H8500 Studies

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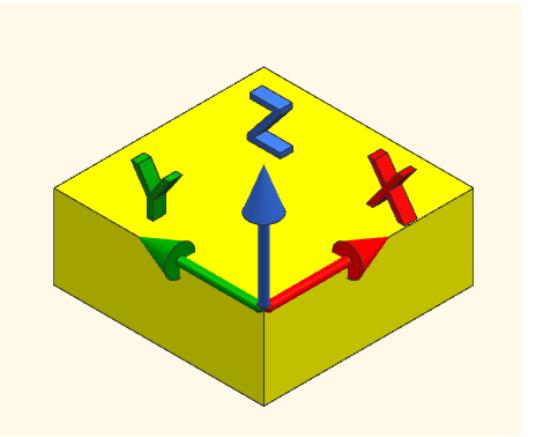
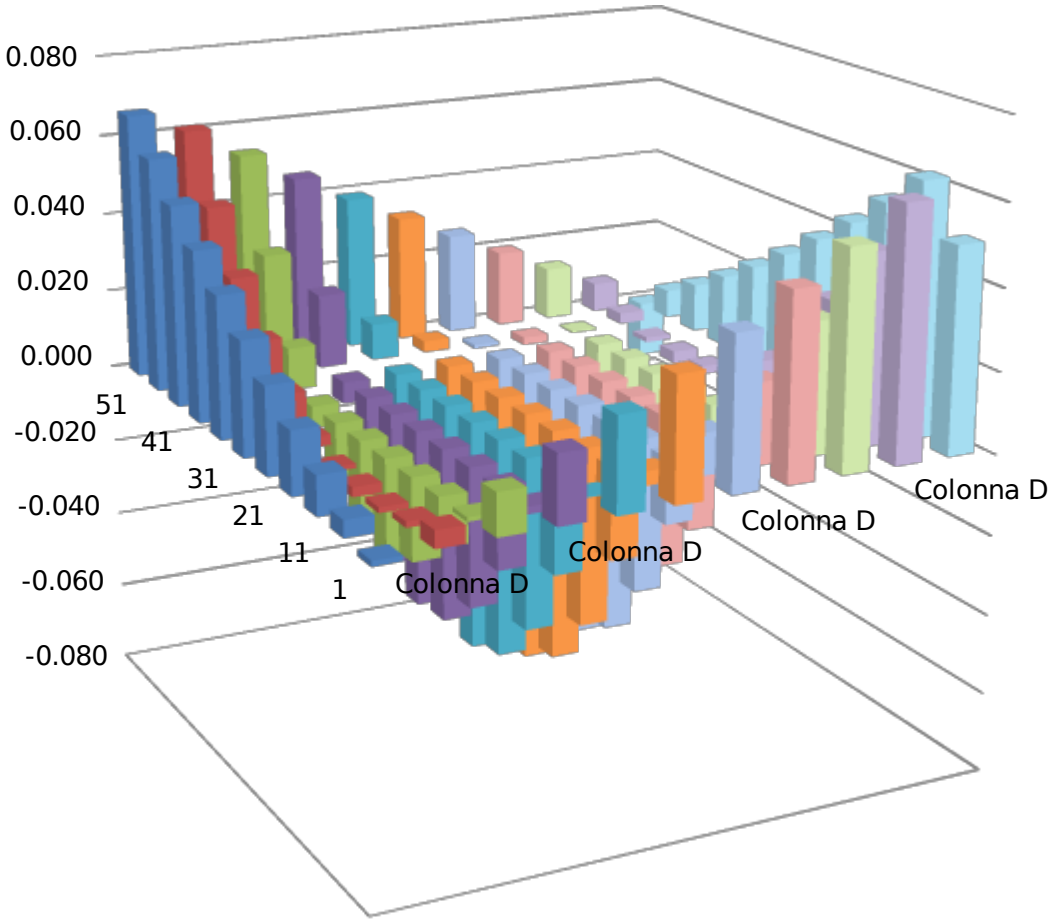
Introduction

- PMT used in this study:
  - H8500-C (2005) lent by NA48
- PiLas laser with fiber on pixel #28
  - Blue
- Wide bandwidth voltage amplifier with 50 Ohm input impendence, 5x voltage gain
- B&H TC-SPC-130
  - Fast timing measurements (5ps resolution)
- PCB with 5kOhm resistors to ground

