Direct Reco Upgrade Progress – PMT Asymmetry and more!

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Presentation topics

- Updates on the potential PMT asymmetry that was showed last time
- Direct Reco reconstruction with no detector sim or noise in simulation

Recap of PMT Asymmetry

- PMT 1 (upwards pointing) seems to get more hits than the downwards facing PMT 0
- This is an event with an upgoing electron
- MC simulation and Direct Reco agree with this apparent asymmetry
- The asymmetry was not seen when looking at which PMTs point towards or away from particle vertex



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PMT Asymmetry [1/2]

- Only looking at MC simulation now
- Every pair of circles represent a module with upwards facing PMT (upper circle), and a downwards facing (lower circle).
- The color represents the total charge in a PMT for all 800 events
- The event is an upwards going electron at z=0
- Simulating a downwards going electron shows the same, but mirrored at z=0 [shown in next slide]



PMT Asymmetry [2/2]

- Downwards going electron shows the same thing but mirrored at z=0
- Furthest away PMT pointing towards gets more light than those closer
- Does the particle travel a few meters before producing cascade? (This still cannot explain everything though)
- Can particle physics explain this? Can anything? Anyone?



Recap of Reco

- We can ignore the apparent PMT asymmetry for now since MC Sim and Direct Reco are agreeing on it
- All scans and testing before doing reconstruction looks great!





Testing Reconstruction using Direct Reco with no noise or detector sim [1/2]

- Feeding Direct Reco with an initial seed of 30 GeV energy and all other parameters are the true parameters
- True energy is 50 GeV
- The time per event was ~30 min
- This is for 200 events and oversampling 300
- Reconstruction of energy undershoots a bit
- Reconstruction of z looks to undershoot as well, only by ~0.25 m



Testing Reconstruction using Direct Reco with no noise or detector sim [2/2]

- Trying with seeding of 70 GeV particle
- True energy is still 50 GeV
- The time per event was ~60 min!
- This is for 200 events and oversampling 300
- Reconstruction of energy overshoots
- Reconstruction of z now overshoots, now by ~0.5 m



What is next?

- Figure out if the asymmetry makes sense.
- Investigate why Direct Reco does not reconstruct better, when testing looks really good
 - Maybe 2D likelihood space looks worse?
 - I have preliminary 2D likelihood plots but should improved
 - Fix all other parameters in fitting so that it does no try to fit those as well
 - Currently running this on the cluster, will see soon how it goes

Backup – 2D scans – Energy vs. Zenith



Backup – 2D scans – Energy vs. Zenith - vmax





Backup – 2D scans – Azimuth vs. Zenith

Dima likelihood scan - splined

