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Misc. CMSSW notes / howtos

Where is the cmsRun source code ?

seems to be FWCore/Framework/bin/cmsRun.cpp☑.

Crashes when using the debugger

- some advice is given here☑ (seems however not to help with uaf and zsh)

How to (graphically) browse CMSSW configuration files and their included paths/sequences

- Use the graphical tool `edmConfigBrowser`. More documentation is available at CMS/SWGuideConfigBrowser☑.

How to produce a vector from non-cartesian coordinates ?

- ROOT's TLorentzVector☑ has a few useful functions in this respect such as:
    - `TLorentzVector::SetPtEtaPhiM(...)`

- See also Commonly used vector/matrix classes in CMSSW (GlobalPoint, LorentzVector, etc.) in the CMSSW workbook.

How to check on an event-by-event basis whether an event is MC or data ?

- use Event::isRealData()☑ (actually defined in the parent class `EventBase`)

How to mix data events (combine different events into one) ?

- have a look at SimGeneral/DataMixingModule☑

How to re-run the HLT ?

How can I combine files which seem to have duplicate events ?

When running an MC production with several jobs each having the same run number, these files look like they have duplicate events.

Assuming your input source is `process.source`, one may add the following line to the `cmsRun` configuration file to ignore duplicates:

```
process.source.duplicateCheckMode = cms.untracked.string('noDuplicateCheck')
```

What parameters does the MessageLogger know in general ?

- see this link ⬀, this link and this link.

What severity levels does the MessageLogger know ?

- see the method `ELseverityLevel::getInputStr()` in FWCore/MessageLogger/src/ELseverityLevel.cc ⬀. At the moment, these seem to be: `?no value?`, `ZERO`, `INCIDENTAL`, `DEBUG`, `INFO`, `WARNING`, `WARNING2`, `ERROR`, `ERROR2`, `NEXT`, `UNSPECIFIED`, `SYSTEM`, `SEVERE2`, `ABORT`, `FATAL` and `HIGHEST`. Unfortunately, it only seems to support the following in the configuration file: `DEBUG`, `INFO`, `WARNING`, `ERROR`.

What destinations does the MessageLogger know ?

- cout, cerr and file names

How to suppress/limit the 'Begin processing the...' messages ?

These are in the category `FwkReport`. Set the limit of this category to zero. For example to print only every 1000th event, do:

```
process.load("FWCore.MessageLogger.MessageLogger_cfi")
process.MessageLogger.cerr.FwkReport.reportEvery = 1000
```

Can I suppress the messages printed when opening/closing a file (e.g. `Initiating request to open ...`) ?

- These messages seem to have the category `fileAction`. However, setting a limit of zero for them seems not to suppress them. (one can however duplicate them e.g. on `cerr`).

How can I know in which modules events are rejected in the HLT paths ?

- Set the parameter `wantSummary` of the process' `options` to true, e.g. by doing:

```
process.options = cms.untracked.PSet(wantSummary = cms.untracked.bool(True))
```

This will produce a rather verbose list of which modules were called how often etc. at the end of the job. This is useful e.g. to see where events are rejected on the HLT etc. Look for lines starting with `TrigReport` (above the ones starting with `TimeReport`).

See also this link in the CMSSW workbook.

How do I select events which passed a certain HLT (higher level trigger) path ?

- For CMSSW_3_5 or later:
    - ♦ There is an `EDFilter` called `TriggerResultsFilter`. See the documentation here (CMS Twiki) and this ⧉ hypernews message.
    - ♦ Note that this seems to be available only in CMSSW 3_5_x and later.
    - ♦ See the file HLTrigger/HLTfilters/python/triggerResultsFilter_cfi.py ⧉ for the default values of its default parameters.
    - ♦ See also the file HLTrigger/HLTfilters/test/triggerResultsFilter.py ⧉ for some examples how to use it.
    - ♦ See also the class TriggerResultsFilter in HLTrigger/HLTfilters/interface/TriggerResultsFilter.h ⧉.
    - ♦ The grammar accepted by the `TriggerResultsFilter` seems to be defined in HLTrigger/HLTcore/interface/TriggerExpressionParser.h ⧉ which is implemented using Boost::spirit ⧉.

