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Subject: new FTF generator in pandaroot

Posted by [Aida Galoyan](#) on Thu, 04 Sep 2014 15:06:31 GMT

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Hi all,

I have implemented new generator FTF of Geant4 in PandaRoot in directory trunk/pgenerators.

FTF can generate Pbar-P, Pbar-Nucleus, light Anti-nucleus-Nucleus, Hyperon-P, Hyperon-Nucleus interactions at wide energy range from 100 MeV to 1000 GeV.

FTF is based on ideas of DPM and extended them on Pbar-Nucleus interactions. It works faster than UrQMD.

For FTF generator, I created sub-directory FtfEvtGen similar to DpmEvtGen.

Some words, about FTF run.

-----  
At first, you need to compile FTF.

For this, in the folder pgenerators/FtfEvtGen give a command:

```
> make -f FTFmake
```

You will obtain FTFGen executable file.

For generation of Pbar-P events, you have to use file PbarP.mac .

In the file PbarP.mac, you need to set

after line

```
#events
```

```
Number of Events
```

after line

```
#Plab(GeV/c)
```

```
Momentum of projectile antiproton
```

Then, you give command

```
> ./FTFGen PbarP.mac
```

and will obtain FTF.root file with Root-Tree, where all information about produced particles is presented.

-----  
For generation of Pbar-A events, you can use PbarA.mac.

You need to insert some values there.

First of all, Geant4 name of material - G4\_Name, for example, for carbon - G4\_C, for gold - G4\_Au, for copper -G4\_Cu and so on,

after line

```
#material
```

```
G4_Name
```

after line  
#targetA  
mass number of target nucleus

after line  
#generator  
ftfp or ftfb

after line  
#events  
Number of Events

after line  
#Plab(GeV/c)  
Momentum of projectile antiproton

-----  
"ftfp" is combination of FTF generator and simple generator Preco  
for low particles proceeding in nucleus.  
"ftfb" is composition of FTF generator and Binary Cascade model of Geant4.  
"ftfp" works faster, but "ftfb" gives more correct information about  
evaporated nucleons.  
-----

Next command must be  
> ./FTFGen PbarA.mac

After run, you will obtain "FTF.root" file with all information in the Root-Tree.  
-----

We can apply "FTF.root" for future simulation in PandaRoot,  
using class PndFtfGenerator similar to PndDpmGenerator.

-----  
Information about FTF run is also presented in the file  
pgenerators/FtfEvtGen/README.txt .  
If you have questions about FTF, please, write me.  
Good luck  
Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Fri, 05 Sep 2014 06:47:51 GMT  
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Dear Aida,  
Thank you very much for making FTF available within pandaroot!

I tried to compile it according to the instruction. But after "make -f FTFmake" got following  
error:

```
Linking binary FTFGen ...
/usr/bin/ld: tmp/main.o: undefined reference to symbol 'aTouchableHistoryAllocator'
/usr/bin/ld: note: 'aTouchableHistoryAllocator' is defined in DSO
/panda/fairroot/apr13Build/lib/libG4geometry.so so try adding it to the linker command line
/panda/fairroot/apr13Build/lib/libG4geometry.so: could not read symbols: Invalid operation
collect2: error: ld returned 1 exit status
make: *** [FTFGen] Error 1
```

Did somebody else try it with apr13 external packages?

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Fri, 05 Sep 2014 13:29:54 GMT  
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Hello Anastaciya,

> Did somebody else try it with apr13 external packages?

When I implemented FTF,  
I used apr13 external packages in linux cluster gsi : ica.hpc.gsi.de .  
SIMPATH is  
/cvmfs/fairroot.gsi.de/fairsoft/apr13

About errore

```
-----
Linking binary FTFGen ...
/usr/bin/ld: tmp/main.o: undefined reference to symbol 'aTouchableHistoryAllocator'
/usr/bin/ld: note: 'aTouchableHistoryAllocator' is defined in DSO
/panda/fairroot/apr13Build/lib/libG4geometry.so so try adding it to the linker command line
/panda/fairroot/apr13Build/lib/libG4geometry.so: could not read symbols: Invalid operation
collect2: error: ld returned 1 exit status
make: *** [FTFGen] Error 1
-----
```

I think, if your linker requires to add  
"aTouchableHistoryAllocator" from libG4geometry.so,  
add in the file common.mk

-IG4geometry

in the line  
LDLIBS += \$(PANDALIBS) -L\$(GEANT4\_LIBRARY\_DIR) -IG4clhep -IG4global  
-IG4physicslists \$(GLIBS)

after -IG4clhep .

