

Solar Flare Studies at UNH

Two recent Ph.D. Theses involved solar flare results:

Martina Arndt

August, 2000

***X-Ray and Gamma-Ray Observations of the
15 November 1991 Solar Flare***

Alex Young

Nearing Completion

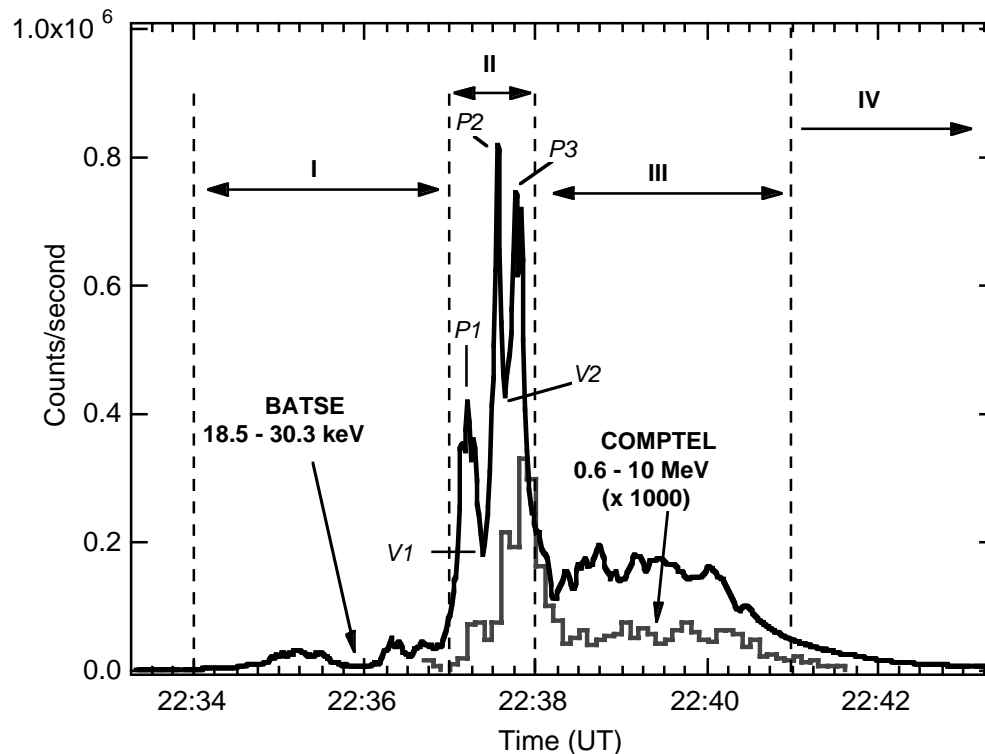
***Solar Flare Gamma-Ray Spectroscopy
with CGRO-COMPTEL***

Solar Flare of 15-Nov-1991

Summary of Arndt's Thesis

- **Well-observed class X1.5 event :**
 - > **CGRO, Yohkoh, PVO, Ulysses, and various ground-based observatories.**
 - > **Data covers entire electromagnetic spectrum.**
- **Sun was 66° from COMPTEL Z-axis. BSA data only.**
- **Spectra deconvolved with Maximum Entropy Method.**
- **Time constant of 2.2 MeV decay**
 - > **Sensitive to ^3He and ambient density.**
 - > **Measured as 26 (+20,-15) secs.**
 - > **Marginally consistent with other measurements.**
 - > **Lower value suggests high ^3He or ambient density**
- **Line ratios**
 - > **2.2, 4.4, 6.1 and 4-7 MeV fluences.**
 - > **Derived spectra consistent with other measurements.**
 - > **Ion spectral index = -4.5**
- **Modeling of particle precipitation**
 - > **Footpoint intensity measurements from Yohkoh**
 - > **Particle transport model of Ryan and Lee**
 - > **Provided a measure of turbulence within the loop.**

Class X1.5 Flare of 15-Nov-1991



(I) precursor (22:34 – 22:37 UT)

