Crosstalk Analysis

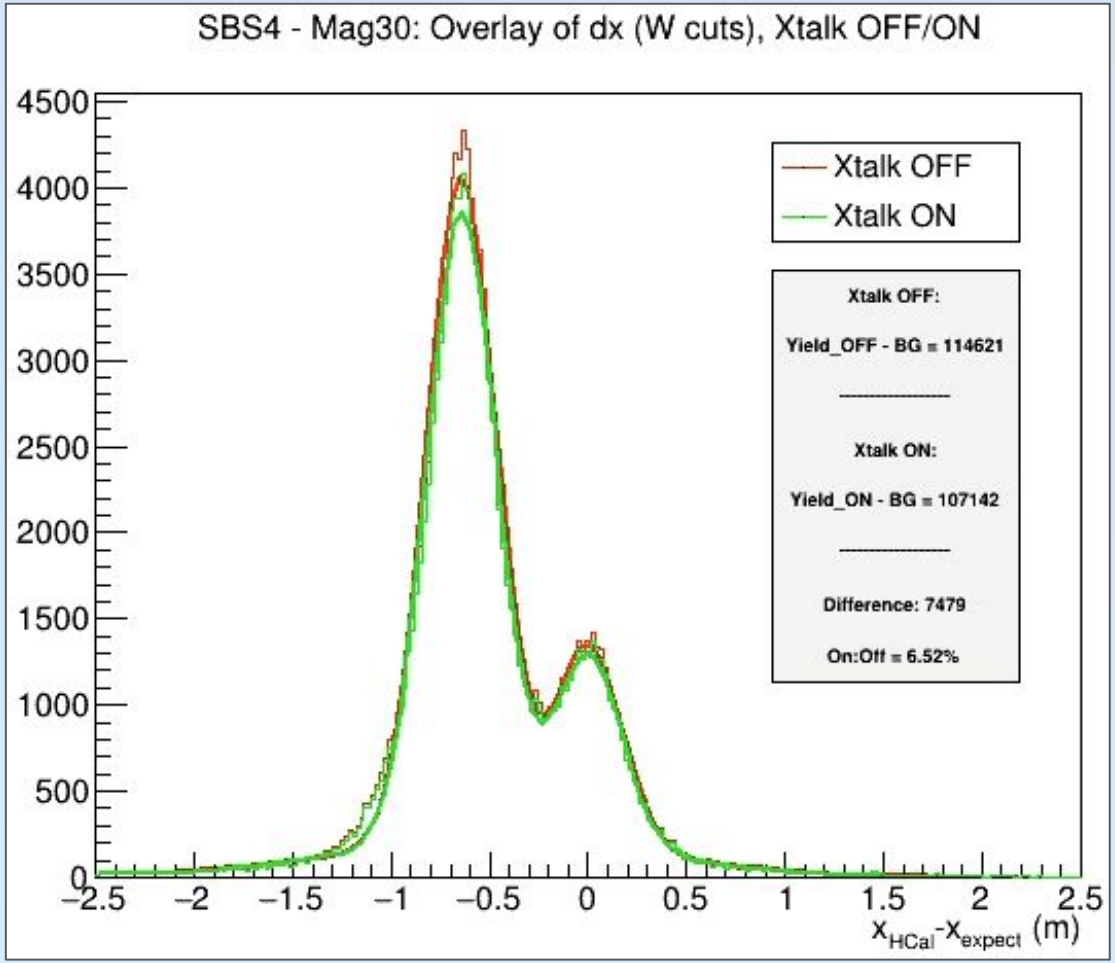
J. Boyd - Mar. 10, 2023

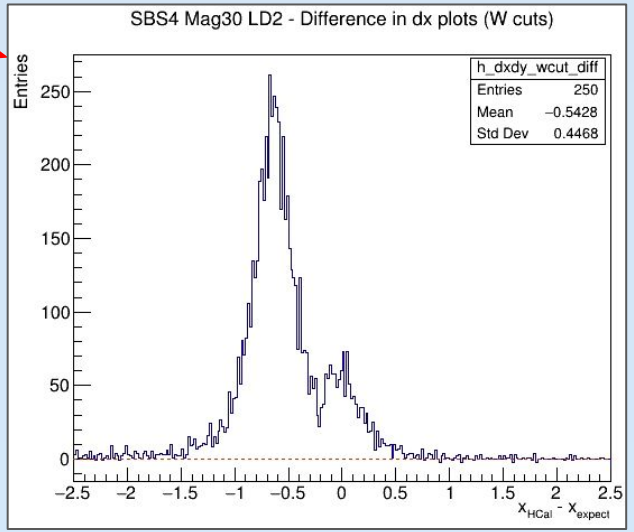
- Focused on “digital crosstalk” that may create fake tracks/hits and other spurious signals
- Xtalk On vs. Xtalk OFF Metrics:
  - Strips: Xtalk ON/OFF comparison for number of clusters on track, number of crosstalk corrections performed, etc.
  - Yields & dx:
    - First approach was to compare yields from fits to dx plot
    - Final: Difference between Xtalk ON/OFF histograms

