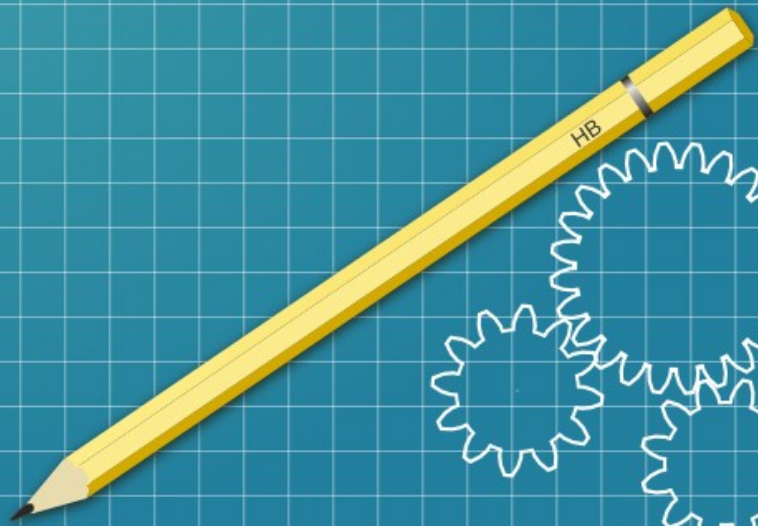
2023 Pb run summary from NA61/SHINE

Piotr Podlaski



Key points

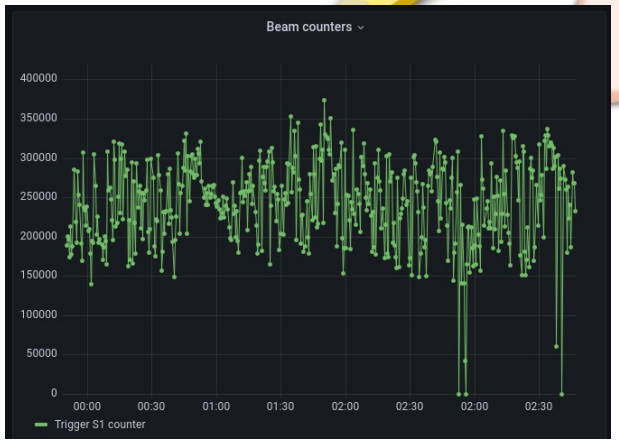
- The run took place between 30th of September and 30th of October
- We got the beam 2 days earlier than originally planned
- Good detector performance – stable operation with 1.2 kHz
- During this time we collected 296M events for charm physics, comprising 280M target IN and 16M target OUT

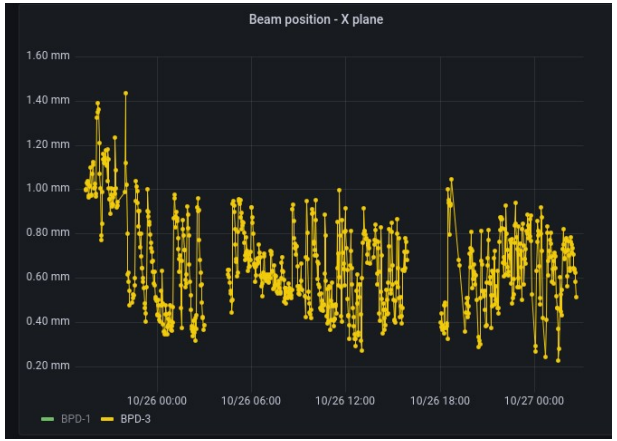
Additional data/tests

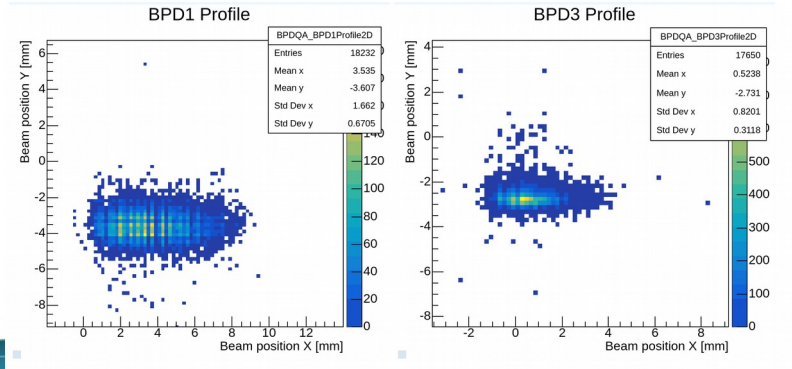
- RP test measurements
  - We run high intensity Pb beam to validate our shielding situation
  - Up to 2M Pb ions per spill shielding is OK (detailed feedback from RP expected)
  - At 3M we triggered a radiation alarm
- High rate VD test:
  - Stable running with ~4kHz and T2 trigger
  - More is possible, some firmware debugging required
- K0S B=0 data
  - We took ~7M events without the TPC and mRPC (up to 20x smaller events) without magnetic field
  - They will be used to test the idea of V0 reco based on decay topology and no direct momentum reconstruction

