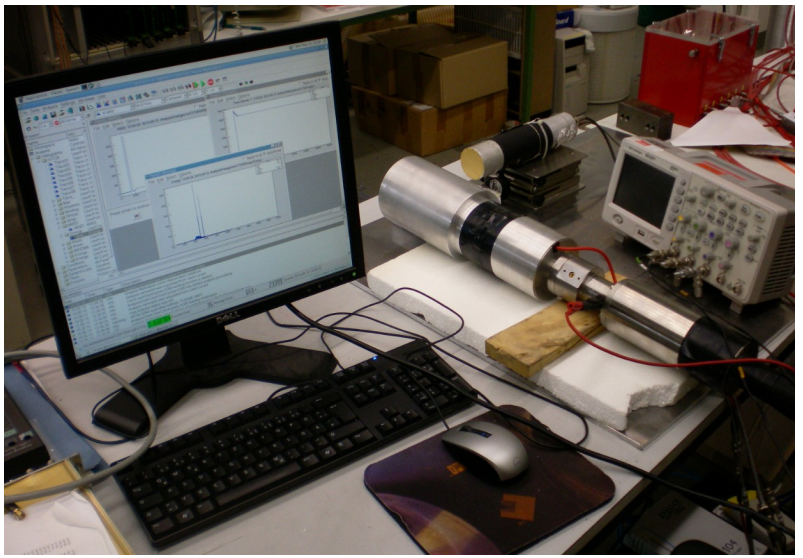
Status Report

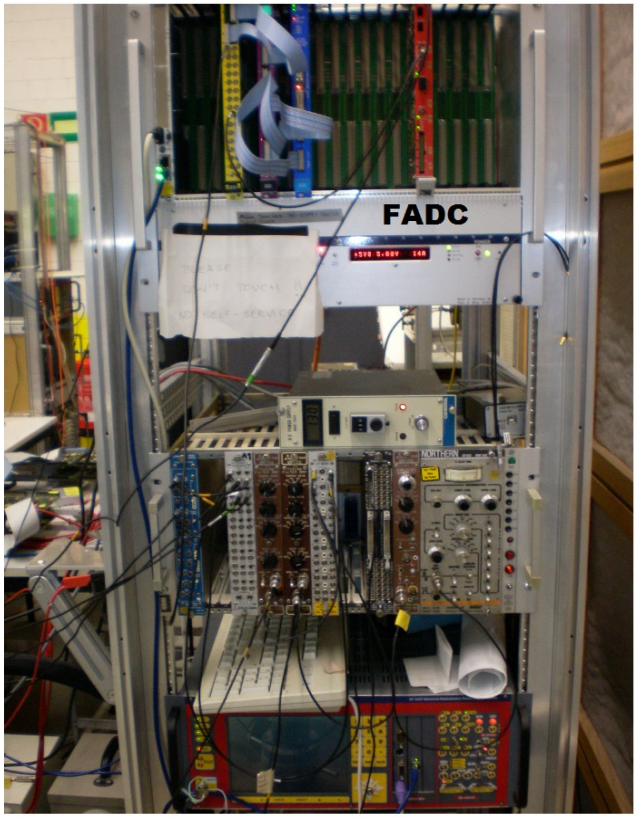
Pulse Shape Analysis of HPGe Detectors in Mainz

