dE/dX -TOF detector test beam in Trento¶

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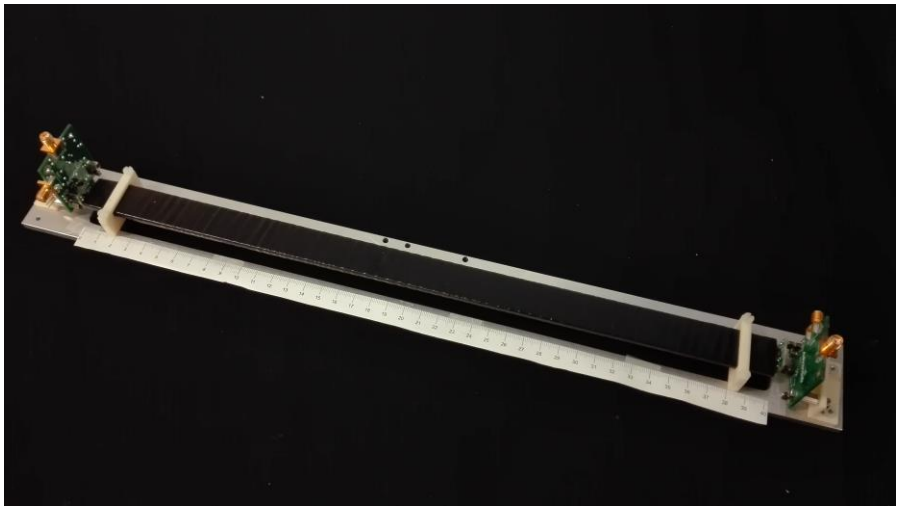
Epic Scintillators

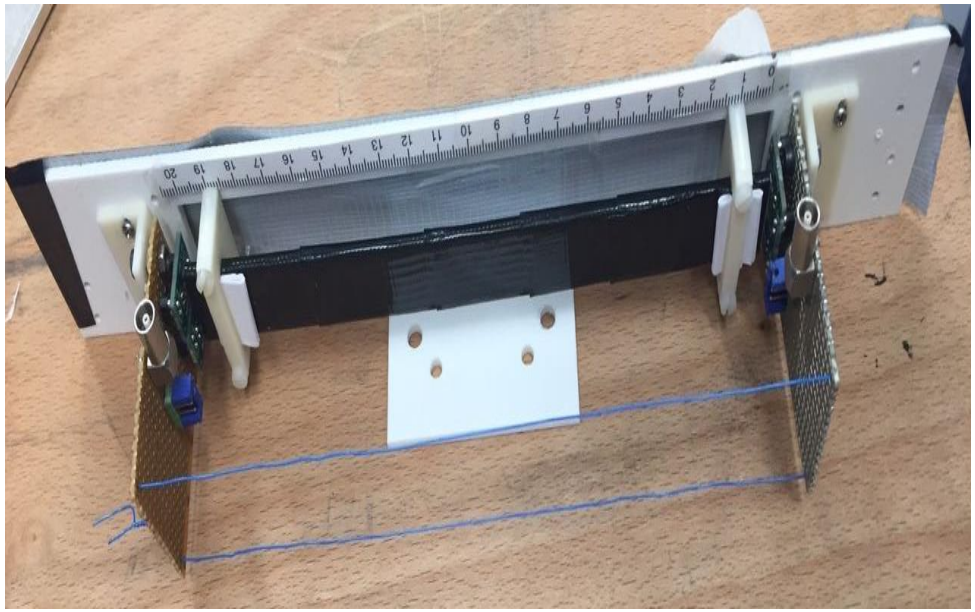


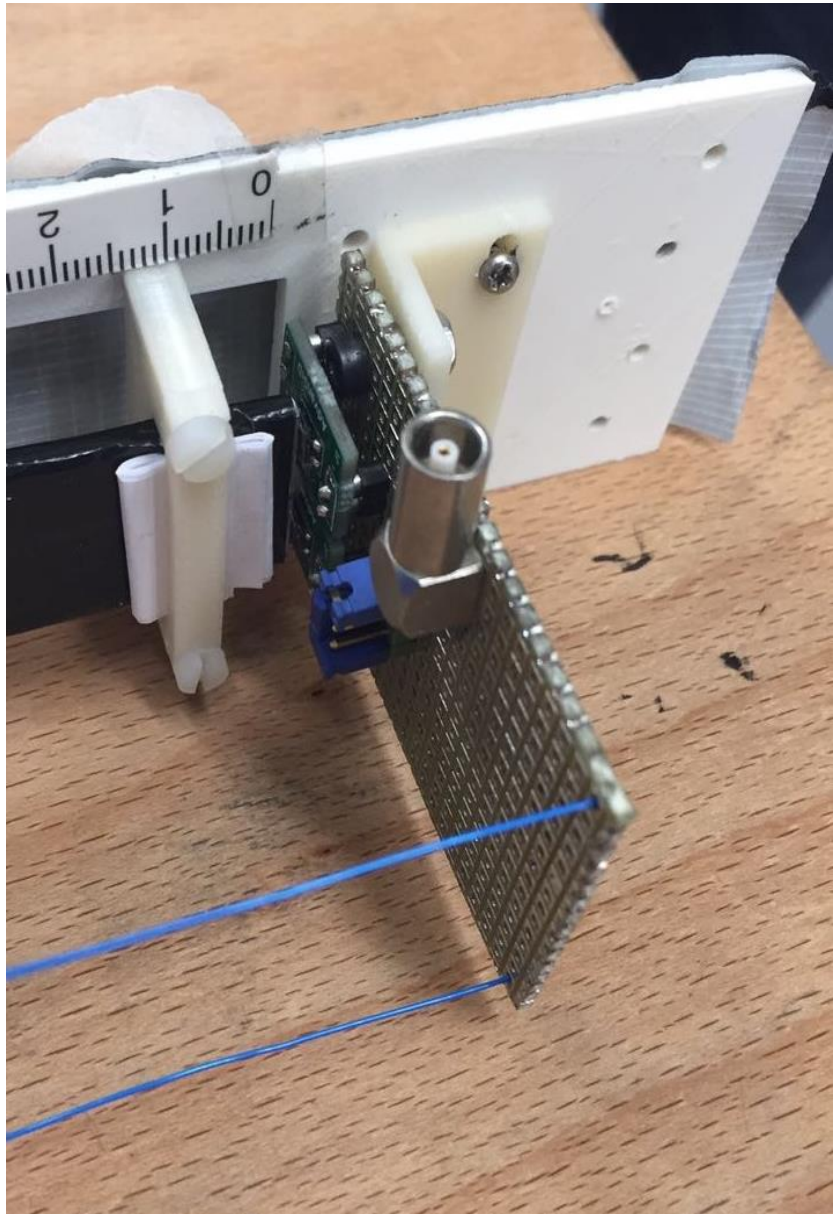
440 mm long and 20 mm large

Base material	Polystyrene
Density (g/cm^3)	1.05
Max emission wavelength (nm)	415
Rise time (ns)	0.9
Primary decay time (ns)	2.40
Light output (%relative to Anthracene)	50-60
H/C ratio	1.10
Refractive index	1.58
Reflector and light shielding sheet	Aluminum foil and black vinyl

Experimental Setup

- 20x2x0.2 cm^3 Eljen plastic scintillator bar (EJ212), wrapped with teflon
- 4 SiPMs (2 for each side connected in series, AdvanSiD)
- Bias Voltage: 62.8 Volt (BD=26.4 V, OV=5 V)





