

# HVStrip1 Testbeam

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# Presentation Outline

- 1 Introduction
- 2 HVStrip1
- 3 Testbeam
- 4 Results
- 5 Irradiation with Fe-55

# Aims

- Investigate characteristics of HVStrip1 prior the testbeam
- Gain experience for the future testbeams which would involve HVStrip1
- Obtain response data of the pixel matrix during X-ray illumination

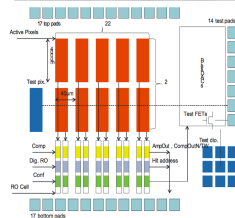
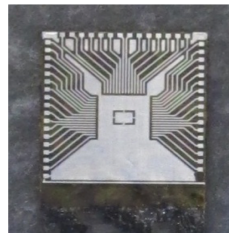
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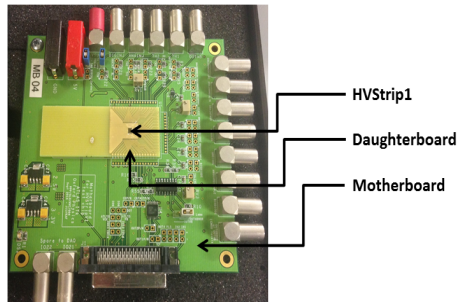
# The HVStrip1 Chip (1)

- HVStrip1 is the CMOS testchip (HVCMOS process)
- Among several test devices also contains strip-like active pixel matrix consisting of 44 pixels
- Pixels divided into 2 rows and 22 columns with each pixel having dimensions of  $40\mu m \times 400\mu m$



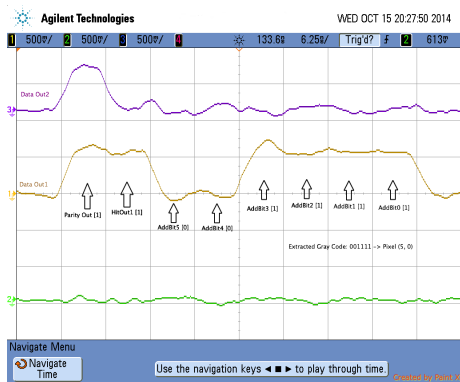
# The HVStrip1 Chip (2)

- Mounted on daughterboard and subsequently on motherboard
- The arrangement is programmed and controlled via Atlys FPGA board
- First power up less than a week before the testbeam



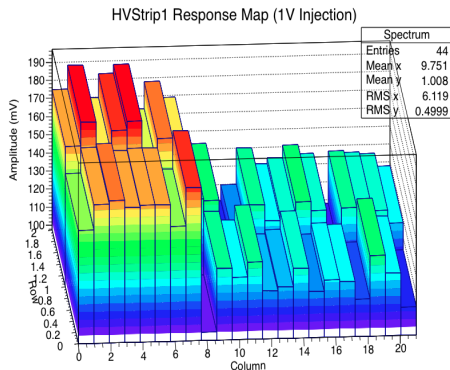
# Initial tests (1)

- Firstly response was tested of the digital readout block (digital injection)
- Later HVStrip1 was configured for analogue injection
- Output pulses were observed of charge sensitive amplifier part of the pixel circuit (OutAB)



# Initial tests (2)

- Output pulse heights were mapped for all pixels of 3 HVStrip1 chips
- 1V injection pulses were used for  $\approx 0.5fF$  input capacitance (equivalent to  $\approx 3100e^-$ )
- Amplitude drop was observed for all chips after column 7 (due to different types of feedback transistors used for pixels)



