

**Recent Activities in Activity Measurement at the  
Czech Metrology Institute**

P. Dryák, J. Sochorová, P. Auerbach, M. Havelka, P. Kovář  
April 2007

The work during 2005-7 was focused on these areas:

- 1. Routine activities**
- 2. International comparisons**
- 3. Digital coincidence counting**
- 4. TDCR**
- 5. Spectrometry and decay data evaluation**

### **1. Routine activities**

More than 20 radionuclides ( $^{51}\text{Cr}$ ,  $^{54}\text{Mn}$ ,  $^{56}\text{Mn}$ ,  $^{55}\text{Fe}$ ,  $^{56}\text{Co}$ ,  $^{57}\text{Co}$ ,  $^{60}\text{Co}$ ,  $^{65}\text{Zn}$ ,  $^{88}\text{Y}$ ,  $^{85}\text{Sr}$ ,  $^{89}\text{Sr}$ ,  $^{90}\text{Sr}$ ,  $^{109}\text{Cd}$ ,  $^{113}\text{Sn}$ ,  $^{125}\text{I}$ ,  $^{129}\text{I}$ ,  $^{131}\text{I}$ ,  $^{133}\text{Ba}$ ,  $^{134}\text{Cs}$ ,  $^{137}\text{Cs}$ ,  $^{139}\text{Ce}$ ,  $^{152}\text{Eu}$ ,  $^{192}\text{Ir}$ ,  $^{203}\text{Hg}$ ) have been measured for the production of standards.

### **2. International comparisons**

CMI has participated in the CCRI(II)-K2, I-125(2) and CCRI(II)-K2, Fe-55 comparisons. Two radionuclides –  $^{56}\text{Co}$  and  $^{131}\text{I}$  were submitted to the International Reference System. In the frame of “The IAEA-CU-006-09-CCRI(II) supplementary comparison on the determination of gamma emitting radionuclides”, soil, water and grass samples were measured.

CMI was also involved in the project CRP E2.10.05, „Harmonization of quality assurance practices for nuclear medicine radioactivity measurements“

### **3. Digital coincidence counting**

In recent years, the digital coincidence counting system for absolute activity measurement has been developed in the Czech Metrology Institute. Current research is focused on utilization of the system for more precise setting of coincidence parameters of the electron capture nuclides, e.g.  $^{88}\text{Y}$ ,  $^{57}\text{Co}$ ,  $^{56}\text{Co}$ .

In case of  $^{56}\text{Co}$ , the most serious problem is the presence of  $^{57}\text{Co}$  impurity in the  $^{56}\text{Co}$ -solution. The potentialities of the digital coincidence system for separation of  $^{57}\text{Co}$  pulses are checked.

### **4. TDCR**

The mechanical parts and electronic components were completed and tested. The first measurements ( $^{14}\text{C}$ ,  $^3\text{H}$ ) were performed. Typical efficiency in the  $^3\text{H}$  double coincidence channel was about 50%. New software for activity determination is developed.

## 5. Spectrometry and decay data evaluation

A model of HPGe coaxial detector and shield has been developed for MC full-peak efficiency and total efficiency calculation.

Full-peak efficiency was calculated for 0.8 L volume pressure cylinder and photon energy 1293 keV (Ar-41).

Gaseous radionuclide Ar-41 was standardized for calibration and verification of stack monitors in nuclear facilities.

Full-peak and total efficiencies were calculated for Co-56 photons and photon intensities have been determined. The probabilities of the photons summing in the complex decay schemes have been recalculated for  $^{56}\text{Co}$ ,  $^{133}\text{Ba}$  and  $^{134}\text{Cs}$ . The results were used for summing correction of the  $^{56}\text{Co}$  photon yields. The calculation of probabilities were done by Monte Carlo method by the own programming code.