Glass window planarity

- Measured the planarity of the glass window of the PMT
- Relevant for the mechanical and optical coupling between PMT face and crystal plane
- Concave hammock shape
  - +60 μm on the highest corners (x,y)=(50mm,0mm) (0mm,50mm)
  - 0 μm on the other two corners (x,y)=(0mm,0mm)




0.080
0.060
0.040
0.020
0.000
-0.020
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-0.060
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51
41
31
21
11
1
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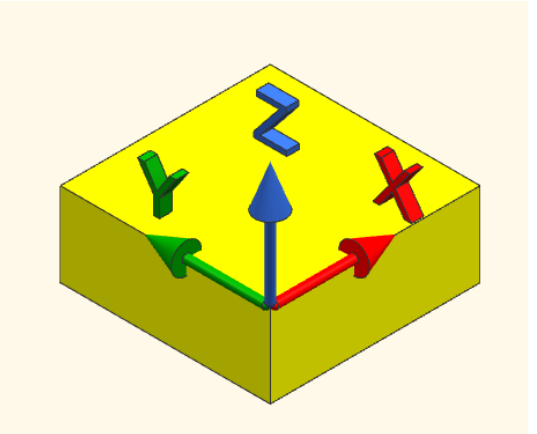
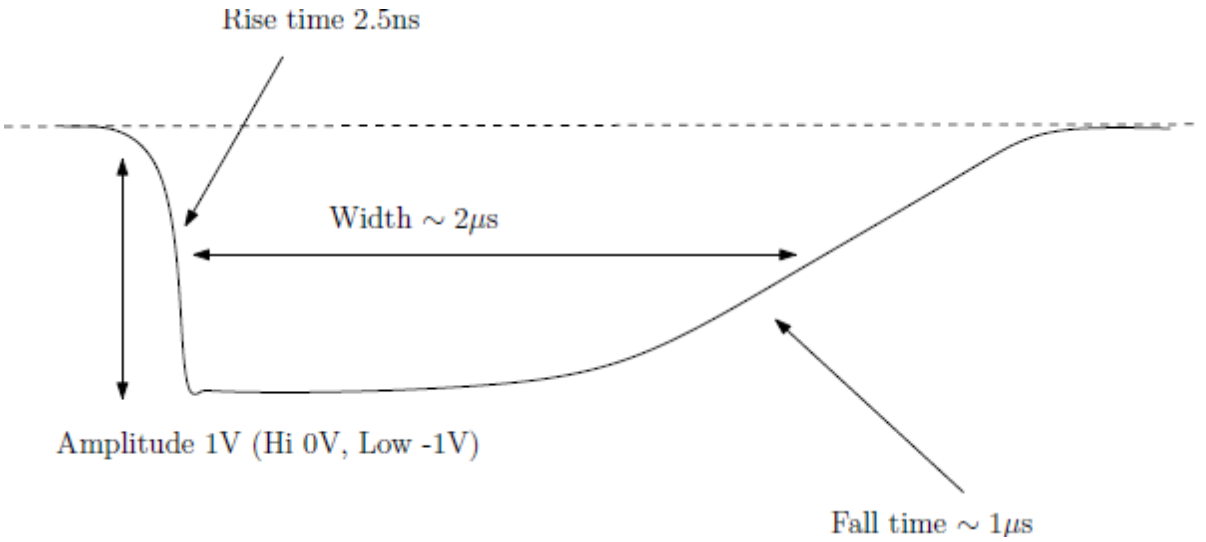

