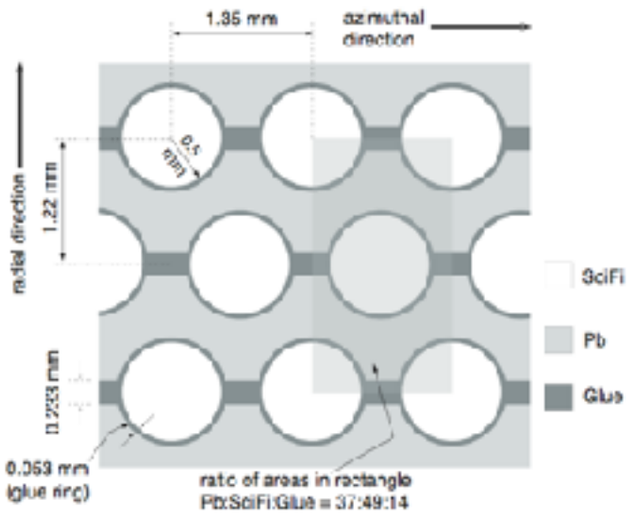
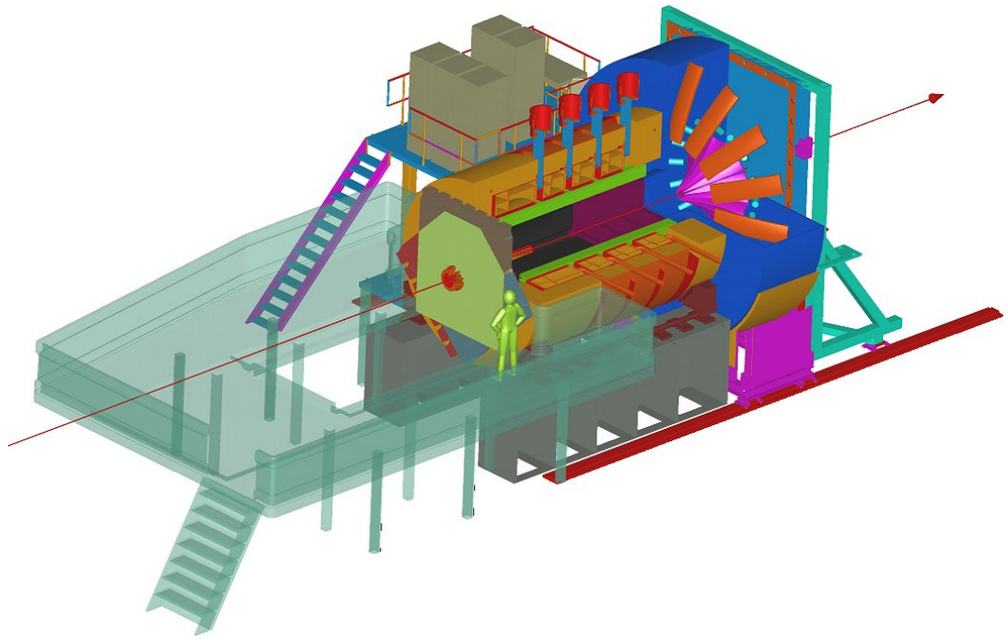




GlueX Baby BCAL Prototype

In-Person Barrel Imaging Calorimeter Meeting

Argonne National Lab

June 12-16, 2023

Z. Papandreou

GlueX-BCAL Construction

- Baby BCAL specs
- Beam Test setup - Hall D/JLab
- Analysis and goals

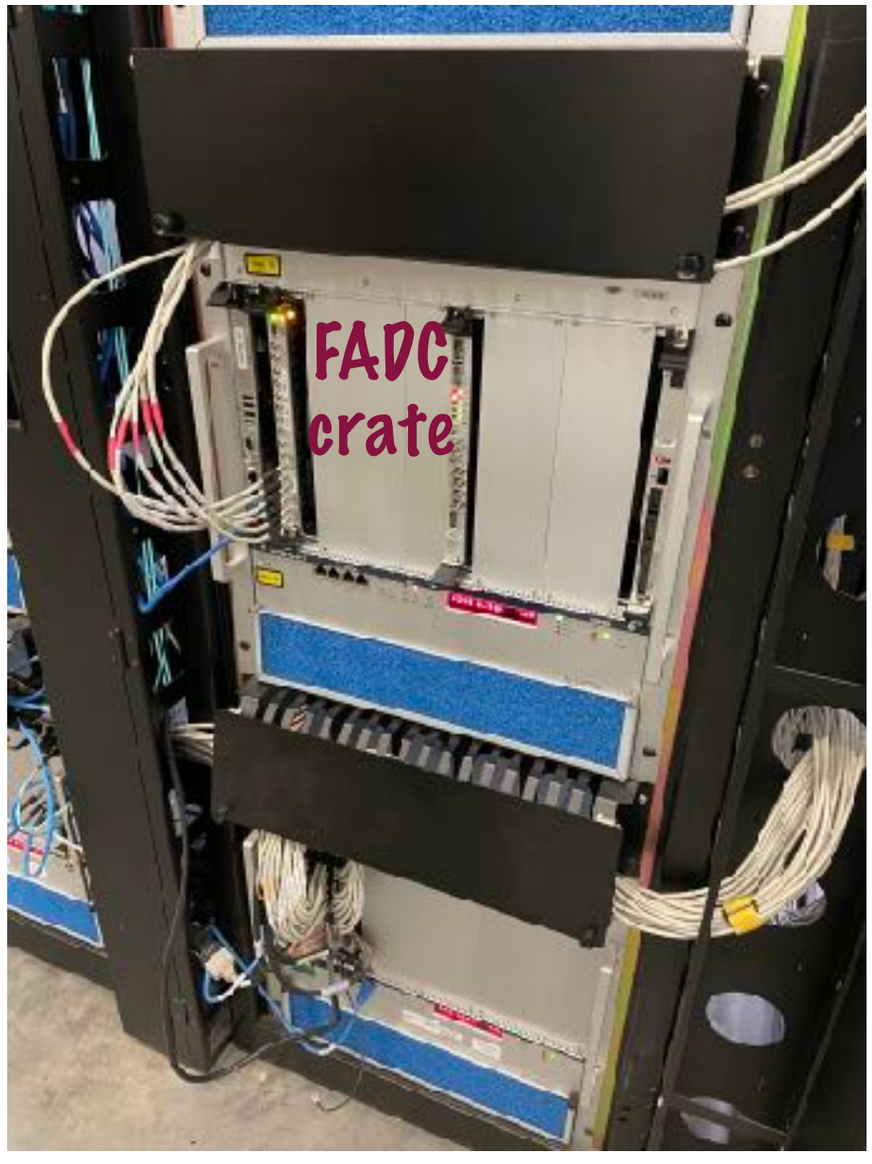
Pair Spectrometer (PS)

