$\mu^+\mu^-$ generator

Combines Coherent Bremstrahlung Photon generator with muon pair production (including photon polarization effect)

- *CobremsGenerator* and *GlueXPrimaryGeneratorAction* from HDGeant4 (R.T. Jones)*
- *G4GammaConversionToMuons* from Geant 4.10.02
- Phi polarization added based on R. Miskimen document *(https://halldweb1.jlab.org/wiki/images/a/aa/20130418_cpp_rory.pdf)*

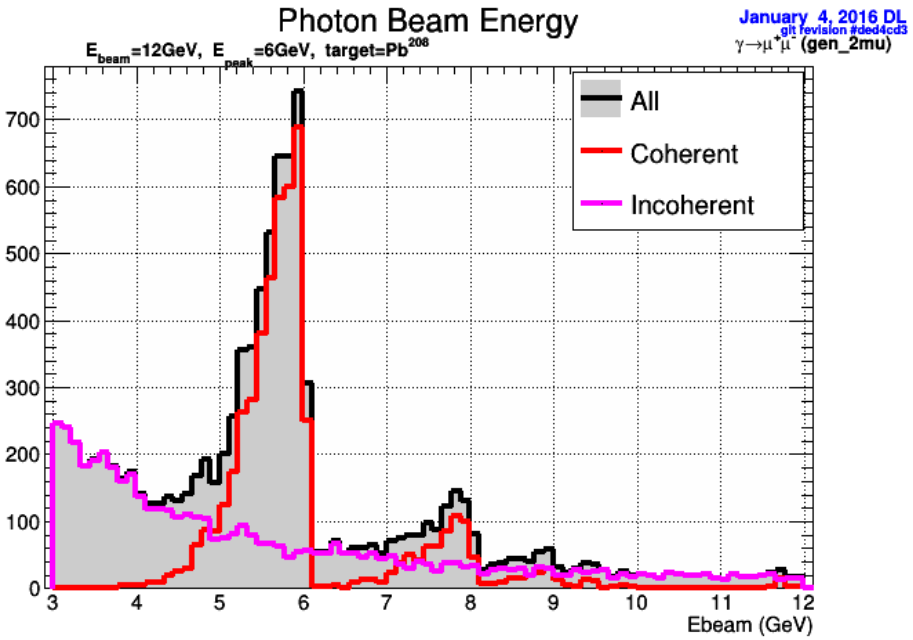
$$\gamma A \rightarrow \mu\mu A$$

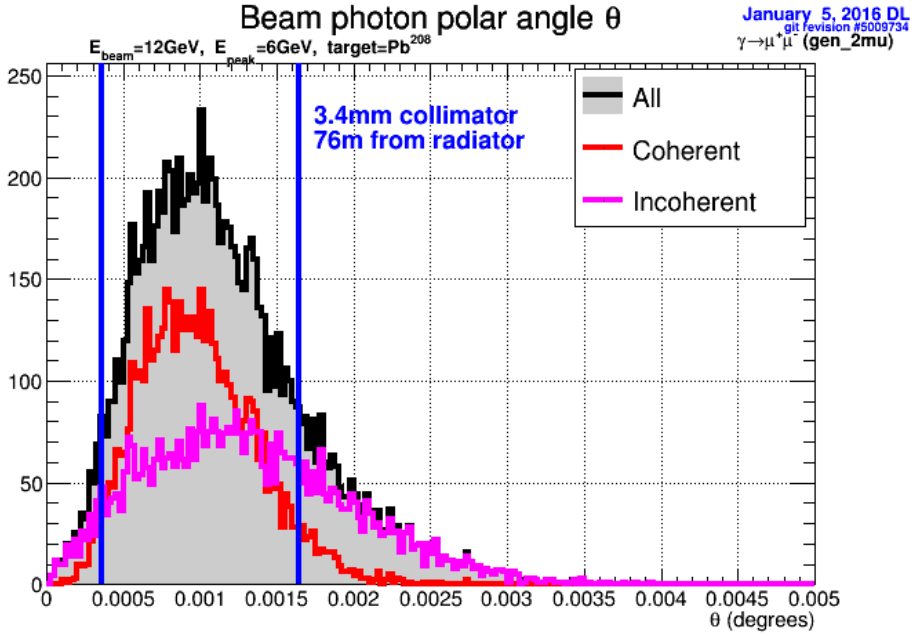
$$\frac{d\sigma}{d\Omega_{\mu\mu}} \propto \left|(\vec{\varepsilon}\times\vec{q})\cdot\vec{q}\right|^2 \approx \cos^2\phi_{\mu\mu} = 1+\cos 2\phi_{\mu\mu}$$

