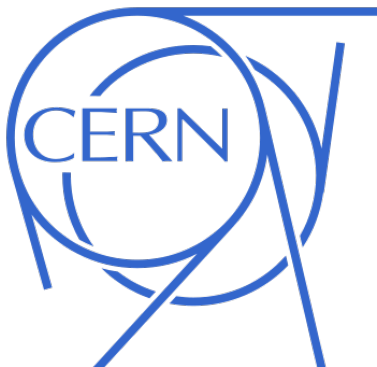


ATLAS Geant4 Performance

*Geant4 Collaboration Week
September 2016*

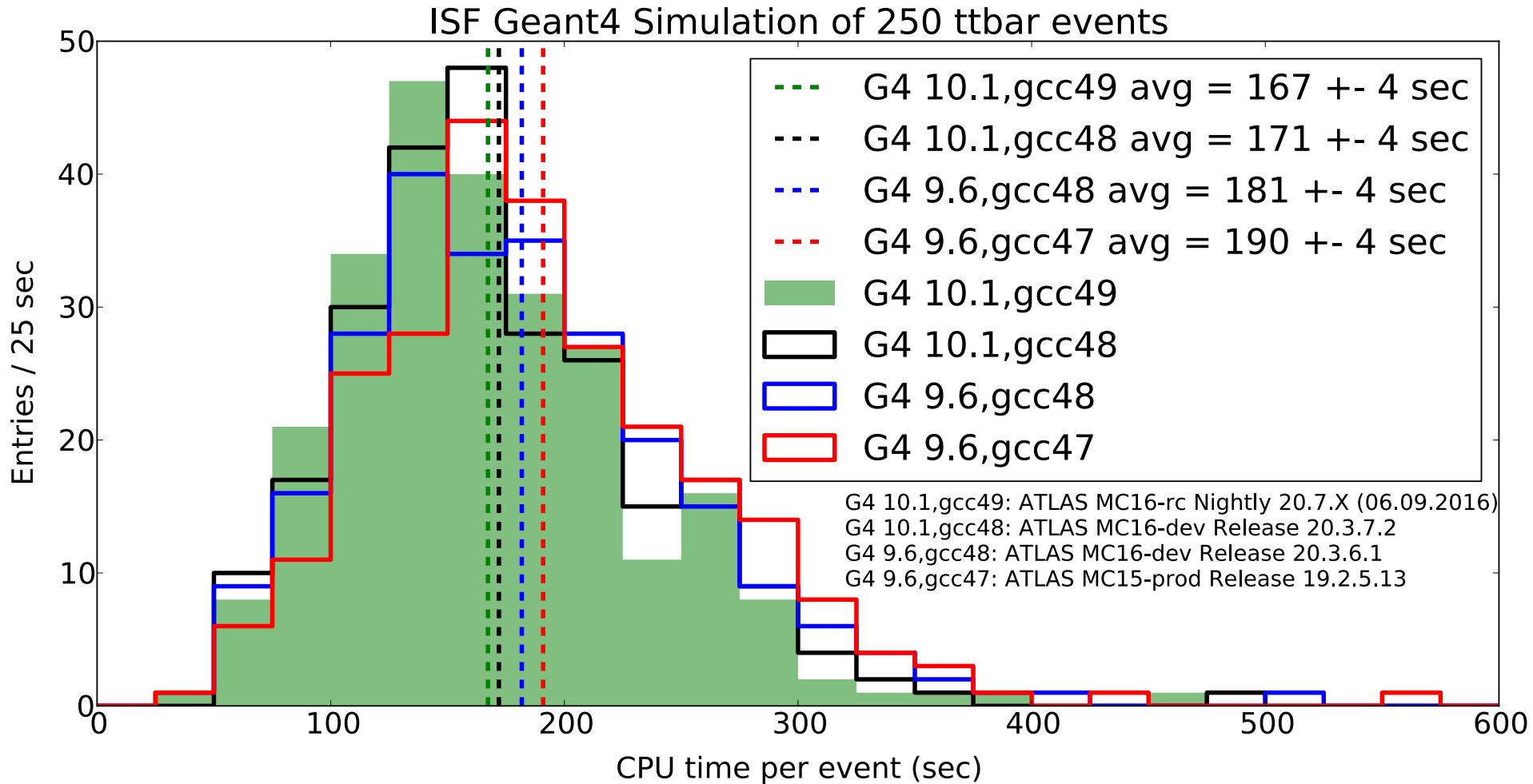
Elmar Ritsch (CERN)
for the ATLAS Simulation Team



