

# Results of Wire Scanner quench test

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summarizing work of

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and

Arjan Verweij (QP3)

# Reminder

- November 1st, 2010 a quench test at 3.5 TeV using slowed down wire scan has been performed
- Beam intensity was 144 bunches ( $1.53 \times 10^{13}$  protons)
- Beam size was 0.28 mm (in direction of scan - H)
- Wire speed was only 5 cm/s (nominal 1 m/s)
- MBRB (4.5K) magnet has quenched (placed about 32 meters from wire scanner)

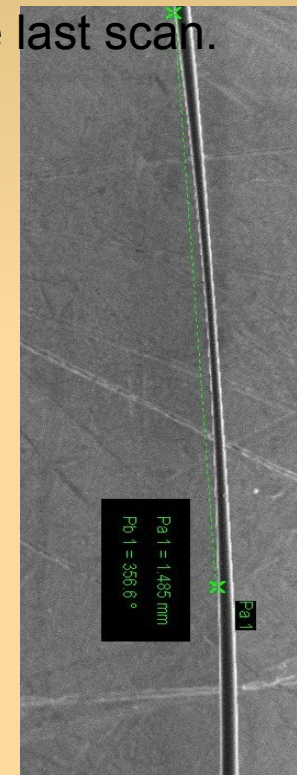
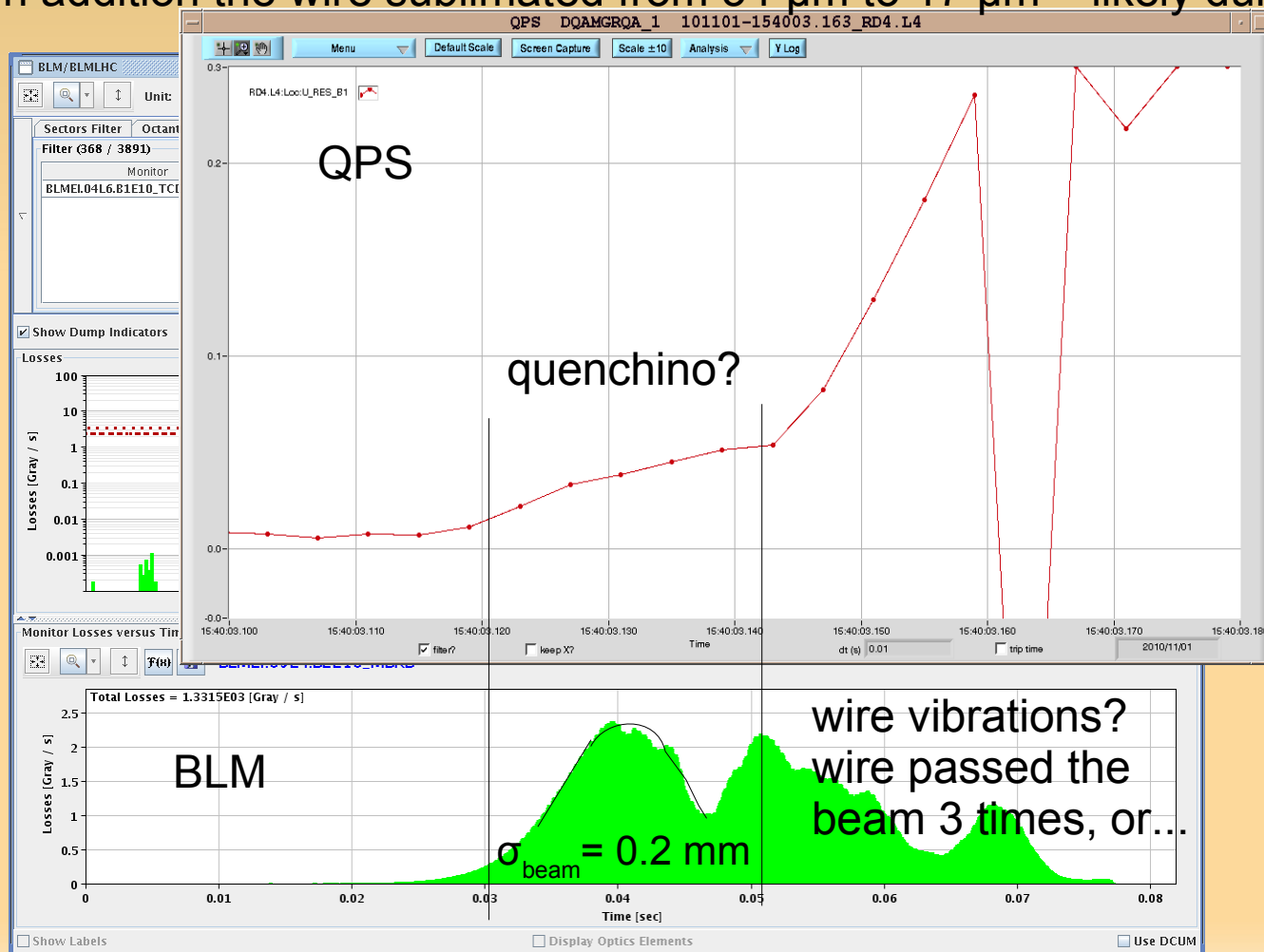
# Post Mortem data

