Misc.

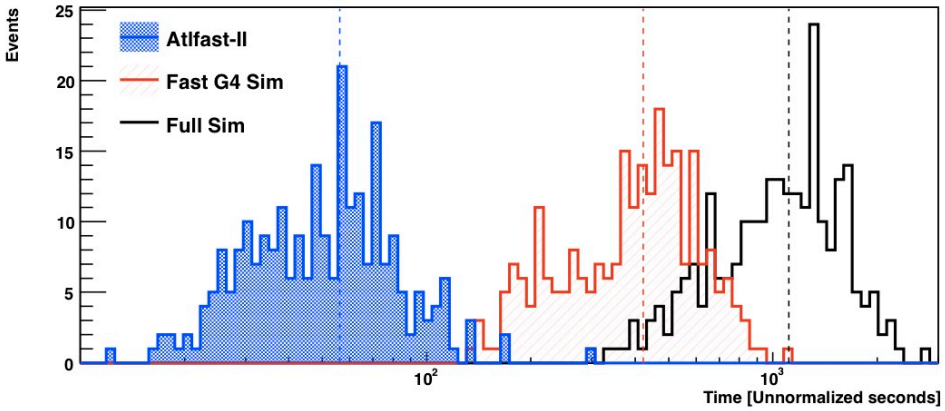
Andy Haas (NYU) and Zach Marshall (LBNL)

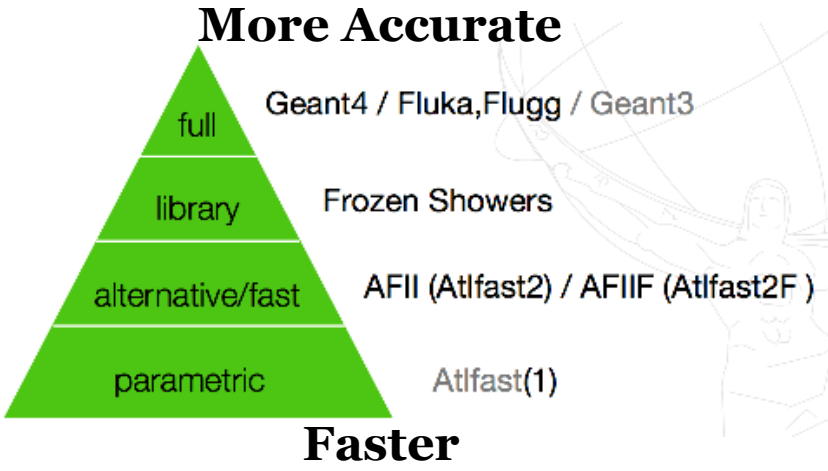
Software TIM in Glasgow

7 June 2016

FastSim for Run 3

- Frozen Showers
  - Part of our DEFAULT simulation! Everybody uses this unless they specifically ask not to.
- ATLFAST-II aka FastCaloSim
  - Our STANDARD fast simulation. Common for signal models and large backgrounds in Run 1; several billion events.
- ATLFAST-IIF aka FATRAS+FastCaloSim
  - VERY popular for potential **upgrade** studies. Moving quickly for phase-2 upgrades…
- ATLFAST-I
  - Considering revitalization. Don't want to "just" reinvent Delphes/PGS.
- Planning currently too keep all these options alive into Run 3





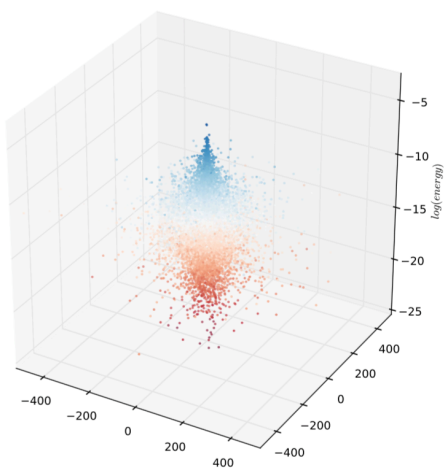
Updates in the Pipeline

- Frozen showers, FastCaloSim, FATRAS, etc all a part of ISF
  - Right now they follow a single algorithm / many tool design much like digitization. See Steve's talk for a bit about general thread safety issues and design discussions in ISF
- Frozen showers to be made **thread safe**
  - Again, see Steve's talk; this should be ready soon
- Atlfast-II aka FastCaloSim being **re-written** now
  - New tune and substantial re-write of the athena-side code
  - Hoping to make this at least thread friendly on the way
- Lots of work recently on the Fast Chain
  - Fast sim + fast digi + fast reconstruction; lots of configuration headaches and a tough time validating, but we are getting close
  - This setup goes back to the reconstruction model of having several heavy algorithms in flight at the same time
  - One of those algorithms is Pythia – anyone look at that thing's performance lately?

