Argonne NATIONAL LABORATORY

# HepSim status report

*Steps towards "HepSim decentralization"*

**S. Chekanov**

*HEP/ANL*

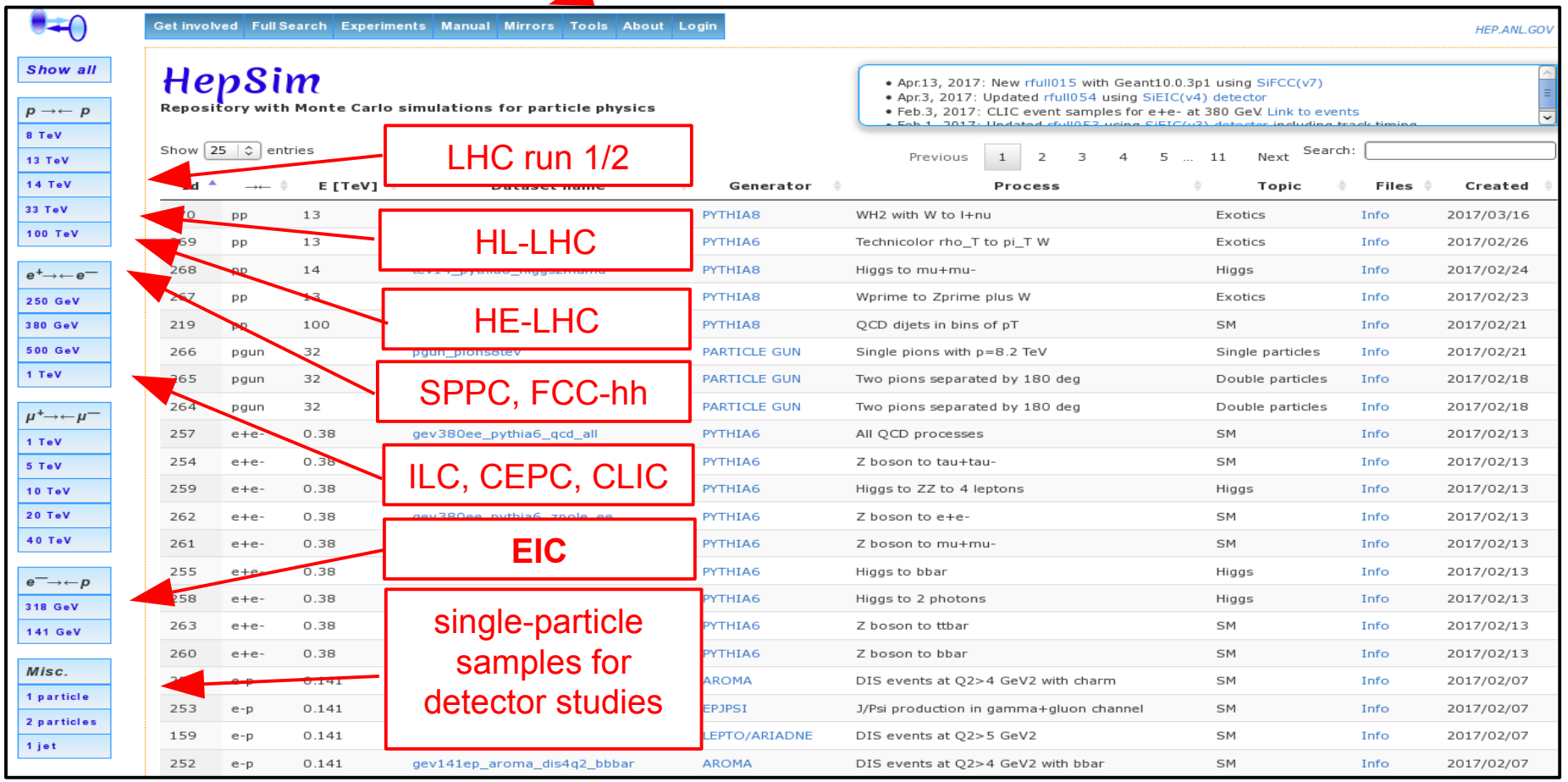
*EIC Software Consortium Meeting*

*Oct 16, 2017*

# HepSim repo

http://atlaswww.hep.anl.gov/hepsim/

NERSC, CERN, **JLab** mirrors



# JLab mirror

Get involved | Full Search | Experiments | Manual | Mirrors | Tools | About | Login

