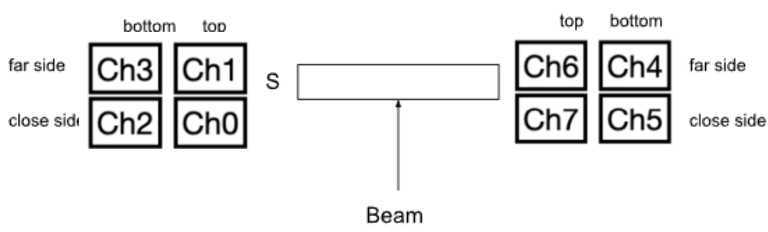
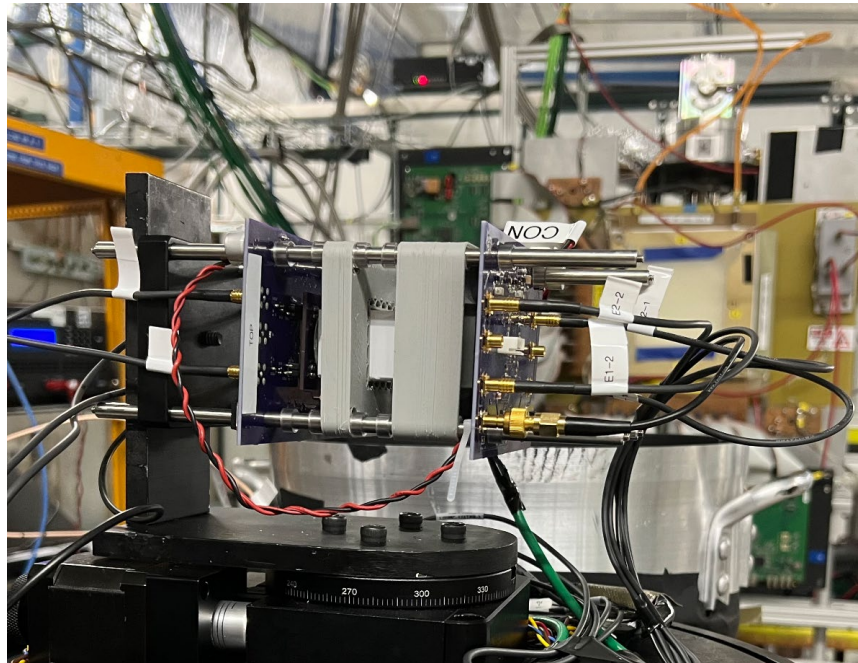
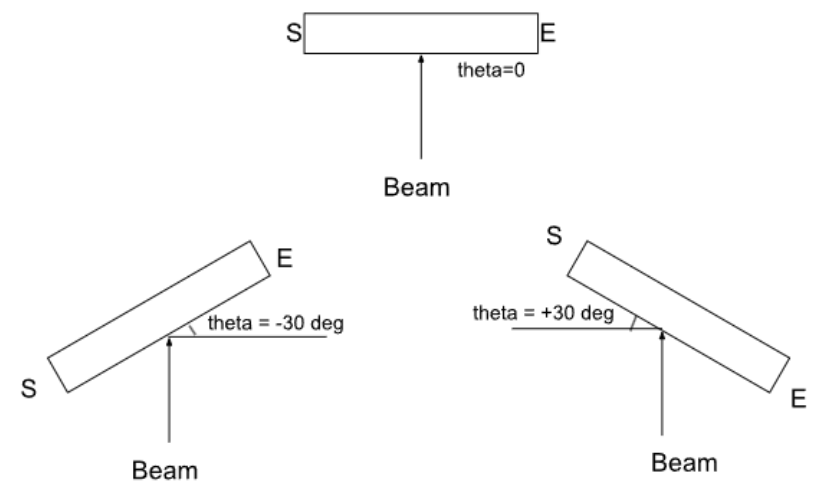


June test beam setup

- Fermilab: 120 GeV protons, ~45k protons evenly distributed in 4 s, only one spill per minute, 8 mm horizontally and 4 mm vertically, only at most one proton expected in our readout window