DAQ

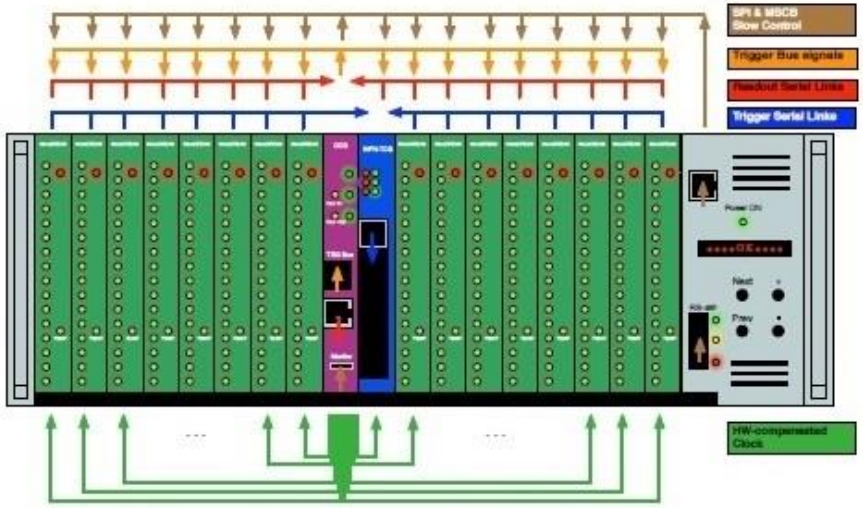
WaveDreams

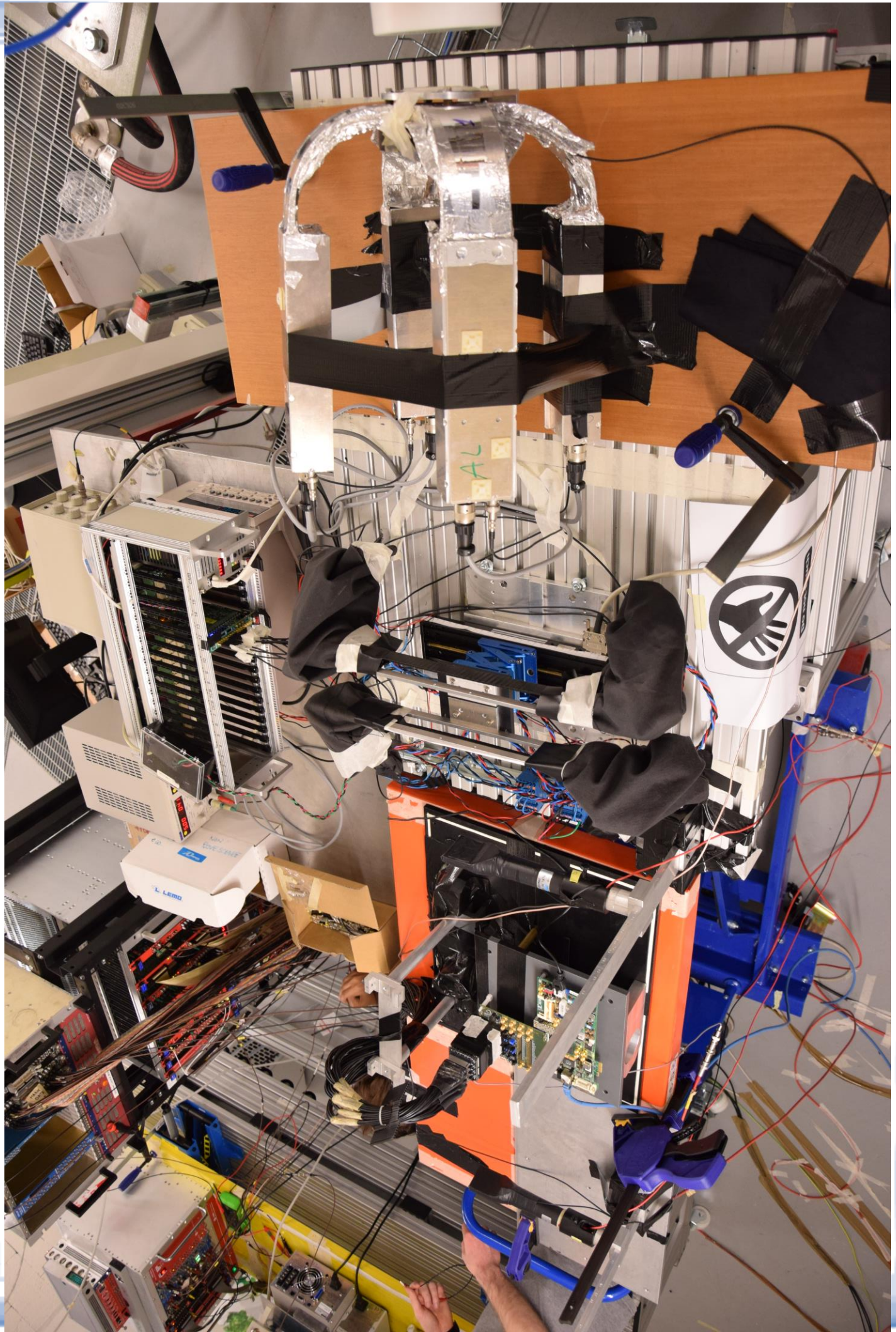
- 16 acquisition channels

- SiPM power supply

- Amp w Variable gain and PZC

- Bandwidth 900 MHz





Measurements

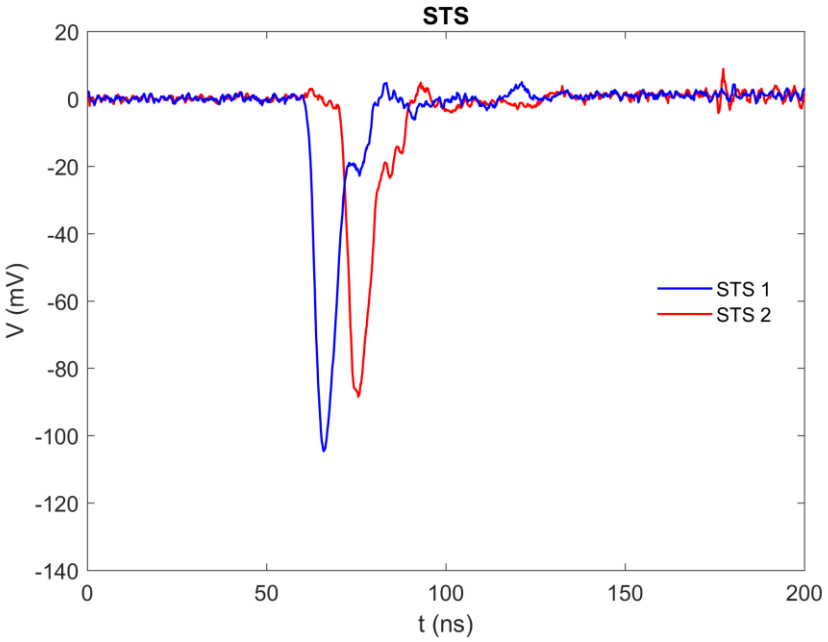
Scan	Beam position	Beam energy	SiPM overvoltage	Time resolution
Beam position	[-7,+7], 0.5 cm steps	110 MeV	5 V	with STS1
Beam energy	0 cm	70-230 MeV	5 V	with STS1
SiPM overvoltage	0 cm	140 MeV	2-7, 1 V steps	with μ(STS1,STS2)

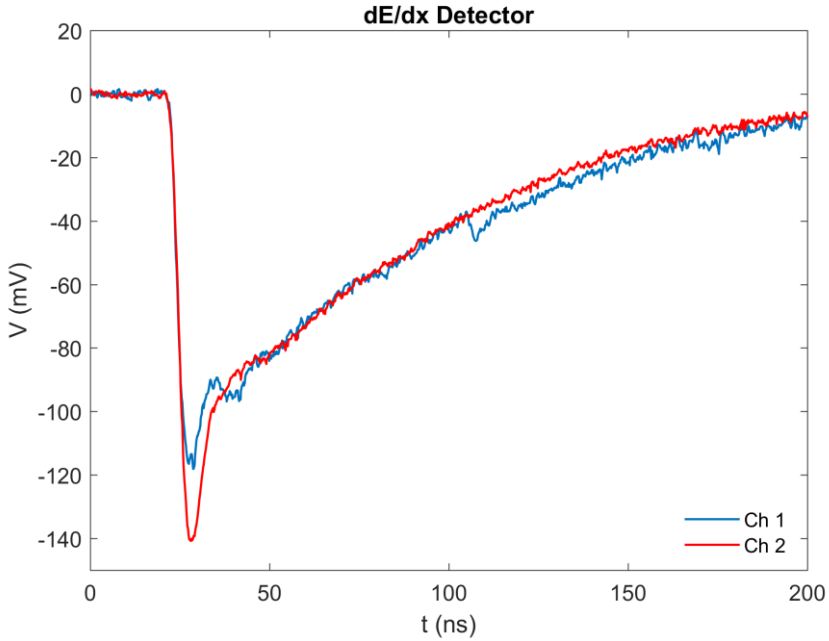
Detector performance evaluation

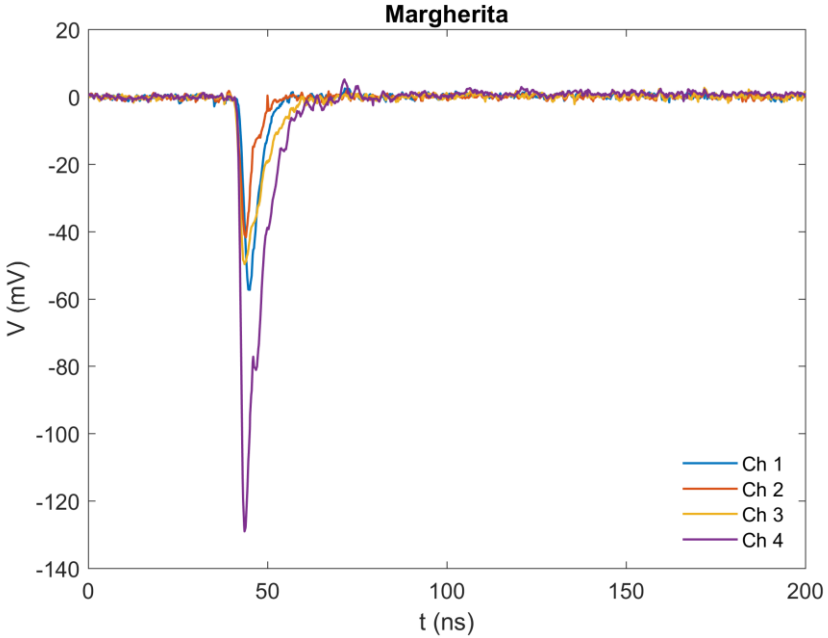
- **Energy resolution**

- **Time resolution** Standard deviation of the difference between the average photon arrival time at the ends of the bar and reference time information (STS1 or the average of the 2 STS timestamps)

