Fermilab testbeam data analysis

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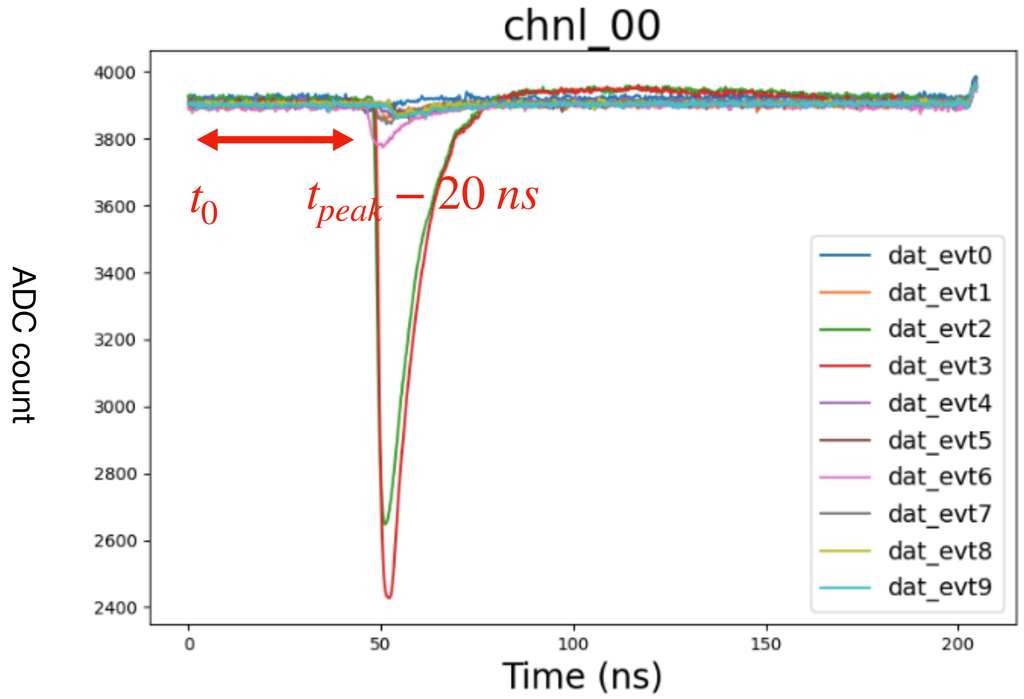
On behalf of the analysis team

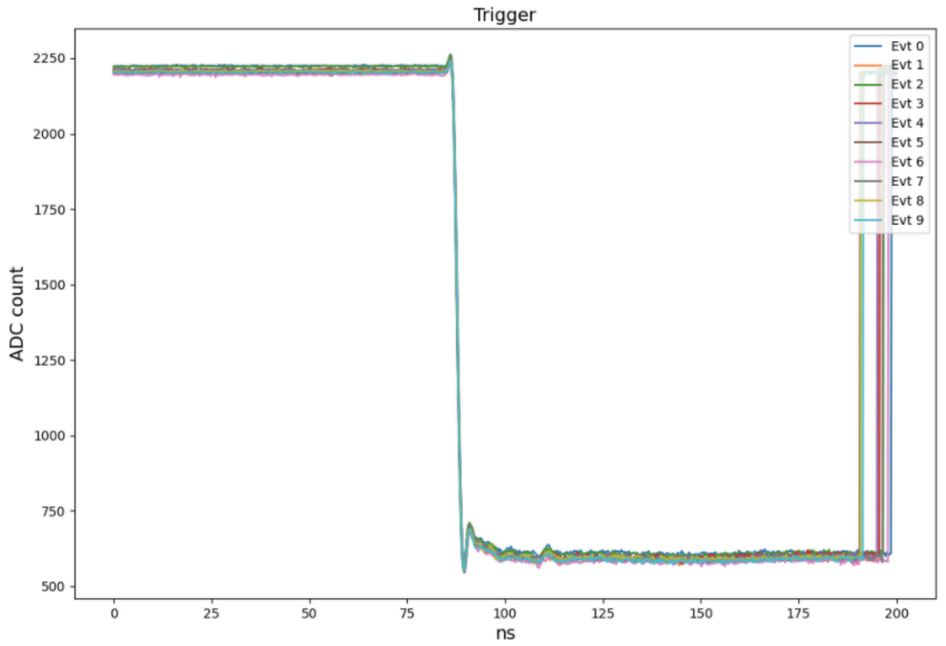
Calvision meeting July 13 2023

Data pre-processing

- **Overflow events removal**
  - Some large signals exceed the range of the DRS readout system. Those events were removed before processing.
- **Pedestal correction & Time correction**