Kai Rittgen
26.06.2013

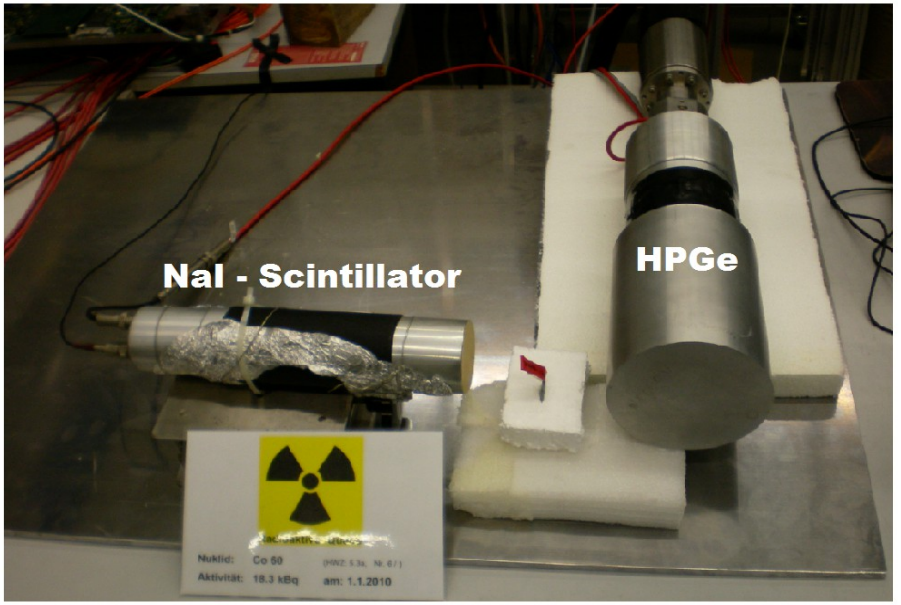


- Experimental Setup -
- Analysis -
- Optimizing the Analysis -

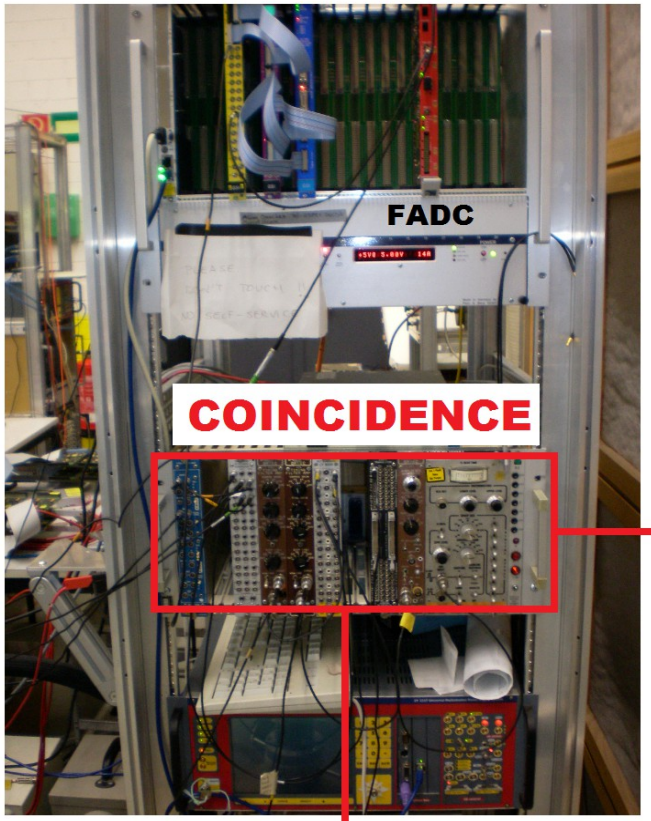
Experimental Setup

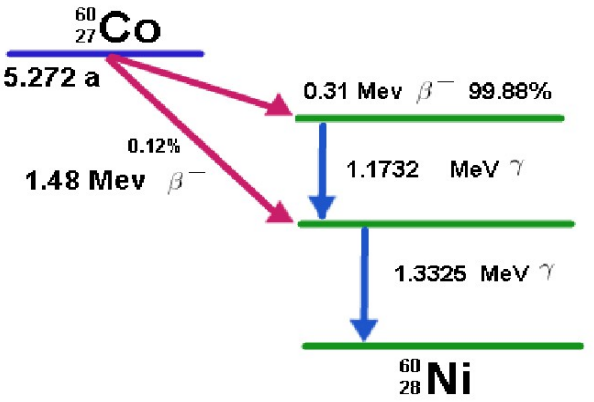


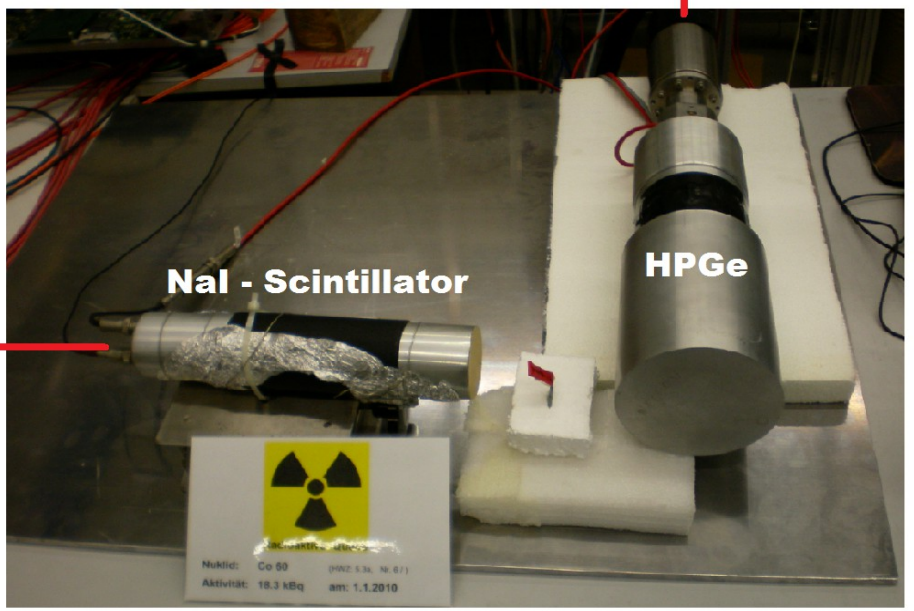
Behavior of HPGe Detectors
after Neutron Damaging in reference to
Resolution and Risetime