Sample Signals

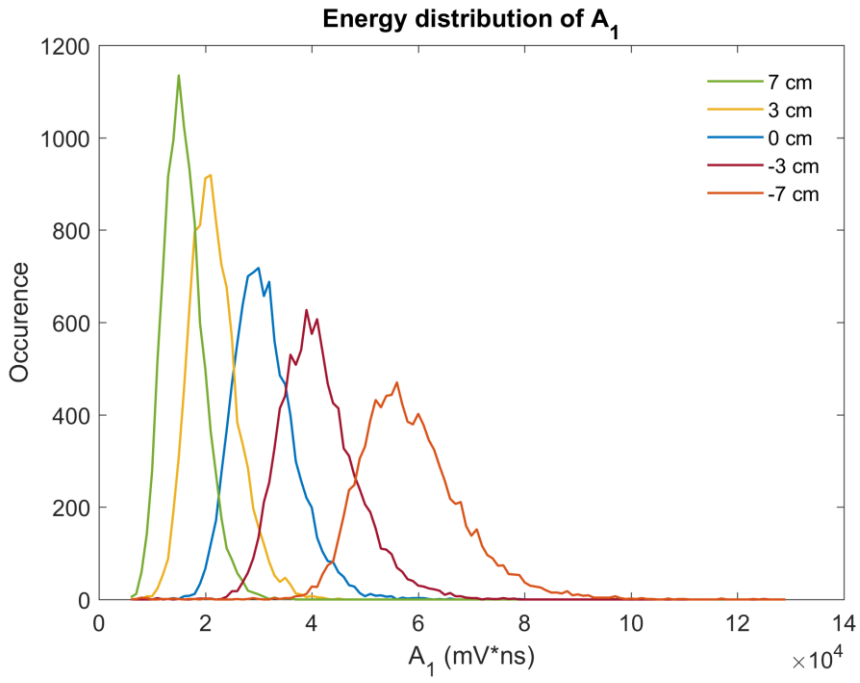




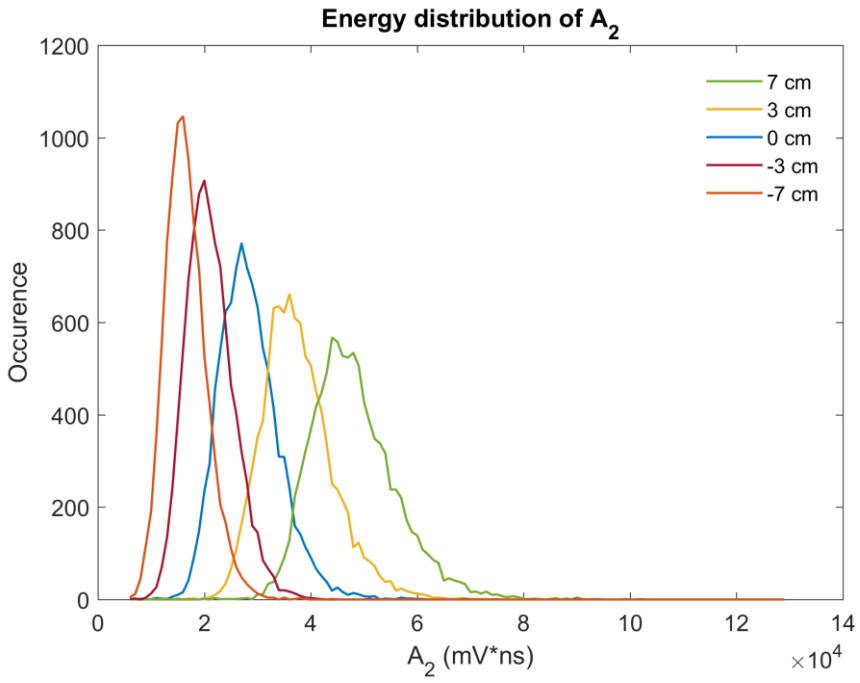


Scan of Beam Position

Energy measured at bar ends



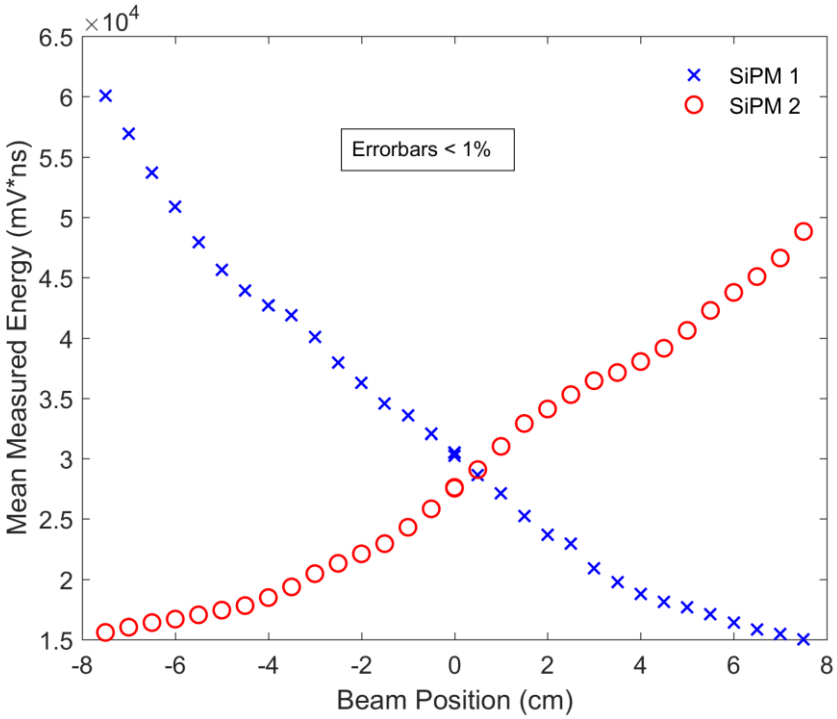
SiPM 1

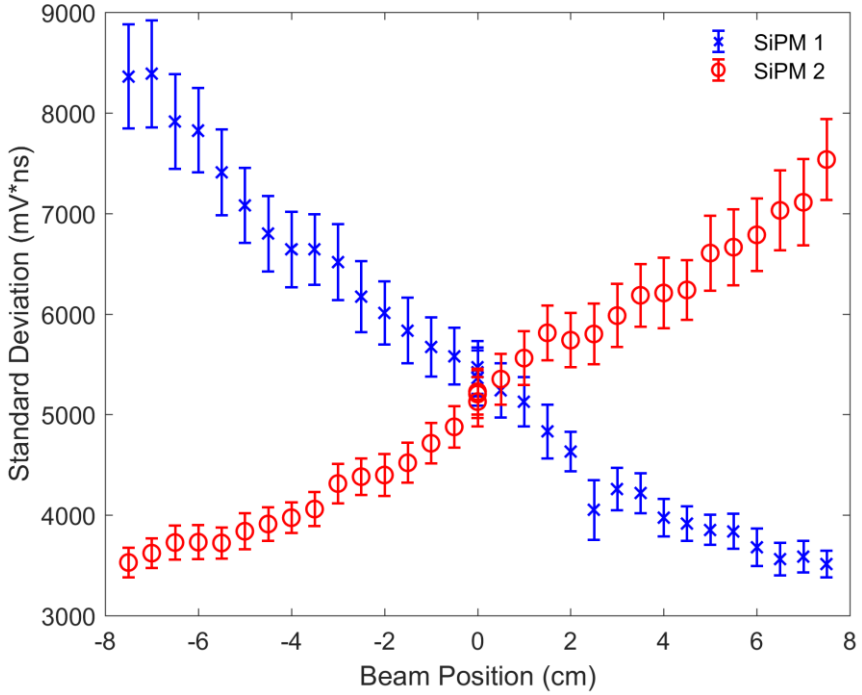


SiPM 2

Scan of Beam Position

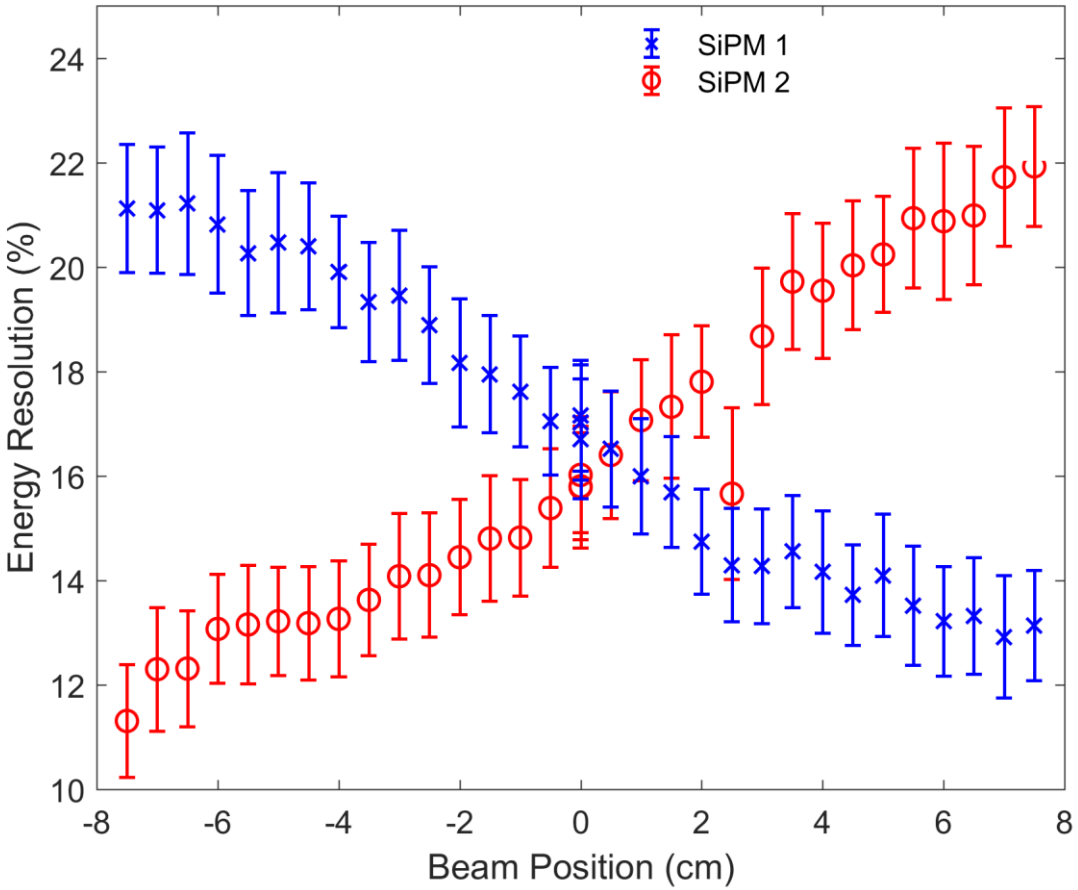
Mean and standard deviation of measured energy





