Creation of HITS samples and transformation of Local to Global coordinates from EVNT samples.

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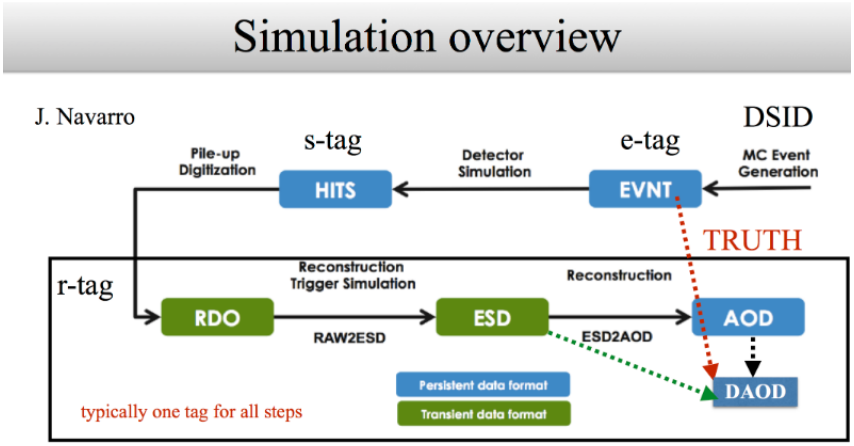
1 s-tag



For the s-tag simulation (HITS), we use the s4038 geometry.

All commands can be copy-pasted from the file Simulation_s4038.txt

Connect to the terminal on the CERN account and type the commands.

```
mkdir s4038; cd s4038
setupATLAS
asetup Athena,23.0.14
GetTfCommand.py --AMI=s4038 > run_s4038.sh
vim run_s4038.sh
```

Modify the file run_s4038.sh to match the input and output, you need to delete all lines of code except lines 10 and 11. It should look like this after the modification:

```
asetup Athena,23.0.14
Sim_tf.py --CA 'all:True' --conditionsTag 'default:OFLCOND-MC15c-SDR-14-05'
--geometryVersion 'default:ATLAS-P2-RUN4-01-01-00' --multithreaded 'True'
--postInclude 'default:PyJobTransforms.UseFrontie    r' --preExec
'ConfigFlags.HGTD.Geometry.useGeoModelXml = True' --preInclude
'EVNTtoHITS:Campaigns.PhaseIISimulation' --simulator 'FullG4MT_QS'
```

Add the input and output at the end of the second line as follows:

```
--inputEVNTFile '/chemin/fichierEVNT/nomfichier.root'
--outputHITSFile '/chemin/nouveaufichierHIT/nomfichier.HIT.root'
```

To obtain something like this:

```
asetup Athena,23.0.14

Sim_tf.py --CA 'all:True' --conditionsTag 'default:OFLCOND-MC15c-SDR-14-05'
--geometryVersion 'default:ATLAS-P2-RUN4-01-01-00' --multithreaded 'True'
--postInclude 'default:PyJobTransforms.UseFrontie    r' --preExec
'ConfigFlags.HGTD.Geometry.useGeoModelXml = True' --preInclude
'EVNTtoHITS:Campaigns.PhaseIISimulation' --simulator 'FullG4MT_QS'
--inputEVNTFile '/chemin/fichierEVNT/nomfichier.root' --outputHITSFile
'/chemin/nouveaufichierHIT/nomfichier.HIT.root'
```

It is possible to choose the number of events, for example, 100, that we want to simulate by appending the command at the end of the line in Sim_tf.py:

```
--maxEvents '100'
```

Once the .sh file is modified, you can launch the execution with the command:

```
setupATLAS
source run_s4038.sh
```

2 Local to global transformation.

Connect to the terminal on the CERN account and type the commands.

```
mkdir  work/athena_sparse_checkout_3
cd work/athena_sparse_checkout_3
setupATLAS
lsetup git
git atlas init-workdir https://:@gitlab.cern.ch:8443/atlas/athena.git
cd athena/
git fetch upstream
git checkout -b master-my-topic upstream/23.0 --no-track
git atlas addpkg HitAnalysis GeoAdaptors
mkdir ../build && cd ../build
asetup 23.0,latest,Athena
```

```
cmake ../athena/Projects/WorkDir/
source x86_64-centos7-gcc11-opt/setup.sh
make -j8
```

Go to the SiHitAnalysis.cxx file to fix the bug.

```
vi ../athena/DetectorDescription/GeoModel/GeoAdaptors/GeoAdaptors/GeoSiHit.icc
```

In the SiHitAnalysis.cxx file, replace

```
55    if (geoelement) {
56      const HepGeom::Point3D<double> globalStartPos =Amg::EigenTransform
ToCLHEP(geoelement->transformHit()) *  HepGeom::Point3D<double>(m_hit->local
StartPosition());
57
58      double x=globalStartPos.x();
59      double y=globalStartPos.y();
60      double z=globalStartPos.z();
61      return HepGeom::Point3D<double>(x,y,z);
62    }
63
```

By: (the code to be replaced can be copied and pasted from the txt file)

```
5
56    if (geoelement) {
57      if(m_hit->isHGTD()){
58        const HepGeom::Point3D<double> localHit = m_hit->localStartPosition();
59        HepGeom::Point3D<double> flippedHit;
60        flippedHit[0]=localHit.y();
61        flippedHit[1]=localHit.z();
62        flippedHit[2]=localHit.x();
63        const HepGeom::Point3D<double> globalStartPos =
Amg::EigenTransformToCLHEP(geoelement->
transformHit()) * (flippedHit);
64        double x=globalStartPos.x();
65        double y=globalStartPos.y();
66        double z=globalStartPos.z();
67        return HepGeom::Point3D<double>(x,y,z);
68      }else{
69      const HepGeom::Point3D<double> globalStartPos =
Amg::EigenTransformToCLHEP(geoelement->transformHit()) *
HepGeom::Point3D<double>(m_hit->localStartPosition());
70
71      double x=globalStartPos.x();
72      double y=globalStartPos.y();
73      double z=globalStartPos.z();
74      return HepGeom::Point3D<double>(x,y,z);
75      }
```

```
76    }
```

To access the PDG index, you also need to go to the SiHitAnalysis.h file and replace false by true

```
Gaudi::Property<bool> m_extraTruthBranches {this, "ExtraTruthBranches", true, ""}
```

After modifying the file, type the following commands in the terminal. (Once the file has been modified for the first time, you only need to perform this step from the 'build' directory.)

```
setupATLAS
lsetup git
asetup 23.0,latest,Athena
cmake ../athena/Projects/WorkDir/
source x86_64-centos7-gcc11-opt/setup.sh
make -j8
```

Then, launch the transformation on the desired file.

```
RunHitAnalysis.py -i /chemin/du/fichier/nomfichier.HIT.root
```

A SiHitAnalysis.root file will be created in the 'build' directory, corresponding to the HIT file with the transformed coordinates.