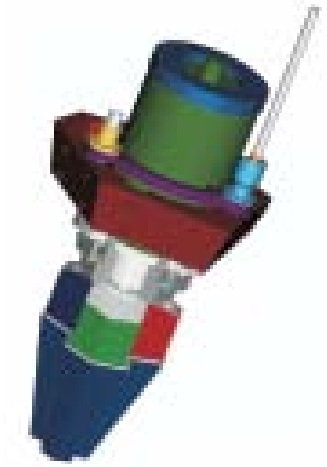
C001 Coincidence Scanning in Liverpool

AGATA Bonding Meeting –
University of Liverpool,
Oliver Lodge Laboratory, Nov 09



Timeline of Measurements (Part 1)

Measurement	Started	Finished
Post-repair Diagnostics		9/6/09
Energy Calibration on Digital System	11/6/09	12/6/09
^{60}Co Proportional Crosstalk	12/6/09	14/6/09
Energy Calibration on Scan Table (CAEN HV)	15/6/09	17/6/09
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Front Face Singles Scans at 4000 – 2000 V Bias	23/6/09	26/6/09
Full Bias (4500V) Front Face Singles Scan	26/6/09	2/7/09
Coincidence Scan with CAEN HV Supply	3/7/09	2/9/09
Front Face Singles Scans at 50 – 1500 V Bias	3/9/09	8/9/09
No Trace Singles Scan For Alignment	10/9/09	11/9/09

Timeline of Measurements (Part 2)

Measurement	Started	Finished
Gain Matching for Core with ORTEC supply	12/9/09	12/9/09
Coincidence Scan with ORTEC HV Supply	13/9/09	3/11/09
Alignment Tests	3/11/09	5/11/09
Plane Illuminated Data	6/11/09	9/11/09
^{137}Cs Side Singles Scan	11/11/09	19/11/09
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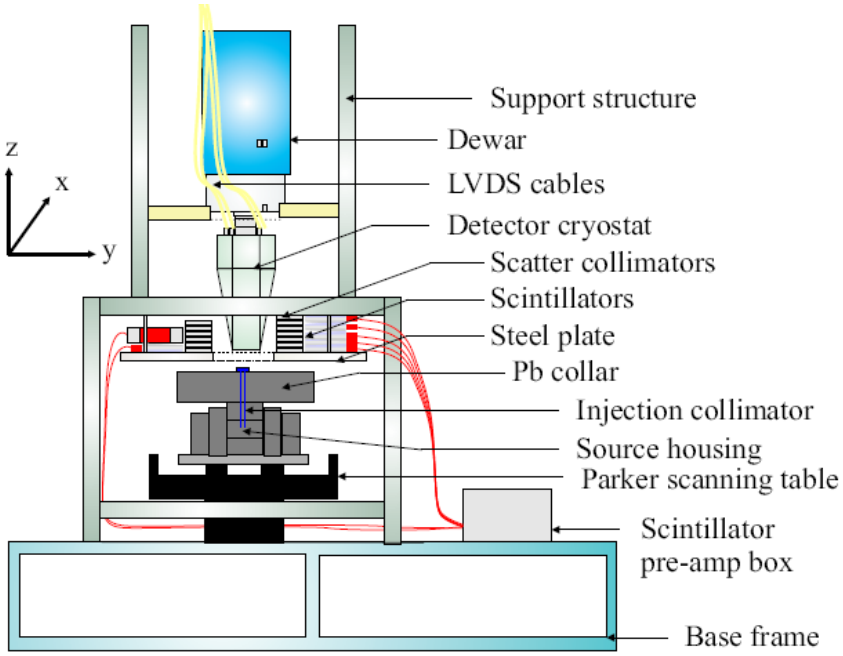
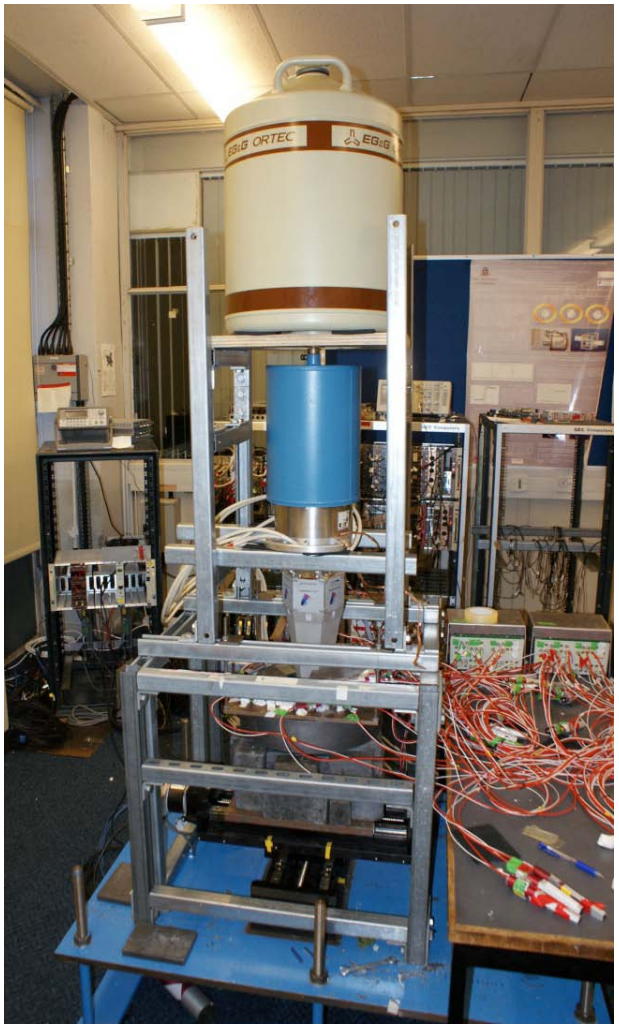
^{60}Co Flood Measurement for Prop & Diff Xtalk	21/11/09	23/11/09
^{60}Co and ^{241}Am Prop Xtalk Measurement	23/11/09	Ongoing
^{241}Am Front Face Singles Scan		

