

TARGET COMPLEX FOR ISOTOPE PRODUCTION ON THE ELECTRON ACCELERATOR

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Abstract

The composition and design are reported for the target complex intended for industrial production of isotopes on the electron accelerator.

The target complex consists of:

1. Target device where the capsule is placed during irradiation process.
2. Bremsstrahlung converter and capsule cooling system.
3. Removal device which is intended to remotely withdraw the capsule from target device immediately after irradiation.
4. Transport system which conveys hot irradiated capsule into shielded transport container. Trial results are reported

Industrial production of isotopes on the accelerator requires specific properties of structure of the target complex. These properties are:

- easy remote withdrawal of irradiated target capsule.
- remote transportation of the capsule to shielded container.
- simplified installation of new capsule.

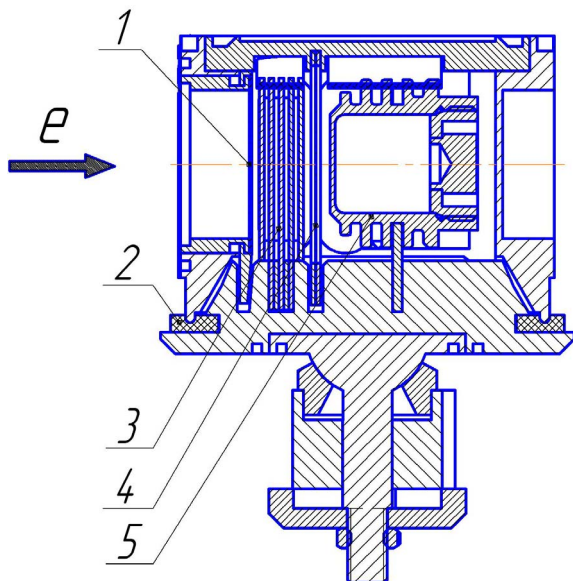


Figure 1: Vertical section of target device.

- 1 – Inlet titanium foil, 2 – EPDM sealing gasket, 3 – Bremsstrahlung converter, 4 – Separating titanium foil, 5 – Target capsule.

The main piece of target device is an all-metal casing with titanium foil inlet window 50 μm thick. Target device also contains bremsstrahlung converter and target capsule.

What with great difference of midsection and hydraulic resistance of converter and target capsule, the converter and capsule are placed in the different water cooled chambers. Thin titanium foil 50 μm thick separates these chambers to provide sequential cooling of converter and then capsule. Special pipe returns the cooling water from the output of converter chamber to inlet of target capsule chamber. Labyrinth-like seal prevents by pass of water from target chamber into capsule chamber.

The converter and the target capsule are installed onto its holders in the hinged door.

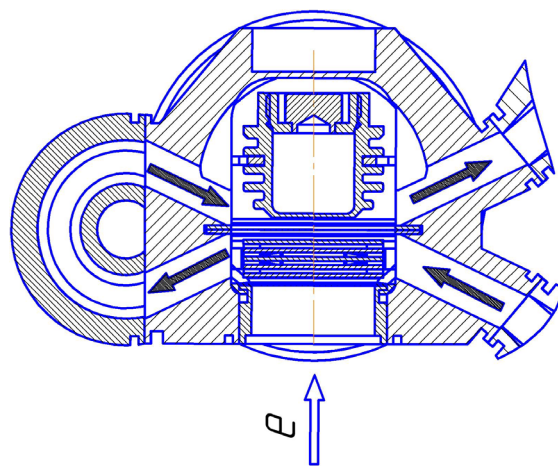


Figure 2: Horizontal section of target device. Trajectory of water flow.

O-ring water sealing (Figure 1) between the casing and the door is made of EPDM rubber. This gasket seals during one irradiation process and should be replaced simultaneously with new target capsule.

11 kg weight placed on lever creates the sealing force. Lever can be remotely driven to give access to target capsule.

Bremsstrahlung converter (Figures 1,2) is an assembly of 4 tantalum plates (1.2 mm thick) with 1mm gaps between each other to provide sufficient cooling.

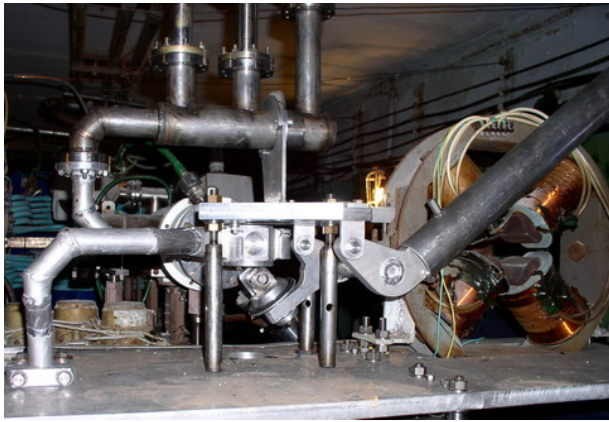


Figure 3: Appearance of the target device.

