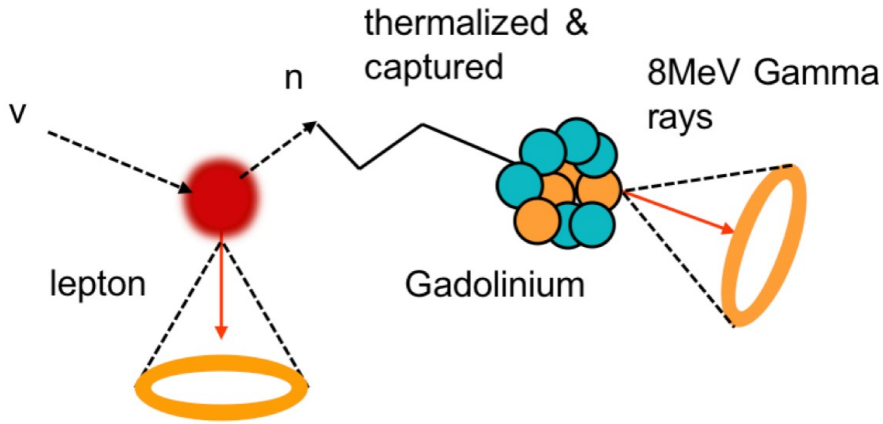
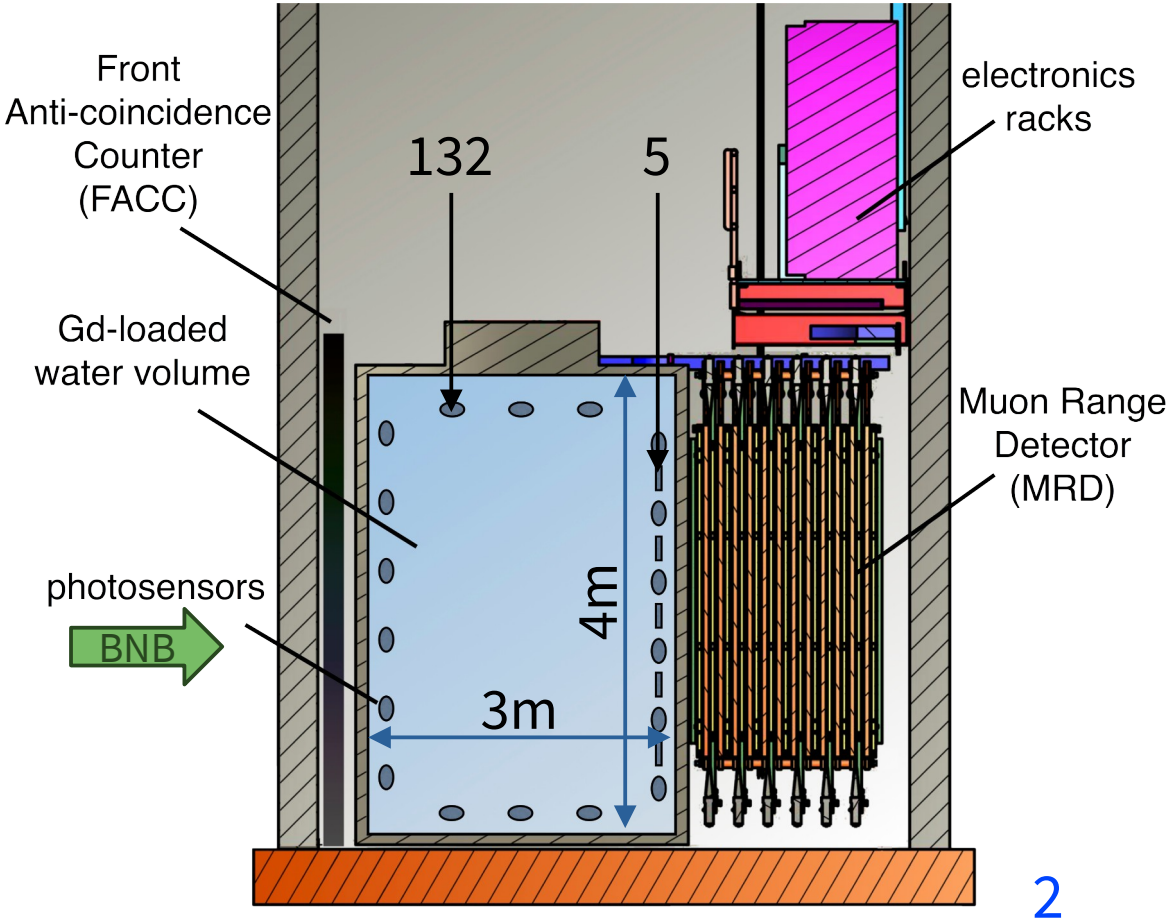
First LAPPD Deployment in ANNIE