PS
aperture

BCAL location
(yellow arrow)

Power and Electronics

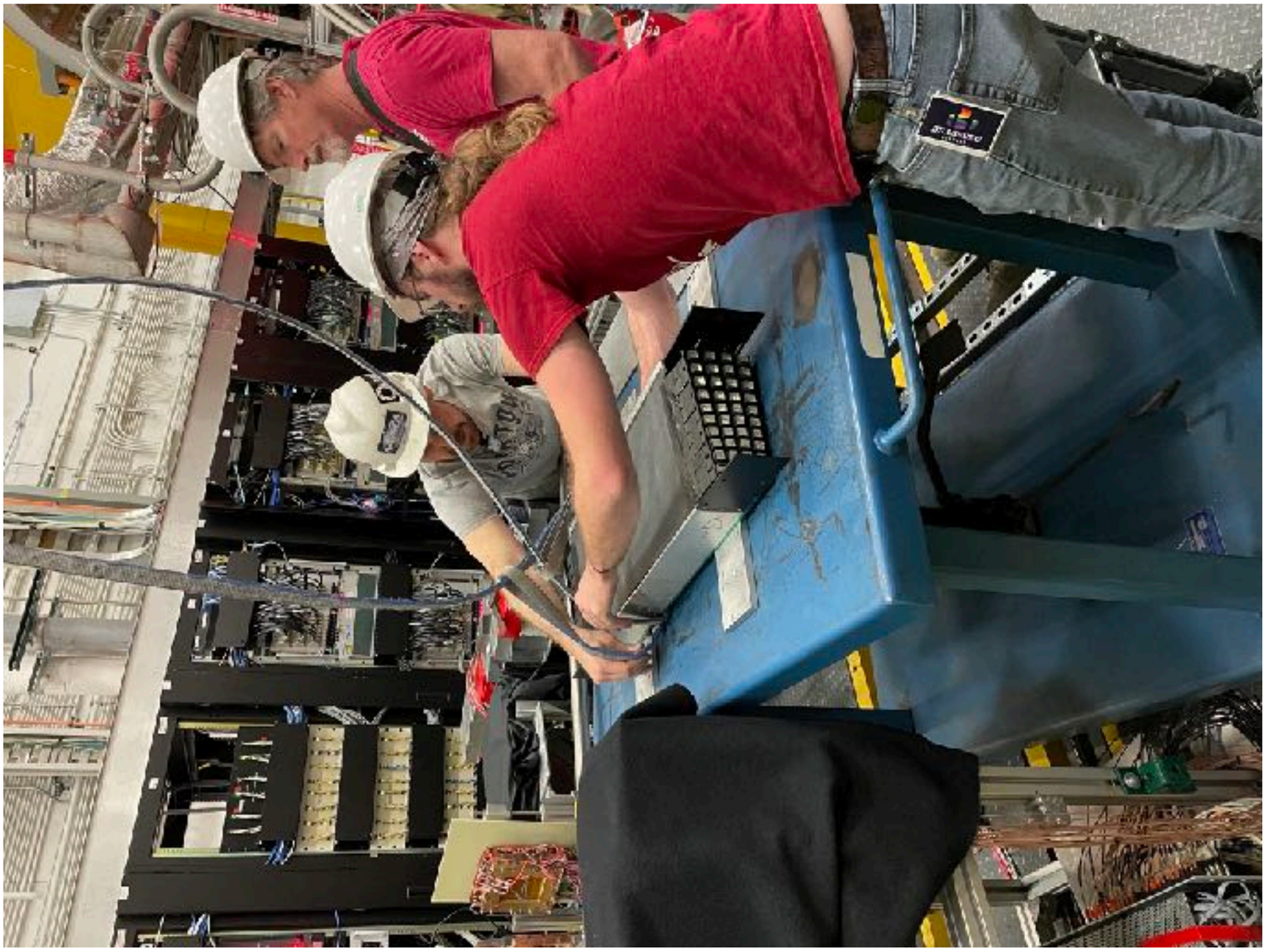
electronics in Hall D under spectrometer



