

# CLAS12 Software Demonstration

## Part 1 of 2

Nathan Harrison

CLAS Collaboration Meeting  
November 1, 2016  
Jefferson Lab, Newport News, VA

## Preliminary setup:

Simulations will be run on the farm, everything else will be done locally on your laptop. We are currently supporting Mac and Linux. Windows users may want to install a virtual machine. The following preliminary setup is required:

### Farm

- Please use the tcsh shell and make sure your .tcshrc file doesn't contain anything unusual; a blank .tcshrc file is fine.
  - `echo $SHELL` should give /bin/tcsh

### Laptop

- download the directory of ancillary files
  - `scp -r username@ftp.jlab.org:/volatile/clas/clas12/nathanh/demo_1nov16 .`
  - **Tip:** this directory contains a text file, commands.txt, for your copying and pasting convenience.
- make sure you have an up-to-date version of the Java Development Toolkit (JDK) on your laptop
  - the output of the command `java -version` should be `>= 1.8`
  - if not, download the latest JDK from oracle.com (don't confuse JDK with Java Runtime Environment (JRE))
- also make sure groovy is up-to-date
  - `groovy -version` should give Groovy Version `>= 2.4` and JVM `>= 1.8`
  - if not, get the latest version from groovy-lang.org
- download the latest version of COATJAVA 3.0
  - `wget --no-check-certificate https://userweb.jlab.org/~gavalian/software/coatjava/coatjava-3.0.tar.gz`
  - **update:** `scp username@ftp.jlab.org:/volatile/clas/clas12/nathanh/coatjava-3.0-31oct16.tar.gz .`
  - `tar -zxvf coatjava-3.0-31oct16.tar.gz`
  - `setenv COATJAVA /path/to/coatjava/`

## Running CLAS12 Simulations with GEMC (on ifarm65)

The current version of GEMC is 2.5. To pick up this version on the farm, source the following environment:

```
source /site/12gev_phys/production.csh 2.0
```

We will be simulating  $e p \rightarrow e K^+ \Lambda$  events from a lund file using the baseline CLAS12 configuration, this is done with the following command:

```
gemc /group/clas12/clas12.gcard -INPUT_GEN_FILE="LUND,  
/group/clas12/mcdata/generated/lund/klambda/clasdispr.00.e11.000.emn0.75tmn.10.xs76.38nb.321.0000.dat"  
-OUTPUT="evio, gemcOut.evio" -RUNNO=11 -USE_GUI=0 -N=10
```

option	description
/group/clas12/clas12.gcard	A plain text file containing options and settings for the simulation. This particular file sets up baseline CLAS12.
INPUT_GEN_FILE	Specifies the format and file path of the input file containing the generated events.
OUTPUT	Specifies the format and file name of the simulated output file.
RUNNO	Specifies the run number (used to connect to CCDB).
USE_GUI	Specifies interactive mode (1) or batch mode (0).
N	The number of events to simulate.

# Running CLAS12 Simulations with GEMC

This should produce a file called gemcOut.evio, copy it to your laptop:

```
scp username@ftp.jlab.org:/path/to/gemcOut.evio .
```

A quick way to check this file (or any other evio or hipo file – raw or cooked) is with eviodump:

```
$COATJAVA/bin/eviodump gemcOut.evio
```

```
Press Enter for Next Event or Bank Name:
***** EVENT # 2 *****

+-----+-----+-----+
|                                     | bank | nrow | ncol |
+-----+-----+-----+
|                                     | BMT::dgtz | 2 | 6 |
|                                     | CND::dgtz | 2 | 11 |
|                                     | DC::dgtz | 72 | 11 |
|                                     | DC::truel | 72 | 24 |
|                                     | EC::dgtz | 67 | 7 |
|                                     | EC::truel | 67 | 24 |
|                                     | FT0F1A::dgtz | 14 | 7 |
|                                     | FT0F1A::truel | 14 | 24 |
|                                     | FT0F1B::dgtz | 9 | 7 |
|                                     | FT0F1B::truel | 9 | 24 |
|                                     | FT0F2B::dgtz | 2 | 7 |
|                                     | FT0F2B::truel | 2 | 24 |
|                                     | GenPart::truel | 5 | 7 |
|                                     | HTCC::dgtz | 2 | 6 |
|                                     | HTCC::truel | 2 | 25 |
|                                     | PCAL::dgtz | 72 | 7 |
|                                     | PCAL::truel | 72 | 24 |
+-----+-----+-----+

Press Enter for Next Event or Bank Name: GenPart::true
****>>>> BANK GenPart::true >>>> SIZE = 7
pid (int) : 11 321 2112 22 22
px (double) : 1195.60000 -1164.10000 -37.70000 -25.60000 31.80000
py (double) : -217.90000 500.60000 -328.00000 5.40000 39.90000
pz (double) : 7558.10000 2226.60000 1136.70000 102.90000 -24.40000
vx (double) : 0.00000 0.00000 -1.43300 -1.43300 -1.43300
vy (double) : 0.00000 0.00000 -12.84200 -12.84200 -12.84200
vz (double) : 0.00000 0.00000 55.20000 55.20000 55.20000

Press Enter for Next Event or Bank Name: █
```

