



PERFORMANCE OF THE ION CHAIN AT THE CERN INJECTOR COMPLEX AND TRANSMISSION STUDIES DURING THE 2023 SLIP STACKING COMMISSIONING

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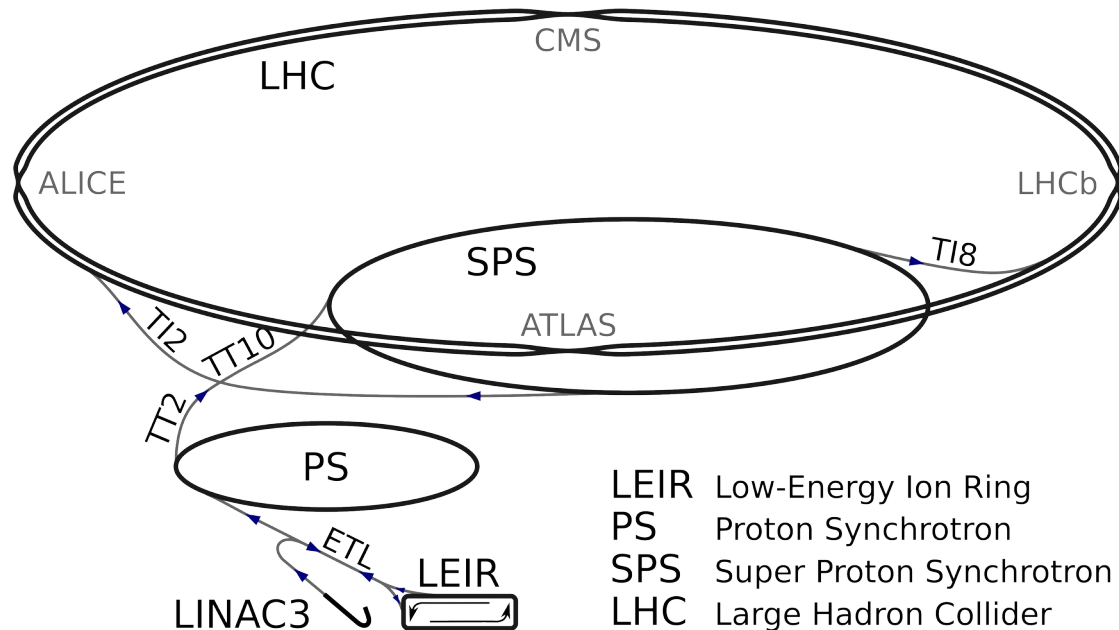
CERN ion injector complex

