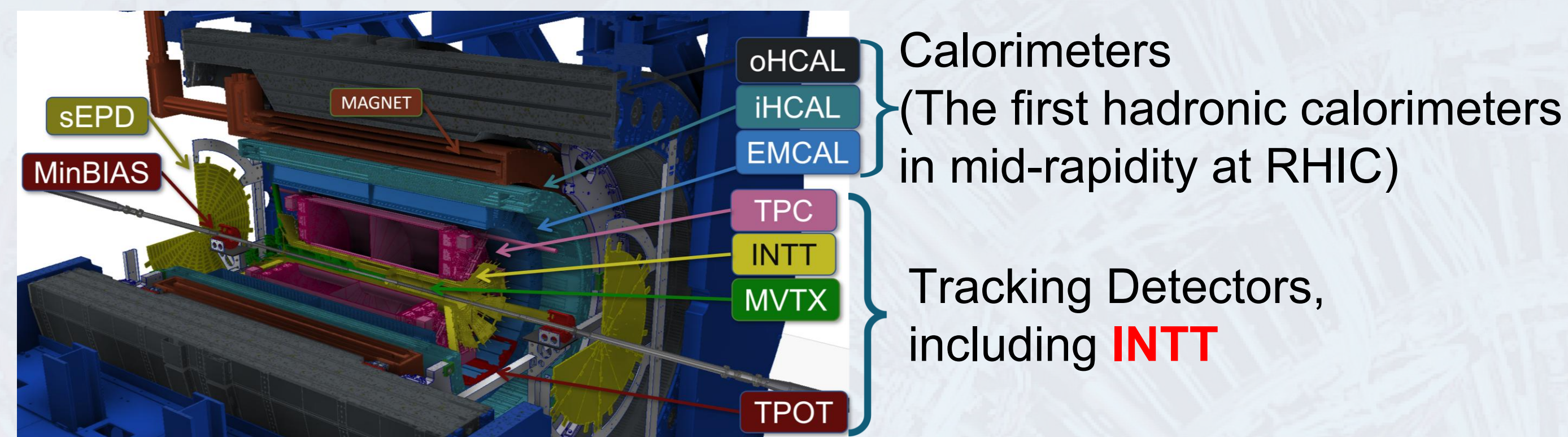


## Abstract

sPHENIX is a second generation RHIC experiment, designed for precise measurements of QGP properties and the nature of the proton spin structure. sPHENIX recorded 200 GeV p+p and Au+Au collision data in 2024, and Au+Au data taking is ongoing from June 2025. Evaluation and assurance of each subsystem's performance during the run are important for coming solid physics results. Intermediate silicon tracker (INTT), a two-layer cylindrical tracker using strip type silicon sensors, have shown great performances such as z-vertex reconstruction. On top of that, INTT's most important role is to separate each beam-crossing in time, making use of its time resolution. Online data taking parameters has been optimized to maximize the capability of INTT. A delay parameter scan was done to assure the delay setting we employed was best and almost all hits were recorded within an interval of beam crossing. Other parameters that define a window to accept/reject hits based on the relative timing between an INTT hit and trigger was also optimized, so that hits mistakenly associated with a wrong event can be corrected in offline analysis. As a fruit of such efforts to achieve a solid data, the first physics publication from sPHENIX reporting a measurement of charged hadron multiplicity was recently published.

## sPHENIX detector

- State-of-the-art jet detector at RHIC with  $2\pi$  full azimuthal angle coverage for mid-rapidity ( $|\eta| < 1.1$ ).