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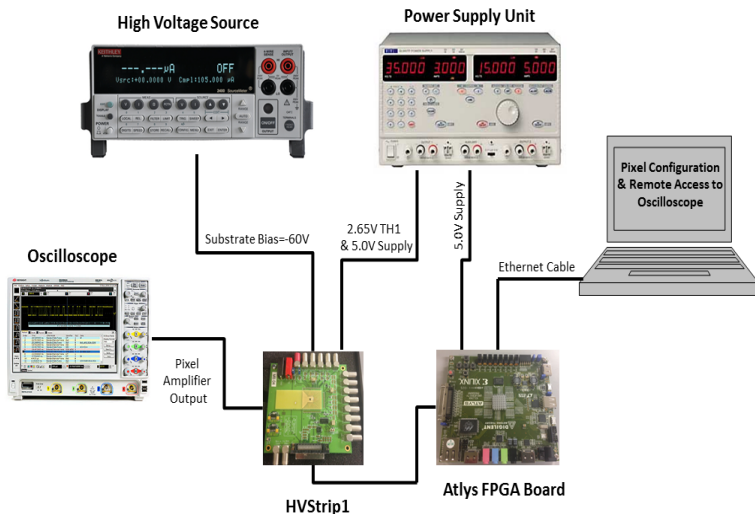
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# Overview

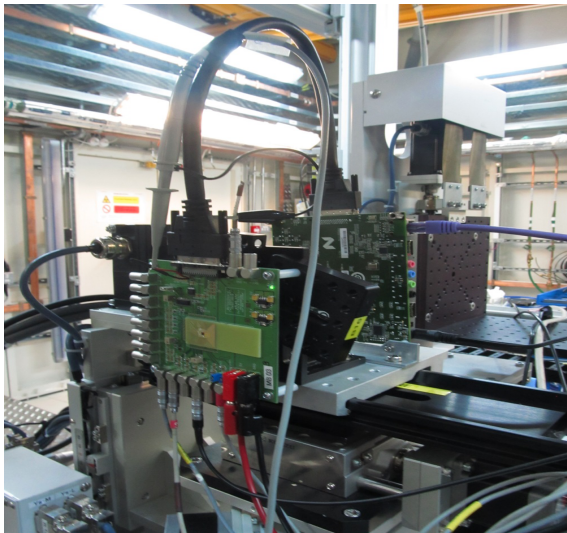
- Testbeam took place at Diamond Light Source
- Beam of 15keV X-rays of few  $\mu m$  width (when microfocused) was used
- Correspond to  $\approx 4100e^-$
- 2 attempts were made to test the chip



# Experimental Setup (1)



# Experimental Setup (2)





# DAQ

- Proper DAQ system was not available during the testbeam
- One pixel at the time could be set for analogue output
- Oscilloscope was used via remote access to record data

# Progress

- During first attempt the beam position could not be identified
- Fortunately second attempt was successful and data was acquired
- The beam position was identified when the microfocus was off (thus illuminating larger area)

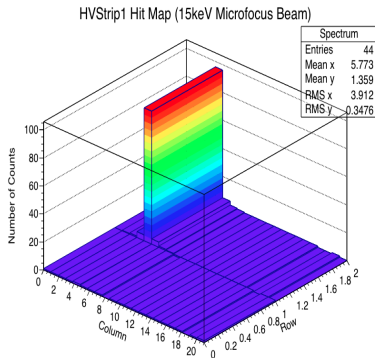


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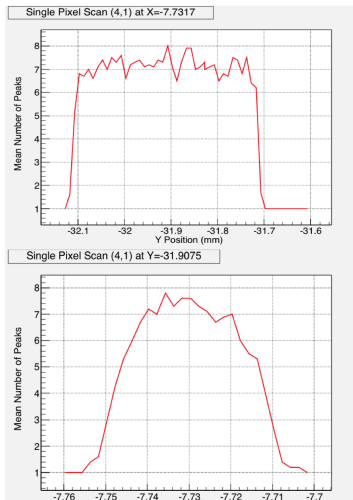
# Results (1)

- When the beam position was identified, it was then positioned approximately at the centre of pixel matrix
- Microfocus was turned on and 3mm of Al was placed to reduce intensity
- Scan was performed across all pixel matrix, and thus locating microfocused beam



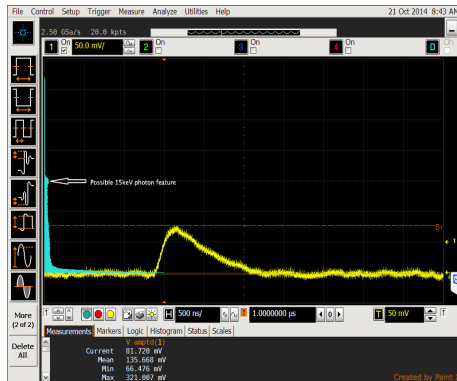
## Results (2)

