

## Progress report on photon dosimetry at the CMI (April 2007)

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### Maintenance and development of standards

#### Monte Carlo simulation of the irradiator units

Since 2003 all the collimated beams utilised in CMI were simulated using the MCNP4 (and recently MCNPX) code. The purpose of this simulation was to get more detailed information about those parameters, which cannot be measured easily (e.g. energy distribution of photons), and to gain some experience with the code, as it will be used for other calculations. The results of the simulation were in a good agreement with the experimental values - as a measure of simulation accuracy the longitudinal and transversal profiles of the collimated beams were used.

In August 2006 a new Cs137 source (appr. 18 TBq) was bought and installed, so recently a simulation of this source was created and compared with the experimental results.

#### Development of primary graphite cavity chamber

Years ago, CMI manufactured a set of three graphite cavity chambers of different volumes for the high energy range ( $^{60}\text{Co}$ ), 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. In 2004 CMI decided to resume the development of the primary graphite cavity chamber based on this older project.

Presently, the simulation of the chamber using a MCNP code was created; it is used for calculation of some correction factors and for research of chamber parameters (like influence of small air cavity at the base of central electrode, influence of shape irregularity to the uncertainty).

Simulation results were compared with measured values with a good agreement.

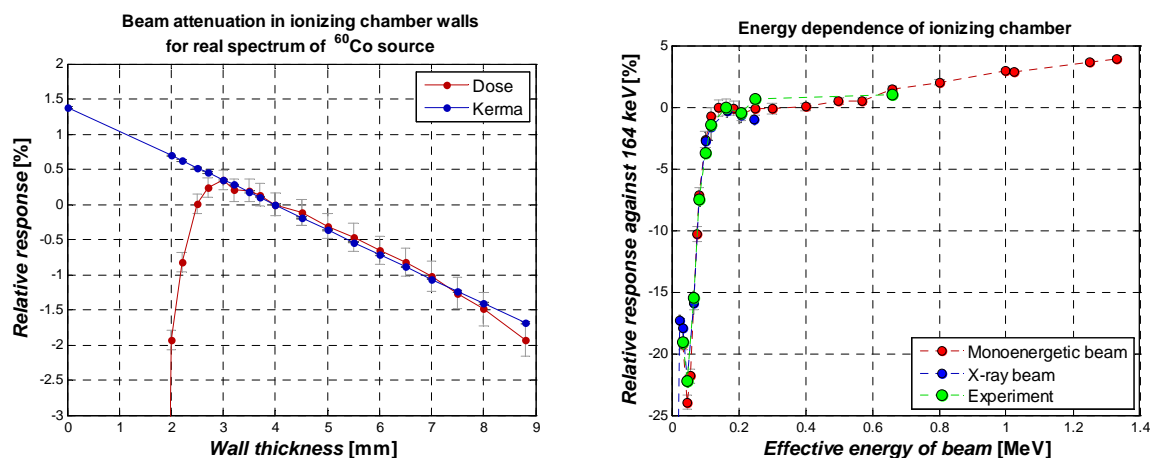


Figure: Simulation of graphite cavity chamber (attenuation in a wall and energy dependence of the chamber)

### Development of extrapolation chamber for dosimetry of beta radiation

CMI is developing an extrapolation chamber for standardisation for beta radiation. It is intended for future standardisation of absorbed dose from beta sources, mainly ophthalmic applicators.

Model of an ophthalmic applicator chamber using a MCNP code was created; it will be used for study of more complex shapes of sources in comparison to the simple geometry used for the standardisation.



Figure: General view of the extrapolation chamber

### **International activities**

In 2005 and 2006 the CMI photon dosimetry laboratory participated in the TLD audit organised by IAEA for the SSDLs.

In 2005 CMI participated in the Euromet project No. 813 (double key comparison).

### **Services performed**

Main task: routine verification and calibration of measuring instruments according to the Czech Metrology Act.

- Calibration of irradiation facilities (3 visits) in other authorised metrology centres
- Verification of measuring instruments acc. to the Czech Metrology Act No. 505/1990 (yearly appr. 400 instruments for radiation protection, 10 standard class instruments for radiotherapy, 20-30 instruments for X-ray diagnostics, 2-3 systems of personal integral dosimetry (films and TLDs))

- Type approval of measuring instruments (13 new and extended approvals) acc. to the Czech Metrology Act No. 505/1990

In November 2006, the reference chamber Exradin A4 (30 ccm) was calibrated at the OMH primary laboratory in terms of air kerma.

### **Personnel**

Current status of the staff in the photon dosimetry laboratory of CMI is as follows:

1 scientist (FTJ), 1 scientist (60 % PTJ), 2 technicians (FTJ), 1 technician (20 % PTJ)