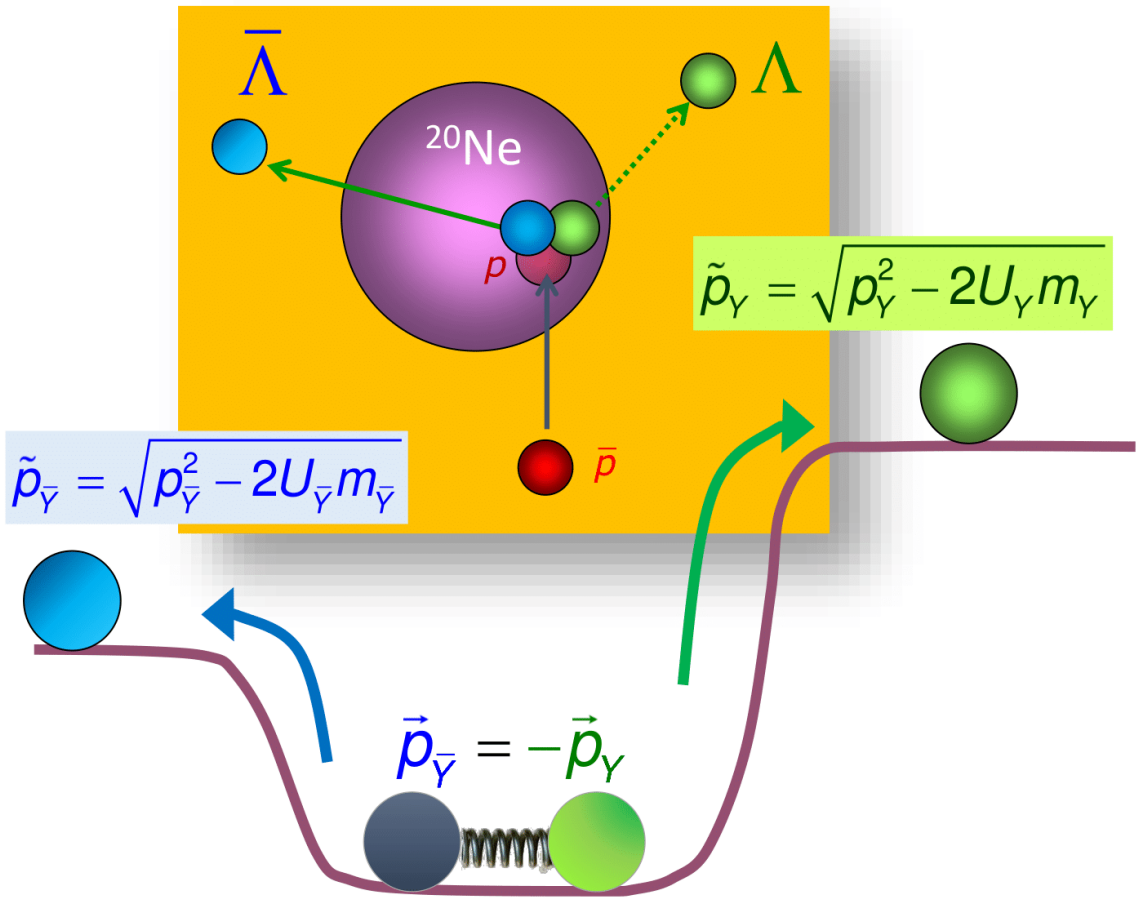
Status report of the hyperon-antihyperon experiment at day-1

Falk Schupp

Antihyperon-hyperon pair production in nuclei



- inital transverse momentum of
  $\bar{p} + A \rightarrow Y\bar{Y}$ is zero
  - except fermi motion

- Respective nuclear potentials will influence their momenta

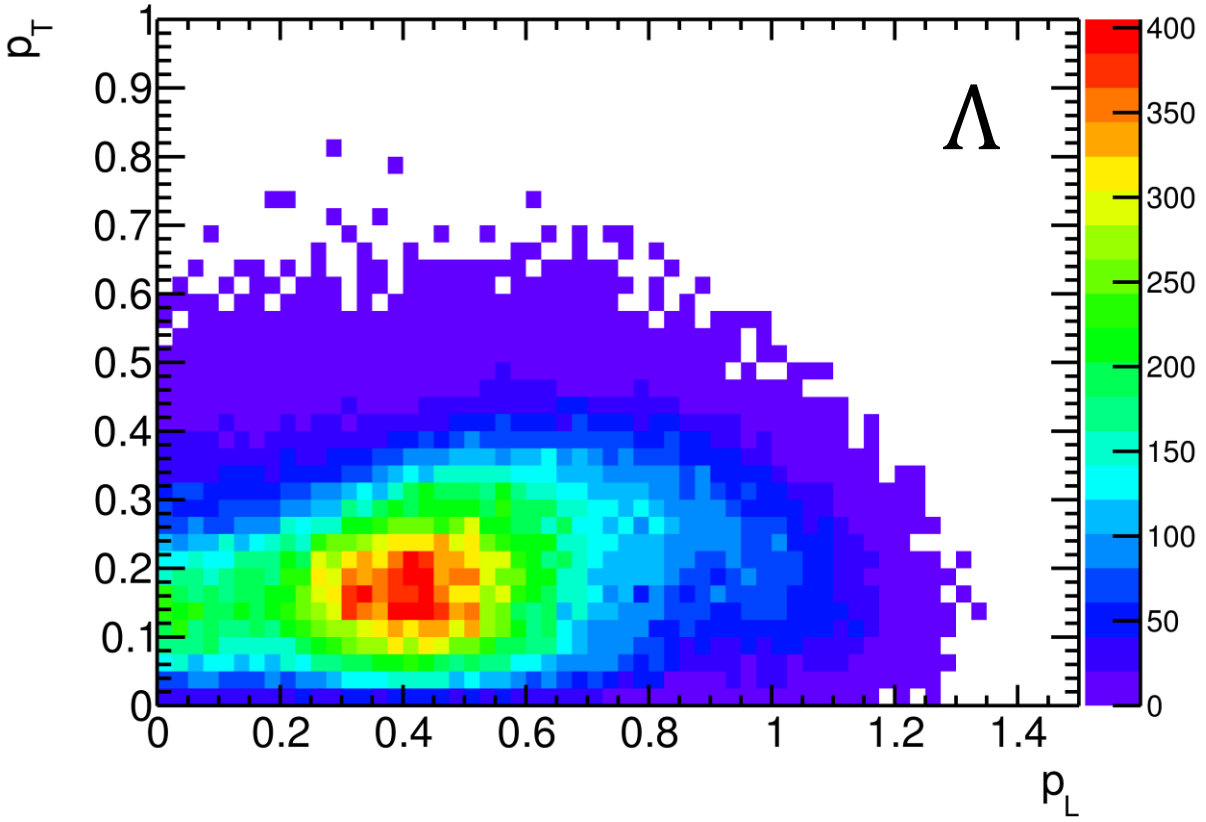
- Momentum distribution will reflect depth of potential