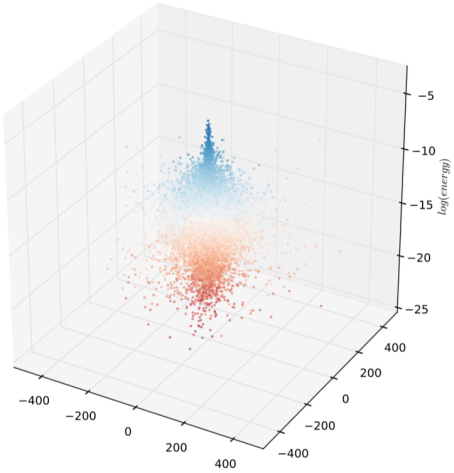
Atlfast-III (?)

- New ideas to use **Generative Neural Networks** for showers
  - See more at: https://indico.cern.ch/event/528097/
  - Or alternatively to rely more heavily on neural networks for the heavy lifting; the current revision of Atlfast-II uses NNs in place of single histograms, but we could be more aggressive than that
- Adversarial training model already shows some nice potential with limited stats and setup; moving to 'real' setup

None of these are real pictures!



$\mathbf{x} \sim p_{\text{data}}$



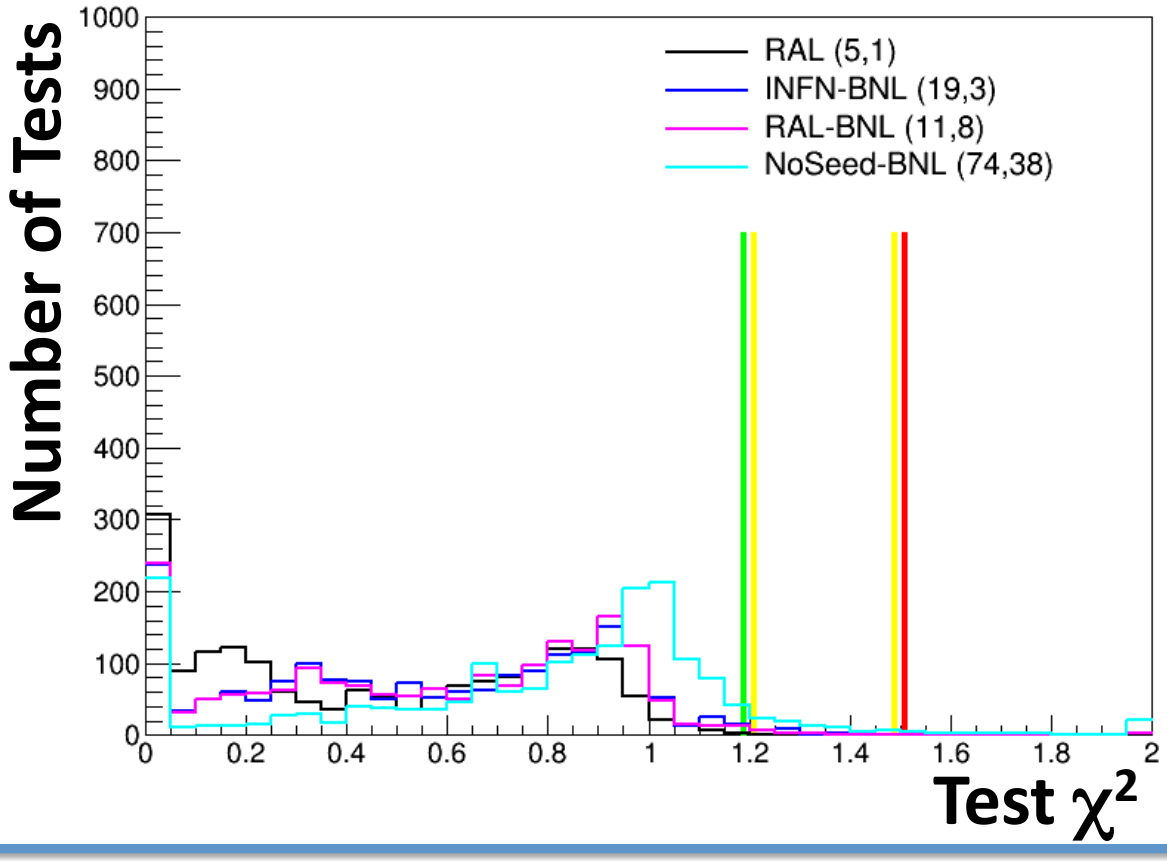
$\mathbf{x} \sim p_{\text{model}}$

Reproducibility / Site Validation

- The Geant4 team now sees reproducible results at most levels (restart points) with most physics configurations
  - All the ones that are applicable to us, and some others
- We know in ATLAS it's very tough to get reproducible results in MP/MT across different sites
- Currently impossible for Intel vs AMD
  - Scott did some promising tests in a simple 64-bit setup
  - But we definitely see disagreement in Geant4 results
- At a very basic level, we are having trouble justifying all of the information that we have (it seems like it cannot all be correct)
  - Some help would be very welcome in tracking this down.
- Doing lots of comparisons with no pile-up digi+reco
  - Remember that we re-seed for every event, so we should have good control over the seeds
- All of this is Jose's and Martina's work, I'm just the messenger