AGATA Scan Setup

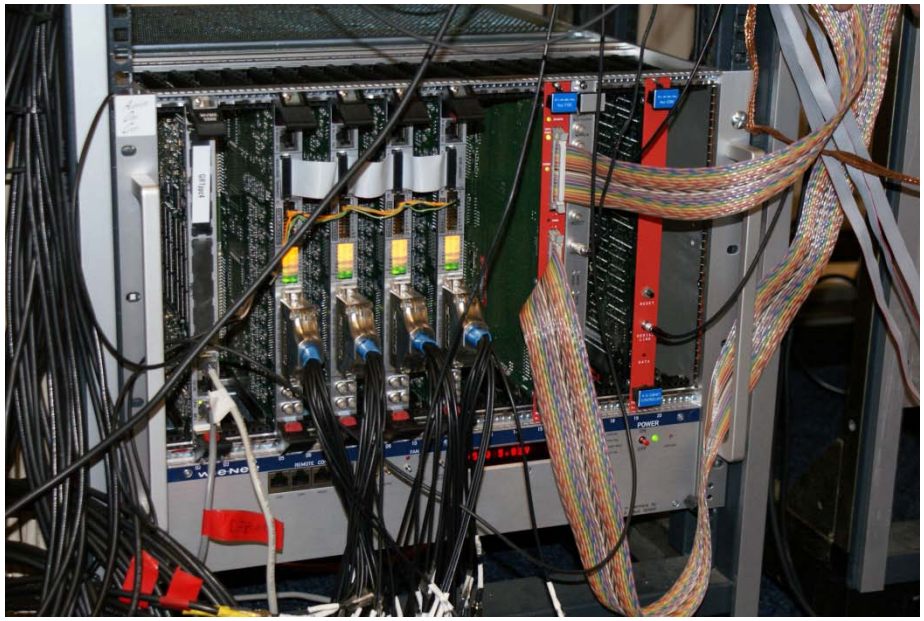


- 1 GBq ^{137}Cs source housed in lead assembly.
- Two stage Tungsten collimator parallel to z axis:
  - 8 cm x 5mm diameter
  - 8cm x 1mm diameter
- Spot size ~1.3mm at front face, ~2.4mm at back.
- Sources provides ~1000 cps with 450keV threshold.
- Collimator assembly movable in x-y plane.
- BGO and NaI scintillation detectors aligned with six depths of scatter collimation for coincidence scan.
- Trigger conditions:
  - > 450 keV on core for singles scan.
  - Core AND Scintillator within 100 ns for coincidence scan.

