

# CLAS12 Software Demonstration

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First CLAS12 Experiment Workshop

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# Outline

- **Introduction**

- gemc
- coatjava
- ced

- **Getting started**

- setting your environment
- downloading the packages and tutorial

- **Simulating CLAS12 with gemc**

- DVCS events
- $\pi^0$  events

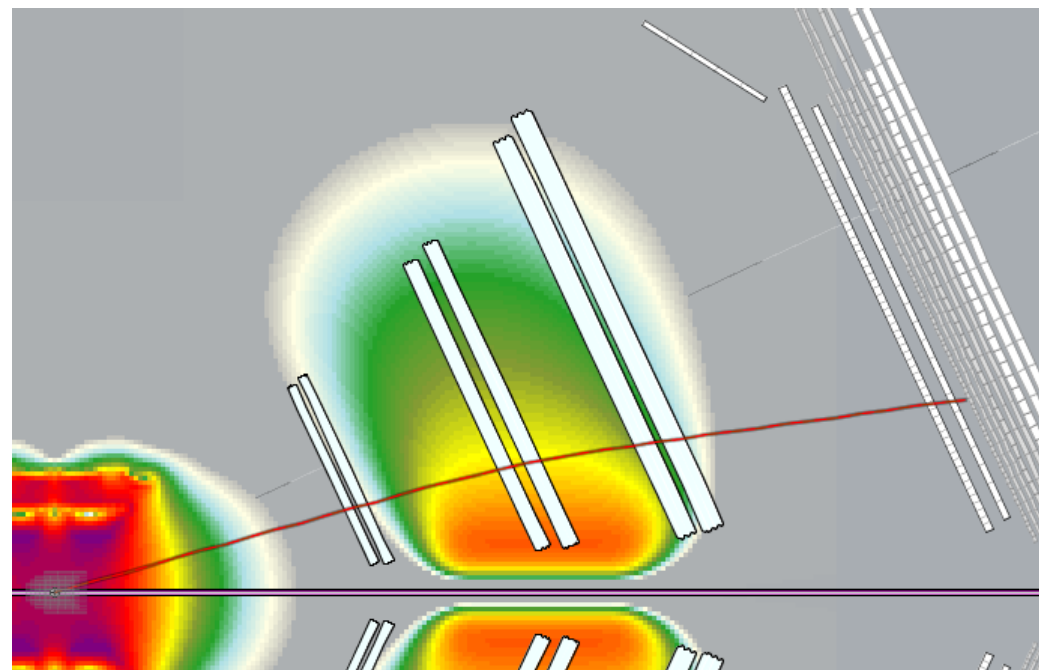
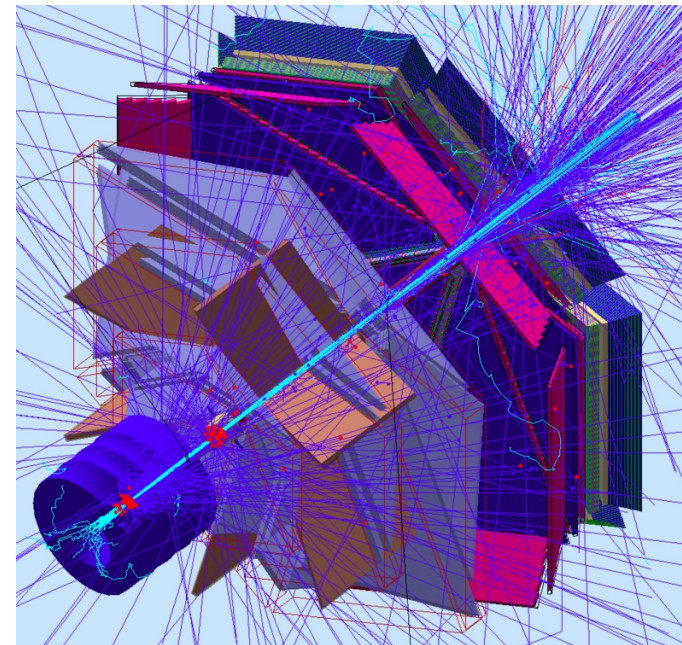
- **Running CLAS12 reconstruction**

- **Monitoring and analysis**

- clas12-monitor
- displaying events with ced
- writing/running analysis codes with groovy

# Introduction

- **GEMC** – GEant4 Monte Carlo
  - the official detector simulation of CLAS12
  - developed by Maurizio Ungaro
  - see Mauri's talk and [gemc.jlab.org](http://gemc.jlab.org) for more info.
- **Coatjava** – CLAS Offline Analysis Tools
  - offline common tools for building CLAS12 reconstruction, calibration, and analysis software
  - developed by Gagik Gavalian
  - see Gagik's talk and <http://clasweb.jlab.org/clas12offline/docs/software/html/index.html> for more info.
- **ced** – CLAS Event Display
  - developed by Dave Heddle



