Improving the efficiency and performance of electrostatic collection for radon measurement

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Radon (^{22}Rn) and thoron (^{220}Rn) monitoring systems based on electrostatic collection play a crucial role in environmental radiation safety. In our laboratory, we have been actively engaged for years in the simulation, design and testing of advanced measurement systems that detect radon and thoron through electrostatic collection of their ionized progeny (^{218}Po and ^{216}Po) and alpha spectrometry.
A radon-thoron Reference Chamber is used to carried out experiments with controlled atmospheres and validate the simulation results. In it, we tested and modelled several homemade (such as RaMonA and Ramonino) and commercial (such as RAD7 and Radim3A) chambers. The influence of geometry and two different types of detectors (Surface Silicon and Photodiode detectors) was evaluated.
A study was carried out to simulate and validate multiple radon-thoron detection systems using a hybrid modelling approach combining Geant4 for particle transport and COMSOL Multiphysics for electric field simulation. These simulations provided results in agreement with experimental data and demonstrated that hemispherical geometries provide superior electric field uniformity and detection efficiency compared to other geometries.
Now, a New Reference Chamber is in operation to maintain a constant temperature and humidity, which influence electrostatic collection in a non-negligible manner. The updated results will be the subject of this contribution.