(II) impulsive (22:37 – 22:38 UT)

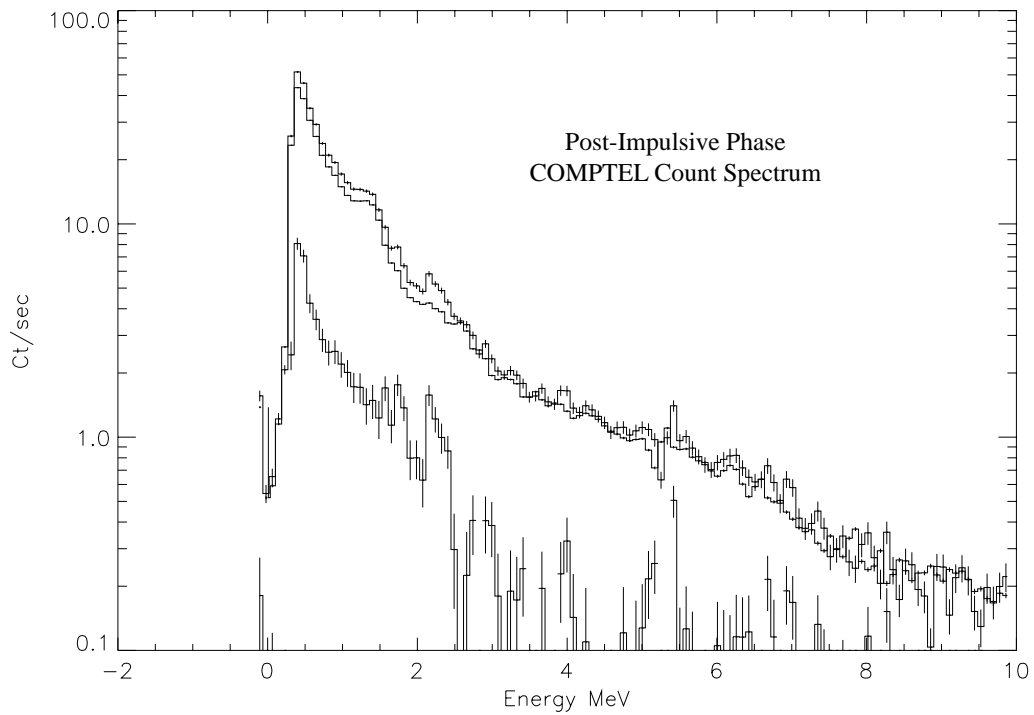
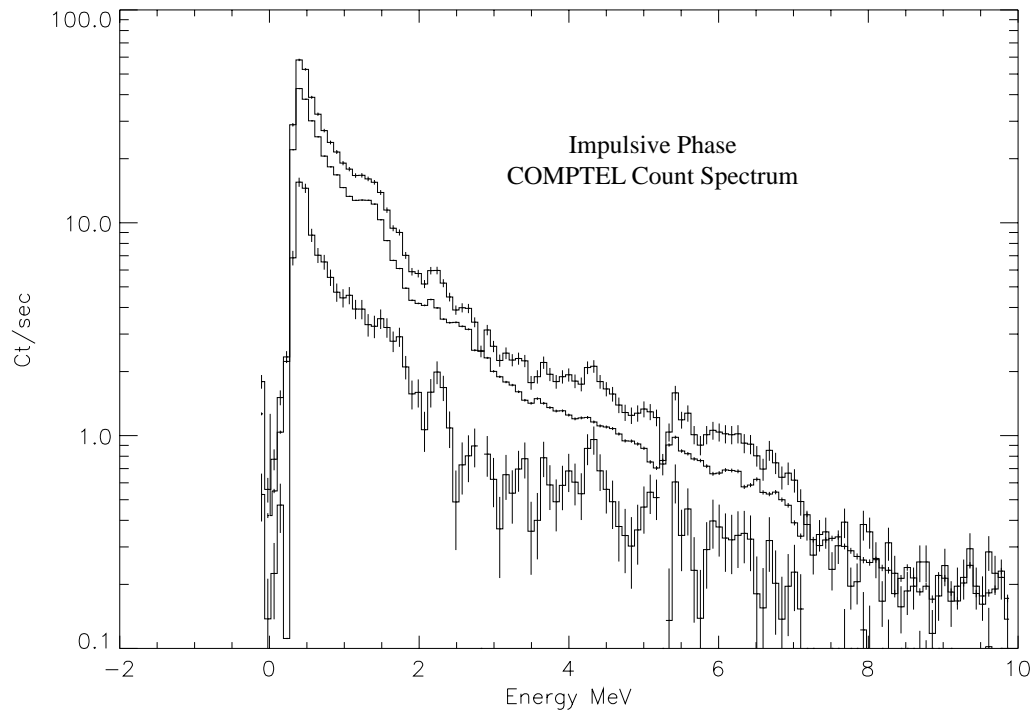
(III) post-impulsive (22:38 – 22:41 UT)

