2018
Low Energy EM physics workplan

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January 26th

CERN

Based on census and discussions

1) Low Energy EM Physics

(*) if time permits

1. **Livermore related models**
   1. High precision unpolarised photoelectric absorption model by Jeremy B
      - will complement Jeremy's Compton model in « option4 » Standard EM physics constructor
      - revision of atomic momentum distributions of ground state atoms
      - development is on-going and validation will start soon
      - polarised version is also foreseen, in combination with polarised Compton model
   2. Polarized pair production in nuclear field by Gerardo D and Francesco L
      - fully parameterized, no nuclear shielding
   3. Pair production in the electron field by Gerardo D and Francesco L (*)
   4. Reorganize & verify electron ionisation / stopping power by Vladimir I.
2. **ICRU73 models**
   1. Verify ionisation at high energy by Alexander B. and Vladimir I.
3. **Atomic deexcitation: shell ionisation cross section models for protons and alphas**
   1. Inclusion of soa ANSTO database of cross sections after publication by Samer B., Susanna G., Alfonso M., Sébastien I.
   2. Extension of Reis and Taborda model to ions by Miguel R. and Ana T.
   3. Validation by Samer B., Susanna G., Alfonso M., Sébastien I.
4. **MicroElec models**
   1. New metals (Al, Ag) by Mélanie R. and Christophe I.
5. **Test and validation in the context for ESA EXACRAD project** by Paolo D. et al
   1. Electron backscattering
   2. Proton ionisation
   3. Soft proton scattering vs angle
6. **Validation of photon physics** by Susanna G., D. Bolst
7. **Validation for medical physics**
   1. G4MSBG by all
   2. validation of Geant4 for incident alpha, carbon and oxygen beams in water phantoms, of relevance for heavy ion therapy (Bragg Peaks and fragmentation) by Susanna G. et al.

2) Very Low Energy EM Physics

1. Release of **gold specific models for electrons** by Dousatsu S., Ioannina team, Sebastien I.
   - Just published
2. **Extension of Ioannina models up to 1 MeV** by Ioannina team, Wook Geun S., Sebastien I.
3. **Replacement of PW elastic model** by Wook Geun S., Marie-Claude B., Ioanna K., Sebastien I.
4. New **cross sections for e- and ions for DNA** by Ziad F. and Ziad E. B.
   - Ionisation done
5. **Extension of p, H models to relativisitc energies** by Miguel C., Ziad F., Sebastien, …
6. **New models for gold based on the DRF** by Ioanna K., Dousatsu S., Sebastien I., Susanna G.
7. **New CPA100 e- models for DNA bases** by Marie-Claude B., Wook Geun S., Sebastien I.
8. **Propane and nitrogen cross sections from Ptra** by Heidi N., Carmen V.