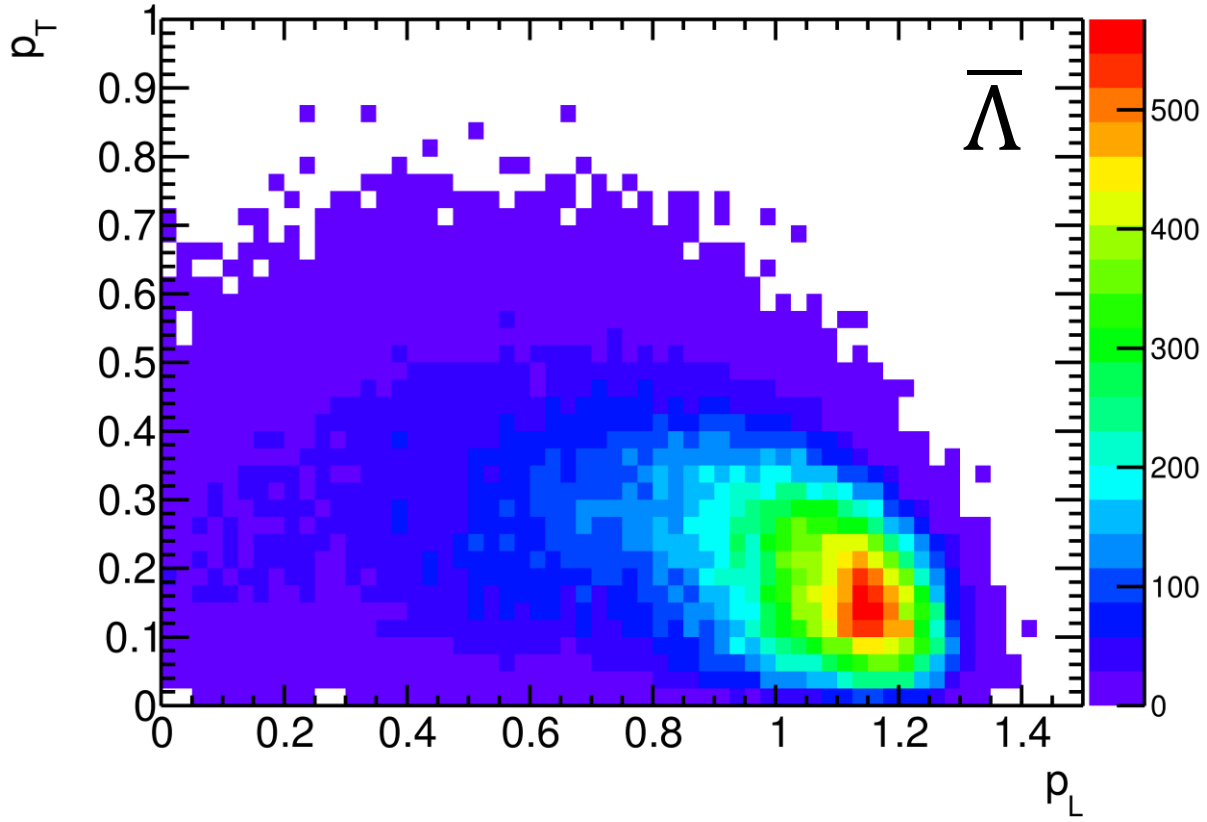
Simulation using the GiBUU transport model

- ^{20}Ne ($\bar{p}$, $Y\bar{Y}$)X reaction at different momenta
  - With antihyperon potentials scaled between $\xi_{\bar{\Lambda}/\bar{\Xi}}$ = 0.0 – 1.0
  - With GiBUU rel. 2017

	Momentum [GeV/c]	$\xi_{\bar{\Lambda}/\bar{\Xi}}$	# simulated events	Effective Panda time	Simulation time	Disc space
$\bar{p} + A \rightarrow \bar{\Xi}\Xi$	2.90	0.0, 0.5, 1.0	812,700,000	56.0h	45d	5.8 TB
	1.64	0.0, 0.25, 0.5, 0.75, 1.0	162,540,000	11.2h	15d	1.9 TB
$\bar{p} + A \rightarrow \bar{\Lambda}\Lambda$	1.52	0.0, 0.25, 0.5, 0.75, 1.0	135,450,000	9.3h	12d	1.6 TB

