UT-BATTELLE

# Efficiency of Alpha Detector from Neutron Correlation Measurement

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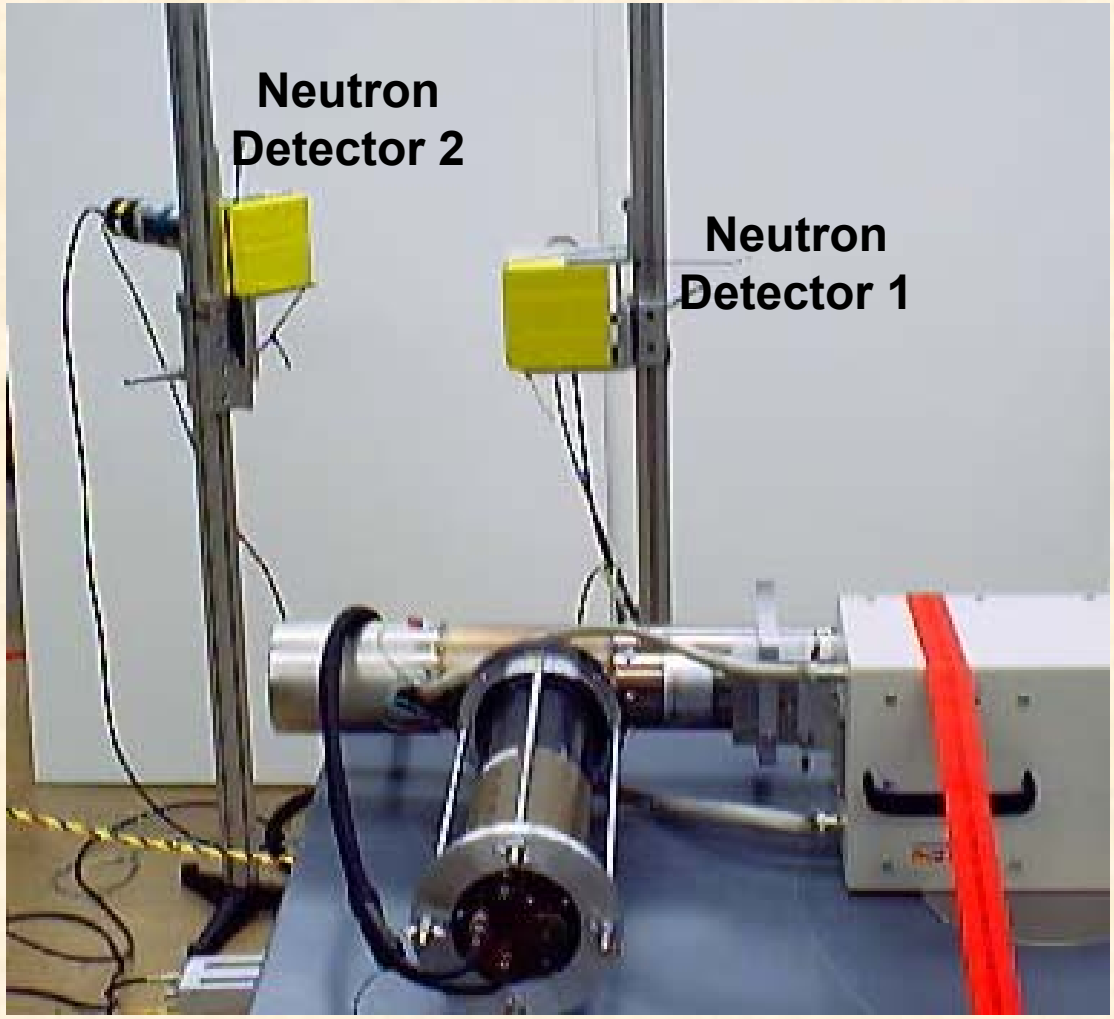
# Practical In-Plant Calibration of Alpha Detector

