

Computer Set-up Session - CMS

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29.6.2009

Introduction to PAT (from Roger Wolf)

- The following slides are taken from June PAT tutorial
- Please have a look at the tutorial pages for longer introduction to PAT:
<http://indico.cern.ch/conferenceOtherViews.py?view=standard&confId=57695>

Introduction to PAT (from Roger Wolf)

Physics
Analysis
Toolkit

The Physics Analysis Toolkit

Interface

- b/w Reconstruction & Analysis Level
- simplifies access via **DataFormats**
- canalizes expertise (POG & PAG contacts)
- crossing point between POGs & PAGs ('vertical integration')

Common Tool

- approved algorithms & sensible defaults
- synergy (everybody can profit from recent developments)
- quick start into analysis for beginners

Common Format

- facilitates transfer & comparisons
- PAG common configurations
- sustained provenance

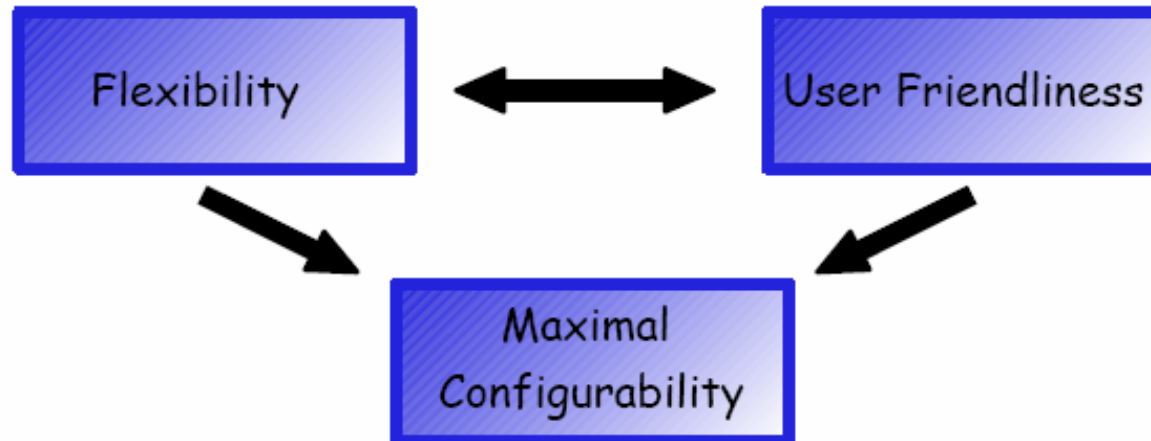
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Concepts

- Make use of the modular structure of CMSSW (in full FW/FWLite)
- Provide easy access via member functions in **DataFormats**
- Serve 80% of all analyses in CMS

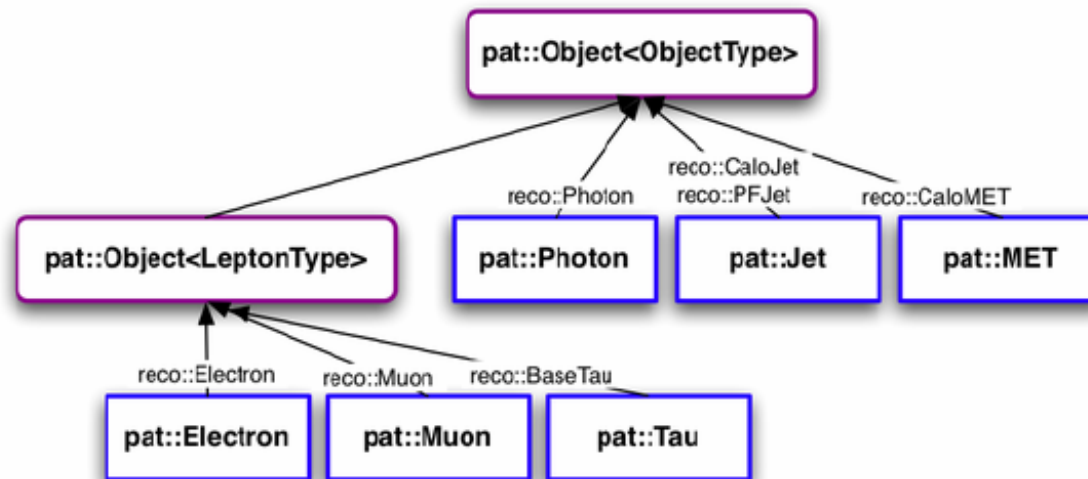


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Data Formats

- DataFormats in PatCandidates



- All `pat::Objects` inherit from their corresponding `reco::Candidates`
- A `pat::Object` is a `reco::Object` (plus more)