After time shifting

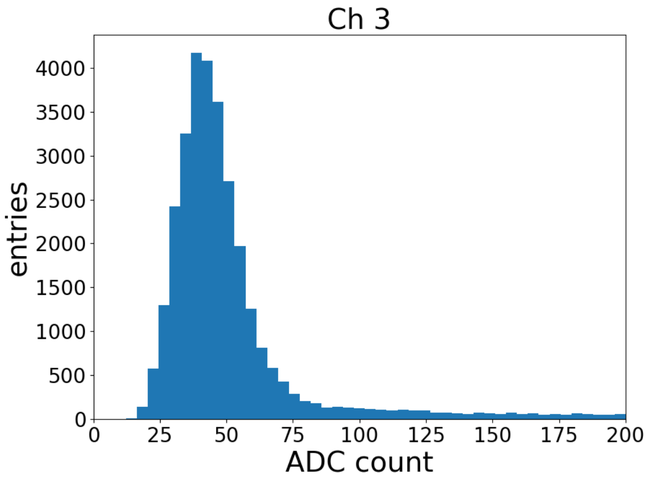


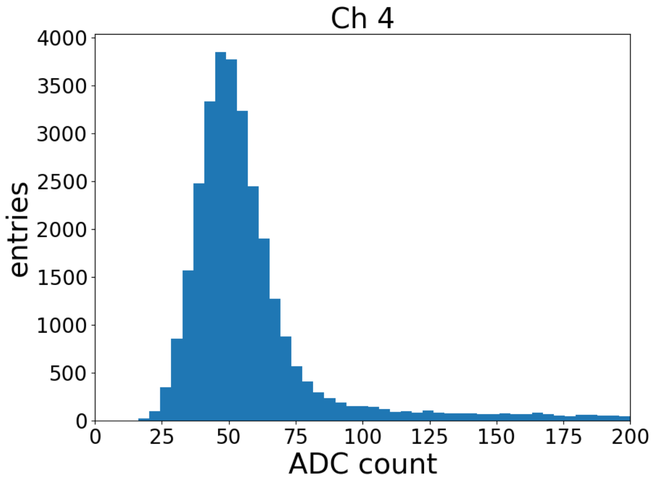
Statistics

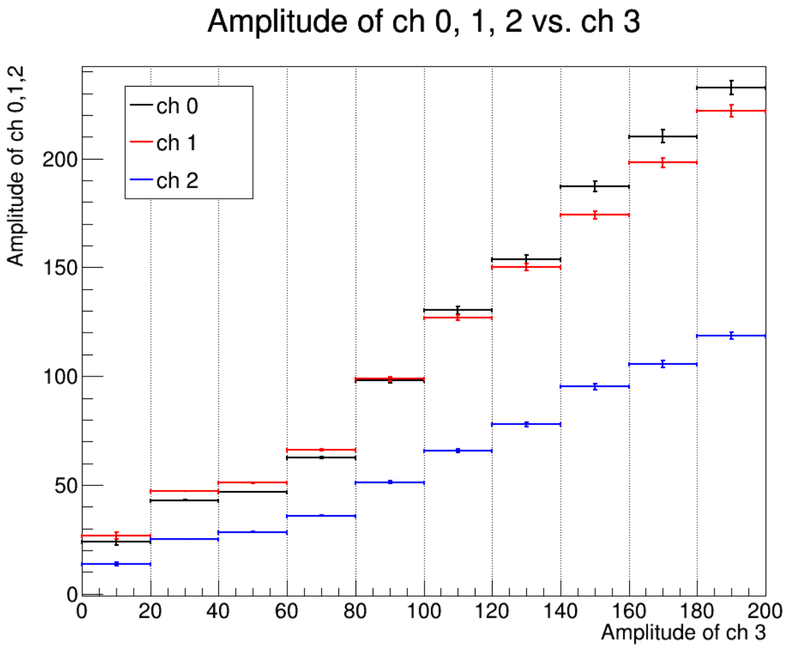
	PbF2 0	PbF2 +30	PbF2 -30	PWO 0	PWO +30	PWO -30	BGO 0	BGO 30	-BGO 30
Tot events	41939	40638	47216	66059	71300	49457	54147	57512	55896
Overflowed events	90	660	810	939	1253	1340	3323	5390	4905
Fraction of overflowed events (%)	0.21	1.62	1.72	1.42	1.76	2.71	6.14	9.37	8.78

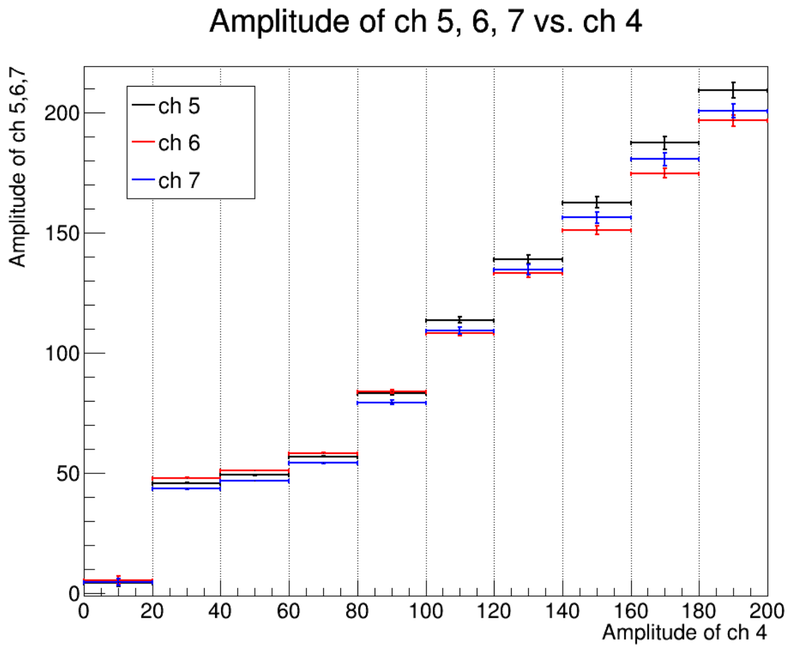
Correlation between channels

- **PbF2 0 degree (all Cherenkov)**
  - Channels on the same side show a linear relation.
  - For the region of amplitude 20-80 ADC counts, where most events locate, the channels are weakly correlated.
  - Choose two channels far from the beam to be the ones on the x-axis. Same behavior seen if changing the channel on the x-axis [backup].



