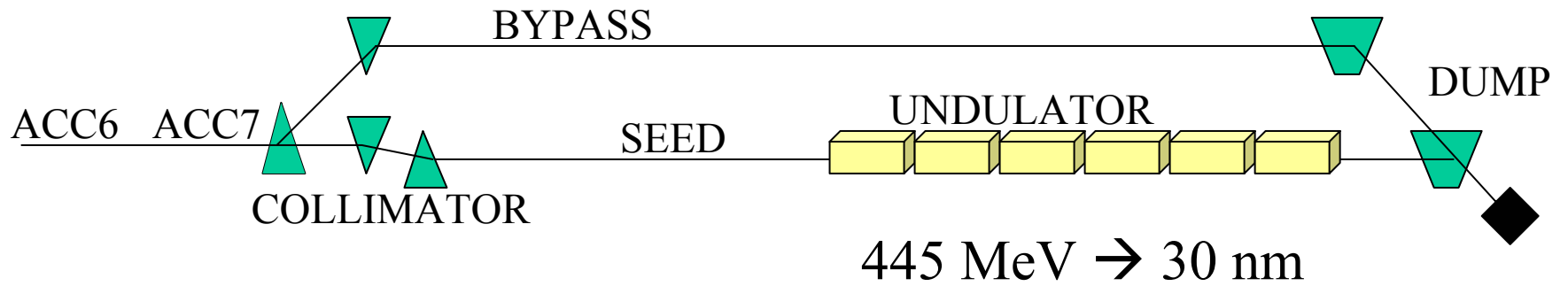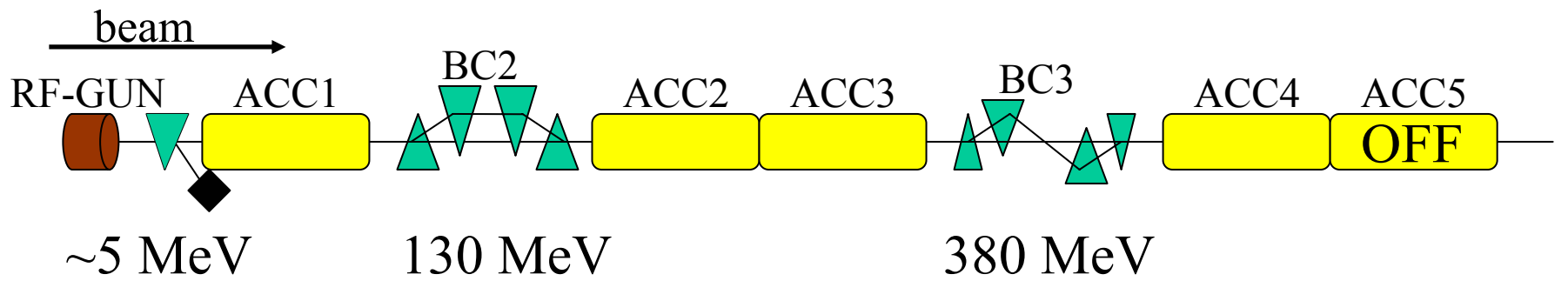- commiss. of photon diag. with spon. emission

8 weeks **Saturation+ 6-100 nm** ⟨
- commissioning of FEL diagnostics
- study of FEL beam, compression schemes, etc.
- establish reproducible settings, etc.

TTF1

7 months

19 months

Aug.99

Feb.00

Sep.01

first beam
(in und.)

FEL

saturation

30 Jul

13 Aug

29 Oct

22 Dec

3 months

2 months

TTF2

Beam energy at commissioning

space charge effects

undulator length required for saturation

445 MeV

30 nm

Beam energy

Photon wavelength

beam

RF-GUN   ACC1   BC2   ACC2   ACC3   BC3   ACC4   ACC5
OFF

~5 MeV   130 MeV   380 MeV

BYPASS

ACC6   ACC7   SEED   UNDULATOR   DUMP

COLLIMATOR

445 MeV → 30 nm

Options:

- BC3 on/off

- velocity bunching

- spike (as in TTF1)

- …

decided on 11.Dec.2002

New issues in operation:

1) Bypass
2) Undulator design
3) Diagnotics
4) High-level application software

1) Bypass operation:

