

The meeting of the ICRM Gamma-Ray Spectrometry Working Group was held in Paris, in the building of the Laboratoire National d'Essais, on November 26-27<sup>th</sup>, 2006.

Sixteen participants gathered ([List of participants](#)) and the meeting went off according to the proposed agenda:

### Monday November 27<sup>th</sup>

9 h 30	Welcome - Information	Marie-Christine Lépy
9 h 45	<a href="#">Presentation MCNP/VGSL</a>	Romano Plenteda
10 h 05	<a href="#">Comparison GESPECOR/GEANT</a>	Octavian Sima
10 h 25	<a href="#">Introduction to GEANT4</a>	Santiago Hurtado
10 h 45	<i>Coffee break</i>	
11 h 15	<a href="#">Presentation PENELOPE</a>	Marios Anagnostakis
	<a href="#">Comment on efficiency simulation</a>	Marios Anagnostakis
11 h 35	<a href="#">Presentation DETEFF</a>	Miguel Jurago Vargas
11 h 55	<a href="#">Exercice synthesis</a>	Tim Vidmar
12 h 15	Discussions	
12 h 45	<i>Lunch</i>	
14 h 15	<a href="#">Presentation TRIPOLI</a>	Yi-Kang Lee
14 h 45	Discussions by groups according to the Monte Carlo code used	
15 h 45	<i>Coffee break</i>	
16 h 00	Synthesis of the group discussions	
17 h 00	<i>End</i>	

### Tuesday November 28<sup>th</sup>

9 h 30	Monte Carlo action : further run abstract for ICRM 2007	
10 h 10	Demonstration GESPECOR	Octavian Sima
10 h 30	Demonstration EFFTRAN	Tim Vidmar
10 h 50	<i>Coffee break</i>	
11 h 10	Gamma Spectrometry WG possible actions Efficiency calibration in the energy range around 100 keV Correlations Coincidence summing corrections	
12 h 15	ICRM Web page and Forum: content – way of exchanging information	
12 h 45	<i>Lunch</i>	
13 h 40	Informal discussions – software presentation	
14 h 15	Conclusion	
14h 30	<i>End</i>	

The presentations are included as pdf file.

## 1. Monte Carlo action

The main goal of the meeting was to examine the results obtained during the first step of the Monte Carlo exercise and to discuss about further developments.

The Monte Carlo action, led by Tim Vidmar, started on January 2006. The participants were asked to run Monte Carlo codes to compute full energy peak and total efficiencies for three simple sample-germanium detector geometries, for a list of energies from 45 keV to 3 MeV. The dead line for the first series of results was June 30<sup>th</sup>, 2006.

Eighteen different participants are involved in the action and six different Monte Carlo codes are used: five generalist codes (MCNP, GEANT, PENELOPE, EGS, TRIPOLI) and one specific (GESPECOR); some participants used several codes.

The first part of the meeting included different presentations to point out the main characteristics of each code.

During its presentation Octavian Sima pointed out some important features of the codes that could lead to significant differences: cross-sections tables (4 % bias between XCOM and GEANT for the low-energies), and energy cut-off (including or not the Ge escape in the total efficiency computation).

Tim Vidmar presented the whole set of results, according to the codes used. Contrarily to what was expected, rather spread results were observed (except for geometry #1). However, relative results (example ratios from Geometry 3 to Geometry 2) show less discrepant results.

Thus, some questions were raised:

- The differences within a single code are large, much larger than initially expected: Errors in geometry input?
- Better results for total efficiencies: Problem of peak-area definition?

These *a priori* not satisfactory results were discussed and some clues were given to try to explain the differences (cross sections, efficiency definitions, size of the bins used, ...).

Small “working groups”, according to the code used, discussed together to determine the significant parameters for each method and a “code leader” was appointed to transfer the remarks linked to each code to all the relevant participants, and to collect further results :

MCNP : Romano Plenteda

GEANT 3 : Tim Vidmar

GEANT 4 : Santiago Hurtado

PENELOPE: Marios Anagnostakis

Remarks:

As two series of results was obtained with GEANT, according to different cross sections, the results with this code will be considered separately.

