



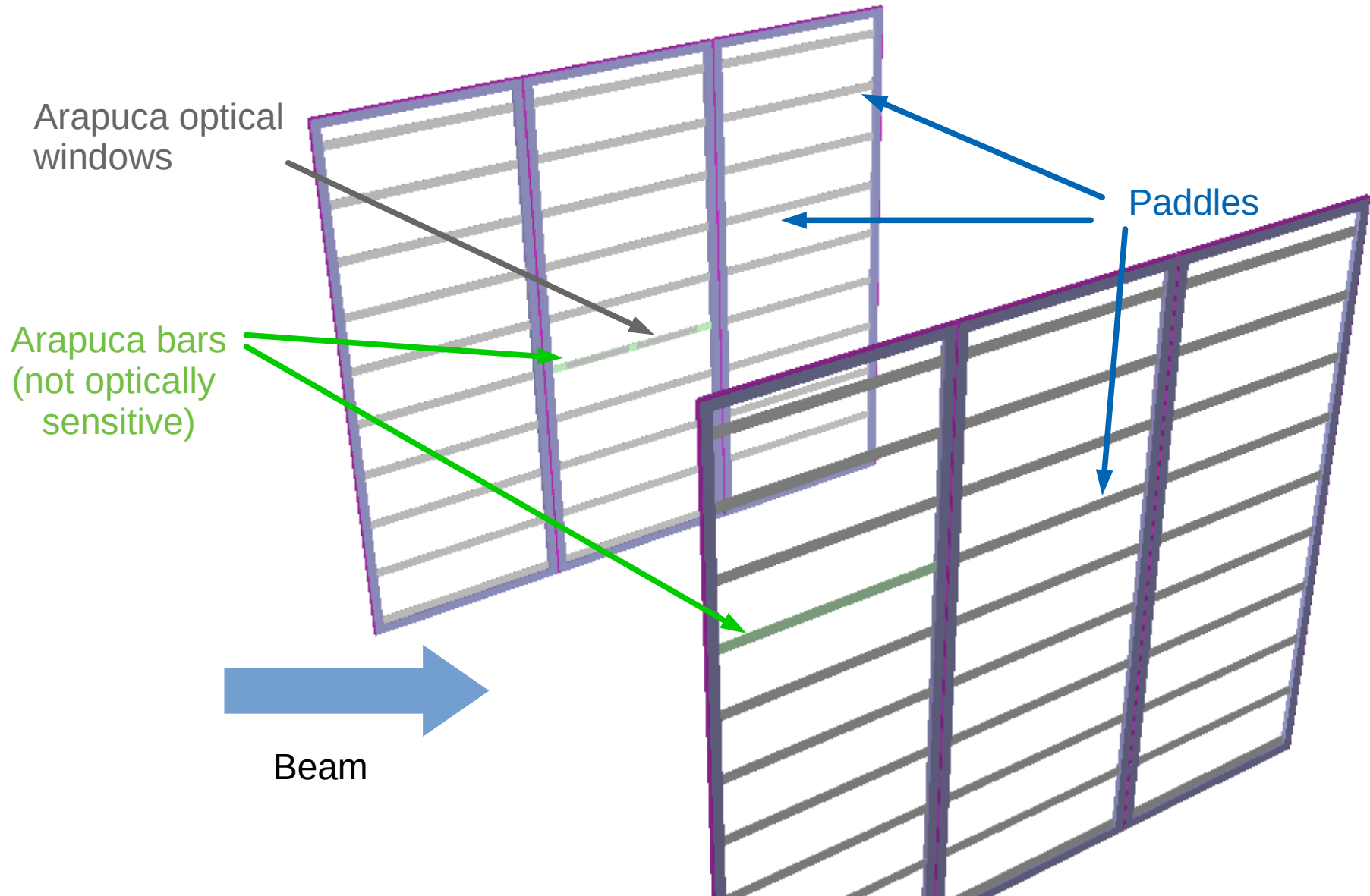
Universidade Federal do ABC



# Larsoft Light Simulation for ProtoDUNE's ARAPUCAs

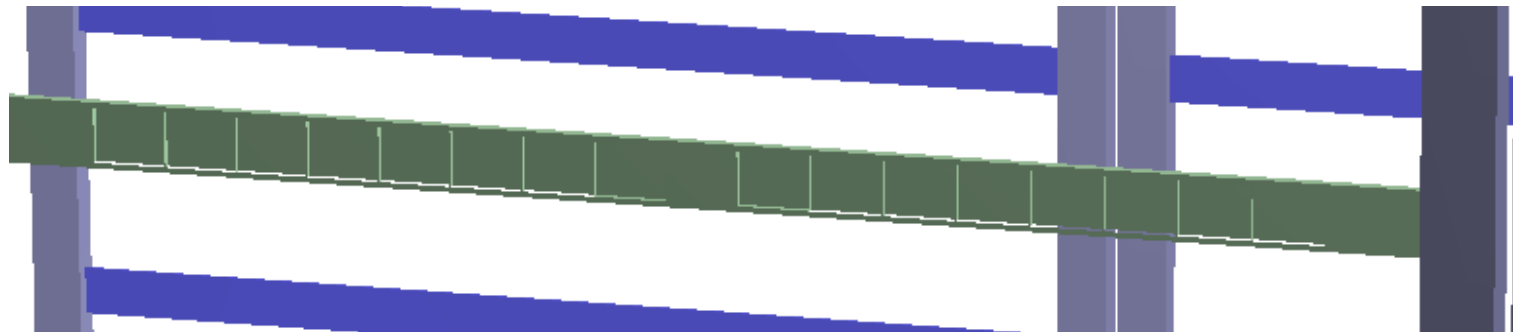
*L. Paulucci*, F. Marinho, D. Totani, F. Cavanna