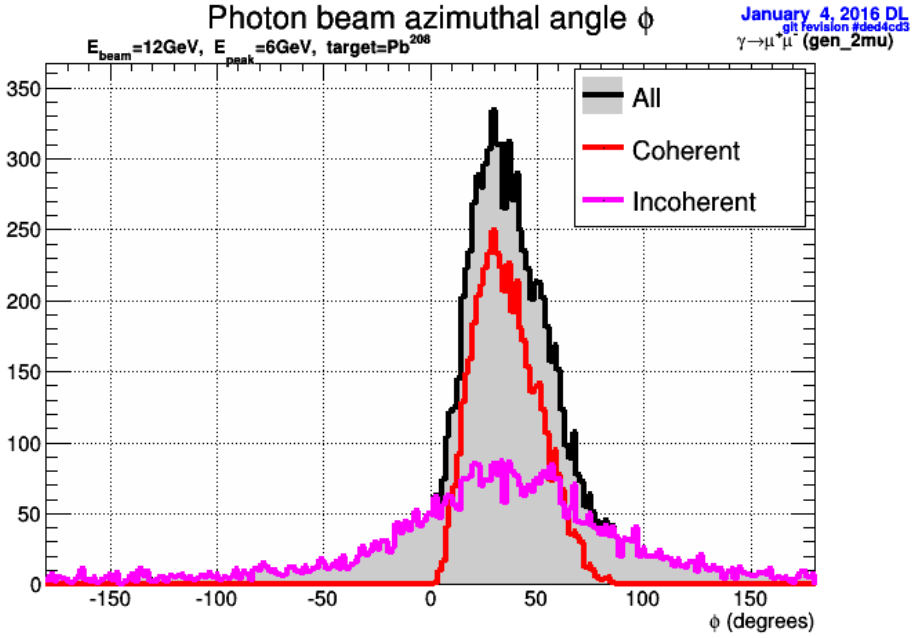
In git sim-recon respository: https://github.com/JeffersonLab/sim-recon

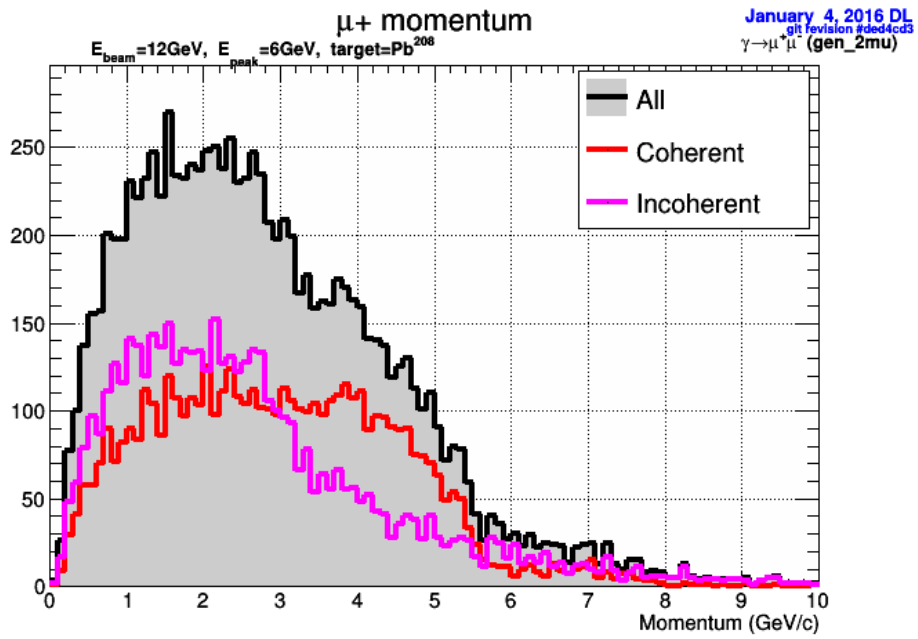
$HALLD_HOME/src/programs/Simulation/gen_2mu/

