Gamma Spectroscopy

22.104 Spring 2002
“Ideal” Spectrum
HPGe vs. NaI
Compton Edge

\[ E_C = h\nu - E_e|_{\theta = \pi} = \frac{h\nu}{1 + 2h\nu/m_0c^2} \]
Compton Energy
Small Detector
Medium Detector
Large Detector
Geometrical Effects
Real Spectrum
Real Spectrum with Notes

Spectrum:
Title:
Sample Title:

Counts

Energy (E)

Start Time: 7-MAR-93 16:05
Real Time: 00:03:07.87
Live Time: 00:55:23.15

Sample Time: 25-FEB-93 00:15
Sample ID:
Sample Type: U

FWHM Parameters:
Offset: 8.92E-01
Slope: 2.56E-02
Expanded Spectrum
Solving the Problem
Determining Elemental Mixtures

- Assume we know roughly what we are looking for
- May not be able to use high resolution detectors
- Limited time for measurement
Analysis of Spectrum

- Not looking for trace elements so NaI best choice considering efficiency and cost

- Spectral fitting method uses entire spectrum to fit to composition
  - fit entire spectrum and check by closure

- Extensively proven in application in other fields
  - well logging
  - coal analysis
Example of Standard Spectral Library
Comparison between HPGe and NaI in Lab

![Graph comparing HPGe and NaI in a lab setting.](image-url)
One Hour Measurement With NaI
15 Second Measurement With NaI in Field
PELAN Technique

- Reactions: (n,n’γ), (n,pγ)
- Gamma: Prompt
- Elements: C, O
- Activation: (n,α), (n,p)
- Delayed: O, Al, Si

10 µs

90 µs
Example of Spectral Analysis