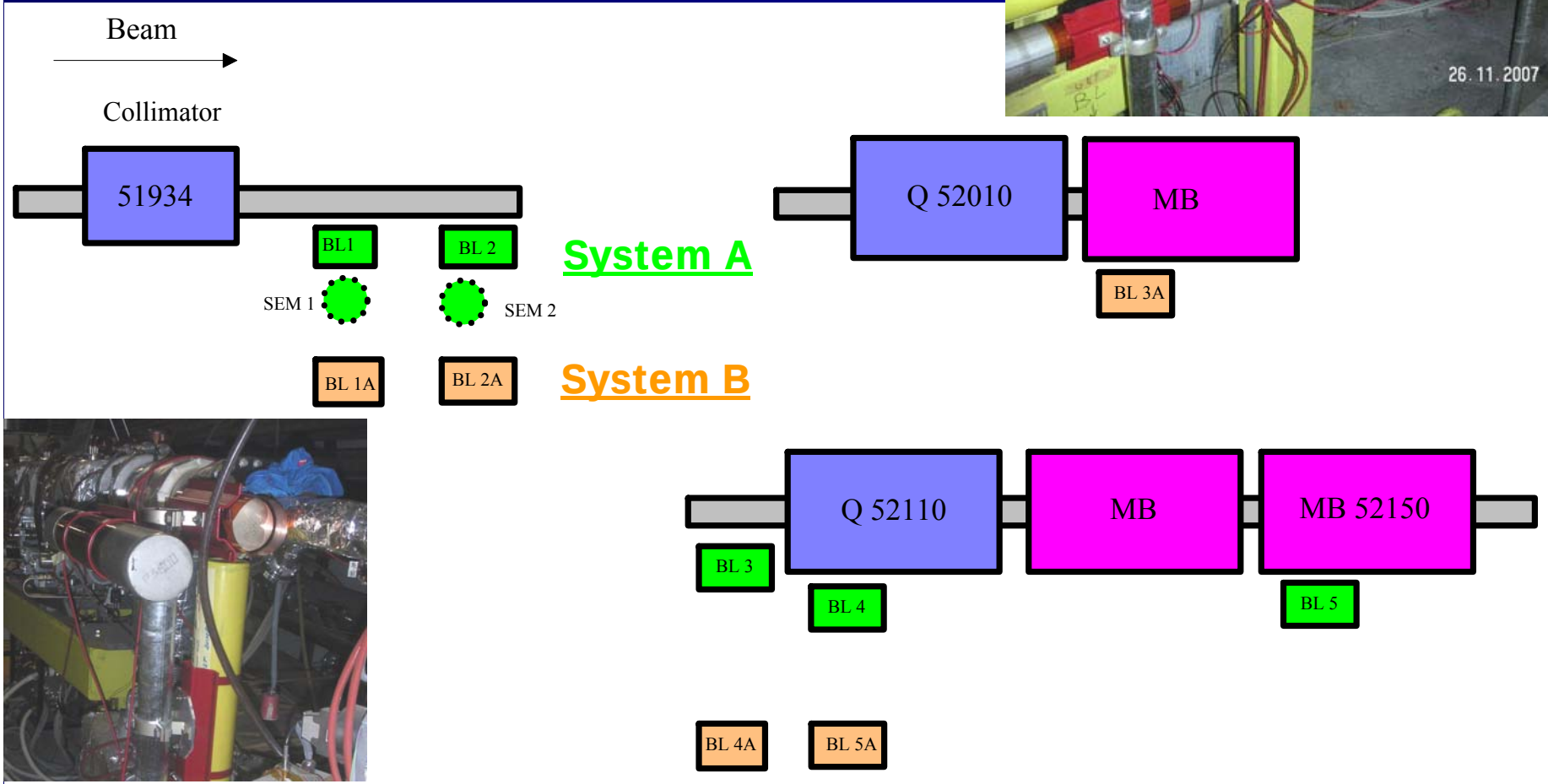
Results of the 2007 BLM hardware tests in LSS5