- Absolute neutron counting is not generally available for in-plant applications
- A means of periodically verifying the alpha detection efficiency is needed
- Large correlated backgrounds in-plant from scattered radiation passing through both detectors
- Elastic scattering at a particular angle eliminates correlated background at a particular time

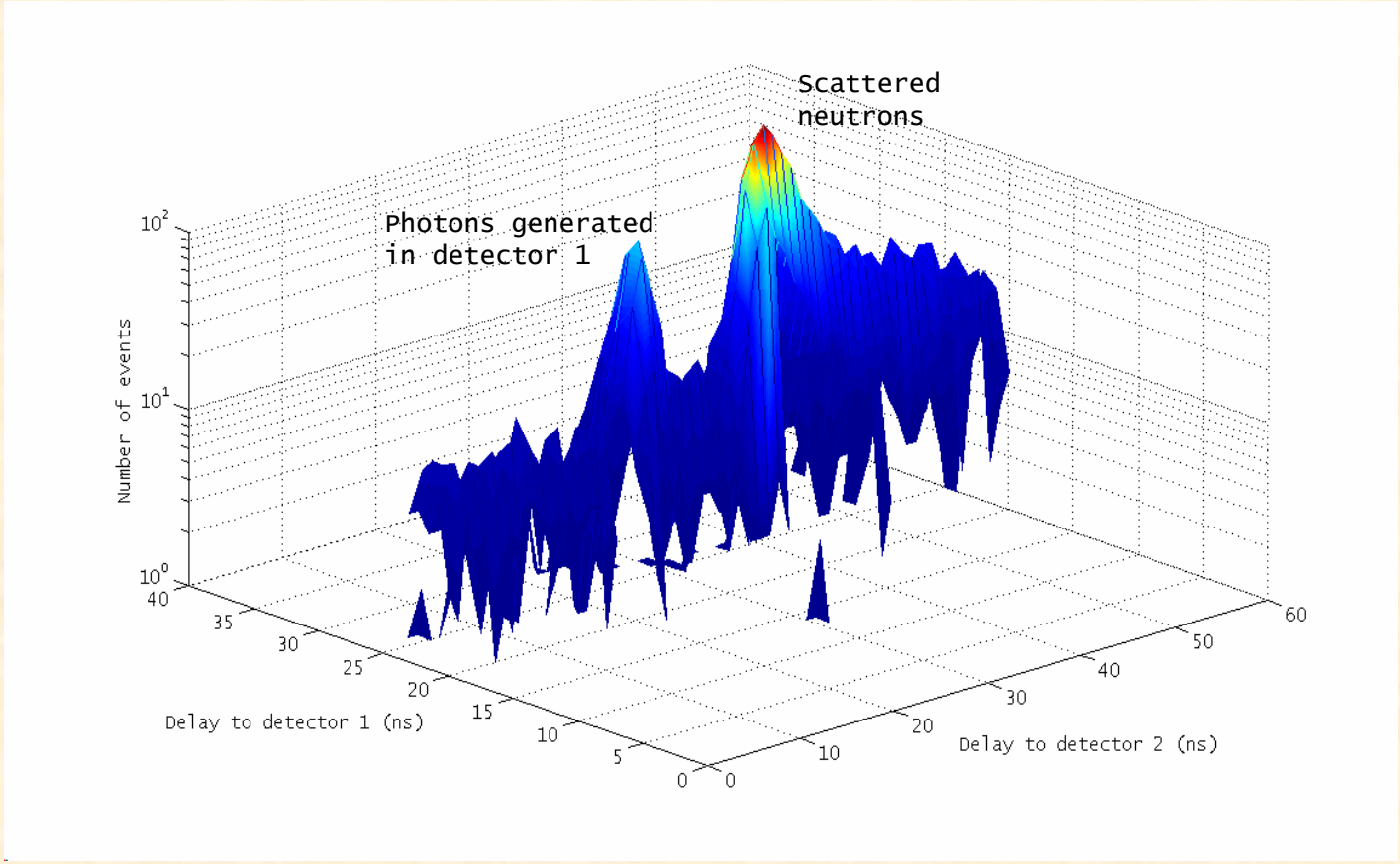
# Alpha-detector Efficiency Measurement



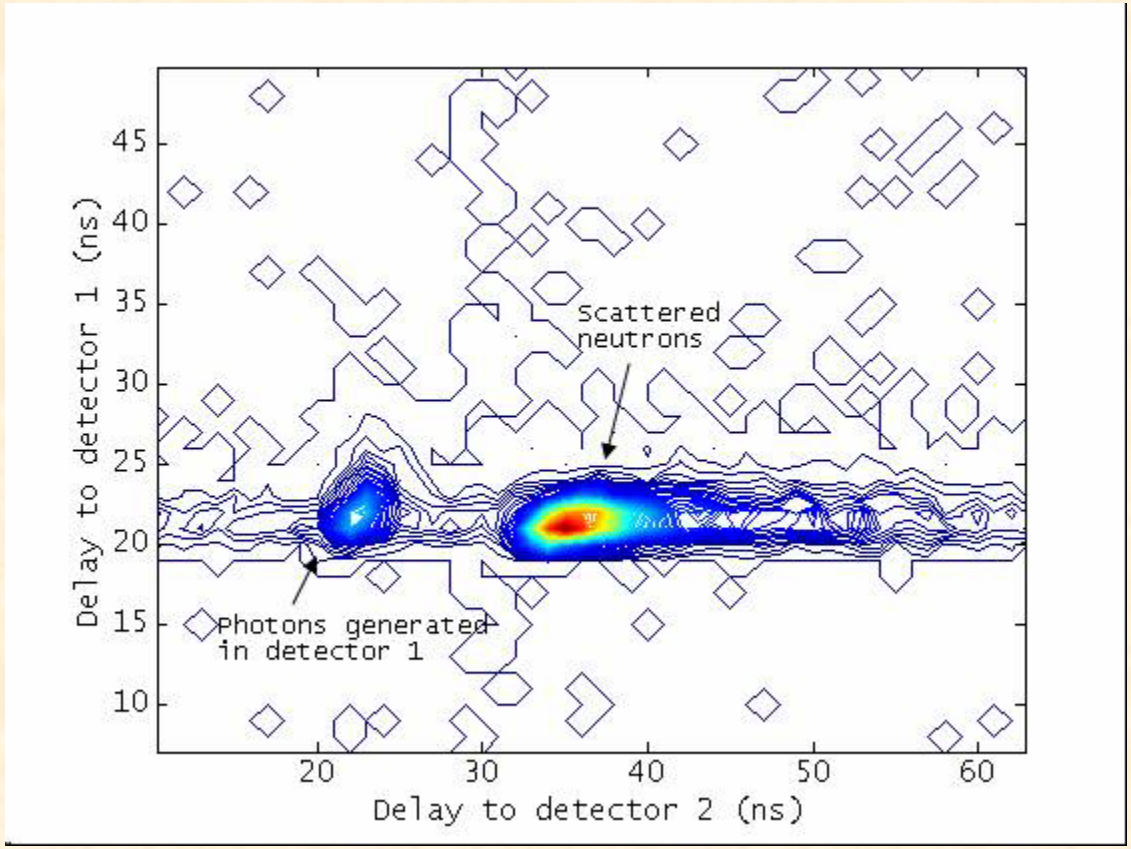
# Method for Alpha Detection Efficiency

- Ratio of source-detector-detector (G123) to detector-detector (G23) correlation (G123/G23) is the alpha detection efficiency
- NMIS Processor acquires these 3rd and 2nd order correlations from which the alpha detection efficiency can be obtained
- G123 contains only events in both detectors associated with an alpha count
- G23 also contains events in both detectors that are not associated with an alpha count
- Use of this ratio at a particular time utilizes only elastically scattered 7 MeV neutrons
- This reduces extraneous correlated background in G23 considerably since it must occur in a particular 5-10 nanosecond time interval