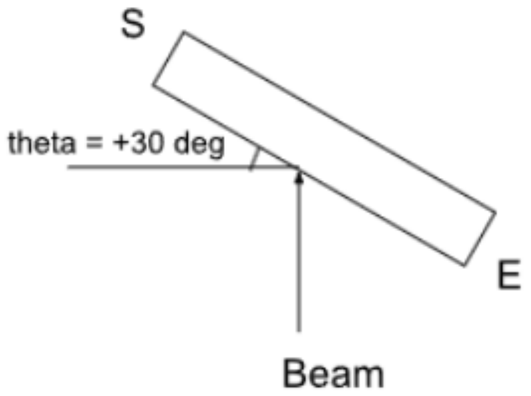




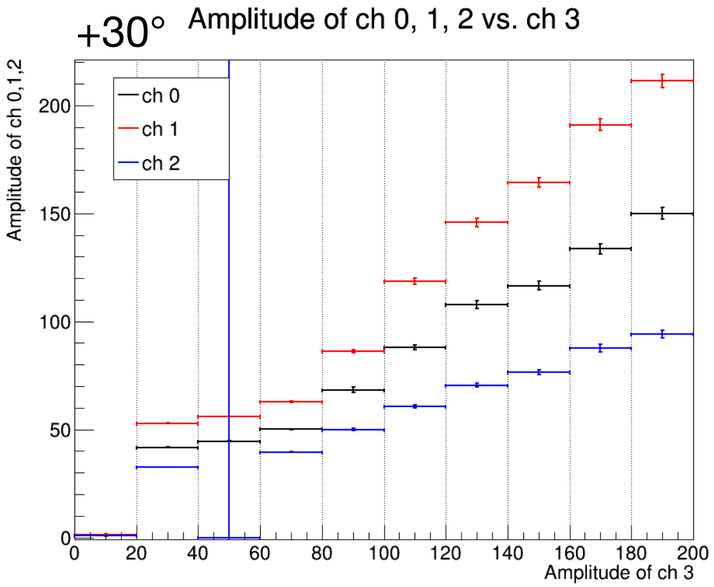


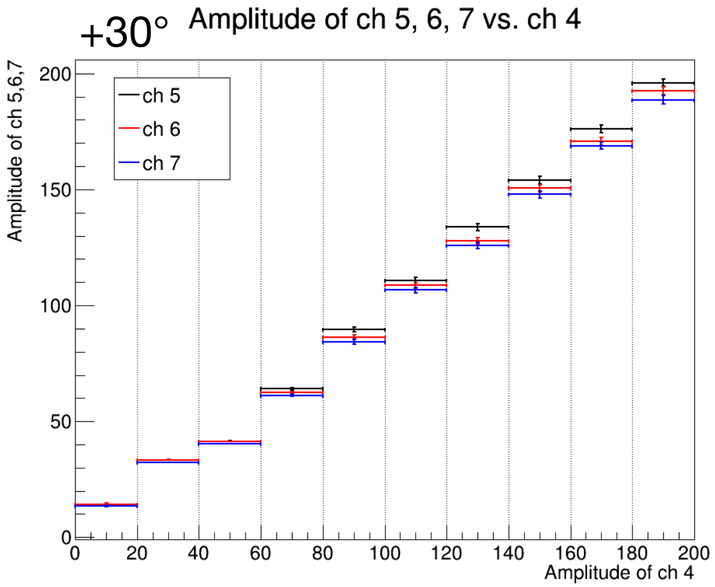
Correlation between channels

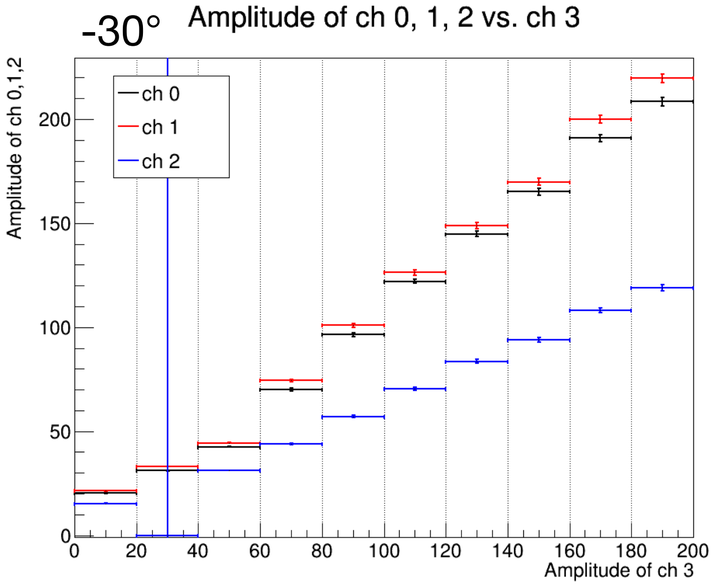
- **PbF2 ±30 degree (all Cherenkov)**
  - Channels on the side closer to the beam have a stronger linear relation.

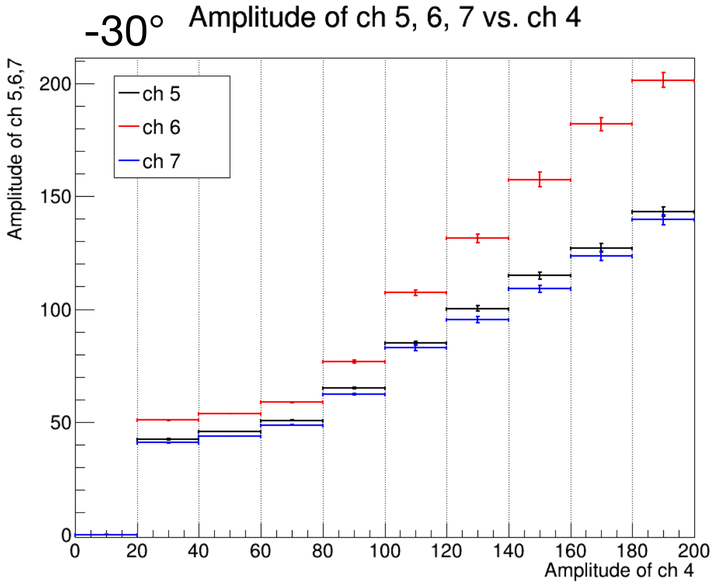


S side: ch 0-3
E side: ch 4-7



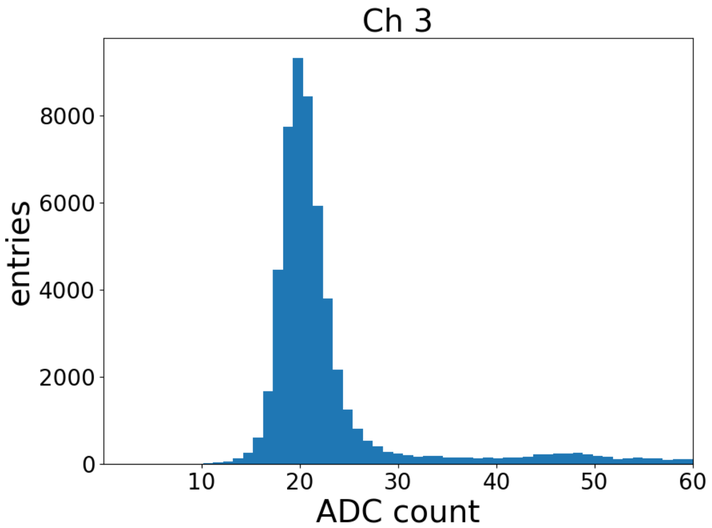


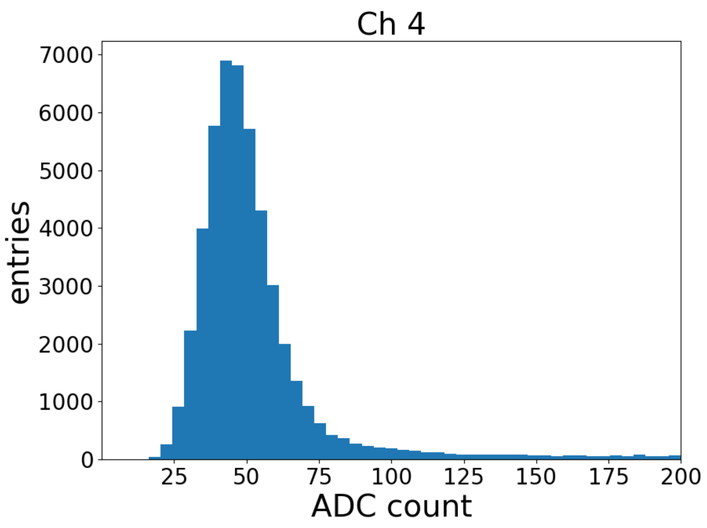




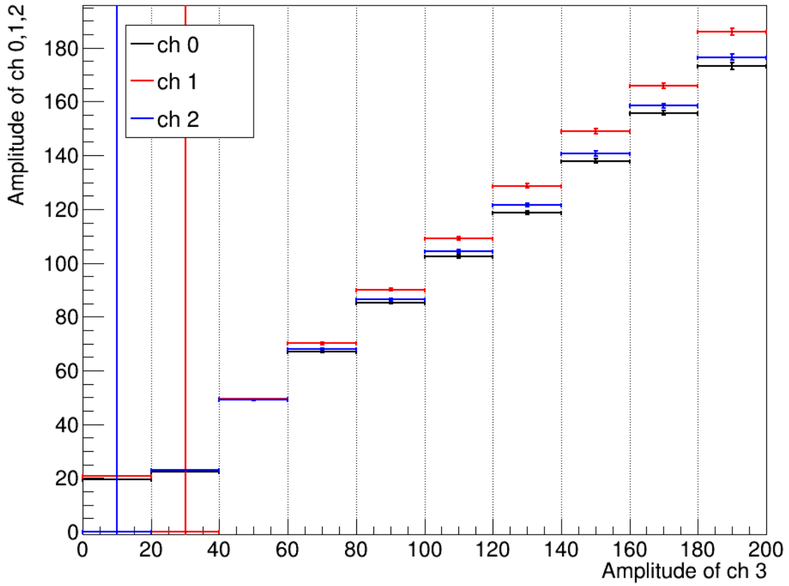
Correlation between channels

- **PWO 0 degree (ch0-3 w/ filter)**
  - Channels on the side with a filter show stronger linear relation within the 20-80 ADC counts region, while the other side show weaker linear relation.
  - Results with ±30 degree shown in [backup].

