UT-BATTELLE

NMIS PROCESSING CAPABILITY

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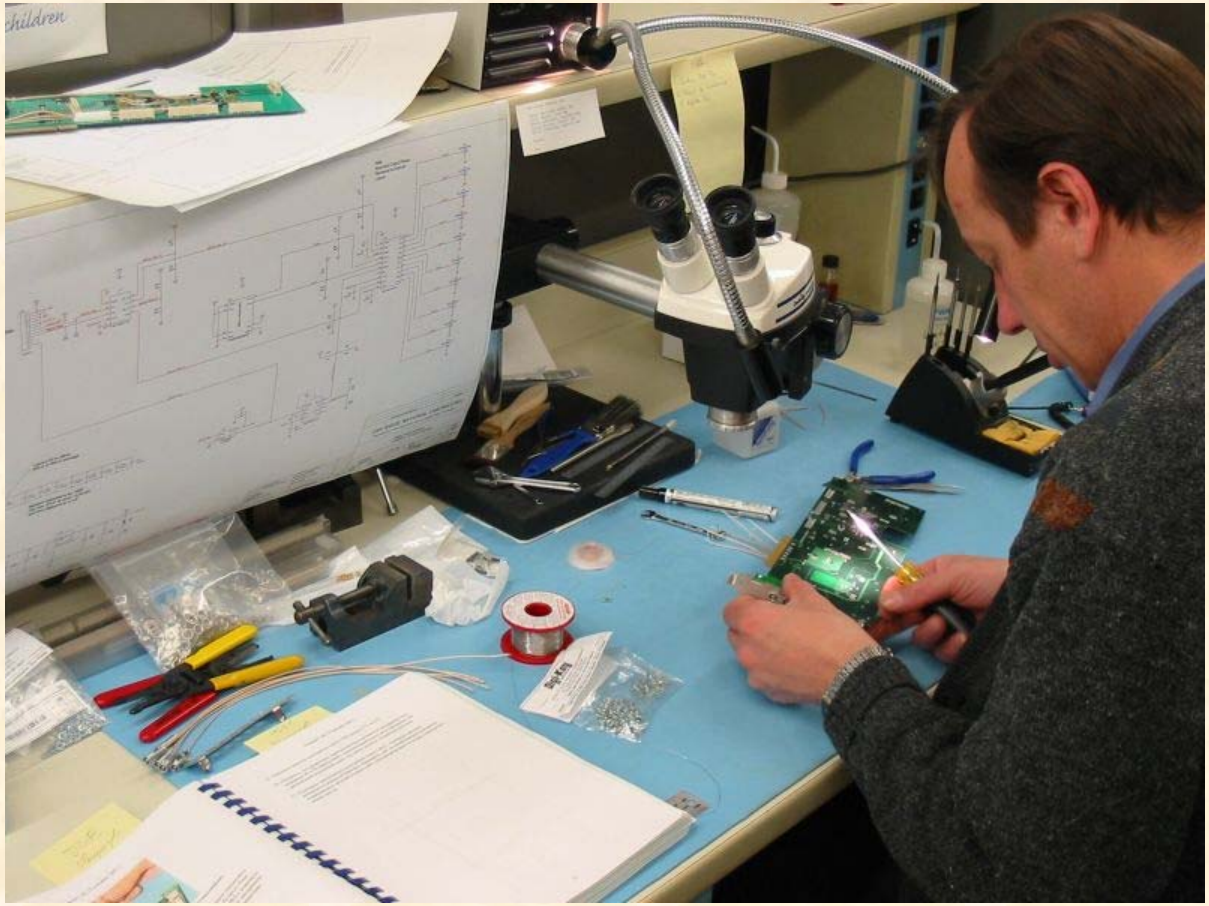
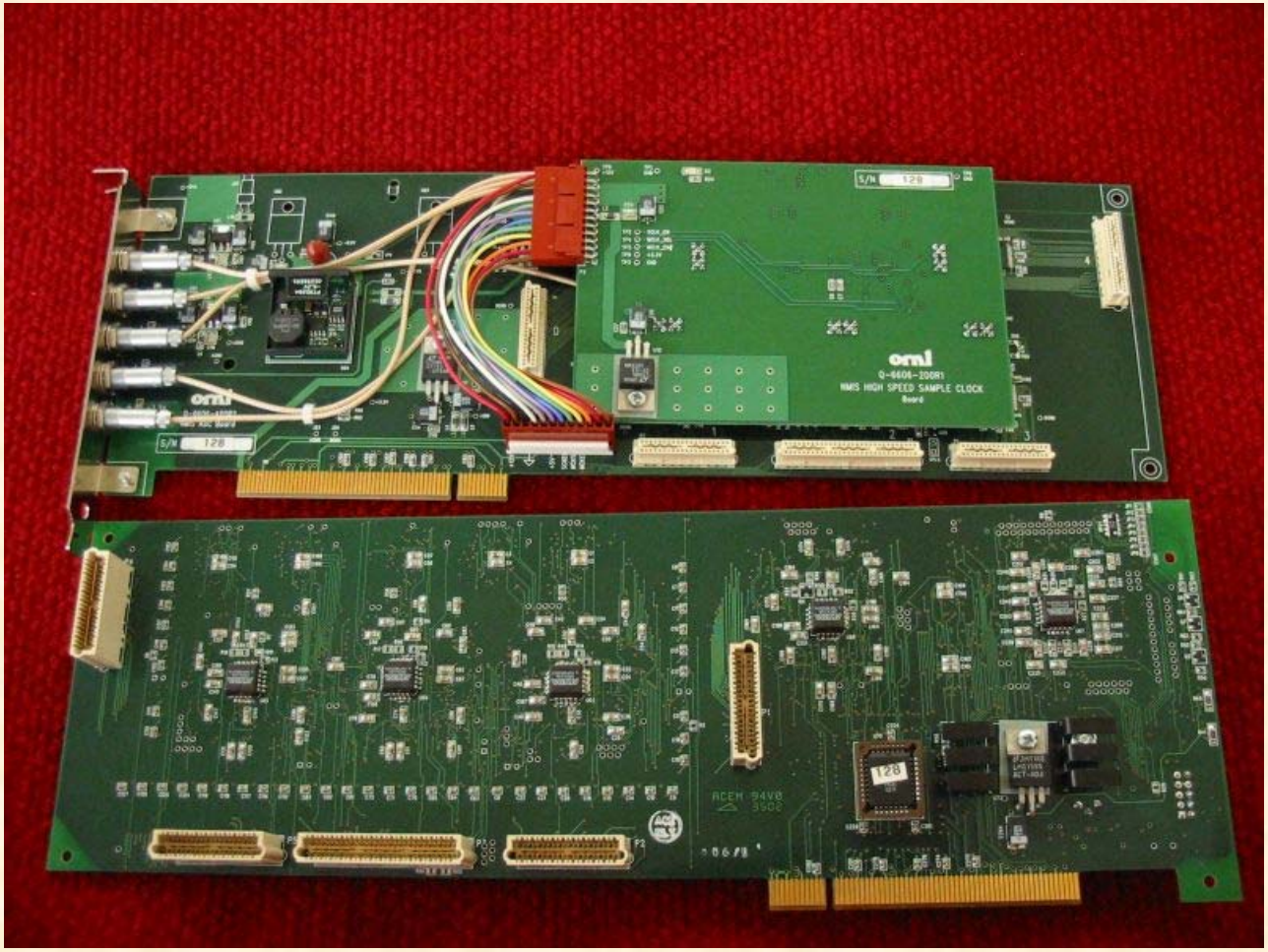
Testing of Processor Board in a NMIS System