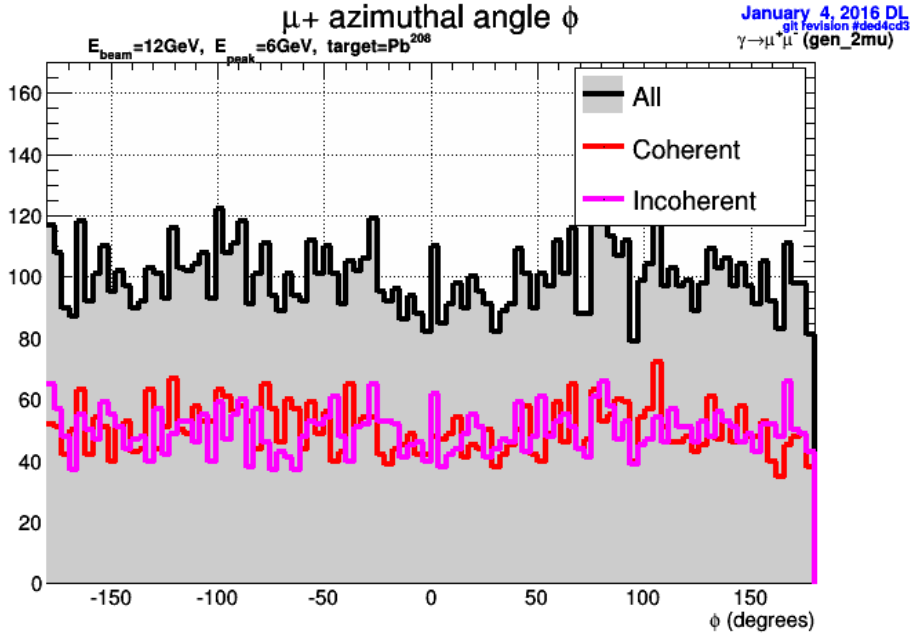
```
>gen_2mu -h

Usage:
    gen_2mu [options]

 -h            print this help message
 -N events     number of events to generate
 -o filename   set output filename (def. is gen_2mu.hddm)
 -p Epeak      coherent peak energy (def=6)
 -b Ebeam      electron beam energy (def=12)
 -min Emin     minimum photon energy to generate (def=1)
 -c            only generate coherent photons
 -i            only generate incoherent photons
 -e            let electron direction define z (def.
               is for photon beam to define z)
 -pol phi      set photon beam polarization direction
               relative to x-axis (def. is 0 degrees)
```

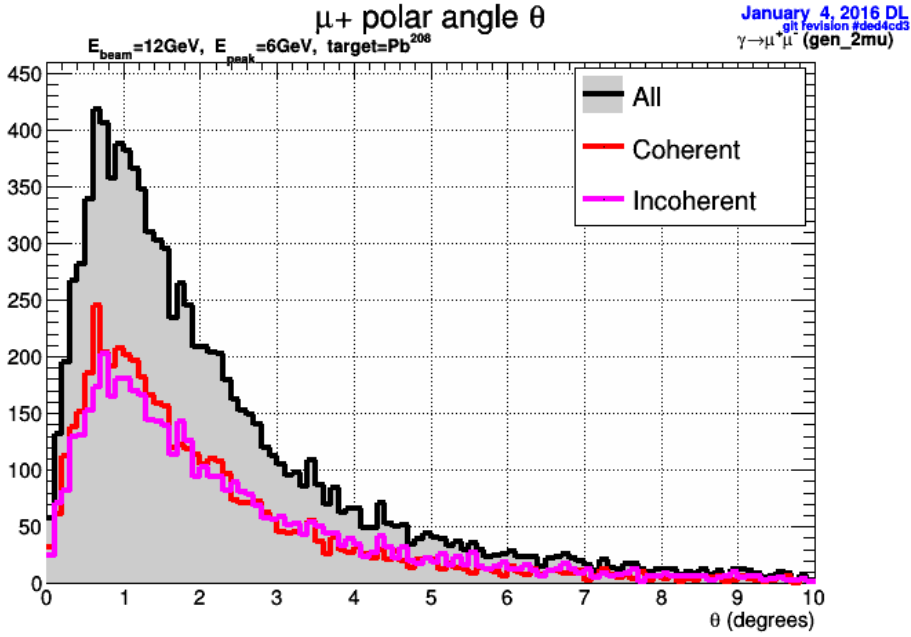

Photon Beam Energy
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
All
Coherent
Incoherent
Ebeam (GeV)

