PhysicsLists in Geant4
Advanced Examples

http://www.ge.infn.it/geant4/examples

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On behalf of the Advanced Examples Working Group

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Mission

Investigate, evaluate and demonstrate Geant4 capabilities in various experimental environments.

Provide guidance to Geant4 users in realistic experimental applications.

Provide feedback to Geant4 developers about successful results, problems etc.

Identify requirements for further Geant4 improvements and extensions to address new experimental domains.
Advanced Examples

- Released
- In preparation

Wide experimental coverage
- HEP
- Space science/astrophysics
- Medical physics
- Radiobiology
- Detector technologies

Wide Geant4 coverage
- Geometry features
- Magnetic field
- Physics (EM and hadronic)
- Biological processes
- Hits & Digis
- Analysis
- Visualisation, UI

1. air_shower
2. brachytherapy
3. cell_irradiation
4. composite_calorimeter
5. cosmicray_charging
6. gammaray_telescope
7. hadrontherapy
8. human_phantom
9. lAr_calorimeter
10. medical_linac
11. microbeam
12. nanotechnology
13. purging_magnet
14. radiation_monitor
15. radioprotection
16. raredecay_calorimetry
17. Rich
18. Tiara
19. underground_physics
20. xray_fluorescence
21. xray_telescope
Physics Lists in Advanced Examples

- **PhysicsLists**
  - Ad hoc in most examples: transparent, easy to understand
  - A couple of examples use pre-packaged Geant4 PhysicsLists

- **Goal:** document quantitatively the validation of the physics selections of all advanced examples
  - Objectively supported physics options rather than “educated guess” PhysicsLists
  - Work in progress: it took 2 years to validate the PhysicsList of hadrontherapy!

- **Strategy**
  - **Generic** validation studies of processes/models used
  - **Specific** validation studies with ad hoc experimental data
**Physics in Advanced Examples**

of interest for space applications

- Brachytherapy
- Cell_irradiation
- Cosmicray_charging
- Gammaray_telescope
- Hadrontherapy
- Microbeam
- Nanotechnology
- Radiation_monitor
- Radioprotection
- Underground physics
- Xray_fluorescence
- Xray_telescope

- LowE EM for e,
- Biological processes
- LISA (space charging)
- Standard EM physics for e,
- Optimised EM/hadronic for p up to ~100 MeV
- For TRIM/SRIM fans
- EM physics at the <100 nm scale
- Effects on components: packaging
- GCR and SPE environments
- LowE EM processes, radioactive decay, neutrons
- X-ray fluorescence, Auger electrons
- XMM-Newton/Chandra like

**Other examples may be relevant to space applications too**

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Validation

1. air_shower
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17. Rich
18. Tiara
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20. xray_fluorescence
21. xray_telescope

1. Generic + Specific
2. Generic + Specific
3. Specific
4. Specific
5. Specific
6. Generic + Specific
7. Not pertinent
8. Not pertinent
9. Generic + Generic + Specific
10. Generic + Specific
11. Specific
12. Specific
13. Specific
14. Specific
15. Generic (EM, partly hadronic)
16. TNS?
17. NSS 2006?
18. Generic + Specific
19. Published
20. Published
21. Published

Existing, to be published
In preparation

Under development

Under development

Apologies for any omissions
Please let me know of other pertinent validation results and publications
This lecture

**brachytherapy**
- LowE EM processes for e,
- How to use them below 1 keV for precise dosimetry

**hadrontherapy**
- LowE EM processes for p (ICRU49 model)
- Hadronic physics validated and optimised up to 100 MeV

**radioprotection**
- LowE EM processes for e, p, ions
- Hadronic processes relevant to GCR/SPE environments