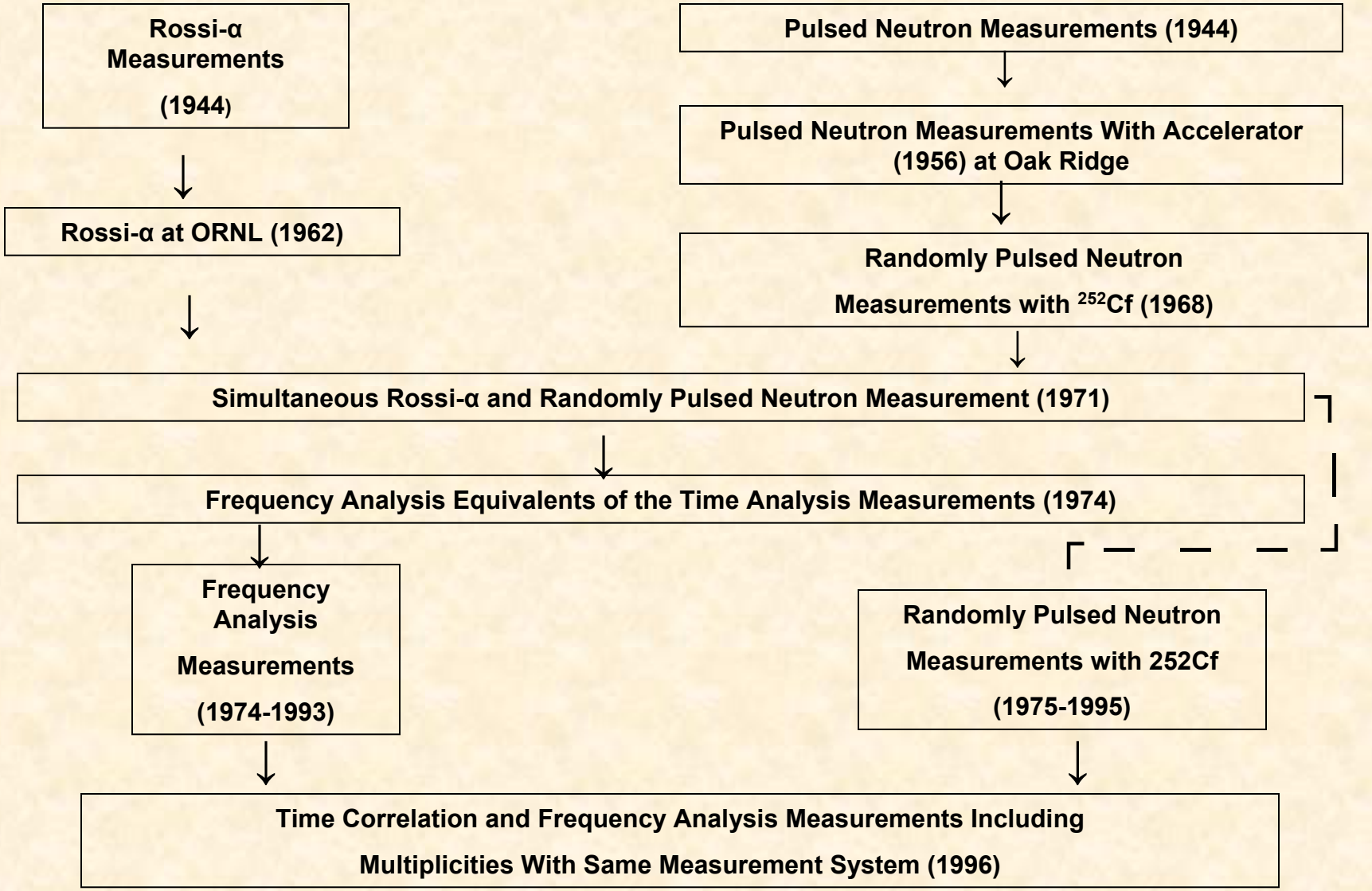


Work in Progress



NMIS Processor Board Set

Evolution of NMIS



NMIS Processor

- Five to ten input data channels
- Synchronously sampled up to 1 GHz in each channel
- Real time processing of signals

What the NMIS Processor Measures

- Average count rates in all channels
- Auto correlation function related to single detector Rossi-α (e.g. R_{22})
- Cross Correlation function – time destribution of counts with respect to counts in other channels
  - Equivalent to two detector Rossi-α for channels not including the source (e.g. R_{23})
  - Equivalent to pulsed neutron measurements if one channel is the source channel (i.e., R_{12})

What the NMIS Processor Measures (cont'd)

- Multiplets up to order n
  - Number of times 0, 1, 2… n events occur in each channel
  - Number of times 0,1,2… n events occur in sum of channels
  - Source, detector, and randomly triggered
- Third order correlations or bicorrelation functions (i.e., R_{ijk}) – Higher order statistics (HOS)

Biocovariance: Real Three-Way Coincidence

- Gamma-gamma-gamma (G-G-G)
  - All three counts in rapid succession (few nanoseconds delay)
  - Form concentrated "peak" centered near origin
- Gamma-gamma-neutron (G-G-N)
  - Two gammas counted first in sequence in rapid succession (few nanoseconds delay) & time-delay to neutron count distributed (over tens of nanoseconds) according to flight-speed
  - Form "Ridges" along axes and diagonal
- Neutron-neutron-neutron (N-N-N)
  - Time-delays distributed according to differences between flight-speeds
  - Form Broad "bump" centered near origin

NMIS Processing Speed Capability for ~3 GHz PCs

- For 5 channel operation each channel can acquire at rates of 2xE+6 cps and not loose information
- For 5 channel operation, NMIS loses 5% of the counts for 7xE6 cps in the source channel and 1E+5 cps in the 4 detection channels
- NMIS processes all 15 auto and cross correlations at this rate
- For multiplets and 3rd order correlation acquisitions live time throughtput is decreased
- For higher throughputs system finishes a block and stops acquiring data until board's buffers are only ¼ full