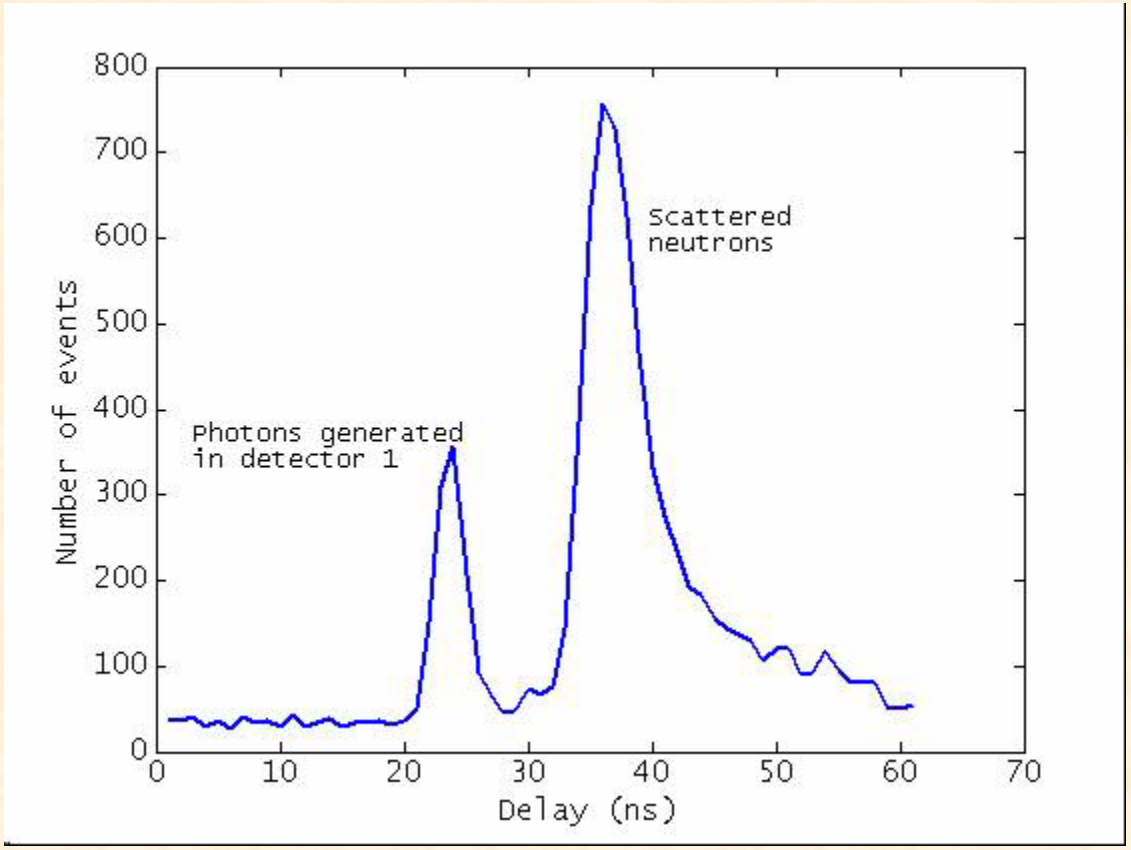
# Source - Detector 1- Detector 2 Bicorrelation



