Project of RIC-80 facility at PNPI for medical isotope production

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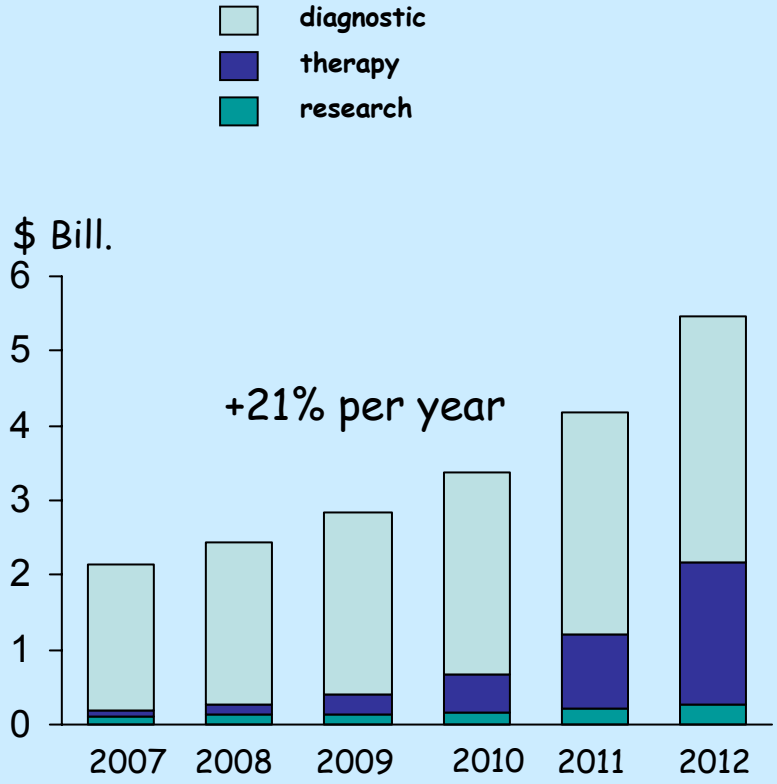
World market of medical radioisotopes



Cost of production of 82Sr

At the world market
0.06 Ci of 82Sr ~ 14.700$

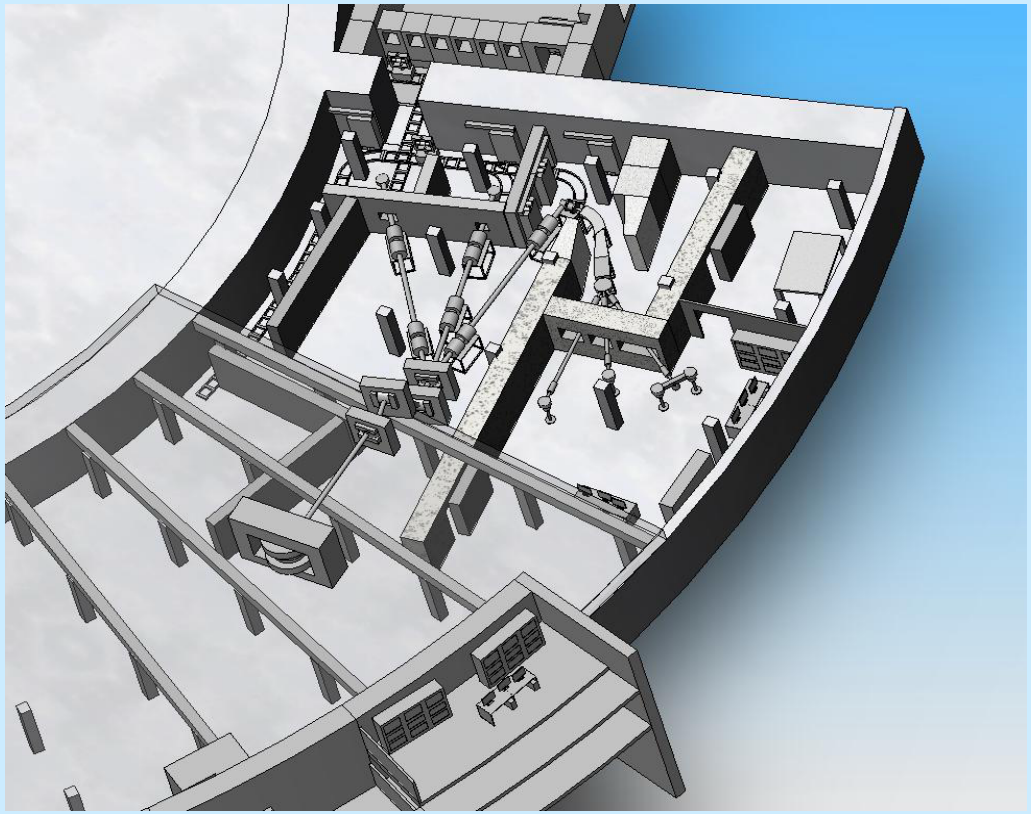
At RIC-80 (I_p=100 мкА, t_{irr}= 240 h) after target cooling
and strontium extraction from the target material
4 Ci of Sr-82 can be obtained ~ 900 000$

