Testing and Calibration of Silicon Strip Detectors

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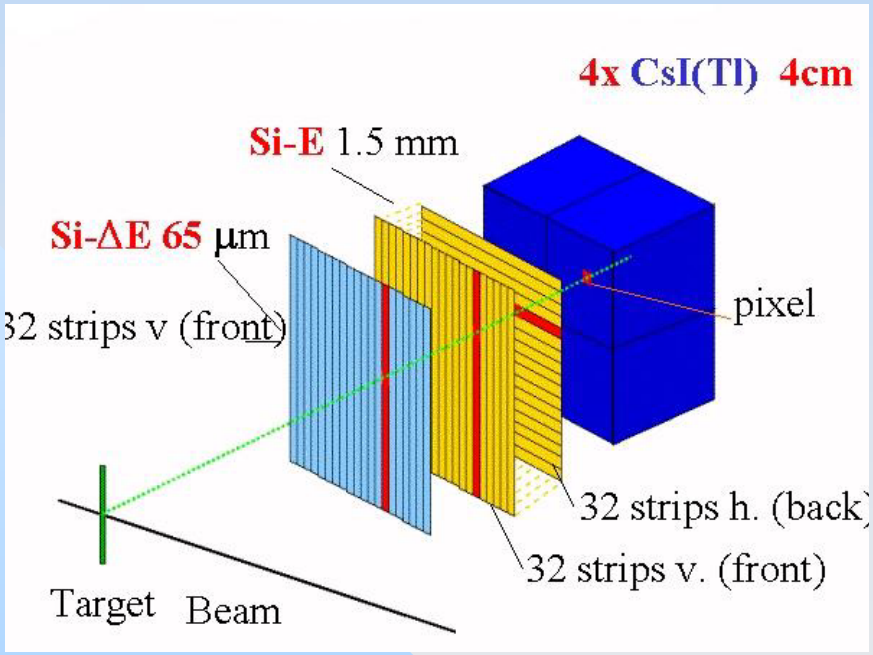
August 6, 2003

The High Resolution Array

- 20 telescope array
- One thin, single sided silicon strip detector, one thick, double sided
- 4 Thallium-doped CsI (Tl) detectors

