Halo population studies

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On behalf of BE-ABP-NDC

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# MD 8183: Halo Population Measurements

- Halo population higher than Gaussian: Observed since Run 1

- Three halo population measurements in 2022

- Over-population confirmed

- Potential threat for HL-LHC if this scales to post-LS3 beams – mitigation hardware not available

- Motivates further measurements for better understanding

A. Gorzawski

Assuming nominal σ with ε_N=3.5μm
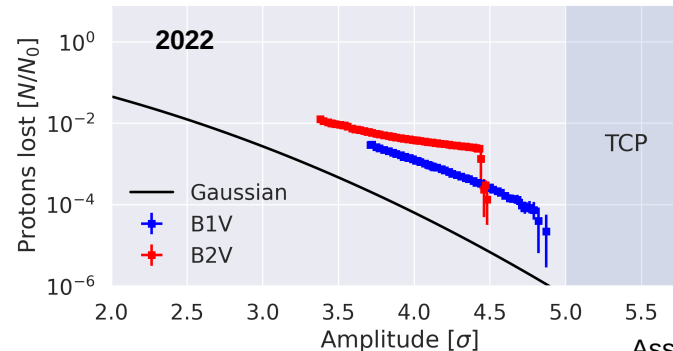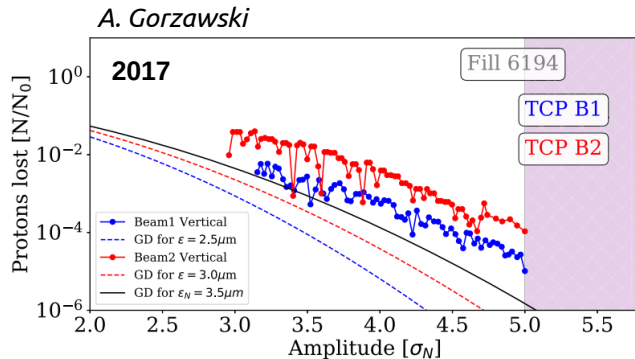
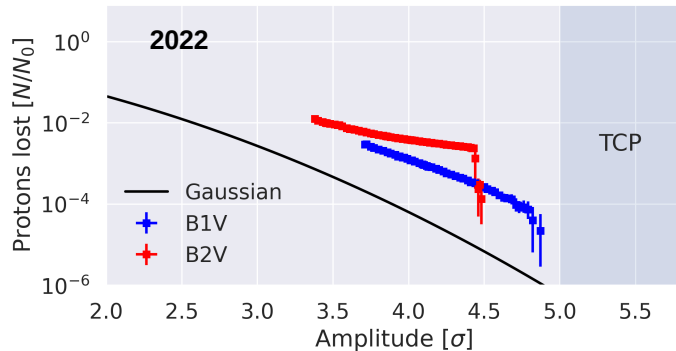# MD 8183: Halo Population Measurements
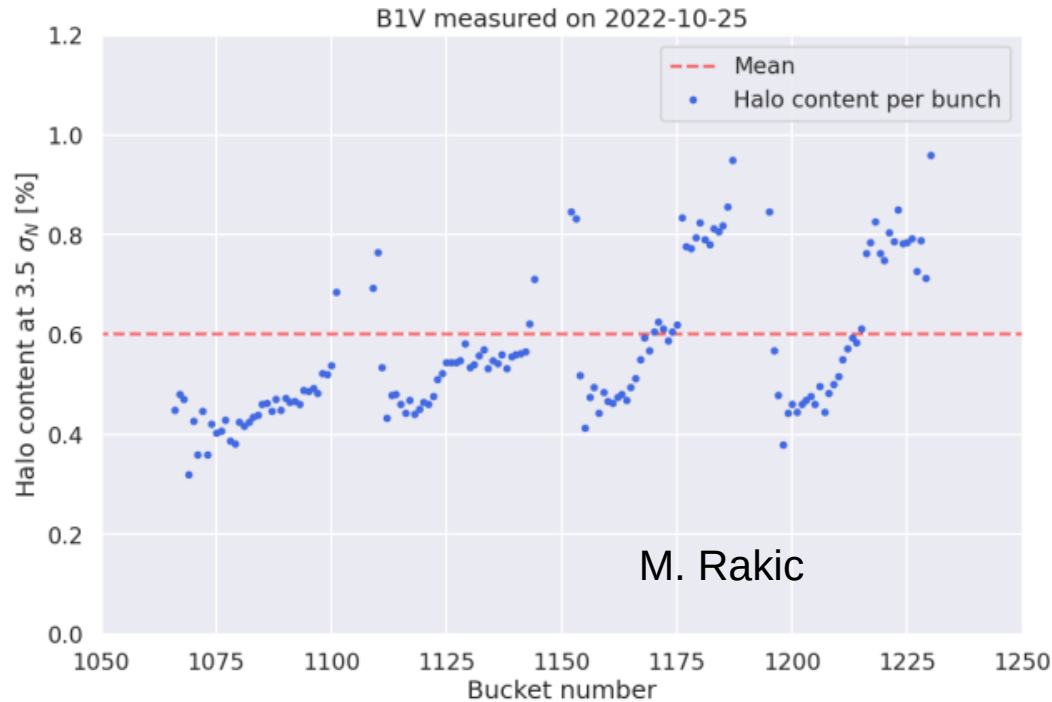
- Refined analysis: bunch-by-bunch dependence of halo