Concerning PENELOPE, at last 3 different versions were used (2001, 2003 and 2005); Eduardo Garcia-Toraño contacted Francesco Salvat to check whether there was any change in the cross sections. The reply of F. Savat was “The photon cross sections used in the versions 2001 to 2006 of Penelope are essentially the same. The only difference is that version 2006 uses a denser grid of energies and, therefore, slightly more accurate interpolation. I believe this has a negligible impact on simulation results.”

Finally, Tim Vidmar drew the main conclusions of the discussions as follows:

“At the meeting in Paris, we analyzed the results of the intercomparison exercise gathered so far and decided to improve them, which will require additional calculations, but in a reduced amount.

Given that the spread in the results within individual groups is larger than expected, we decided to redo the calculations for geometries #2 and #3 for a reduced set of energies, employing a well defined set of control parameters for each code and a precise definition of the full energy peak. We also agreed that no variance reduction techniques should be applied in this second run of calculations.

The agreed definition of the full energy peak adopted for the purpose of this exercise is that a spectrum of 1000 channels should be formed for each of the energies (and geometries) considered, with channel 1000 corresponding to the (each) simulated energy. The number of counts in this channel, divided by the number of simulated events then defines the full-energy-peak efficiency. For the energy of 45 keV each channel should thus have the width of 45 eV.

As far as the control parameters of each code are concerned, have been designated for each group (each code), who will be contacting you shortly with the details. When reporting the results, the group leaders should also be provided with the listing of the cross-sections used in the simulation, as these turned out to differ considerably from code to code.

The list of energies for which the calculations should be repeated is 45, 60, 120, 500 and 2000 keV. In order to reduce the computation time, we are only looking for a relative precision of the results of 0.3% this time, as opposed to the initial value of 0.1%.”

The new results are expected on December 31<sup>st</sup>, 2006, to allow Tim Vidmar to prepare an updated abstract for the ICRM 2007 conference.

## 2. Other topics

Some proposals on other GSWG actions were discussed:

- Fitting of efficiency curves and correlations: Marie-Christine Lépy asks the question of correlations in efficiency curves: are they currently taken into account or not? Eduardo Garcia-Toraño mentions that a previous comparison of this kind was made in the past: “Comparison of fitting procedures of efficiency curves”.
- Efficiency calibration in the energy range around 100 keV : the interest of this subject is underlined, however, there is no
- Coincidence summing corrections: the subject is of main interest for all participants. During the 2005 ICRM meeting, it was decided to momentarily postpone the action and to start by the Monte Carlo action, as this one could bring precious information before dealing with the more complex problem of coincidence. We have been told that a EUROMET action on this topic is under consideration. It would be advisable to have a common thought on this subject.
- Comparison of peak area determination: Marios Anagnostakis underlines the interest of such comparison. It is noted that comparisons of gamma packages are currently organized by IAEA.

Remark: After checking on the IAEA web page, there are test spectra:

“IAEA Gamma-ray Spectra for Testing of Spectrum Analysis Software”, Nucl. Instr. Meth. A387 (1997) 410-415.

And there was a recent action of software comparison: “The 2002 IAEA intercomparison of software for low-level  $\gamma$ -ray spectrometry” by Dirk Arnold, Menno Blaauw, Stjepko Fazinic and Vladimir P. Kolotov, Nucl. Instr. Meth. A536 (2005) 196-210.

It is pointed out that some proposed actions could also be part of the “Low Level” working group activities.

### 3. GSWG Web page and forum

Up to now, the recent web page of the GSWG contains little information.

Moreover, as requested by some members of the working group, a forum has been created and is very few used. Some suggestions are given to update the web site: some basic references could be included and also recent publications.

Marie-Christine Lépy reminds that this GSWG Web page is the site of the participants of the WG: each one is welcomed to include any useful information, to make any comment.

The report of this meeting together with the presentations will be included in the web page as soon as possible.