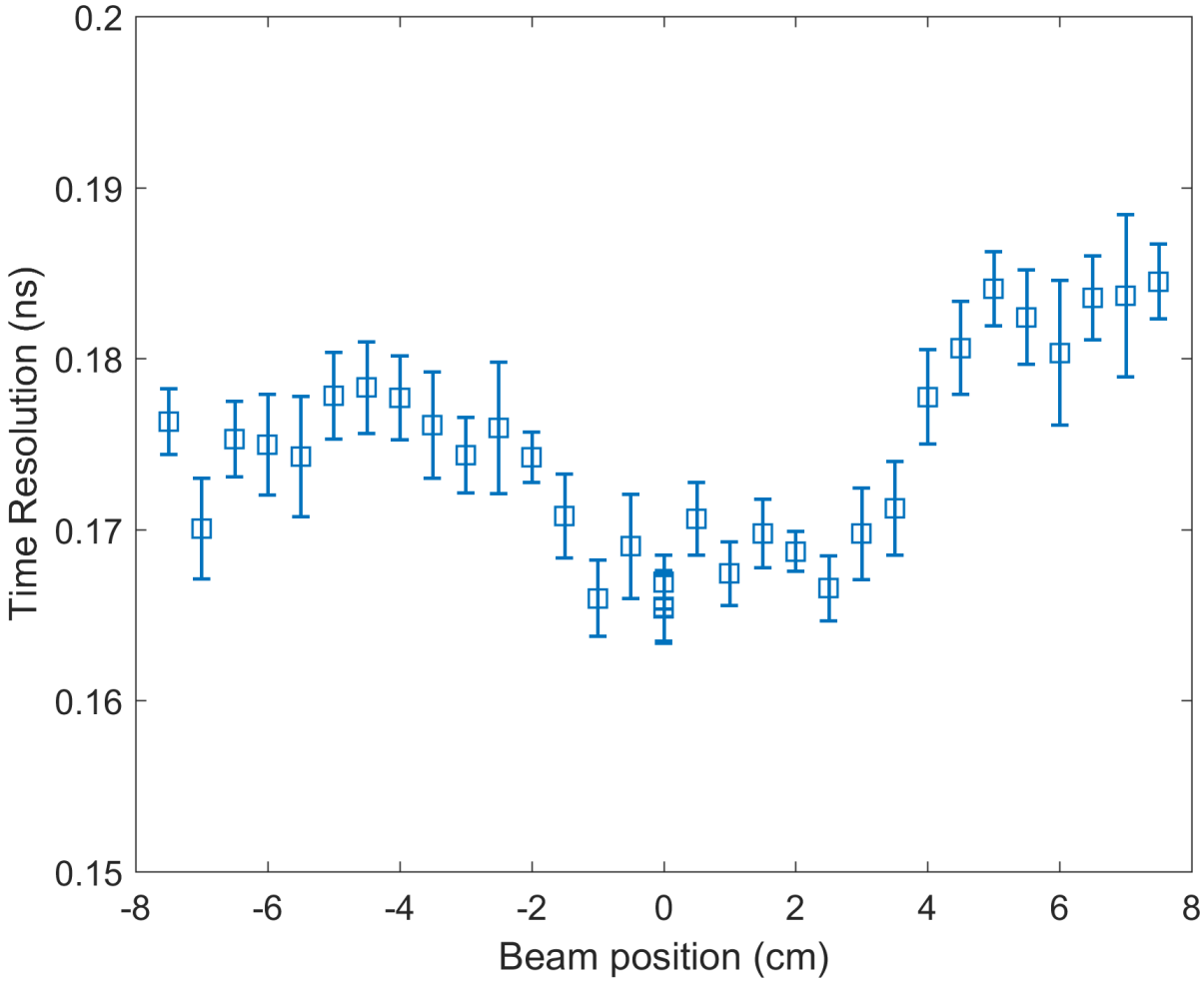
Scan of Beam Position

Energy resolution



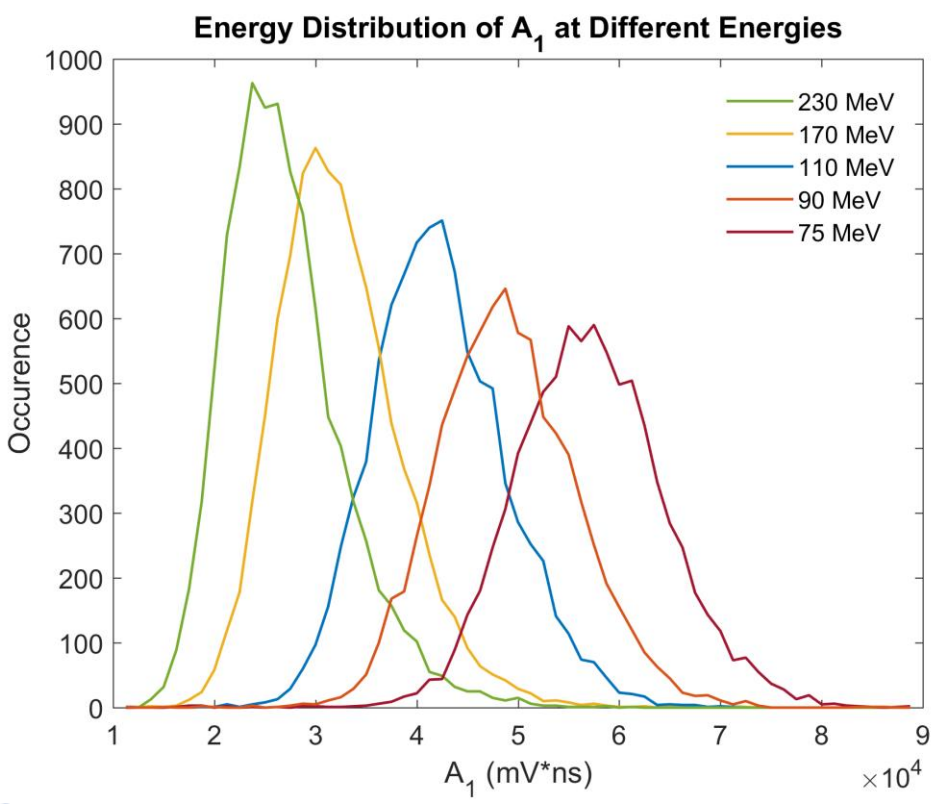
Scan of Beam Position

Time resolution between SiPMs and STS1

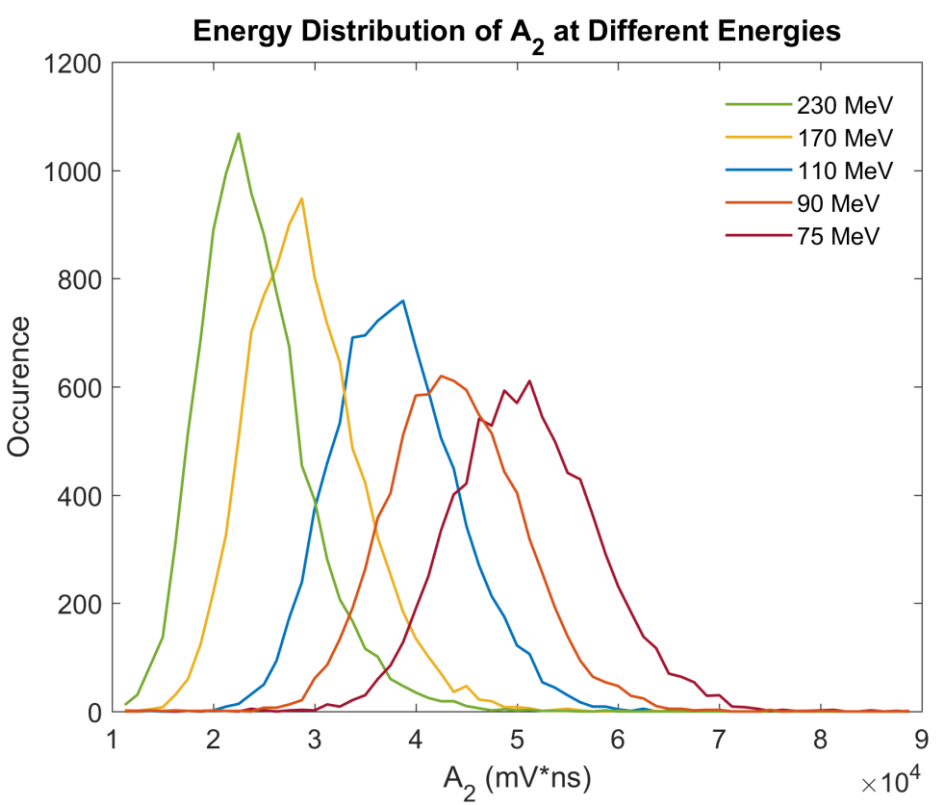


Scan of Beam Energy

Energy measured at bar ends

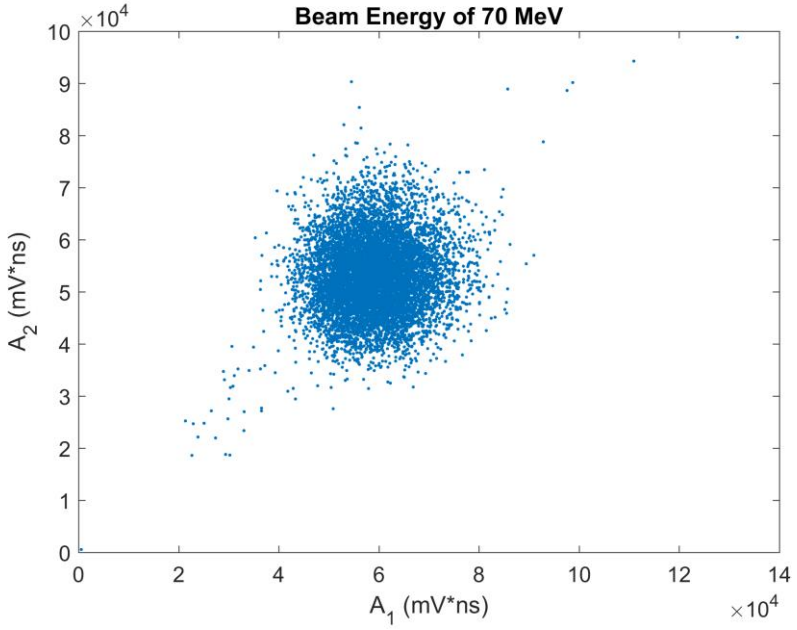


