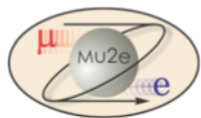


# Mu2e Geant4 Usage and Feedback

Krzysztof Genser/Fermilab/SCD  
(based on input from Rob Kutschke et al)

Geant4 Technical Forum

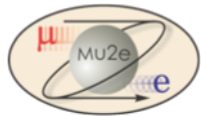
December 6<sup>th</sup>, 2012



# Introduction



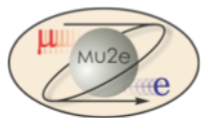
- Mu2e is an experiment searching for neutrino-less muon-to-electron conversion in the Coulomb field of a nucleus ( $^{27}\text{Al}$  target) currently under design at Fermilab
  - looking to detect the conversion even if it occurs at a rate of about  $10^{-17}$  per muon capture
  - background processes simulation is very important
- Mu2e has been using Geant4 v9.4.p02 and is transitioning to v9.5.p02 now
  - particle timing problem prevented using v9.5.p01
    - in hadElastic processes daughter particle creation times are before the creation of their parent particle
- QGSP\_BERT\_HP is the main physics list used
- Scientific Linux SLF 5 is the dominant production platform
  - migration to SLF 6 expected next year



## Introduction - cont'd



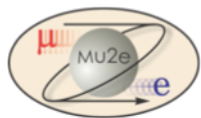
- Mu2e uses a Non-Geant4 Framework (**art**) to drive its event loop
  - supported by Fermilab Scientific Computing Division
  - used by several Fermilab experiments
  - with an increasing user base
- Geant4 also wants to own the event loop
- Until now Mu2e has been using a run manager class which inherits from G4RunManager and has BeamOn function refactored into four pieces



# Update on the List of Wishes From the last Technical Forum (in March 2012)



1. Refactor `G4RunManager::BeamOn` to allow to externally drive the event loop
  - Makoto modified `G4RunManager` accordingly (part of 9.6 release)
2. Include elements of Kevin Lynch's muon capture (exotic atoms) code in the toolkit, or provide an equivalent functionality
  - first version of modifications addressing the case of heavy target nuclei done by Vladimir Ivanchenko (mainly) and Fermilab Geant4 Group (part of 9.6 release)
3. Provide a way to access all Geant4 extensions to the PDG particle information independent of the particle creation
  - a method was provided by Fermilab Geant4 Group (Julia Y and Krzysztof) based on `G4ParticleTable::GetParticleTable()->GetIonTable()->CreateAllIon()`;
4. Indicate when Geant4 does(not) take ownership of pointees
  - pending



## List of Wishes - cont'd and New



- Regarding (2), the work related to the muon capture, Mu2e would like it to continue to improve the agreement with the previous experiments and to allow the possibility to include the experimental data to be collected in the near future (now at PSI?)
- 5. (new) Allow for a suppression of the NeutronHP package warning messages of the type:
  - /Elastic/ file for  $Z = \dots$ ,  $A = \dots$  is not found and NeutronHP will use ...
- 6. (new) Mu2e would appreciate if a list of known problems for a given release was available once the problems are reported and confirmed to help with the decision to migrate to a specific release and eliminating the need to search scattered sources once a problem is encountered

Mu2e thanks Geant4 Collaboration for accommodating its needs