LUXE Cherenkov Prototype

ARES testbeam July 2023 - Data analysis

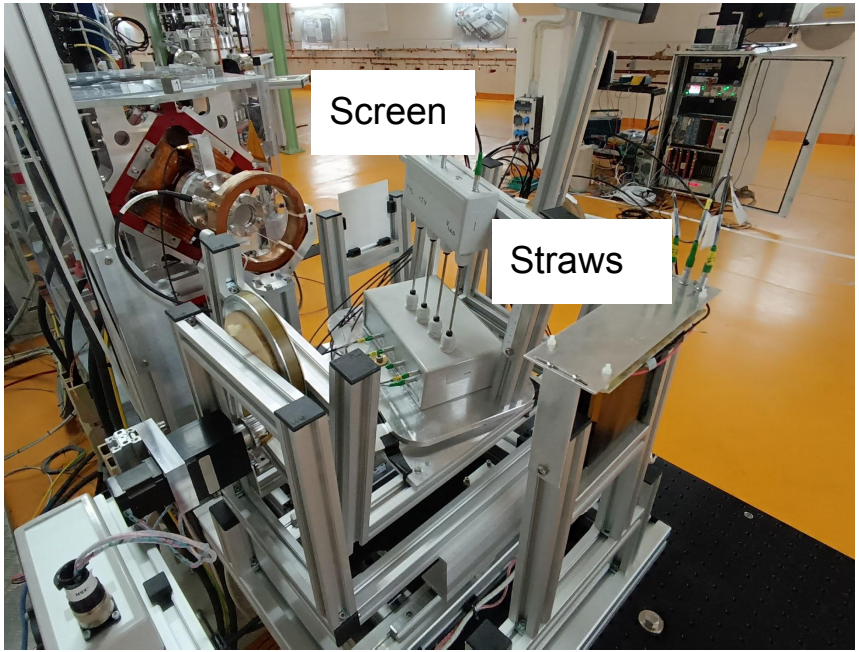
Status Update, Antonios Athanassiadis, 26.10.2023

HELMHOLTZ

DESY.

Testbeam setup and measurables

- Goal: Measure the relation between light yield and electron bunch charge
- Test of various Silicon Photomultiplier models and two scintillator screens
- Electron bunch charge range covered: 1pC, 34pC 67pC and 100pC
- Straw Angles covered: 0°, 10°, 20°
- Beam energy: 155 MeV



SiPM configurations

Configurations	Model	Number
0	Onsemi MicroFC 30035 Onsemi MicroFC 30050	4 (ch0), 5 (ch1) 6 (ch2), 7 (ch3)
1	Onsemi MicroFC 60035 Onsemi MicroFC 30035	8, 9 6, 7
2	Hamamatsu S14160-3010 Hamamatsu S14160-3015	10, 11 12, 13

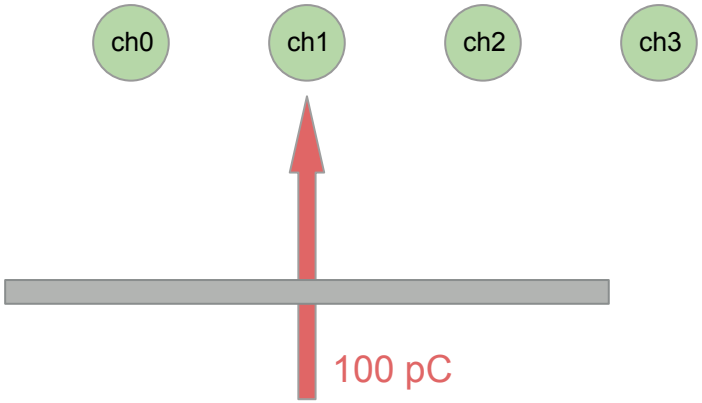
Measuring configurations

- With or without screen in front of straws
- Full-on straw channel or in between straw 1 and 2
- Angle at 0, 10 or 20 degree

➥ Charge scan

Measuring configurations

- With or without screen in front of straws
- Full-on straw channel or in between straw 1 and 2
- Angle at 0, 10 or 20 degree
  - ➨ Charge scan



e.g.:

- SiPM configuration = 2 (SiPM 10,11,12,13)
- Full-On channel 1
- Angle = 0°
- Screen in front
- Bunch charge = 100 pC

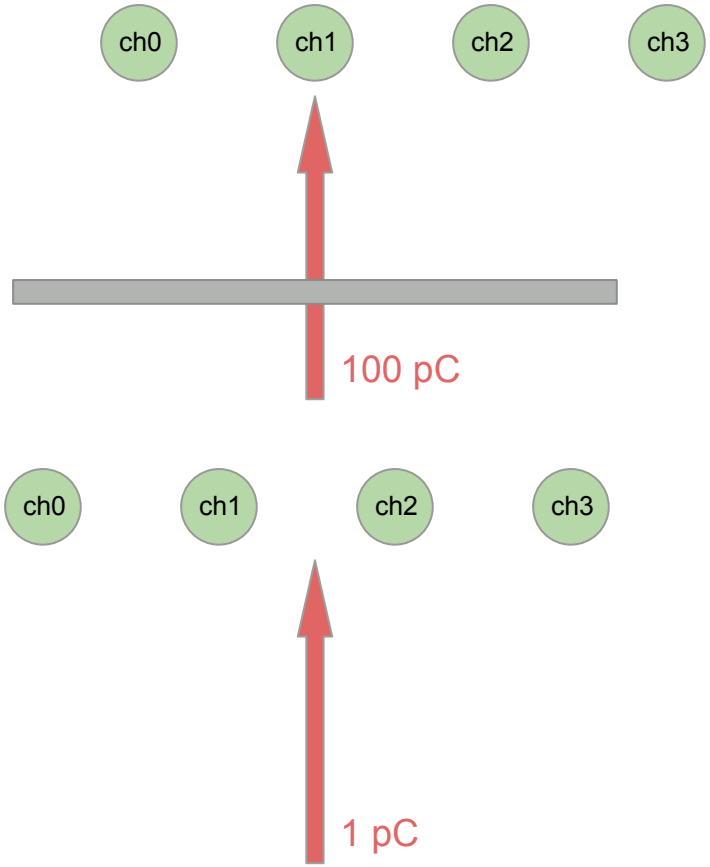
Measuring configurations

- With or without screen in front of straws
- Full-on straw channel or in between straw 1 and 2
- Angle at 0, 10 or 20 degree

➨ Charge scan

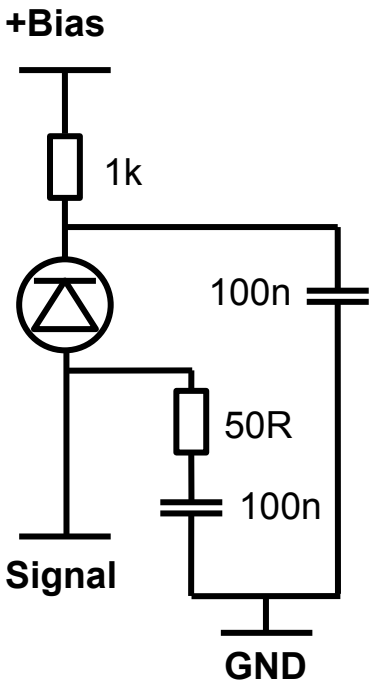
e.g.:

- SiPM configuration = 0 (SiPM 4,5,6,7)
- In between channel 1 & 2
- Angle = 20°
- No Screen
- Bunch charge = 1 pC



