HVStripV1 Sr-90 Setup at Glasgow

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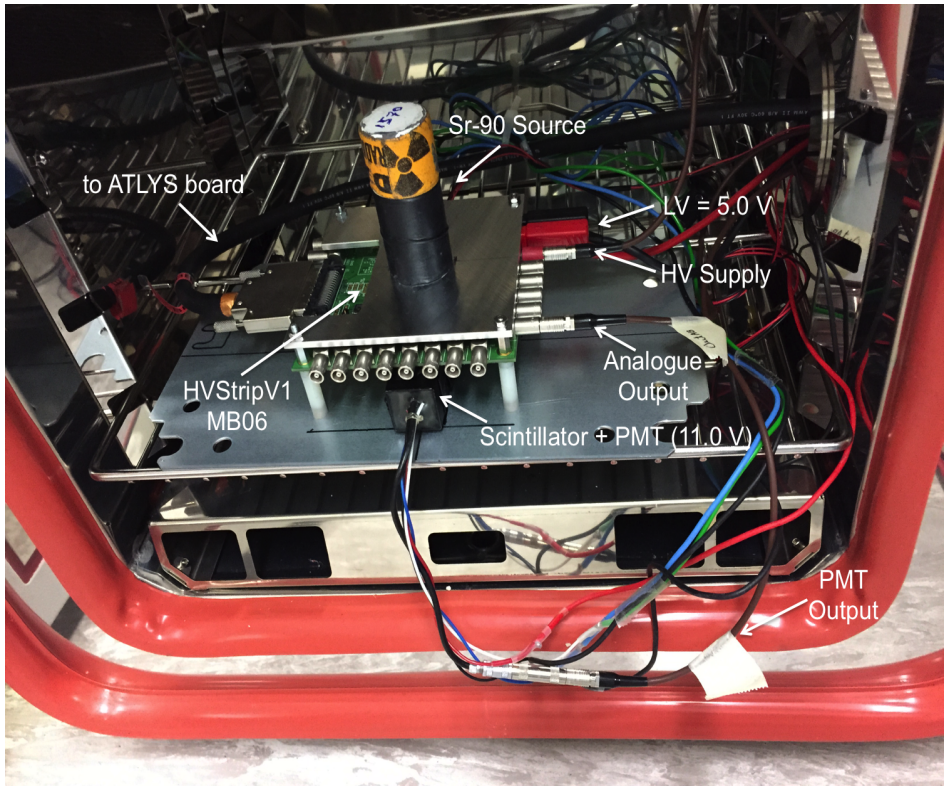
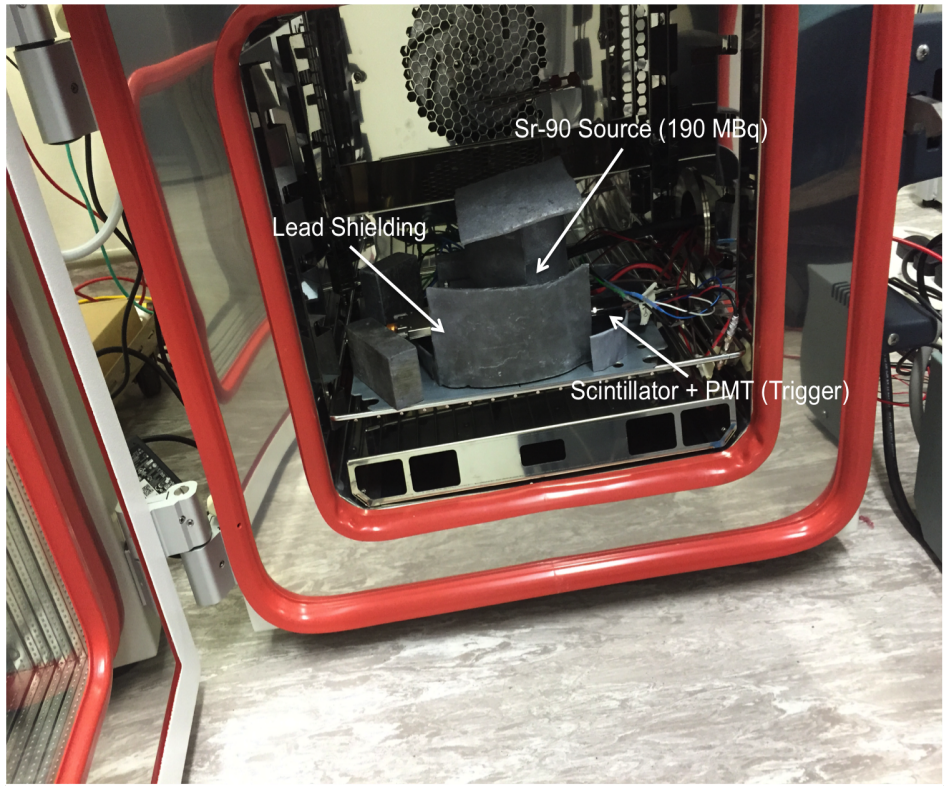
Setup (1)

