

detectorSimulations_v10 Angular Correlations Extension Documentation

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All changes were made to the September 12 2017 commit to `detectorSimulations_v10` on the GRIFFINCollaboration GitHub page.

Event Action

This is where we save the energy deposited if there is a hit on a detector of interest (germanium or PACES).

This is also where the angle maps are stored. These tell us what the angle between two hits will be. There are currently two angle maps declared: `thisGriffinCryMap` is used when both hits are in germanium, and `thisPacesGriffinCryMap` is used when one hit is in germanium and the other is in PACES. A PACES-PACES map needs to be added.

The hits are paired and, depending on which detection systems were hit, the deposited energies and the angle between hits is passed into one of three 2D histograms (germanium-germanium, PACES-germanium/germanium-PACES, or PACES-PACES).

This is also where we fill the total angular distribution graph.

Header File

Additions:

- declared variables for deposited energy of particle pairs in cascade
 - the first particle will be paired with the second, then the second and third particles will be paired together, etc. Similar to the way `G4VGammaDeexcitation` works.
- declared variables for binning 2D angular correlations histograms (one for $\gamma\gamma$ correlations, and one for γe^- and $e^- \gamma$ correlations)
- declared variables for deciding whether or not to produce histograms for a specific particle pair (`gg`, `ge`, `ee`)
 - there are a matching set of booleans in `HistoManager.hh`. Both sets need to have the same values for each variable. There is definitely an easier way to do this.
 - the `G4bool ee` variable will have no effect until a PACES-PACES map is added and the code is modified accordingly
- declared array of angles for germanium-germanium hits (`thisGriffinCryMap`): organized by crystals indexed from 0 to 63
 - first index refers to the first crystal that was hit, and the second index is the second crystal hit
 - index formula: `crystal_index = detector_number × MAXNUMCRYGRIFFIN + crystal_number`
 - the maximum number of GRIFFIN crystals (`MAXNUMCRYGRIFFIN`) is currently 4

- declared array of angles for PACES-germanium/germanium-PACES hits (`thisPacesGriffinCryMap`): first index is the PACES detector that was hit (0 to 4), and the second is the germanium crystal that was hit (0 to 63)

Source File

Additions:

- tracked incoming hits in groups of two (along with their energies) and filled the appropriate 2D histograms based on particle types
- accessed the crystal map corresponding to the particle pair to retrieve the angle between hits
- filled 1D histogram tracking all angles produced in the simulation

HistoManager

This is where all the graphs are initialized.

Header File

Additions:

- `G4int EDEPNBINSGRIFFIN` : binning for GRIFFIN and PACES histograms
- `G4int EDEPXMINGRIFFIN` and `G4int EDEPXMINGRIFFIN` : range for GRIFFIN and PACES histograms
- `const G4int MAXNUMANG_GG` and `const G4int MAXNUMANG_GE` : the number of angles used in the $\gamma\gamma$ and mixed particle graphs, respectively
- `G4int MAXANGCORRHISTO` : number of different *types* of angular correlation graphs (one for $\gamma\gamma$, one for both γe^- and $e^- \gamma$, and one for $e^- e^-$)
- `short AngCorrNumbers[MAXNUMANG_GE*MAXANGCORRHISTO+MAXANGCORRHISTO]` : stores the 2D histograms. `MAXNUMANG_GE` should be replaced by `MAXNUMANG_GG` if the latter is greater. Again, there is definitely an easier way to do this.
- `short fAngCorrAngles[1]` : stores the 1D histogram of all angles produced in the simulation
- declared a set of booleans matching the ones in `EventAction`. Both sets need to have matching values.

Source File

Additions:

- created 2D histograms for all correlation types
- fixed PACES spectra titles
- replaced range and binning for GRIFFIN and PACES graphs
- created 1D histogram for displaying distribution of all angles produced in the simulation.

DetectionSystemPaces

This is where information on the PACES system setup is stored.

Header File

Unchanged.

Source File

modified measured ϕ angles to match the *NIM* paper.