JLAB.ORG *(read only)*

**Show all**

| $p \rightarrow\leftarrow p$ |
|---|
| 8 TeV |
| 13 TeV |
| 14 TeV |
| 27 TeV |
| 33 TeV |
| 100 TeV |

| $e^+ \rightarrow\leftarrow e^-$ |
|---|
| 250 GeV |
| 380 GeV |
| 500 GeV |
| 1 TeV |
| 3 TeV |

| $\mu^+ \rightarrow\leftarrow \mu^-$ |
|---|
| 1 TeV |
| 5 TeV |

# HepSim

**Repository with Monte Carlo simulations for particle physics**

- Sep,22 2017: Z+Higgs → nunu+XX event samples
- Sep,15 2017: Higgs → mu+mu- event samples
- Sep,10 2017: rfull059 tag with improved tracking strategy
- Aug 25, 2017: rfull200 for the DRF (ATLAS/CMS_like) detector

Show 25 entries

Previous 1 2 3 4 5 … 12 Next

Search:

| Id | →← | E [TeV] | Dataset name | Generator | Process | Topic | Files | Created |
|---|---|---|---|---|---|---|---|---|
| 303 | e+e- | 0.38 | gev380ee_pythia6_zhiggs_nunumumu | PYTHIA6 | Z+Higgs to nunu+mumu | Higgs | Info | 2017/09/23 |
| 302 | e+e- | 0.38 | gev380ee_pythia6_zhiggs_nunugg | PYTHIA6 | Z+Higgs to nunu+gg | Higgs | Info | 2017/09/23 |
| 301 | e+e- | 0.25 | gev250ee_pythia6_zhiggs_nunumumu | PYTHIA6 | Z+Higgs to nunu+mumu | Higgs | Info | 2017/09/23 |
| 300 | e+e- | 0.25 | gev250ee_pythia6_zhiggs_nunugg | PYTHIA6 | Z+Higgs to nunu+gg | Higgs | Info | 2017/09/23 |
| 299 | e+e- | 0.38 | gev380ee_pythia8_zhiggs_nunubbar | PYTHIA8 | Z+Higgs to nunu+bbar | Higgs | Info | 2017/09/21 |
| 298 | e+e- | 0.38 | gev380ee_pythia8_zhiggs_nunugg | PYTHIA8 | Z+Higgs to nunu+gg | Higgs | Info | 2017/09/21 |
| 297 | e+e- | 0.38 | gev380ee_pythia8_zhiggs_nunumumu | PYTHIA8 | Z+Higgs to nunu+mumu | Higgs | Info | 2017/09/21 |
| 296 | e+e- | 0.25 | gev250ee_pythia8_zhiggs_nunubbar | PYTHIA8 | Z+Higgs to nunu+bbar | Higgs | Info | 2017/09/21 |
| 295 | e+e- | 0.25 | gev250ee_pythia8_zhiggs_nunugg | PYTHIA8 | Z+Higgs to nunu+gg | Higgs | Info | 2017/09/21 |
| 294 | e+e- | 0.25 | gev250ee_pythia8_zhiggs_nunumumu | PYTHIA8 | Z+Higgs to nunu+mumu | Higgs | Info | 2017/09/21 |
| 293 | e+e- | 0.38 | gev380ee_pythia8_higgs_mumu | PYTHIA8 | Higgs to mumu (all processes) | Higgs | Info | 2017/09/15 |