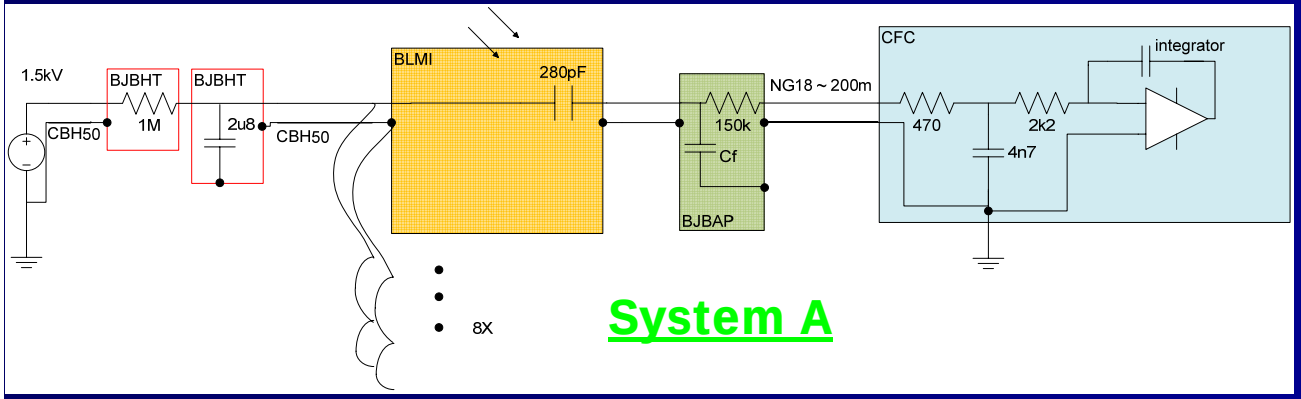
Daniel Kramer for the BLM team

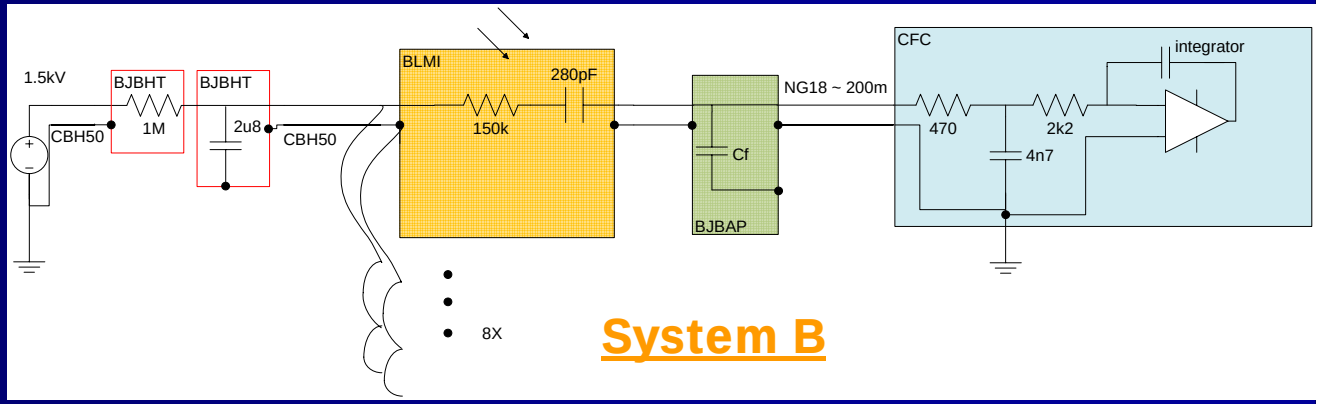
BLM installation in LSS5 of SPS 2007



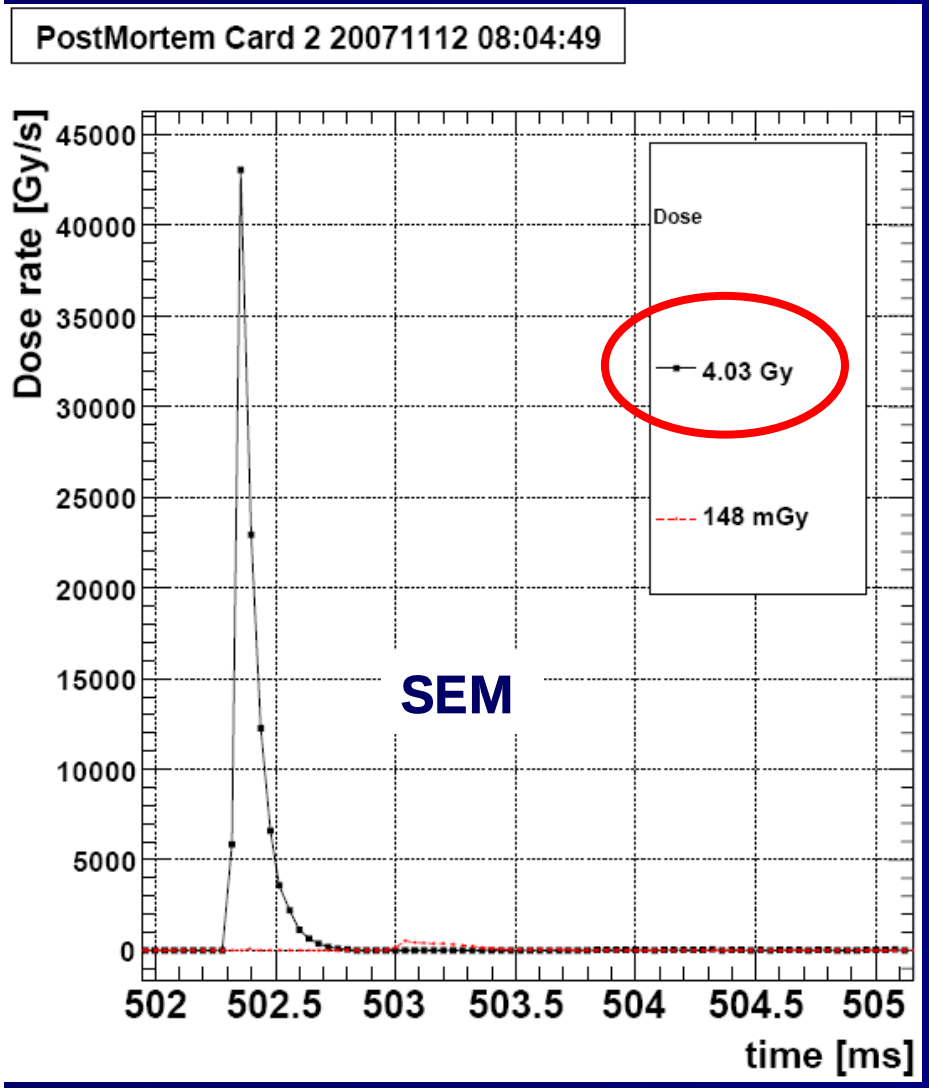
SPS LSS5 Installation – System A

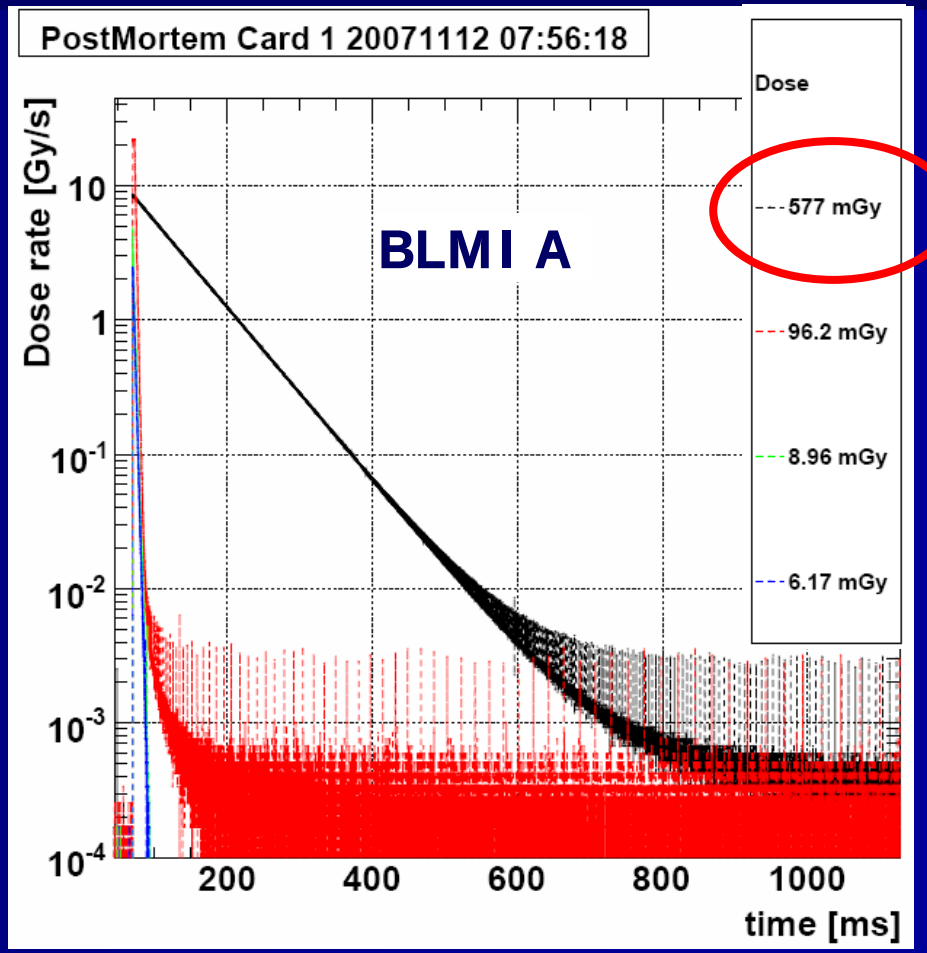
- Study space charge effects with large doses
- Compare directly BLMI with SEM
- Study cable crosstalks with different filters
- Verify the peak current limitation by the 150k resistor





