Measurements
of TCL losses
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Outline

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Introduction & motivation

- **Goal:**
  - Assess the effect of the TCLs during collision
  - Benchmark of simulation tools
  - What to do after LS1?
  - Check losses in DS & which magnets are protected

- **TCLs:**
  - Absorbers for physics debris (1 m, Cu)
  - Set to 10 $\sigma$ since the beginning of 2012
  - In cell #5 on both sides of IP1 and IP5

- **2nd series of scans (1st: 15/05/2012, cf. CWG #141)**

- **Beam conditions: nominal physics fill #2806**
  - Intensity: $B1 = 1.8e14$ p, $B2 = 1.55e14$ p
  - Luminosity at the beginning of study: $5e33$ cm$^2$.s$^{-1}$
Principle: list of scans

1) Symmetric scans for all 4 TCLs
   - The jaws are moved symmetrically: out, then back in
   - Regular steps of 0.5 \( \sigma \), up to 60 \( \sigma \)

2) Faster scan for TCL.5L1.B2 and TCL.5R5.B1
   - Jaws are moved symmetrically
   - Bigger manual steps: 2 \( \sigma \), up to 70 \( \sigma \)

3) Asymmetric scan for TCL.5L1.B2 and TCL.5R5.B1:
   - Moving only 1 jaw in then out; then same for other jaw
   - Manual 2 \( \sigma \) steps, up to 70 \( \sigma \)

4) Asymmetric scan for TCL.5R1.B2 and TCL.5L5.B1
   - Manual 2 \( \sigma \) steps, up to 70 \( \sigma \)
Jaw positions vs. time

A. Marsili, BE-ABP-LCU, CERN
Effect of TCL scans & data processing

- TCL protects elements up to 200 m downstream

- Effect of TCL moving in:
  - Losses at the TCL increase
  - Losses downstream decrease

- Losses have to be divided by luminosity
  - Exact matching! (second by second)
  - Technical issue with the available timestamps

- Loss profiles with TCL in or out
- Ratio of the normalised losses
- Normalised losses vs. jaw position
Principle: collimator gap

Jaws move symmetrically, $\sigma = 0.35$ mm
Losses at the TCL

Effect of the decreasing luminosity
Normalised losses at the TCL

Effect of luminosity corrected
Results
Results: effect of the TCL seen on the loss maps
Results: in/out ratios of normalised BLM signal

Long. position of TCL.5R5.B1

More losses at TCL.5R5.B1

All losses were divided by luminosity.

Effect of TCL: decreasing losses

signal ICs B2
signal ICs B1
Normalised losses at TCL vs. jaw position

BLM_TCL/L vs. gap

Scan one way (out)

Scan two ways (out then in) ⇒ good agreement after normalisation
Most losses increase, then reach a plateau.

Another BLM decreases with TCL opening (first BLM downstream the TCL – sees the shower).

One BLM first decreases, but starts increasing again at the end of the scan: first cross-talk from another shower (TCL), then “real” losses?
Movie!

Evolution of loss profile 5R1

20120704-083530_RS09

Signal [Gy/s]

Signal ICs B2
Signal ICs B1

DCUM [m]
Evolution of loss profile 5L5
Observations on the scan

- Losses start to appear first the furthest away from the TCL, then get closer.
- We can observe a shower from the TCL.
- Cell #9 might not be protected enough.
- We can measure the effect of the TCL: up to factor 100 in cleaning.
Conclusion & Follow-up

- Compare these results with the ones for the asymmetric scan
- Understand the evolution of the losses
  - Study of the values of slope, plateau, setting at which each plateau starts
  - Dependence on the phase advance?
- Simulate these losses in SixTrack using debris distributions
Extra slide: UFO
Extra slide: before