Analysis of the test run on the Catania detector from ST Electronics

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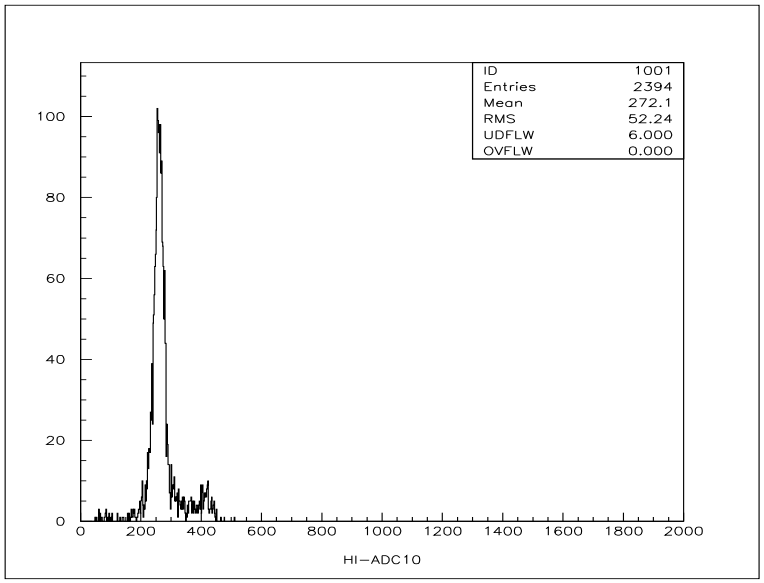
First what is expected? The test detector consists of 5 1um dE pads deposited on a substrate of thick (300um?) Si. The test beam was Ne21 ions at 270 keV/u. SRIM predicts a loss of ~1.8 MeV in the 1um dE pad and 3.6 MeV in the E. Range is 4um.

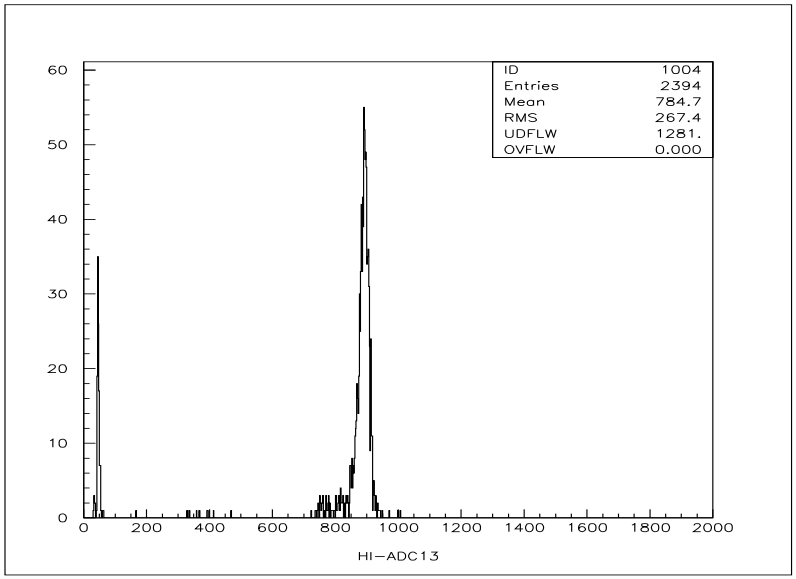
The tests with the pulser show that the 0 offset is ~ch35. The gains on all outputs are about equal, with worse resolution on the dE as expected from the capacitance. While the histogram range changed from 1000 to 2000 channels this does not affect the width and offset.

- dE resolution of <2%. This is better than expected and should be sufficient for separating the isobars.
- 7% resolution on the full energy.
- The E channel only registers in ch 260, 25% of the dE energy, instead of twice as expected.

This can be seen in e_10955.eps, de_10955.eps, ede_10955.eps.

- In the E spectrum there is a small high energy peak at ch 420 which might be due to events that miss the dE pads. This identification is strongly supported by the anticorrelation with dE in ede_10955.eps The difference of 160 channels is inconsistant with the peak at 890 in the dE spectrum.
- The peaks at ch 420 and 260 are consistant with SRIM if there is a large loss in the E collection leading to an apparent much reduced gain.


ID 1001
Entries 2394
Mean 272.1
RMS 52.24
UDFLW 6.000
OVFLW 0.000
HI−ADC10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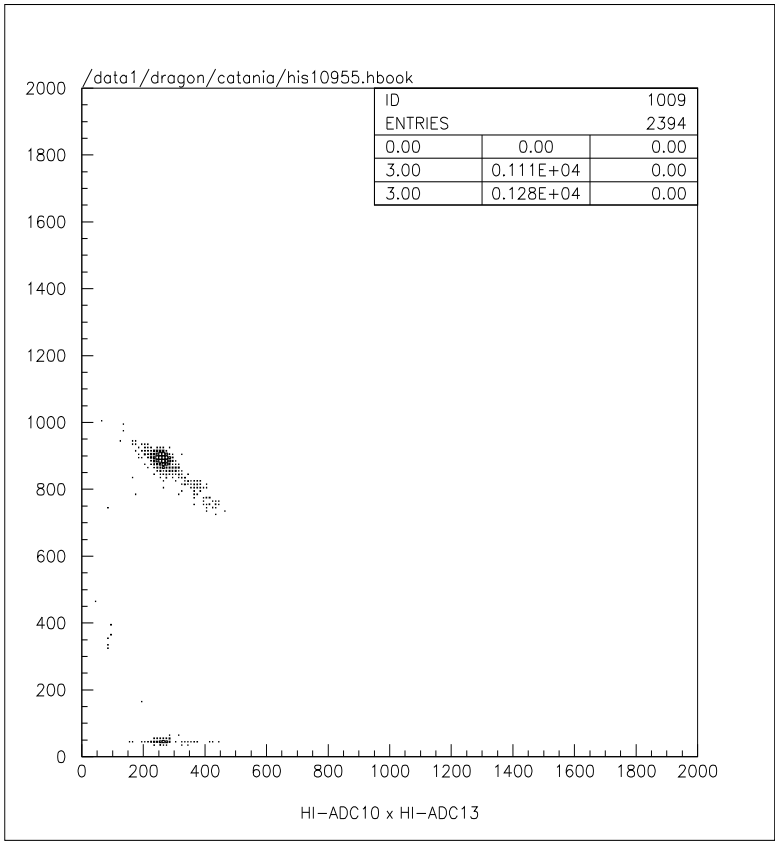
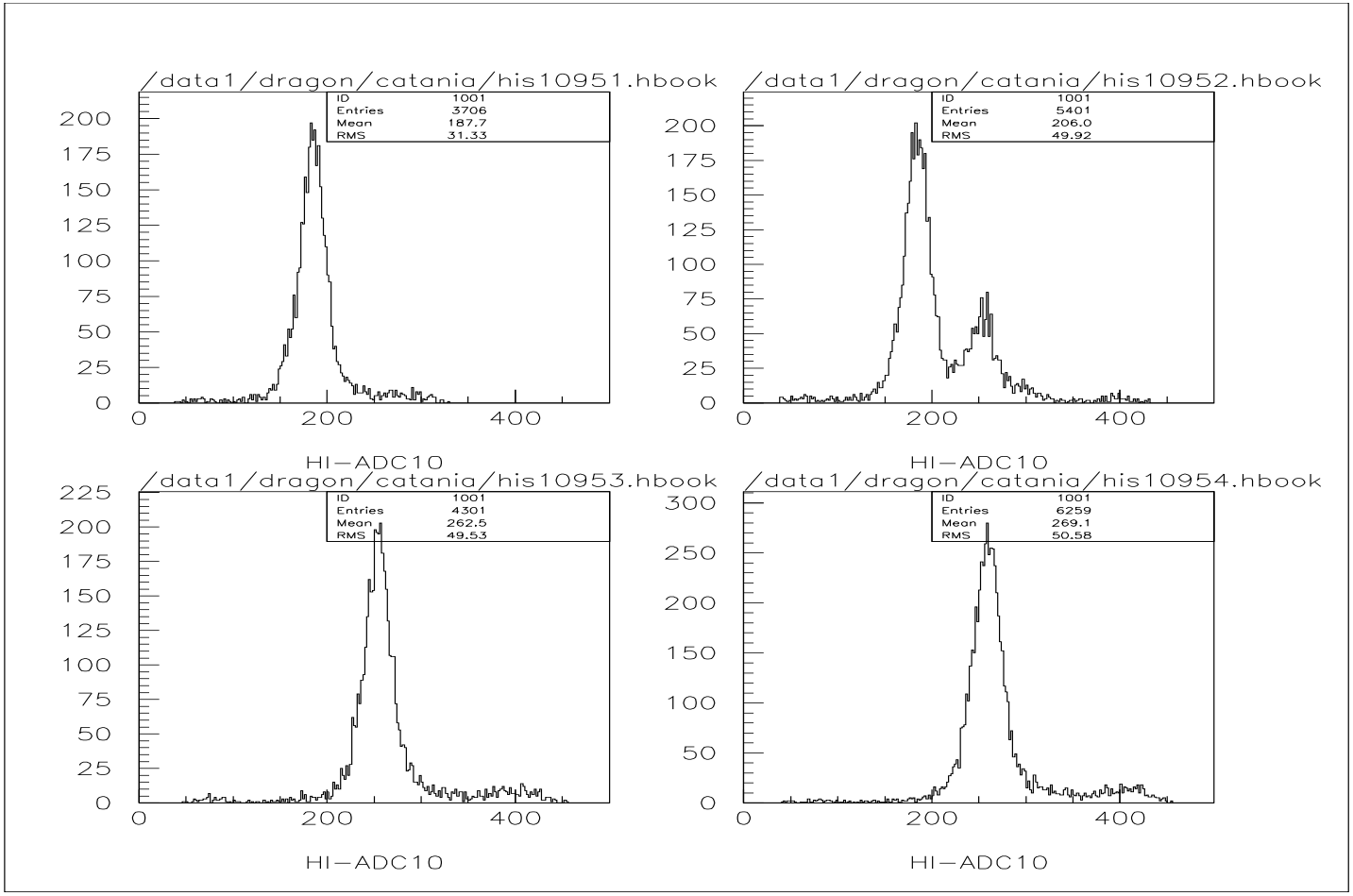
OVFLW 0.000
HI−ADC13