Beam dump on Closed Jaws
SEM to BLMI comparison 1.3 $10^{13}p^{+}$

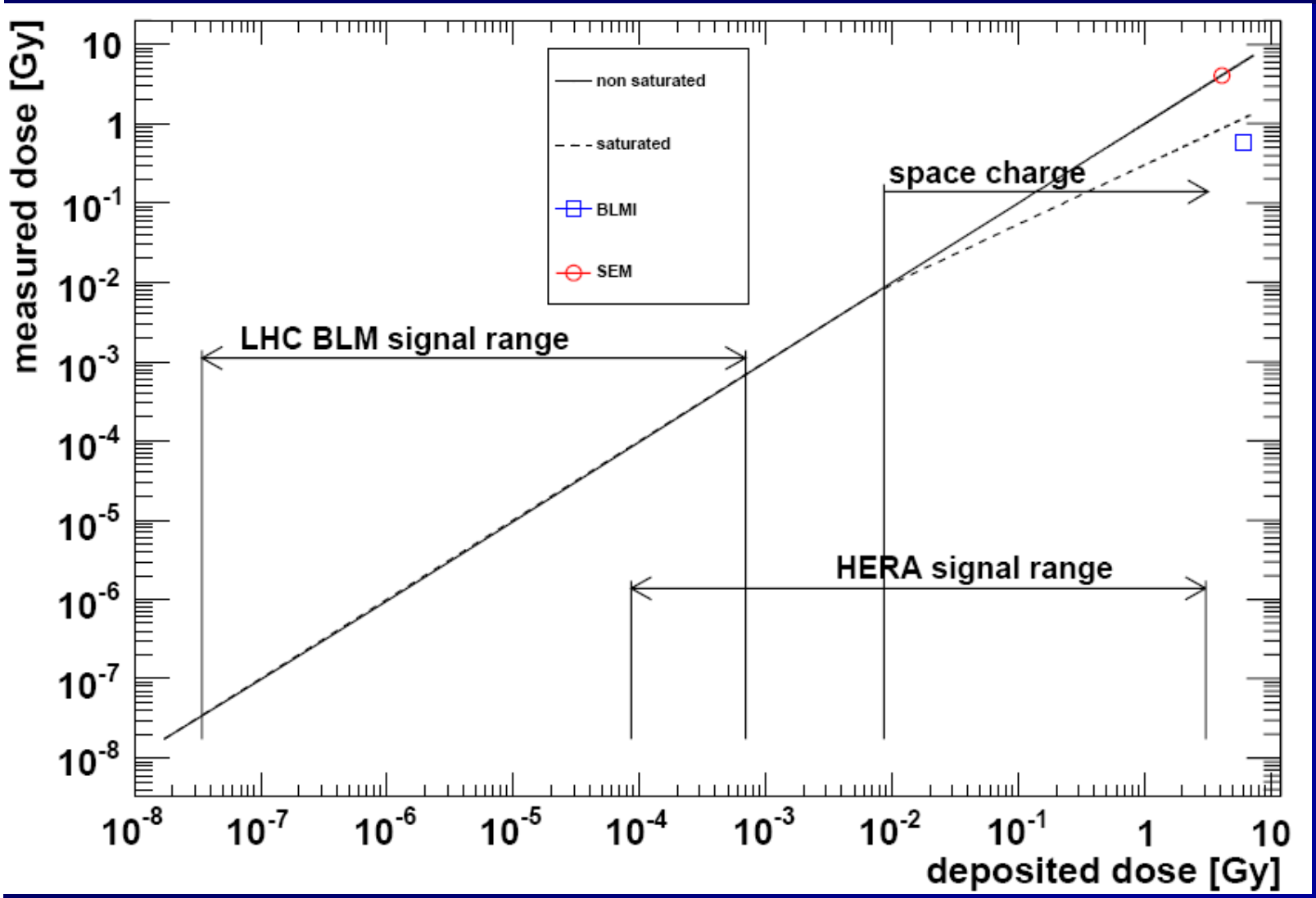




Black line – signal not clipped

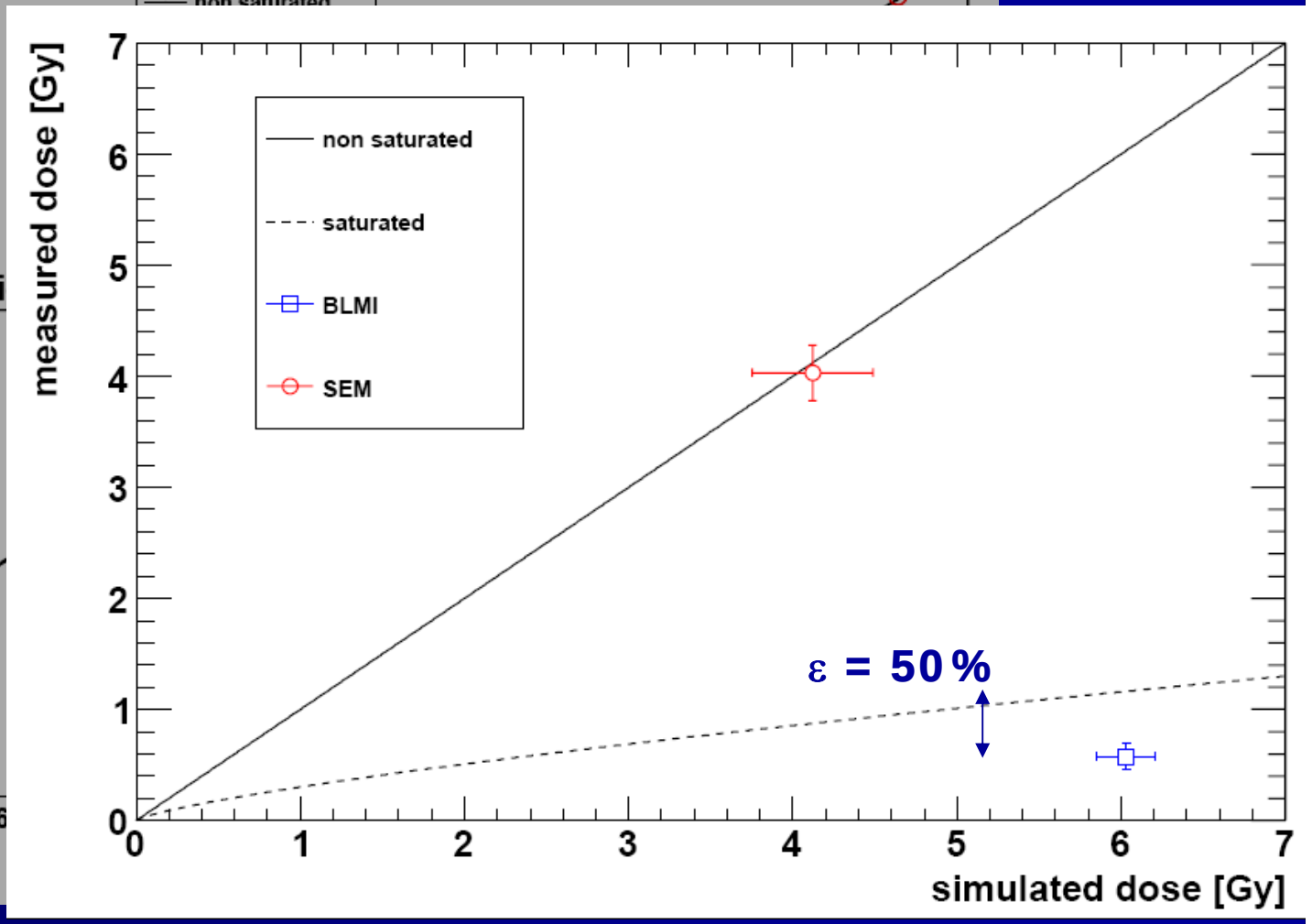
$5*\tau\_filter = 350ms$

BLMI Space charge effect estimation ("signal saturation" for 20us loss duration)



BLMI Space charge effect estimation ("signal saturation" for 20us loss duration)

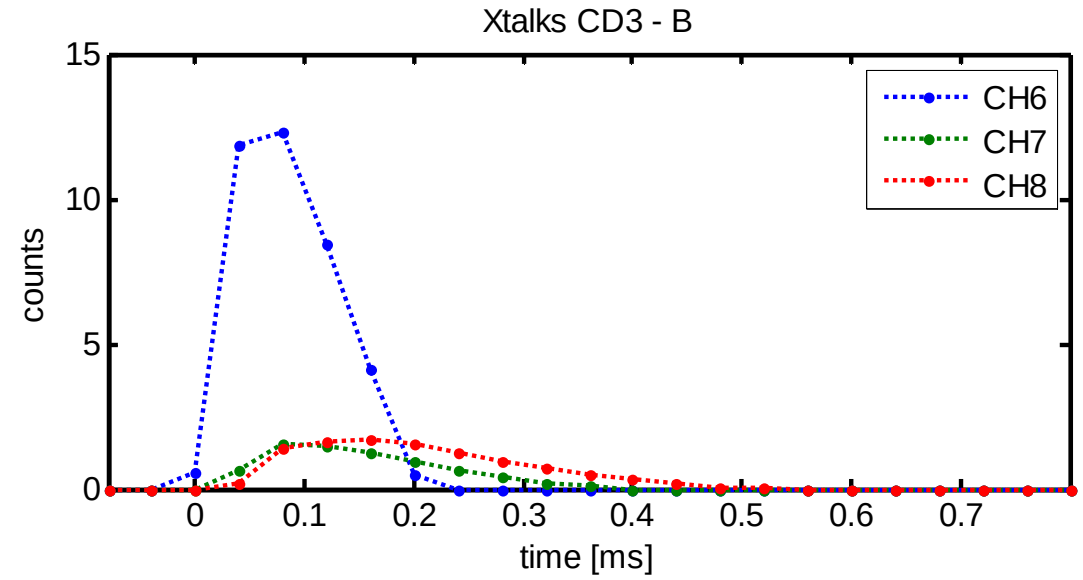
- SEM expected to be "saturation free"
- SEM signal predicted by combination of **Fluka and Geant4**
- Error of the theoretical prediction is **50 %** (in the heavy 'saturation' regime)