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How to access pat::Objects

- For an examples with a FWLiteAnalyzer have a look at:

SWGuidePATExamplesFWLite

```
// load framework libraries
gSystem->Load( "libFWCoreFWLite" );
AutoLibraryLoader::enable();
```

Never forget to enable
the AutoLibraryLoader

```
// loop the events
unsigned int iEvent=0;
fwlite::Event event(inFile);
for(event.toBegin(); !event.atEnd(); ++event, ++iEvent){
    // break loop after end of file is reached
    // or after 1000 events have been processed
    if( iEvent==1000 ) break;
```

Loop the events of an
input file

```
// simple event counter
if(iEvent>0 && iEvent%100==0){
    std::cout << " processing event: " << iEvent << std::endl;
}
```

```
// fwlite::Handle to to muon collection
fwlite::Handle<std::vector<pat::Muon> > muons;
muons.getByLabel(event, "selectedLayer1Muons");
```

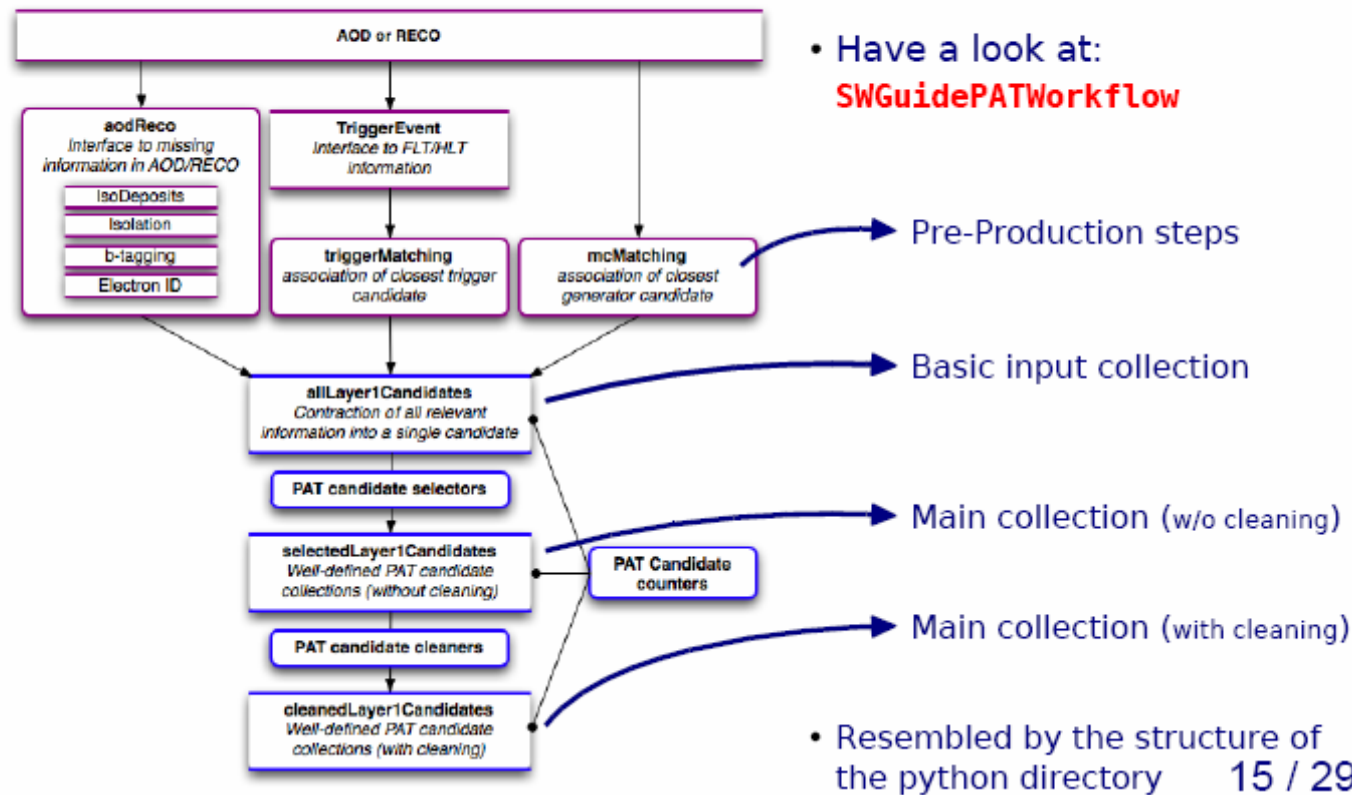
Receive the jet collection
by label

```
// loop muon collection and fill histograms
for(unsigned i=0; i<muons->size(); ++i){
    muonPt_ ->Fill( (*muons)[i].pt() );
    muonEta_ ->Fill( (*muons)[i].eta() );
    muonPhi_ ->Fill( (*muons)[i].phi() );
}
// close input file
inFile->Close();
```

