



# MC Production of Single Muon & Analysis

Korea University  
Eunsung Seo, Hanbum Rhee, Seungsu Shin

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# Construction of Analyzer



```
lx64slc4.cern.ch - PuTTY
Eunsung
[~] ~/scratch0/CMSSW_3_1_0/src/ses > cmsenv
[~] ~/scratch0/CMSSW_3_1_0/src/ses > mkedanlzl SES
I: using skeleton: /afs/cern.ch/cms/sw/slc4_ia32_gcc345/cms/cmssw/CMSSW_3_1_0/bin/slc4_ia32_gcc345/mkT
ates/EDAnalyzer/edanalyzer.cc
I: authors name is: Eunsung Seo, determined by the gcos entry
I: creating file: SES/src/SES.cc
I: using skeleton: /afs/cern.ch/cms/sw/slc4_ia32_gcc345/cms/cmssw/CMSSW_3_1_0/bin/slc4_ia32_gcc345/mkT
ates/EDAnalyzer/ConfFile_cfg.py
I: authors name is: Eunsung Seo, determined by the gcos entry
I: creating file: SES/ses_cfg.py
I: using skeleton: /afs/cern.ch/cms/sw/slc4_ia32_gcc345/cms/cmssw/CMSSW_3_1_0/bin/slc4_ia32_gcc345/mkT
ates/EDAnalyzer/BuildFile.temp
I: authors name is: Eunsung Seo, determined by the gcos entry
I: creating file: SES/BuildFile
I: using skeleton: /afs/cern.ch/cms/sw/slc4_ia32_gcc345/cms/cmssw/CMSSW_3_1_0/bin/slc4_ia32_gcc345/mkT
ates/EDAnalyzer/CfiFile_cfi.py
I: authors name is: Eunsung Seo, determined by the gcos entry
I: creating file: SES/python/ses_cfi.py
```

```
lx64slc4.cern.ch - PuTTY
[~] ~/scratch0/CMSSW_3_1_0/src/ses > cd SES
[~] ~/scratch0/CMSSW_3_1_0/src/ses/SES > ls
BuildFile  doc  interface  python  ses_cfg.py  src  test
[~] ~/scratch0/CMSSW_3_1_0/src/ses/SES >
```

# MC Production of Single Muon by Particle Gun



```
lx64slc4.cern.ch - PuTTY
[~] [lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES > cmsDriver.py SingleMuPt100.cfi -s GEN:ProductionFilterSequence,SIM,DIGI -n 100 --conditions FrontierConditions_GlobalTag,IDEAL_31X::All --datatier GEN-SIM-DIGI --eventcontent FEVTDEBUGHLT --python_filename RelValSingleMuPt100_IDEAL_31X.py --no_exec
GEN:ProductionFilterSequence,SIM,DIGI,ENDJOB
We have determined that this is simulation (if not, rerun cmsDriver.py with --data)
GEN:ProductionFilterSequence
SIM
DIGI
ENDJOB
Config file RelValSingleMuPt100_IDEAL_31X.py created
[~] [lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES >
# Other statements
process.GlobalTag.globaltag = 'MC_31X_V5::All'
process.generator = cms.EDProducer("FlatRandomPtGunProducer",
    PGunParameters = cms.PSet(
        MaxPt = cms.double(100.01),
        MinPt = cms.double(99.99),
        PartID = cms.vint32(-13),
        MaxEta = cms.double(1.6),
        MaxPhi = cms.double(3.14159265359),
        MinEta = cms.double(-1.6),
        MinPhi = cms.double(-3.14159265359)
    ),
    Verbosity = cms.untracked.int32(0),
```