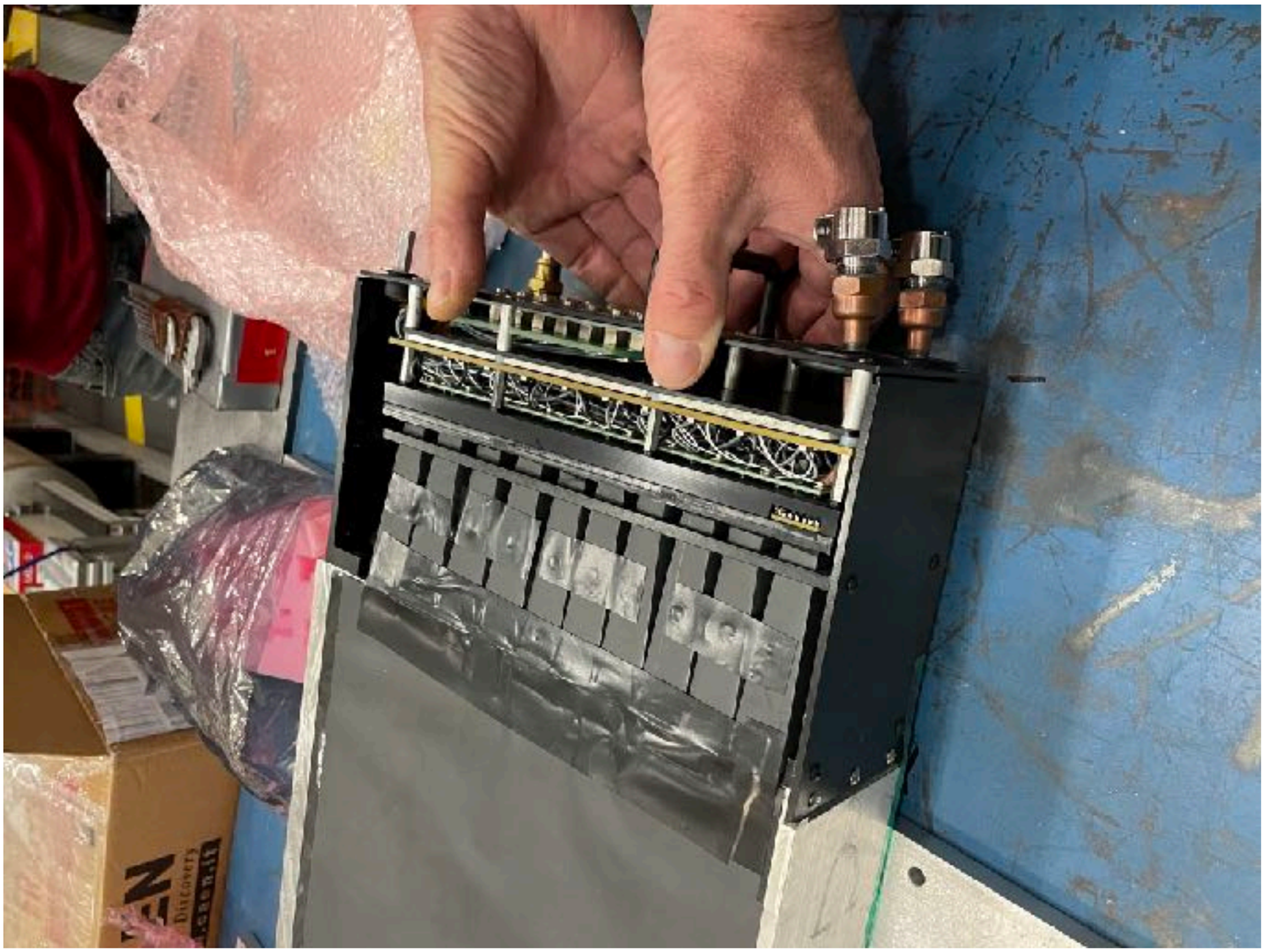
Baby BCAL Stand & Rail

Baby BCAL Tilt Arm

Installation



SiPM Assembly Mounting



SiPM Assembly Panel

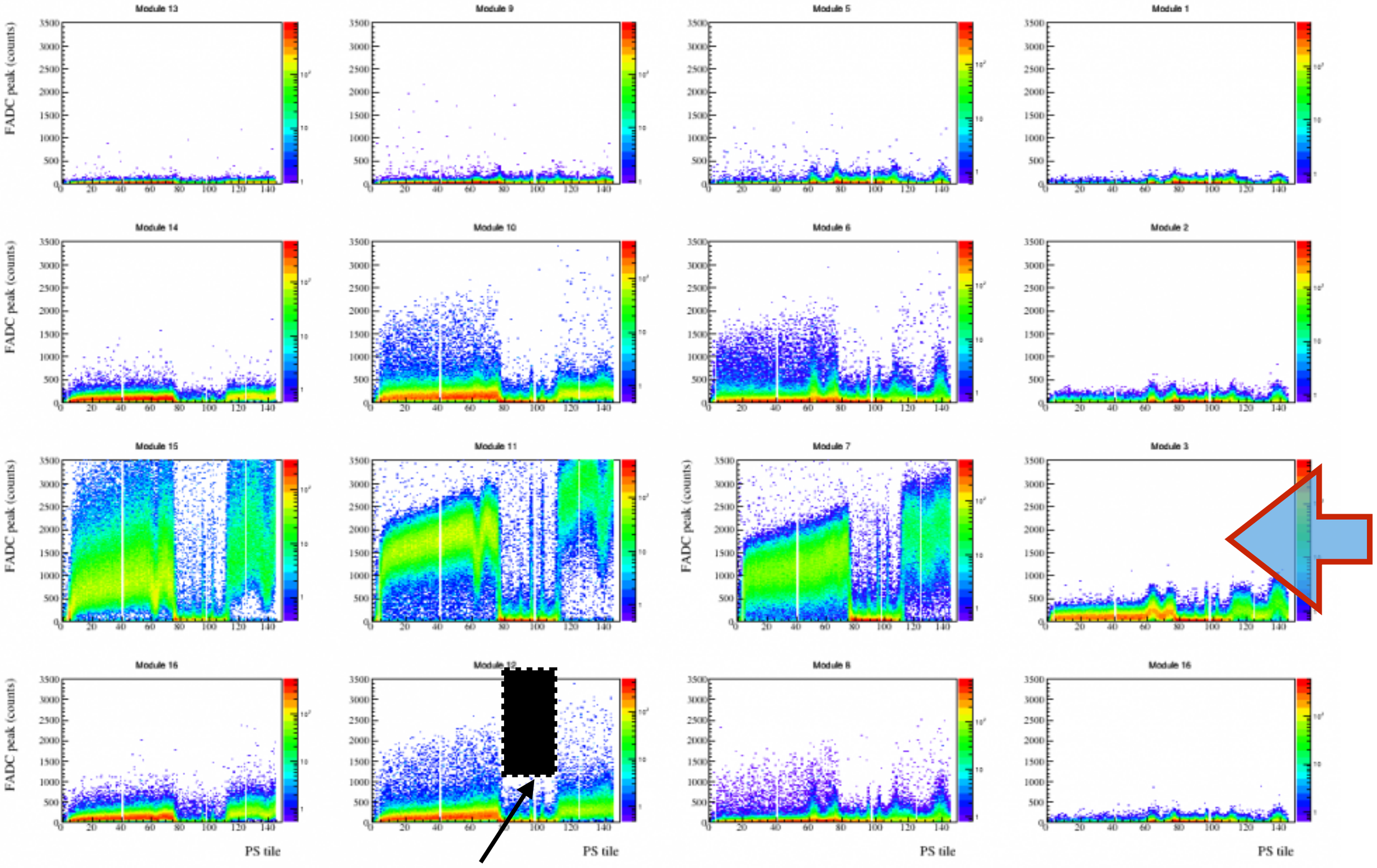
Before Cabling

Karthik Suresh

Stjepan Orešić