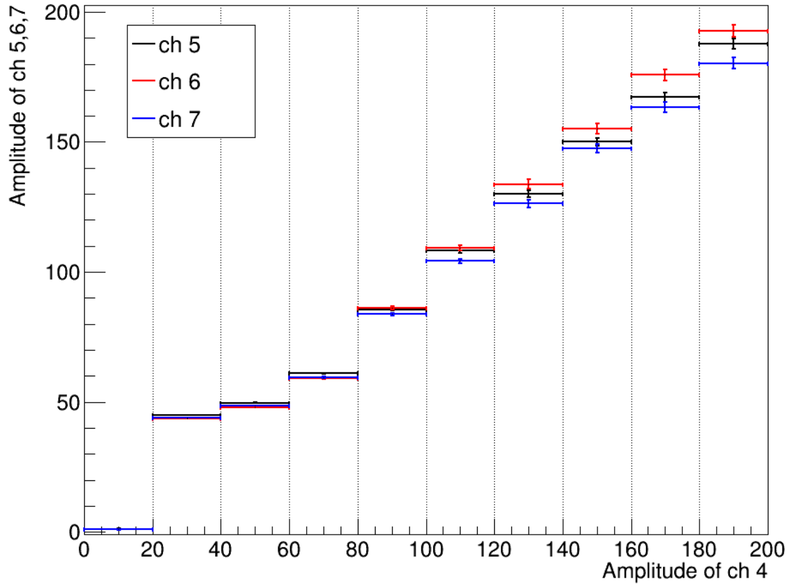




Amplitude of ch 0, 1, 2 vs. ch 3

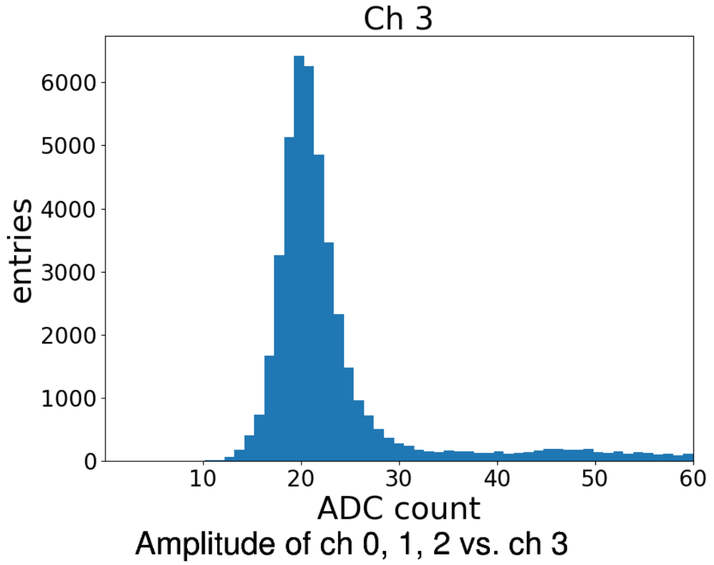


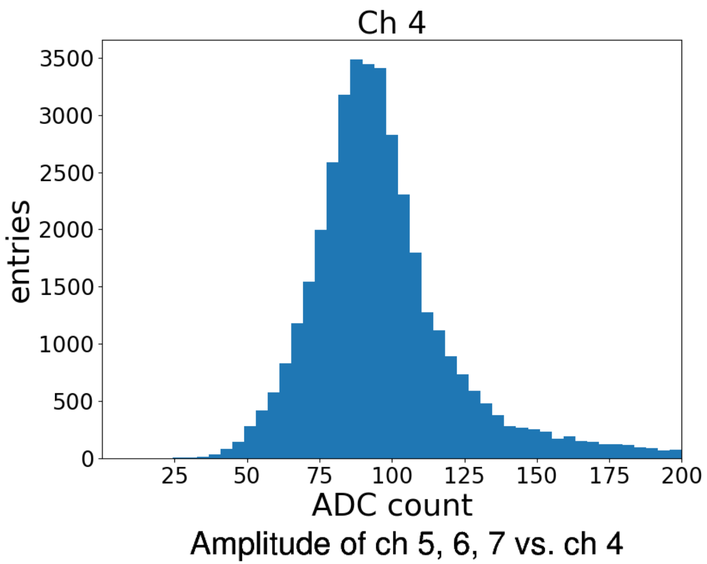
Amplitude of ch 5, 6, 7 vs. ch 4

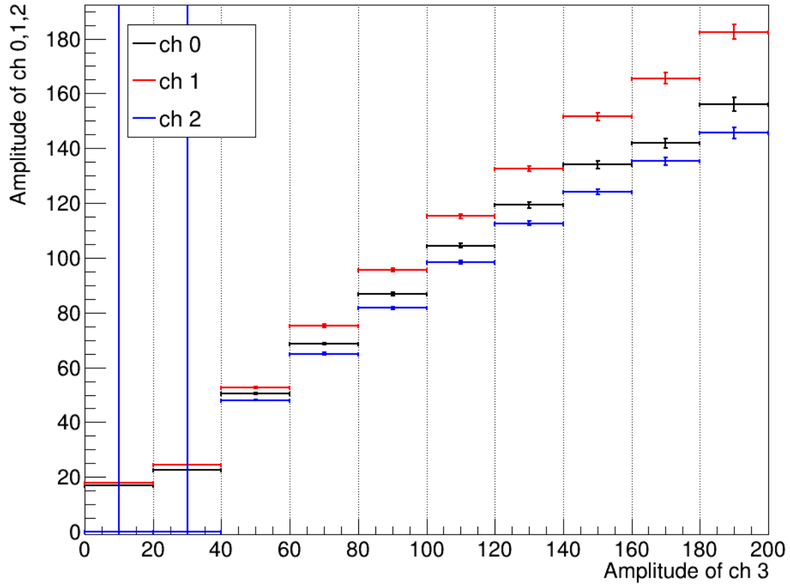


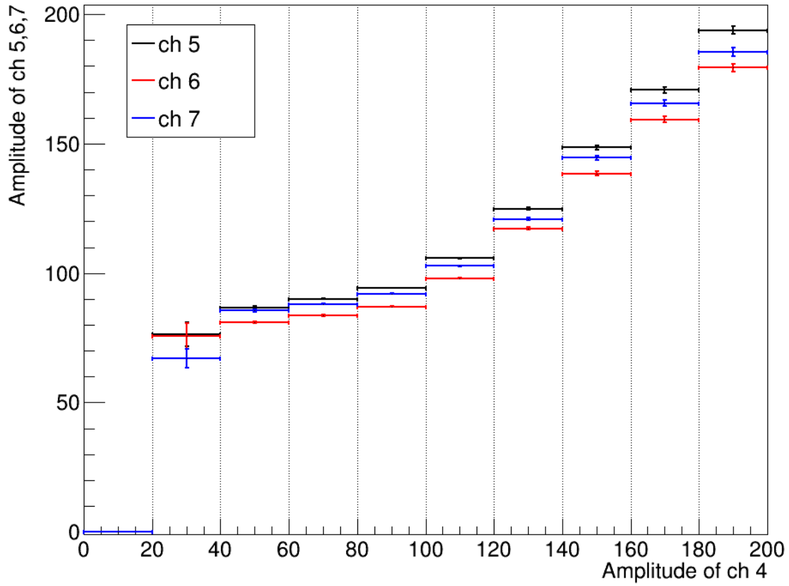
Correlation between channels

- **BGO 0 degree (ch0-3 side w/ filter)**
  - Channels on the side with a filter show stronger linear relation within the 20-80 ADC counts region, while the other side show weaker linear relation.
