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Subject: DPM theta cut off

Posted by [donghee](#) on Mon, 27 Aug 2012 14:49:11 GMT

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Hello DPM expert,

I have couple of questions for DPM generator.

Now I'm trying to evaluate contributions of inelastic and elastic part from DPM generator with a particular beam momentum.

I used theta\_min 0.01 degree for inelastic plus elastic mode during the DPM generation. When I try to calculate the ratio of cross-section between total and elastic in DPM. I have too high elastic contribution due to small theta cut off. (I'm now understanding theta\_min in DPM direct represents theta cut off.) Which kind of theta cut off value do I have to introduce to get correct ratio, which is pronounced in many reference, for instance, beam momentum 15GeV/c case the elastic cross section must to be 10mb.

I'm also wondering wheather the elastic cross section of 10 mb has been taken into account the coulomb contribution in the reference?[K.Nakamura et al. (PDG), J.Phys.G 37, 075021 (2010)]

I assume that coulomb and interference part of elastic process are used in the DPM model. In order to make correct ratio between elastic and inelastic part, I have to apply correct theta cut off value during the generation in my understanding.

Thank you for your teaching in advance.

Donghee

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Subject: Re: DPM theta cut off

Posted by [Simone Bianco](#) on Mon, 27 Aug 2012 15:37:25 GMT

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Dear Donghee,

Thomas performed a detailed analysis of the effect of the theta\_min cut-off. In his thesis (that you can download here <http://hss.ulb.uni-bonn.de/2011/2623/2623.pdf>) you can find his parametrization in order to select the correct cut-off as a function of the beam momentum (see section 6.1). The DPM code might have changed a bit in the meanwhile, but I think this could be useful for you anyway.

Regards,

Simone

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Subject: Re: DPM theta cut off  
Posted by [donghee](#) on Wed, 29 Aug 2012 09:09:56 GMT  
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I'm considering now a simple approach to introduce cut off parameter theta according to Thomas work.

I found cut off values for certain beam momentum from the equation, which is suggested in his Thesis.

Quote:

```
double mom = 15; //beam momentum
double cut = 0.0777-0.976*TMath::Log10(mom);
double cutoff=TMath::Power(10, cut);
```

Quote:

```
mom = 1.43170 ; cms = 2.23 ; cut off theta =0.842536
mom = 15.000  ; cms = 5.474 ; cut off theta =0.085079
```

Then I put this value into the theta minimum in the control option for PndDpmDirect.

Could someone confirm about the value and this approach?

Best wishes,  
Donghee

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Subject: Re: DPM theta cut off  
Posted by [Simone Bianco](#) on Wed, 29 Aug 2012 09:28:31 GMT  
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Dear Donghee,

the work of Thomas and the results of some discussions of one year ago about the theta\_min parameter were included in the PndDpmDirect class.

Johan introduced the parametrization of theta\_min in the implementation of the ctor PndDpmDirect::PndDpmDirect(Double\_t Mom, Int\_t Mode, Long\_t Seed):

```
PndDpmDirect::PndDpmDirect(Double_t Mom, Int_t Mode, Long_t Seed) {
//
// Calculate ThtMin first. For this we make a cut-off on the value of -t of 1e-2 GeV^2 (~100
// MeV/c momentum)
// This estimated from a parametrization found in thesis of Thomas Wuerschig (figure 6.4, page
// 121):
// Roughly: 0.4 deg at 15 GeV/c and 4 deg at 1.5 GeV/c, linear interpolation in double
// log-scale.
//
```

```
Double_t logangle =  
TMath::Log(0.4)+(TMath::Log(15.)-TMath::Log(Mom))*(TMath::Log(4)-TMath::Log(0.4))/(TMath  
::Log(15)-TMath::Log(1.5));  
Double_t ThtMin = TMath::Exp(logangle);  
  
PndDpmDirect(Mom, Mode, Seed, ThtMin) ;  
}
```

so if you use this ctor you don't need to calculate by hands a value for theta\_min, since this is automatically obtained as a function of the beam momentum.

I hope this helps.

Cheers,

Simone

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Subject: Re: DPM theta cut off  
Posted by [donghee](#) on Wed, 29 Aug 2012 10:26:22 GMT  
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Dear all,

So, I am now more clear than before for this approach.

The value of  $-t=1e-2 \text{ GeV}^2$  is chosen to get standard cut-off value.  
Then I'm wondering the ratio between total cross-section and elastic one for this cut-off value.  
Is it still comparable with experimental data?  
Thomas used the cut-off value at the coulomb-nuclear interaction in his study, and found reasonably well described ratio.

That mean, that he used  $-t$  equal to  $1e-3 \text{ GeV}^2$  and cut-off theta is deduced 4 times smaller than introduced value in PndDpmDirect.  
It was about 0.1 degree at  $15 \text{ GeV}/c$ .

Does anyone make some test for that?  
or motivated just MVD detector point of view, which have sufficient energy to go through the MVD layers.  
I think that cut off 4 degree at  $1.5 \text{ GeV}$  might be too large to study lumi detector, for example.  
Because Lumi can cover 3-8 degree.

Thank you for your teaching.  
Best regards,  
Donghee

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Subject: Re: DPM theta cut off  
Posted by [Mathias Michel](#) on Wed, 29 Aug 2012 11:25:05 GMT  
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Donghee Kang wrote on Wed, 29 August 2012 12:26  
I think that cut off 4 degree at 1.5 GeV might be too large to study lumi detector, for example.  
Because Lumi can cover 3-8 degree.

Just to prevent misunderstandings let me correct a small typo:  
The Lumi covers about 3-8 mrad = 0.17-0.46 degree.  
To study effects of the magnetic fields and stuff we even have to simulate lower than 3 mrad,  
but i guess we are a special case

Cheers,  
Mathias

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Subject: Re: DPM theta cut off  
Posted by [donghee](#) on Wed, 29 Aug 2012 12:51:54 GMT  
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Thanks Mathia for your kind correction.

Anyhow, the case of studying the range of 0.17-0.46 degree with DPM, one has to care this  
fact, when the efficiencies or some normalization of event rates are calculated.

Best wishes,  
Donghee

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