Paul Hackspacher
on behalf of the
ANNIE Collaboration

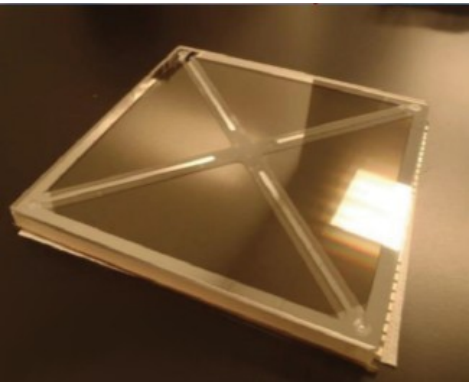
ANNIE

- Accelerator Neutrino Neutron Interaction Experiment
- Water Cherenkov detector
- Measure neutron multiplicity from ν_μ w.r.t. momentum transfer
- Measure ν cross-section in $H_2\underline{O}$

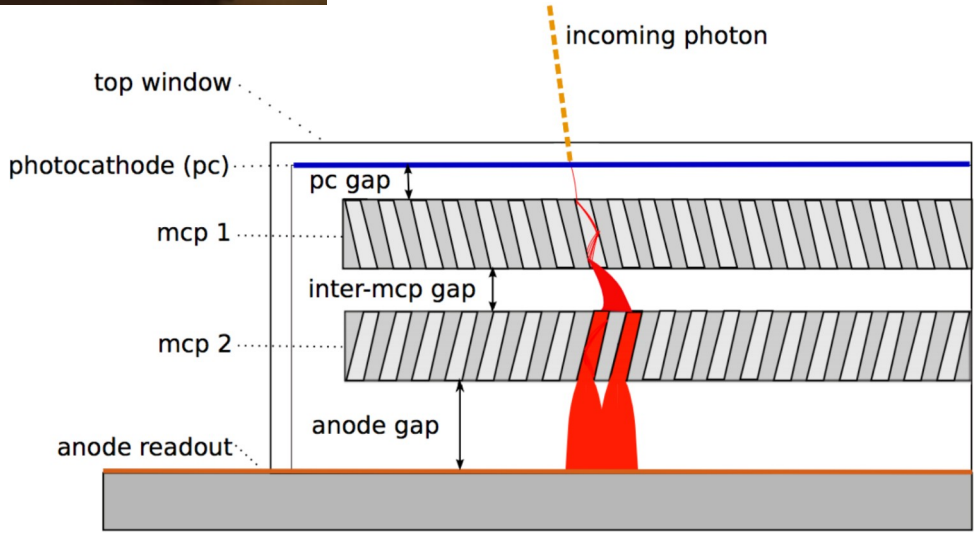


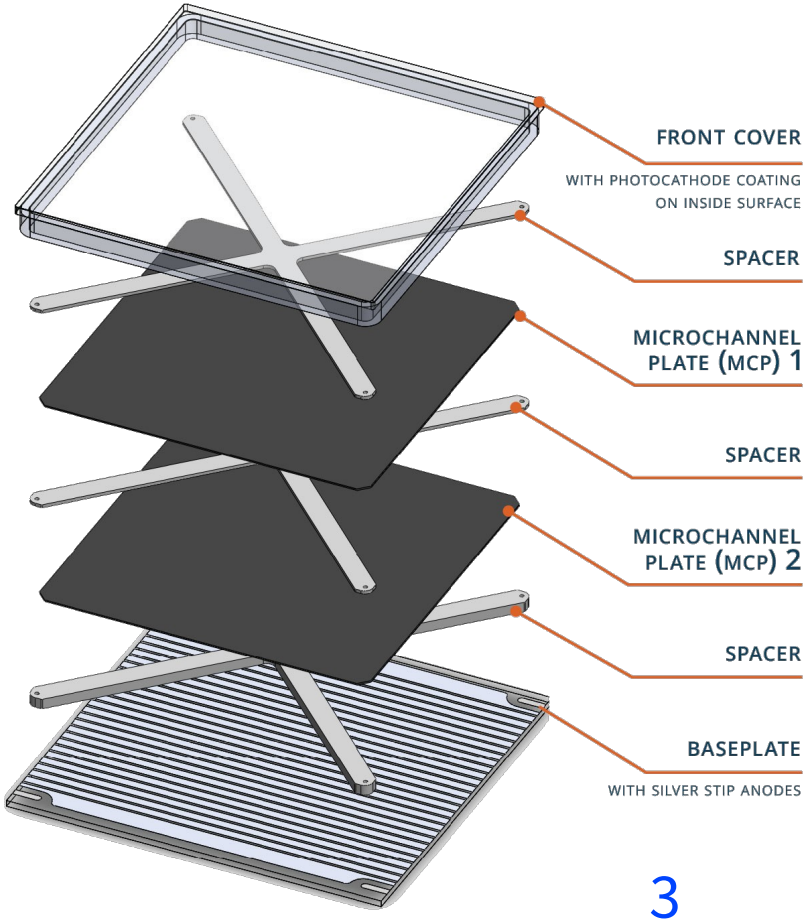


LAPPD



