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MERIT
BEAM INTENSITIES

Contents

Aim:

- Single bunch intensities
- Relative precision of a few percent
  - Must be better than the aimed precision for detecting production deficiencies due to cavitation.

- Beam intensity monitors
- Data synchronization
- MERIT BCT data and analysis
- PS transformer data
- Self-contained analysis and comparison of different systems

Beam intensity monitors

1. **BSM**
   - Bunch shape measurements in the PS ring
   - On last turn before extraction
   - Single bunch intensities available
   - Not always recorded, data stored graphically

2. **BeamCurrentTransformers (PSCT) on TT2**
   - Pulse intensities measured, no single bunch intensities
   - "wrongly" measured intensities for pulses in pump-probe method beyond a certain delay
   - Automatic logging (data electronically available)

3. **MERIT BCT on TT2A (MCT)**
   - About 10 meter upstream of z=0
   - Single bunch intensities available
   - 500 MHz (2 ns) sampling rate
   - Attenuation factor was increased x2, once on 26.Oct 2008 at 16:03 (BCT time)
   - Automatic logging (data electronically available)

- The crux of the matter is in the details
….

which takes a long time to analyse

…

Step 1 – Synchronize data

Sources with different data management and timing systems

Ilias prepared a file with all major parameters combined with beam run numbers.

- MERIT logbook and beam run numbers
- PS logging system (PSCTs, B-fields ...)
  - UTC time (2 hour off, 1 hour off after 28th Oct. 2007) compared to CERN time GMT+1)
- MERIT BCT, stand-alone server (with different day-light adjustments than usual)
- Mercury system
- Particle detector systems

For the case of beam intensities:
- Satisfactory!
- Minor discrepancy, where the discrepancy has other origins than timing synchronization.

A typical MCT recording

Bunch (h16)