Setup

- Machine: 16 Intel® Xeon® E5-2667 v2 @ 3.30GHz w/ HT, 32 GB DDR3 SDRAM @ 1600 MHz
- Event time measurement
 - 250 ttbar events
- CPU Profiles
 - Profiler: GPerfTools
 - Events: average over 3 ttbar events (profiler activated only *after* first event in eventloop)

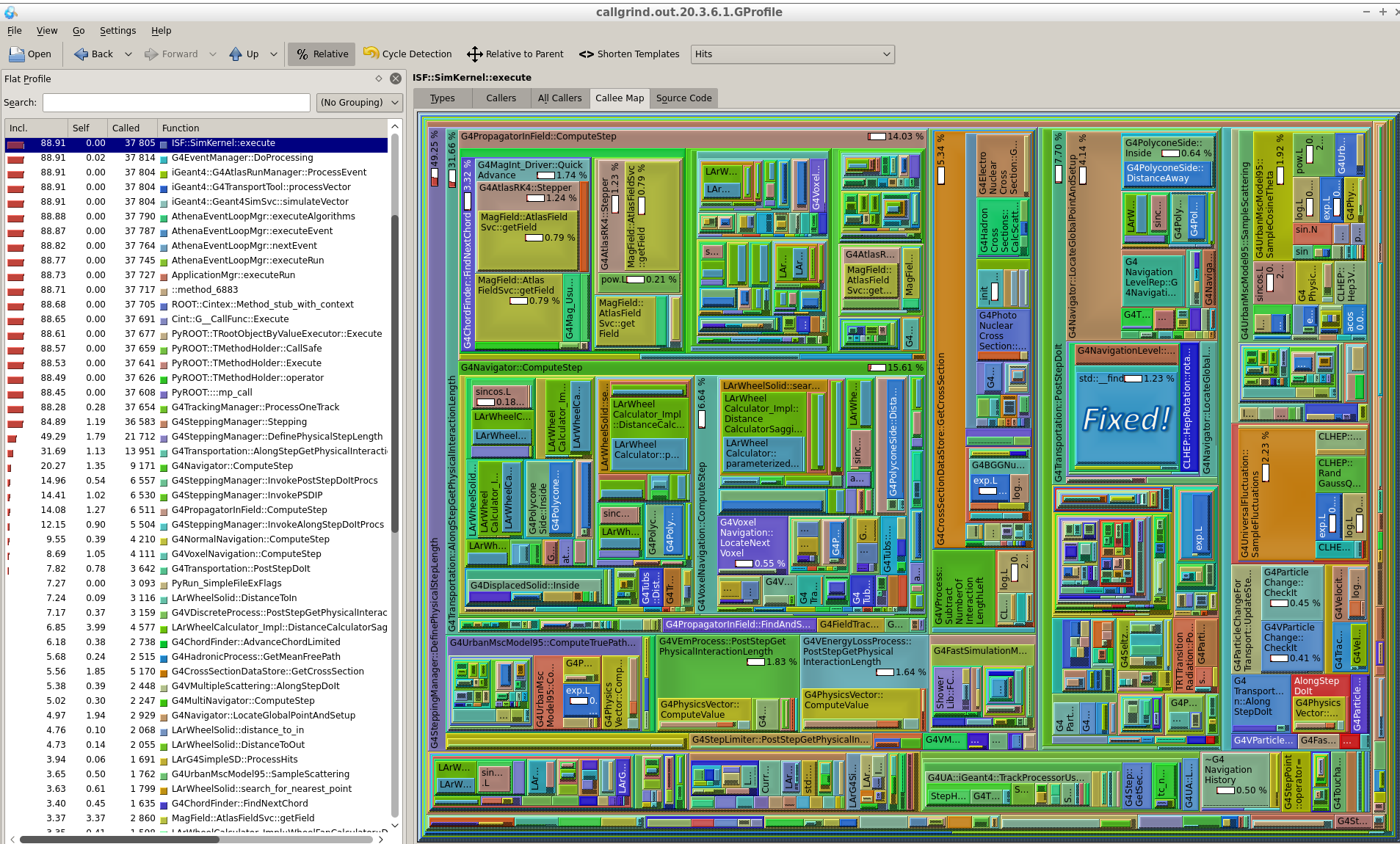
Event Time Measurement



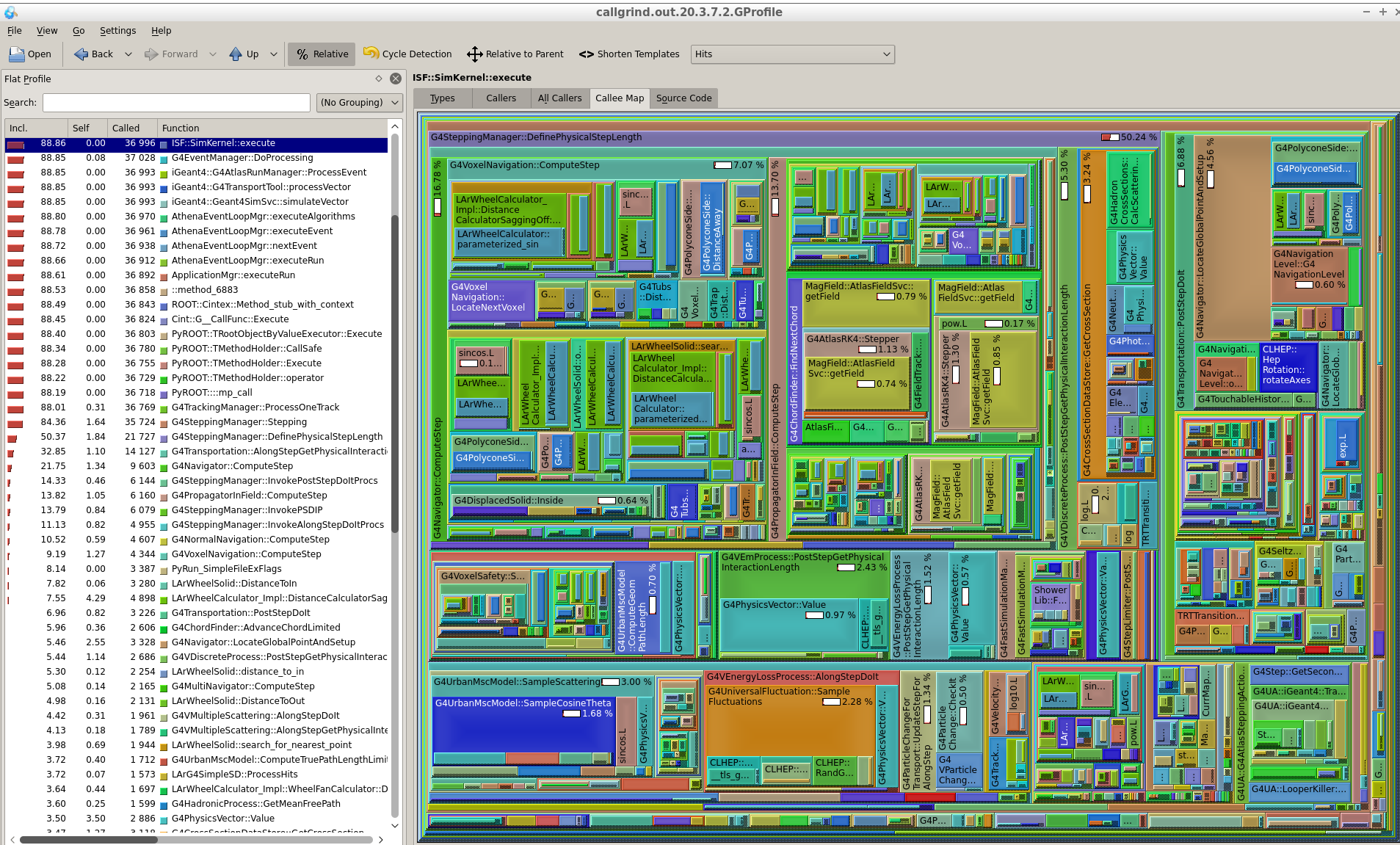
Event Time Findings

- **Impressive 15% speedup** between ATLAS MC15 and MC16, attributed to:
 - Move from G4 9.6 to 10.1
 - Roughly 6% speedup (with gcc48)