Because of technical problems we have scanned with 15 cm/s and 5 cm/s (no 10 cm/s).

Post Mortem data allows various interpretations:

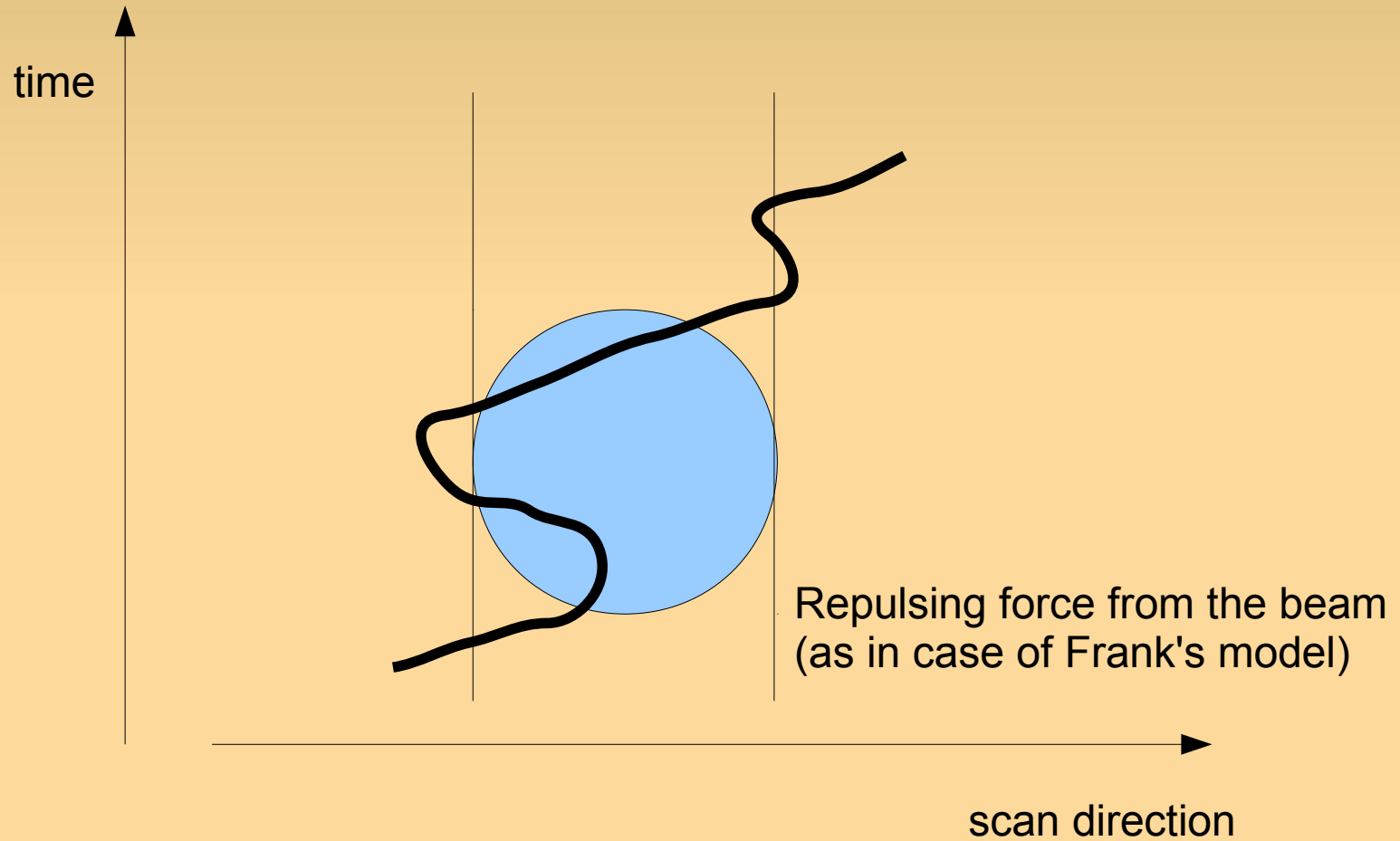
- maybe already 5-10 cm/s without vibrations was enough to quench
- or the wire passed the beam actually 3 times (then  $< 5$  cm/s without vibrations is needed)

