Quark Matter 2022 - the 29th International Conference on Ultra-relativistic Nucleus-Nucleus Collisions
4-10 April 2022, Krakow, Poland

Performance evaluation and mass production status for sPHENIX intermediate silicon tracker

Genki Nukazuka

(RIKEN BNL Research Center)

on behalf of the sPHENIX collaboration





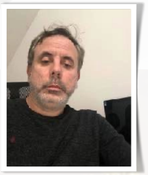




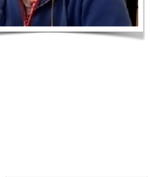




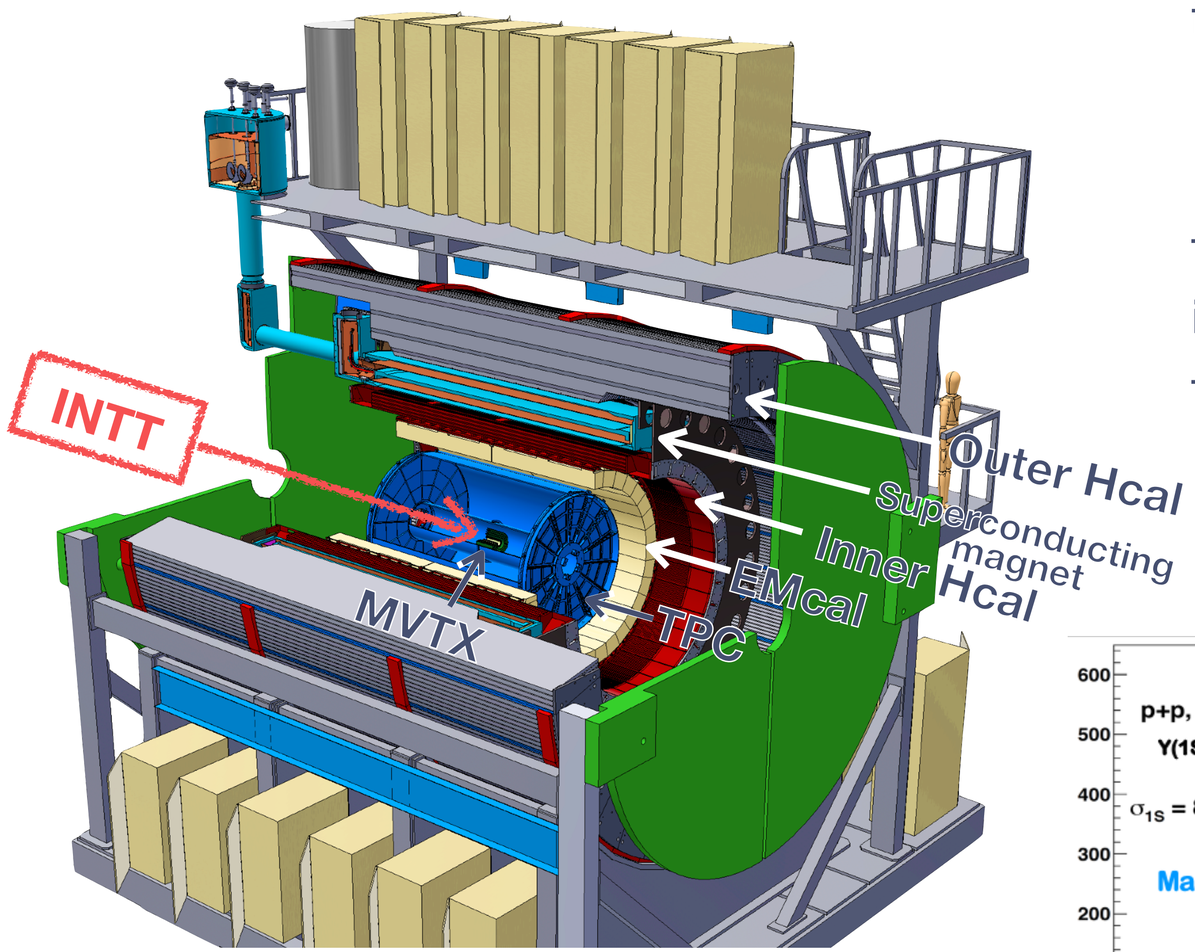










THE sPHENIX DETECTOR

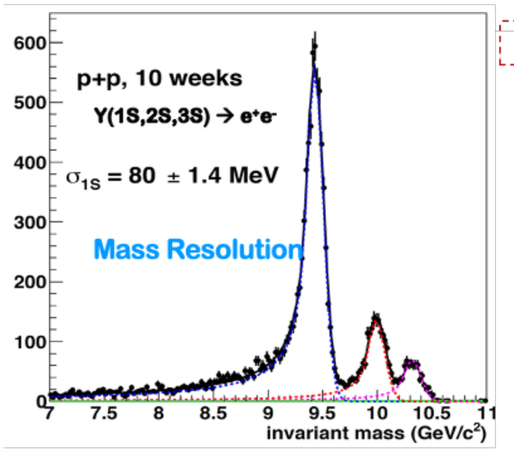
sPHENIX at RHIC in BNL will start data taking from 2023 for QGP and cold QCD physics:

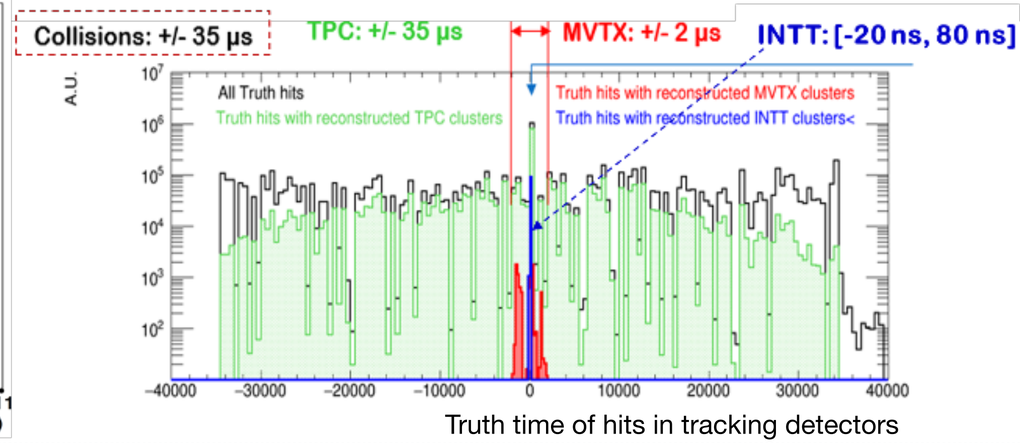
- QGP: γ-jet, b-quark tagged jet, Y (1S, 2S, 3S), …
- Cold QCD: transverse single spin asymmetry (direct γ, D^0, and inclusive jet in mid-rapidity), …

The sPHENIX detector covering full azimuthal angle in $|\eta| < 1.1$ and $|z_{vtx}| < 10$ cm is under construction.

The tracking system consists of 3 tracking detectors:

