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CMS Heavy Ion Software

NEW Dedicated twiki for 2018 heavy-ion reco developments: [HiRecoTaskForce2018](#)

This page is intended as the primary source of heavy ion specific software development and end user information. Development status and plans are discussed on the [SoftwareTaskForce](#) page. It is a supplement to the following resources:

- CMS Workbook: <https://twiki.cern.ch/twiki/bin/view/CMS/WorkBook>
- CMS Software Guide: <https://twiki.cern.ch/twiki/bin/view/CMS/SWGuide>
- MIT Computing Guide: <http://www.cmsaf.mit.edu/twiki/bin/view/Cms/CmsafUserGuide> [↗](#) [↗](#)

Some hints on getting started with CMSSW and finding information are included at the end of this page.

CMSSW Release Plans

Table of heavy ion plans for future releases (beginning from CMSSW 33X)

CVS Subsystems and Packages reserved for Heavy Ions in CMSSW

Show Packages Details... Hide Package Details

CMSSW/SimDataFormats/HiGenData ([CVS](#) [↗](#), [LXR](#) [↗](#)): Generated Data

- This is the CVS area for data formats related to *generated & simulated* events (so far, this package contains: generated vertex & sub-event information)

CMSSW/DataFormats/HeavyIonEvent ([CVS](#) [↗](#), [LXR](#) [↗](#)): For Reconstructed Data

- This package is for all kinds of data formats that are common for both generated and reconstructed data. This includes:
 - ◆ Centrality : Various detector deposits and assigned centrality bin
 - ◆ Event Plane : Various event plane angle values corresponding to different measures

CMSSW/RecoHI ([CVS](#) [↗](#), [LXR](#) [↗](#)) : Reconstruction Modules

- Subsystem for algorithms (EDProducers and related tools) that are used to produce data formats of the kinds that are in `DataFormats/HeavyIonEvent`. Packages include: [HiCentralityAlgos](#) [↗](#), [HiEvtPlaneAlgos](#) [↗](#), [HiTracking](#) [↗](#), [HiEgammaAlgos](#) [↗](#), [HiJetAlgos](#) [↗](#)

CMSSW/CondFormats/HIObjects ([CVS](#) [↗](#), [LXR](#) [↗](#)) : For Conditions Database Objects

- Package to hold conditions objects that are related to Heavy Ions.

CMSSW/CondCore/HIPlugins ([CVS](#) [↗](#), [LXR](#) [↗](#)) : To register conditions objects

CMSSW/HeavyIonsAnalysis/Configuration ([CVS](#) [↗](#), [LXR](#) [↗](#)): For Physics Analysis

- For high level heavy ion analysis code, EDAnalyzers and configurations
- Currently keeping analysis code in `UserCode` e.g. `UserCode/CmsHi/JetAnalysis`

Generators

PYQUEN

- The PYQUEN event generator [is](#) integrated into CMSSW. Main contacts: Yetkin Yilmaz / Camelia Mironov / Igor Lokhtin.
- Interface info available [here](#)

HYDJET

- The HYDJET event generator [is](#) integrated into CMSSW. Main contacts: Yetkin Yilmaz / Camelia Mironov / Igor Lokhtin.
- Interface info available [here](#)

HIJING

- Interface info available [here](#)

AMPT

- Interface info available [here](#)

J/ , and Z generation

- Generation can follow a flat particle gun or a distribution file of our choice (like Ramona Vogt's distribution for example). Details can be found [here](#)

Generator Common Tools

- Tools for heavy ion event generation which are not specific to an individual Monte Carlo generator, e.g. HiCentralityBiasFilter, GenEvtSelectors. Details can be found [here](#)

Simulation

Full Simulation

- Standard GEANT4 simulation is used in HI
- Timing [and](#) peak memory [usage](#) of b=0 and MinBias HYDJET GEN-SIM-DIGI-RAW can be viewed for all ReIVal samples from the DataCertReIValPerformance page.
- GFlash timing studies: setting `--gflash` option in cmsDriver

HI Event Mixing

- Main Contact: Yetkin Yilmaz
- Link: [SWGideHeavyIonEvtMixing](#)

HI Data Mixer

- Main Contact: Edward Wenger
- Link: [SWGideHeavyIonDataMixer](#)

HI Event Tuning (under development)

- Main Contact: Yetkin Yilmaz
- Link: SWGuideHiEventTuning

▣ More Simulation Details... ▣ Hide Details

FAMOS

- The fast simulation could be an useful tool as it runs ~1000 faster than full simulation, but so far has not been used for heavy ions.