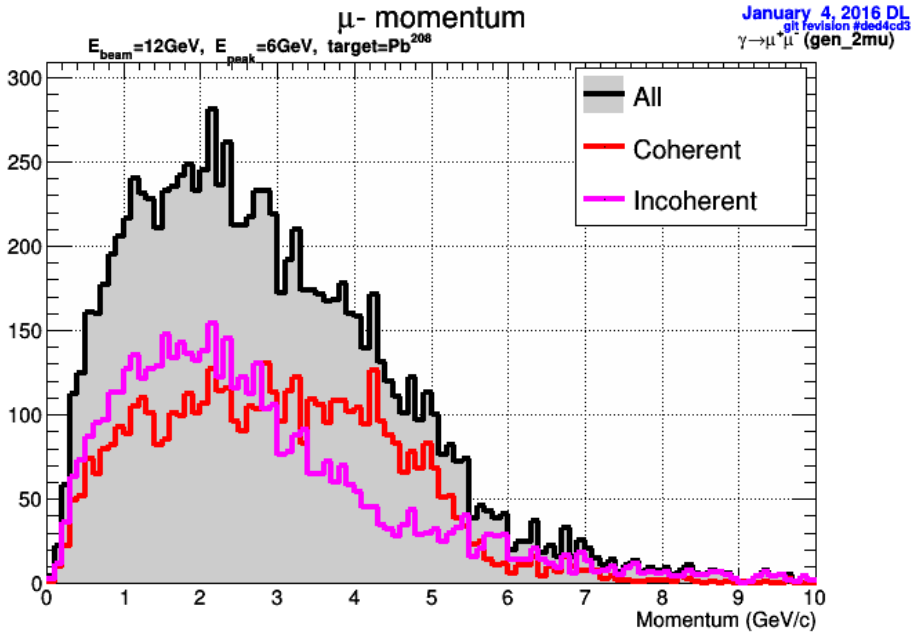

Beam photon polar angle θ
January 5, 2016 DL
git revision #5009734
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
3.4mm collimator
76m from radiator
All
Coherent
Incoherent
θ (degrees)

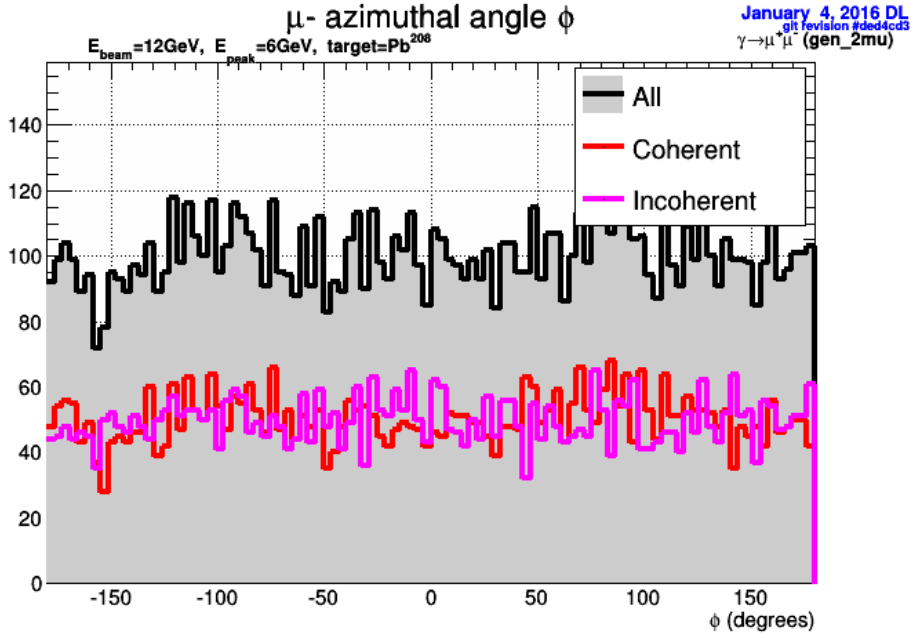

Photon beam azimuthal angle ϕ
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
All
Coherent
Incoherent
ϕ (degrees)