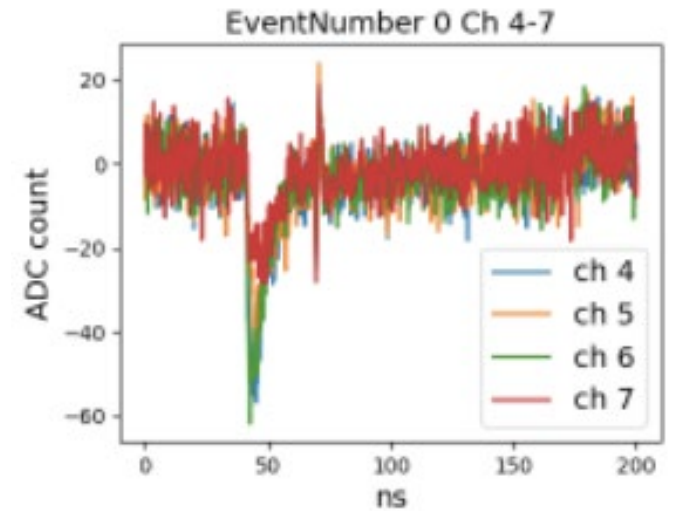
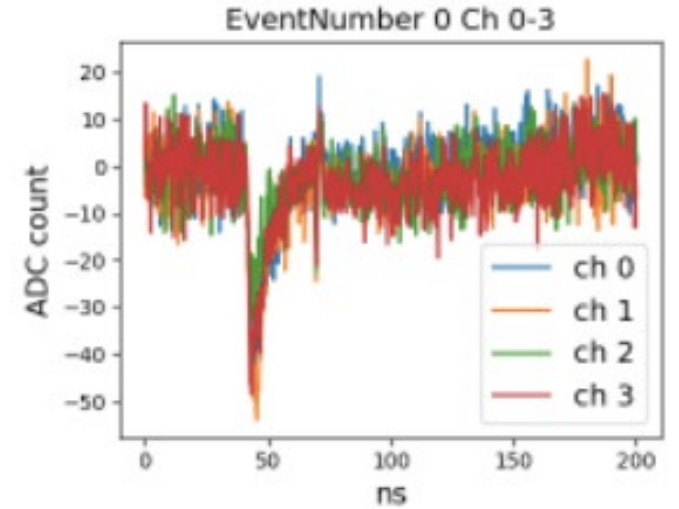
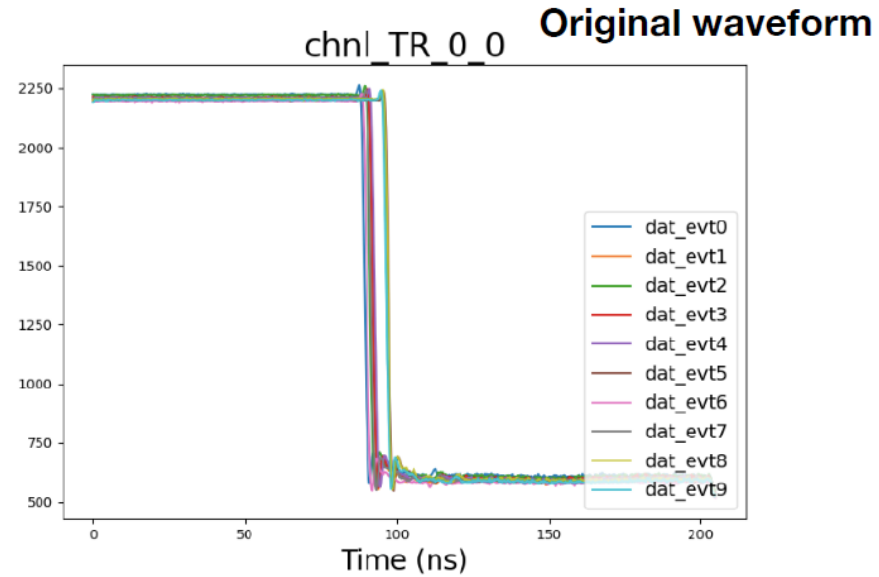
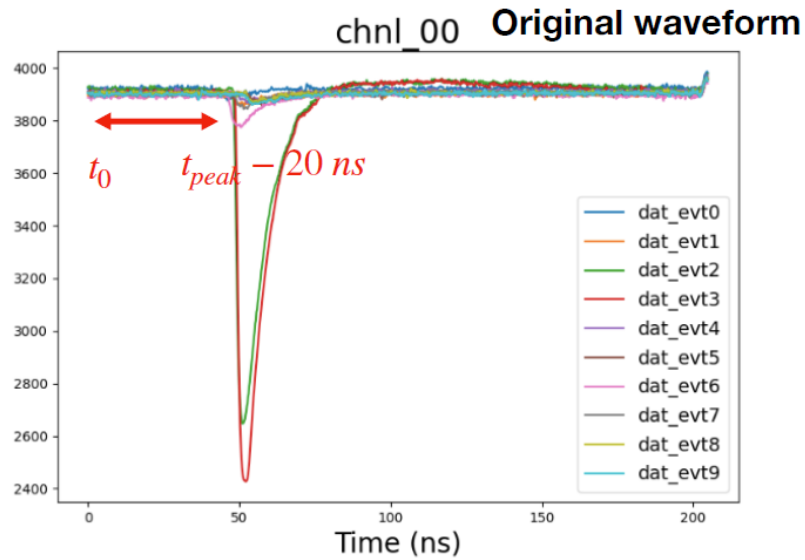
Four 6mmx6mm SiPMs on each side
 0-3 on the S side
 4-7 on the E side



