



# **Clarifications on optics versions and optics scenarios**

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# Optics repository

A version (e.g. [/afs/cern.ch/eng/optics/lhc/HLLHCV1.5](https://afs.cern.ch/eng/optics/lhc/HLLHCV1.5)) of an optics repository contains:

1. an HL-LHC sequence corresponding to a version of the layout (normally corresponding with approved drawings, . e.g. drawings for HLLHCV1.4 where not produced).
2. A set of strengths files belonging to possible operational scenarios.  
Typically:
  1. An injection optics (e.g.  $\beta^*=6$  m in Point 1/5)
  2. Several end of levelling optics (round optics  $\beta^*=15$ cm in Point 1/5, flat optics, high beta optics)
  3. Several intermediate steps used for studies.

## Notes:

- Do not confuse optics version with operational scenarios.
- In the recent optics versions, strength files do not contain default values for crossing angle and separation because this information belong to operational scenarios

# Operational scenarios

The present baseline operational scenario CERN-ACC-NOTE-2018-0002, specify:

- Injection optics:  $\beta^* = 6\text{m}$
- Beginning of levelling:  $\beta^* = 64\text{ cm}$  ( $5 \cdot 10^{34}\text{cm}^{-2}\text{s}^{-1}$ ) or  $\beta^* = 41\text{ cm}$  ( $7.5 \cdot 10^{34}\text{cm}^{-2}\text{s}^{-1}$ )
- End of levelling:  $\beta^* = 15\text{ cm}$

The document does not specify the intermediate steps of ramp and squeeze and the ATS factors.

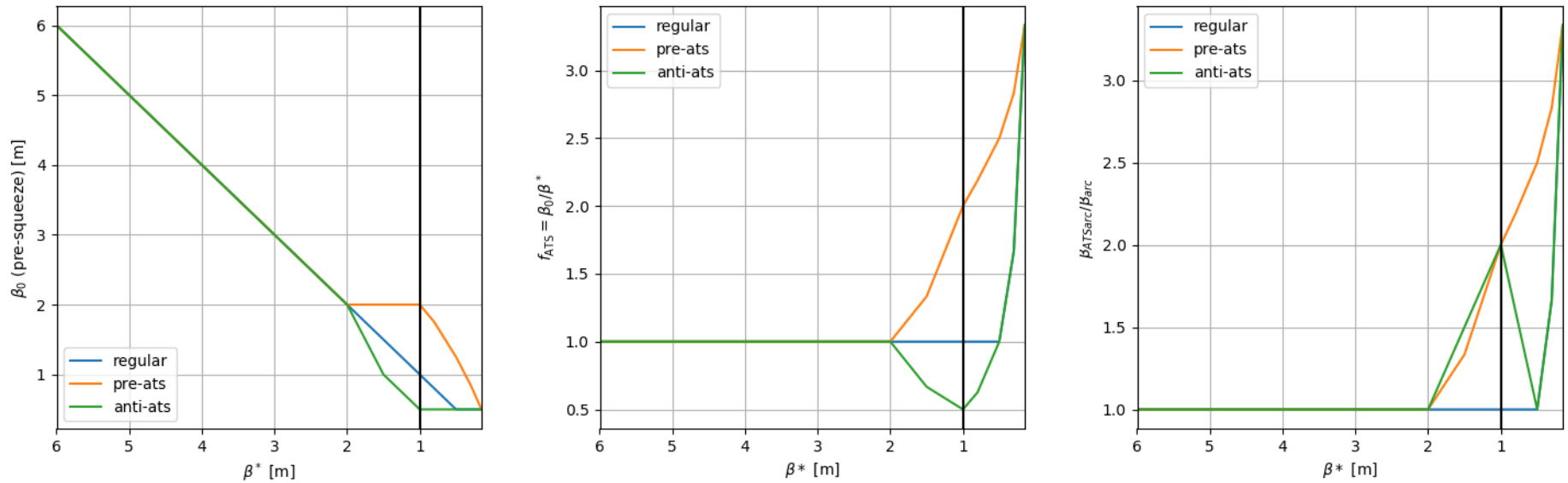
The baseline scenario is being updated to:

- Include new cryogenics requirements presently at  $2.5 \cdot 10^{34}\text{cm}^{-2}\text{s}^{-1}$
- Include new stability constraints during collapse process
- Specify ATS factors

# Operational scenarios: main options

The main options under studies foresee to collide at  $\beta^* = 1\text{m}$  with ATS factors in between 1 and 2.

