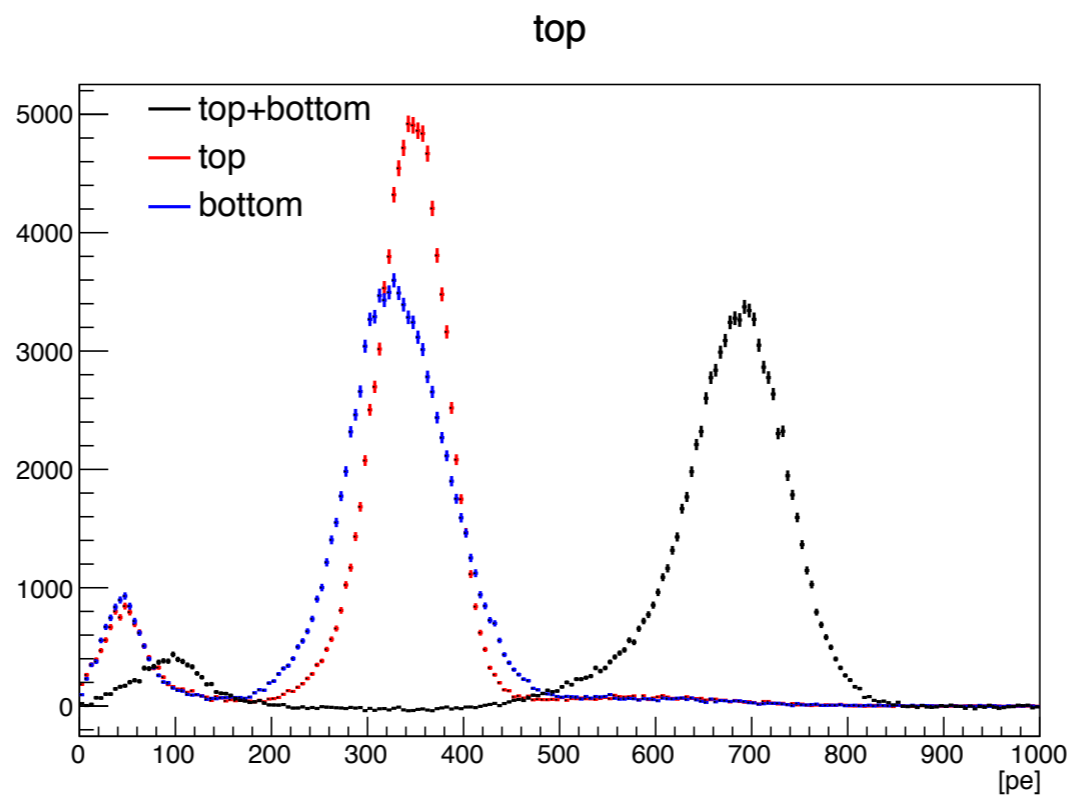
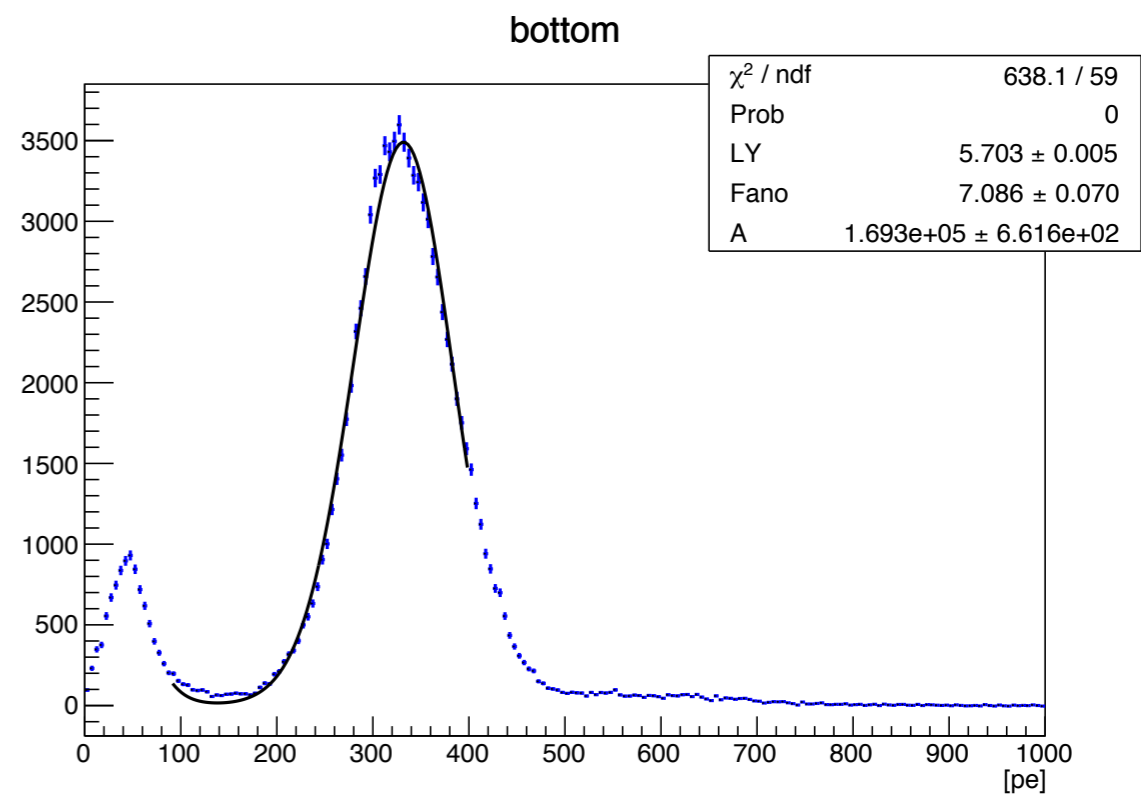
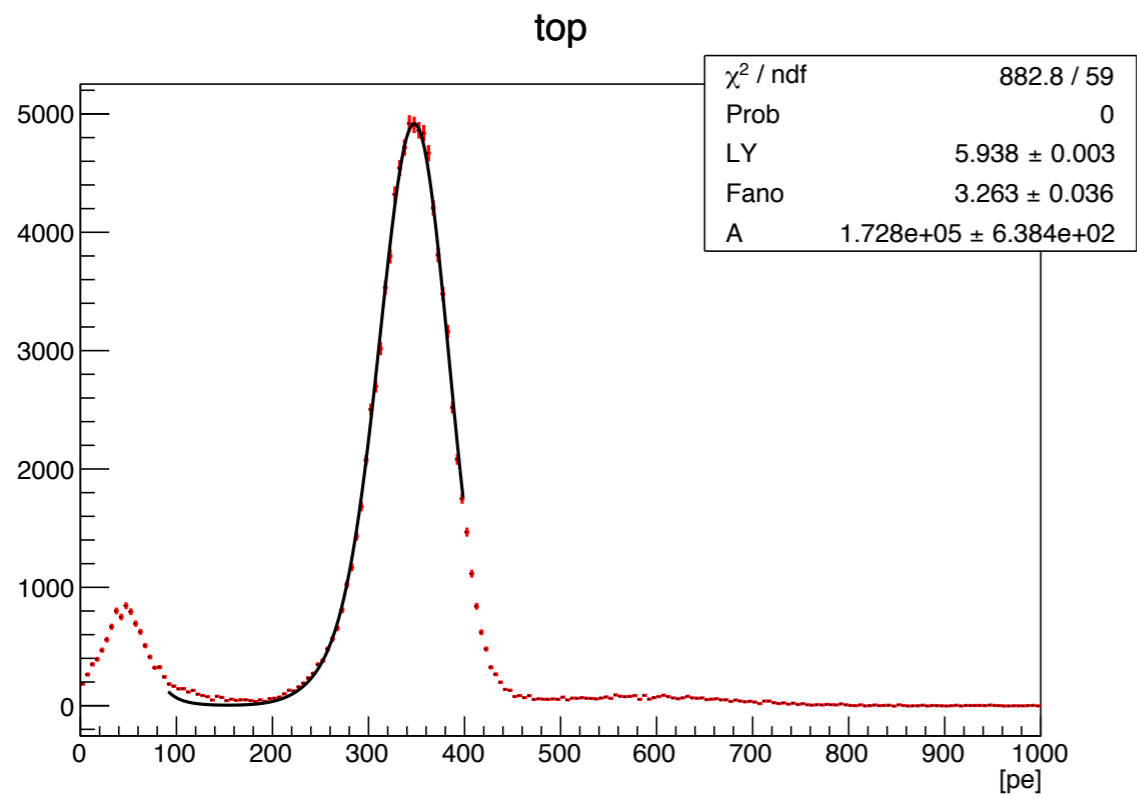


# **Analysis of Am241 data in Naples**

Claudio and Davide

# Outline

- Look at Am241 data taken with different bias voltages and source position (run 826 to 833)
- Fit top and bottom spectra with Am241 MC true deposited energy spectrum smeared with a gaussian with mean and sigma given by
  - $npe = LY * ene$
  - $\sigma = \sqrt{(npe * Fano)}$
- Fit the data to extract LY and Fano fact

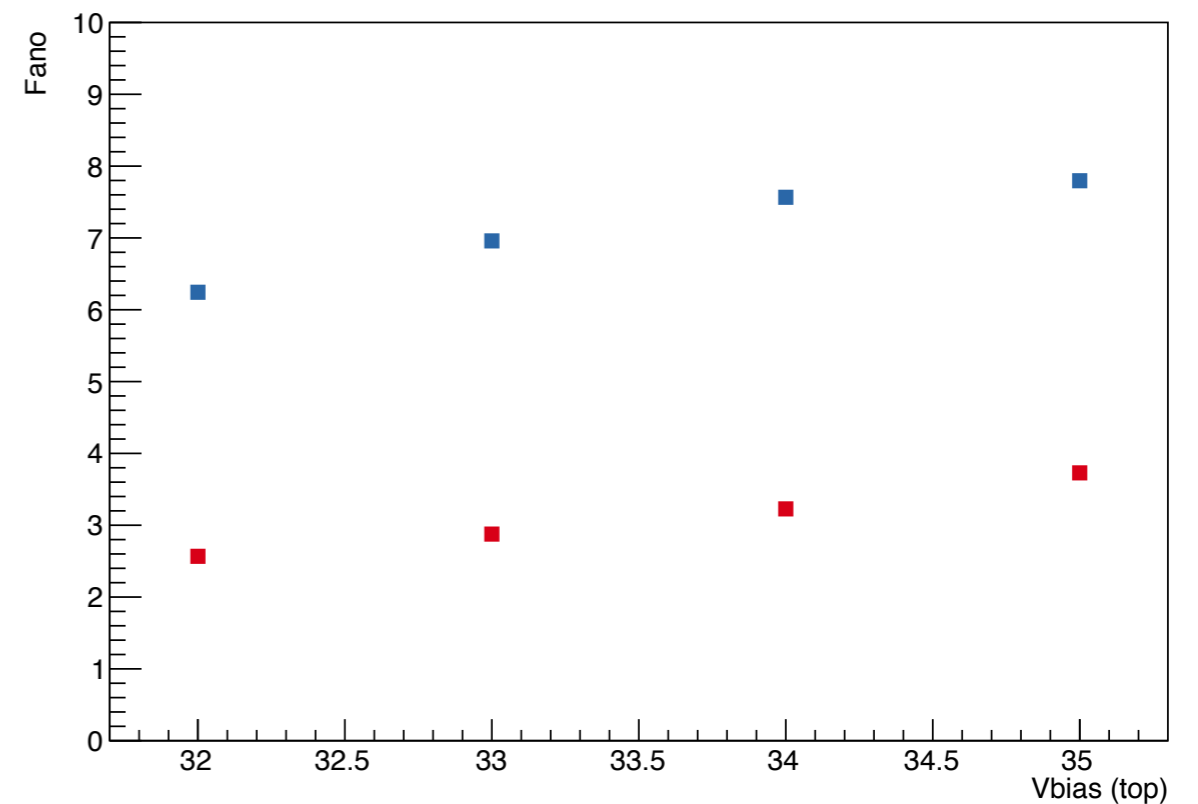
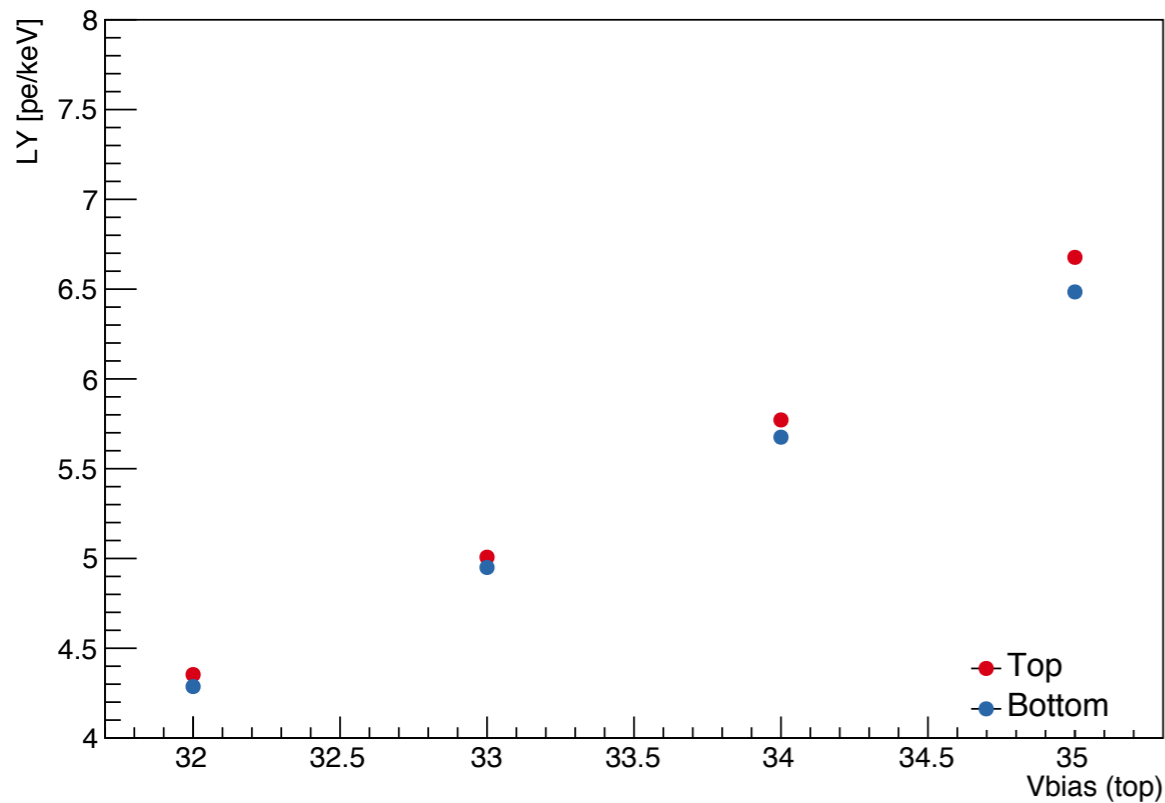


# Voltage scan

**Top is narrower than bottom  
(~2 times smaller Fano factor)**

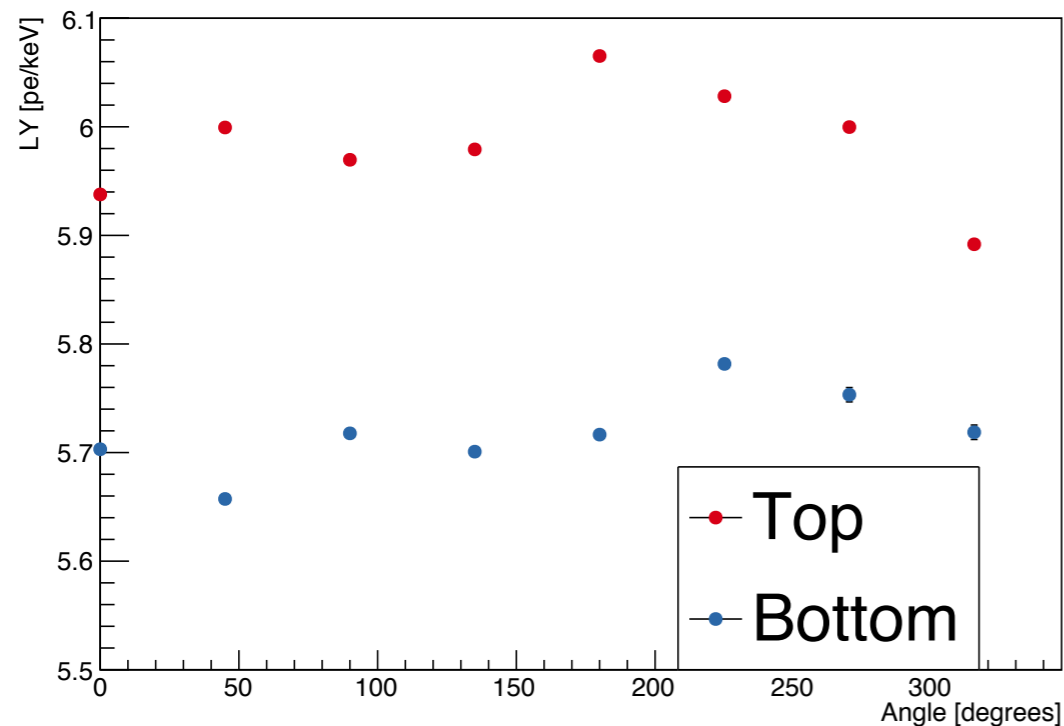
**LY increase with the bias voltage**

Run	$V_{\text{bias top}}$	$V_{\text{bias bot}}$
779	32	64
782	33	66
785	34	68
789	35	70