Experimental Setup

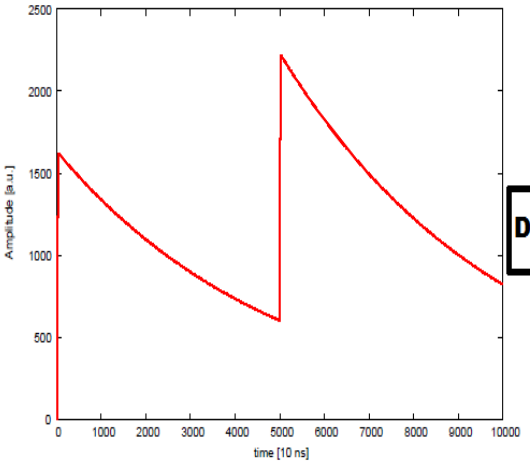






Triggering for high rates at COSY

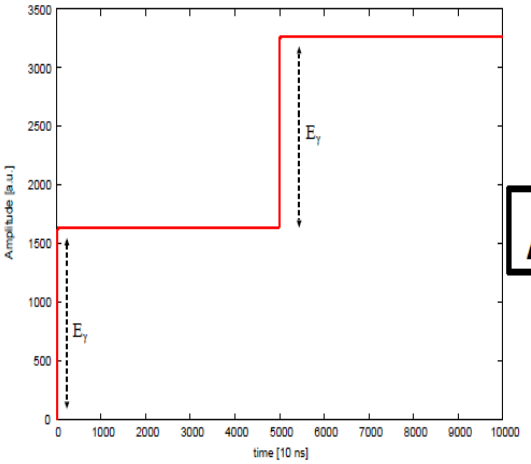
Moving Window Deconvolution



Preamplifier Signal

$$f(t) = A \exp\left(-\frac{t}{\tau}\right)$$

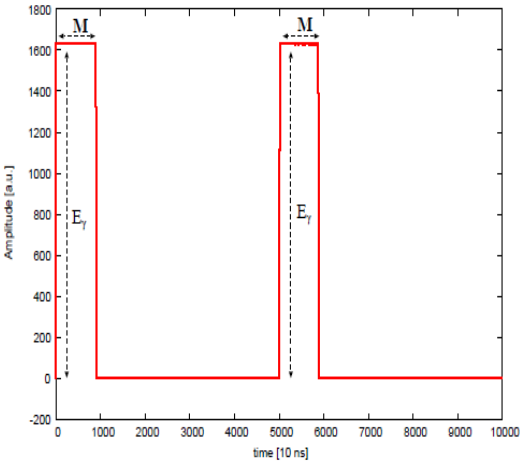
Deconvoluion



Deconvoluted Signal

$$A[n] = x[n] + \frac{1}{\tau} \sum_{k=-\infty}^{n-1} x[k]$$

Moving Average

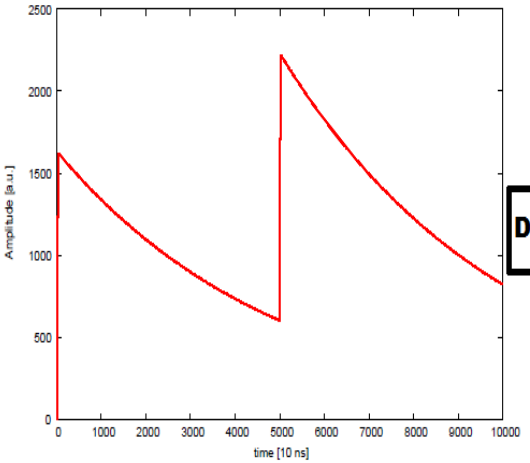


MWD - Signal

$$\mathrm{MWD}[n] = \mathrm{A}[n] - \mathrm{A}[n-M]$$

Digital Signal Processing for segmented HPGe Detectors Preprocessing Algorithms and Pulse Shape Analysis by Martin Lauer, 2004