  - Results with ±30 degree shown in [backup].



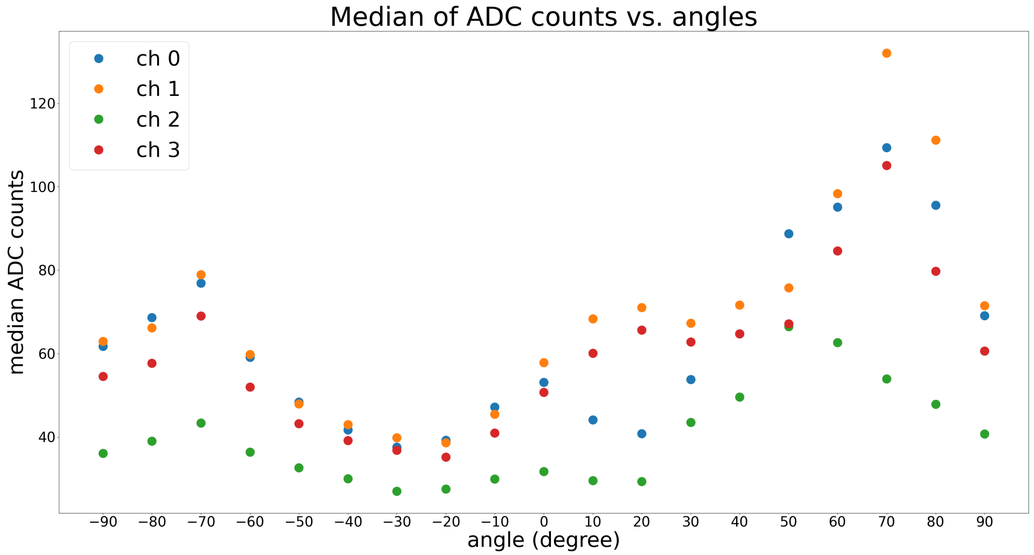


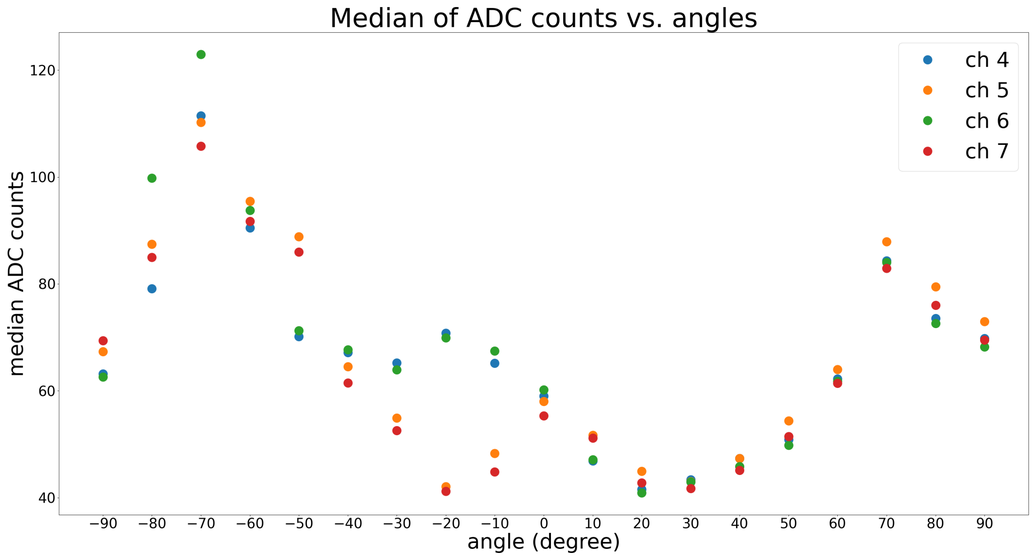




Amplitude w.r.t. angle

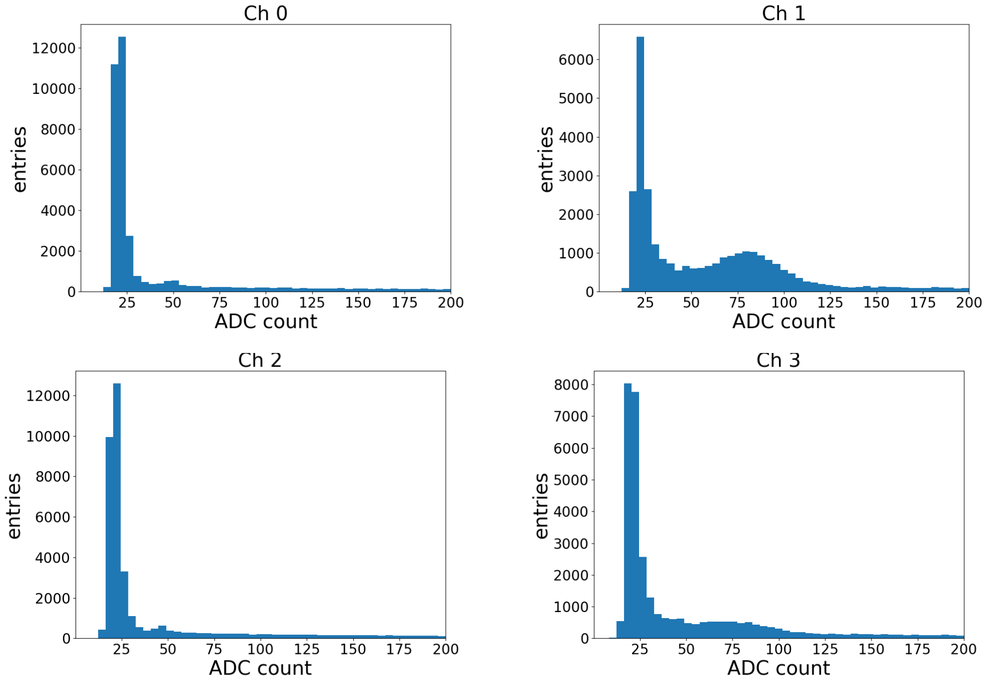
- **PbF2 (all Cherenkov)**
  - Amplitude is not symmetric between positive and negative angles.
  - Channels on the same side generally correlate with each other.
  - But around +20 degree for ch 0-3, and -20 degree for ch 4-7, channels closer to the beam behave differently from those far from the beam.