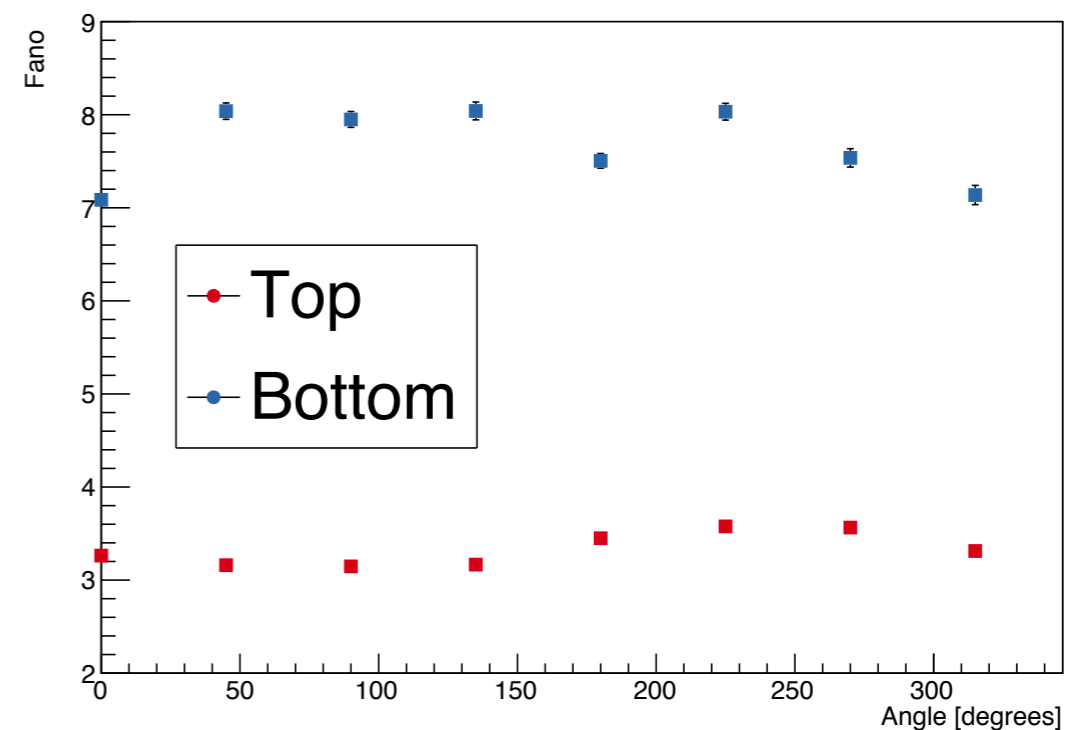


# Different source position

LY

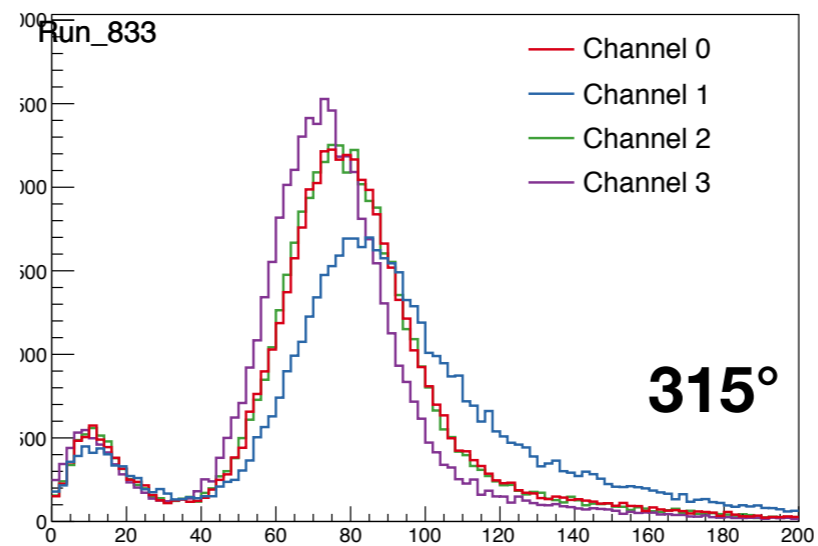
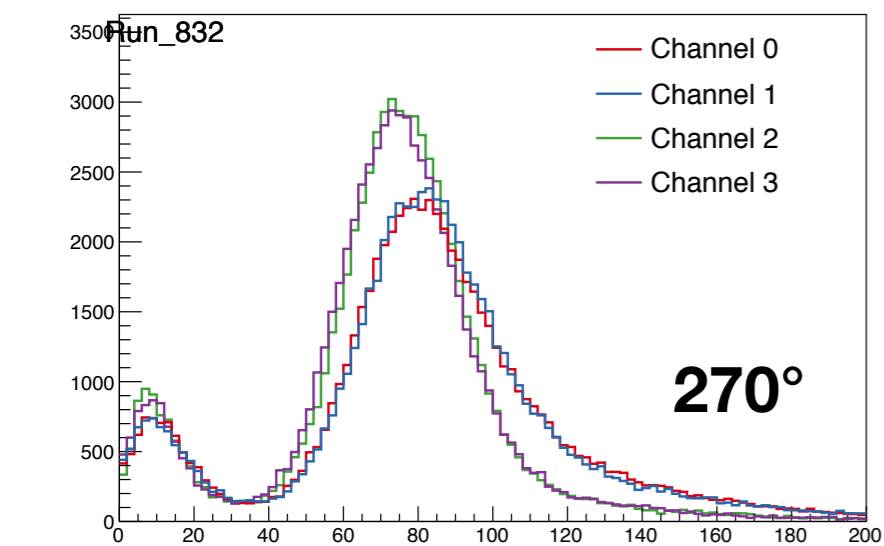
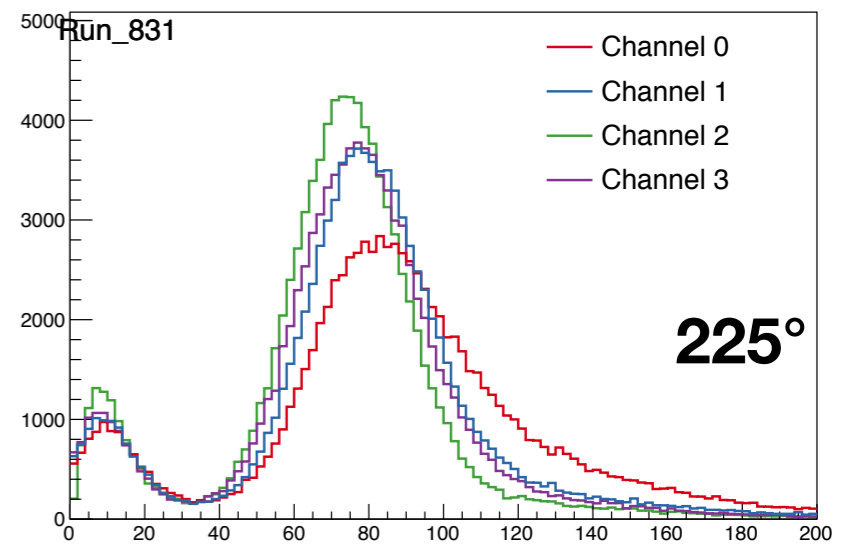
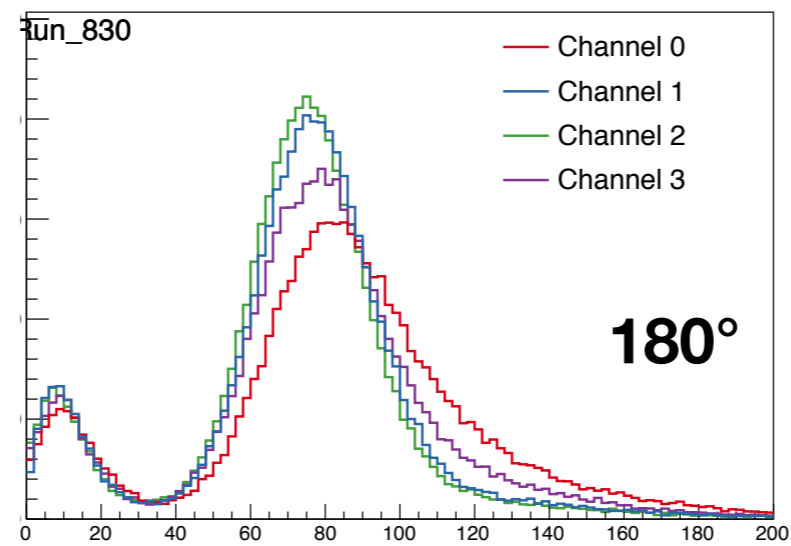
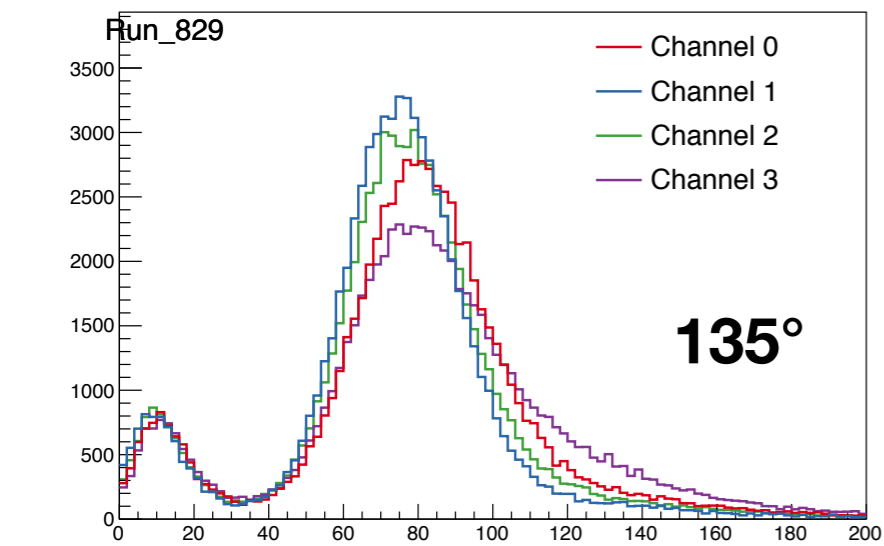
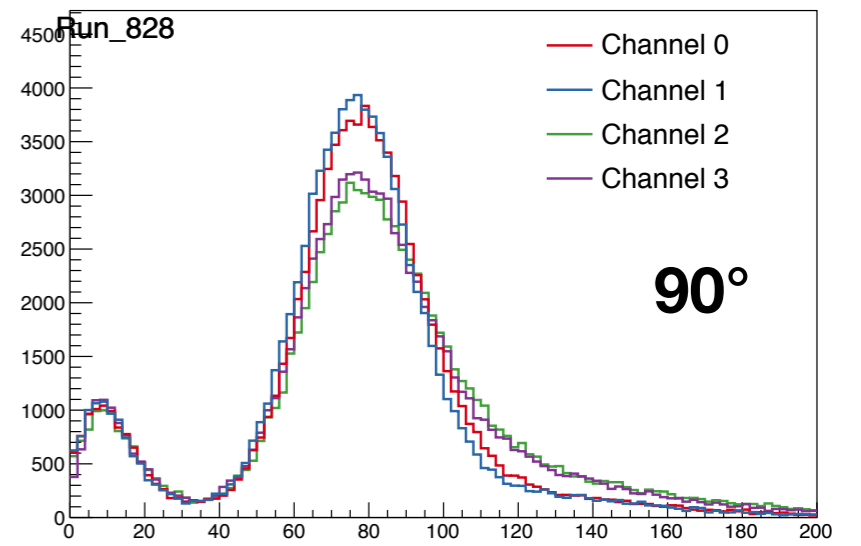
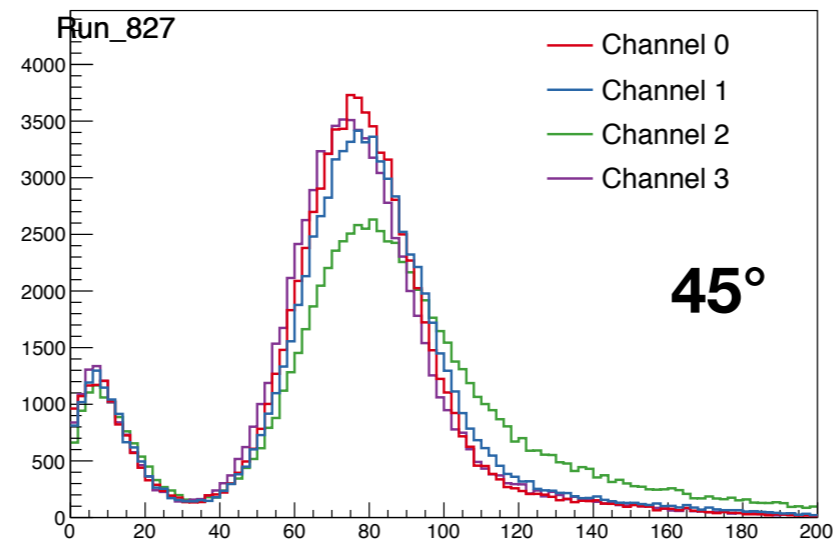
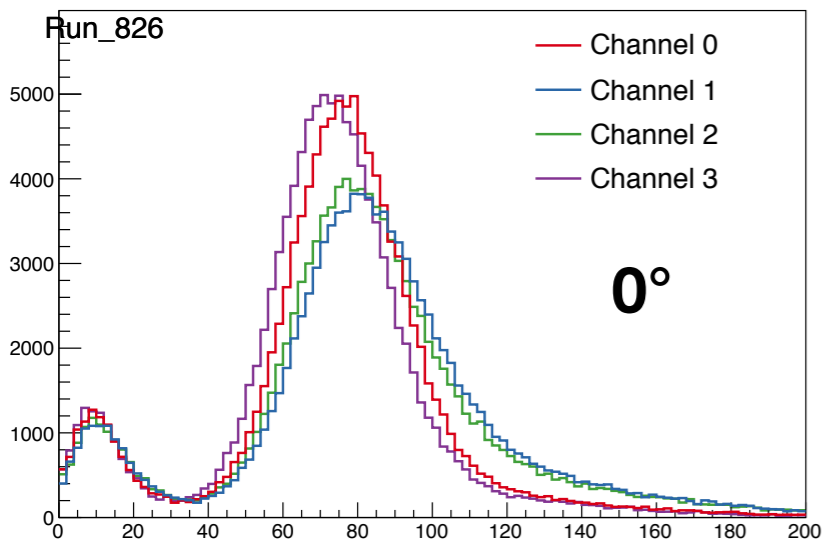


Fano

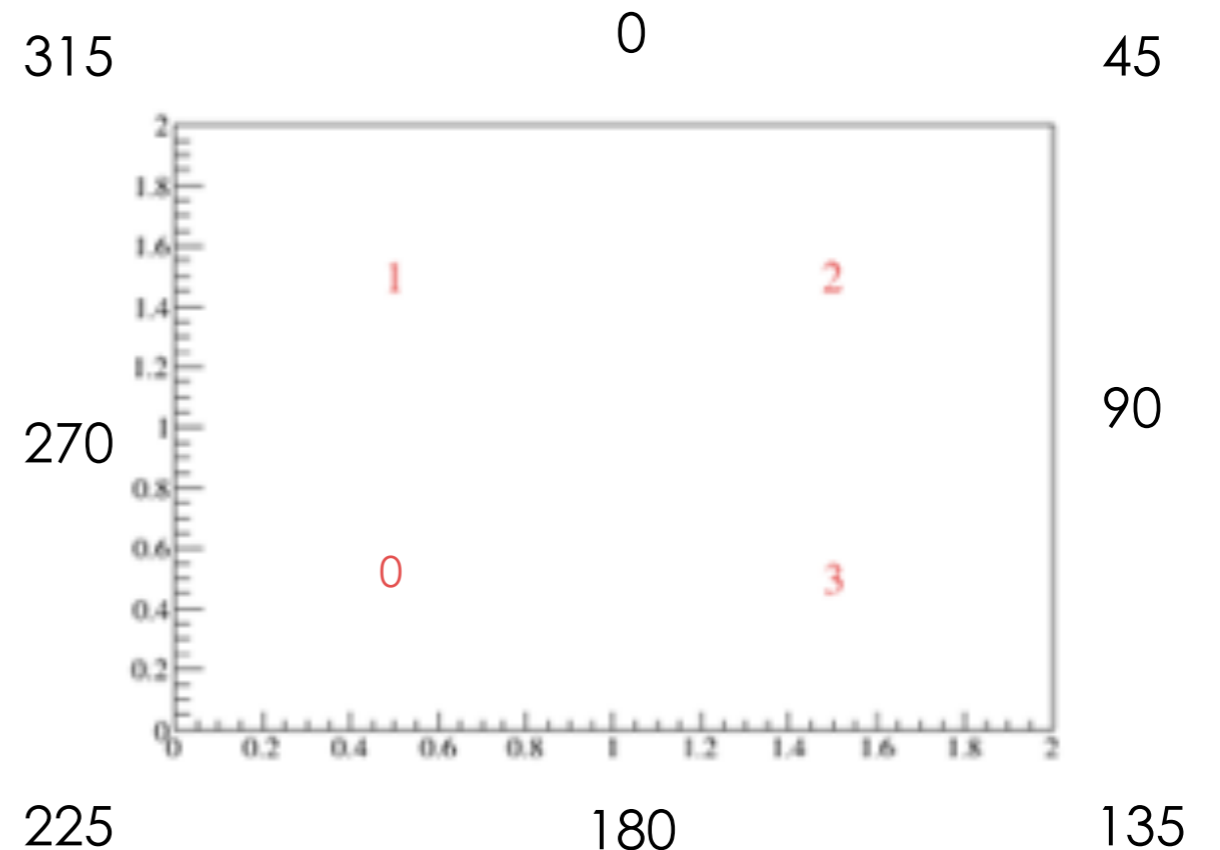
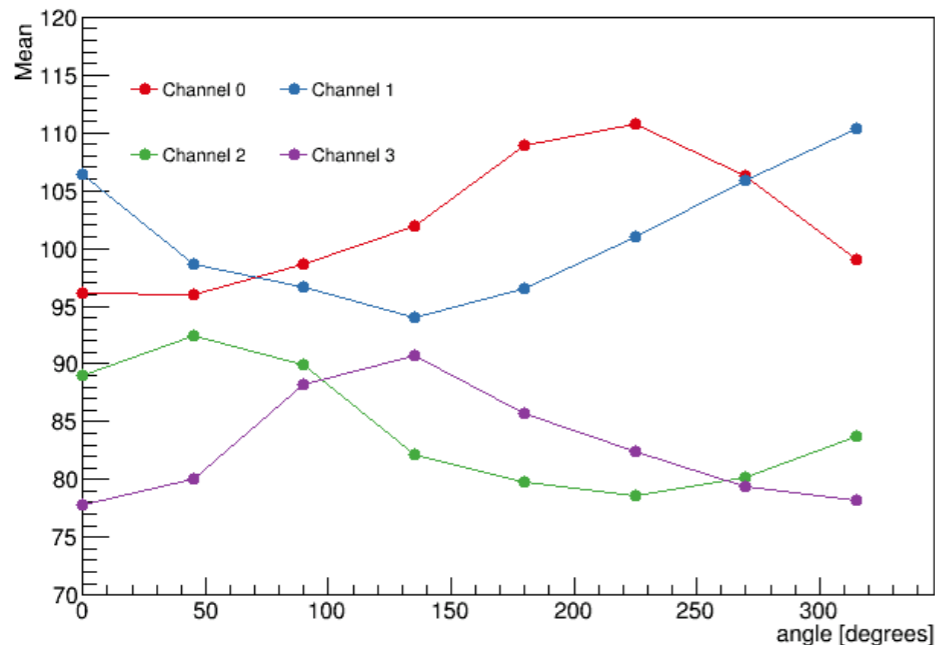


- LY in top and bottom is stable within  $\sim 2\%$  with respect to the source position
- Fano factor is also stable within  $\sim 10\%$  and is more than 2 times larger for the bottom array

# Bottom Channels



# Source position



- Looking at the mean can reconstruct the position of the source with respect to the SiPM
- Oscillatory behaviour on each channel compatible with the moving of the source

# Top channel

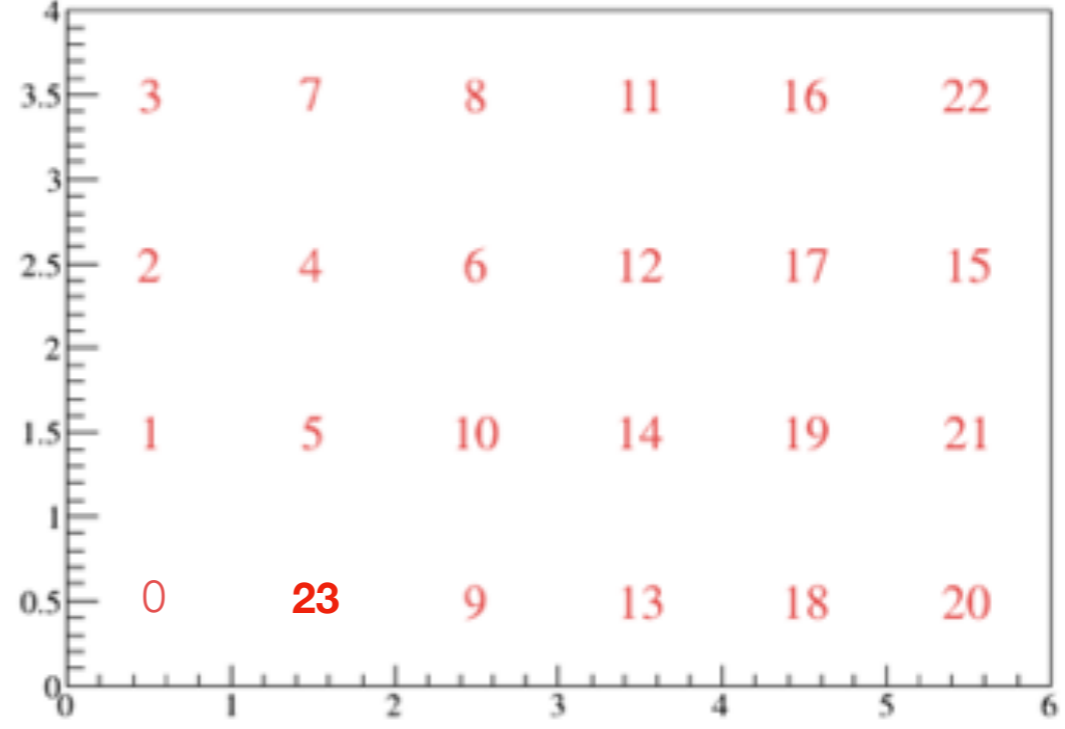
Top Tile 24 Ch (corrispondenza geometrica SiPM canali)					
M01 == A1	M02 == A2	M03 == A3	M04 == A4		
M06 == B1	M07 == B2	M05 == A5	M09 == B4		
M11 == C1	M12 == C2	M08 == B3	M10 == B5		
M16 == C5	M17 == D1	M15 == C4	M14 == C3		
M21 == D5	M22 == E2	M20 == D4	M19 == D3		
M23 == E3	M24 == E4	M18 == D2	M25 == E5		

lato alimentazione

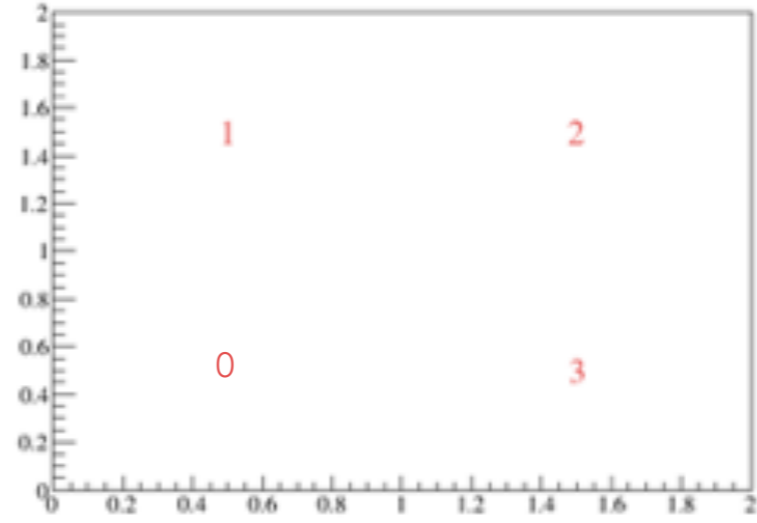
Bottom Tile 4 Ch (corrispondenza geometrica canali)	
F2	F3
F5	F4

lato alimentazione

Lato Alimentazione



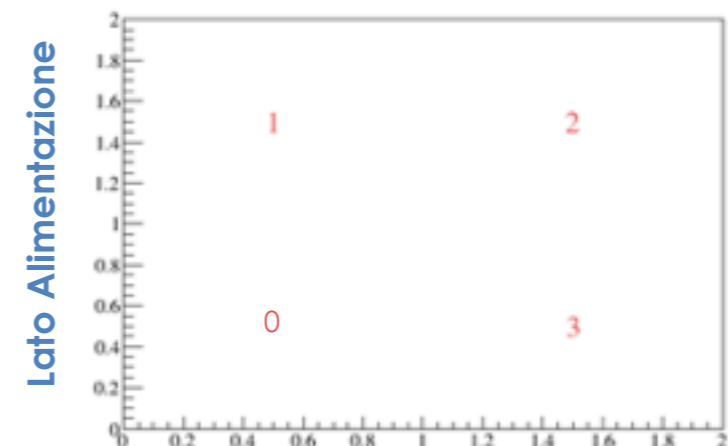
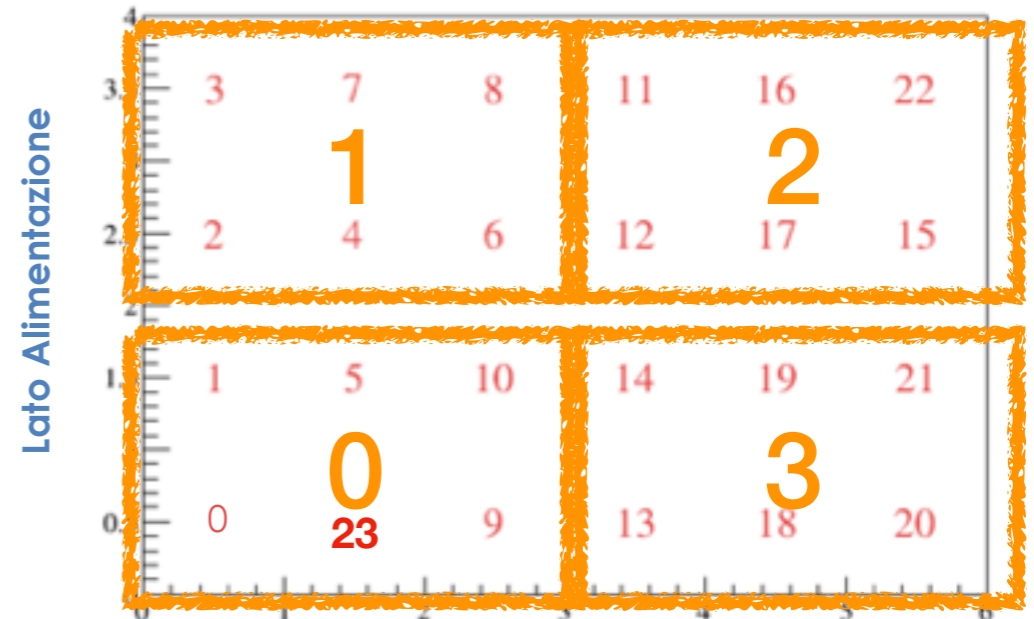
Lato Alimentazione



