

## Progress report on the photon dosimetry at CMI

Vladimír Sochor  
Czech Metrology Institute  
Inspectorate for Ionising Radiation  
Prague, Czech Republic

### Facilities

Between September 2003 and January 2004 a massive reconstruction of the CMI photon laboratory was performed; dismantling and reinstallation of most of the equipment was necessary, including dismantling and reinstallation of the X-ray unit. During this reconstruction, one new 160 kV HV generator and control electronics for the 160 kV X-ray unit were added, so the original X-ray set (one 160 kV tube and one 320 kV tube plus two HV generators, one of them interchangeable between the two tubes) was separated into two independent X-ray units (160 kV and 320 kV), but with shared shielding case and filter wheel. The "light" irradiation room is shown in Figure 1 after reconstruction

Figure1. The "light" irradiation room after reconstruction



A second control room was built, allowing control of both irradiation rooms of the CMI photon dosimetry laboratory from two independent locations, i.e. at present it is possible to utilise both irradiation facilities simultaneously. This improvement was enforced by the increased amount of the performed verification services. The reconstruction also involved an implementation of a new LAN-based control system for remote control of the sources and carriage movement from either control room. Presently, the low level layer of the system is functioning reliably, however the high level of the new control system is under tests, so it's used simultaneously with the original planning system.

This reconstruction interrupted the services of the photon dosimetry laboratory for almost 5 months.

## Gamma dosimetry

In 2003 and 2004 some of the collimated beams were simulated using the MCNP4 code. The purpose of this simulation was to get more detailed information of the energy distribution of photons and to gain some experience with the code, as it will be used for other calculations (e.g. for corrections calculation for intended graphite cavity chambers, see below). The results of the simulation were in a good agreement with the experimental values (longitudinal and transversal profiles of the beams).

Figure 2. Monte Carlo simulation of the Chisobalt  $^{60}\text{Co}$  unit, visualization using the Sabrina code

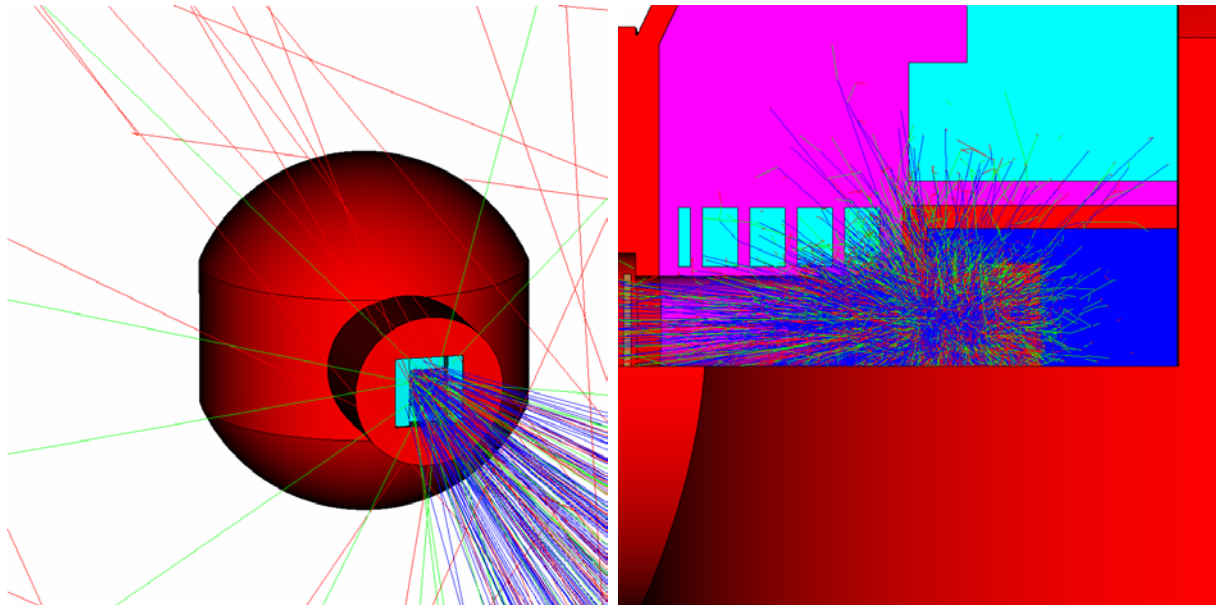
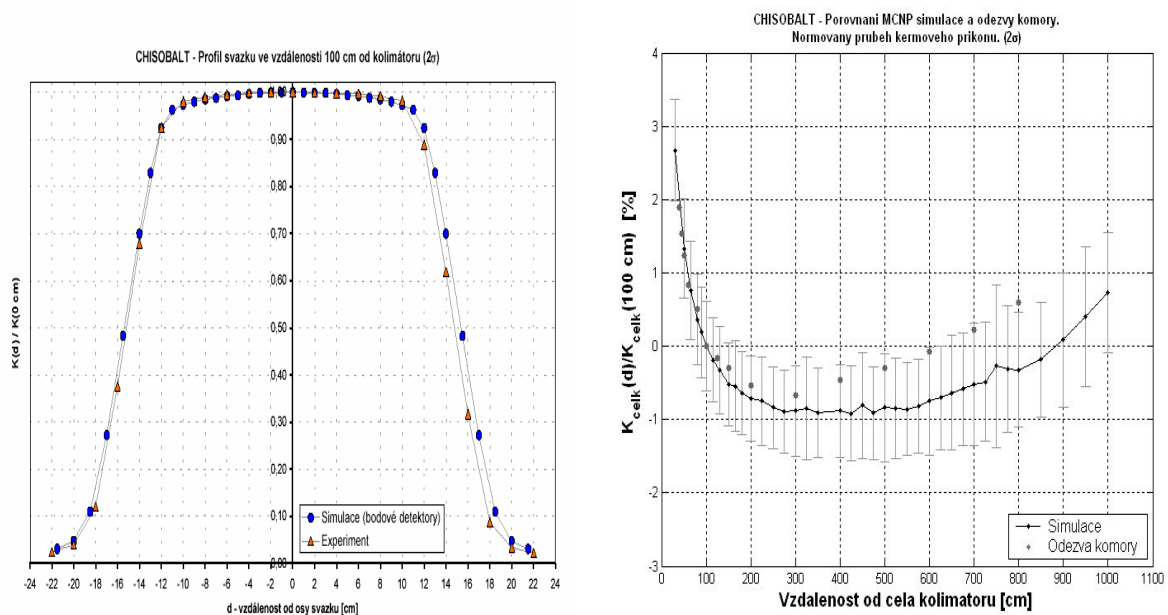
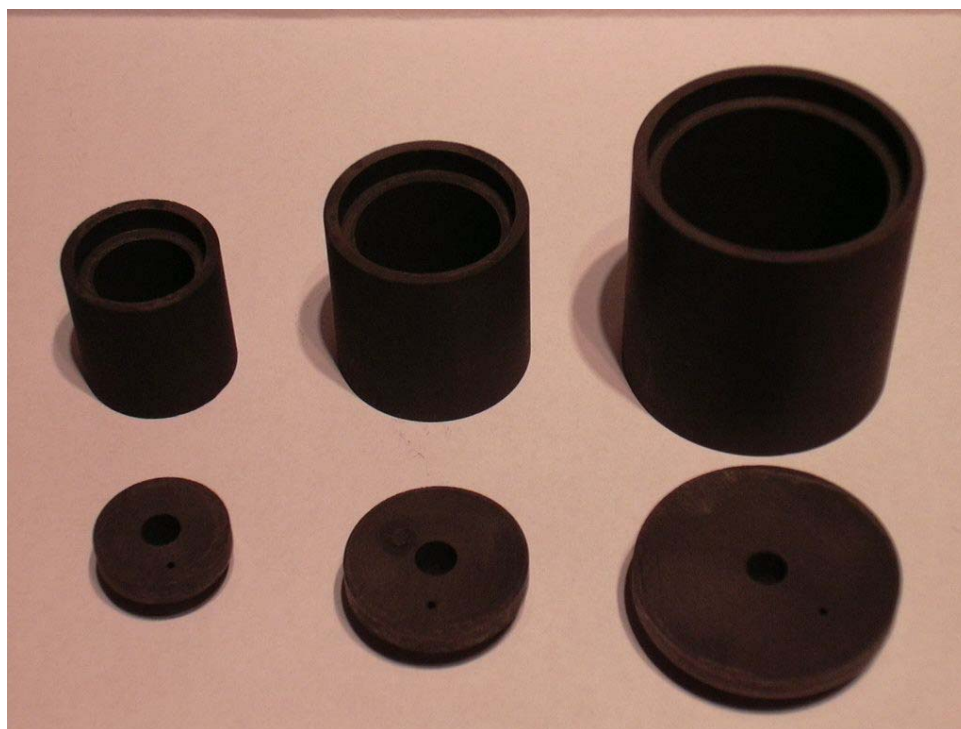