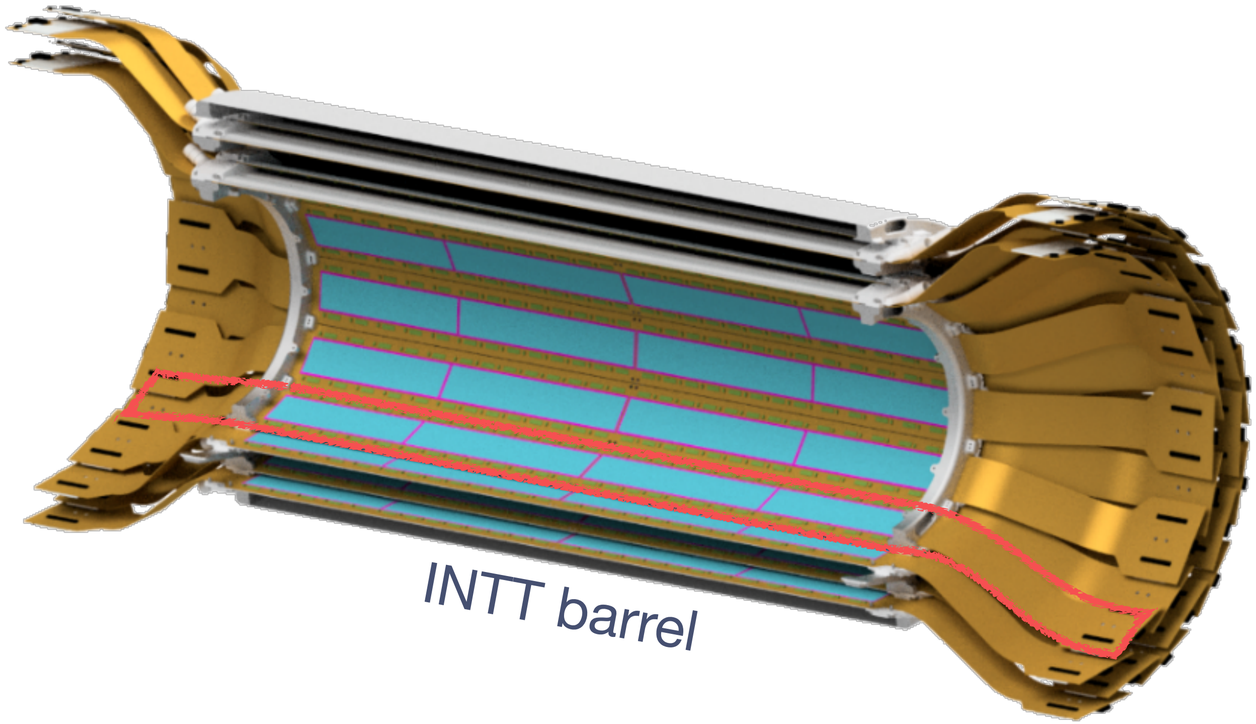
- MVTX (r < 4cm) : vertexing
- INTT (r < 10 cm) : hit position&timing matching
- TPC (r < 80 cm) : good momentum resolution

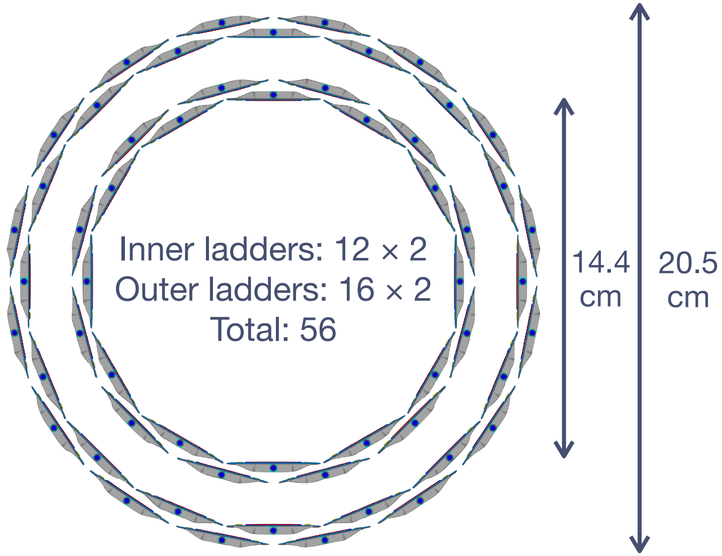




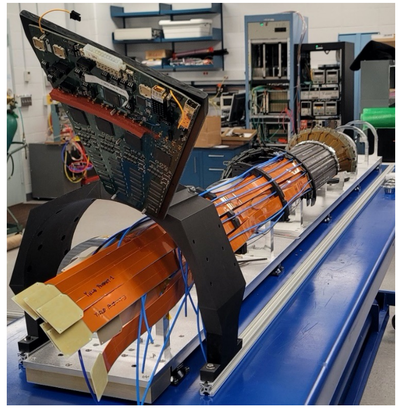
Truth time of hits in tracking detectors

INTermediate Tracker (INTT)

