

**Academy Science of Uzbekistan
Institute of Nuclear Physics**



INSTITUTE OF NUCLEAR PHYSICS, UZBEKISTAN

Tashkent - 2015

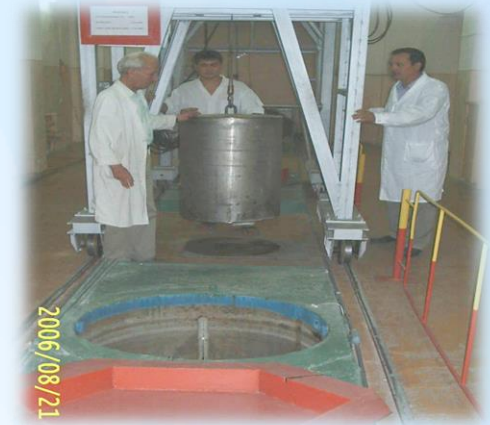
NUCLEAR FACILITIES AT THE INP



Cyclotron U-115



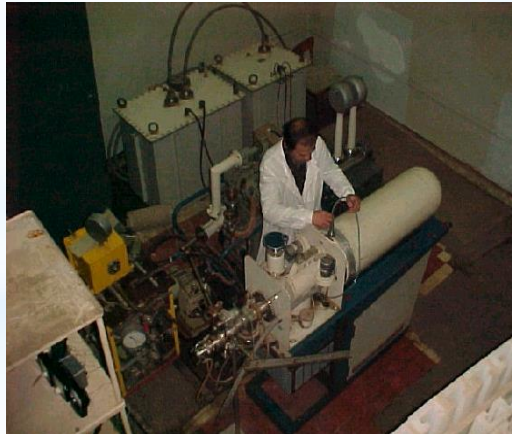
WWR-SM Reactor



Gamma facility



Cyclotron U-150



Neutron Generator



**A new Electron
accelerator U-003**

FOR STORAGE OF RADIOACTIVE SOURCES THE NEW RADIOISOTOPE DEPOSITORY IN THE INP WAS CONSTRUCTED AND PUT INTO OPERATION



64 cells for sources and 15 holes for non standard sources and large containers. At present in this facility 220 radioactive sources are stored.



REACTOR PHYSICAL PROTECTION SYSTEM

In 2002 the Reactor physical protection system has been upgraded



КРИК

Under sponsorship of the LLNL
Detection (50 cm)

Co-60 – 10 kBq (27 microCu)