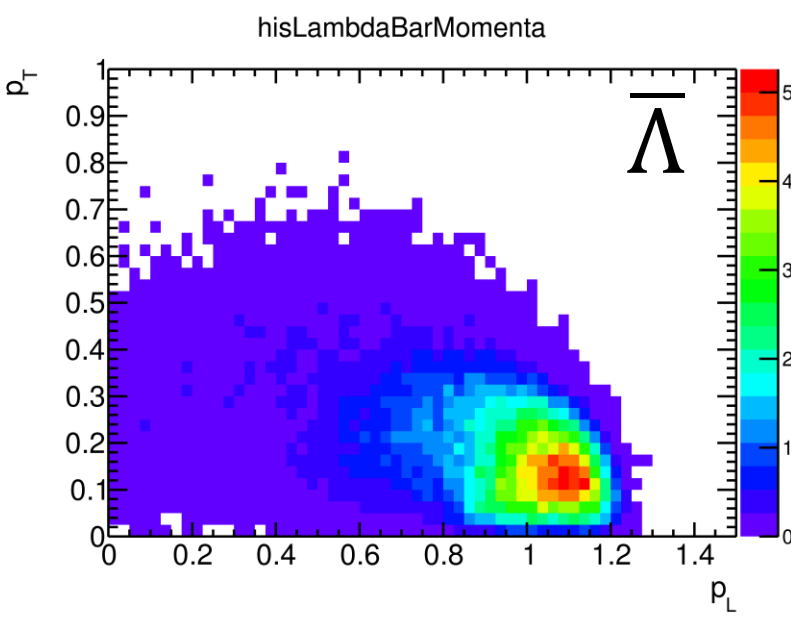
Momenta distribution at 1.64 GeV/c



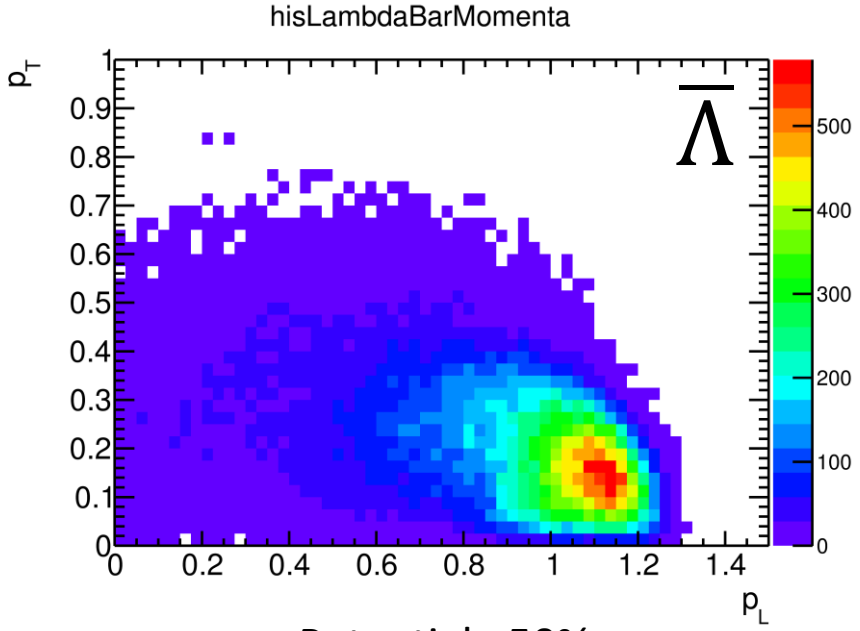


- $\overline{\Lambda}$ peaking in forward direction
- Expected distribution but smeared out by fermi motion

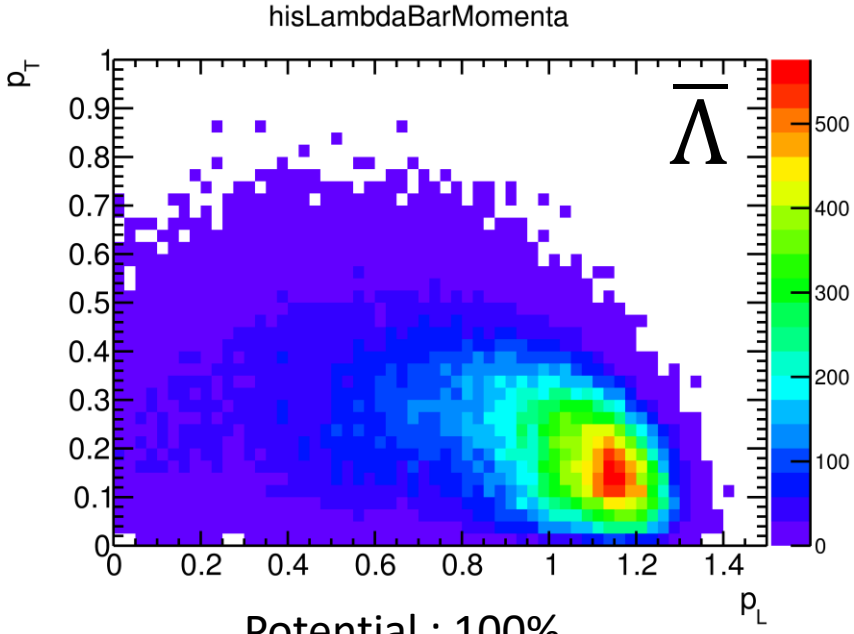
Potential dependence of momenta distribution