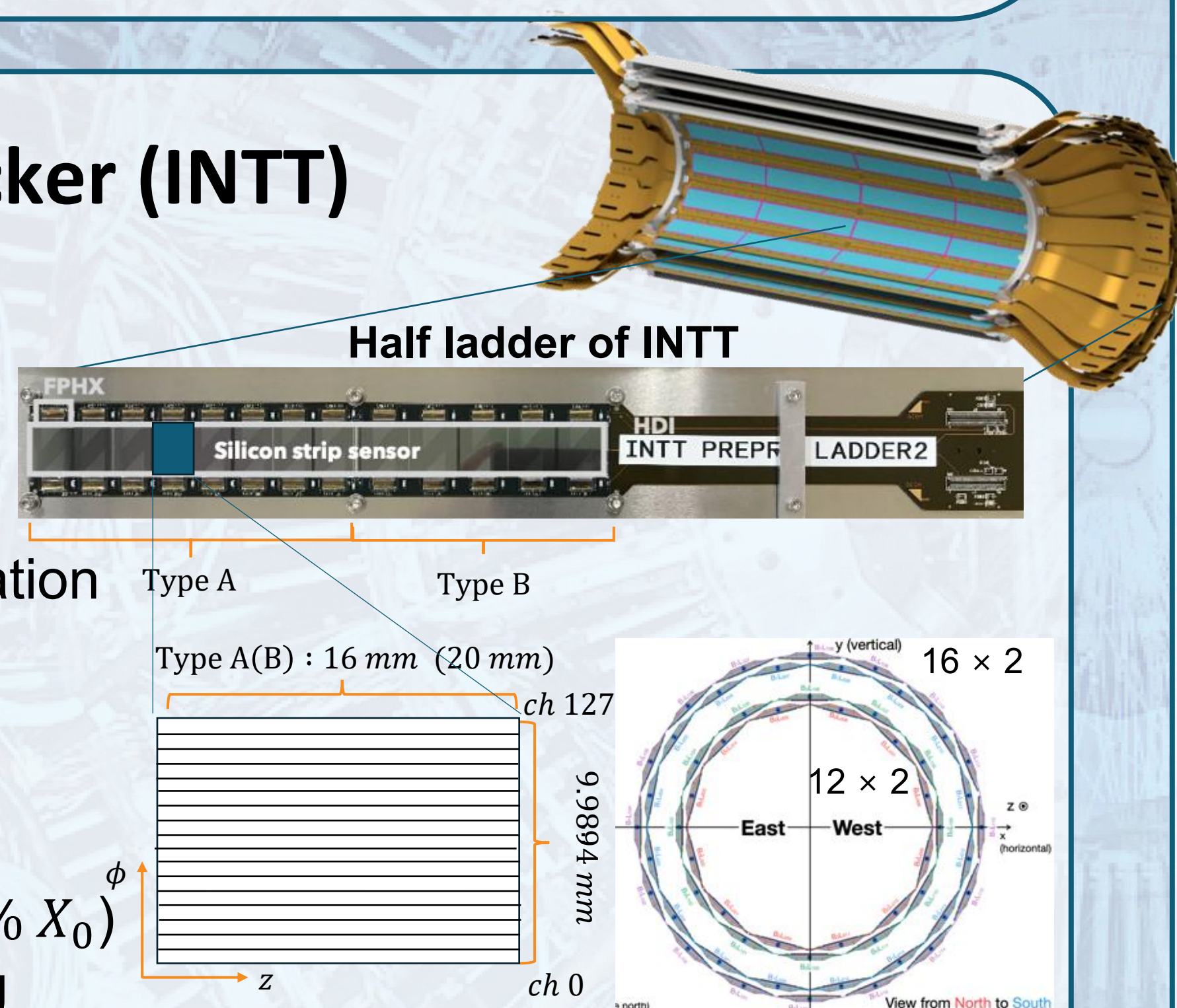


oHCAL Calorimeters  
iHCAL (The first hadronic calorimeters in mid-rapidity at RHIC)  
EMCAL  
TPC  
INTT Tracking Detectors, including INTT  
MVTX  
TPOT

Au+Au collision data taking ongoing for the study of QGP!

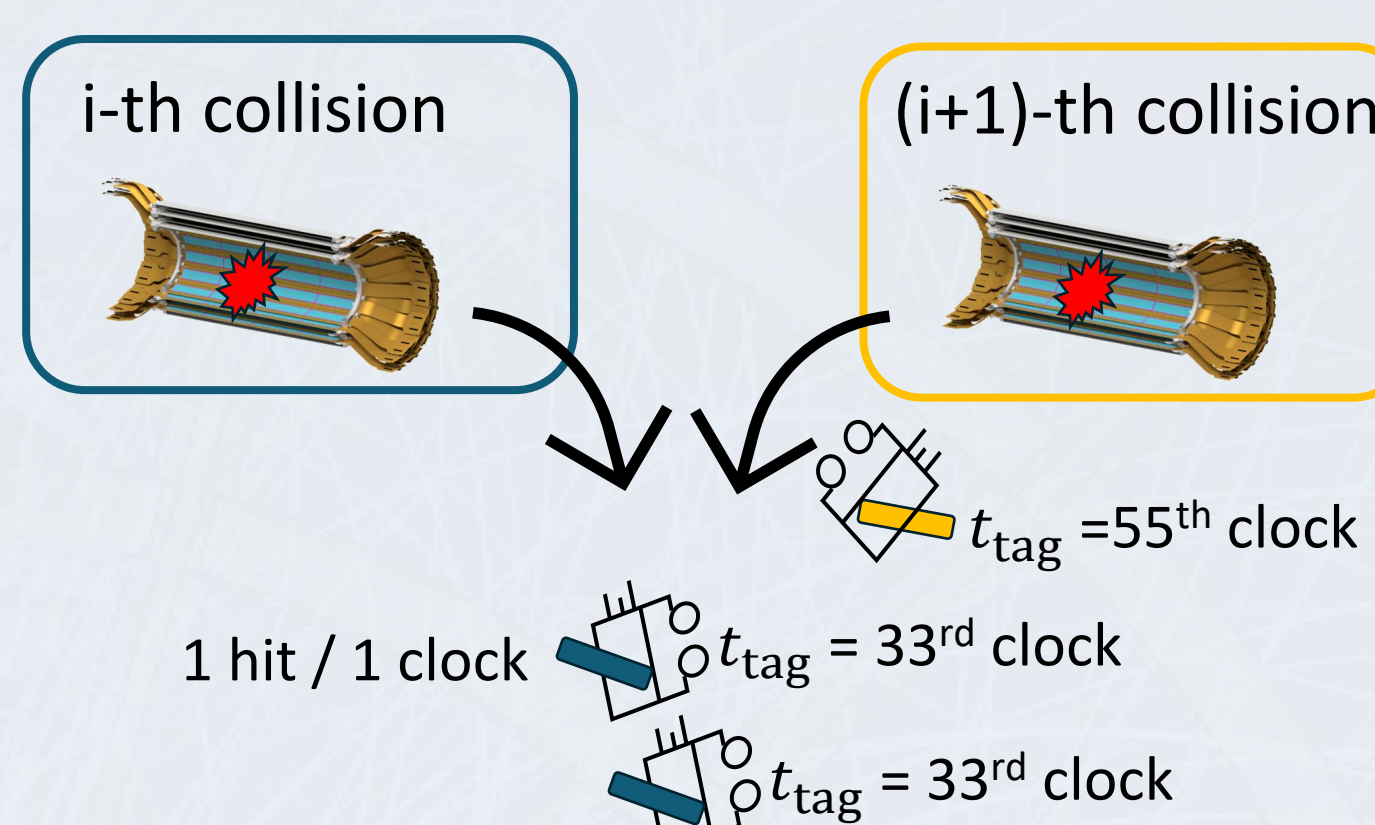
## Intermediate silicon tracker (INTT)