A Look at HiRA

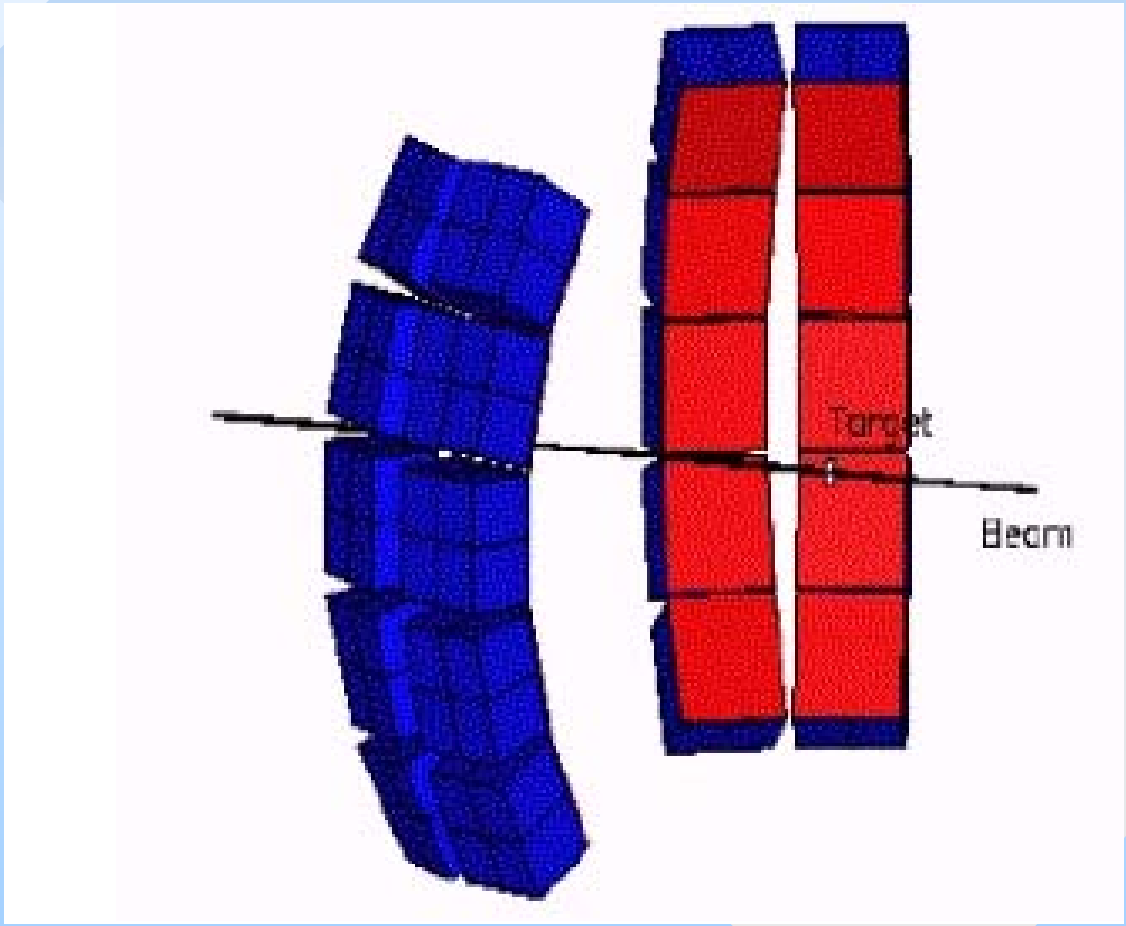


http://groups.nscl.msu.edu/hira/hira/HiRA-homepage.htm

Why HiRA?

- The High Resolution Array is versatile:
- Detects alphas, deuterons, protons, isotopes through neon (Z=10)
- Transfer reactions, resonance spectroscopy, multi-fragmentation, etc.
- Various configuration capabilities

A Look at HiRA



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Silicon strip detectors

- Semiconductor detectors
- Excitation of electrons produces signal
- Electrons "migrate" towards the anode while holes move towards the cathode via and electric field
- Signal detected by the electronics of the detector

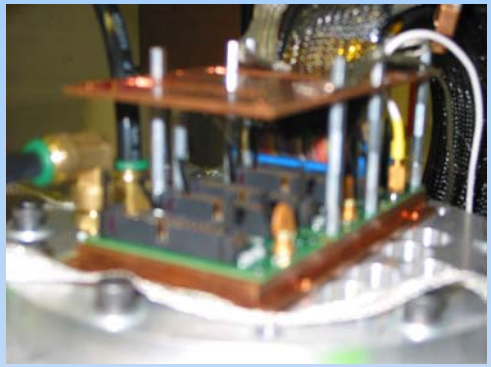
The two problems:

- Sometimes the deposit of a particle in the silicon results in energy being detected on two neighboring strips
- Why does this occur?
- Occasionally it has been seen that the signal of a particle on one strip corresponds to a signal of opposite polarity found on a neighboring strip
- Why does this occur?

The Experiment

- Thin sided silicon detector
- 5.4 meV Am 241 alpha source
- Each set of channels sent through individual preamplifiers, shapers, and discriminators and digitized to be read as spectra.