# ProtoDUNE PDS Geometry



# ProtoDUNE ARAPUCA bar

Arapuca bar

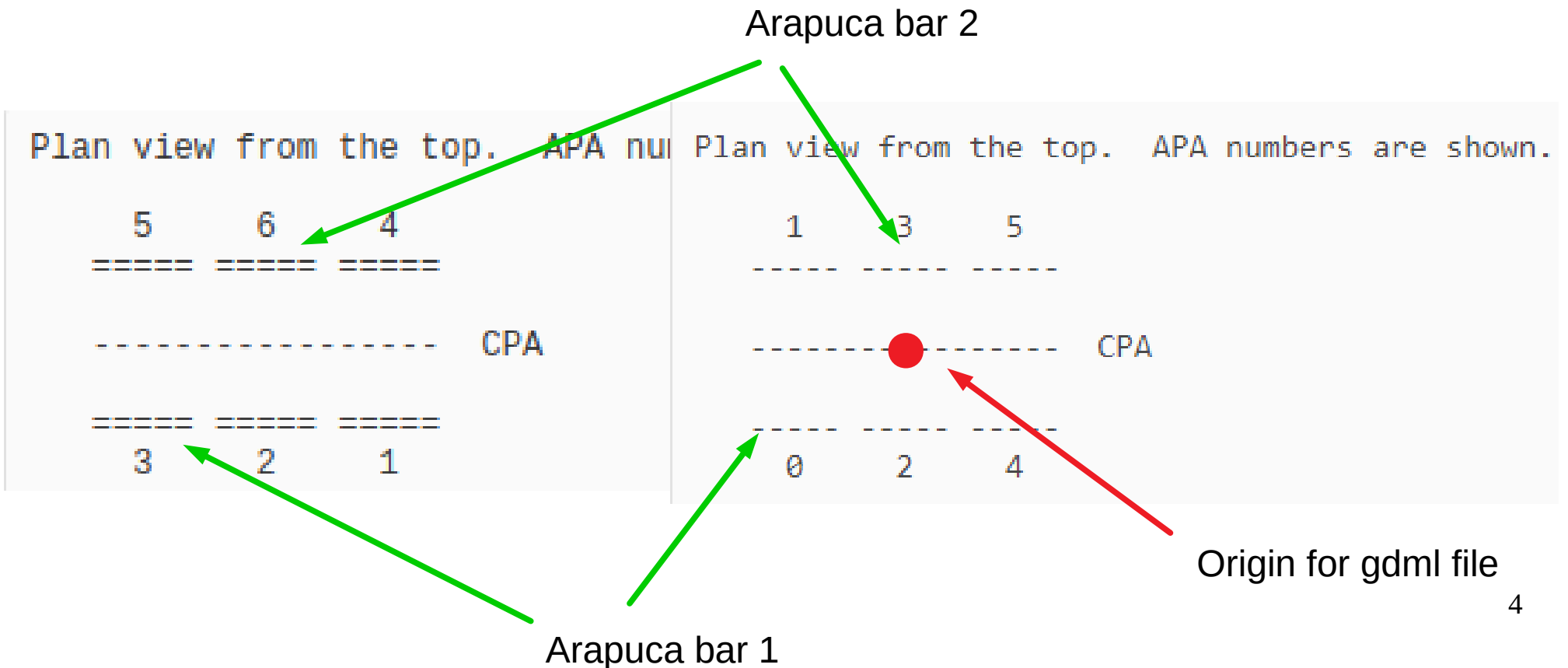


Arapuca optical windows  
(1 mm depth)