(IV) decay (> 22:41 UT) phases are indicated.

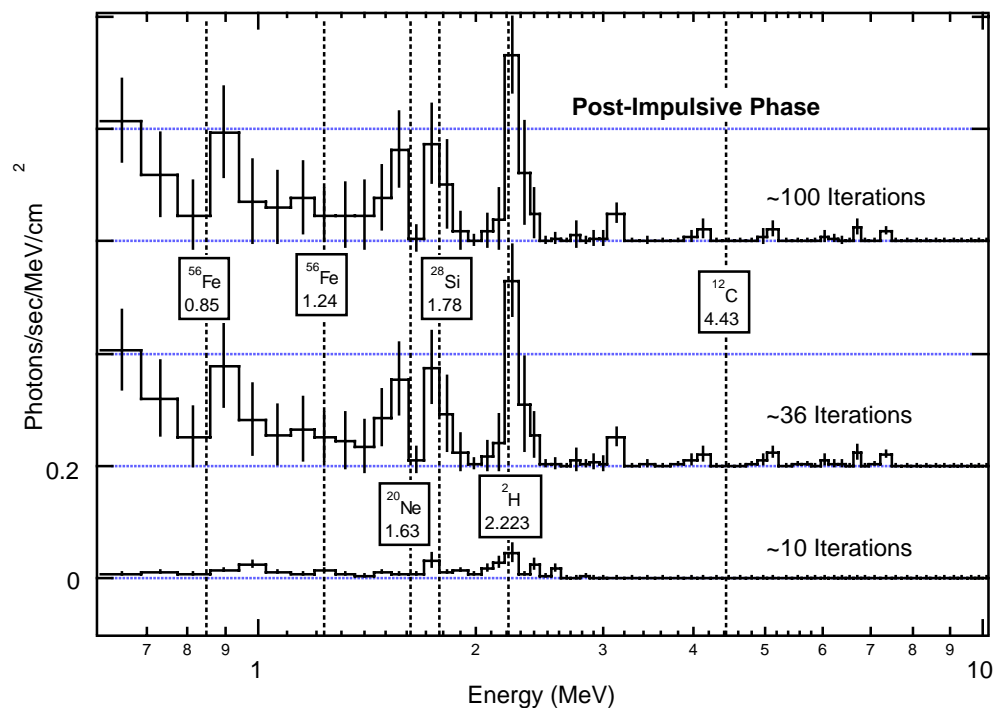
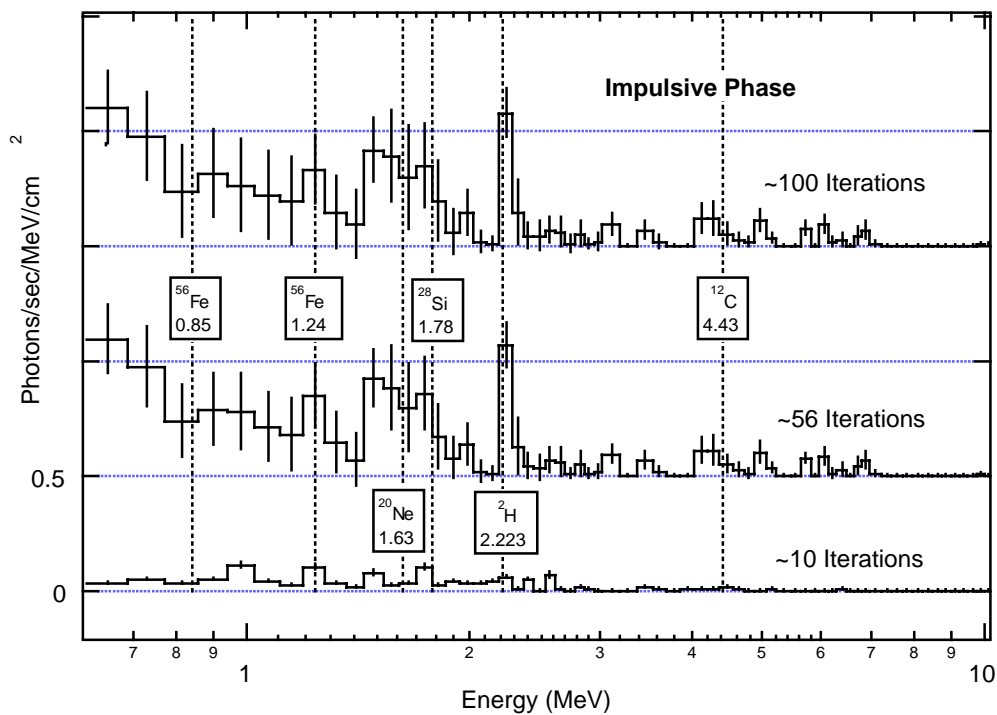
BATSE data are not background subtracted.