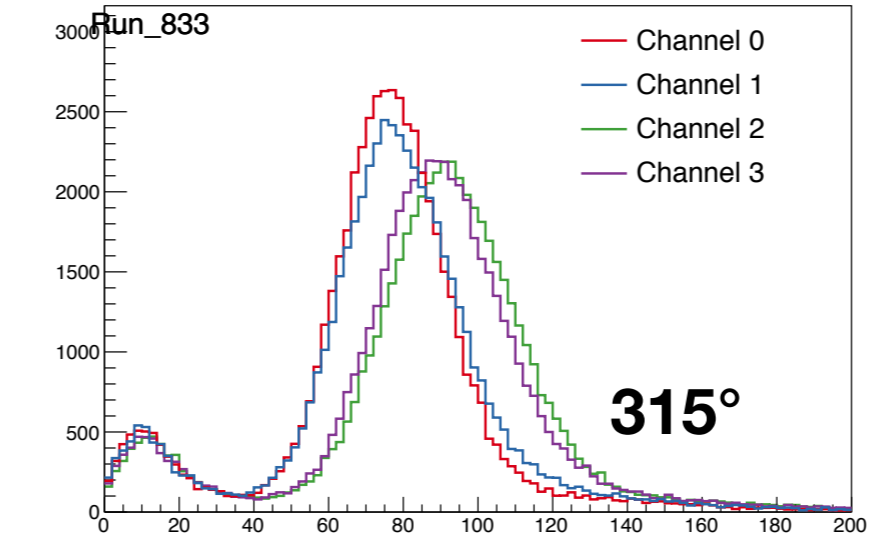
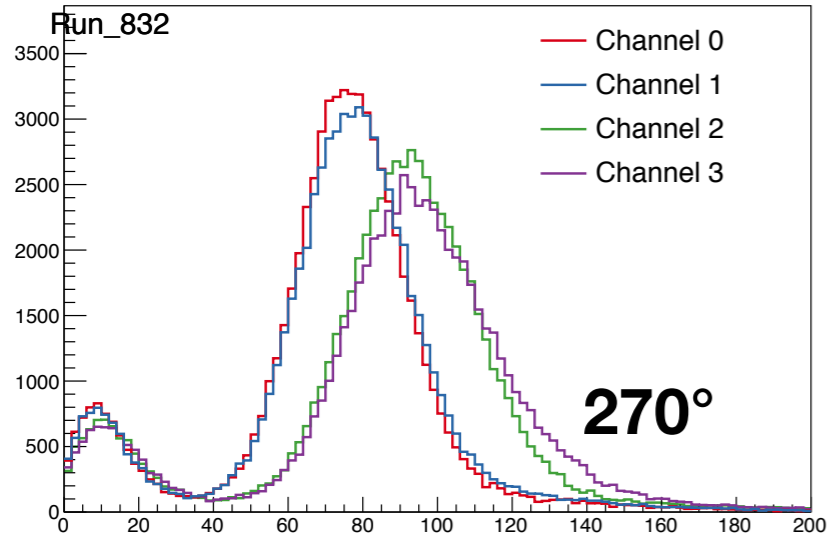
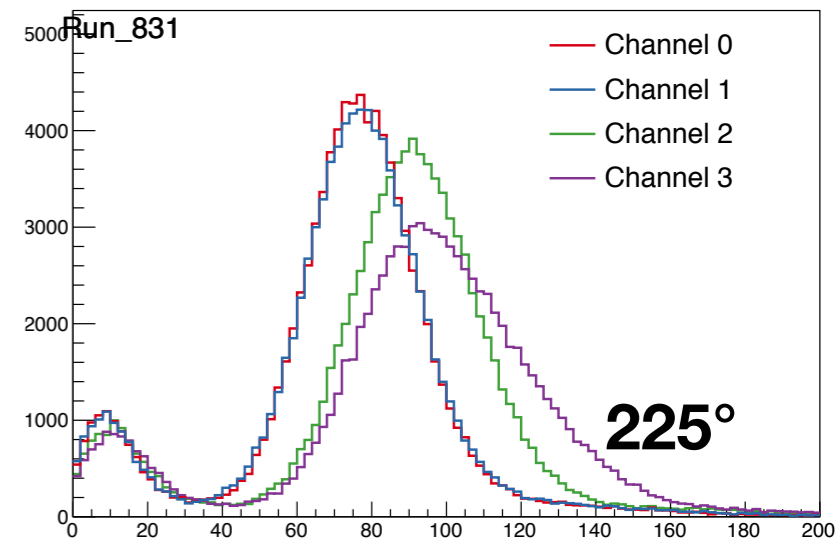
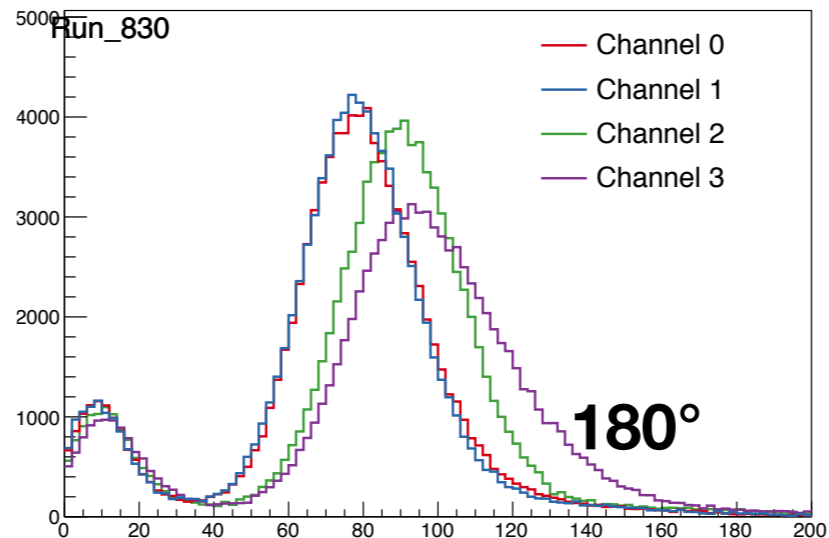
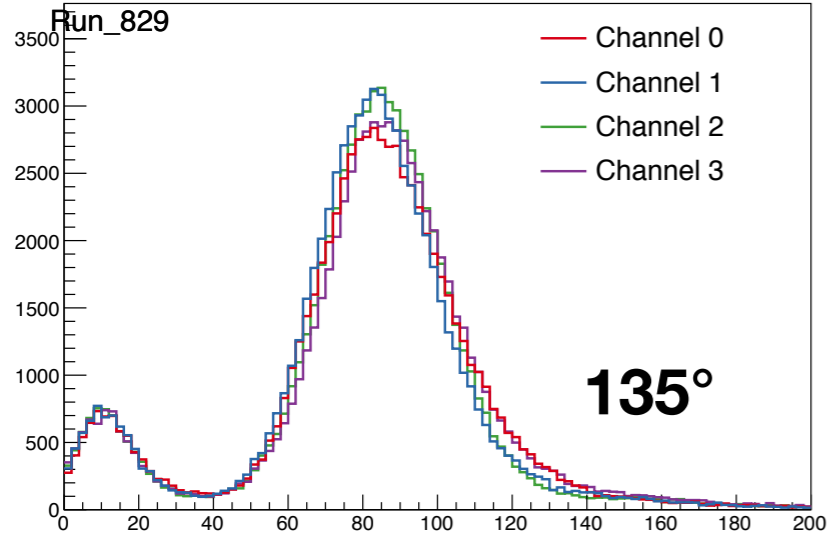
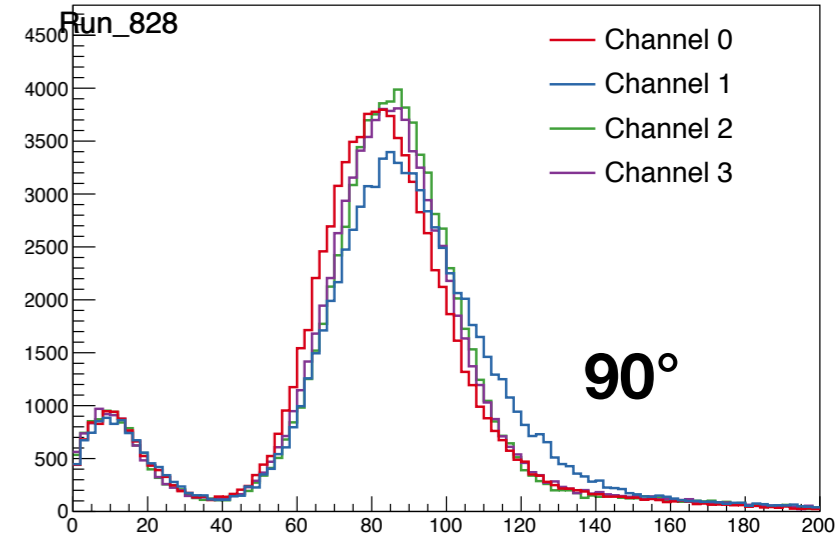
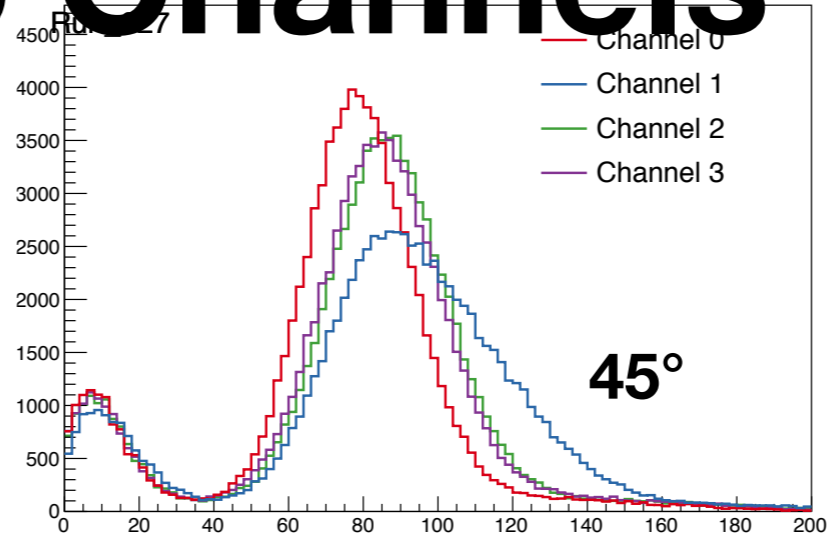
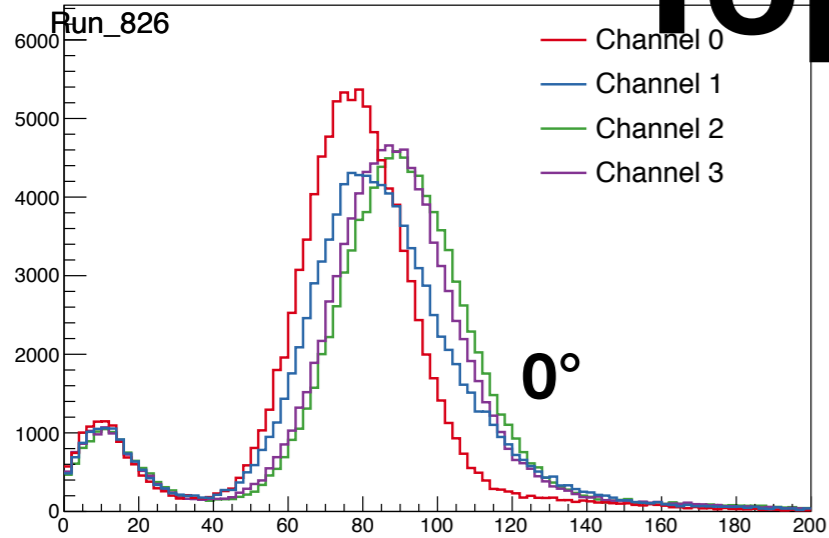


# Top channels

- Difficult to do the same with 24 channels (plots in back-up) → we decided to sum 6 SiPM together to mimic the bottom → 4 channels as in the bottom

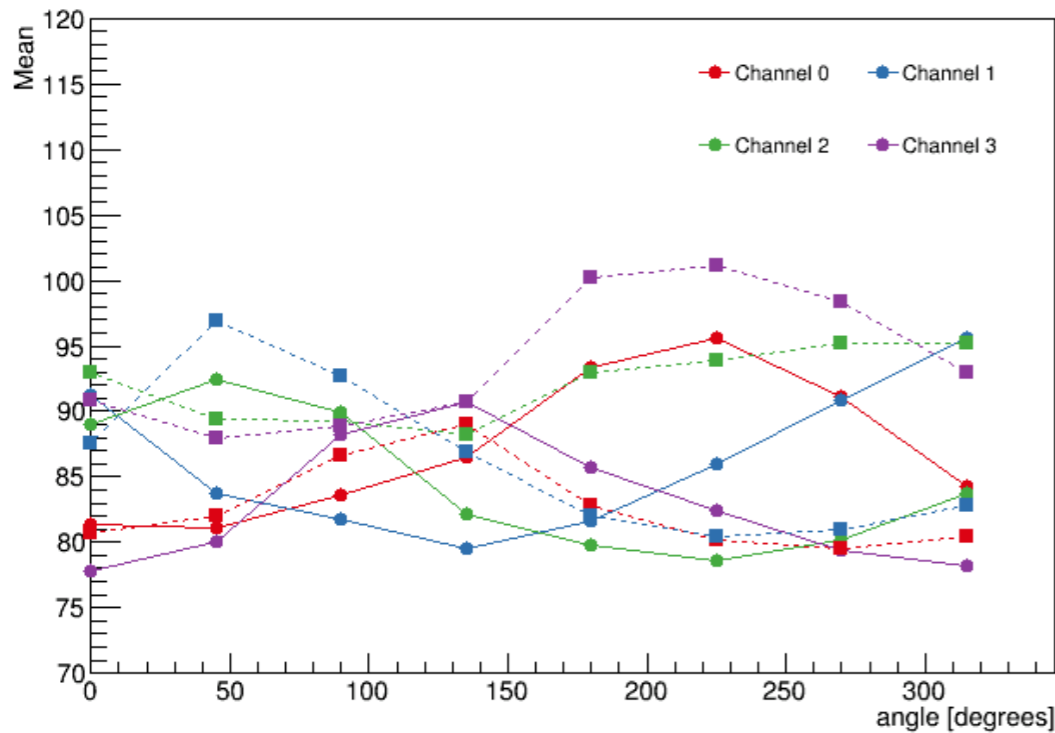


# Top Channels

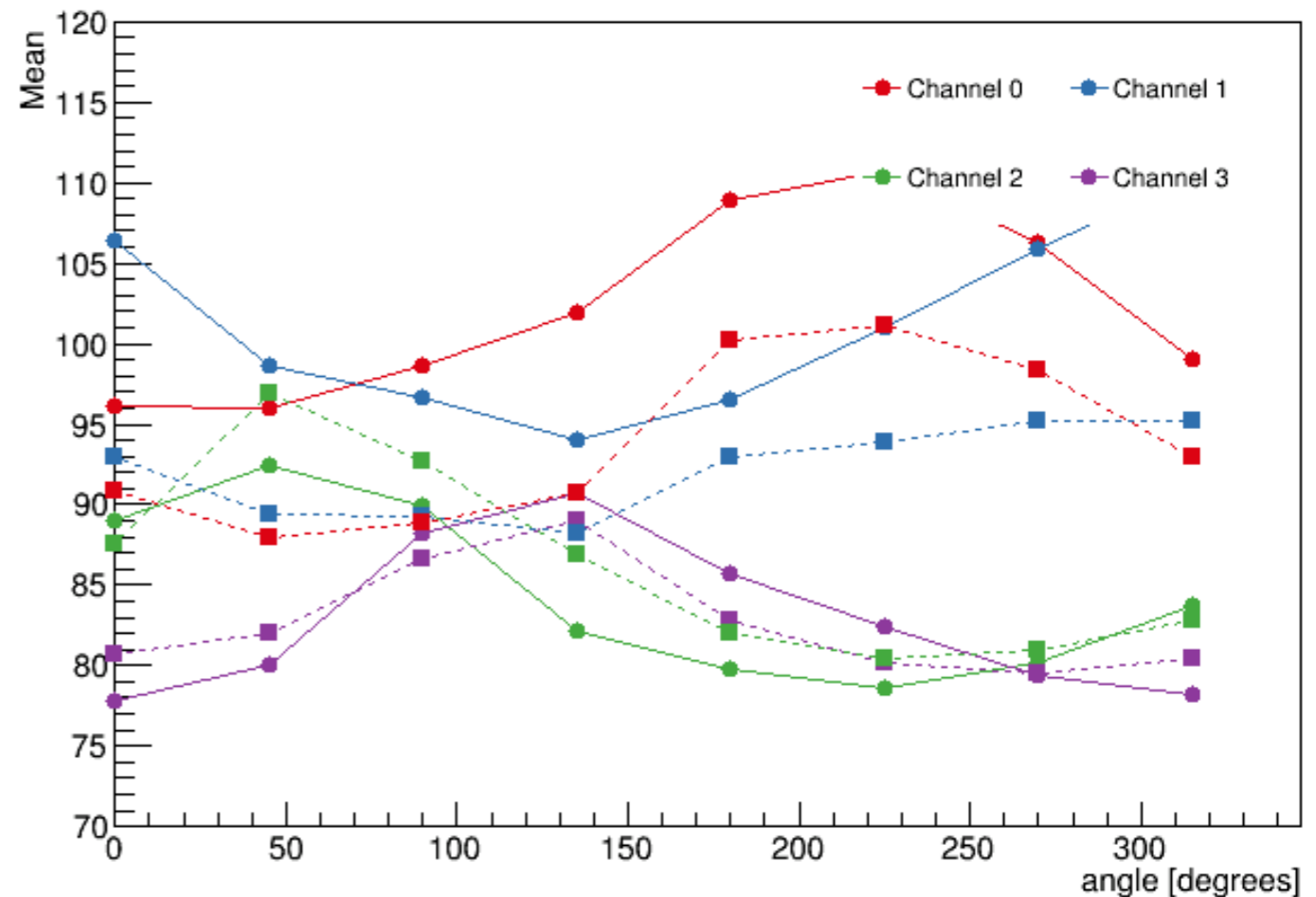


# Mapping problem

dotted: Top  
continuous: Bottom



Works much better swapping  
0 → 3 and 1 → 2



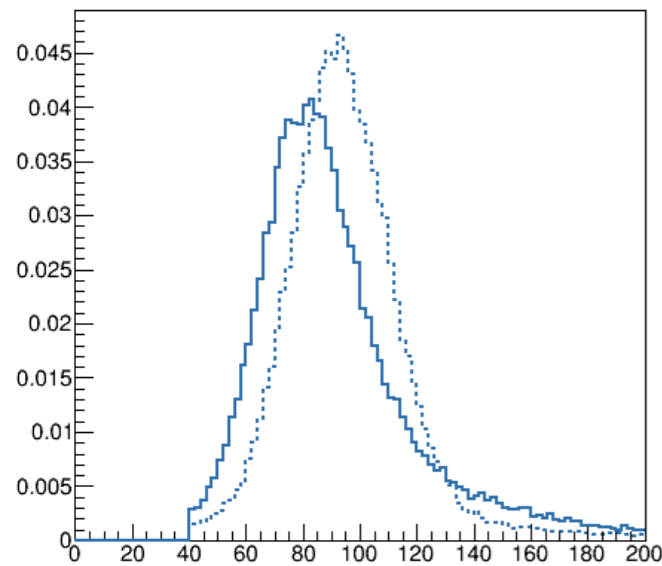
In the following we assume that we need to swap the channels

# Compare top and bottom

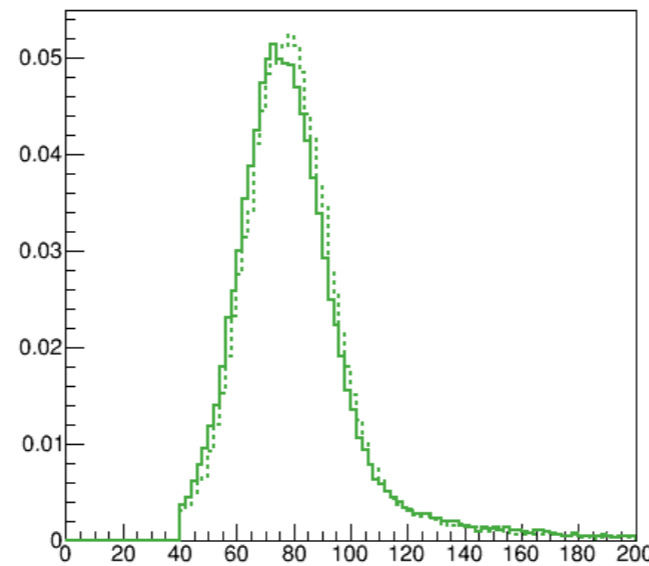
**dotted: Top**  
**continuous: Bottom**