Ringing

drift - offset
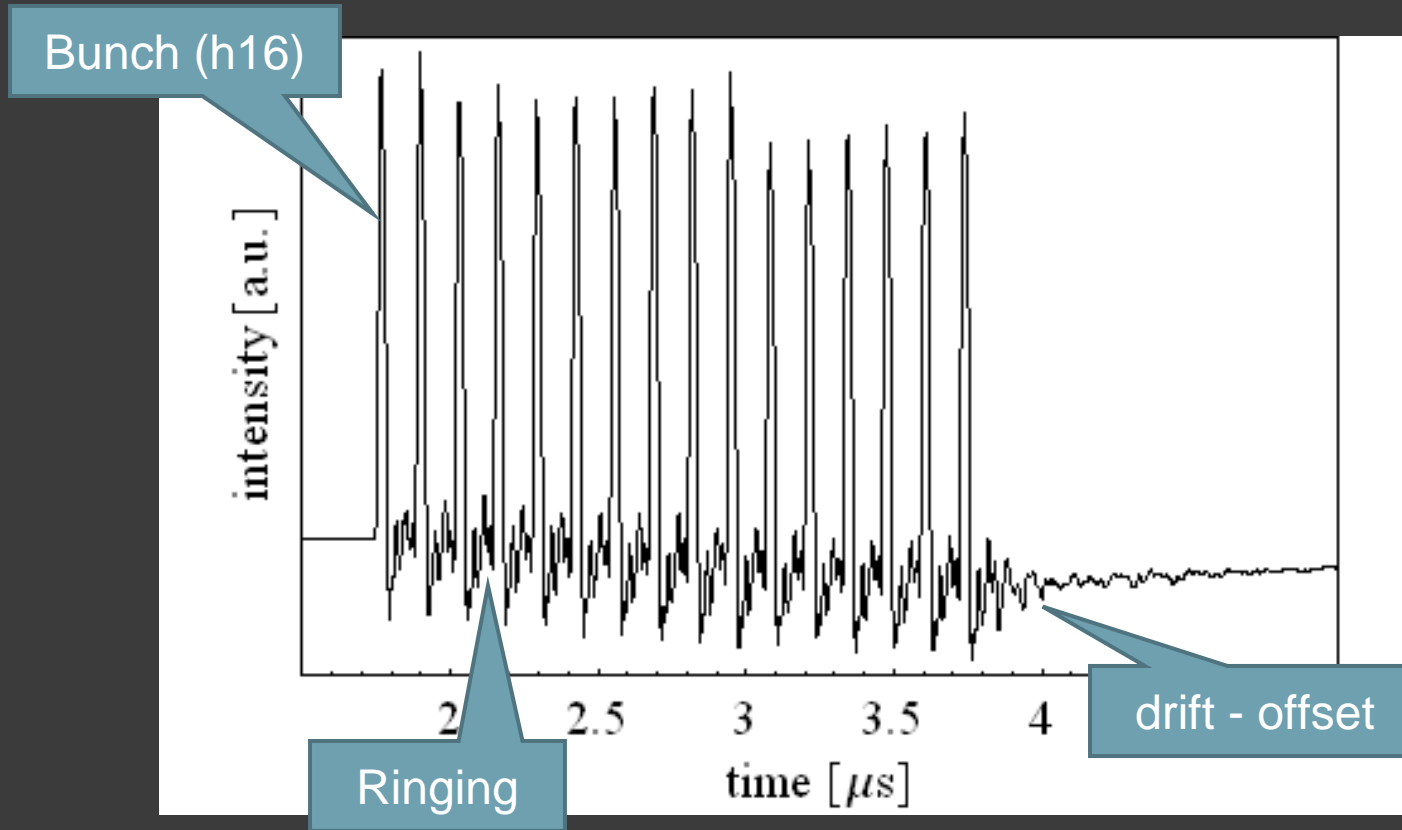
PS in different harmonic modes
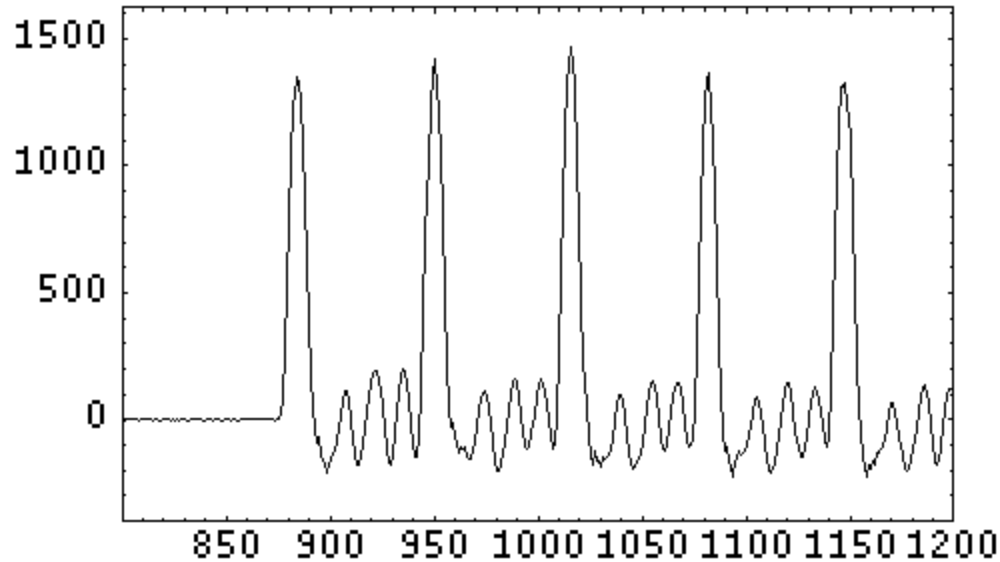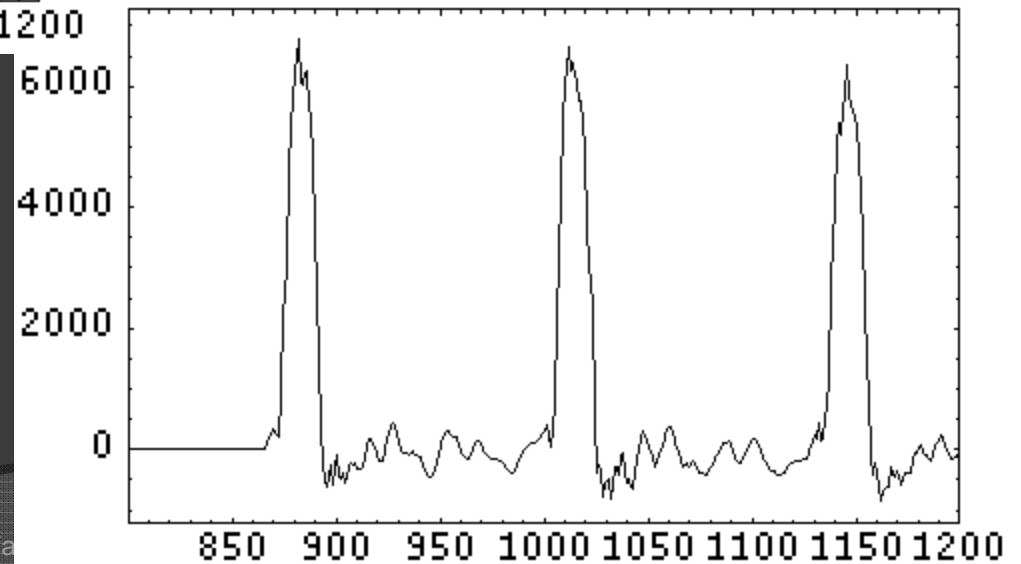
Single pulse response