 - Move from gcc47 to gcc49
 - gcc48→gcc49 roughly 3% speedup (with G4 10.1)
 - Major ATLAS code cleanup
 - No isolated timing measurement

CPU Profile: ISF G4 9.6 gcc48 (ATLAS MC16-dev)

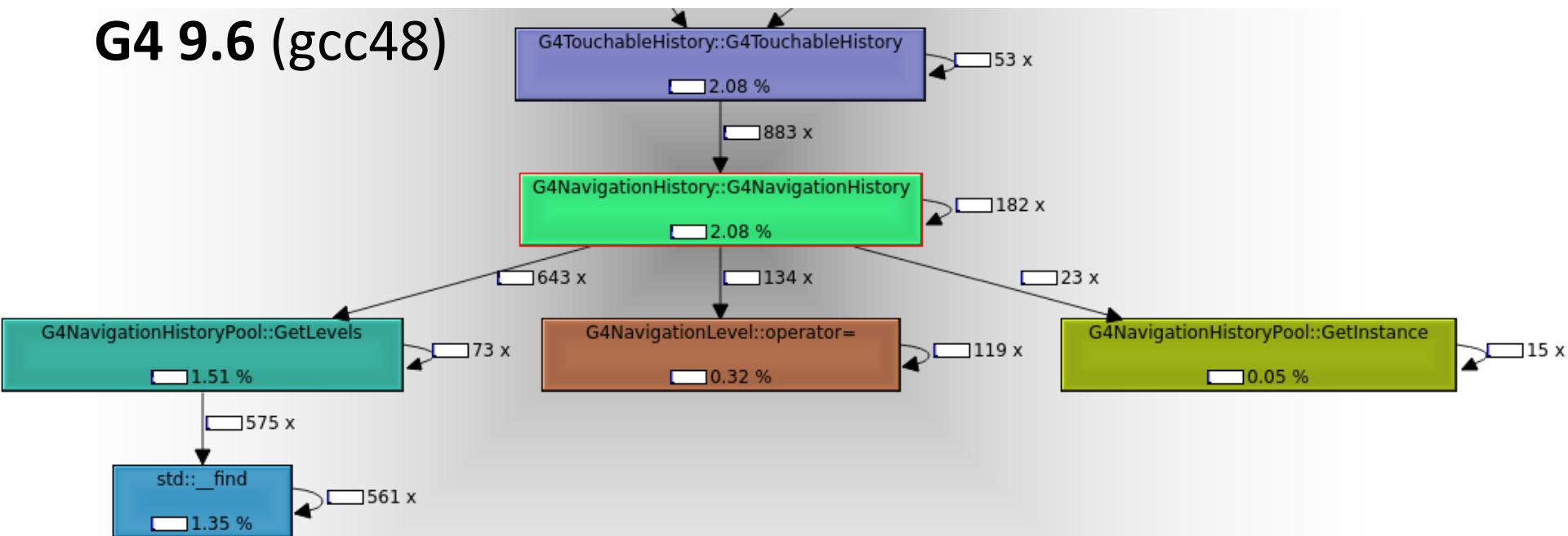


CPU Profile: ISF G4 10.1 gcc48 (ATLAS MC16-dev)