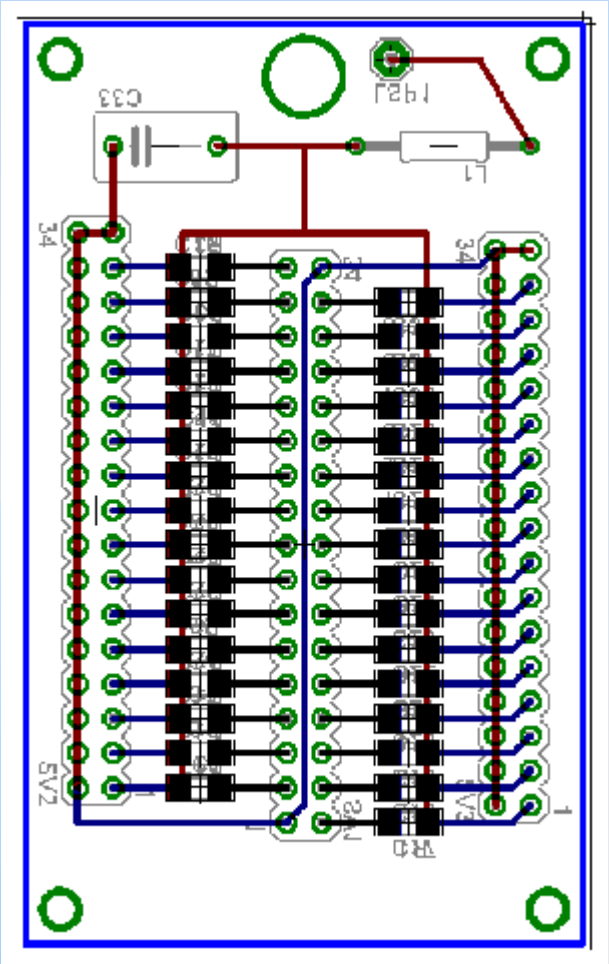
Splitter Boards



- Shapers have inputs of 16 channels with a ground for each
- Silicon has 34 channels: 32 signals and two ground
- Splitter boards divide 34 channel signal into two groups of 16 with a ground for each
- Convenient layout for testing “the two problems”