**Comparison of same channel top and bottom**

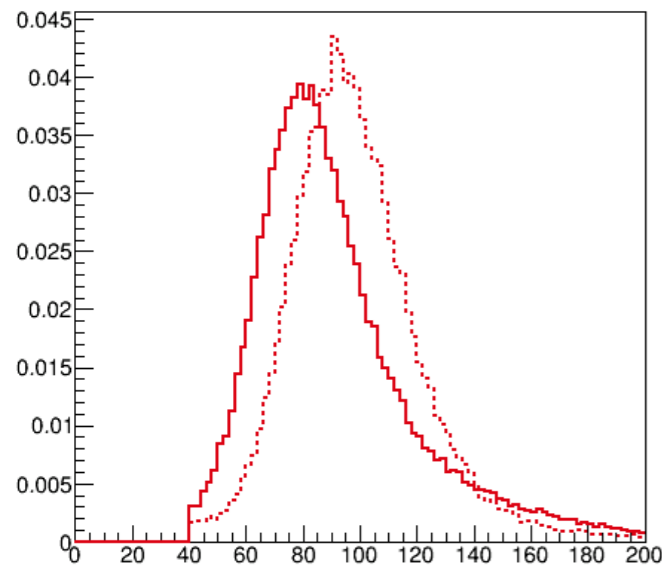
270 degrees - Channel 1



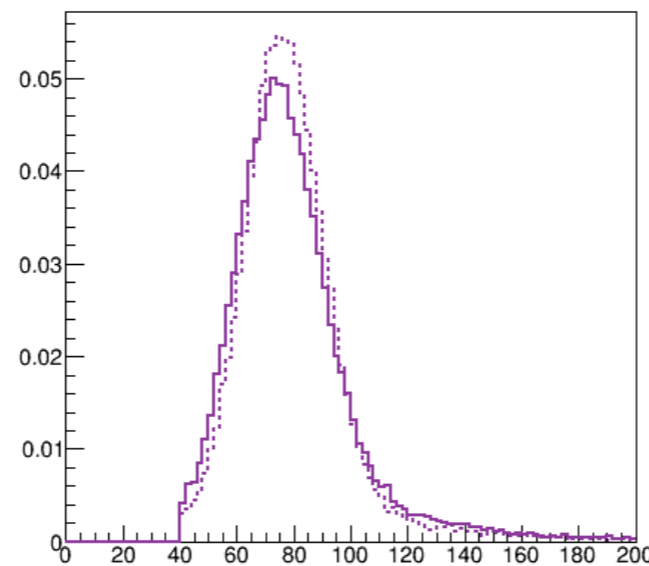
270 degrees - Channel 2



270 degrees - Channel 0

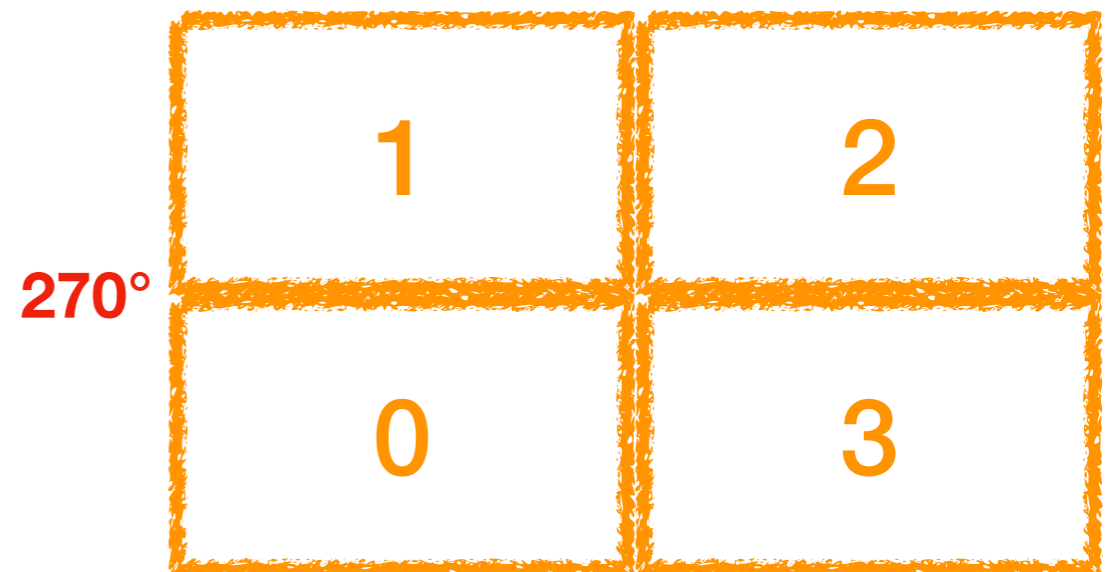


270 degrees - Channel 3



**2 and 3 → far from the source**  
**Top and Bottom same shape**

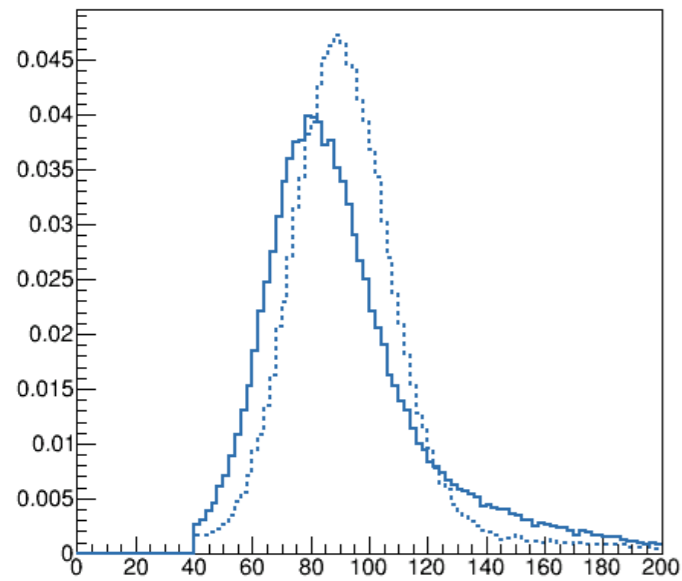
**0 and 1 → large tail in the bottom →**  
**responsible for the observed worst**  
**resolution**



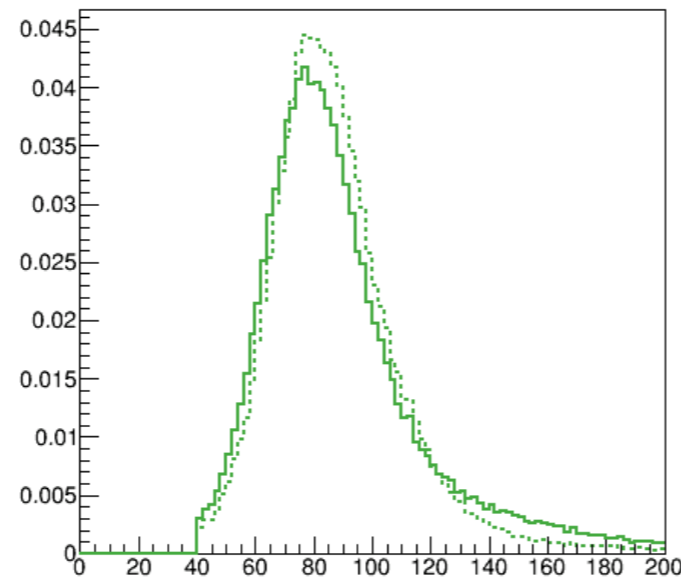
# Different runs

**dotted: Top**  
**continuous: Bottom**

0 degrees - Channel 1



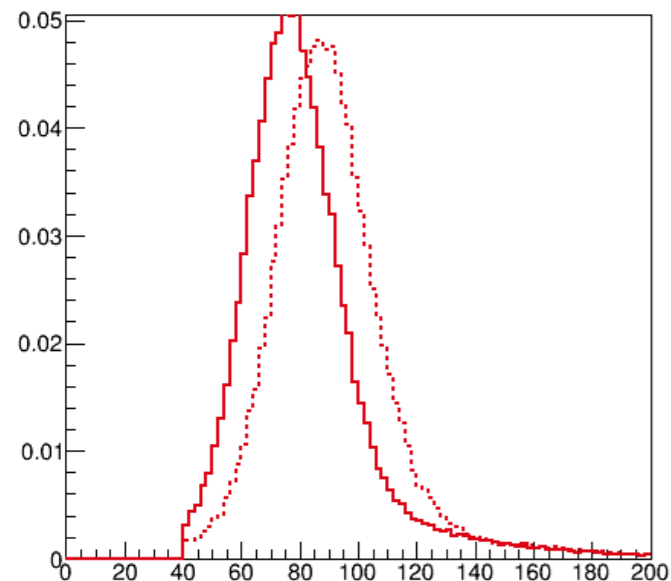
0 degrees - Channel 2



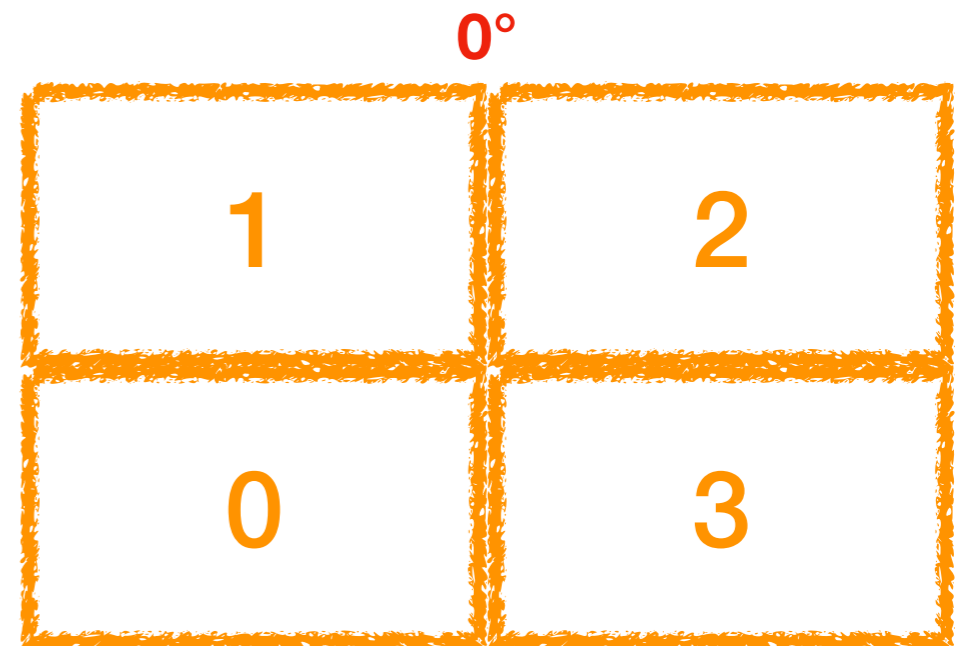
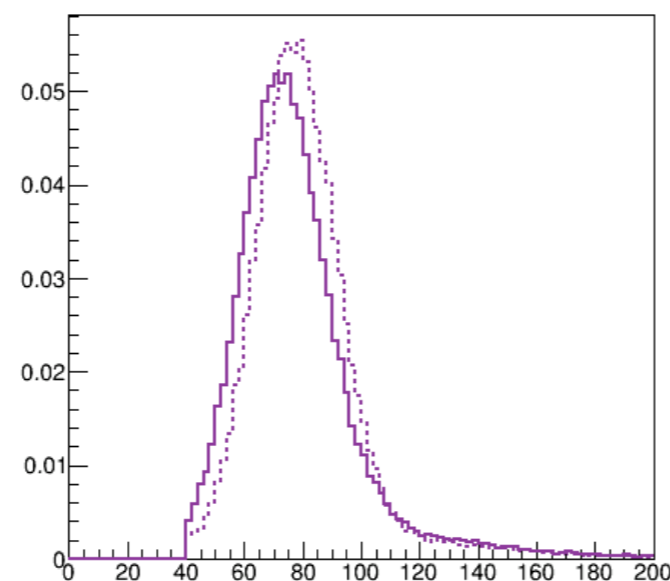
**0,3 → same**

**1 and 2 → large tail in the bottom → responsible for worst resolution**

0 degrees - Channel 0



0 degrees - Channel 3



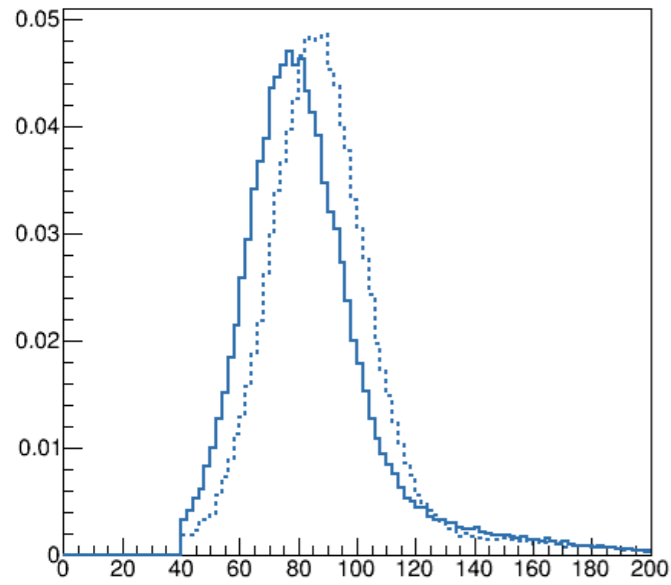
**dotted: Top**  
**continuous: Bottom**

**0,1,3 are the same**

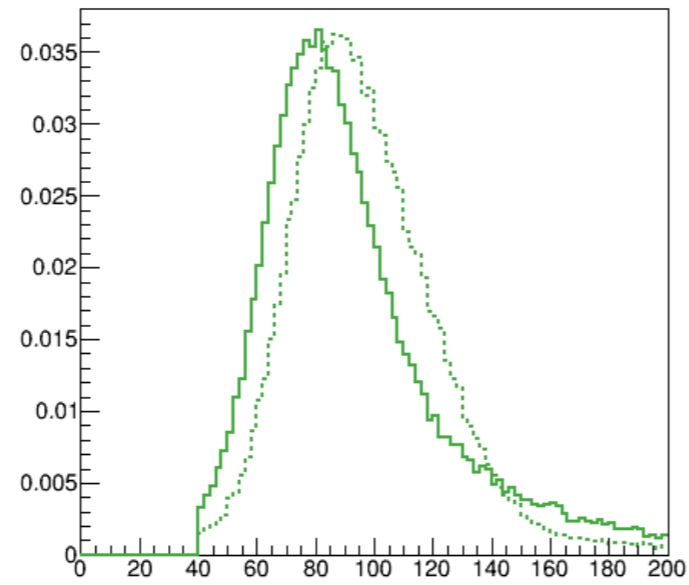
**Tail only observed in the  
Channel 2 → closest to the  
source**

**45°**

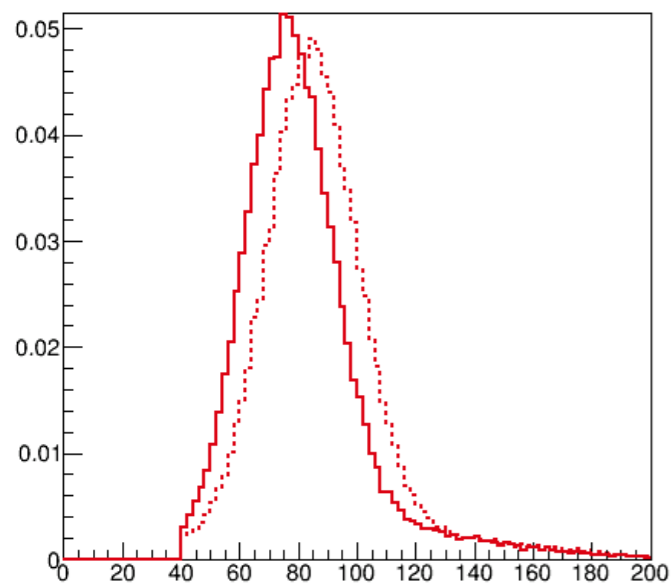
45 degrees - Channel 1



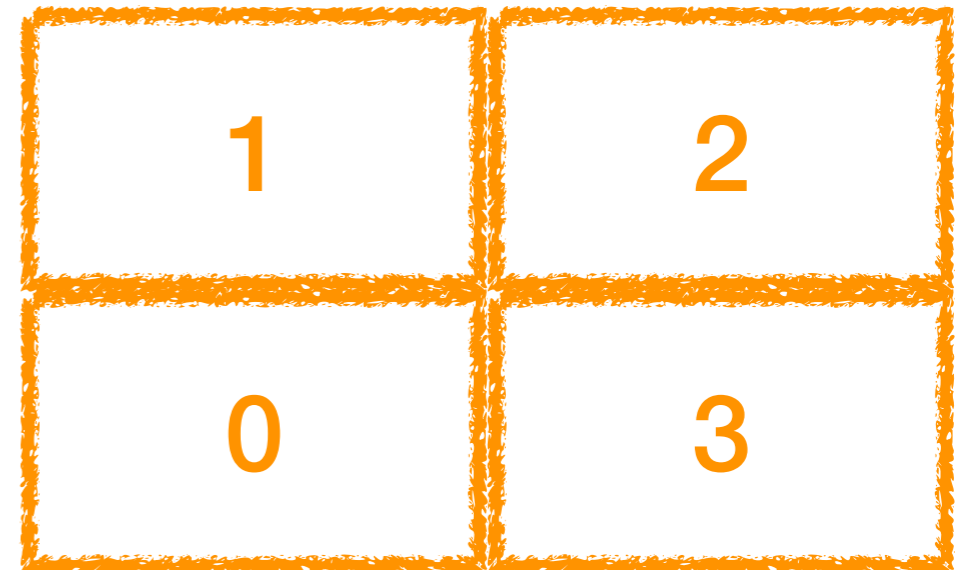
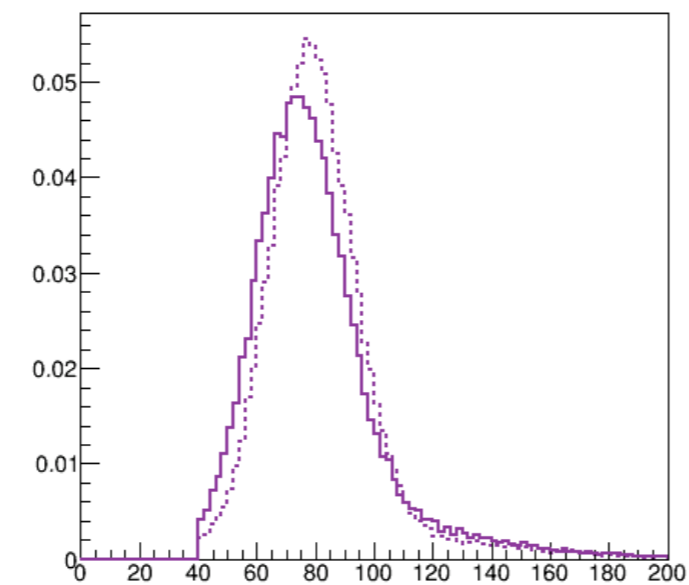
45 degrees - Channel 2



