MD 2269 - Round Telescopic optics - revalidation and BBLR studies with trains

- MD setup
- Revalidation part
- BBLR part

MD set up

• Hypercycle (35 cm telescopic optics starting from 1m pre-squeeze)

- RAMP-SQUEEZE-6.5TeV-ATS-1m-2017_V3_V1_TELE_ATS_CloneMD1
- → nearly nominal ramp (latest TCDQ/TCSP nominal ramps and limits)
- TELE-ATS_knobs-2017_V1
- \rightarrow knob exchange, standard vs. tele
- SQUEEZE-TELE-6.5TeV-ATS-1m-35cm-2017
- → Strictly telescopic squeeze from 1 m to 35 cm (with crossing angle increased from 300 mrad to 340 mrad in IR1 and IR5)
- QCHANGE-TELE-6.5TeV-ATS-2017_35cm_V1
- → Tune jump onto the nominal (design report) collision tunes, using the TELE knobs, from 62.28/60.31 to 62.31/60.32,
- PHYSICS-TELE-6.5TeV-ATS-2017_35cm_V1
- → Collapse the separation bumps and IP shift in IR2 and IR5
- Optics measured and corrected (MD1). Full mechanics demonstrated with 3E11 (MD3). New TCT functions calculated and uploaded (post-MD3). <u>Nominal collimator in IR3/6/7</u>

Revalidation

• One shift of 7(+2h) with 3E11

✓ Fill # 1: <u>set up fill</u> with 2 nominal and ~10 probes (<3E11)

(i) Loss maps before collision at 35 cm,

(ii) Re-establishing collisions and loss maps in collision at 170 μ rad half-crossing angle,

(iii) Crossing angle reduction down to 100 μrad with "orchestration tool" and loss maps at 100 μrad half-crossing angle,

(iv) Roll back to 170 $\mu rad,$

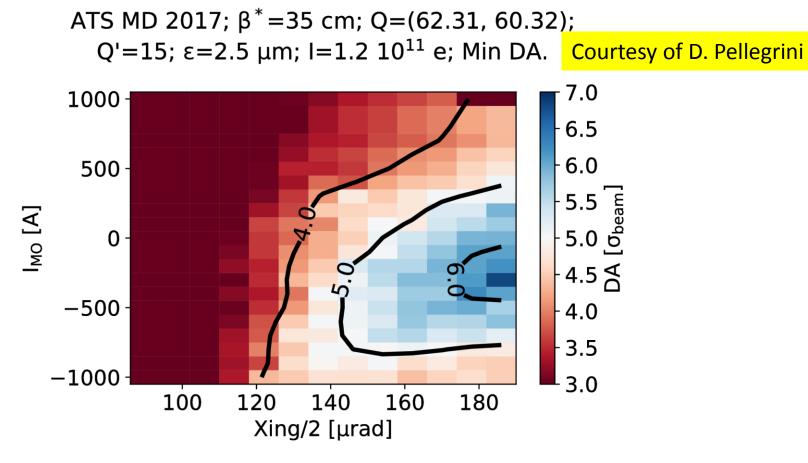
(v) Intensity scraping down to 1-2 pilots and triplet aperture measurement.

✓ Fill # 2: pure validation fill with 2 INDIVs (<3E11)

→No other activities than an asynchronous dump test in collision (with 8.4 σ TCT setting in IR1 and IR5, corresponding to the end point of the Nsigma TCT functions at 35 cm).

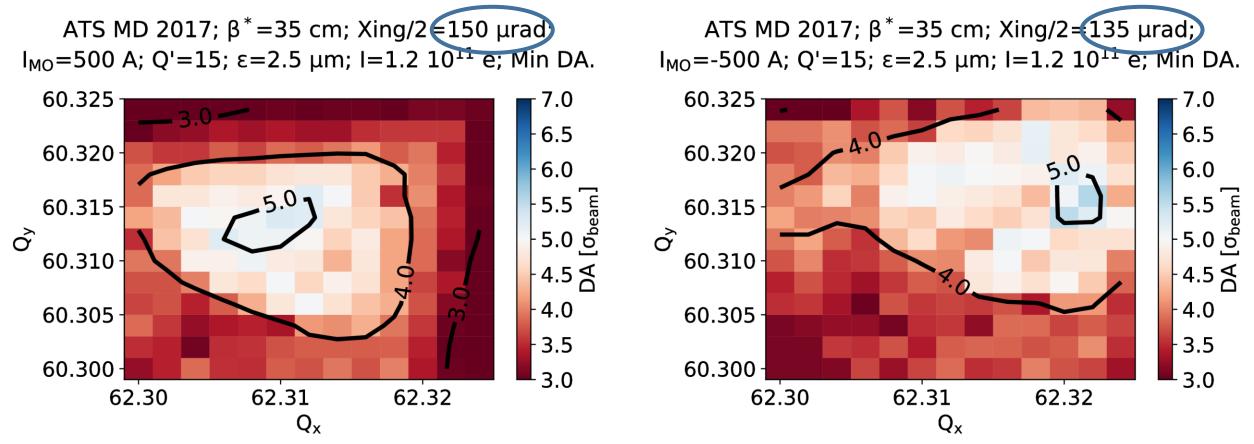
After discussion the MO>0 polarity is kept (negative knob), while the BBLR compensation occurs with MO<0 (see later)