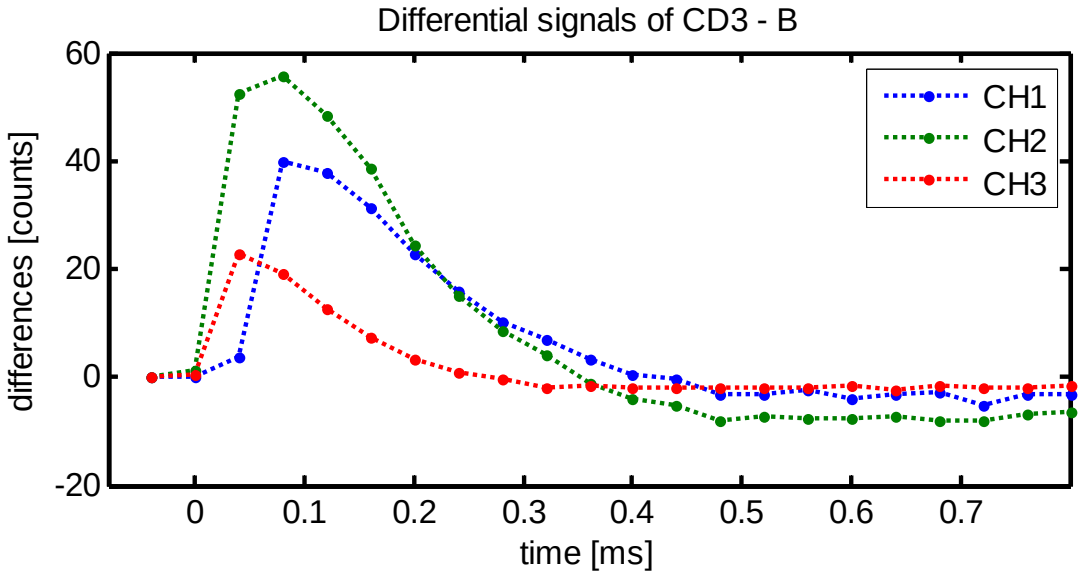


150kOhm R_p resistor limitation (between HV capacitor & IC)

- Limits the peak current on the chamber input to 1500 / 150k = 10mA
- Fast loss has only the Chamber charge available 280pF * 1500V = 0.4 uC
  - Corresponds to ~ 7 mGy total loss
  - Corresponds to ~ 180 Gy/s (PM limit = 22 Gy/s)
- Slows down the signal collection
- DC current limited to 1500 / 1M = 1.5 mA
  - Corresponds to ~ 26 Gy/s (total in max 8 chambers)

Cable crosstalks study System B



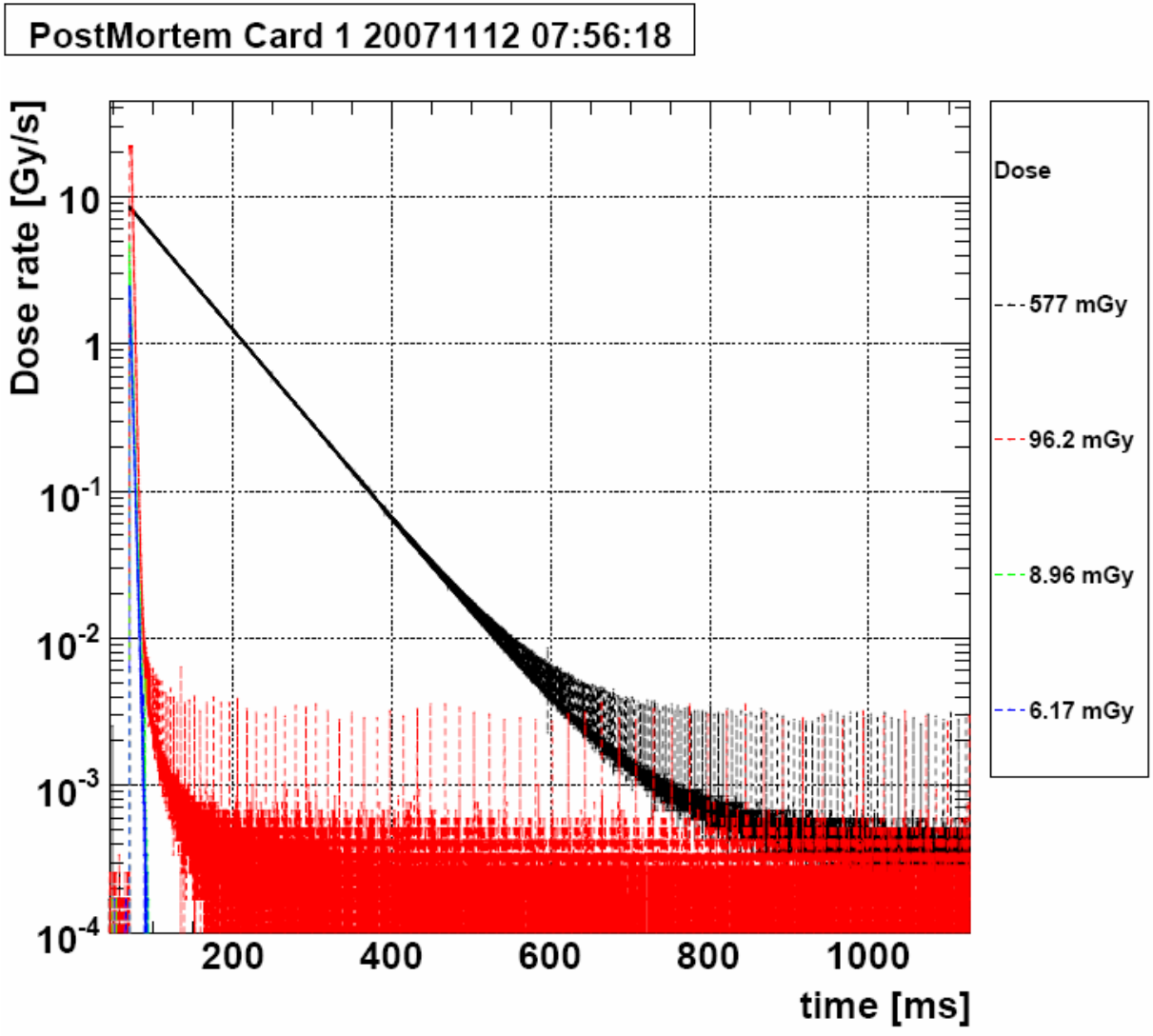


- Ch 6..8 unconnected
- Xtalk clearly depends on the derivation
- Signal peak ratio 5e-2 (26dB) (worst case)
- Integral ratio 4.4e-3 (47dB)
- Similar behavior for system A
- X-talks limited to 1 CFC card only!

Resulting actions for the LHC installation

- HV cables separated between SEM and BLMI
- Signal cables (NG18) not shared by SEM and BLMI
- CFC cards not shared either
- For collimation areas
  - capacitors removed from the chambers and grouped together
  - 150kOhm resistance to limit the i/o BLMI current