# Getting Started

1.) ssh into ifarm65

2.) run the following commands to set your environment

```
source /site/env/syscshrc  
module load java_1.8  
use groovy
```

3.) create a directory to work in, e.g.

```
mkdir demoDir ; cd demoDir
```


4.) download and unpack ced:

```
wget https://userweb.jlab.org/~heddle/ced/builds/ced\_build\_0.97.04.tar.gz  
tar -zxvf ced_build_0.97.04.tar.gz
```

5.) copy all \*.csh and \*.groovy files in /volatile/clas/clas12/nathanh/demo\_15Jun16 to your working directory

# Simulating CLAS12 with GEMC

Update: use 1.3.1 to pick  
up GEMC version 2.4



runGEMC.csh:

```
1 #!/bin/csh -f
2
3 source /site/12gev_phys/production.csh 1.3
4
5 setenv Nevents 20
6 setenv gcardFile /group/clas12/clas12.gcard
7
8 gemc $gcardFile -INPUT_GEN_FILE="LUND, /group/clas12/mcdata/generated/lund/dvcs/dvcsgen1.dat" -OUTPUT="evio, dvcsgen1.evio" -RUNNO=11
  -USE_GUI=0 -N=$Nevents
9
10 gemc $gcardFile -INPUT_GEN_FILE="LUND, /group/clas12/mcdata/generated/lund/pi0/pi0sgen1.dat" -OUTPUT="evio, pi0sgen1.evio" -RUNNO=11
  -USE_GUI=0 -N=$Nevents
```

- To simulate 20 DVCS events and 20  $\pi^0$  events passing through CLAS12, run this script with the command:

./runGEMC.csh

(the events have already been generated)

- Line 3 sets the environment to use gemc version 2.4
- the gcard file contains options such as what detectors to use, magnetic field settings, which physics processes to simulate, etc.
- RUNNO=11 tells the database (CCDB) which constants to use
- You should now have 2 simulated files: dvcsgen1.evio and pi0sgen1.evio, next we will cook them

\*High statistics files are already available to save time.

# Running CLAS12 Reconstruction

reconstruct.csh:

```
1 #!/bin/csh -f
2
3 /group/clas12/packages/coatjava-2.4/bin/clas12-reconstruction -s CVT:DCHB:DCTB:CTOFRec:FTOFRec:HTCC:ECREC:FTCAL:FTHOD0:FTMATCH:EB
  -i dvcs1gen1.evio -o rec_dvcs1gen1.evio -config DATA::mc=true -config CCDB::CALIBRUN=11
4
5 /group/clas12/packages/coatjava-2.4/bin/clas12-reconstruction -s CVT:DCHB:DCTB:CTOFRec:FTOFRec:HTCC:ECREC:FTCAL:FTHOD0:FTMATCH:EB
  -i pi0s1gen1.evio -o rec_pi0s1gen1.evio -config DATA::mc=true -config CCDB::CALIBRUN=11
```

