Update on Signal-to-Noise Ratio

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Motivation

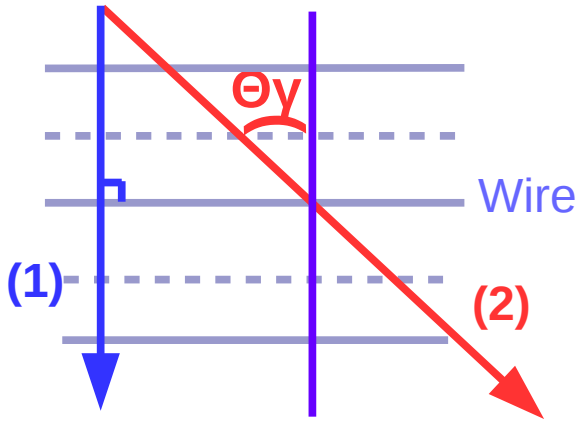
- Try to understand the discrepency between the S/N from DQM & my previous result*
  - S/N from DQM shows ~60 (collection plane)
  - S/N from my previous result showed ~30 (collection plane)

ID	Run	TPC	Timestamp	LifeTime	Error	Count	S/N	S/N Clusters	DriftTime	Infile
9160	5432	1: APA-RaS-US/APA3	10/20/2018 2:47 p.m.	3.65	0.74	27	57.9	103	1.91	np04_raw_run005432_0036_dl1.root
9183	5432	10: APA-DaS-DS/APA4	10/20/2018 3:57 p.m.	7.42	1.16	43	61.4	109	1.55	np04_raw_run005432_0045_dl10.root
9182	5432	9: APA-RaS-DS/APA1	10/20/2018 3:57 p.m.	6.99	1.65	31	60.2	99	1.61	np04_raw_run005432_0045_dl10.root
9181	5432	6: APA-DaS-MS/APA6	10/20/2018 3:57 p.m.	4.67	0.69	51	61.6	83	1.51	np04_raw_run005432_0045_dl10.root
9180	5432	5: APA-RaS-MS/APA2	10/20/2018 3:57 p.m.	5.31	0.99	32	59.3	131	2.13	np04_raw_run005432_0045_dl10.root
9179	5432	2: APA-DaS-US/APA5	10/20/2018 3:57 p.m.	6.57	0.88	35	63.3	64	2.31	np04_raw_run005432_0045_dl10.root
9178	5432	1: APA-RaS-US/APA3	10/20/2018 3:57 p.m.	4.05	0.65	24	62.5	104	1.95	np04_raw_run005432_0045_dl10.root
9177	5432	10: APA-DaS-DS/APA4	10/20/2018 3:28 p.m.	5.47	1.21	27	57.8	91	1.87	np04_raw_run005432_0047_dl4.root

*Details can be found here:
https://indico.fnal.gov/event/19015/contribution/5/material/slides/0.pdf