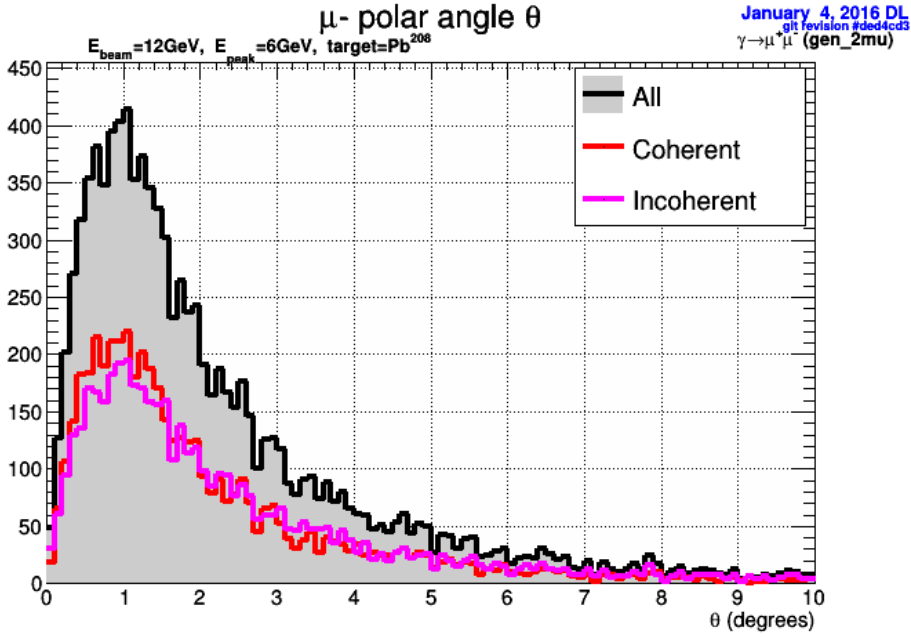

μ+ momentum
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb^208
All
Coherent
Incoherent
Momentum (GeV/c)


μ+ azimuthal angle ϕ
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb^208
All
Coherent
Incoherent
ϕ (degrees)

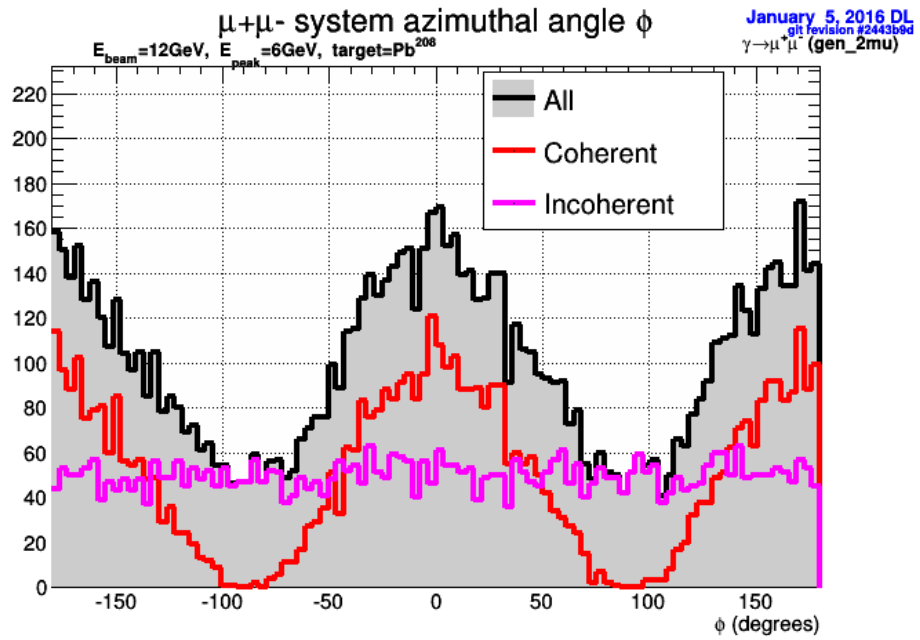

μ+ polar angle θ
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb^208
All
Coherent
Incoherent
θ (degrees)

