CH/doc/97/03

Document

PSD Resolution Notes

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Date: 26 August 1997

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This document details some very brief tests on resolution of PSD ‘‘E’’ signals comparing the signals from different amplifiers. The possibilities for improvement are considered.

Test:
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3 line alpha source (near 5 MeV) at GANIL (experiments E281/E259) using ‘‘Nobby’’ preamps and 500 um Eurysis detector (#1376) at +120 V Bias. 1MOhm Bias resistor, 270 Ohm offset resistors. The Charissa amplifiers used were the modified ones as detailed in report CH/doc/97/02.

Results:

Amp	Shaping (uS)	Resolution (KeV)
Charissa ‘‘Old’’	3.6*	111
Charissa ‘‘New’’#1 in crate	3.6*	127
Charissa ‘‘New’’#32 in crate	3.6*	139
Ortec 571	3	96
Ortec 571	6	80

*As calculated by comparison to Ortec pulse shape

Model Results for Capacitative noise

For 0 pF expect 3.7 keV noise using an Ortec amplifier at 2uS.

for 500 um detector --> capacitance = 0.21pF / mm2
=> 525pF for 50mmX50mm 2D PSD'S

@1uS shaping   noise=30eV/pF => 15.75 keV
@2uS shaping   noise=22eV/pF => 11.55 keV

Assume we have capacitance contributions from detector as above = 525pF. What about the cabling? Guess around 3m cable. For screened ribbon as inside chamber at GANIL have 131 pF/m between neighbouring conductors. For RGB178B/U as used in SPGC 41 pin cabling for ANU have 96pF/m. Guestimate contribution to capacitance from cabling =3m X 131pF/m = 393 pF. This implies Total capacitance = 918 pF. Take 30eV/pF as order of magnitude estimate gives around 30 keV resolution due to capacitative part of noise. This compares with the same order of magnitude for measured values above. At 6uS expect to be a factor of 2 better for this noise contribution than at 3uS. This looks roughly true...

For the Ortec 571 ...
@3uS 30 keV (capacitative) + 70 keV (other)
@6uS 15 keV   + 70 keV

Conclusions

These noise contributions are SMALL when considering heavy ions. Yes, a better amplifier will do better. The Ortec amp is better able to filter the noise in the particular environment found in these tests. A cheaper solution is to reduce length of cables (up to a factor of 2 improvement can be gained) , investigate preamp performance and use thicker detectors. ''Reasonable'' long time constants should be used but extending the time constant >6uS would seem to have a minor effect in improving noise but a major problem for peak detection. Charissa amplifiers with the simple pulse shaping are roughly a factor of 2 worse i.e. up to 60 to 70 keV from capacitative noise effects. Proper detailed measurements are required.

Note

The capacitance of strip detector + 3m of cable is about the same as

Sheet detector + no cable. So we shouldn't be surprised that both of these combinations give similar results at ANU!