Subject: NeuLAND tracking algorithm
Posted by C. A. Douma on Thu, 10 Mar 2016 09:14:41 GMT
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Dear all,

For my simulations on the VETO, I need to know which primary particle fired which bar of NeuLAND (in the case of multiple primaries, possibly with different PDG). I would like to use the R3BRoot tracking algorithm for NeuLAND to answer this question. I tried to run the tracker by
run->AddTask(new R3BNeutronTracker());
run->AddTask(new R3BNeutronTracker2D());
This indeed produces an output file with some histograms and a tree containing tracks. However, the tree is always empty and for some variations of the R3BRoot setup the tracker crashes.
Can anyone explain what I'm doing wrong?

Christiaan.

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Thu, 10 Mar 2016 09:35:30 GMT
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Dear Christiaan,

a how-to use NeuLAND tracker is described here
https://www.r3broot.gsi.de/multi-neutron-simulation
You can find there names of macros, and then look-up proper usage of the task.

The algorithm produces "LandNeutHits" output, which are coordinate and time of reconstructed first interactions of primary neutrons.

Best regards,
Dima

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Wed, 16 Mar 2016 15:45:30 GMT
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Dear Mr. Kresan,

Thank you for the explanation. It took me some time to get through all the macros (hence the late reply).
I can understand most of it, but I have a few questions about the calibration of the cuts (calibr.C):

1) I see that there are 2 versions of the calibration macro: calibr.C and calibr_mini.C
Is one of them better then the other (regarding the physics), or is the difference just code

optimization?
In Jan Mayers talk from last NUSTASR week I also see a difference in efficiency between calibr.C and calibr_mini.C
What is the meaning of this?

2) What is the physics behind 'kappa'?

3) calibr.C has a few flaws on my computer. It returns kappa=0 on my computer and no cuts (with the second function).
Could this be caused by the fact that the histogram boundaries are too small for 4n? Or did I miss something else?

4) The calibration text file that comes out of the macro is just a small list of numbers. What is the meaning of those numbers?

5) I used the NeuLandDigitizer from Jan Mayer, not the LandDigitizer (which was suggested in precalibr.C).
Is this the right way or should I use the LandDigitizer?

6) For the R3BNeutronTracker, What is the Purpose of the UseBeam-memberfunction? I see that the mean energy and the
beta from relativity should be added here, but I would like to understand how exactly these numbers are used by the tracker.

Yours sincerely,
Christiaan Douma.

File Attachments

1) calibr_1000AMeV_999keV_14m.eps, downloaded 511 times

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Thu, 17 Mar 2016 09:37:52 GMT
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Hi Christiaan,

1) Maybe Jan Mayer can comment on this. I wrote calibr.C macro, where efficiency is calculated depending on specified impurity level for each event type. I do not know how it is done in calibr_mini.C.

2) kappa is just an artificial parameter, which sets the inclination of linear 2D cuts on number of clusters versus deposited energy. It is set per hand, in order to best described simulated data. Physics behind - anti-correlation between mentioned 2 variables.

3) second function in calibr.C (with automatic calculation of kappa) has to be revised and fixed. It does not work for me also. Use the function with manual setting of kappa.

4) The meaning of numbers is: parameter 1 - kappa value used. The rest of parameters: energy cuts on each type of event.

5) I do not know. We have to ask Jan Mayer. But I do not expect divergences in output results.

6) The value of beam velocity is used in the tracker in order to select best candidates for hits from primary neutron(s) interaction. The point is that incident neutrons have velocity very close to the beam.

Hope I could help a bit.

Best regards,
Dima

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Thu, 17 Mar 2016 09:54:22 GMT
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Dear Mr. Kresan,

I have tried to use calibr.C for maula kappa of 0.07 and then this is the resulting picture. Given the small distances
between some of the cuts I do not trust the output. What am I doing wrong? In order to ensure that the blob for 4n
falls in the energy range, I changed the CreateHistograms-function to:

```
void R3BNeutronCalibr2D::CreateHistograms()
{
  fh_etot = new TH1F("h_etot", "Total light", 2*fBeamEnergy, 0., ((Int_t) 2*fBeamEnergy));
  fh_ncl_etot = new TH2F("h_ncl_etot", "Number of clusters vs. total light", 2*fBeamEnergy, 0.,
((Int_t) 2*fBeamEnergy), 200, -0.5, 199.5);
}
```

And I set fBeamEnergy=1000

Yours Sincerely,
Christiaan Douma.