Cs-137 – 25 kBq

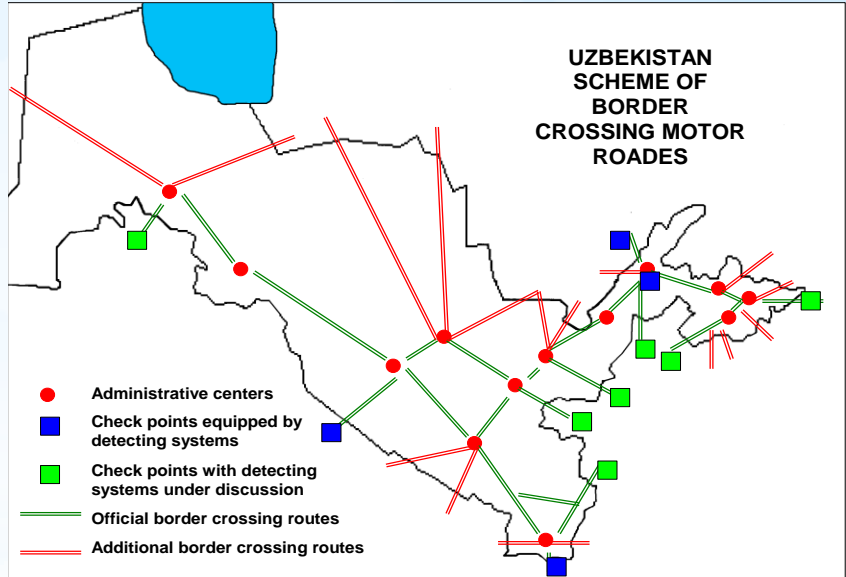
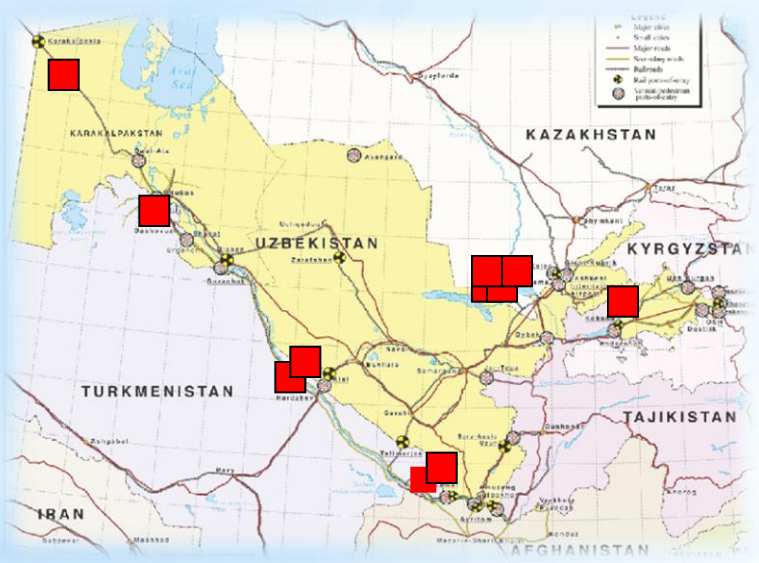
Co-57 – 170 kBq

Pu-239 – 7 grams

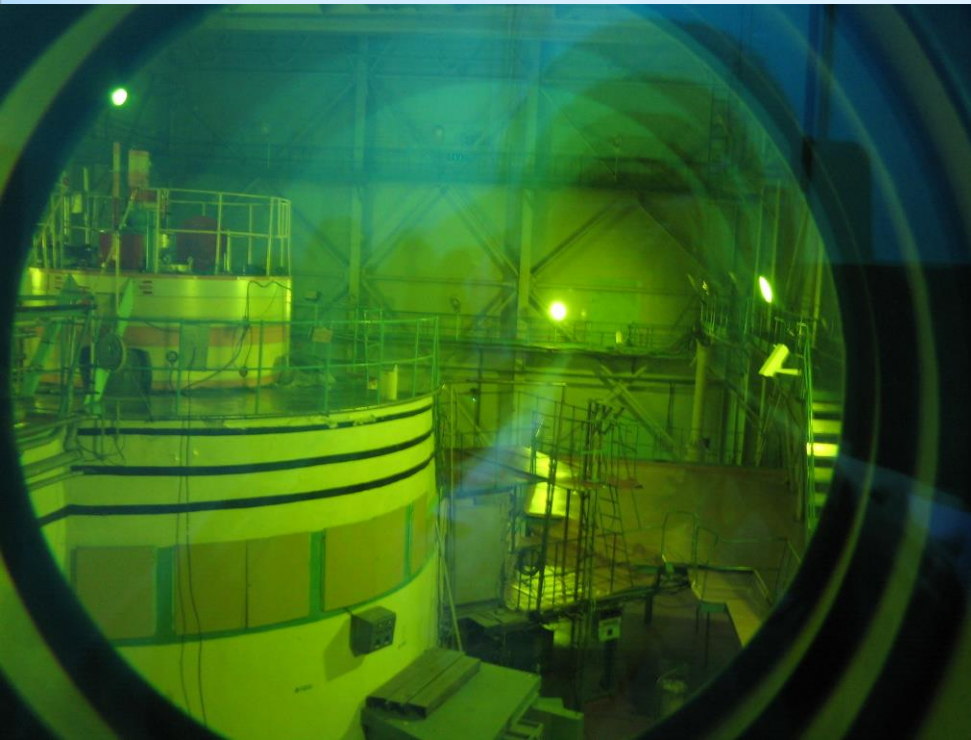
U-235 – 30 grams



CUSTOMS CONTROL TRAFFICKING OF NUCLEAR AND RADIOACTIVE MATERIALS



* WWR-SM Reactor



Power 10 MW

Maximal neutron flux
 $1,5 \cdot 10^{14}$ n/cm²s.