- Sr-90 setup was arranged in environmental chamber to study non-irradiated HVStripV1 response to MIPS
- Temperature range from $-40^{\circ}C$ to $+180^{\circ}C$ with possibility to supply dry air/nitrogen
- MB06 was chosen for testing as it is already calibrated with Fe-55 source by Luigi Vigani at Oxford
- Currently measurements are done at $\approx +20^{\circ}C$

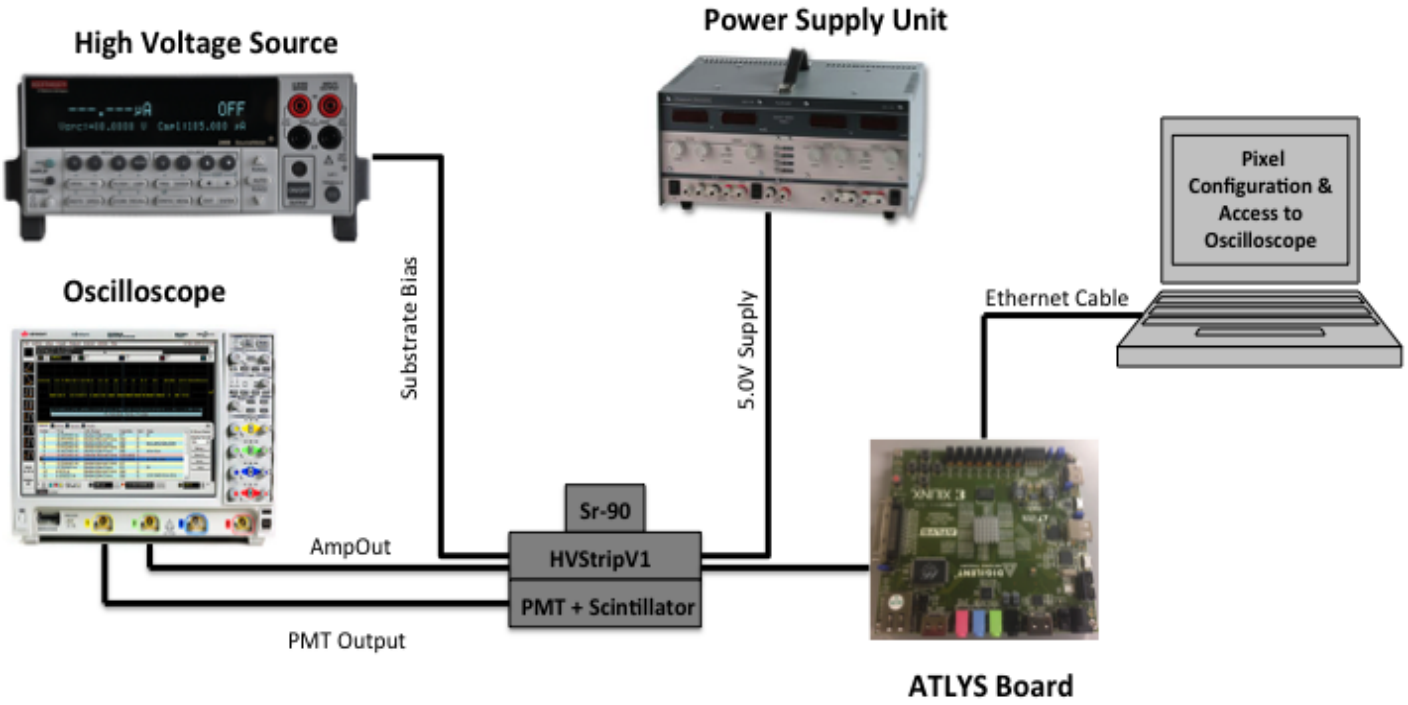


Setup (2)

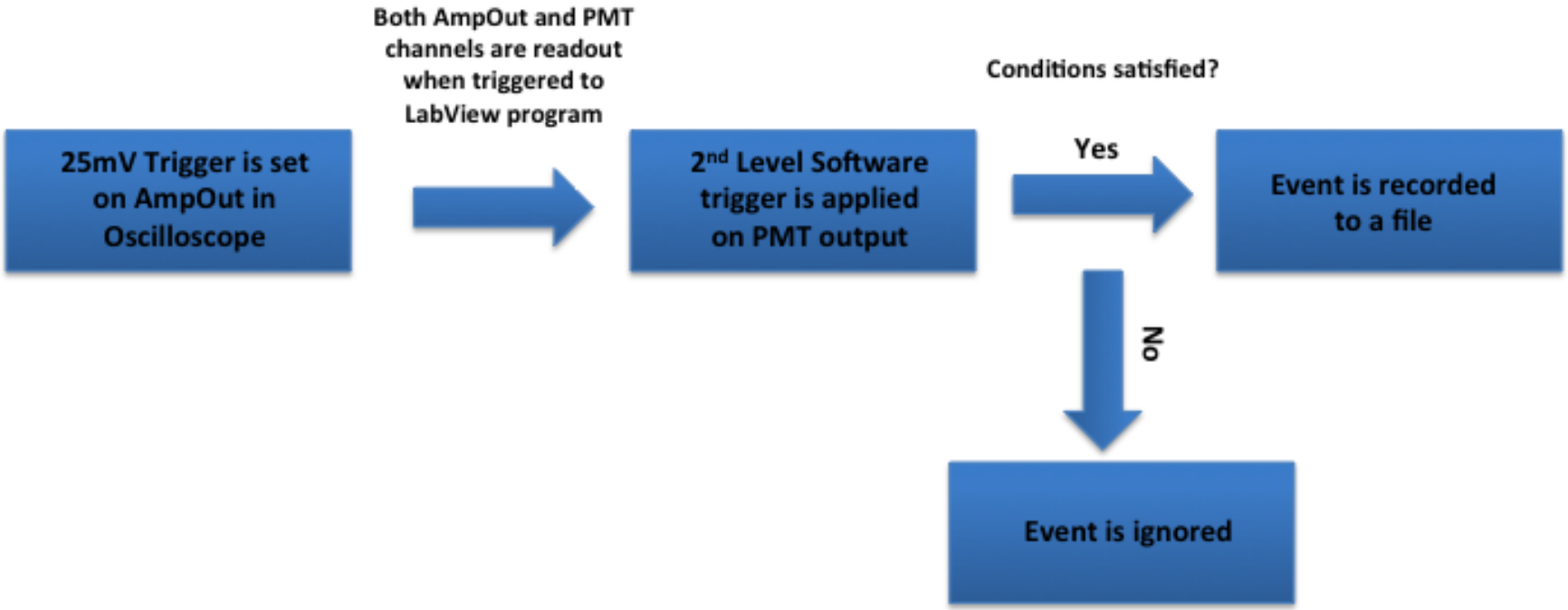
- Initial tests were done with 4MBq source which was later replaced with the 190MBq one $\Rightarrow$ significant increase in trigger rate
- Trigger rate of $\approx$ $0.08Hz$ was achieved, however, this is strongly influenced by chosen triggering options
- So far measurements for all row 0 pixels were done at $-60V$ and for a few at $-30V$ bias voltages
- Initial goal was to select acceptable PMT trigger time window