All single h16-bunches

- ⊙ normalized to unity.
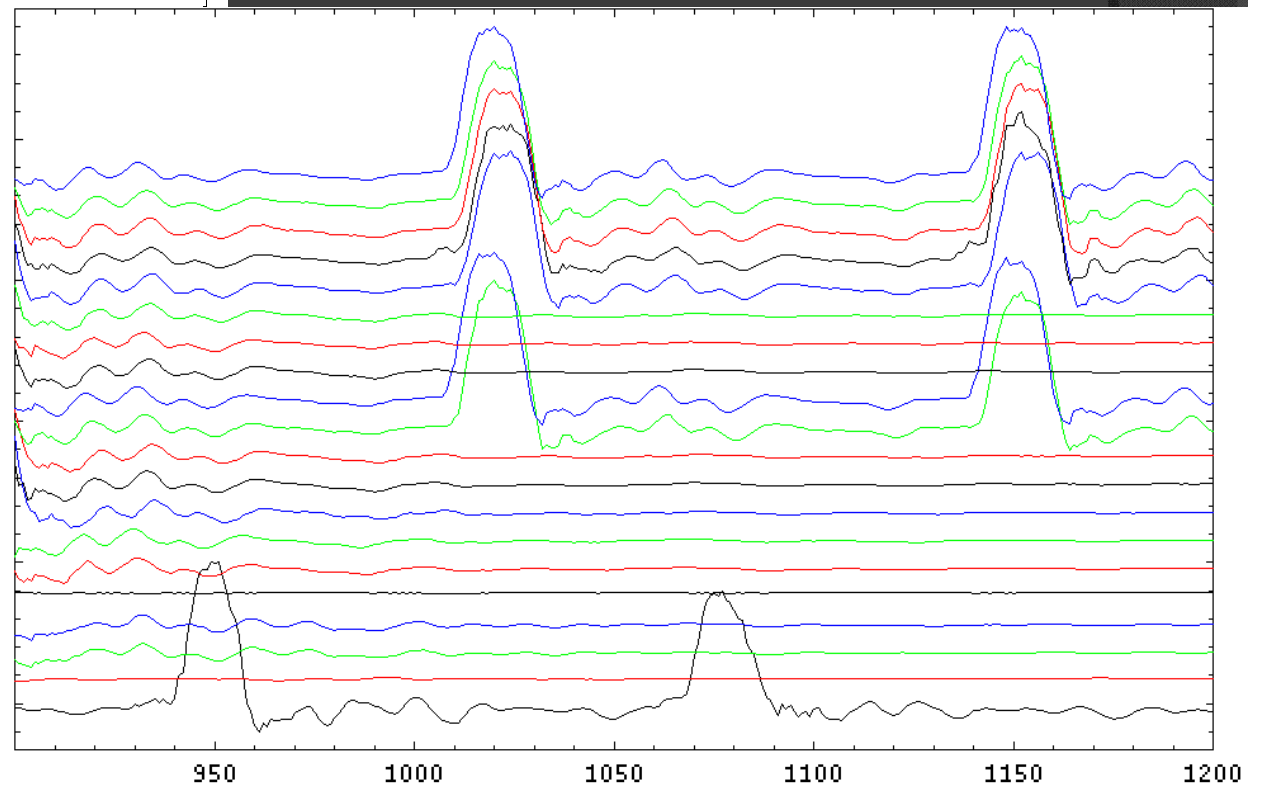- ⊙ Time shifted
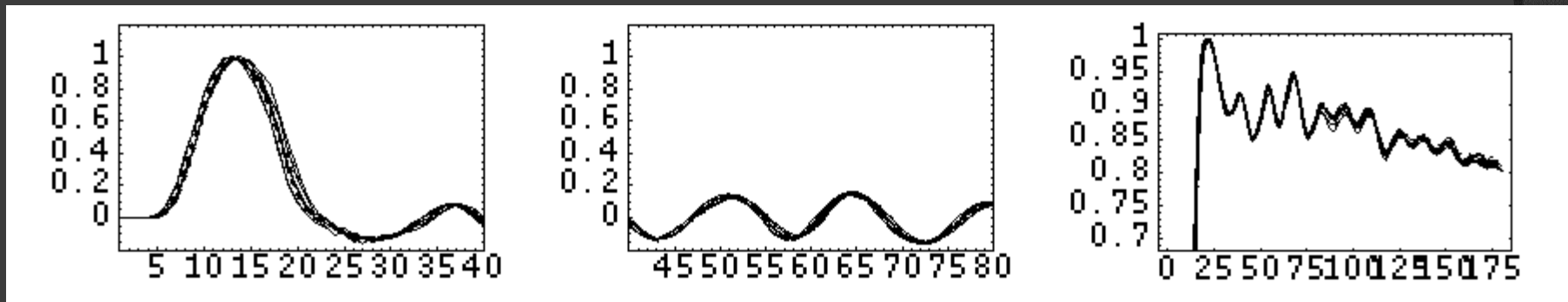