Vertical channels - 43,
Horizontal - 9.

Thermal column-1

Radioisotopes end productions:

Gold-198 labeled compounds

**Phosphorus-32 labeled
compounds**

Phosphorus - 33.

Iodine - 125.

Mercury - 203.

Iron - 55.

Cobalt - 58.

Sulfur - 35.

Material science

Activation analysis, Radiochemistry

Nuclear physics

Nuclear spectroscopy

Radioisotopes production

Irradiation of natural minerals

Testing new fuel assemblies

Personnel training and education



COMMERCIAL AREA

Radionuclides : ^{32}P , ^{33}P , ^{35}S , ^{51}Cr , ^{54}Mn , ^{55}Fe , ^{58}Co , ^{60}Co , ^{99}Mo , ^{90}Y ,
 ^{125}I , ^{131}I , ^{147}Pm , ^{182}Ta , ^{188}W , ^{192}Ir .





РАДИОПРЕПАРАТ

РАДИОИЗОТОПНАЯ ПРОДУКЦИЯ И
ИММУНОЛОГИЧЕСКИЕ ТЕСТ-СИСТЕМЫ

7



* Generator of $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$

Nominal activity of the $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ generator on the day of calibration:

18,5 GBk / 0,5 Ci

11,1 GBk / 0,3 Ci

7,4 GBk / 0,2 Ci

5,5 GBk / 0,15 Ci

radiochemical purity: > 99.0%

radionuclide impurities: ^{99}Mo : less than 0.01%





РАДИОПРЕПАРАТ

РАДИОИЗОТОПНАЯ ПРОДУКЦИЯ И
ИММУНОЛОГИЧЕСКИЕ ТЕСТ-СИСТЕМЫ

9



TECHNETRIL, ^{99m}Tc

Suitable agent for evaluation of the myocardium perfusion at its different pathological states and for the scintigraphy of the malignant tumors of the lung and breast.

TECHNEMAG, ^{99m}Tc

suitable agent for evaluation of renal function radionuclide measurements.

MEZIDA, ^{99m}Tc

Suitable agent for dynamic scintigraphy of the hepatobiliary system.

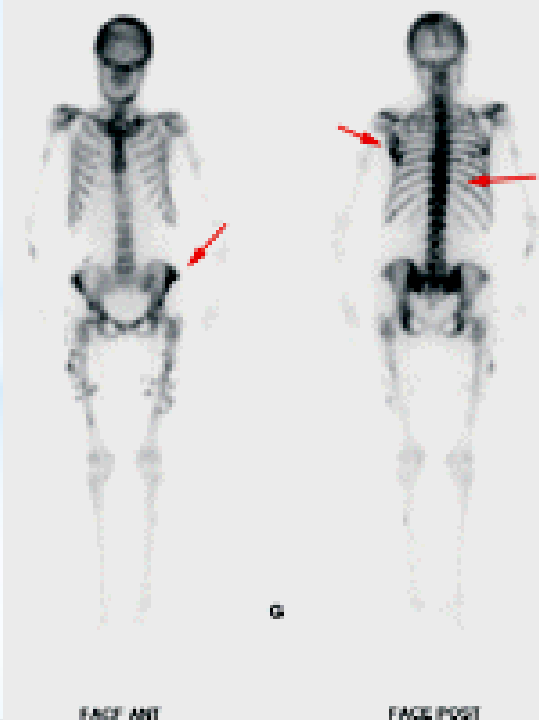
PHOSPHOTECH, ^{99m}Tc

Suitable agent for primary and metastatic tumours, osteomyelitics, bone-joint tuberculosis etc.

