Update on quench analysis

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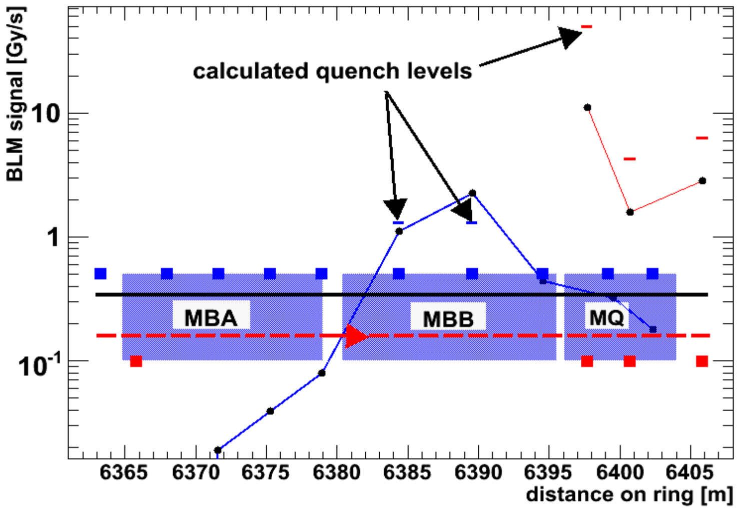
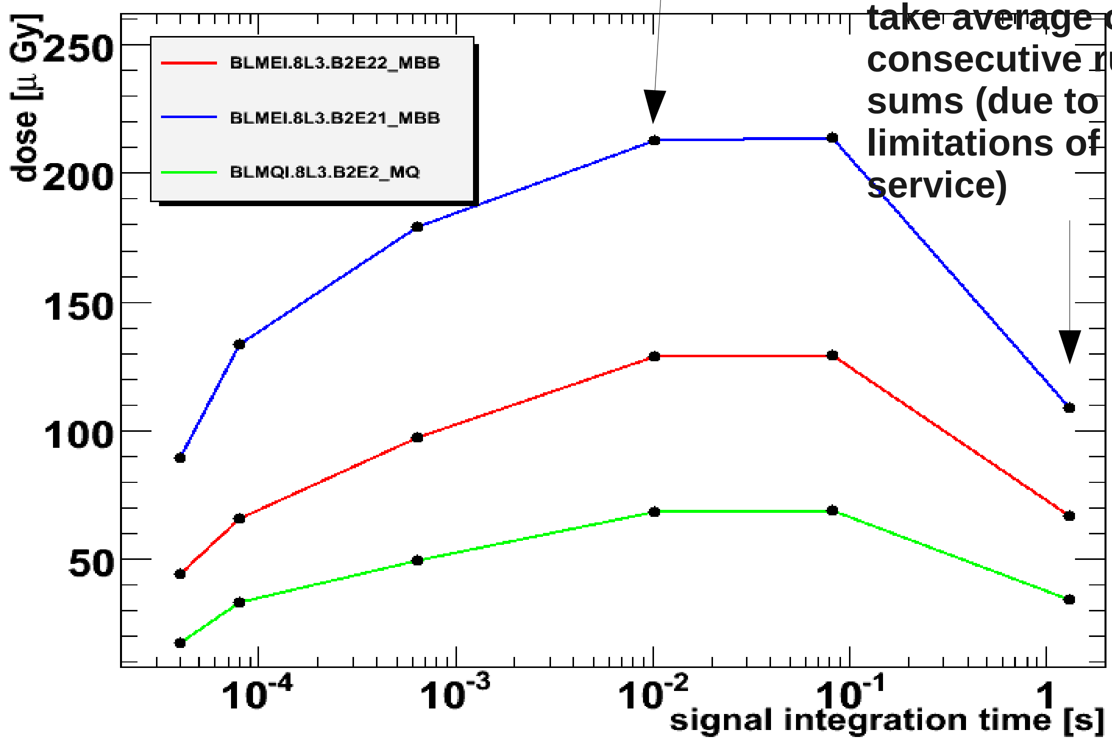
Signal integration time



Initial analysis: take 40 (later 80) µs integration time

but: **RS06 which is: 10 ms**

1.3 s signal is again lower because we take average of 2 consecutive running sums (due to limitations of logging service)



