TIARA simulation package User's guide

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Package name: Tiara2.tar.gz (Tiara + EXOGAM arrays)

The Tiara detector is used to detect light charge particle emitted in nucleon transfer reaction in inverse kinematics. It is design to be coupled to the cubic configuration of the gamma-ray array EXOGAM. **See edoc2000 for a detailed description.**

Installation requirement:

The minimum requirement to run the package is GEANT4, CLHEP and ROOT.

Successful installations have been achieved on Red Hat Linux with gcc 3.2.2 and Scientific Linux 4.5 (via VMWare Player) with gcc 3.4.6. with following versions:

GEANT4.9.2.p01, CLHEP-2.0.4.2, ROOT 5.22 (gcc 3.4.6)

GEANT4.9.1.p01, CLHEP-2.0.3.2, ROOT 5.18 (gcc 3.2.2)

GEANT4.7.0.p01, CLHEP-1.8.2.0, ROOT 4.03.04 (gcc 3.2.2)

You can find installation instructions here:

- http://geant4.slac.stanford.edu/installation/ and http://root.cern.ch/drupal/content/installing-root-source

  for GEANT4 and ROOT on Linux, Macintosh and Windows (using Microsoft Visual C++ and Cygwin)

- http://geant4.in2p3.fr/spip.php?rubrique8&lang=en (Recommended !!)

  for full installation (GEANT4,ROOT,CLHEP, graphical visualisation interface, and much more) on Windows and Macintosh with VMware.

Compilation:

To Compile the package with make or gmake, untar and unzip the Tiara.tar.gz file and go to the main dierectory Tiara2/:

gzip Tiara2.tar.gz

tar –xvf Tiara2.tar

cd Tiara2

make(or gmake)

How to run:

To run the program type:

./BinDirectoryPath/Tiara

Or, if you have defined the environment variable G4BINDIR and G4SYTEM type:

$G4BINDIR/Tiara or **$G4BINDIR/$G4SYSTEM/Tiara**

By default the program will execute the vis.mac macro. To run another macro type:

./BinDirectoryPath/Tiara MacroName.mac

The program will run until the prompter Idle> appears. At this point further interactive commands can be used, like a new run of events with the command: **Idle>/run/beamOn 100**

In order to exit the execution process type:

Idle>exit

The output tree is saved in the file Trees/mysimul.root and can be inspected by running the root macro SimTreeRead.cpp with the command:

root -l SimTreeread.cpp

Choose the Geometry

The user can easily run simulations without the EXOGAM array, without the annular detector S1, S2 and Hyball, without the barrel and without the vacuum chamber.

To remove the EXOGAM array from the setup, open the file src/TiaraDetectorConstruction.cc and, after the call of the include files, put in comment the line

#define EXOGAM i.e.: //#define EXOGAM

To keep EXOGAM, but use only one clover use:

#define EXOGAM

//#define REPLICAS_CLOVER

#define REPLICAS

To keep EXOGAM, but use only one crystal in the clover use:

#define EXOGAM

#define REPLICAS_CLOVER

// define REPLICAS

To remove the BARREL array put in comment the line

#define BARREL i.e.: //#define BARREL

Same for S1, S2, Hyball and the vacuum chamber.

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Choose the emitted particle:

By default the particle emitted is a proton, but you can change to another GEANT4particle or generic ion by modifying the input macro and using the command: /gun/particle.

For example, in vasialpha.mac macro below, one thousand alpha particle will be simulated.

Vasialpha.mac:

```
/run/verbose 0
/event/verbose 0
/gun/particle alpha
/N02/det/setField 0 tesla
/tracking/verbose 0
/hits/verbose 1
/run/beamOn 1000
```

Choose the event generator:

All the event generators are defined in the TiaraPrimaryGeneratorAction.cc. The User should select the event generator among the following:

- **Isotropic source (g, p, d, t, He, etc..)**
- **Anisotropic source**
- **Elastic and inelastic scattering (reading kinematics and cross-section from ASCII files)**
- **One- and two nucleon Transfer (reading kinematics and cross-section from ASCII files)**

The selection is done in src/TiaraDetectorConstruction.cc after the material definition and before the volume definition. To run with an isotropic source uncomment the line:

```
Answer="iso";
```

And comment all the others:

```
//Answer="trans";
//Answer="Elas";
//Answer="aniso";
```

For elastic/inelastic scattering and transfer reactions, the program read 2 ASCII files via the class Readkinematics.cc . The first file contains the energy and correlated polar angle of the emitted

particle while the second file contains the angular differential cross section. For the later, a flat cross-section distribution can be assumed at first.

Choose the target:

Like for the detectors, the user can choose a target between CH2, CD2 and no target at all in the file src/TiaraDetectorConstruction.cc.

For instance the sequence below is for a CD2 target.

```
#define TARGET

#define CD2     // deuterated polyethylene target

//#define CH2    // paraffin target

//#define HOLE // no target
```