The Splitter Boards

- Even

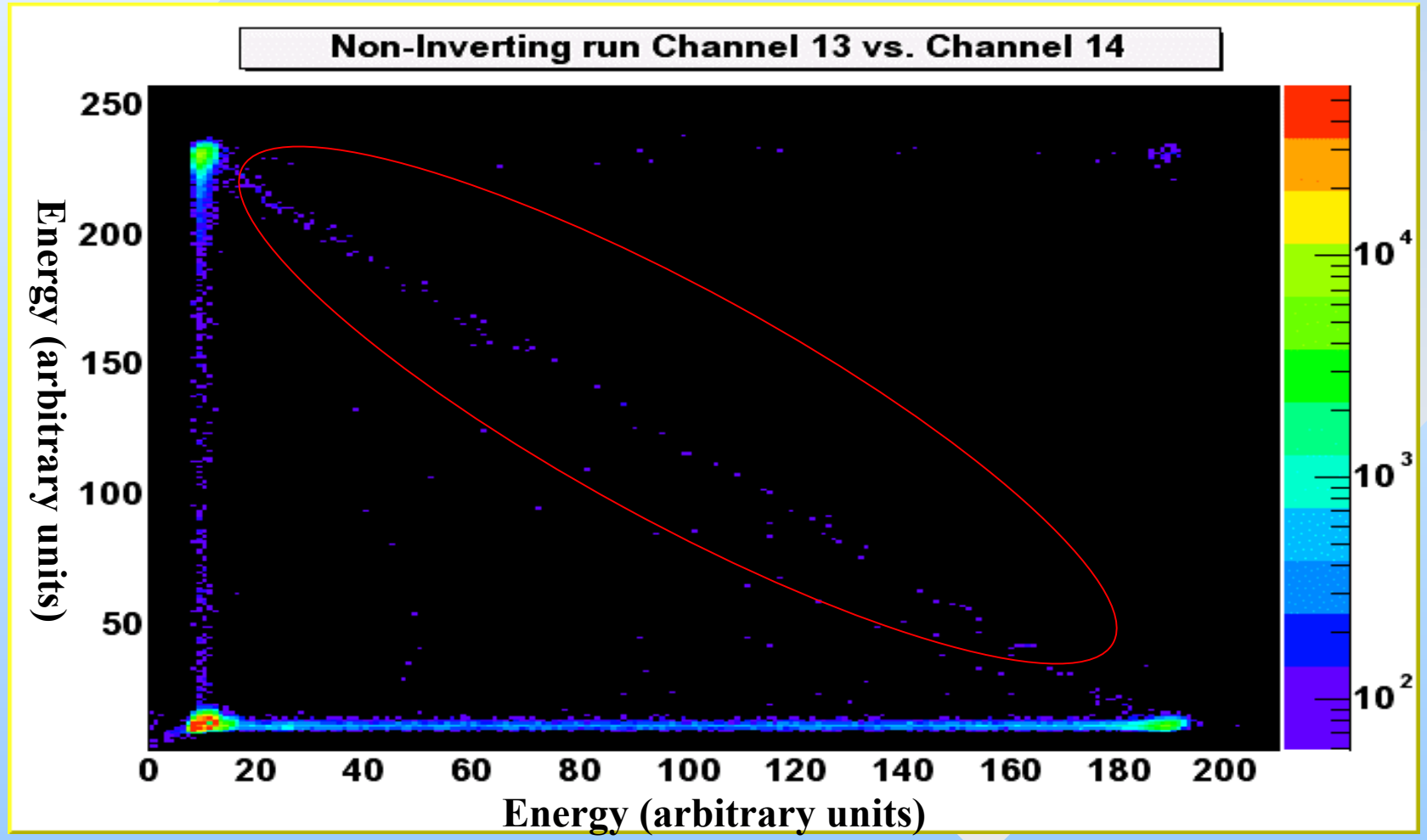


- Odd

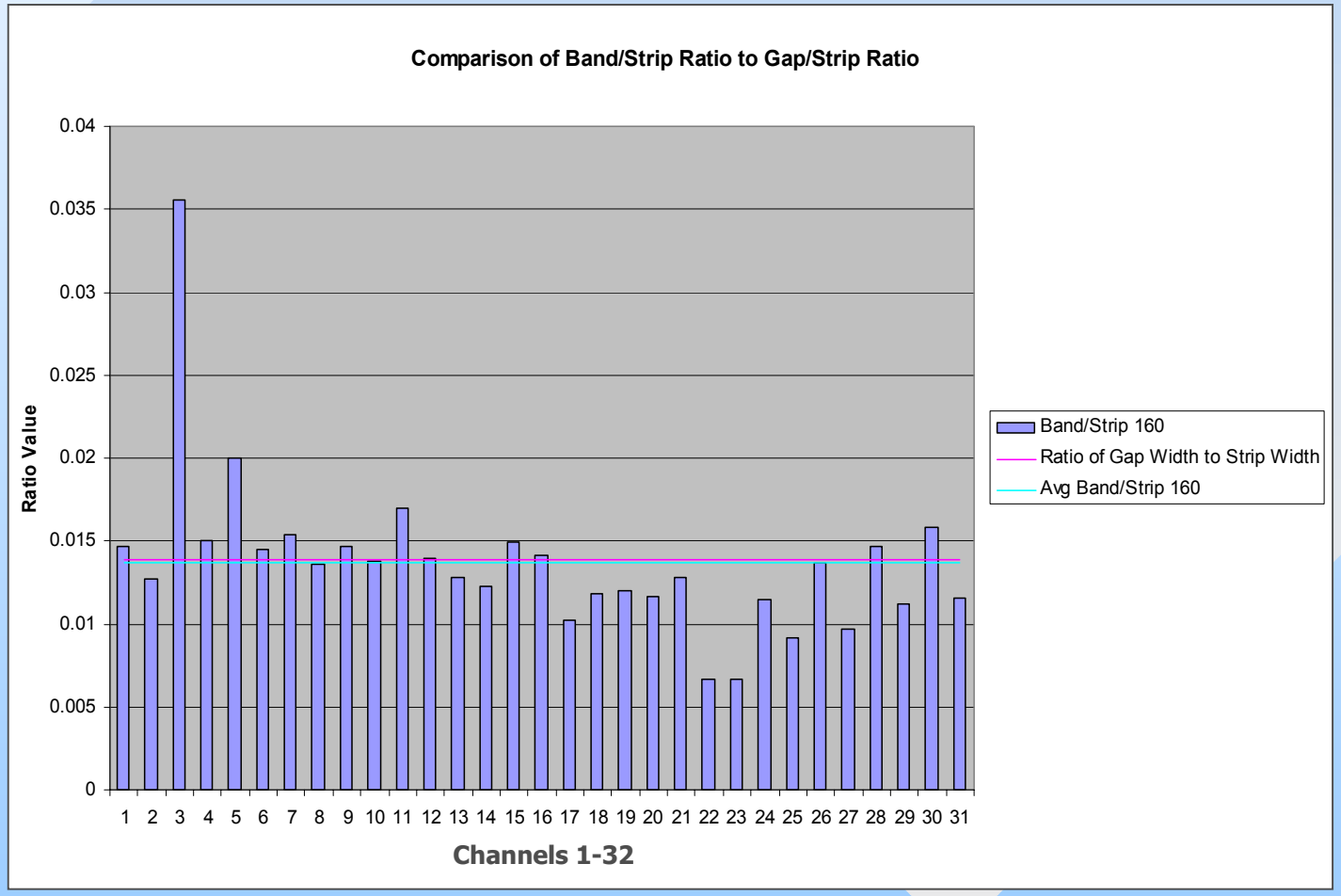
The Presence of Charge Splitting

- Two non-inverting shapers for both sets of 16 channels
- Spectrum created that plots neighboring strips versus each other
- Look to see if energy from one signal was deposited on two strips…….