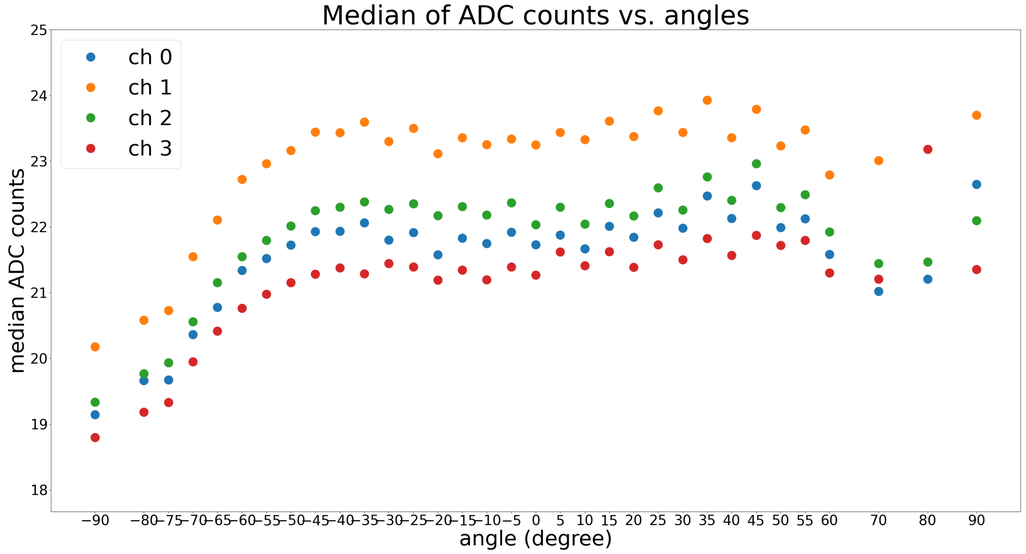


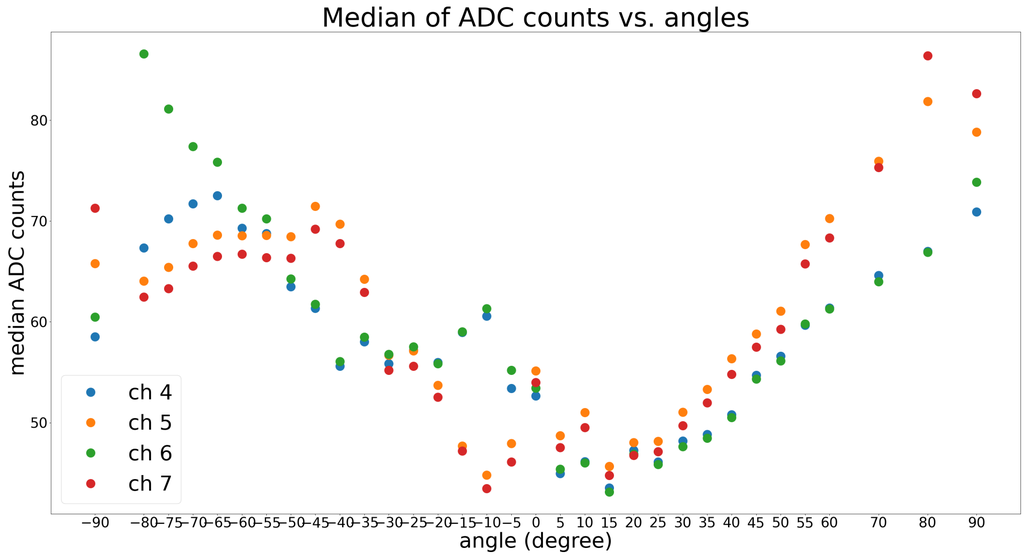


Amplitude w.r.t. angle

- **PWO (ch0-3 w/ filter)**
  - For ch 4-7, channels closer to the beam behave differently from those far from the beam.
  - Ch1 at +80 degree has extreme high amplitude than others.