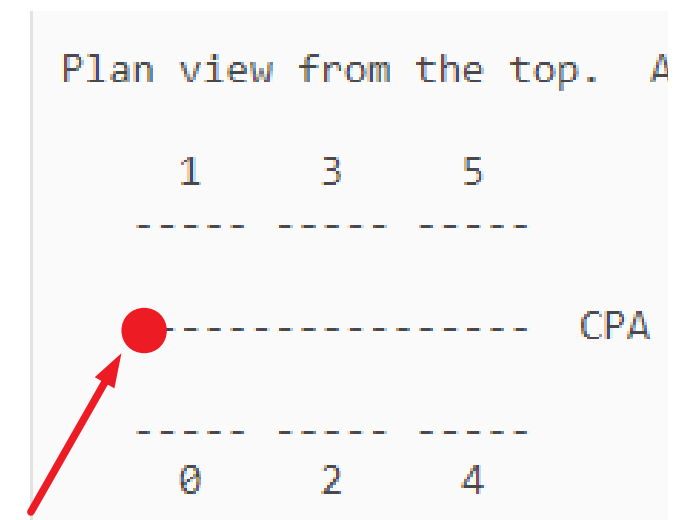
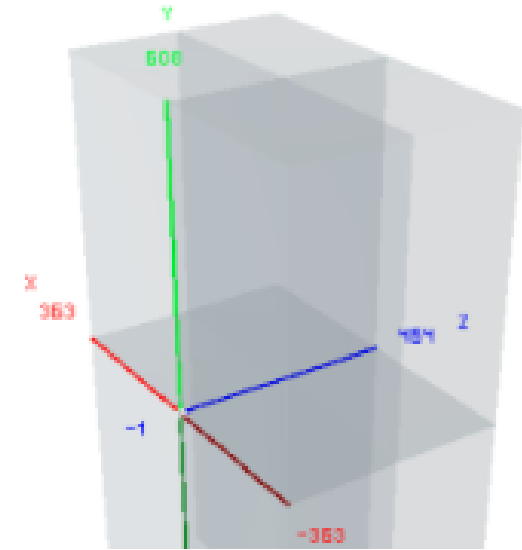
# ProtoDUNE ARAPUCA bar

- APA 3, slot 4       $\longrightarrow$     APA 0, slot 6
- APA 6, slot 6       $\longrightarrow$     APA 3, slot 4