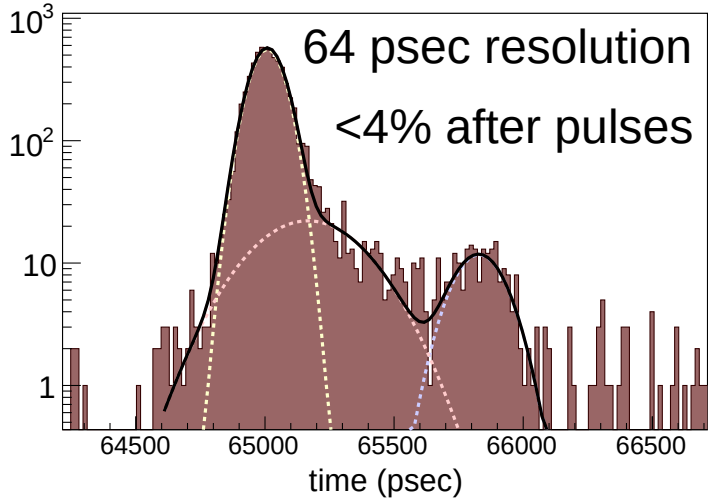
- Large Area Picosecond Photo-Detectors
- 2.35 kV PC voltage
- 10^7 uniform gain

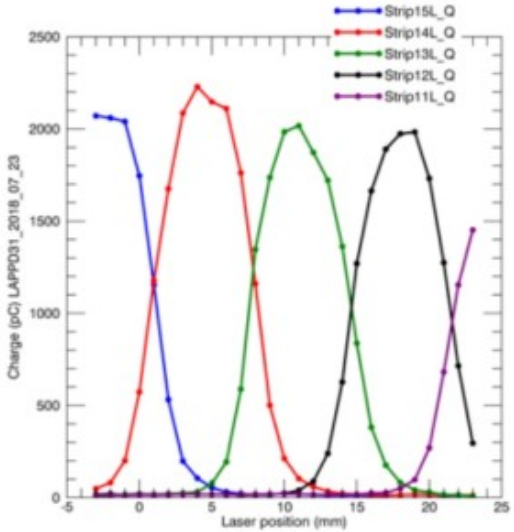


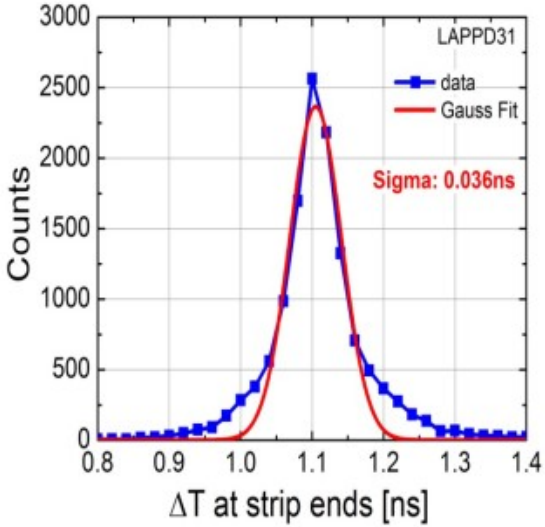


Resolution

- 25.6ns circle buffer
- ~60ps TTS timing resolution
- 20cm×20cm active area (8″×8″)
- 28+2 channels (sig+trig)
- ~5mm spatial resolution (⊥)
- ~7mm spatial resolution (||)