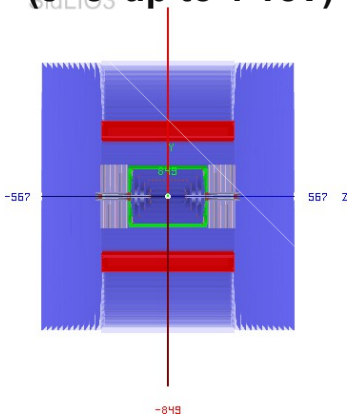
Update of databases every 2 h for all mirrors
Updates of software components when changes are made on the central server

*Thanks to Markus Diefenthaler, Kurt Strosahl*

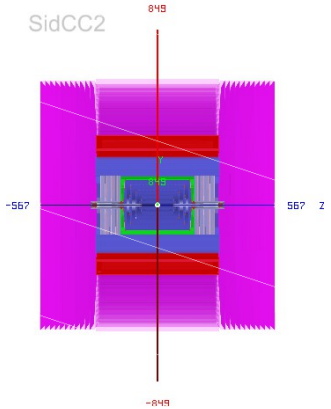


# ‘All-silicon’ design concepts supported in HepSim

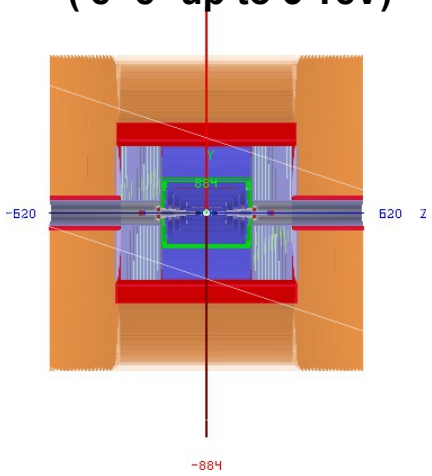
**SiD (SiD LO3)**
**($e^+ e^-$ up to 1 TeV)**



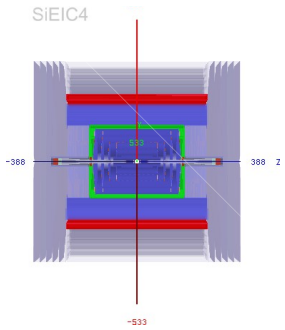
**SiCPEC**
**( $e^+ e^-$ 250 GeV)**



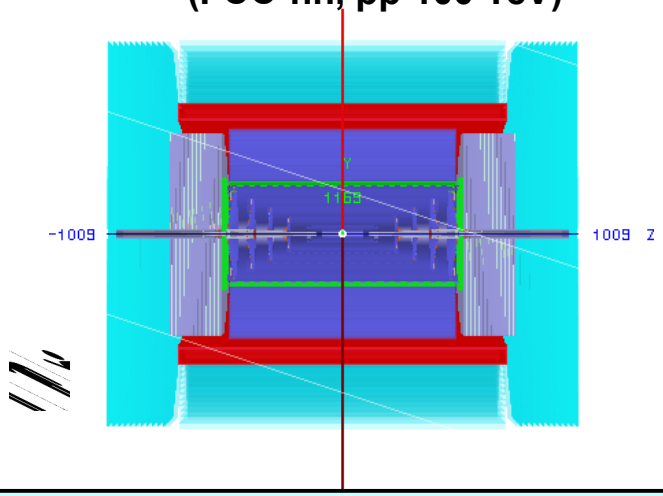

**CLIC-SiD (CDR)**
**( $e^+ e^-$ up to 3 TeV)**



**SiEIC**
**(ep, 141 GeV)**




**SiFCC**
**(FCC-hh, pp 100 TeV)**



**Performance detectors:**

- Physics reach studies using Geant4 simulations & full reconstruction
- Playground for various technologies and detector optimizations
- Fast turnover to modify detector & create events samples