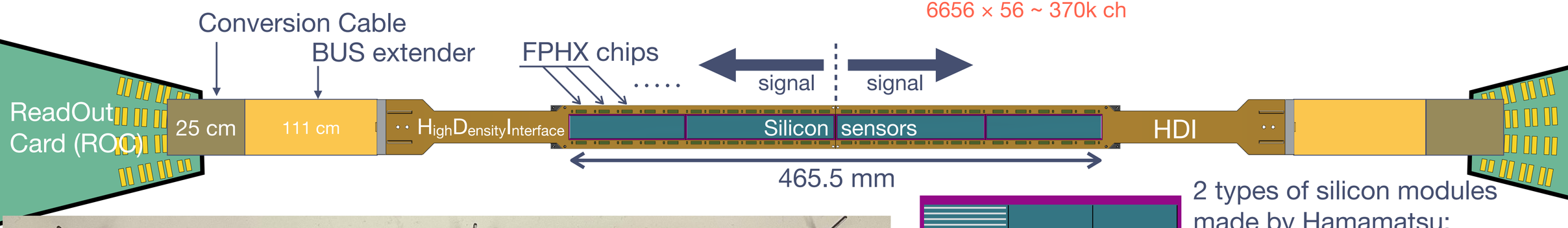




Cross-section



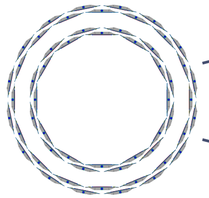
128 × 26 × 2 = 6656 ch/ladder
6656 × 56 ~ 370k ch



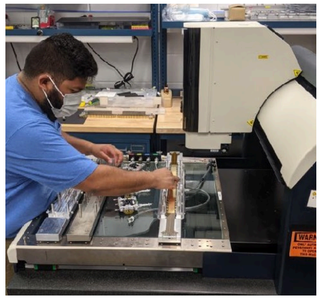
2 types of silicon modules made by Hamamatsu:

#strip:	128
strip width:	78 μm
strip length:	16 mm or 20 mm
thickness:	320 μm

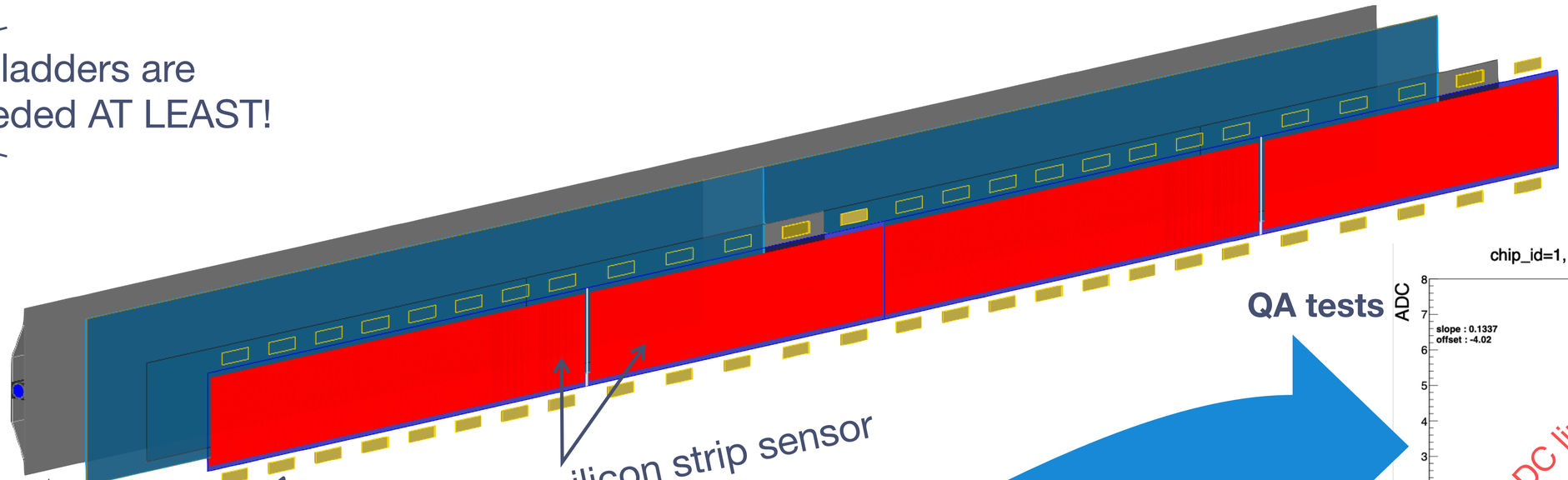
Ladder Mass Production: Smoothly done



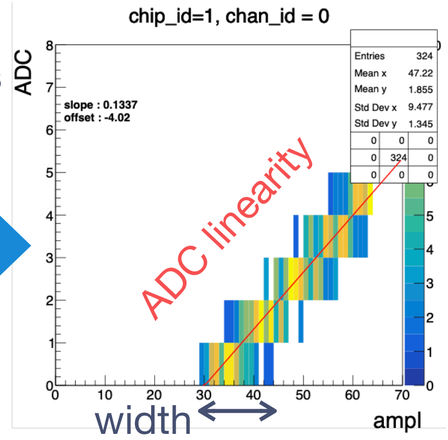
56 ladders are
needed AT LEAST!