- linac tuning:
    - RF phases
    - orbit corrections, etc

- measurements:
    - emittances
    - longitudinal profile, etc

- commissioning of components
    - diagnostics, etc

- non-FEL studies
   - cavity performance
    - material test experiments, etc

without risk to undulator modules

2) Undulator design (what is new):

- separate undulator-quadrupole structures
  - variable quadrupole strengths for beam-based alignment
  - quadrupoles on micromovers
  - relaxed alignment required for undulator modules
  - less number of BPMs required

- 3-wire positioning system

3) Diagnostics (what is new):

- longitudinal profile:
  - LOLA (transverse deflecting cavity)
  - infrared undulator
  - streak camera in BC2

- emittance measurements:
  - two FODO sections with 4 screens/wirescanners
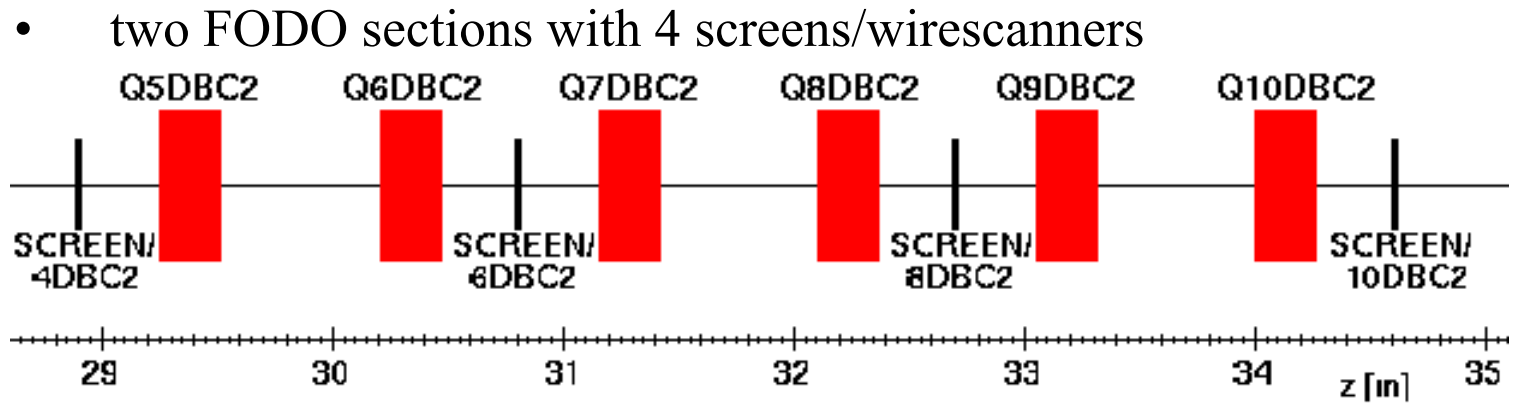
  - undulator section with 7 wirescanners
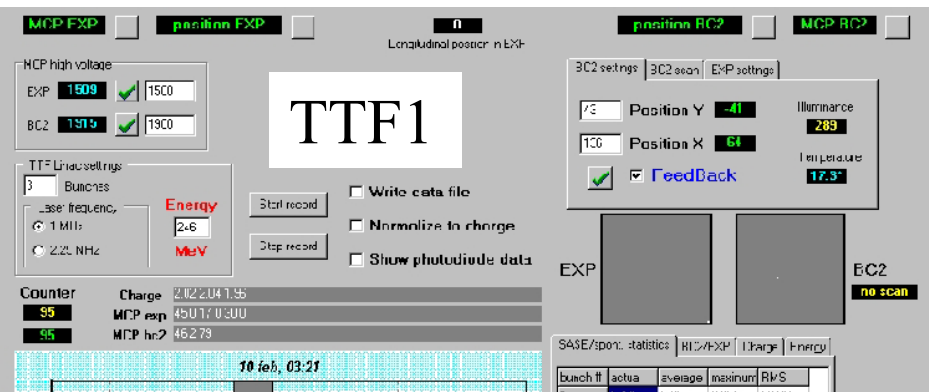
- phase monitors, etc.

