Primary liver cancers (PLC) such as *hepatocellular carcinoma* and *cholangiocarcinoma* are one of the most frequently diagnosed malignancies. PLC show relatively low survival rates. The most common approaches to cancer treatment include surgery, chemotherapy and radiotherapy. However, the external-beam radiotherapy and chemotherapy affect not only the tumour but also its surrounding tissues. Administration of a radiopharmaceutical in direct proximity of the tumour yields superior therapeutic results and limits the number of side effects (radiolabelled particles do not affect healthy tissues). Radiopharmaceuticals used for PLC treatment are yttrium or holmium microspheres. Microspheres are administered directly to the hepatic arteries supplying the tumour. This ensures the spheres will reach cancer cells and limits the irradiation of healthy tissues surrounding the tumour. Radiolabelled microspheres administration, or radioembolization, is a procedure nowadays commonly performed in leading nuclear medicine facilities. In Poland - uniquely in Military Institute of Medicine in Warsaw (MIM). Process of Y-90 microspheres administration is shown on the Figure 1.

Figure 1. Simplified process of radioembolization of cancer tissue using Y-90 microspheres.

The aim of our study is to comprehensively assess the distribution of radiation emitted by Y-90 microspheres used for liver tumour embolization in a model. Absorbed dose of both cancerous and healthy tissue will be evaluated. The data from NEMA phantom studies will be correlated with PET/CT results (PET/CT scans will be acquired in patients after Y-90 microspheres radioembolization procedures performed in MIM). Biodistribution of Y-90 microspheres produced via sol-gel process in animal model will also be evaluated. In cooperation with Warsaw University of Life Sciences (WULS) we will investigate microspheres biodistribution in two domestic pigs (*sus scrofa f. domestica*). The experiments simulating intra-arterial radioembolization of liver tumours in animals will be performed by a team of interventional radiologists in accordance with relevant guidelines and regulations. The authors will develop innovative formulas enabling quantitative assessment of Y-90 microspheres radioactivity distribution and the radiation dose administered to the tumour and its surroundings. Our study will yield quantitative data on Y-90 microspheres radioactivity distribution and radiation dose administered to the tumour and its surroundings. Such information will be useful in assessing response to radioembolization and qualification for further treatment and, finally, will lead to personalisation in radioembolization. We believe that introducing new simple dosimetric tools will increase effectiveness and safety of radioembolization. Microspheres biodistribution assessment in animal model will be performed in order to evaluate their utility in liver tumours radioembolization. If these preclinical studies give positive results, research on this new type of microspheres and their utility in liver tumour embolization will be continued.