AGATA Scan Setup

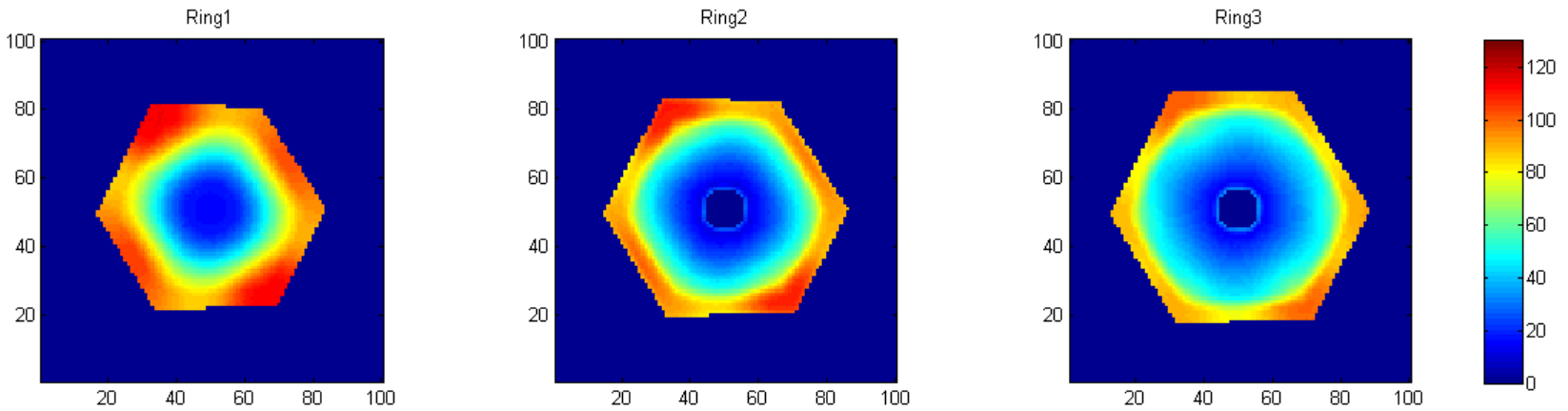


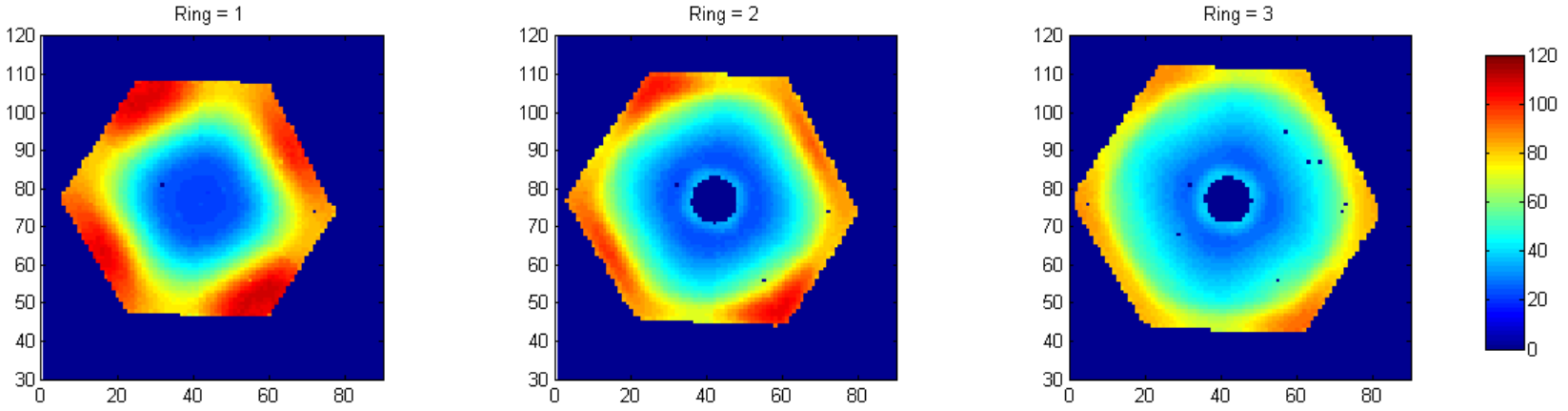
- Storage Dewar provides 7 days LN_2 capacity.
- Filled every day to monitor rate of use.
- TTL bias shutdown device provided by IKP Cologne.
- 4 x GRETINA digitiser cards providing 40 channels of 100MHz, 14 bit, time-aligned, FADCs.
- VME64x crate with ~3.8MB/s maximum data rate, equating to approximately 420 events per second.



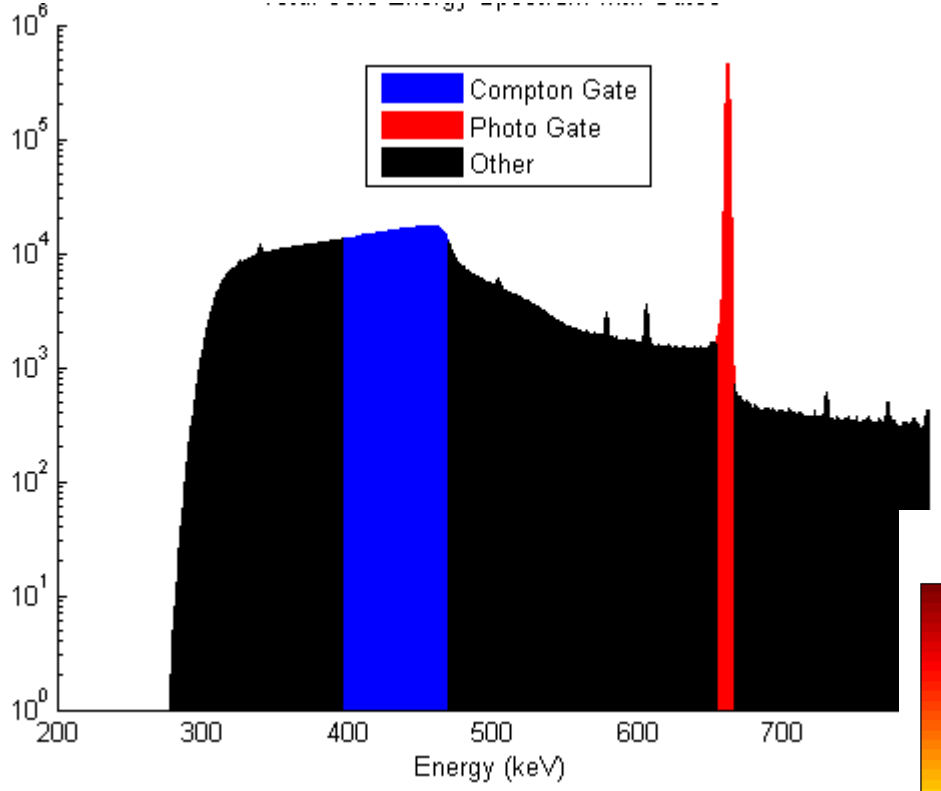
Front Face ^{137}Cs Singles Scan

- Singles scan successfully completed.
- Generally good match between experimental and simulated risetime maps.
- Some difference in risetime near the back of the detector.