/data1/dragon/catania/his10955.hbook
ID 1009
ENTRIES 2394
0.00 0.00 0.00
3.00 0.111E+04 0.00
3.00 0.128E+04 0.00
HI−ADC10 x HI−ADC13

The evidence is that we may have been getting poor charge collection from the E because of some defect in the detector. In biaschange.eps you can see histograms of Ne21 beam as we applied the bias. There is a considerable change in amplitude which seems to have occurred suddenly during the 30v run, with no apparent problems with bias current.
In comparison look at the resolution achieved previously with alphas, cat59_e.eps, while with alphas on a detector that could not hold bias we got
2% resolution.Cooling the detector reduced the gain 20% but did not help the resolution.
Another possibility is that we have a 3um Si equivalent dead layer on our detector so that the ions barely reach the E layer, or that the pads are 3um thick. This is inconsistant with the ch420 peak that we identify as ions in the area between the pads.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RMS 31.33
HI−ADC10
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ID 1001
Entries 5401
Mean 206.0
RMS 49.92
HI−ADC10
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ID 1001
Entries 4301
Mean 262.5
RMS 49.53
HI−ADC10
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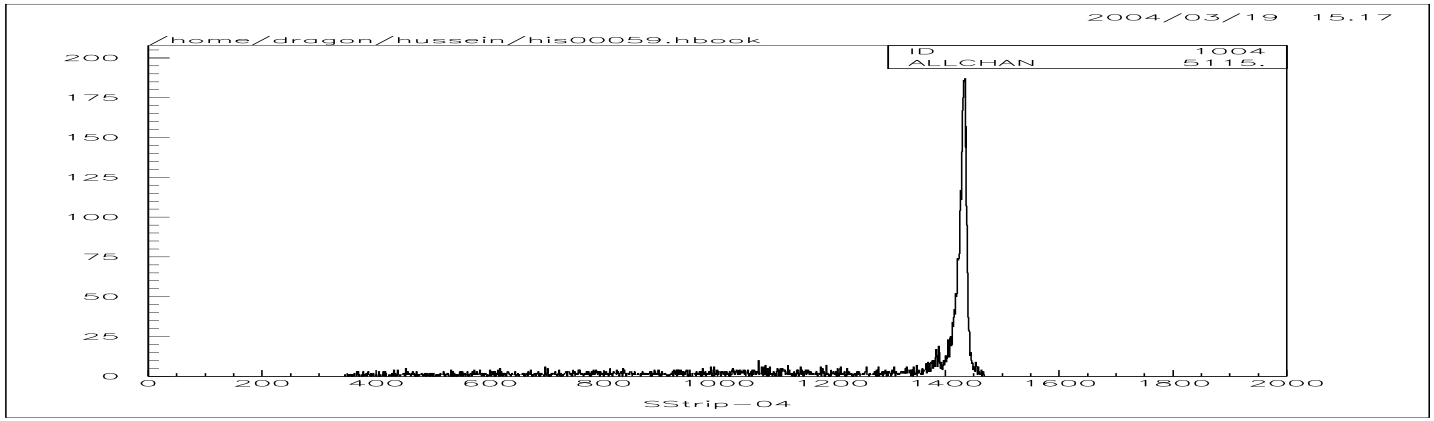
ID 1001
Entries 6259
Mean 269.1
RMS 50.58
HI−ADC10