The Presence of Charge Splitting



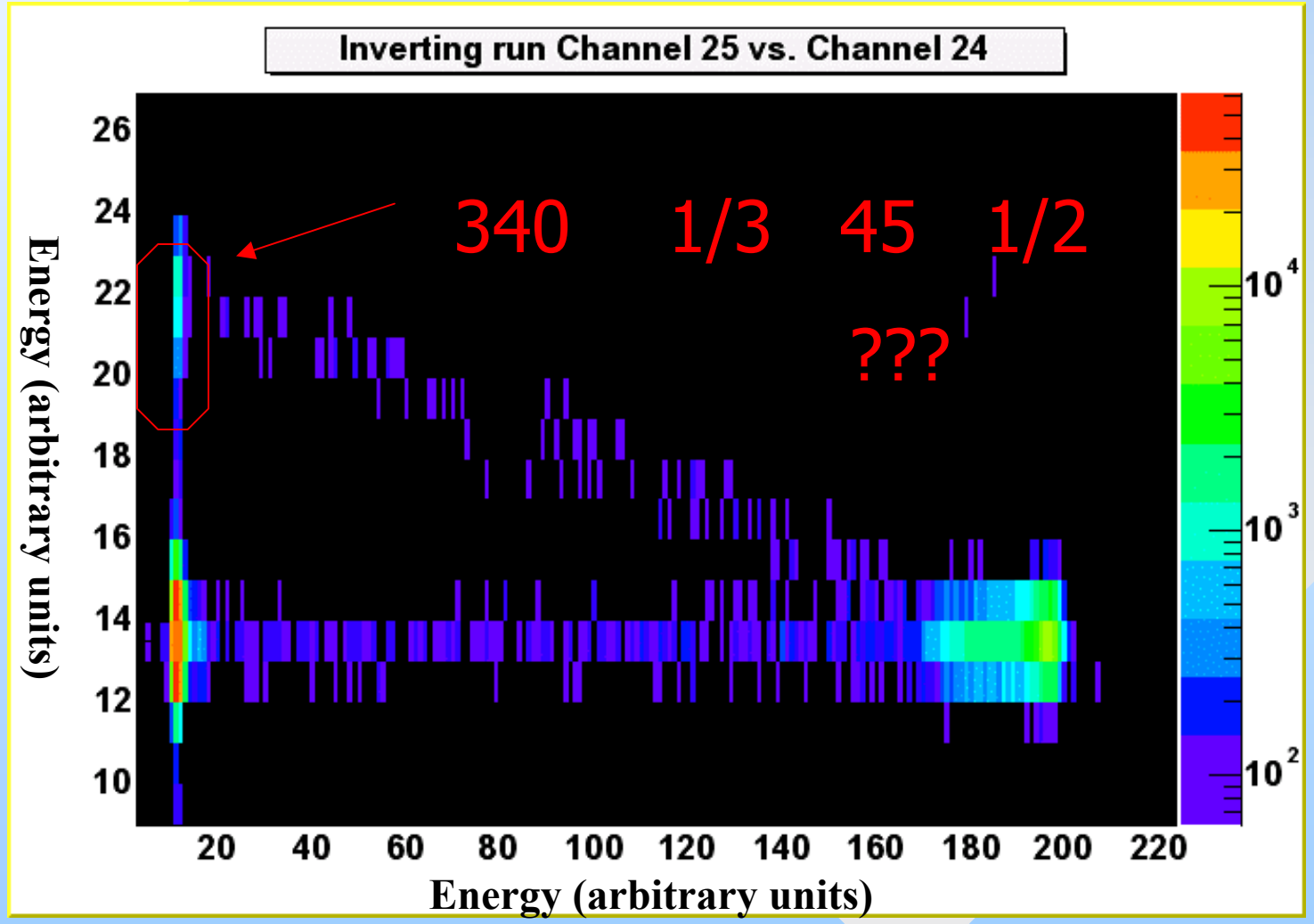
- A comparison of band counts/strip counts versus gap width/strip width shows there is a correlation between the two