# MC Production of Single Muon by Particle Gun



```
lx64slc4.cern.ch - PuTTY
[~] [lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES > vi RelValSingleMuPt100_IDEAL_31X.py
[~] [lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES > cmsRun RelValSingleMuPt100_IDEAL_31X.py
```

```
lx64slc4.cern.ch - PuTTY
[~] [lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES > cmsRun RelValSingleMuPt100_IDEAL_31X.py
Begin processing the 1st record. Run 1, Event 1, LumiSection 1 at 18-Aug-2009 15:54:06 CEST
Begin processing the 2nd record. Run 1, Event 2, LumiSection 1 at 18-Aug-2009 15:54:21 CEST
Begin processing the 3rd record. Run 1, Event 3, LumiSection 1 at 18-Aug-2009 15:54:22 CEST
Begin processing the 4th record. Run 1, Event 4, LumiSection 1 at 18-Aug-2009 15:54:25 CEST
Begin processing the 5th record. Run 1, Event 5, LumiSection 1 at 18-Aug-2009 15:54:27 CEST
Begin processing the 6th record. Run 1, Event 6, LumiSection 1 at 18-Aug-2009 15:54:30 CEST
Begin processing the 7th record. Run 1, Event 7, LumiSection 1 at 18-Aug-2009 15:54:32 CEST
Begin processing the 8th record. Run 1, Event 8, LumiSection 1 at 18-Aug-2009 15:54:38 CEST
Begin processing the 9th record. Run 1, Event 9, LumiSection 1 at 18-Aug-2009 15:54:40 CEST
Begin processing the 10th record. Run 1, Event 10, LumiSection 1 at 18-Aug-2009 15:54:42 CEST
Begin processing the 11th record. Run 1, Event 11, LumiSection 1 at 18-Aug-2009 15:54:43 CEST
Begin processing the 12th record. Run 1, Event 12, LumiSection 1 at 18-Aug-2009 15:54:46 CEST
Begin processing the 13th record. Run 1, Event 13, LumiSection 1 at 18-Aug-2009 15:54:47 CEST
Begin processing the 14th record. Run 1, Event 14, LumiSection 1 at 18-Aug-2009 15:54:50 CEST
Begin processing the 15th record. Run 1, Event 15, LumiSection 1 at 18-Aug-2009 15:54:51 CEST
Begin processing the 16th record. Run 1, Event 16, LumiSection 1 at 18-Aug-2009 15:54:53 CEST
Begin processing the 17th record. Run 1, Event 17, LumiSection 1 at 18-Aug-2009 15:54:56 CEST
Begin processing the 18th record. Run 1, Event 18, LumiSection 1 at 18-Aug-2009 15:55:00 CEST
Begin processing the 19th record. Run 1, Event 19, LumiSection 1 at 18-Aug-2009 15:55:02 CEST
```

# Analysis of RPC Digi



- ▶ `/CMSSW/DQM/RPCMonitorDigi/src/RPCMonitorDigi.cc`
- ▶ Edit to `ses_cfg.py`
- ▶ Edit to BuildFile
- ▶ Edit to `/src/SES.cc`

# Analysis of RPC Digi



```
lx64slc4.cern.ch - PuTTY

process.load("FWCore.MessageService.MessageLogger_cfi")

process.maxEvents = cms.untracked.PSet( input = cms.untracked.int32(-1) )

process.source = cms.Source("PoolSource",
  # replace 'myfile.root' with the source file you want to use
  fileNames = cms.untracked.vstring(
    'file:myfile.root'
  )
)

5,1 30%
```

```
lx64slc4.cern.ch - PuTTY

process.load("FWCore.MessageService.MessageLogger_cfi")

process.maxEvents = cms.untracked.PSet( input = cms.untracked.int32(-1) )

process.source = cms.Source("PoolSource",
  # replace 'myfile.root' with the source file you want to use
  fileNames = cms.untracked.vstring(
    'file:SingleMuPt100_cfi_GEN_SIM_DIGI.root'
  )
)

:wq
```

# Analysis of RPC Digi



```
ix64slc4.cern.ch - PuTTY
// user include file
#include "FWCore/Framework/interface/Frameworkfwd.h"
#include "FWCore/Framework/interface/EDAnalyzer.h"
#include "DataFormats/RPCDigi/interface/RPCDigiCollection.h"
#include "DataFormats/RPCDigi/interface/RPCDigi.h"
#include "FWCore/Framework/interface/Event.h"
"SES.cc" 120L, 2346C written      24,21      19%
```

```
ix64slc4.cern.ch - PuTTY
void
SES::analyze(const edm::Event& iEvent, const edm::EventSetup& iSetup)
{
    using namespace edm;

    Handle<RPCDigiCollection> rpcdигis;
    iEvent.getByType(rpcdигis);

    for( RPCDigiCollection::DigiRangeIterator collectionItr=rpcdигis->begin(); collectionItr!=rpcdигis->end(); ++collectionItr) {
        RPCDetId detId=(*collectionItr).first;
        std::cout<<"<detId"<<detId<<">"<<std::endl;
    }
}
```

```
98,0-1      86%
```