PS: Does Jan Mayer receive copies of this exchange?

File Attachments
1) calibr_1000AMeV_999keV_14m.eps, downloaded 479 times

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Thu, 17 Mar 2016 10:46:27 GMT
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If you change the binning of histogram in the code, you also have to do this in the calibr.C macro. It is not taken into account automatically. As I see, you also changed the range. This should be adopted as well.

Cheers,
Dima

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Thu, 17 Mar 2016 12:52:13 GMT
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I adapt adapt calibr.C as well for that. I changed the 1500. into 2000. on lines 45 and 57.

Christiaan.

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Thu, 17 Mar 2016 13:04:25 GMT
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You also need to change number of bins 150 --> 200 on line 350.

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Thu, 17 Mar 2016 15:49:59 GMT
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Dear Mr. Kresan,

Thank you. I will try again with this modification.

In the mean time I have been working to obtain some cuts from Jan Mayer his calibr_mini.C macro and that produced some sensible cuts (although I am not very happy with it, because the 4th blob still runs of the scale). With these cuts I was able to run the NeutronTracker (according to the principles of r3blanreco.C). At least I do not get a crash.

But in the output tree I only see 4 NeutHit-leafs (and some starndard leafs without physics): the X, Y, Z and T of the startpoint of the track. Then how do I get the total reconstructed energy in the track? Or the initial momenta of the track? And is there a way to obtain which NeuLAND scintillator bar belongs to which track?

Christiaan.

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Fri, 18 Mar 2016 07:30:14 GMT
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NeuLAND is the time-of-flight spectrometer, position and time allows to calculate the energy.

You can make use of member function GetP() of the R3BNeutHit class, which returns total momentum in MeV. Then knowing momentum and mass you get the energy.

Bar index can be obtained from global X,Y,Z coordinates of the neutron hit, having at hand position and layout of the detector. There is currently no function implemented. Feel free to

contribute.

Best regards,
Dima

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Fri, 18 Mar 2016 08:57:59 GMT
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Thank you. I understand. If I know the target position I can use the position of the hit to calculate the travel distance. Combining this with the TOF and the fact that the particle is a neutron gives me the energy.

My question about the bars is however different. The digitizer contains the fired bars of NeuLAND. Now in the case of multiple tracks within one event, I want to know which of these bars contributed to which track. Is there a way to obtain this? If not, then at which lines of code should I look to implement an additional leaf containing this information?

One other question: In the case of a 4n experiment and some background particles, we might end up with more then 4 distinct tracks. Then some of these tracks have to be VETOed so that we are left with with 4 tracks for the neutrons. So is the tracker capable of reconstructing more then 4 distinct tracks? In this case, do I then just have to submit more energy cuts in the calibration .txt-file or do I have to make more advanced changes?

Christiaan.

Subject: Re: NeuLAND tracking algorithm
Posted by Dmytro Kresan on Fri, 18 Mar 2016 10:35:45 GMT
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There is nothing like neutron track in the current model. Only one hit - primary interaction - per incident neutron.

Fired bars contribute to the clusters - tracks of charged particles, but not to the neutron tracks.

Currently, the decision on number of incident neutrons is taken on the basis of the 2D cuts on clusters and energy. If you want to plug-in VETO information, I would recommend to create a new task for such combined reconstruction. The answer is: you have to do much more advanced changes.

Subject: Re: NeuLAND tracking algorithm
Posted by C. A. Douma on Fri, 18 Mar 2016 12:37:10 GMT
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Thank you for the explanation. But I was just thinking that maybe I can first reconstruct each incoming particle as if it were a neutron and then simply throw away the tracks that are close to

a VETO hit. That would not require too much work I think. But in order to do that I need the tracker to be able to reconstruct more then 4 distinct tracks.

Christiaan.