4) High level application software:

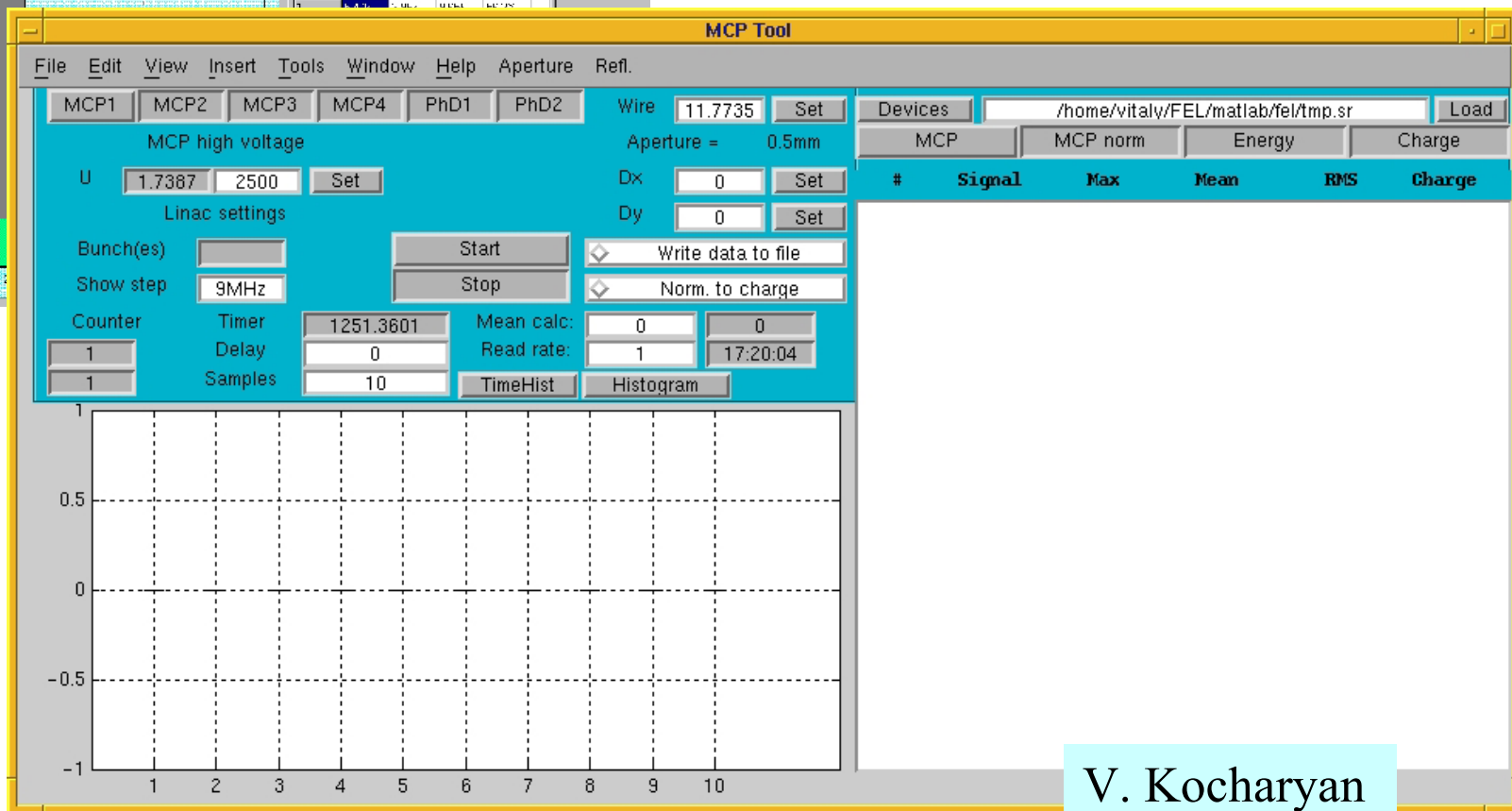Specifications, planning and pre-tests <u>before</u> commissioning

Status:

- FEL display (matlab): tested
- orbit correction: tested
- wire scanner (undulator): tested
- DAQ: project in preparation
- optics display + matching: in preparation
- emittance measurement: in preparation
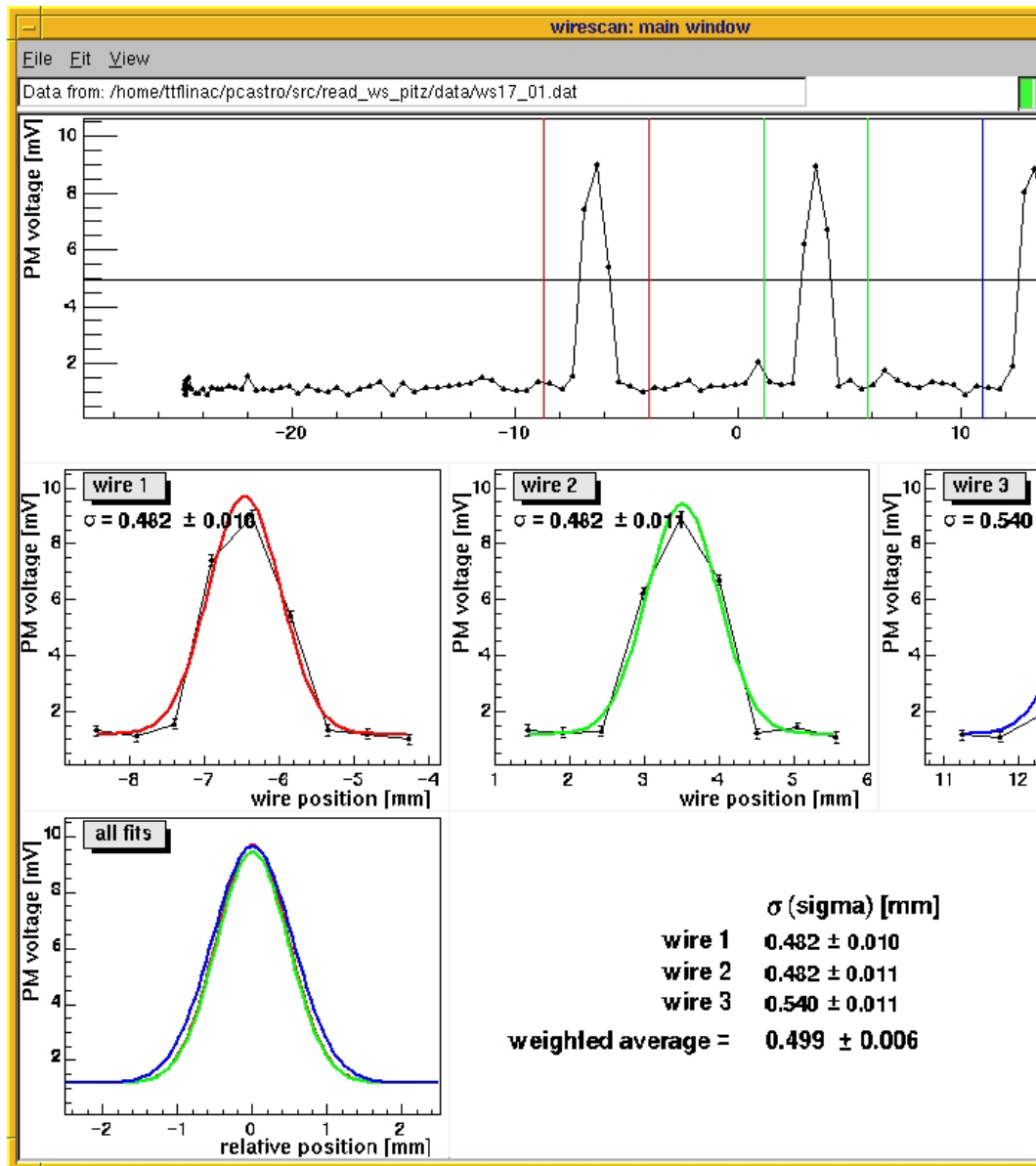
On-line FEL display: tested with MCP signals

TTF1

TTF2

V. Kocharyan

MCP EXP   position EXP   Ω   position BC2   MCP BC2
Longitudinal position in EXP

MCP high voltage
EXP 1509 ✔ 1500
BC2 1915 ✔ 1900

TTF Linac settings
3 Bunches
Laser frequency
● 1 MHz
○ 2.25 MHz

Energy
2.46
MeV

Start record
Stop record

☐ Write data file
☐ Normalize to charge
☐ Show photodiode data

BC2 settings | BC2 scan | EXP settings
73   Position Y -41   Illuminance 289
100 Position X 64   Temperature 17.3°
✔ ☑ FeedBack

EXP   BC2
                             no scan

Counter   Charge 2022041.95
95   MCP exp 450170300
95   MCP bc2 46279

10 feb, 03:21

SASE/spont. statistics | BC2/EXP | Charge | Energy
bunch # | actua | average | maximum | RMS