- Fine strip width:  $78 \mu\text{m}$  in  $\phi$   $\Rightarrow$  high spatial resolution
- 56 silicon ladders arranged in a barrel configuration with two layers
- Total  $\sim 370\text{k}$  channels
- Thin sensors  $320 \mu\text{m}$  ( $\sim 0.34\% X_0$ )  $\Rightarrow$  reduced multiple scattering
- Timing resolution less than one bunch-crossing of 106 ns.  
**The only detector capable of resolving each beam crossing,** among the sPHENIX tracking detectors.

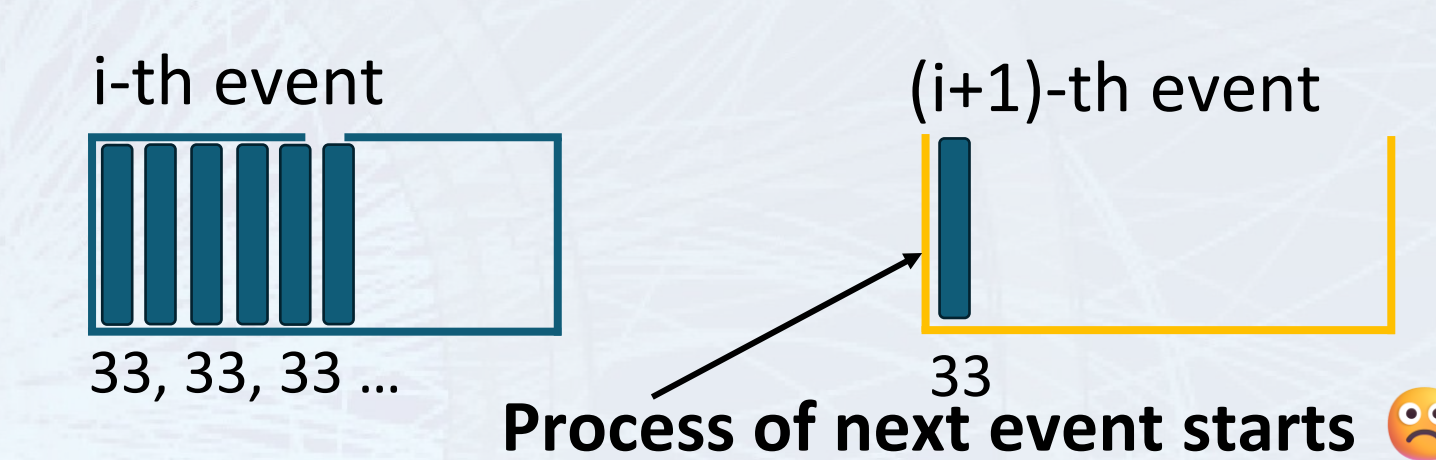


## Recovery of carryover hits

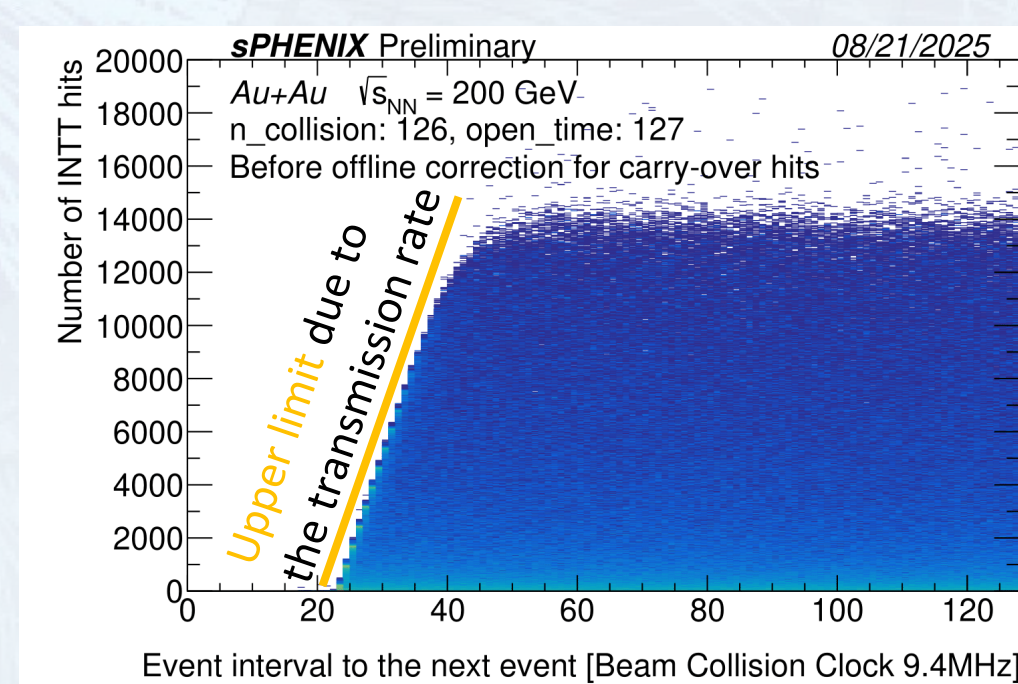
### Cause of the issue



If the next trigger comes before all hits arrive in DAQ server, Switch the rail, move to a new event!