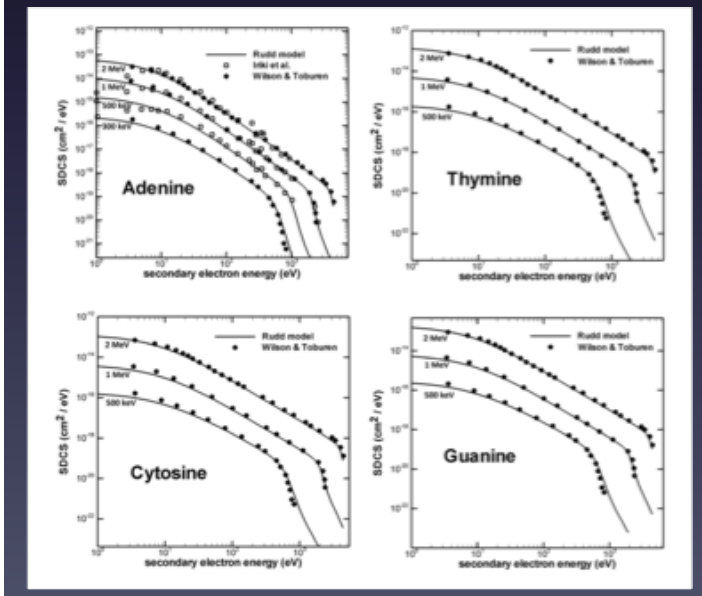
2018-2019

J. Appl. Phys. 122 (2017) 014701 (link)

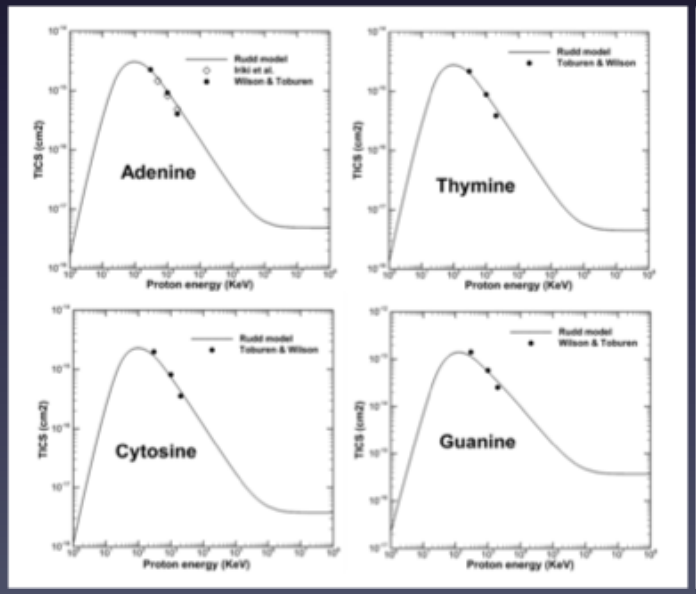
Cross sections for bio-materials

- New model describing ionisation of the four bases of DNA (adenine, thymine, cytosine and guanine) by incident protons, by Z. Francis (St Joseph U., Lebanon)
- large energy coverage: 1 keV – 10^8 keV
- based on the relativistic analytical Rudd approach, fitted to experimental data
- will be publicly released in the near future

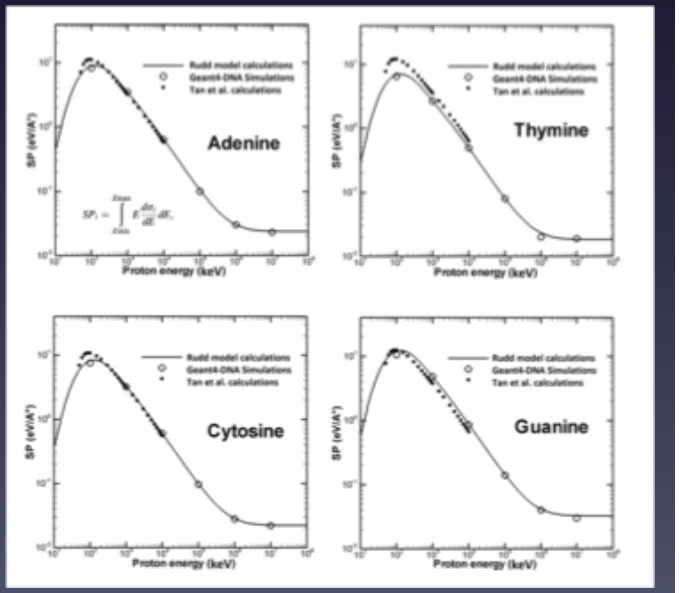
Single differential cross section



Total cross section



Stopping power



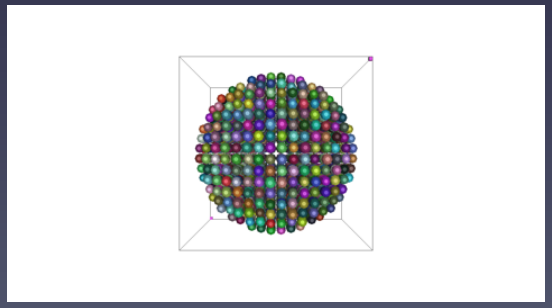
3) Chemistry

1. Alternative **3D IRT** debug, improvement and publication by Mathieu K. and help from colleagues
2. Systematic verification of **G-values from chem4** by Jose RM, Wook Geun S., Mathieu K., Sebastien I.
3. **Revision of parameters** for liq. Water & DNA by Jose RM, Wook Geun S., Mathieu K., Sebastien I.
4. **Addition of scavengers & reactions** (DMSO, glycerol) (*)

4) Geometries

1. **Replacement of « wholeNuclearDNA » example** by Hoang T., Nicolas T., Carmen V., Martha B.
   - Whole physics+chemistry+geometry simulation chain
2. Delivery of **Molecular-DNA application** based on IRT (*)
3. Inclusion of **CPOP** (*) (in collaboration with GATE)
4. Create a **library of geometries of biological targets** (*)

http://cpop.in2p3.fr



Third Geant4 International User Conference

at the Physics - Medicine - Biology frontier

- **29-31 October 2018, Bordeaux, France**
- Topics
  - imaging, classical radiotherapy, including brachytherapy and targeted radioimmunotherapy, protontherapy, hadrontherapy, radiobiology (Geant4-DNA), detector development, computing
- under the auspices of the **Geant4 Collaboration**
- peer reviewed regular papers in EJMP / Physica Medica (Elsevier) in full open access and free for authors