Summary – R&D plan 04/05

- Study 3 vs. 4 crystals/cryostat
  - Performance
  - Cost
  - Schedule
  - Maintenance and availability
- Test 3-crystals detector module
  - Acceptance test
  - Segmentation by surface scan
  - Pulse shape measurements
  - End-to-end test to compare measurements with simulations (source and in-beam)
- Develop trigger algorithm
- Develop trigger module
  - Test serial trigger for bit error rate and latency
- Develop prototype acquisition system
  - Digitizer read out computer
  - Network switch
  - 8-node processing farm
  - Implement “proof of principle” software
- Install 120 digitizer channels (15 modules)

Summary

- Rate:
  - Decomposition is the bottleneck → need benchmark 2x2 version
  - Tracking the next bottleneck
  - No electronics bottleneck
- Simulation & Pulse Shape Calculation
  - Program develop
  - Speed is not issue
  - Need geometry confirmation
  - Need direct input from optimization geometry to Geant
  - Prioritize improvement of signal generation

Summary cont.

- Decomposition
  - Most important part of software
  - Short term need test 2x2 version with in-beam test data
  - Develop performance metric
  - Develop other algorithms (physics based)
- Tracking
  - Speed is not issue
  - Need efficiency improvement
  - Several area can be explored
- Event Building
  - Not computational intense
  - Need to handle all error conditions and generate alarms

Summary cont.

- Control and read out
  - EPICS is a good choice
  - Data flow and interface need better definition
- Programming environment
  - Small number of simple languages
  - Need documentation
  - Need uniform programming style
  - Need code review
- On Line monitoring
  - ROOT base
  - Need better definition of requirements

Action items

Signal Generation

- Anisotropy in drift velocity
- Temperature effect
- Neutron damage
- Electronic response

Signal Decomposition

- >2 interactions per segment
- Improve & speed up multi-segments algorithm
- Adaptive/fixed grid
- grid size/shape
- T0 alignment
- Failure mode analysis
- SVD $\rightarrow$ grid search $\rightarrow$ least-squares (time issue)
- Deal with irregular-hexagon
- Calibration of position res.
- Separate radial analysis
- Develop priority improvement list

Action items - Tracking

- Electron range
- Single interaction of low energy gamma ray
- Improve χ^2
- Speed up
- Improve cluster creation & splitting
- Explore physics based/adaptive permutation sequence
- Coupling with signal decomposition
- Detector Geometry/ alignment

Action items - Geometry

- Confirm geometry optimization
- Independent Geant 4 code / Double check Geant 4 Agata code
- Test for overlapping volume
- Interface optimization code directly to Geant 4 geometry
- Performance calculation of 3 vs. 4 crystals/cryostat

Action items – Control Read out and On Line analysis

- Better definition of data flow and interfaces
- Better definition of requirement for on-line analysis
- Define interface with electronic group

Short term items – in beam test

<u>Understand limits in position resolution</u>

- Electron range (1-2 mm)
- >2 interactions per segment (2 mm)
- 1x1x1 grid (2 mm)
- Improve T0 alignment (0.5 mm)
- Possible different energy?

- Anisotropy (<1 mm)
- Temperature (0.5 mm)
- Detector geometry / alignment (1 mm)
- Neutron damage (negligible)