# Analysis of RPC Digi



```
lx64slc4.cern.ch - PuTTY
<use name=FWCore/Framework>
<use name=FWCore/PluginManager>
<use name=FWCore/ParameterSet>
<use name=DataFormats/RPCDigi>
<flags EDM_PLUGIN=1>
<export>
  <lib name=sesSES>
  <use name=FWCore/Framework>
  <use name=FWCore/PluginManager>
  <use name=FWCore/ParameterSet>
  <use name=DataFormats/RPCDigi>
</export>
```

11,2 All

```
lx64slc4.cern.ch - PuTTY
-----
System                3                3
[lxplus255] ~/scratch0/CMSSW_3_1_0/src/ses/SES > cmsRun ses_cfg.py
```

# Analysis of RPC Digi



```
ix64slc4.cern.ch - PuTTY
Begin processing the 94th record. Run 1, Event 94, LumiSection 1 at 18-Aug-2009 17:12:18 CEST
<detId Re 0 Ri 0 St 1 Se 4 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 1 Se 10 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 1 Se 4 La 2 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 1 Se 10 La 2 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 2 Se 4 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 2 Se 10 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 2 Se 4 La 2 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 2 Se 10 La 2 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 3 Se 4 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 3 Se 10 La 1 Su 2 Ro 3 Tr 0 >
<detId Re 0 Ri 0 St 4 Se 10 La 1 Su 2 Ro 3 Tr 0 >
Begin processing the 95th record. Run 1, Event 95, LumiSection 1 at 18-Aug-2009 17:12:18 CEST
<detId Re 0 Ri 1 St 1 Se 4 La 1 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri -1 St 1 Se 9 La 1 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri 1 St 1 Se 4 La 2 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri 1 St 2 Se 4 La 1 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri -1 St 2 Se 10 La 1 Su 1 Ro 2 Tr 0 >
<detId Re 0 Ri 1 St 2 Se 4 La 2 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri -1 St 2 Se 10 La 2 Su 1 Ro 1 Tr 0 >
<detId Re 0 Ri 1 St 3 Se 4 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri -1 St 3 Se 10 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri -1 St 4 Se 10 La 1 Su 1 Ro 3 Tr 0 >
<detId Re 0 Ri 1 St 4 Se 4 La 1 Su 2 Ro 3 Tr 0 >
Begin processing the 96th record. Run 1, Event 96, LumiSection 1 at 18-Aug-2009 17:12:18 CEST
<detId Re 0 Ri -2 St 1 Se 5 La 1 Su 1 Ro 1 Tr 0 >
```

# Analysis of RPC Digi



```
lx64slc4.cern.ch - PuTTY
// ----- method called to for each event -----
void
SES::analyze(const edm::Event& iEvent, const edm::EventSetup& iSetup)
{
    using namespace edm;

    Handle<RPCDigiCollection> rpcdigis;
    iEvent.getByType(rpcdigis);

    for( RPCDigiCollection::DigiRangeIterator collectionItr=rpcdigis->begin(); collectionItr!=rpcdigis->end(
); ++collectionItr){
        RPCDetId detId=(*collectionItr).first;
        std::cout<<"<detId="<<detId<<">"<<std::endl;

        for( RPCDigiCollection::const_iterator digiItr =(*collectionItr ).second.first;digiItr != (*collectionItr
r ).second.second; ++digiItr){
            int strip= (*digiItr).strip();
            int bx=(*digiItr).bx();

            std::cout<<"<strip="<<strip<<">"<<"<bx="<<bx<<">"<<std::endl;
        }
    }
}
```

82,0-1

85

# Analysis of RPC Digi



```
ix64slc4.cern.ch - PuTTY
<strip=47><bx=0>
<strip=48><bx=0>
Begin processing the 98th record. Run 1, Event 98, LumiSection 1 at 18-Aug-2009 18:01:36 CEST
<detId= Re 1 Ri 2 St 1 Se 2 La 1 Su 2 Ro 1 Tr 0 >
<strip=14><bx=0>
<strip=15><bx=0>
<strip=16><bx=0>
<detId= Re -1 Ri 2 St 1 Se 5 La 1 Su 2 Ro 1 Tr 0 >
<strip=5><bx=0>
<strip=6><bx=0>
<detId= Re 1 Ri 2 St 2 Se 2 La 1 Su 2 Ro 1 Tr 0 >
<strip=17><bx=0>
<strip=18><bx=0>
<detId= Re -1 Ri 2 St 2 Se 5 La 1 Su 2 Ro 1 Tr 0 >
<strip=7><bx=0>
<detId= Re -1 Ri 3 St 3 Se 5 La 1 Su 1 Ro 2 Tr 0 >
<strip=4><bx=0>
<detId= Re 1 Ri 3 St 3 Se 2 La 1 Su 2 Ro 2 Tr 0 >
<strip=16><bx=0>
<detId= Re -1 Ri 3 St 3 Se 5 La 1 Su 2 Ro 2 Tr 0 >
<strip=25><bx=0>
Begin processing the 99th record. Run 1, Event 99, LumiSection 1 at 18-Aug-2009 18:01:36 CEST
<detId= Re 0 Ri -2 St 1 Se 1 La 1 Su 1 Ro 1 Tr 0 >
<strip=30><bx=0>
<detId= Re 0 Ri 2 St 1 Se 7 La 1 Su 1 Ro 1 Tr 0 >
<strip=53><bx=0>
```