Cost of cyclotron beam time ~ 15 000 rub/h (500$/h); cost of 240 h - 120 000$
4 irradiations per year ~ 3 120 000 $

Potential consumers of produced radionuclides and pharmaceuticals

Medical centers of North-West region. Presently we have the request from RNC RCT for supply of strontium-82 for clinical tests. It is planned supplies of medical radionuclides (generators - ^{82}Sr and ^{68}Ge) and other pharmaceuticals to other regions of Russia and abroad.

RIC-80 Complex for radioisotope production



The schematic view of radioisotope complex RIC-80 situated in the basement of PNPI synchrocyclotron experimental hall

The project of medical radioisotope complex includes three target stations for production of the most at present time widely used radionuclides. The automatic transport system ensures the transportation of irradiated targets to hot cells, where the produced radionuclides are extracted from the target material and the process of preparation of pharmaceuticals is carried out. The energy of external proton beam is varied in the region of 40-80 MeV and intensity reaches 200 μA. The RIC-80 complex ensures very wide possibilities for production of pharmaceuticals and radionuclides for diagnostics and therapy. Presently there is no any installation in Russia for radioisotope production which could give such possibilities. According its parameters and possibilities RIC-80 corresponds to the best world analogs. In production of radionuclides of a high purity The RIC-80 installation will not have world analogs.

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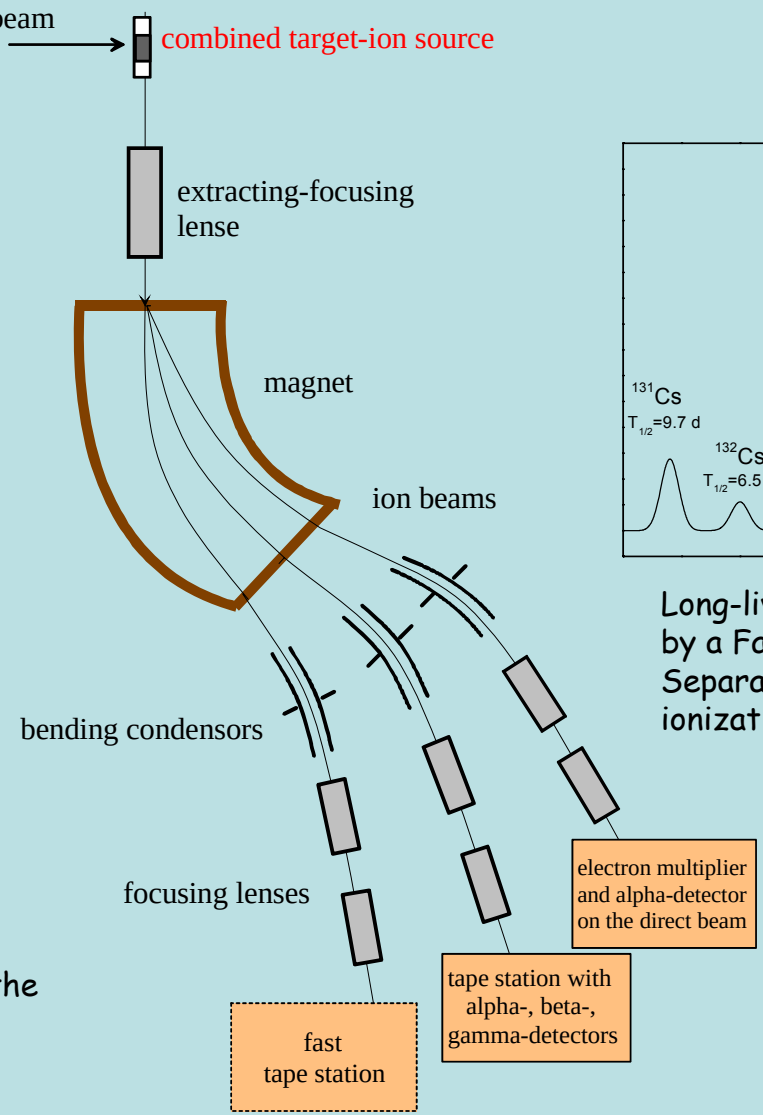
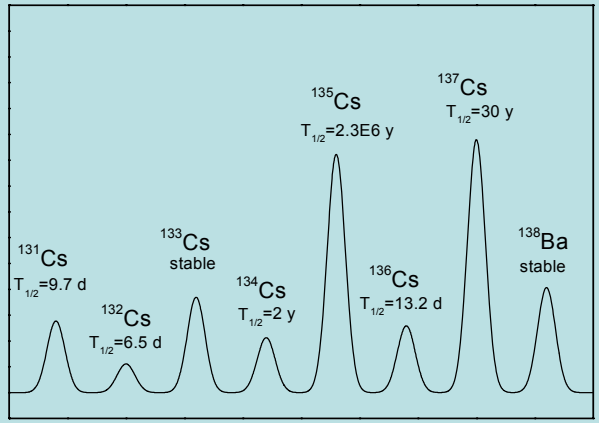
IRIS facility – the ISOL installation at the beam of PNPI synchrocyclotron (in function from 1975)