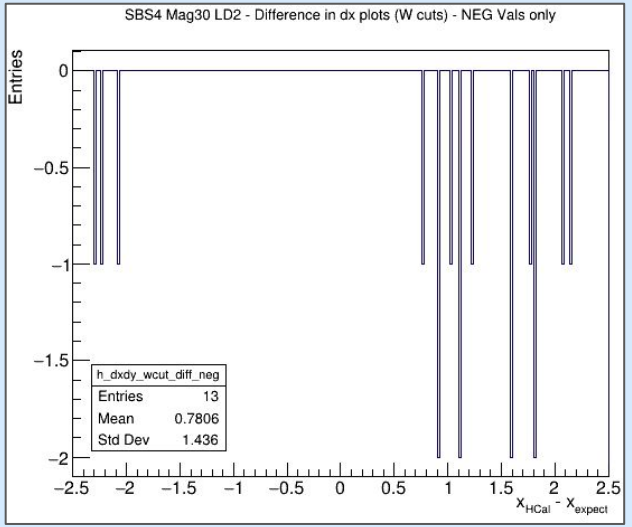
SBS4 - 30%

SBS4 - Mag 30%

Xtalk_ON_histo - Xtalk_OFF_histo







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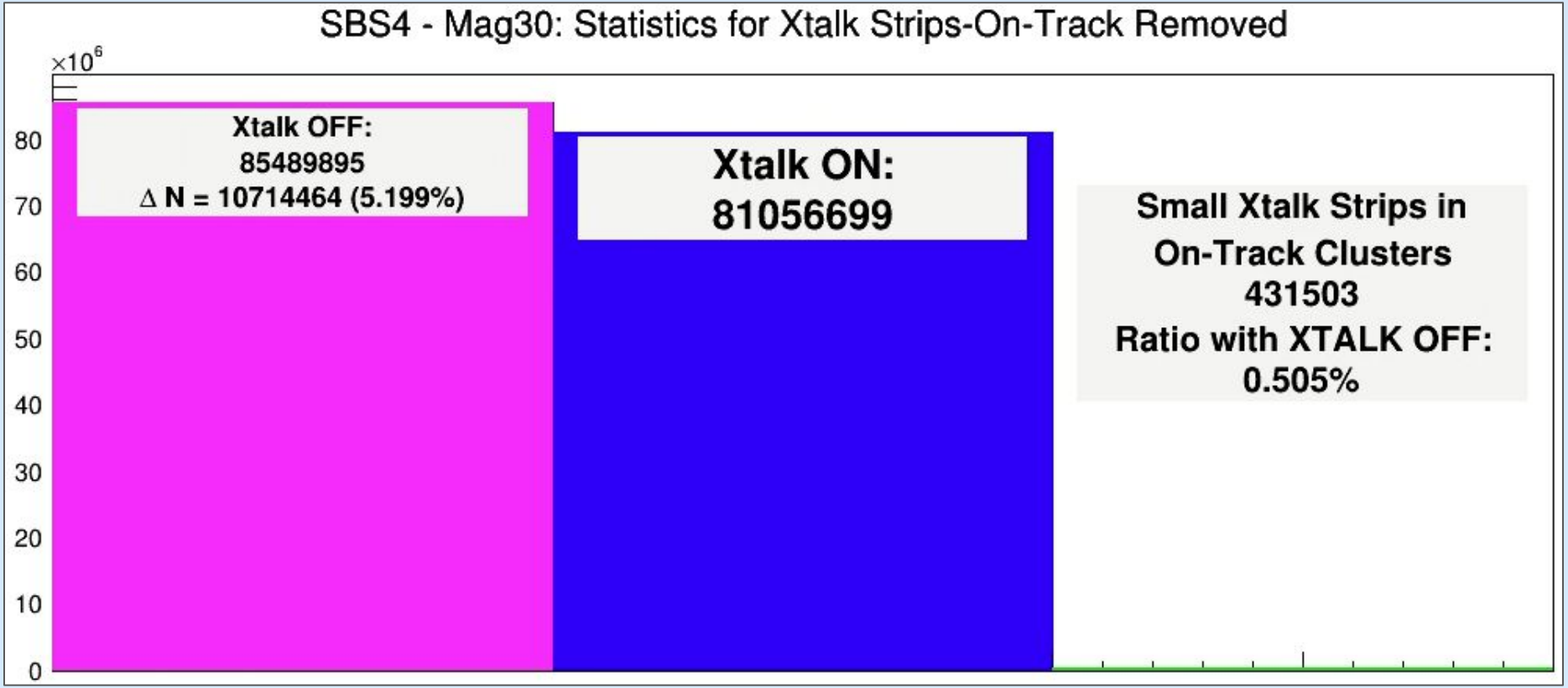
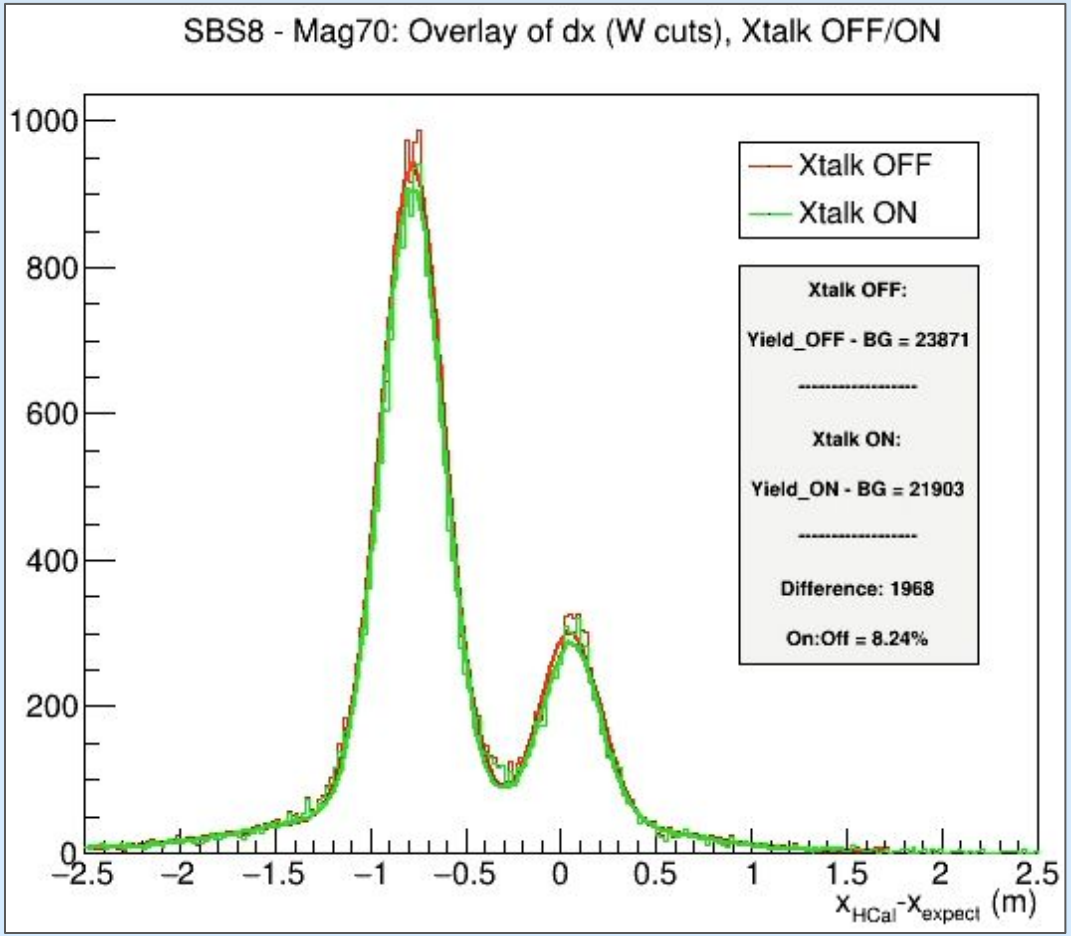
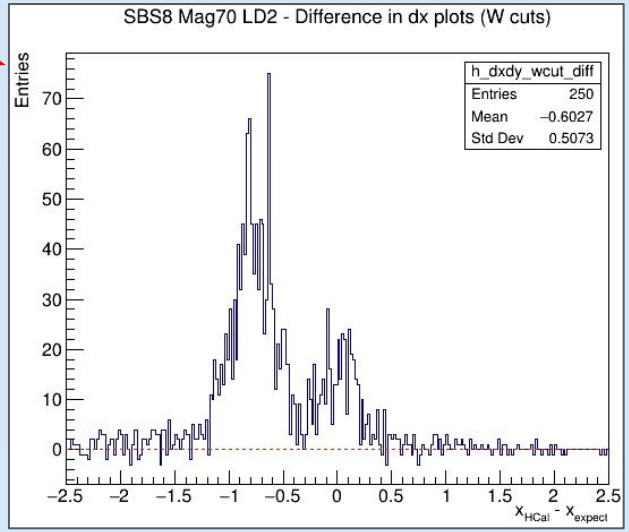