Runs taken

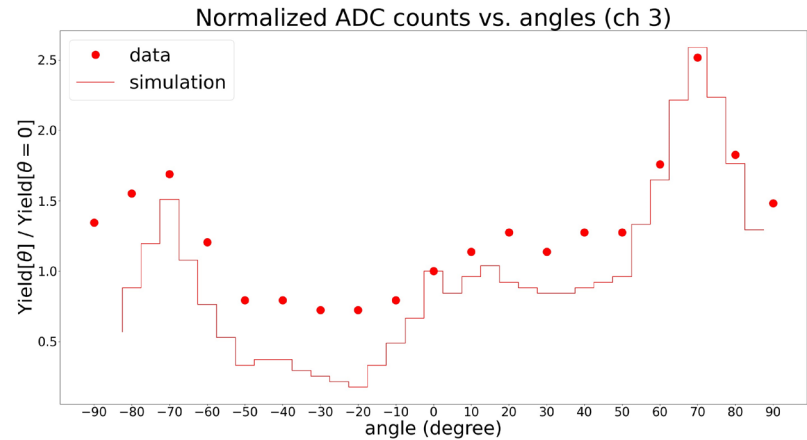
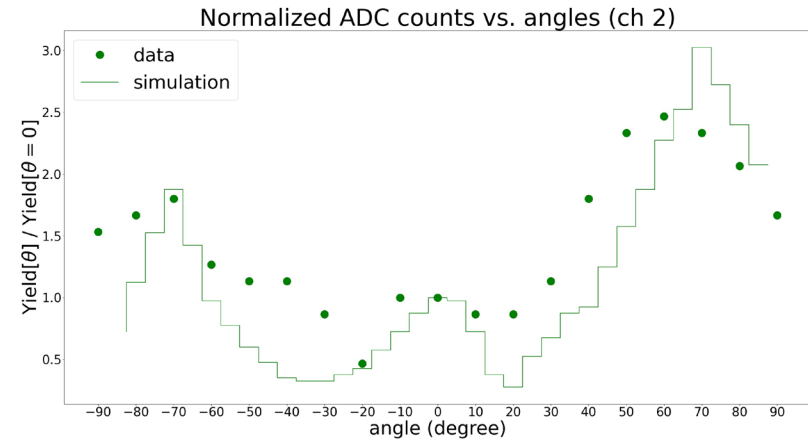
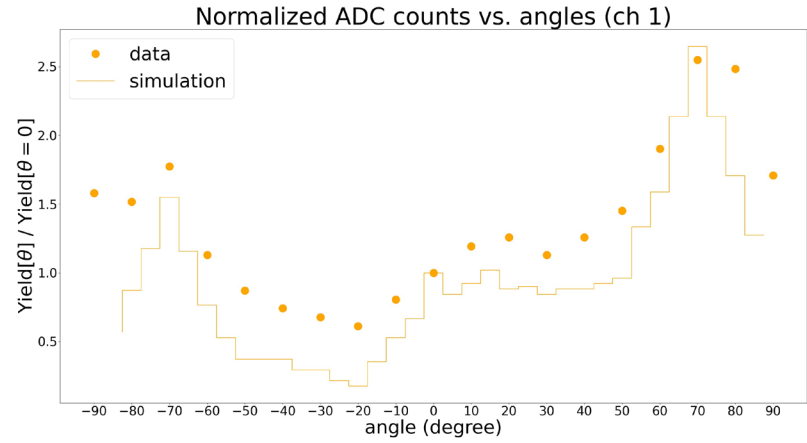
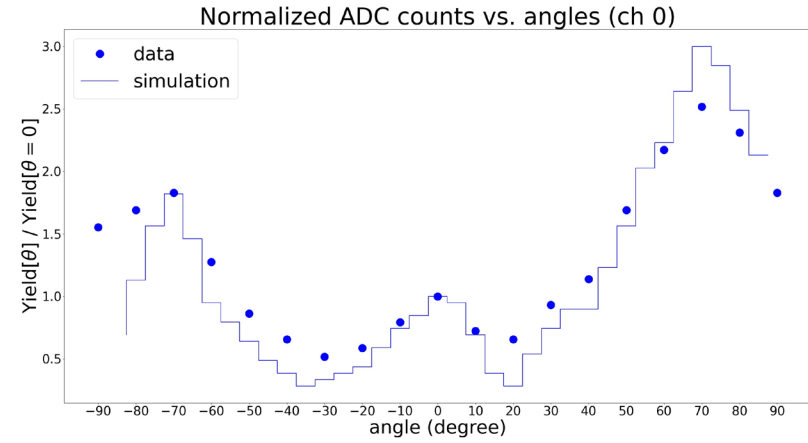
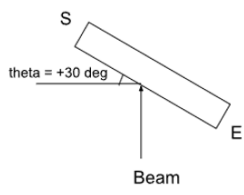
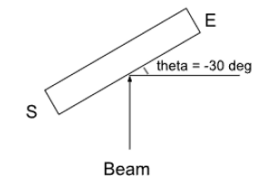
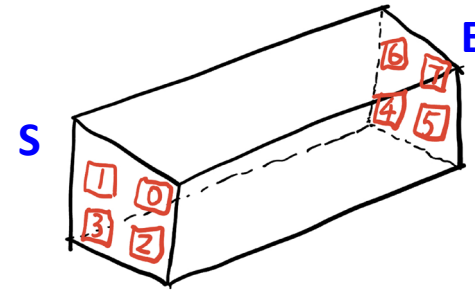
- As a second user and only have access every 10 hours
- Four different configurations tested:
 - PbF2 crystal with different rotation angles
 - PWO crystal with R60 filter placed on the S side with different rotation angles
 - BGO crystal with U330 filter placed on the S side with different rotation angles