45 degrees - Channel 0

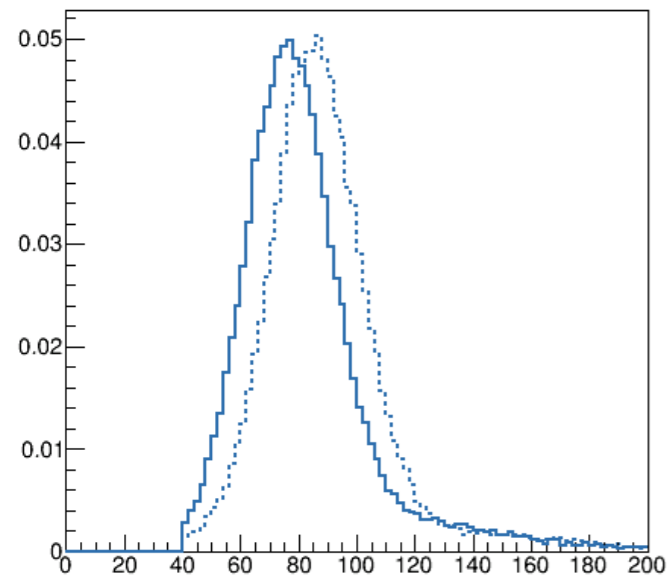


45 degrees - Channel 3

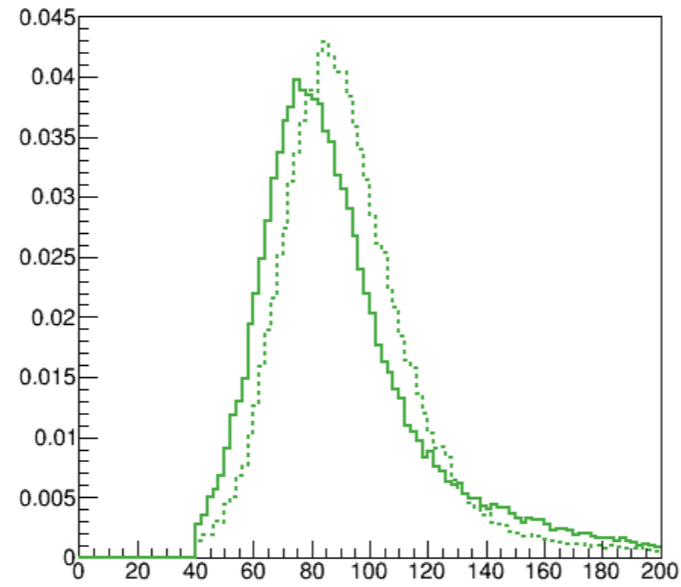


**dotted: Top**  
**continuous: Bottom**

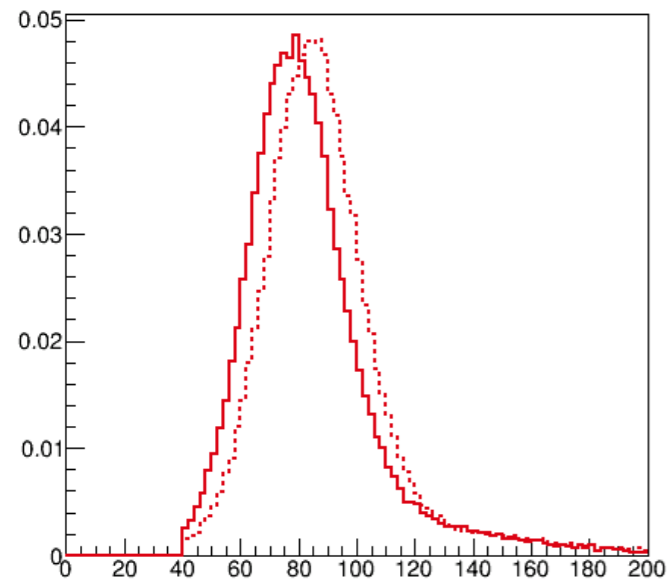
90 degrees - Channel 1



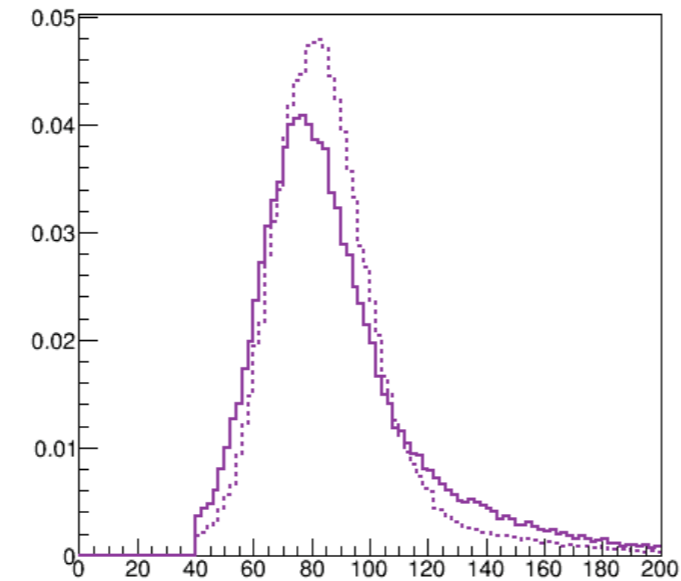
90 degrees - Channel 2



90 degrees - Channel 0

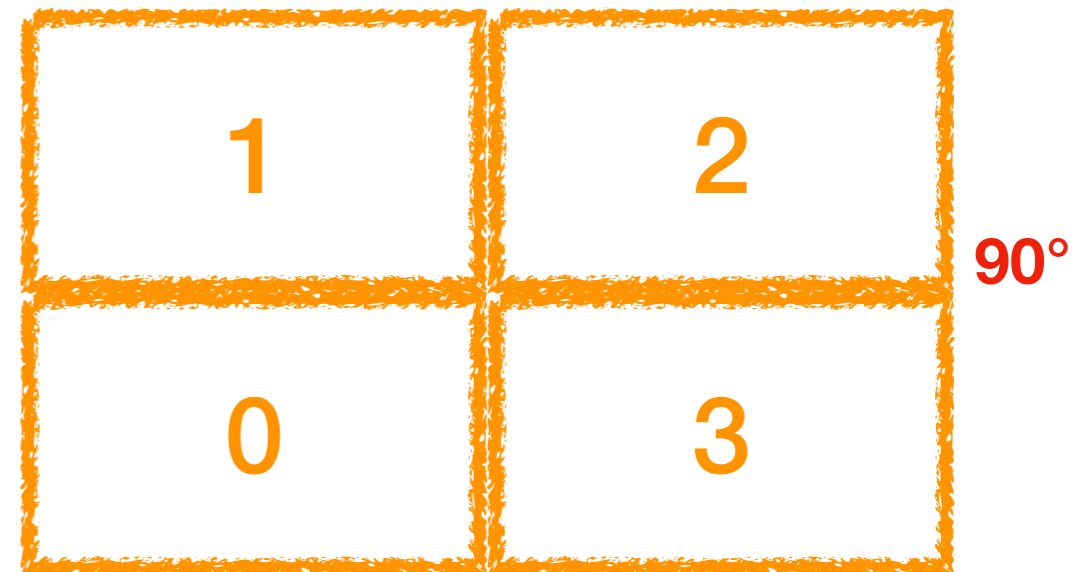


90 degrees - Channel 3



**0,1 → same**

**Tail in 2 and 3 (closest to the source)**

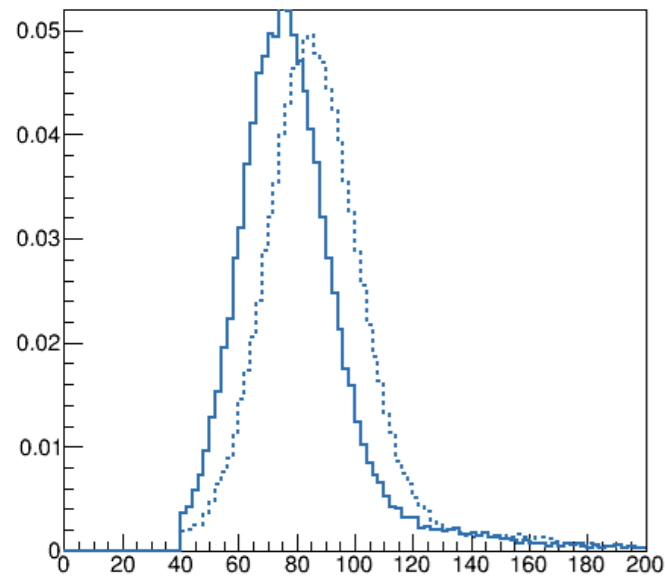


**dotted: Top**  
**continuous: Bottom**

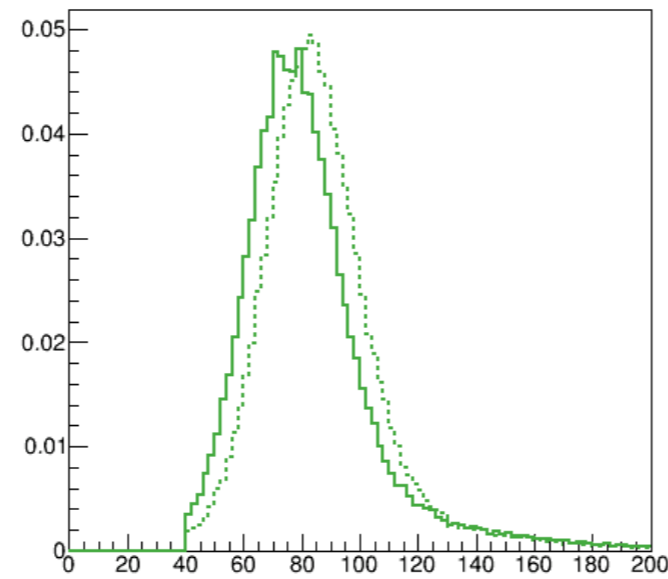
**0,1,2 are the same**

**Tail only observed in the  
Channel 3 → closest to the  
source**

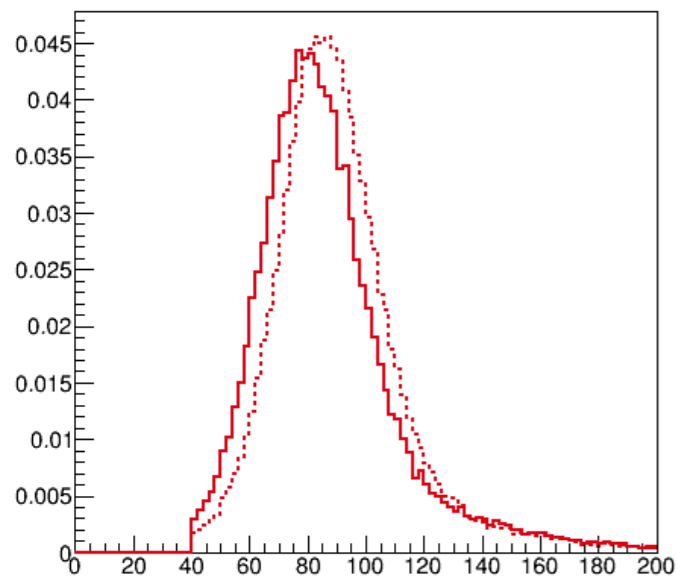
135 degrees - Channel 1



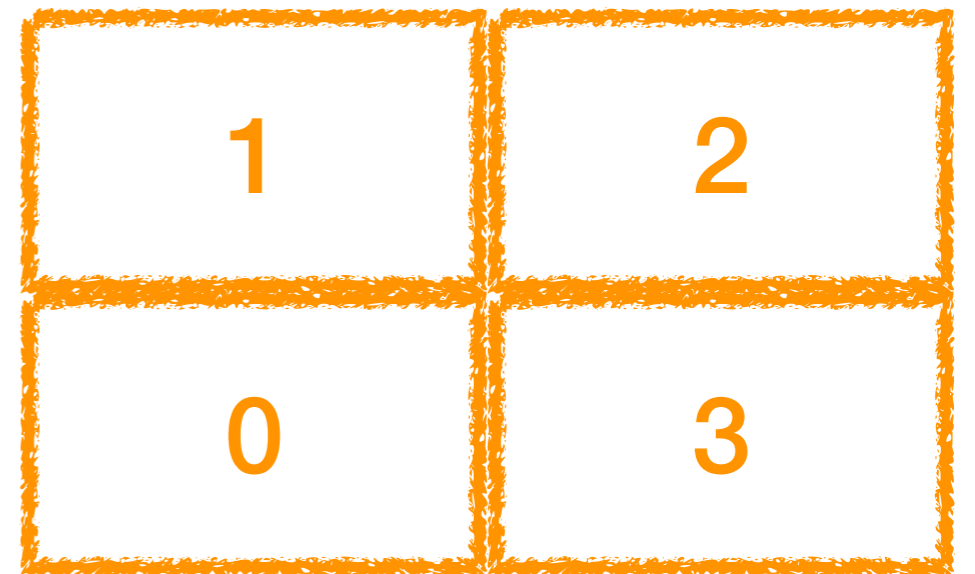
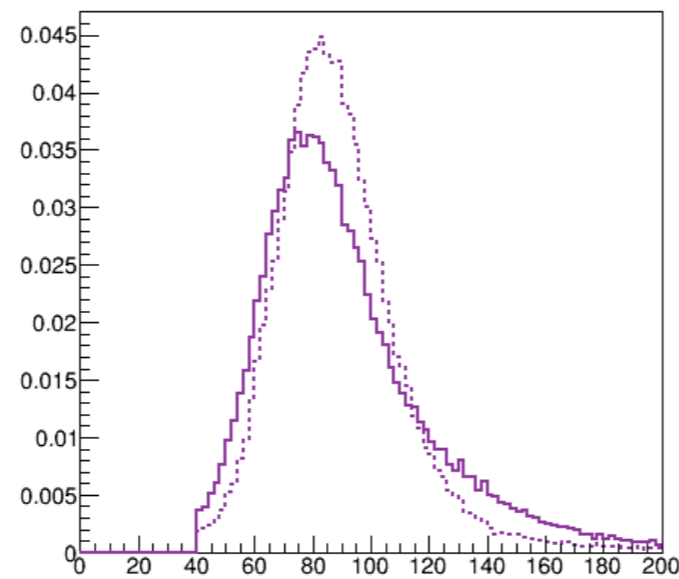
135 degrees - Channel 2