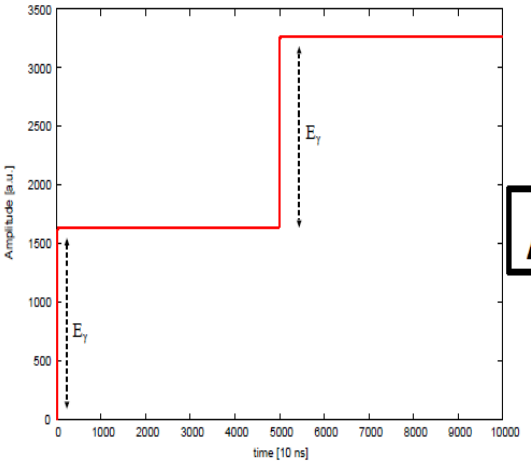
Moving Window Deconvolution



Preamplifier Signal

$$f(t) = A \exp\left(-\frac{t}{\tau}\right)$$

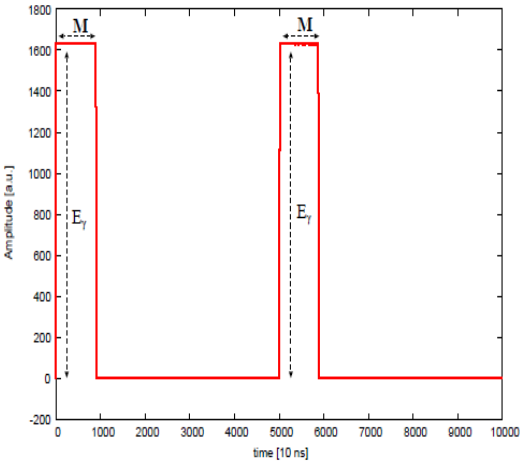
Deconvoluion



Deconvoluted Signal

$$A[n] = x[n] + \frac{1}{\tau} \sum_{k=-\infty}^{n-1} x[k]$$

Moving Average

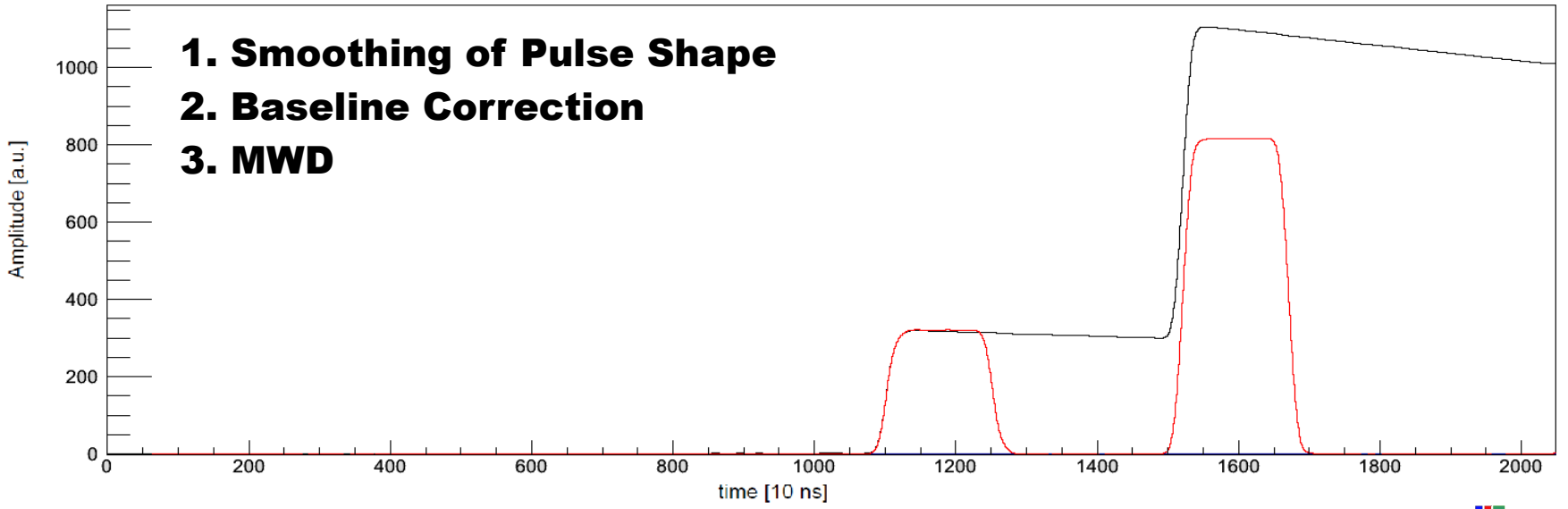


MWD - Signal

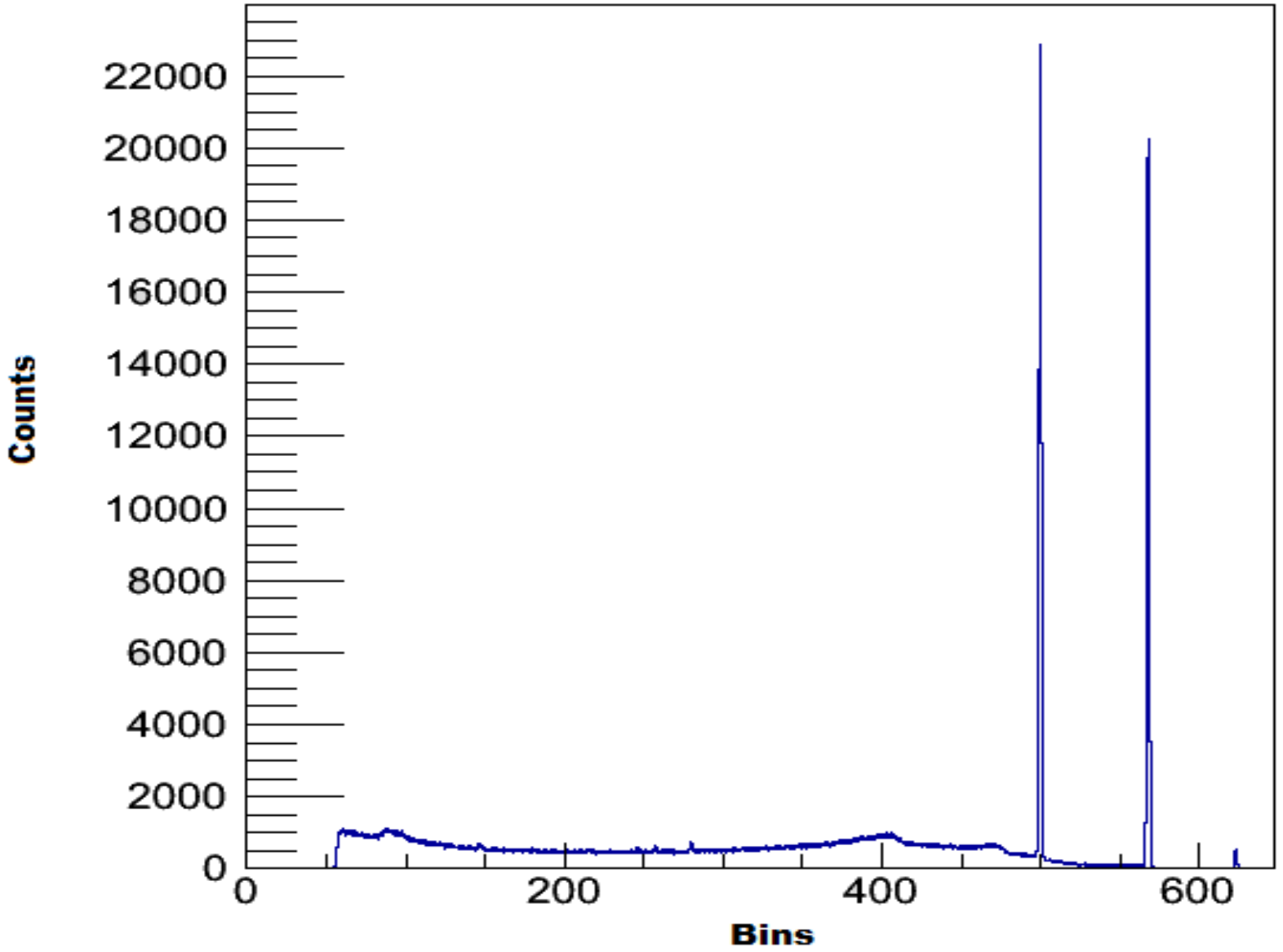
$$\mathrm{MWD}[n] = \mathrm{A}[n] - \mathrm{A}[n-M]$$