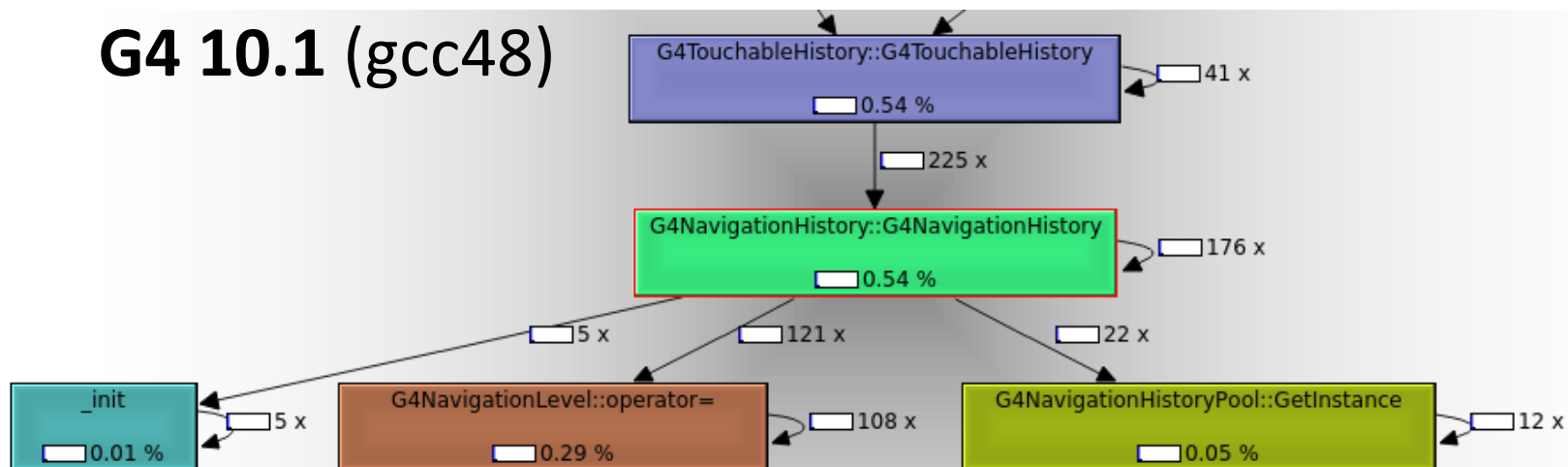


G4NavigationHistory Speedup

G4 9.6 (gcc48)



G4 10.1 (gcc48)



CPU Profile Findings: G4

- **No crucial G4 hotspots**, neither in our MC15 (G4 9.6, gcc47) nor MC16 (G4 10.1, gcc49) simulation 😊
- **Small G4 hotspot disappeared** from G4 9.6 to 10.1
 - G4NavigationHistory: call to `std::__find` removed 😊 (~1.5% job time)

CPU Profile Findings: ATLAS

- ATLAS “LAr Wheel” **Custom Solid is expensive**
 - LArWheelSolid::DistanceToIn: 7% job time
 - LArWheelSolid::DistanceToOut: 5% job time
- ATLAS Magnetic Field **became a little faster**
 - 5% job time in MC15 (G4 9.6, gcc47)
 - 3% job time in MC16 (G4 10.1, gcc49)
 - Speedup *likely* due to switch from gcc47→gcc48
- ATLAS **Sensitive Detectors** together about 4% job time
 - Almost all LAr (3.7%)
- All ATLAS **Stepping Actions** together about 2.2% job time
 - Half of it for ISF-specific SteppingAction (required for G4 integration into ISF)
- **Frozen Showers Fast Simulation** about 1.3% job time

G4SteppingManager::Stepping

G4 10.1,gcc49