Potential : 0%



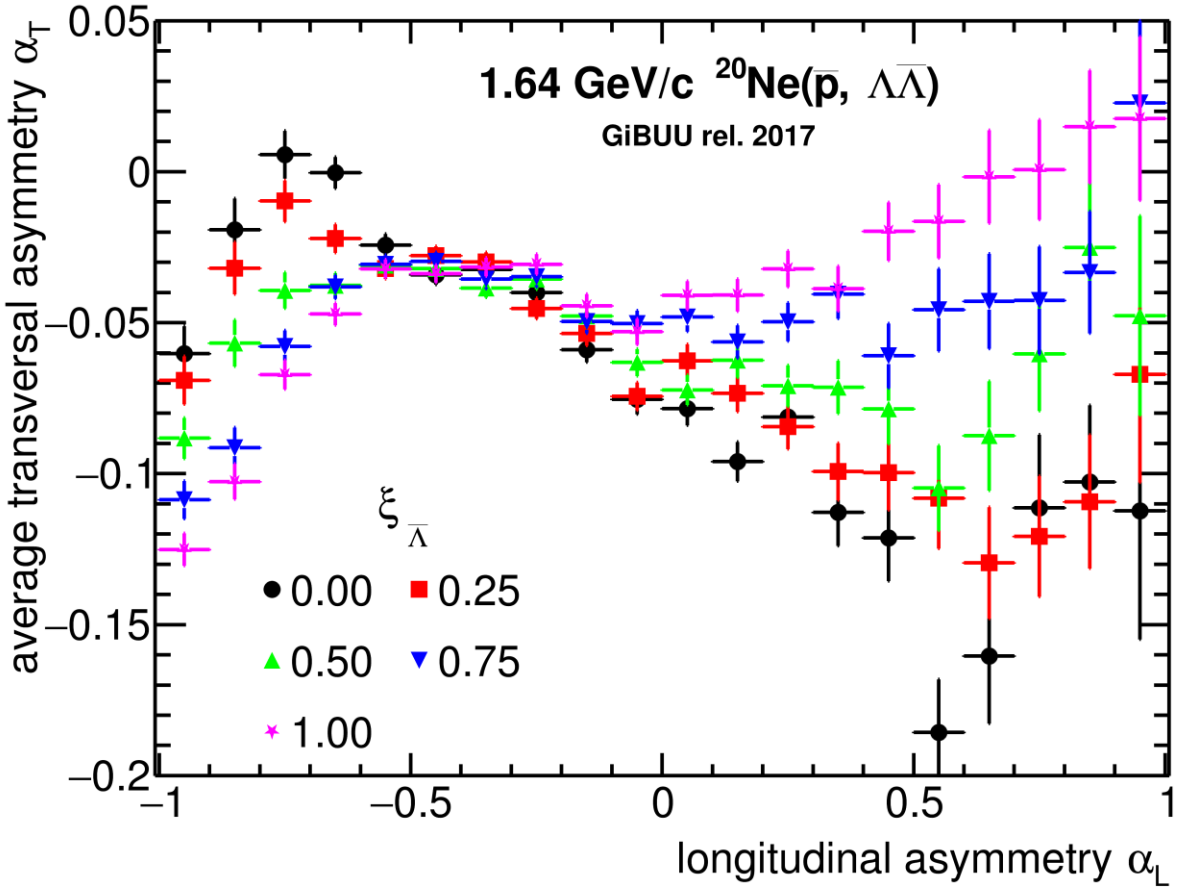
Potential : 50%



Potential : 100%

- $\overline{\Lambda}$ momentum distribution barely affected by potential scaling

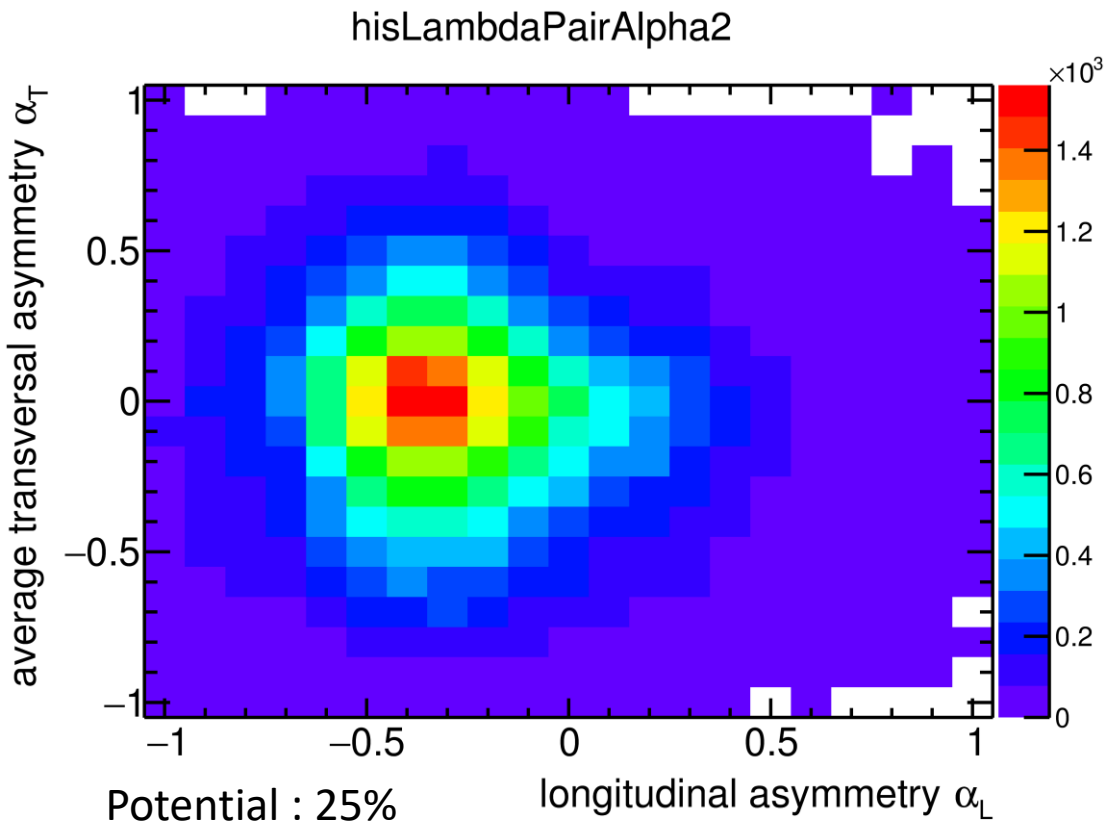
Momentum asymmetry



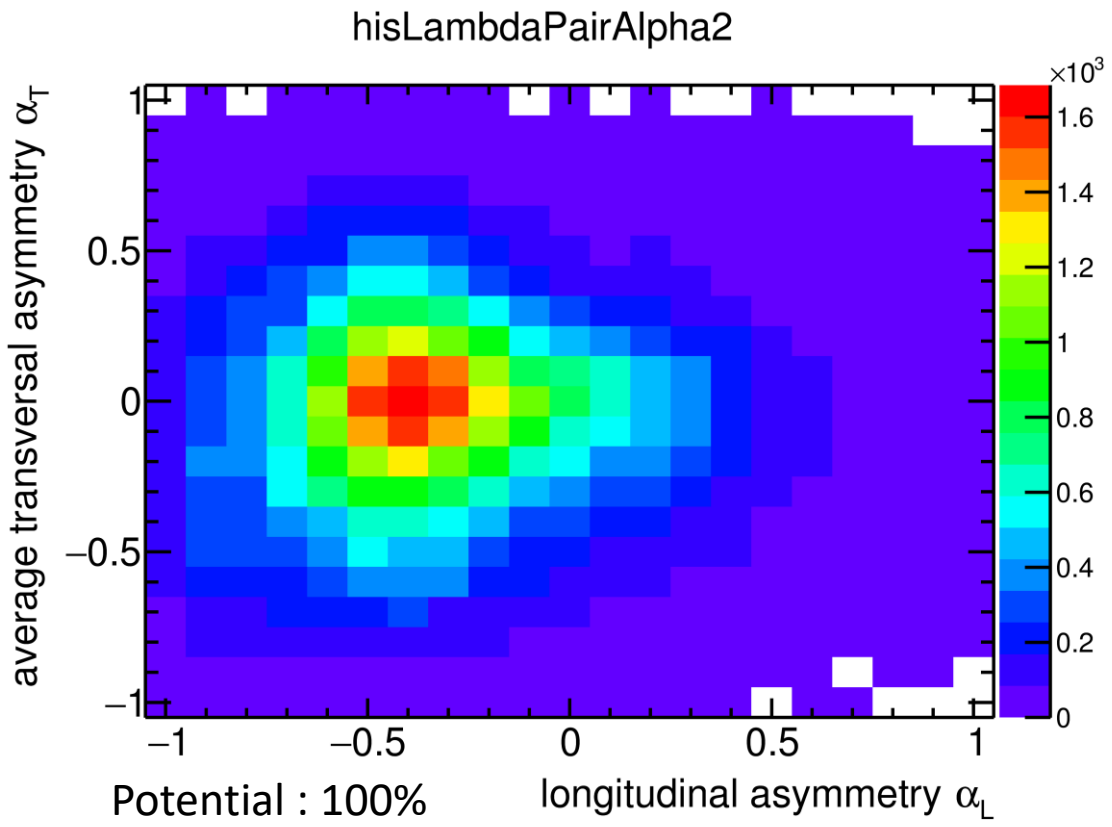
$$\alpha_T = \frac{p_T(\Lambda) - p_T(\bar{\Lambda})}{p_T(\Lambda) + p_T(\bar{\Lambda})}. \qquad \alpha_L = \frac{p_L(\Lambda) - p_L(\bar{\Lambda})}{p_L(\Lambda) + p_L(\bar{\Lambda})}.$$