Here is an example for vetoing random trigger events (`HLT_Random` path):

```
import HLTrigger.HLTfilters.triggerResultsFilter_cfi as hlt
process.rejectHltRandom = hlt.triggerResultsFilter.clone(
        hltResults = cms.InputTag( "TriggerResults","","HLT"),
        triggerConditions = ( 'NOT HLT_Random', ),
        l1tResults = '',
        throw = False
        )
```

This is creates an `EDFilter` object which can then e.g. be put in front of other sequences. In order to remove these events from the output file (if any), one needs to use the `SelectEvents` parameters of the `PoolOutputModule` (see also Which parameters does PoolOutputModule know), e.g. like:

```
process.... = cms.OutputModule("PoolOutputModule",
    SelectEvents = cms.untracked.PSet(SelectEvents = cms.vstring('myfilterpath')),
    ...
)
```

Which parameters does `PoolOutputModule` know ?

- new: there seems to be a list here.

- Look for calls to `getParameter` and `getUntrackedParameter` in IOPool/Output/src/PoolOutputModule.cc ⧉. There seems to be additional parameters (such as `selectEvents`) which seem to be defined somewhere else in the code...

How can I find out which CMSSW versions are installed on a grid site ?

- go to https://cmsweb.cern.ch/sitedb/sitelist/ ⧉ (hypernews login required)

How can I know in which modules events are rejected inthe HLT paths ?   3

- select the site you're interested in
- at the bottom left you should see a frame titled `Software installed on <sitename>`
- this lists the installed software versions for each scram architecture

How can I dump the HLT decisions from a file ? (How to print out which trigger path fired how often ?)

- Make sure there is a `MessageLogger` known to the process, e.g. by adding:

```
process.load("FWCore.MessageLogger.MessageLogger_cfi")
```

- Add something like the following to the configuration file:

```
process.hltTrigReport = cms.EDAnalyzer( 'HLTrigReport',
    HLTriggerResults = cms.InputTag( 'TriggerResults','','HLT' )
)
process.HLTAnalyzerEndpath = cms.EndPath( process.hltTrigReport )

process.MessageLogger.categories.append("HLTrigReport")
```

where the `HLT` in the input tag refers to the process which actually calculated these bits.

Which eventcontents are available for cmsDriver.py and what do they contain ?

Not sure, but probably those defined in Configuration/EventContent/python/EventContent_cff.py ⧉ (look for variables ending in `EventContent`).

The following python snippet:

```
import Configuration.EventContent.EventContent_cff as evc
for name in dir(evc):
    if not name.endswith("EventContent"):
        continue
    print name[:-len("EventContent")]
```

gave me (at the time of writing) the following output:

```
ALCARECO
AOD
AODSIM
Common
DATAMIXER
FEVTDEBUG
FEVTDEBUGHLT
FEVT
FEVTHLTALL
FEVTSIM
HLTDEBUG
MIXINGMODULE
RAWDEBUG
RAWDEBUGHLT
RAW
RAWSIM
RECODEBUG
RECO
RECOSIM
```

One can then get the keep/drop statements for e.g. `HLTDEBUG` by doing:

```
print evc.HLTDEBUGEventContent
```

How to get the number of events in a given run and dataset ?

e.g. with the following query:

```
find sum(file.numevents)  where dataset = /XXX/YYY/ZZZ and run = 123456
```

FWLite: Getting the aliases of an Events tree

create a dict mapping from branch name to alias:

```
import pprint.pprint
pprint.pprint(dict([ (x.GetTitle(), x.GetName()) for x in ROOT.Events.GetListOfAliases() ]))
```

finding a string in branch names and print the alias:

```
searchtext = "trackcandidates"

searchtext = searchtext.lower()
for x in ROOT.Events.GetListOfAliases():
  if searchtext in x.GetTitle().lower():
    print "branch:",x.GetTitle(),"/ alias:",x.GetName()
```

No registered converter was able to produce a C++ rvalue of type std::string from this Python object of type

When running with my configuration file, I get the following error message:

```
%MSG-s ConfigFileReadError:  11-Sep-2010 18:32:42 CEST pre-events
Problem with configuration file test.py
---- Configuration BEGIN
python encountered the error:
```

when running

```
python test.py
```

the python interpreter does not complain.

One possibility to find out where this comes from is to do

```
edmConfigDump test.py | less
```

and look for occurrences of `None` or `NoneType` and check whether they should be there or not. See also this hypernews message .

A possible source for this problem is the following scenario:

- module `X` is created and put into the process object as `process.X`
- a path `Y` referencing module `X` is added to the process

Which eventcontents are available for cmsDriver.py andwhat do they contain ?   5

- another configuration file is loaded into the process which contains a new module which ***also***
  defines a module `x` and thus overwrites the old module definition. The original modules now appear
  with label `None`.