# Analysis of SIM Hit(Particle Id)



```
lx64slc4.cern.ch - PuTTY
#include "FWCore/Framework/interface/EDAnalyzer.h"
#include "DataFormats/RPCDigi/interface/RPCDigiCollection.h"
#include "DataFormats/RPCDigi/interface/RPCDigi.h"
#include "SimDataFormats/TrackingHit/interface/PSimHitContainer.h"
#include "FWCore/Framework/interface/Event.h"

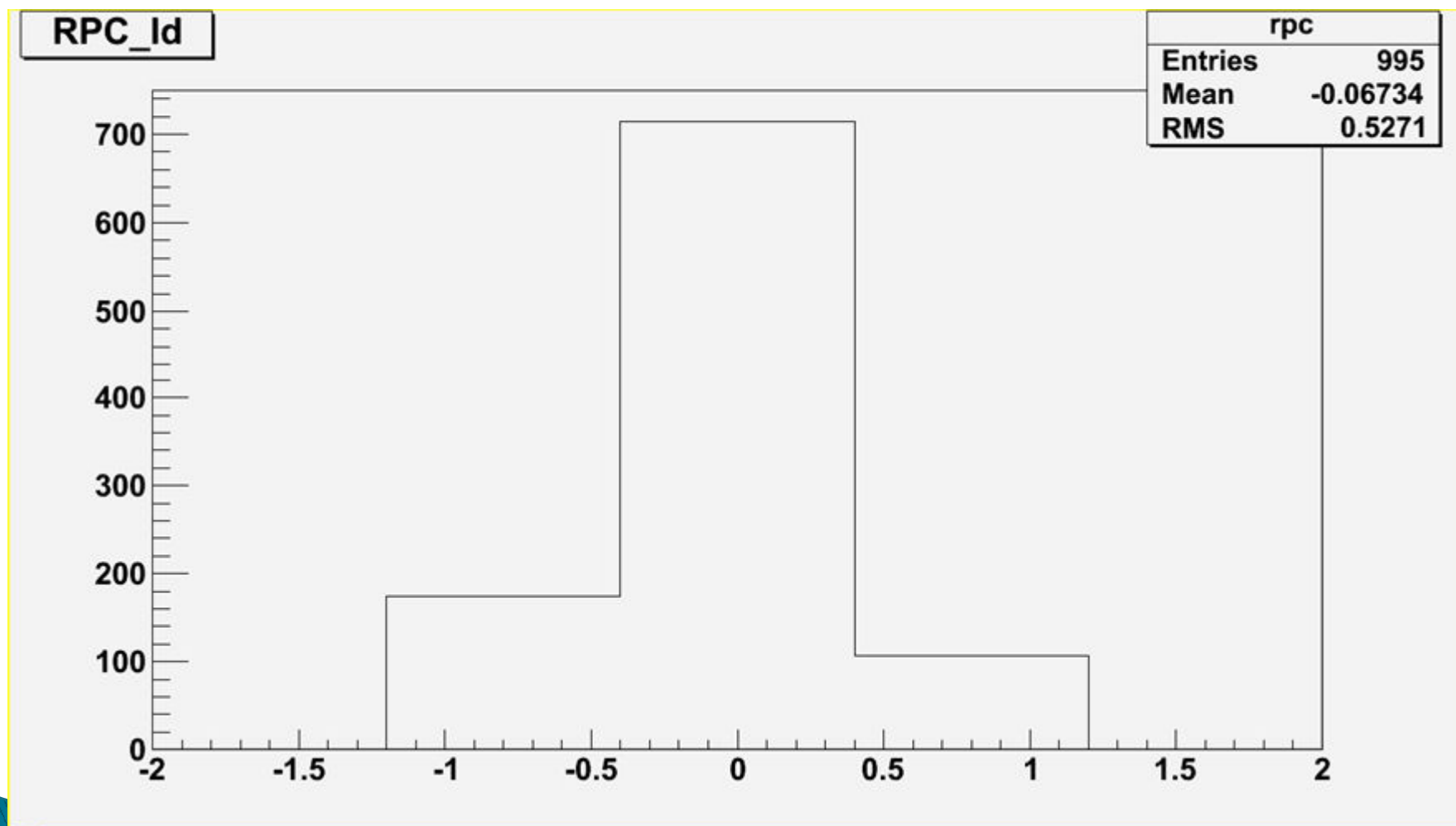
lx64slc4.cern.ch - PuTTY
edm::Handle<PSimHitContainer> simHit;
event.getByLabel("g4SimHits", "MuonRPCHits", simHit);

lx64slc4.cern.ch - PuTTY