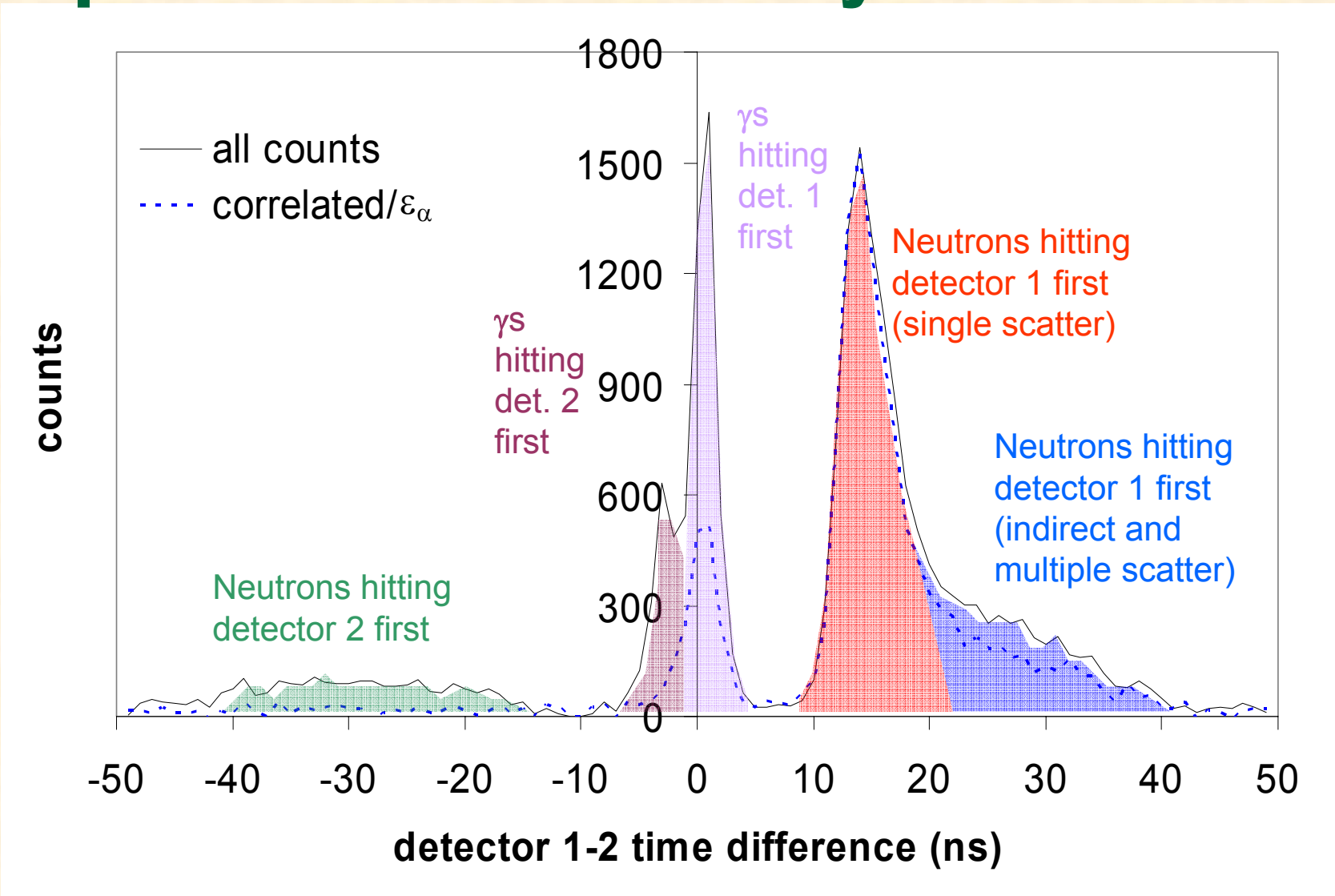
# Source - Detector 1- Detector 2 Bicorrelation (Contour Plot)



# Source - Detector 2 Correlation, Given Detection in Detector 1



# Alpha Detection Efficiency Determination



# Conclusions

- Elastic scattering measurements allows simple alpha detection efficiency determination for in-plant applications where absolute neutron counting may not be practical
- This will be implemented in the NMIS DAUI and IDAS software