MEMO June 6, 2003

To: Dave Hutcheon, Lothar Buchmann, and John D'Auria

From: Joel Rogers

Re: Asymmetry Test for DRAGON EMS Losses

Lothar's analysis of the 2+ resonance data seems to indicate a varying acceptance, even here at the high energy (1.46 Mev/u) end of our excitation function. I report here on the continued analysis of the same data Lothar has been analyzing.

The DRAGON gamma array is left-right symmetric, so the counts in the left and right banks of detectors should be equal if the EMS is uniformly efficient left and right. Also the crown detectors, which lie in the vertical plane through the beam, might be less effected by acceptance losses because the kick given the recoil by a vertically going gamma is orthogonal to the EMS bend plane. The data from file run08430.mid was analyzed three times, once with only left gamma detectors, once with crown detectors, and once with only right gamma detectors.

The attached figure shows sample spectra, labeled LEFT, CROWN, and RIGHT depending on which detectors are included in the analysis. The top row of plots are the gamma-energy spectra, with the selected ground-state (g.s.) gammas shown as a solid portion of the curves. The other plots are for the g.s. gammas only, which should have more losses due to acceptance because they give a maximum kick to the recoils. The LEFT spectra have fewer counts than the RIGHT, which is a surprise because GIOS simulations predict that the left-going recoils have a narrower (i.e. smaller) acceptance, which would correlate with the opposite sign for the left-right gamma-asymmetry. The top-left plot shows that the g.s. gammas are attenuated more strongly than the cascade gammas, which are almost the same left-and-right.

The cH-Energy spectra (c.f. 2nd row of Figure) are interesting since Lothar analyzed the sum of these three spectra in his Monte Carlo analysis. The left-right asymmetry in these spectra correlates with a forward-backward asymmetry in the gamma rays, which should be small for this nearly pure E2 resonance. Only the CROWN spectrum is nearly symmetric (asymmetry = 9%), as it would be without acceptance losses. The LEFT and RIGHT spectra are more asymmetric, and the asymmetry is much larger RIGHT than LEFT. This seems to support the idea that the gammas detected in CROWN detectors are less distorted by EMS losses that either the LEFT or RIGHT gamma rays.

Perhaps this type of analysis would be useful in retuning the separator for full acceptance. Because the DAQ rate is high at the resonance energy, the asymmetry of the recoil energy spectrum could be used as a tuning parameter. Later, lower-energy resonances could perhaps be used similarly to extend the retuning downward toward energies nearer the Gamow window.

/isdaq/data42/dragon/c12analysis/c12asym.doc

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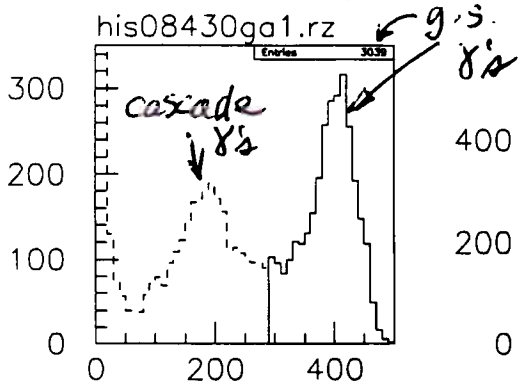
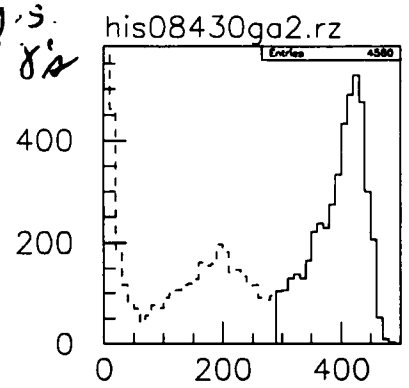
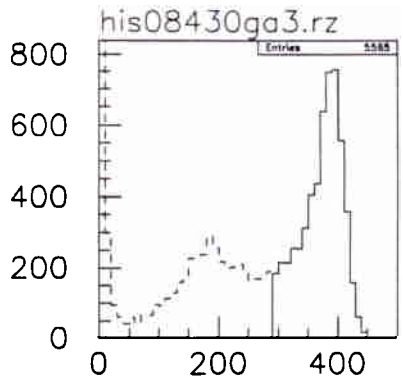
1460KeV/u LEFT