Digital Signal Processing for segmented HPGe Detectors Preprocessing Algorithms and Pulse Shape Analysis by Martin Lauer, 2004

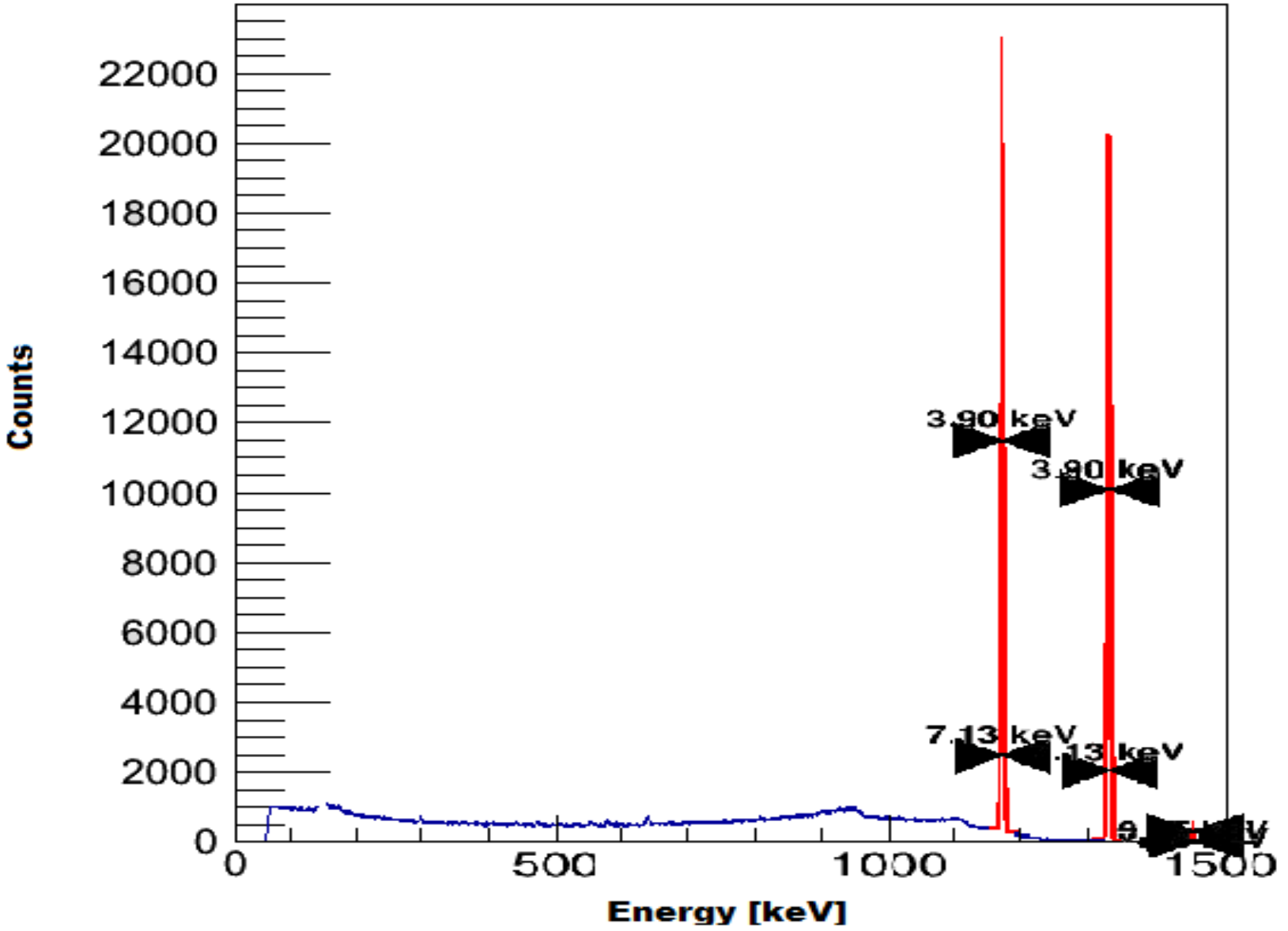
1. **Smoothing of Pulse Shape**
2. **Baseline Correction**
3. **MWD**



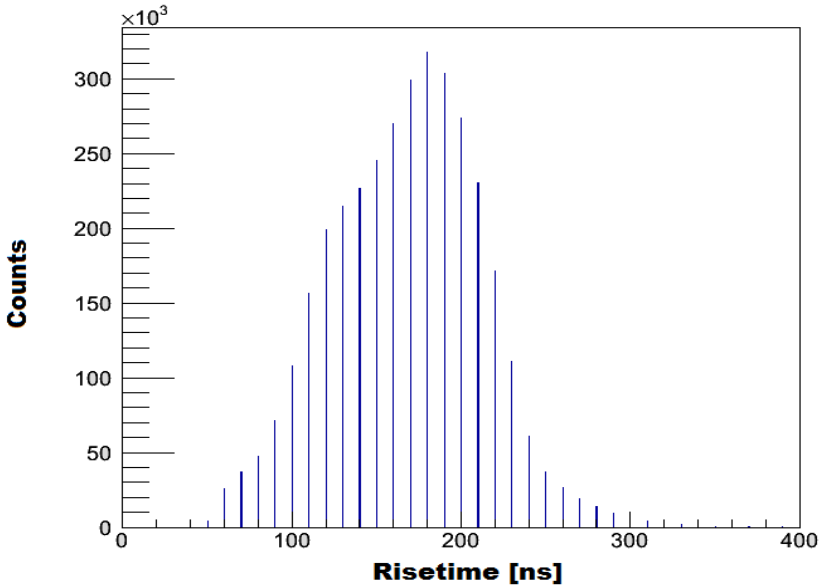
Spectrum of ^{60}Co & Risetime

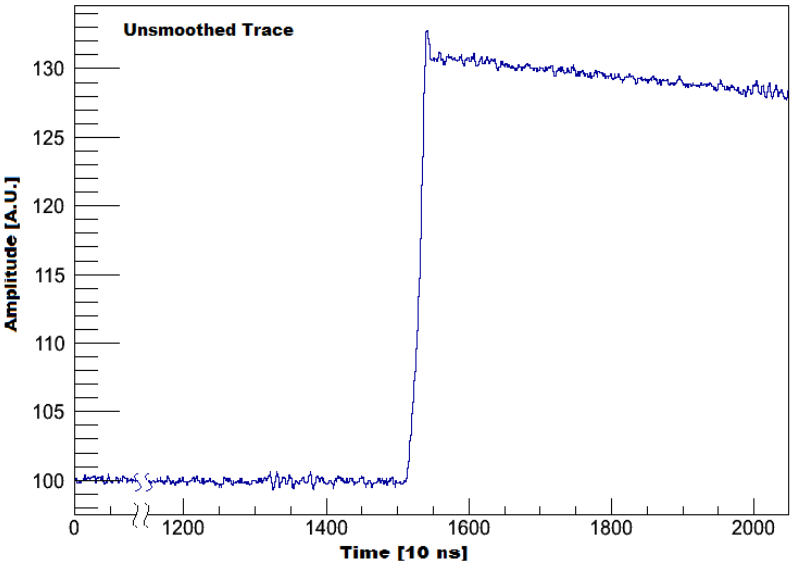


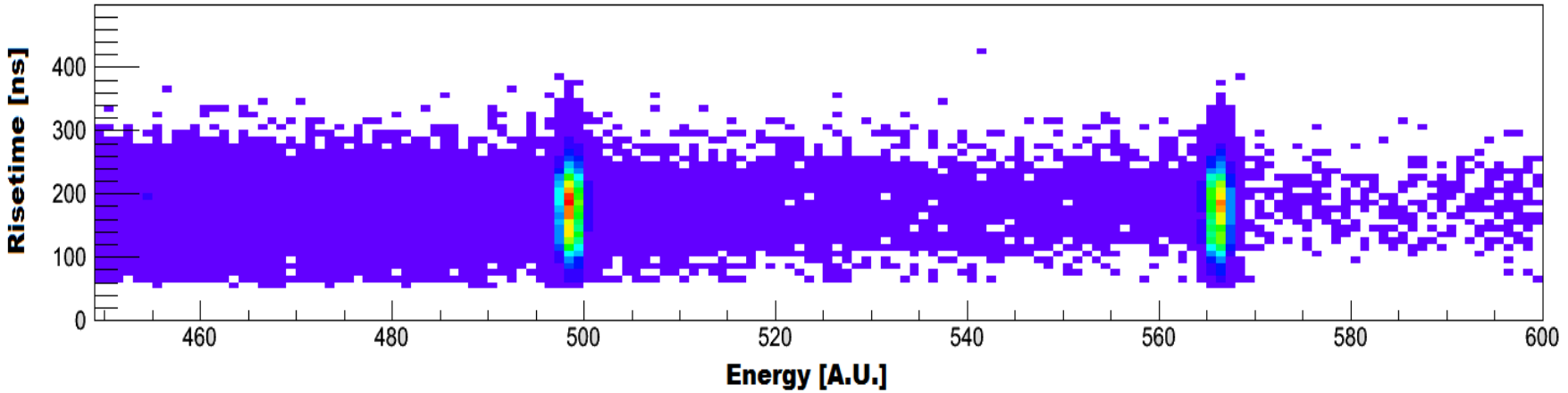
Spectrum of ^{60}Co & Risetime



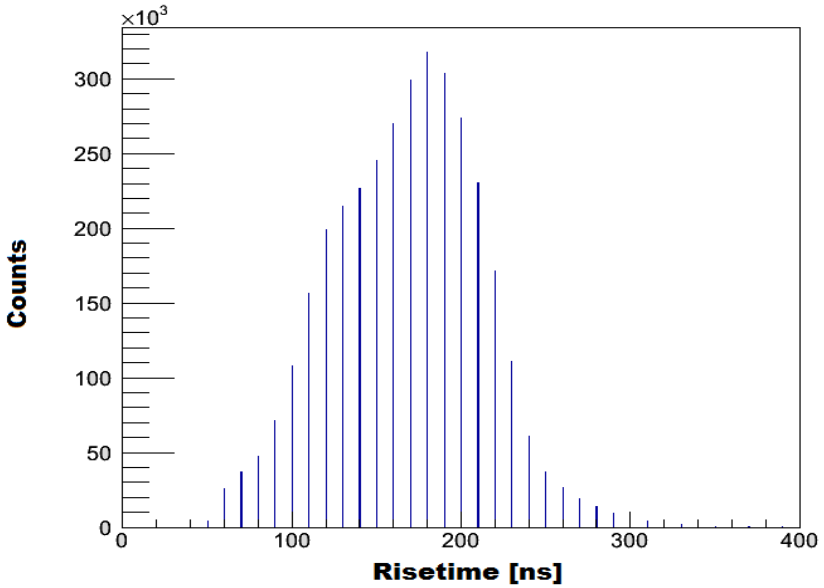
Spectrum of ^{60}Co & Risetime

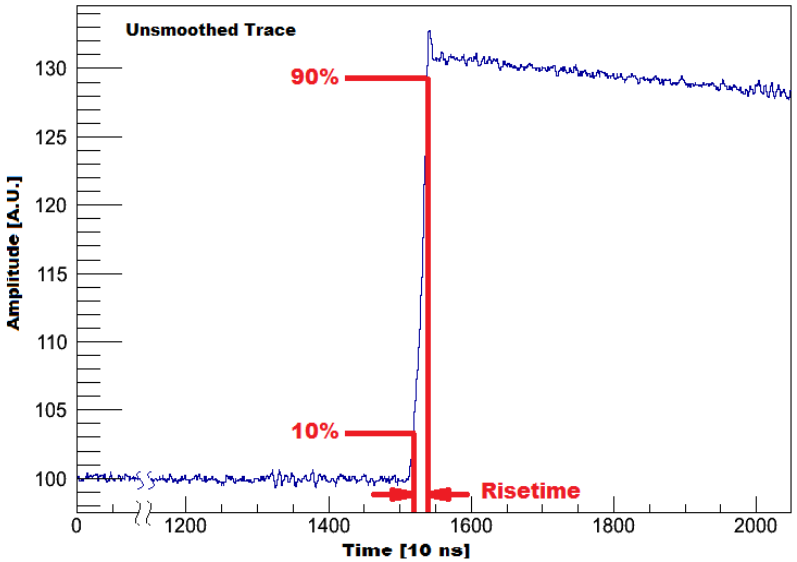


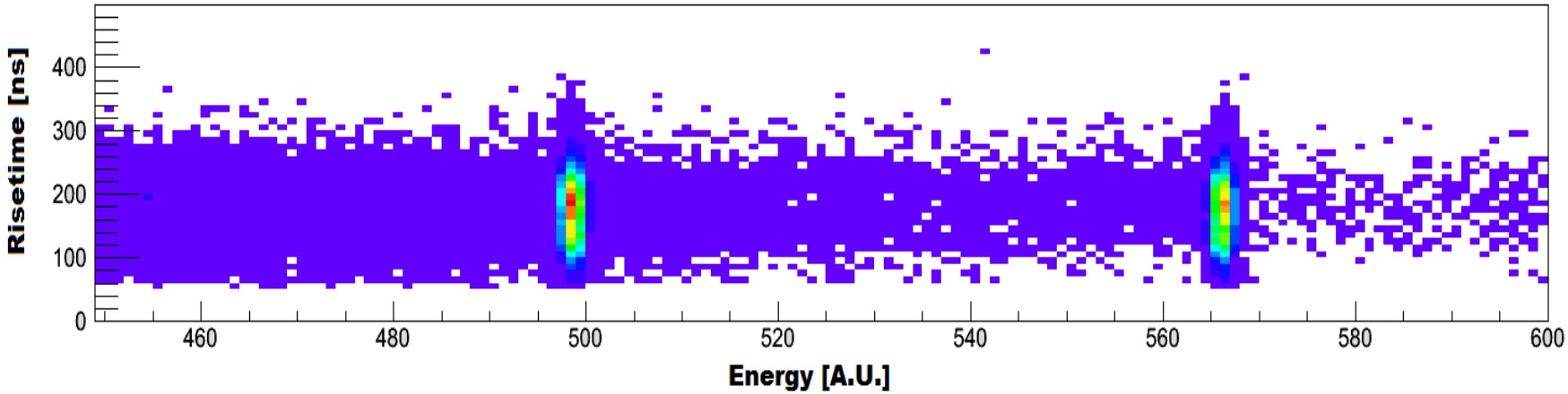




Spectrum of ^{60}Co & Risetime

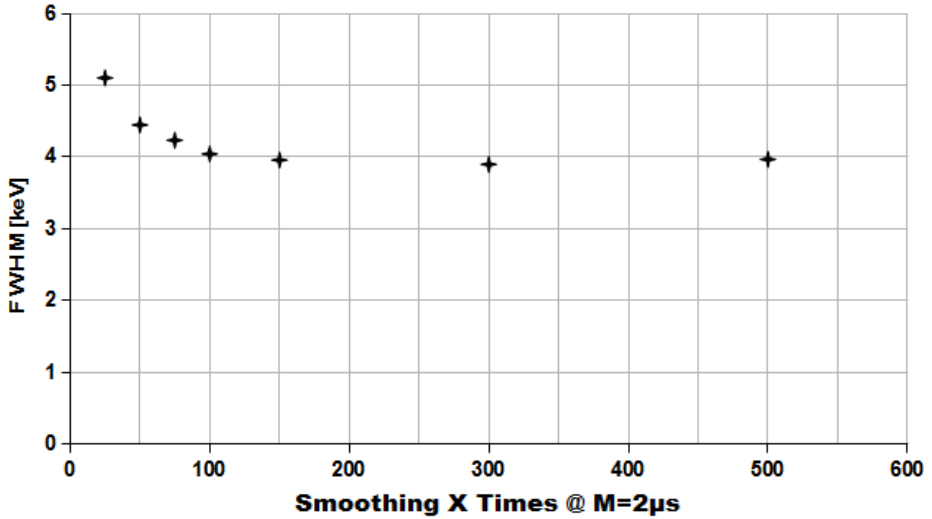






Optimization of the Analysis