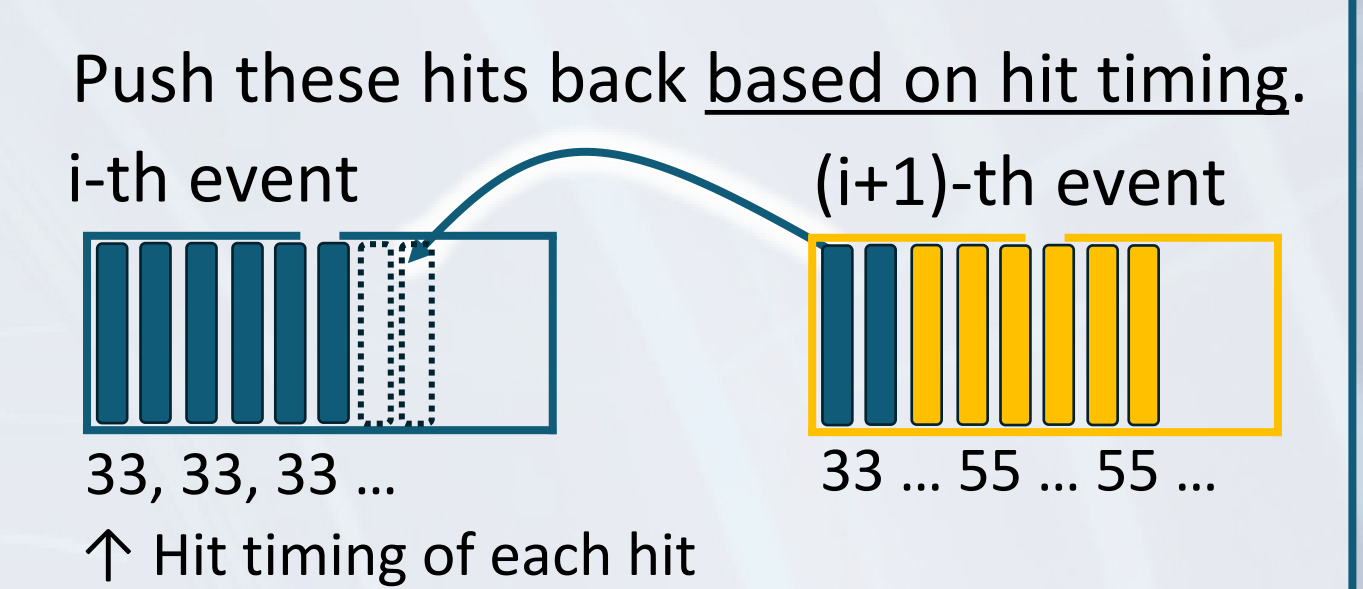
### Evidence



- Hit carryover occurs when
- multiplicity was so high that
  - hits cannot be fully sent to DAQ until next trigger comes.