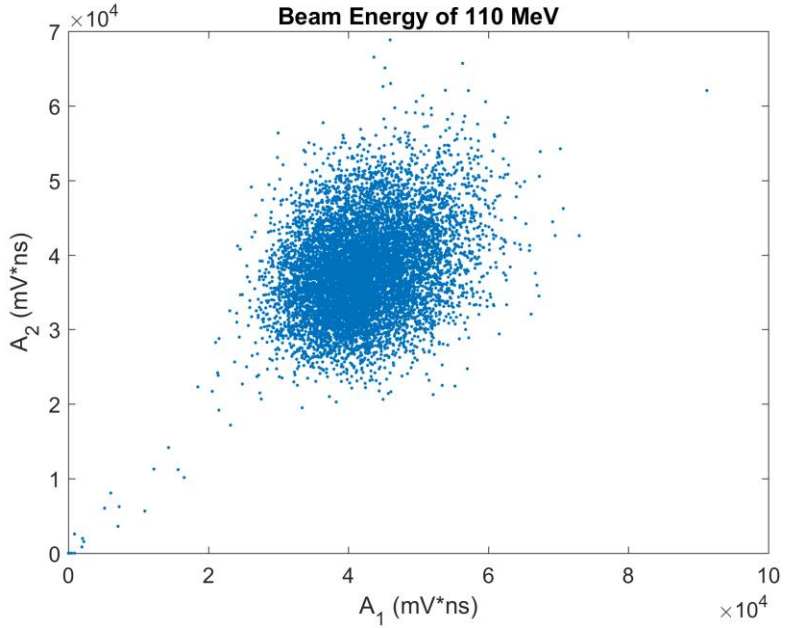
SiPM 1

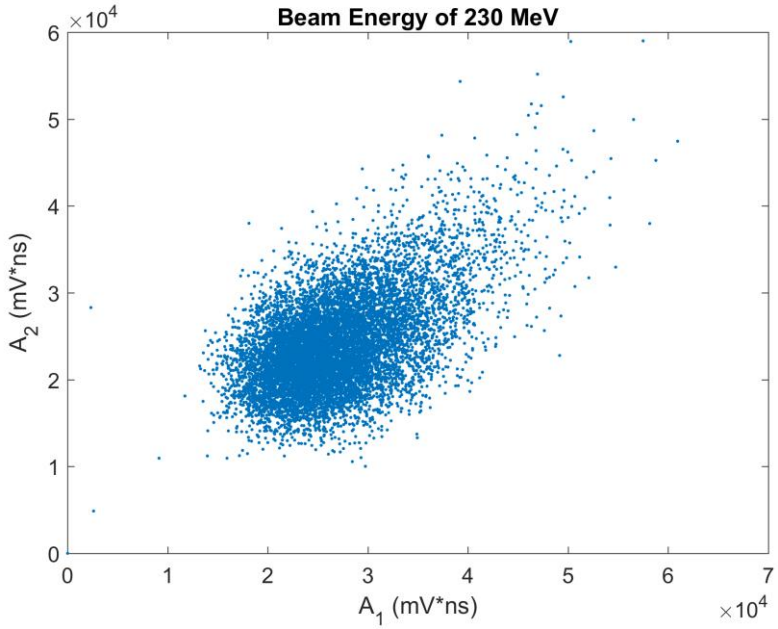


SiPM 2

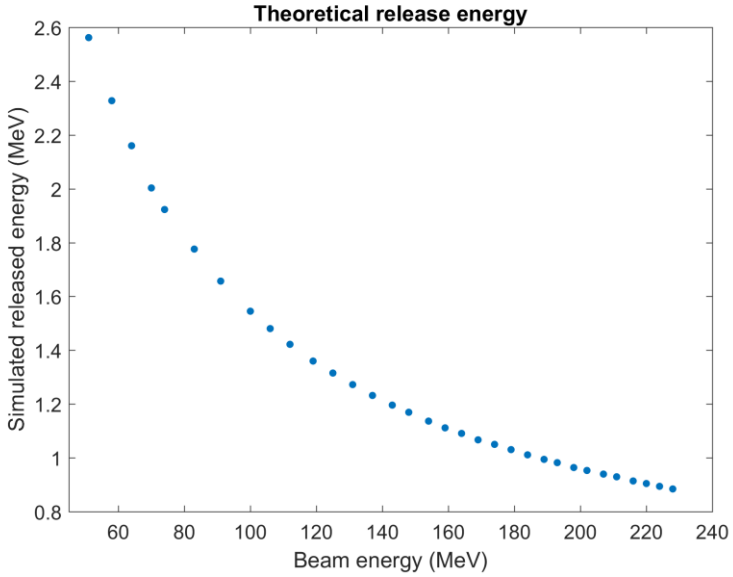
Scan of Beam Energy





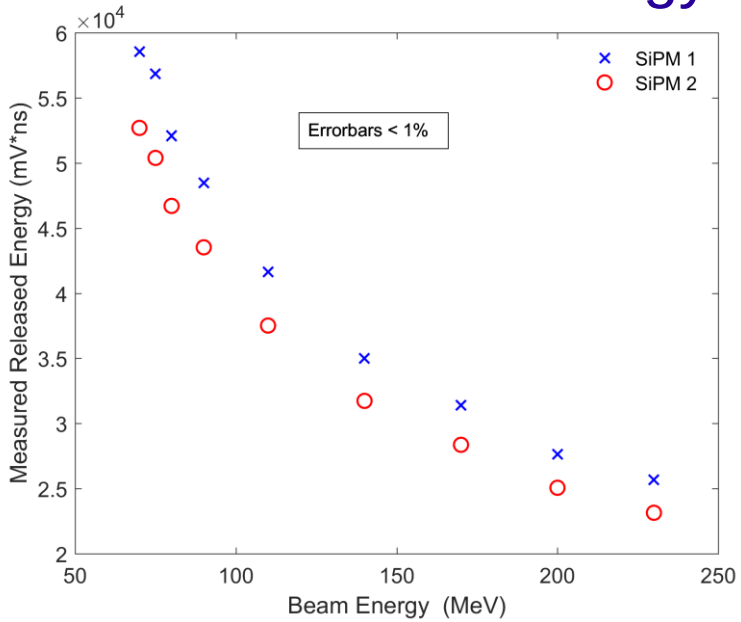


Scan of Beam Energy

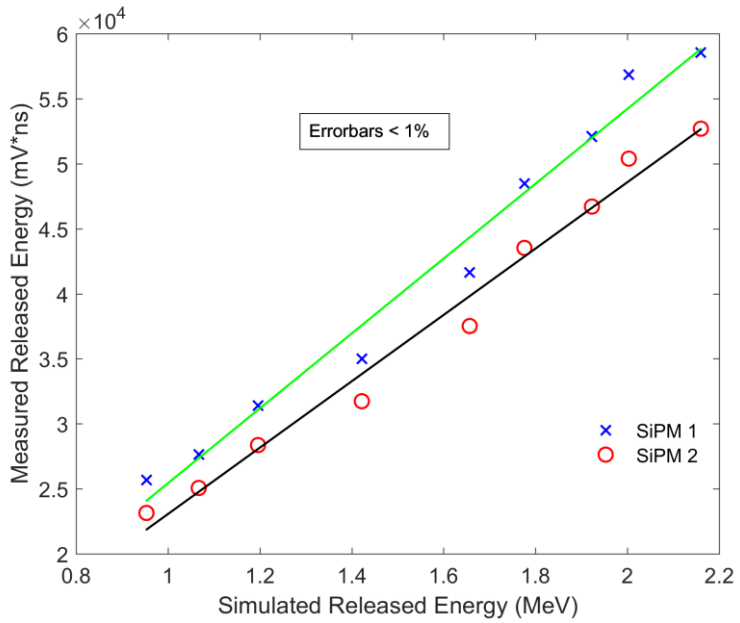


FLUKA Monte Carlo Simulation of the energy released in the bar for a given beam energy