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Workflow



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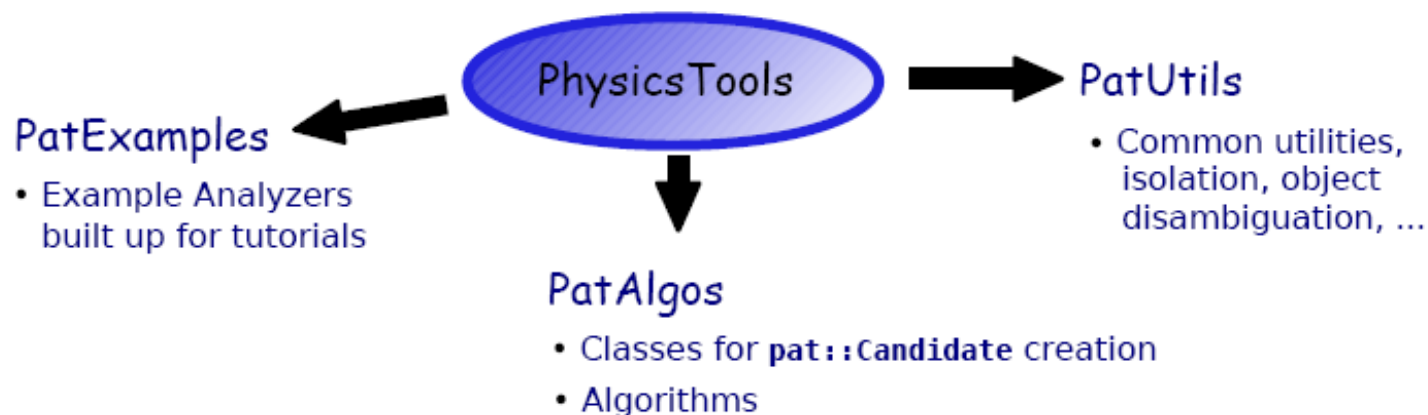
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Code Location

- All code located in the CMSSW domain distributed over two systems

- **DataFormats/PatCandidates**

- Structures and Candidate Classes
- `pat::Photon`, `pat::Electron`, `pat::Muon`, `pat::Jet`, `pat::MET`, ...



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AOD/Reco Steps

- **Pre-pat::Candidate** Production steps on RECO/AOD input
- It happens that 'old'-CMSSW version input files lack finest newest, objects/algorithms
 - BTag algorithms
 - Tau discriminators
 - Electron isolation from RecHits
 - Electron Id, ...

```
# Sequences needed to deliver external information for objects
# You can remove modules from here if you don't need these features
patAODExtraReco = cms.Sequence(
    #patBTagging +           # Empty sequences not supported yet
    patElectronId +
    patElectronIsolation +
    patJetMETCorrections +
    patJetTracksCharge +
    #patMuonIsolation +     # Empty sequences not supported yet
    #patPhotonID +          # Empty sequences not supported yet
    patPhotonIsolation +
    #patTauDiscrimination + # Empty sequences not supported yet
    patPFCandidateIsoDepositSelection +
    patPFTauIsolation
)
```

→ This sequence fills up this gap

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selectedLayer1Candidates

- Simple selection via string parser:

```
# module to select Muons
# See https://twiki.cern.ch/twiki/bin/view/CMS/SWGuidePhysicsCutParser
# on how to use the cut-string
#
# These are only dummy cuts
selectedLayer1Muons = cms.EDFilter("PATMuonSelector",
    src = cms.InputTag("allLayer1Muons"),
    cut = cms.string('pt > 0. & abs(eta) < 12.')
)
```

- Can use all kind of functions and all kind of member functions of the `pat::Candidate`
- For more details have a look at [SWGuidePhysicsCutParser](#)
- Results in **selectedLayer1Candidates** (std candidate collection of `pat::Candidates` w/o object cleaning)
- For the choice of standard selection strings have a look at [SWGuidePATConfiguration](#)

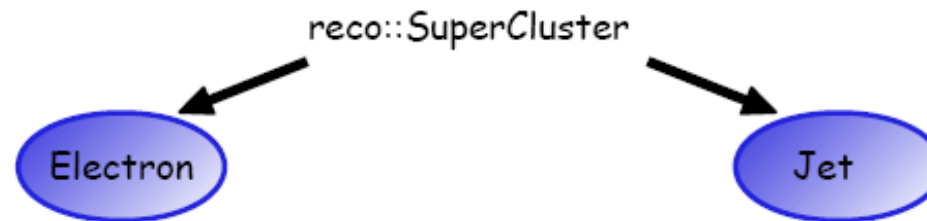
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cleanLayer1Candidates

- What is object (cross) cleaning?



