



CEPCSW Tutorial

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Beginning



- We assume you are familiar with:
 - Linux, git, ssh
 - C++/Python
 - ROOT

Also, you should have one IHEP computing account.
If you belong to other experiments, request the sub-group “higgs” under:
<http://ccsuser.ihep.ac.cn/>

Get access to IHEP Cluster



Windows: WSL, vscode, putty, mingw, Mobaxterm.....

Linux/Mac: your terminal

ssh -XY provides X11 forwarding.
(mobaxterm for windows)

- `ssh youraccount@lxlogin.ihep.ac.cn`
- `export PATH=/cvmfs/container.ihep.ac.cn/bin:$PATH`
- `hep_container shell CentOS7 -g higgs`
- You will see:

```
Singularity>
```

Alternatively, you can also use CEPCSW outside of the Centos7 container.

For hepjob, add this to your bashrc:
`export PATH=/cvmfs/common.ihep.ac.cn/software/hepjob/bin:$PATH`

- If you do not need any changes for CEPCSW, use the official release:
 - `source /cvmfs/cepcsw.ihep.ac.cn/prototype/releases/tdr25.3.0/CEPCSW/setup.sh`

To test:

- `cd /cvmfs/cepcsw.ihep.ac.cn/prototype/releases/tdr25.3.0/CEPCSW/`
- `./run.sh Examples/options/helloalg.py`

```
Singularity> ./run.sh Examples/options/helloalg.py
# setting LC_ALL to "C"
# --> Including file '/cvmfs/cepcsw.ihep.ac.cn/prototype/releases/tdr24.10.0/CEPCSW/Examples/options/helloalg.py'
# <-- End of file '/cvmfs/cepcsw.ihep.ac.cn/prototype/releases/tdr24.10.0/CEPCSW/Examples/options/helloalg.py'
ApplicationMgr    SUCCESS
=====
                                     Welcome to ApplicationMgr (GaudiCoreSvc v36r16)
                                     running on lxlogin003.ihep.ac.cn on Sat Oct 26 14:52:13 2024
=====
ApplicationMgr    INFO Application Manager Configured successfully
helloAlg         INFO MyInt: 42
EventLoopMgr     WARNING Unable to locate service "EventSelector"
EventLoopMgr     WARNING No events will be processed from external input.
ApplicationMgr    INFO Application Manager Initialized successfully
ApplicationMgr    INFO Application Manager Started successfully
ApplicationMgr    INFO Application Manager Stopped successfully
EventLoopMgr     INFO Histograms converted successfully according to request.
ApplicationMgr    INFO Application Manager Finalized successfully
ApplicationMgr    INFO Application Manager Terminated successfully
```

Your CEPCSW



you /afs only 500M. Maybe in /cefs/higgs/your directory.
If you build your CEPCSW in container, always in container.
If you build your CEPCSW without container, always without container.

- If you would like maintain your own fork:

- Login <https://code.ihep.ac.cn>

- Manage your own ssh key

- Fork

<https://code.ihep.ac.cn/cepc/CEPCSW>

- git clone

git@code.ihep.ac.cn:you/CEPCSW.git

- git clone <https://code.ihep.ac.cn/cepc/CEPCSW.git>

- cd CEPCSW

- git checkout tdr25.1.1

- source setup.sh

- ./build.sh

- source setup.sh

- ./run.sh Examples/options/helloalg.py

Sample Production Process



- copy scripts in Reconstruction/RecPFACyber/script/ to your working dir.
 - Run them one by one
 - ./run.sh sim.py
 - ./run.sh digi.py
 - ./run.sh tracking.py
 - ./run.sh rec.py

sim.py performs GEANT4 full simulation.
use stdhep file as input.

Calo Digitalization

Track reconstruction

Get CyberPFO containers
Extra: run ana.py for jet clustering

Scripts you may modify:



- Sim.py stdheprdr.Input =

/cefs/higgs/zhangkl/stdhep/E240/higgs/E240.Pnnh_e2e2.e0.p0.whizard195/nnh_e2e2.e0.p0.0001.stdhep “
- rec.py out.filename = "Rec_TDR_o1_v01.root"
- rec.py EvtMax=10

Found other samples in data dirs.

Do not run too much events in front end.

Optional: Generator input



- Generator and CEPCSW are decoupled.
 - You can use either stdhep/HepMC/Hepevt/slcio/ParticleGun as input.
 - Existing stdheps in /cefs/higgs/zhangkl/stdhep
 - Existing samples in /cefs/higgs/zhangkl/Production
- Normal users are not suggested to generate your own sample
 - Limited computing source and disk quota.
 - Most SM sample will be officially provided for CEPC240/360 with Whizard1.9.5.
 - For generating stdhep files, <https://code.ihep.ac.cn/zhangkl/whizardais>
 - Whizard1.9.5 with ISR. If you use MadGraph or other processes, validate them.