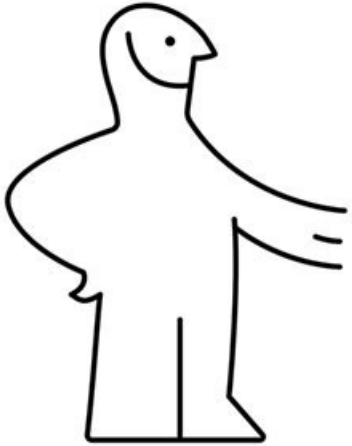




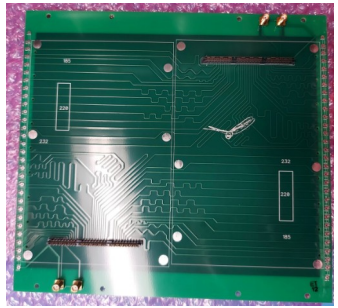


Components

LAPPD



LAPPD ×1

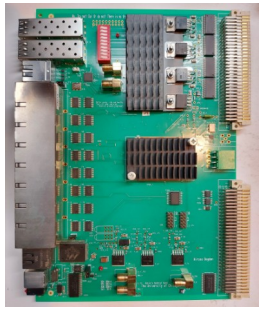


Pick-Up Board ×1

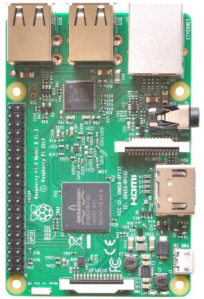
Trigger Card ×1

ACDC ×2

LVHV ×1

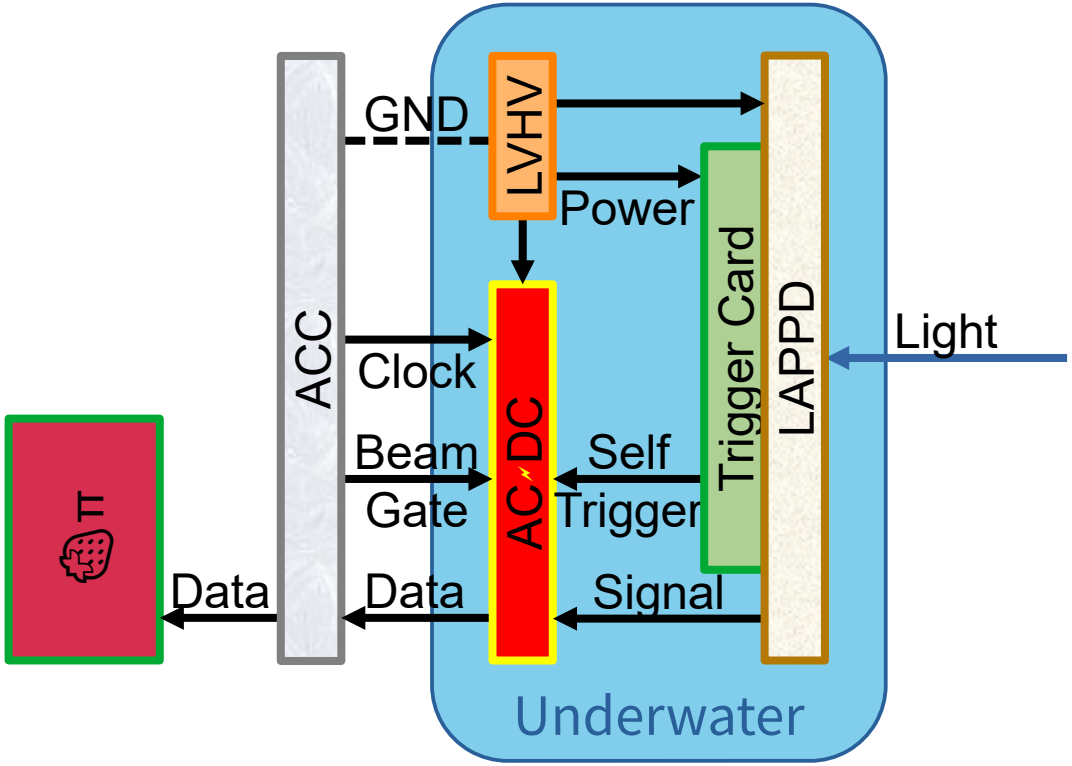