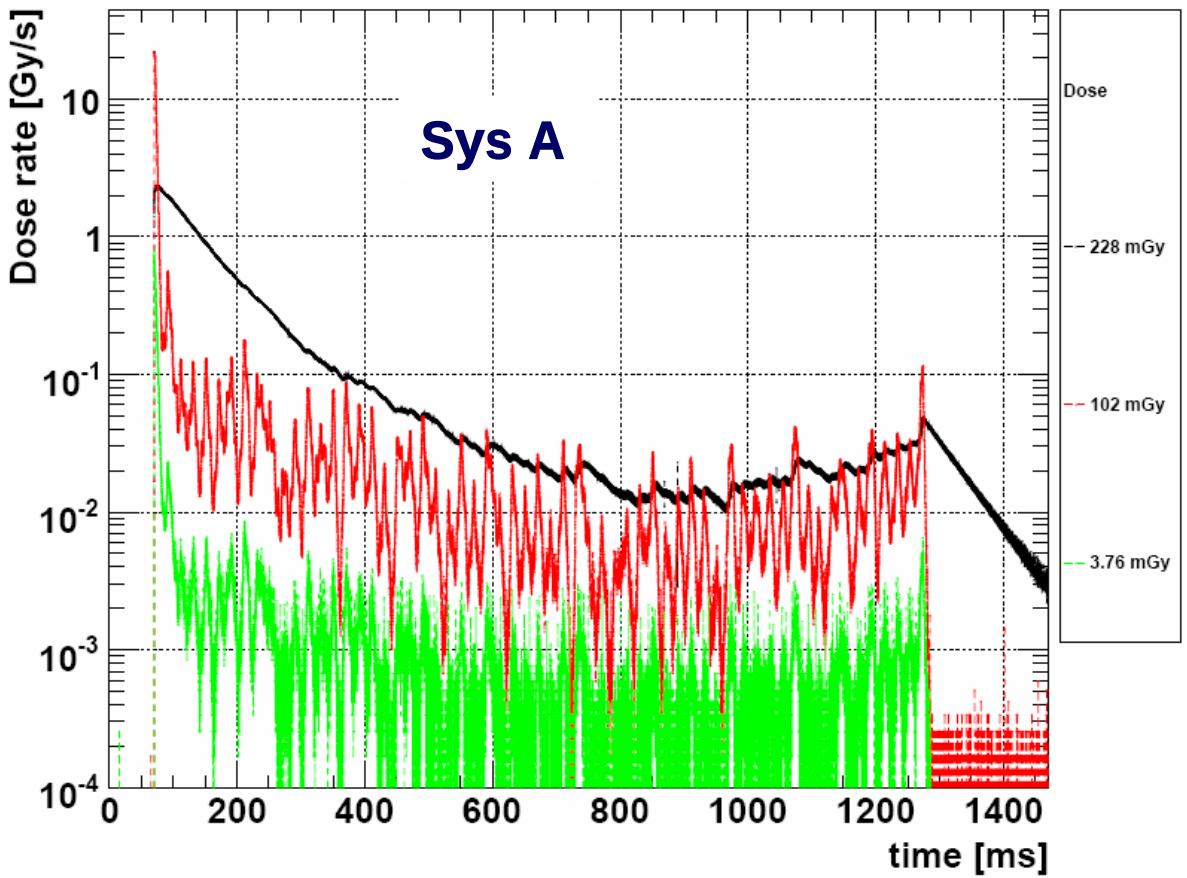
System A 1.3e13 p^+ injected on the collimator, Left Jaw at -5 mm, Right Jaw out



- -5mm means over the beam center
- The DUMP on the collimator (kindly allowed by Gianluigi...) to be compared to the slower loss with partial hit of the jaw

Comparison of A and B to test limitation by Rp
Left Jaw at 10mm, Right Jaw out, Dump @ 1.2s

PostMortem Card 1 20071112 07:36:11



- For slow losses no difference between A & B => no limitation by the 150kΩ resistor

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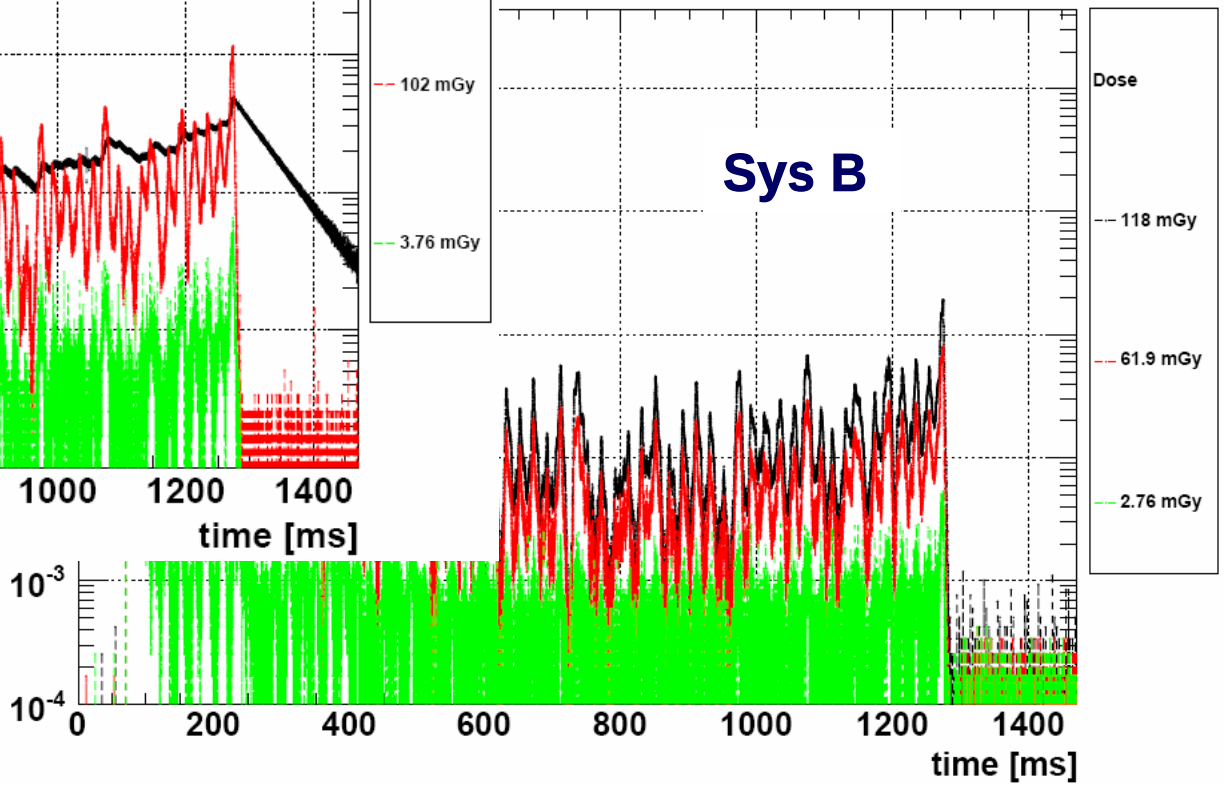
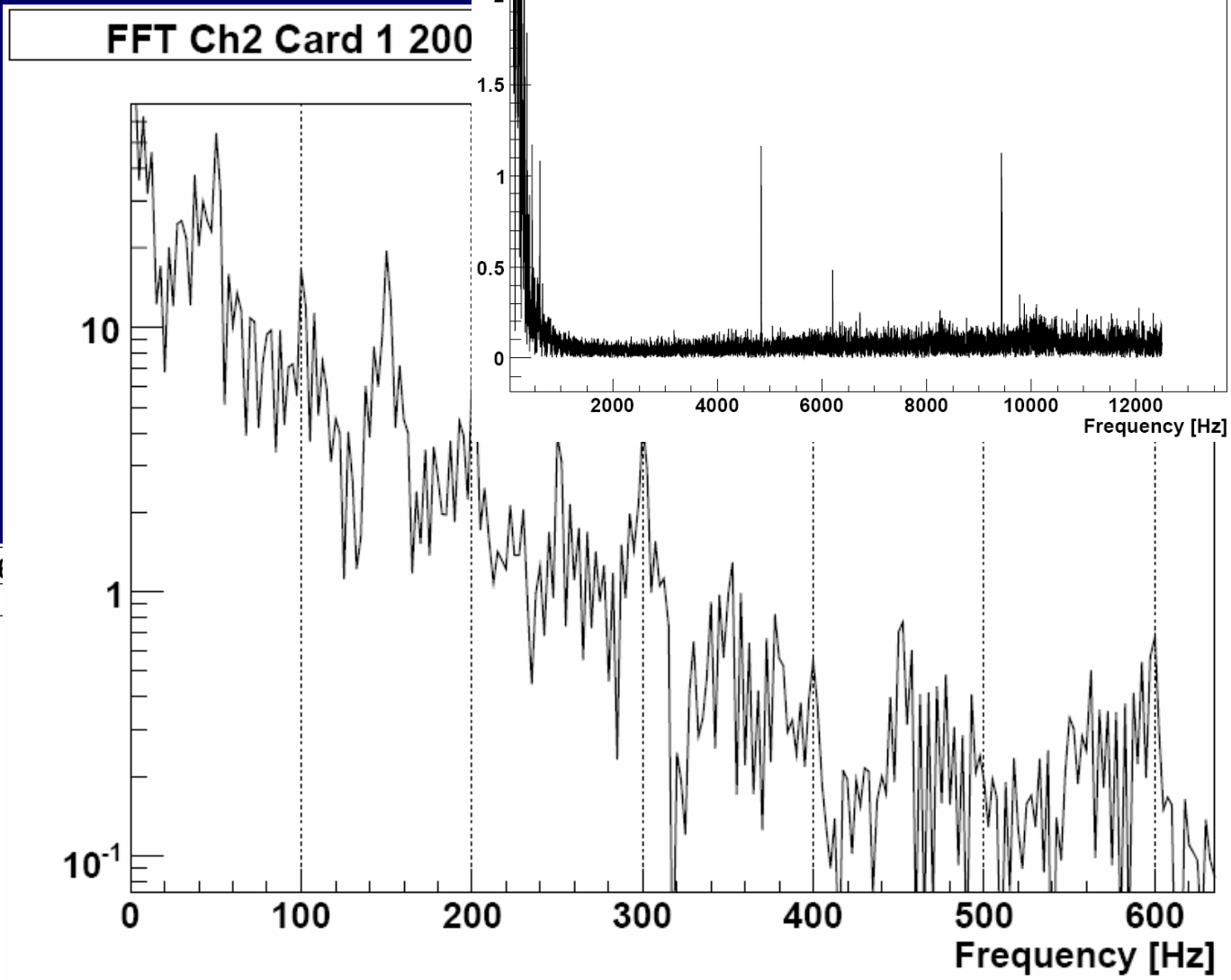
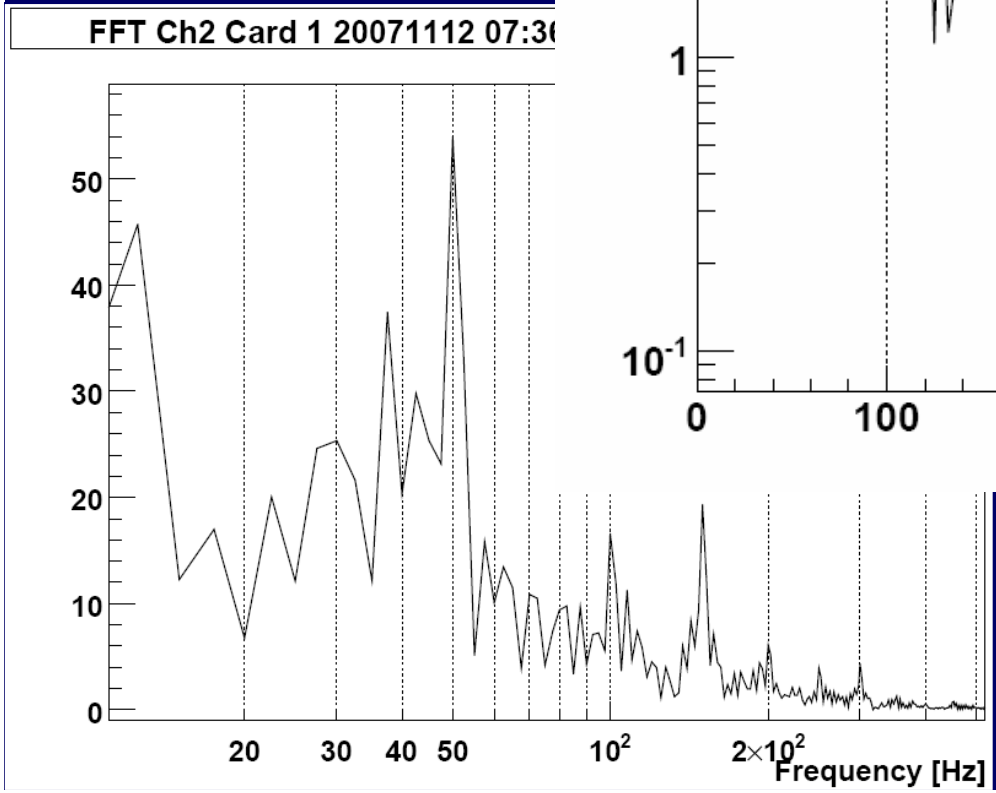