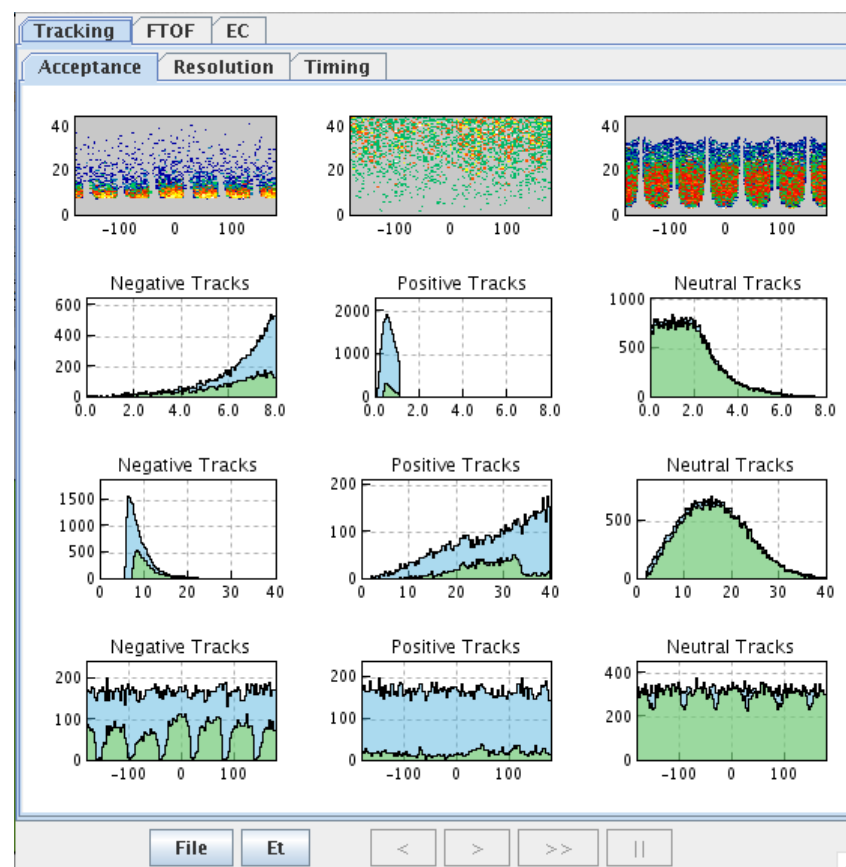
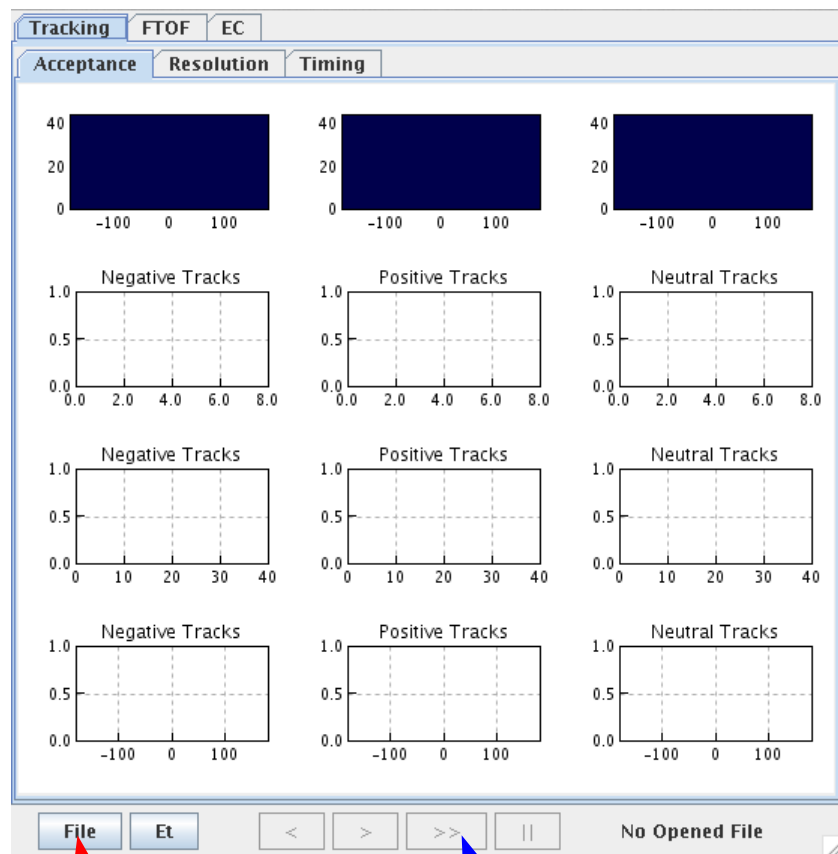
- To reconstruct the files you just simulated, run this script with the command:  
./reconstruct.csh
- clas12-reconstruction is part of the coatjava package
- The “-s” argument is a list of services, this reconstruction will include the Central Vertex Tracker, the Drift Chambers, the Time Of Flights, etc.
- CALIBRUN=11 tells the database (CCDB) which constants to use (this will soon be programmed to automatically match GEMC)
- You should now have 2 reconstructed files: rec\_dvcs1gen1.0.evio and rec\_pi0s1gen1.0.evio, next we will inspect and analyze them

\*High statistics files are already available to save time.