Linac3

- Source: Pb29+
- Stripping to Pb54+
- 4.2 MeV/n

LEIR

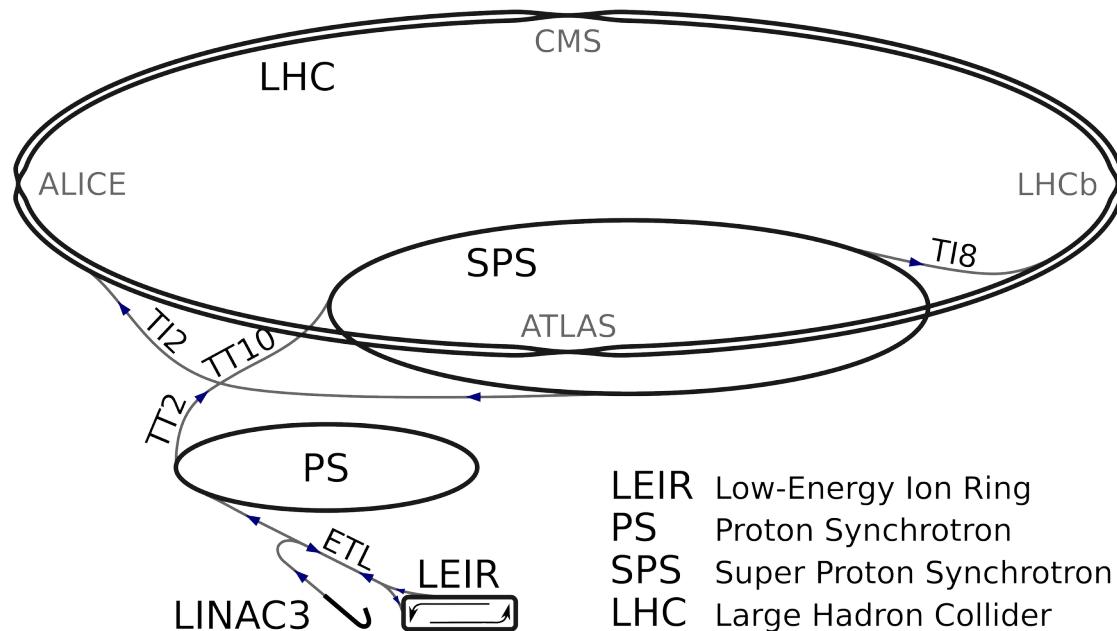
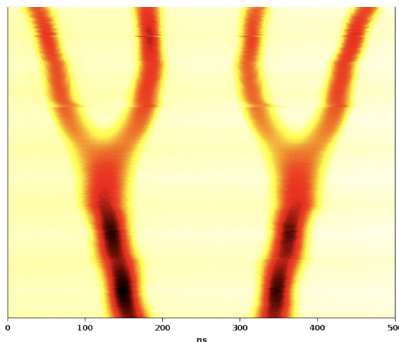
- Accumulation of seven 200 μ s-long pulses from Linac3
 - Electron-cooling
 - Multiturn injection
- RF capture: 2b
- Acceleration to 72 MeV/n



CERN ion injector complex

PS

- Bunch splitting ($2b \rightarrow 4b$)
- Bunch separation at extraction: 100 ns
- 6 GeV/n

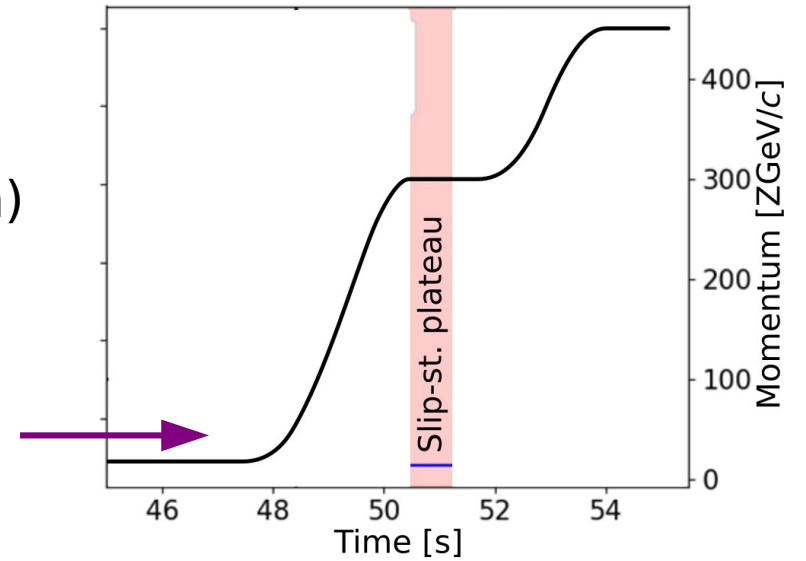


SPS

- Long injection plateau: 48 s
- 14 injections from PS
- Slip-stacking
- Bunch separation at extraction: 50 ns