135 degrees - Channel 0



135 degrees - Channel 3

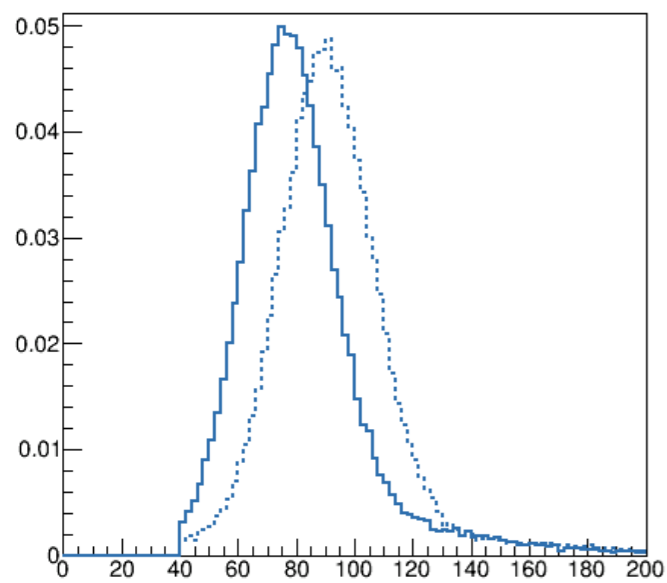


**135°**

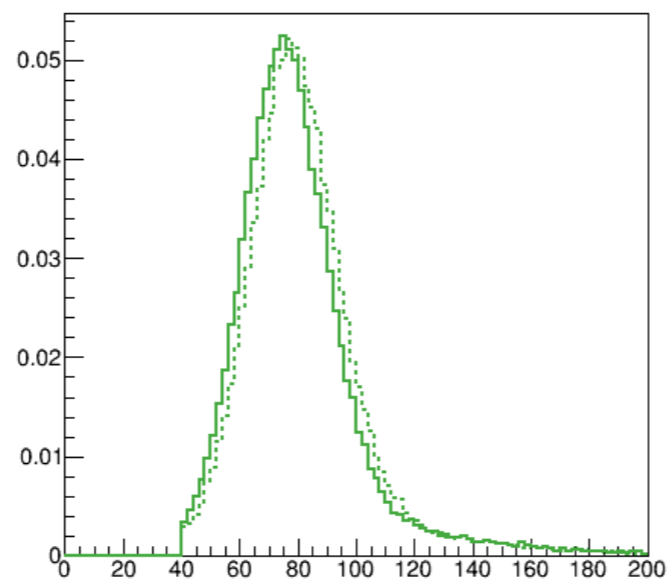


**dotted: Top**  
**continuous: Bottom**

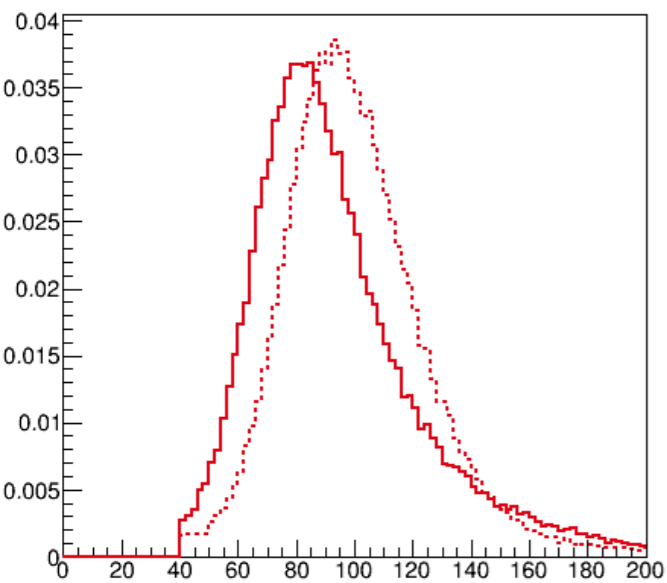
180 degrees - Channel 1



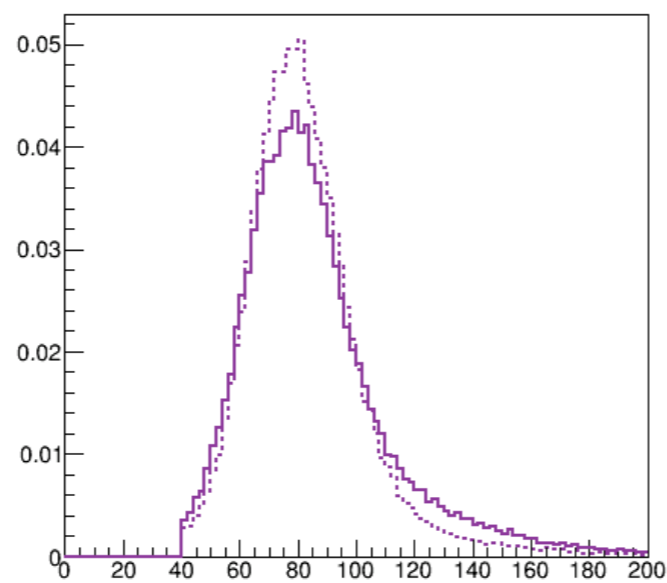
180 degrees - Channel 2



180 degrees - Channel 0

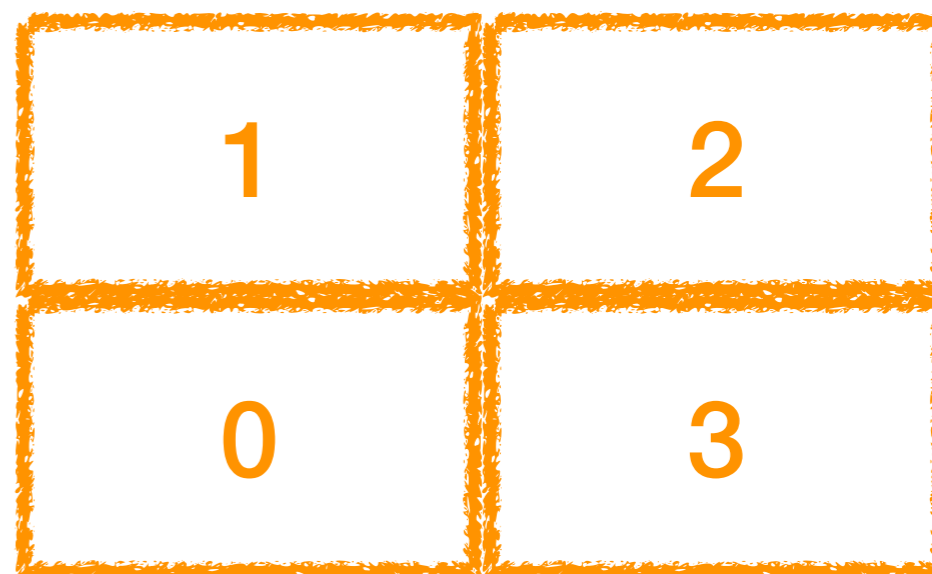


180 degrees - Channel 3



**1, 2 → same**

**Tail in 0 and 3 (closest to the source)**



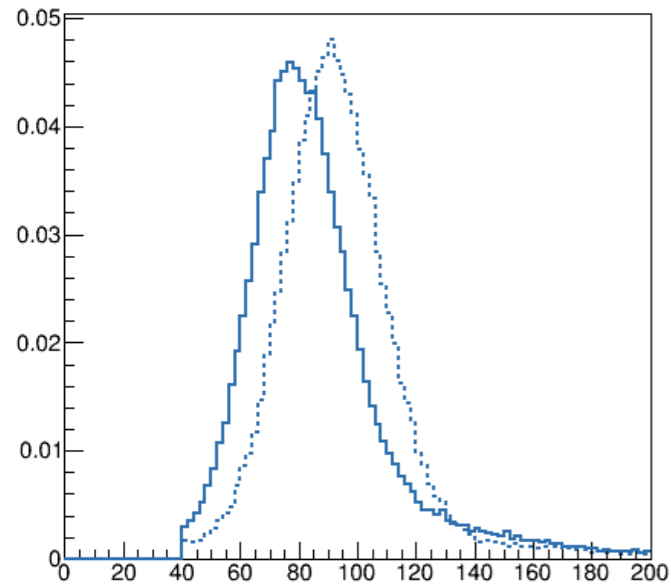
**180°**

**dotted: Top**  
**continuous: Bottom**

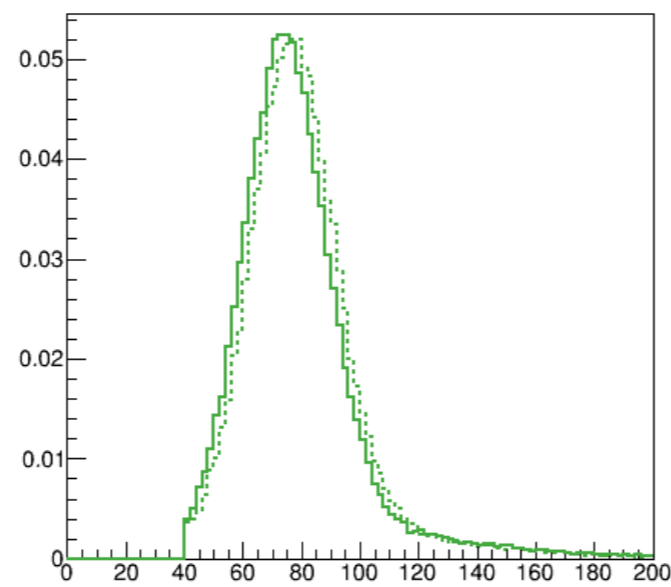
**0,1,2 are the same**

**Tail only observed in the  
Channel 3 → closest to the  
source**

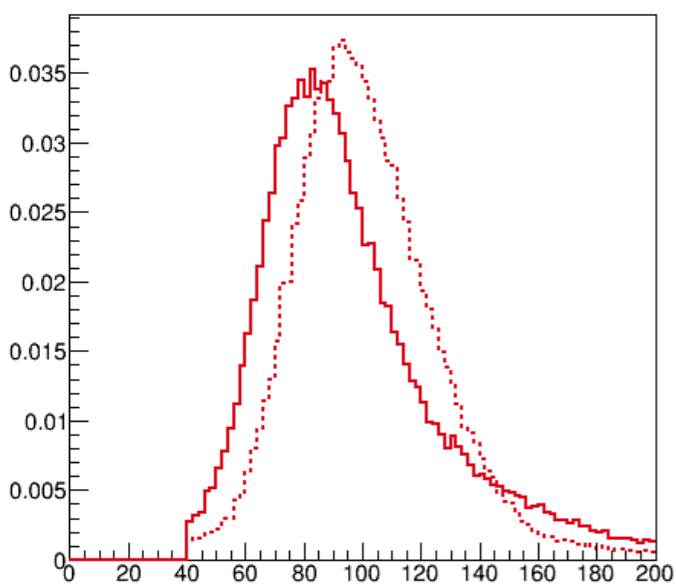
225 degrees - Channel 1



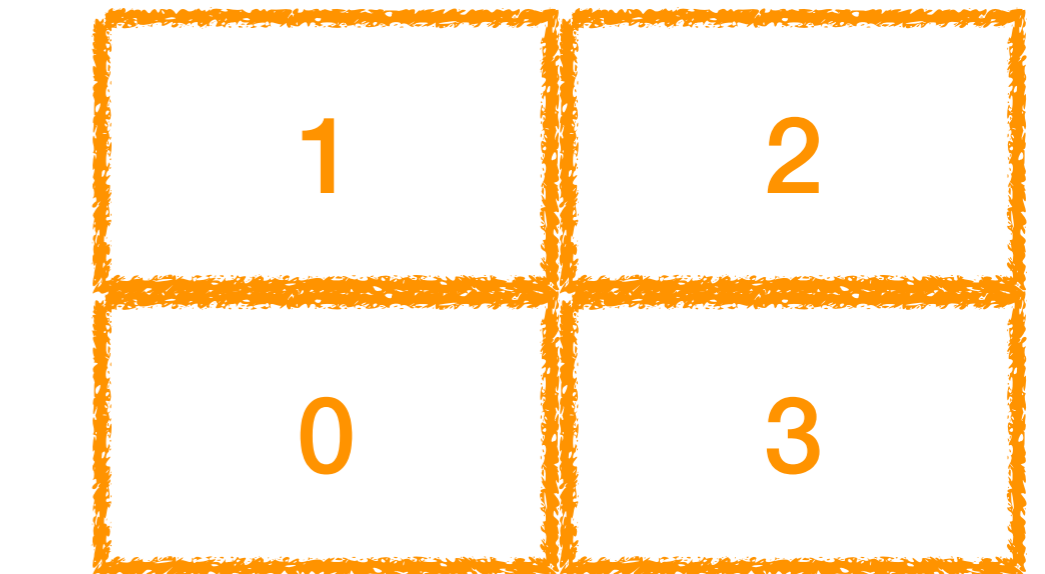
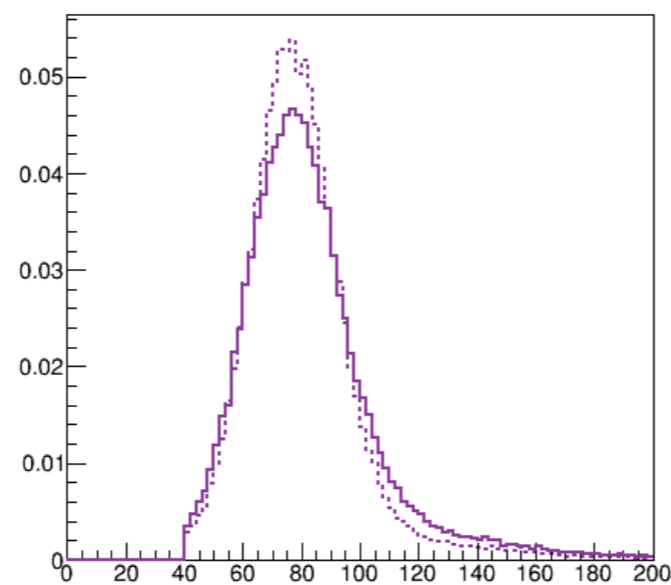
225 degrees - Channel 2



225 degrees - Channel 0



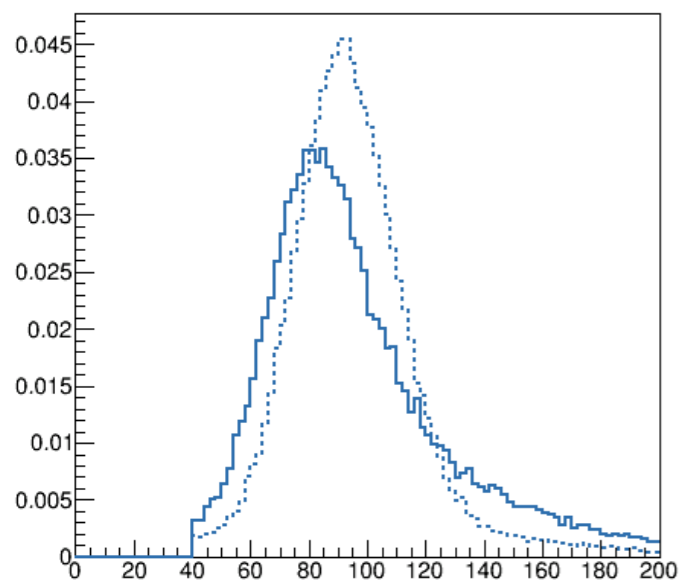
225 degrees - Channel 3



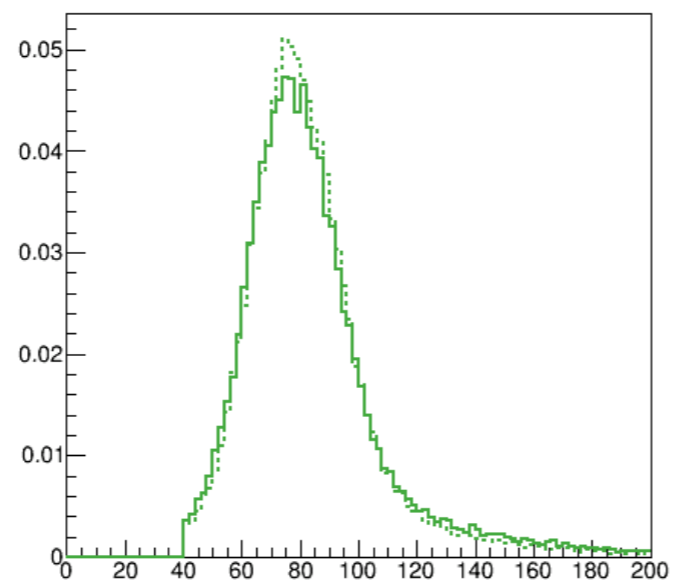
**225°**

**dotted: Top**  
**continuous: Bottom**

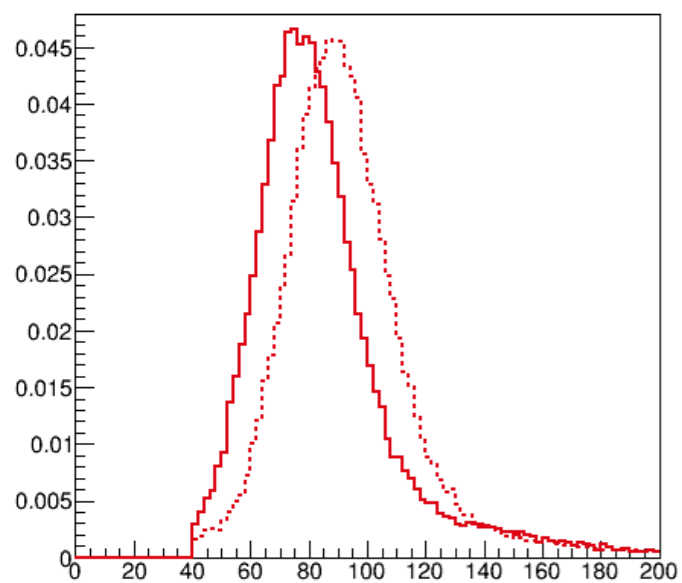
315 degrees - Channel 1



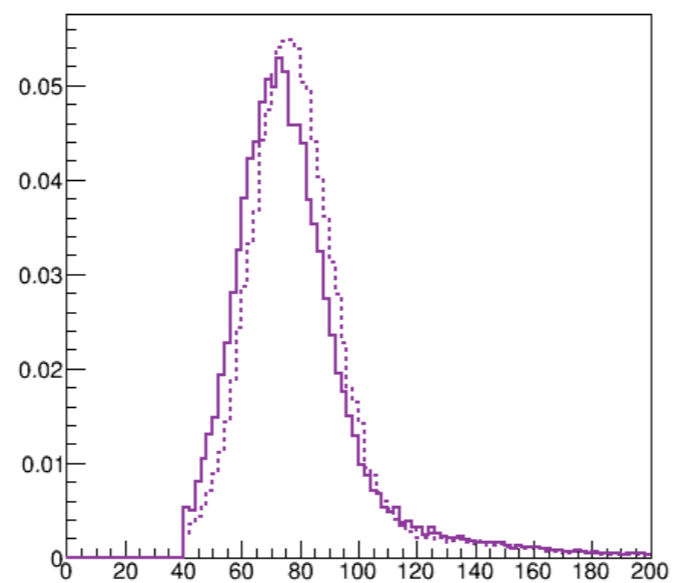
315 degrees - Channel 2



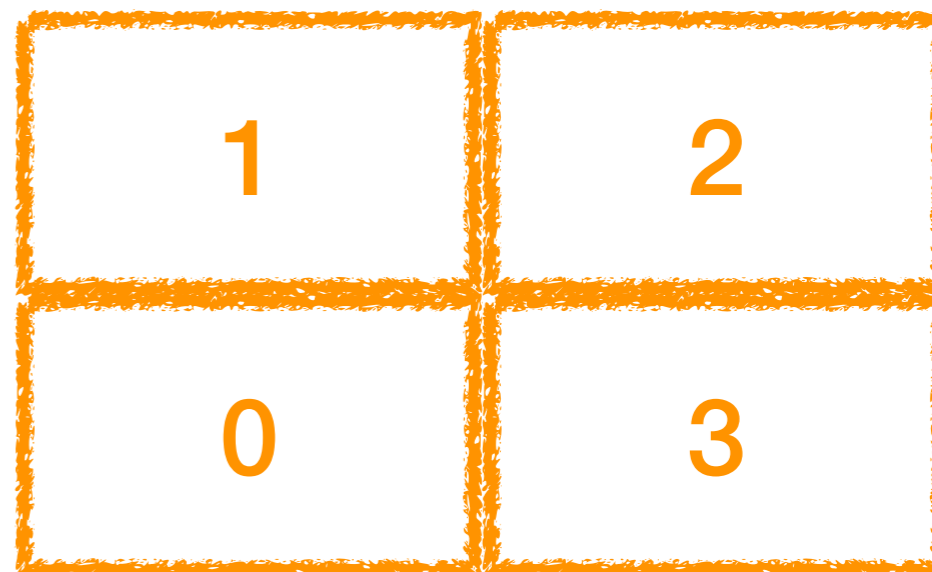
315 degrees - Channel 0



315 degrees - Channel 3

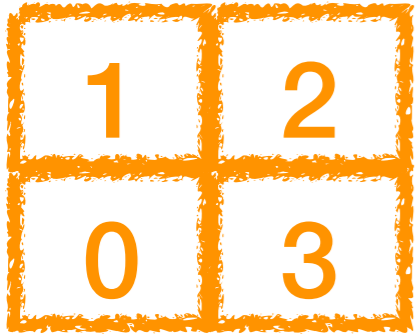


**315°**



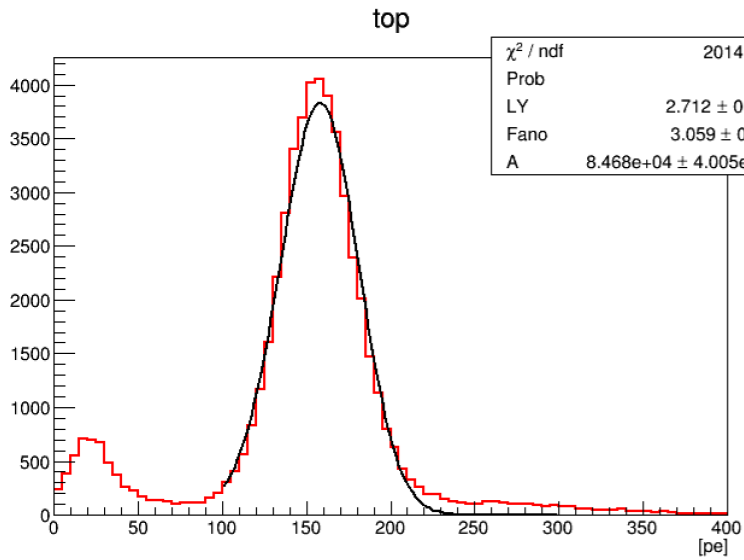
315°

# Resolution

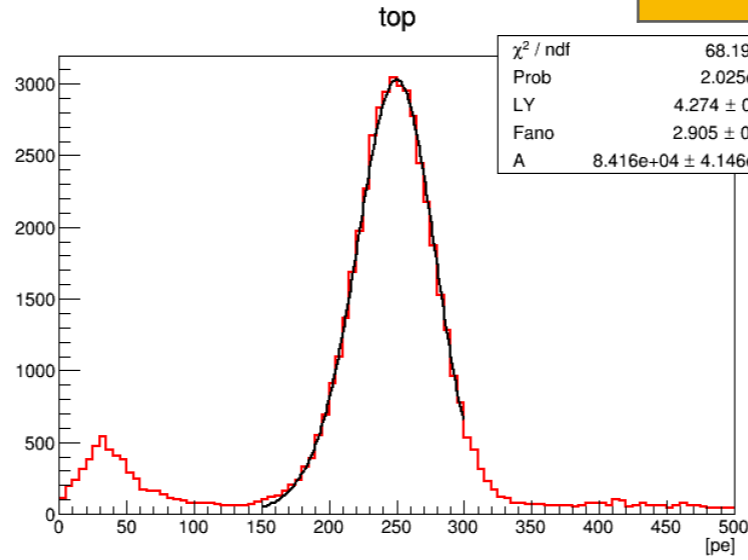


- Test for one run, taking only tiles away from the source
- Sum of 2 ch (2,3), 3 ch (0,2,3) and 4 ch
- Clear impact of the SiPM closest to the source on the resolution

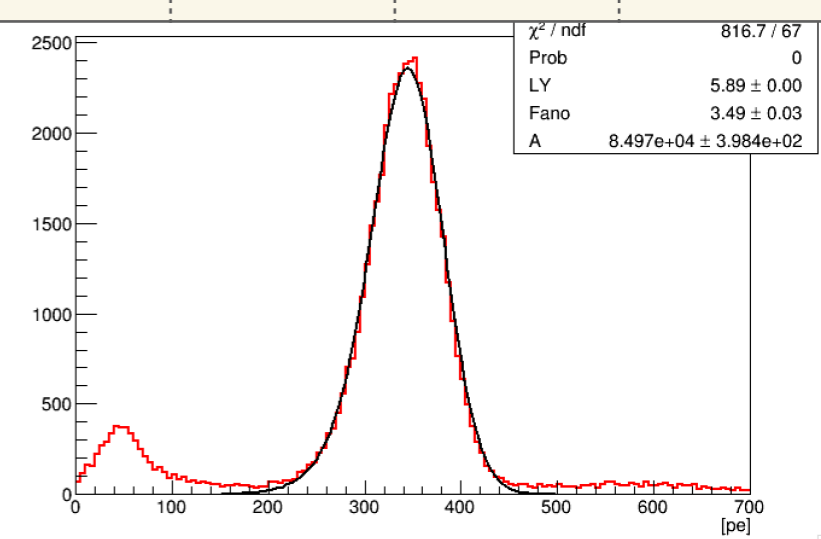
	LY top	LY bot	Fano top	Fano bot
2+3	2.7	2.6	3.1	4.1
0+2+3	4.2	4.0	2.9	4.4
0+1+2+3	5.9	5.8	3.5	8.1



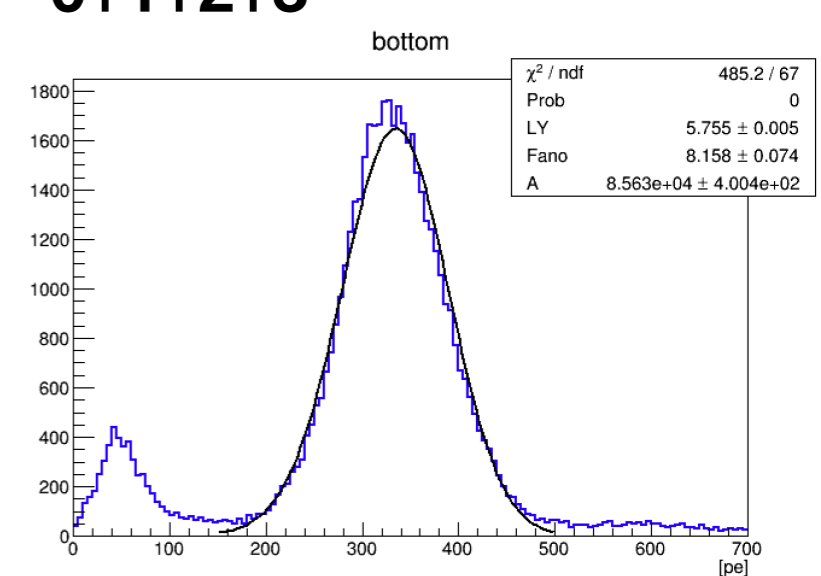
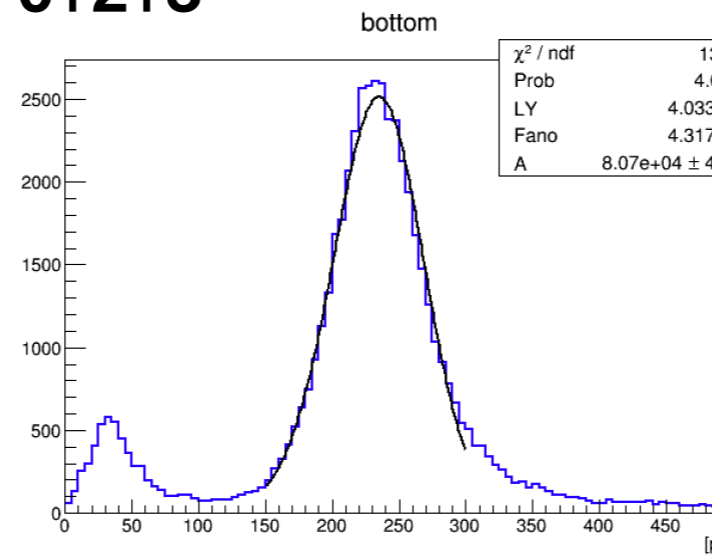
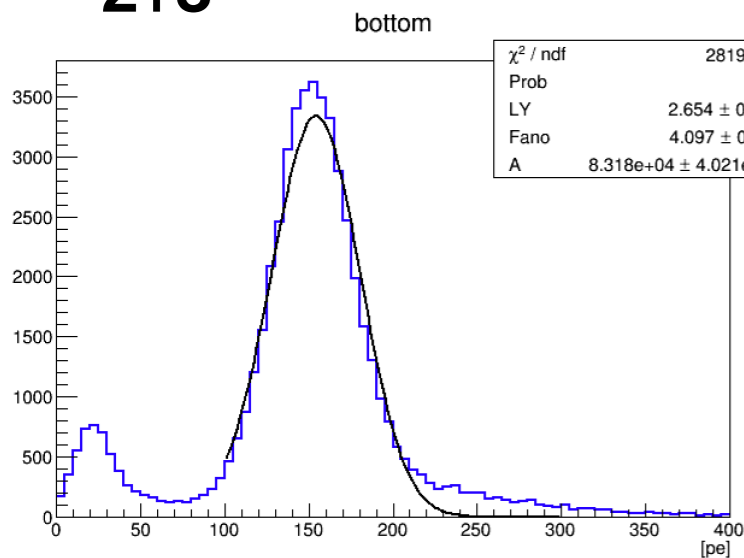
2+3