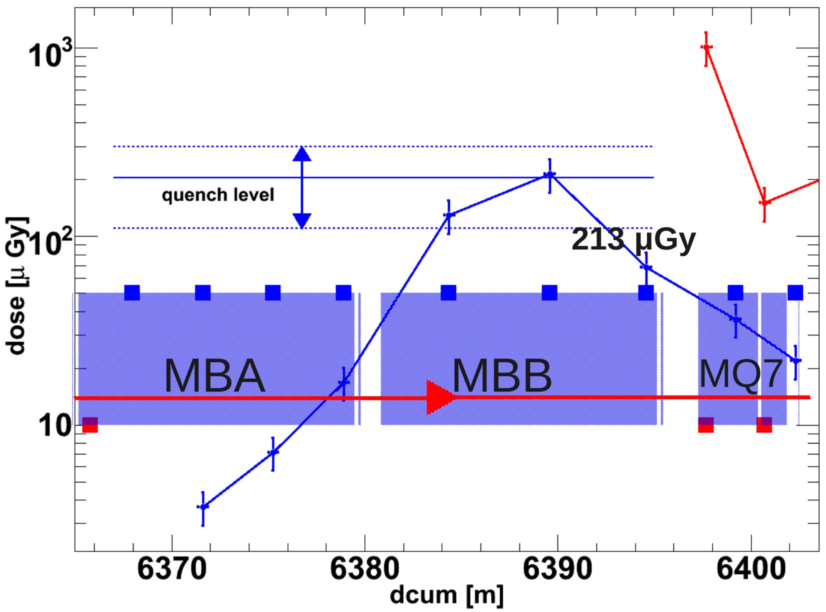
There is more than a factor 2 difference between signal collected in 40 µs and 10 ms.

The difference between short integration times were expected but 10 ms is long.

This is probably due to long cables in Straight Sections

First quench

- UTC timestamp:
  2008-08-09 00:19:51
- Quenched: MB.A8L3
- Bunch intensity: $4 \cdot 10^9$ protons
- Corrector MCBV.9R2.B1 (dcum 3680.22 m, 2.7 km from MBB), deflection set to 80 μrad, oscillation amplitude 12 mm
- On BPM.8L3.B1 (dcum= 6357.23, last before quenched magnet): Vpos = 10mm
- The distance from BPM to front of MBB is 25 meters.
- Between this BPM and MBB there is MQ.8 (defocusing, dcum=6361) and MBA plus correctors



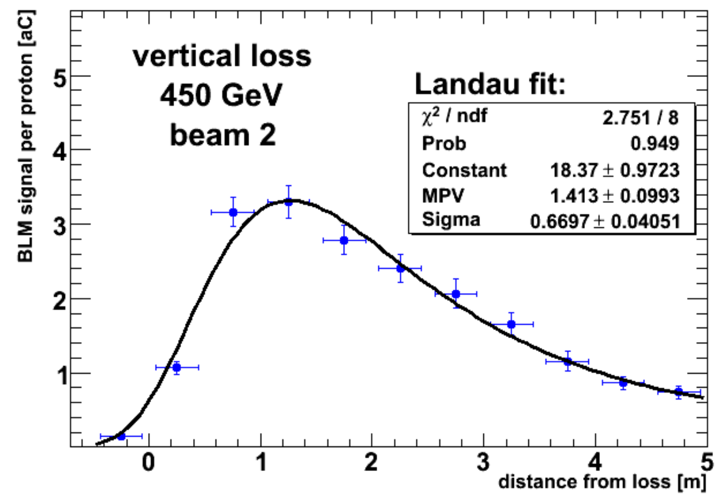
· Modeling the beam trajectory by Elena failed to hit the magnet – not all data are available.
· From beam position at BPM.8L3.B1 and distance to quenched magnet the impact angle is 260-300 μrad.
· BLMs are on Beam2 and are distributed every about 5 m