In addition the wire sublimated from  $34 \mu\text{m}$  to  $17 \mu\text{m}$  – likely during the last scan.



Only a fraction of protons led to quench, but what fraction?

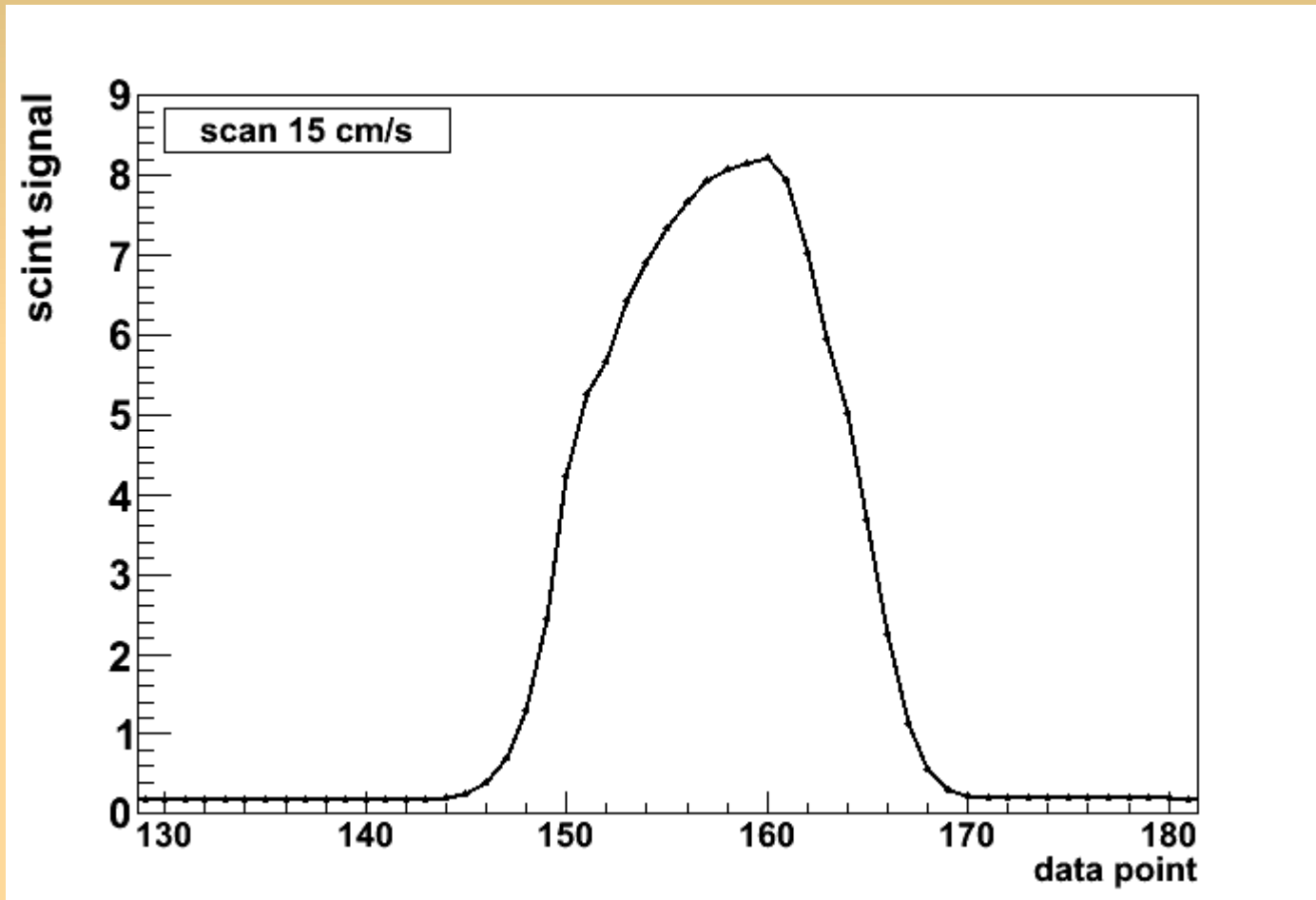
# Wire Scanner data



# Wire Scanner data

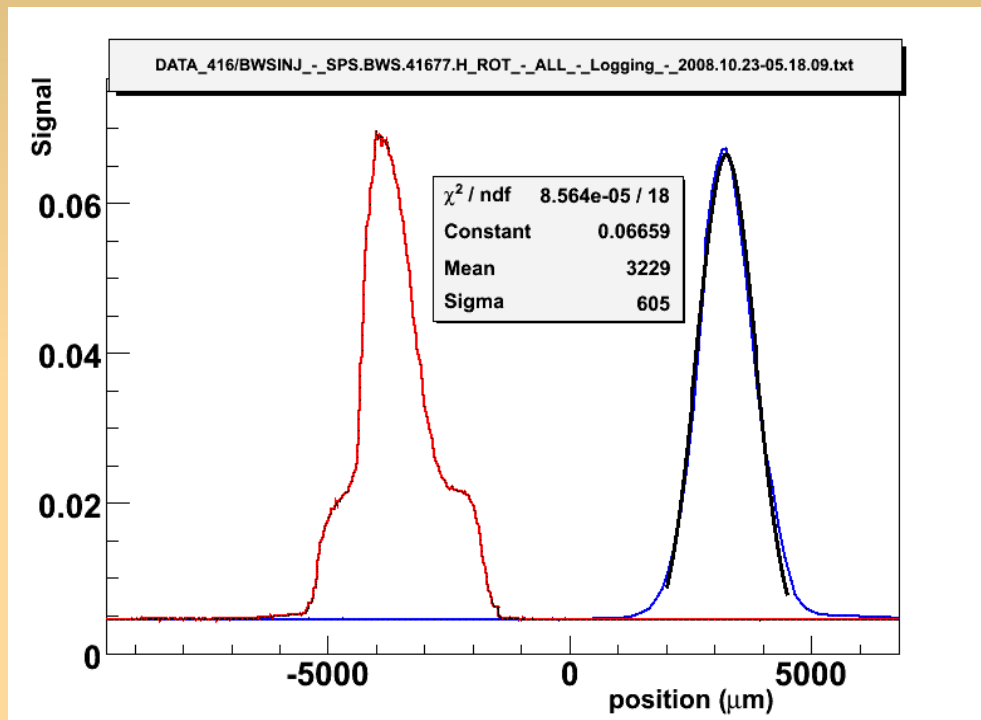
Profile at 5 cm/s has not been saved.