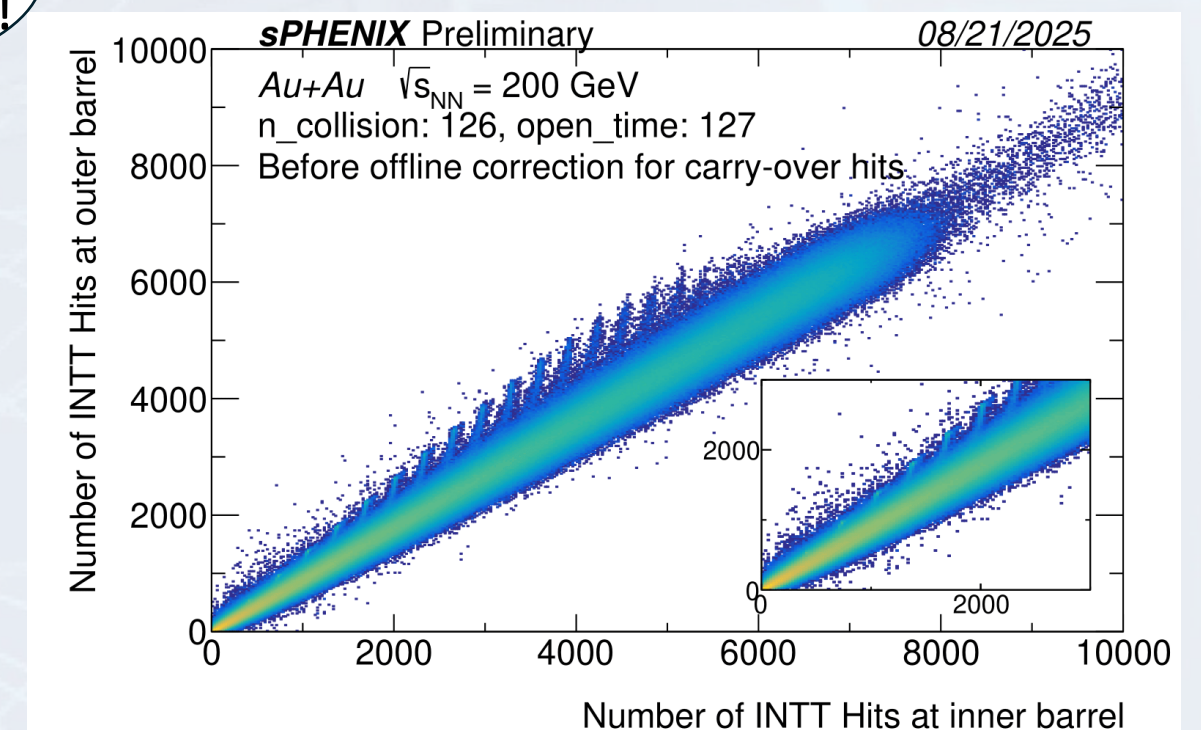
### How to push them back

Carryover hits should be pushed back to original event in offline.