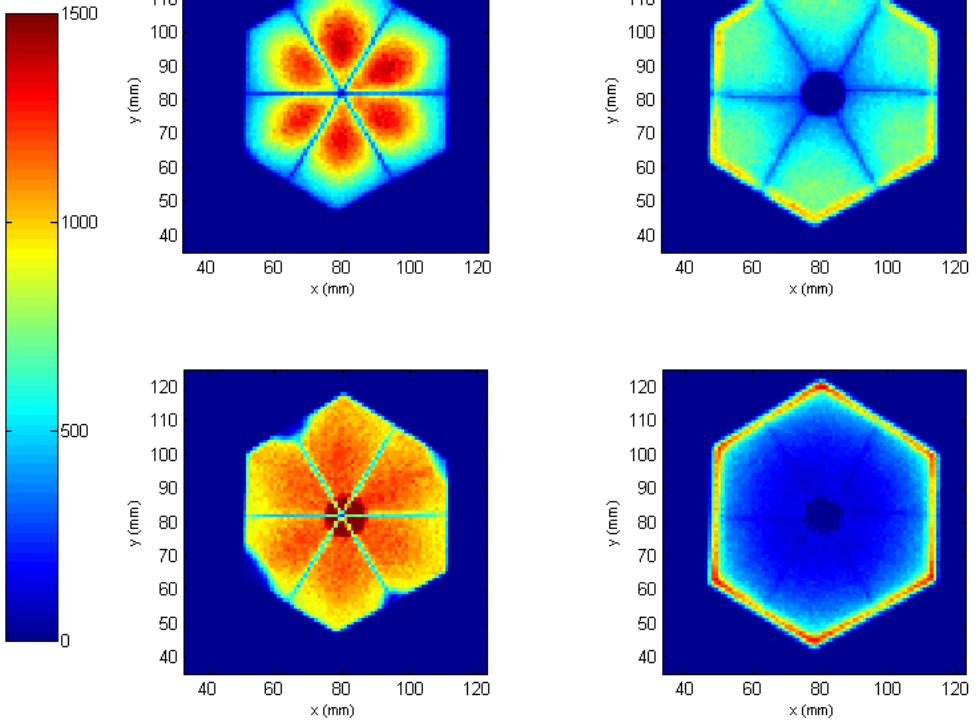
Front Face ^{137}Cs Singles Scan



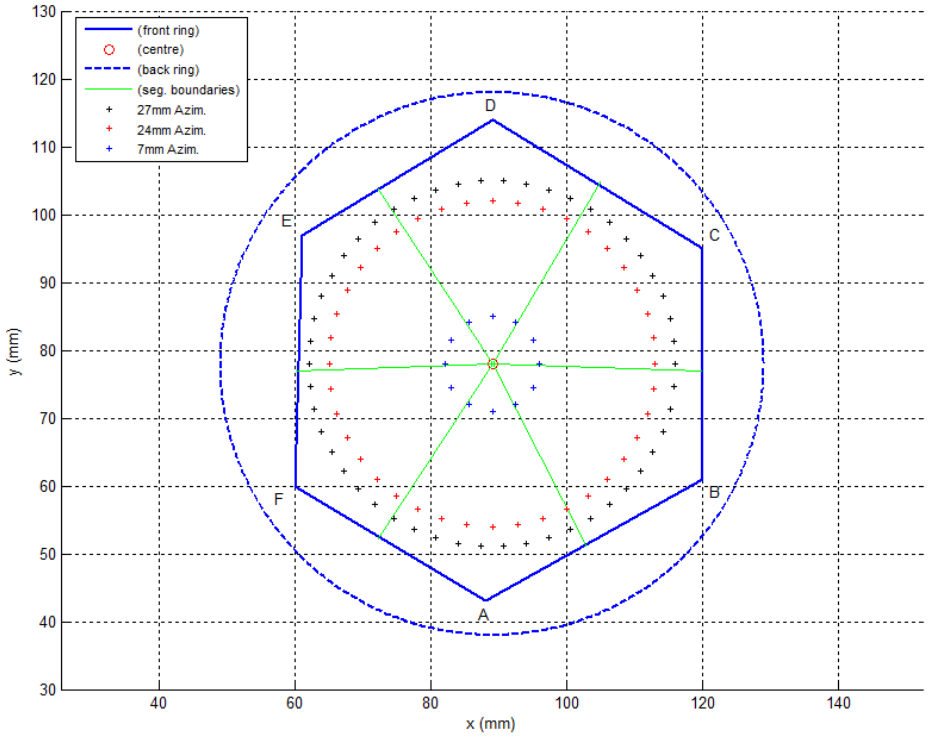
- Several interesting features found when comparing Compton edge gated data with photopeak gated.

- Increased counts in front of core can possibly be attributed to reduced dead time.

- Reduced counts at segment boundaries and corners possibly due to CFD long risetime rejection.