COMPTEL data are background-subtracted and magnified by a factor of 1000.

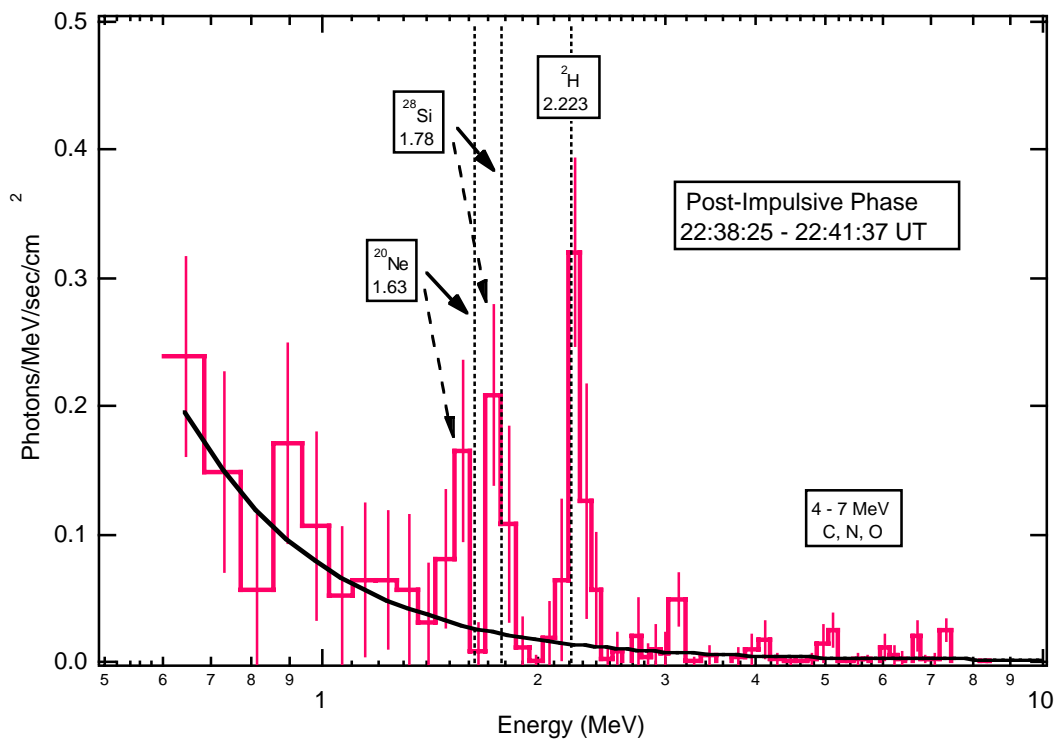
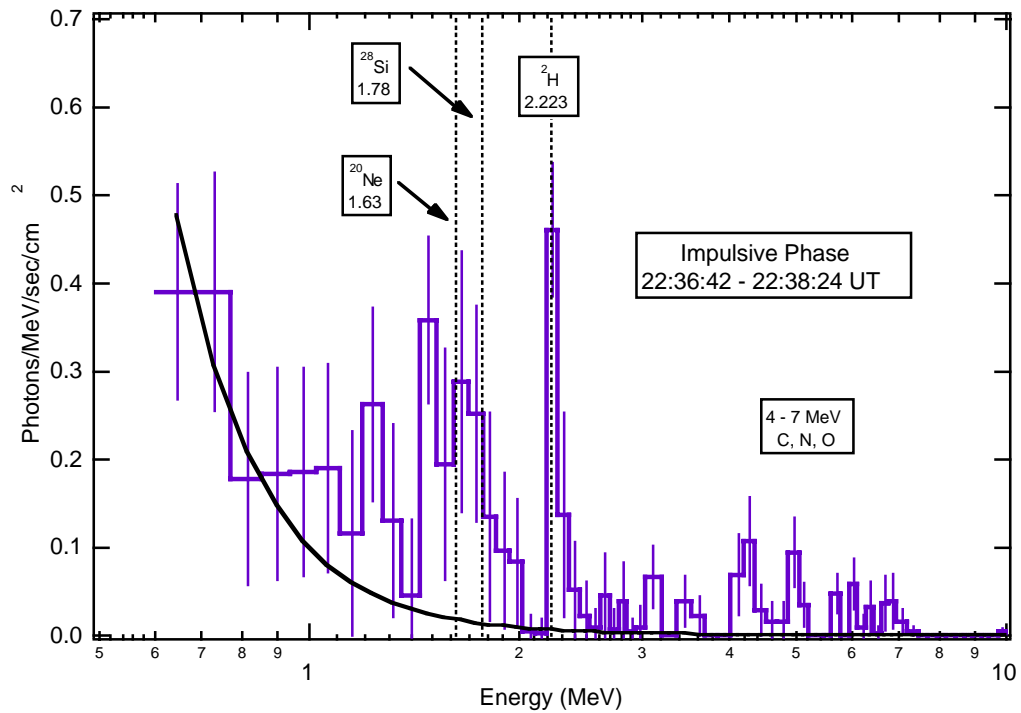
15-Nov-1991 Flare Spectra