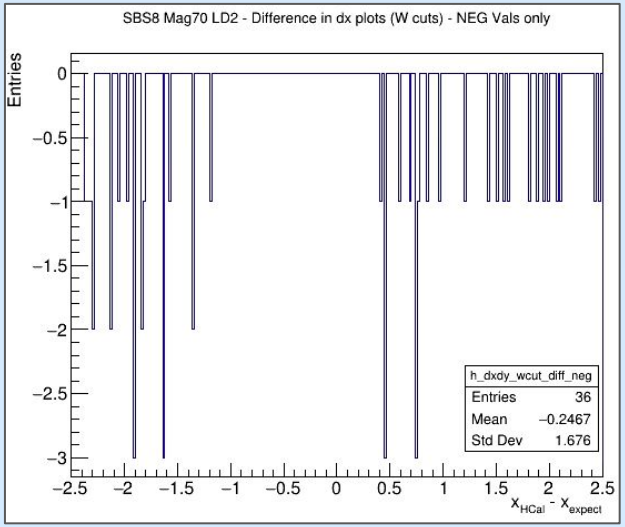
SBS8 - 70%

SBS8 - Mag 70%

Xtalk_ON_histo - Xtalk_OFF_histo







4 Runs: 13491, 13492, 13493, 13494

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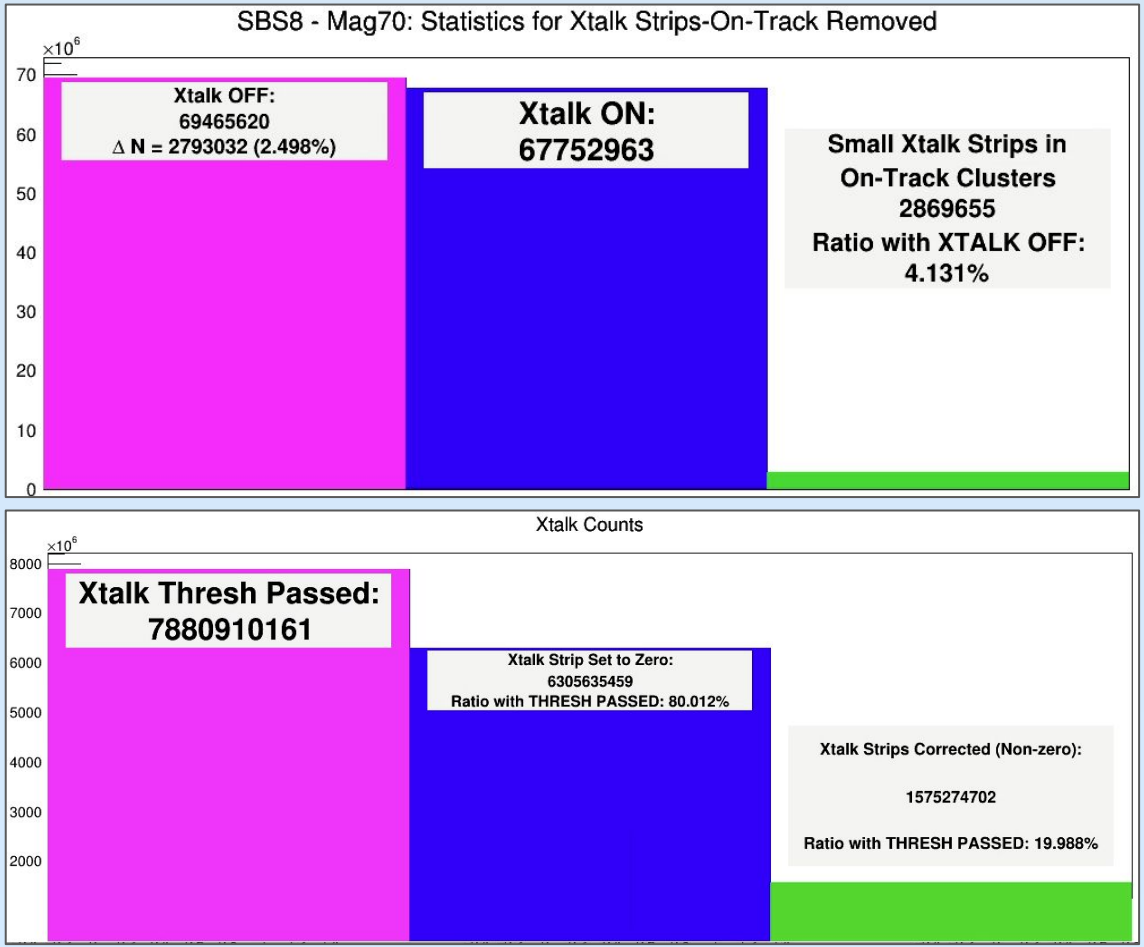

Summary Concepts

- For GMn it seems to primarily reduce the reconstruction efficiency more than it reduces spurious signal/fake tracks
- Some peeks into other kinematics → More effective at higher rates/occupancy??
- But…. for the most recent GMn conditions it is not as an effective means as was hoped

Crosstalk Analysis Terms & Approach

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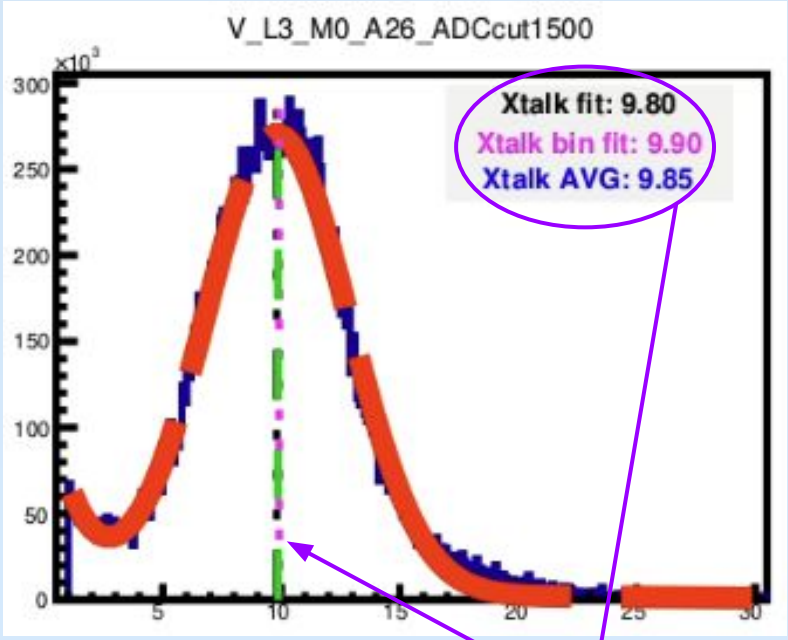
- **Digital Crosstalk** on APV25 (multiplexer) channels (*channel-space vs strip-space*)
- ***Ratio of Neighboring Channels***
  - **"The Ratio"** is calculated by dividing the ADCs of neighboring channels
  - **The larger ADC is always divided by the smaller ADC**
  - **Calculation is skipped if either ADC is 0.**
  - A threshold (ADC cut) can be applied to the numerator (larger ADC) to expose "dominant" ratios
  - Ratio is calculated using all channels on a single APV