 - PWO crystal with no filters on either side with different rotation angles
- Beam only available from Friday afternoon around 4 pm to Monday morning around 6 am, accelerator issues and no beams for Monday and Tuesday
- In total ~5M events collected with 121 runs
- All data available at:
<https://www.dropbox.com/scl/fo/sm8u74vzdonjtt5bfozhe/h?dl=0&rlkey=omv08dy6swlvrx2rwa78m2au>

Timing distribution

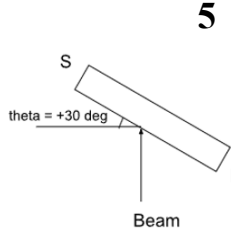
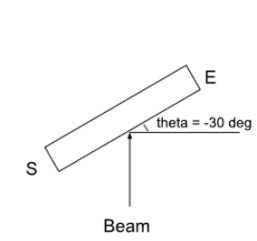
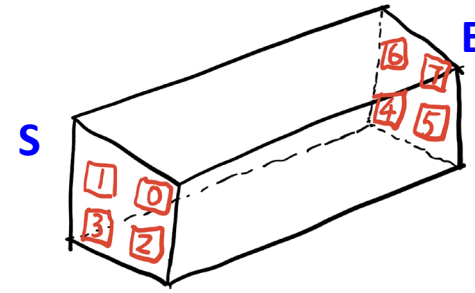