Figure3 Comparison of the simulated and experimental data: transversal and longitudinal profiles of a collimated beam



In 2004 CMI decided to continue development of the primary graphite cavity chamber for the high energy range ( $^{60}\text{Co}$ ). Years ago, CMI already manufactured a set of three graphite cavity chambers of different volumes, but this development was interrupted about twelve years ago, when it had been decided to rely on the secondary standard linked to a primary standard abroad instead. Presently, the preliminary experiments with these chambers are performed (determination of the measuring volume, extrapolation measurements of  $k_{\text{att}}$ , comparison with the past experiments).

Figure 4 Outer shells of the three graphite cavity chamber under development



### **X-ray dosimetry**

After the completion of the above mentioned reconstruction in 2004 a set of the narrow spectra qualities (N10 – N30) was standardised using the Radcal standard chamber RC6M calibrated in October 2003 at BEV, Austria. These qualities are generated by the “new” 160 kV X-ray unit.

### **International activities**

During 2003 and 2004 the CMI photon dosimetry laboratory took part in the TLD audit organised by IAEA for the SSDLs.

The CMC data file in the dosimetry section has been revised, accepted and published.

### **Services performed**

- Calibration of irradiation facilities (4 visits) in Czech Republic
- Verification of measuring instruments acc. to the Czech Metrology Act No. 505/1990 (about 500 pieces in the photon dosimetry laboratory, 5 in-field measurements)
- Type approval of measuring instruments (3 completed, 5 pending) acc. to the Czech Metrology Act No. 505/1990

### **Personnel**

The current status of the staff is as follows:

1 scientist (FTJ), 1 scientist (60 % PTJ), 1 technician (FTJ), 1 technician (40 % PTJ)

This is quite sufficient for routine services (verifications) in field of radiation protection and high energy ( $^{60}\text{Co}$ ) dosimetry, however the dosimetry laboratory unfortunately suffers by a lack of staff, especially in the area of X-ray dosimetry development.

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