- Possible observable : momentum asymmetry
- High sensitivity to antihyperon potential
- Statistics as expected after ~12h with PANDA

Scatter plot of momentum asymmetry



Potential : 25%



Potential : 100%

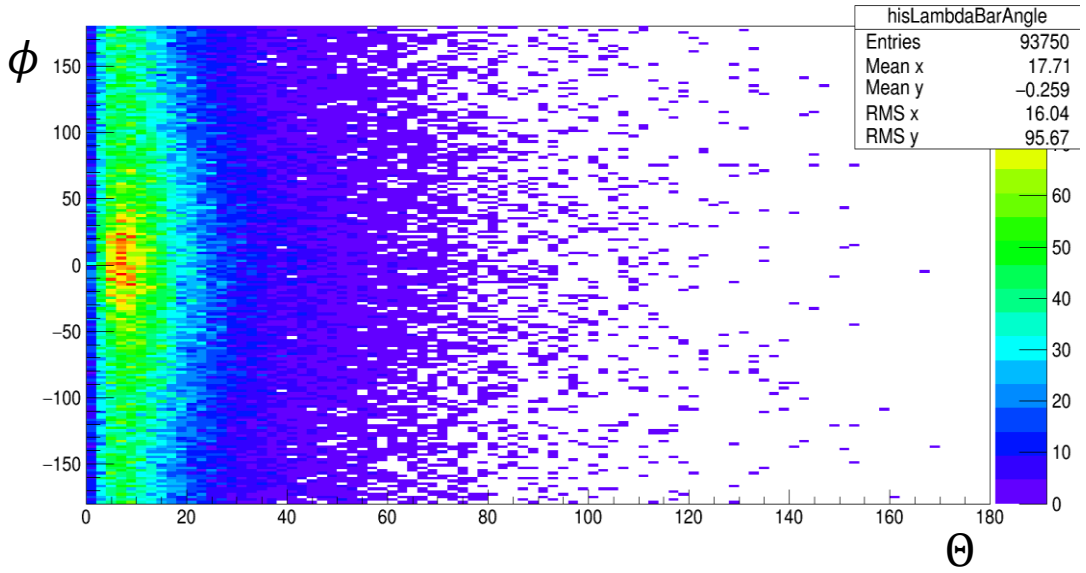
PandaROOT tracking/reco with day1 setup

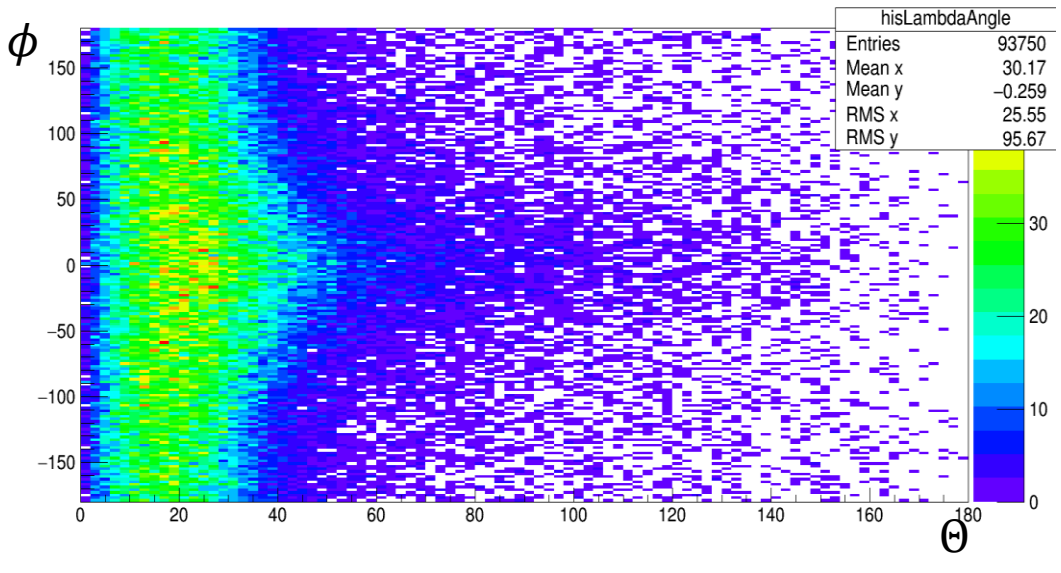
GiBUU