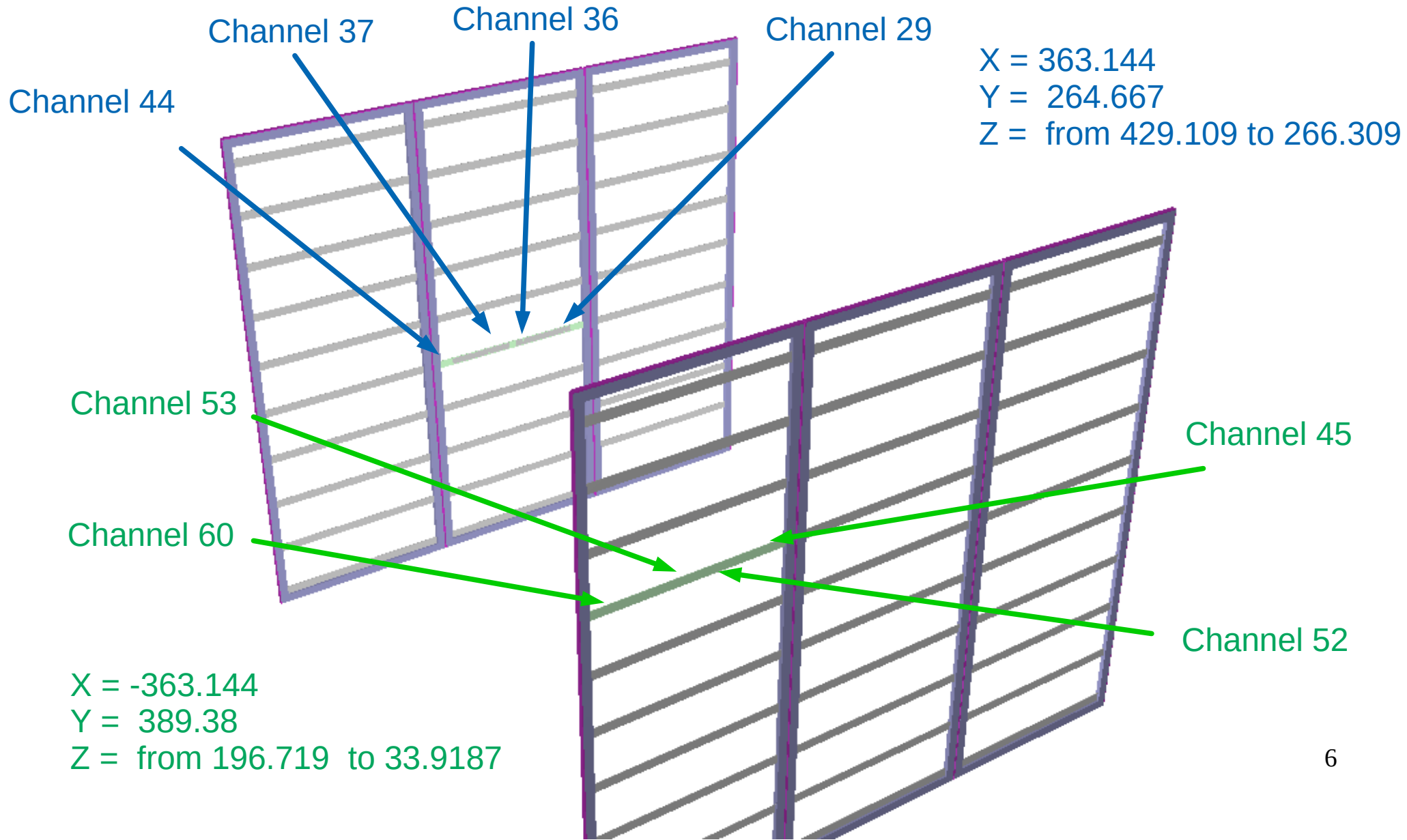
# Optical Channels

- 90 optical channels – **New library**
- Channel mapping
  - APA 1: 61 – 70
  - APA 2: 71 – 80
  - APA 3: 81 – 89: paddles  
45 – 60: arapucas
  - APA 4: 19 – 28
  - APA 6: 10 – 18: paddles  
29 – 44: arapucas
  - APA 4: 0 – 9: paddles



Origin for Larsoft

# Arapuca Optical Channels

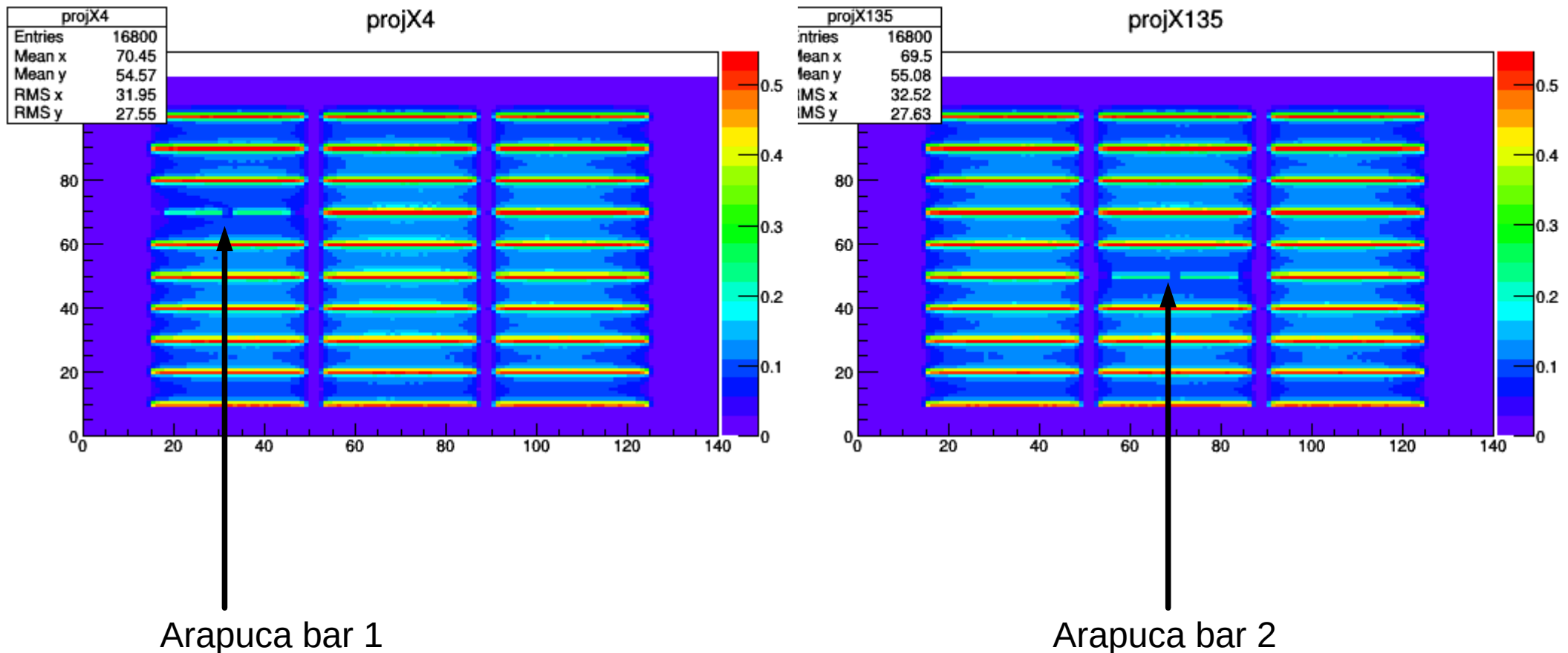


# Generation of Optical Library

- Library parameters
  - # voxels: 2350000 (140 x 120 x 140)
  - Voxel size: 5.55 cm x 6.25 cm x 6.13 cm Using Cryo boundary
  - # photons/voxel: 50000
  - services.OpDetResponseInterface.LightGuideAttenuation: **false**
  - services.LArPropertiesService.ScintPreScale: **1**
  - # To disable wireplane absorption, uncomment this line  
#services.LArG4Parameters.OpticalParamModels:  
["TransparentPlaneAction"]
    - No difference in visibilities with on/off