# Monitoring and Analysis

- clas12-monitor is another coatjava tool, it is useful for quickly checking the contents of a data file, open it with the command:

`/group/clas12/packages/coatjava-2.4/bin/clas12-monitor`



click here to select your file

then click here

\*The directory `/volatile/clas/clas12/nathanh/DVCS_pi0/cookedFiles/` contains high statistics files

# Monitoring and Analysis

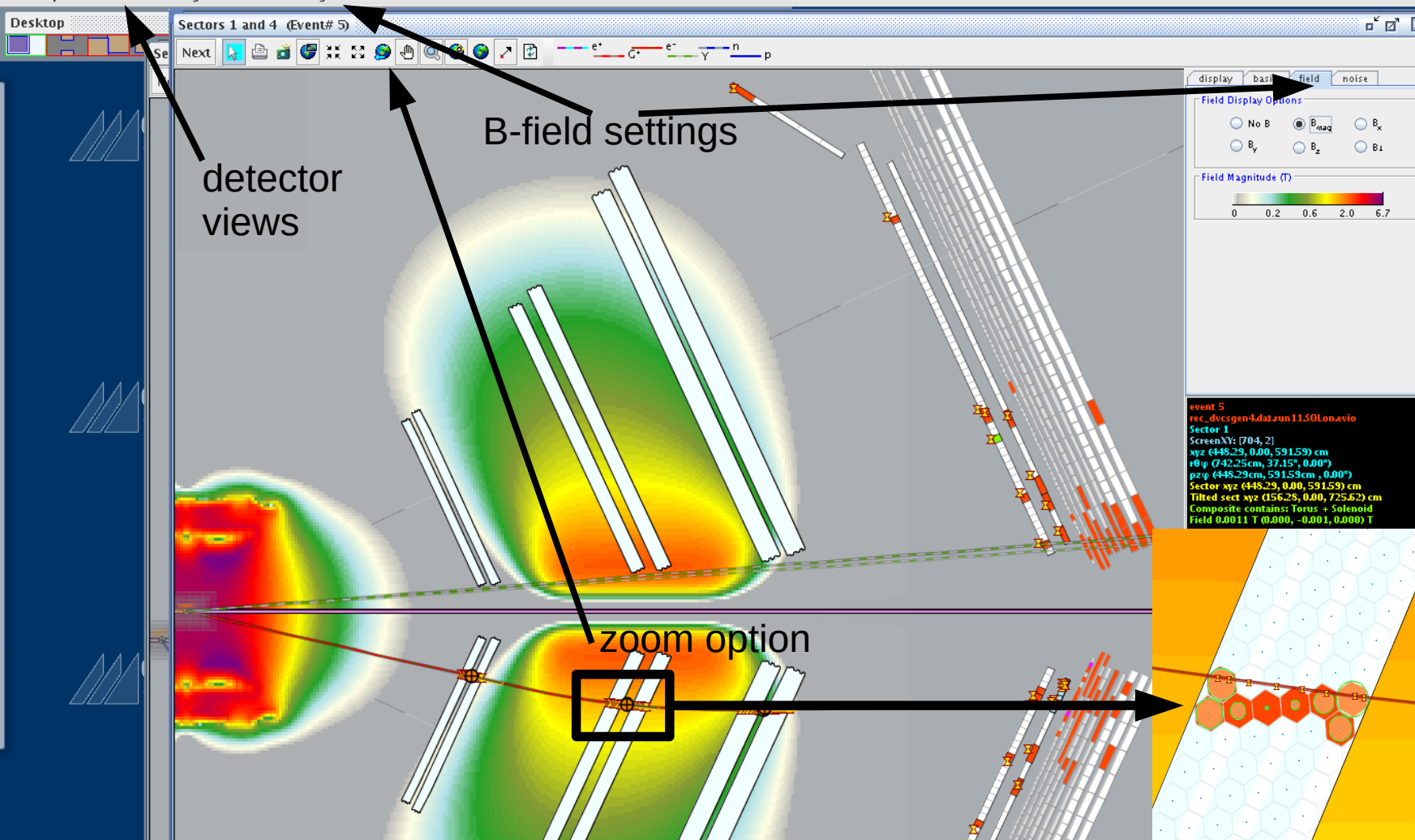
- ced is a tool for displaying individual events in CLAS12
- go into the cedbuild directory that you unpacked earlier and launch ced:  
`cd cedbuild ; java -jar -Dsun.java2d.pmoscreen=false ced.jar`

optional for faster graphics

ctrl+n for next event

- File → Open event file...

File Options Views Histograms Events Magnetic Field Swim Define FastMC





# Monitoring and Analysis

- CLAS12 analyses are done with groovy scripts. This method ties well with the coatjava framework and provides standard tools for reading EVIO files and reconstructed banks.
- For example, the DVCS and  $\pi^0$  data files just produced can be used to study  $\pi^0$  contamination ( $\pi^0 \rightarrow \gamma\gamma$ ) in DVCS. To run the sample analysis code, do:  
`/group/clas12/packages/coatjava-2.4/bin/run-groovy theta_gX.groovy file1.evio file2.evio ...`  
where the files are the DVCS and  $\pi^0$  cooked files.