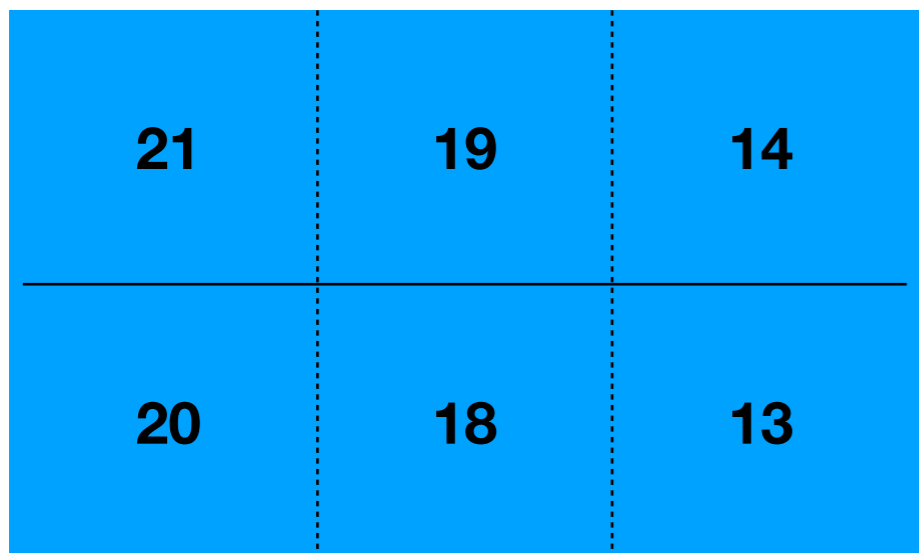
0+2+3



0+1+2+3



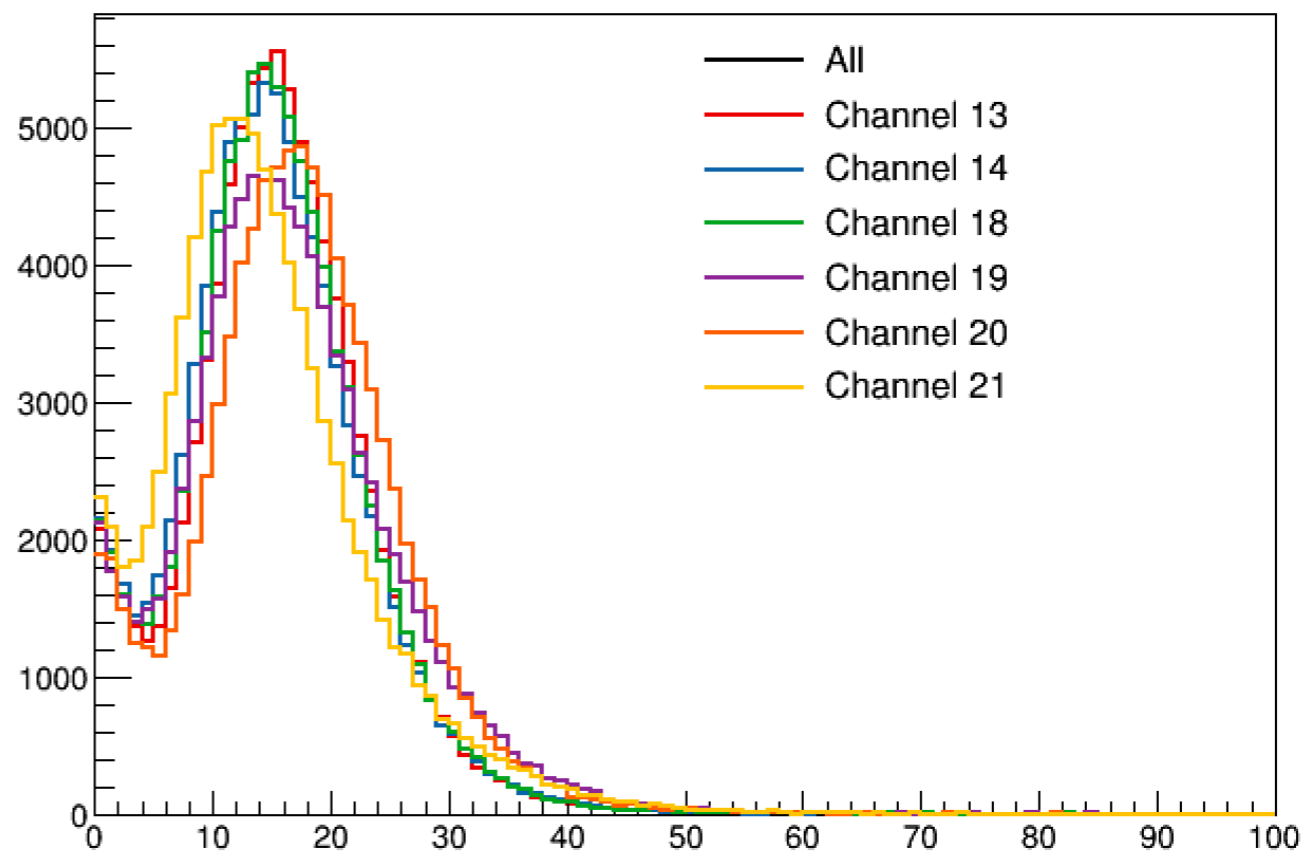
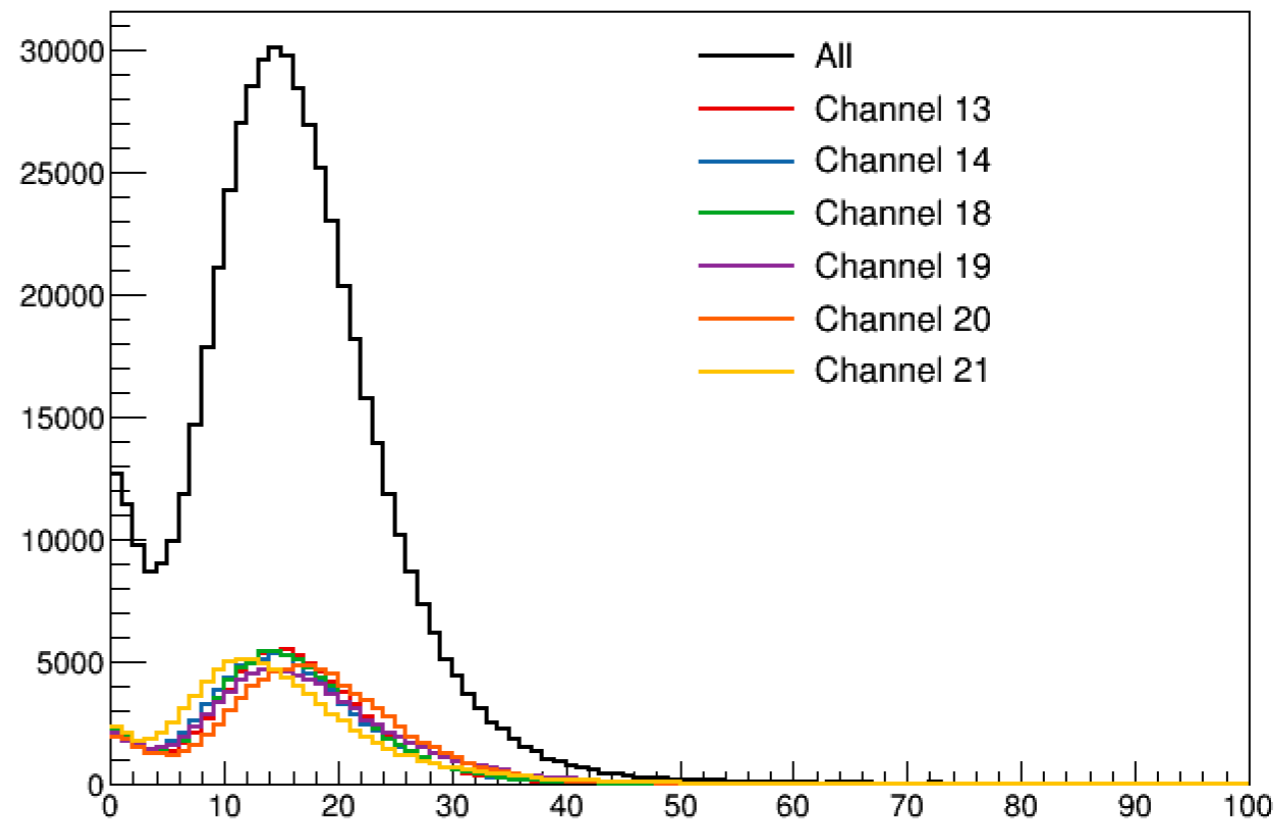
225



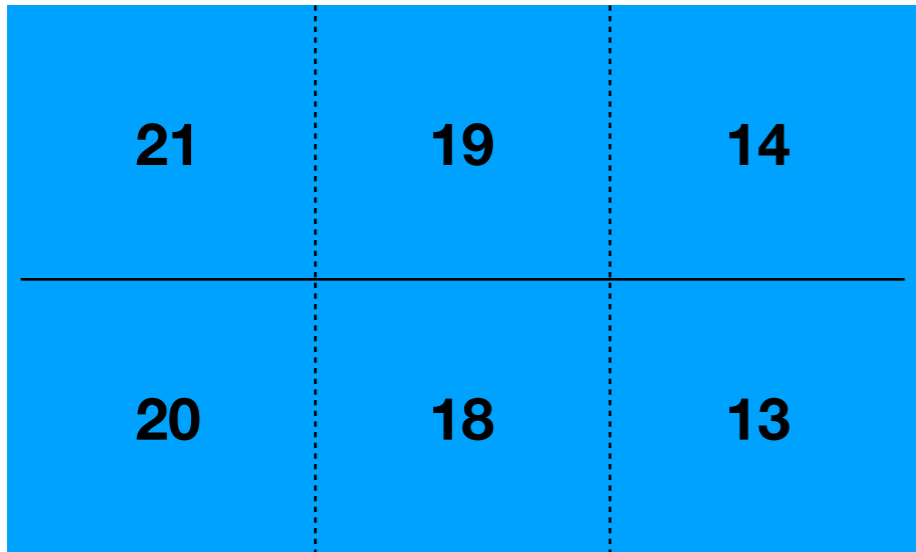
**CHANNEL 0 TOP**

**Top channel → Compare 6 SiPM  
of one channel  
with source at different position**

**Source close to channel**



0°

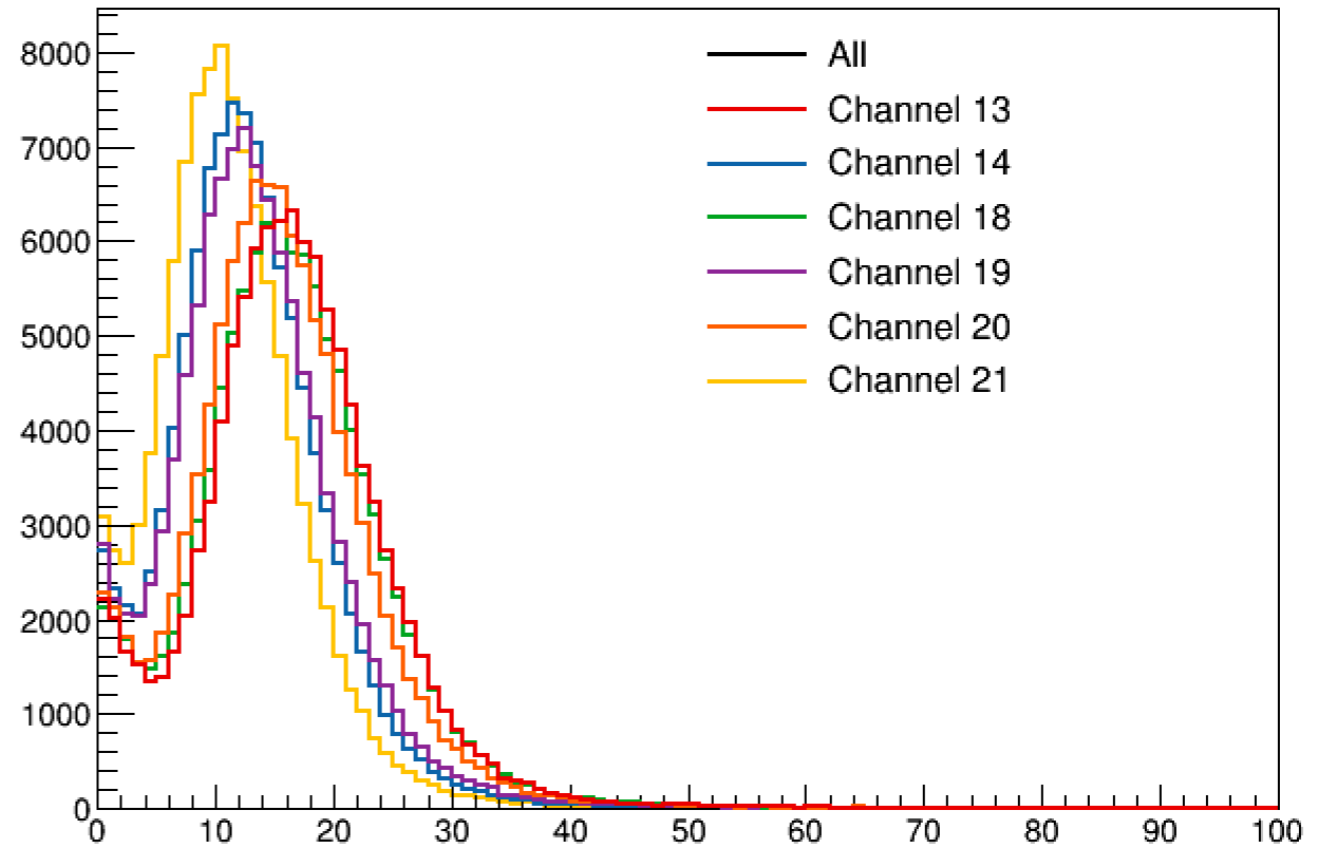
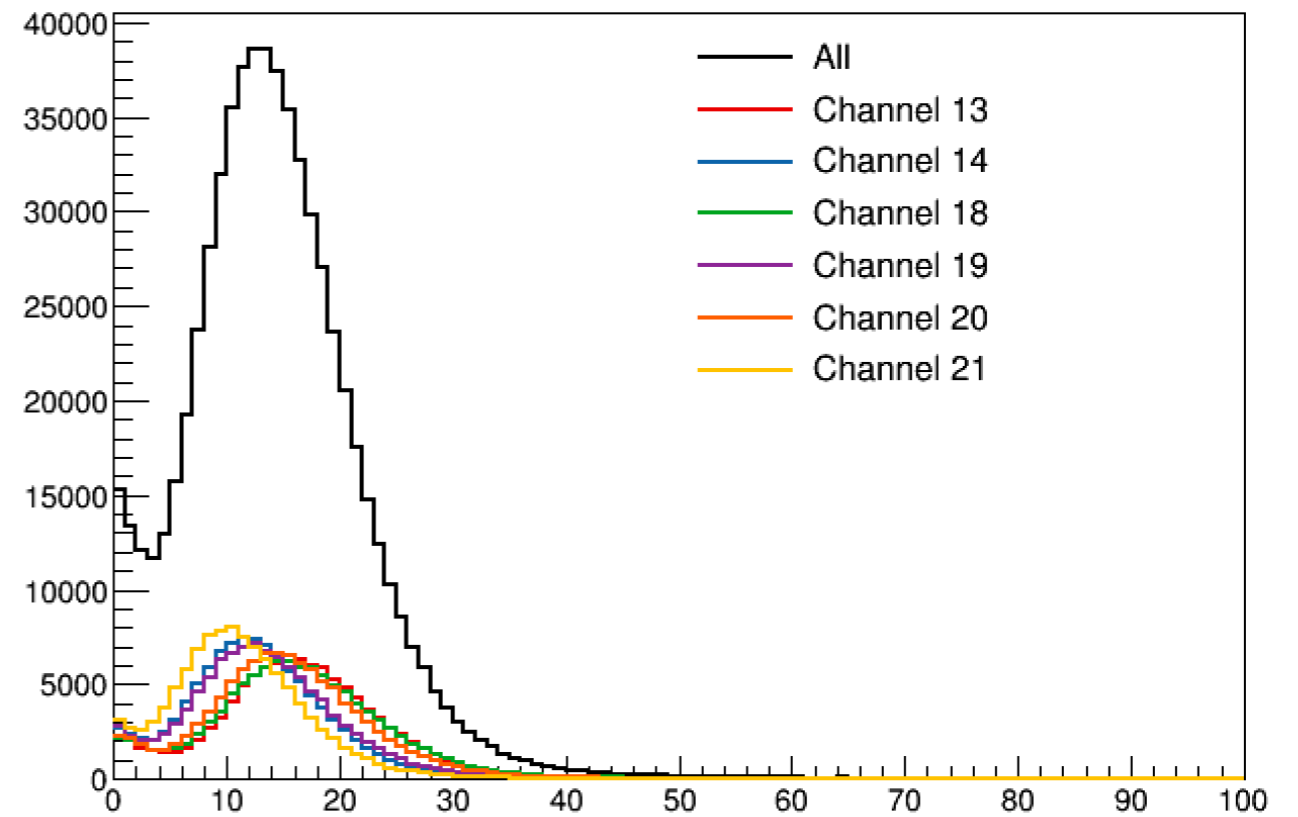


**CHANNEL 0 TOP**

**Top channel → Compare 6 SiPM  
of one channel  
with source at different position**

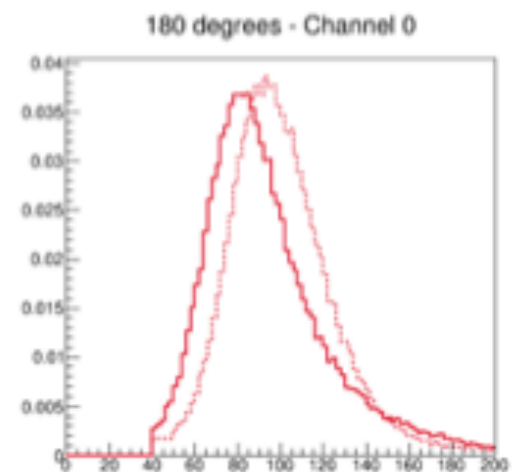
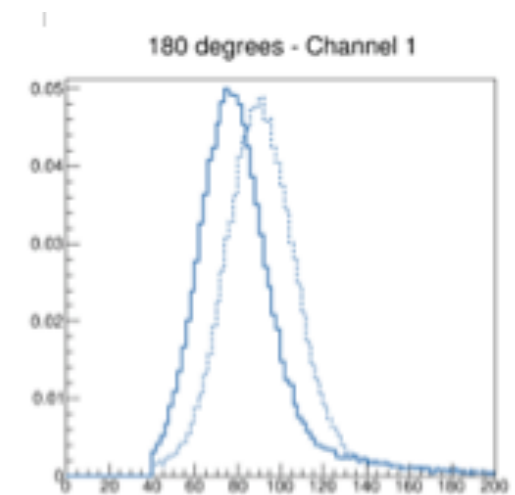
**Source far from channel**

**In both cases all SiPM have the same  
shape**



# Conclusions

- Top and bottom tiles are not different → very similar behaviour when the source is far from the tile
- Obtain ~ same resolution if only SiPM far from the source are considered
- The charge in the bottom in Channel 0 and Channel 1 is consistently smaller than the top → maybe one of the six SiPM in the bottom tiles doesn't work properly?