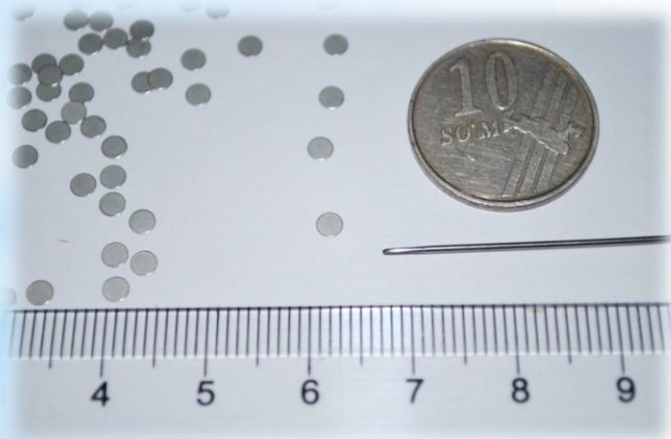
Samarium-153, oxabiphor



Volume activity: 240 - 2000 MBq / ml
radiochemical purity:> 99.0%
radionuclide purity:> 99.99%



^{192}Ir PRODUCTION





* IRRADIATION IR-192



The Advanced Experimental Fuel Counter (AEFC)



PURPOSE

To measure fuel element burnup

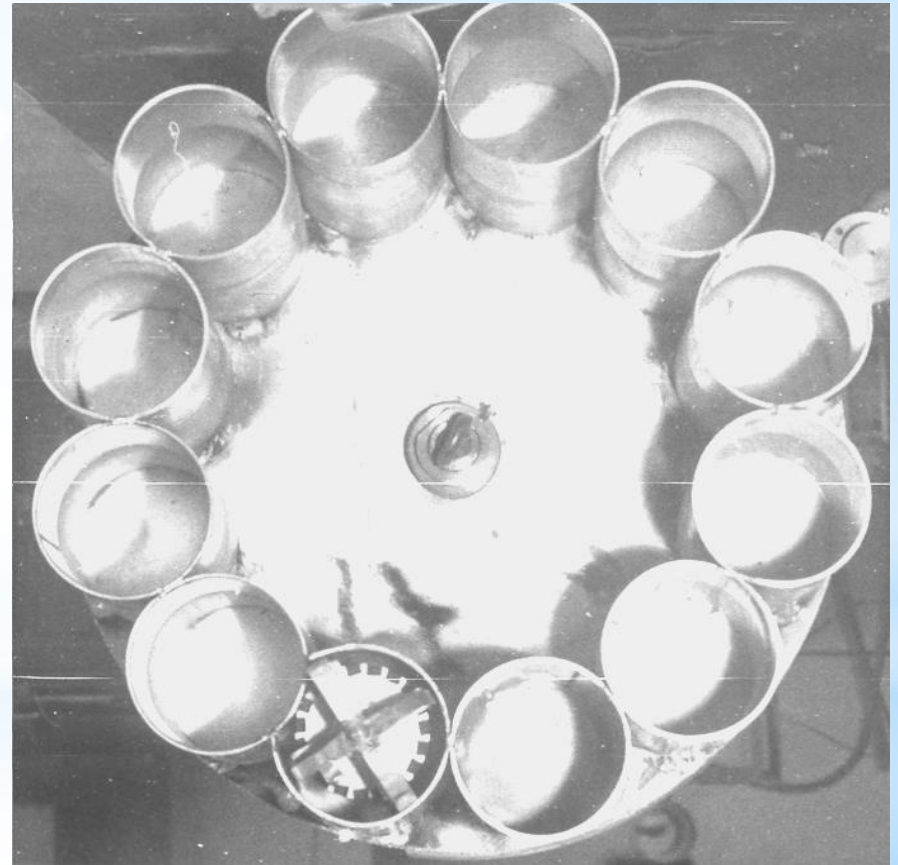
To measure residual U-235 content (active mode)