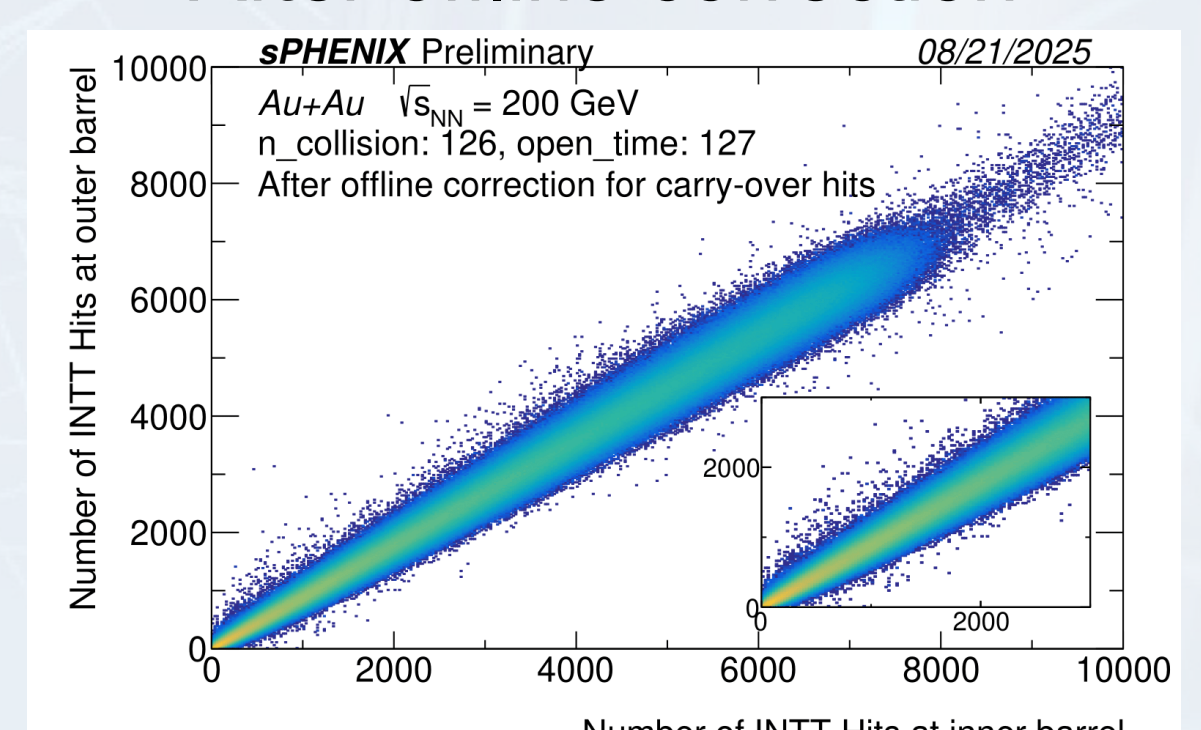


### Results

#### Before offline correction



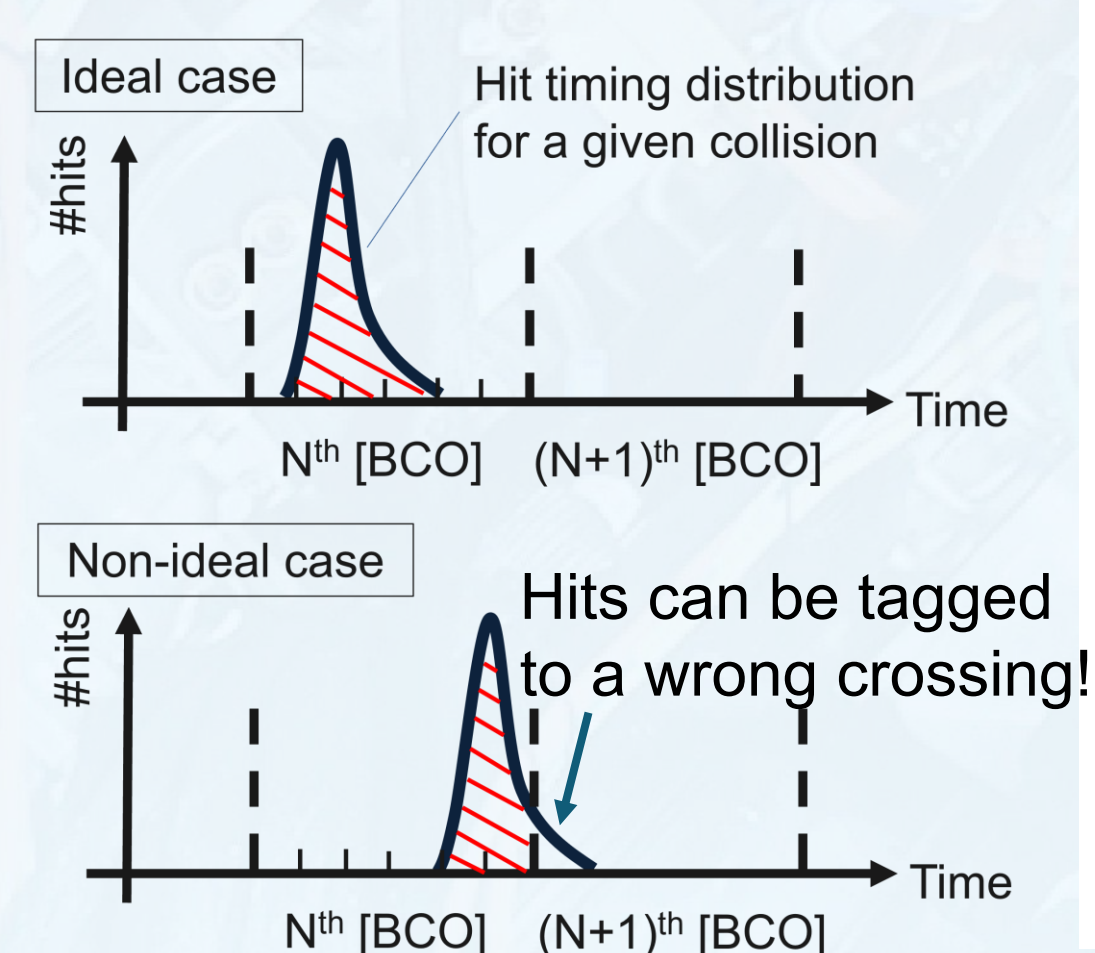
#### After offline correction



Offline correction works, and all carryover hits are pushed back!

## Timing Tuning

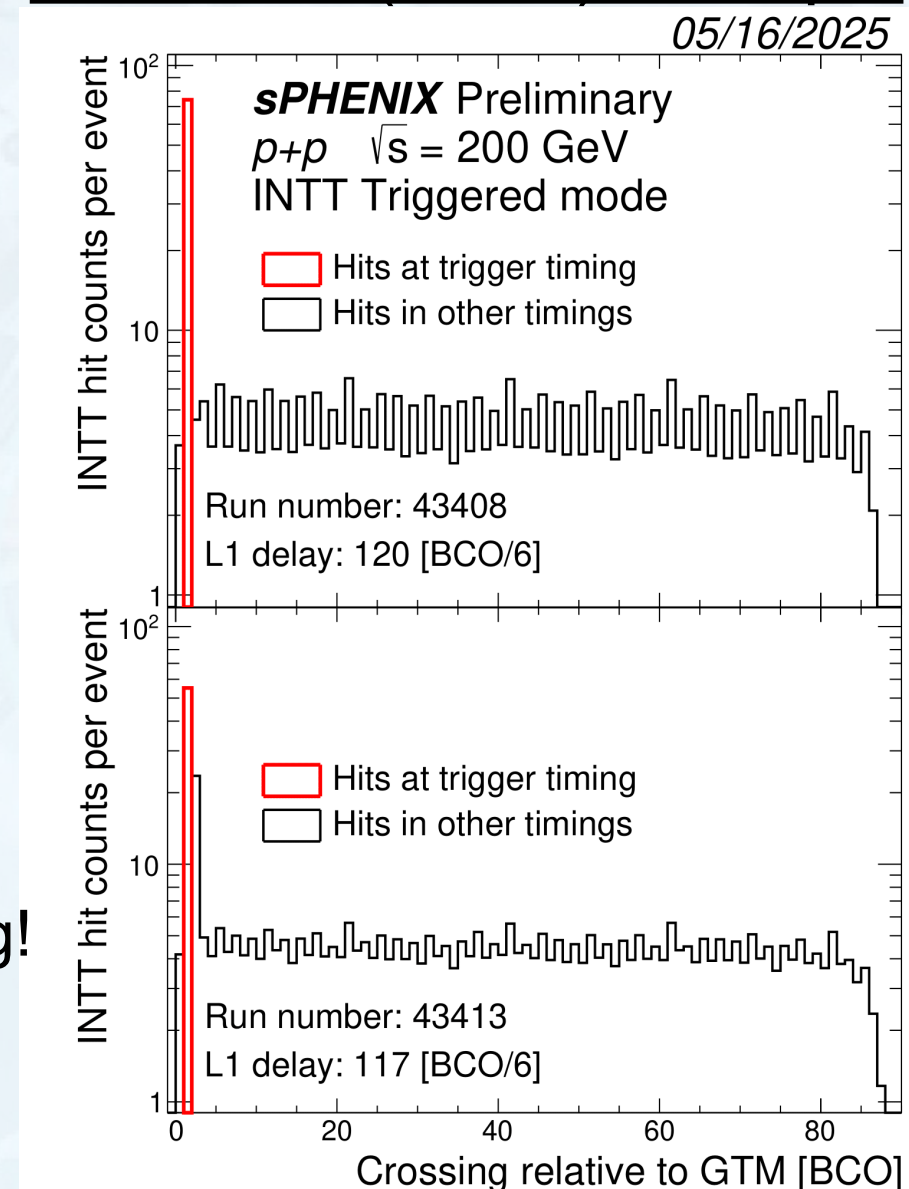
An online parameter was optimized to tune the delay between INTT's clock and sPHENIX's global clock.