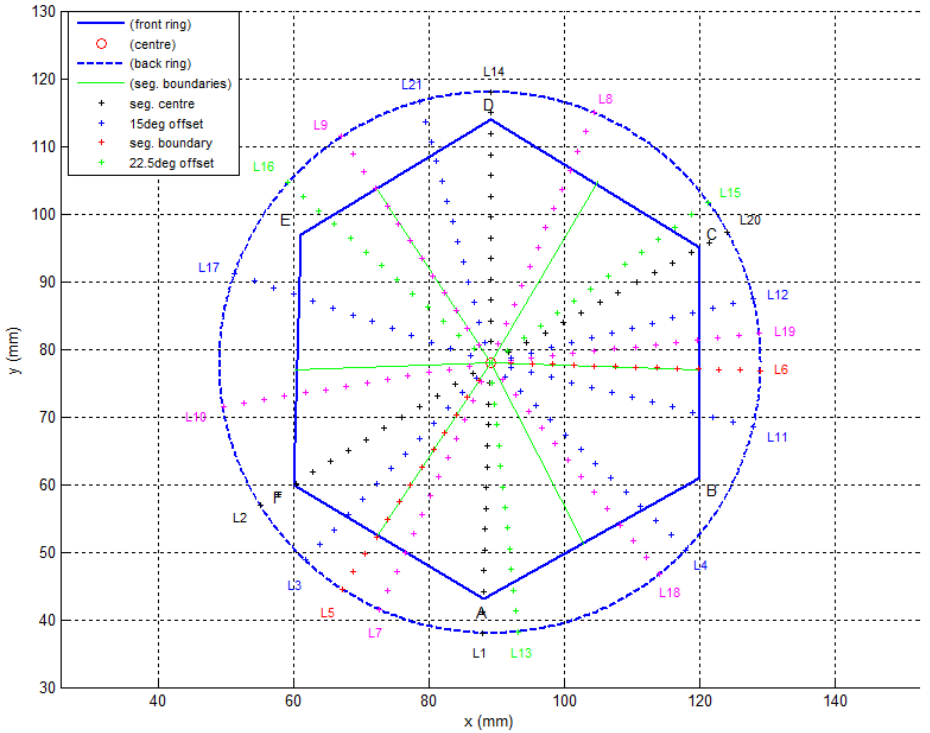


Coincidence Scanning

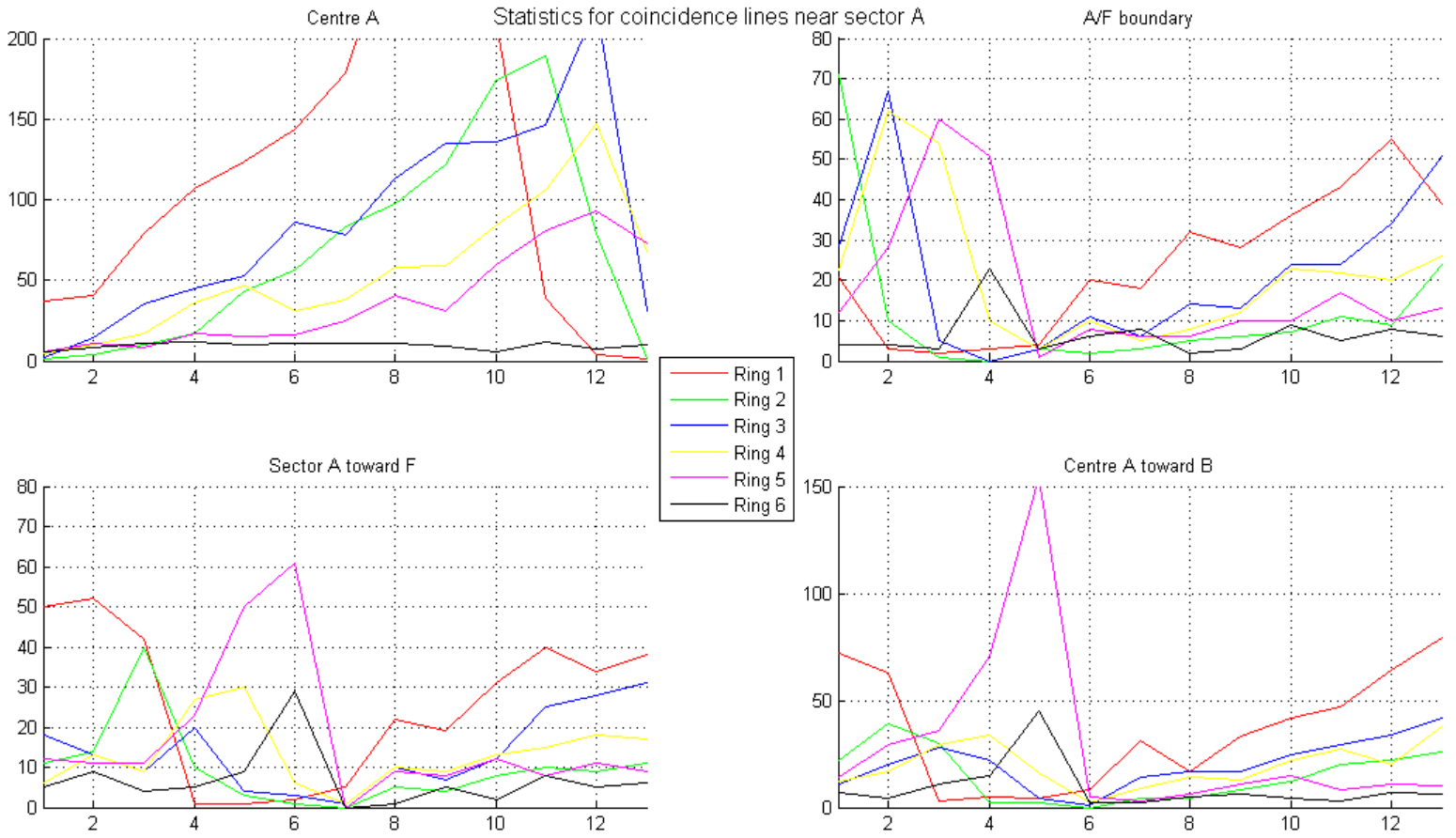


- 21 lines and 3 azimuths scanned.
- 3 – 5 hours of data collected per position.
- Coincident trigger requests ~ 50 cpm

- Due to high noise levels caused by the CAEN HV supply all points were repeated using an ORTEC supply.