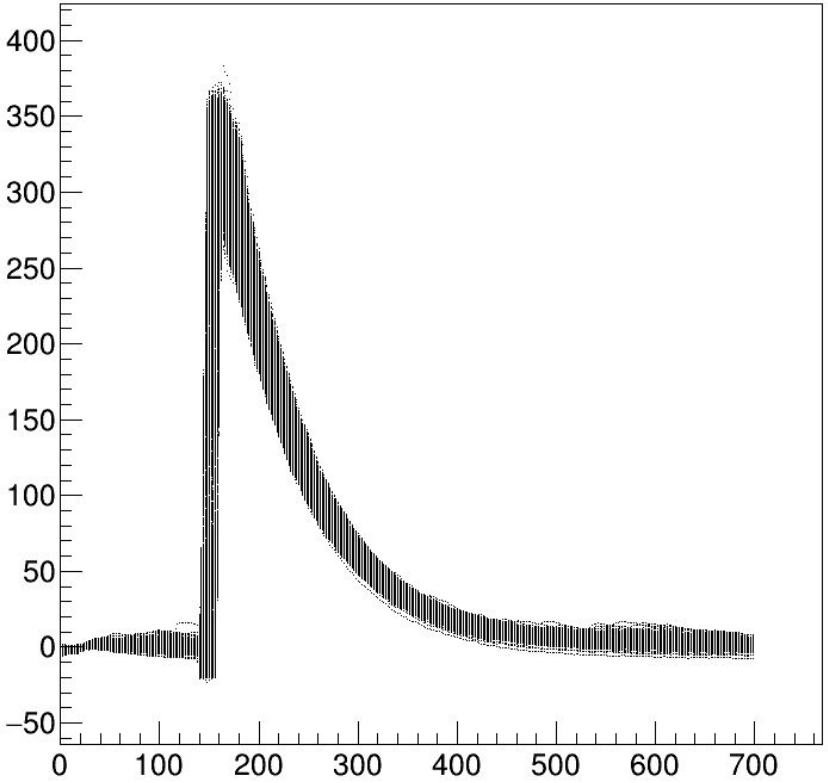
Data acquisition

- SiPMs biased with +28V for Onsemi and +45V for Hamamatsu
- SiPM connected with bias in parallel and signal readout at anode
- Signal via 1x0.5m + 3x5m LEMO cable to digitizer
- Digitizer: CAEN V1730
  - 16 channel
  - 14-bit flash ADC
  - 500 MS/s
  - 2 V_{pp} input range
- External trigger used from accelerator clock
- Software stores TTree with a std::vector<double> containing 350 samples of each signal waveform

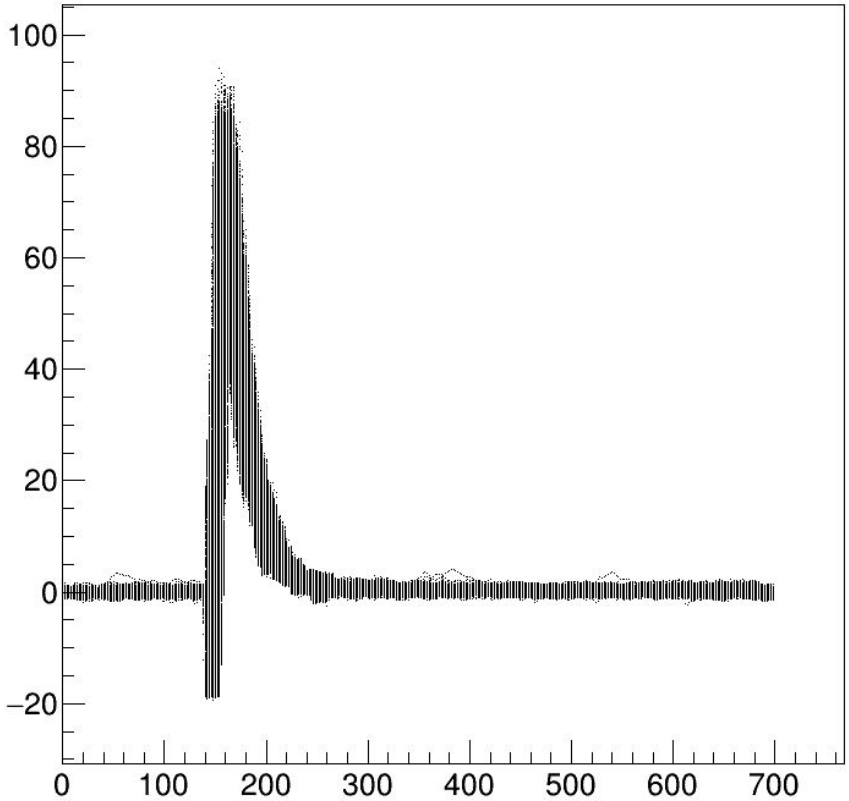


Signal shape

Configuration 0



Configuration 2 **ch1 100 pC 20°**



Signal shape

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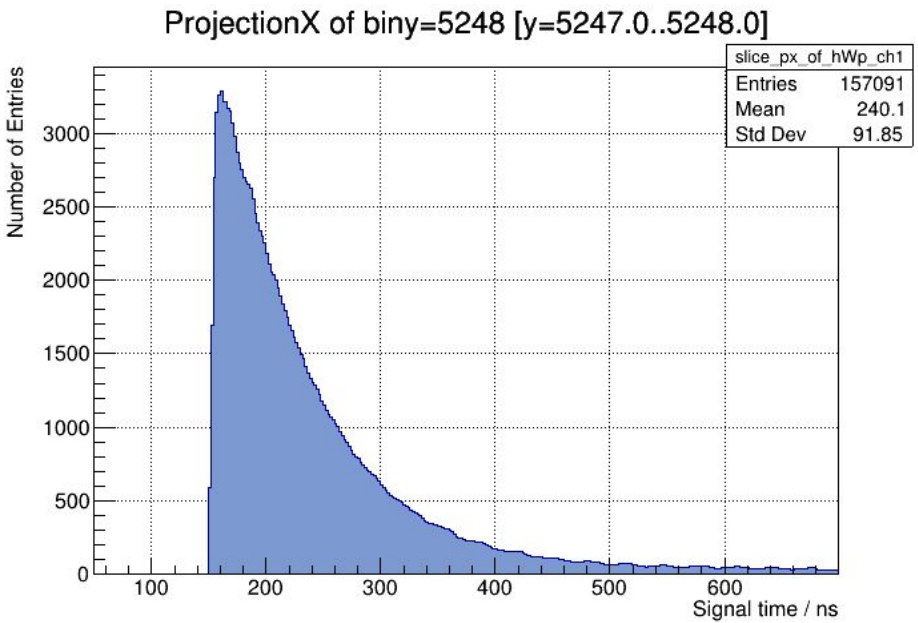