Variation of Smoothing

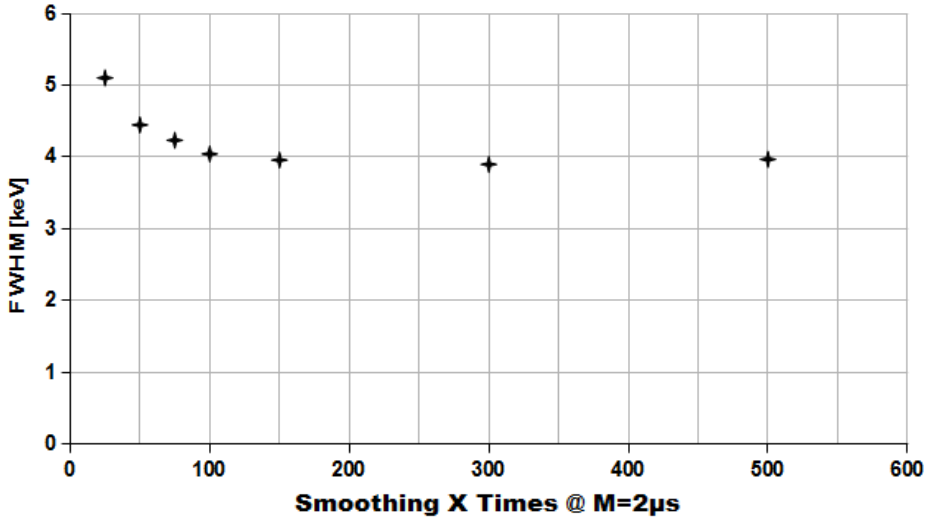


$$x[n] = \frac{x[n-1]}{4} + \frac{x[n]}{2} + \frac{x[n+1]}{4}$$

Resolution limited by dynamic range of FADC

Optimization of the Analysis

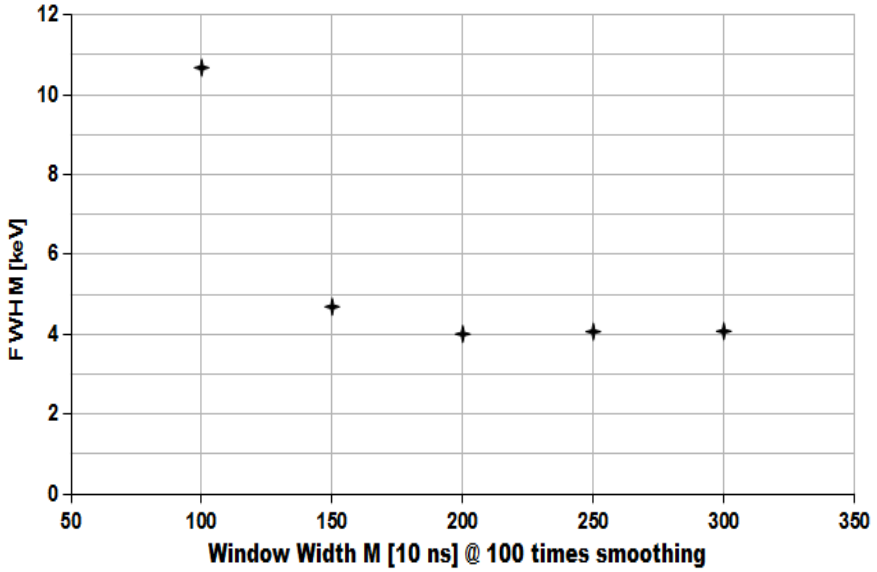
Variation of Smoothing

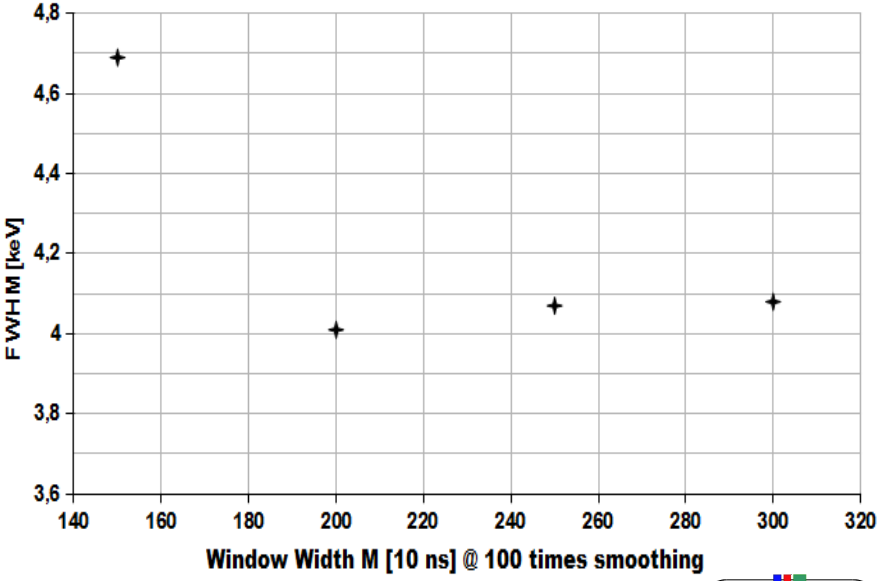


$$x[n] = \frac{x[n-1]}{4} + \frac{x[n]}{2} + \frac{x[n+1]}{4}$$

Resolution limited by dynamic range of FADC

Variation of Window Width





Summary & Outlook

- Resolution of 3.9 keV
  Expecting better Resolution with modified FADC
  (2,25Vpp → 0,5Vpp)

- Further optimization of the Analysis Algorithm

- Beam Time at COSY in Jülich in October 2013

Summary & Outlook

- Resolution of 3.9 keV
  Expecting better Resolution with modified FADC
  (2,25Vpp → 0,5Vpp)

- Further optimization of the Analysis Algorithm

- Beam Time at COSY in Jülich in October 2013

Thank you for your attention!