Detector acceptance tests and characterization

- Acceptance tests to ensure compliance with specifications
  - Source measurements with analog electronics and analysis
  - Specifications developed by detector working group and to be incorporated into contract
  - Test procedure for each specification developed jointly LBNL/MSU
  - MSU tests and advises LBNL of results
  - LBNL decides on disposition of detector
  - Manufacturer can perform the same tests to reduce number of returns
- Detector characterization
  - Pulse shape measurements with collimated source
  - In-beam characterization with analysis
- Perform acceptance tests and characterizations in cost-effective manner
  - Develop procedures by scientists and faculty (LBNL/MSU)
  - Production work done by graduate students
  - Continuity and quality assurance by faculty (Glasmacher/Starosta)

Acceptance tests
guided by IEEE 325-1996

- Energy resolution for segments and central contact
  - Cryostat pointing down
- Energy resolution for central contact
  - Cryostat pointing up
  - Ambient noise 80 dbC, 85 dbC, 88 dbC, 90dbC
- Absolute efficiency
  - Each crystal
  - triplet
- Peak-to-total ratio
  - Each crystal
  - 3-crystal summing
- Bandwidth of preamp
- Noise power spectrum
- Time resolution at nominal bias (CsF or fast plastic with ^{22}Na)

Acceptance tests II

- Time resolution at nominal bias (CsF or fast plastic with ^{22}Na)
- Cross talk between selected channels
- Depletion voltage (manufacturer to provide curve)
- Cool-down time
- Dewar holding time detector pointing up and down
- Heater resistance
- Temperature monitor PT100
- HV shutdown operational
- Mechanical dimensions
  - Crystal cans relative to cryostat
  - Crystal cans relative to mounting flange

Detector characterization

- Singles pulse shape measurements with collimated source on automated 2-D test stand (100 MHz, 12 bits) illuminating detector front
  - Locate front segments relative to optical reference point on cryostat housing (^{57}Co)
- Coincidence pulse shape measurements (^{60}Co)
  - Measure selected pulse shapes to compare to calculations
    - Segment geometry
    - Crystal orientation
- In-beam measurement with analysis
  - Doppler correction ability with slow and fast beams

MSU experience with highly-segmented HPGe dets

- Completed SeGA (an array of 18 32-fold-segmented HPGe detectors) in 2001 (funded by NSF and MSU) within budget and time
  - SeGA runs about 1500 hrs/year in about half of all NSCL CCF experiments
  - Acceptance tested 18 detectors with graduate students and characterized in automated test stand
- Available infrastructure
  - Dedicated gamma detector laboratory
  - Real-time data acquisition, HV and central contact digitizers for three central contacts, waveform digitizers for 1 crystal
  - Motion control for test stand, but need to build larger test stand
  - LN2 fill system
  - Established procedures (and culture) of handling Ge detectors

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Z. Hu *et al.* Nucl. Instr. Meth. **A 482** (2002) 715.

K.L. Miller *et al.* Nucl. Instr. Meth. **A 490** (2002) 140.