Beam quality

- No problem with reaching desired intensity of ~300k Pb/spill
- Large fluctuations of the beam intensity
- Decent beam spot size (sub 1mm RMS)
- Fluctuations of beam position by up to 1mm in X, much more stable in Y

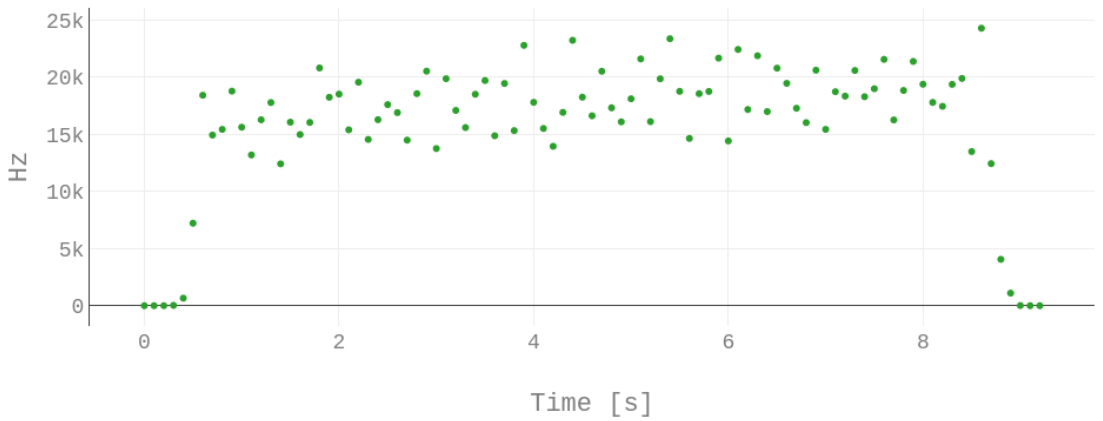




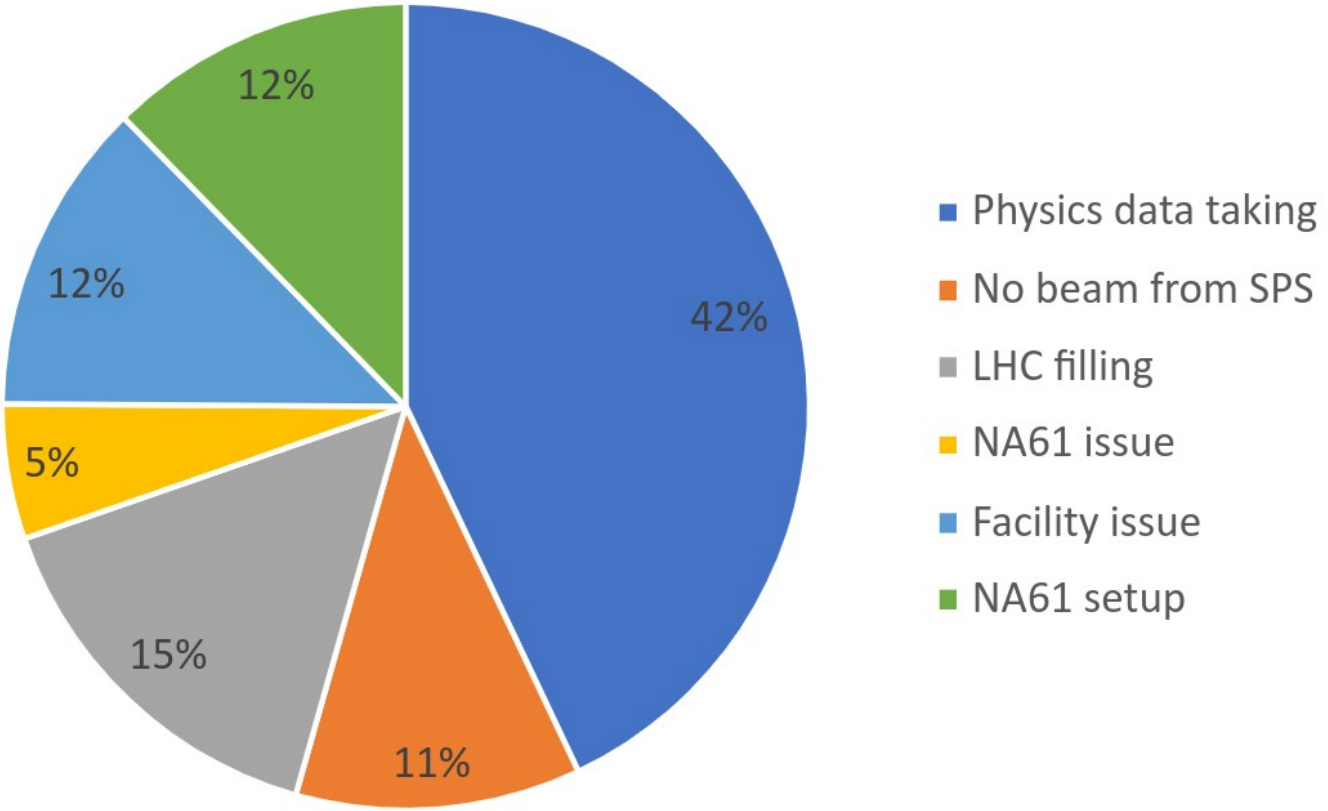


Spill structure

- **The best ion spill structure in the history of NA61!**
- Optimal data taking conditions, nothing to improve here. Flat intensity profile →maximal efficiency
- When any problems occurred they were immediately corrected by the SPS operators



Beam time distribution



AWAKE in our supercycle

- AWAKE run:
  - 8-22.10 (15 days)
  - Duty cycle without AWAKE: ~32%
  - Duty cycle with AWAKE: ~18%
  - During AWAKE run for ~40% of time it was present in the supercycle
- Assuming 32% duty cycle is our full efficiency, due to AWAKE our effective beam time was reduced by:
  - 40%*(1-18%/32%)=17.5% (during AWAKE run)
  - 17.5%*(14 days/30 days) = 8.8% (averaged over whole period)

