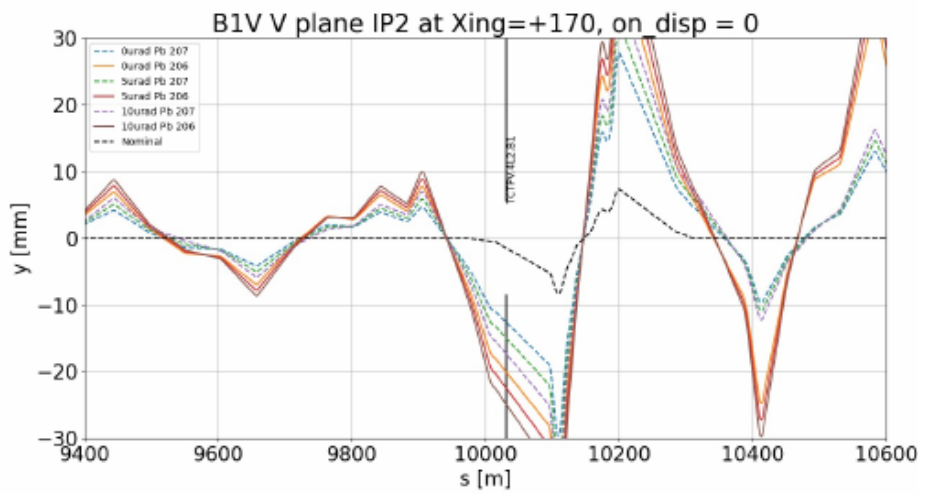
# Optimization of machine-induced backgrounds at ALICE

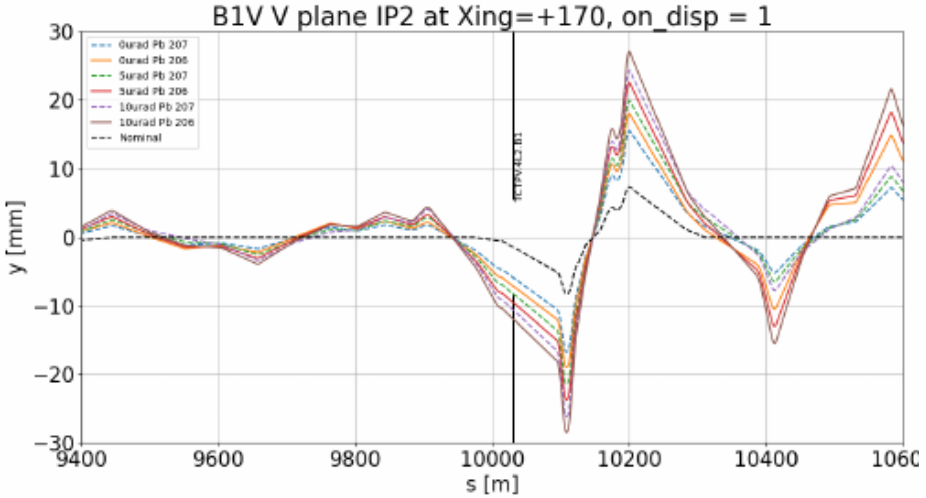
MD14326

# Background on the background

*R. Cai et al.*

- In 2023, strong limiting background observed in ALICE
  - Some chips of ITS fully saturated; 25% of inner barrel acceptance lost
  - Main source identified as showers from $^{207}Pb^{82+}$ impacting on TCTPV.4L2.B1; produced in IR7
  - Mitigated by on_disp knob (orbit bump changing $^{207}Pb^{82+}$ dispersive trajectory)
- Some remnant non-blocking background remains
  - Not a showstopper, but ALICE expressed wish to further reduce it



# Proposed MD program

- Bring a setup beam of 21b , <3E11 charges to collision

- To empirically identify the source of remaining background, measure background in the ALICE experiment for a number of different machine configurations
  - different collimator settings,
  - values of on_disp, potentially other orbit bumps,
  - separated or colliding beams in the other IPs,
  - with additional ADT excitations (like in loss maps)

- Around 10 minutes needed per configuration, plus a few minutes to put the ALICE detector in safe mode and bring it back while machine settings are changing

- Note: First tests could be carried out already in the ion commissioning on 27/10.
  - Results are being analyzed by ALICE – could adopt MD program based on results and also findings in start of ion operation