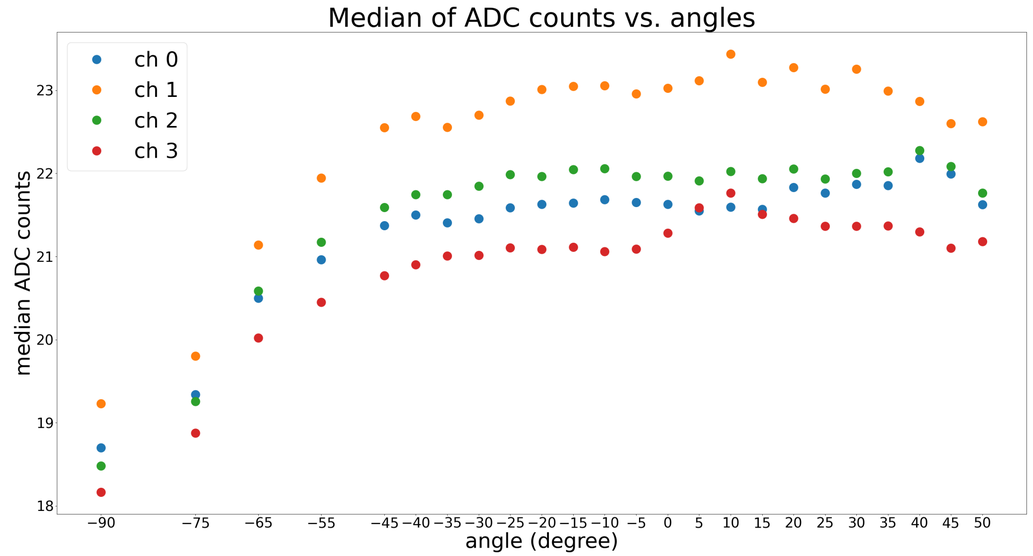


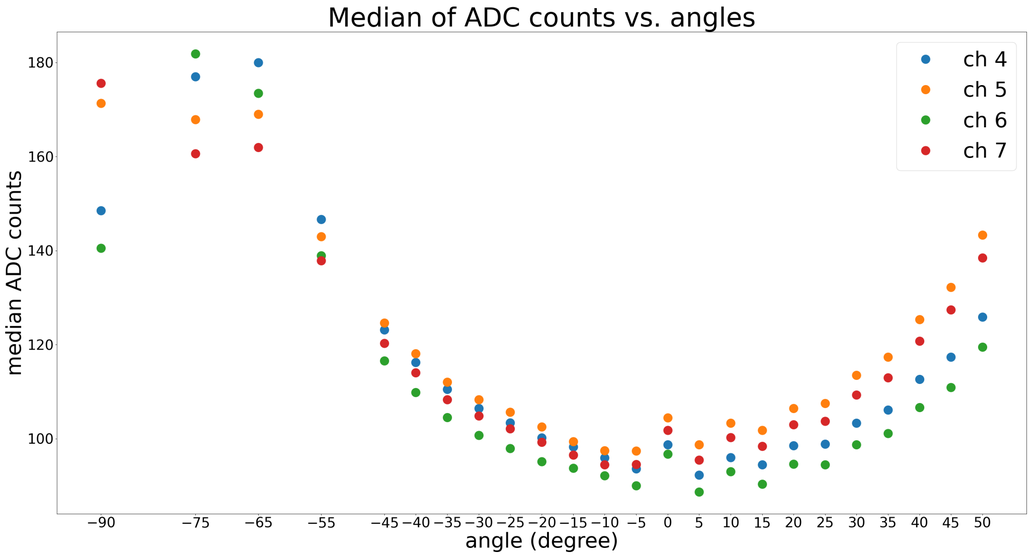




Amplitude w.r.t. angle

- **BGO (ch0-3 w/ filter)**



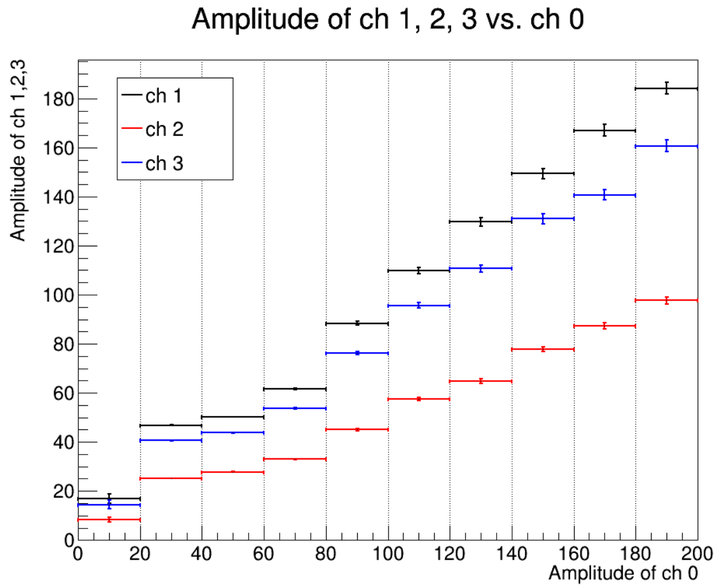


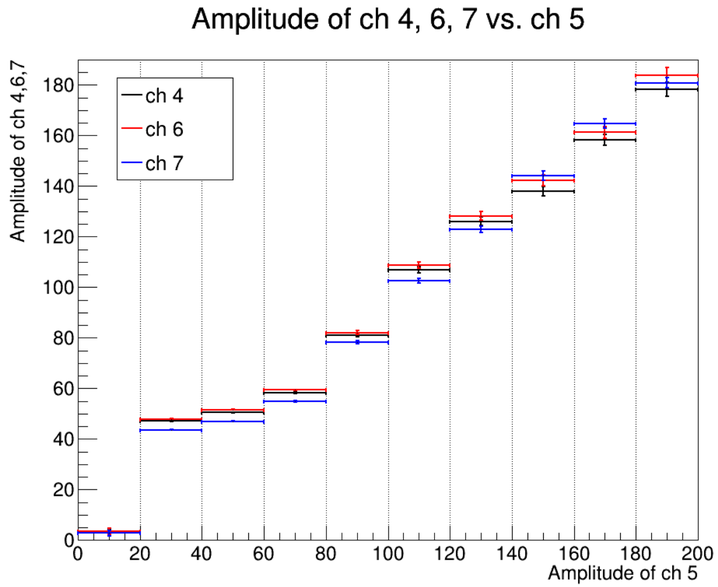
Back up

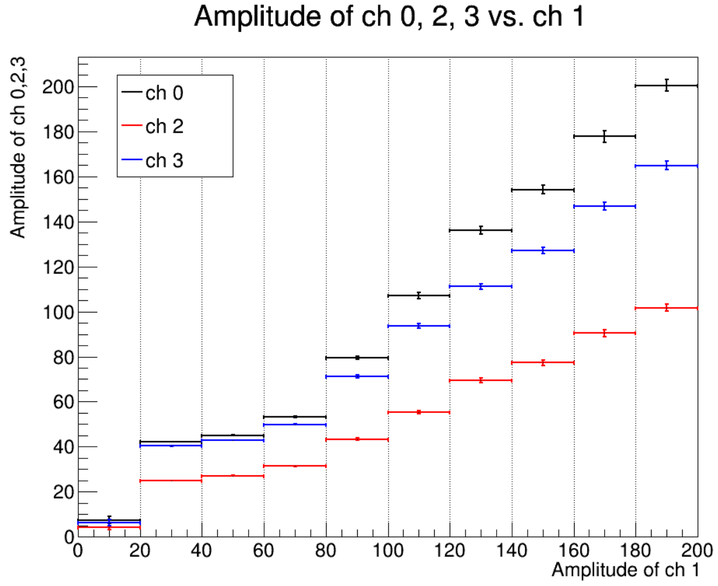
Correlation between channels

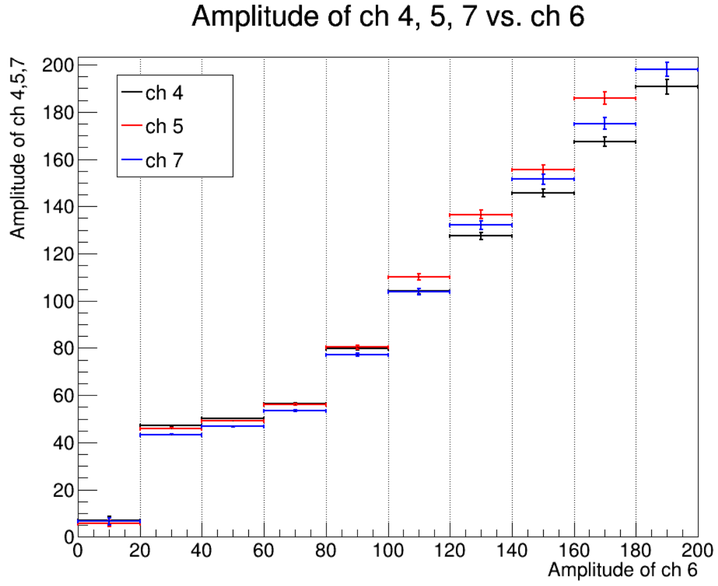
[back]