Determining APV Ratio

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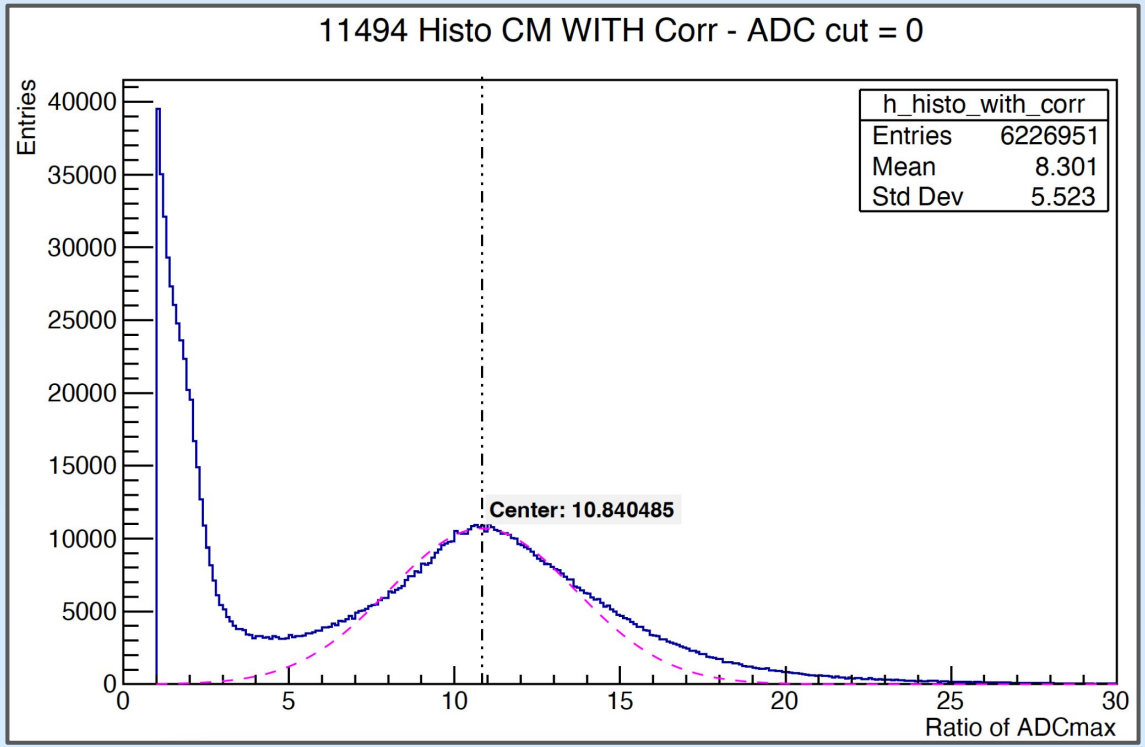
- Histogram for **Ratio of All Neighboring Channels** on a single APV for a single run.
- The bump near the center of the plot is the crosstalk → crosstalk ratio for APV25 is typically ~10

- Run: 11494
- Single APV on one GEM
- Fit “ratio bump”
- Find center of bump

From graph:

Ratio = 10.84



Determining APV Ratio

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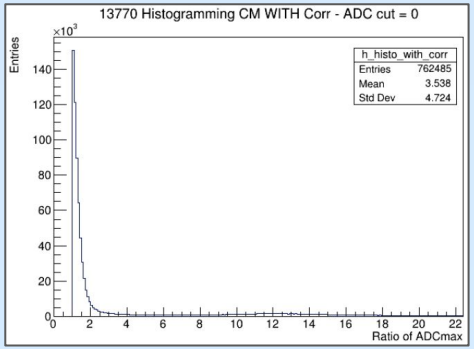
Taking a higher occupancy run:

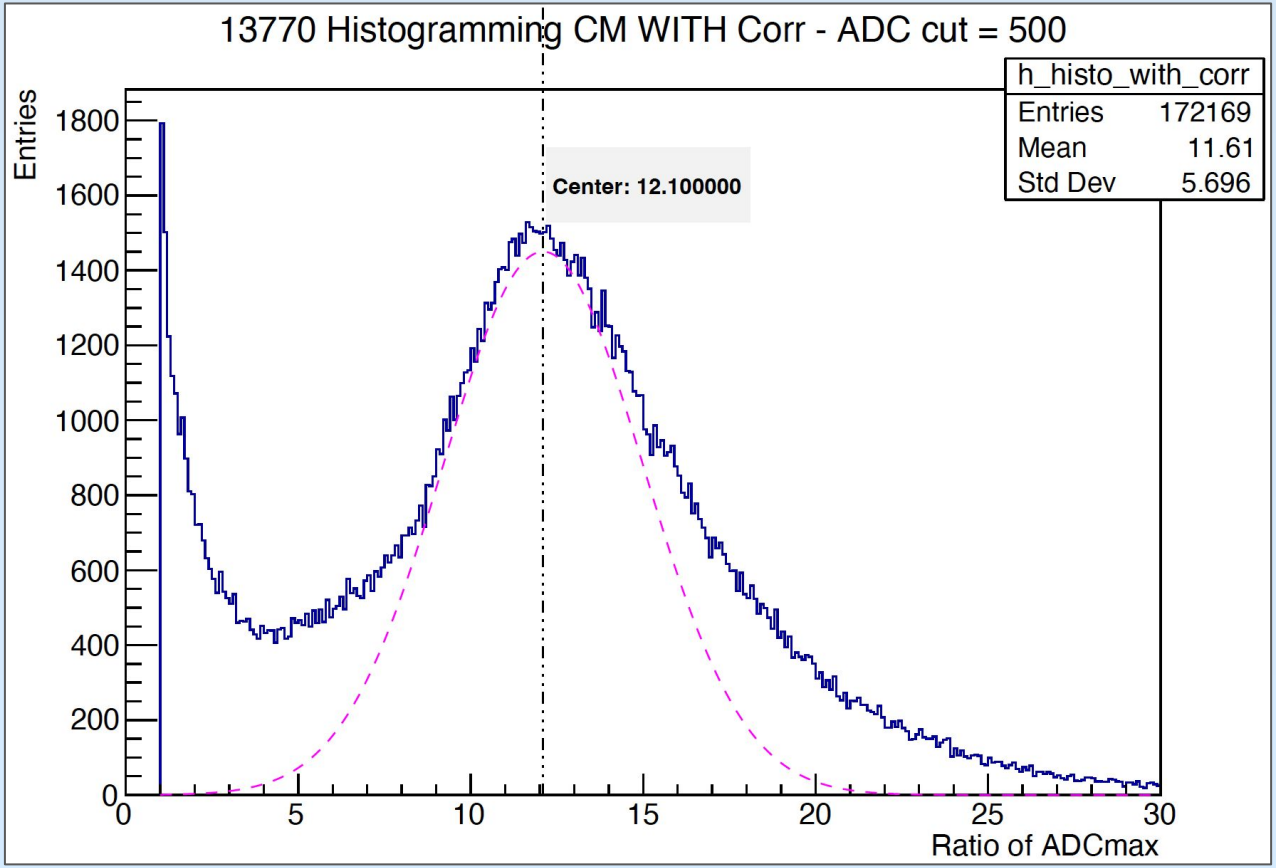
- Run: 13770
- Beam current: 12 uA
- Single APV on one GEM
  - Front UV GEM
  - APV 9
- Fit “ratio bump”
- Find center of bump

From graph:

Ratio = 12.1

“Correction Ratio”





APV Ratios - Needed for Every APV!!