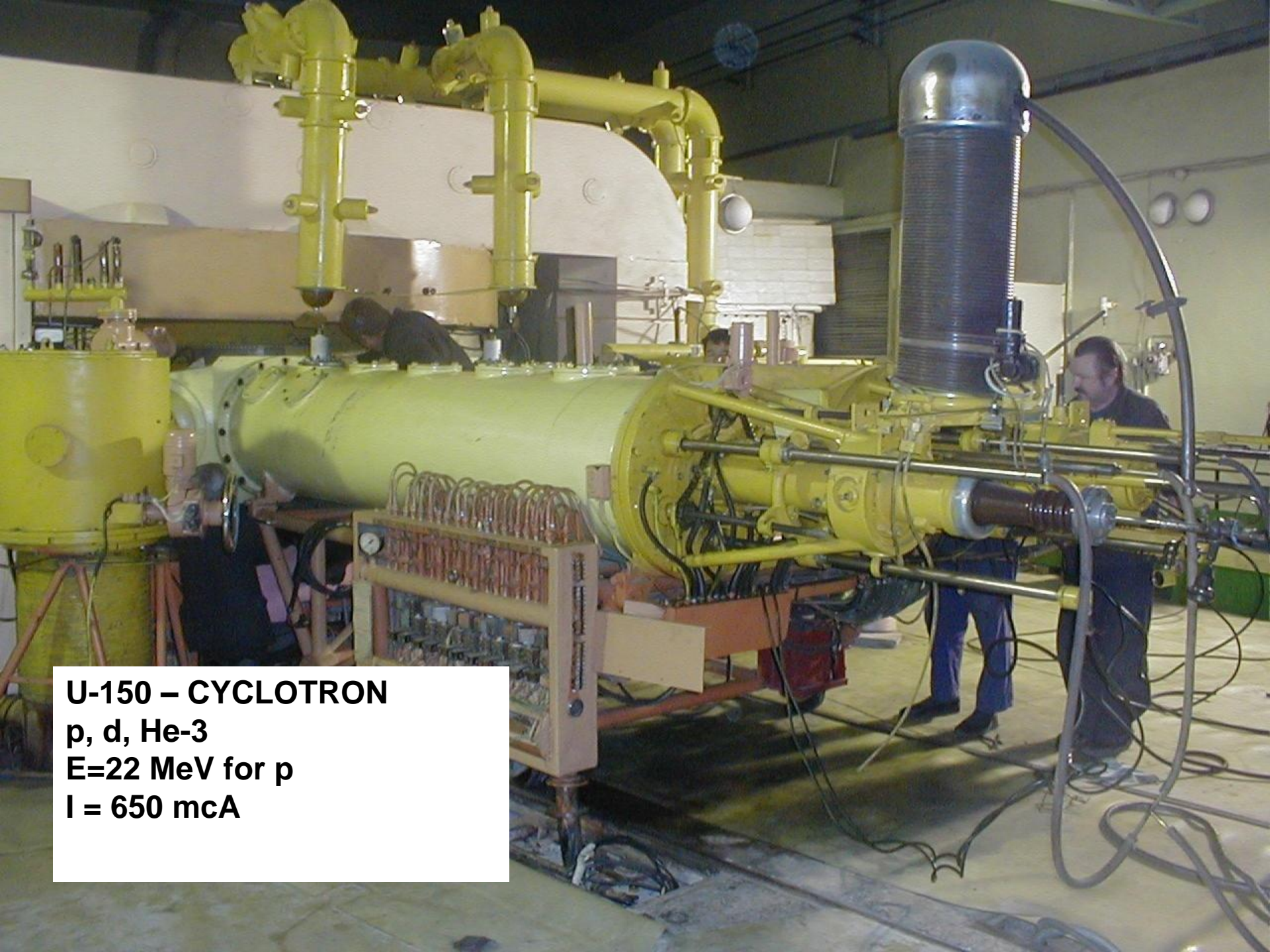
To measure Pu-240 content (passive mode)

To determine flux profile in element and core

To verify the initial enrichment of the fuel elements

Nuclear transmutation Si





U-150 – CYCLOTRON

p, d, He-3

$E=22$ MeV for p

$I = 650$ mcA

* Experimental apparatus for studies of nuclear reactions at cyclotron U-150



* The first precise measurements for (d,t) and (d, ^3He) nuclear reactions are completed.