// Loop on simhits
PSimHitContainer::const_iterator simIt;
// RPCRecHitCollection::const_iterator recIt;
// int clsize = (*recIt).clusterSize();

//loop
for (simIt = simHit->begin(); simIt != simHit->end(); simIt++) {
  RPCDetId Rsid = (RPCDetId) (*simIt).detUnitId();
  // const RPCRoll* soll = dynamic_cast<const RPCRoll* >( rpcGeom->roll(Rsid));
  int ptype = simIt->particleType();

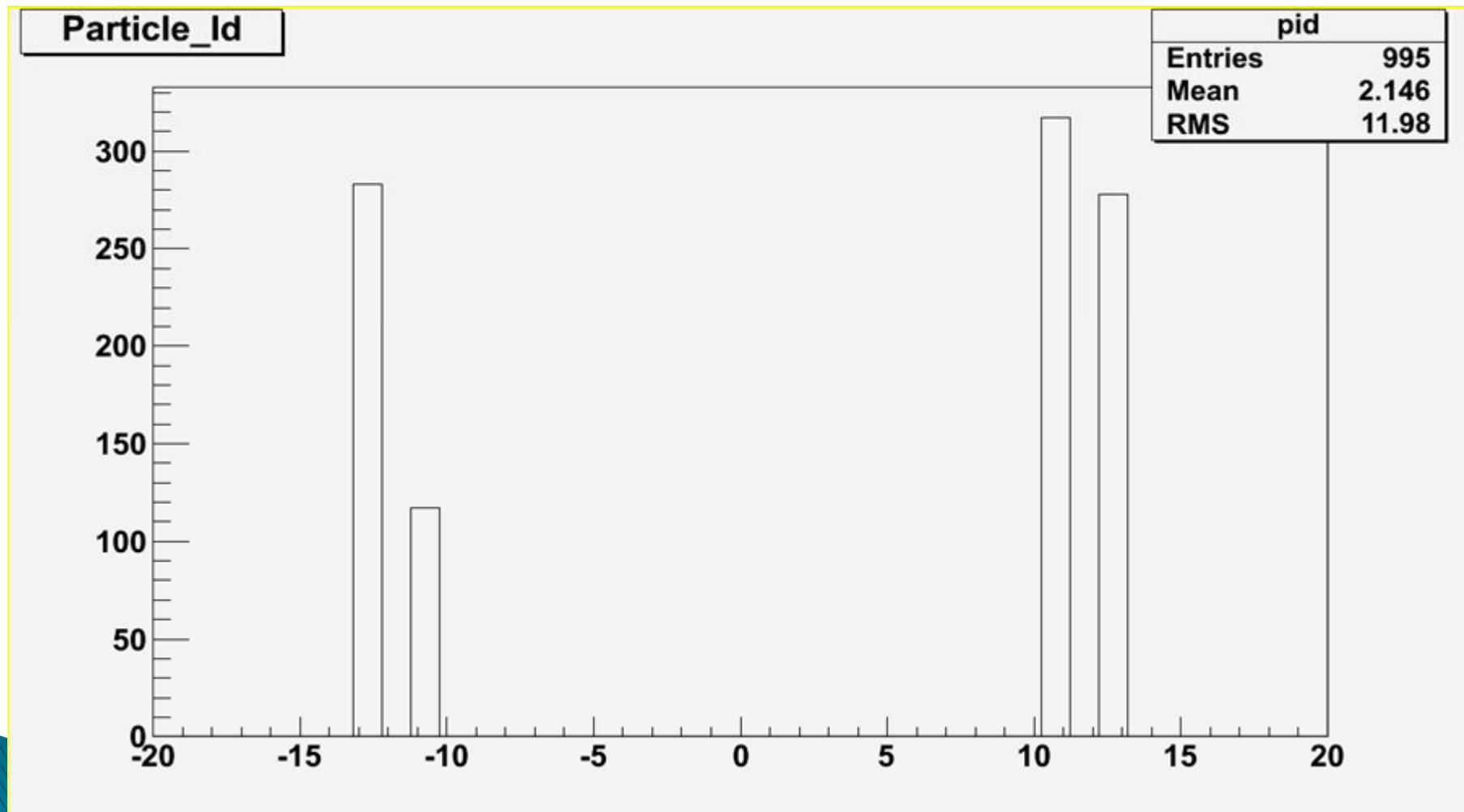
  std::cout<<"Detector Id="<<Rsid<<"><<std::endl;
  std::cout<<"Particle Type="<<ptype<<std::endl;
}
```