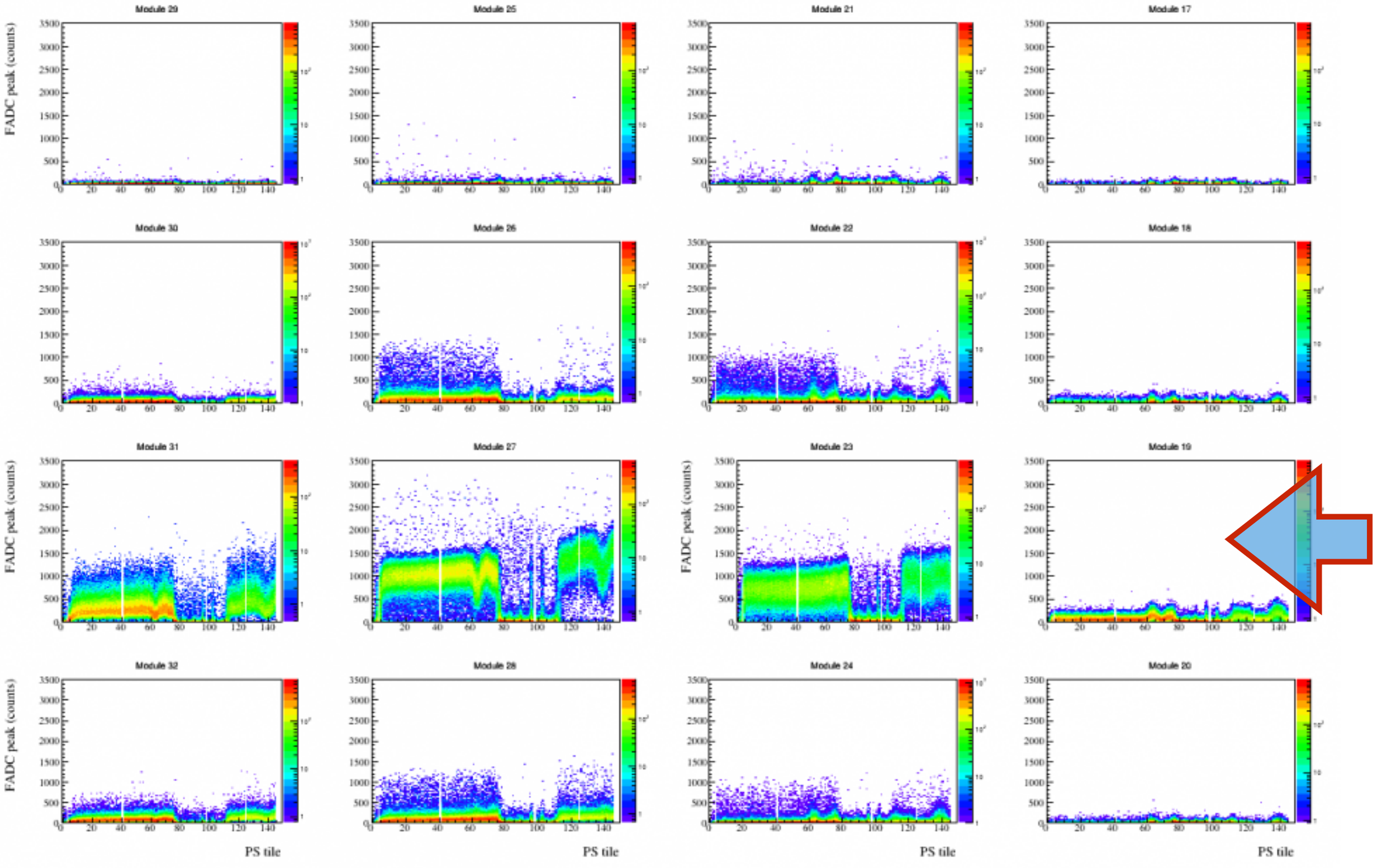
Cabling

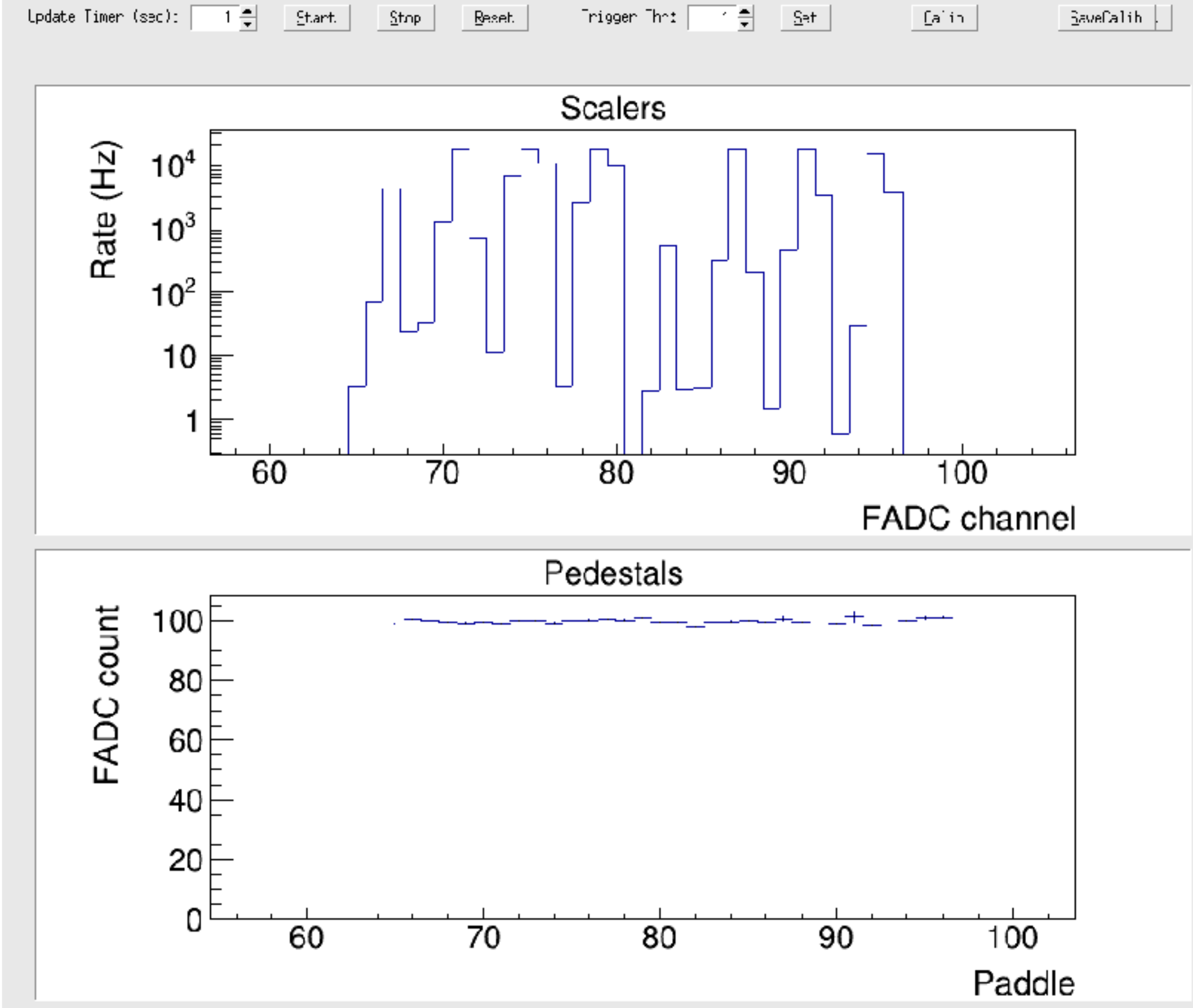
FADC Amplitudes North



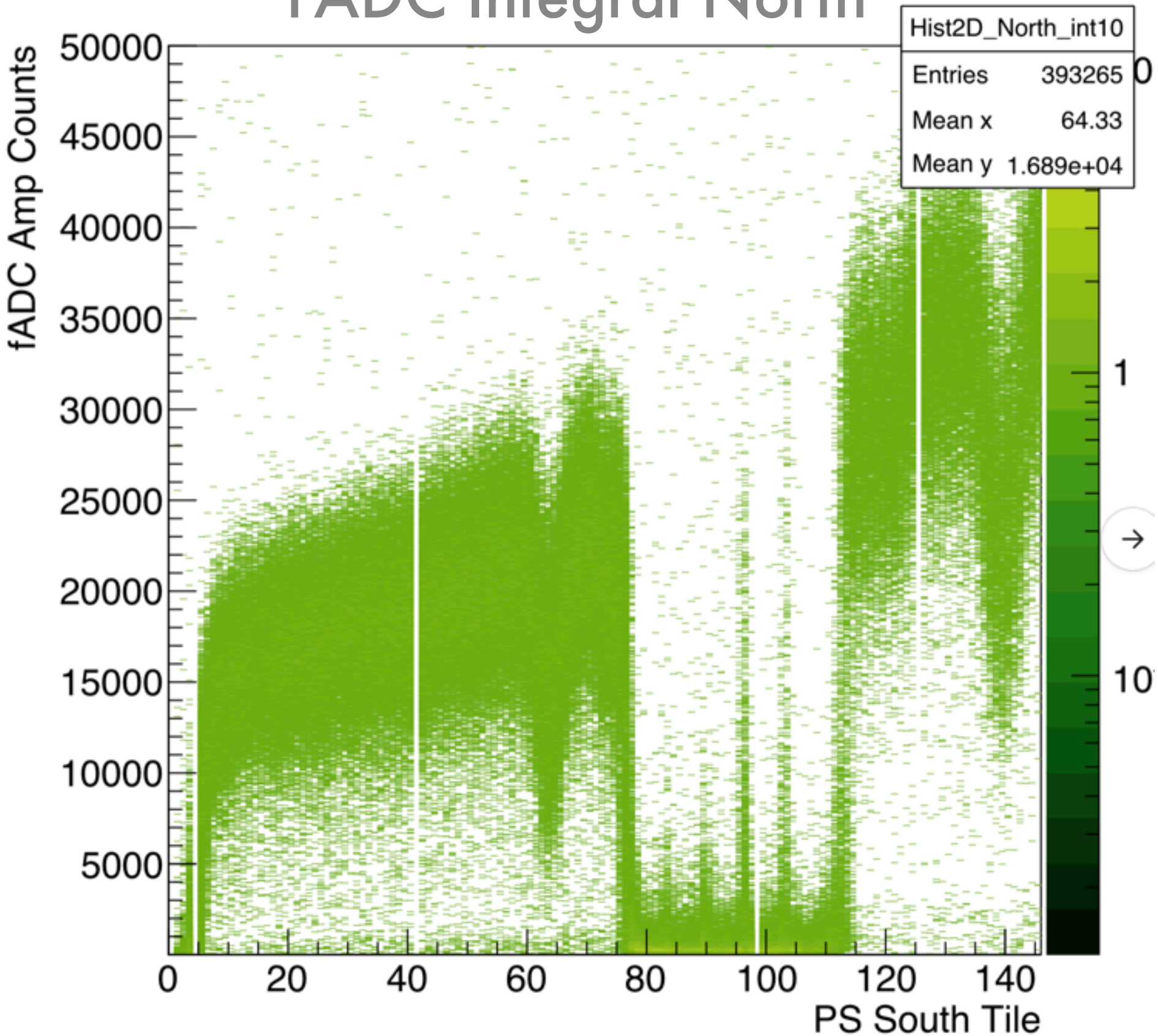
SciGlass shadow

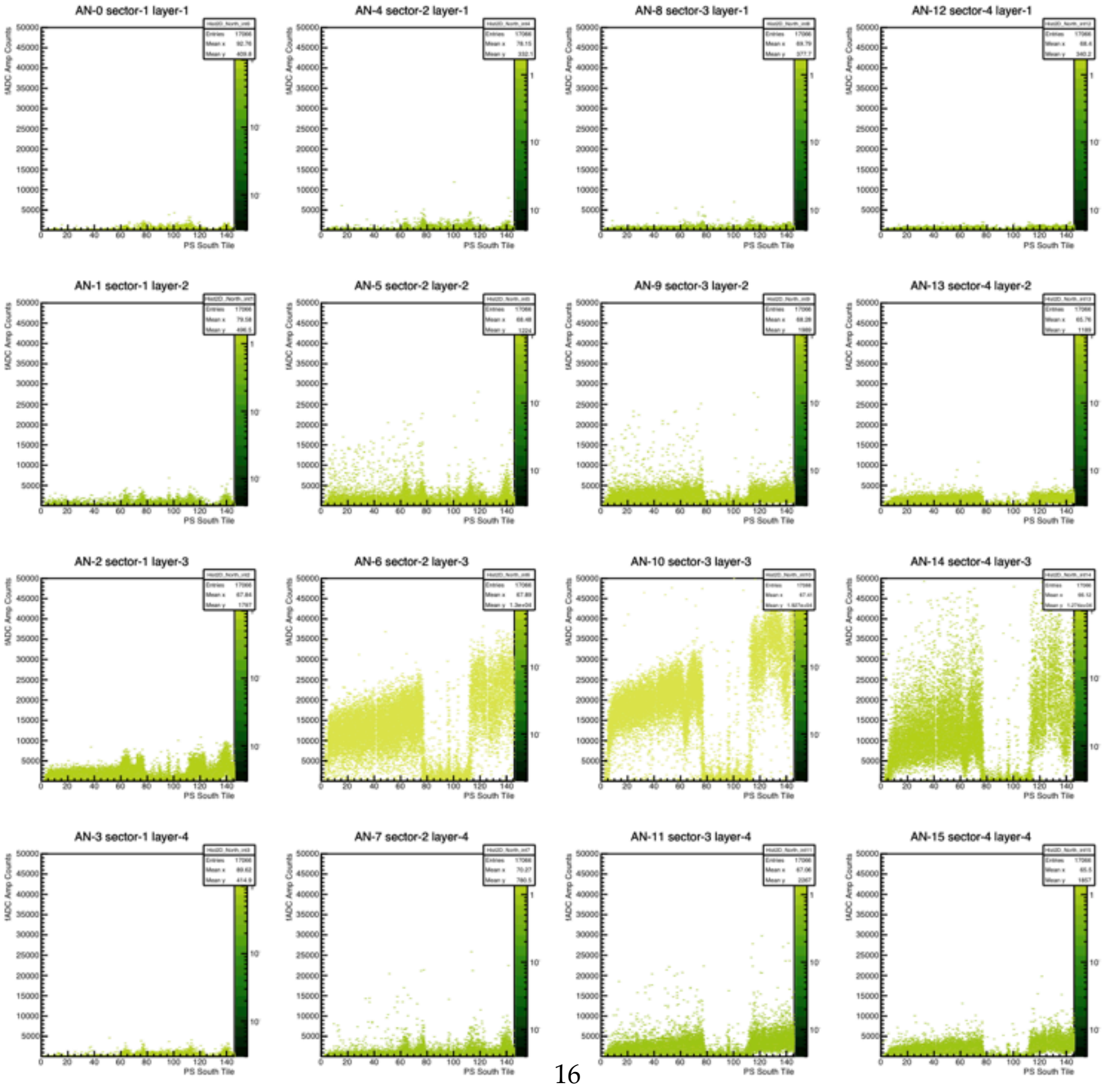
FADC Amplitudes South