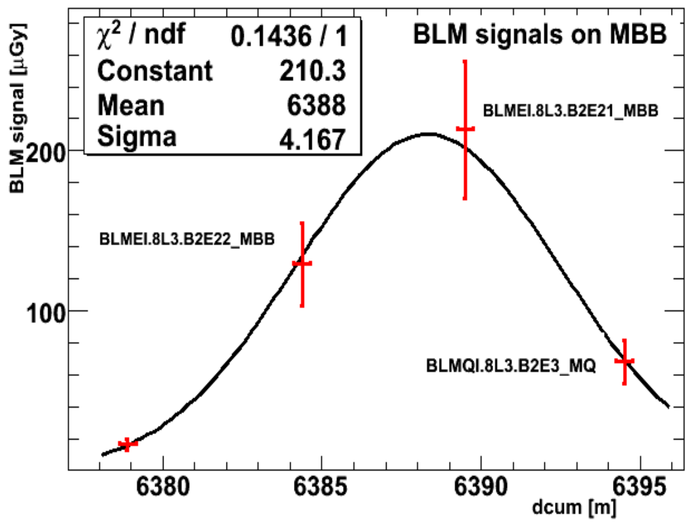
First quench - simulation

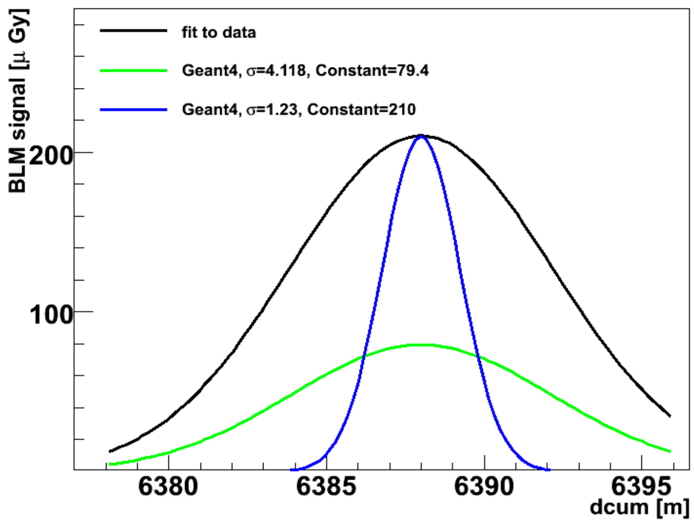
Simulation of $4 \cdot 10^9$ protons hitting the upper side of beam screen with angle 250μrad:

Recipe:

- Take simulated BLM signal
  - – Landau parametrization (*)
- Take gaussian beam loss profile
- Fold both: the result typically should be gaussian distorted by the Landau tail, because the length of the loss is larger then the cascade length (as seen outside cryostat)







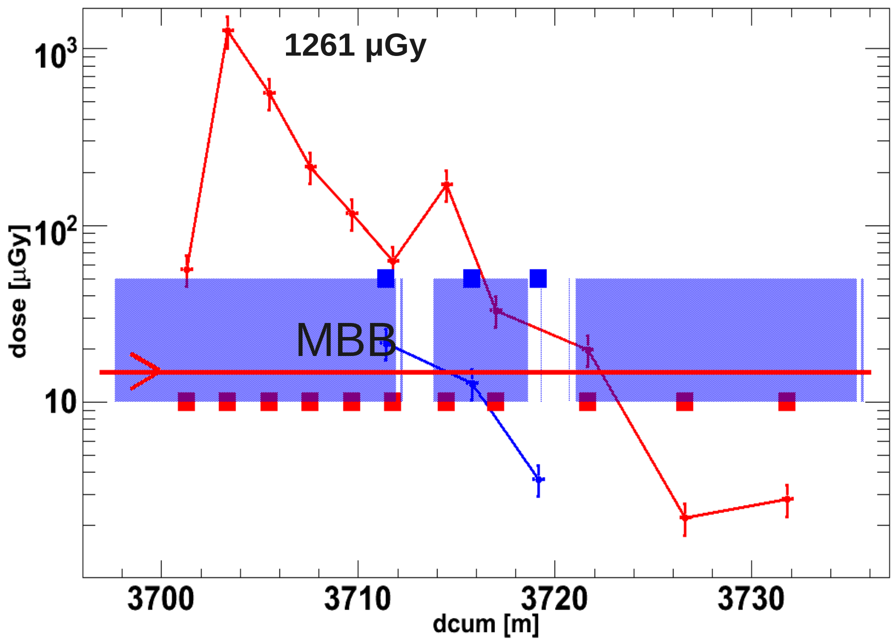
Quench energy:
49.88 mJ/cc
Initial loss σ: 0.81 m
σ_{beam} = 0.2 mm

Quench energy:
13.05 mJ/cc
Initial loss σ: 3.7 m
σ_{beam} = 0.9 mm

(*) there is no theoretical background for use of Landau

Second quench

- UTC timestamp:
  2008-09-07 15:34:05
- Quenched: MB.B10R2
- Bunch intensity: $2 \cdot 10^9$ protons
- Corrector MCBV.9R2.B1 (dcum 3680.22 m) set to 750 µrad
- No BPM between corrector and quenched magnet
- The distance from MCBV to front of MBB is 17.4 meters.
- Between the MCBV.9R2.B1 and MBB there is NO Quardupole therefore the 750 µrad angle is almost exactly the impacting angle



