

Geant4 in ATLAS

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Geant4 Technical Fourm
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Current Production (I)

- **New 13 TeV MC production (MC16) has started**
 - **G4 10.1 patch03, CLHEP 2.2, 64-bit, gcc 4.9, SLC6/CC7, C++14 (moving to gcc 6.2 soon)**
 - **Compiling G4 as part of our nightly builds**
 - **Significant number of updates to ATLAS user code (geometry and detector response), including several speed ups.**
 - **HPCs, Amazon cloud, BOINC in use; Testing underway for icc, clang, and ARM builds. Could be used for production if they prove useful.**
 - **First campaign that could include multithreading (!!)**
- **770M events simulated so far with this configuration! (Out of 2.0B events requested to be produced so far.)**

Current Production (II)

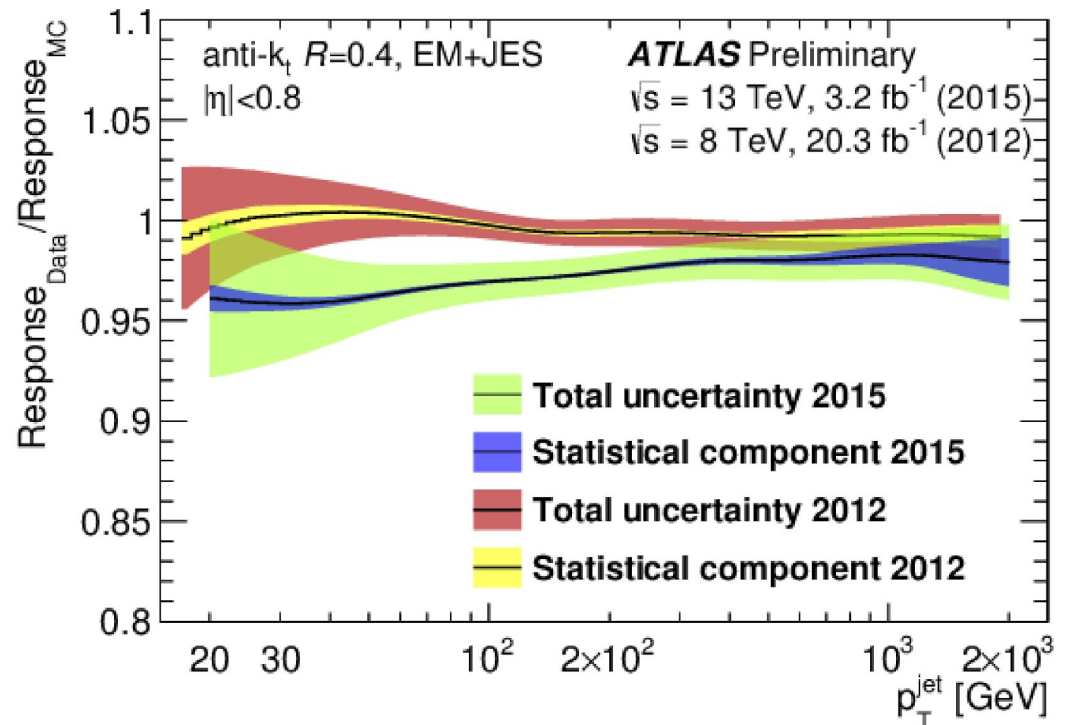
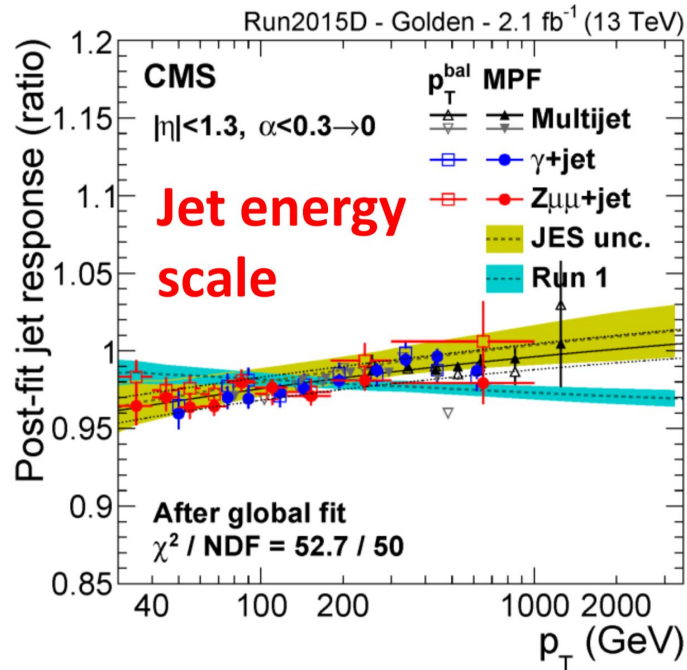
- **MC16 will be the main campaign well into 2018**
 - **We felt we should move to the newest gcc version to start this campaign, which is why we will move to gcc 6.2 (not formally a supported configuration)**
- **Still running tails of (much) older production campaigns:**
 - **MC15**
 - **Geant4 9.6 patch03, CLHEP 2.1, 64-bit, gcc 4.7, SLC6, C++11**
 - **MC12**
 - **Geant4 9.4+ patches for “MC12” production**

Intel vs AMD vs KNL

- **Significant exploration of differences between Intel and AMD results**
 - These differences are annoying in production, as they prevent us from reproducing crashes on different hardware
 - Appears to be down to a change in the angles of the secondaries in a neutron inelastic collision at low energy in the Bertini model
 - Outgoing angles have $O(1)$ changes
 - Under investigation with the G4 team (trying to find an AMD machine to use as a testbed).
 - NB Intel & AMD runs already drift apart at the lowest bits. This can cause problems too, but it is the big jumps in differences that we would like to fix.
- **Investigating performance issues on KNL (Cori @ NERSC)**
 - 60% frontend bound stalls; instruction cache thrashing
 - CPI of 3 (pretty bad)
 - Similar results in G4 standalone – we want to try to understand this!!