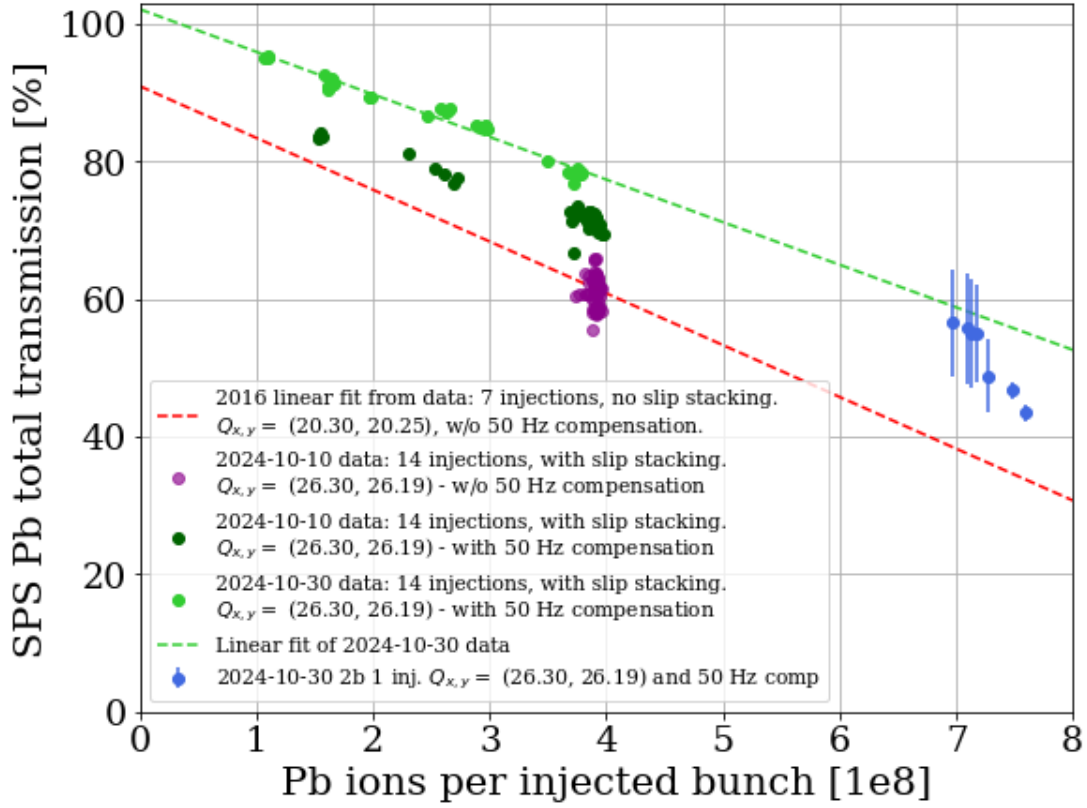
- Time needed: 8h

# LHC cycle with high-intensity Pb ion beams from injectors

MD14324

# Motivation

- Alternative production schemes in the injectors considered for future ion operation beyond Run 4
  - Other ion species than Pb under consideration
  - Significant increase in luminosity requested by ALICE3 study
  - R. Alemany, H. Bartosik, H. Damereau, E. Waagaard et al., Light ion working group studying the feasibility in the injector complex
- 50 ns beams without PS splitting
  - Shorter trains and fewer bunches, but significantly higher bunch intensity




*E. Waagaard et al.*

# Motivation (2)

- 25 ns beams
  - Requires 50 ns batches from the PS, slip-stacking in the SPS - batches of 4b requires upgrades to the PS RF system
  - Tests with 2b, without PS splitting, can be done with present hardware, but gives sub-optimal LHC filling
  - Nevertheless, 2b tests interesting to study achievable intensity and if a future PS upgrade is motivated

- 25/50 ns spacing
  - Slip-stacking in SPS of 75 ns beams from the PS gives varying bunch-spacing 25-50 ns

- 50 ns beams with triple-splitting in the PS
  - Lower bunch intensity, but also smaller emittance and longer trains, giving a shorter LHC injection time

- Testing these beams in the LHC can give very important information
  - Study if the alternative schemes can give potential performance gains in the future, and if injector upgrades are motivated
  - Investigate whether alternative schemes can give any performance increase for Pb operation

# MD procedure

- Inject a few trains produced with the most promising new schemes
  - If injectors can switch quickly, inject different types of trains
- Note: All beams are not yet optimized in the injectors
  - Will have to choose scheme(s) by the time of the MD
  - If no promising scheme has been identified, drop MD
- Bring the beams through the full LHC cycle to collision, with nominal machine settings
- Observe
  - Losses
  - Emittance growth in the LHC
  - Achievable bunch-by-bunch luminosity at start of collision
- Time needed: 8h (could maybe be reduced if the injectors can switch quickly)

# Test of optics with smaller beta* at IP8

MD14365

# Motivation

- Strong request by LHCb for increased integrated luminosity in ion runs
  - Presently using β*=1.5m  - reducing β* could give an important gain
  - Previous (few) aperture measurements with protons in IR8 show potential margin

- Idea: test new optics in MD to identify potential showstoppers
  - Collimation and beam losses
  - Aperture
  - ALICE background

- Potential to use similar optics in O-O and p-O run in 2025 at low intensity

# Procedure

- New optics cycle needed, adding a new IP8 squeeze segment to the present ion optics
  - Several optics candidates under study – e.g., round β*=1m, and flat β*=0.5/1.5m (R. De Maria)
  - Pre-study ongoing, final candidate to be chosen in the coming days
- 1 shift of optics measurement and correction commissioning (OMC)
- 1 shift of mixed studies using setup beam (21b)
  - IR8 aperture measurement
  - Loss maps
  - ALICE background check
- Time needed: 2x8h. To be seen if optics can be quicker