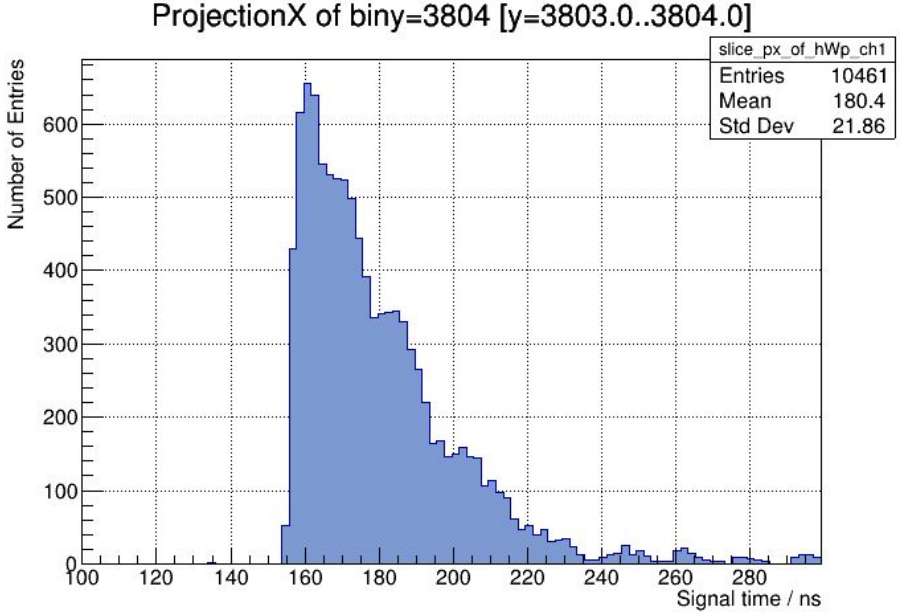

Signal shape

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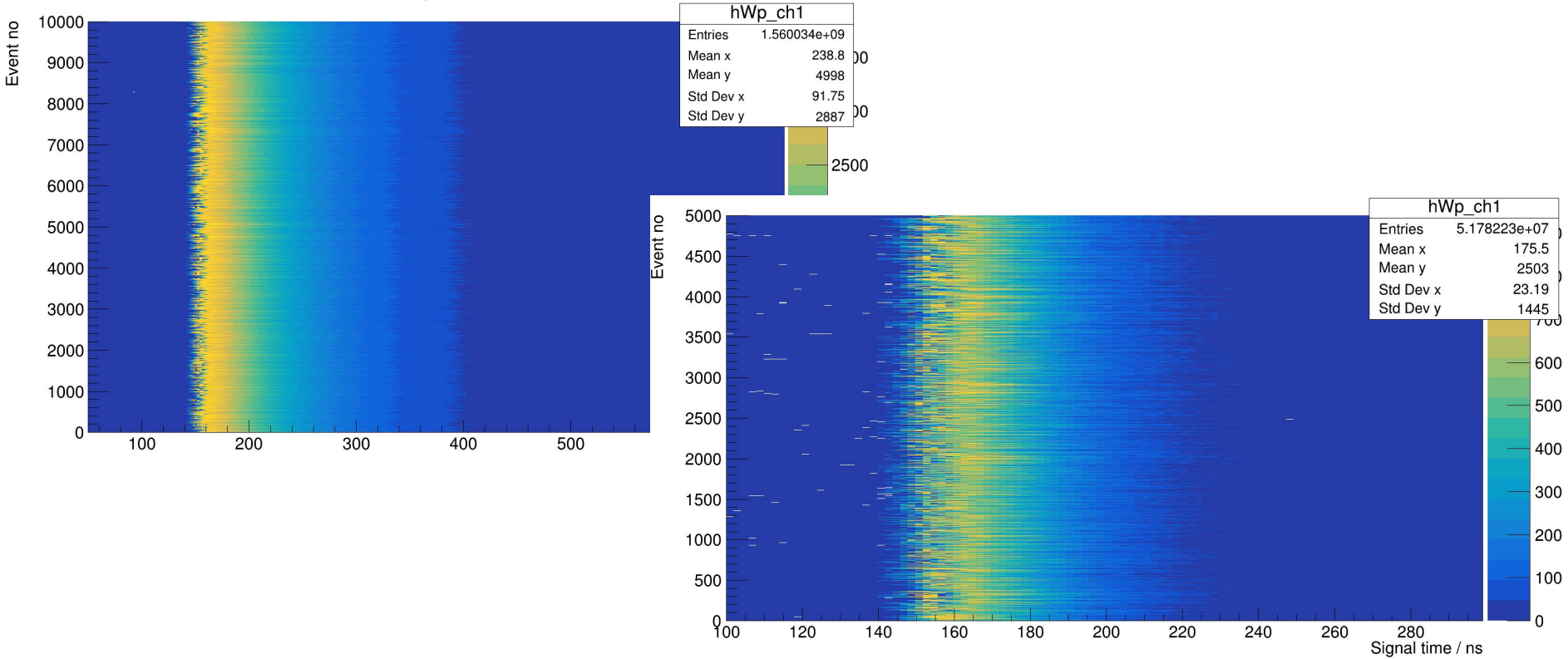
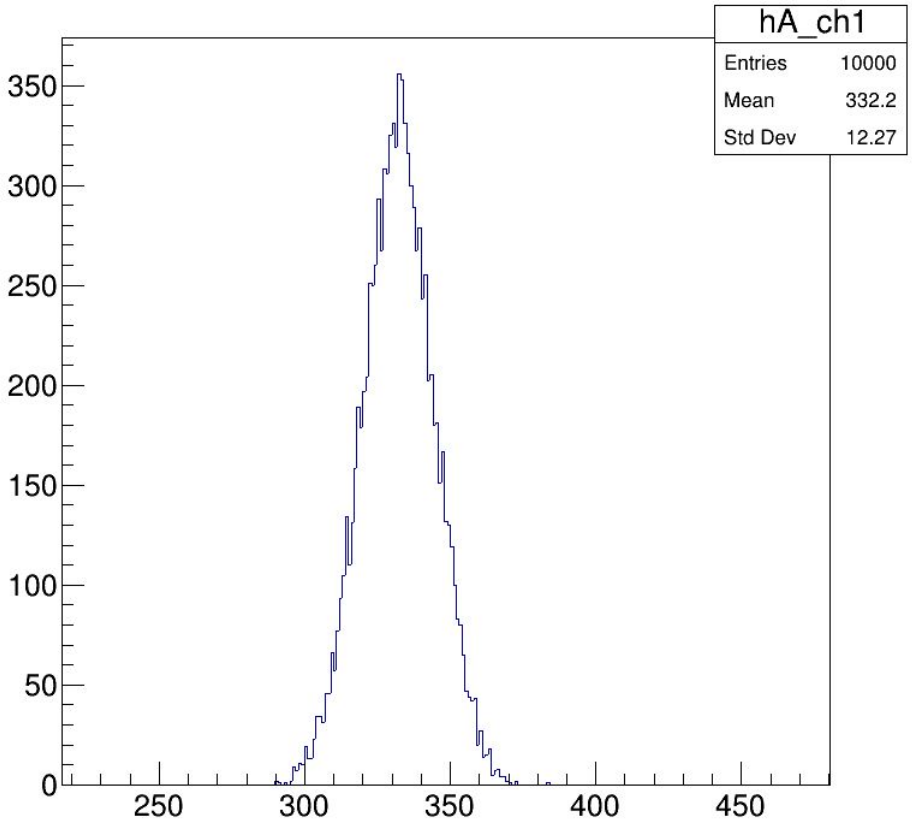


Signal processing and cuts

Configuration 0



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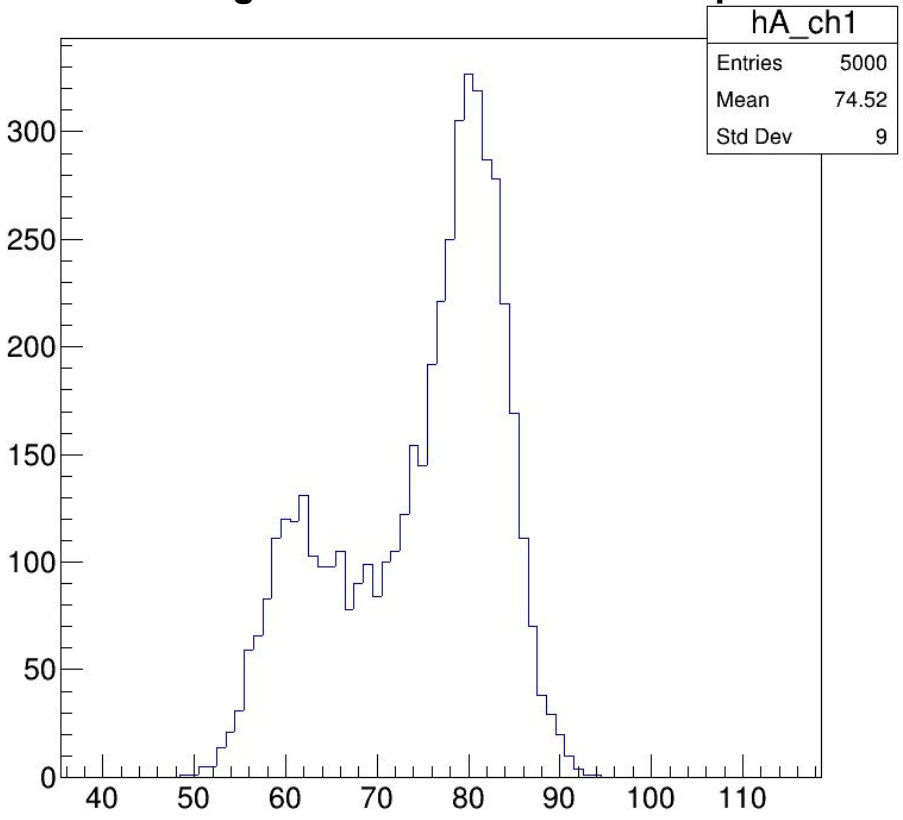

