TIARA SIMULATION PACKAGE DESCRIPTION

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Package name: Tiara2.tar.gz (EXOGAM array included)

The Tiara detector is used to detect light charge particles emitted in nucleon transfer reaction in inverse kinematics. It is designed to be coupled to the cubic configuration of the gamma-ray array EXOGAM.

Filing structure:

+ **Main directory (Tiara2/):**

Tiara2.cc	main program.
vis.mac	default macro used for geometry visualisation.
vasiXXXXX.mac	(XXXXX=gamma, proton, alpha, 58Ni …) macro used to simulate high number of events without visualisation.
SimTreeread.cpp	generic root macro to inspect the raw output tree in Trees/mysimul.root
treeread.C	root macro to analyse the raw tree data recorded in the Silicon array (Tiara)
gtreeread.C	root macro to analyse the raw tree data recorded in the EXOGAM (Central contact signals)
gSegtreeread.C	root macro to analyse the raw tree data recorded in the EXOGAM (Central contact and segmentation contact signal)

+ **Subdirectories:**

Src/	= directory including all .cc files.
Include/	= directory including all .hh files.
Kin/	= directory including 2 body reaction kinematics files (for Elastic, inelastic and nucleon-transfer reaction)
Sec/	= directory including 2 body reaction cross- section files (for Elastic, inelastic and nucleon-transfer reaction)
Trees/	=directory where the output file: mysimul.root is saved at the end of the simulation
Hist/	=directory where the output file after analysis is saved.
Macro/	= contains some examples of root macros comparing histograms in different root files
Vec/	= obsolete.

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Geometry:

All the geometry of the setup is defined in the files Tiara2/src/TiaraDectectorConstruction.cc and Tiara2/include/TiaraDectectorConstruction.hh

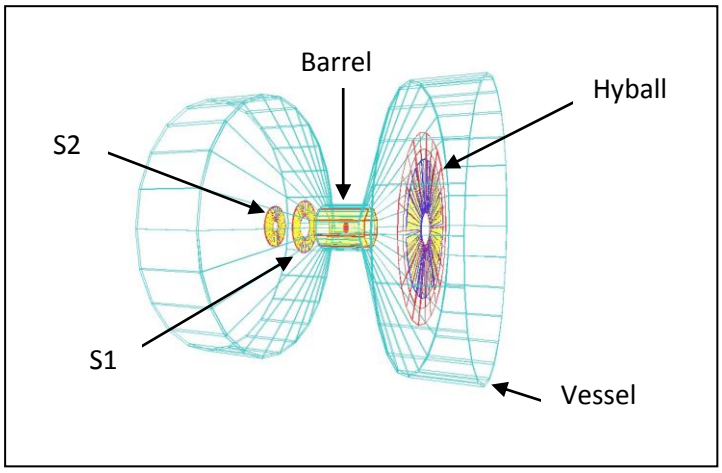

Figure 1: TIARA without EXOGAM

+ **Targets at centre coordinates (x=0; y=0; z=0)**

  Possible choice of targets between CH2, CD2, and just a hole (no target)

+ **8 resistive strips silicon detectors assembled in an octagonal barrel around target position.**

  Geometrical dimensions are from Micron-Semiconductor Ltd for X2 detectors

  Thickness: 400 um

+ **2 forward Double Sided Strip Detectors:**

  Geometrical dimensions are from Micron-Semiconductor Ltd for S1 and S2 detectors.

  Thickness: 500 um for S1 and S2 detectors

+ **6 backward Double Sided Strip wedges to form the "Hyball" detector:**

  Geometrical dimensions are from Micron-Semiconductor Ltd for Hyball detectors.

  Thickness: 400 um

+ **Tiara vacuum vessel:**

  Divided in 5 volumes: 2 large diameter tubes and 2 conical tubes at backward and forward angles covering the annular detectors, and a small diameter tube at the target position covering the barrel detector.

  Material: Aluminium, Thickness: 2 mm at the barrel position, 4 mm elsewhere.

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+ **Four Ge clovers of EXOGAM**

Each clover includes 4 tapered crystals, and each crystal includes a central contact (ECC) and 4 position information segments (GOCCE)

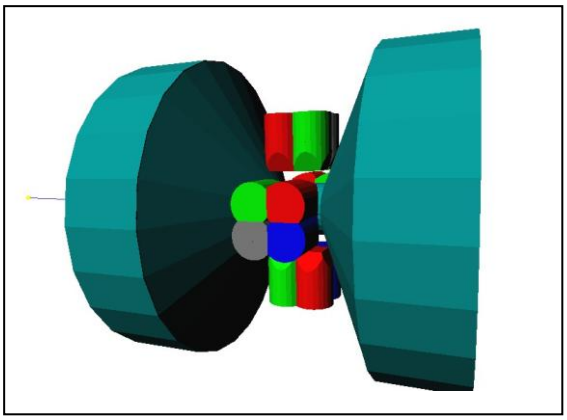

Figure 2: Tiara with 4 Ge clovers of EXOGAM

Event generators:

All are defined in the TiaraPrimaryGeneratorAction.cc

+ **Isotropic source (γ, p, d, t, He, etc...)**
+ **Anisotropic source**
+ **Elastic and inelastic scattering (kinematics and cross-section provided externally)**
+ **One- or -two nucleon Transfer (kinematics and cross-section provided externally)**

ROOT Tree structure:

+ **File Name:** mysimul.root
+ **Location:** Tiara2/Trees/
+ **Tree name:** EventTree
+ **Structure:**

The output root tree contains a single branch. For each detector, there are as many leaves as channels. Extra leaves are used to keep simulation input information (initial kinetic energy, initial theta emission angle) and extra leaves are also defined for total energy deposited in detectors (for example in all Tiara Si detector or for all clovers of EXOGAM)

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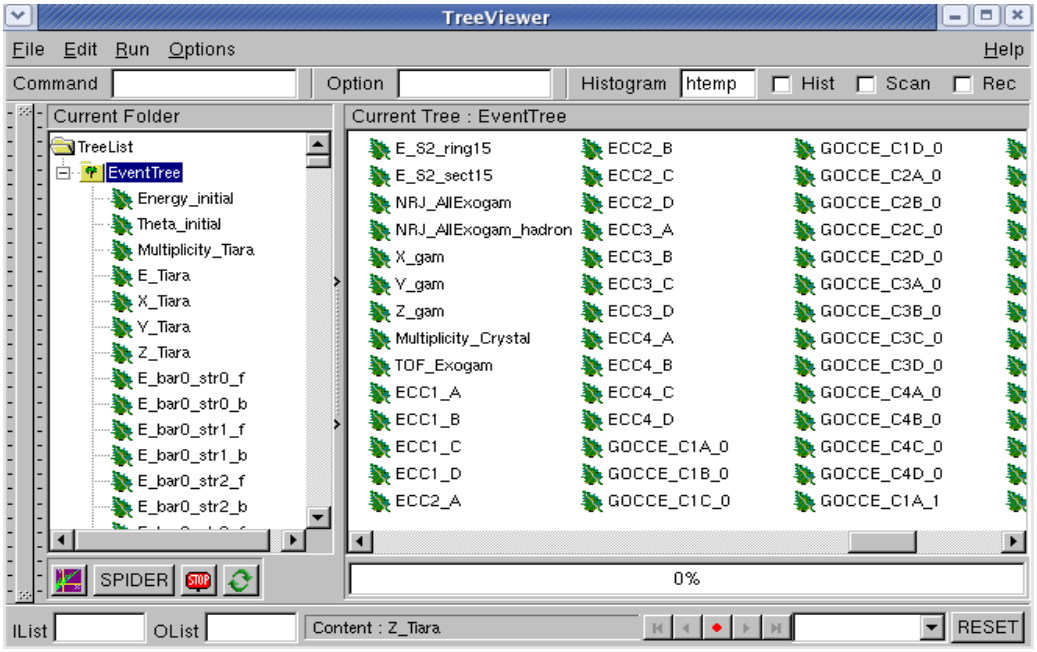

Figure 3: Subset of leaves in the root tree.

Leaves' name convention:

Tiara:

Energy_initial = initial kinetic energy of the particle

Theta_initial = initial polar angle of the particle

Multiplicity_Tiara = number of strip hit in Tiara

E_Tiara = smeared energy deposited in all Silicon detectors

X_Tiara, Y_Tiara, Z_Tiara = smeared Geant4 position of the particle detected in Tiara

E_BarX_strY_f = Energy recorded in front (downstream) strip#Y of Barrel detector#X

E_BarX_strY_b = Energy recorded in back (upstream) strip#Y of Barrel detector#X

E_HywedgeX_ringY = Energy recorded in ring#Y of the Hyball wedge#X

E_HywedgeX_sectY = Energy recorded in sector#Y of Hyball wedge#X

E_S1wedgeX_ringY = Energy recorded in ring#Y of the S1 wedge#X

E_S1wedgeX_sectY = Energy recorded in sector#Y of S1 wedge#X

E_S2wedgeX_ringY = Energy recorded in ring#Y of the S2 wedge#X

E_S2wedgeX_sectY = Energy recorded in sector#Y of S2 wedge#X

Exogam:

Multiplicity_Crystal = number of crystal hit in Tiara

NRJ_AllExogam = smeared energy deposited in all Silicon detector

X_gam, Y_gam, Z_gam = Geant4 position of the first interaction in EXOGAM

ECCX_Y = Energy in central contact of crystal#Y (Y=A,B,C,D) in Clover#X (X=1,2,3,4)

GOCCE_CXY_Z = Energy in Segment#Z (Z=1,2,3,4) of crystal#Y (Y=A,B,C,D) in Clover#X (X=1,2,3,4)

Note: structure should be changed to TClonesArray or Vector so that variable length data records can be used instead of fixed length data records.