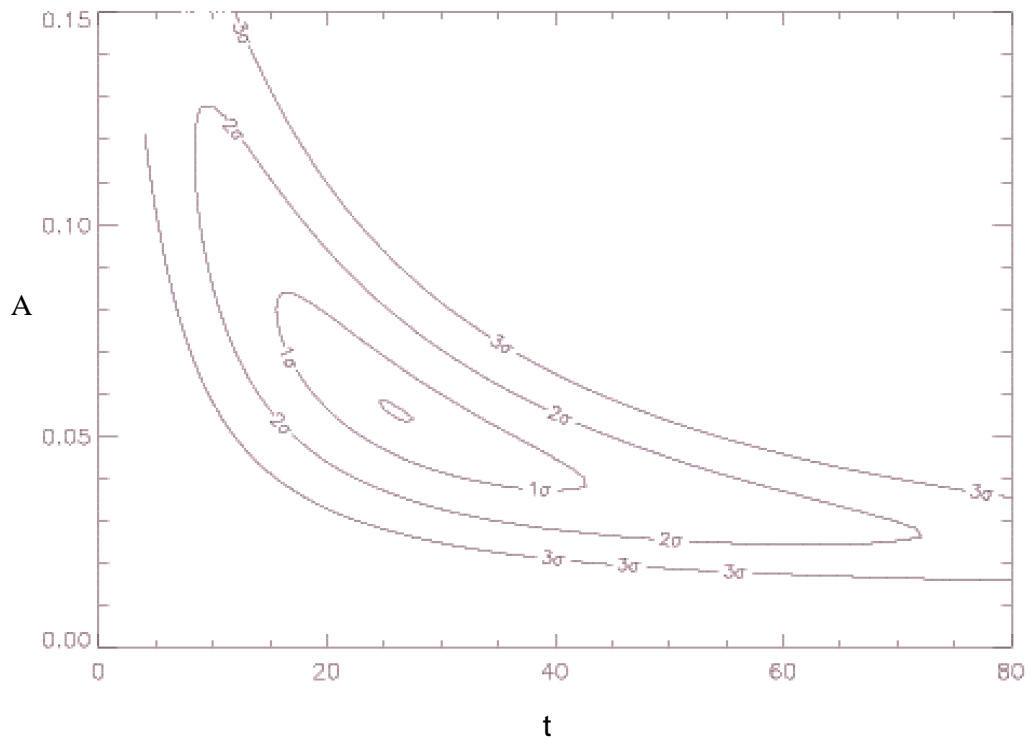