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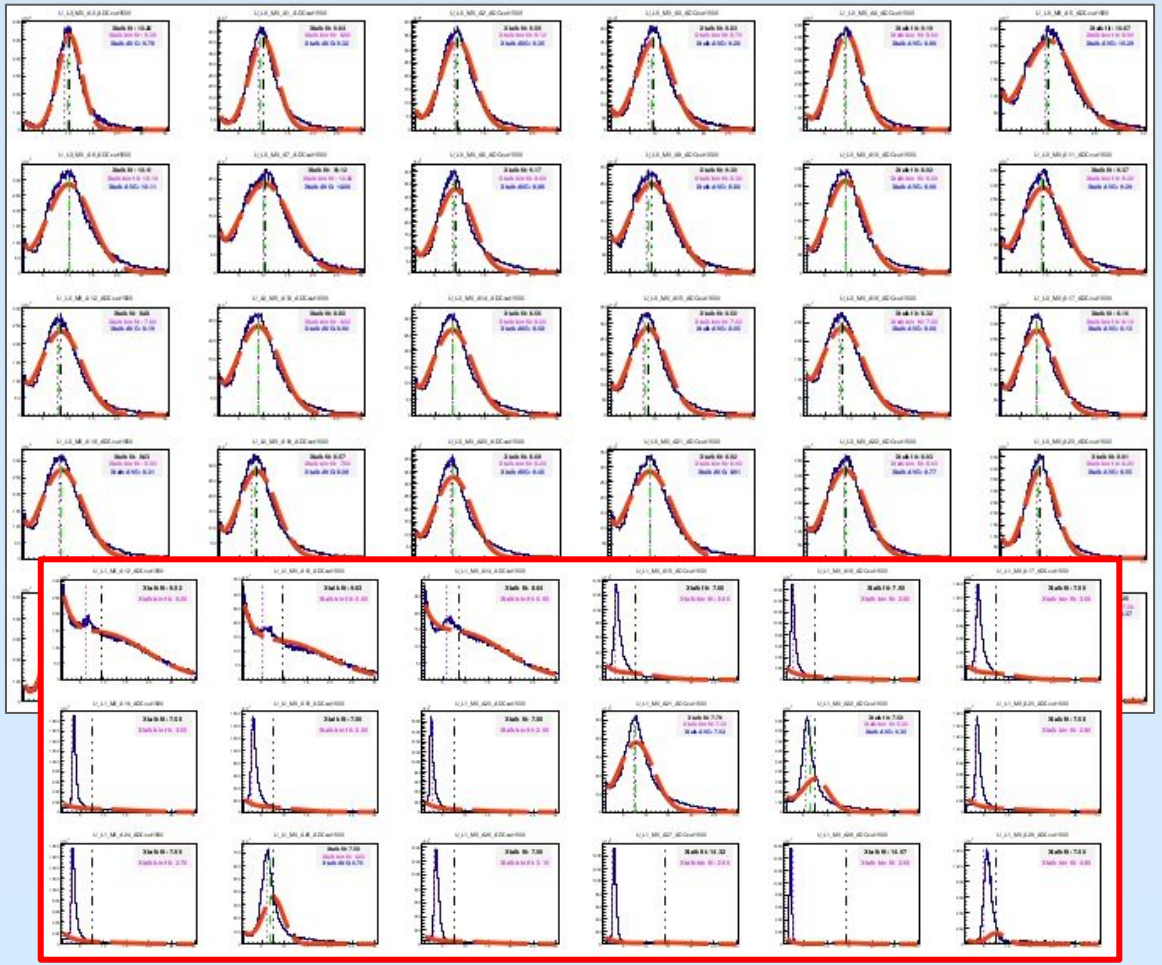
- Select an ADCcut
  - ADCmax → 500 ADC
  - ADCsum → 1500 ADC
- Plot the ratios of all neighboring channels (larger ADC on top)
  - Find center of ratio peak
  - Store in lookup DB
  - Similar to GEM Ped. or CMR
- Missing APVs or “bad” ratios are set to -1 and skipped in Xtalk analysis

```
13770_ADCcut1500

m0_U 9.78055 9.31826 9.34691 9.26499 8.89284 10.2856 10.1072 1
m1_U 18.5434 17.191 7.80 7.10 6.80 6.40 6.70 7.50 18.5 6.70 6.
m2_U 8.59065 9.80266 8.62947 8.90197 9.3462 9.37749 9.96117 10
m3_U 11.8503 11.6094 12.0308 7.85081 9.08355 9.7474 6.80 9.789
m4_U 9.35474 9.10927 8.40972 8.63515 9.77219 8.36806 8.50 9.50
m5_U 9.83932 9.09855 9.41668 8.41508 8.63694 8.10824 10.2623 9
m6_U 9.54211 9.59571 9.71726 9.27348 8.24308 9.13846 9.60212 9
m7_U 10.6642 9.16783 10.5955 10.1481 9.26633 9.16167 7.23094 9

m0_V 8.58219 8.36564 9.44706 9.47673 8.65184 8.11254 8.62629 8
m1_V 16.2245 18.80 17.4883 19.60 16.486 12.9129 7.50 7.50 7.76
```



SBS8 - Mag 70%

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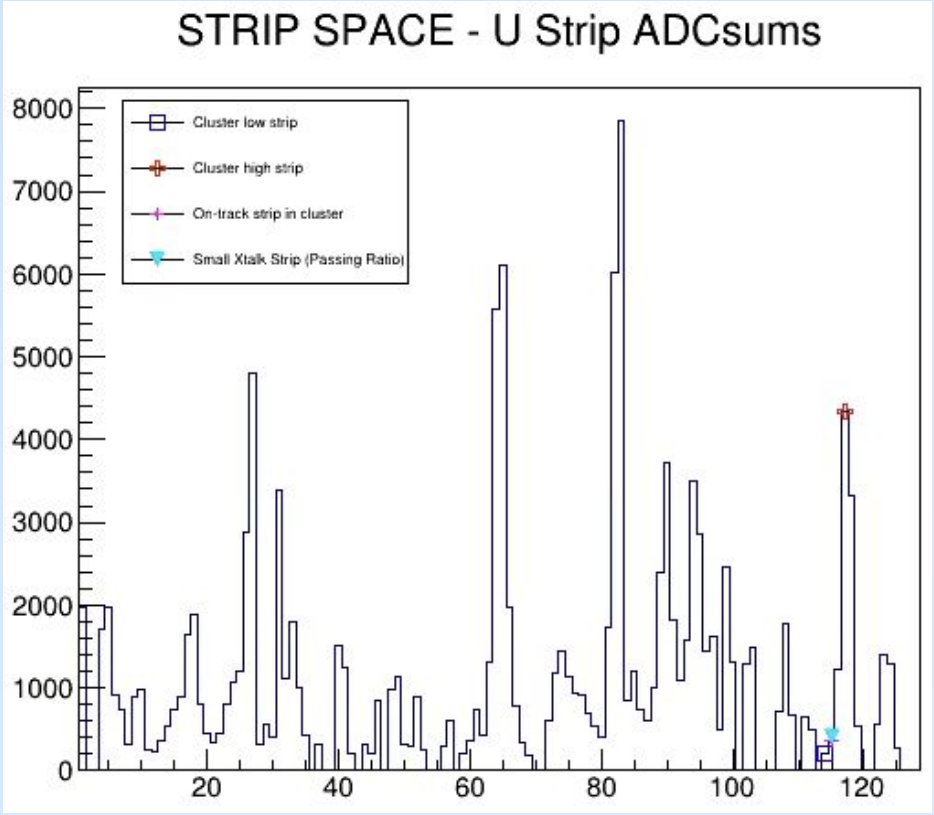