Examples of Tests

- **NoSeed-BNL**: Seeded vs unseeded simulation (real statistical fluctuations)
- **RAL**: All Intel CPUs, different sites for (sim+digi+reco)
- **RAL-BNL**: All Intel CPUs, different sites for sim, BNL for digi+reco
- **INFN-BNL**: Different architectures for sim, BNL for digi+reco

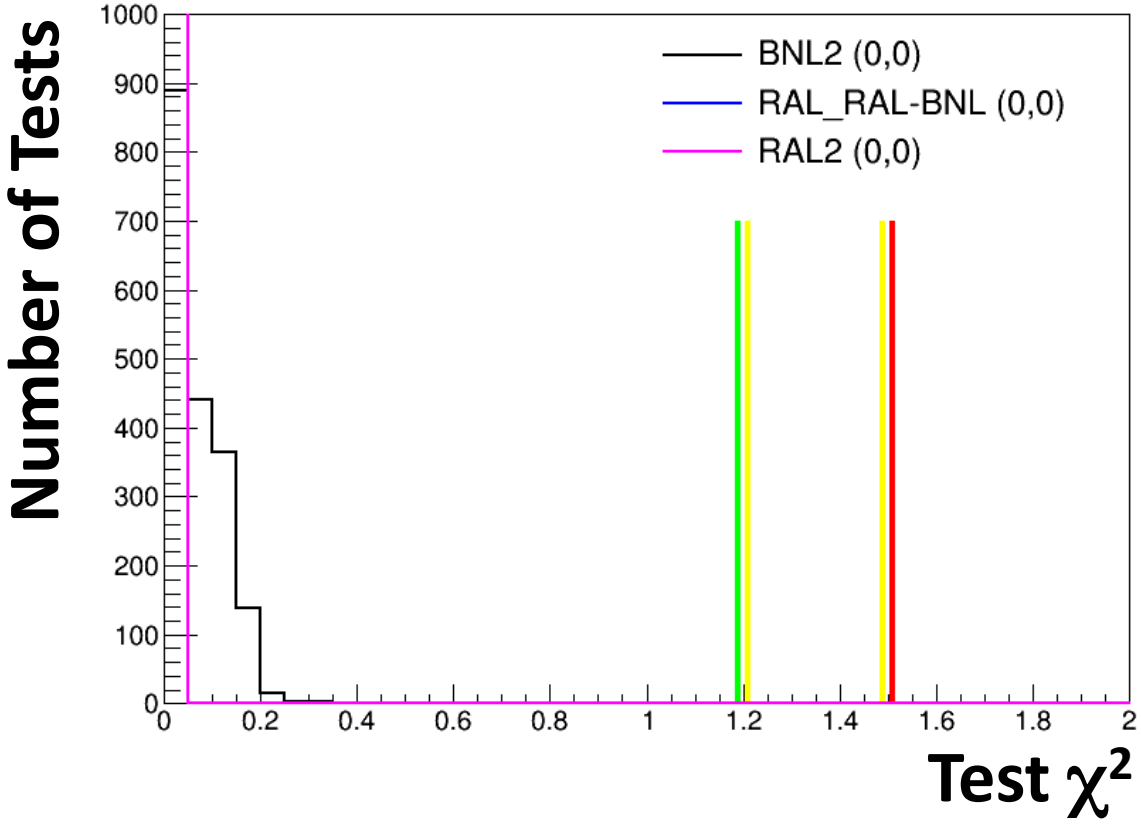


Seems reasonable that different seeds give different results

Good that **RAL** shows the smallest deviations, but really those are still pretty big deviations!

Reproducibility / Site Validation

- We know it's very tough to get reproducible results in MP/MT across different sites
- Currently impossible for Intel vs AMD (looking into why)
- Some very confusing test results (any ideas??)



BNL2: Digi+reco of the same input dataset twice, each time at BNL

RAL_RAL-BNL: Digi+reco of the same input dataset twice, once at RAL and once at BNL

RAL2: Digi+reco of the same input dataset twice, each time at RAL

Summary of Issues

- We believe there is ~no irreproducibility on all-Intel sites in digi+reco, even for multi-core jobs
  - As long as the TRT digi is patched
  - But how do we explain the previous slide??
- We see no difference in the hits in a single event when we look at the hits coming from G4 10.1, though the order changes from job to job
- We see significant differences after digi+reco for hit sets where the order changes
  - Even with the TRT patch

How can all of these be compatible statements??