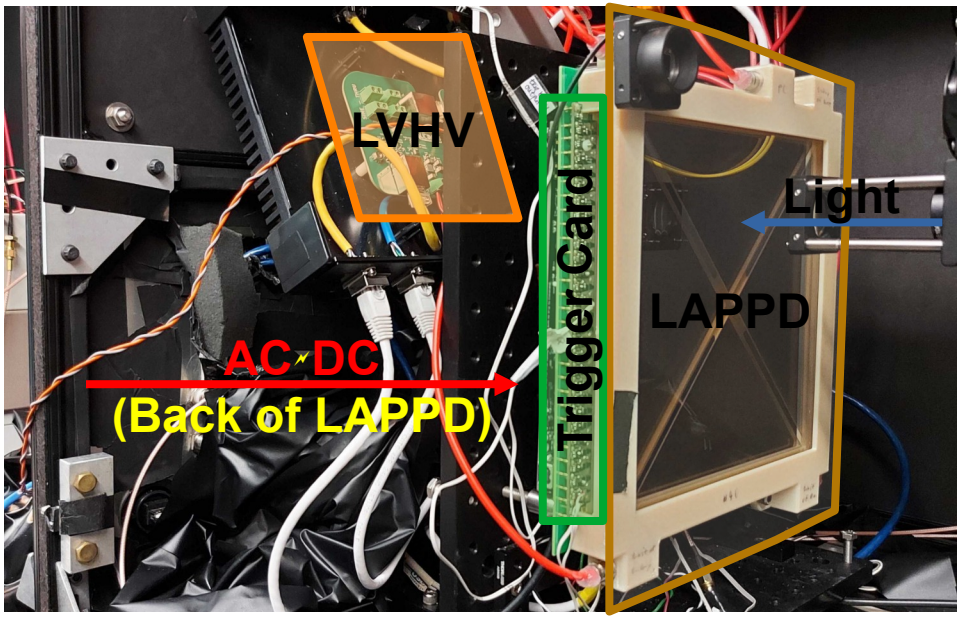
ACC ×1



RPi ×2

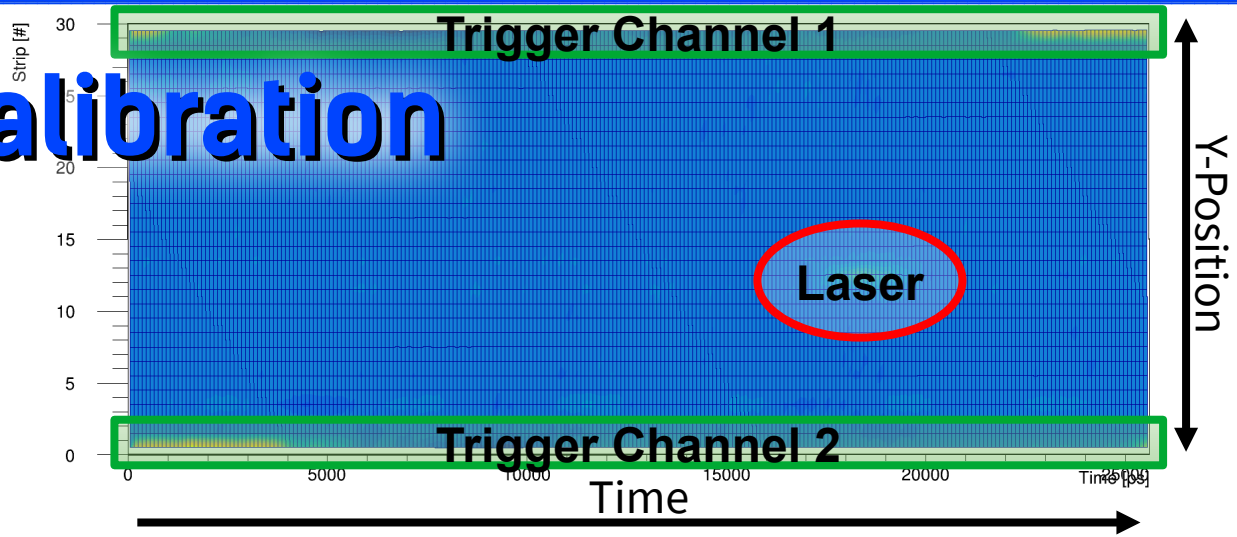
Testing

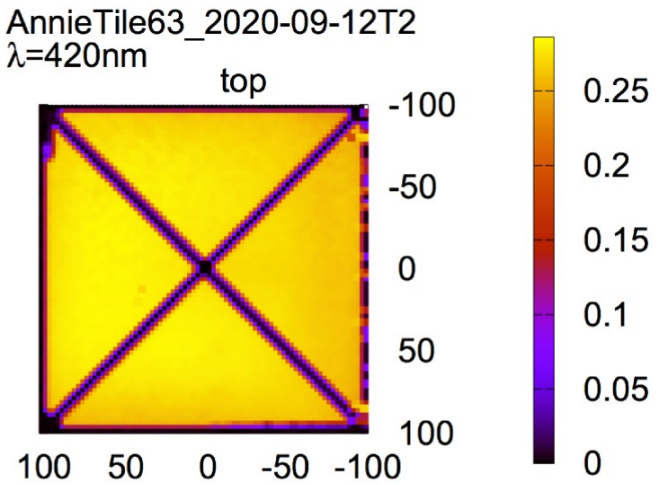

GND
LVHV
Power
ACC
Clock
Beam
Gate
AC-DC
Self
Trigger
Trigger Card
LAPPD
Light
Data
Data
Signal
Underwater