Update Timer (sec):
1
Start
Stop
Reset
Trigger Thr:
Set
Calib
SaveCalib
Scalers
Rate (Hz)
10^4
10^3
10^2
10
1
60
70
80
90
100
FADC channel
Pedestals
FADC count
100
80
60
40
20
0
60
70
80
90
100
Paddle

FADC Integral North

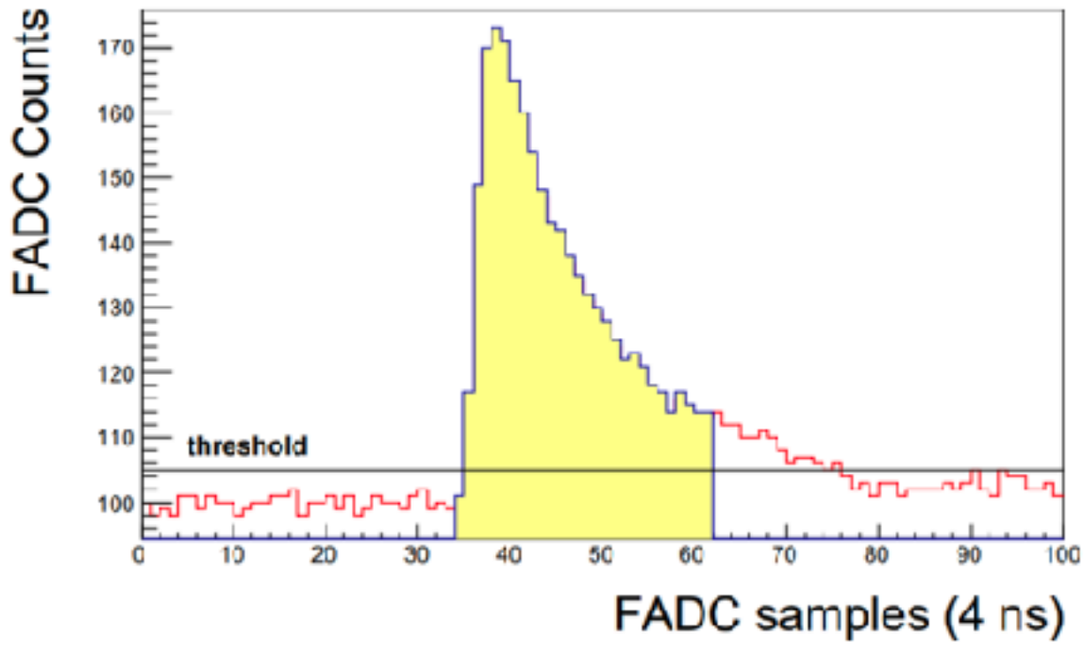




Cut: 40% in L3S3

FADCs

- Flash electronics report integral (or amplitude) of each pulse when miniBCAL has a showering e^+
- 32 channels in all
- Need conversion factor between integral below ⇒ energy (in GeV)