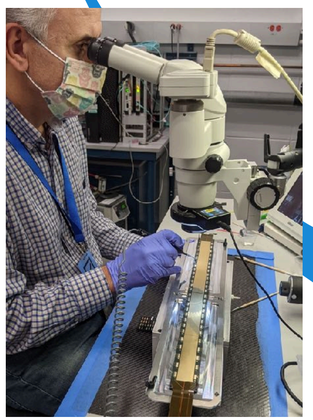


Gluing HDI to stave

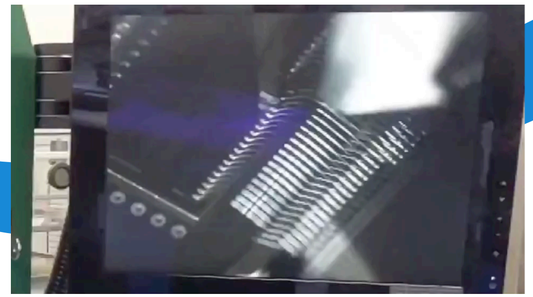


QA tests





Gluing FPHX
chips on a stave



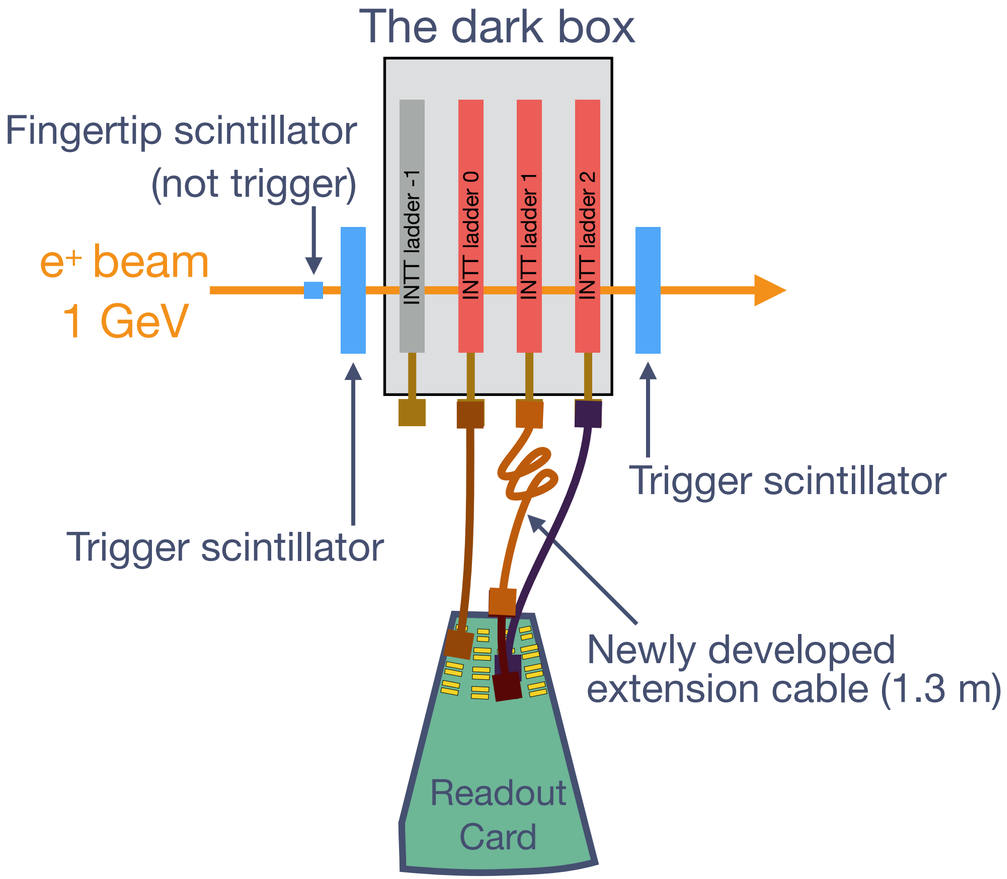
Wire bonding

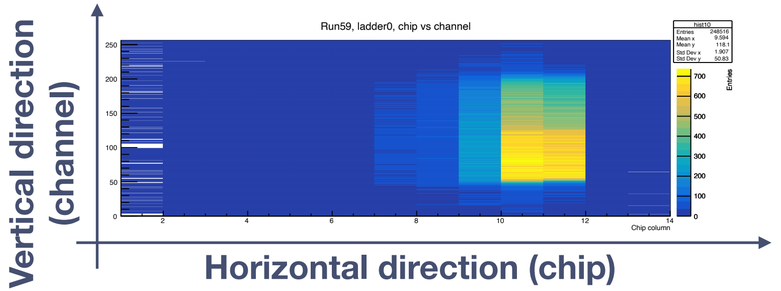
Encapsulation

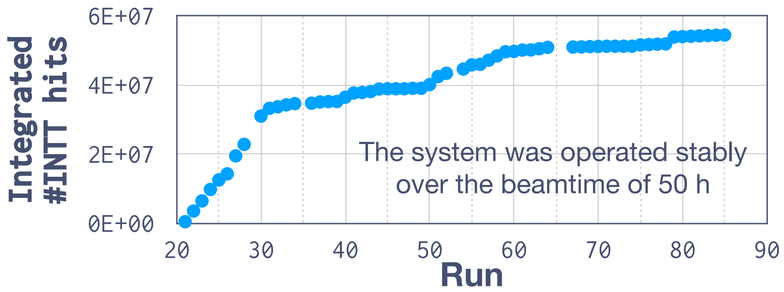
QA results	BNL	Taiwan	Total
Class 1 (#bad ch ≦ 0.5%)	71	11	82
Class 2 (0.5% < bad ≦ 1%)	2	2	4
Class 3 (1% < bad ≦ 2%)	1	0	1
Class 4 (2% < bad ≦ 3%)	9	0	9

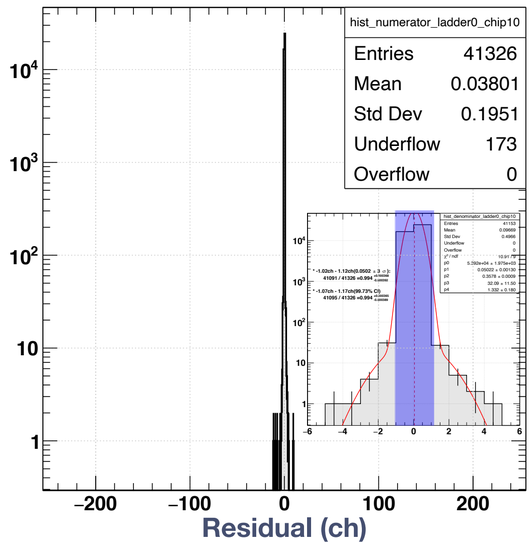
Ladder mass production was almost finished.
QA showed that most of them are in quite good condition.

Performance: Test beam experiment in 2021









Detection efficiency: $\varepsilon_i \equiv \dfrac{N(h_i \cap h_j \cap h_k)}{N(h_j \cap h_k)}, \ (i \neq j \neq k)$

	ε Ladder 0	ε Ladder 1	ε Ladder 2
My analysis	0.994	0.986	0.992
Cheng-Wei's analysis	0.992	0.998	0.991
MC	0.995	0.996	0.998

More than 99% efficiency even with the new extension cable confirmed!

WE ARE READY FOR THE INSTALLATION!