

MiniCLEAN

Nick Decheine

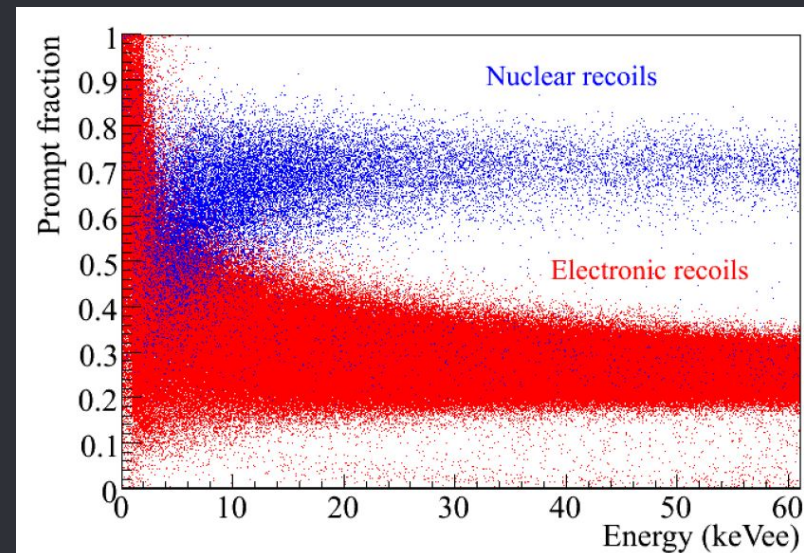
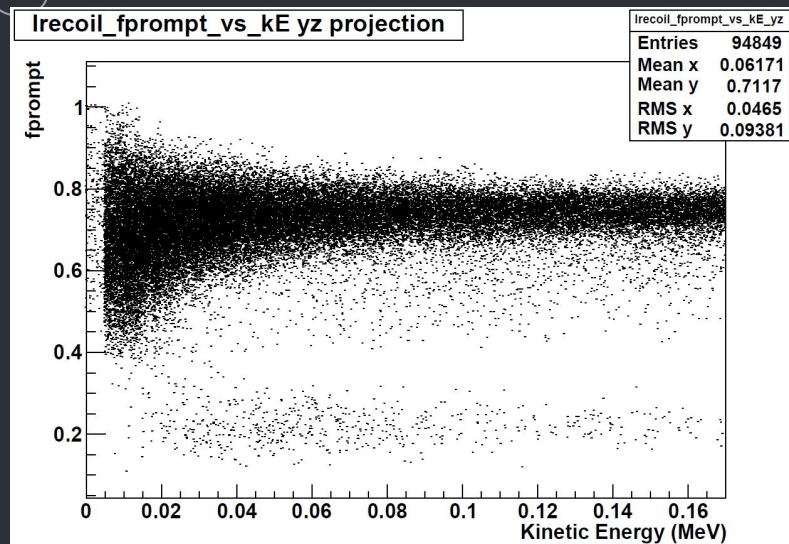
Progress

- ❖ Poster creation went well, we showed our poster at the symposium.
- ❖ Working with Chris, Kolahol, Ryan et al. on pulse discrimination in gas referencing work from Ryan's thesis.

Plans + Problems

- ❖ Working on further understanding geometry in RAT to make a geometry configuration with both gas *and* liquid. We will use data from the detector to define the distribution of gas.
- ❖ New pulse discrimination, if valid, could prove a remarkable method to discriminate α , β , and γ completely.
- ❖ Working towards a comprehensive description of the behavior of argon scintillation detectors, combining data from the detector with expected data from simulations.