**Share similar design, but differ in sizes, calorimeter readouts etc**
**Interfaced with common Monte Carlo samples**

# EIC detectors based on “all-silicon concept”

http://atlaswww.hep.anl.gov/hepsim/detectors.php

| EIC (ep/eA) | | | | reconstruction “tags” |
|---|---|---|---|---|
| sieic1 | Info | | ☐ | rfull051 |
| sieic2 | Info | | ☐ | rfull052 |
| sieic3 | Info | | ☐ | rfull053 |
| sieic4 | Info | | ☐ | rfull054 |
| sieic5 | Info | | ☐ | rfull056 \| rfull057 \| rfull058 \| rfull059 |
| sieic6 | Info | | ☐ | rfull060 |

**Latest simulation and reconstruction is based on FPadSim-1.4:**

- stable “frozen” version (exists in docker/singularity/tgz)
- fully decoupled from ILCSoft environment
- includes “head” versions from GitHub:
  - SLIC version 5.1 (+Geant 10.3p1) - SLAC/gitlab
  - LCSIM 4.0 - SLAC/gitlab
  - LCIO (master) - DESY/CERN/github
  - ProMC - ANL/gitlab

3 latest EIC-Si detectors implemented by D. Blyth

In development: ongoing replacement of SLIC by DD4HEP
David has a version based on DD4HEP+LCIM (but no PandoraPFA) → Testing

# Simulation and reconstruction in HepSim

3 things needed to create HepSim events on OSG/HPC:

**Input Monte Carlo generator files**

wget from HepSim or generate yourself
(fast changing part)

**“tag” - file with detector description, calibration files, processing workflow**

→ a small file that can be sourced from HepSim to each processing node
(fast changing part)
Can be uploaded by users

