

# **ATS MDs for Run II**

**S. Fartoukh for the ATS MD team**

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# Reminder

- The **HL-LHC project** critically relies on the [Achromatic Telescopic Squeezing \(ATS\) scheme](#) .
- All ATS principles have been proven during MD series in Run I **down to  $\beta^*=10$  cm but only with low intensity beams** (see e.g. [CERN-ATS-Note-2013-004 MD](#), 2013).
- All ATS optics produced, tested and studied so far shows however a severe pathology with  **$\pi/2$  phase advance between the MKD and several TCTs**
  - Decision not to start with ATS optics in 2016 (see [LMC188 decision](#), 2014)
  - This put some question marks on the ATS suitability for HL-LHC, at least the  $\beta^*$  reach (unless more robust TCT's with preserved absorption properties).
- A new ATS optics generation is being developed to overcome the above limitations (see [61<sup>st</sup> HiLumi WP2 meeting](#), 2015).

# Goal & overall Strategy

→ **Goal:** Fully validate and gain experience with the ATS (new generation) for the HL-LHC:

1. Linear optics and chromatic effects: monitoring and high quality correction down to the lowest  $\beta^*$ ,
2. Intensity effect studies in particular for telescopic optics : trade off between LR and octupoles, IBS, e-cloud, or any other coherent or incoherent multi-particle effects which could be impacted by ATS optics.

→ **Strategy:** Use the LHC as bench test for the ATS

1. **Pre-squeeze down to  $\beta^*=60-40$  cm (depending on Cham 2016 decision) to be fully validated to replace the “nominal” LHC optics,**
2. **Apply Telescopic techniques for producing selected (LHC aperture compatible) optics,**
  - a) flat telescopic optics (80/20 cm) to boost LHC performance at bigger than nominal  $\sigma_z$
  - b) “efficient octupole optics”: pre-squeeze limited to only 2 m, and telescopic squeeze down to  $\sim 50$  cm
  - c) very large  $\beta^*$  optics (e.g. 2.5 km with “anti-ATS” techniques).

# Proposal for 2016 & 2017-2018

## → 2016: gain confidence with ATS pre-squeezed optics in view of implementation for LHC in 2017

1. MD1: Commission injection, ramp and pre-squeeze at low intensity, including optics correction at 40 cm, X-angle set-up, aperture measurements → **4 shifts**
2. MD2: Achieve an intensity ramp up to one train of 36 bunches (+12 ?), including loss maps, asynchronous dumps, and first collisions → **4(+1?) shifts**
3. If time permits, spend 2-3 h in the end of some MD1 sessions to demonstrate and measure first flat (telescopic) optics 20/80 & 80/20 starting from 40/40 (adding a special squeeze/un-squeeze telescopic sequence in the end of the pre-squeeze)

## → 2017-2018: gain experience with **ATS telescopic optics for HL-LHC**

1. **At small intensity:** Push/correct the optics down to 10 cm  $\beta^*$  → **2 shifts**
2. Idem with a telescopic optics with  $\beta^* = 50$  cm (pre-squeezed limited to 2 m) or flat optics (depending on LHC findings) → **2 shifts**
3. **Intensity ramp up with one selected telescopic optics** → **xx shifts**