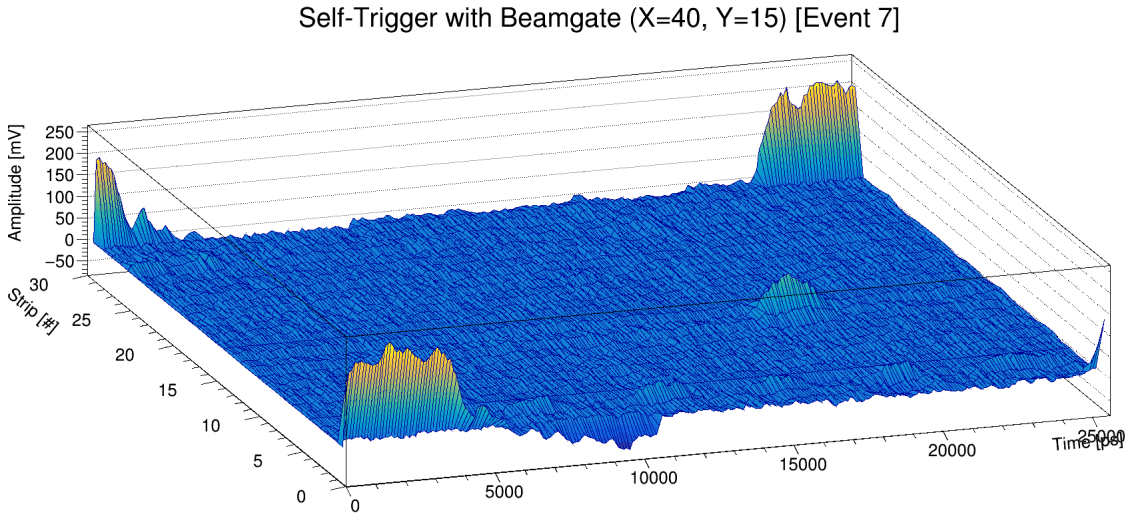

LVHV
Trigger Card
Light
LAPPD
AC-DC
(Back of LAPPD)

Calibration

- Timing check with LASER (right)
- QE scan with LED (below)
- Average QE: (26.8±2.55)%
- Typical PMT QE: ~25%