Which operators exist to put together modules into a sequence ? How can I negate a EDFilter decision ?

- see
  https://twiki.cern.ch/twiki/bin/view/CMS/SWGuideAboutPythonConfigFile#Processing_and_trigger_path_pat
- one can negate by using ~ before the module name when building the sequence. See also this🗗
  hypernews message.

How do I get a list of modules which are used in any path in a CMSSW configuration file ?

`process.load(..)` often loads more modules into the `process` object than are actually put into any of the
paths. To get a list of the names of all modules which are used in at least one path, the following should work:

```
import itertools
set(itertools.chain(*[ path.moduleDependencies().keys() for path in process.paths.itervalues() ])
```

Note that this does not include things like `ESProducers` etc. which usually aren't part of any path. This also
does not include endpaths.

How can I select events with at least n objects of a given type ?

Try using a `CandViewCountFilter` in the CMSSW configuration, e.g. as follows:

```
process.goodElectronsCounter1 = cms.EDFilter("CandViewCountFilter",
                                             src = cms.InputTag("gsfElectrons"),
                                             minNumber = cms.uint32(2)
                                             )
```

Not sure with which type of input collections this works however. Most likely it works only with collections
of elements inheriting from `reco::Candidate`.

There is also a selector acting on the elements of such a collection, e.g.:

```
 process.selectedObjects = cms.EDFilter("CandViewSelector",
                                        src = cms.InputTag("inputCollectionLabel"),
                                        cut = cms.string("pt > 20 & abs( eta ) <1.4")
                                        )
```

Note that these can be chained, e.g. first produce a collection with objects passing a given pt cut and then with
a filter require that there is at least one object in this collection.

See also CommonTools/CandAlgos/plugins🗗, CMSPublic/SWGuideCandidateModules and
CMSPublic/SWGuidePhysicsCutParser.

No registered converter was able to produce a C++ rvalueof type std::string from this Python objectof type N

Are there predefined functions to calculate delta phi and delta R ?

There are functions called `deltaPhi` in DataFormats/Math/interface/deltaPhi.h☑. One of these (overloaded) functions also works with objects which have a member `phi()`, e.g. some of the vector classes used in CMSSW.

There is a similar file for `deltaR` in DataFormats/Math/interface/deltaR.h☑

How can I combine two (sets of) files with different data tiers of the same events ?

This was called 'two file solution' (use 'secondary input files'). One can do the following in the configuration file:

```
process.source = cms.Source("PoolSource",

    # main data tier to run on (e.g. RECO)
    fileNames = cms.untracked.vstring(...),

    # these should be a 'parent' data tier
    # e.g. simhits when the other files are rechits
    secondaryFileNames = cms.untracked.vstring(...),

    ...
)
```

Is there a FAQ for the E/gamma Higher Level Trigger (HLT) ?

Yes, see this link.

Are there any tools to match reconstructed objects to generated particles ?

Yes, see this link.

Where does the E/gamma HLT calculate the distance in phi (delta phi) and eta (delta eta) between track and cluster ?

See RecoEgamma/EgammaHLTProducers/src/EgammaHLTElectronDetaDphiProducer.cc☑.

No record found in the

I'm trying to associate reconstructed to generated/simulated tracks, as described here but I get the following error message:

```
No "TrackAssociatorRecord" record found in the EventSetup.
 Please add an ESSource or ESProducer that delivers such a record.
```

even though I added

```
process.load('SimTracker.TrackAssociation.TrackAssociatorByHits_cfi')
```

to my configuration.

Solution: see this link .

How can I select events with at least one supercluster in a given eta range ?