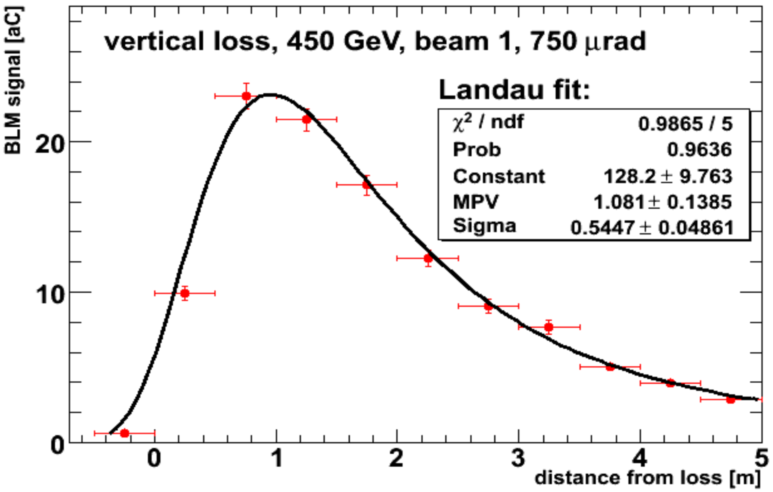
Modeling of the beam trajectory not yet done but not critical – much simpler case.

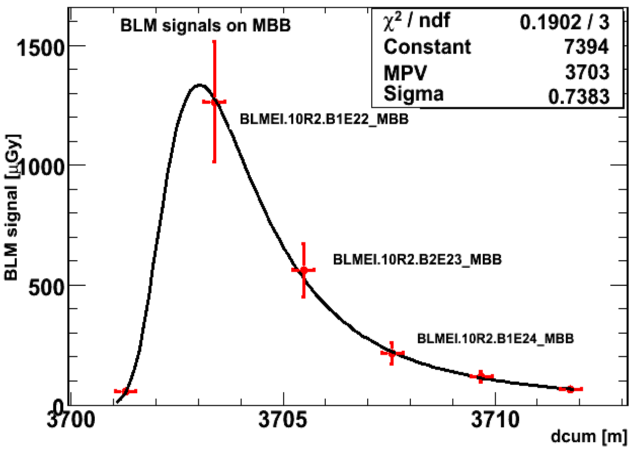
BLMs are on Beam1 and are distributed every about 2 meters

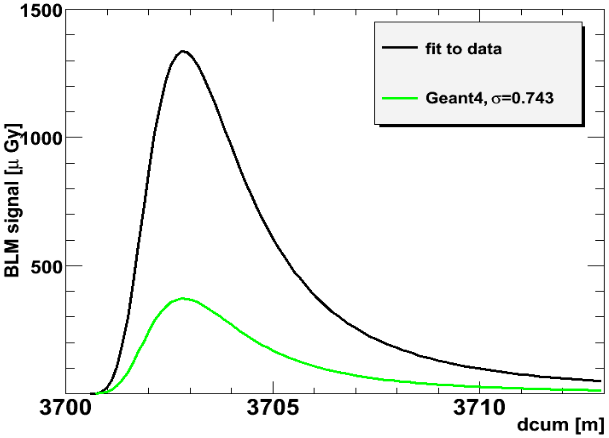
Second quench - simulation

Simulation of $2 \cdot 10^9$ protons hitting the upper side of beam screen with angle 750 μrad:

- Profile of the signal outside is NOT gaussian
  – it is fitted with Landau
- Therefore the loss is more localized
(loss length scale ≈ cascade length)







Not possible to get distribution which agrees in maximum

Quench energy:15.6 mJ/cc
Initial loss σ = 1.25 m
σ_{beam} = 0.9 mm

Remarks and Conclusions

- Two very interesting quenches have been made
- Geant4 simulations systematically underestimates the signal in the BLMs by factor 2-3
- This can be fault of wrong simulation of the tail of the cascade (similar behavior discusses in M.Stockner thesis)
- This can be fault of G4 geometry too, but it is difficult to localize...
- Probably we can still trust the results in the coil, in this case the quench energy is about 13-16 mJ/cc
- A cross check with FLUKA simulation (M. Brugger) shows good agreement in energy density estimation

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J. Wenninger (the quench maker)