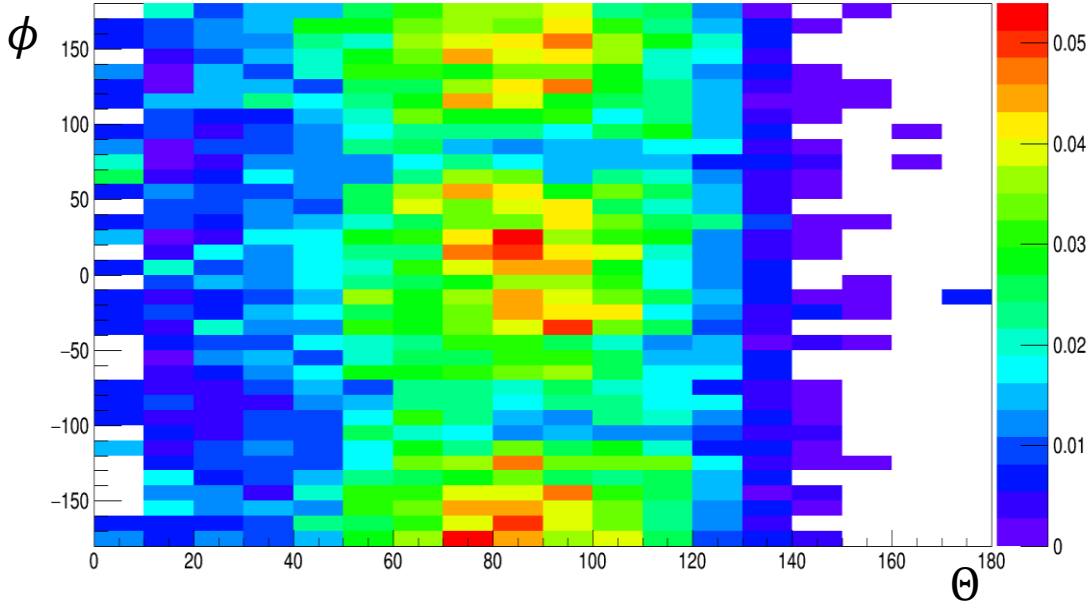
Pnd BoxGen

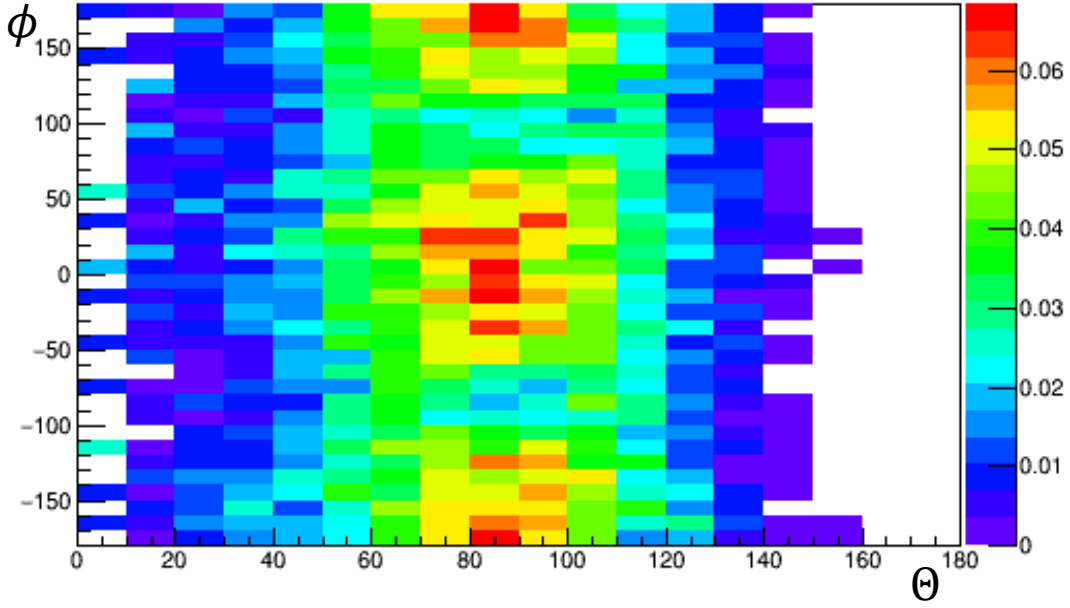
$\overline{\Lambda}$

Λ



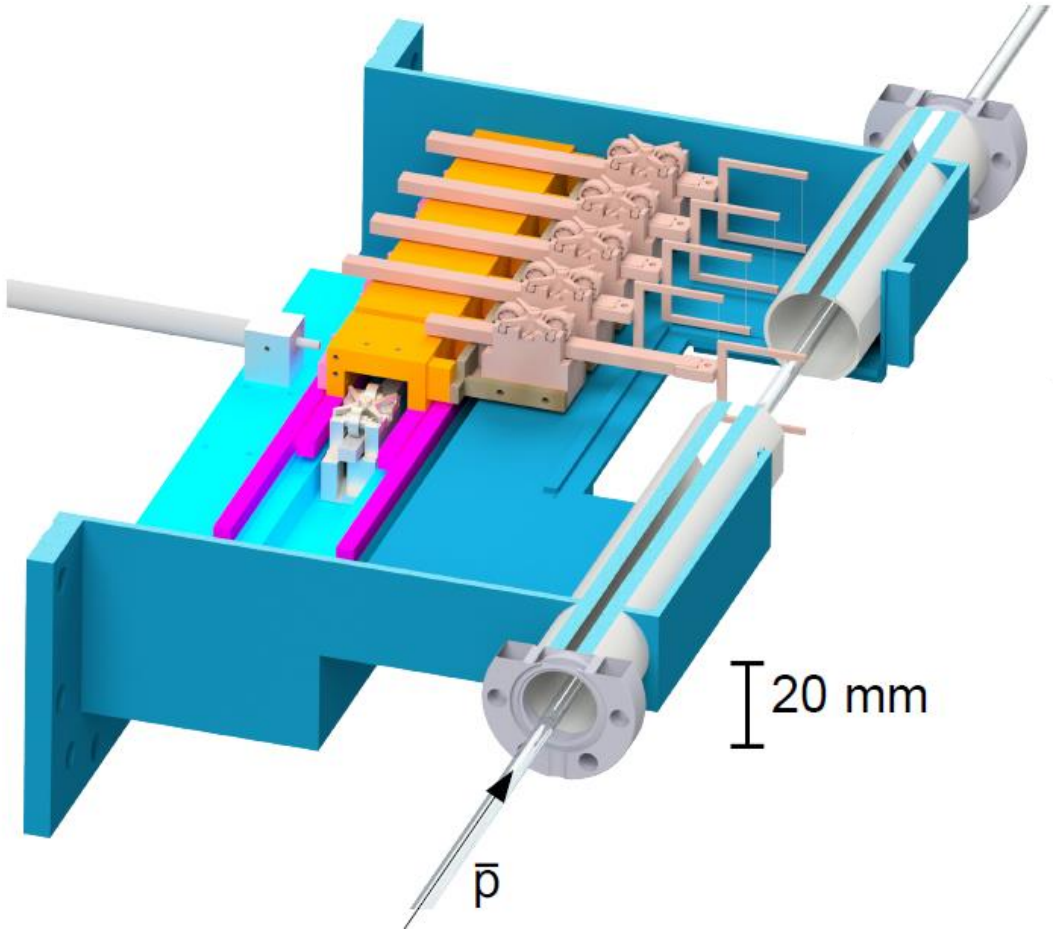


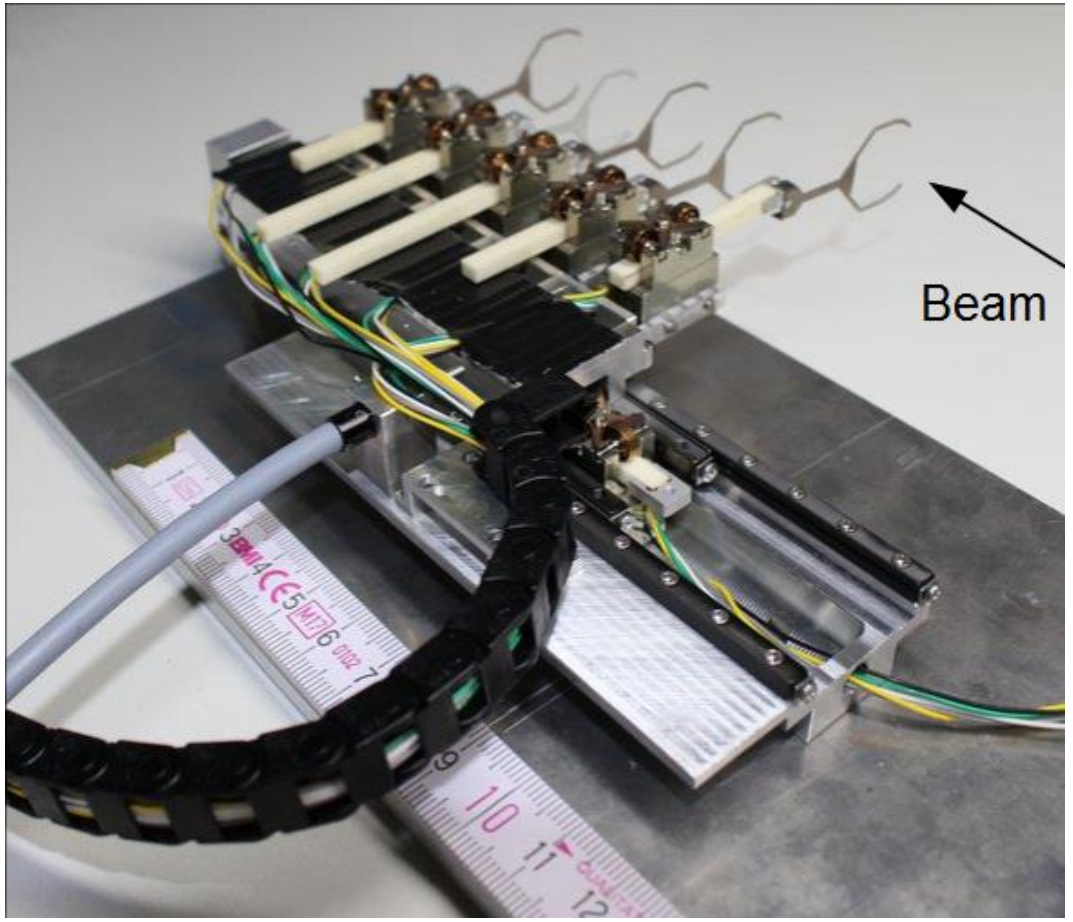




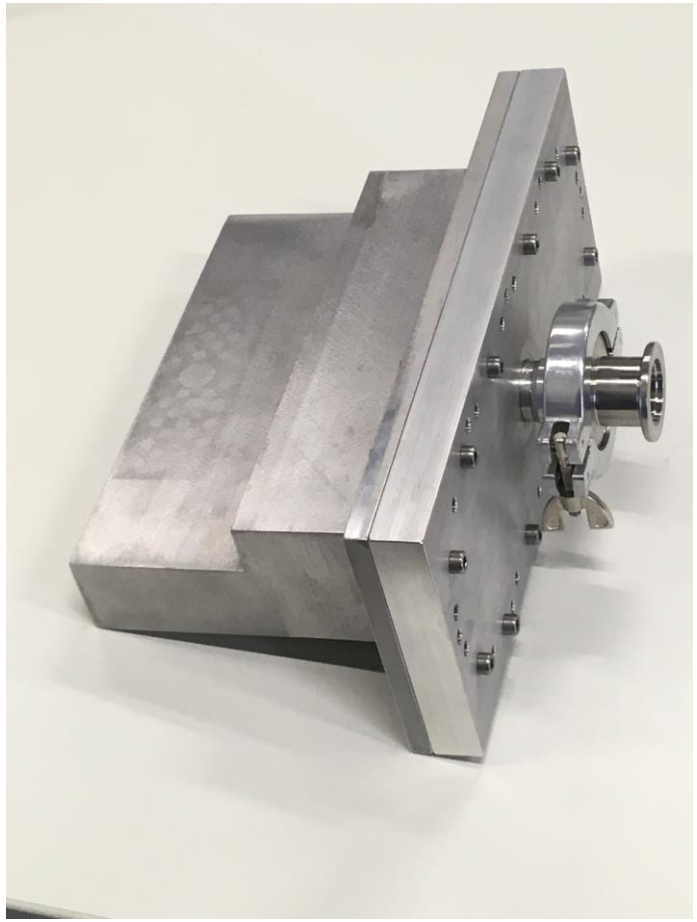
- Current status:
  - No reconstruction for pairs using day1- setup and idealTracking with StandardTrackFunctor
    - $\overline{\Lambda}$ reco insufficient in forward direction
    - Λ reco also quite low
- Few percent pair reconstruction using the AllTracksFunctor
    - Might be to few detector planes for $\overline{\Lambda}$
- Or might be a bug in my tracking/analysis
  - Just started working on it and lots of work still to do ☺