FFT of the previous plot A (red channel from 200 to 1200ms)

Different scales presented

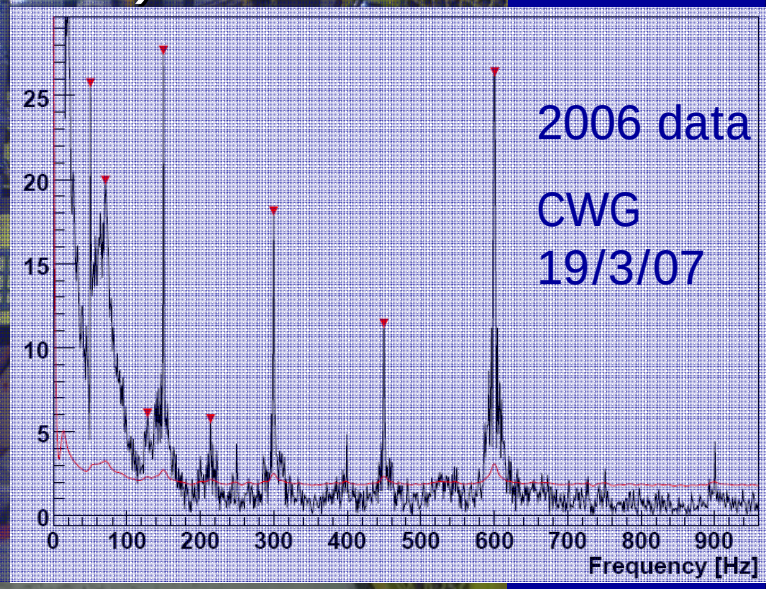




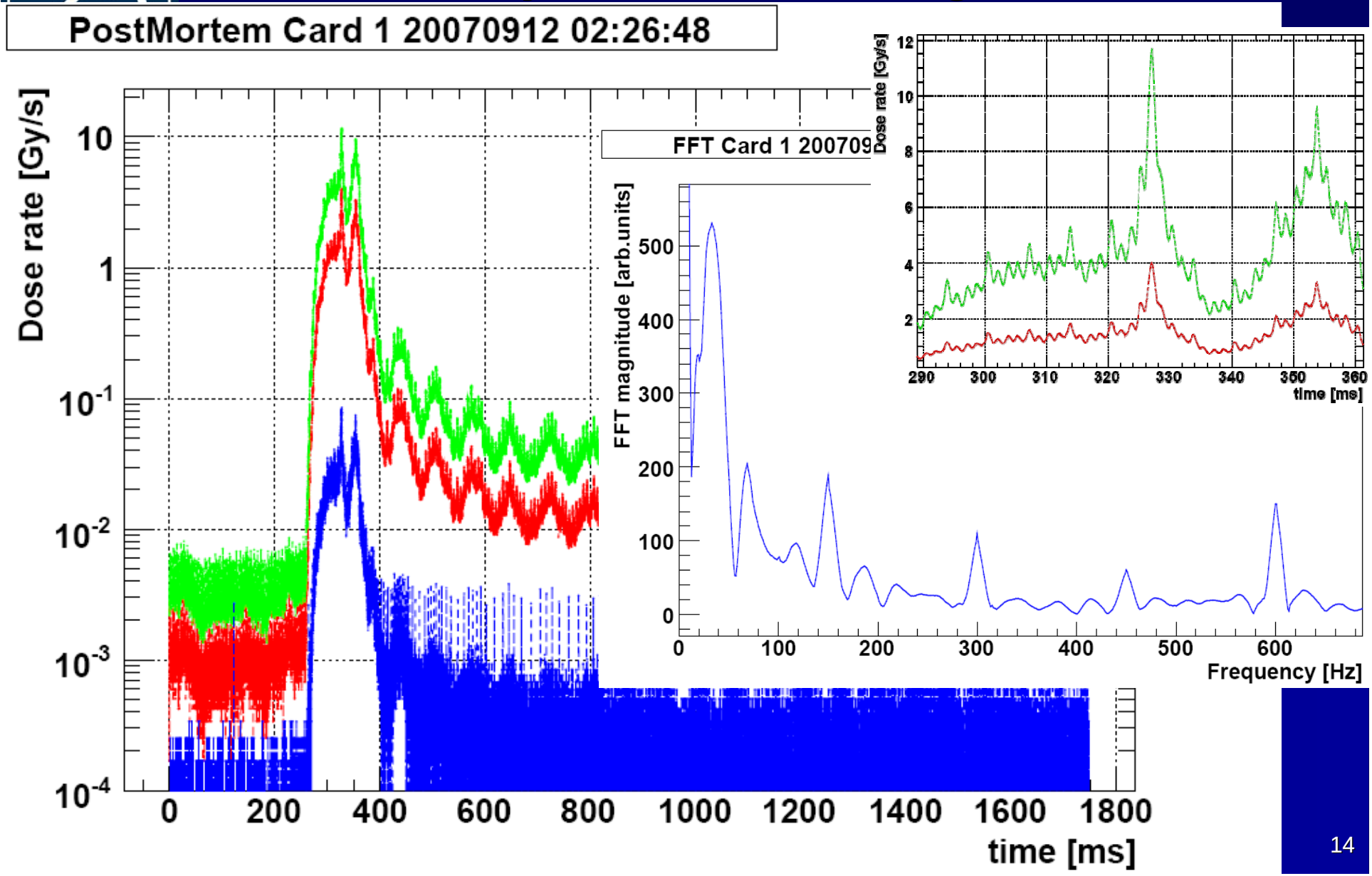
The 3-phase power supply lines similar to the coasting case. 600Hz should be caused by the 12-pole converter of the rectifier