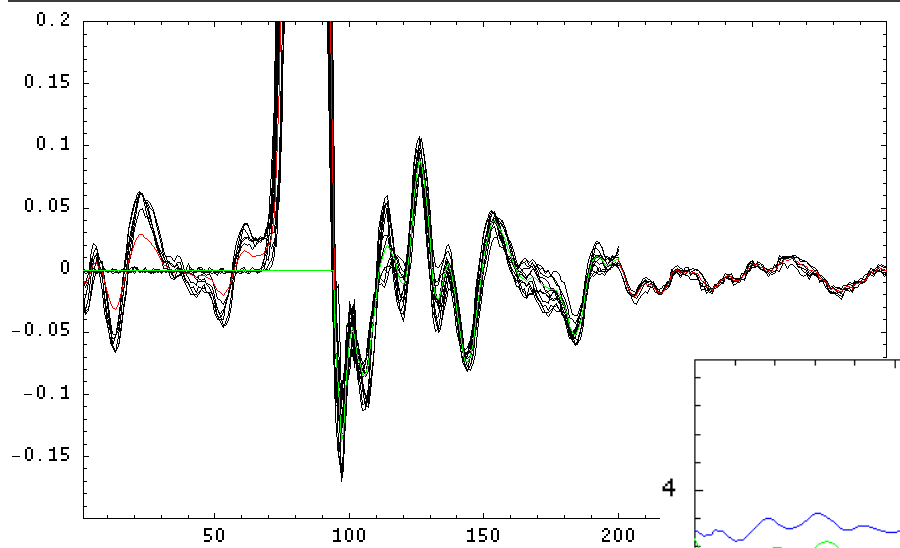
Left: start of MCT response
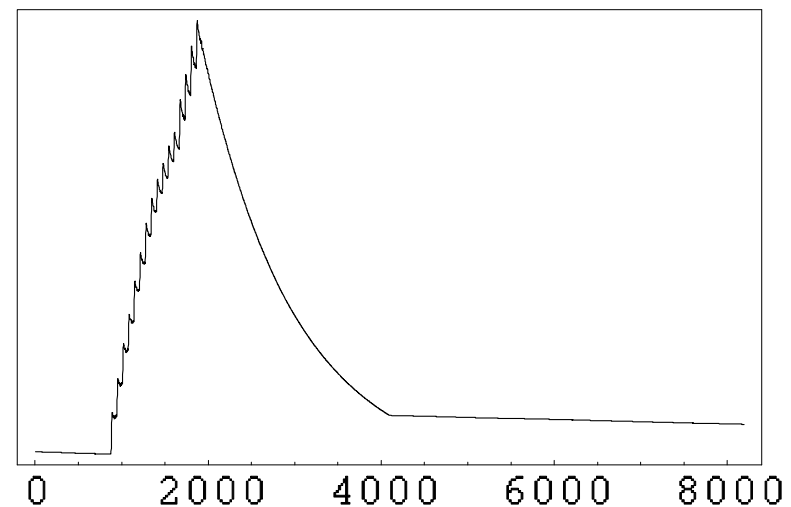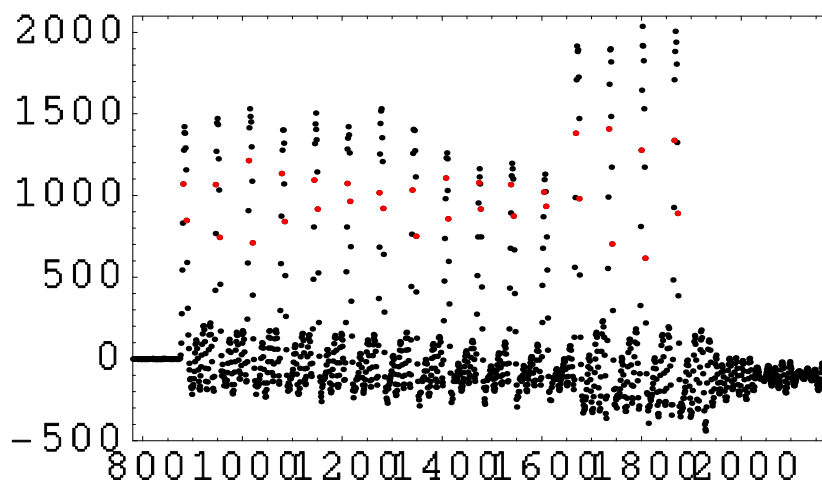Center: ringing up to "next" bunch
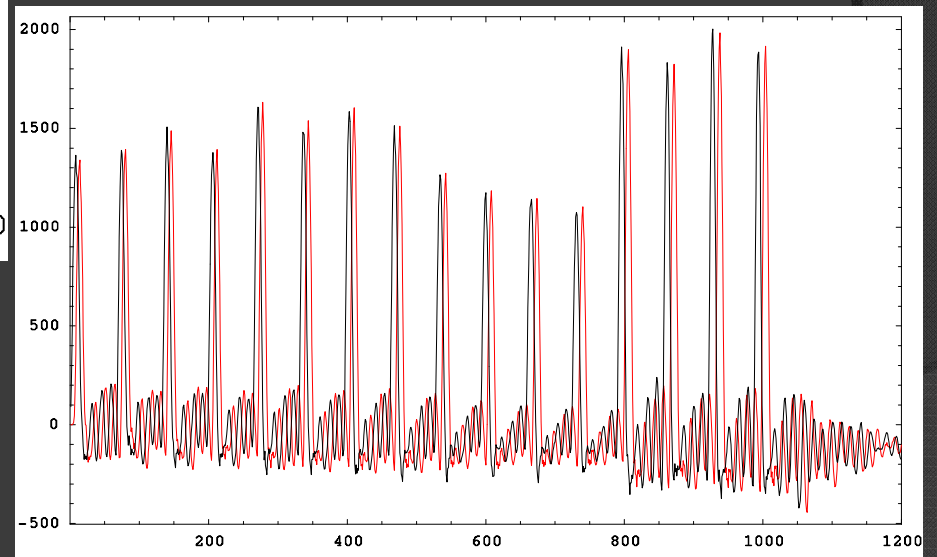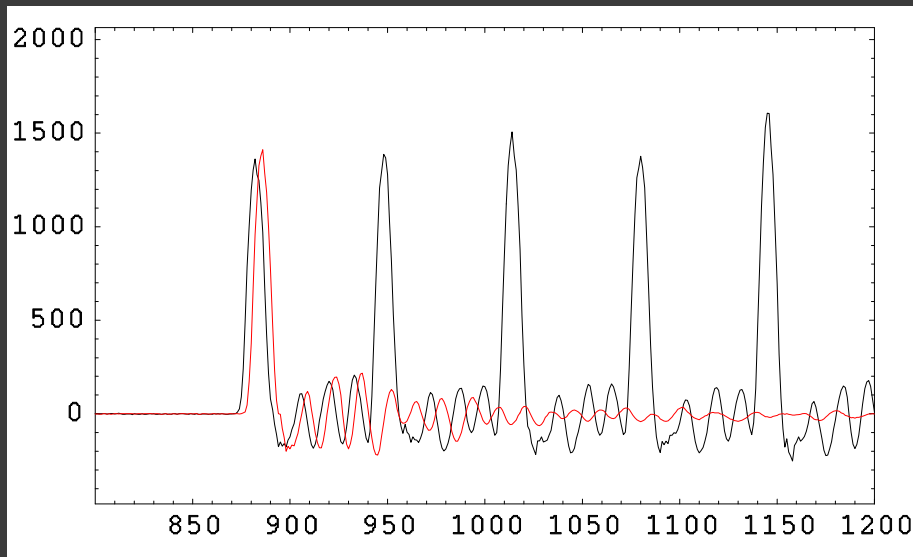Right: Numerical integral