The target room of IRIS (Investigation of Radioactive Isotope at Synchrocyclotron) installation

IRIS is the only in Russia on-line installation on nuclear and astrophysics investigations of radioactive isotopes. Targets from foils of refractory metals, melted metals, high temperature metal carbides have been developed for production and investigation of radioactive isotopes of the most elements of the Periodic table.





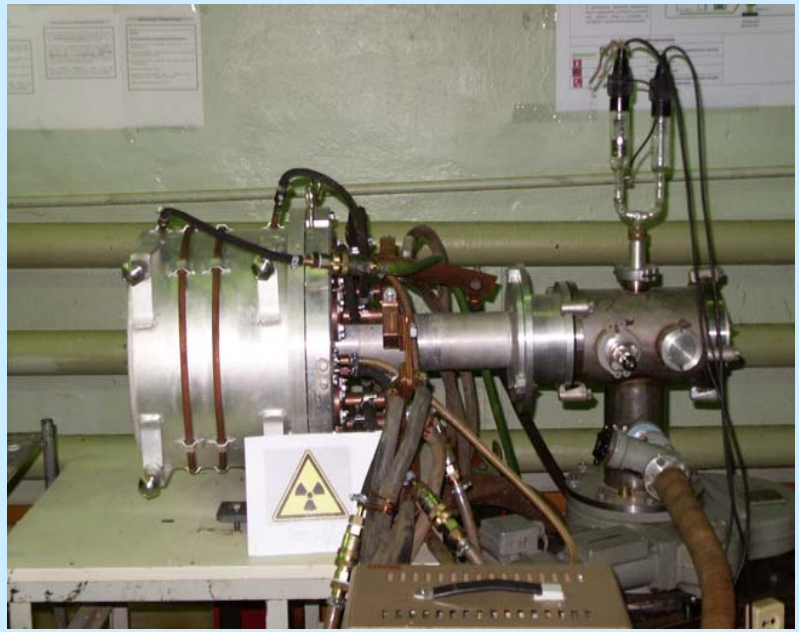
Long-lived Cs isotopes measured by a Faraday cap at the mass-Separator collector. The release-ionization efficiency ~ 70%

Some of radioisotopes which will be produced at RIC-80

Isotope	Half life	Target	Irradiation time (h)	Target Activity (Ci)
^{68}Ge	270.8 d	Ga	240	2
^{82}Sr	25.55 d	Rb	240	10
^{111}In	2.8 d	Cd	25	24.7
^{123}I	13.27 h	Te	5	10.4
^{124}I	4.17 d	Te	25	9.3
^{201}Tl	3.04 d	Tl	25	9.2
^{223}Ra	11.4 d	Th	240	7.3

Yields of some radionuclides planned to be obtained at RIC-80 facility with proton beam energy of 40-80 MeV and current of 100 μA.

Test bench for high temperature target heating tests



Temperature of the target material:
up to 2500 °C
Dicipated power:
up to 9 кW

The developed target device construction will allow to produce radionuclides from different target materials: refractory metal foils, liquid melted metals and high temperature resistant metal carbides

