TCDQ levelling MD (MD3270)

rMPP MD2 preparation meeting

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Contents

- Motivation & principle
- Strategy for the first MD
- Outlook

Motivation and basic principle

- High intensity beams (LIU) severely constrain the TCDQ minimum gap at about ~ 5mm vs. 3.7 mm presently (for beam2)
→ **~ 10 σ normalized settings (at 7 TeV) vs. 7.3 σ presently**
→ **About 2.5 σ lost in IT aperture (12.5 σ instead of 10 σ)**
→ **50 % lost in β* reach in Run III both for round and flat optics**
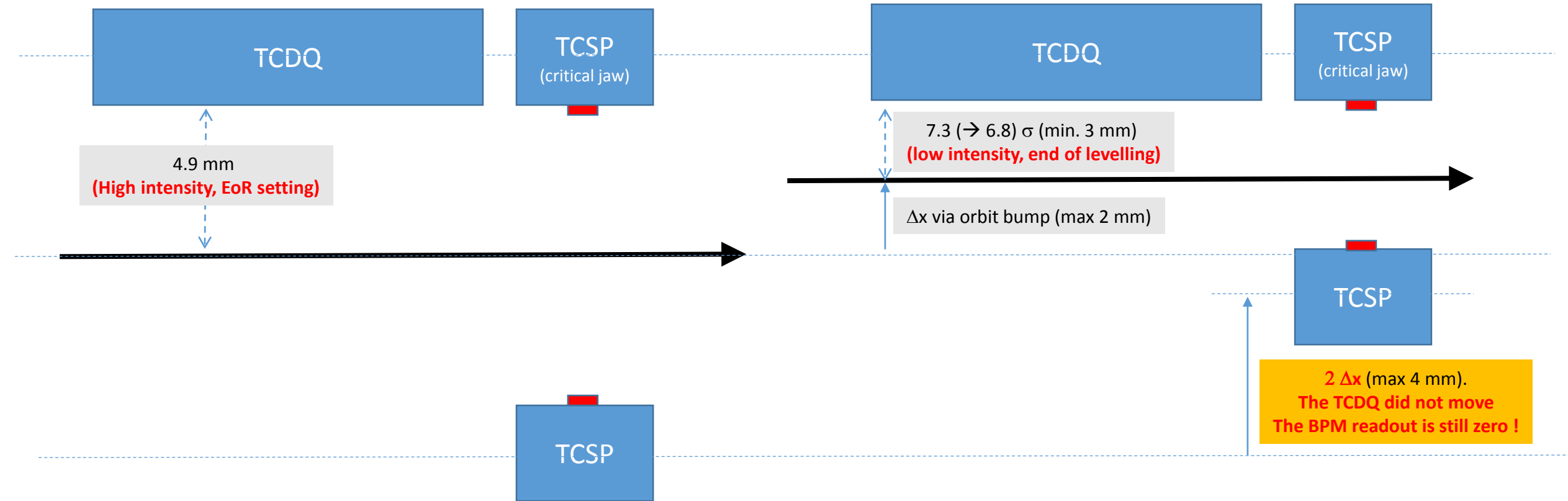**(β* ∝ 1/(IT aperture)^2, see LCR3 meeting #4)**