**Software environment (FPadSim 1.4 + others)**

→ Can be deployed using cvmfs or using Docker/Singularity images
→ see later

# New functionality: uploading “tag” files

http://atlaswww.hep.anl.gov/hepsim/doc/doku.php?id=hepsim:dev_tags

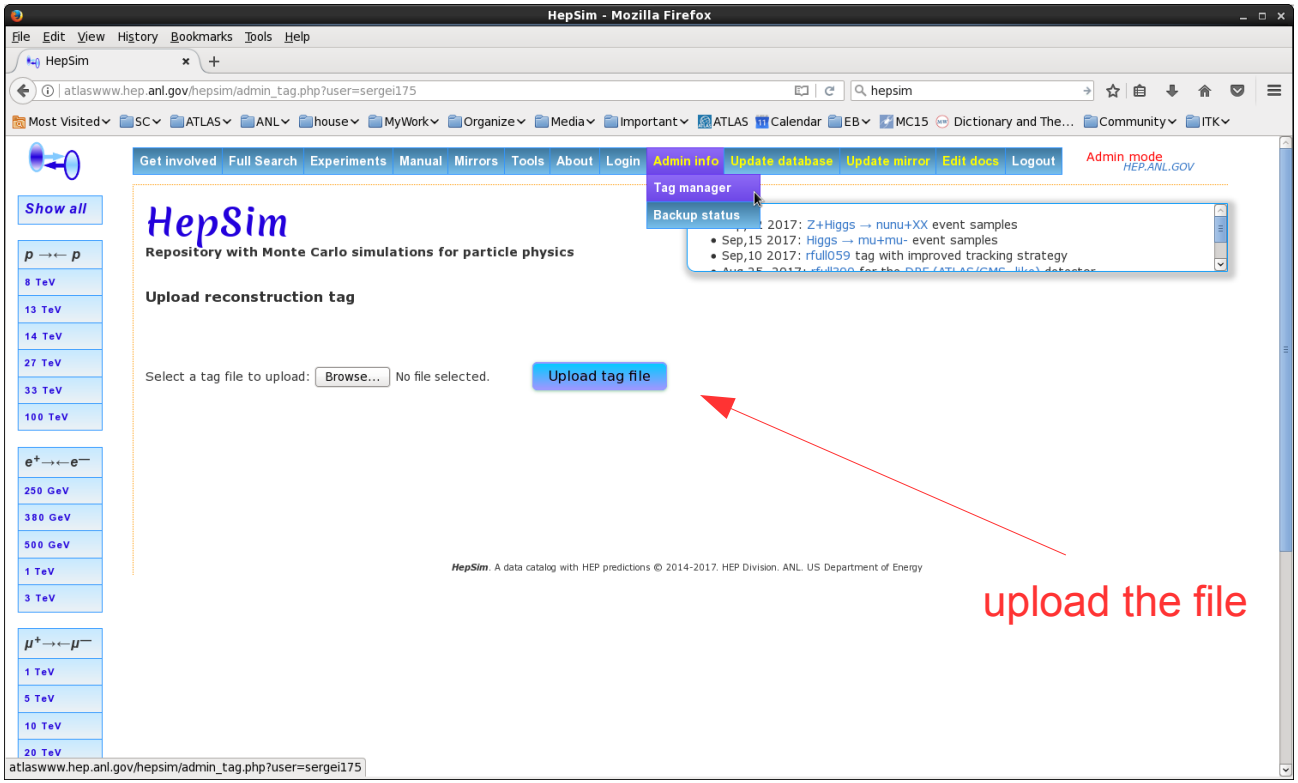
- File convention: rfull{XXX}.tgz or rfast{XXX}.tgz where {XXX} is a number
- Used for:
  - archiving the detector geometry, creating the web page with the detector description, archiving calibration files etc, defining the used software, defining the tag name to be used for downloading events, defining the workflow of the simulation-reconstruction steps
- Example structure of the tag file:

```
A_RUN     # main script to process events (free form)
TEST      # script for testing (optional)
source.sh # setup script (optional)
.....     # other required files if needed
sifcch7   # the directory with detector geometry    (always required!)
    - compact.xml     # main detector geometry file (always required, but can be a dummy)
    - other.xml ...   # some other XML files with detector components -> optional
    - sifcch7.heprep  # some converted files, if needed -> optional file
    - sifcch7.lcdd    # file for event displays -> optional file
    - sifcch7.pandora # file for Pandora        -> optional file
    - sifcch7.json    # geometry JSON file      -> optional file
    - sifcch7.root    # geometry file (use to make 3D display) -> optional file
    - sifcch7.html    # HTML description                       -> required file
    - view1.png       # main image to view the detector (440x480 px, Y-Z) -> required for HepSim page
    - view2.png       # 2nd image to view the detector (440x480 px, X-Y)  -> optional file
    - some config files
```



# How to upload your tag file with detector

- Get HepSim account
- Prepare a file “rfull{XXX}.tgz”. Download examples from HepSim if needed




**What it does:**
Extracts the detector components, post it to HepSim Web, post tag file, create a form to update tag database, etc.

# Final note: Containerization of HepSim software

- http://atlaswww.hep.anl.gov/hepsim/doc/doku.php?id=hepsim:dev_singularity

- (1) Singularity and Docker image based on CERN Scientific Linux 6.8
  - *docker pull chekanov/slc6hepsim*
  - Designed for f77 Monte Carlo generators using LHAPDF5.8, CERNLIB, Paw, ROOT5
  - For running HERA legacy generators: Lepto, Ariadne, Aroma, etc.

- (2) Singularity and Docker image based on CentOS7 (~7GB)
  - *docker pull chekanov/centos7hepsim. Deployed on OSG grid via cvmfs*
  - Modern software stack (still gcc4.9.2 from OSG, not CentOS7 native gcc!)
  - Pythia8230 integrated with ProMC. ep DIS options are available
  - FPadSim 1.4 simulation and reconstruction (Geant 4.3p2 – new!)
  - ROOT6, ProMC, Jas4pp, Delphes, LHAPDF6,1, FastJet, HEPMC etc
  - But no support for f77, CERNLIB etc

Tested and available on OSG grid, Cori (NERSC), BeBop (ANL)

- *(3) "EIC" containers from David/Whit vased on ArchLInux*
  - *singularity pull docker://argonneeic/fpadsim:v1.4 Deployed on OSG grid via cvmfs*
  - *argonneeic/evochain:* - includes DD4HEP*

See David's talk