# Histogram (Sim Hit) Sim\_region

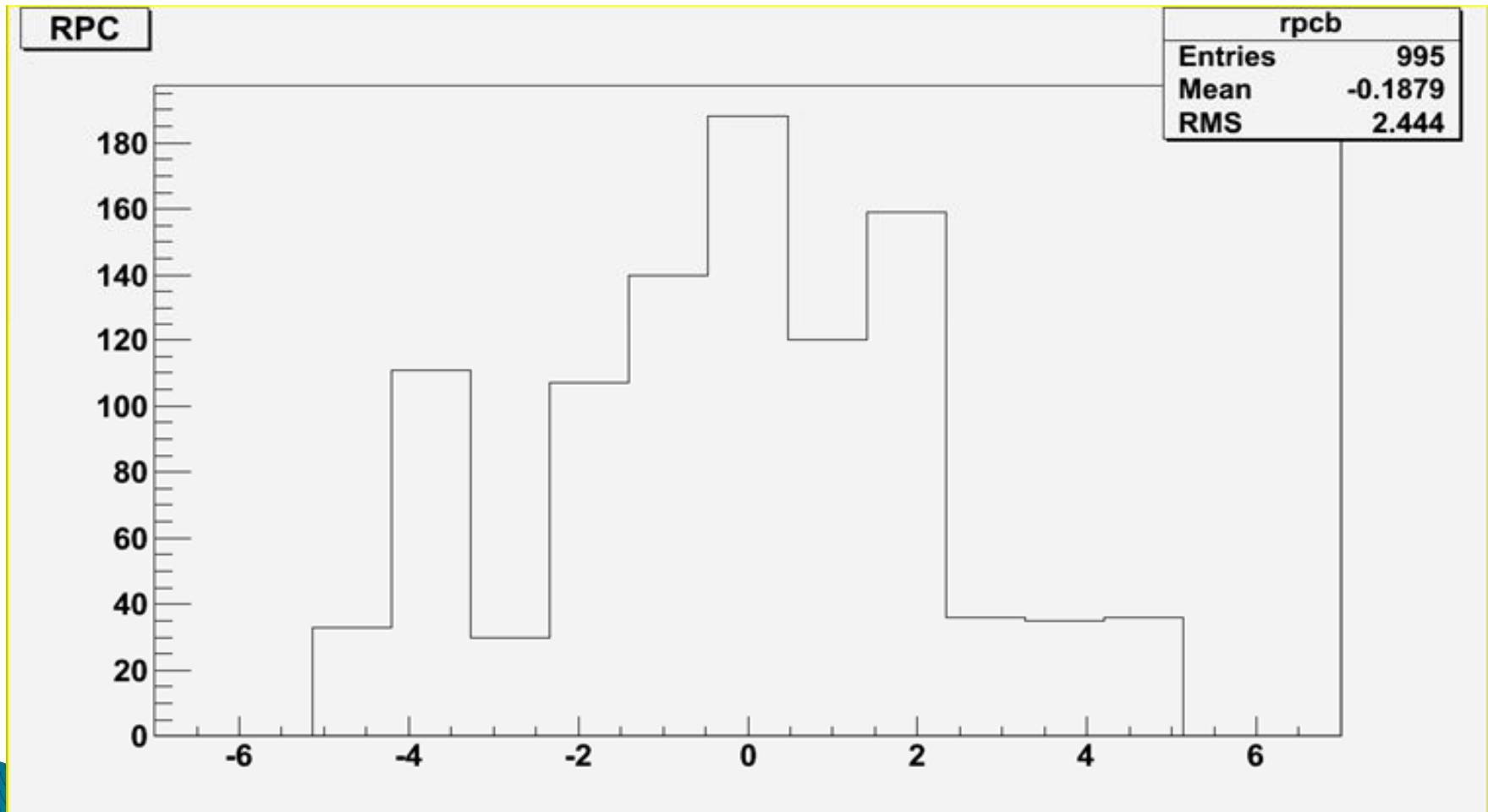




# Histogram (Sim Hit) particle id



# Histogram Sim-detector Id (Endcap-station, barrel-wheel)





# Analysis of RecHit & Geometry



```
ix64slc4.cern.ch - PuTTY
#include "FWCore/Framework/interface/EDAnalyzer.h"
#include "DataFormats/RPCDigi/interface/RPCDigiCollection.h"
#include "DataFormats/RPCDigi/interface/RPCDigi.h"

#include "SimDataFormats/TrackingHit/interface/PSimHitContainer.h"

#include "DataFormats/GeometryVector/interface/LocalPoint.h"
#include "DataFormats/GeometryVector/interface/GlobalPoint.h"

#include "Geometry/RPCGeometry/interface/RPCGeometry.h"

#include "DataFormats/RPCRecHit/interface/RPCRecHitCollection.h"

#include "FWCore/Framework/interface/Event.h"
#include "FWCore/Framework/interface/MakerMacros.h"
"src/SES.cc" 168L, 4048C written 37,64 16%
```

```
ix64slc4.cern.ch - PuTTY

Handle<RPCRecHitCollection> recHit;
iEvent.getByLabel("rpcRecHits", recHit);