Setup (3)

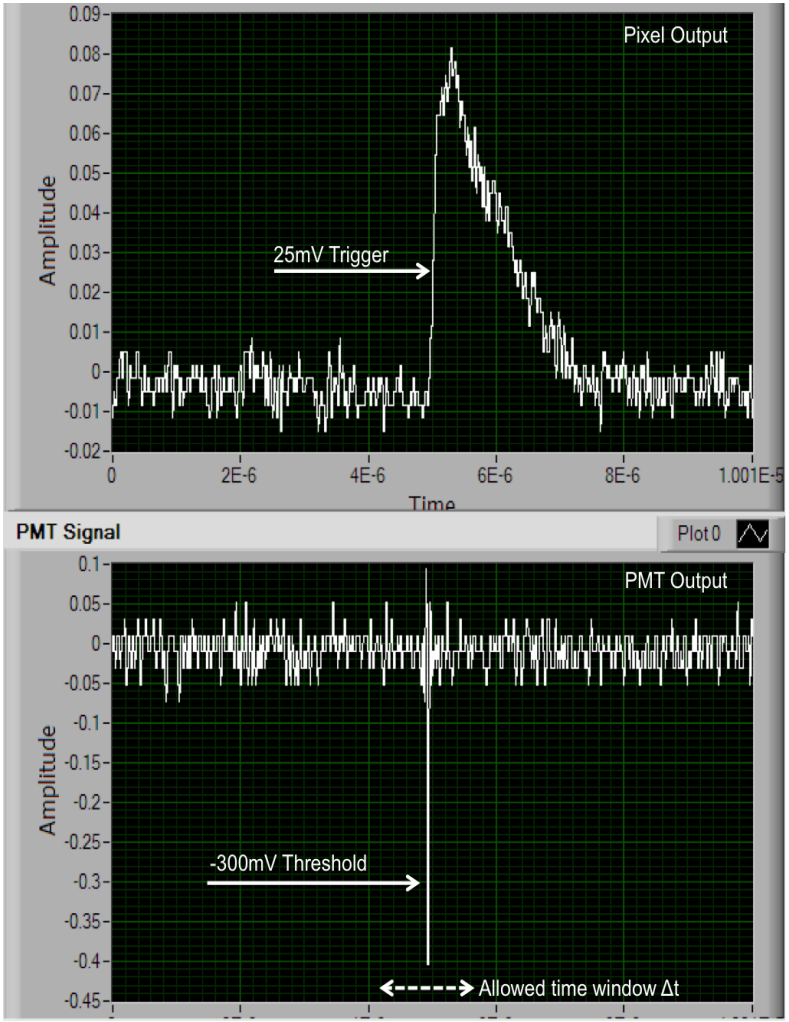

High Voltage Source
Power Supply Unit
Pixel Configuration & Access to Oscilloscope
Oscilloscope
Substrate Bias
5.0V Supply
Ethernet Cable
Sr-90
AmpOut
HVStripV1
PMT + Scintillator
PMT Output
ATLYS Board

MIP Trigger (1)