Profile at 15 cm/s is already slightly irregular:

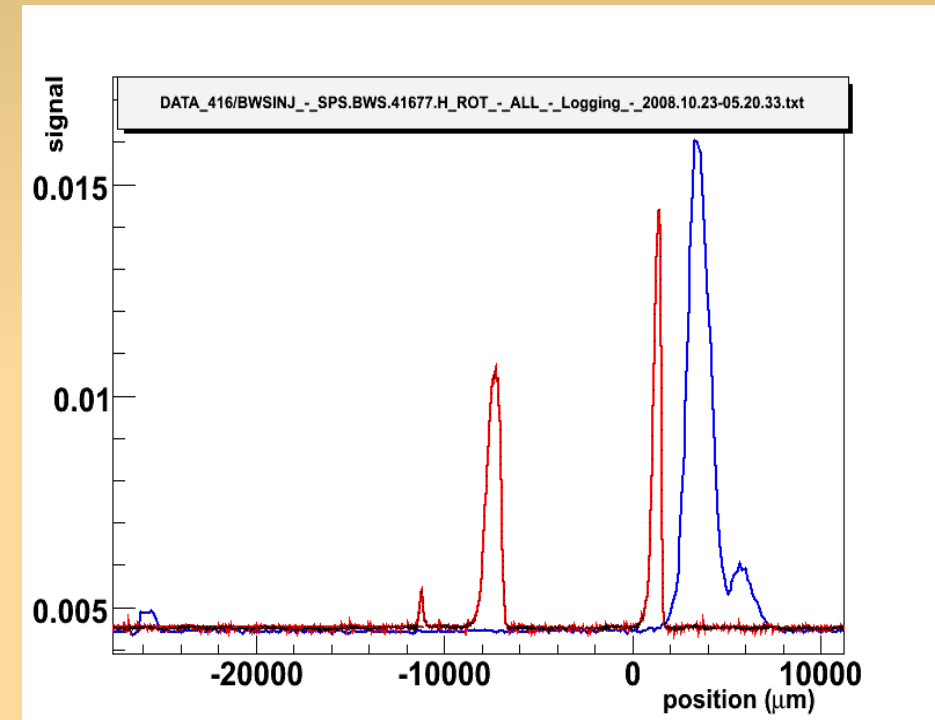


# (digression:wire-breaking MD 2008)

In 2008 we broke 2 wires on SPS, example of scan profiles (SPS, 416 H):