"Single" pulses – h8

Analysis – step by step

- Any beam taken (in fact 2007-10-31,10:00:52 transformer time)
  - harmonic 16
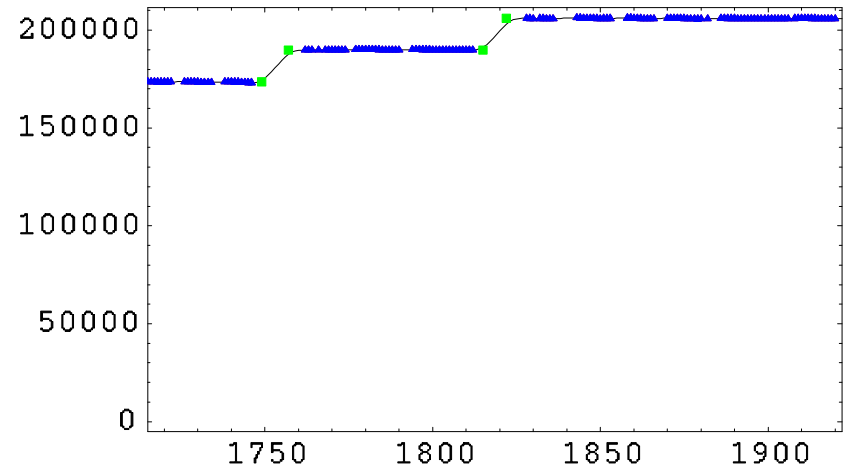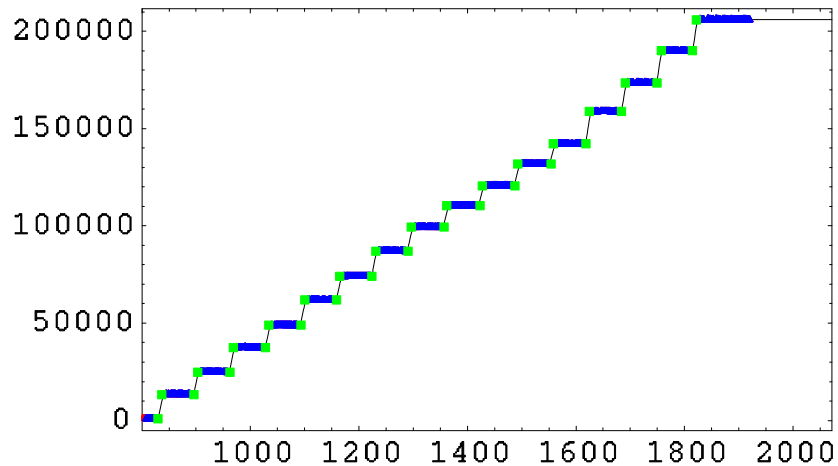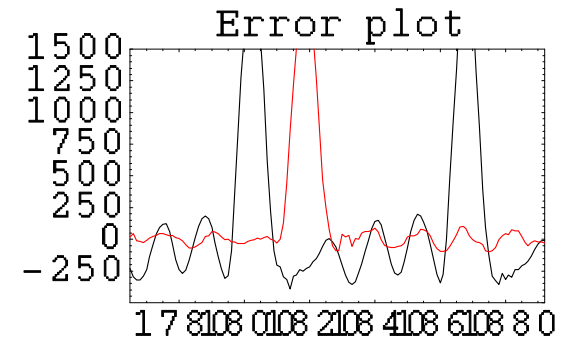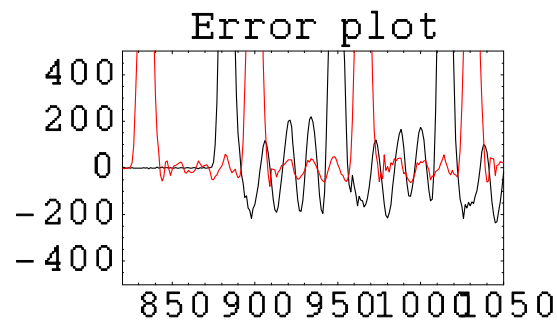 - 16 bunches
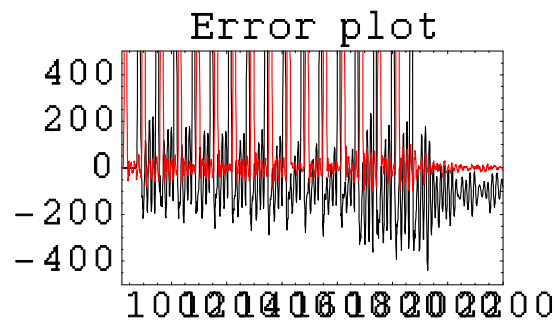 - NO pump-probe; extraction within one turn
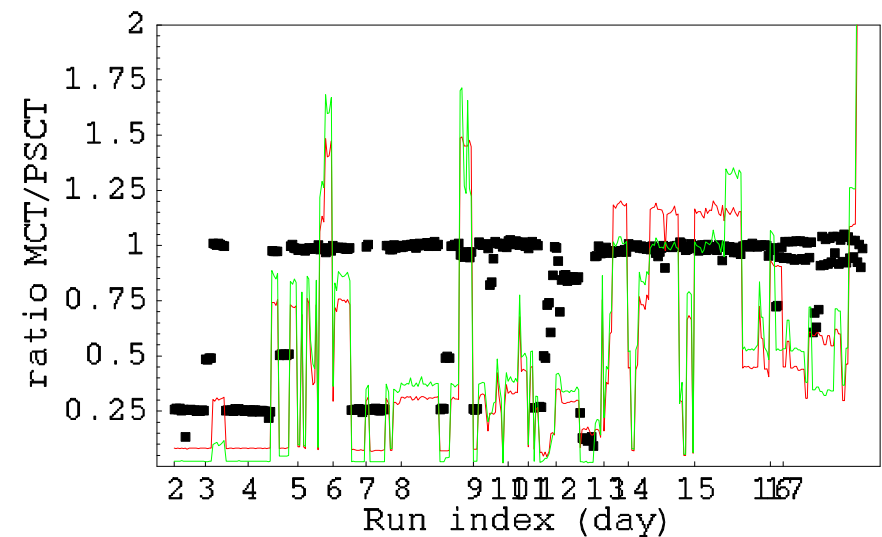
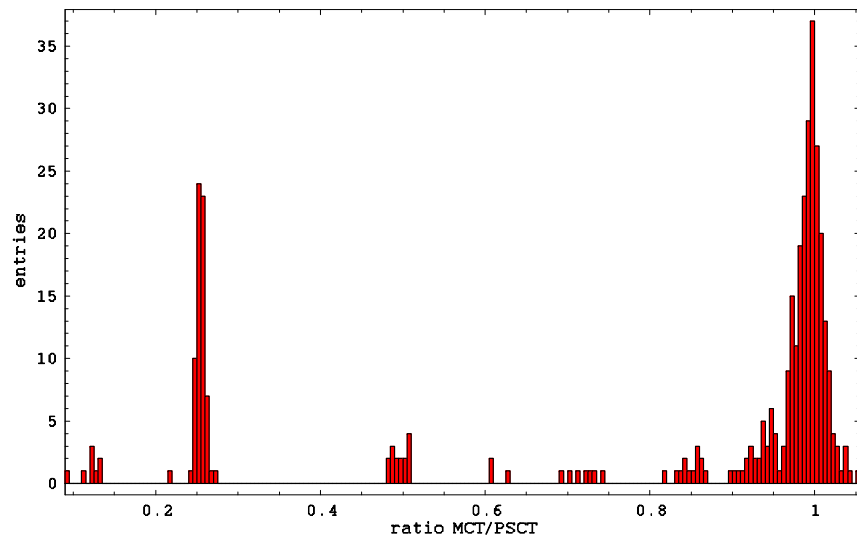# Reconstruct with single pulse response

