Preparation (DAQ and data analysis) for the $^3\mathrm{He}$ breakup test

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The ^{3}He breakup test

- At RHIC, the proton beam polarimetry, based on detecting of recoil protons from the forward elastic beam scattering off the polarized proton target, was successfully used.

- The same (similar) method is being considered for the hadronic polarimetry at RHIC.

- However, for the ^{3}He beam, there is a concern that the helion breakup can significantly affect result of the polarization measurement.

- To tag and veto the breakup events, a system consisting of scintillator counters V_p and V_d, and ZDC V_n to detect the breakup protons, deuterons, and neutrons, respectively, is considering.
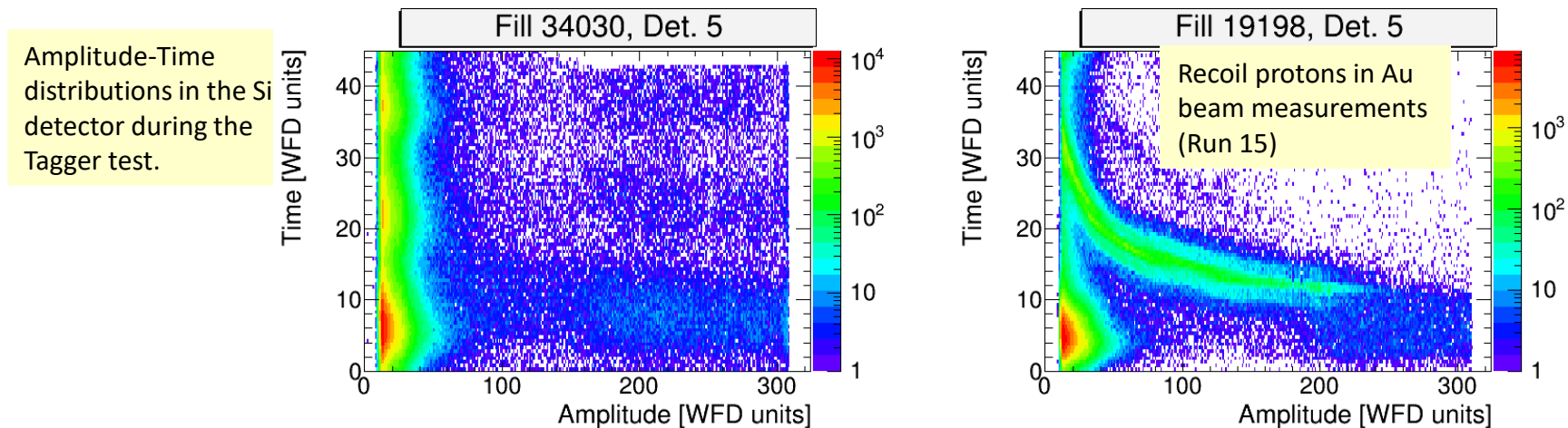

Deflection angle $\propto Z/A$
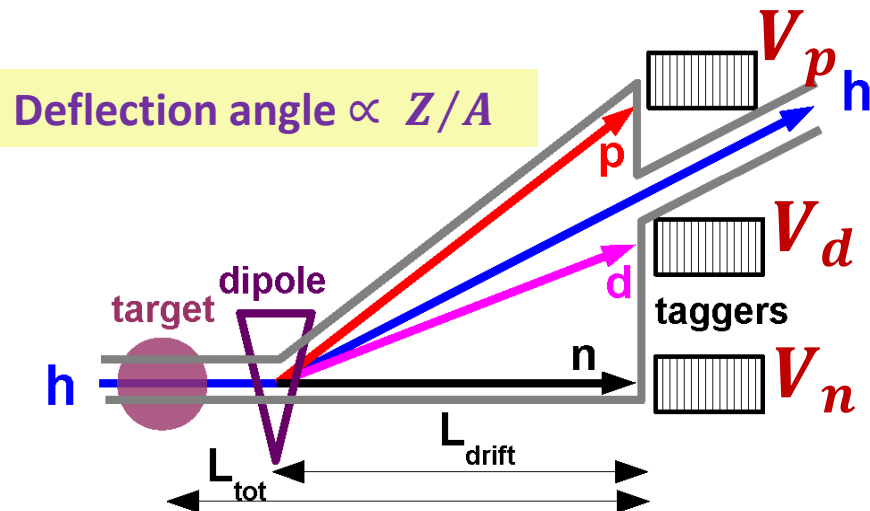
- Only ZDC (V_n) will be used in Run 23 APEX.