Signal processing and cuts

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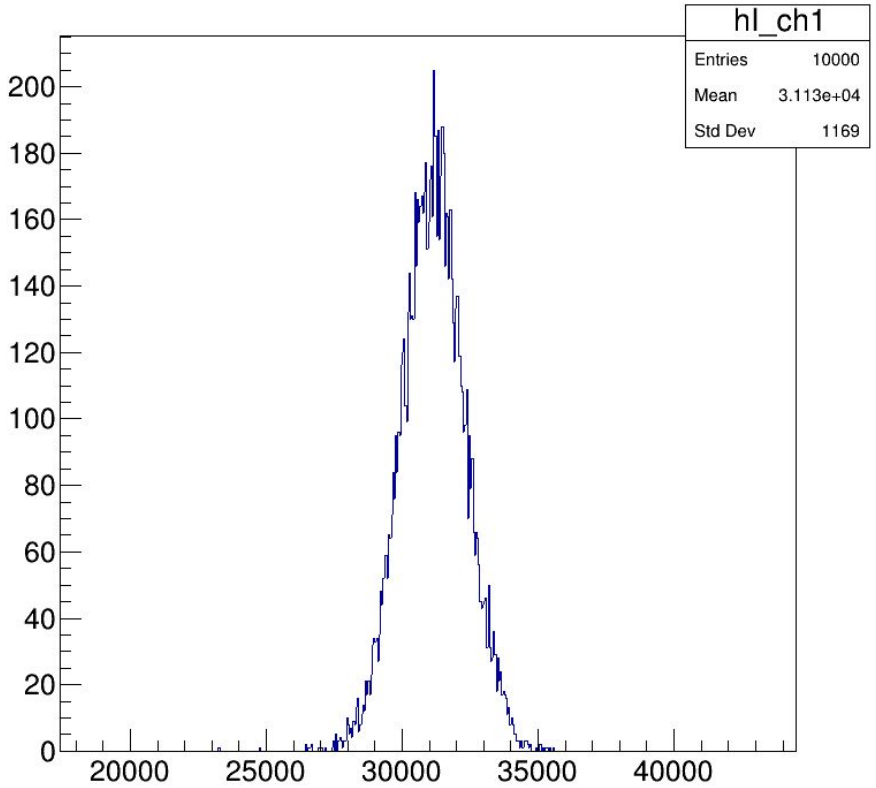

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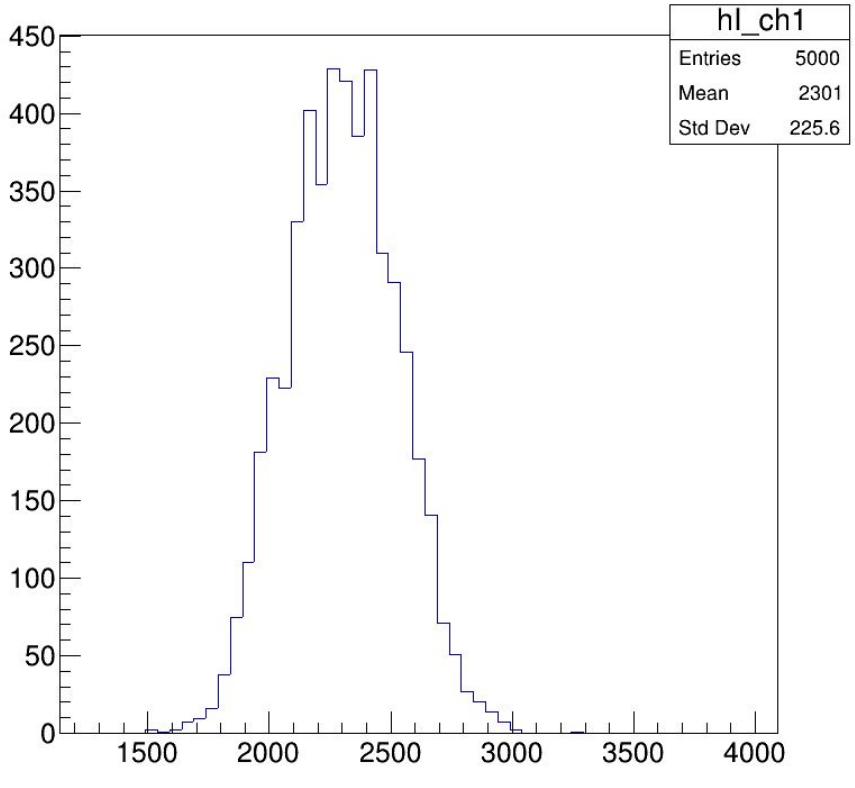
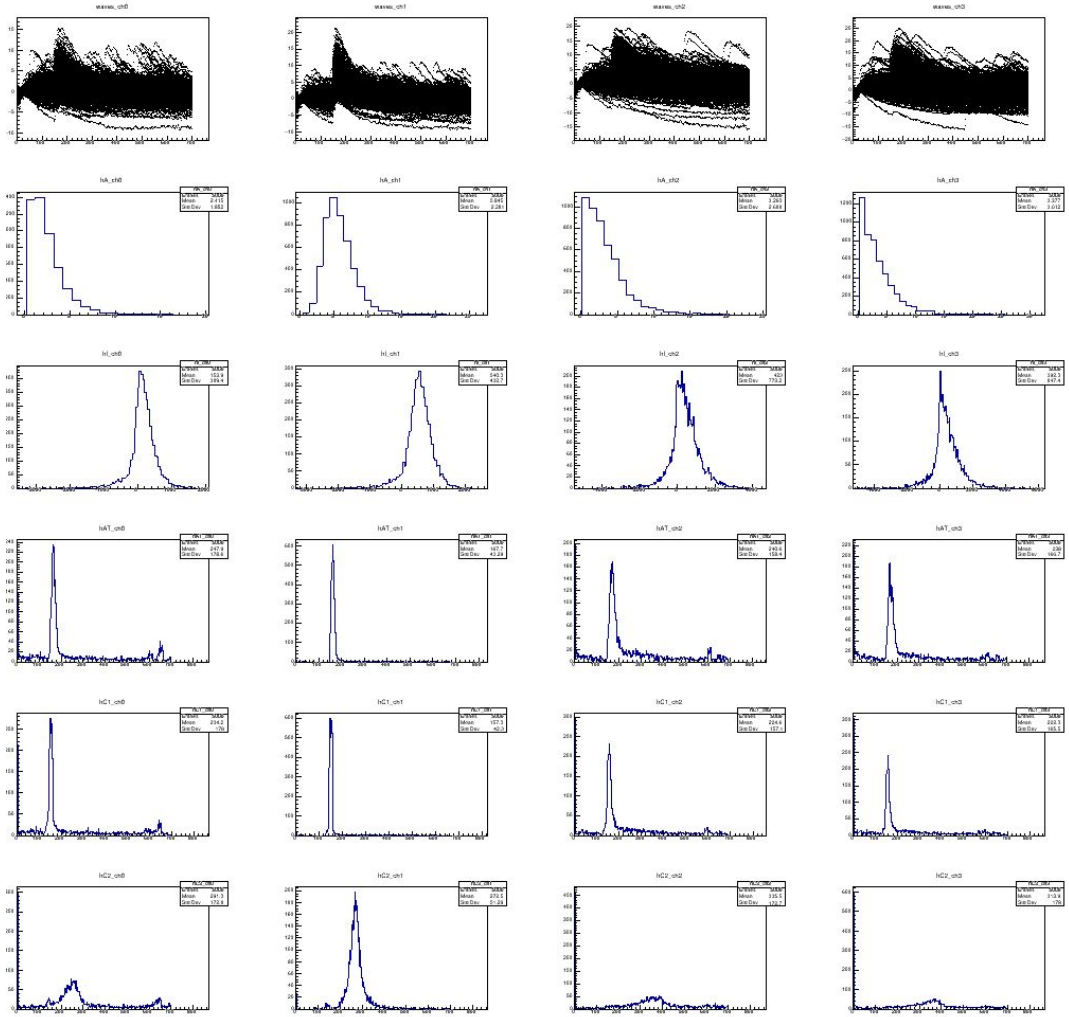
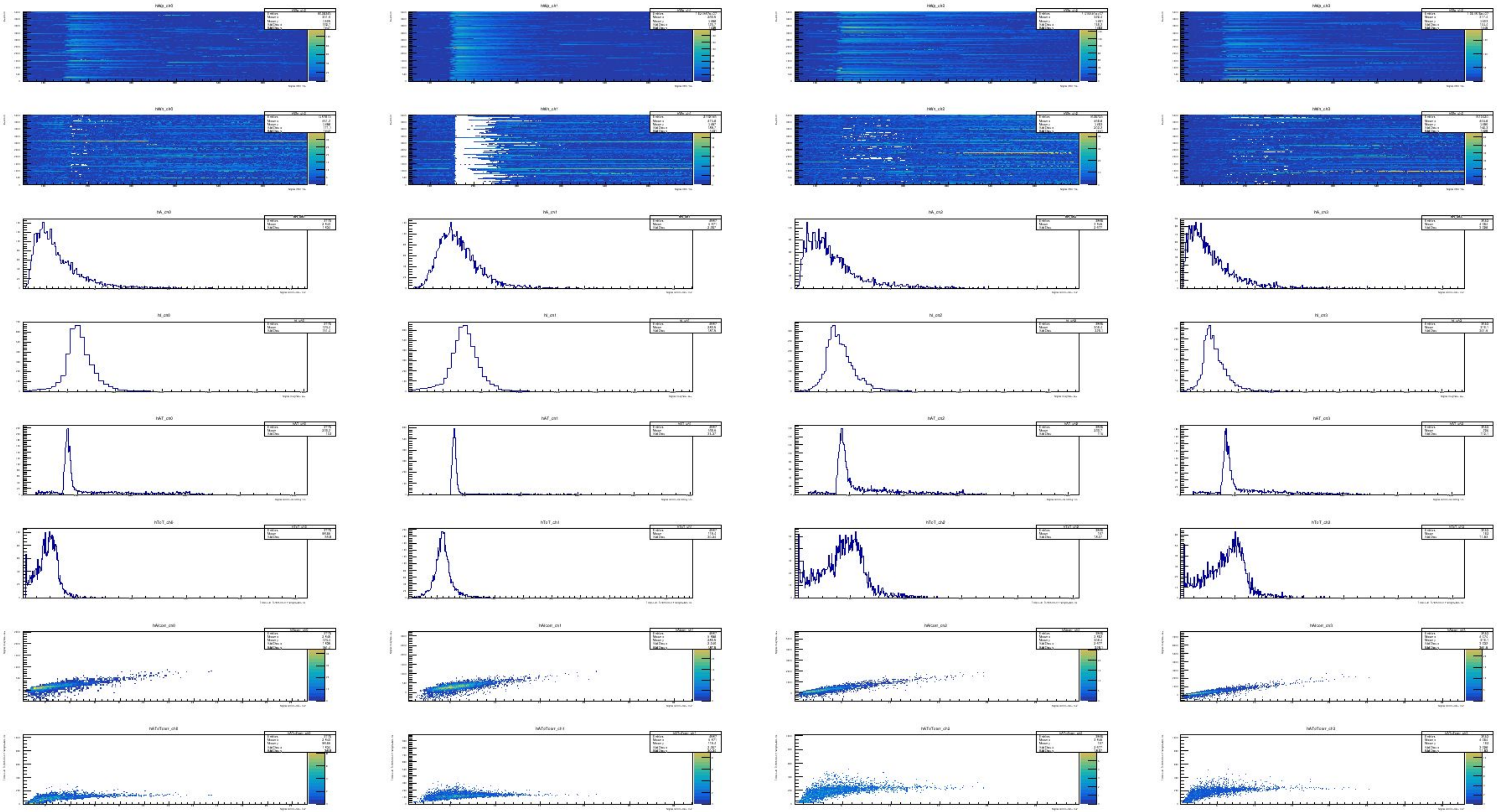