Z
Y
X

Calibration

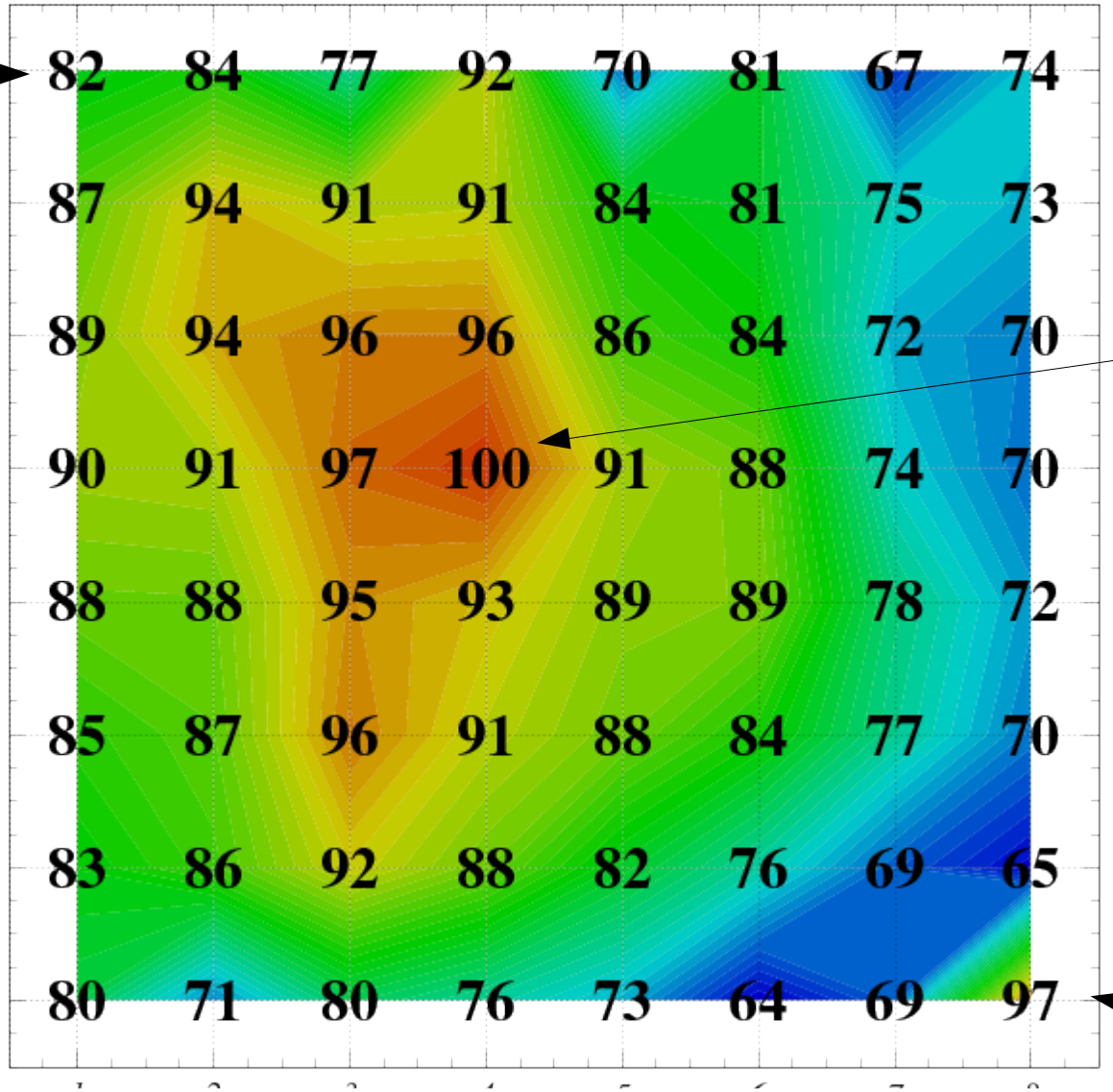
- Idea by G.Collazuol
  - Use the dy12 pin to inject a charge signal on each pixel anode
  - Generate the signal using a 1V step function signal



Calibration: PMT response

- The response to the charge injection on dy12 is equivalent to a single photon signal
  - With our setup (HV=1000V) and a wide bandwidth voltage amplifier the response to a single photon is
    - Pulse height=~60mV
    - FWHM=~1.3ns
- Check the uniformity of the response as a function of the position of the pixel
- Can be done with HV=0