Scenario	TCP [σ]	TCSG [σ]	TCDQ	Comment
Limit 1 (pushed IR7)	5.00	6.00	6.80 σ	TCDQ levelling assumed, b2-gap down to 3.2 mm @ 7.0 TeV
Limit 2 (LHC 2018)	**5.00**	**6.50**	**7.30 σ**	**TCDQ levelling assumed, b2-gap down to 3.5 mm @ 7.0 TeV**
Limit 3 (HL-LHC)	xx	yy	4.9 mm	**Min. TCDQ gap for Hilumi beam, corresponding to ~ 10 σ**
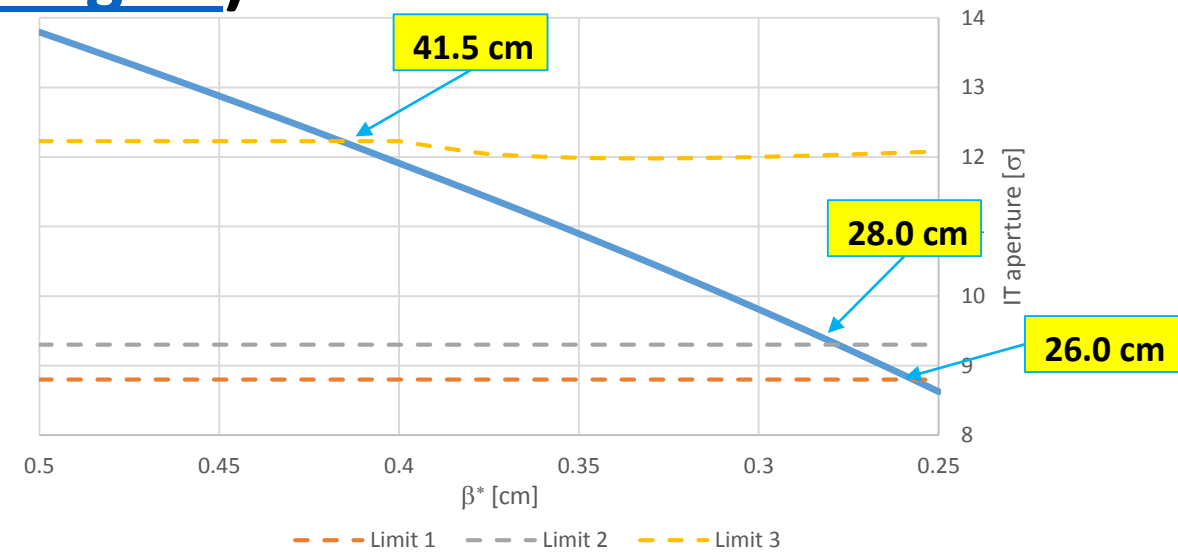
IT aperture vs. β* (X-angle calibrated to 9.2 σ with γε=2.5 μm)

TCDQ-levelling principle (Paul, Stéphane, Jan @ LCR3#3)
→ Moving the beam rather than the TCDQ

TCDQ

TCSP
(critical jaw)

4.9 mm
(High intensity, EoR setting)

TCDQ

TCSP
(critical jaw)

7.3 (→ 6.8) σ (min. 3 mm)
(low intensity, end of levelling)

Δx via orbit bump (max 2 mm)

TCSP

2 Δx (max 4 mm).
The TCDQ did not move
The BPM readout is still zero !

TCSP

The 400 μm TCSP limit (including the non-critical jaw ☺) is actually the last air bag !!

Detailed MD preparation/planned activities

- Ideally one would like to do this with **the orchestration tool**, but it is not ready for that, and possible interference with nominal OP discarded this option.
- A **special BP** is in preparation (TCDQ bump function 0 $\rightarrow$ +2 $\rightarrow$ -2 $\rightarrow$ 0, with corresponding ref. orbit and TCSP mvt), together with a sequence to play the BP in steps or continuously.
- First MD planned **at injection**
    a. Fill # 1 with **probes to debug**
    b. Fill # 2 with **2 nominal for DOROS resolution**
- **Interlock masking strategy & Collimator limits**
    a. No interlock masked (PC interlock TBC), except **the BPM-SIS @ Pt6 for the first fill only**.
    b. Nominal collimator limit, except for the **TCSP limit (non-critical jaw only) set to e.g. 5 mm instead of 400 μm.**

Summary & Outlook

- **If time available in MD4**, the continuation would be to repeat the MD with **setup beams at 6.5 TeV**

- at the end of the ramp (1 m) or intermediate β^* just compatible with TCDQ EoR setting enlarged to 5 mm (BETS masked)

- Performing loss maps vs TCDQ bump amplitude

- Reducing β^* after each successful loss maps to reach back 30 cm (e.g. bump amplitude of 5-3.7=1.3 mm for Beam 2 .. with the right sign ☺)

- All this is

a) For β^* **preservation in Run III vs. Run II** (and give some sense to further push the IR7 hierarchy for 10% more β^* reach in Run III)

b) For β^* **improvement in HL-LHC vs. present baseline**