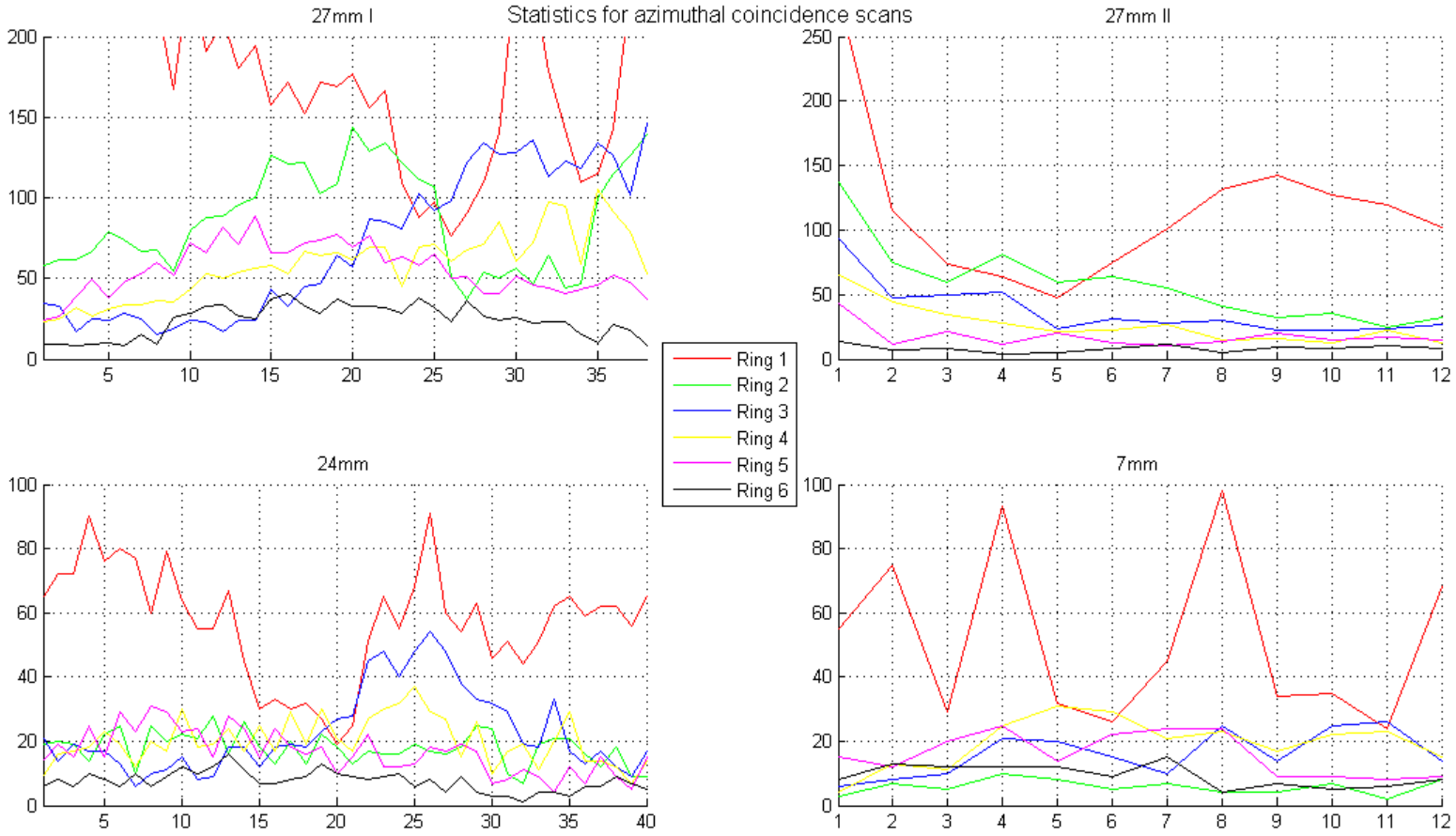


Coincidence Scan Statistics



• Plots show remaining events after gating on core energy, scintillator energy, segment fold, scintillator fold and segment-scintillator matching.