Response uniformity

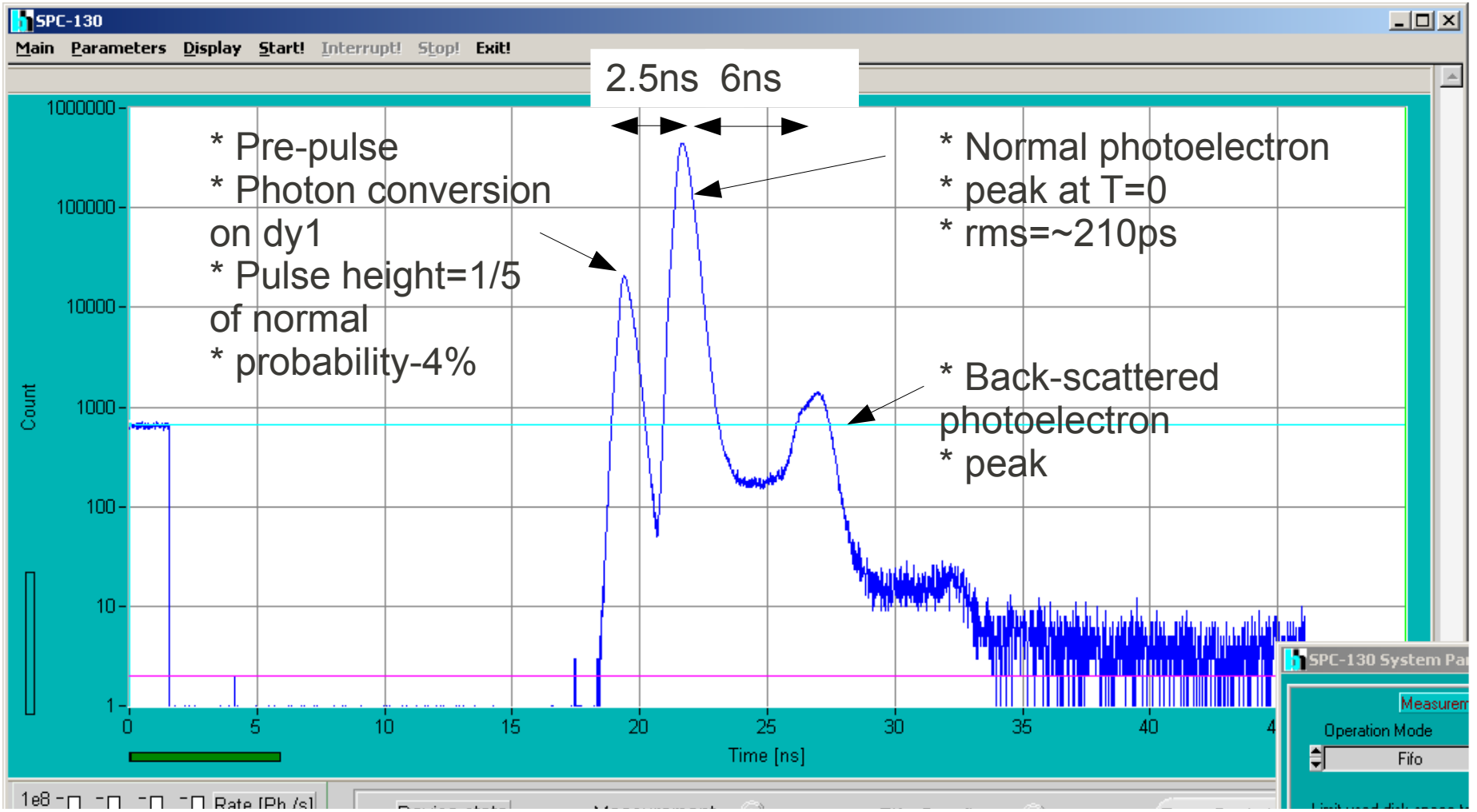


Considerations on Calibration

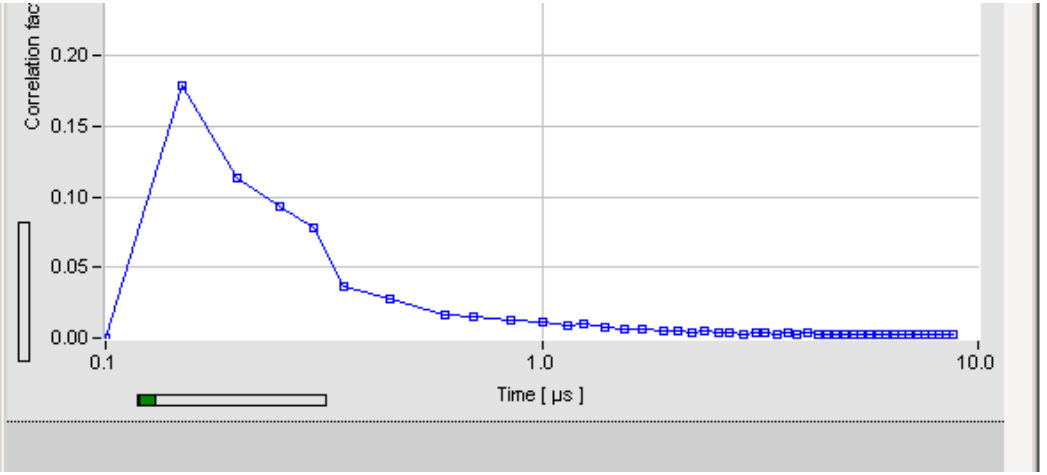
- pro
  - Allows to implement a calibration scheme based on a signal synchronous on all the pixels in a PMT
  - => Allows to align the time of all the readout channels of a PMT
  - Can be extended to a set of PMT by broadcasting a common reference signal
  - Allows to test the connection between the PMT and the electronics
- cons
  - Cannot be used without a PMT attached to the electronics
  - Amplitudes are uniform only within 30%

