SPS BLM MD 15-16 Nov 2006 results and 2007 MD proposal

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SPS Beam Conditions

- Coasting beam 270 GeV
- Type LHC2
- Intensity 4 bunches (1.1x10^{11}p^{+}/bunch)
- RF ON
- LHC Collimator in LSS5 active
Available data

- 4 BLMIs installed downstream the collimator (~10m)
- 2 positions per jaw (motors) recorded
  - Single jaw moved (parallel displacement)
- 1.7s long Post Mortem triggered by collimator movement (40us integration time)
- 80 ms long Collimation Logging triggered by collimator movement (2.52 ms integration time)
- Peak of 12 Running Sums every second

Filtered + raw Post Mortem data

- 1 mm/s assumed for jaw speed
- Start @ trigger + 9ms
- CFC electronics introduces systematically additional counts
  - problem solved for the new version
PM data zoom with jaw Start Stop marked

- Offline filtering does not change spectra (adapted for the specific CFC miscounting)
- Most visible ripple: 600Hz

FFT of the filtered PM data (previous plot) zoom

- Dominant frequencies from 3-phase Magnet Power Supplies
  - 50 150 300 450 600 Hz
- 71 Hz from the jaw bending..? (tau = 14ms)
Possible sources of the ripple

- HV BLM power supply
  - Low pass filter at the HV input to the BLM
  - Single phase PS (would not have 600Hz)
- EMC into the BLM signal or HV cables
  - Unlikely as not seen if no losses occur
- Introduced by transverse beam oscillations

Sum of FFTs of relevant PM files

- High frequency lines to be identified
  - H & V tune + Qs
  - Electronics chain effects
Zoom of previous plot (sum over 32 collimator movements)

- Frequency spectra stable over ~2h time

FFT of Quadrupole voltage from “Power Supply Ripple Study at the SPS” (1994)

Highest peak at 600 Hz and 50 Hz
SPS Horizontal tune ripple measurements (92 & 93)

- 200,500 and 1000 Hz do not come from MPC
- 150,300,600 are also in the voltage spectra
- Inconsistency of the 150 Hz line in 1993

![Comparison of Schottky Tune Ripple Measurements](image1)

Example of longer jaw movement

![Motor movement 50ms (50um)](image2)
Collimation logging was verified by reproducing it from PM data

- PM file timestamp: 00:13:23
- Logging timestamp: 00:13:22
- Standard offset of 1.7s?

Long jaw displacement

- Nonlinear behavior at 1 count due to miscounting of the ADC in the CFC electronics
- Jaw movement long compare to 80ms logging
Corresponding Logging data

- Please notice the different time scales

Jaw move out of the beam

- Please notice the different time scales
LSS5 MD request for 2007

- Tests of the new electronics version
- Investigation of the beam loss signal oscillations (influence of RF, Transverse Damper, no HV Power Supply)
- Final prototype of SEM (BLMS) to be installed instead of 1 BLMI (next to the beam pipe)
- Optimization of the Collimation Data

Conclusions & remarks

- 80 ms Collimation logging might not be enough?
- Important horizontal beam oscillations – possible cause for tail repopulation? (to be confirmed...)
- 2007 MD time for testing the SEM and firmware upgrade
Spare plots: Measured Relative quadrupole current/voltage ripple in SPS 1993

Figure 26: Relative Current Ripple

0:22:41 full PM file length

PMDATA-20061116242241.txt Noise filtered
0:22:41 Logging reproduced from full PM file length

PMDdata-20091116242241.txt Logging 2.5ms Reproduced from 40us PM

Dose Rate [mGy/s]

BLM 0
BLM 1
BLM 2
BLM 3

Time [ms]

-200 0 200 400 600 800 1000 1200 1400 1600

0 5 10 15 20 25 30 35

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