And, try to compile FTF.

If again you have problems, please, give command  
>echo \$GEANT4\_LIBRARY\_DIR

what "path" do you obtain?

If you go to this "path", can you observe files: libG4clhep.so, libG4global.so, libG4physicslists.so ?

good luck,  
Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Fri, 05 Sep 2014 14:23:34 GMT  
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Dear Aida,  
Thank you for quick reply!  
Indeed my LDLIBS path required some changes, following your recipe I ended up with this line:

```
LDLIBS += $(PANDALIBS) -L$(GEANT4_LIBRARY_DIR) -IG4clhep -IG4geometry  
-IG4materials -IG4particles -IG4processes -IG4track -IG4global -IG4physicslists $(GLIBS)
```

(just in case if somebody else will have similar problems during compilation)

Generation of FTF.root went smoothly and output looks ok

Best regards,  
Anastasia

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Tue, 16 Sep 2014 06:28:09 GMT  
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Dear Aida,  
I have question concerning processes included in FTF. Does it contain only inelastic or both elastic and inelastic interactions?

Best regards,  
Anastasia

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Tue, 16 Sep 2014 12:33:51 GMT  
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Dear Aida,  
I had a look at main.cc file in pgenerators/FtfEvtGen and came to conclusion that elastic scattering is included, but only hadronic part of it.

Is it right?

It would be nice to have option to switch off elastic part and use only inelastic mode, as it was before in DPM.

Also I notice, that energy of final particles is stored in MeV, while pandaroot deals with GeV. I suspect due to this reason particles are treated as particles with high energy and propagation with GEANT4 (within pandaroot) is extremely slow.

I introduced conversion to GeV by changing one line in main.cc:

from

```
Mom.SetPxPyPzE(px,py,pz,e);
```

to

```
Mom.SetPxPyPzE(px/GeV,py/GeV,pz/GeV,e/GeV);
```

But I am not sure if it is correct place to do this conversion. What do you think?

Best regards,  
Anastasia

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Wed, 17 Sep 2014 16:13:34 GMT  
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Hello Anastasia,

>I had a look at main.cc file in pgenerators/FtfEvtGen and came  
>to conclusion that elastic >scattering is included, but only hadronic part of it.  
>Is it right?  
>It would be nice to have option to switch off elastic part and  
>use only inelastic mode, as it was before in DPM.

It is not possible, because for FTF generator in PandaRoot, I apply to Geant4 lib and can not change compiled source files of FTF.

But, you can obtain only inelastic events using FtfEvtGen/main.cc .

For this, you need to add in the main.cc after line

```
-----  
if(std::abs(pd->GetBaryonNumber()) < 2)  
-----
```

line

```
-----  
if( (n>2) || ((abs(id)!=2212)&&(n==2)) ) {  
-----
```

and after line

```
-----  
new((*fEvt)[cnt++]) TParticle(fparticle);  
-----
```

to add

-----  
}  
-----

After this, it is needed to compile FTF.

About "MeV" or "GeV", thank you, I didn't draw attention to it.  
Just now, I have changed and committed main.cc .  
Output particles are stored in GeV.

Good luck  
Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Wed, 17 Sep 2014 18:03:35 GMT  
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Dear Aida,  
Thank you very much for quick reply and fix of the problem in the code.  
Solution for "inelastic only" didn't work for me, because empty particles branches were still written in the TTree and PANDARoot could not handle them. Therefore I added flag for filling tree with inleastic events only.  
This seems to be working

Best regards,  
Anastasia.

P.S: All interested people can find attached my modification of main.cc

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#### File Attachments

1) [main.cc](#), downloaded 526 times

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Wed, 17 Sep 2014 19:42:24 GMT  
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Hello Anastasia,

Before writing you, I included "lines" (for inelastic),  
what about I wrote you,  
and obtained normal Tree with about 2800 particles  
in 1000 Events at 2 GeV/c initial mometum.  
Without these "lines", number of particles was about 3500.