Problems

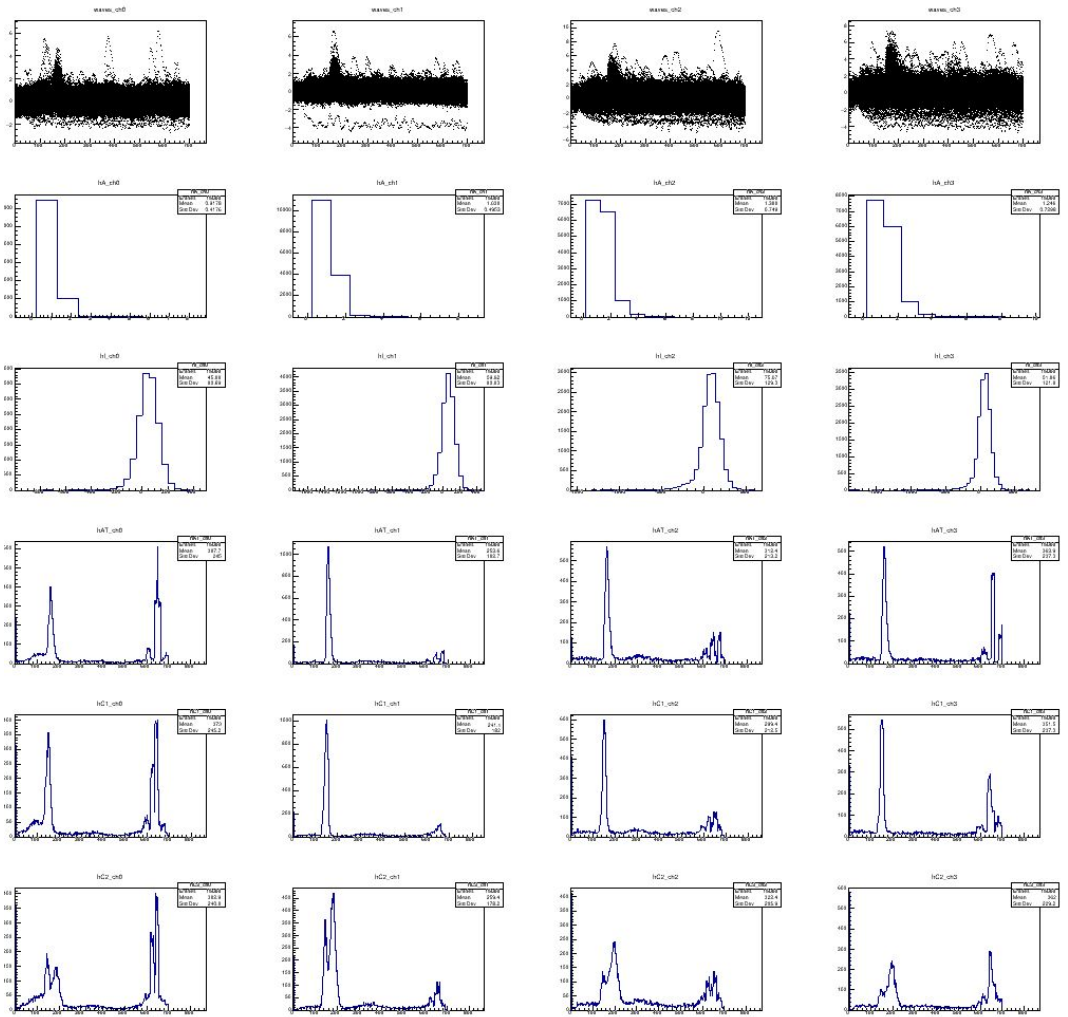
Configuration 0 1 pC 20°

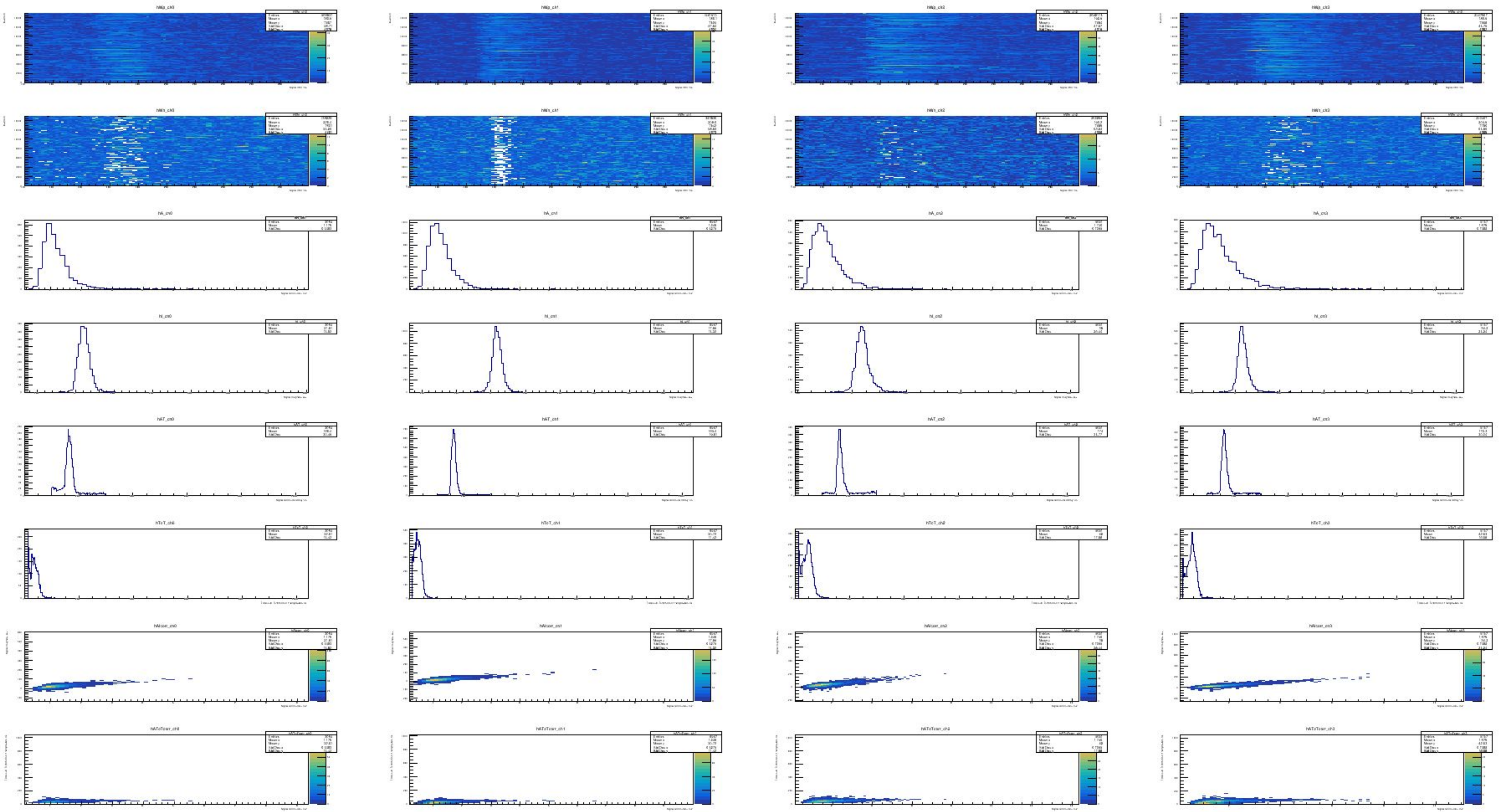




Problems

Configuration 2 1 pC 20°




hWp_ch0
hWp_ch1
hWp_ch2
hWp_ch3
hWs_ch0
hWs_ch1
hWs_ch2
hWs_ch3
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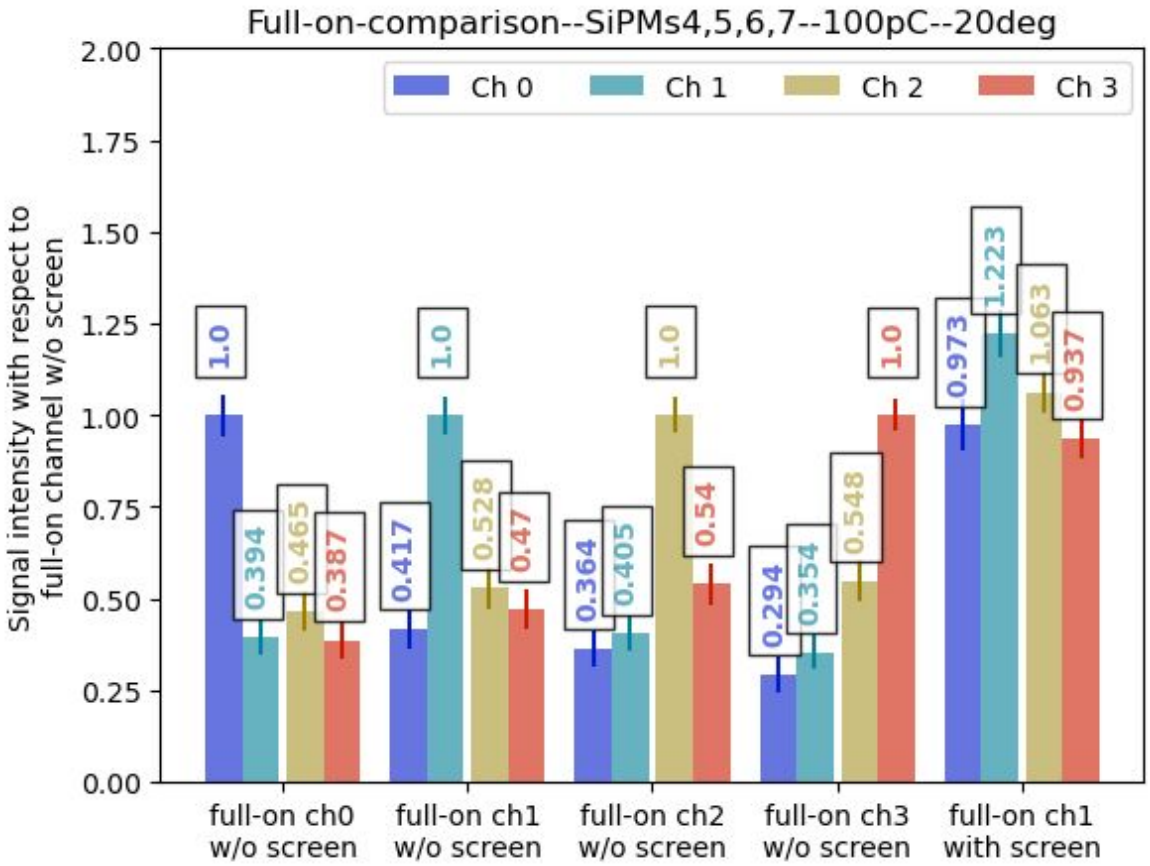