edm::ESHandle<RPCGeometry> rpcGeom;
iSetup.get<MuonGeometryRecord>().get(rpcGeom);

108,1 68%
```

# Analysis of RecHit & Geometry



```
ix64slc4.cern.ch - PuTTY
process.maxEvents = cms.untracked.PSet( input = cms.untracked.int32(10) )
#process.maxEvents = cms.untracked.PSet( input = cms.untracked.int32(-1) )

process.source = cms.Source("PoolSource",
  # replace 'myfile.root' with the source file you want to use
  fileNameNames = cms.untracked.vstring(
    'file:step2_RAW2DIGI_RECO_POSTRECO.root'
  )
)

process.demo = cms.EDAnalyzer('SES'
)

13, 47 85%
```

```
ix64slc4.cern.ch - PuTTY

for (recIt = recHit->begin(); recIt != recHit->end(); recIt++) {
  RPCDetId rid = (RPCDetId) (*recIt).rpcId();

  LocalPoint rhitlocal = (*recIt).localPosition();
  GlobalPoint p=soll->toGlobal(simIt->localPosition());
  ClSize->Fill(clsize);

  std::cout<<"Detector Id="<<Rsid<<"><<std::endl;
  std::cout<<"Parcicle Type="<<ptype<<std::endl;
}

135, 0-1 89%
```