This & next 3 slides by Jon Zarling

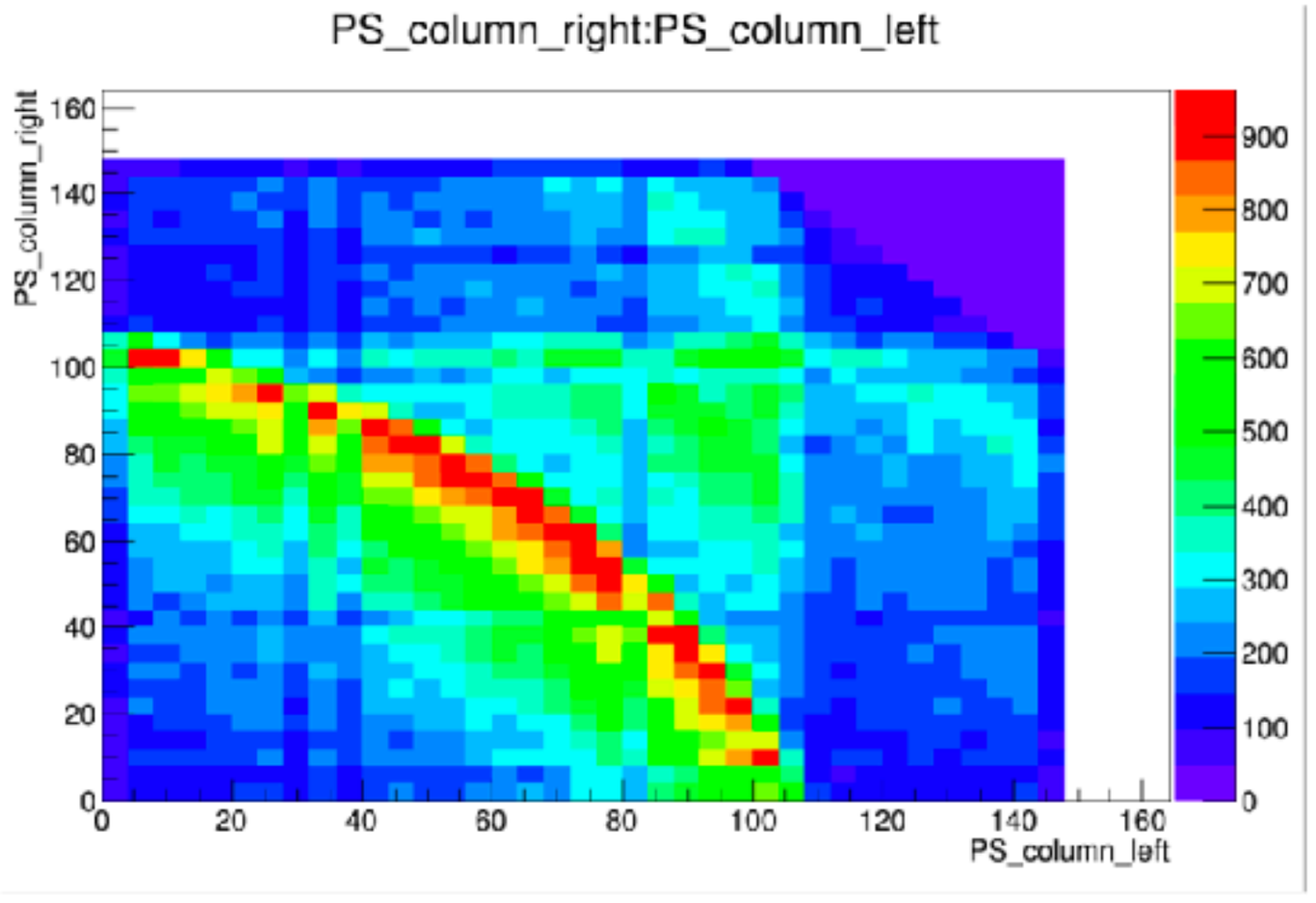
Gain Calibration Goal

- Gain factors determined by weighted sum $c_j = \frac{\sum_i E_i^{PS} A_{ij}}{\sum_i A_{ij}^2}$
  - Sum over i events
  - Readout channel j
  - ADC pulse integral A_{ij}

- Want: conversion factor c_j such shower energy
  - E=$\sum_j \; c_j A_j$

e+/e- Energy Correlation

- e^- measured right PS
- e^+ measured left PS
- Energy difference seems more natural to use than counter numbers
- Need to add other PS energy to plugin though



Gain Factors

- $F = \sum_i^N \left(\left(\sum_j^{32} c_{ij} A_j \right) - E_i^{PS} \right)^2$
- Pick gain factors c_j such that $\frac{\partial F}{\partial c_j} = 0$
  - Assume $\frac{\partial c_{j'}}{\partial c_j} = 0$ for $j' \neq j$

