SimSET's user functions

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Overview

- SimSET's user functions:
  - Called at critical points in event processing.
  - Provide safe way for users to modify SimSET.
  - Easily ported to new versions.
- User functions are called:
  - Just before photons are passed to the collimator.
  - Just before photons are passed to the detector.
  - At the beginning of the binning module.
  - Just before events are binned by the binning module.
  - By addrandoms for each collection of photons within a coincidence time window.
  - By addrandoms for each coincidence after time-windowing.

Overview (cont.)

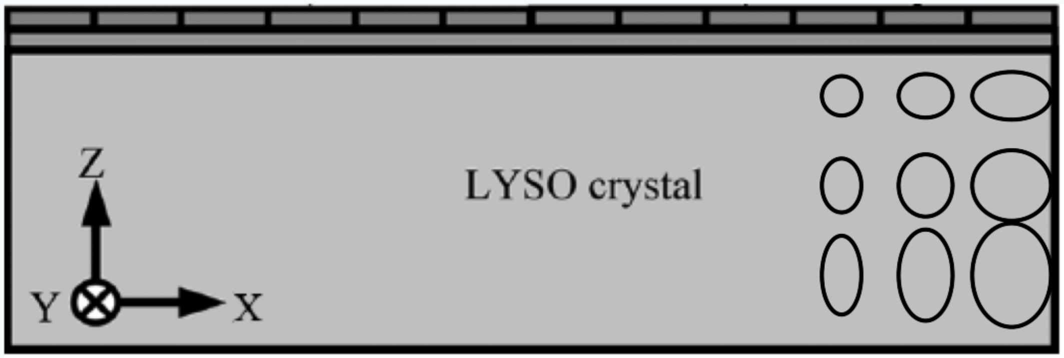
- User function modules include initialization and termination functions.
  - Read in user parameters, inputs.
  - Define global variables for user module.
  - Output user data.
  - Print user reports.

Example

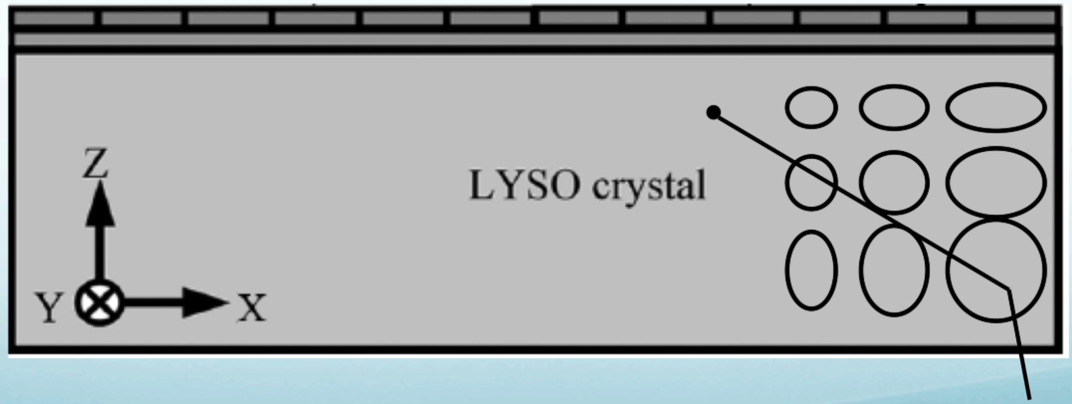
- Implement first-interaction positioning in a solid block detector with depth-of-interaction.
    - Position-dependent 3D blurring function (or table) for photons with a single interaction.
    - Position-dependent 3D blurring function (or table) for photons with two interactions.
    - Photons with 3 or more interactions discarded.
- We will use the function called for each photon just before binning.
    - PhgUsrBinPETPhotons for PET.
    - PhgUsrBinSPECTPhotons for SPECT.

Example (cont.)

Estimation for single hit



Estimation for double hit



Initialization

- PhgUsrBin.h
  - Declare constants and prototypes needed by other modules.
- PhgUsrBin.c
  - Declare local constants and variables.
  - Modify the function PhgUsrBinInitialize.

Initialization function

- PhgUsrBin.c

```
void PhgUsrBinInitialize(PHG_BinParamsTy *binParams,
        PHG_BinDataTy *binData)
{
        /* Do your initialization here */
        /* load tables or parameters for detector response */
        PhgUsrBin_get_detector_response ( );
        /* note that a prototype should be created for new functions */
        /* initialize array for histogramming number of  interactions by block */
        PhgUsrBin_create_interaction_array ( );
}
```

Declaring global variables, prototypes

- PhgUsrBin.c

```
/* Local Prototypes */
void PhgUsrBin_get_detector_response ( );
void PhgUsrBin_create_interaction_array ( );

/* Global variables */
static struct {
	/* Your fields of  choice go here */
	real	*detectorResponseTable;
	int	*interactionArray;
} PhgUsrBinVars;
```

Assigning photon’s detected position

- PhgUsrBin.c

```
Boolean PhgUsrBinSPECTPhotons(PHG_BinParamsTy *binParams,
        PHG_BinDataTy *binData,PHG_Decay *decay,
        PHG_TrackingPhoton *photon)
{
        Boolean acceptPhoton = false;        /* Should photon be binned? */
        /* change detected position below */
        do {
                if (photon->num_det_interactions > 2) break;
                photon->location = PhgUsrBin_sample_det_table( *photon );
                /* Set acceptance to true if we made it to here */
                acceptPhoton = true;
        } while (false);
        return (acceptPhoton);
}
```

Finding type definitions

- Use good programming environment.
- Contact us.
- The PHG_TrackingPhoton is defined in Photon.h.

```
/* Tracking Photon */
typedef  struct  {
        LbUsOneByte                  flags;
        PHG_Position                 location;
        ...
        detInteractionInfoTy         det_interactions[MAX_DET_INTERACTIONS];
        LbUsFourByte                 num_det_interactions;
        ...
}PHG_TrackingPhoton;
```

Other ideas for user functions

- Improved electronics simulation.
  - Use the addrandom user functions to simulate deadtime/pileup.
- More realistic modeling of the detection process for a given tomograph.
  - Use the binning user functions.
- Unsupported collimators, new binning variables...

Finally

- We are always willing to help.
- If your extension would be useful to others, please consider sharing it.