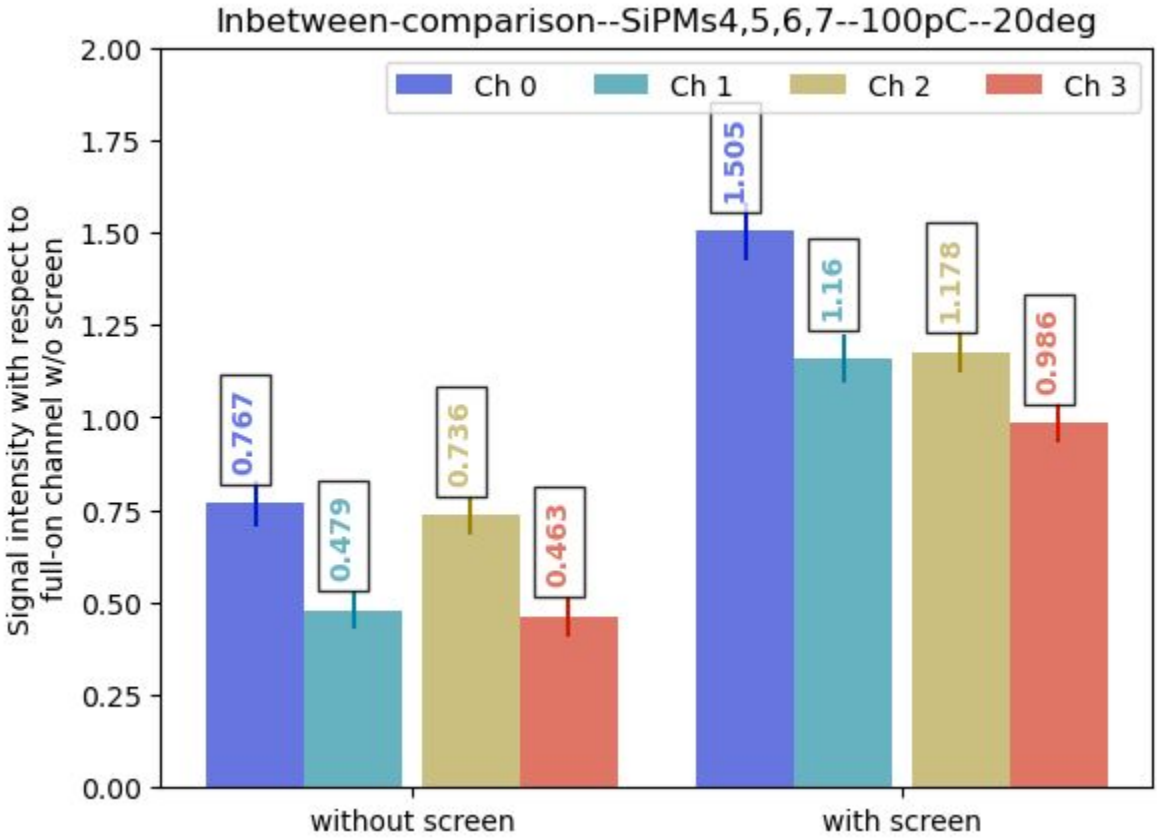
hA_ch1
hA_ch2
hA_ch3
hI_ch0
hI_ch1
hI_ch2
hI_ch3
hAT_ch0
hAT_ch1
hAT_ch2
hAT_ch3
hToT_ch0
hToT_ch1
hToT_ch2
hToT_ch3
hAIcorr_ch0
hAIcorr_ch1
hAIcorr_ch2
hAIcorr_ch3
hAToTcorr_ch0
hAToTcorr_ch1
hAToTcorr_ch2
hAToTcorr_ch3