CROWN



RIGHT γs



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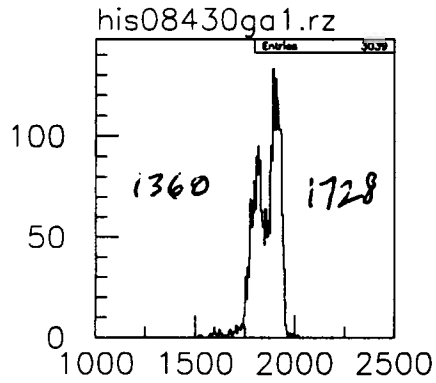

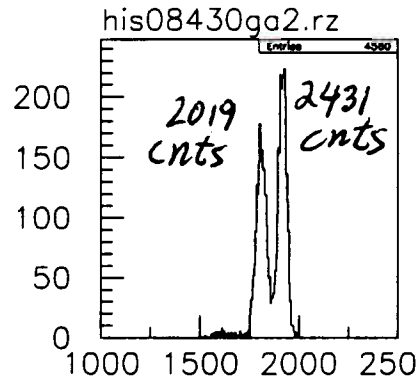

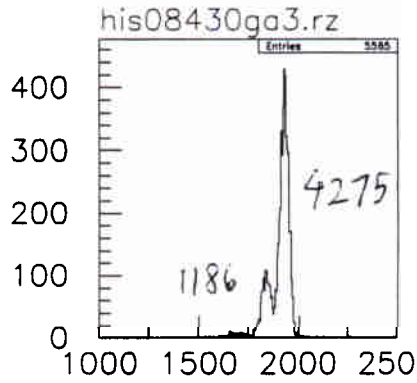

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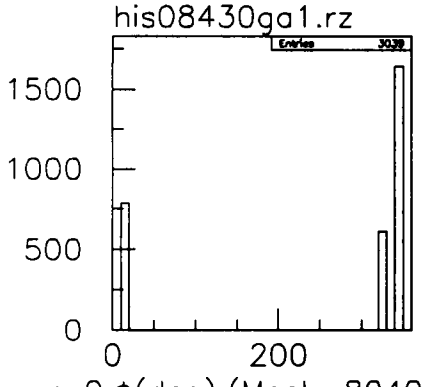

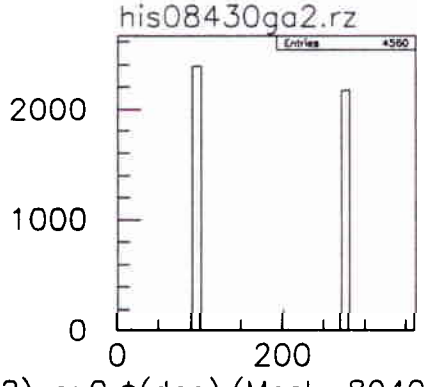

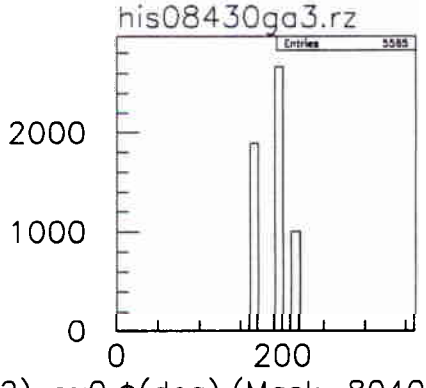

cγ0 Φ(deg) (Mask=804002) cγ0 Φ(deg) (Mask=804002) cγ0 Φ(deg) (Mask=804002)

Joel