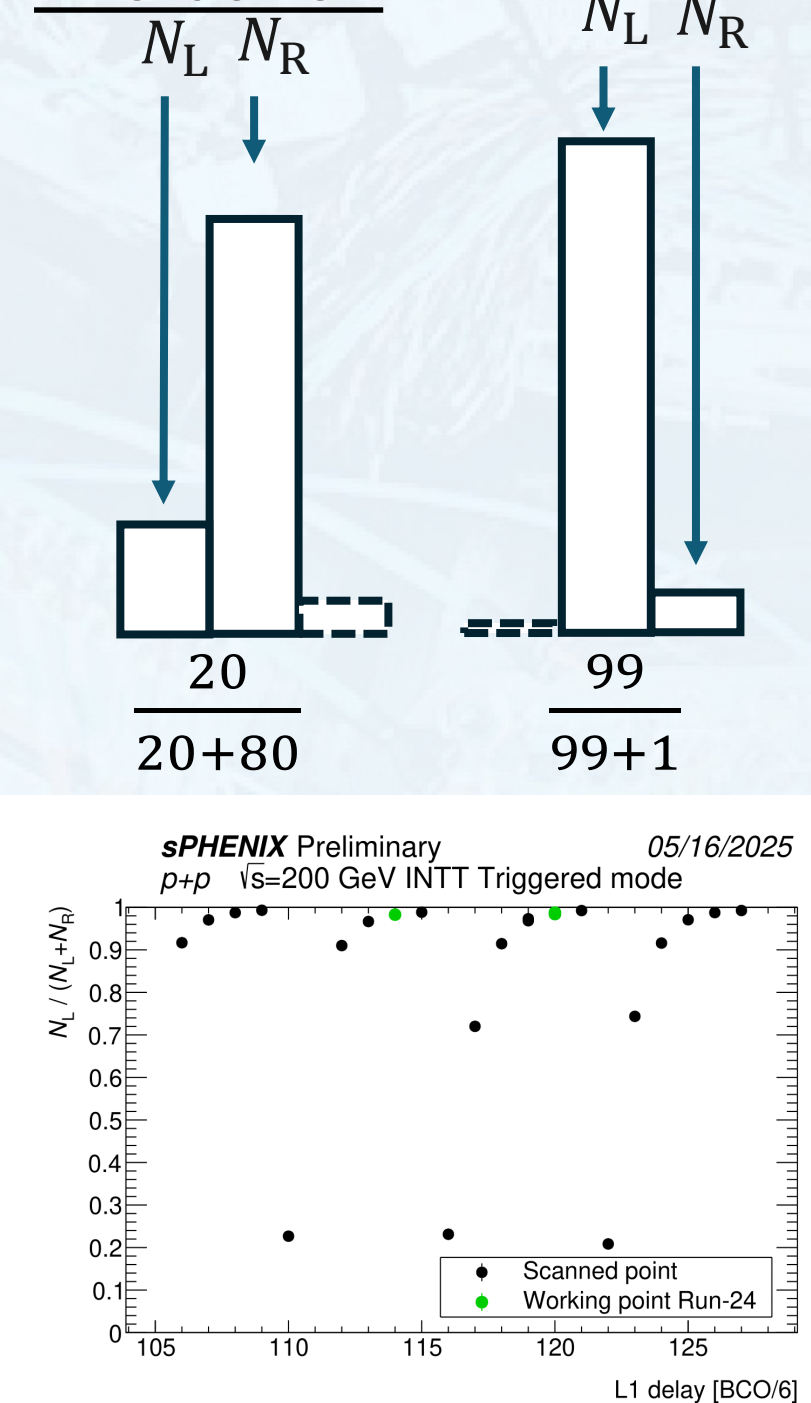
Note: BCO = 106 ns, an interval between each beam crossing

INTT has been operated with optimized delay parameter.