Measured released energy

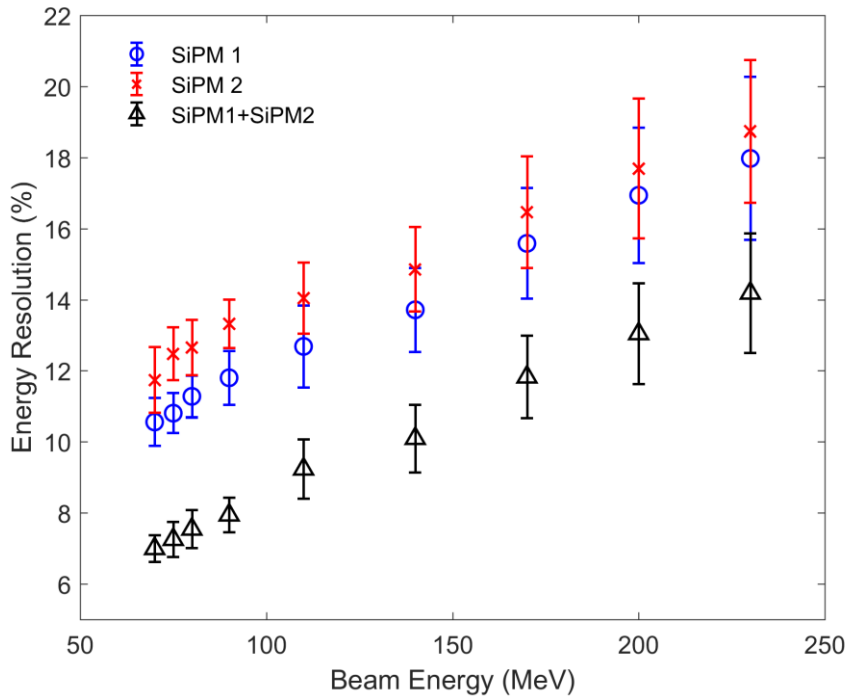


Measured vs Simulated

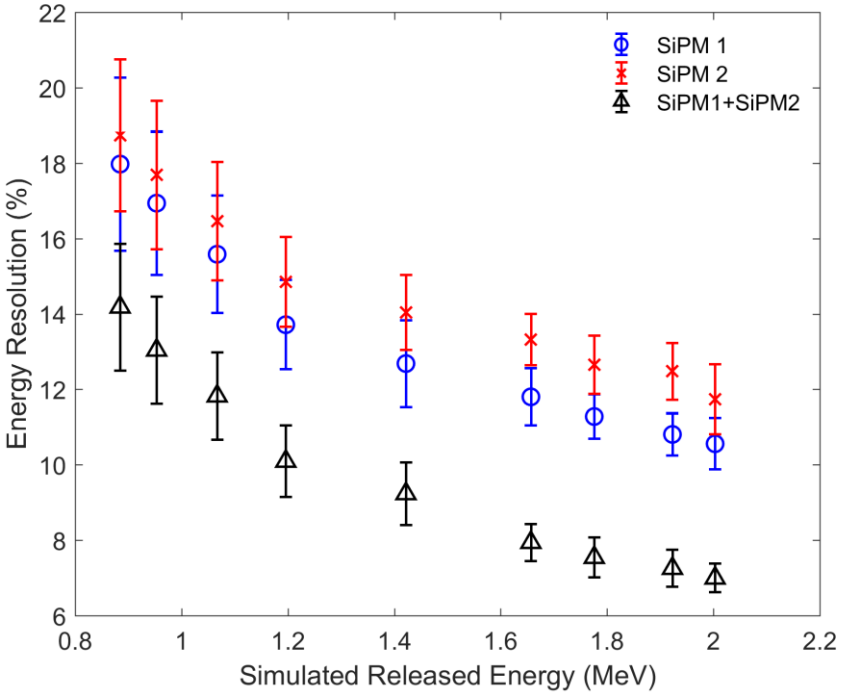


Scan of Beam Energy

Energy Resolution vs Beam Energy

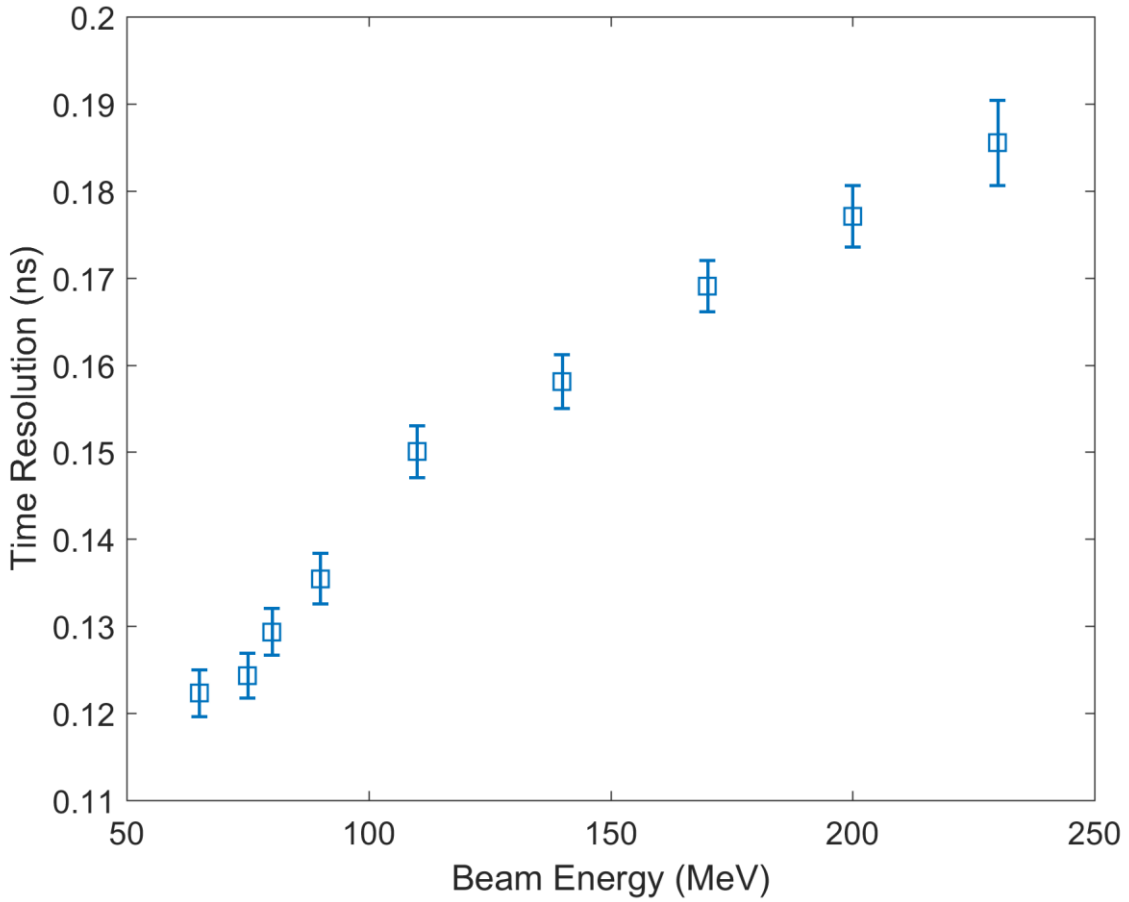


Energy Resolution vs Released Energy



Scan of Beam Energy

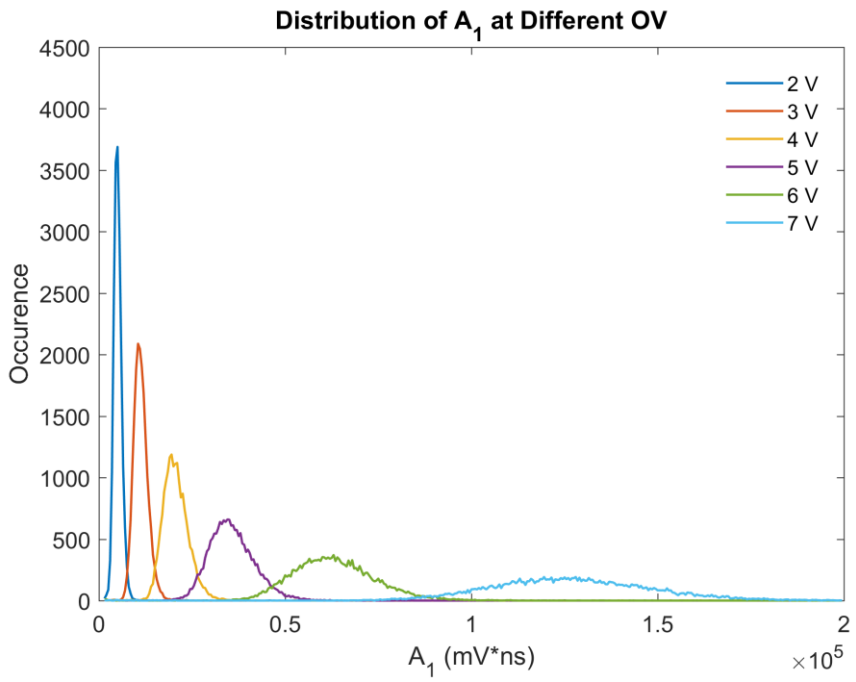
Time resolution between SiPMs and STS1



