

# G4RadioactiveDecay workshop

Luciano Pandola

INFN, Laboratori Nazionali del Sud

# RDM workshop at CERN

- Workshop at CERN, March 3rd and 4th, to review the status of the Radioactive Decay Module and the associated databases
  - Participants: L. Desorgher, A. Howard, V. Ivanchenko, M. Maire, LP, L. Sarmiento, D. Wright, J. M. Quesada (telecon), T. Koi (telecon)
  - Slides: <https://indico.cern.ch/event/372884/>
- Discussion items
  - Existing **bugs** (mostly reported by Michel)
    - some of them *automatically fixed* by enforcing the mutual coherence of **G4NuclideTable**, **G4RADIOACTIVEDECAYDATA** and **G4GAMMALEVELDATA**
      - Some information duplicated → can get rid of **G4NuclideTable** ?
    - Energy non-conservation due to the interface to the atomic de-excitation module following EC and IC decays
  - Maintenance and update of databases
  - Plans for future developments
    - New "exotic" decay channels, biasing, etc.
  - Testing

# Where does EM package come into the game?

- Outstanding coupling point to the EM category: **atomic de-excitation**
  - Atomic vacancy following EC decay or IT
  - At the moment, no boolean flag to switch on/off the AD, it is always on for EC and always off for IT
    - Clearly a bug → will be fixed
  - Only fluorescence produced, no Auger e- (need to minimize i/o and memory allocation)
- Eventual source of energy non-conservation (bug report #1408)
  - The G4RadioactiveDecay process does not use to allow for any local energy deposition
  - The part of the atomic binding energy which is not used to create real secondaries is lost
    - Also, cuts come into the play
    - We have now the option to generate sub-threshold secondaries
  - G4RadioactiveDecay fills the G4ParticleChange, so it must be possible to fix "a posteriori" the energy conservation

# Extension to super-heavy elements

- Proposal to extend the RDM to super-heavy nuclei ( $Z > 100$ )
  - Will need atomic de-excitation data, as **binding energies**, etc
    - Theoretical calculations and predictions exist, so the fluo/ database could be extended "easily"
  - We are **not** going to use super-heavy elements in any **G4Material** (but only as primary particles), so we don't need to provide data files for bremsstrahlung,  $dE/dx$ , etc.
    - The highest-Z element that could be sensibly used for a G4Material is – in my knowledge – Am ( $Z=95$ ), because of AmBe sources
- The EM code has quite a lot of hard-coded if-blocks like

```
if (Z>5 && Z<100){
    [do things]
}
```

  - Driven by the 250-eV cut ( $Z>5$ ) and by the availability of data files ( $Z<100$ )
  - Need to properly get rid of (or cure) these blocks