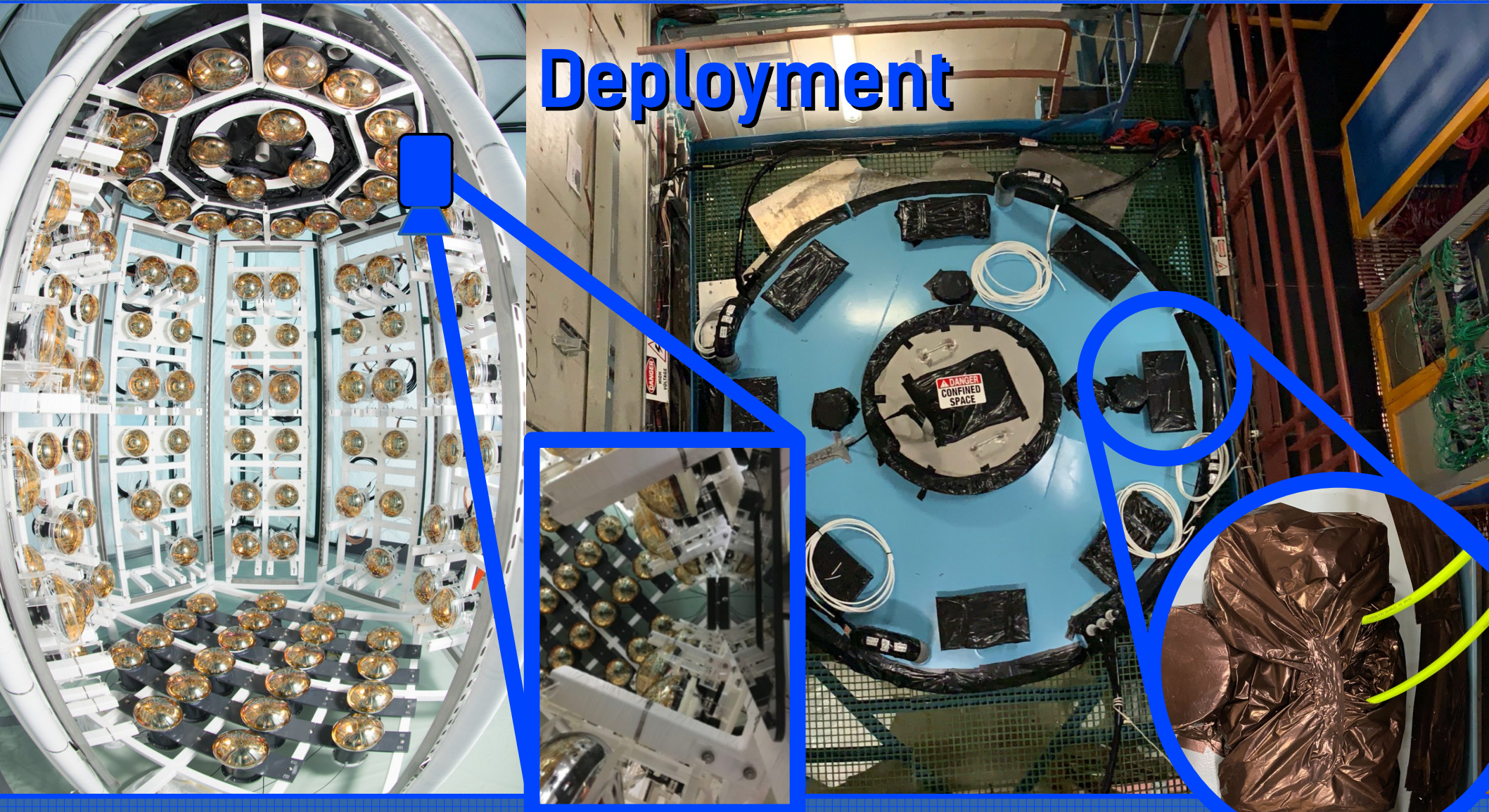






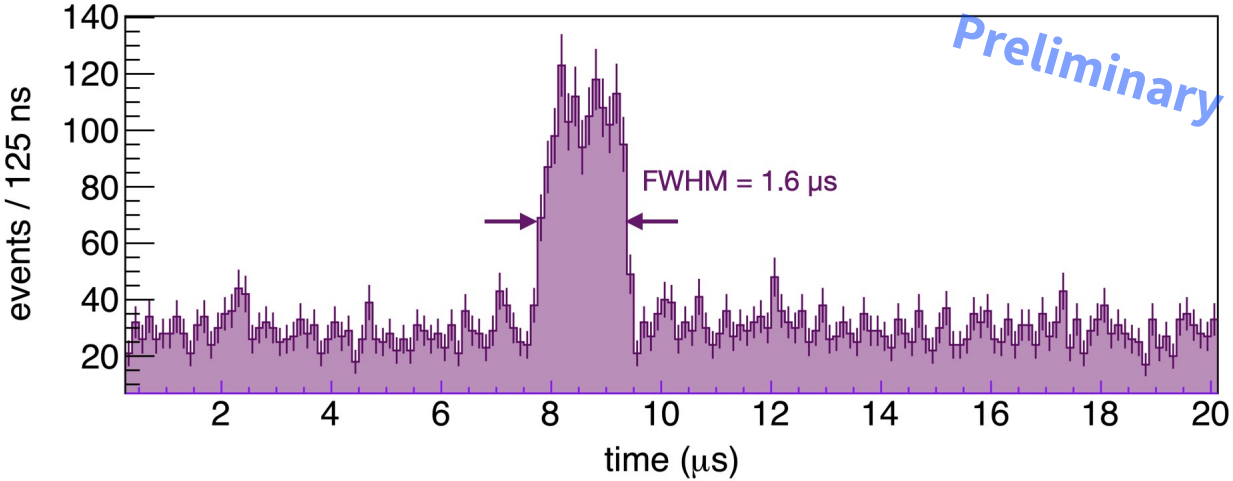
Waterproof Housing

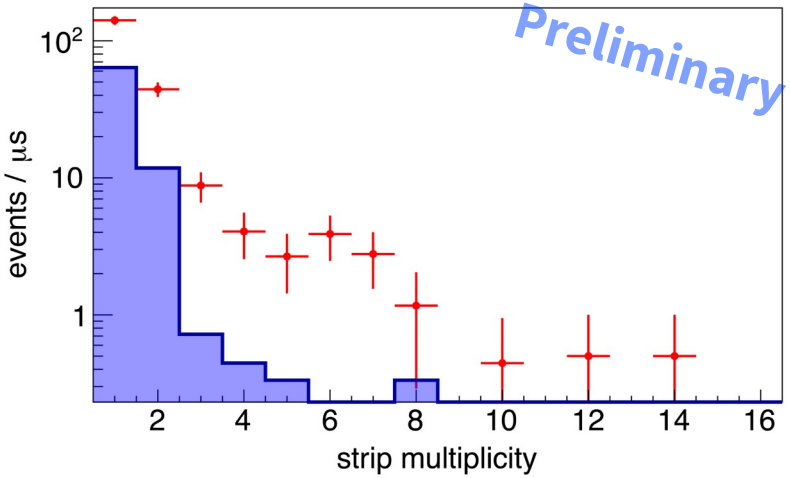
Deployment



KOREA·1950·
REVOLUTIONARY·WAR·1775–1783

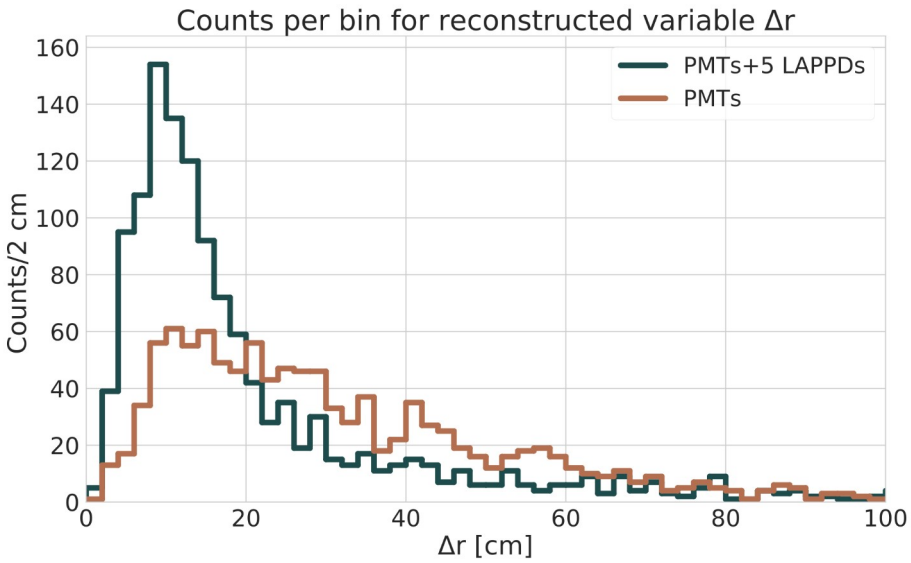
First Light

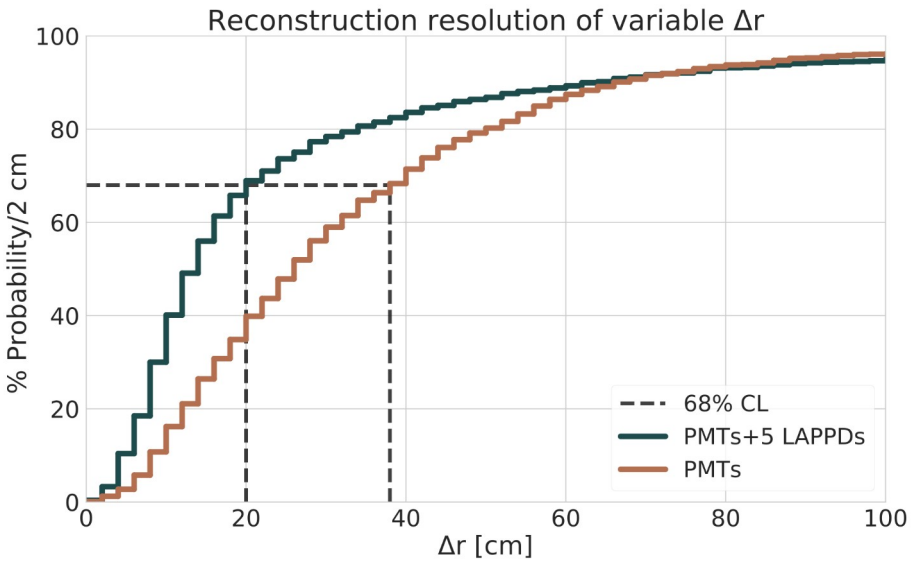




- Left: Time distribution of events in beam-on data w.r.t. start of beamgate
- Right: Strip multiplicity in beam-on data (red) vs beam-off data (blue)

Improved Resolution





Better resolution ⇒ Better vertex reconstruction ⇒ Better energy reconstruction
⇒ Better results

Thank You For Your Attention!