How did you obtain empty Tree?  
May be, you didn't put closing "}" on the needed pkace.

Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Sat, 20 Sep 2014 22:57:00 GMT

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Hi Aida and Anastasia,

I am very interested in FTF, and now trying to compare with DPM.  
Do I have to update main.cc (which is attached by Anastasia) in order to have only inelastic event?

Best wishes,  
Donghee

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Sun, 21 Sep 2014 07:14:31 GMT

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Hi Donghee,  
Very good, one more tester user

In our private discussion with Aida we resolved all misunderstanding and she also checked main.cc attached above. The conclusion, for inelastic events only the attached main.cc version is OK.

Best regards,  
Anastasia

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Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Sun, 21 Sep 2014 08:55:33 GMT

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Hi FTF frontier,

I have a trouble to compile it.  
I changed LIBS in common.mk as you suggested but fail to produce executable object with make -f FTFmake

```
-----  
collect2: error: ld returned 1 exit status  
make: *** [FTFGen] Error 1  
-----
```

fairsoft\_apr13 and pandaroo\_trunk I am currently using.

Best wishes,  
Donghee

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Subject: Re: new FTF generator in pandaroot  
Posted by [Anastasia Karavdina](#) on Sun, 21 Sep 2014 11:43:57 GMT  
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Hi Donghee,  
Unfortunately I can't help much. I believe it's OS or compiler related problem. The compilation trick, which I mentioned before, works for Fedora. Compilation on our computing cluster (HIMster) works out of box. However, at my home PC with Kubuntu(14) it does not work. I just tried it now and got many "undefined reference to" errors, which in the end lead to "error: ld returned 1 exit status"  
Maybe our computing experts could have a look?

Cheers,  
Anastasia

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Mon, 22 Sep 2014 09:48:53 GMT  
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Hi Donghee,

The main difficulty of FTF compilation is find right path to Geant4 library files.

In your trunk directory, please give:

```
> echo $GEANT4_LIBRARY_DIR
```

what "path" do you obtain?

If you go to this "path", do you see lib-files:  
libG4clhep.so, libG4global.so, libG4physicslists.so ?

Do you observe there lib-files, proposed by Anastasia:  
libG4geometry, libG4materials, libG4particles, libG4processes?

Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Mon, 22 Sep 2014 15:11:28 GMT  
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Hi Aida,

All libraries related Geant4 are correctly in position, where is in fairsoft\_apr13.  
This problem is only for some OS. At GSI and Mainz farm everything went fine but I met in my private machine with ubuntu 12.10 or some OS.  
I think something gcc or other common libraries are weired.  
Thank you for your help.

Best wishes,  
Donghee

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Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Mon, 22 Sep 2014 17:10:35 GMT  
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Hi Aida,

What about random seed during the production?  
If I do two times without change option string, output will be different?  
./FTFGen PbarP.mac | mv FTF.root FTF\_1.root  
./FTFGen PbarP.mac | mv FTF.root FTF\_2.root

or Do I need some more action to get different events from output?

Best wishes,  
Donghee

---

Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Mon, 22 Sep 2014 21:29:55 GMT  
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Hi Aida,

I have a question about stable particle in FTF.

In DPM, some generated particles are stable, which is  $\text{Pi}^0$ ,  $\text{K}_S^0$ , Lambda, anti-Lambda, eta.  
I am now interested in the fundamental kinematics of both generators.  
At pure stand-alone generator study or fast simulation, they(stable particles) are normally turning to be unstable for DPM case.

If I want to do same study with FTFGen at fast simulation or stand-alone generator, Do I need to allow decay in order to compare with DPM generator.  
What about the situation for this at FTF generator?

At full simulation, all stable particles will be decayed at GEANT level afterwards, therefore we

don't need to care about it.

But generator level or fast simulation case, we have to know correctly how they are handled.

Best wishes,  
Donghee

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Tue, 23 Sep 2014 08:35:26 GMT  
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Hi Donghee,

> What about random seed during the production?

In Geant4 and in FTF is used a random number generator implemented in Pythia. It is not start from a single number. It is not start from computer time. To download final generator state it is needed to open in PbarP.mac or PbarA.mac the line

```
//#saverand
```

If it is given #saverand, the state will be saved in file initial.conf after each event.