(single pulse from 2007-10-29 16:20:51)
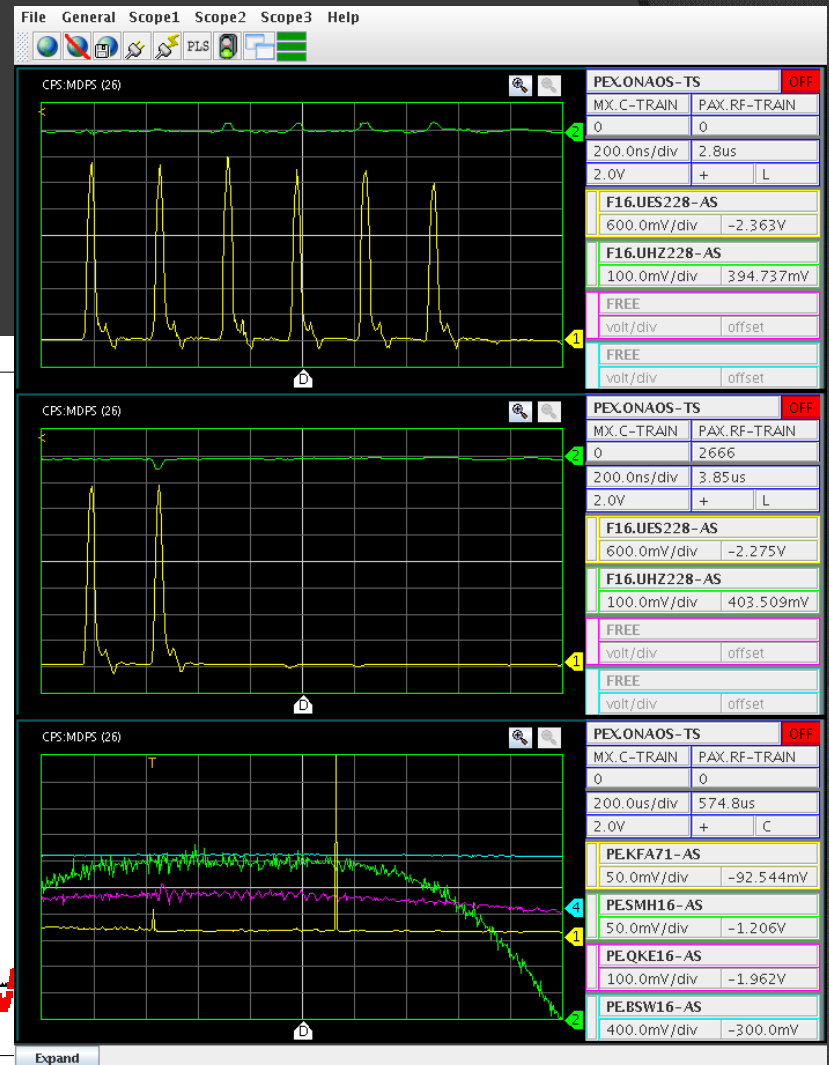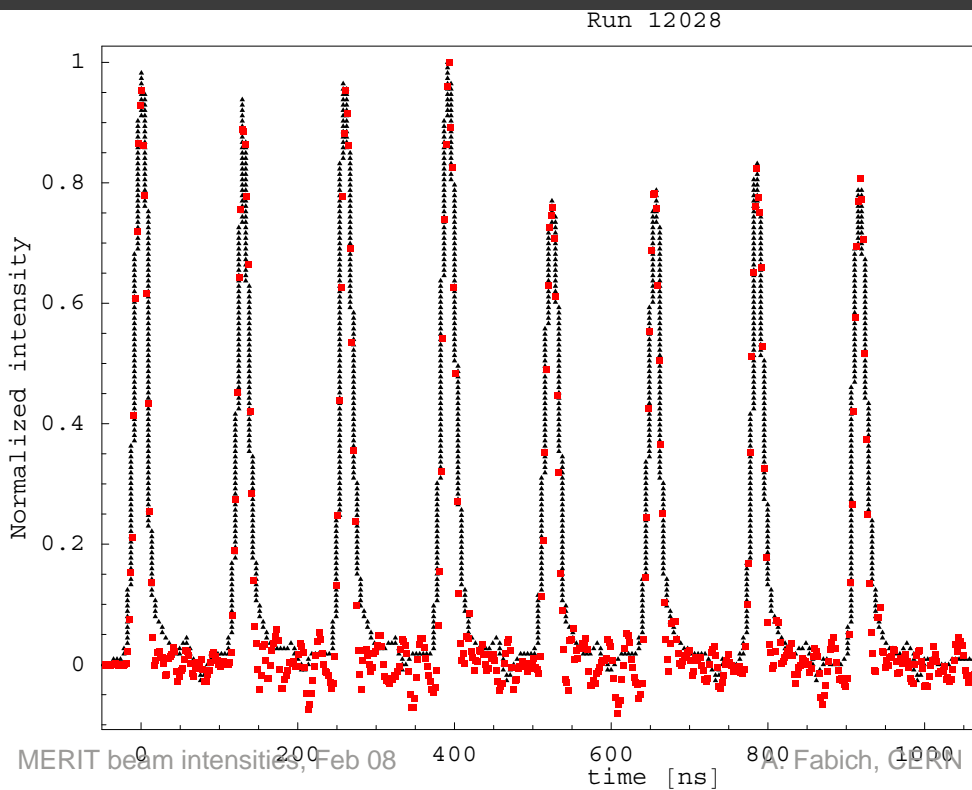
The intensity integral