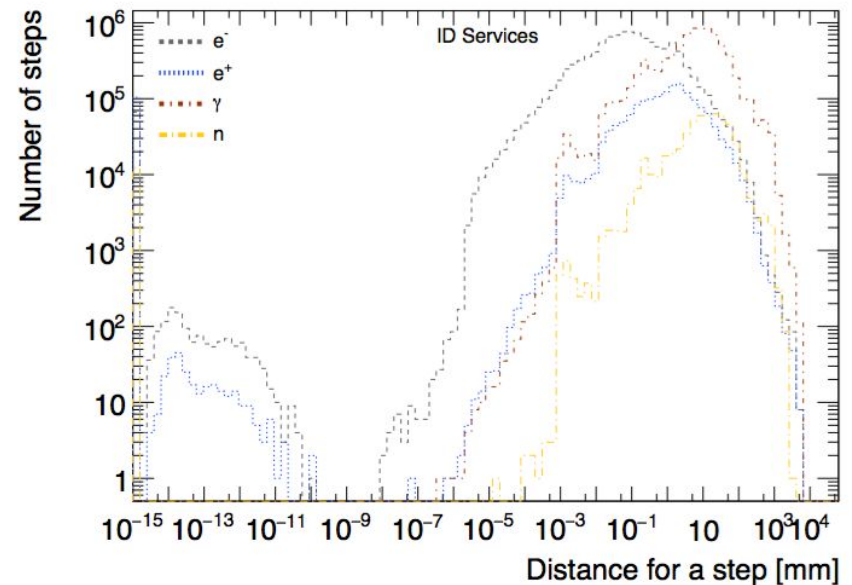
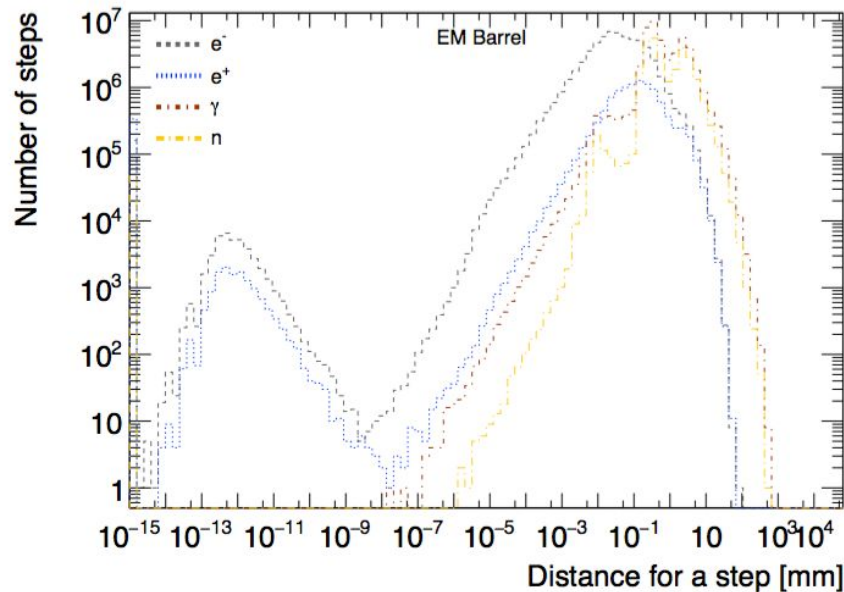
JES Issue

- FTFP_BERT_ATL Physics List provided by G4 Team is in use in MC16 Campaign.
- Working on producing full recommendations, so that we can see the impact of the new Physics List.



Bugs and Crashes

- **G4 10.1 crash rate seems to be no higher than G4 9.6**
- **No firm crash rate, but indications are good after 900M events.**
- **Small step issue is still hanging around in G4 10.1.**



Geant4 MT work

- **Infrastructure upgrades, mentioned previously are almost complete**
 - **Rewrite of ATLAS simulation code to be more Athena-based introducing concepts of tools and services, matching Geant4 concepts like sensitive detectors and user actions**
 - **Making some serious progress towards running production with AthenaHive + G4MT 10.1.**
 - **LAr calorimeter sensitive detectors in the final stages of validation now. No issues seen so far!**
 - **Final stage is dealing with writing out Geant4 Truth info.**
 - **Thank you for the help and for the interface tweaks (multi-SD, multi-useraction, changes to const-ness) that we have discussed to make our lives easier!**
 - **Still some discussion to be had about calibration hit SDs (energy deposits in dead material for calibration studies)**

Other good stuff

- **Atlas offline software has now moved to use git/CMake rather than SVN/CMT. This allows us more flexibility to try out different build and linking options.**
 - **Interesting discussions on this last week at ATLAS Software & Computing week.**
 - **First on the list is to merge all ATLAS code with a G4 dependency into a single library which we will statically link to Geant4.**
 - **Then we will look into profile guided optimization.**
 - **More info next time.**
- **After this will look into biasing options for further speed-ups.**