PMT time response and after-pulses

- TC SPC 130 for precise time measurement
- HV=1.1kV; prepulse probability = 4%



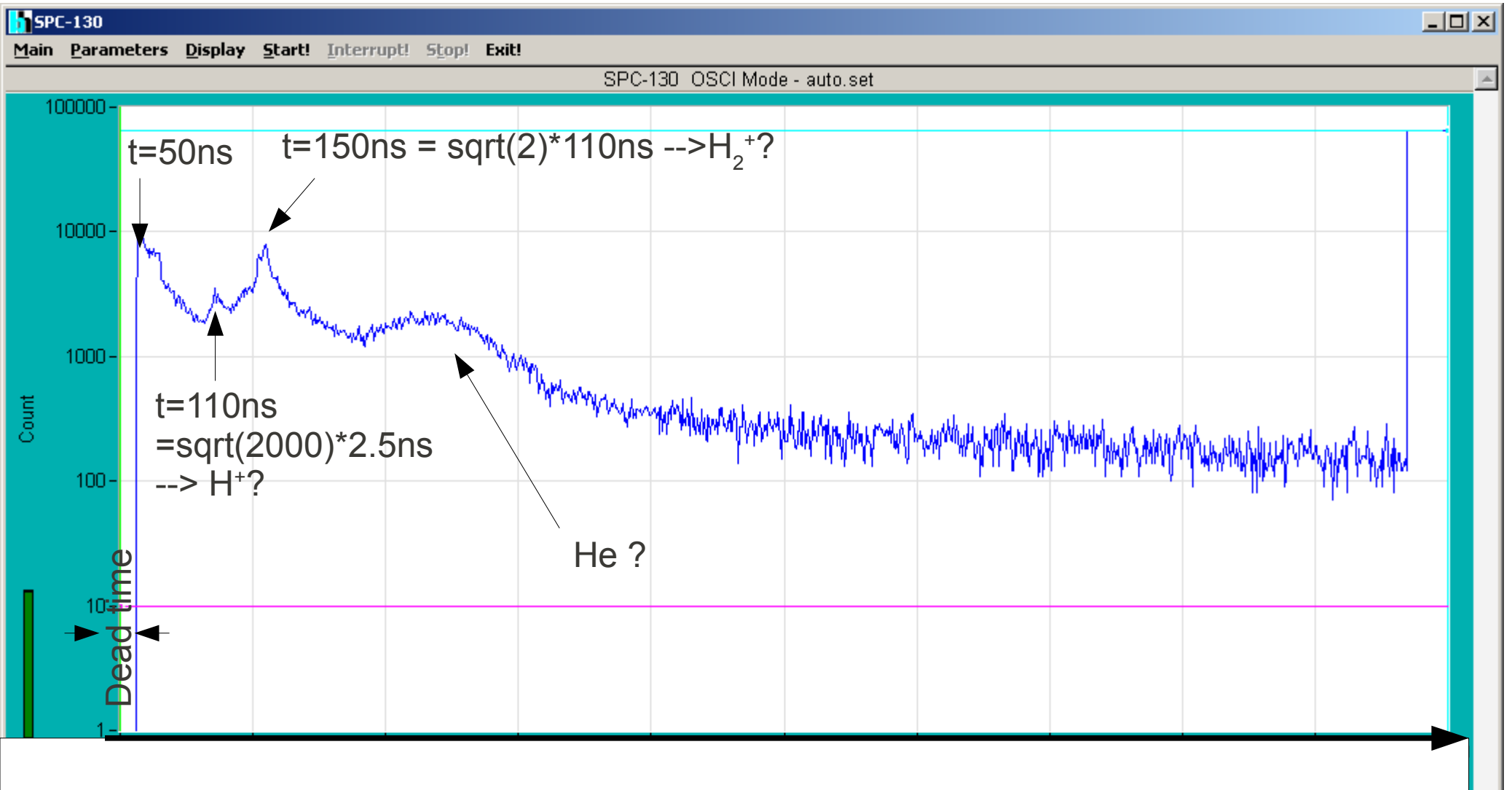
Autocorrelation



- Hits generated by laser pulses
- Autocorrelation defined as $\Sigma\, N(t)*N(t+\tau) / \Sigma\, N(t)^2$