- Events with at least one channel with saturated readout are thrown away
- Ch 2 has very different responses compared to other channels for the PbF2 run

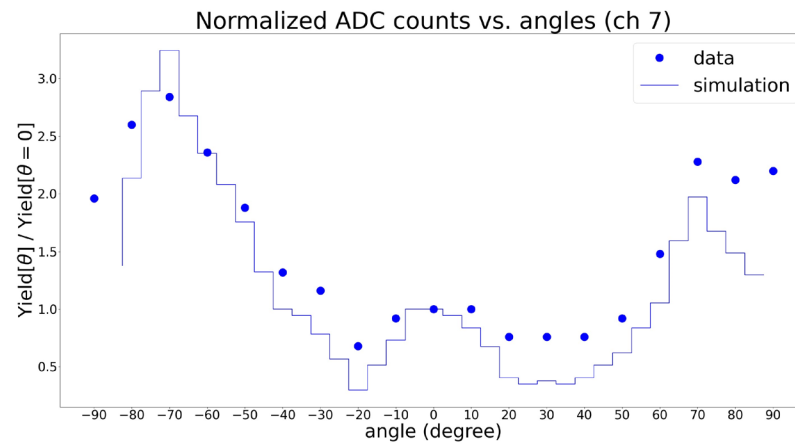
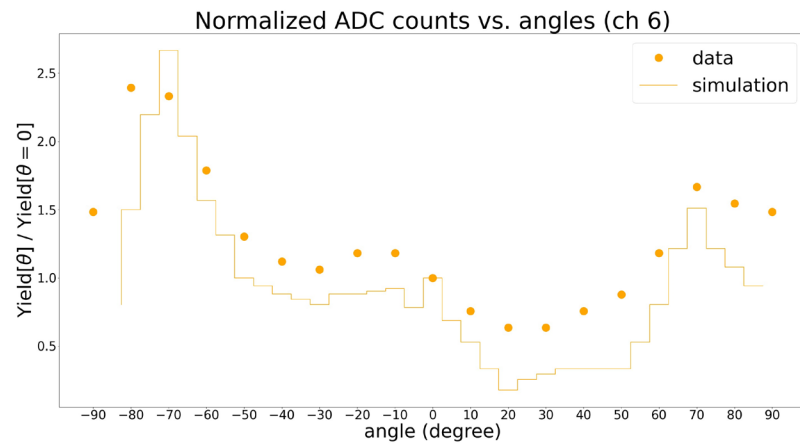
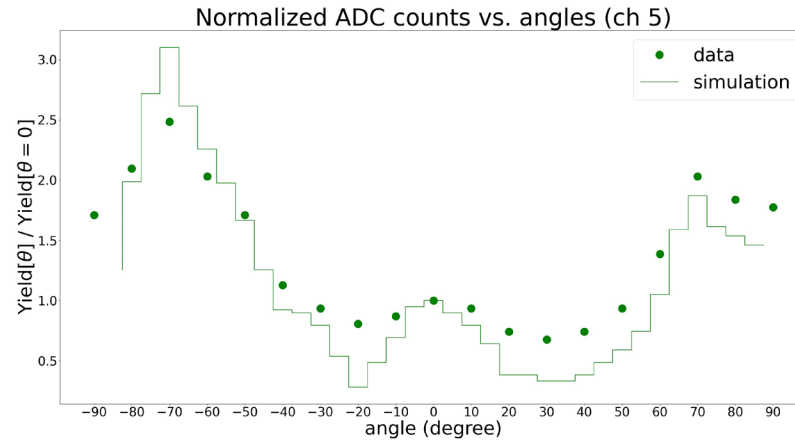
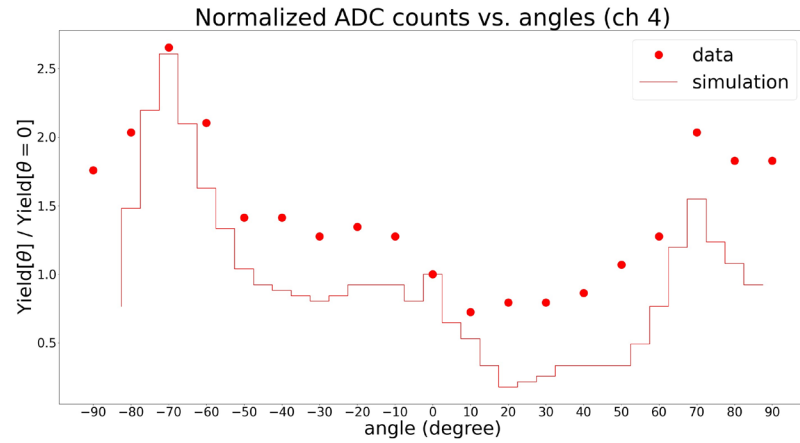
PbF2 channels 0-3



