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# FLUKA simulation of Ac-225 production with a medical cyclotron

Alpha-emitting Ac-225 is a radionuclide being developed and used in the treatment of some cancers [1]. Currently, the Department of Energy (DOE) isotope program's Tri-Lab Effort (Brookhaven National Laboratory, Oak Ridge National Laboratory, Los Alamos National Laboratory) effort provides Ac-225 from a Thorium target irradiated with a high energy proton beam [2]. We have a plan to make Ac-225 from Ra-226 target using the relatively low energy proton beam from a medical cyclotron.
FLUKA is a general-purpose Monte Carlo simulation code used to model the interaction and transport of particles from a few KeV to thousands of TeV in arbitrary materials. It is built and maintained with the aim of including the best possible physical models in terms of completeness and precision [3]. In this study, we are using the RESNUCLEi card to score the residual isotopes and activities from the Ra-226 target irradiated in the EBCO TR19 cyclotron.
For the simulation, we used 300 mg of Ra-226 (5.0 g/cm3) which is 8.0E+20 atoms. These atoms can be deposited as a 0.0086 cm thick layer on a 1.58 X 4.45 X 0.234 cm aluminum plate. The Ra-226 target geometry is specially designed to fit the solid target holder for the EBCO TR19 cyclotron. The EBCO TR19 cyclotron proton beam energy range is from 13 to 19 MeV and the beam current is 200 μA (1.248E+15 protons/s). At 19 MeV, the highest proton beam energy, protons can penetrate 0.198 cm of Ra-226 (13 MeV, 0.106 cm) and 0.192 cm of aluminum. Thus, the proton beam penetrates the radium layer and is completely stopped in the aluminum plate. Ra-226 target irradiations were simulated using a 40 hours irradiation time using a varied particle energy from 13 to 19 MeV and 200 μA proton beam currents to find the best conditions for Ac-225 production in the EBCO TR19 cyclotron.
The maximum yield for the Ac-225 production was obtained at the beam energy 14.5 MeV. The amount of the produced Ac-225 from Ra-226 target is about 340 mCi at EOB.

References
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## Email Address

dohkim@bnl.gov

## Presentation Type

Poster

**Primary author:** Dr KIM, Dohyun (Collider-Accelerator Department, Brookhaven National Laboratory, Upton, NY 11973, USA)

**Co-authors:** Dr CUTLER, Cathy S. (Collider-Accelerator Department, Brookhaven National Laboratory, Upton, NY 11973, USA); Dr BENMERROUCHE, Mohamed (Radiological Control Division / National Synchrotron Light Source II, Brookhaven National Laboratory, Upton, NY 11973, USA)

**Presenter:** Dr KIM, Dohyun (Collider-Accelerator Department, Brookhaven National Laboratory, Upton, NY 11973, USA)