- Distribution proportional to the after pulse probability density
- Integrated after pulse probability ~ 0.85%
- 150ns dead time (SPC in fifo mode)

After pulse spectrum

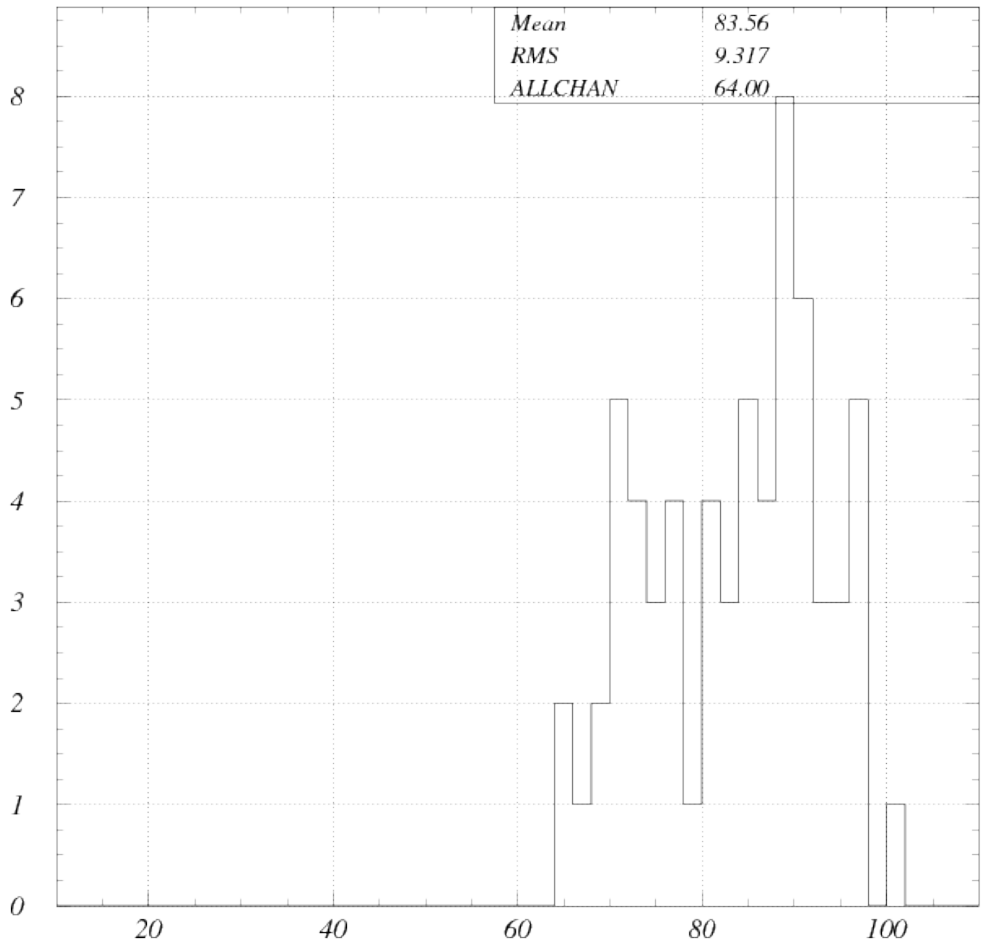
- Spans also the first 150ns; better definition
- A few identifiable peaks



