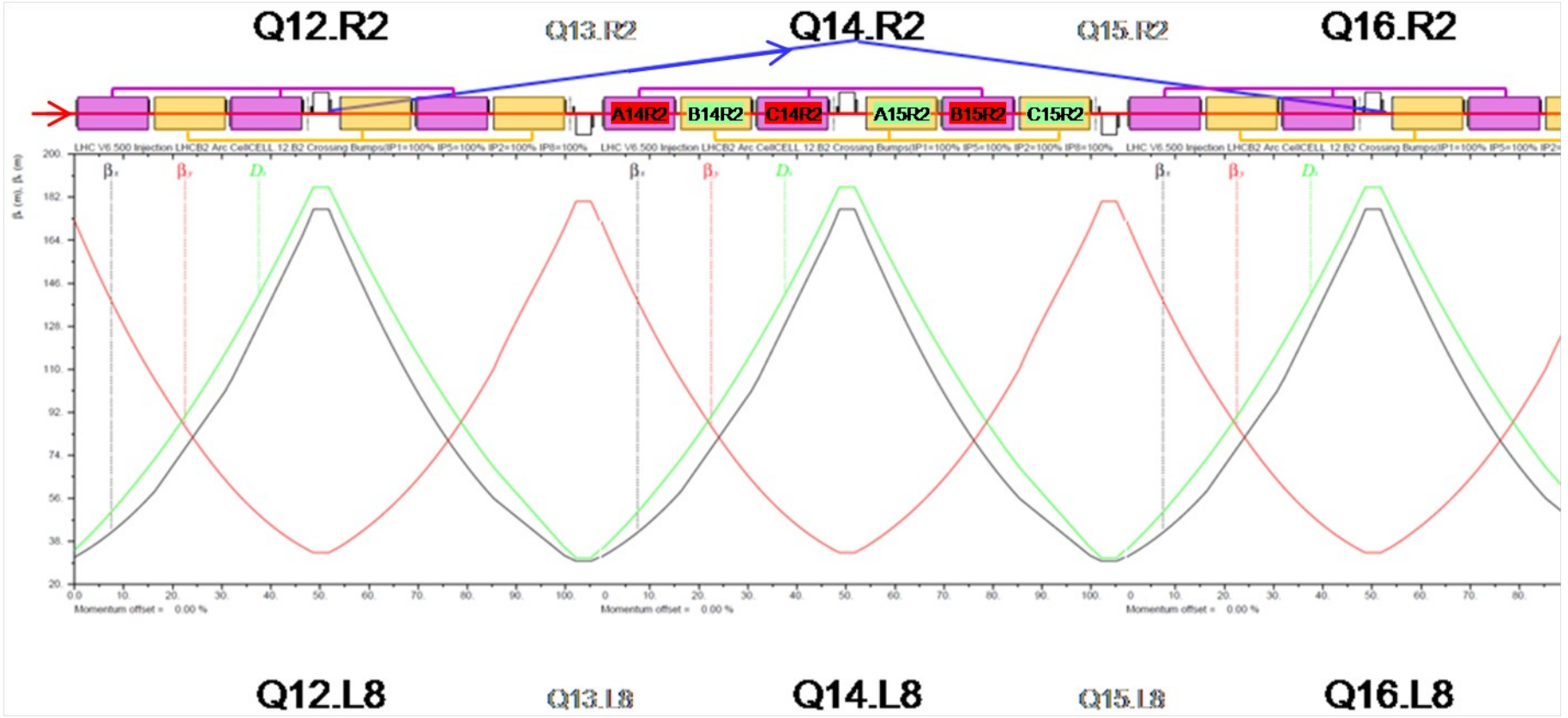
Determination of Quench Levels

- **Transient** losses:
  - Past: two times done on a MB with vertical loss (5 and 2 10^9 protons, 250 and 750 µ rad)
    - Coil voltage drop out of the range = > “quench limit” with additional uncertainty
    - About 50 % uncertainty comparing shower and enthalpy simulation with measurement (not taking into account the voltage out of range situation)
    - Uncertainties dominated by systematic effects of shower simulation and coil voltage measurements (enthalpy simulation good accuracy)
  - Future: to be done on MQ
    - To be gained: with accurate coil voltage drop measurements (nQPS set-up) => more accurate systematic error determination
- **Steady state** loss on a MQ:
  - Never done before, check of steady state quench level predictions
  - Mainly test of heat transfer in coil
  - Combination with transient test should allow an disentangling of effects