## Running CLAS12 Reconstruction with CLARA and COATJAVA

The reconstruction code needs to be told what the run number and magnetic field scales were, this is done by adding a header bank to the gemcOut.evio file:

```
$COATJAVA/bin/gemc-evio gemcOut.evio 11 -1.0 1.0
```

option	description
gemcOut.evio	the file to which the header bank is added
11	the run number used in the simulation
-1.0	the torus scale used in the simulation (defined in the gcard)
1.0	the solenoid scaled used in the simulation (defined in the gcard)

This will automatically create the file gemcOut\_header.evio.

Reconstruction is done with the following command:

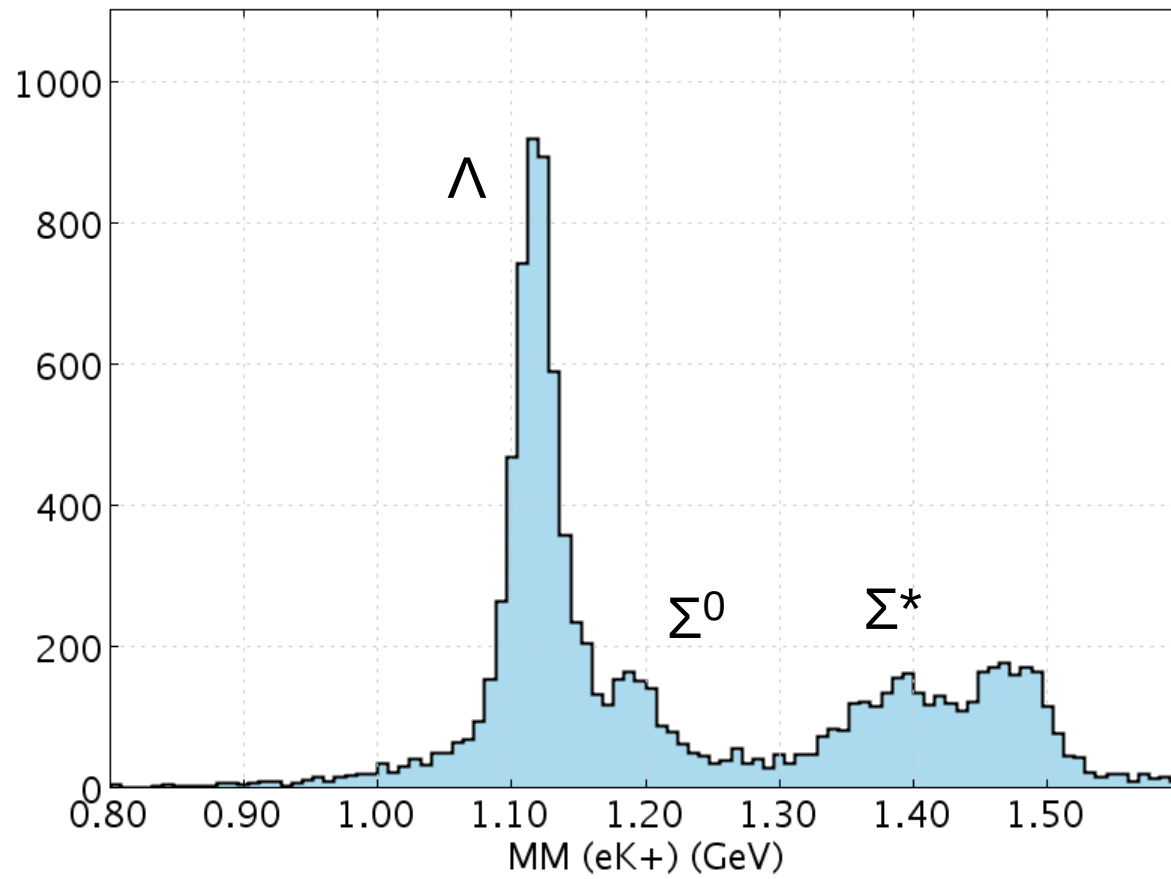
```
$COATJAVA/bin/clara-rec -t 1 -r $COATJAVA/etc/services/reconstruction.yaml gemcOut_header.evio rec.evio
```