PbF2 channels 4-7



5



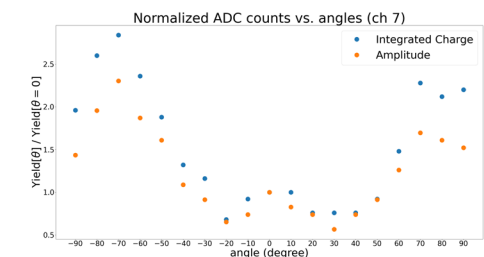
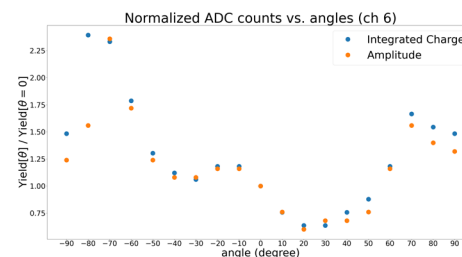
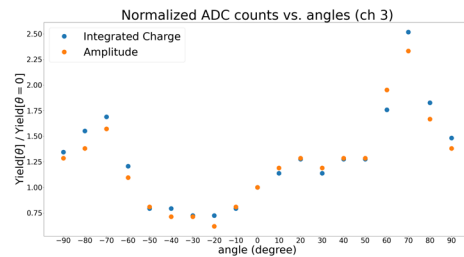
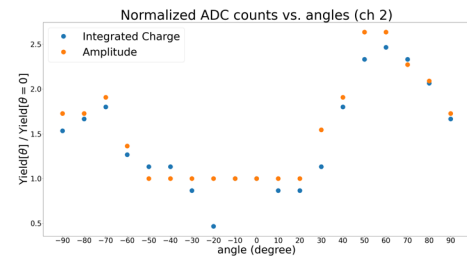
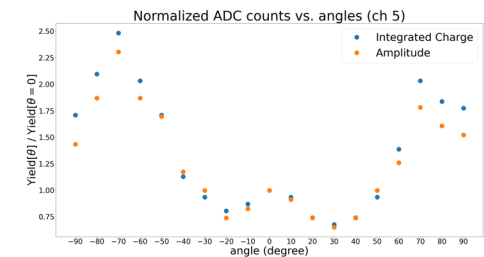
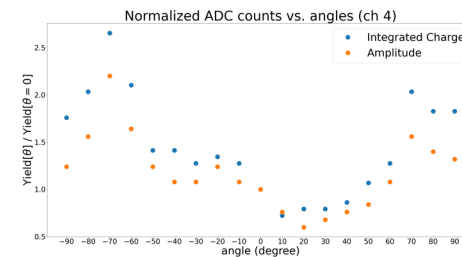
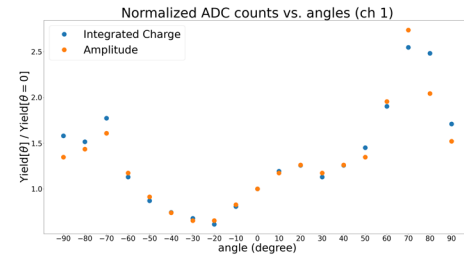
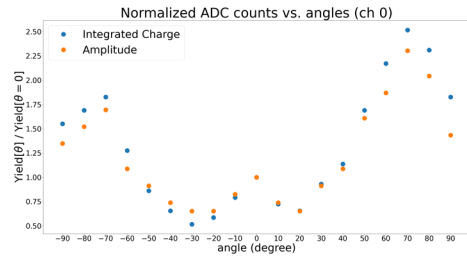
From Hui-Chi and Mekhala