- **PbF2 0 degree (all Cherenkov)**





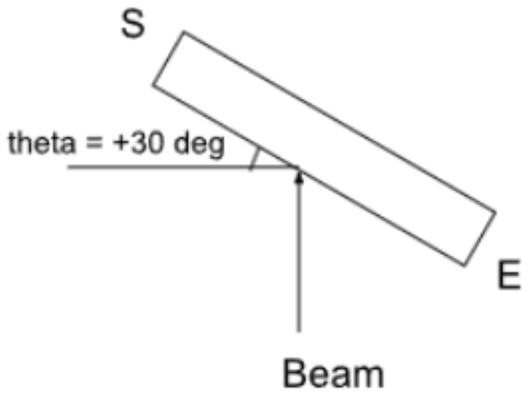




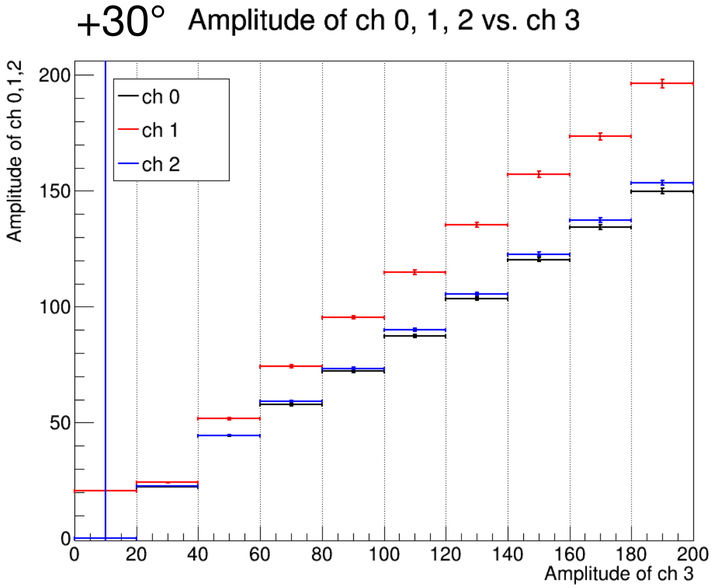
Correlation between channels

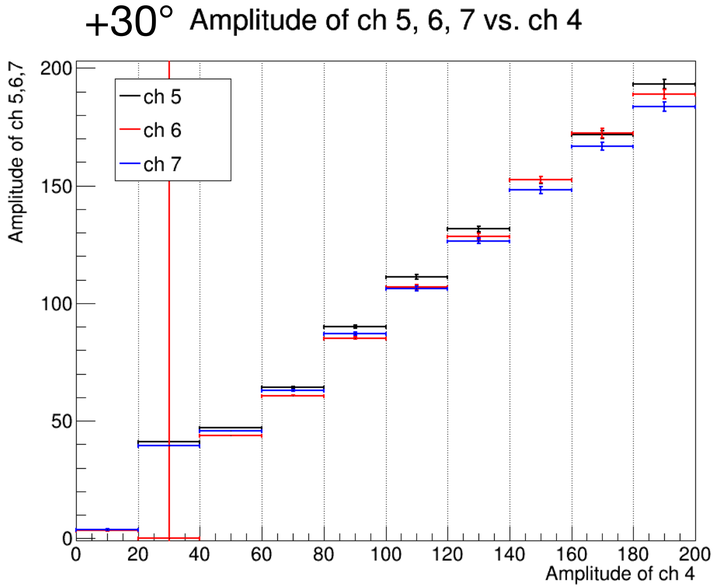
[back]

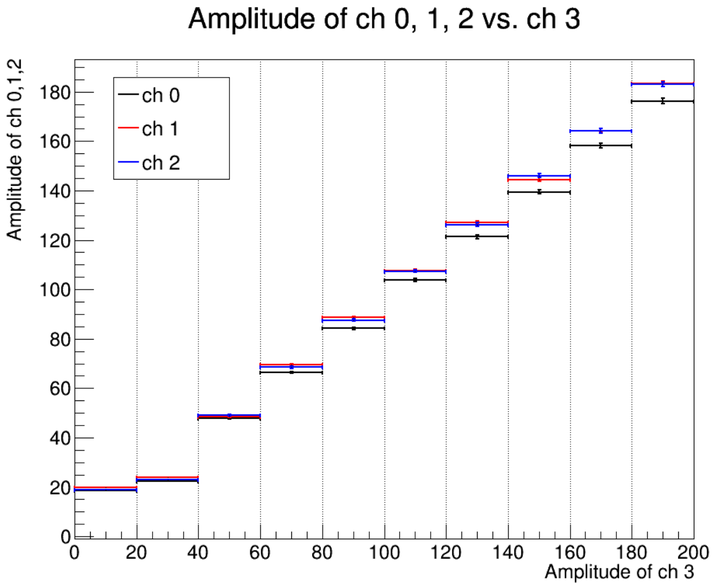
- **PWO ±30 degree (ch0-3 w/ filter)**
  - Channel 0-3 (w/ filter) have a stronger linear relation.

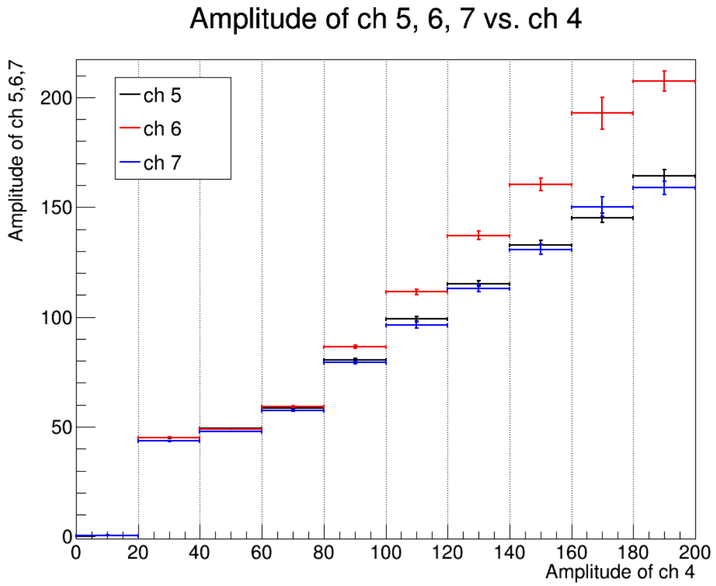


S side: ch 0-3
E side: ch 4-7





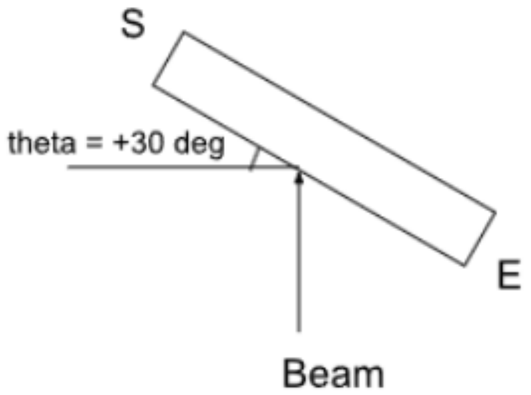




Correlation between channels

[back]

- **BGO ±30 degree (ch0-3 w/ filter)**
  - Channel 0-3 (w/ filter) have a stronger linear relation.



S side: ch 0-3
E side: ch 4-7