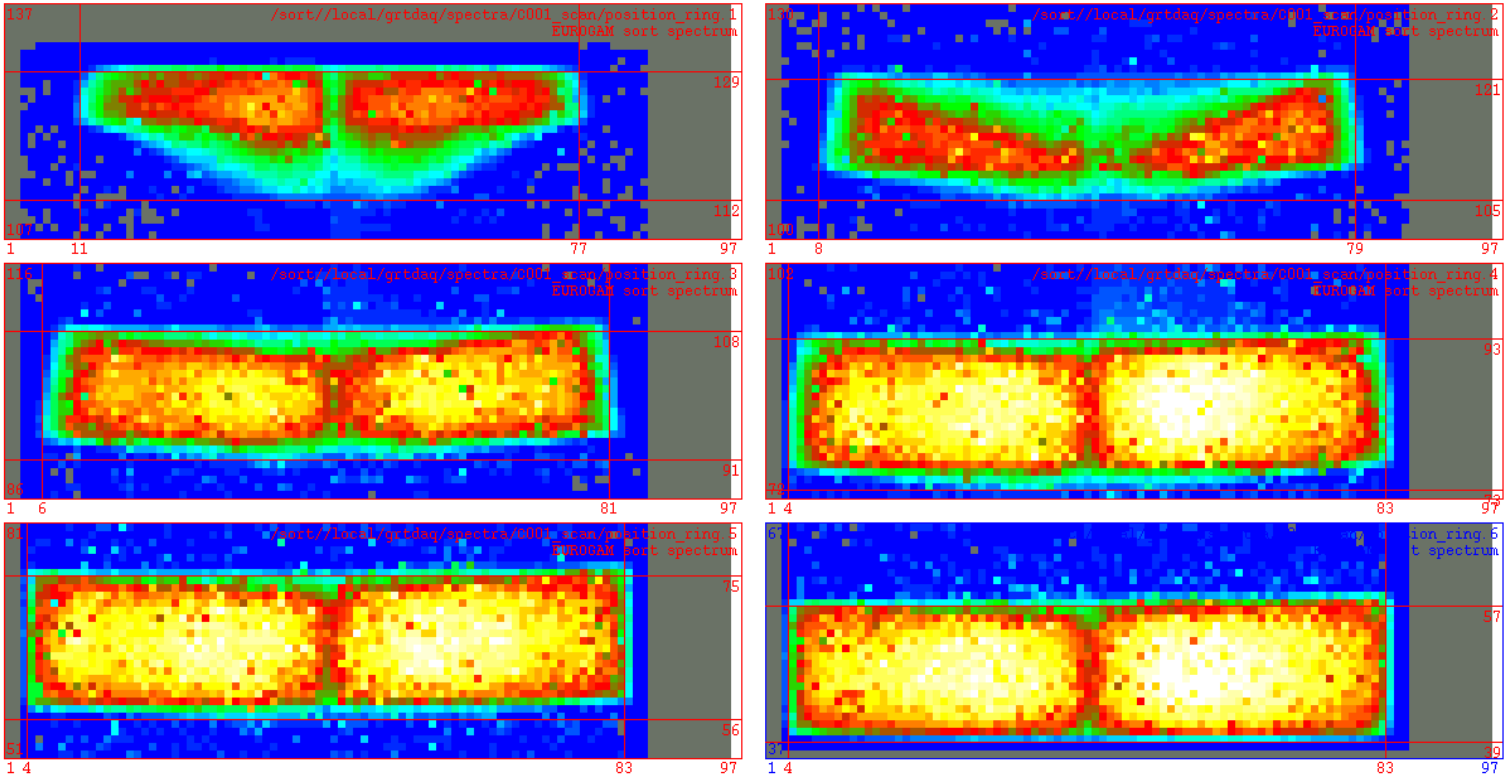
Coincidence Scan Statistics



^{137}Cs Singles Side Scan

• Images below show the intensity of single segment photopeak counts for 662keV photons.

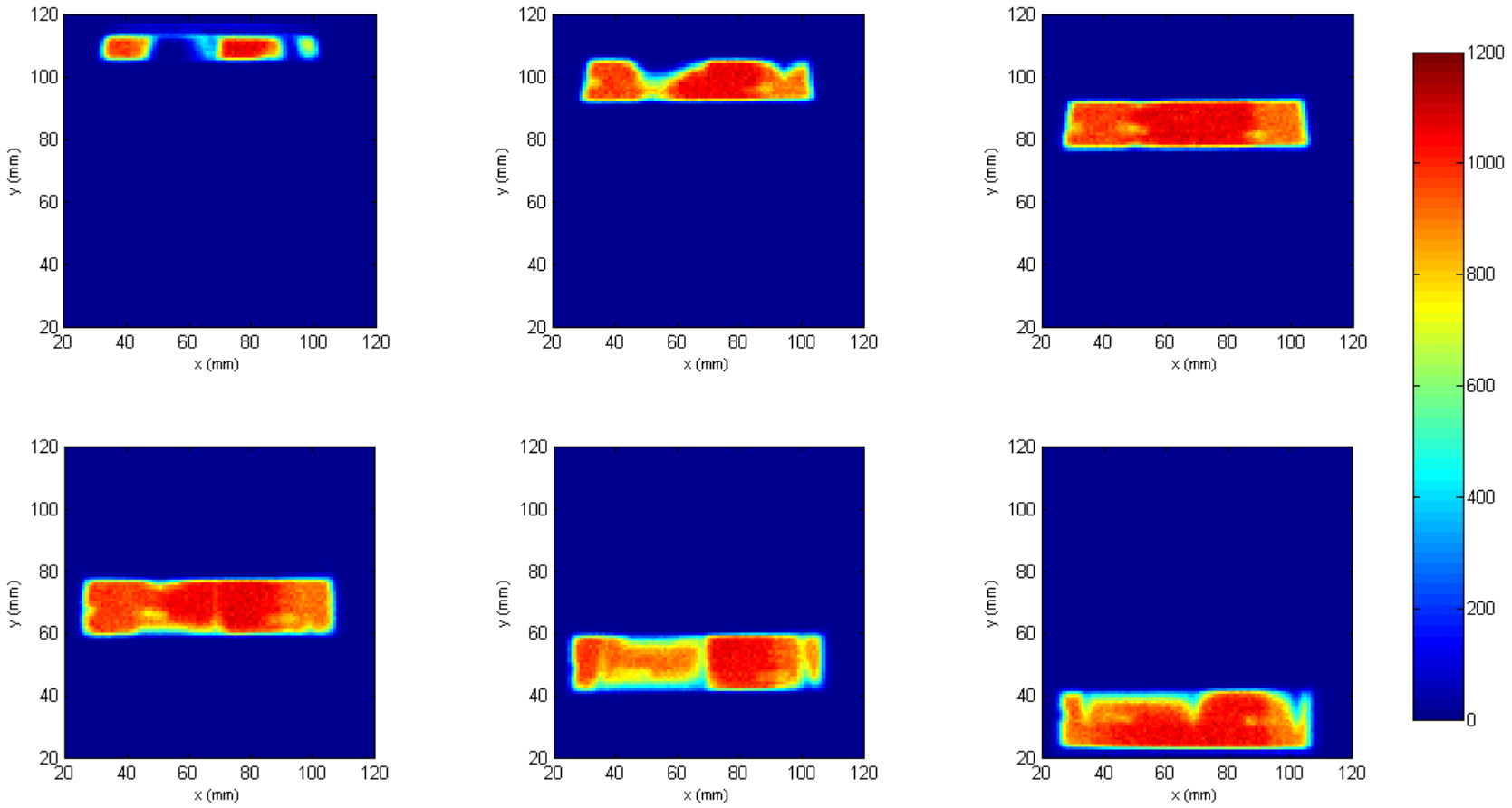
• Segment boundaries are visible due to increase in probability for gammas to scatter between segments.