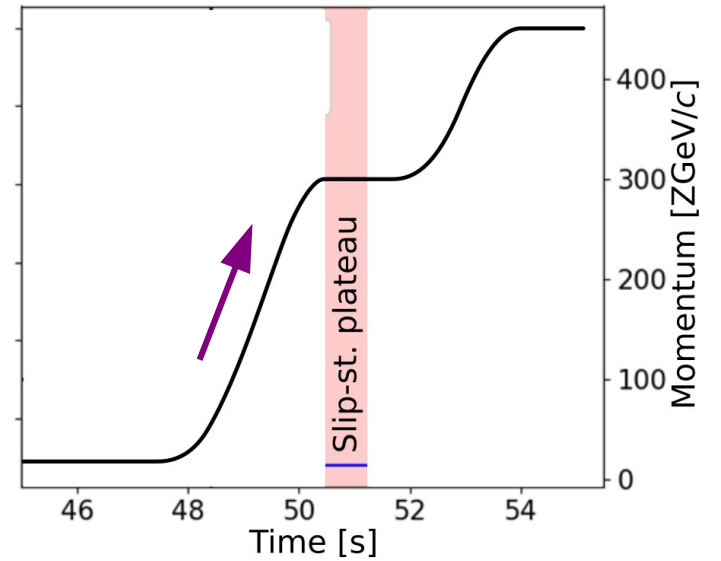
SPS Slip-stacking

- Injection of 14 PS batches (4 bunches each)



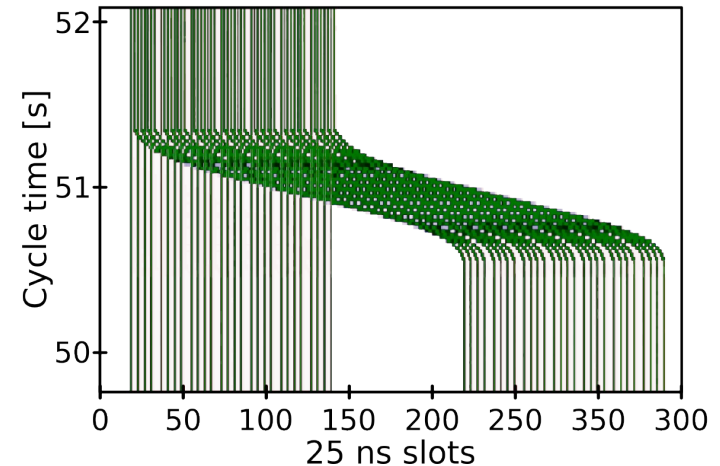
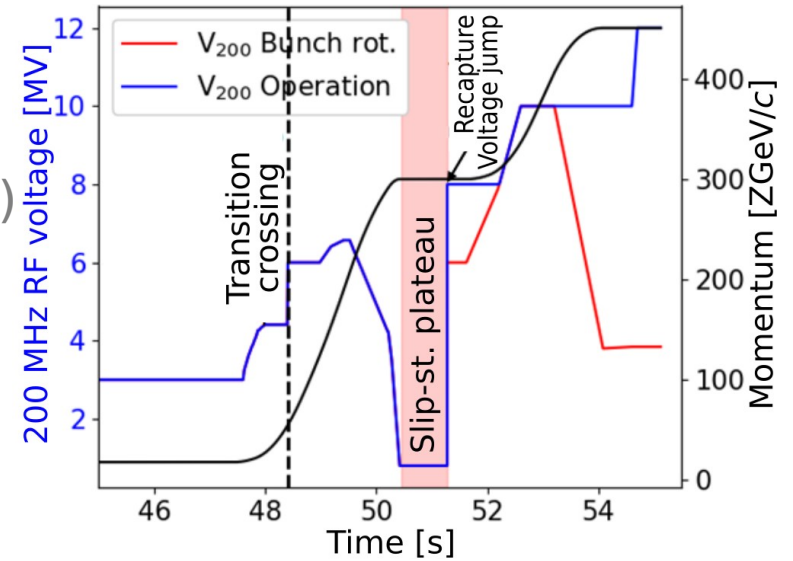
SPS Slip-stacking

- Injection of 14 PS batches (4 bunches each)
- Ramp up to intermediate slip-stacking plateau



SPS Slip-stacking

- Injection of 14 PS batches (4 bunches each)
- Ramp up to intermediate slip-stacking plateau
- Two particle beams of different momenta and different RF frequencies slip longitudinally relative to each other in the same beam pipe
- When the two beams are in the correct longitudinal position, the full beam is recaptured with a non-adiabatic voltage jump at the average RF frequency
 - Extracted bunch spacing is 50 ns