Observations and studies to be performed

- Observations:
 - Reasonable but not perfect agreement between data and simulation
 - Similar behaviors expected between ch 0 and 2 and also between ch 1 and 3 in data and simulation
 - Similar behaviors expected between ch 4 and 6 and also between ch 5 and 7 in data and simulation
 - Ch 0/2 are mirror images of ch 5/7 (same for ch 1/3 and 4/6), they have very similar shapes if we change the sign of the angle
 - Only need to understand the behaviors of two groups (ch 0/2/5/7 and ch 1/3/4/6)
 - Deeper distributions observed for $\pm 30^\circ$ for ch 0/2 (also for ch 5/7) , but shallower distributions observed for $+30^\circ$ for ch 1/3 (-30° for ch 4/6)
 - Slightly better agreement observed for ch 0/(2)/5/7 that are on the forward side

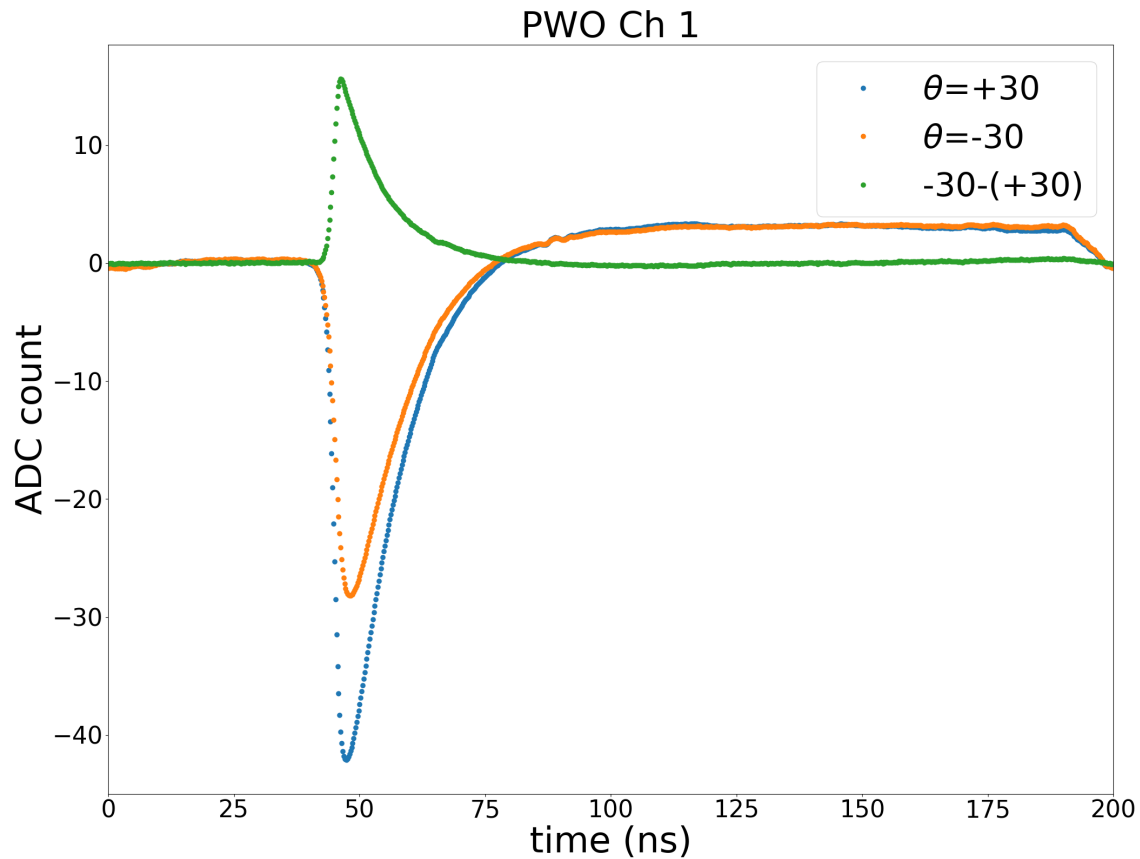
- Studies to be performed:
 - Improve MC statistics
 - Understand why the predicted shapes are different between ch 0/2 and ch 1/3
 - Plan to generate simulated samples with information (timing and hit position) for all photons reaching both ends of the crystal, this will allow us to check the difference at the generator level, and then we can try to add photon detection efficiency by hands
 - Understand the effect of the wrapper material (white tape used, perfect reflective material used in the simulation)
 - Understand the effect of surface modelling in the simulation
 - Understand the effect of hadronic shower in both data and simulation
 - ...

