

ATS-33cm-140 μ rad (1/3)

Table 1: Basic beam and machine parameters during the MD

Beams required [1, 2, 1&2]	1&2
Beam energy	Injection 450 GeV, combined ramp & squeeze, 6.5 TeV, pre-squeeze to 40cm (140 μ rad), tele-squeeze to 33 cm (140 μ rad)
Bunch intensity [#p, #ions]	Max 3.0E11
Number of bunches	Single_7b_1_1_1_5ncPilots2cNom (at most 2 colliding nominal + xx probes, to not exceed 3E11)
Transv. emittance [m rad]	As small as possible < 2 μ rad
Bunch length [ns @ 4s]	Not relevant
Optics change [yes/no]	Yes (ATS optics with X-bumps on).
Orbit change [yes/no]	Yes (ATS optics with X-bumps on)
Interlocks [yes/no]	No change w.r.t. nominal (as much as possible)
Collimation and MP change [yes/no]	Yes but <u>Quasi-nominal</u> (see Tab. 2)
RF system change [yes/no]	Yes (same voltage but new momentum compaction)
Feedback changes [yes/no]	Yes (new ADT settings for the new IR4 optics as established in MD1 for the injection and presqueezed optics, and MD4 for the telescopic part)

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Table 2: Collimator and MP settings

Collimator	Comparison of settings w.r.t. nominal
TDI-TCLI's	No change (both in mm and sigma) except relaxed settings for TCLIB (8.3 σ)
TCDQ	No change for absolute position in mm (very slight reduction in sigma due to the optics change at 40 cm, more and more pronounced with the telescopic squeeze)
TCSP	From MD3: New functions for the center, nominal Nsigma functions (8.3 σ)
IR3/IR7	No change for absolute position in mm
TCTs in IR2/8	From MD3: New functions for the center, nominal Nsigma functions vs. β^*
TCTs in IR1/5	From MD3 (almost): New functions for the center (down to 40 cm and kept constant from 40 cm to 33 cm). Nominal Nsigma functions vs. β^* almost all along, but set to 9.7 σ for the last two matched points of the pre-squeeze (45 cm and 40 cm), then kept constant in mm down to 33 cm.

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Table 3: Key steps with time estimate

Activity (and comments)	Time estimate [h]
<i>Recycling the machine from 6.5 TeV to new injection settings before MD start</i>	(2.0)
Fill # 1 with 10 non-colliding probes for IT aperture measurement	
Machine conditions: “quasi-nominal collimator settings” (see Tab. 2), Crossing bumps at all IPs, QFB matrix pointing to tele-knob, octupole OFF, ADT for injection oscillation only - Injection, ramp, pre- and tele-squeeze down to 33 cm (140 μ rad @ IP1/5) \rightarrow 1.5 h - IT aperture measurement \rightarrow 2.5 h - Intensity scraping (5E10), de-bunching, and asynchronous dump with TCT@ 9.0 σ \rightarrow 0.5h	4.5
Ramp down and refill	1.0
Fill # 2 with Single_7b_1_1_1_5ncPilots2cNom (2 nominals + pilots <3.0E11)	
- Machine conditions: as above, except octupole ON and ADT ON. - Injection, ramp, pre- and tele-squeeze down to 33 cm (140 μ rad @ IP1/5) \rightarrow 1.0 h - Ref. orbit at 33 cm \rightarrow 0.5 h - TCT and TCSP center measurement \rightarrow 0.25 h - Loss maps (beam separated, ADT gated on pilot bunches only) \rightarrow 0.5 h - Finding collisions \rightarrow 1.0 h - TCT and TCSP center: measurement and incorporation \rightarrow 0.25 h - IP15 phase scan (in collision ?, max +/- 0.1 \times 2 π in H plane) \rightarrow 1.5 h - Loss maps (parallel separation collapsed) on- and off- momentum \rightarrow 1.0 h - Intensity scraping (5E10), de-bunching, and asynchronous dump with TCT@ 7.0 σ \rightarrow 0.5h	6.5
Contingency	--1.0
Total	11.0