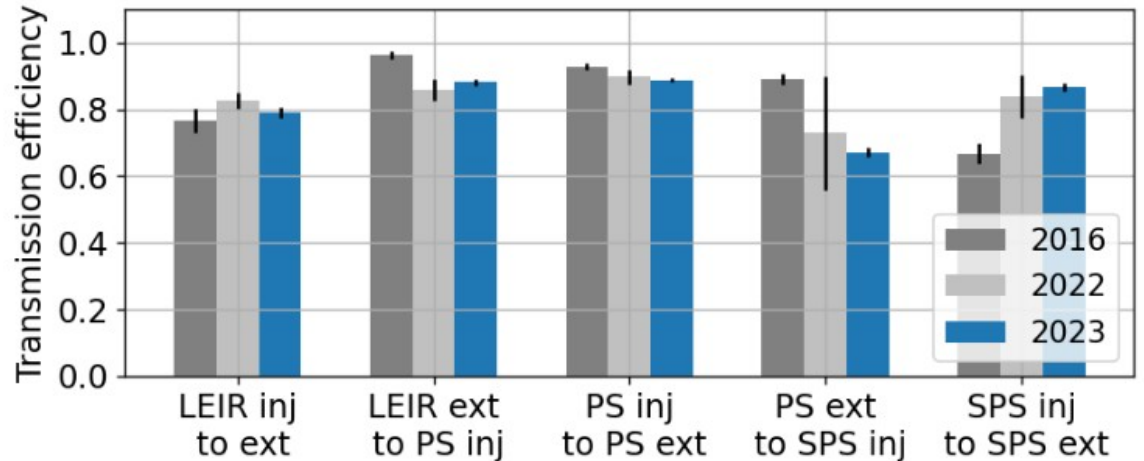
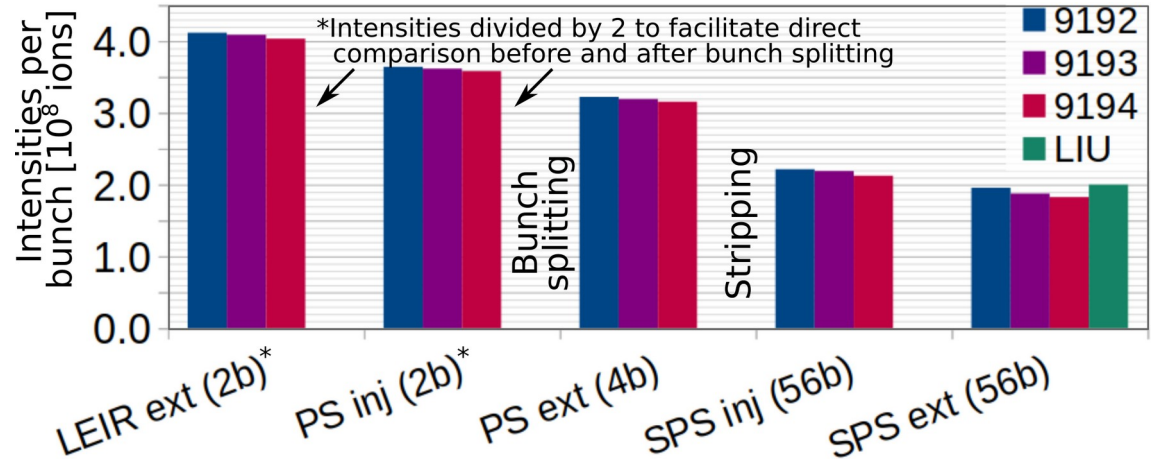
Performance

Intensity per SPS-equivalent bunch in the first three LHC fills of 2023 ion run

- Beam scraping at SPS due to limitation of the LHC injection system
 - Extracted intensity slightly below LIU
- Most losses between PS ext and SPS inj
 - stripping and long injection plateau

Transmission

- Consistent across the years: 2016, 2022 and 2023
- 2023: average of the first 3 LHC fills
- PS extraction to SPS injection data from 2016 used DC BCT (incl. unbunched beam); following years used Fast BCT



Let's meet at the poster session!

Follow-up topics

- LEIR performance issues
- SPS slip-stacking details
- Emittance across the complex



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