User Requirements

Medical Physics

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Geometry

Originator: A. McNamara, MGH

- **Develop a string volume**
  - to model DNA
  - e.g. defined by coordinates and radii at each coordinate
- **Applications: study of radiation effects at nanoscale**
- **Status: new**

Physics: new physics models (1)

- **Not from one originator only: from papers, conferences, etc.**
- **Develop ad-hoc track structure physics models for nanomaterials**
  - Graphite, gold, platinum, gadolinium, iodine
  - Similar to Geant4-DNA
- **Applications: nanomedicine**
- **Status**: **in progress**
  - Models for silicon available
  - Models for gold under development: S. Incerti and D. Sakata, CENBG

Physics: new physics models (2)

- **Originator: Elke Braeuer-Krisch, ESRF, France**
- **Modeling of x-ray optics**
  - E.g. Model surface effects
- Relevant for the Synchrotron Radiation community
- **Status: New**

Physics validation

Not from one originator only: from papers, conferences, etc.

- **Validate e.m. and hadronic physics models in set-ups of interest**
  - KV, MV beams, protons and heavier ions (E < 400 MeV/nucl)
- **Validate e.m. physics models in**
  - Non electronic equilibrium / at the interface between different media / high spatial resolution
  - Dictated by small field X-ray radiotherapy treatments (e.g. tumors in lungs)
  - Originator: S. Guatelli, CMRP, UOW.
- **Validation of bremsstrahlung process for targets used in radiotherapy (such as tungsten), energy range: 6-15 MeV.**
  - Progress: validation up to 2.8 MeV. Lack of exp data above that energy
  - Originator: B. Caccia, Istituto Superiore di Sanita', Rome, Italy
- **Validate Geant4 physics lists**
- **Status: In progress**
  - G4MedPhys Benchmarking Group (e.g. See parallel sessions 2A and 4A)
  - Medical physics groups providing high resolution measurements with small uncertainties

Regions

- **Originator: MGH**
- **Easier assignment of physics processes/model by geometry**

- **Status: in progress**

Visualisation

- **Originator: MGH**
- Visualisation capability may be improved for patient CTs and cell geometries with DNA components
  - gMocren was a nice approach, but it seems to have stopped being developed
  - using HepRApp only works for a limited amount of DNA otherwise the files get too big.
  - OpenGL is extremely slow to draw the DNA
  - Maybe system to hide smaller structures when the image resolution can't resolve them anyways to speed up the display, but visible when zooming in.
- **Status: new**

G4 medical physics framework

- **Originator: D. Cutajar, Centre For Medical Radiation Physics, UOW.**
- One main difference between one of the most heavily used toolkits in medical physics, EGSnrc, and Geant4 is that EGSnrc has "generic" codes (DOSRZnrc, FLURZnrc, BEAMnrc etc..)
  - Easily customable MC applications for medical physics via GUI
- Develop a Geant4 "generic" framework for particular tasks (e.g. X-ray medical linacs), where
  - the physics packages have been verified and set,
  - the users can create geometries, radiation fields and sensitive regions with minimal ease
- **Status: in progress**
  - Functionality added in Geant4 to support this: scoring mesh, DICOM interface, validation of physics lists, etc
  - TOPAS

Other (1)

- **Originator: H. Byrne, University of Sydney**
- Provide a central share site/library for phase space files from different medical beams
- **Status: new**

Other (2)

- **Originator: B. Caccia, Istituto Superiore di Sanita', Rome**
- Provide a tool to teach Geant4 more easily to medical physicists
- **Status: in progress**
  - Development of Geant4 hands-on courses targeted to medical physicists (e.g. S. Guatelli)
  - TOPAS