Subject: Pions decays in detector
Posted by AndreiSemenov on Wed, 09 Oct 2019 13:17:37 GMT
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Hello,
We want to estimate background muons which come mainly from pions (and kaon) decays. I tried an example from tutorial thailand2017 with DPM generator and I got very few muons, 10-20 muons (and ~1000 pions) per 1000 events.
It looks like pions does not decay in detector. I tried BOX generator to inject pions or kaons, and I see (with IdealCharged algorithm) 15-20 muons and ~850 initial particles per 1000 events. Is this normal? Or particle decays in detector should be switched on somewhere?
Kind regards,
    Andrei Semenov.

Subject: Re: Pions decays in detector
Posted by Radoslaw Karabowicz on Thu, 17 Oct 2019 09:35:26 GMT
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Hi Andrei,

what pion momentum did you use? Did you try to lower the momentum?

Radek

Subject: Re: Pions decays in detector
Posted by AndreiSemenov on Thu, 17 Oct 2019 12:22:41 GMT
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Hi Radek,
I used 6.23GeV in dpm and 1GeV in box. I tried to switch to Geant 4, but it complains about undefined environment variables. May be I have a problem with Geant installation.
Andrei.

Subject: Re: Pions decays in detector
Posted by Radoslaw Karabowicz on Thu, 17 Oct 2019 12:30:10 GMT
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And what would be the mean fly distance of a 1GeV/c pion before it decays?

Subject: Re: Pions decays in detector
Posted by AndreiSemenov on Thu, 17 Oct 2019 13:31:59 GMT
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I guess it is near 30 meters. Pythia tells approx. 1/7 of pions decay in detector.

Subject: Re: Pions decays in detector
Posted by Radoslaw Karabowicz on Thu, 17 Oct 2019 13:39:02 GMT
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You guess...

Ok, and how far is your detector from the place the pions are created?

Subject: Re: Pions decays in detector
Posted by Anna Skachkova on Fri, 18 Oct 2019 10:17:45 GMT
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According to PDG, the mean life time of charged pion is tau = 2.6 x 10^-8 sec, that means, the mean lenght of pion decay is c x tau = 7.8 m.
Simulation in PYTHIA shows (see muon TDR p.19 or arXiv:hep-ph/0506139v2 p.23) that the most part of decay muons are produced close to the interaction point,
while the rest are distributed over detector volume (with a mean value for the whole space close to 7.8 m). And there are about 3 muons from meson decays per 10 background events at this energy produced in detector volume, according to branching ratio of meson decays. So such a small number of final muons after PandaRoot looks pretty strange. While the initial number of pions in PYTHIA and DPM backgrounds are rather compatible, the final number of muons in fast simulation in PYTHIA and after simulation in PandaRoot are drastically differ. Is it possible to pull out the model of pion decays, contained in PandaRoot (Geant) to understand such a difference?

Subject: Re: Pions decays in detector
Posted by Radoslaw Karabowicz on Fri, 18 Oct 2019 11:09:49 GMT
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Dear Anna! Dear Andrei,

you are simulating 1 GeV/c pions. When I was studying physics, these would be called highly relativistic pions. I _did_ the calculation for you, I haven't done this exercise in years, so I hope I didn't do some stupid mistake.
p = 1GeV/c
m = 141MeV/c^2
tau = 2.6e-8 s
From p = gamma(v) * m * v
I get v ~= 0.98995c
and gamma(v) ~= 7
Hence the mean length of a 1GeV/c pion is:
length = gamma(v) x v x tau ~= 7 x c * tau = 7 x 7.8m ~= 50m

If you want to see more decays, LOWER the energy of the pion.