- A set of `PATCandidateCleaners` can help to resolve this double counting if desired
- Results in **cleanLayer1Candidates** (std candidate collection of pat::Candidates with object cleaning)
- For the standard configuration of these cleaners have a look at **SWGidePATConfiguration**

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Access to the NAF

- Follow the instructions handed out on paper (individual logins etc.)

What you should have done before the workshop...

All work will be done on the NAF.

- o Detailed instructions are on the workshop webpage:

<https://indico.desy.de/getFile.py/access?resId=0&materialId=0&confId=1811>

The Monte Carlo files will be analysed using PAT.

Please install the version CMSSW-2-2-13 on the NAF:

On your workgroupserver at DESY or CERN get your proxy:

- o `voms-proxy-init -voms cms -rfc`

Log on to the NAF:

- o `gssh cms.naf.desy.de`

Once on the NAF, install the software:

- o `ini cmssw`

- o `cmsrel CMSSW_2_2_13`

- o `cd CMSSW_2_2_13/src`

- o `cmsenv`

Add the following packages before compiling

```
addpkg DataFormats/PatCandidates V03-26-07
addpkg PhysicsTools/PatAlgos V05-05-15
addpkg PhysicsTools/PatUtils V03-06-04
cvs up -r 1.2.2.6 PhysicsTools/PatAlgos/python/tools/tauTools.py
addpkg RecoTauTag global_PFTau_22X_V00-02-03
addpkg DataFormats/TauReco V00-12-01-02
addpkg CondFormats/JetMETObjects V01-08-04
addpkg PhysicsTools/RecoAlgos V08-06-16-06-02
addpkg PhysicsTools/PFCandProducer V03-01-16
cvs up -r 1.7 PhysicsTools/PFCandProducer/python/pfTaus_cff.py
addpkg RecoMET/Configuration V00-04-02-17
addpkg RecoMET/METAlgorithms V02-05-00-21
addpkg RecoMET/METProducers V02-08-02-17
addpkg DataFormats/METReco V00-06-02-09
addpkg DataFormats/MuonReco V07-02-12-03
addpkg JetMETCorrections/Type1MET VB04-00-02-04
addpkg RecoJets/JetAssociationAlgorithms V01-04-03
addpkg JetMETCorrections/Algorithms V01-08-02-01
addpkg JetMETCorrections/Configuration V01-08-15
addpkg JetMETCorrections/JetPlusTrack V03-02-06
addpkg JetMETCorrections/Modules V02-09-02
```

Or have a look here:
https://twiki.cern.ch/twiki/bin/view/CMS/SWGuidePATRecipes#CMSSW_2_2_X_with_PAT_version_2

Last but not least...

... compile!

```
> cd CMSSW_2_2_13/src  
> cmsenv  
> scramv1 b -j11                (-j11 for 8 cores, -j5 for 4 cores)
```

If you are ready with compiling, you are almost done.

Set up your rootlogon-file for the FWLite (see next page)

Setting up your Rootlogon for FWLite (from Workbook)

```
rootlogon.C:
{
// Set up FW Lite for automatic loading of CMS libraries
// and data formats. As you may have other user-defined setup
// in your rootlogon.C, the CMS setup is executed only if the CMS
// environment is set up.
  TString cmsswbase = getenv("CMSSW_BASE");
  if (cmsswbase.Length() > 0) {
  //
// The CMSSW environment is defined (this is true even for FW Lite)
// so set up the rest.
//
    cout << "Loading FW Lite setup." << endl;
    gSystem->Load("libFWCoreFWLite.so");
    AutoLibraryLoader::enable();
    gSystem->Load("libDataFormatsFWLite.so");
    gSystem->Load("libDataFormatsPatCandidates.so");
  }
}
.rootrc:
Rint.Logon: $(HOME)/rootlogon.C
```

you can copy both files from:
~isabell/public/Workshop

... and enjoy the reception tonight!!!