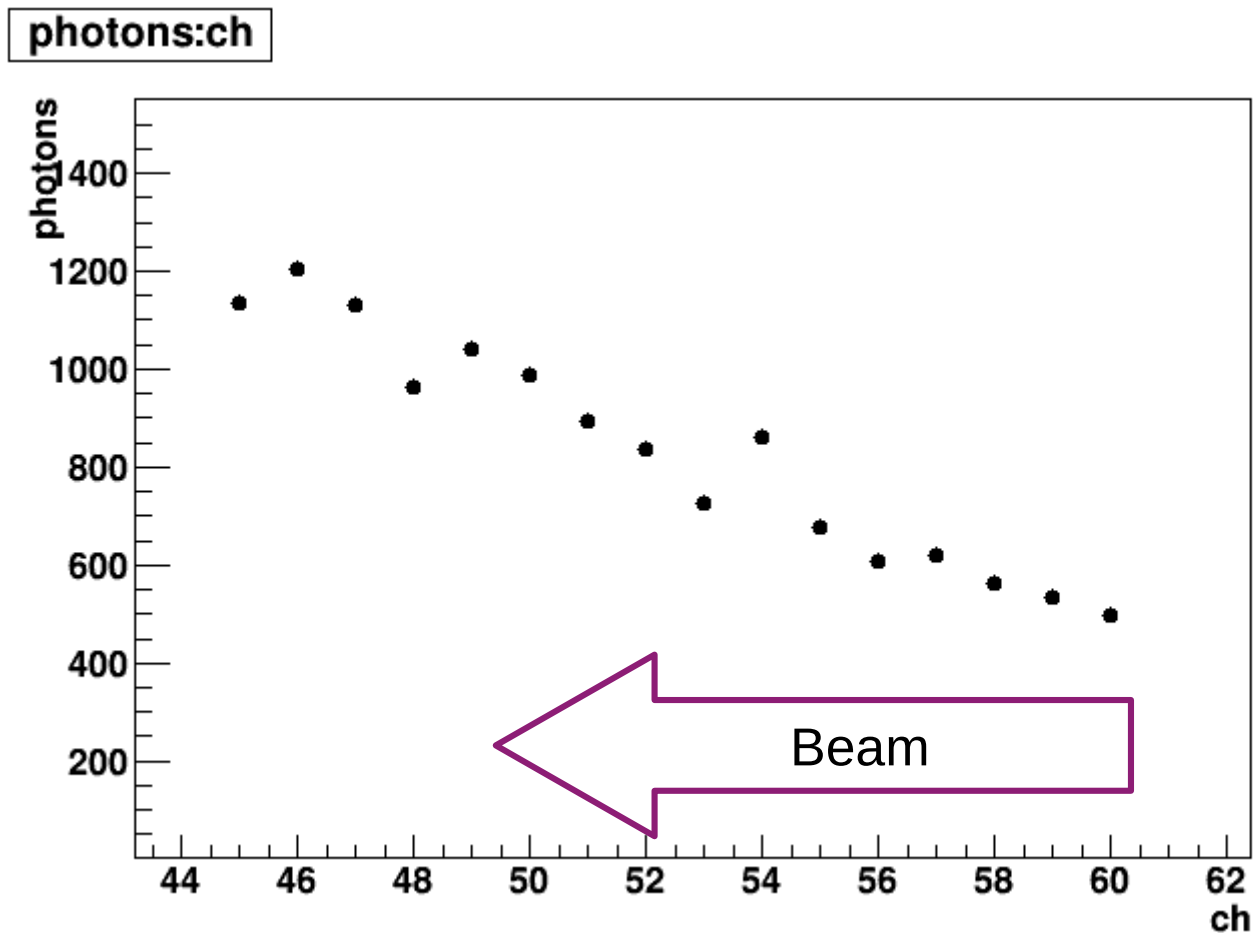
# Optical Library - Visibilities





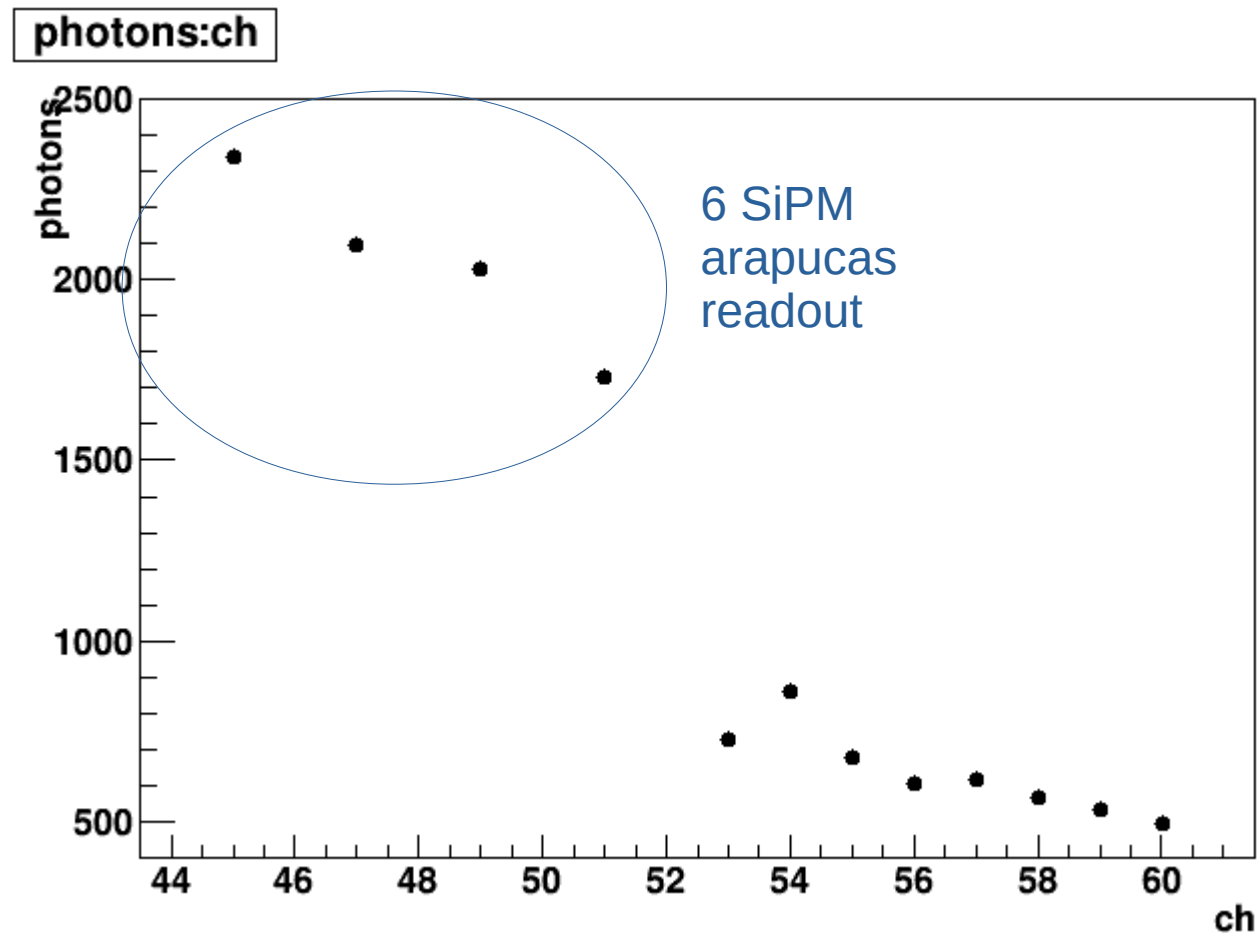
# <Photons> - Larsoft

- 1000 7 GeV muons from beam – Arapuca channels



