Using the Neutron Flux from p,n Reactions for n,p Reactions on Medical Cyclotrons

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The formation of the isomeric pair $^{58}Co^{m,g}$ can be reached via the $^{58}Ni(n,p)$, $^{59}Co(n,2n)$, $^{59}Co(p,pn)$, $^{58}Fe(p,n)$, $^{57}Fe(d,n)$, $^{55}Mn(a,n)$, and $^{61}Ni(p,a)$ reactions. Natural nickel (68.1% ^{58}Ni) foils were placed behind a [^{18}F]Flouride water target to produce ^{58}Co[**1**] ($T_{1/2}$=70.86 d, β^+=14.9%, Eγ=811 keV, 99.4%) through the $^{58}Ni(n,p)^{58}Co$ reaction. The water target is mounted on a MC 17 Scanditronix cyclotron (15.5 MeV protons on water). To quantify the ^{58}Co activity the irradiated foils were measured after four days (after EOB) for a full conversion of the co-produced metastable state ^{58m}Co ($T_{1/2}$=9 h).

Nickel foils (~20x20 mm) with different thicknesses were placed between the water cooling tubes on the backside of the water target according to figure 3. The foils were irradiated with ejected neutrons from the $^{18}O(p,n)^{18}F$ reaction for different accumulated proton charges (µAh) in the water target.

So far, ^{58}Co-activities of about 0.1-0.15 kBq/µAh have been produced in 0.25 mm thick foils and approximately 1 kBq/µAh in a 2 mm thick foil. The ^{58}Co activities were quantified with an HPGe detector against a known 511 keV peak in same geometry. More results will be presented at the conference.

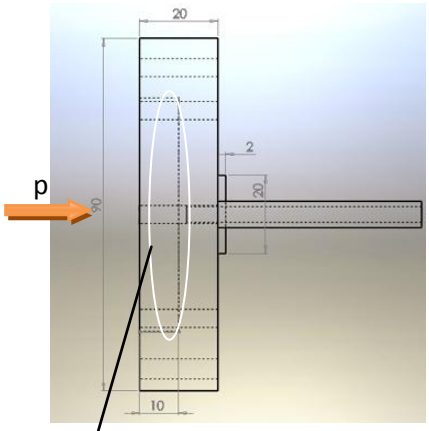

Fig 1: Backplate, side view

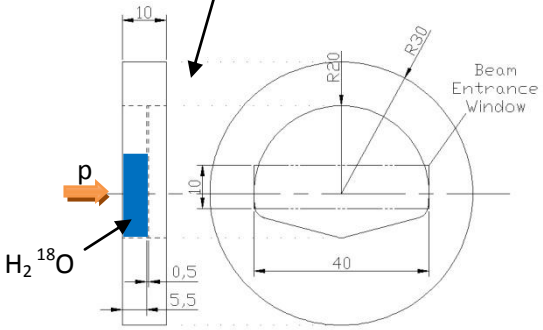

Fig 2: niobium insert

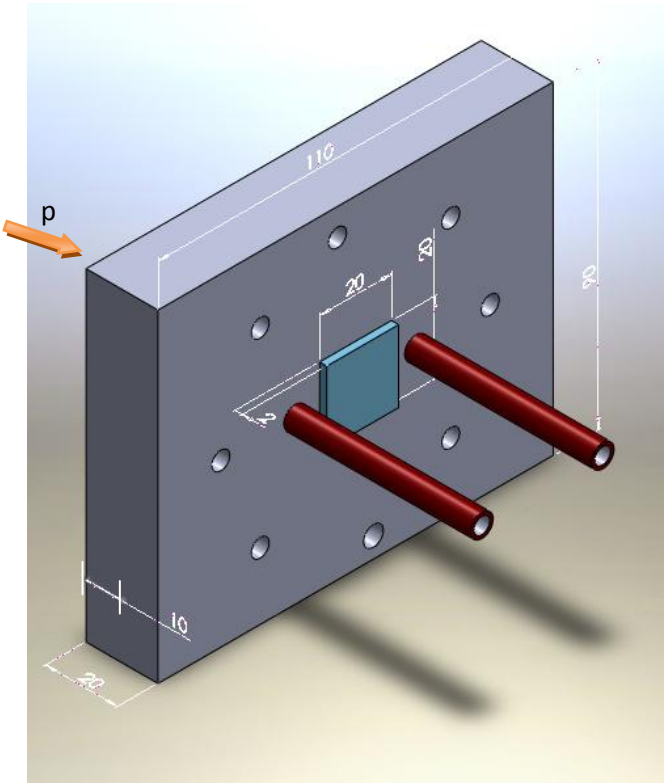

Fig 3: Backplate housing the niobium-insert with a 2 mm nickel foil on the rearside between water tubes

References:
C.E. Mellish & J.A. Payne, Nature Vol 187/275-276/1956
H.-J. Lincke, Radioanal.Nucl.Chem.,Letters 87/5/311-316/1984