ZDC

- Main contact: Edmundo Garcia
- Link: Simulation


CASTOR

- Main contact: Panos Katsas
- Link: Software: Simulation-Reconstruction

Reconstruction Software

Listed below are the various heavy ion reconstruction projects with the names of the main contact persons and links to the relevant web pages:

- **HI Muon Reconstruction** -- *Olga Kodolova, Camelia Mironov* -- (main page)
- **HI Jet Finders** -- *Marguerite Tonjes* -- (main page)
- **HI Photon Reconstruction** -- *Yenjie Lee, Yongsun Kim* -- (main page)
- **Pixel Tracklet Reconstruction** -- *Yenjie Lee* -- (main page [↗](#)[↗](#))
- **HI Tracking** -- *Edward Wenger* -- (main page)
- **HI Vertexing** -- *Edward Wenger* -- (main page)
- **HI Centrality Determination** -- *Yetkin Yilmaz, Gunther Roland* -- (main page) (MIT Twiki [↗](#))[↗](#))
- **HI Event Plane Determination** -- *Sergey Petrushanko* -- (main page)
- **HI Flattened Event Plane** -- *Victoria Zhukova* -- (main page)
- **ZDC** -- *Edmundo Garcia* -- (main page)
- **CASTOR** -- *Panos Katsas* -- (main page)

 An example of a full reconstruction configuration can be found in `/UserCode/CmsHi/Utilities/test/reconstruct_PbPb_cfg.py` [↗](#)[↗](#). Such configurations can be generated with cmsDriver with a script like reco.sh [↗](#)

Zero Suppression

- Calorimeters

Trigger Software

- Instructions for setting up the **Heavy Ions HLT Menu** can be found at this page
- Instructions for setting up the **Heavy Ions L1 Menu** can be found at this page

Analysis Software

Some Heavy Ion analysis projects are listed below with contact people and relevant web pages:

- **Heavy Ion PAT** -- *Eric Appelt* -- (main page)
- **MC Track Matching** -- *Philip Allfrey* -- (main page)

A whole host of useful analysis tools can be found on the SWGuidePhysicsTools page.

Code for some individual analyses has also been documented and can be found at the following pages

- **DiMuon Trigger Analysis** -- *Ji Hyun Kim and Dong Ho Moon* -- (main page)
- **Upsilon->Dileptons in Ultraperipheral collisions** -- *Vineet Kumar and David d'Enterria* -- (main page)

Getting started with CMSSW

A reminder or maybe new information for people that are just getting started with CMSSW on sources of information to find (back) documentation:

1) The CMS Offline WorkBook

<https://twiki.cern.ch/twiki/bin/view/CMS/WorkBook>

A very complete introduction to CMSSW and computing in CMS. Explains how many things work in the generation, simulation, digitisation and reconstruction. Also contains many pointers.

2) The CMS Offline Guide

<https://twiki.cern.ch/twiki/bin/view/CMS/SWGuide>

Not quite as complete in all areas, but explains a lot about the EDM (Event Data Model) and the Framework that form the basis of CMSSW.

3) The LXR Cross Referencer

<http://cmslxr.fnal.gov/lxr/source/>

The fastest (only) way to quickly find your way around the CMSSW source code and config files. It allows the lookup of identifiers and random text for any version of CMSSW. It is also great to just browse and read.

4) Google

A very efficient way to find info about CMS/CMSSW add "site:twiki.cern.ch" to find things in the CMS twiki. For example, search for

mixingmodule site:twiki.cern.ch/twiki/bin/view/CMS

returns a top three of highly relevant pages documenting mixing/pileup in CMSSW (try for yourself!)

5) Example and Standard configuration samples

The CMSSW repository [↗](#) contains default and example configuration files you can use and derive from. In particular see:

- Configuration/Examples/python [↗](#): complete examples
- Configuration/StandardSequences/python [↗](#): files for the major phases in the simulations chain (these are used in the examples above)
- Configuration/EventContent/python [↗](#): pre-defined collections of data to be written out (aka data-tiers, SIM, RECO, AOD, FEVT see workbook)

Remote Computing Info

- Running on pre-releases with Crab at MIT Tier-2
- Remote MIT Tier-2 file access
- Condor running at MIT Tier-2

Assorted Tips and Links

- Initial discussion of plans and goals [↗](#) of creating Simulation and Reconstruction of Heavy Ion events using CMSSW
- Getting an MIT account for work on the MIT cluster:
<http://www2.lns.mit.edu/compserv/cms-acctappl.html> [↗](#)
- Example of Generating HI events in HIROOT then analyze output using CMSSW

UpdateCentralitySoftware2016

Contacts

- **Group main page:** HeavyIons
- **Conveners:** Wei Li and Camelia Mironov
- **Software main contact:** Matthew Nguyen
- **Hypernews fora:**
 - ◆ General: <https://hypernews.cern.ch/HyperNews/CMS/get/hi.html> [↗](#)
 - ◆ CMS-HI software: <https://hypernews.cern.ch/HyperNews/CMS/get/hiswDevelopment.html> [↗](#)

Review Status

Editor/Reviewer and date	Comments
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PhilipAllfrey - 17 Aug 2009	Copied content from CmsHiSoftware as part of documentation review
DavidDEnterria - 04 Jun 2007	Page Author

Responsible: EdWenger

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