Experiments

- **Transient** loss measurements
  - Inject 5 E9 and use 3 corrector orbit bump in steps to deposit energy in the coil
  - For each orbit bump excitation use at least two injections
  - Observe:
    - trigger of the nQPS system
    - beam loss at this magnet (stop if beam loss is about 70 % of quench level)
- **Steady state** loss measurements
  - Measurements @ 450 GeV with circulating beam of 1 E10
    - Use same orbit bumps as for the transient losses
    - Move beam in steps towards the beam screen until first losses could be seen
    - Move beam in steps of 0.5 sigma further (check of threshold levels will to be done to have a better sigma bump amplitude determination)
    - Observe:
      - coil temperature
      - trigger of the nQPS system
      - beam loss
  - Repeat measurements @ 3.5 TeV with circulating beam of 2 E9

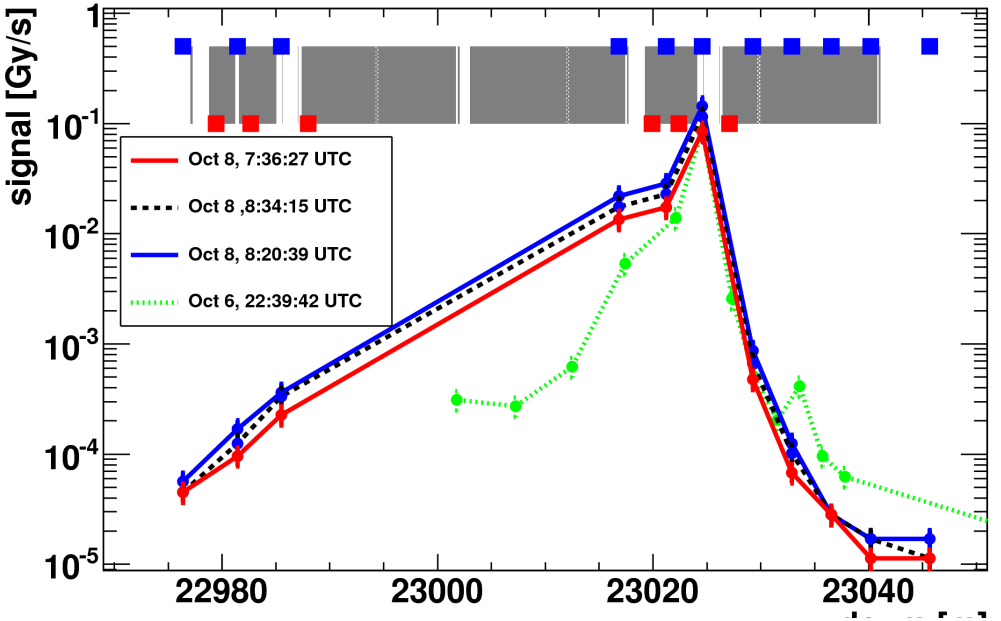
The magnets

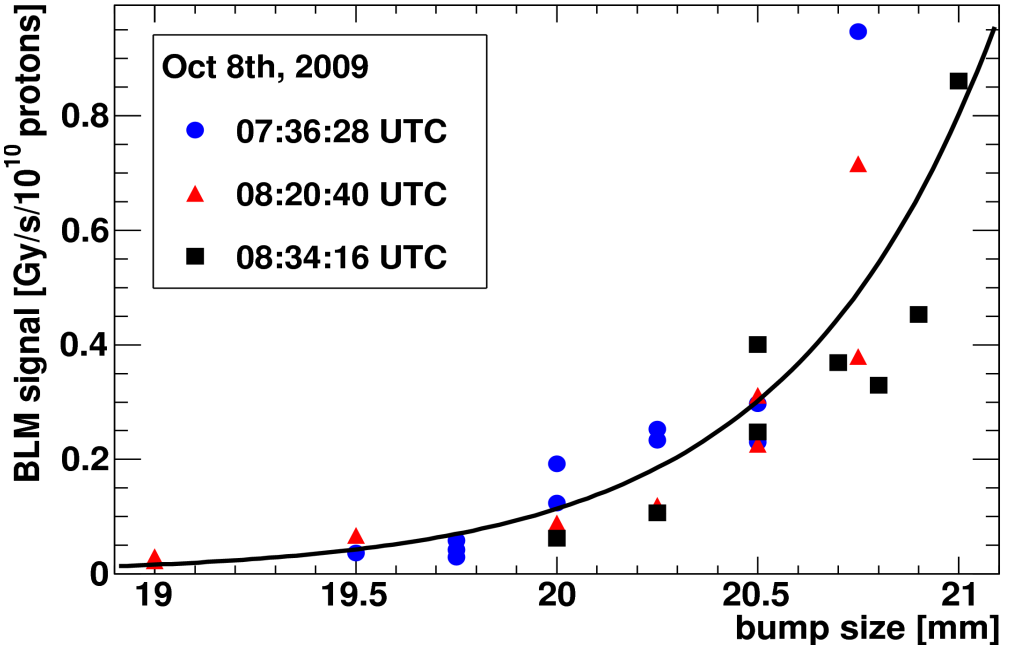


- The non existence of non conformities of this were checked by Michele Modena
- outfitting the new QPS crates that cover A14.R2-C14.R2-B15.R2 and B14.R2-A15.R2-C15.R2 (one of which includes Q14.R2) and the Q14.R2

3 corrector orbit bump measurements

- 3 corrector bump already used during threshold tests.
- Top: orbit amplitude at trigger level vs dcum
- Bottom: BLM signal vs bump size.
- Transverse beam position reproducibility is estimated to 150 μm peak to peak, max signal variation 50 %
- Coming experiment: at least 2 injection per position