# *Preliminary study of the Tagger performance*

- Gold beams can be used to study the Tagger performance and to make adjustments.
- The jet beam was not turned on yet. The prompts were used to trigger the Tagger readout.

Amplitude-Time distributions in the Si detector during the Tagger test.

Fill 34030, Det. 5

Recoil protons in Au beam measurements (Run 15)

Fill 19198, Det. 5

- Only events with one and only one detected signal in HJET Si strips were considered.
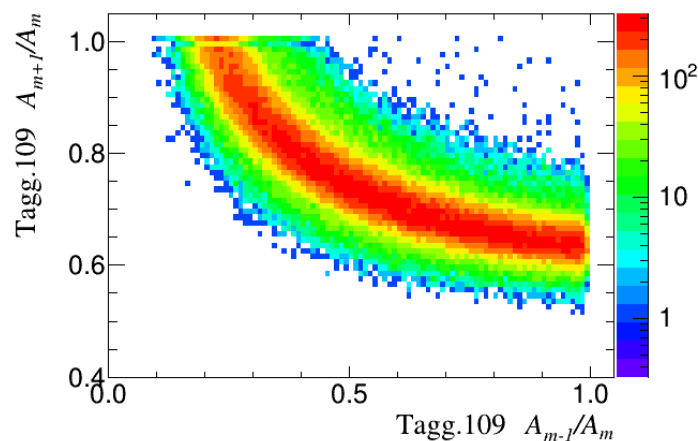
Blue amd Yellow Au beams, no JET.   Run 34030.001

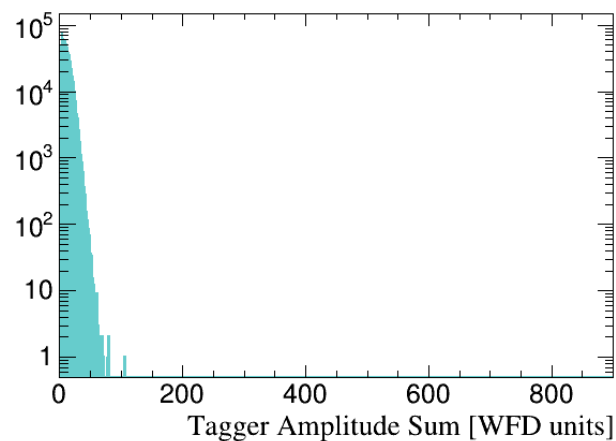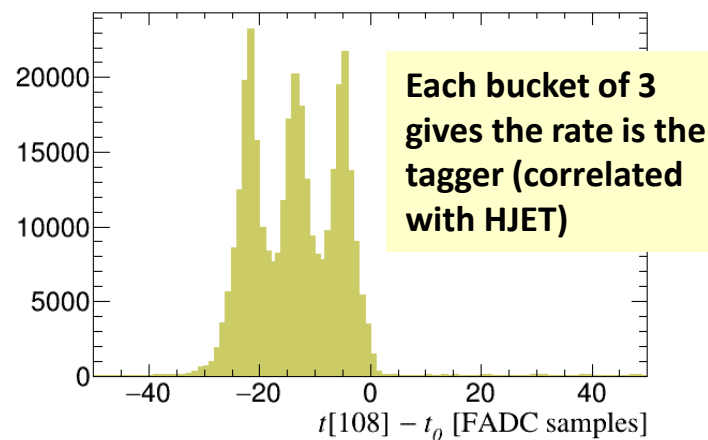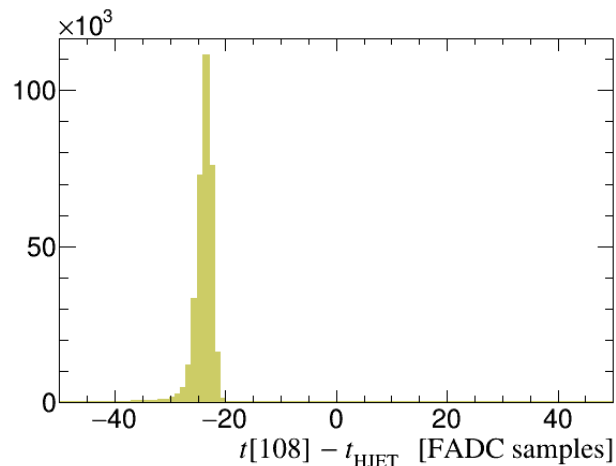**Two different coincidence between HJET and Tagger signals are observed.**