Optional: job submitting



- git clone https://code.ihep.ac.cn/zhangkl/cepcsw_tutorial.git

Name	Last commit	Last update
📁 Zebing	add Zebing's slides and noteb...	just now
📁 analysis	Update to TDR25.1.1, for new...	1 month ago
📁 scripts	Update scripts to TDR25.3.0	17 hours ago
📄 20241028_CEPCSW_K...	Add tutorial pdf	4 months ago
📄 20250115_CEPCSW_K...	Update to TDR25.1.1, for new...	1 month ago
📄 20250304_CEPCSW_K...	Update slides to TDR 25.3.0. ...	17 hours ago

- See template script for submitting jobs
 - Please only submit when you know what you are doing.
 - You may need to remove JetOrigin package in your SW.

```
unset PYTHONHOME
```

You may need this if hep_sub not correctly set;

```
-os CentOS7
```

You can submit CEPCSW jobs either in containers or not.

But be consistent with your cepcsw build.

```
-g higgs
```

Can also be other groups like ATLAS.

Structure of outputs

- `root -b Rec_TDR_o1_v01.root`
- `.ls`
- `events->Print()`
- `events->Show(0)`
- PFO objects as ntuple
 - Information is lost in ntuple stage. To get all information, use packages in CEPCSW.

```
Warning in <TClass::Init>: no dictionary for class podio::ObjectID is available
Warning in <TClass::Init>: no dictionary for class edm4hep::Vector3f is available
Warning in <TClass::Init>: no dictionary for class edm4hep::Vector3d is available
Warning in <TClass::Init>: no dictionary for class edm4hep::MCParticleData is available
Warning in <TClass::Init>: no dictionary for class edm4hep::Vector2i is available
Warning in <TClass::Init>: no dictionary for class edm4hep::ReconstructedParticleData is available
Warning in <TClass::Init>: no dictionary for class podio::GenericParameters is available
Warning in <TClass::Init>: no dictionary for class podio::CollectionIDTable is available
Warning in <TClass::Init>: no dictionary for class podio::version::Version is available
(TFile *) 0x1cc8b30
```

This indicates that you are not in CEPCSW env.
However, you don't need it for ntuple reading.

Tree events are organized like normal ntuple.
You can play with it with your good old tools.

Developing codes in CEPCSW



- Examples in
 - Analysis/GenMatch Jet Clustering and parameters to store
 - /cefs/higgs/zhangkl/CEPCSW/Analysis/JetOrigin/src
 - A complete application for tracking, reco PID, truth matching and so on.

Analysis: Dimuon mass plot



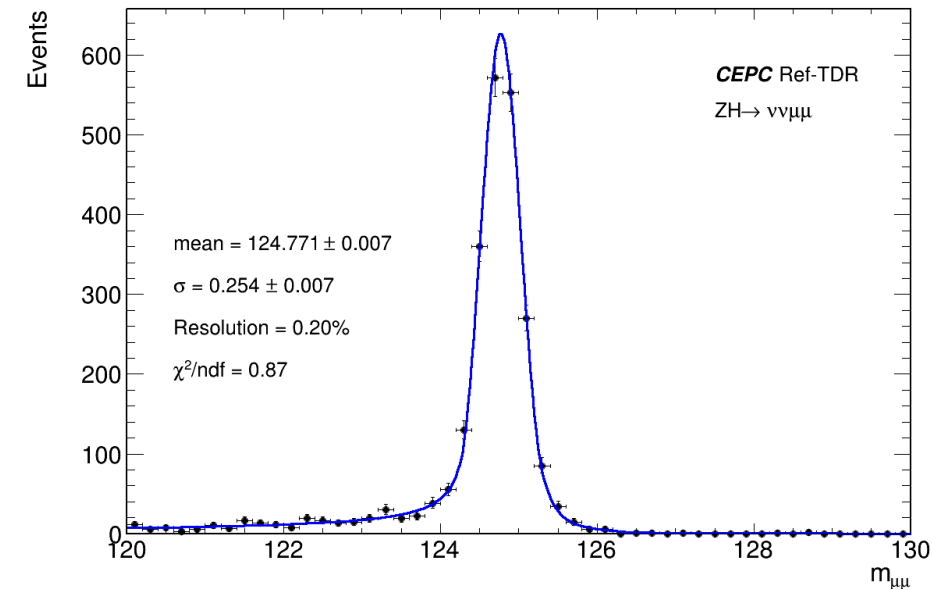
- `cd cepcsw_tutorial/analysis`
- `root -b Reader_CEPCSW_mmGenmatch.cxx`

Analysis codes



- CEPCStyle.h: Recommended to use in CEPC.
- TChain + TTreeReader(Array);
- CyberPFO for reco and MCParticleGen for truth info.
- Gen-Reco Match by DeltaR
- RooFit: DSCB Fit
- 1D/2D plotting, formatting

Please explore more after the tutorial.



Vscode+Python+Jupyter Notebook



- @Zebing Tutorial
- More user friendly