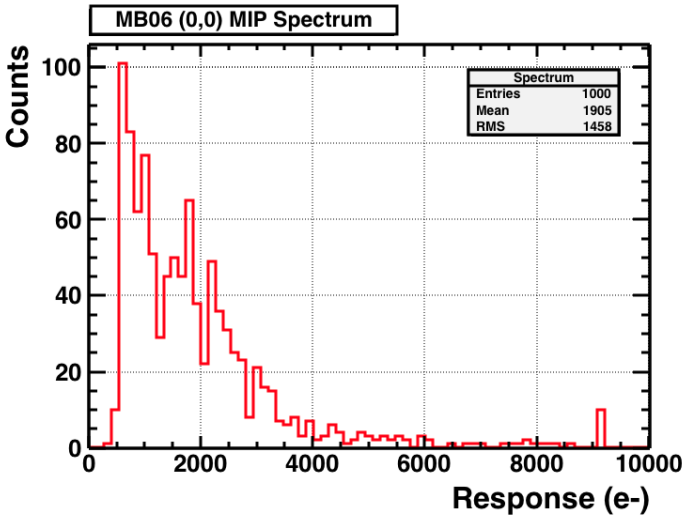
MIP Trigger (2)

- Firstly the trigger is applied on the analogue output at 25mV level (above the noise)
- Both AmpOut and PMT signals are then readout and additional criteria is applied for PMT signal (within LabView VI), which determines whether the AmpOut signal should be written to a file
- Various time windows were tested in order to determine optimal one for DAQ

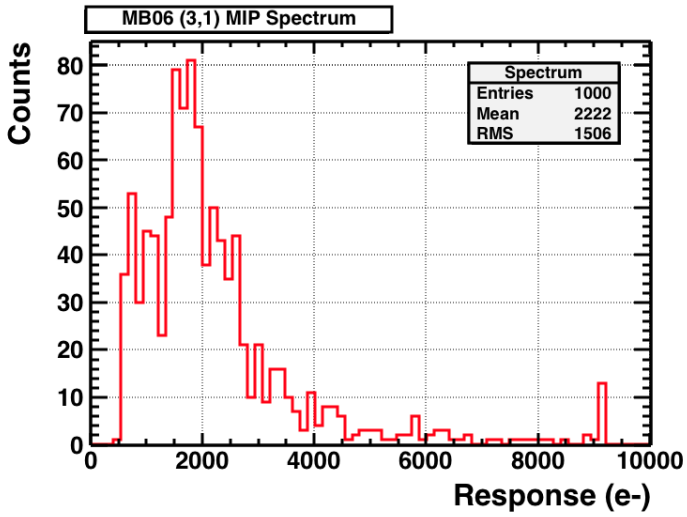


MIP Trigger (3) (at -60V)