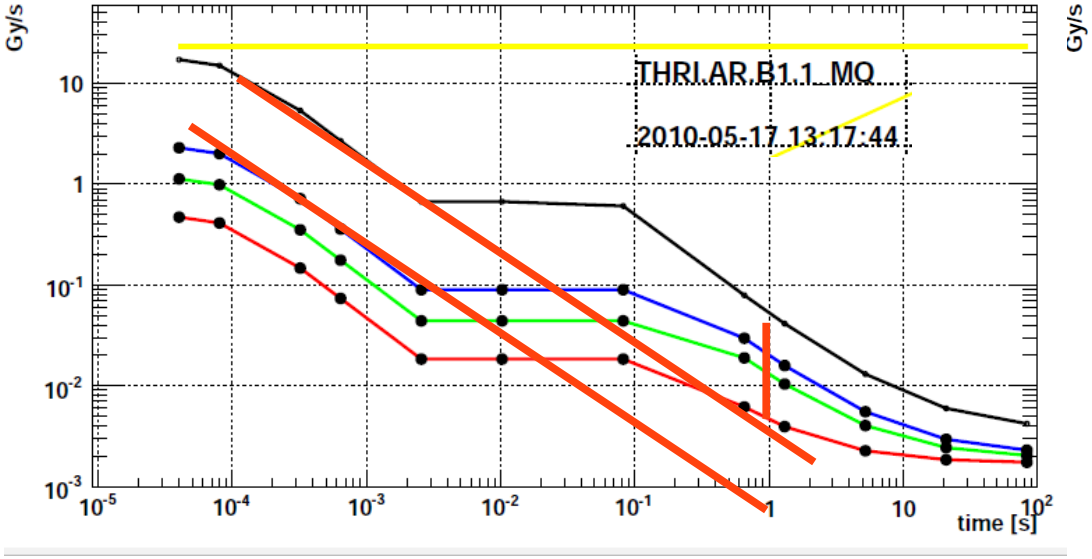


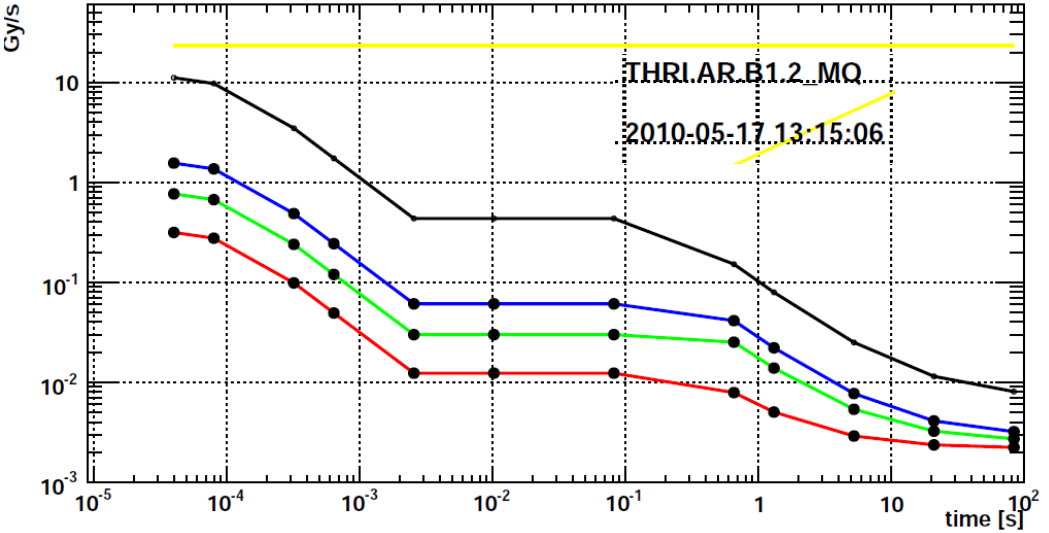


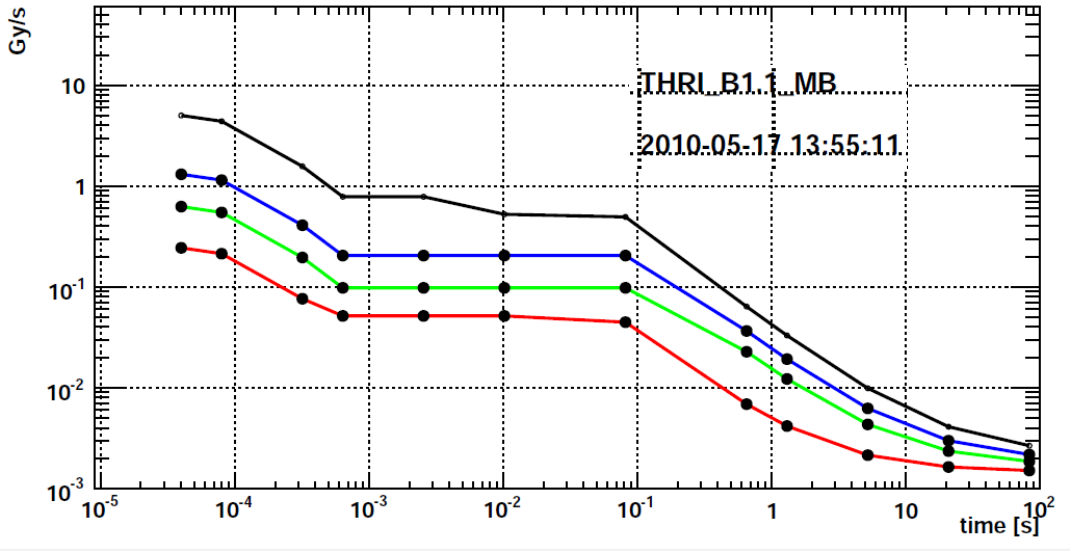
nQPS

- Trigger level about 50 mV (freely adjustable)
- Resolution: 7 mV
- Sampling frequency 2 kHz, low pass filter with 1kHz cut-off frequency
- Buffer size 3072 values => 1.5s
- Buffer geometry ½ before and ½ after trigger
- One compete measurement cycle: 15 min

Abort Thresholds MQ, MB







- Transient quench with 5 e9 at 450 GeV
- Steady state:
  - At 450 GeV about one order increase in intensity needed
  - AT 3.5 TeV about 1.5 orders needed in in