There are three main family of solutions: regular, pre-ats, anti-ats



Energy ramp could occur during  $\beta^*$  squeeze in up to the collapse  $\beta^*$ .

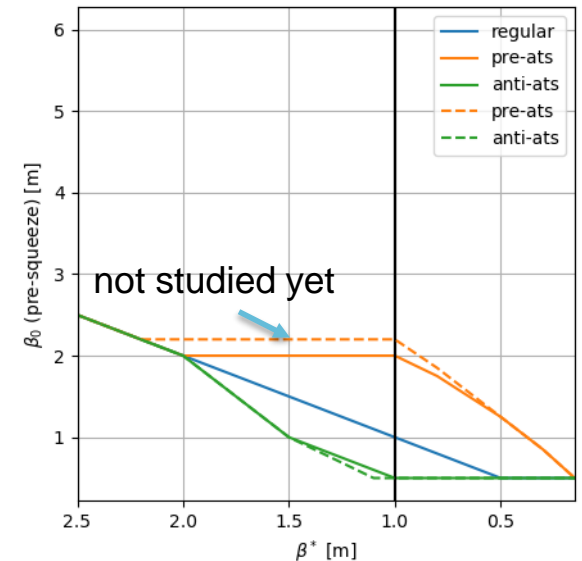
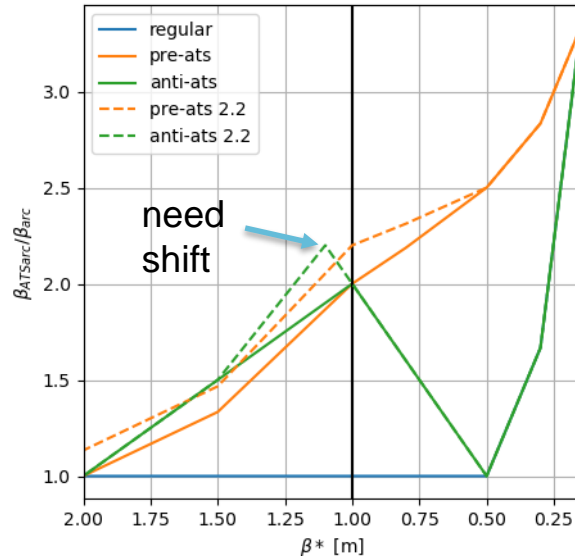
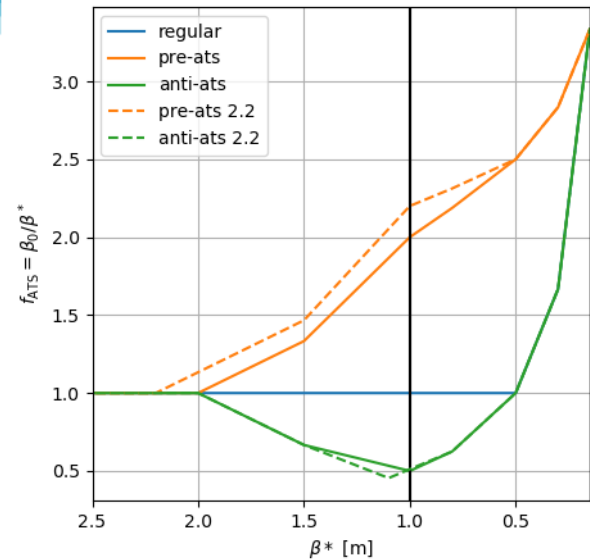
# Operational scenario: variations

Pre-squeeze  $\beta_0$  studied in between 2.0 m and 0.5 m:

- $\beta_0 > 2.0$  m soft constraints on squeeze smoothness
- $\beta_0 < 0.5$  m hard constraints on Q7 strength and soft on MS strengths

In case one needs to change  $\beta^*$  or  $f_{ATS}$  at the collapses:

- pre-ats: flexibility to increase  $\beta_0$  and  $f_{ATS}$  at constant  $\beta^*$
- anti-ats:  $\beta^*$  and  $f_{ATS}$  linked since  $f_{ATS}$  is maximal in one point only peak.



# Impact for IR4

In the following the beta function are extracted for few optics in a cycle.

The changes will smoother.

Dispersion and phase advance data depends strongly from the operational scenario and are subject to change.

Freezing phase advance might not be possible on short time scale.