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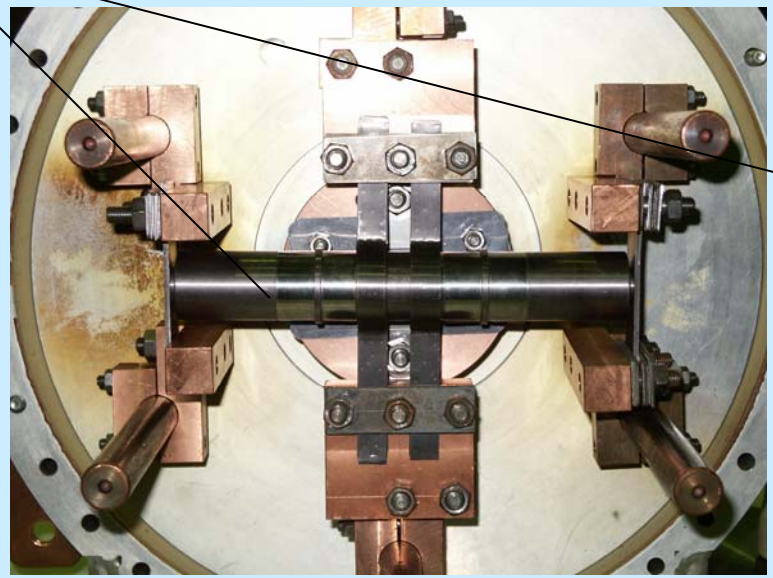
First tests on the extraction of ^{82}Sr from niobium foil mass separator target

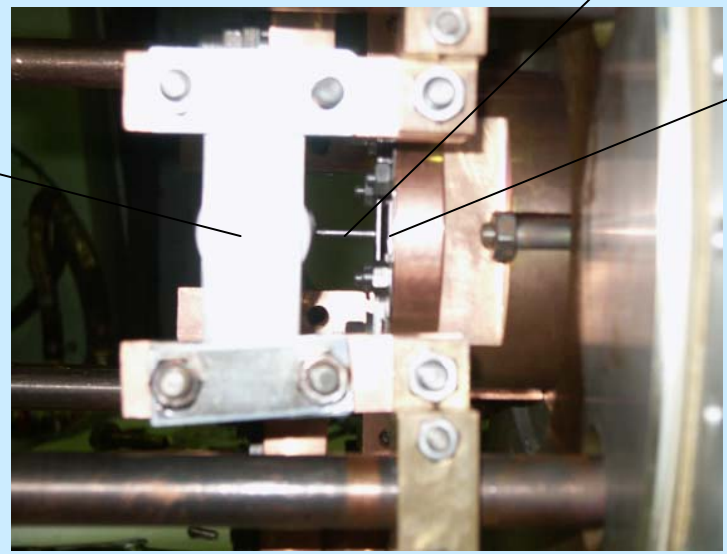
Target

Mass separator target for 82 Sr production

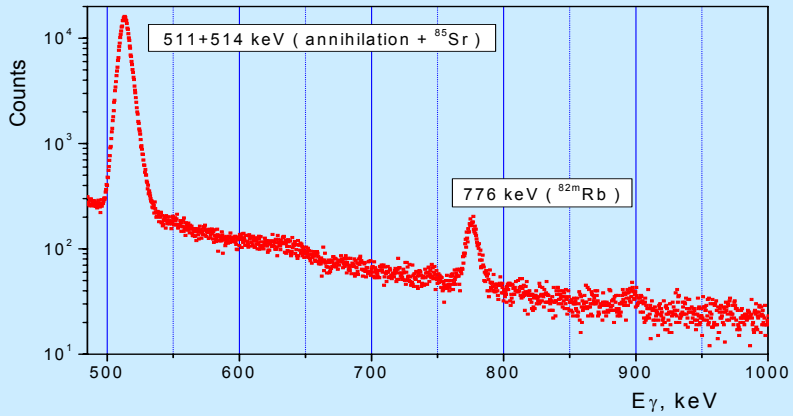


Ion source
ungsten tube

Tantalum
foil collector



The niobium foil target was irradiated at the proton beam of 1 GeV synchrocyclotron and after was heated at the test bench at T=1700-2000 °C to extract ^{82}Sr on the tantalum collector



To the tantalum foil collector ~ 65% of ^{82}Sr was collected for 20 hours of the target heating at the temperature 1700-2000 °C

Part of γ-spectra of the sample collected at tantalum foil collector. γ-line 776 keV is from the decay of daughter ^{82}Rb

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Current status and perspectives

The magnet of cyclotron C-80 in the experimental hall

The cyclotron C-80 (proton energy 40-80 MeV, current up to 200 μA) assembly will be completed in the end of 2012.

The proton beam first switching on – end of 2012 – beginning of 2013.

The 100 μA external proton current obtaining – second part of 2013.

Presently finance funding is provided for complete building and assembling of cyclotron and proton beam lines to three target stations of the RIC-80.

RIC-80 radioisotope complex

The project design work - 2012 -2013 (partly funded).
The RIC-80 complex building, equipment manufacturing and assembling - 2014 -2016.
The generator radioisotope Sr-82 production – end of 2016.