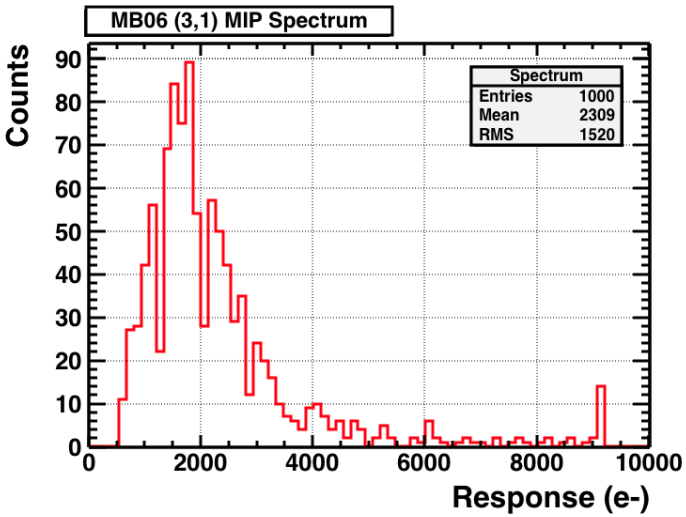
$\Delta t = 1\mu s$



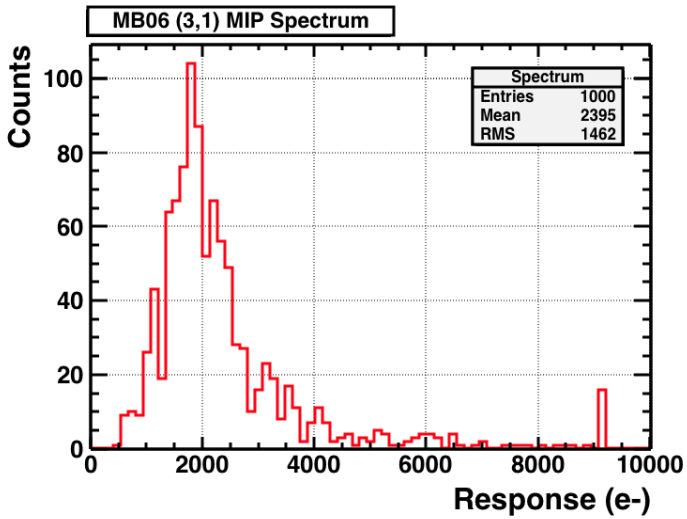
$\Delta t = 400ns$



$\Delta t = 300ns$

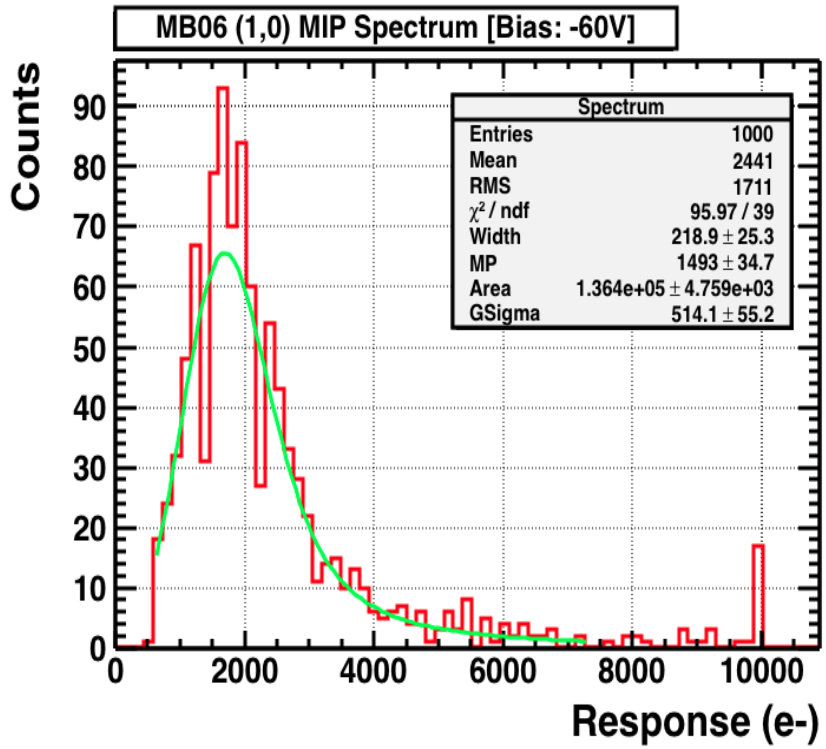


$\Delta t = 200ns$

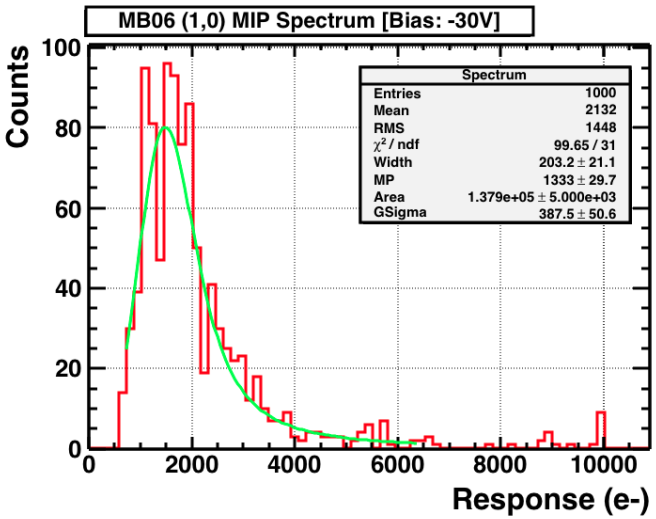


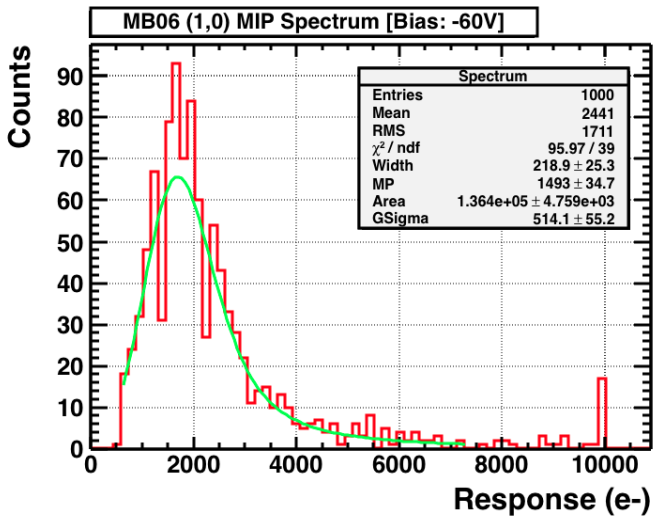
Results (1)

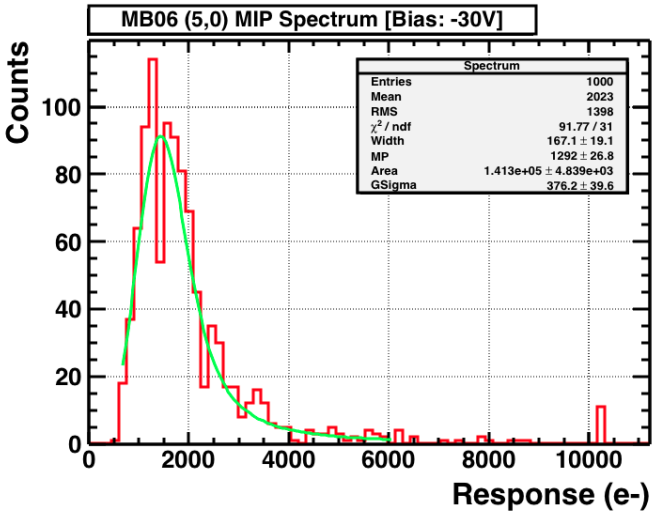