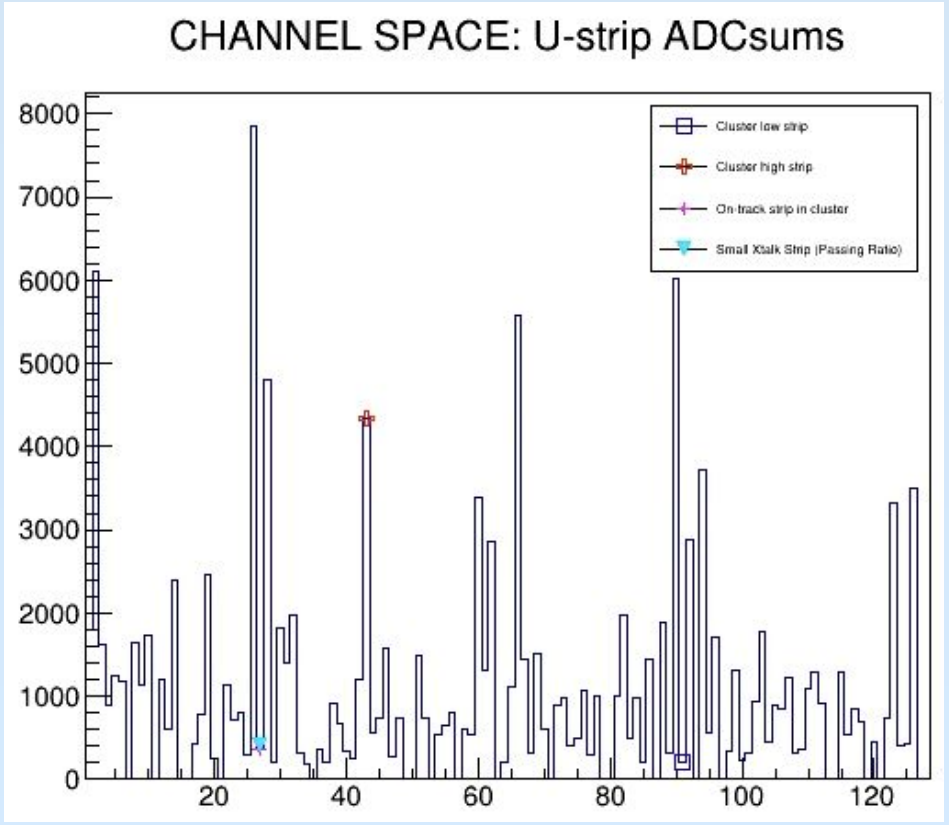

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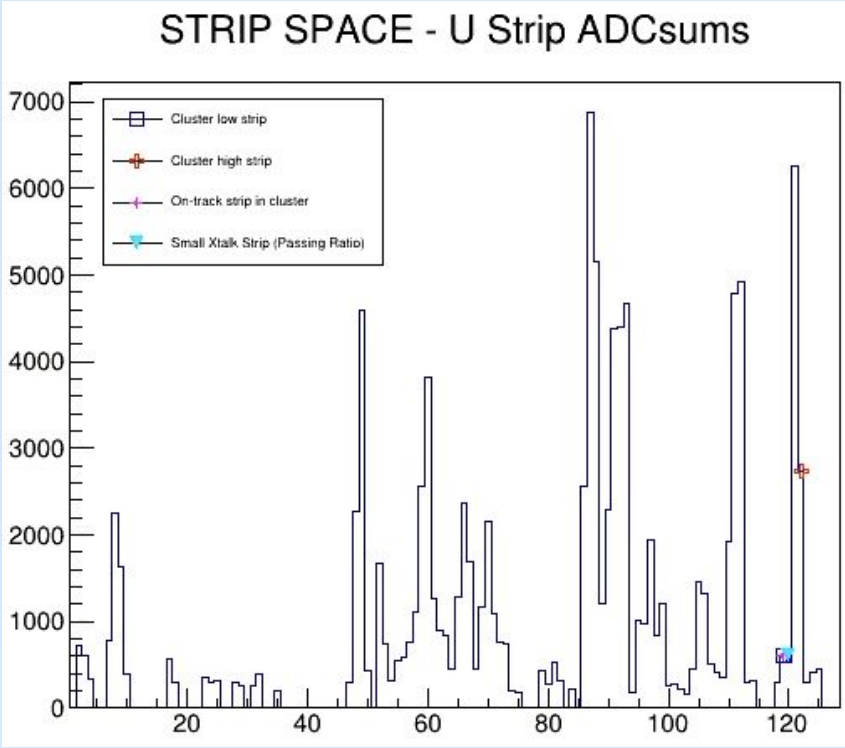

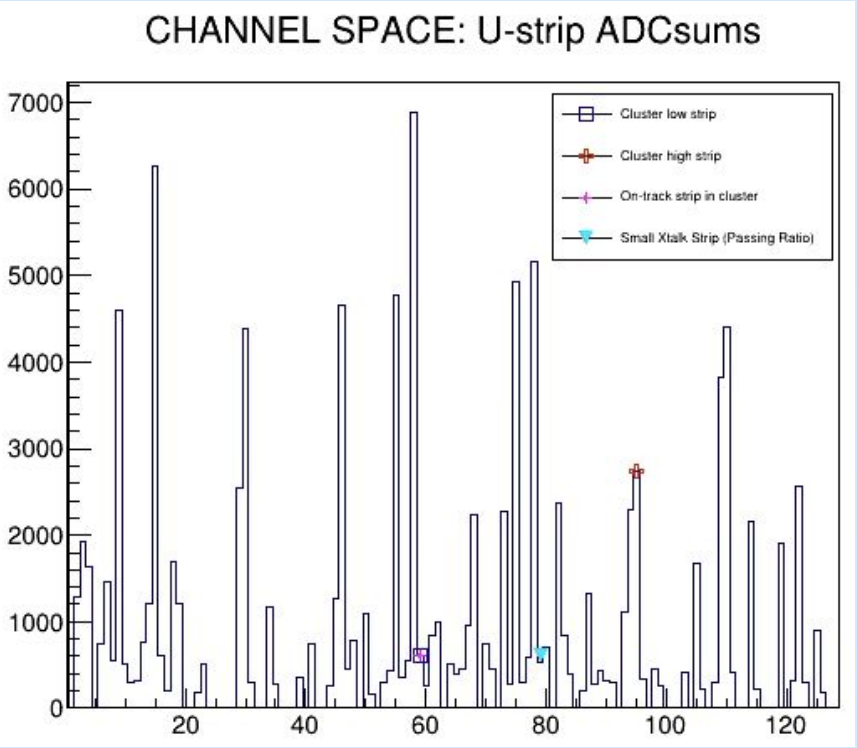

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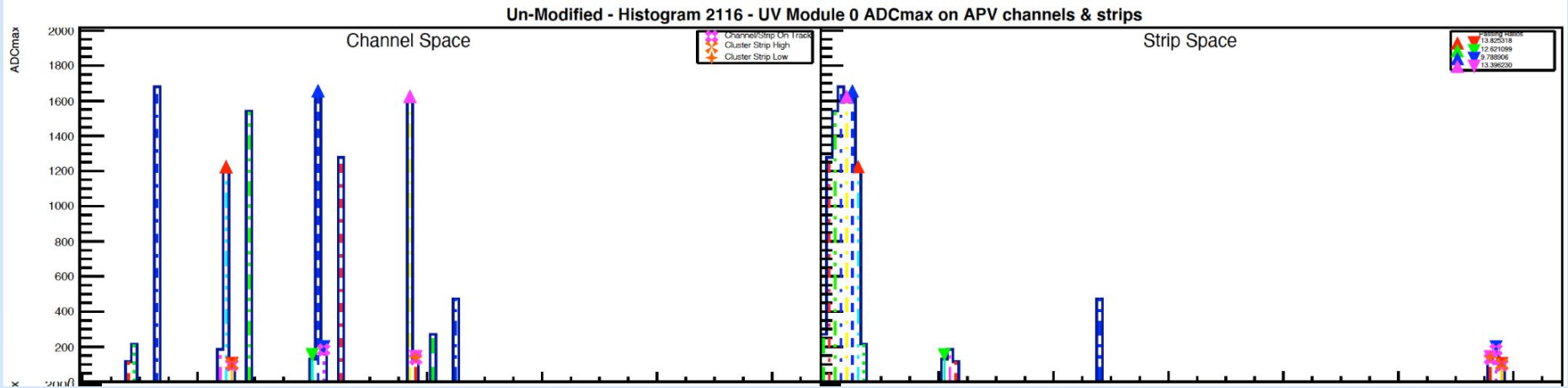