- Resembles e-cloud emittance growth patterns

Transverse halo characterization MDs

Overall Run 3 Halo Study Goals

- **Characterize halo** with post-LS2 beams

- Estimate **impact of missing HELs** for Run 4 operation

- Gather **input for halo depletion studies**

- **Technique: Scrape beam with collimator,** deduce halo population from BLM / BCT

MD Proposals 2024

- Aim to **understand halo formation, evolution and population** at different stages of cycle

  - **Injection (MD1) – combined with SPS study**

  - **Flat top (proposed for MD1)**

  - **End of luminosity levelling (EOF) if possible with mixed filling scheme**

Transverse halo characterization MDs

Measurement at Injection (MD 9364)

- Should be combined with SPS MD – vary SPS scraping before LHC Injection

- Roughly **4h needed**, use **1 nominal train**, as close as possible to high-luminosity operation

- Synergy with BLM calibration measurement?

Measurement at flat top (MD 9363)

- Roughly **4h needed**, use at least **1 nominal train**, as close as possible to high-luminosity operation

- Could be combined with injection measurement – advantage: could scrape one train at injection and inject fresh train – then compare halo content of the two trains

Transverse halo characterization MDs

Measurement at End of Luminosity Leveling (MD 9325)

- To be done at the end of longer fills with colliding beams

- Fullest machine possible : after intensity ramp-up

- If possible aim for mixed scheme to check link to e-cloud (possible?)

- Requires BLM calibration availability for a posteriori analysis

- Exploit synergies: combine with diffusion studies (next slide)

MD 9503 — Diffusion measurements

MD Merit

- Insight on dynamic halo behavior at different collimator positions

- Characterisation of long-term transverse dynamics via diffusive models

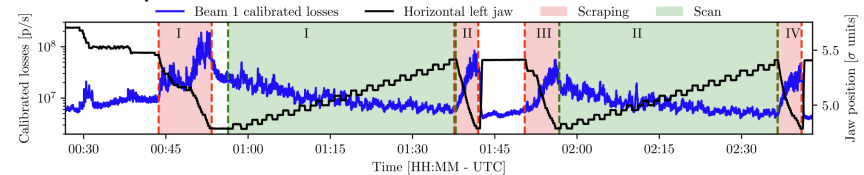- Completion of EoF scans performed 2022

Technique

- Open collimator after scraping with specified collimator motion protocol

Requirements

- Colliding beams at top energy

- Enough time in collision spent before starting

- 7 hours of beam time (>1h per plane, both beams can be done in parallel)

Example: 2022 diffusion measurement result

C. E. Montanari

We propose to combine with halo population measurement MD as EoF

Thanks a lot!