- Currently 300ns time window is chosen for measurements
- Acquired MIP spectrum is fitted with Landau + Gaussian function $\Rightarrow$ MPV is extracted
- 1000 events are collected for each pixel (takes $\approx 2h$ per pixel)
- Shift in spectrum is observed when bias is changed

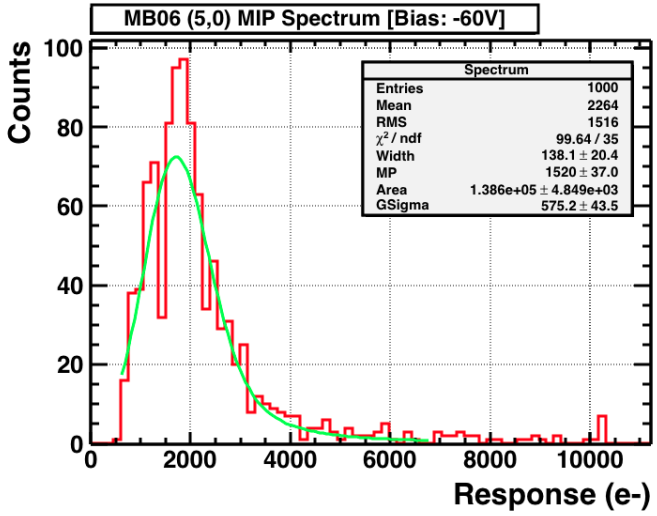


Results (2)