The following sequence worked for me:

```
# combine barrel and endcap super clusters into one collection
process.barrelAndEndcapSuperClusters =  cms.EDProducer("EgammaSuperClusterMerger",
                                            src = cms.VInputTag(
                                                cms.InputTag('correctedHybridSuperClusters'), # ba
                                                cms.InputTag('correctedMulti5x5SuperClustersWithPr
                                        ))

# produce another collection based on the previous one containing only
# superclusters in the given eta range
process.selectedSuperClusters = cms.EDFilter("SuperClusterSelector",
                                            filter = cms.bool(True),
                                            src = cms.InputTag("barrelAndEndcapSuperClusters"),

                                            # using the cut parser. See https://twiki.cern.ch/tw
                                            cut = cms.string('abs(eta()) <= 1.4442 || (abs(eta()
                            )

# we use an count filter here for counting the number
# of superclusters in the collection which contains all those
# within the fiducial volume.
#
# note that this does NOT produce a new collection but just
# veto/let pass the event
process.superClusterCountFilter = cms.EDFilter("EtMinSuperClusterCountFilter",
                                                # input collection for this filter. We take the ou
                                                # of the previous module
                                                # (see CommonTools/UtilAlgos/interface/ObjectCount
                                                src = cms.InputTag("selectedSuperClusters"),

                                                # require at least one object in the collection
                                                # see CommonTools/UtilAlgos/interface/MinNumberSel
                                                minNumber = cms.uint32(1),

                                                # minimum Et for the super clusters
                                                # see CommonTools/RecoAlgos/plugins/EtMinSuperClus
                                                etMin = cms.double(-1),
                                                )

# put these three modules into one path.
# depending on how the filter is used, we could also
# put these three modules into a sequence which is then inserted
# in another path or use this path with the SelectEvents
# option of the PoolOutputModule.
process.superClusterFilterPath = cms.Path(process.barrelAndEndcapSuperClusters *
                                            process.selectedSuperClusters *
                                            process.superClusterCountFilter)
```

Can I easily match generated electrons with reconstructed superclusters ?

There is a module `MCTruthDeltaRMatcher` for this based on a delta R match (which probably does not take into account the bending of the electron in the magnetic field).

See this link☞ and the section 'Using MCTruthDeltaRMatcher' on this page.

How can I merge multiple EDM (CMSSW root) files into one ?

- see this link.

Is there a way to automatically determine the appropriate global tag in a python configuration file ?

- see this link☞.

Can't rfcp a file even though rfdir shows it

Trying to do:

```
rfcp /castor/cern.ch/.... /my/local/dir/
```

I get the following error message:

```
/castor/cern.ch/.... : File has no copy on tape and no diskcopies are accessible
```

even though I can see the file with `rfdir`.

Similarly, when trying to open this file from a `cmsRun` job, I get something like the following:

```
%MSG-s CMSException:  AfterFile 07-Jan-2011 14:04:40 CET pre-events
cms::Exception caught in cmsRun
---- FileOpenError BEGIN
---- StorageFactory::open() BEGIN
Failed to open the file 'rfio:///castor/cern.ch/...' because:
---- RFIOFile::open() BEGIN
rfio_open(name='rfio:///?path=/castor/cern.ch/...', flags=0x0, permissions=0666) => error 'No suc
---- RFIOFile::open() END
---- StorageFactory::open() END

RootInputFileSequence::initFile(): Input file rfio:/castor/cern.ch/... was not found or could not

Error occurred while creating source PoolSource
---- FileOpenError END
```

Also `stager_qry -M` reported the following:

```
stager_qry -M  /castor/cern.ch/...
Error 2/No such file or directory (File /castor/cern.ch/... (.......@castorns) not on this servic
```

In my case, the problem was that the file (according to DBS) was stored at `caf.cern.ch`. The solution was to login to CAF (see https://twiki.cern.ch/twiki/bin/view/CMS/CAF#Access_to_the_Interactive_CAF_cm), then

initialize the environment (see https://twiki.cern.ch/twiki/bin/view/CMS/CAFSETUP#Setup) . After this I could `rfcp` the file.

Is there a simple way to convert a JSON file (good lumi sections file) to a CMSSW configuration fragment ?

See the discussion here .

Which types of parameters does `ParameterSet` support ?

See the template specializations of the method `ParameterSet::getUntrackedParameter()` at http://cmslxr.fnal.gov/lxr/source/FWCore/ParameterSet/src/ParameterSet.cc .

I want to select single events (e.g. for scanning them) but the datasets are not available at my site. How do I select them 'from the grid' ?

See this link.

How do I compile with debug symbols built into the binaries ?

use

```
 scram b USER_CXXFLAGS=-g
```

How do I get the per-bunch crossing instantaneous luminosity for each event in CMSSW ?

see e.g.

- the discussion here: https://hypernews.cern.ch/HyperNews/CMS/get/luminosity/104.html
- and the twiki here: https://twiki.cern.ch/twiki/bin/view/CMS/LumiCalc#LumiDetails

Where is the Event class defined ?

- see e.g. http://cmslxr.fnal.gov/lxr/source/FWCore/Framework/interface/Event.h and http://cmslxr.fnal.gov/lxr/source/FWCore/Common/interface/EventBase.h .

-- AndreHolzner - 26-Feb-2010

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