BBLR part (1/5): Dynamic aperture vs. MO and X-angle



Significant reduction of Xing going from positive to negative octupole

BBLR part (2/5): X-angle reach



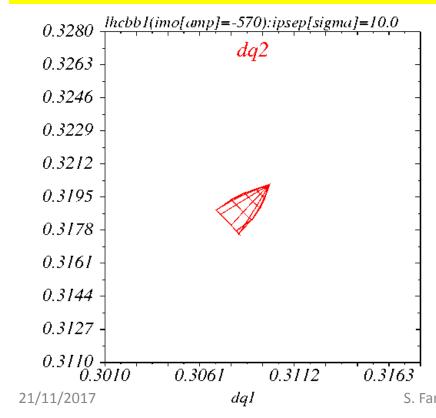
- Negative octupoles with the crossing angle reduced by ~15 μ rad give a comparable DA landscape in the tune space.
- Need to re-optimize the tune to profit! 21/11/2017 S. Fartoukh, rMPP meeting part II for MD4-2017

BBLR (3/5): Choice of MO polarity and scan

→ Full cycle with MO>0 (detailed settings still to be agreed)

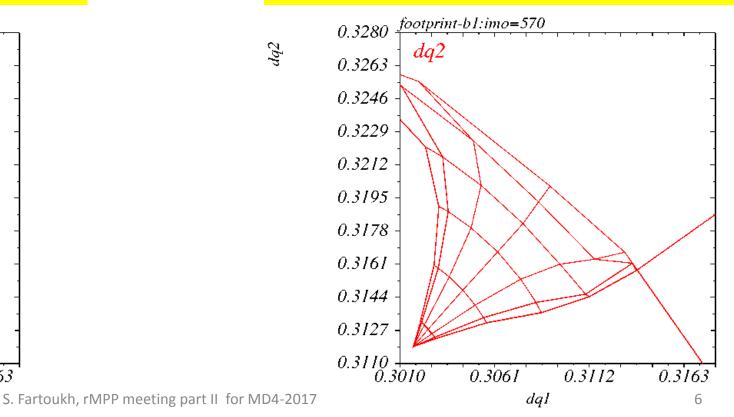
→ Scanning the MO current from >0 to <0 only when colliding</p>

Putting in collision with MO<0 would collapse otherwise the footprint (as in 2012 prior TS2)



 dq^2

Scanning the MO for >0 to <0 (colliding beams) should definitely improve the life time (and help reducing the crossing @ MO<0)



BBLR part (4/5): Filling scheme

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165 bunches

- Collision in IR1/5 only
- 1 INDIV non-colliding
- 2 trains of 48 (colliding)
- 1 trains of 8b4e (colliding)

BBLR part (5/5): Procedure

Activity (and comments)	Time estimate [h]
Fill # 1 with up to 165 nominal bunches (25ns_165_164_0_0_48bpi+8b4e_MD2269)	
Setting up at injection with probes and injection of train(s) $\rightarrow 0.5$ h - Combined Ramp & Squeeze $\rightarrow 0.25$ h - Setting up at flat top, Tele-knob exchange, tele-squeeze down to 35 cm $\rightarrow 0.5$ h - Find and optimize collisions at IP1 & IP5 $\rightarrow 0.5$ h - X-angle reduction with orchestration tool down to 150 µrad (or less) for a substantial reduction of the life time and lumi re-optimization $\rightarrow 0.25$ h	2.00
First MO scan from -1.8 (TBC) to 3 by step of 0.5 (knob value), lumi optimization an, life time inspection over 10-15 min. after each step \rightarrow 3.5 h - New X-angle (life time) limit inspection with negative octupole at full current \rightarrow 0.5 h - X-angle re-increase to 150 µrad and (relatively) fast MO ramp back initial settings (-1.8 in knob value, TBC), and lumi re-optimization \rightarrow 0.5 h	4.50 (-1.0)
Second MO scan, possibly with another working point (.322/.316), requesting to cross the diagonal when in collision (TBC)	3.50 (-1.0)
- Beam separation test (instability) with negative octupole and 170 mrad $ ightarrow$ 1 h - Beam dump	1.00 (+2.0)
Contingency	0.00
Total	11.0