PSA: Introduction

PSA Implementation

- The signal decomposition algorithm (AGS)
- The quality of the signal basis
  - Physics of the detector
  - Impurity profile
  - Application of the detector response function to the calculated signals
- The preparation of the data
  - Energy calibration
  - Cross-talk correction Time alignment of traces
- A well working decomposition has additional benefits, e.g.
  - Correction of energy losses due to neutron damage

GRETINA Decomposition Basis

Courtesy David Radford

- Signal decomposition algorithm appears to work very well
  - Validated using simulated signals
- Most issues with the decomposition results appear to come from the fidelity of the signal basis
- Poor fidelity results in
  - Too many fitted interactions
  - Incorrect positions and energies
- Already included
  - Integral cross-talk
  - Differential cross-talk
  - Preamplifier rise-time
  - Differential cross-talk signals look like image charges, so they strongly affect position determination

Factors influencing performance

- Field and Weighting Potential:
  - Overall impurity concentration
  - Longitudinal impurity gradient (Linear? Nonlinear?)
  - Radial impurity gradient?
  - Hole diameter; hole depth; etching cycles; lithium thickness
  - Neutron damage (p-type)
- Charge carrier mobilities as a function of electric field

Factors influencing performance

- Crystal axis orientation (~ 5 degrees from maker)
- Crystal temperature
- Cross-talk (differential and integral)
- Neutron damage (trapping)
- Impulse response of 37 preamps
- Charge cloud size
- Digitizer nonlinearity

Observations: Clustering of points distributed inside detectors

What can be done?

- Extra timing information to constrain t_0
  - External fast detectors or RF signal
  - Ge-Ge coincidences - Requires event building prior to decomposition; hard
- Further improvements in basis fidelity
  - Preamplifier impulse response function
  - Include charge cloud size and charge-sharing in signal generation
    - Especially important at small radius, near segment boundaries
    - But energy-dependent?
- Better field determination
  - Segment capacitance measurements as a function of bias

PSA tasks going forward

- Pristine basis generation with irregular basis using SIG-GEN
- Optimised basis with experimental corrections (from ^{60}Co flood data)
- Development of an integrated data set of two interactions/segment using collimated scanning data
- Development of an integrated data set of two interactions/segment using collimated scanning data from AGATA digitisers
- New PSA algorithm development

PSA tasks going forward

- Implementation of multiple interaction algorithm for testing in beam
- Inclusion of positon uncertainties in PSA output
- Including regular/irregular basis and ADL/SIG-GEN
- Multiple interaction algorithm implementation
- Tracking: use of uncertainties propagated from PSA





Perspectives

- Availability of AGATA capsules for characterisation
- Continuity of available personnel to implement PSA algorithms

Talks this morning

• Online PSA performance	D. Ralet
• ADL status	L. Lewandowski
• Question on ADL	B. De Canditiis
• In-situ experimental basis	J. Ljungvall