- $\frac{\partial F}{\partial c_j} = \sum_i^N 2 c_j A_{ij}^2 - 2 E_i^{PS} = 0$

$$\Rightarrow c_j = \frac{\sum_i E_i^{PS} A_{ij}}{\sum_i A_{ij}^2}$$

Baby BCAL Goals

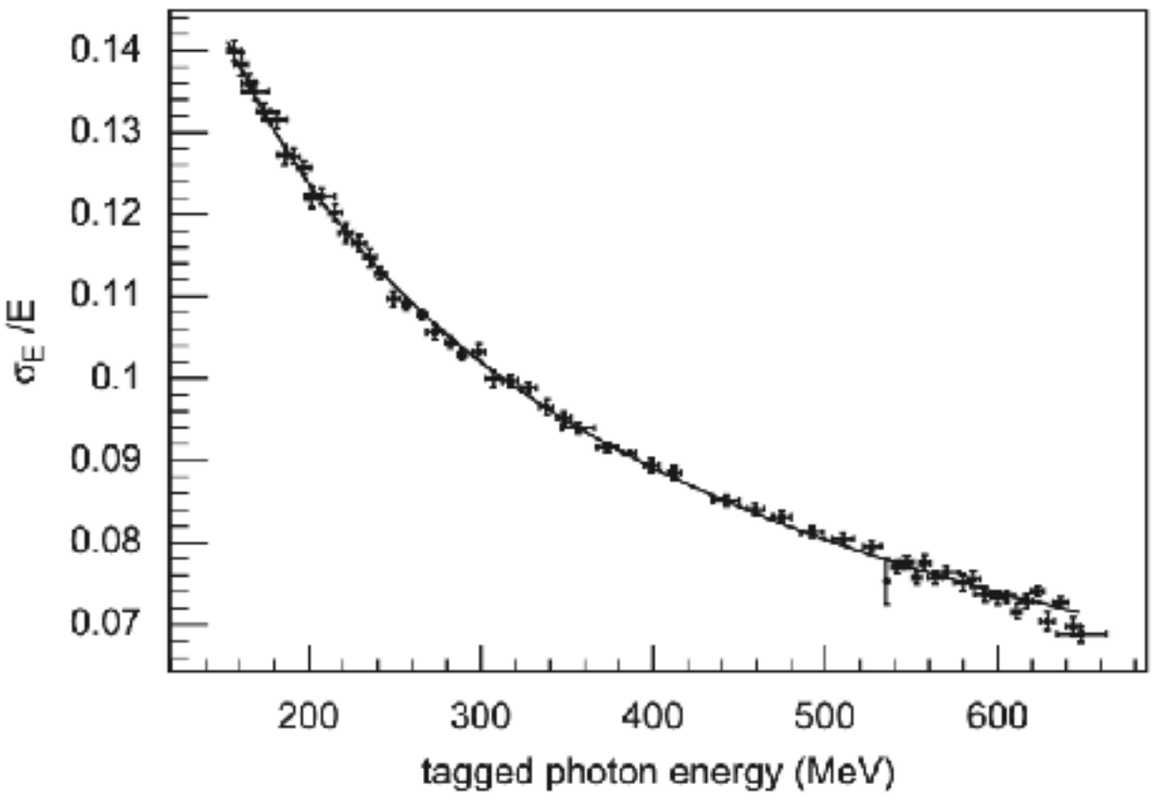


Fig. 11. Energy resolution vs. E_{BEAM} for photons for $\theta = 90^{\circ}$ and $z = 0$ cm. The fit gives $\sigma_E/E = 5.4\%/\sqrt{E(\text{GeV})} \oplus 2.3\%$. The fit of Fig. 10 corresponds to the 40th datum from the right (19th from the left) in this figure.

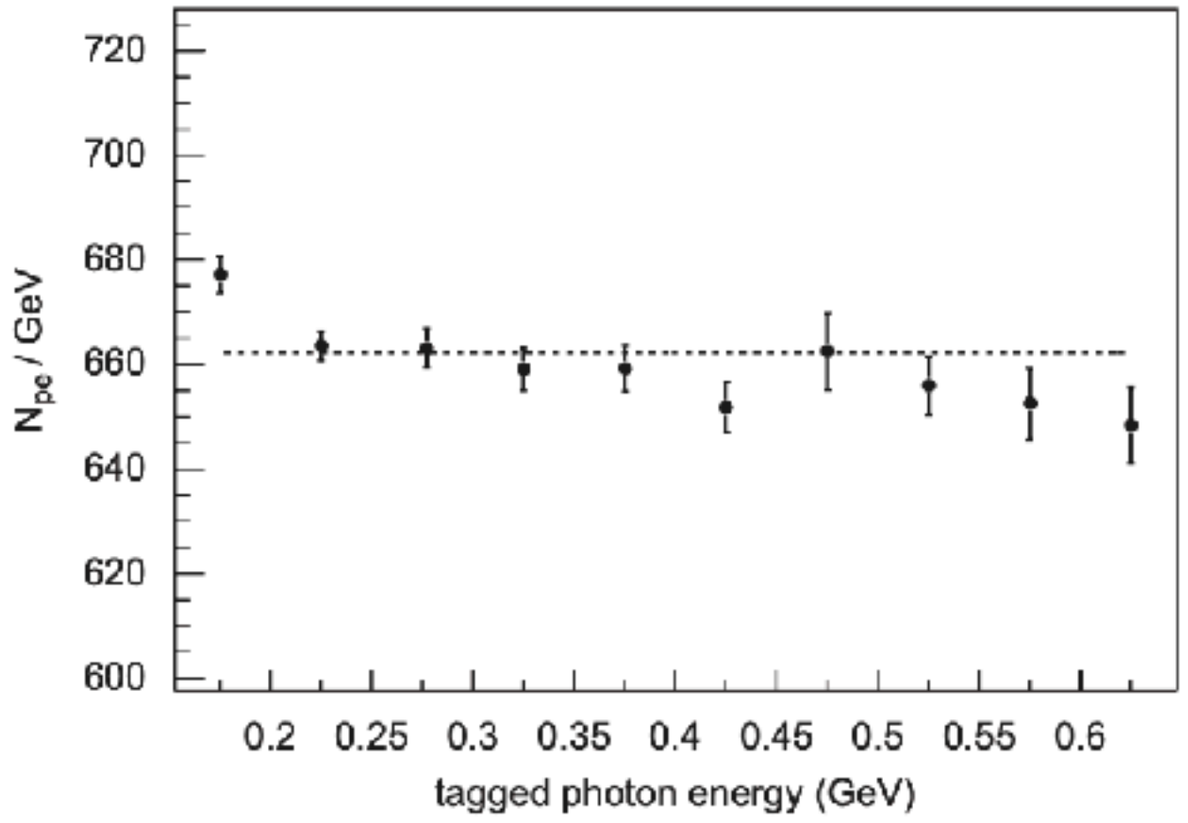


Fig. 16. The number of photoelectrons per GeV per end of the BCAL module is shown as a function of energy. A one parameter fit is plotted (dashed line). For more details see the text.

Jon, Stjepan, Maggie Kerr (MtA)