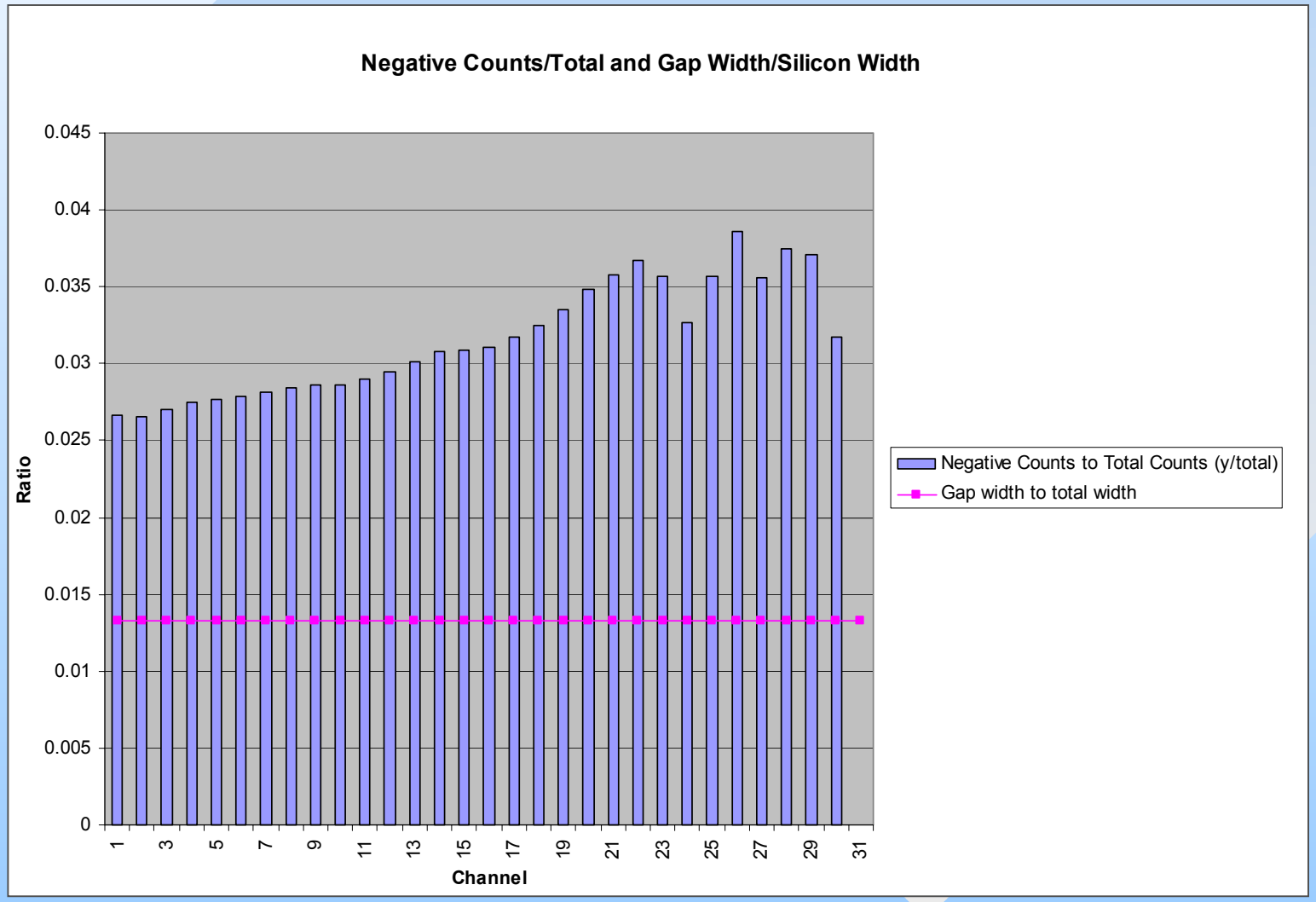
Opposite Polarity Signals

- A second spectrum was taken using one non-inverting shaper and one inverting shaper
- The inverting shaper inverted any opposite polarity signals occurring on that set of 16 channels
- Look to see if any signals are present from that set of channels…….

Opposite Polarity Signals



Ratios of opposite polarity counts/total and gap width/silicon width did not correlate well



Conclusions

- A correlation was found between the signals appearing on neighboring strips and the gap to strip ratio
- Opposite polarity signals were found to appear on the thin silicon detector
- No relationship was found between the presence of opposite polarity signals and the gap to strip ratio
- More study is needed!!

Acknowledgements

- Dr. Bill Lynch, Dr. Mike Famiano, and Mark Wallace for their expertise and guidance during this project
- The National Science Foundation
- Dr. Stump and Michigan State University