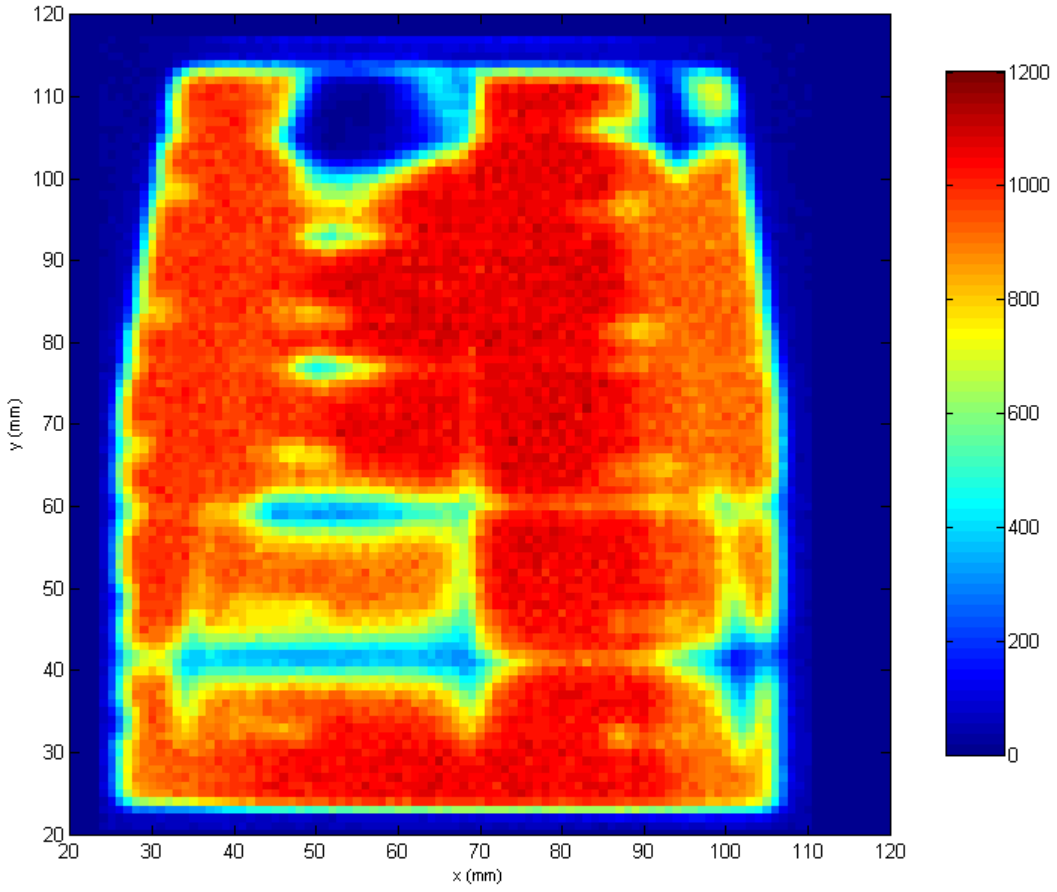
^{241}Am Singles Side Scan

- Images below show the intensity of single segment photopeak counts for 60keV photons.

- Large drops in count rate can be seen in certain regions.



^{241}Am Singles Side Scan



- 60 keV photons interact in 1st mm of Ge.
- Thickness of contacts has a significant effect at this energy.
- If due to absorption this could effect the inter-crystal tracking efficiency.
- Front face singles scan may provide more information.

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Plans for analysis of C001 data

Here in Liverpool:

- Produce quiver plots showing the best matching MGS pulses for each coincidence scan point.
- Calculate coefficients for proportional and differential crosstalk, delays and preamp bandwidths. This will be done using Dave Radford's method of minimising the difference between experimental, segment fold 1, data and GEANT4/MGS simulations.
- Reproduce quiver plots with crosstalk corrections implemented.
- Assessment of scanning at a range of bias voltages as a method of measuring impurity concentrations (Ste Moon).

Elsewhere:

- PSCS method of producing pulse shape database from singles data (Fabio Crespi, Milan)
- Reproduction of interaction positions for collimated beam and flood source data (Andrew Robinson, Manchester)

Thank You

Carl Unsworth, D. Barrientos, A.J. Boston, H.C. Boston, S.J Colosimo,
J. Cresswell, M.R. Dimmock, F. Filmer, D. Judson,
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