option	description
-t	specifies the number of threads to use for multi-threaded systems
-r	specifies a yaml file which contains a list of services to be run
gemcOut_header.evio	the file to be reconstructed
rec.evio	the name of the reconstructed output file

# CLAS12 Analysis with COATJAVA

CLAS12 analysis is done using COATJAVA tools in groovy scripts. Go into the demo\_1nov16 directory and run the analysis.groovy code:

```
cd demo_1nov16
$COATJAVA/bin/run-groovy analysis.groovy
```



# Additional Resources

GEMC documentation: [gemc.jlab.org](http://gemc.jlab.org)

CLARA documentation: [claraweb.jlab.org](http://claraweb.jlab.org)

COATJAVA documentation: <http://clasweb.jlab.org/clas12offline/docs/software/3.0/html/>

Searchable/sortable web-based repository of Monte Carlo datasets: <https://clasweb.jlab.org/clas12mcfiles/>

## CLAS12 Monte Carlo Files

Search:  [Sort by reaction](#) [Sort by energy](#) [Sort by GEMC version](#) [Sort by torus scale](#) [Sort by solenoid scale](#) [Sort by COAT version](#) [Sort by runNo](#) [Sort by variation](#) [Sort by date](#)

Reaction	Energy (GeV)	GEMC version	Torus scale	Solenoid scale	COAT version	runNo	variation	Date	More info	Comment
dvcs	11.0	2.5	-1.0	1.0	3.0	11	default	2016/10/06	<a href="#">click</a>	baseline configuration
dvcs	11.0	2.5	-0.5	0.5	3.0	10	test	2016/10/13	<a href="#">click</a>	baseline configuration, empty target
e-	spread	2.5	-1.0	1.0	3.0	11	default	2016/10/13	<a href="#">click</a>	baseline config., e- in forward region
eppi0	11.0	2.5	-1.0	1.0	3.0	11	default	2016/10/06	<a href="#">click</a>	baseline configuration
eppi0	11.0	2.5	-1.0	0.5	3.0	11	default	2016/10/06	<a href="#">click</a>	baseline configuration
eppi0	11.0	2.5	-1.0	0.0	3.0	11	default	2016/10/06	<a href="#">click</a>	baseline configuration
eppipim	11.0	2.5	-1.0	1.0	3.0	11	default	2016/10/06	<a href="#">click</a>	baseline configuration
test	2.3	1.0	3.5	-2.1	2.0	0	test	2016/10/06	<a href="#">click</a>	test

# (optional) High Performance Output (hipo) Format and DSTs

Hipo files can be used in much the same way as evio files, except they are smaller due to better compression and they can also be read faster by the computer. To convert (and merge) evio files to hipo, do:

```
$COATJAVA/bin/hipo-writer -lz4 -b ALL rec_gemcOut.hipo rec_gemcOut.evio [...optional additional files]
```

Hipo format can also be use for DSTs. To save only the generated and reconstructed tracks, do:

```
$COATJAVA/bin/hipo-writer -lz4 -b EVENTTB rec_gemcOut.DST.hipo rec_gemcOut.evio [...optional additional files]
```

option	description
-lz4	specifies the kind of compression
-b	specifies which banks to save in the output file
rec_gemcOut.hipo	the output file name
[list of evio files]	the list of files that will be merged and converted



## (optional) CLAS12 Reconstruction on the Farm

Steps for running CLAS12 reconstruction on the interactive farm or the batch farm can be found on the CLARA webpage:

<https://claraweb.jlab.org/docs/clara/cre-clas.html>