2004/03/19 15.17
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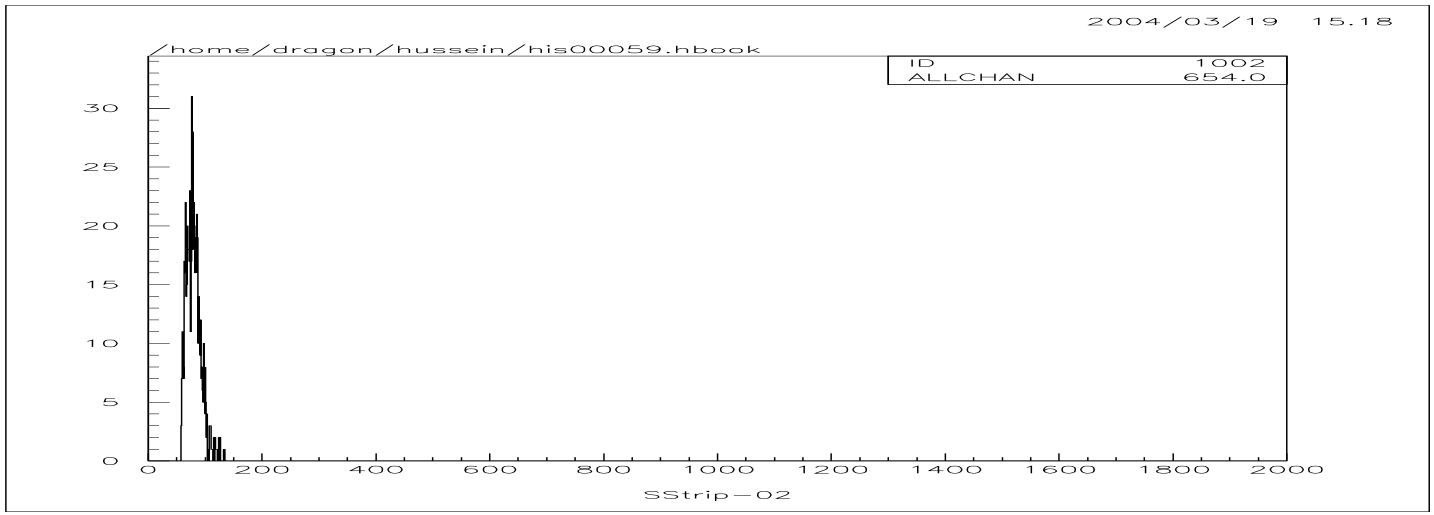
SStrip—04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/home/dragon/hussein/his00059.hbook
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ALLCHAN 654.0
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25
20
15
10
5
0
0 200 400 600 800 1000 1200 1400 1600 1800 2000
SStrip—02

The behavior with source tests is very odd. The package contains 2 detectors, and we instrumented only one. The second could be tested by unplugging the detector and inserting it in the socket in the opposite direction.

We started source tests with det1 until it mysteriously stopped holding bias.Ahmed's source studies worked with det 2. Just before the beam test, det2 stopped holding bias and we switched back to det 1, which now held the bias. After the beam test det1 stopped holding bias. It's not likely a problem with the plugging into the board because the failures occurred in situ.

The best timing resolution measured against the MCP, at full bias voltage, was 6ns. For the measurement we use the E signal. The timing depended very strongly on bias, and poor charge collection would have compromised this result.

In conclusion, acquiring and testing a new detector is recommended. ST and Catania lab should be asked whether they had experienced such odd failures.