# Analysis of RecHit & Geometry



```
ix64slc4.cern.ch - PuTTY
PSimHitContainer::const_iterator simIt;
RPCRecHitCollection::const_iterator recIt;
int clsize = (*recIt).clusterSize();

//loop

for (simIt = simHit->begin(); simIt != simHit->end(); simIt++) {
  RPCDetId Rsid = (RPCDetId) (*simIt).detUnitId();
  const RPCRoll* soll = dynamic_cast<const RPCRoll* >( rpcGeom->roll(Rsid));
  int ptype = simIt->particleType();

for (recIt = recHit->begin(); recIt != recHit->end(); recIt++) {
  RPCDetId Rid = (RPCDetId) (*recIt).rpcId();

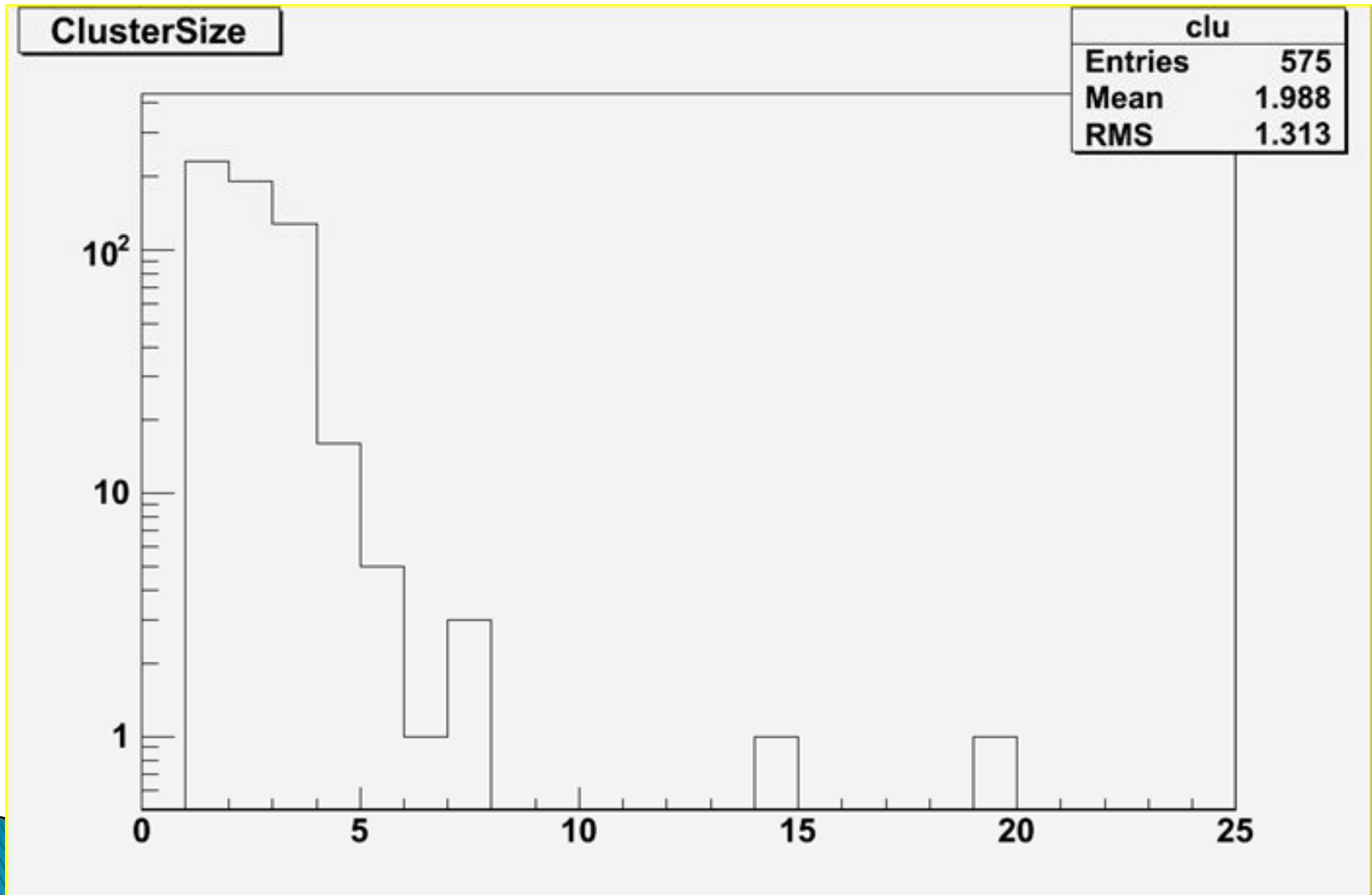
  LocalPoint rhitlocal = (*recIt).localPosition();
  GlobalPoint p=soll->toGlobal(simIt->localPosition());

  std::cout<<"<Detector Id="<<Rsid<<"><<std::endl;
  std::cout<<"<Parcicle Type="<<ptype<<"><<std::endl;
  std::cout <<"<Muon Position phi="<<p.phi() <<">
    <<"<R="<<p.perp() <<">
    <<"<z="<<p.z() <<"><<std::endl;

  std::cout<<"RPCDetId="<<Rid<<"><<"<LocalPosition="<<rhitlocal<<"><<std::endl;
}

"src/SES.cc" 166L, 3982C written 148,17 88%
```

# Histogram (RecHit) Rec-cluster size



# Future Plan



- ▶ Study CMSSW, ROOT, C++
- ▶ More Understanding about Kinematics of muon
- ▶ Join to DPG group, Develop these methods & Apply to real muon data