MCP Tool

File   Edit   View   Insert   Tools   Window   Help   Aperture   Refl.

| MCP1 | MCP2 | MCP3 | MCP4 | PhD1 | PhD2 |

Wire 11.7735 Set

Devices   /home/vitaly/FEL/matlab/fel/tmp.sr   Load

MCP high voltage
Aperture =   0.5mm

| MCP | MCP norm | Energy | Charge |

U   1.7387   2500   Set

Dx   0   Set

| # | Signal | Max | Mean | RMS | Charge |

Linac settings

Dy   0   Set

Bunch(es)
Show step   9MHz

Start
Stop

◇ Write data to file
◇ Norm. to charge

Counter   Timer   1251.3601   Mean calc: 0   0
1   Delay   0   Read rate: 1   17:20:04
1   Samples   10   TimeHist   Histogram

Wirescanner test in PITZ: server + display tested:

O. Hensler, P.Castro

DAQ architecture

K.Rehlich et al.
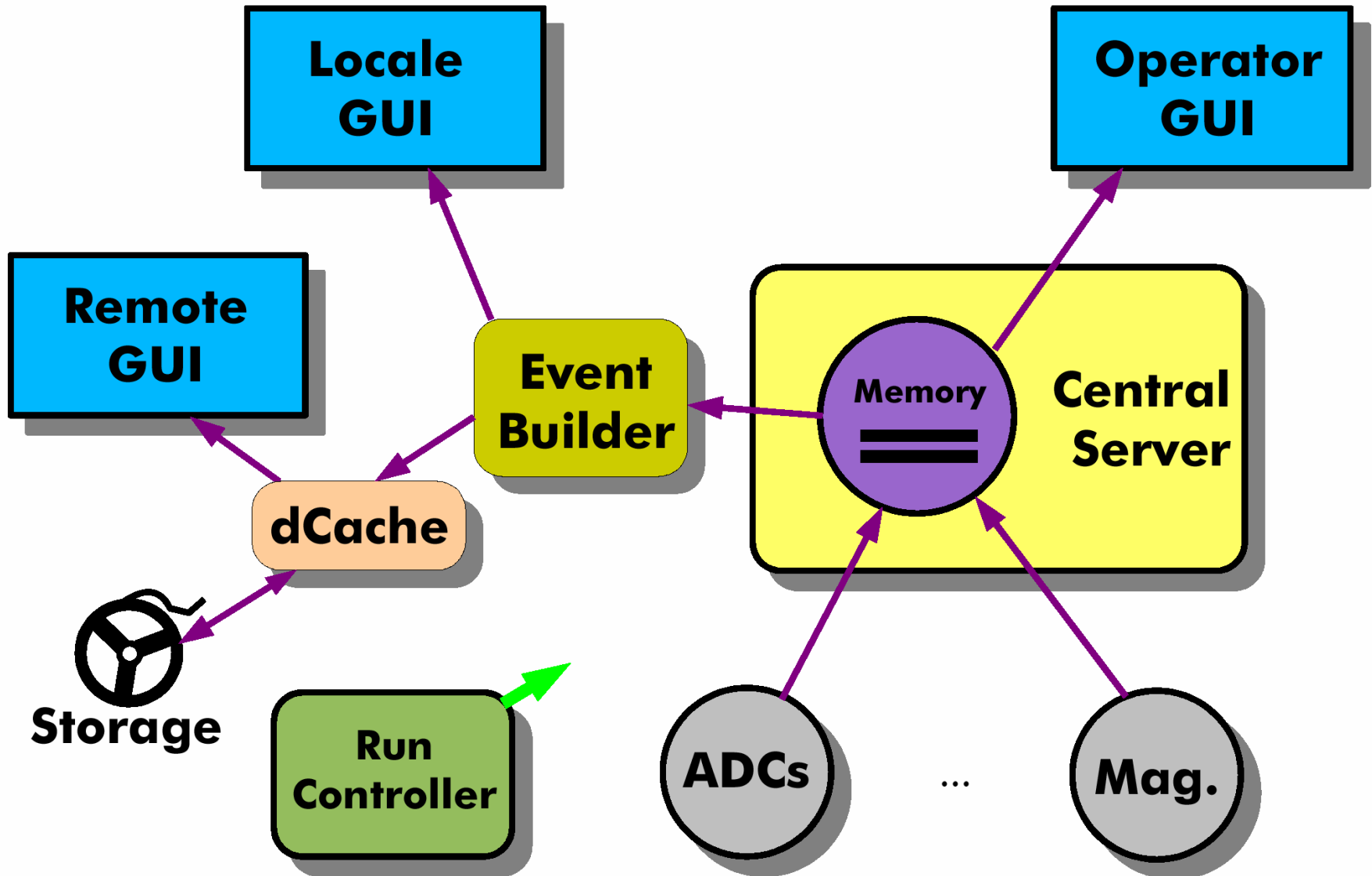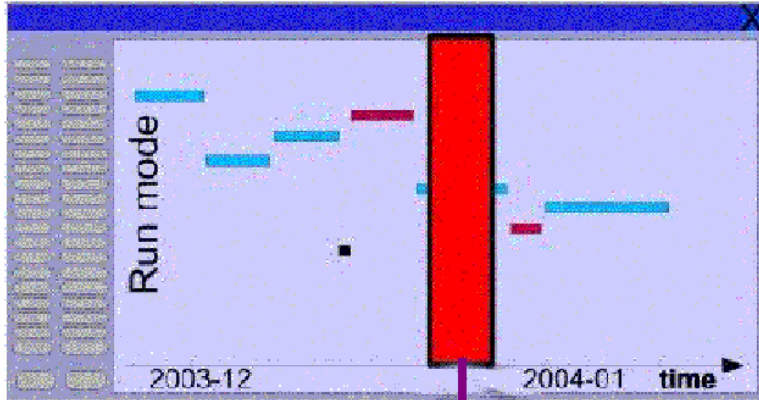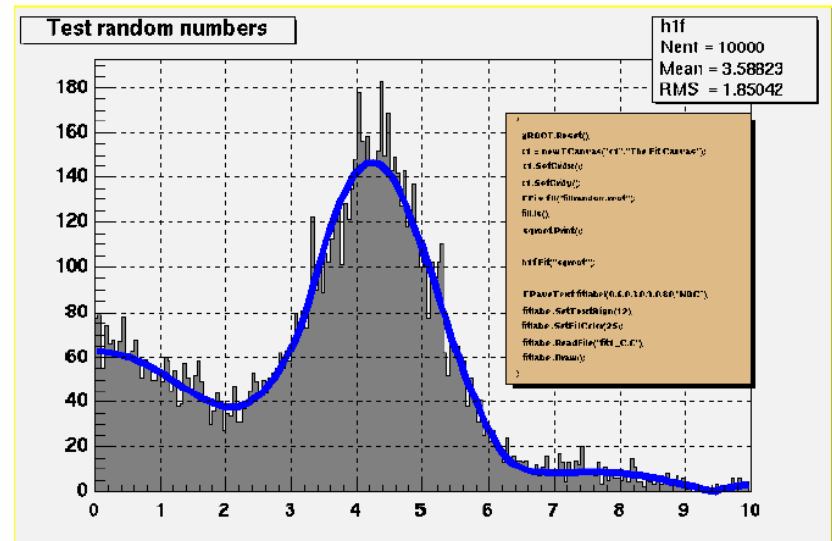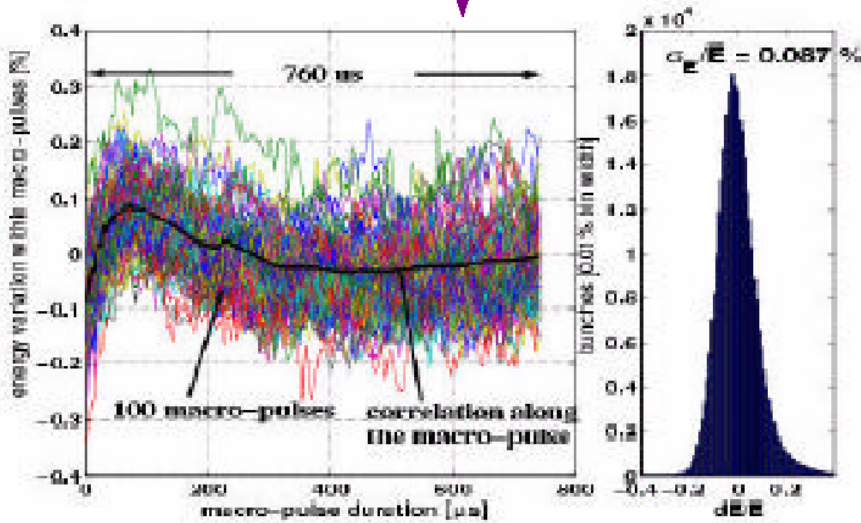
DAQ browser