- Scan was performed on one pixel in both dimensions
- Data consists of position of the chip and number of hits above 100mV threshold in 1ms
- Consistent with dimensions of the pixel given in documentation



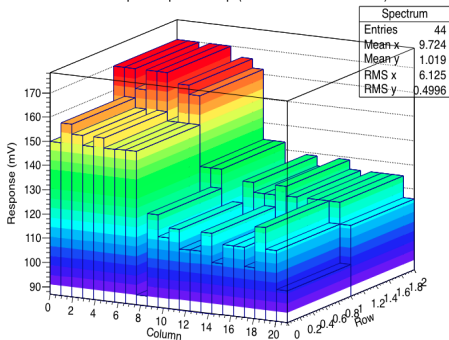
## Results (3)

- Another scan performed was across all pixel centres
- Response amplitude was sampled to produce a histogram
- The 15keV feature was identified in most pixels and similarly to charge injection tests the response map was produced
- Response pulse heights vary from 91mV to 170mV

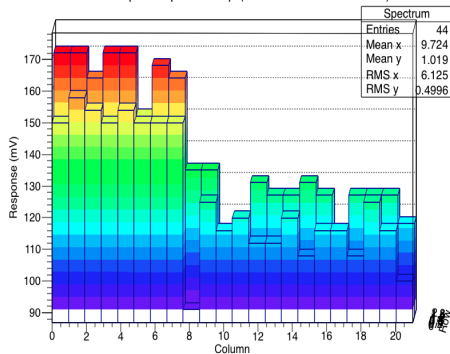


# Results (4)

HVStrip1 Response Map (15keV Microfocus Beam)



HVStrip1 Response Map (15keV Microfocus Beam)



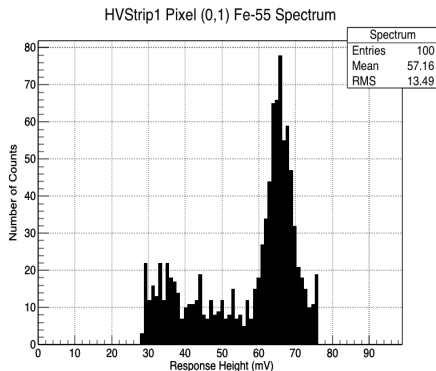
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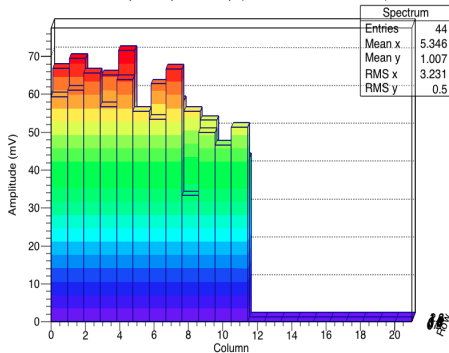
# Fe-55

- After the testbeam the chip was irradiated with Fe-55 X-ray source
- The characteristic line corresponds to 5.9keV (correspond to  $\approx 1600e^-$ )
- Scan was done across half of the pixel matrix
- Results vary from 33 mV to 70 mV and seem to be consistent with those from the testbeam

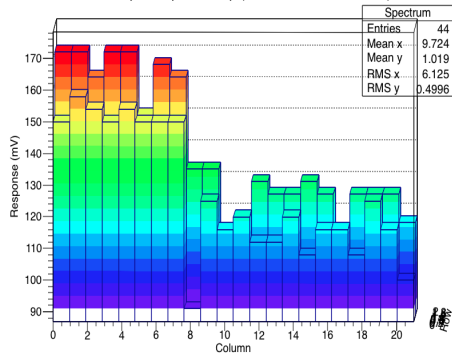


# Result comparison

HVStrip1 Response Map (Fe-55 Irradiation 5.9keV)



HVStrip1 Response Map (15keV Microfocus Beam)



Thank you for your attention!