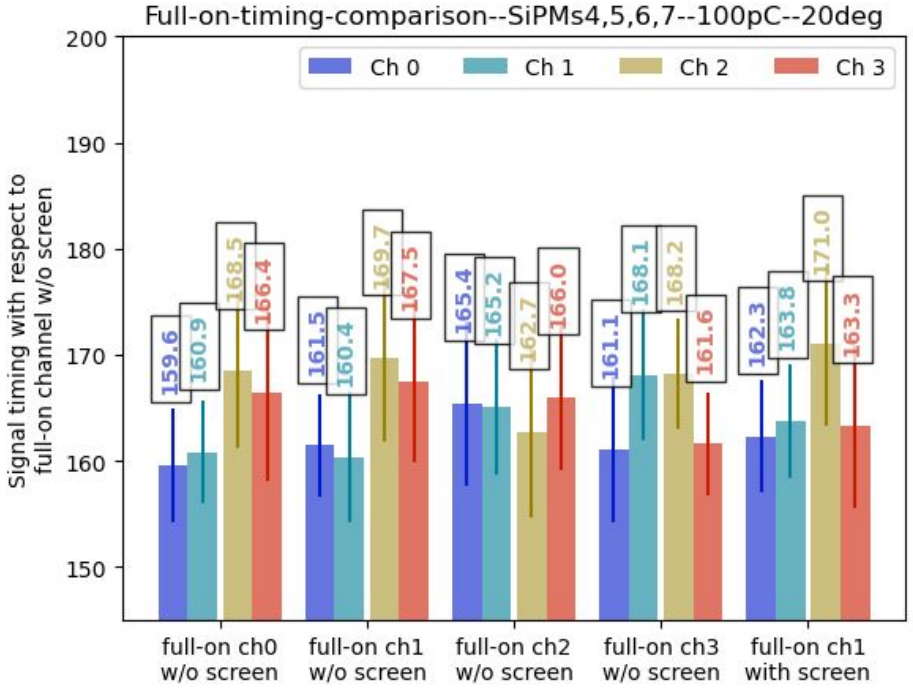
Weighting factors

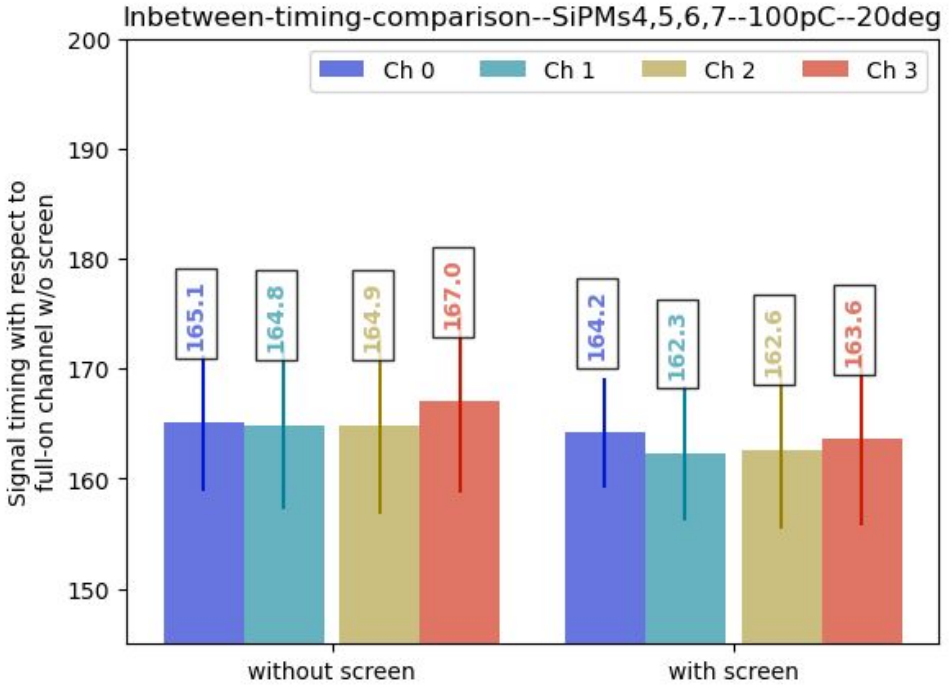


Full-On and In-between comparison

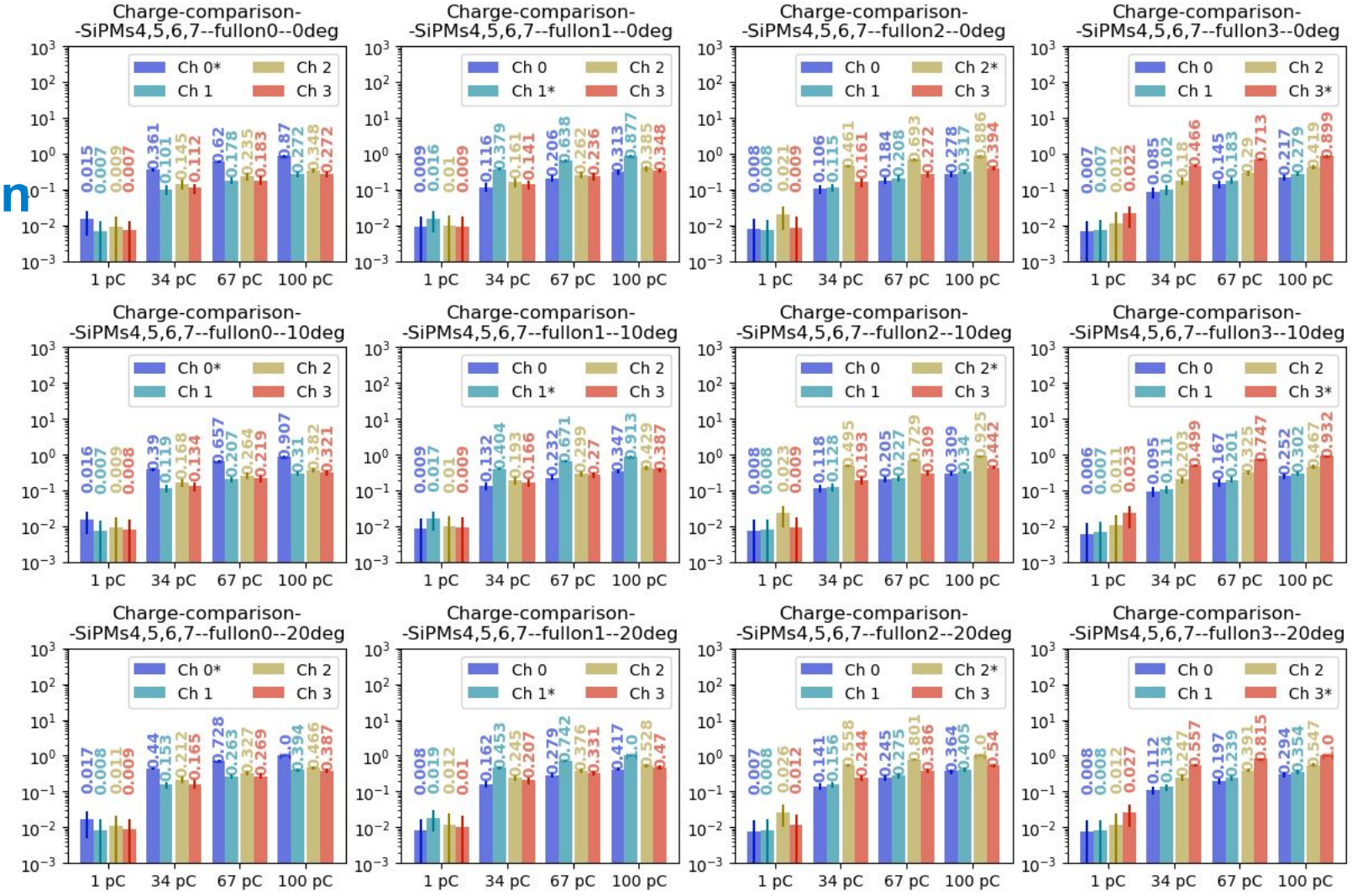