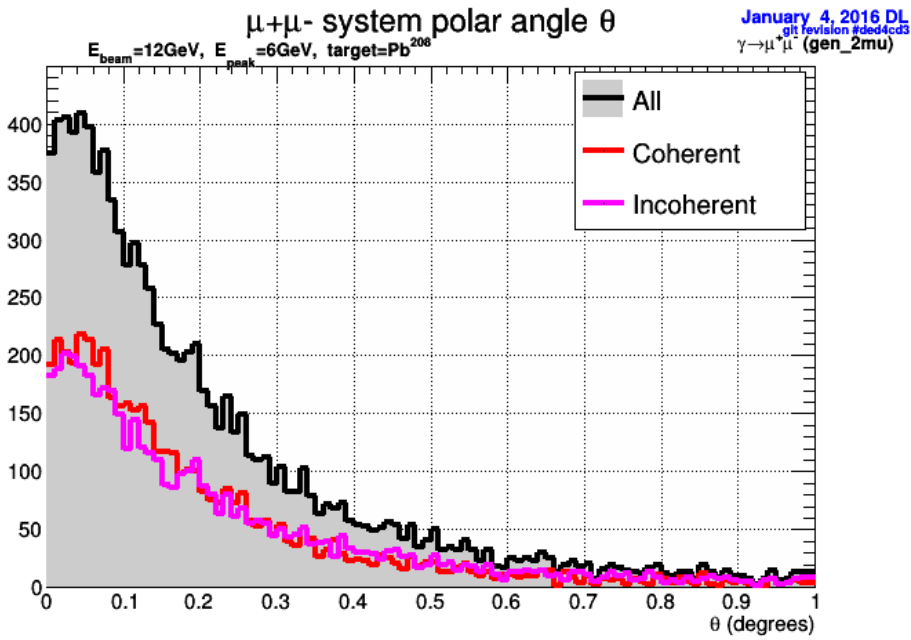

μ- momentum
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
All
Coherent
Incoherent
Momentum (GeV/c)

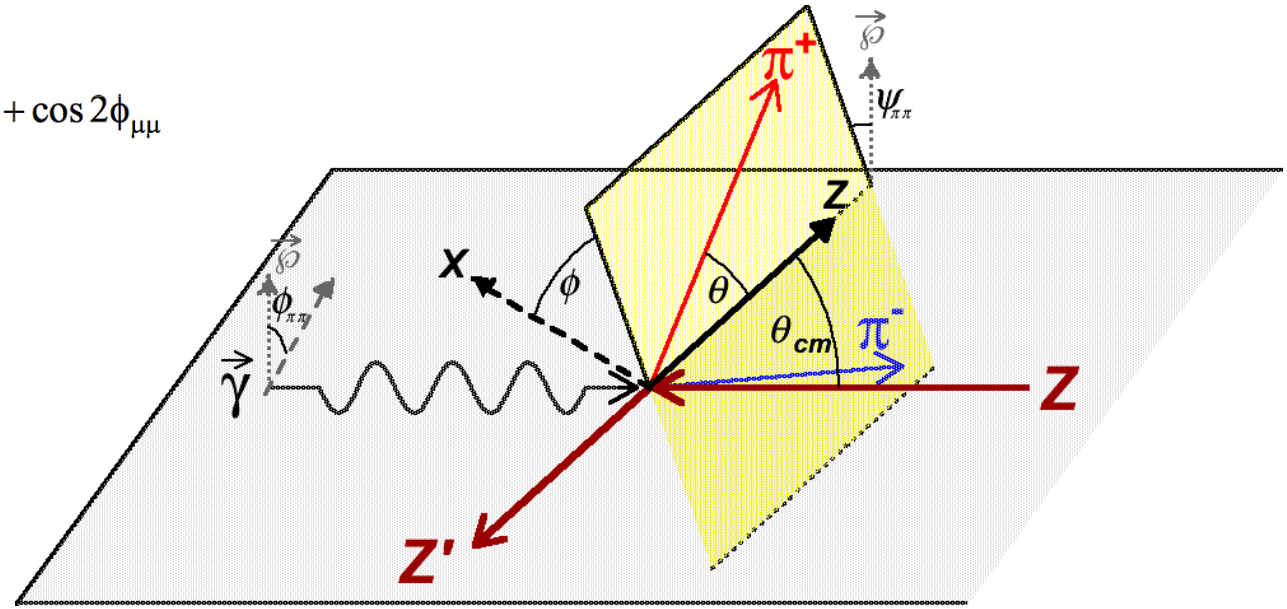

μ- azimuthal angle ϕ
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
All
Coherent
Incoherent
ϕ (degrees)


μ- polar angle θ
January 4, 2016 DL
git revision #ded4cd3
γ→μ+μ- (gen_2mu)
E_beam=12GeV, E_peak=6GeV, target=Pb208
All
Coherent
Incoherent
θ (degrees)

$\mu^+\mu^-$ system





$$\gamma A \to \mu\mu A$$

$$\frac{d\sigma}{d\Omega_{\mu\mu}} \propto \left|(\vec{\varepsilon}\times\vec{q})\cdot\vec{q}\right|^2 \approx \cos^2\phi_{\mu\mu} = 1+\cos 2\phi_{\mu\mu}$$