MD request for 2008

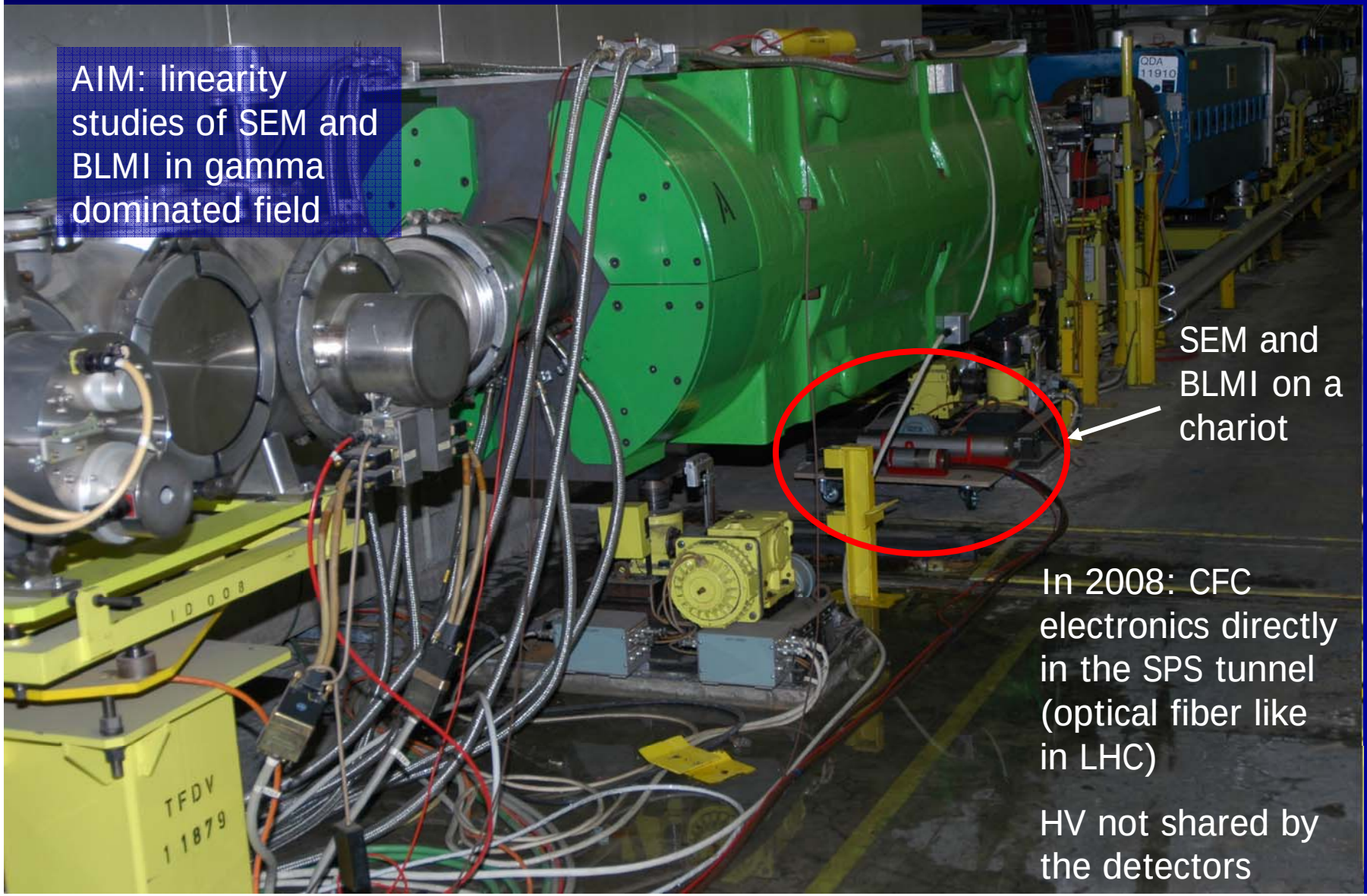
- 2007 halo oscillations estimated to ~1.8 um
- Aim is to verify the beam halo position oscillations
  - by using both horizontal jaws (LHC collimator)
  - By using vertical jaws of the SPS collimator
  - Is the beam center moving? (fast BPMs)
- Need
  - coasting beam 270 GeV
  - Up to 12 bunches
  - LHC Collimator control
  - SPS Collimator control