Signal timing comparison



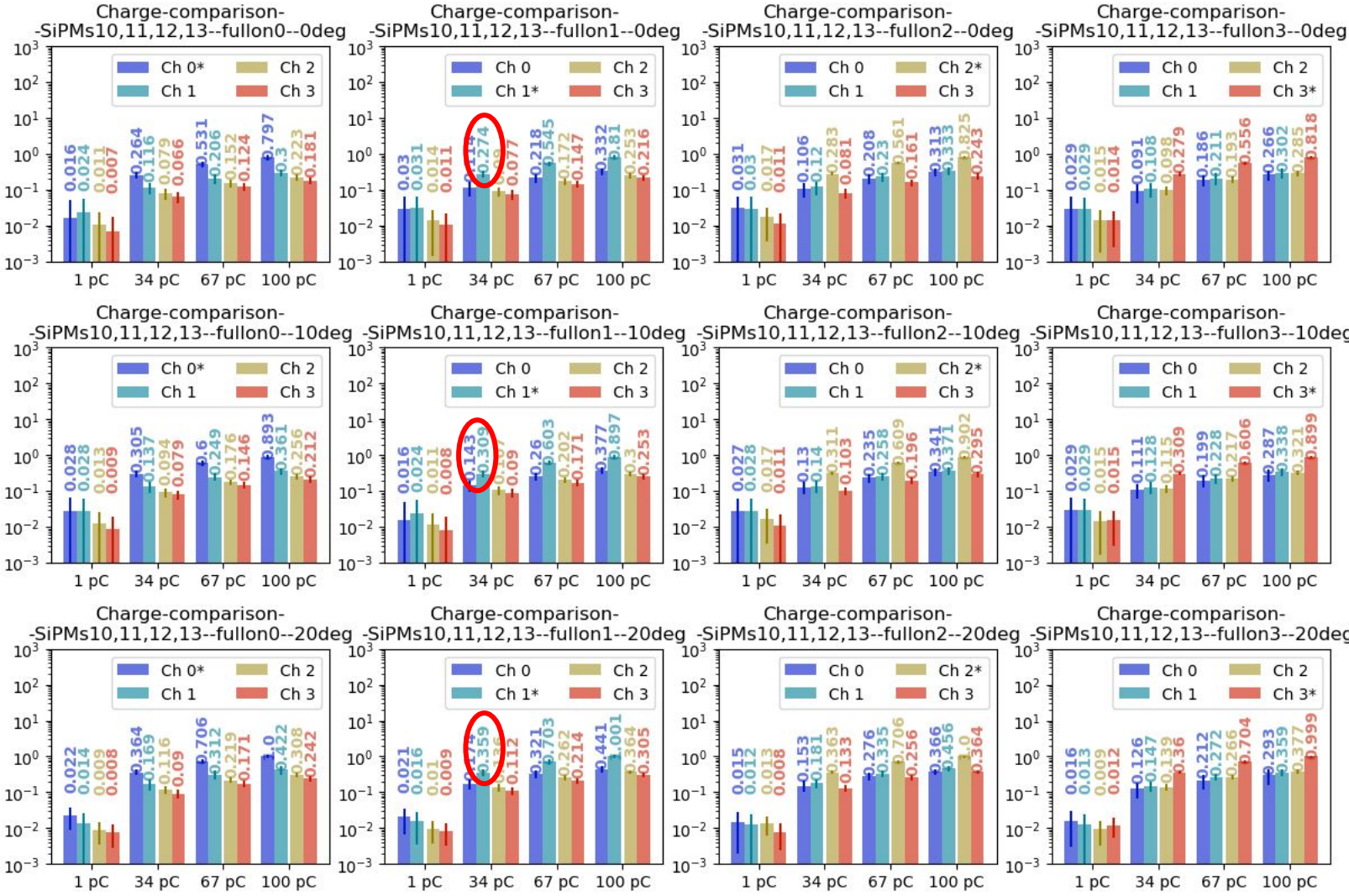


Charge-Angle-Scan comparison



Charge-Angle-Scan compariso

0° -> 0.274
10° -> 0.309
20° -> 0.359



Conclusion

- Scattering
- B