It requires some additional time. After last event, the state will be saved.

You can continue your job with final stored state, if you open in the mac-files the following lines

```
//#initrand  
//initial.conf
```

> If I do two times without change option string, output will be  
> different?

No. It will be the same.

```
> ./FTFGen PbarP.mac | mv FTF.root FTF_1.root  
> ./FTFGen PbarP.mac | mv FTF.root FTF_2.root
```

It will be an exact copie.

> or Do I need some more action to get different events from output?

You'll need as described above.

Best regards!  
Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [Aida Galoyan](#) on Tue, 23 Sep 2014 08:58:16 GMT  
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Hi Donghee,

> In DPM, some generated particles are stable, which is  $\text{Pi}^0, \text{K}_S^0$ ,  
> Lambda, anti-Lambda, eta.  
> I am now interested in the fundamental kinematics of both  
> generators. At pure stand-alone generator study or fast  
> simulation, they (stable particles) are normally turning  
> to be unstable for DPM case.

Mainly, these particles are stable in DPM. It is a user responsibility to point out what particles are unstable. We set stable all long-lived particles -  $\text{Pi}^0, \text{K}_S^0, \text{K}_L^0, \text{Lambda}$  and others.

The same is true for FTF generator.

> If I want to do same study with FTFFGen at fast simulation or  
> stand-alone generator, Do I need to allow decay in order to compare  
> with DPM generator. What about the situation for this at FTF  
> generator?

The lists of "stable" particles in DPM and FTF coincide.

> At full simulation, all stable particles will be decayed at GEANT  
> level afterwards, therefore we don't need to care about it. But  
> generator level or fast simulation case, we have to know correctly how  
> they are handled.

There is a problem in FTF how to point out that we are going to consider rho-mesons (and others) as stable particles. It is needed for various studies. We implemented such possibility in DPM. It is more complicated job in the case of FTF.

Best regards!  
Aida

---

Subject: Re: new FTF generator in pandaroot  
Posted by [donghee](#) on Wed, 24 Sep 2014 10:47:09 GMT  
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Hi Aida,

According to your suggestion, I solved few technical problems related full PADNDA simulation as like control of random seed and naming in the full simulation.

Now remaining couple of questions about physics mode.

There are 6 different theoretical approaches in the hadronic response.

fffp and fffb

QGSp and QGSb

Bertini and Binary

I have heard ftf and QGS already but I am not sure about the meaning of "p" or "b"

And in the Geant4 physics list, couple of theoretical models can combine in different energy region as like

FTF+Bertini, are there such feature in FTFGen? If not, what is the best approach(choice) at

Ebeam=1.5 GeV case

Ebeam=15 GeV case in our simulation?

Best wishes,

Donghee

---

Subject: Re: new FTF generator in pandaroot

Posted by [Aida Galoyan](#) on Wed, 24 Sep 2014 12:50:50 GMT

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Hi Donghee,

I explained difference between fftp and fffb in the file README.txt in the FtfEvtGen folder.

I do it again.

fffp is the FTF + Preco model.

fffb is the FTF + Binary cascade model.

FTF is taken from Geant4 lib.

Preco and Binary Cascade model are also Geant4 models and added for low energy secondary particles interactions in the nucleus.

Binary Cascade model takes into account all cascading processes.

Preco model is simplified model, taking into account only absorption processes.

For Pbar-P interactions use fftp.

For Pbar-Nucleus interactions, one can use fftp or fffb.

There will be difference between fftp and fffb calculations, (especially for heavy nuclei)

but ftfp works faster than ftfb. However, ftfb gives more precise results for secondary nucleons.

Other models(QGSp, QGSb, Bertini,...)are not aimed for Pbar-P or Pbar-Nucleus processes. Corresponding task can be crash.

Best regards  
Aida

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Subject: Re: new FTF generator in pandaroot  
Posted by [Stefano Spataro](#) on Thu, 30 Apr 2015 15:58:24 GMT  
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Would it be possible to create a wiki page with all the information about the FTF generator, as done for DPM? In such a way we have all the event generators information in the same place and one has not to search in the forum  
Thanks in advance.

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