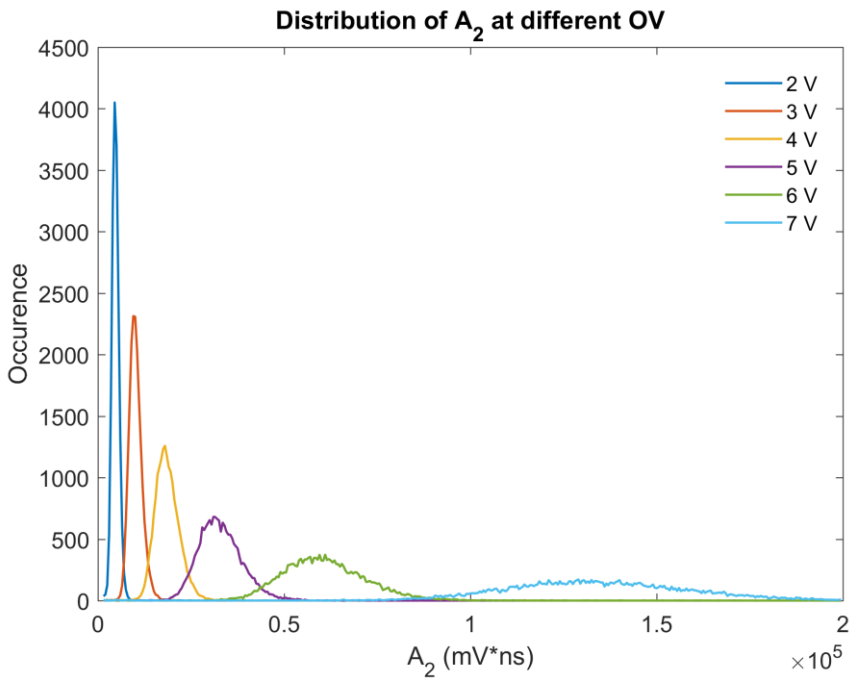
Scan of SiPM Overvoltage

Energy measured at bar ends

Beam energy 140 MeV



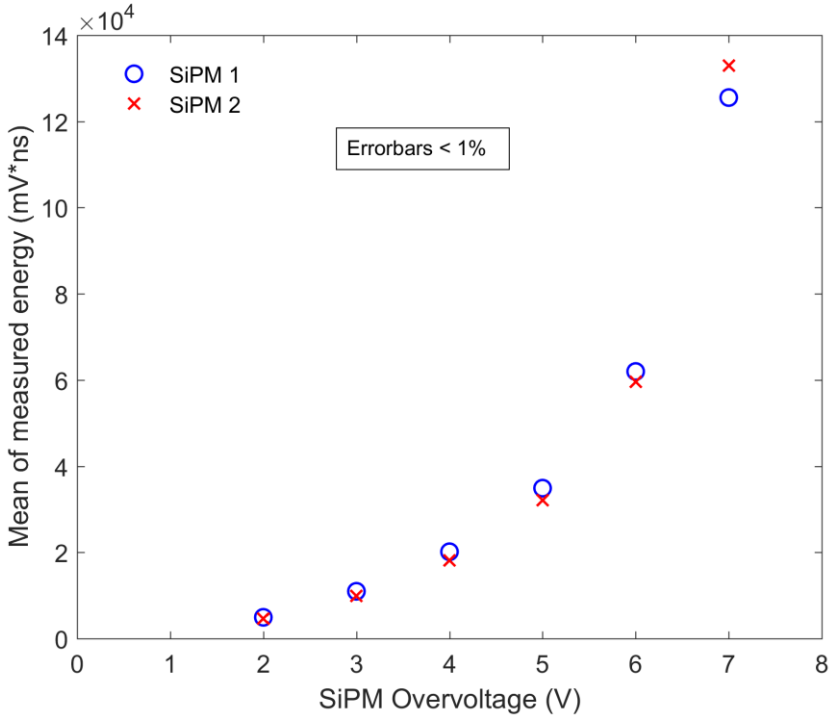
SiPM 1

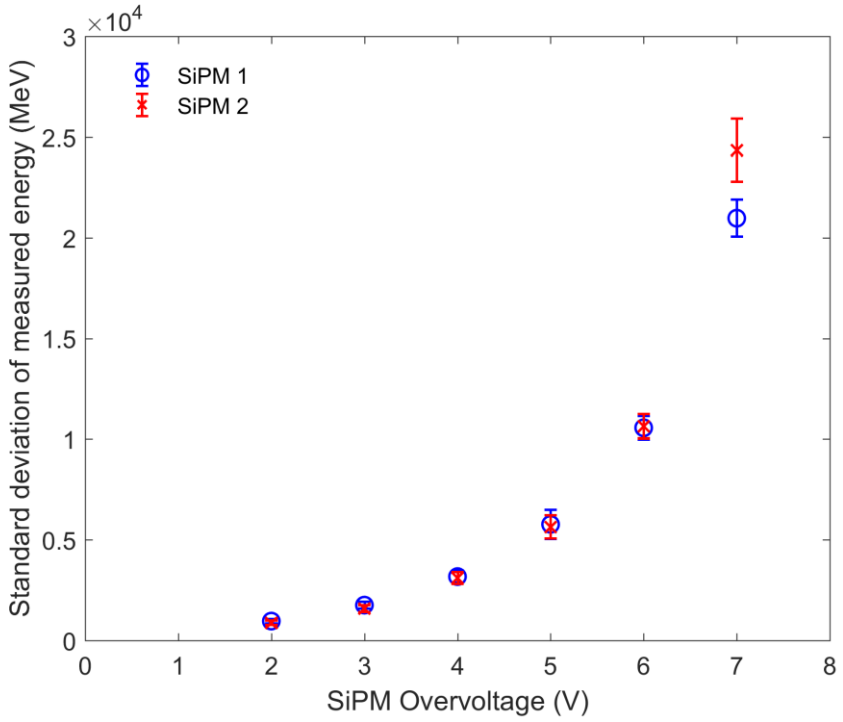


SiPM 2

Scan of SiPM Overvoltage

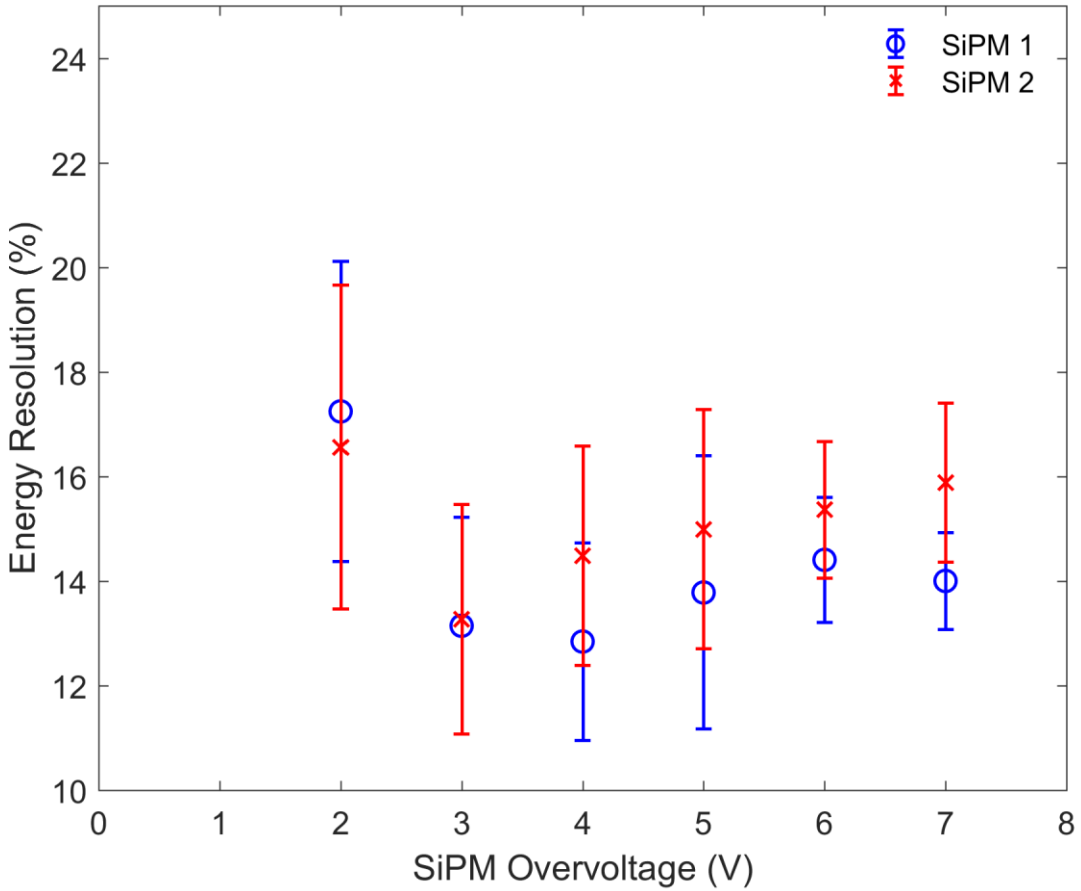
Mean and standard deviation of measured energy