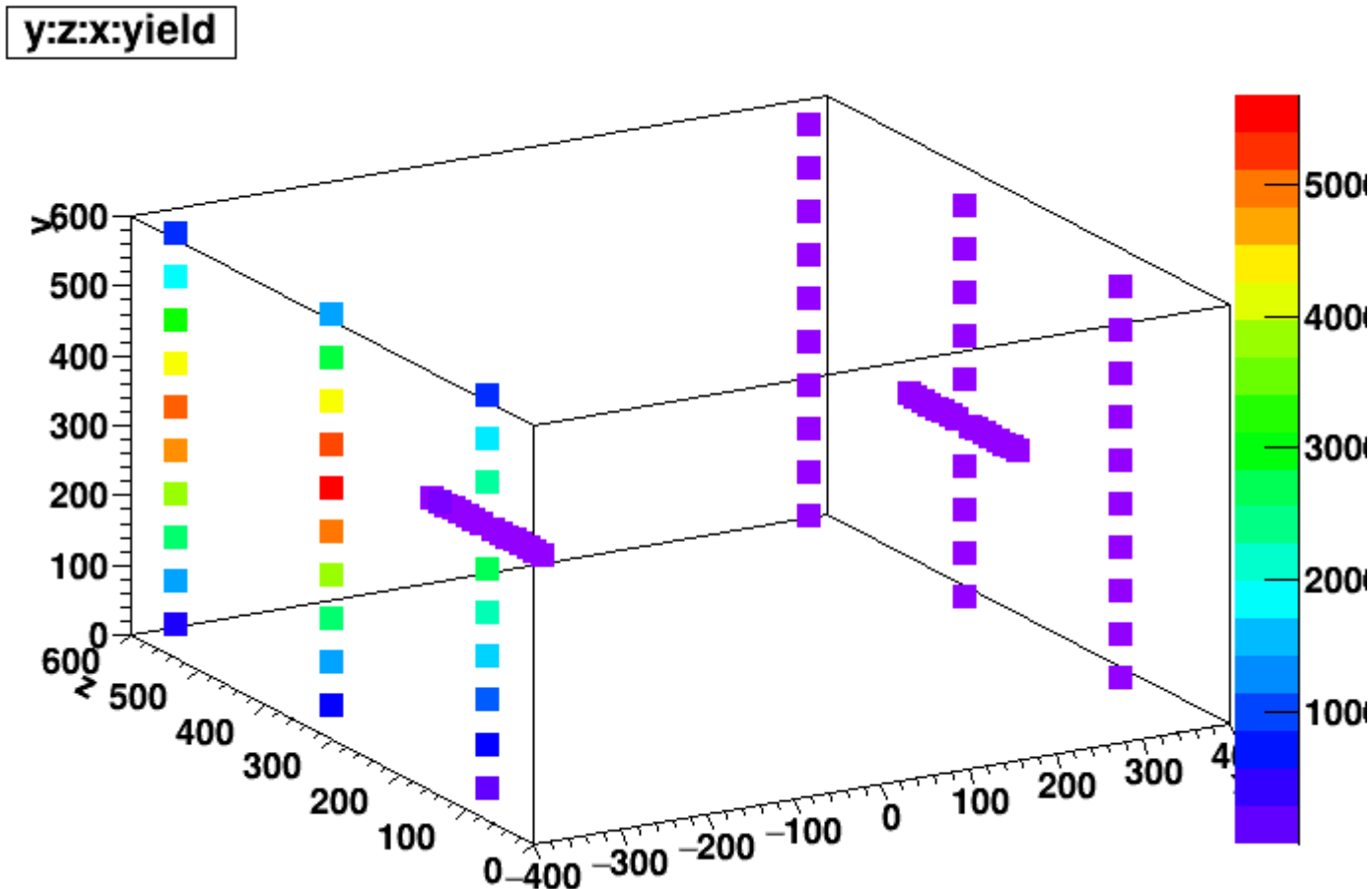
# <Photons> - Larsoft

- 1000 7 GeV muons from beam – Arapuca readout channels



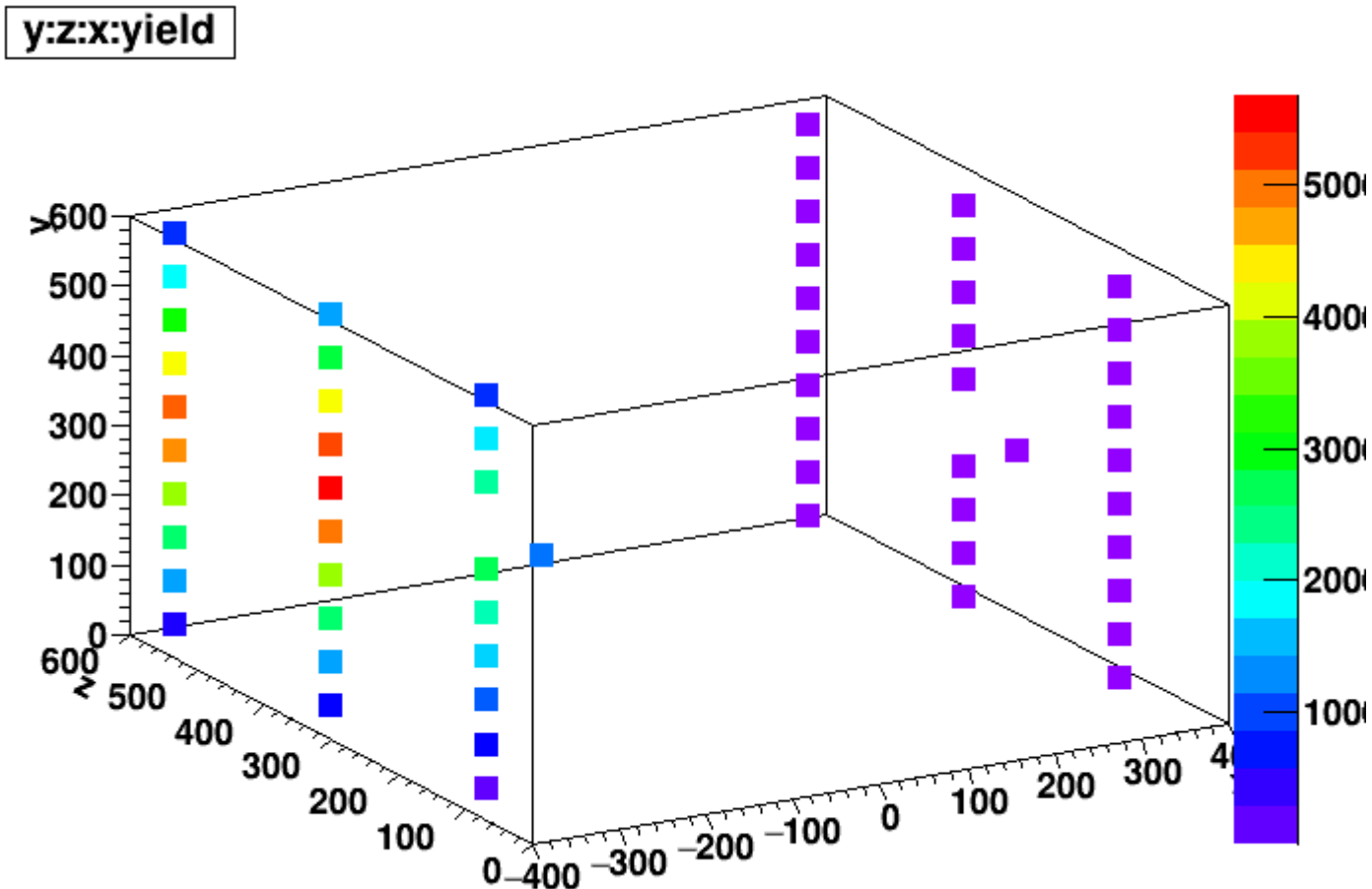
# <Photons> - Larsoft

- 1000 7 GeV muons from beam