Methods of S/N Calculation

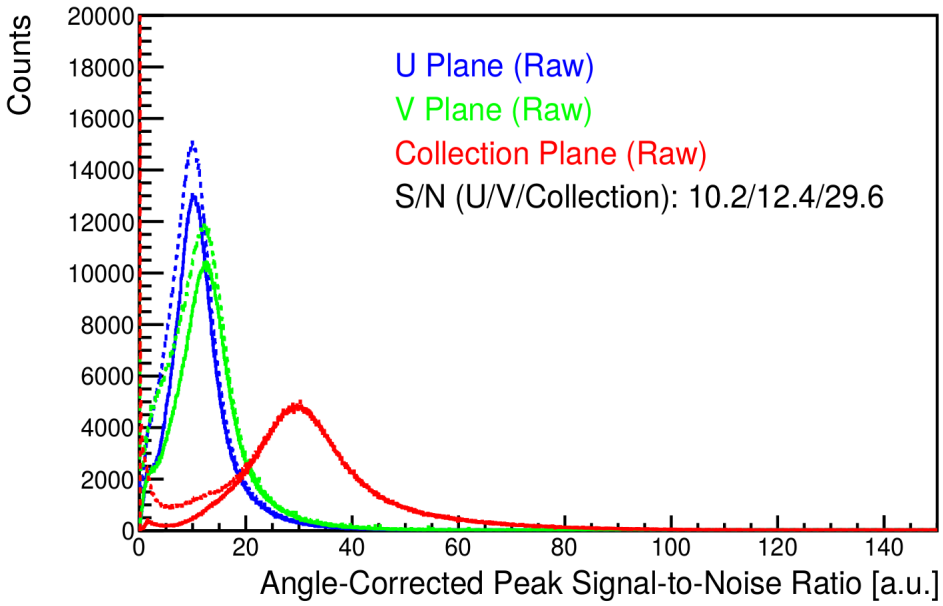
	DQM	HY
Event Selection	Long small-beam-angle clusters	- Remove low S/N tracks (angular cuts) - Remove short tracks
S/N Calculation	Extract from average waveform	Peak position from S/N distribution
Angle Correction	No angle correction (cosΘy = 1)	With angle correction

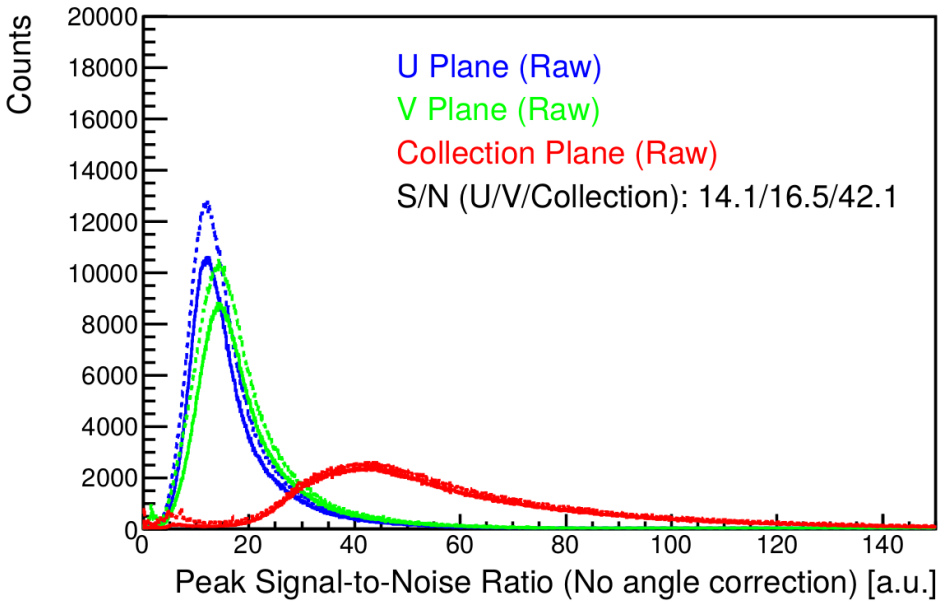


-Signal Definition:
cosΘy * (Maximum pulse height)
[baseline subtracted]

Effect on Angle Correction

Dashed/solid line: before/after track selection cuts (angular cut + length cut)





S/N Ratio

Collection Plane

	Signal-to-Noise Ratio	
	Peak Position	Average*
With angle correction	29.6	34.1
Without angle correction	42.1	57.6

U Plane

	Signal-to-Noise Ratio	
	Peak Position	Average*
With angle correction	10.2	11.7
Without angle correction	14.1	17.6

V Plane

	Signal-to-Noise Ratio	
	Peak Position	Average*
With angle correction	12.4	13.5
Without angle correction	16.5	20.2

*Average: Average value of the S/N distribution

Summary

- Angle-correction certainly plays a role on S/N performance
- Different definitions on S/N calculation for the two methods