$$\mathbf{ToF} = t_{\mathrm{HJET}} - t_0$$
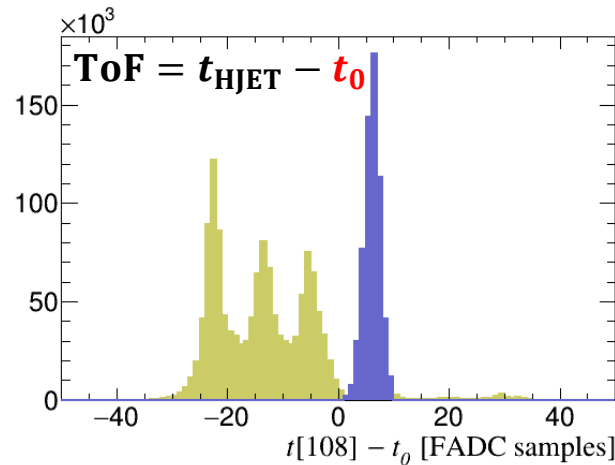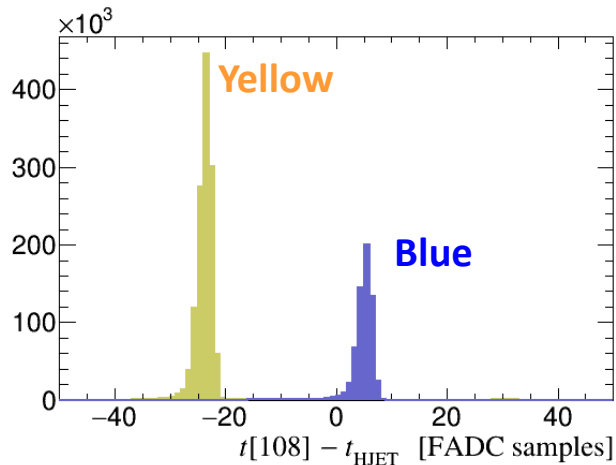
The bunch spacing = 26 FADC samples
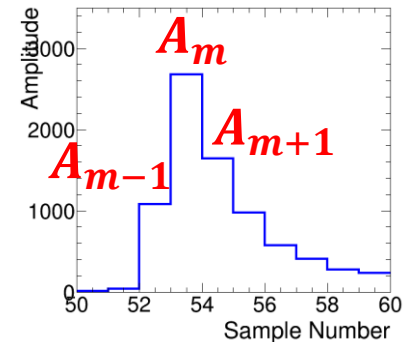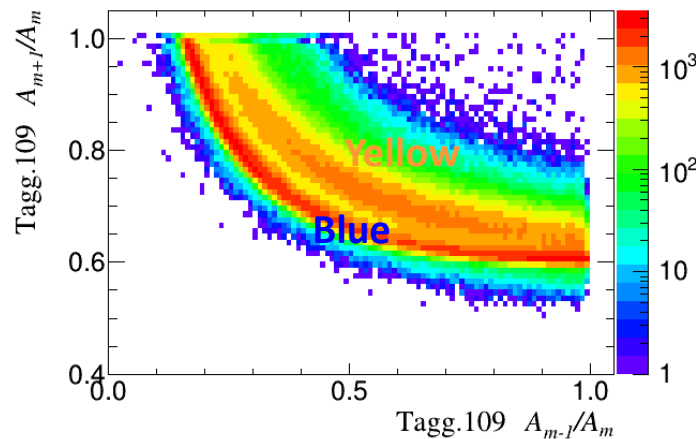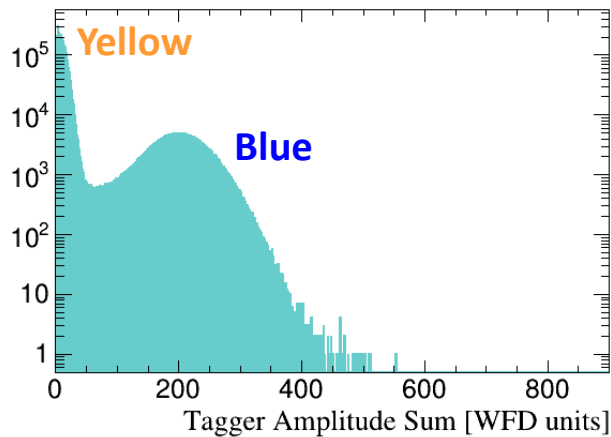
Yellow Au beam, no JET.   Run 34029.005