one before last

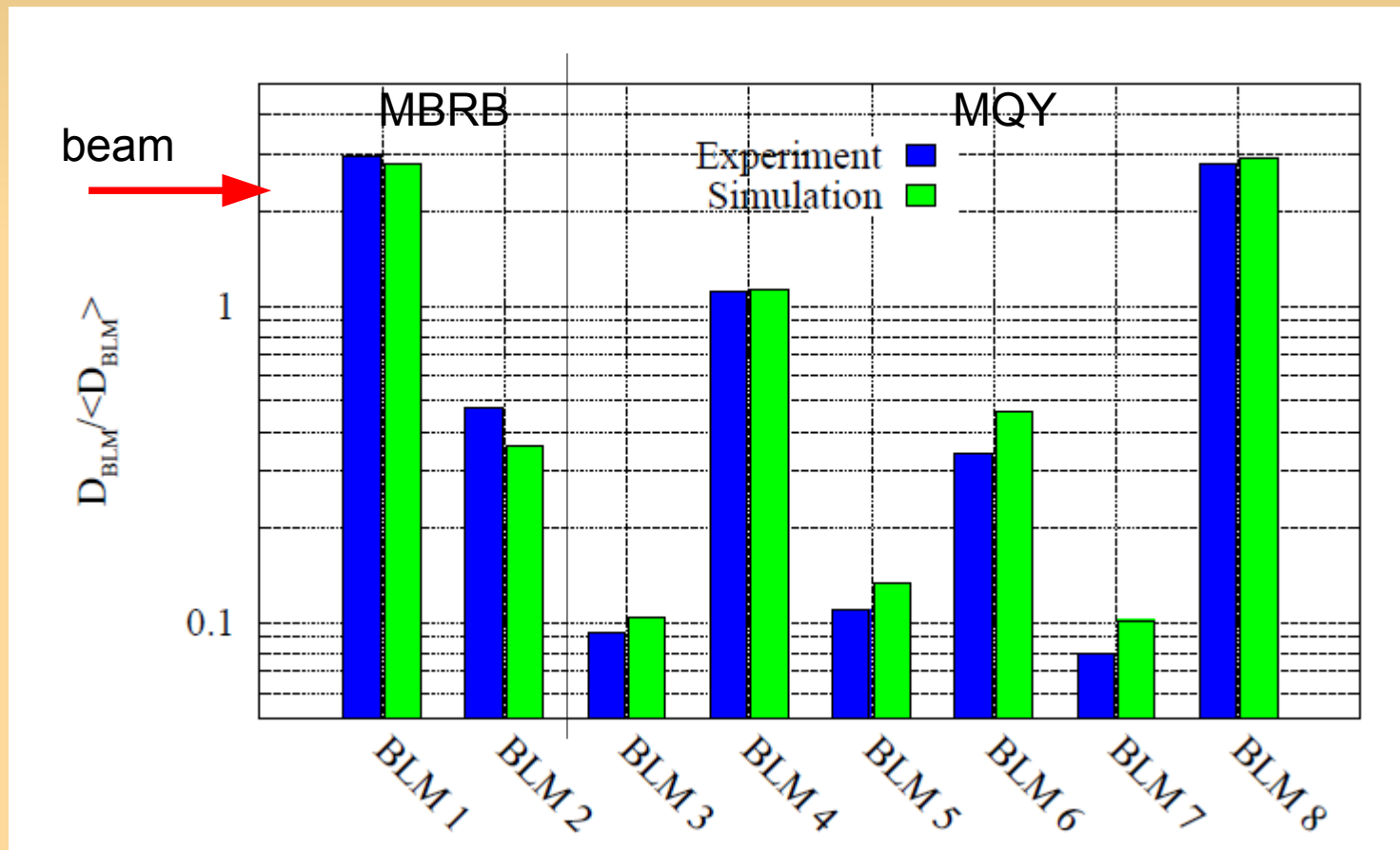


last scan

# FLUKA results - BLMs

Quite good agreement (especially for high signals) between simulated and measured BLM signals - in shape and in amplitude

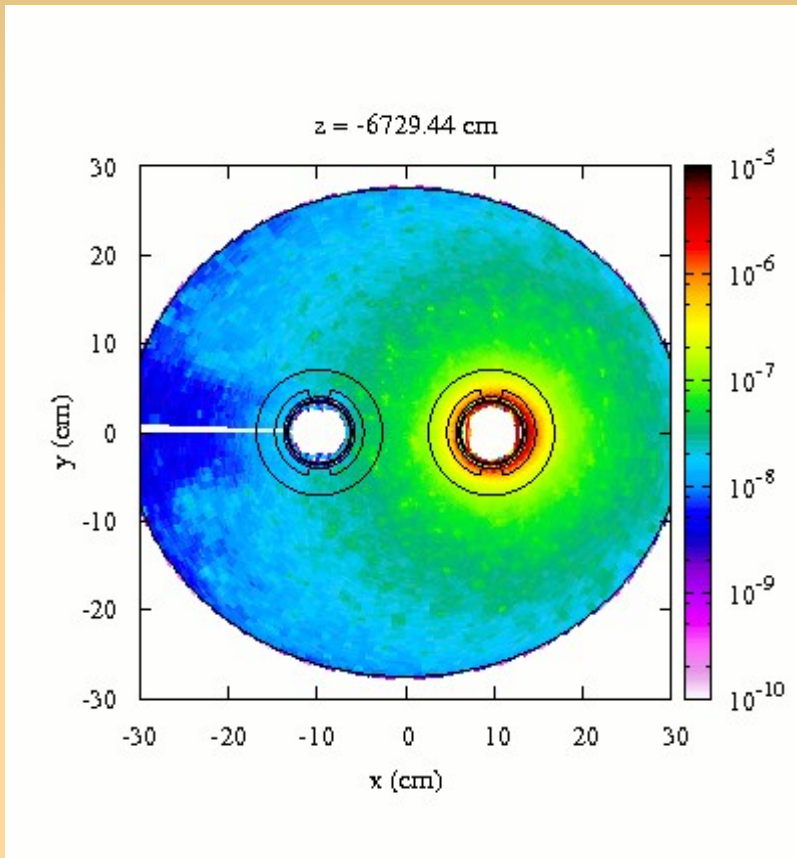
– assuming no wire sublimation (factor 0.7-0.8), no oscillations (factor > 1).