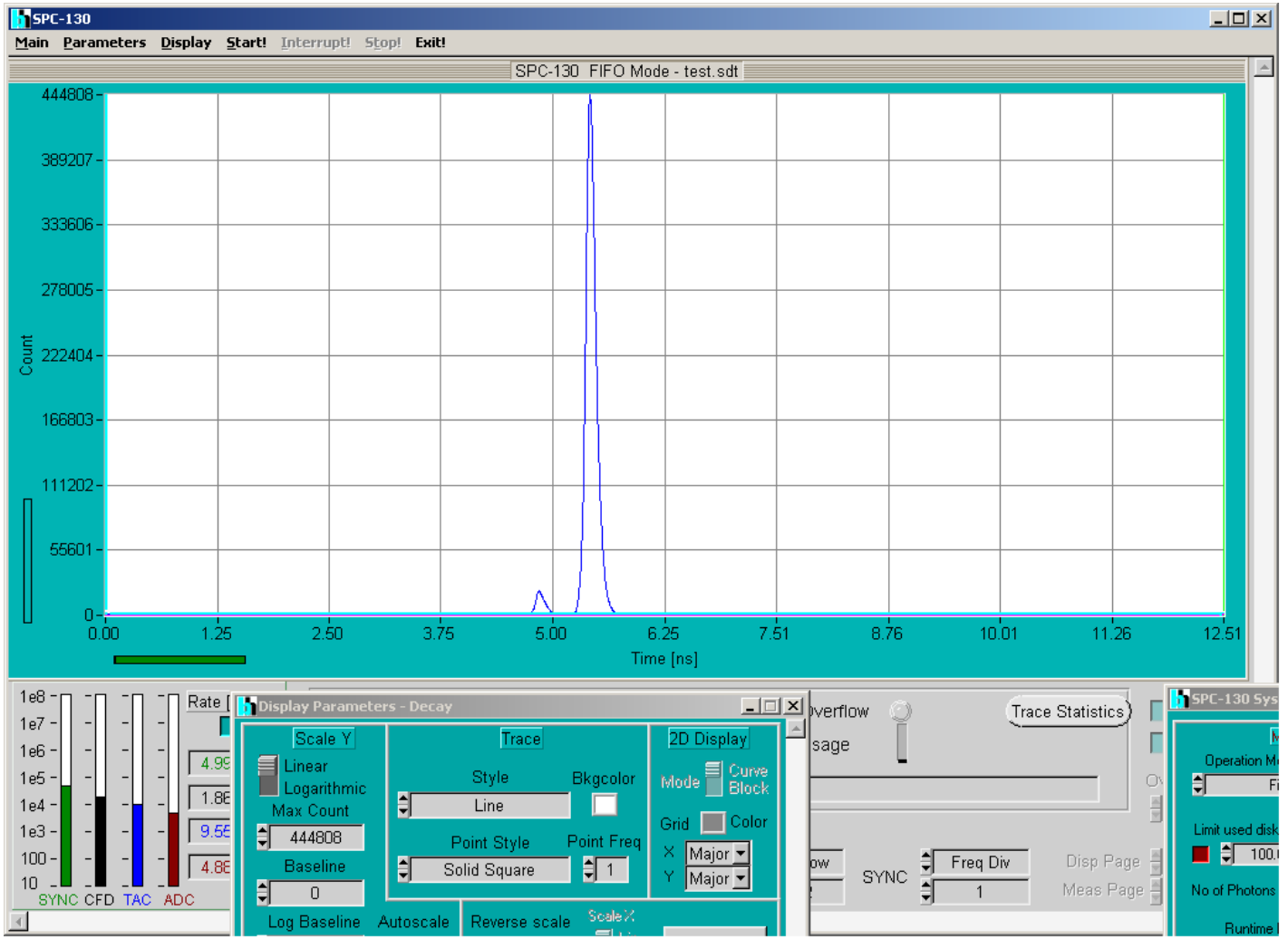
Conclusions

- PMT face planarity +/-60μm
- Investigate calibration scheme based on charge injection on dy12:
  - seems to be usable
- Investigate pre/after pulse characteristics
  - pre pulse ~ 4%
  - after pulses ~ 0.8-0.9%
  - indications of different ions

Calibration signal p.h. distribution



PMT time response and after-pulses



PMT time response and after-pulses

- HV=0.8kV – with lower voltage pre and post pulse are further away from normal peak