W37 Coasting beam 270GeV
200um Left jaw move, no signal filters



BLM installation under TIDV in LSS1



thanks

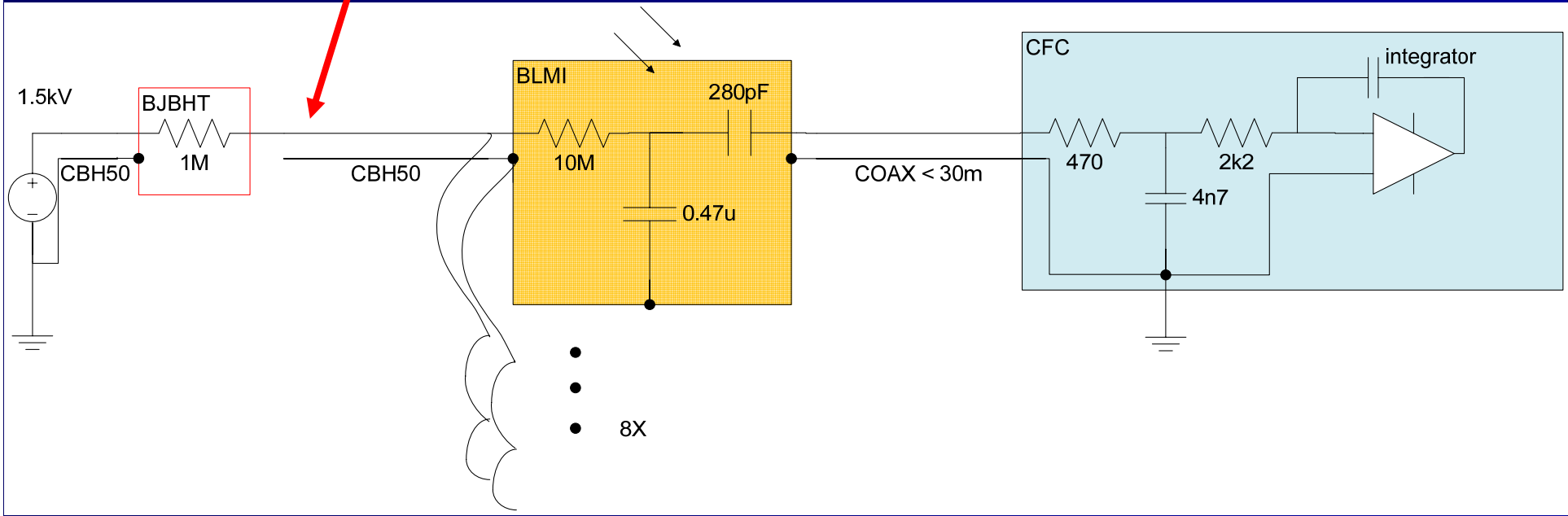
Standard BLMI ARC installation

HV Power Supply

HV ground cut here

BLMI

Small low pass filter in the CFC input stage



Up to 8 BLMs connected in parallel

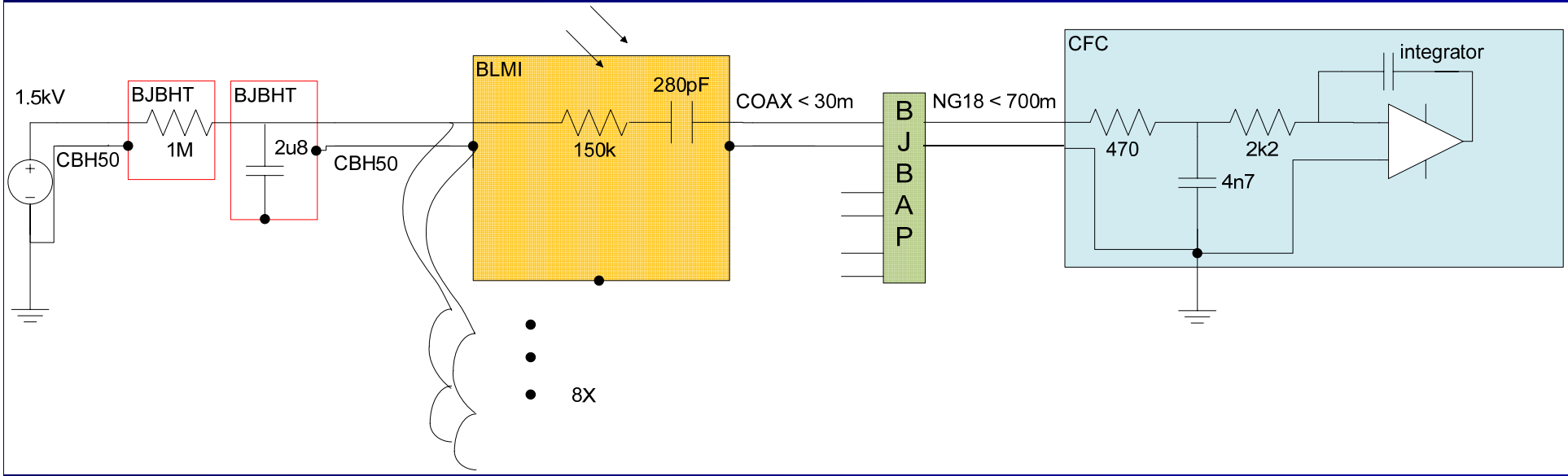
CFC is always close to the quadrupole

BLMI installation for collimation areas

6 HV capacitors in parallel

HV capacitor removed

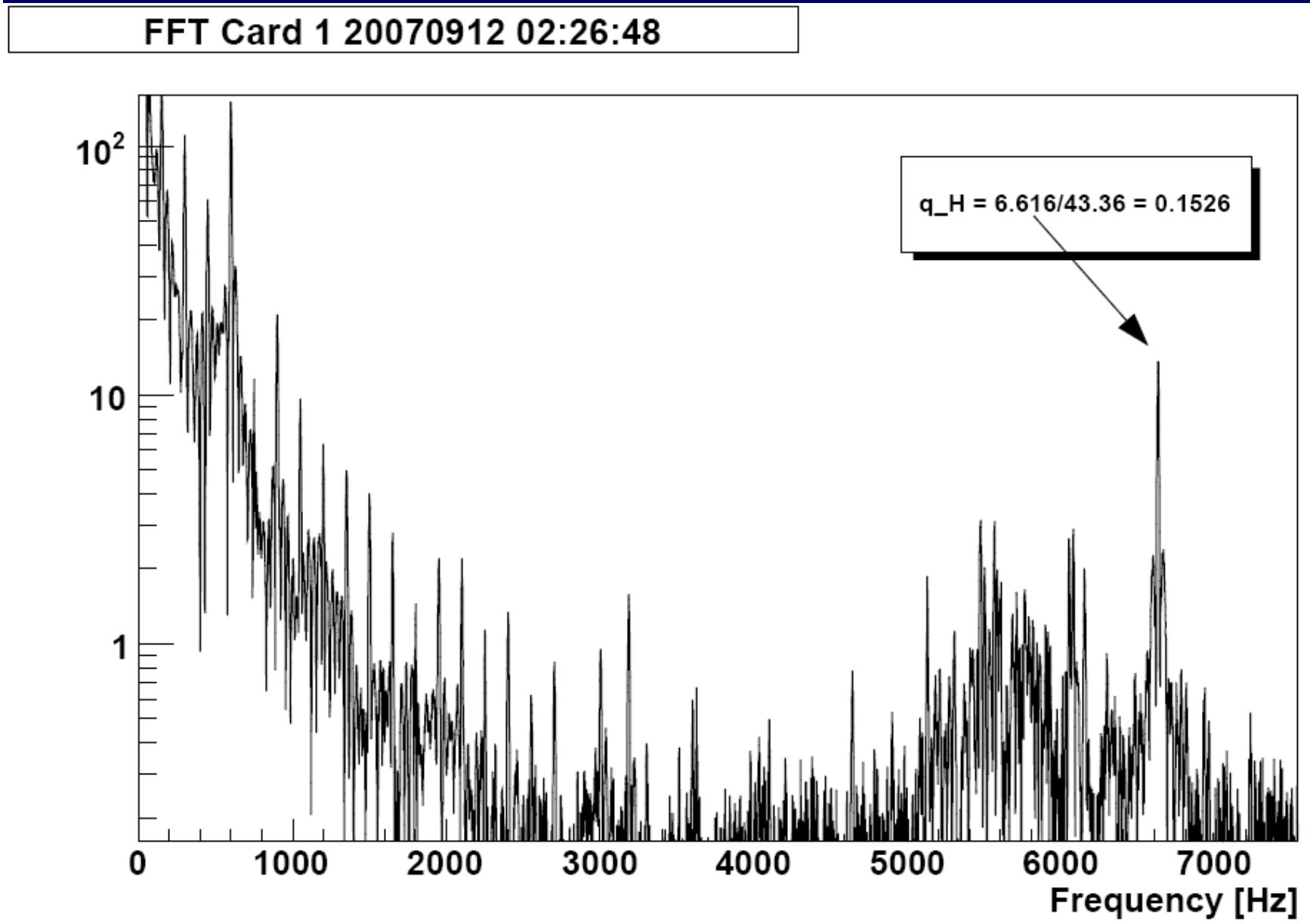
8 chambers in 1 NG18 cable (up to 700m)



150kΩ for current limitation

280pF = chamber's capacity

Spare plots 1 Tune calculation from the BLM measurement



Calibration of the SEM in a mixed radiation field (CERF++ test)

- Response of the SEM measured with 300GeV/c beam hitting 20cm copper target
- Setup simulated in Geant4
- Response of SEM filled by AIR measured and simulated as well
- Result of the calibration (ratio of simulation results)
- 0.259 +/- 0.016 Gy/count (ε = 6.2%)

Spare plots 2 H4 Calibration of the SEM