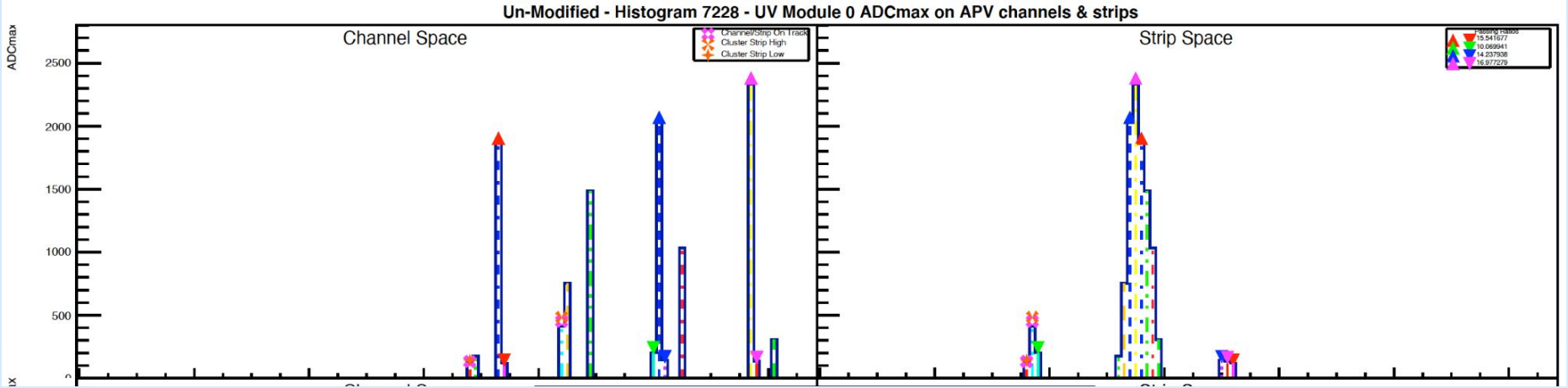

SBS4 - Mag 30%

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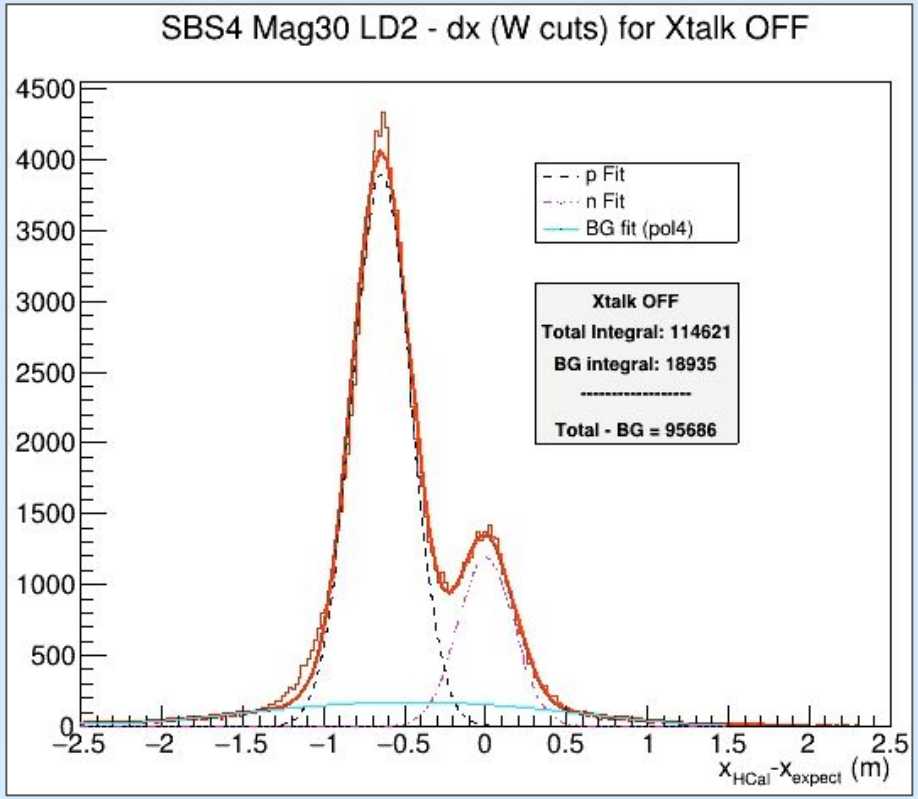
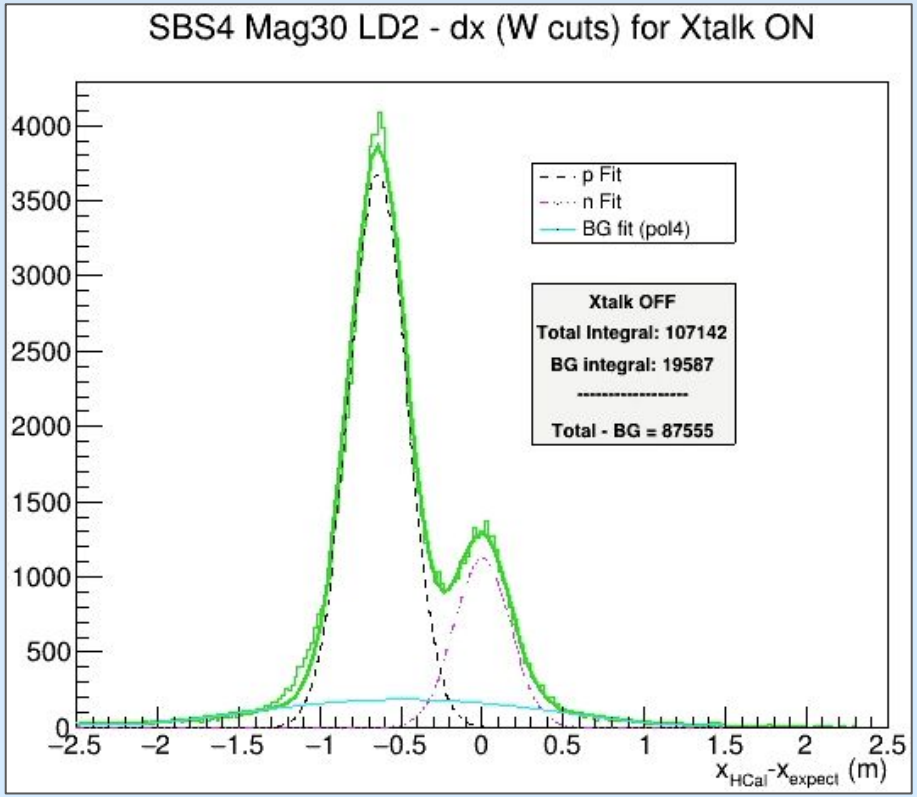
XTALK OFF