  - Channel by channel



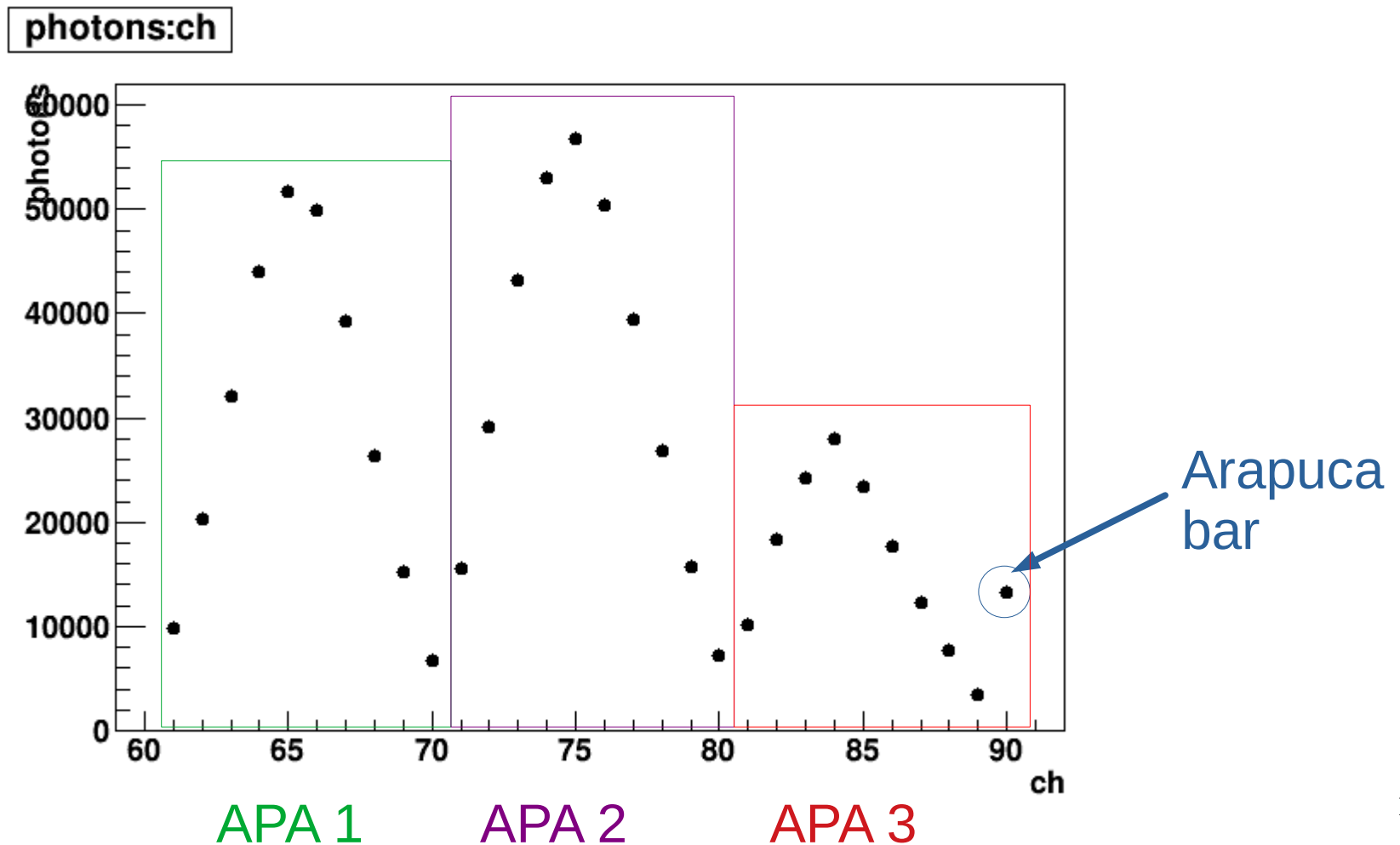
# <Photons> - Larsoft

- 1000 7 GeV muons from beam
  - Integrated signal in arapuca bars



# <Photons> - Larsoft

- 1000 7 GeV muons from beam



# Perspectives

- Improved library being finalized
- Have mean number of photons for other kind of events (electrons, protons...)
- Analyse cosmic muons for Arapuca bar 2