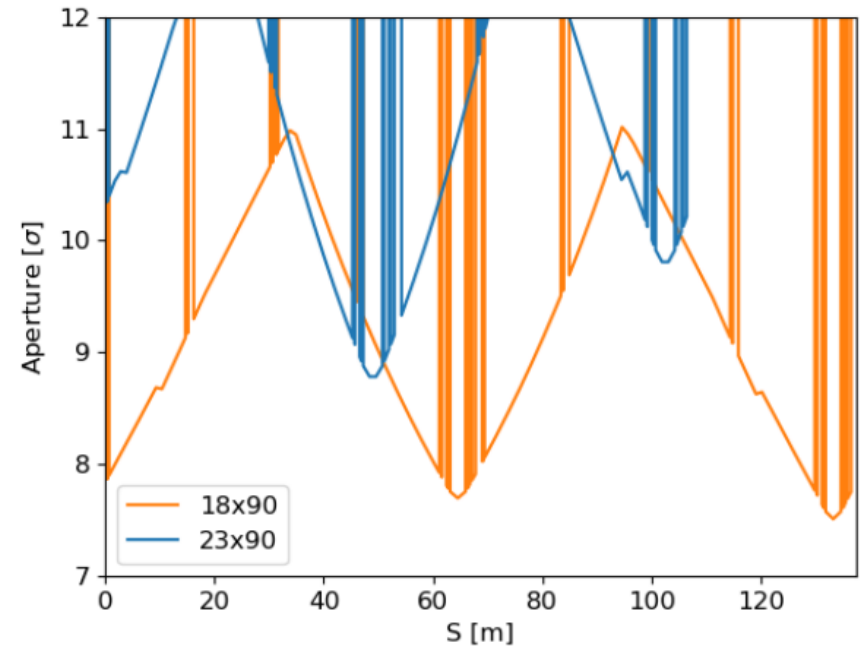


# MD 3328: Studies with tight collimation at injection

Collimation team, injection team,  
impedance team

# Scope of the MD

- FCC and in particular HE-LHC rely on a **very tight machine aperture at injection** => Much tighter collimator settings are needed
- This MD: Study various aspects of tight collimator settings and tight aperture at injection
  - Collimator losses in IR7 during injection and loss maps
    - Not in MD scope: study of losses at injection regions or change of transfer line / inj. protection
  - Impedance and beam stability / lifetime
  - Cleaning with tight arc aperture
- Applications to Run 3 / HL ?



*HE-LHC injection aperture in the arc for two optics options.*

*Courtesy HE-LHC design team*

# Steps to be taken (1)

- **Studies with tight IR7 collimators**

- OP: Perform nominal injection steering
- Close IR7 TCP and TCSGs in steps of  $0.5 \sigma$  down to  $3.2 \sigma$  and inject 1 pilot per step. Observe collimator losses in IR7 and stability / lifetime of circulating beam
- Blow out each pilot with the ADT to record betatron loss map
- Repeat with 1 nominal bunch.
- Repeat with 1 train of 12-48 bunches
  - For this step, no interlocks can be masked. Need to open the inner position limits of the IR7 collimators to allow tightening. Limits will be automatically driven back to nominal values with the sequencer in next fill
- If circulating beam not possible at tightest setting, step back to the last feasible step

- **Impedance studies**

- In the tightest configuration found with circulating beam, measure collimator impedance
- Study tune shift when moving the IR7 collimators back and forth between nominal and tightest position

# Steps to be taken (2)

- **Optional: studies with tight collimators and tight aperture**
  - Introduce in steps a **4-corrector bump in the arc** downstream of IR7. Increase amplitude to achieve an **arc aperture of 9-10  $\sigma$**
  - Perform a **global aperture measurement** to verify aperture, and do betatron loss maps to verify good coverage of aperture
  - Close back to nominal collimator settings, and repeat first part
    - Inject 1 pilot and close in steps. Inject 1 nominal and close in steps. Blow out pilots with loss maps. Study IR7 and arc losses
  - **No trains will be used for this part.** Max 1 nominal bunch will be injected
  - Bump to be reverted at the end of the MD