XTALK ON





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Yield Comparisons

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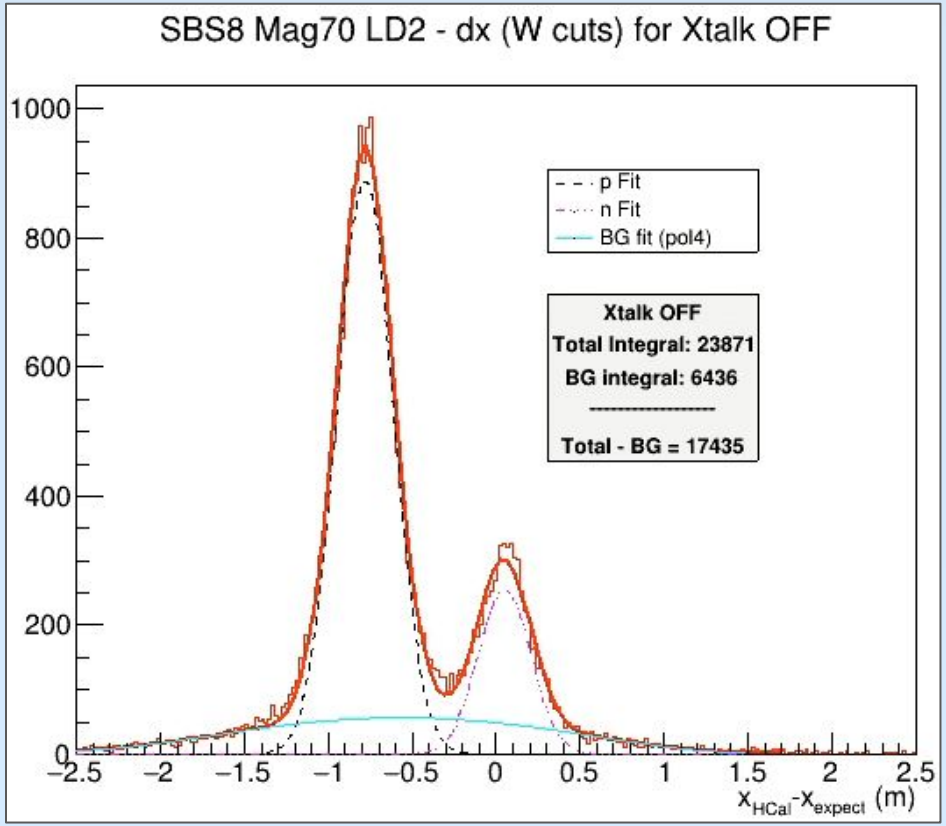
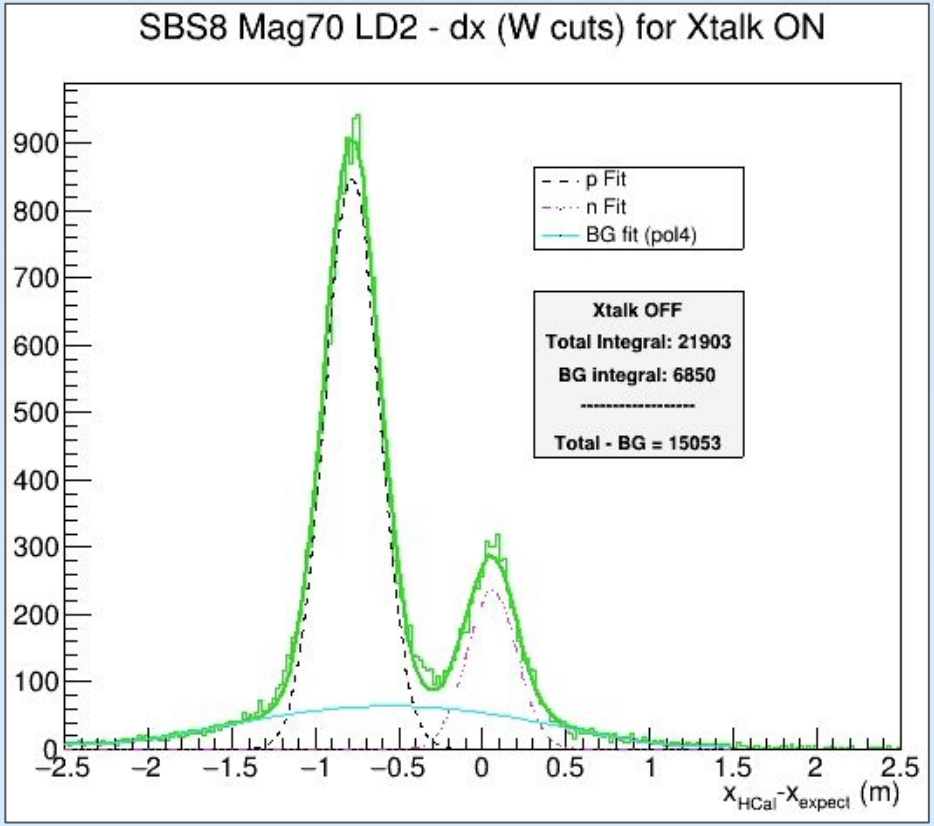
- Start with Xtalk OFF
- Three fits: proton Gaussian, neutron Gaussian, Background pol4





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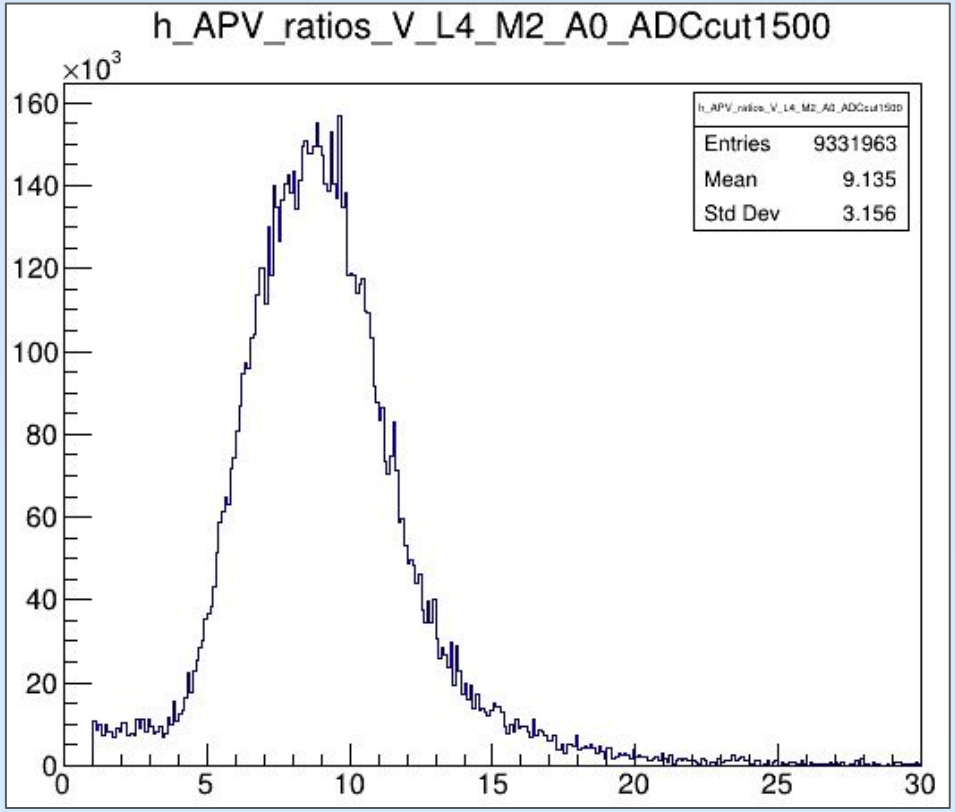
Larger ADC > 1500 & Matching isamp,

No On-Track cuts for Ratio ADCs



Either Channel in Ratio Is On-Track