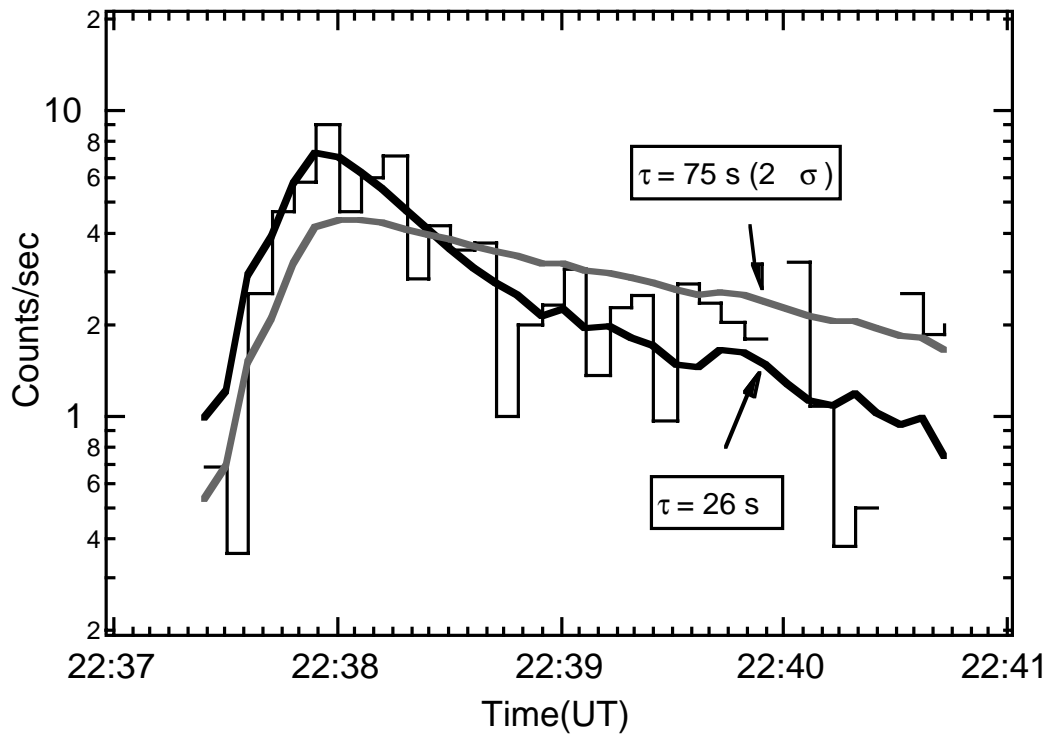
Maximum Entropy Deconvolution