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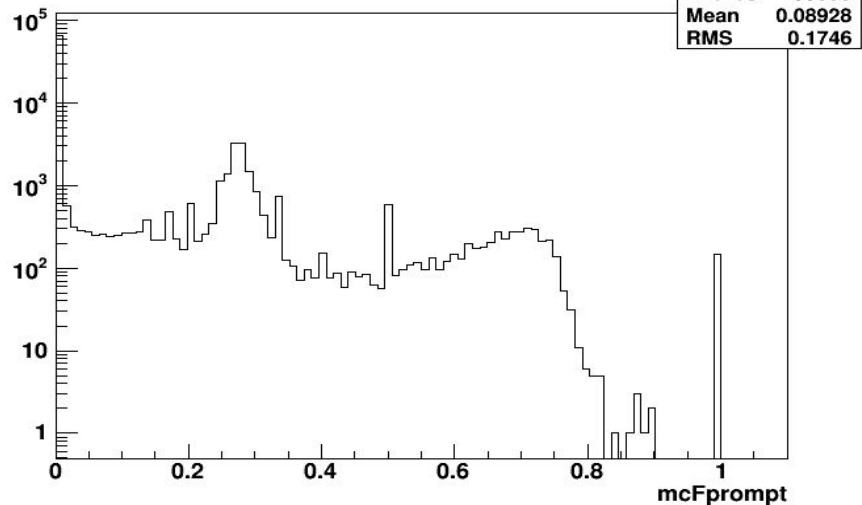


Neutron Simulation in Gaseous Argon

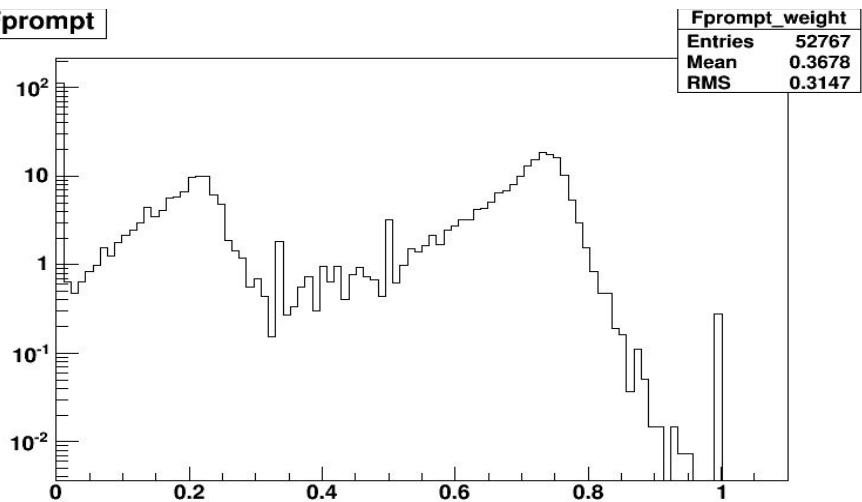


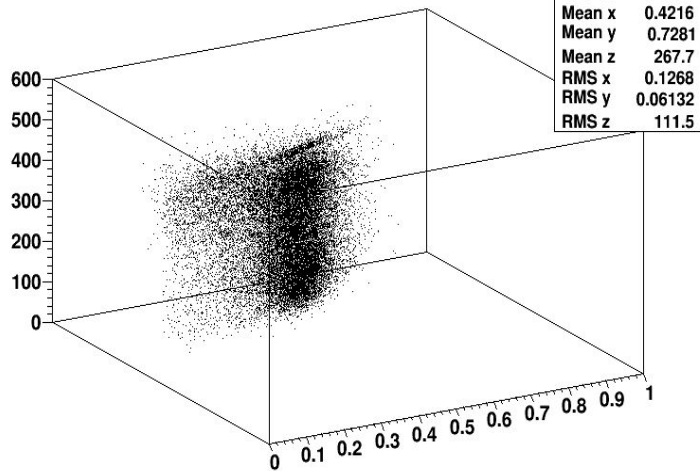
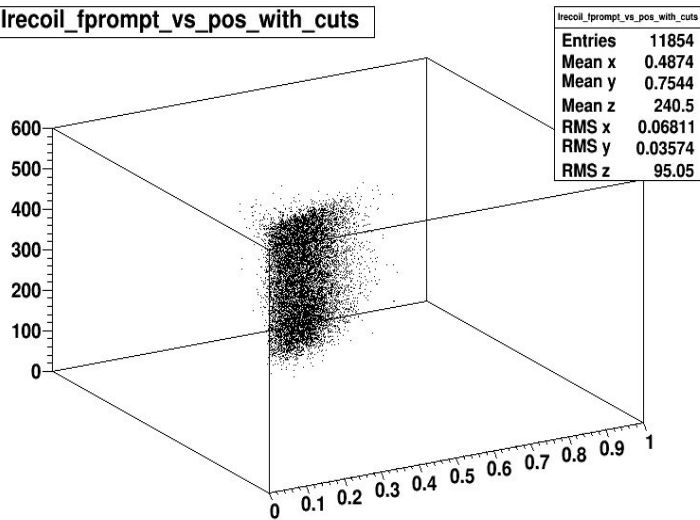
Summary of simulation

[fill]

mcFprompt

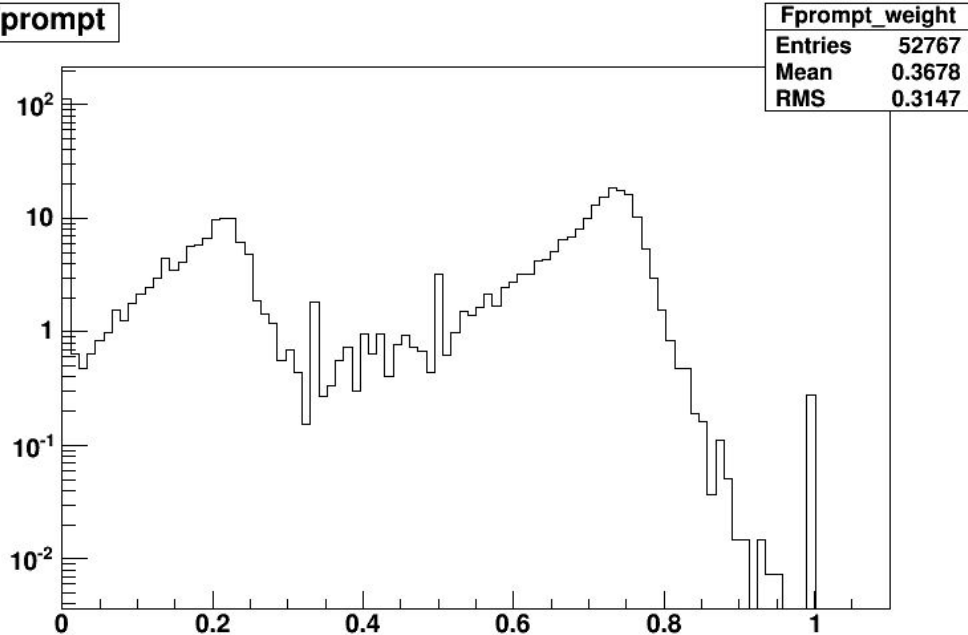
Gas fprompt next to old liquid fprompt

Fprompt

lrecoil_fprompt_vs_pos**lrecoil_fprompt_vs_pos_with_cuts**

Gas Plots

Lrecoil did not print on its own, leading me to believe I failed to uncomment or comment certain parts of the analysis script

Fprompt

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Progress

- ❖ Successfully ran neutron simulations in gas, plots on next slide.
- ❖ MiniCLEAN has made some progress, and is currently in the processing of filling. More monitoring shifts will be done.
- ❖ See next slide for plots
- ❖ Regarding my runtime problem,

Plans + Problems

- ❖ Solve my runtime Problem
- ❖ Once this runtime problem is addressed, I can finally make production analysis using either more neutron data, or neutron data and simulated wimps to make a final discrimination plot.
- ❖ Work with Hans on the symposium presentation.

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Progress

- ❖ Updated RAT to r2178
- ❖ Resolved my (ignominious) condor simulation problem, so now running jobs on condor works.
- ❖ Utilized gen_shellfit to build the shellfit tables for MiniCLEAN so they can be loaded directly prior to initialization, so startup time for macros will be much faster.
- ❖ Gaseous processors for my neutron simulations work.

Plans + Problems

- ❖ Find the source of *another* problem, which is RAT's outroot processor not being able to write to the disk when I run tests straight through command line and not through condor. Always get the message:

```
SysError in <TFile::TFile>: file
output.root can not be opened (Disk quota
exceeded)
```

- ❖ This makes doing offline testing much more difficult. This also causes the gen_shellfit python script to fail before it can output the .root file containing the table.
- ❖ I plan to have cut plots and analysis by late this week or early next week.

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Progress

- ❖ Successfully running Nathan's analysis script on liquidAr neutron events.
- ❖ Reaching out to Kolahal about his document regarding background plots and neutron events.
- ❖ Obtained a more solid understanding of the ROOT data structure, so I have resolved all my previous problems with data manipulation and acquisition from .root files.
- ❖ The analysis script is running as I speak, but has not terminated in time for this meeting, so no plots unfortunately

Plans + Problems

- ❖ Odd issue with the server, as my jobs are taking *much* longer to compute than they have in the past. Although able to run successfully, even less than worthwhile simulations (test jobs) take hours, meaning worthwhile jobs could take days or weeks. This may be a problem on my end, however I do not know yet.
- ❖ Run a clean macro job to condor for purposes of diagnostics for the above issue.
- ❖ Learn more about more sophisticated ROOT analysis techniques, like the 3D histogram cut technique and ROOT projections.
- ❖ Once the server issue is resolved, analyze fprompt and Irecoil from neutron events in both gas and liquid argon

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Progress

- ❖ On the next slide are the mcFprompt plots for liquid argon alongside the preliminary gaseous estimate.
- ❖ For the gas value, oddly, RAT would crash if the IV was filled with anything but liquid_Ar, even if the other material had the same properties.
- ❖ Instead, I set the liquid_Ar density to that of gaseous argon at standard conditions, as the density of liquid_Ar already set was of standard liquid argon density. The gaseous density was $\sim 1.784 \times 10^{-3} \text{ g/cm}^3$.
- ❖ Interestingly, the gaseous simulation went *much* quicker than the liquid

Plans

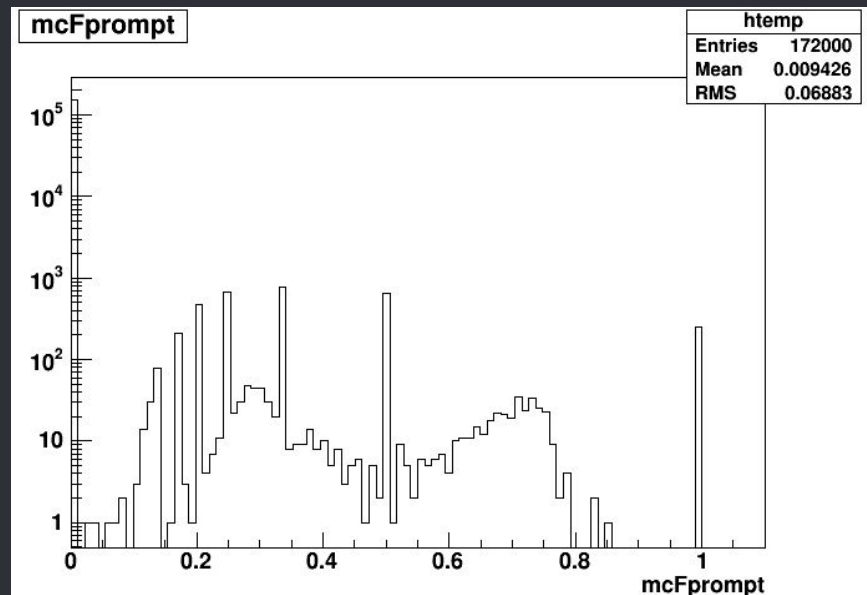
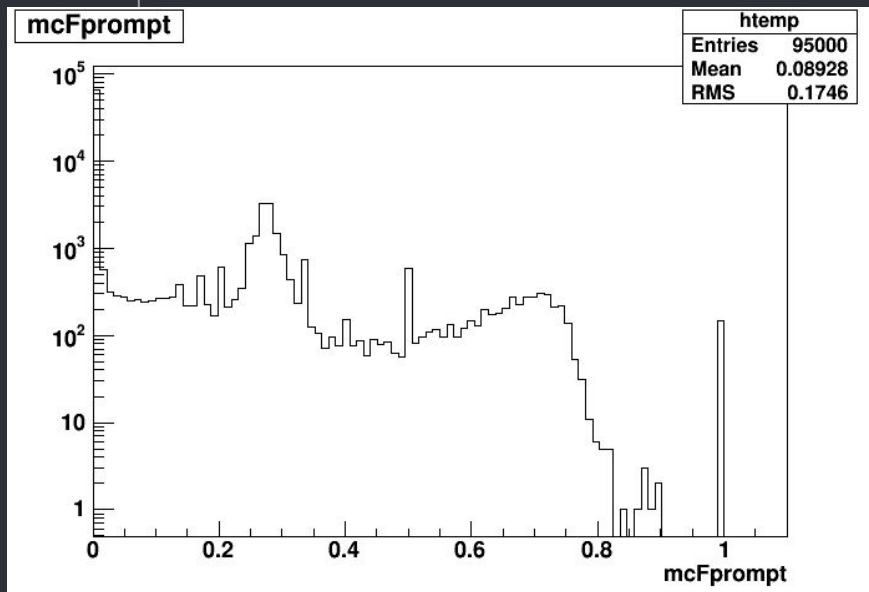
- ❖ System training today
- ❖ Find the material bug/interaction in the detector simulation, because I'm guessing there is an additional calling of liquid_Ar that I'm not accounting for
- ❖ Run wimp simulations with better understanding of GEANT4 and RAT simulation framework