PbF2 comparison using the peak amplitude or the integrated ADC

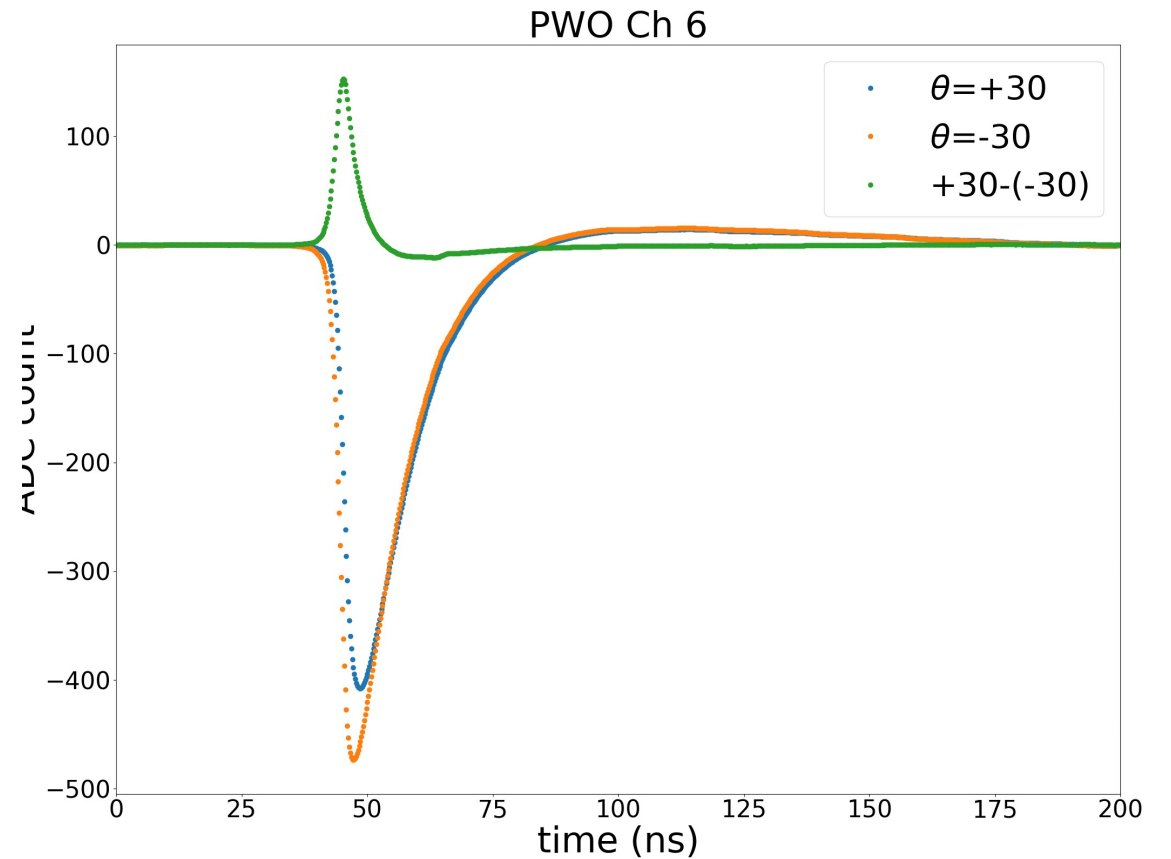


PWO

- We mainly focused on PbF2 studies and did not spend much time looking at PWO data



FWHM: 4-8 ns



From Hui-Chi

Hardware-related development

- Developed and tested the code to read out two CAEN DRS modules
- Developed a python GUI to better control the rotation of the base
- Developed a real time monitoring program