Each bucket of 3 gives the rate is the tagger (correlated with HJET)

- **Since there will not be Yellow beam in the ^{3}He beam measurements, this distributions are not essential for the breakup test.**
- **However, these results may be important for understanding the prompts nature.**

Blue beam distributions. Run 34030.001

- **The Blue beam HJET-Tagger coincidences can be isolated by comparison the signal times.**
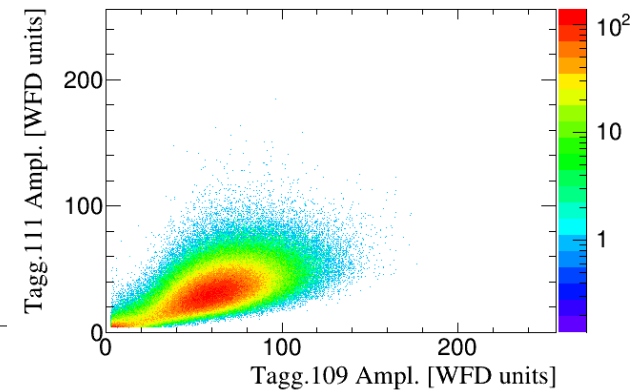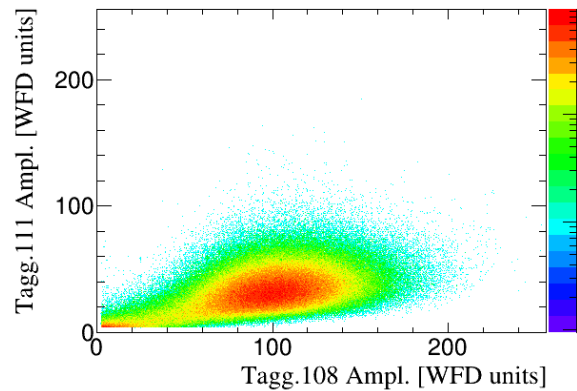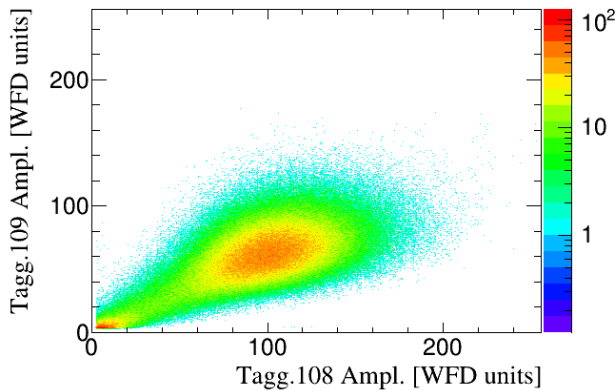- **The recoil proton signals will not be lost in such a selection.**
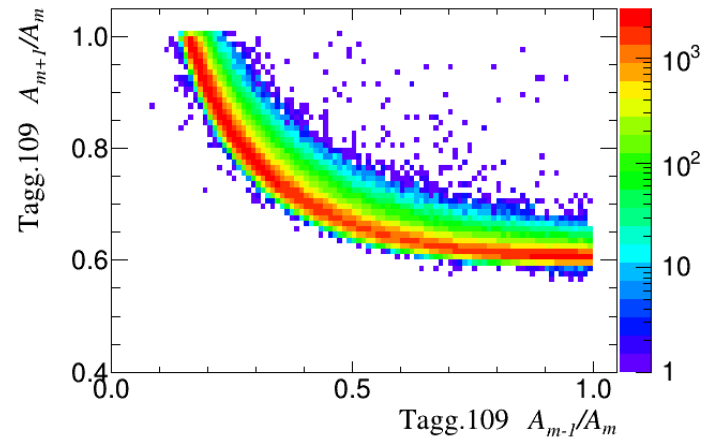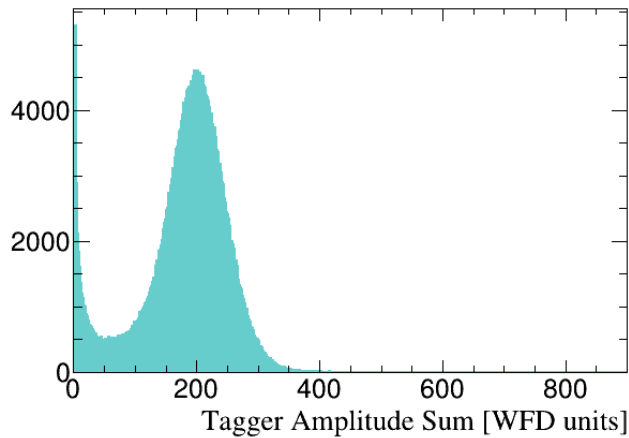