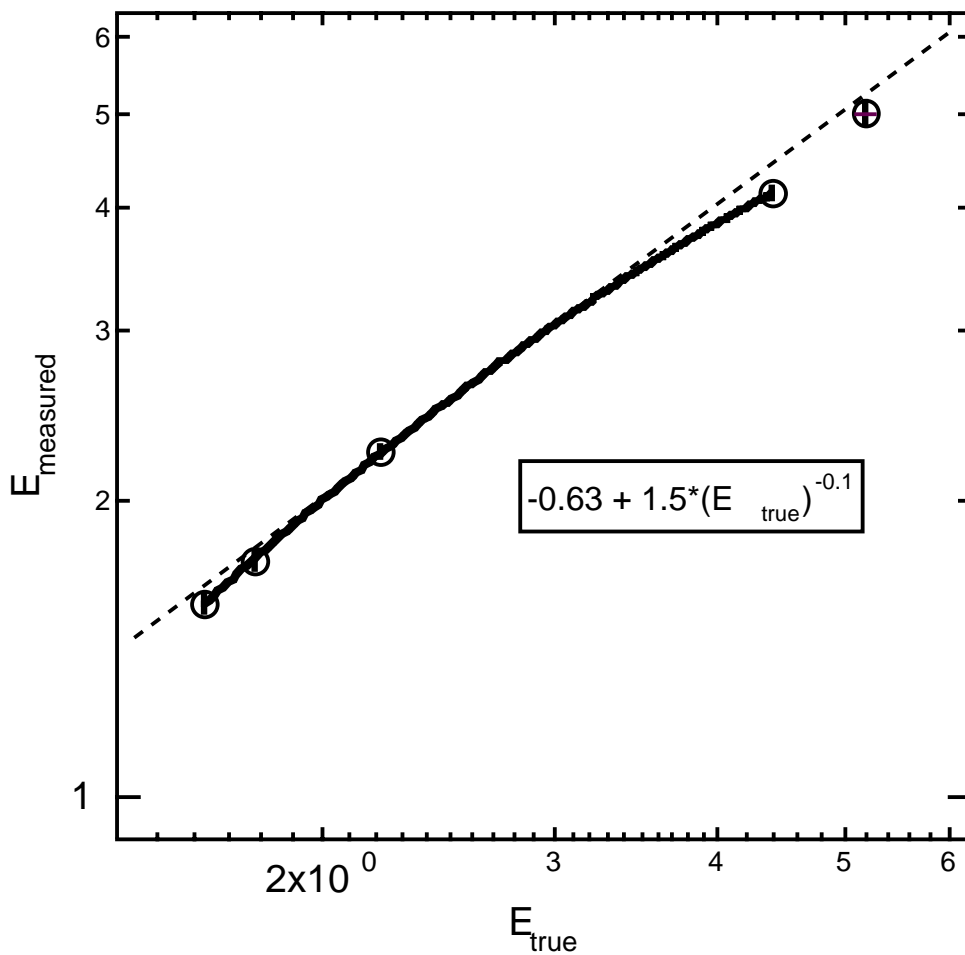
Deconvolved Photon Spectra



2.2 MeV Time History



High Range BSA Calibration



Solar Flare Gamma-Ray Spectroscopy

Brief Summary of Young's Thesis

- **Modeling of Neutron Transport**
 - > **Models 2.2 MeV decay**
 - > **Includes density profile of solar atmosphere**
- **Refinement of Maximum Entropy Deconvolution**
 - > **Bayesian Multiscale Regularization**
 - > **Handles low number of counts (non-Gaussian)**
- **Studies of 11-Jun-1991 Solar Flare (class X12)**
 - **Provides good test case for spectral deconvolution**
 - **Line ratios used to study evolution of particle spectra**
 - **Analysis of 2.2 MeV decay uses transport model**
- **Studies of 20-Jan-2000 Solar Flare (class C4.1)**
 - > **First case of nuclear line detection in C-class event.**