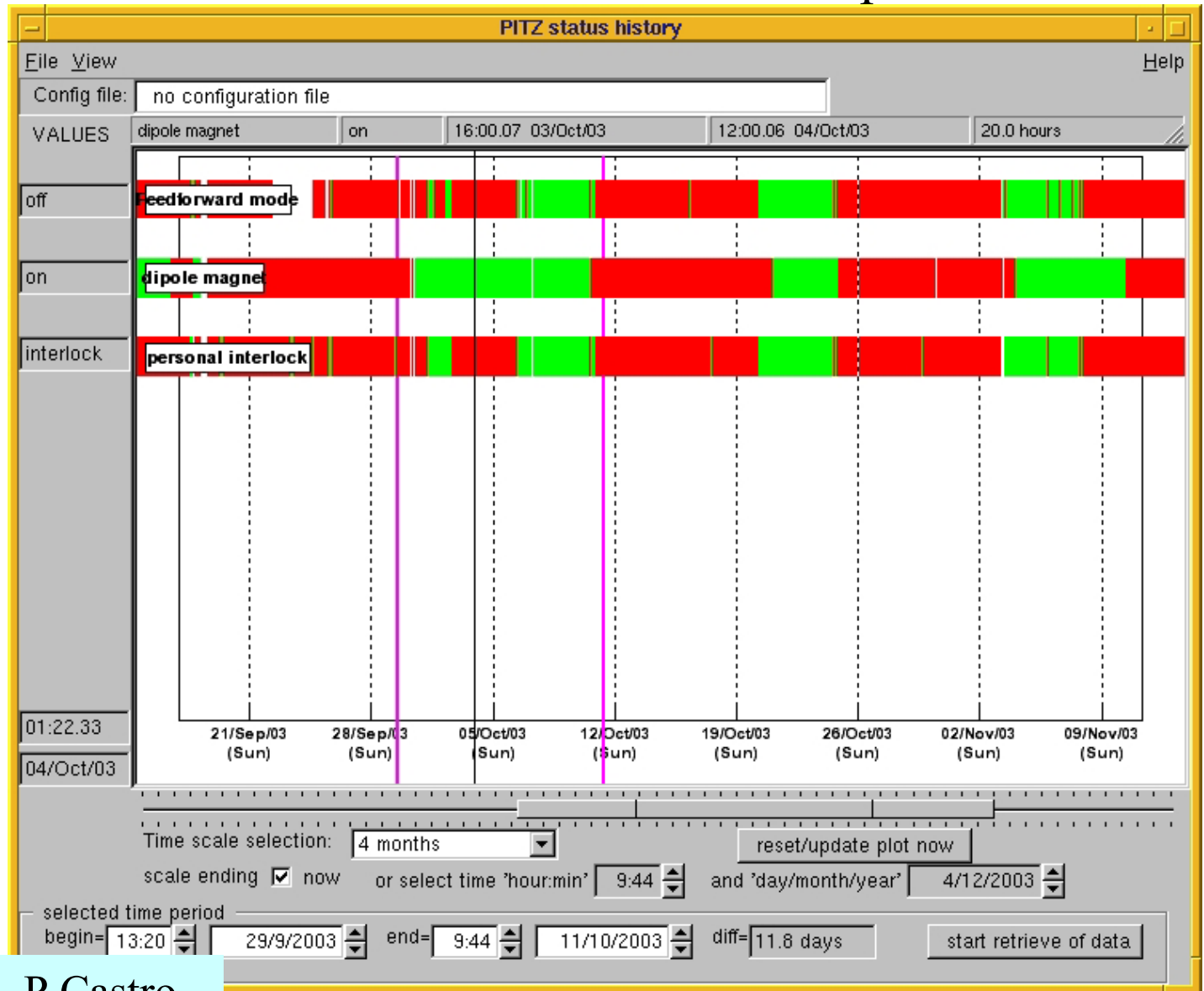Linac mode and status display

1. **Select a time range**
2. **Set filters**
3. **Define channels to analyze**
4. **Activate a plot**
   - Time domain (bunches, macro pulses)
   - FFT
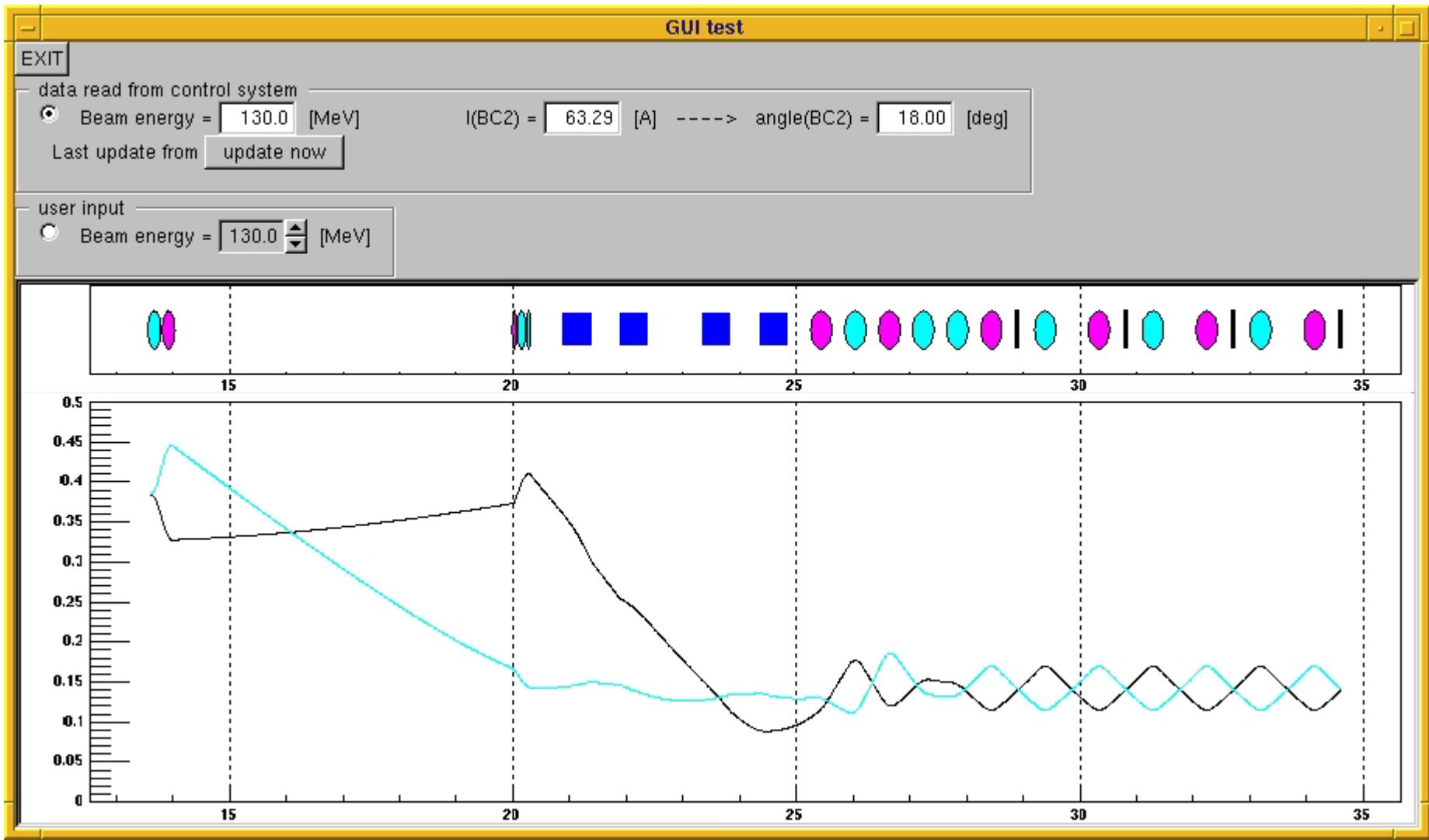   - Correlations (a, b,.. as a function of x)
   - Histograms

K.Rehlich

PITZ status history:

a quick view to the status of PITZ + selection of time period

K. Abrahamyan, P.Castro

Optics display (in BC2): in preparation

P.Castro

Thank you!

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