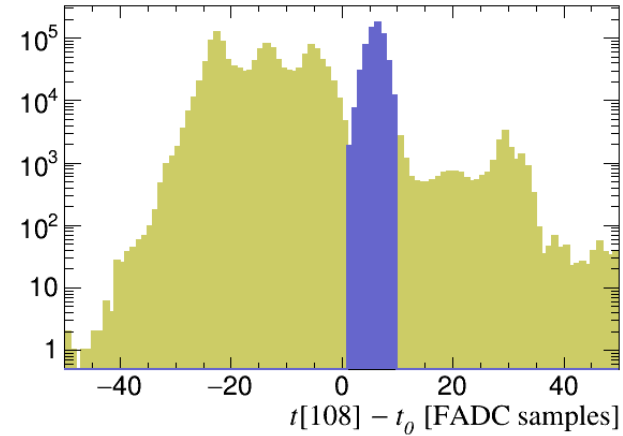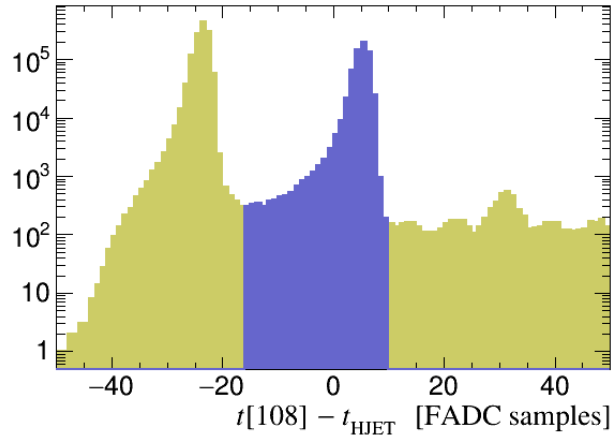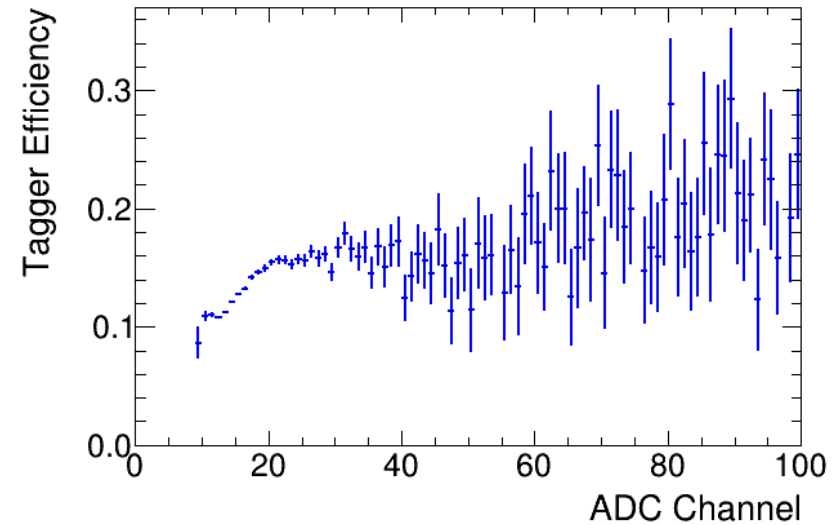
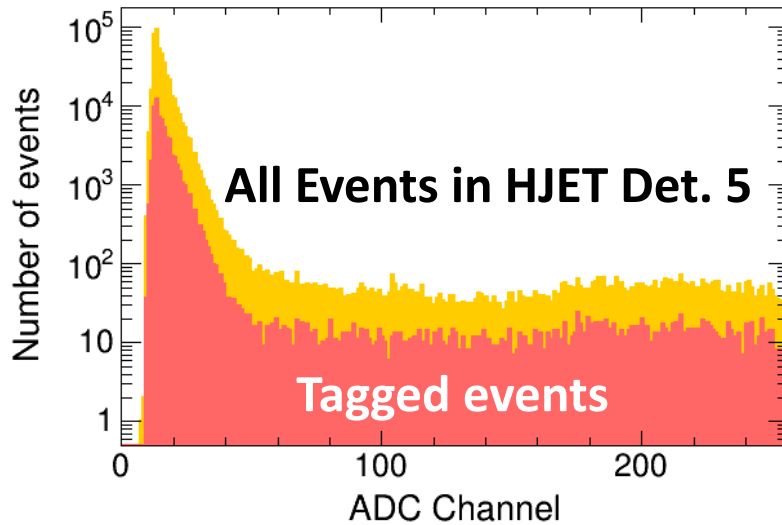# ZDC counters amplitude correlation
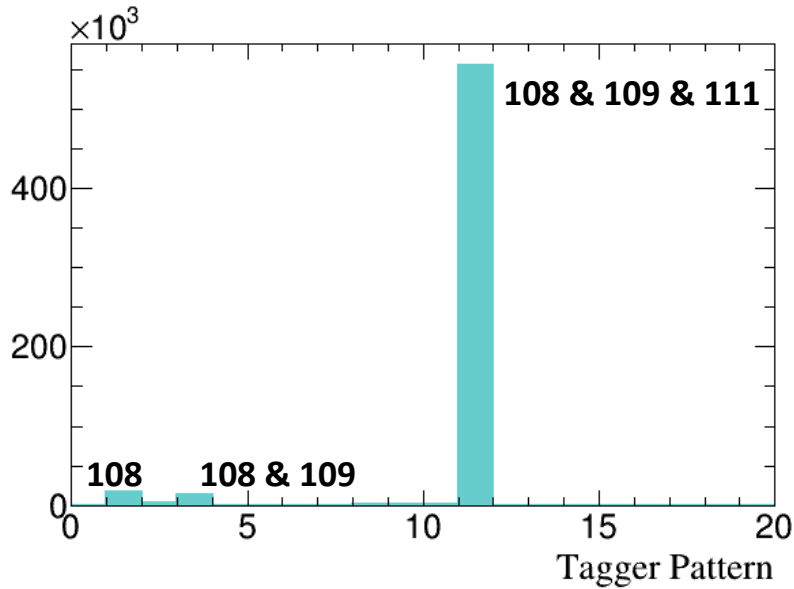
All three ZDC counters are hit in almost every HJET-Tagger coincidence event.