The target capsule (Figures 1,2) is a metal cylinder with thin front wall (0,5 mm) and with threaded back cap. Outer surface of the capsule has a few fins for cooling and for secure location in place.

There is a wedge pusher (Figure 4) which is intended for disengagement of the capsule and its holder. The whole process of withdrawal takes 5 minutes and consists of few stages:

- drainage of water residues.
- remote opening of target device door
- disengagement of the capsule by means of wedge pusher.

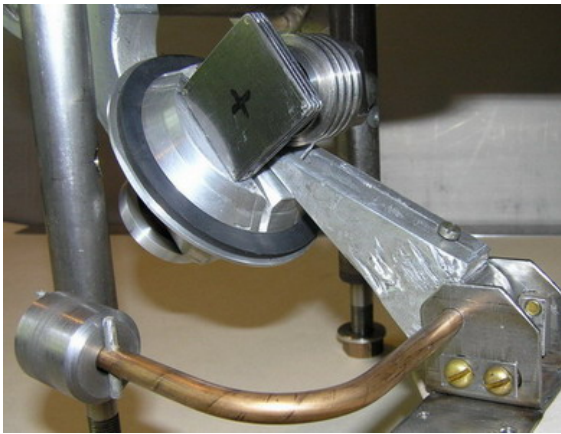


Figure 4: Wedge pusher.

Hereafter the capsule falls into receiving hose of elevating system (Figure 5.). This system transports the capsule upward through the concrete ceiling of target room until shielded transportation container (Figure 6.). Last stage is transportation of the irradiated capsule to the hot cell to fulfil the final treatment.

All of these equipments have been installed at KUT-30 linear accelerator. The test runs of the linac were performed with beam parameters:

pulse current	- 470 mA
beam average current	- 200 μ A
electron energy	- 34 MeV
repetition rate	- \leq 150 Hz

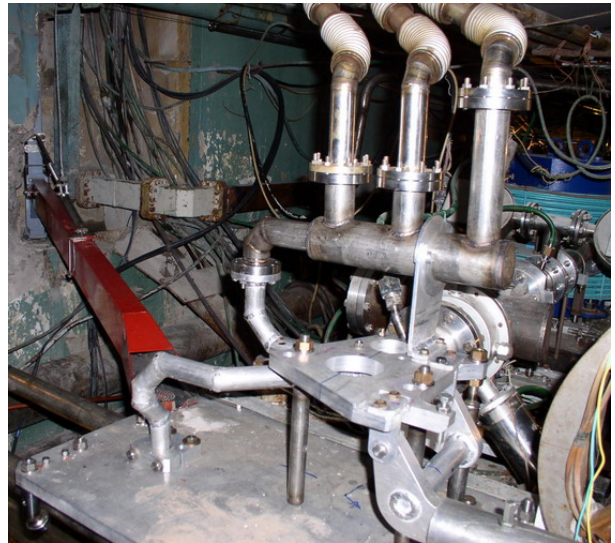


Figure 5: Target device and receiving hose of elevating system.



Figure 6: Shielded transportation container.

Dependence of water flow rate on water pressure has been charted (Figure 7).

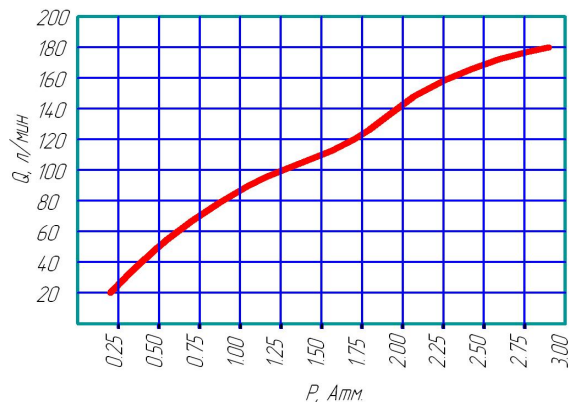


Figure 7: Dependence of water flow rate on water ure

CONCLUSION

1. The ability of tantalum bremsstrahlung converter (aggregate thickness of 4,8 mm) to withstand the heat load has been proven with electron beam and cooling system parameters:

pulse current	– 470 mA
beam average current	– 200 μ A
electron energy	– 34 MeV
repetition rate	– 150 Hz
water flow rate	– 50 l/min
water velocity (in converter area)	– 3 m/s

2. The ability EPDM gasket to seal the opening during the irradiation time has been proven.

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