Progress on the hypernuclear setup:

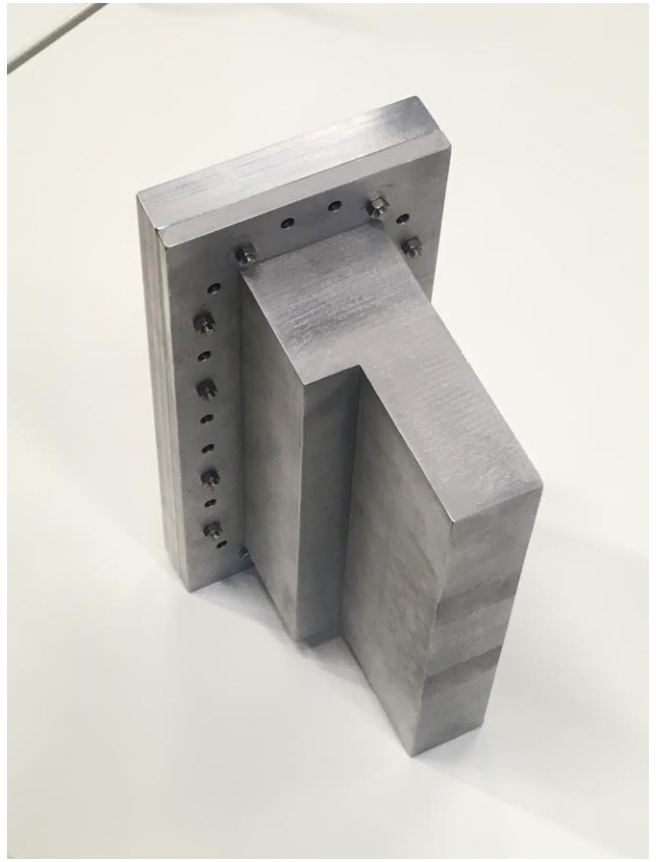




vacuum chamber prototype

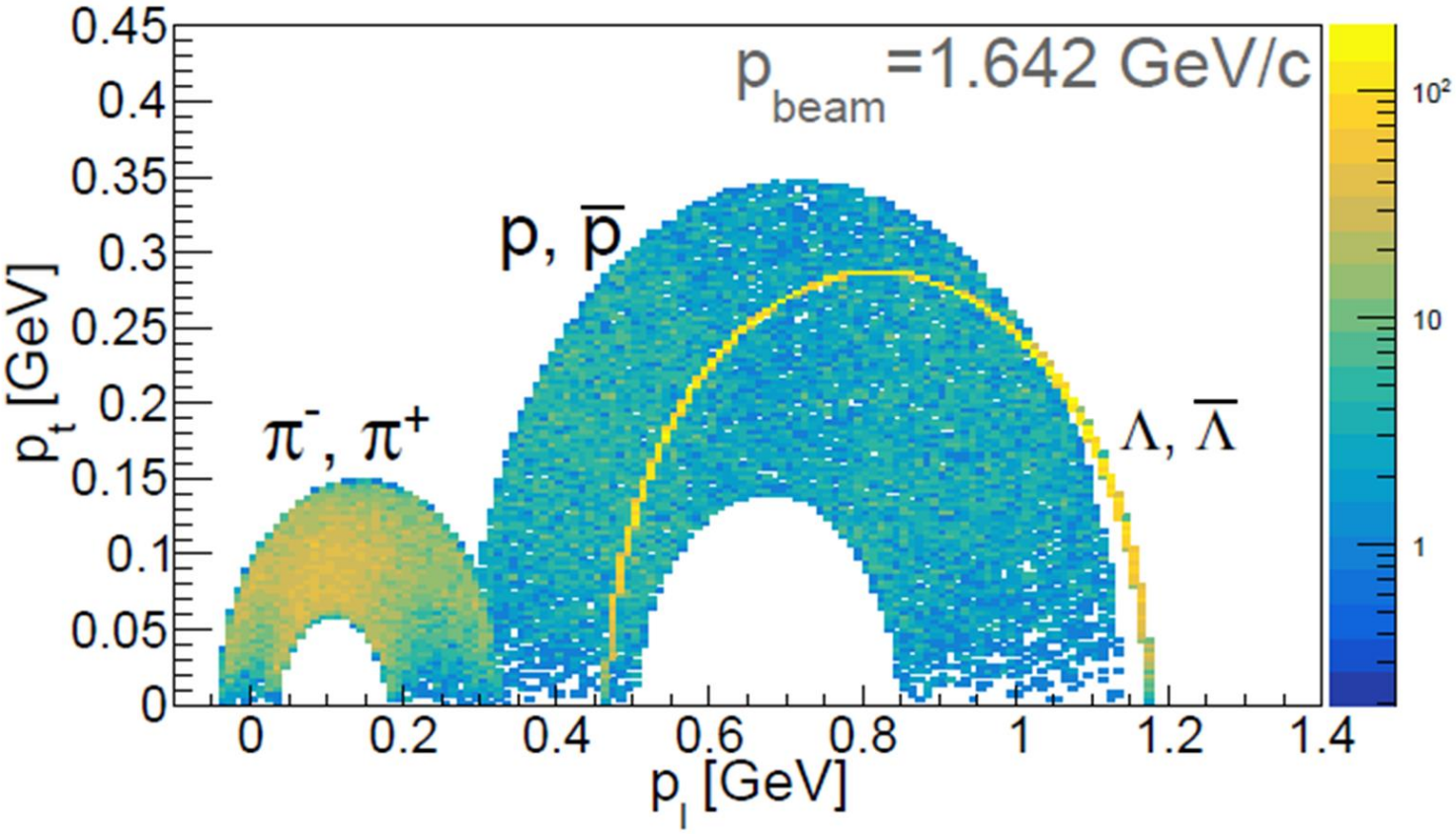


- 3D printed aluminium
  - Advantage: complex structures inside chamber
  - Difficult with CNC
- 1cm wall thickness
  - Printing possible 2mm
- Leak rate tests successful
  - Insignificant leaks
- Next step:
  - measure achievable vacuum
  - reduce wall thinkness



Thank you for your attention

Backup


p_beam=1.642 GeV/c
p, p̄
π⁻, π⁺
Λ, Λ̄
p_t [GeV]
p_l [GeV]
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
10²
10
1