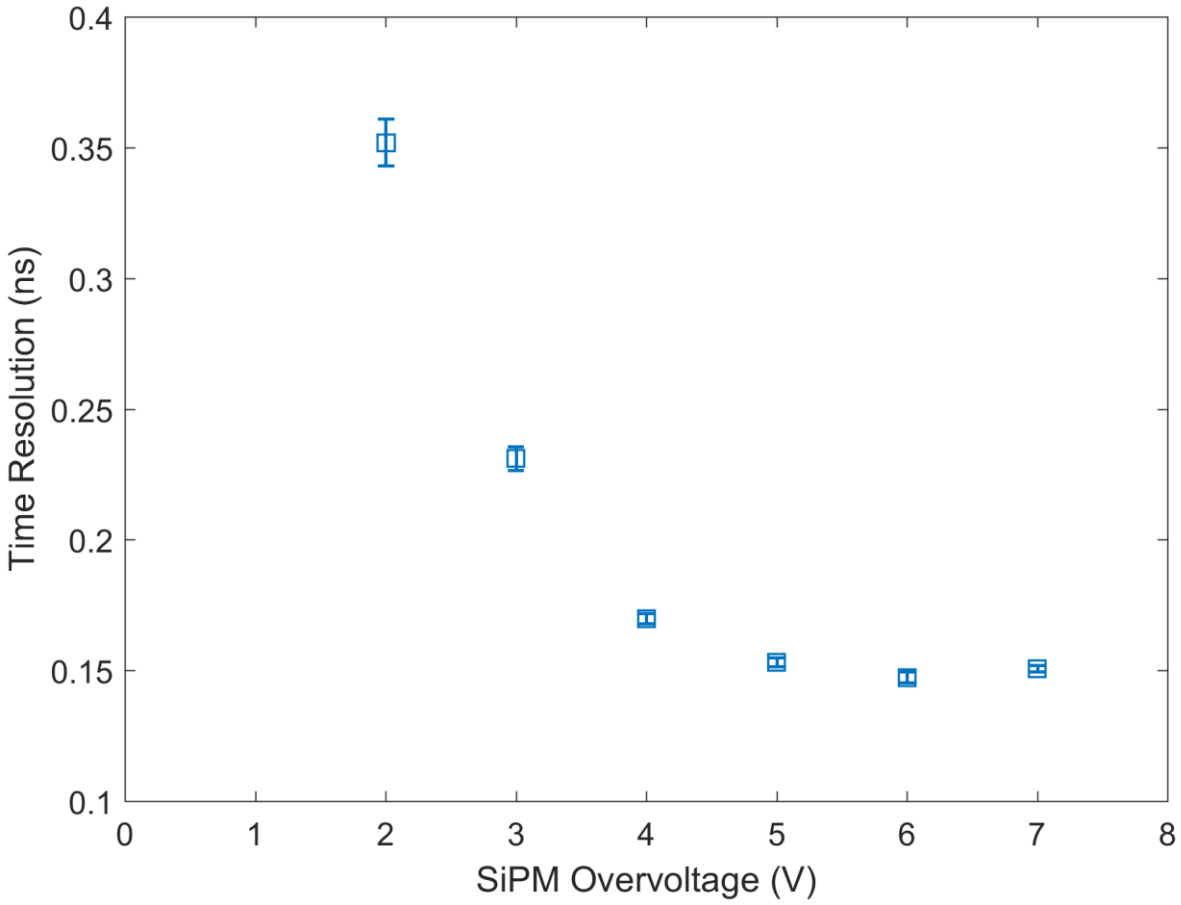
Scan of SiPM Overvoltage

Energy Resolution



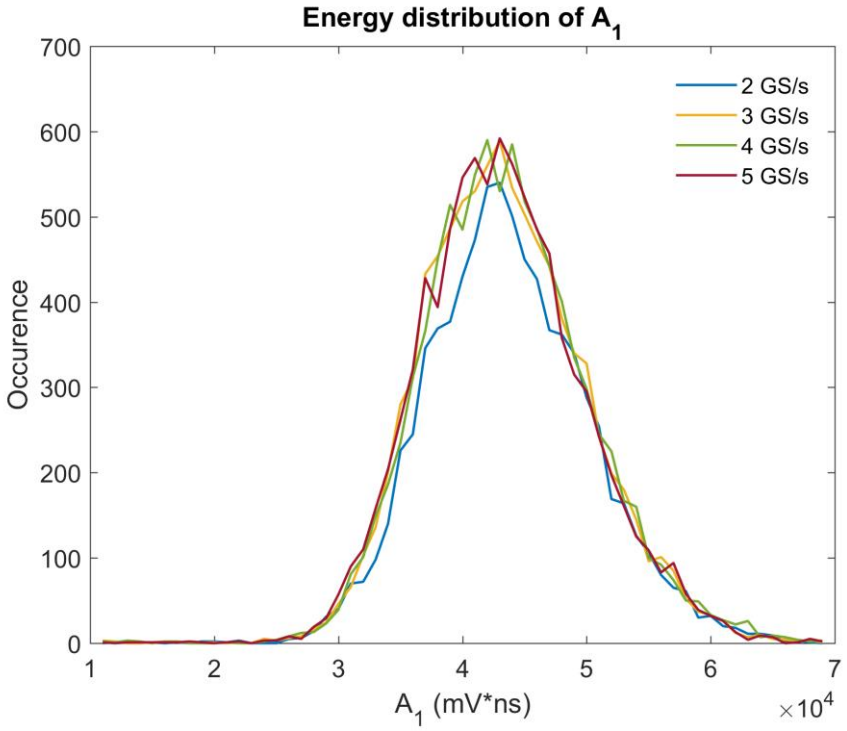
Scan of SiPM Overvoltage

Time resolution between SiPMs and average of 2 STS

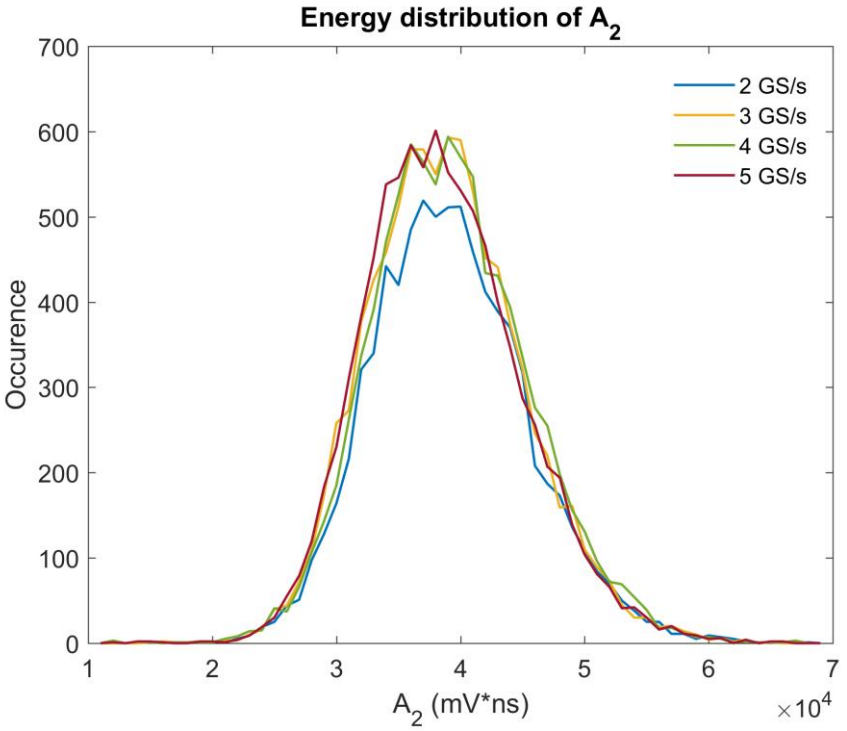


Scan of Sampling Rate

Energy measured at bar ends
Beam energy 110 MeV



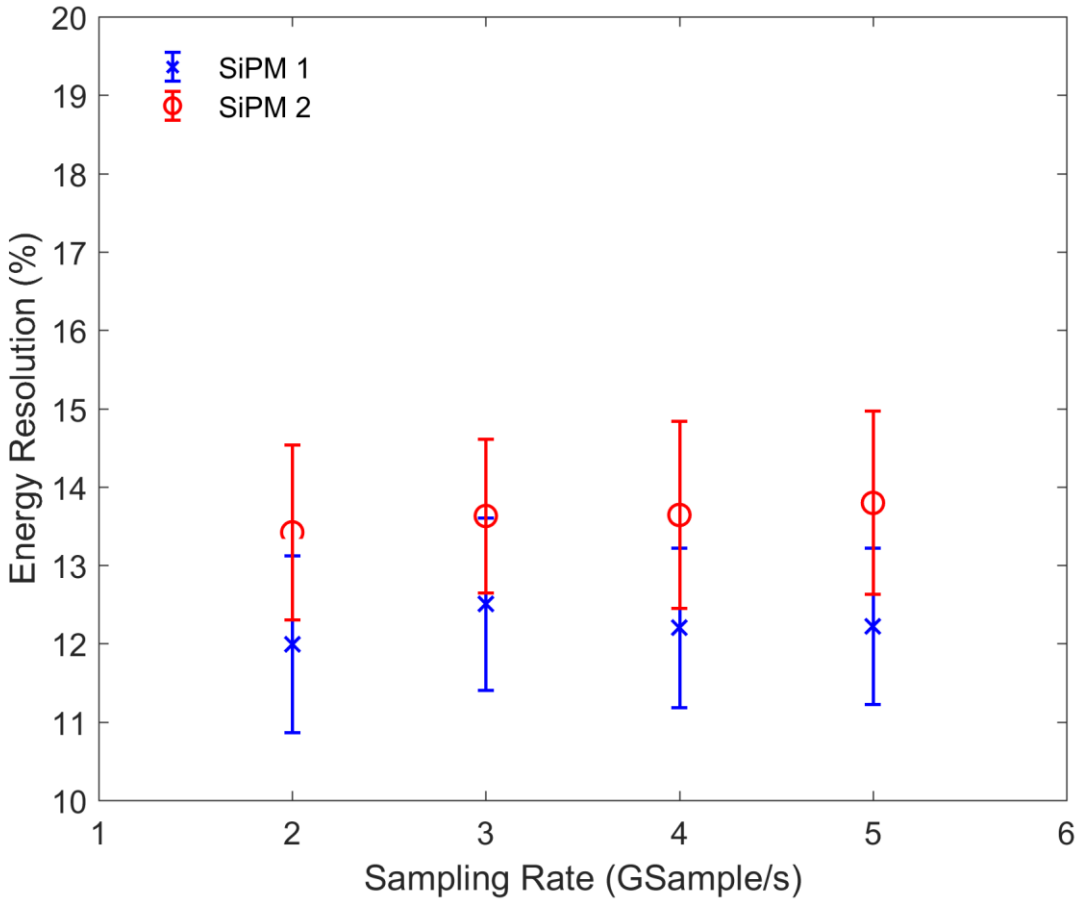
SiPM 1



SiPM 2

Scan of Sampling Rate

Energy resolution



Scan of Sampling Rate

Time resolution between SiPMs and STS1