Comparison PSCT - MCT

- ◉ Right:
  - red and green = PSCT (scaled)
  - Black: ratio MCT/OSCT
- ◉ Left: Histogram of black data from right
  - Peak at 1 is reasonable
  - Some strange peaks and flat distributions
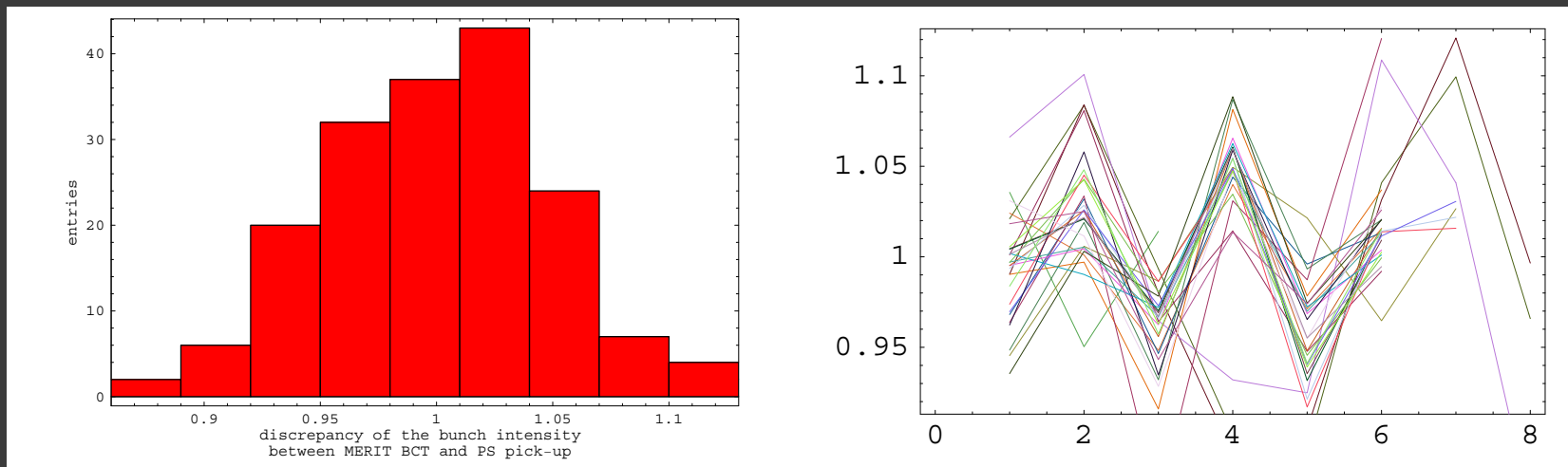 - Peak at 0.25 and 0.5 from "wrong" measurements by PSCT in pump-probe

BSM data

- Right: BSM
- Below: superposition
  of BSM and MCT

Run 12028

BSM summary

- Pulse total from single bunch recordings of BSM and MCT are compared.

- Poor statistics from BSM (to be verified).

Summary

- Analyzed about 500 beam measurements
- Revisit intensity from PSCT for "strange" cases
- Codes (mathematica) available for automated analysis available
- Summary sheet of all single bunch intensities available
  - Need to add flag of good/bad beams
  - If "bad" beam run is needed, has to be evaluated case-by-case.
- Re-evaluate BSM data