Total beam time reduction

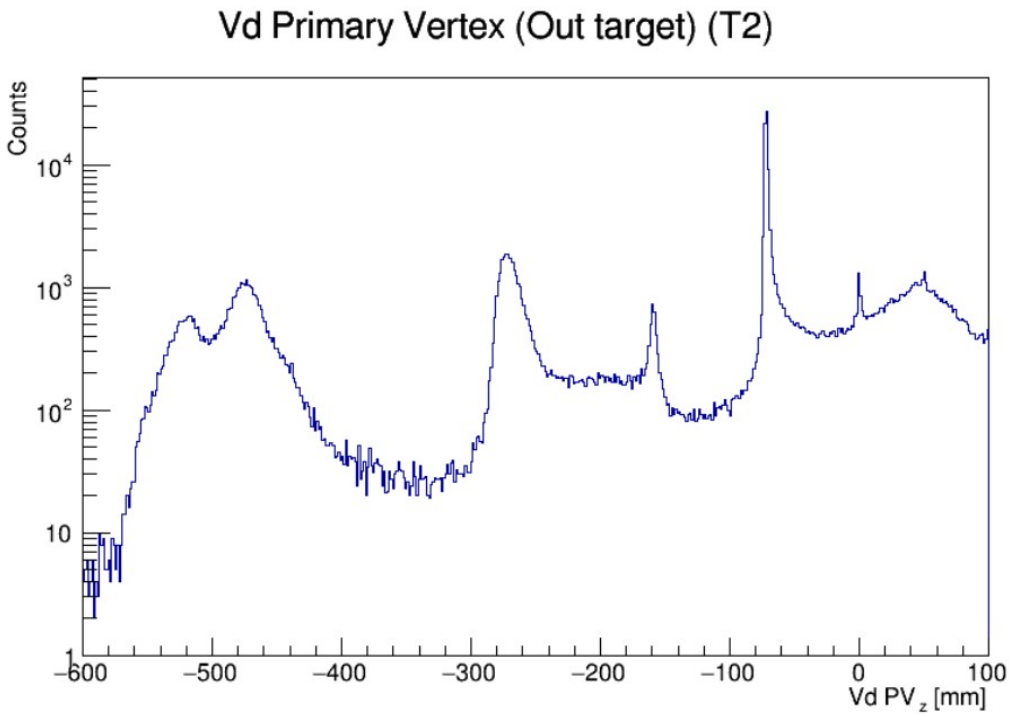
- Planned/predictable:
  - LHC filling: 15%
  - AWAKE: 9%
  - Total planned: 23%
- Unplanned/incidents:
  - Fire incident, accelerator and beamline malfunction: 27%
  - NA61 issues: 5%

Issues

- Beam position and intensity
- Beamline magnets switched OFF after LHC fill (but not only)
- Couple of beam interventions by access issue
- VERTEX magnets:
  - They were powered OFF by a mistake during MD
  - VERTEX-2 discharged during ramp-up
  - followed with cryo and MSS teams

Improvements for future (brief summary)

- Add V0 behind S2
- Swap BPD-3 and V1
- Additional veto V1’/V2?
- Better S3



Acknowledgements

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In particular we want to express our gratitude to Barbara, Martin, Laza, Nikos and Frederic

Summary

- Successful data taking period
- More than 300M events in total for physics analysis
- Additional important tests
- Many thanks to all involved!