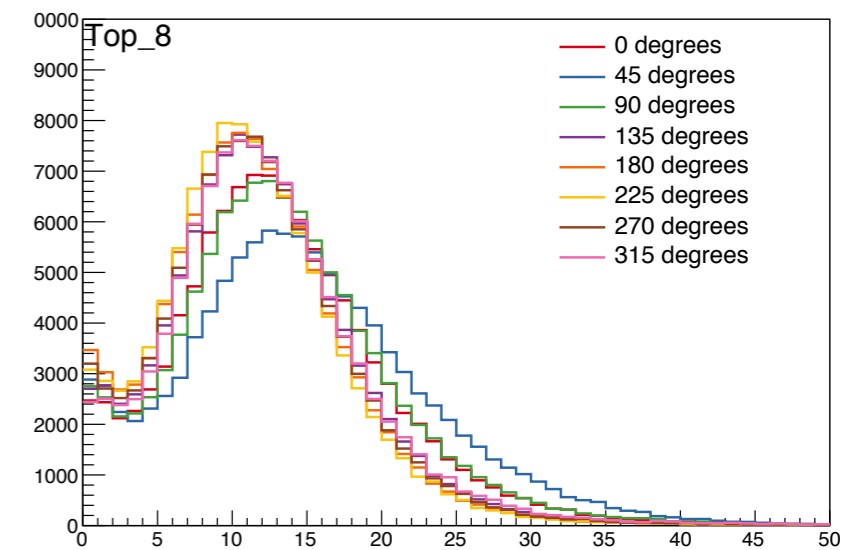
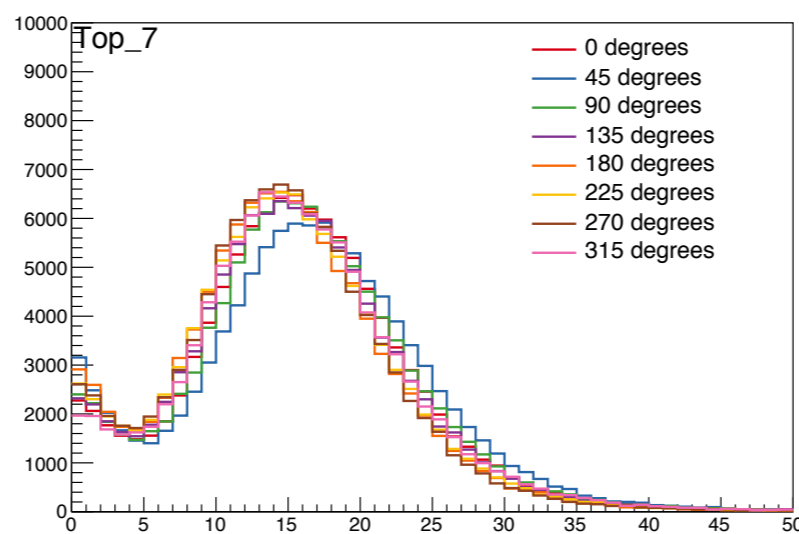
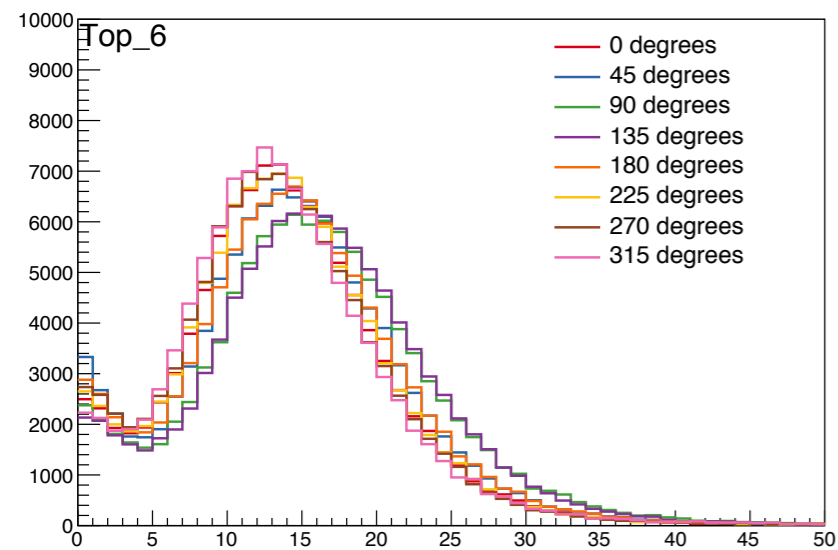
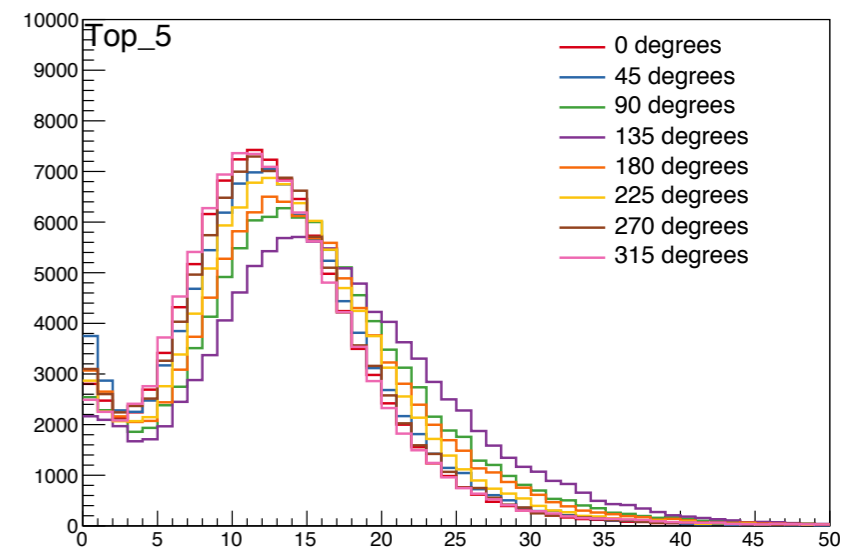
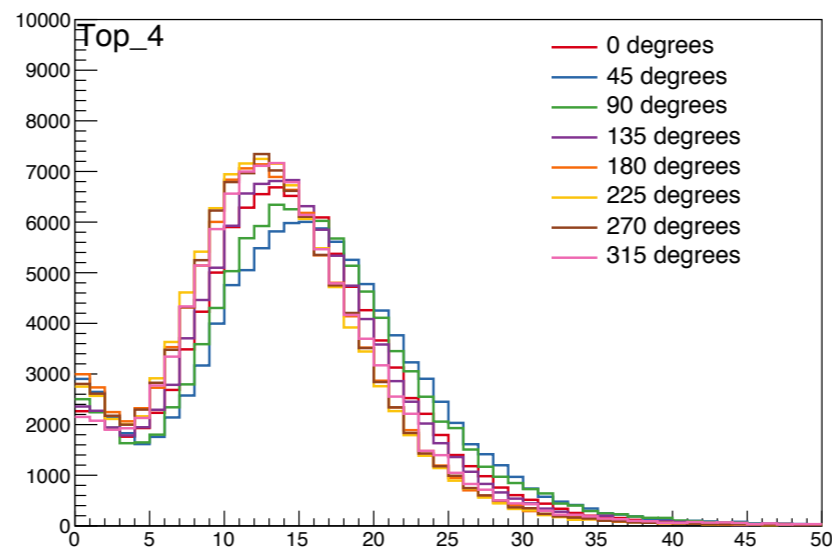
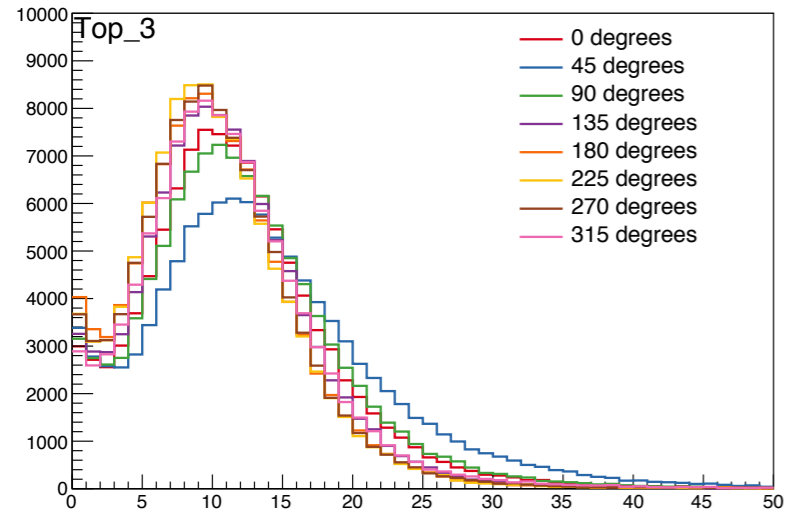
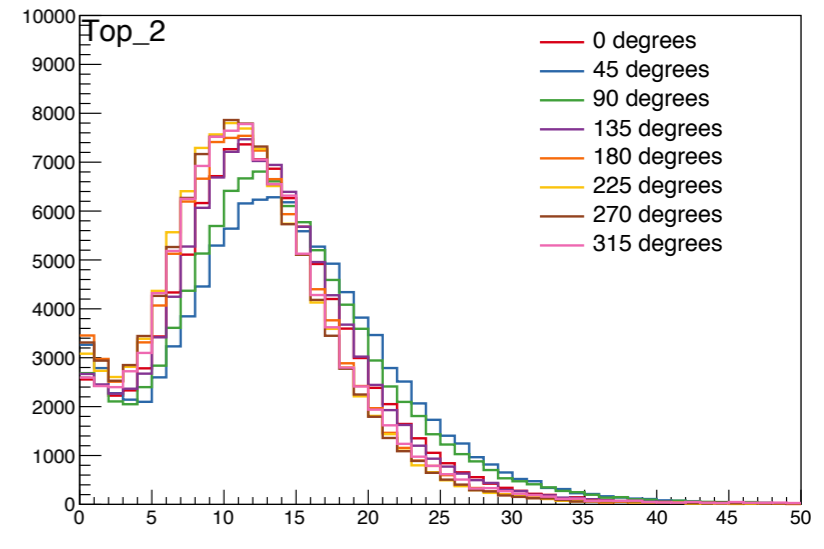
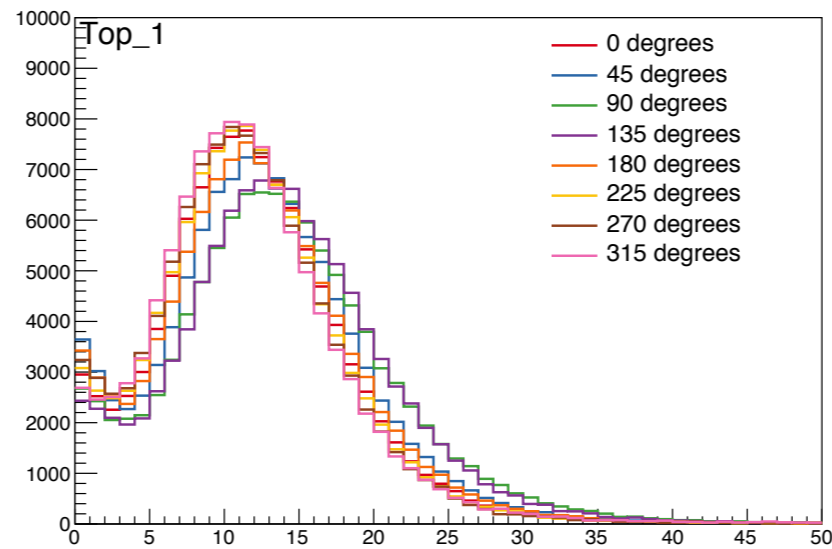
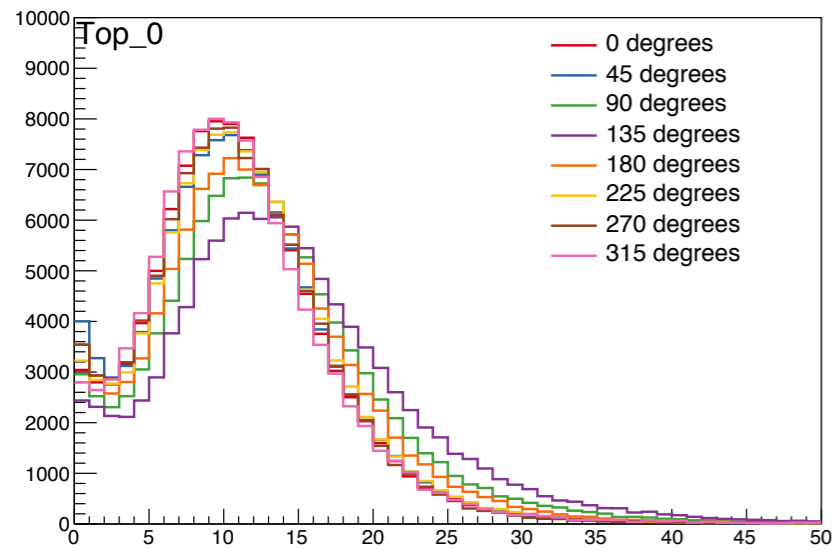
# Next steps

- SiPM works properly and the origin of the difference between top and bottom is due some electronics effect
  - Saturation?
  - After pulse?
- It would be very useful to have data taken at 0 field moving the source up and down in Z and at different angles

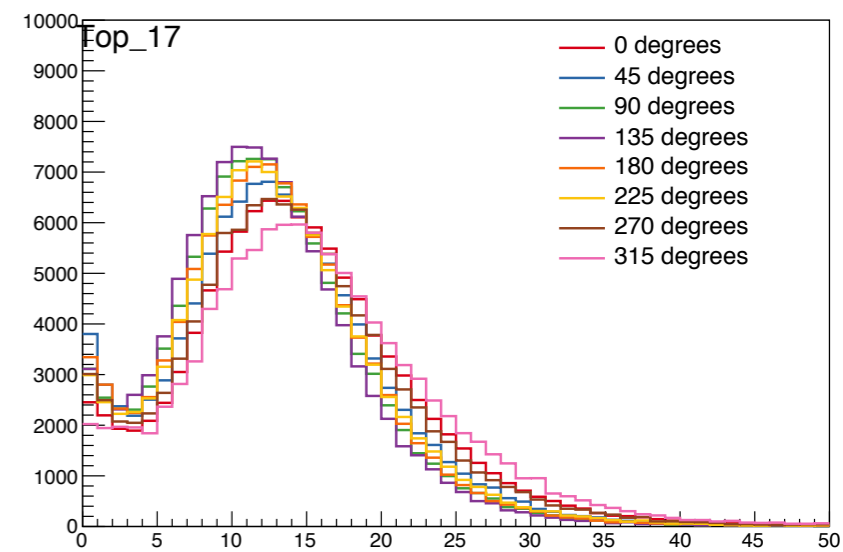
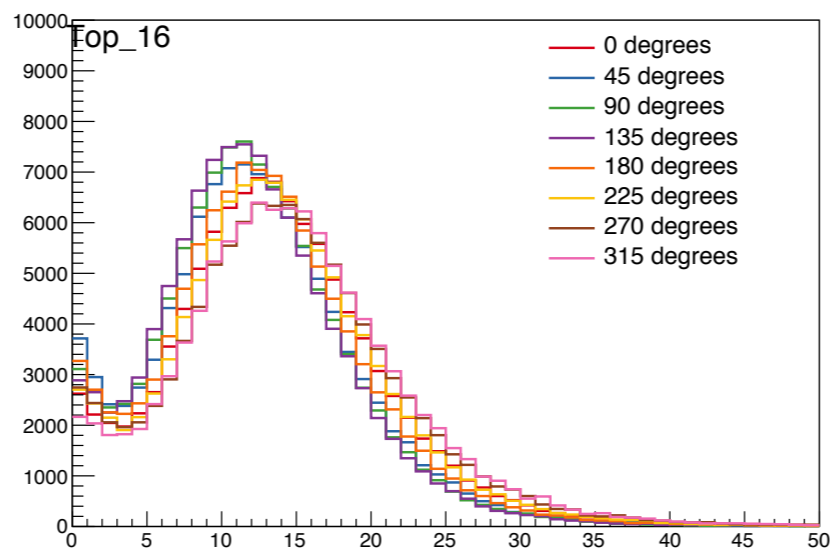
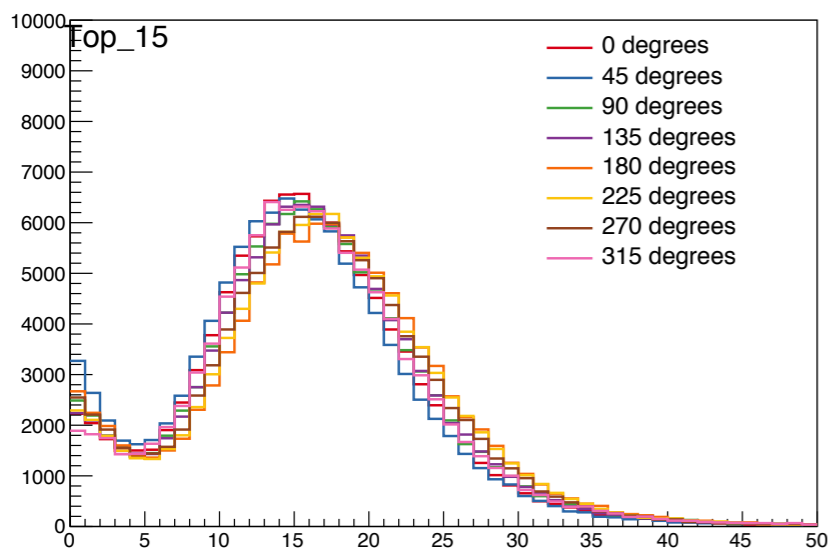
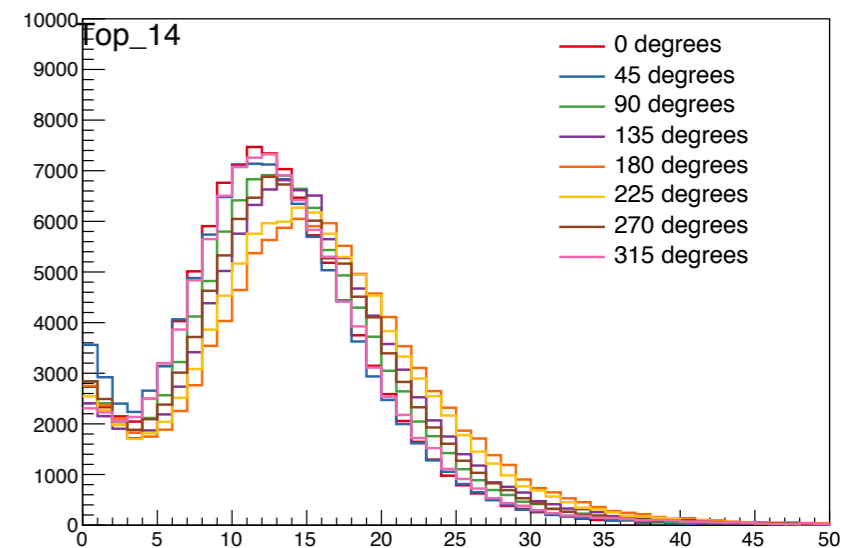
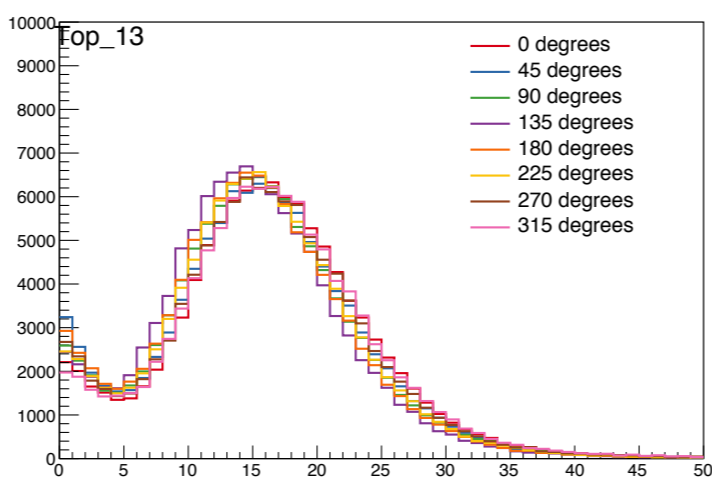
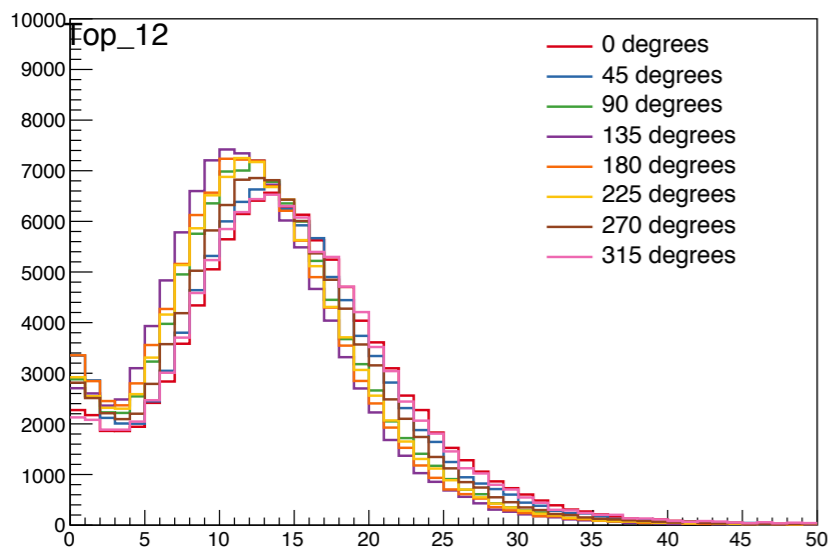
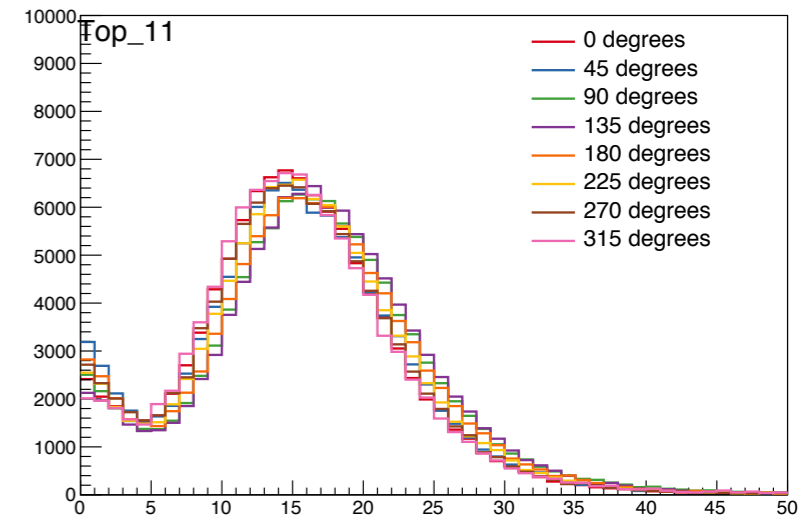
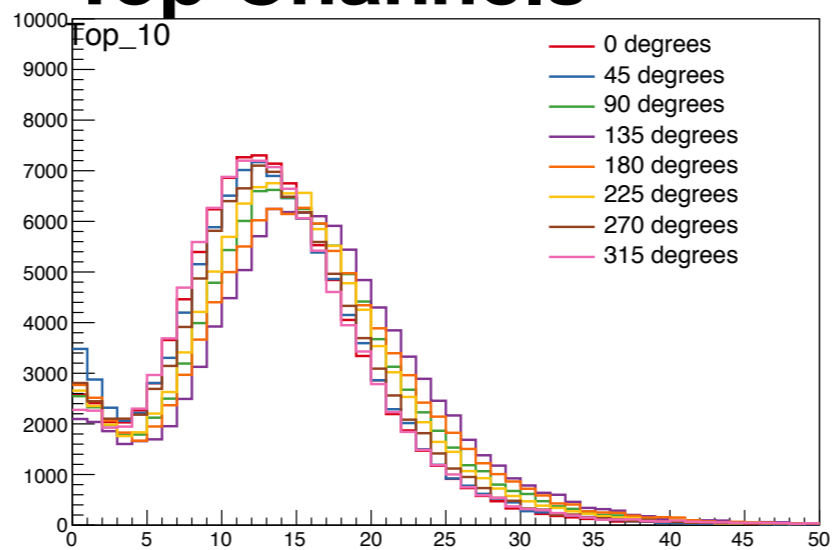
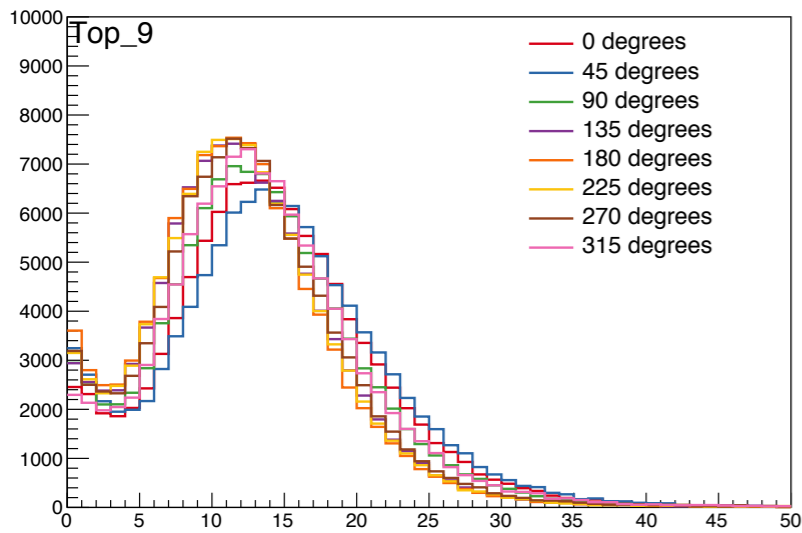


**Back-up**

# Top Channels



# Top Channels



# Top Channels