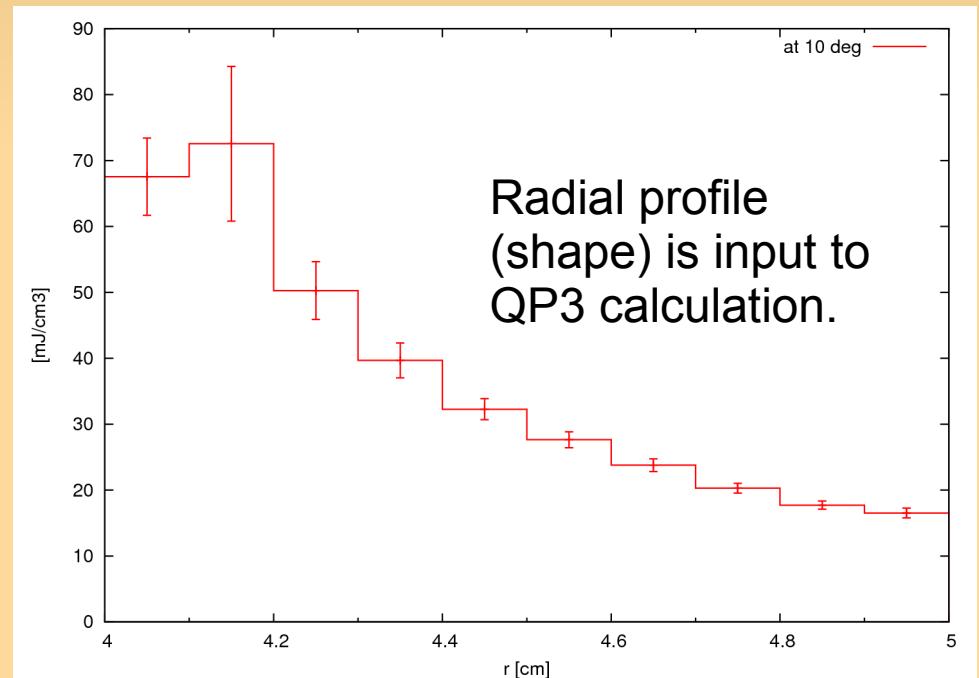
For details see Anton's presentation, January 21st, 2011

# FLUKA results - coil

As BLM signals are well reproduced, the results on energy deposition in the coil can be trusted:



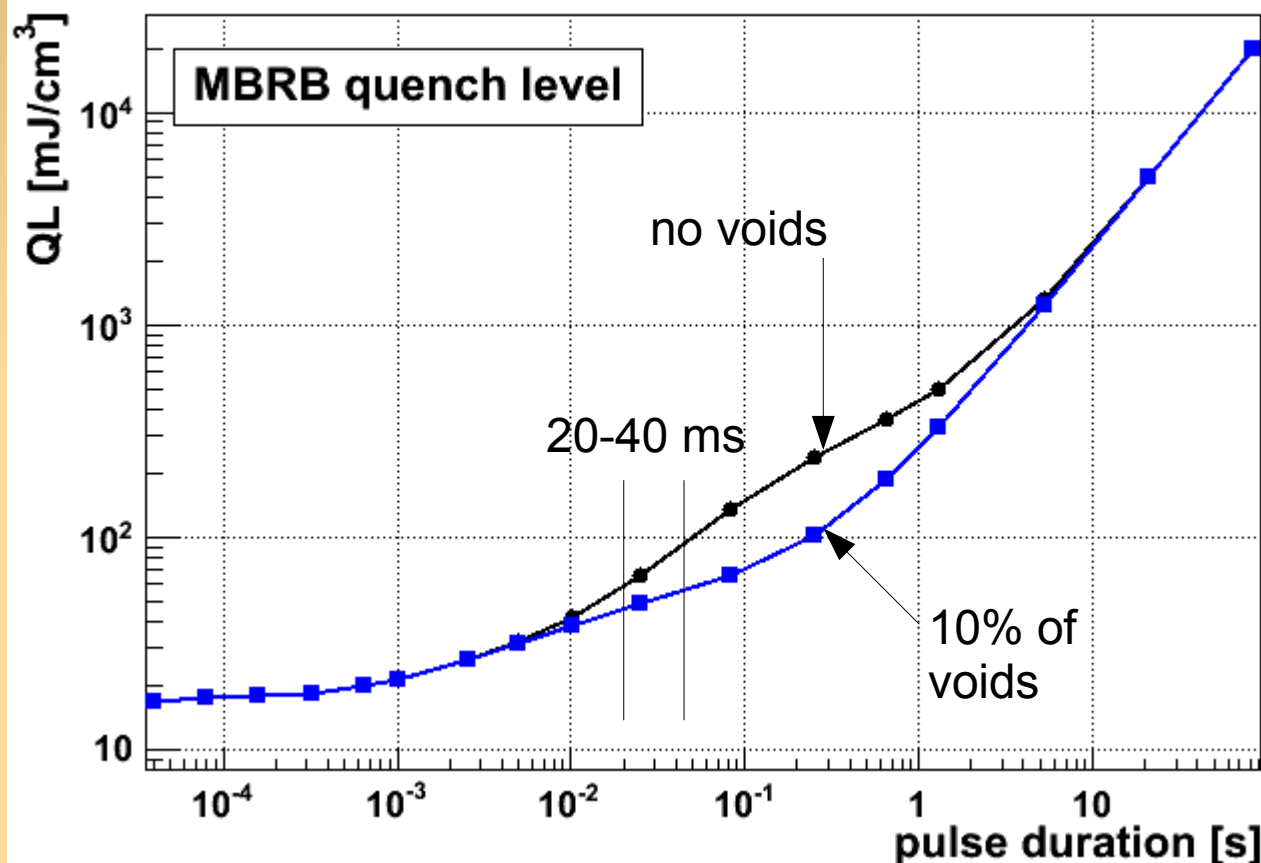
Radial profile for the most exposed cable in the most exposed longitudinal location:



What we know is that quench did not happen at 15 cm/s, ie. 24 mJ (in max) in about  $\sigma = 2$  ms (UFO  $\sigma = 0.2$  ms, from Jorg's PM fits).



# QP3 results



We are in the range between 20 and 40 ms.

The temporal profile plays little role for this timescales.

[mJ/cm³]	20 ms	40 ms
no voids	58	85
voids	45	54

FLUKA:

73 mJ/cm³ in max

37 mJ/cm³ in average

# Conclusions

- FLUKA reproduces well BLM signal neglecting wire sublimation and oscillations (maybe they can be neglected or they compensate)
- FLUKA result is 61-84 mJ/cm<sup>3</sup> in maximum and 37mJ/cm<sup>3</sup> (5% error) in average
- QP3 result is: 45-85 mJ/cm<sup>3</sup> in maximum
- Agreement between FLUKA prediction and QP3
- Scan with 15 cm/s should give **20-28 mJ/cm<sup>3</sup>** (safe) (here we have no sublimations and oscillations)
- Need another test at the end of this year...