What is the probability of the single neuteron detection in the first ZDC counter ?
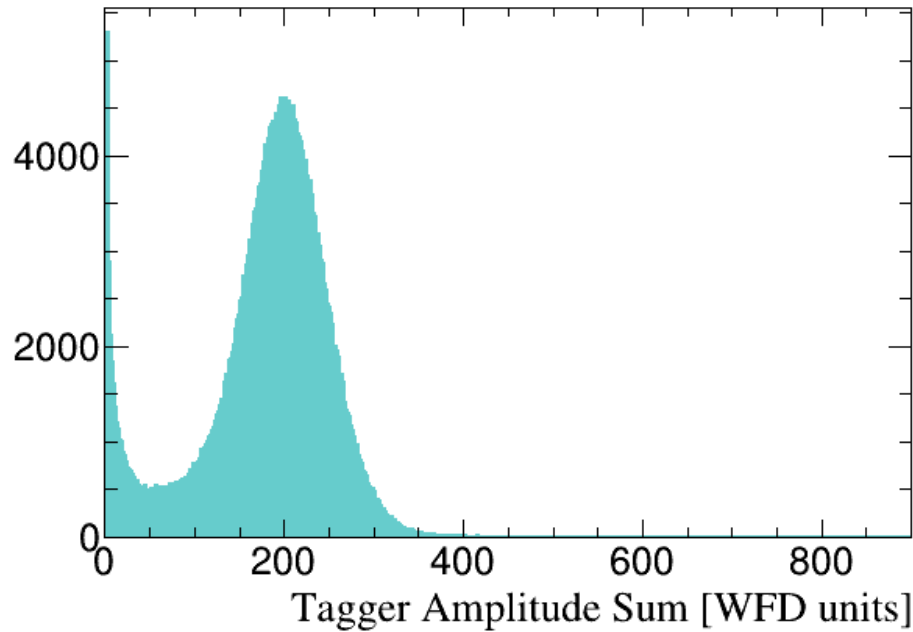
Efficiency of the HJET-Tagger coincidence for prompts signals in HJET

All Events in HJET Det. 5

Tagged events

For the recoil proton signals, the efficiency is expected to be much lower $(< 1\%)$.

What signals do we observe ZDC?

A very good gaussian like,

$$\frac{sigma}{mean} \approx 0.23,$$

amplitude distribution in the Tagger ZDC.

Possible explanations:

- Single neutron   (why there is no two neutrons signals?)
- Multiple neutrons $\langle n \rangle$ (if $\langle n \rangle = n_0 \pm \sqrt{n_0}$ then $n_0 > 20$)
- Scattered Au   (Such events must be suppressed for the coincidence with the recoil protons)

Summary

- **The DAQ and data analysis software are mainly ready.**

- **However, it was not proved that neutrons were detected by the tagger in the gold beam tests.**

- **It is important to make measurements (in parasitic mode) with gold beam and the jet On before running ^{3}He beam.**