MB06 (1,0) MIP Spectrum [Bias: -30V]
Spectrum
Entries 1000
Mean 2132
RMS 1448
χ² / ndf 99.65 / 31
Width 203.2 ± 21.1
MP 1333 ± 29.7
Area 1.379e+05 ± 5.000e+03
GSigma 387.5 ± 50.6
Counts
Response (e-)


MB06 (1,0) MIP Spectrum [Bias: -60V]
Spectrum
Entries 1000
Mean 2441
RMS 1711
χ² / ndf 95.97 / 39
Width 218.9 ± 25.3
MP 1493 ± 34.7
Area 1.364e+05 ± 4.759e+03
GSigma 514.1 ± 55.2
Counts
Response (e-)


MB06 (5,0) MIP Spectrum [Bias: -30V]
Spectrum
Entries 1000
Mean 2023
RMS 1398
χ² / ndf 91.77 / 31
Width 167.1 ± 19.1
MP 1292 ± 26.8
Area 1.413e+05 ± 4.839e+03
GSigma 376.2 ± 39.6
Counts
Response (e-)

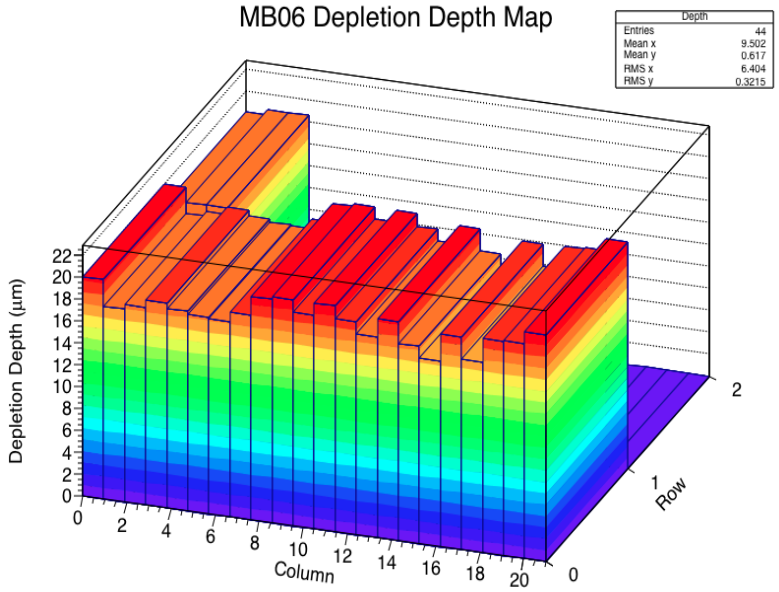

MB06 (5,0) MIP Spectrum [Bias: -60V]
Spectrum
Entries 1000
Mean 2264
RMS 1516
χ² / ndf 99.64 / 35
Width 138.1 ± 20.4
MP 1520 ± 37.0
Area 1.386e+05 ± 4.849e+03
GSigma 575.2 ± 43.5
Counts
Response (e-)

Results (3)

Pixel (Col, Row)	MPV @ -30V	MPV @ -60V	Δ %
(0,0)	1601	1703	6.37
(1,0)	1333	1493	12.00
(2,0)	1410	1527	8.30
(3,0)	1387	1589	14.56
(4,0)	1312	1548	17.99
(5,0)	1292	1520	17.65

- The shift seems to be not completely uniform, although, the selected time window and threshold could have affected this
- More data is being taken at the moment to compare all row 0 pixels
- Different time window is also to be used later for different set of measurements

Results (4)



- Extracted MPV values at $-60V$ bias voltage were used to estimate depletion region depth
- The conversion factor of $85e^-$ per 1 μm for MIPS was used
- The values seem reasonable ($\approx 20\mu m$) but as it was seen before in some cases there is a notable variation

Next steps

- Take the same set of measurements using different time window and at various temperatures
- Try more bias voltage steps and see whether the MPV follows $\sqrt{V}$
- Perform measurements on irradiated chip

Thank you for your attention!