Start the docker

docker pull electronioncollider/escalate

How to install docker:
eic.gitlab.io / documents / quickstart
Entry point for EIC software

Interactive tutorial
Fast and full simulations
In ESCalate

Dmitry Romanov
Start the docker

docker pull electronioncollider/epic-gui

Plan now:
• Short introduction to our software
• 1. Tutorial – running fast simulation
• 2. Tutorial – running in different environments
• 2. Tutorial – running full simulation
• 3 PM - Answering questions (presentation)
• Adjourn!
Software chain

MC generators

Fast detector simulation

Full detector simulation

Reconstruction and analysis
Software chain

MC generators

This tutorial coverage
Full detector simulation

Reconstruction and analysis
Software stack for EIC simulations

ESC – EIC Software and Computing group
## Software version table

### electronioncollider/escalate v 1.0.1

(Changed packet versions are bold)

<table>
<thead>
<tr>
<th>Core tools</th>
<th>HENP</th>
<th>MCEG</th>
<th>EIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>gcc</td>
<td>9.2.1</td>
<td>eigen3</td>
<td>3.3.7</td>
</tr>
<tr>
<td>CMake</td>
<td>3.17.0</td>
<td>clhep</td>
<td>2.3.2.2</td>
</tr>
<tr>
<td>python</td>
<td>3.7.5</td>
<td>hepmc</td>
<td>2.6.9</td>
</tr>
<tr>
<td>ROOT</td>
<td>6-20-04</td>
<td>hepmc3</td>
<td>3.2.1</td>
</tr>
<tr>
<td>Geant4</td>
<td>10.6.1</td>
<td>vgm</td>
<td>4.5</td>
</tr>
<tr>
<td>genfit</td>
<td>2020.1</td>
<td>PYTHONIA6</td>
<td>RAD-CORR</td>
</tr>
<tr>
<td>acts</td>
<td>0.22.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>delphes</td>
<td>3.4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fastjet</td>
<td>3.3.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Update the docker

docker pull electronioncollider/escalate

eic.gitlab.io/documents/quickstart/
Escalate at JeffersonLab JupyterHub

- jupyterhub.jlab.org

To download all examples:

```
git clone https://gitlab.com/eic/escalate/workspace
```

- Full documentation on JupyterHub

![Spawner Options]

[launch binder]
Singularity on farms

- module load singularity
- singularity shell --cleanenv /cvmfs/eic.opensciencegrid.org/singularity/escalate:latest
- source /etc/profile

- Available both for Jlab and BNL farms
- Full ESCalate singularity documentation
Smear tool

• Smearing should be as easy as:

```
smear my_file.txt
```

• Select handbook detector and process only 1000 events:

```
smear -d handbook -n 1000 my_file.txt
```

• Full documentation of the smear tool
Software stack for EIC simulations

- Eic-smea plugin

- DETECTOR NAME?

- JLEIC Smear
  
  - Yulia Furletova

- Eic-smear library

- Full simulation
  - G4E

- Generators

- eJANA
  - Lund, HepMC, Beagle, many others

- Fast simulation

- Reconstruction
  - Genfit
  - ACTCS

- Analysis in (multithreaded) C++

- Python

- Jupyter
G4E – Geant 4 EIC

- Standalone C++ Multithreaded Geant4 application
- Various EIC MC file formats: Beagle, Pythia6, HEPMC - Pythia8, Herwig and others
- Integration with accelerator elements
- Infrastructure to import Geant4 detector geometry and simulation code

https://gitlab.com/jlab-eic/g4e
Grow with user input

Workflow environment for EICUG

• to use (tools, documentation, support) and

• to grow with user input (direction, documentation, tools)
Thank you!

The next tutorials will be on Monte Carlo Event Generators. The dates will be slightly adjusted due to the new dates for the EIC User Group Meeting (July 15-17).

- eic.github.io
- software-support@eicug.org
- http://eicug.slack.com/
- Mailing list (anyone can contact)
- Google forum (for archive of support requests and start of knowledge base)
- EICUG Slack workspace with software-support channel
Jupyterlab new interface to Jupyter
Do we hide complexity?

- Jupyter lab, GUI,
- Python, scripts, analysis
- C++, eJANA, plugins
- JANA, eic-smear, ROOT, Geant4
Run on Open Science Grid

- Configuration
- Tamper with code
- Introspect results
- Run (sim, recon, analysis)

OSG
In preparation
Ways to interact G4E with the docker

1. JupyterLab (in browser)
2. noVNC (in browser)
3. Any VNC viewer
4. X11 (directly or through ssh)
5. Remote debugging

… or just install everything on your machine
https://gitlab.com/eic/ejpm
Geant4Eic (g4e)

- Keep close to raw Geant 4 (10.6)
- Small code base and fast compilation is good - KISS
- Users coding in “Geant4” paradigms
- Coding is OK GOOD
- Few interfaces are well defined and documented. E.g.
  - How to move in a detector
  - What is the output root file structure
  - etc.
- It is up to users what to do, but there are Recommendations to commit code back

https://gitlab.com/jlab-eic/g4e
Main detectors – sub detectors

Beamlines

Master detectors

Subdetectors

Now 24 subdetectors
Naming convention

Names - <region>_<DETECTOR>_sub...

Examples:
- cb_VTX = central barrel Vertex detector
- ffe_LUMI = far forward electron Luminosity monitor
Naming sum up

1. Central Detector (c):
   • Barrel (cb) == Central Barrel
     • *Solenoid (cb_Solenoid)*
   • Electron endcap (ce) == Central Electron endcap
     • *GEM tracking (ce_GEM)*
   • Ion endcap (ci) == Central detector Ion endcap
     • *GEM tracking (ci_GEM)*

2. Forward ion (fi) direction area near D1 magnet:
   • Tracker detector1 (fi_TRKD1)

3. FarForward ion (ffi) direction area (near D2, D3 magnets)
   • ZeroDegree Calorimeter (ffi_ZDC)
   • Roman Pots (ffi_RPOTS)

4. Far forward electron (ffe) direction area
   • Low*Q2 tagger (ffe_LQ2)
   • Electron Polarimeter (ffe_CPOL)
   • Luminosity monitor (ffe_LUMI)
e\textsuperscript{JANA} is JANA + plugins for EIC data reconstruction and analysis

But also:

- tools to manage dependencies and run eJANA in different environments
- Integration with python and extensions to Jupyter Lab

(ejpm, edock, pyjano, and others..)

e\textsuperscript{JANA} stands for EIC JANA
Jupyter lab, Jupyter notebooks, EPW, epic…
Transparency between layers

- JupyterLab -> Python/ROOT C++. Python -> Command line...

```python
./data/beagle_eD.txt
[3]: jana.run()
```

Total events processed: 10001 (~ 10.0 kevt)

Run command

ejana

- Pplugins=beagle_reader,vmeson,event_writer
- Pnthreads=1
- Pnevents=10000
- Poutput=beagle.root
  ..../data/beagle_eD.txt
- PJana:debug_plugin_loading=1
Working with ROOT and CLI

• Run docker with bash
  - docker run -it -p 8888:8888 eicdev/epic:latest bash
  - To run jupyter lab environment > jlab

• Run ROOT + C++ in notebooks: