Direct Reco Upgrade progress

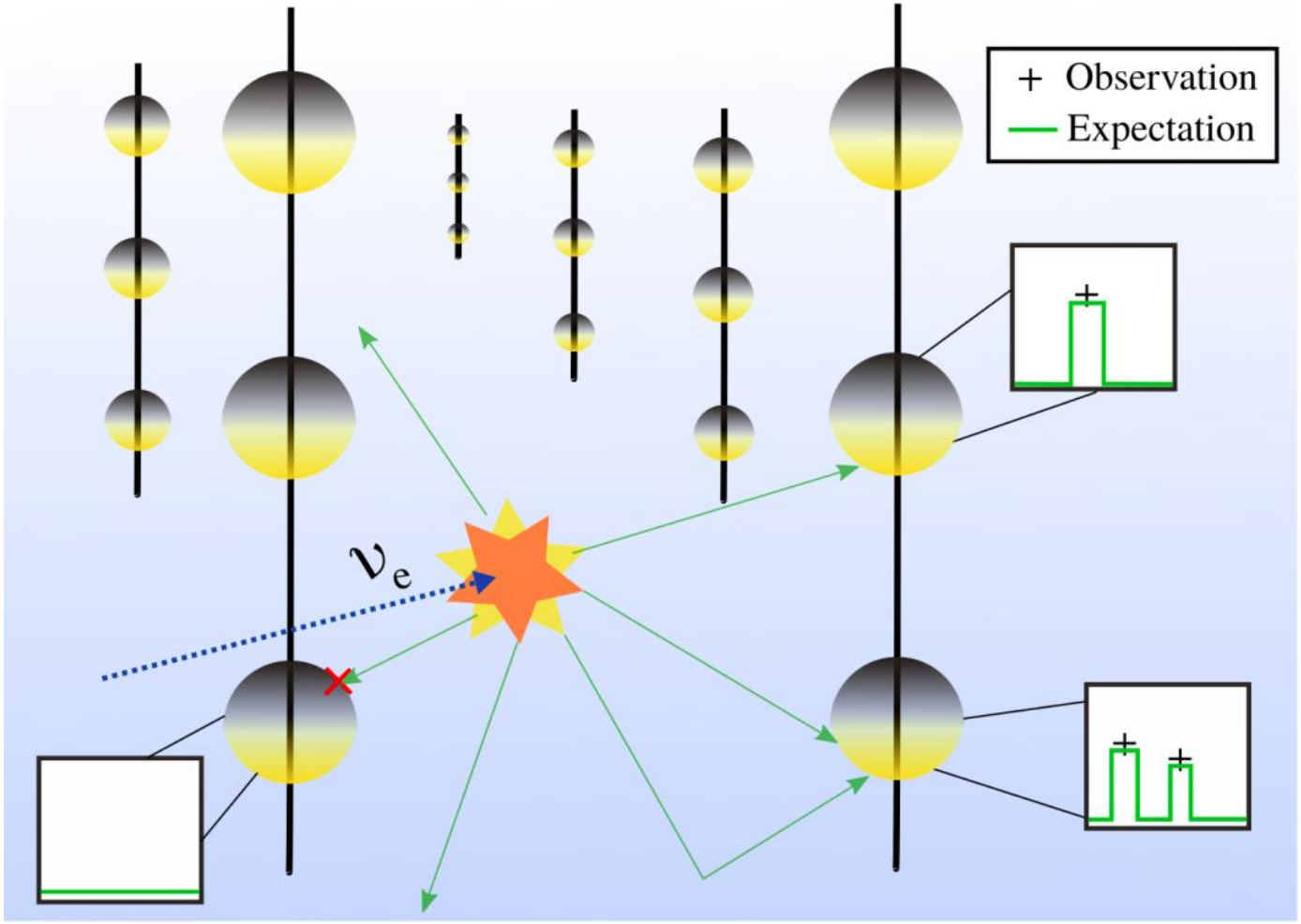
Friday meeting 15-01-2021

Jonathan Jegstrup

UNIVERSITY OF COPENHAGEN

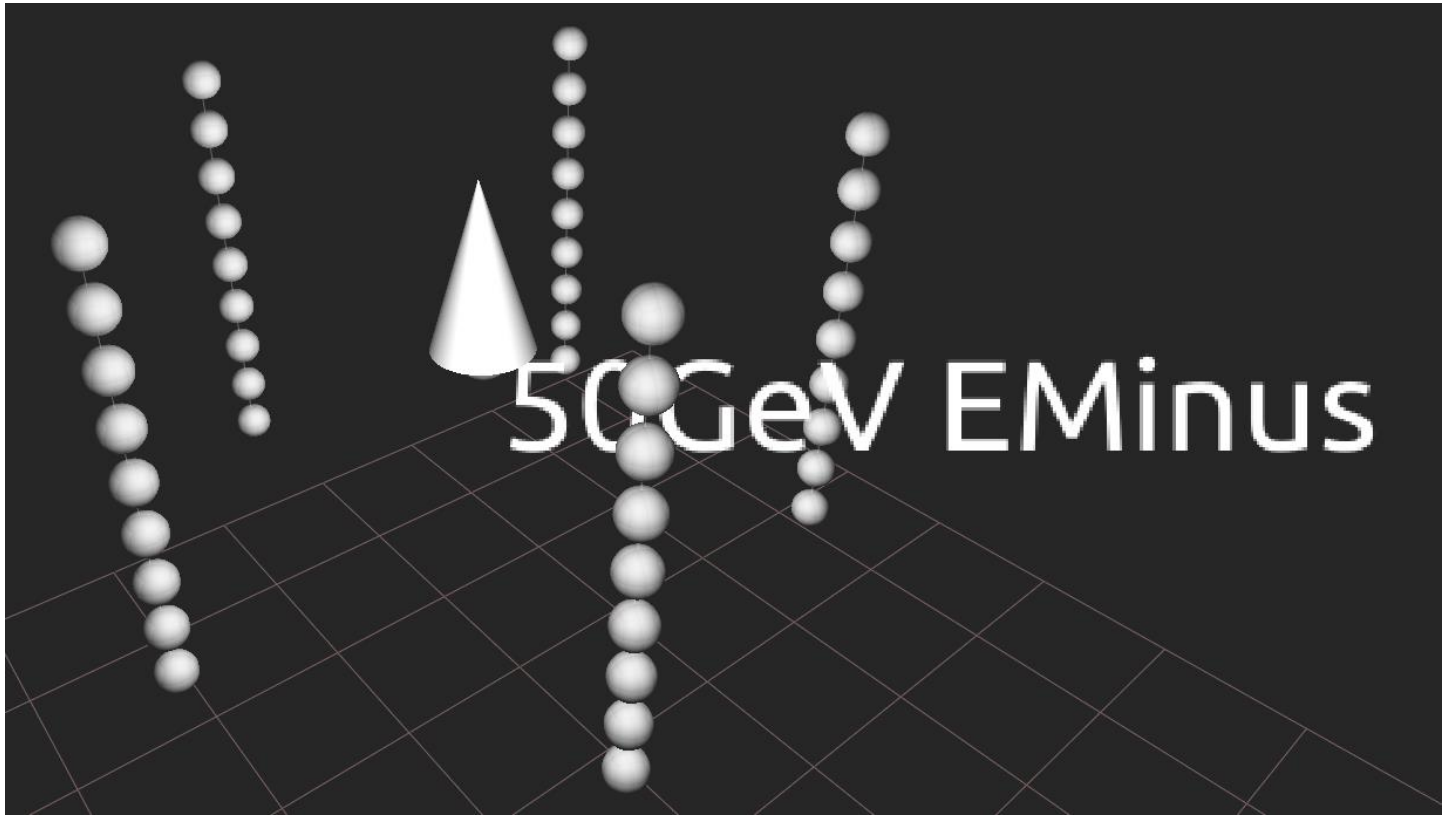
Direct Reco – a reconstruction algorithm

- Direct Reco computes the expected light yield of a given hypothesis, using on-demand simulation
- For a single hypothesis, the simulation is run multiple times to smooth out any stochastic variance in the light yield. This is called *oversampling*.
- To reconstruct the particle parameters Direct Reco uses a log-likelihood which is then minimized



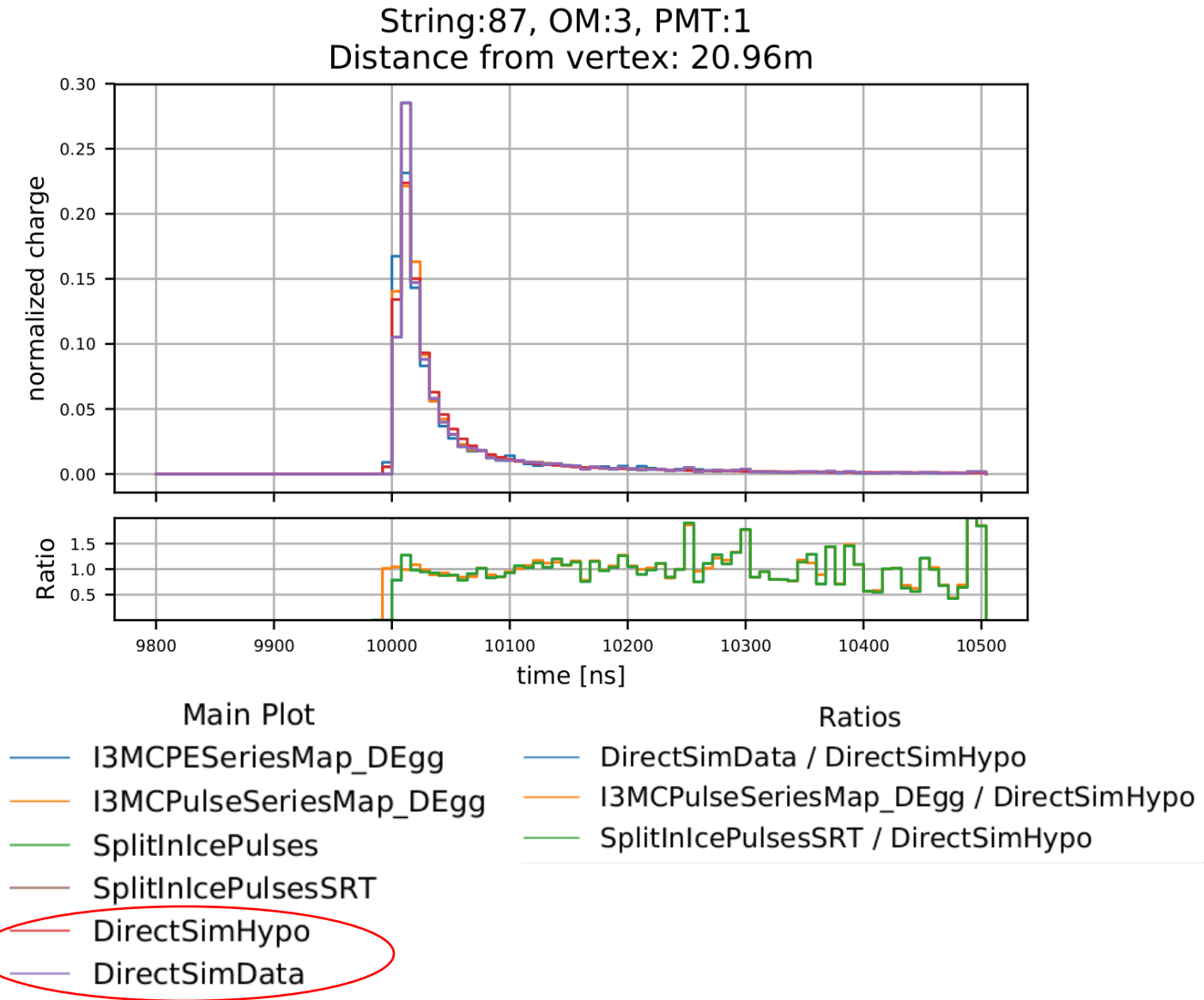
Direct Reco Upgrade – the setup

- I use a simple detector setup consisting of 45 modules on 5 strings in a circle of 20 m radius to the vertex of the particle.
- I am focusing on DEggs which means this detector has 90 PMTs.
- The particle that is simulated in all tests is a 50 GeV electron.



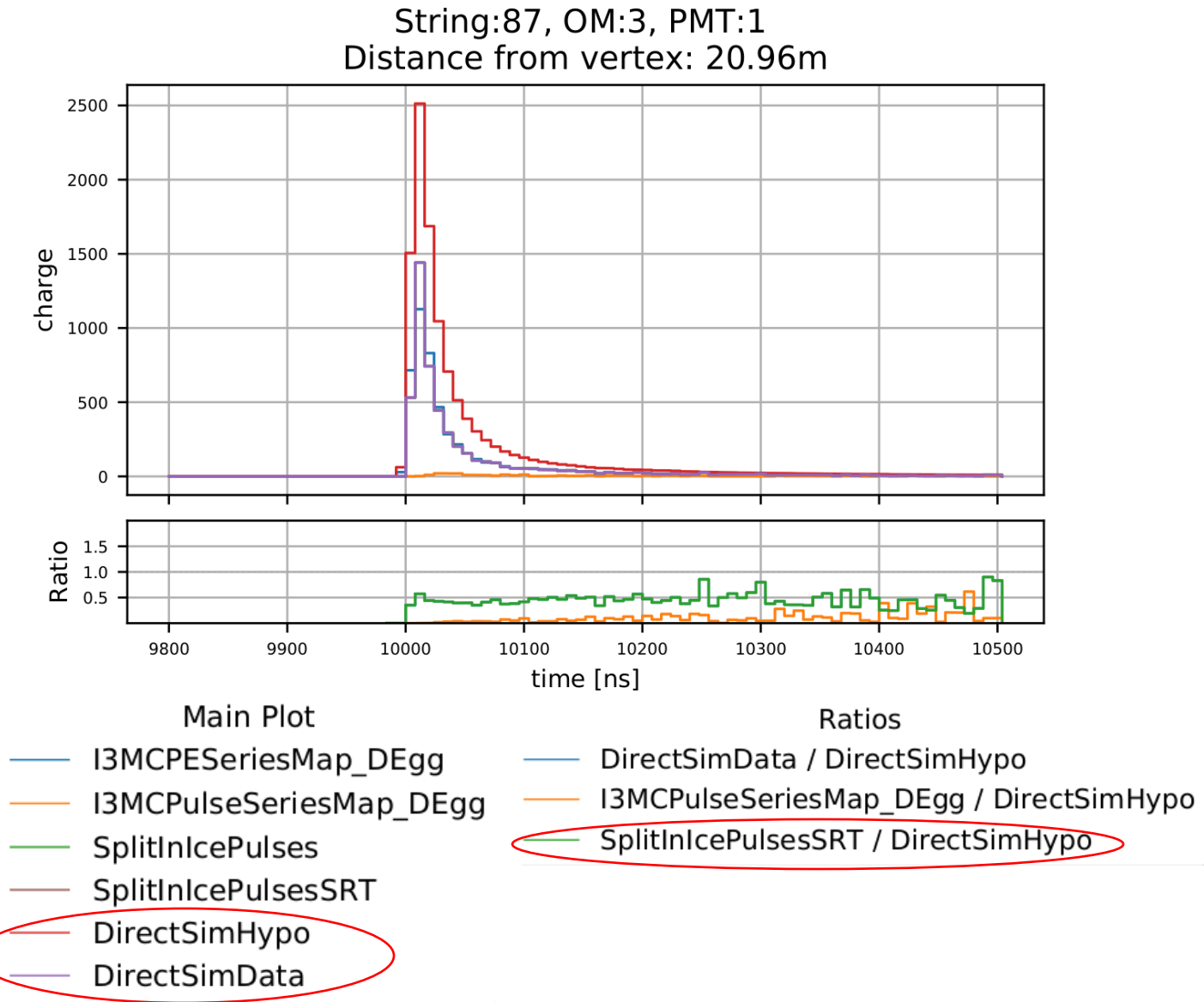
Direct Reco Upgrade – Single hypothesis run

- Testing Direct Reco on a single hypothesis with the true parameters as seed
- The normalized plot looks good and seem to follow the shape of DirectSimData as it should



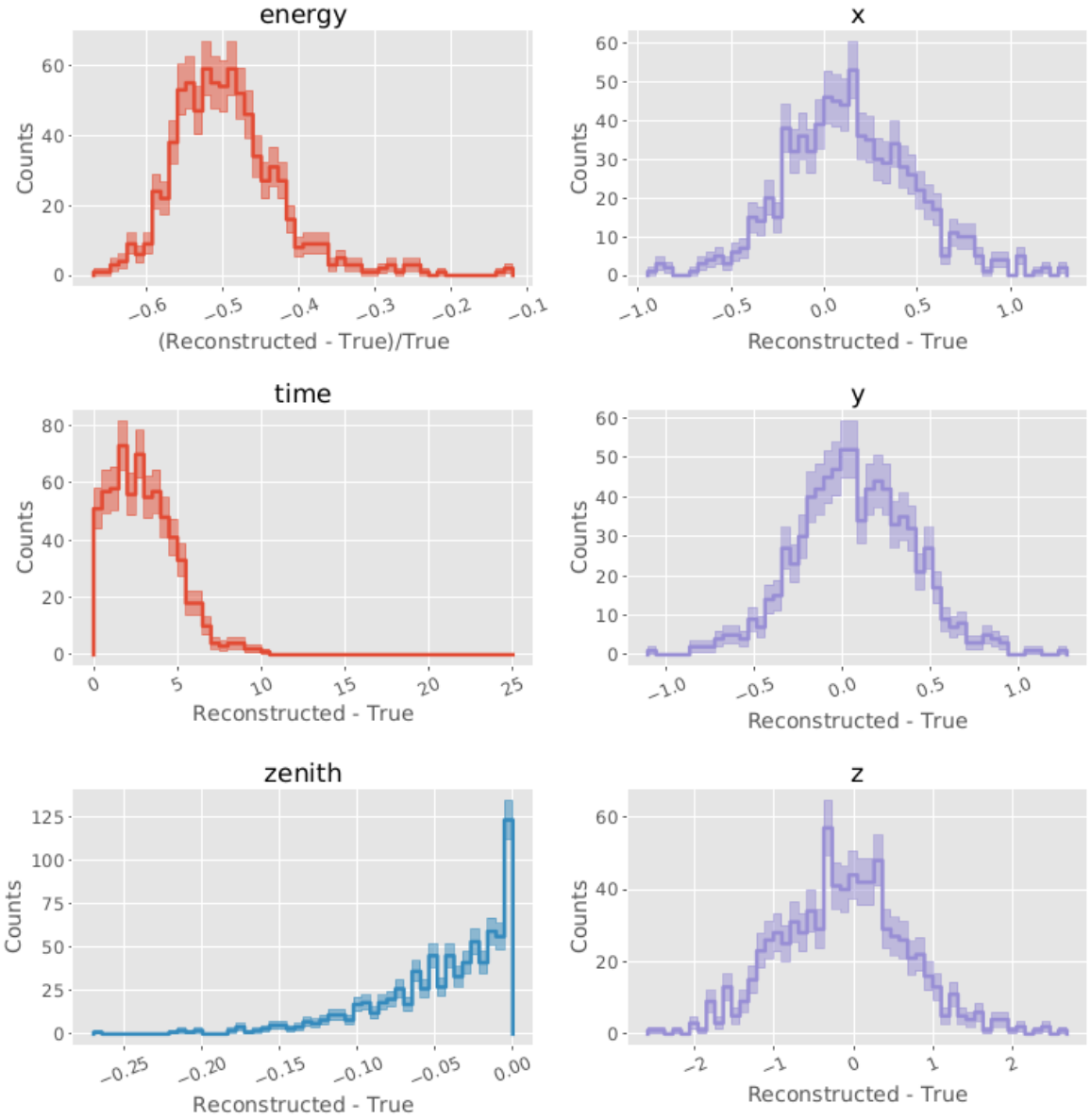
Direct Reco Upgrade – Single hypothesis run

- Testing Direct Reco on a single hypothesis with the true parameters as seed
- The unnormalized plot on the other hand is unfortunately not as good
- The ratio seem to be around 0.5
- Kasper did not see the same thing, so something specific to the upgrade



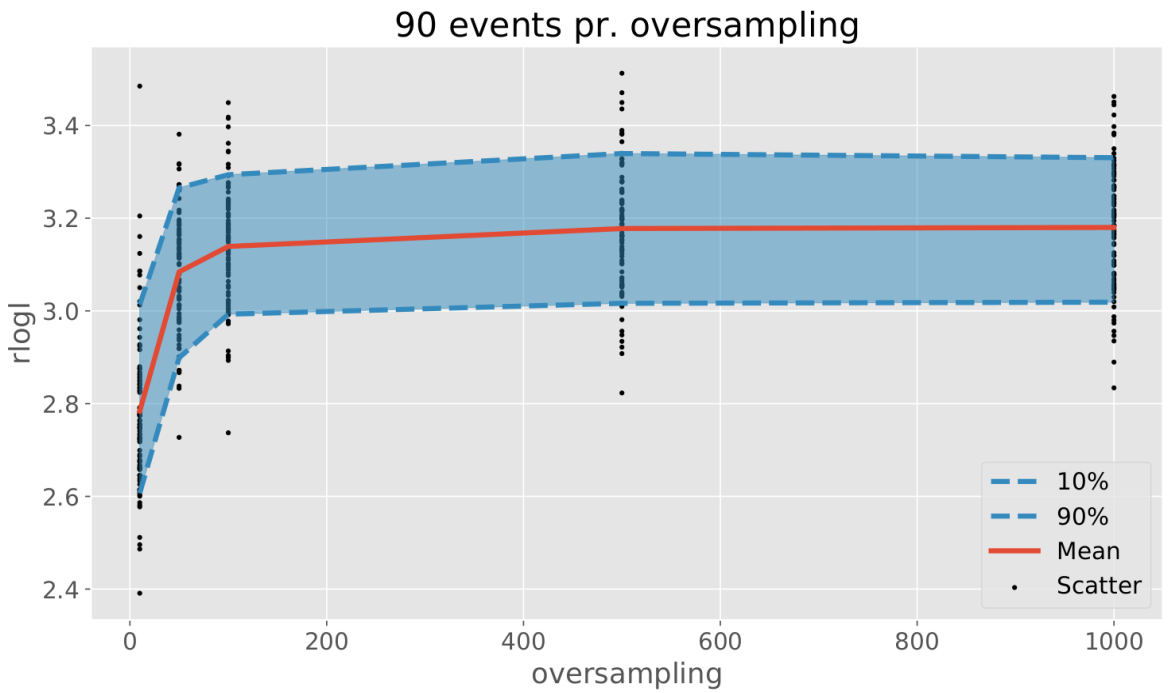
Direct Reco Upgrade – Full reconstruction

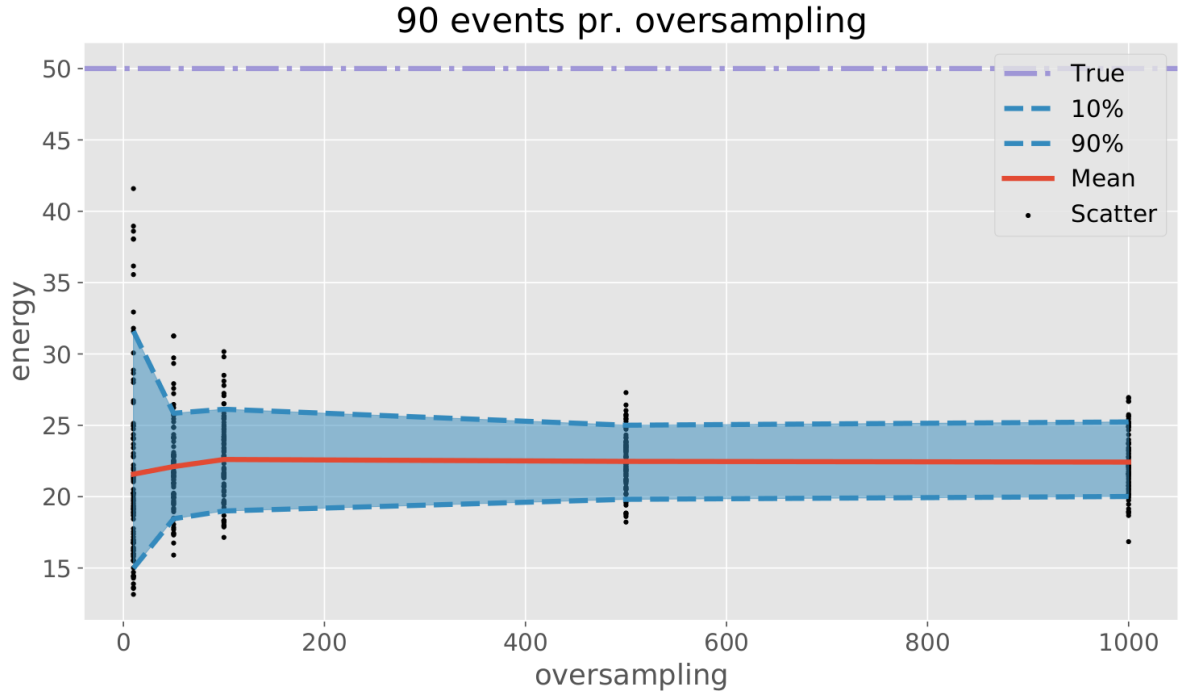
- Full Direct Reco run with parameter reconstruction
- Seems good, except for energy
- Thomas saw that energy was dependent on oversampling, so we wanted to see if that was the same here



Direct Reco Upgrade – Full reconstruction

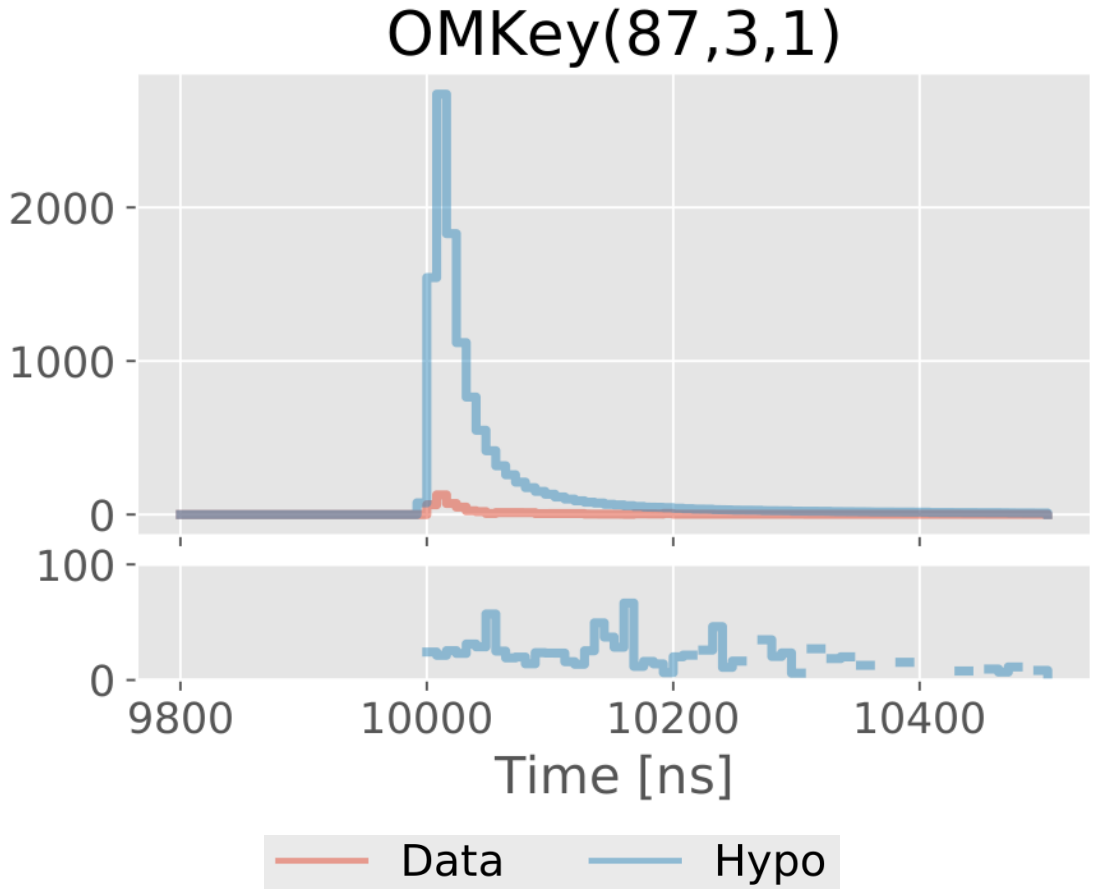
- We see almost no energy dependance, only the precision gets better
- The result is a little under a half of the true energy, similar to what was seen in the single hypothesis runs.





Direct Reco Upgrade – Full reconstruction

- Strangely the final charge vs. time plots looks even worse than for the single hypothesis run
- Bear in mind the low statistics - only 90 events



What is next?

- Find the issue and fix it
- After fixing the issue do reconstruction again and see how well it does
- Move on to different seed than truth seed -> see how well it does
- If good, then possibly move on to mDOMs, but we'll see if I will ever make it this far

Direct Reco Upgrade – Solutions?

- I changed the wavelength bias to DEgg acceptance curve instead of regular DOM -> Did not fix it
- Searching through the files to find something bad – cannot find anything
- Checked the charge distributions – They were fine
- Checked the way we accept photons on the module – it seems to work close enough