mcFprompt

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Liquid Ar

Gaseous (?) Ar



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Progress

- ❖ Wrote a ROOT File renaming script - streamline data processing
- ❖ Wrote a TChain analyzer script that also Draws a chained fPrompt, or whatever leaf I choose
- ❖ Learned about RAT reactor geometry files.
 - Imported (and found) MATERIAL file for gaseous Argon, labeled “gaseous_Ar_ratdeap”
 - Attach modified MiniCLEAN.geo (.ratdb) and MiniCLEAN_IV.geo files, replacing the cryoliquid in *_IV with gaseous argon, referencing the altered IV with an altered MiniCLEAN.geo file
- ❖ The bulk neutron event simulation histogram was drawn, after an hour+, but the file was corrupted unbeknownst to me. I would have included it otherwise.

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Plans

- ❖ Odd bug found with RAT submissions - about 2% of submissions cannot find and source RAT environment variables, therefore only ~40% of submission actually simulate
- ❖ More severe bug, which has already ruled out material altering as an origin, the .root files are either not being created or not being successfully copied/found by condor, so I cannot get any more outputs.
- ❖ These bugs will (hopefully) soon be fixed so I can continue work
- ❖ Hopefully learning about system monitoring

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Progress

- ❖ Created a new submission shell script
- ❖ Successfully ran jobs on the cluster and copied the output back to me
- ❖ Installed Ubuntu, overcame my previous problem

Plans

- Become more proficient with UNIX, ROOT, and Rat
- Further the neutron and wimp simulations for data analysis
- Start training on system monitoring for MiniCLEAN

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Progress

- ❖ With finals looming over me, I've had little time to put towards the project over the past week, however I have still made some progress. Nathan ran his simulation from the berkeley cluster
- ❖ I also have the submission for a job using runWiscJobs correct, except for a working proxy/certificate, although I have a certificate, it doesn't read it. I'll figure it out.

Overall

- Over the course of this project, I have learned so much. I have gained a greater understanding and handle of UNIX, become integrating in the university research process, learned more about ROOT as well as C and Python.
- Learning about this experiment, as well as all of the processes that go into these simulations, has been a truly enlightening experience, and I can't wait to come back to it in the fall.

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Progress

- ❖ Successfully ran a RAT simulation off of the university cluster, outputting a valid ROOT file
- ❖ Obtained a Grid Certificate for the new runWiscJobs script (thank you Carl!)
- ❖ Obtained an analysis script for compiling results from Nathan

Forward

- ❖ Successfully run a macro using runWiscJobs
 - Configure so that the output files have different names depending on run
- ❖ Finish the analysis script
- ❖ After all this, hopefully finally run my wimp macro