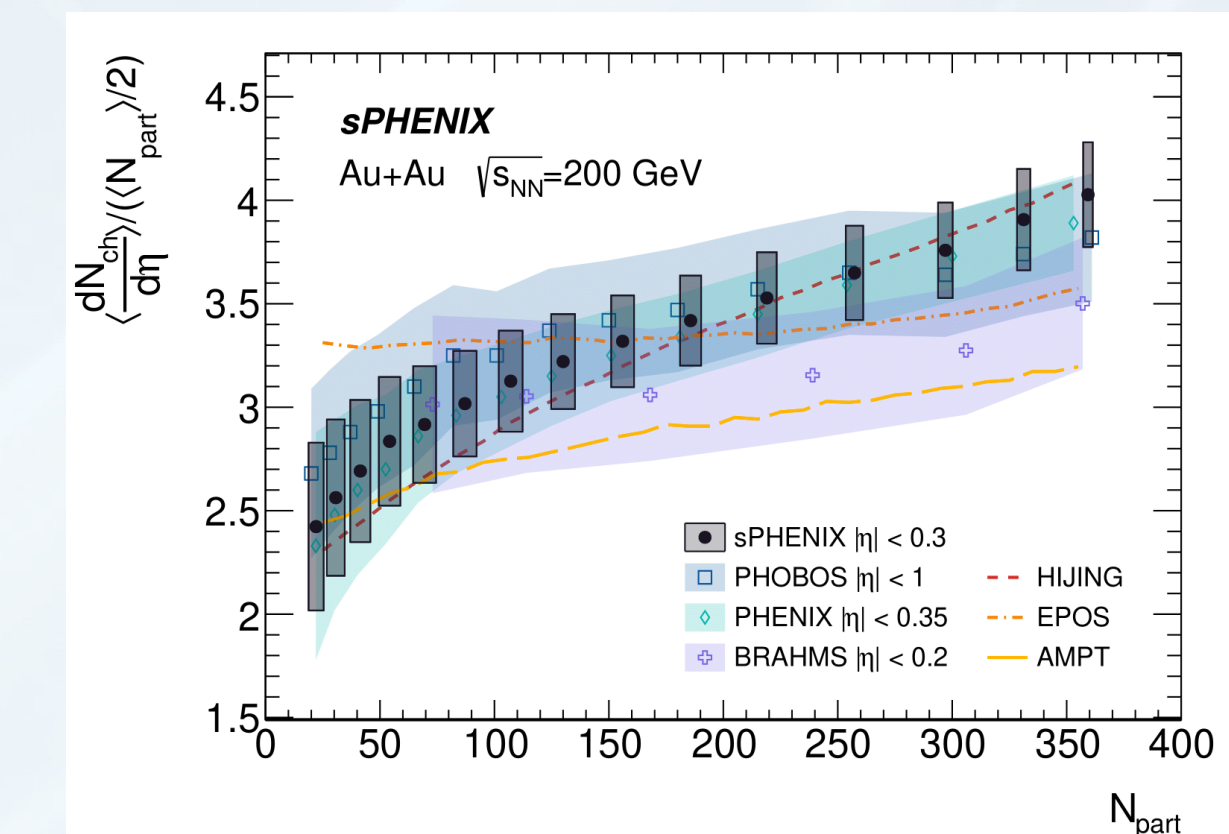
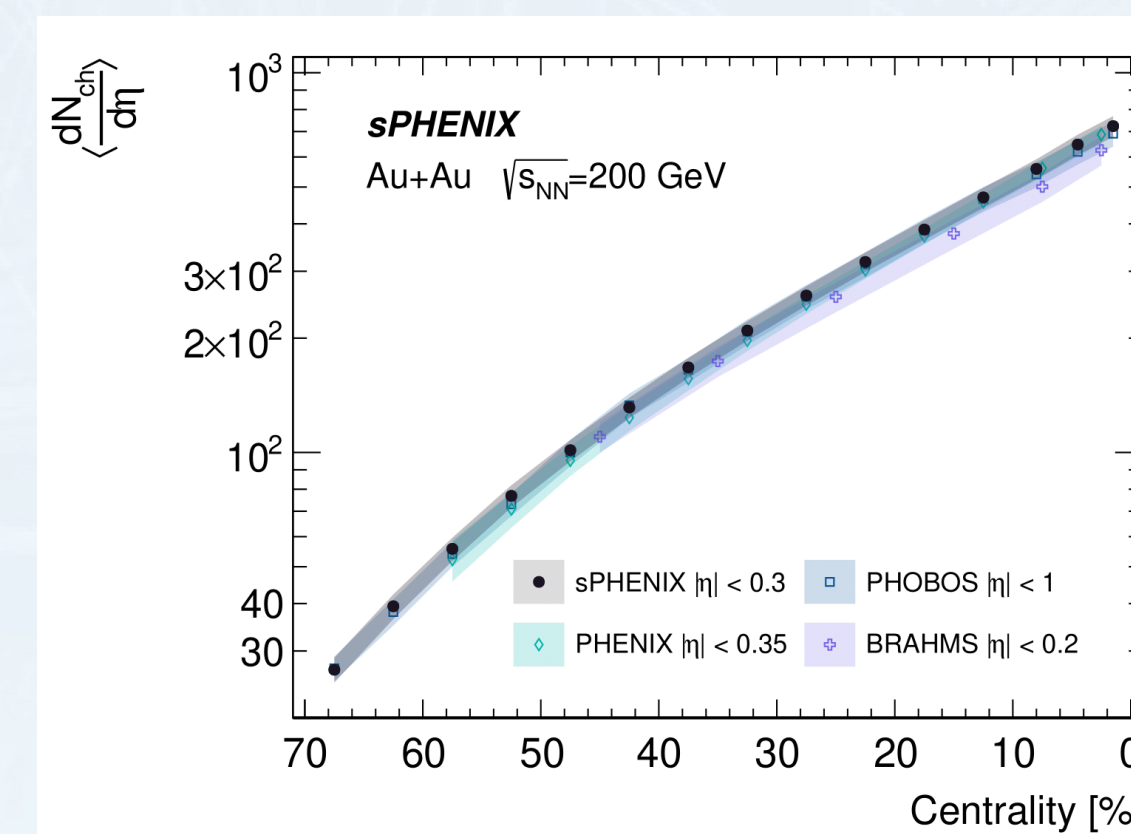
Ideal (upper) and Non-ideal (lower) example



### Evaluation



## Measurement of charged hadron multiplicity



- Consistent results with previous RHIC publications.
- HIJING describes the sPHENIX  $dN_{ch}/d\eta$  measurement best.

**First physics publication from sPHENIX, JHEP 08, 075 (2025) based on reconstructed tracklets by INTT, as a fruit of INTT's capability and solid operation!**