* Important information on the structure of light nuclei is obtained to use for calculations of nuclear and astrophysical processes impossible to provide in the lab.

* Cyclotron U-115



* Current - 200
mA

* Protons

* $E = 20 \text{ MeV}$

Sealed source isotopes Co-57

half-life ^{57}Co	271,7 day
^{57}Co like Co (II) в 0,1M (or 0,5M) HCl	(7000 - 7500) мКю/мг
chemical purity (Fe, Cu, Ni)	0.02 мг/Кю
radionuclidic purity	0,1 %
packing (1 Кю)	300x300x30 0 мм ³
packing weight	6 кг

sealed source ^{57}Co for РФА.
activity
10-15 мКю





- Sterilization of pharmaceuticals and medical equipment

* Electron accelerator
U-003

* Gamma-irradiation facility

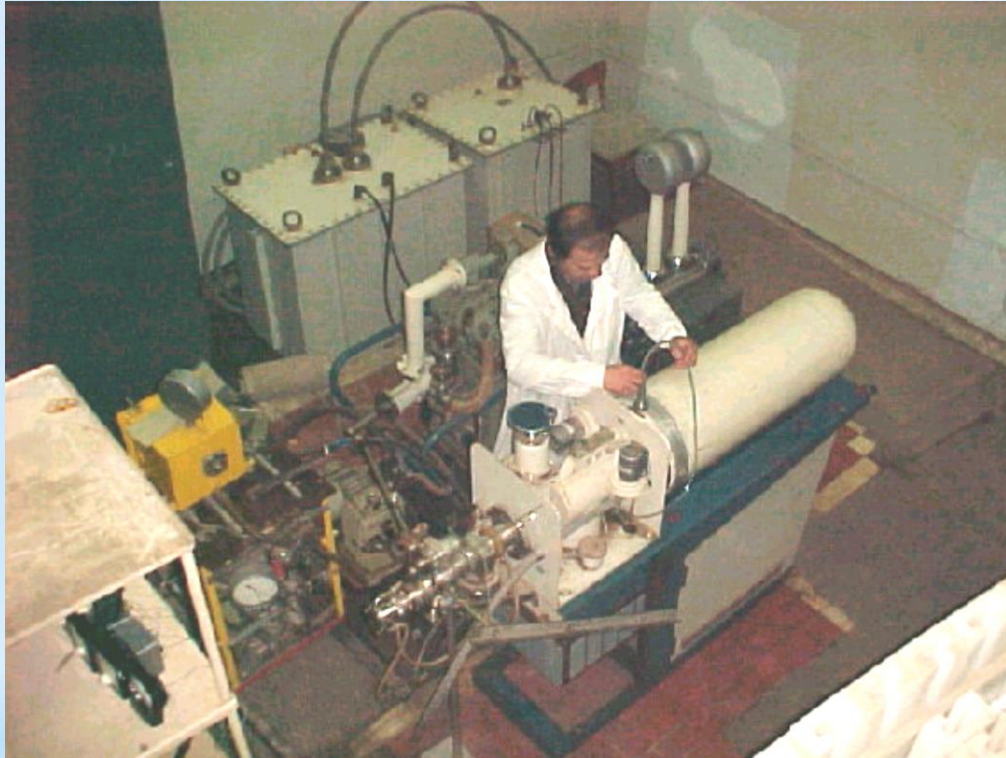
- * 3 channels
- * 612 Co⁶⁰ sources
- * 85000 Cu



- Physics of radiation treatment of materials
- Radiation processing of electronic and technological goods, biological objects and agricultural products
- Sterilization of pharmaceuticals and medical equipment



* Neutron generator



- Generating reactions: $d+D$ и $d+T$
- Energy neutrons: 2.4 МэВ и 14 МэВ
- Neutron flux: до 10^8 и 10^{10} n/c

- * Neutron irradiation ^{238}U targets for studying the properties of daughter nuclei
- * Research the possibility of using boron neutron generator - neutron capture therapy of cancer

Mass Spectrometer prompt fission products, located in a horizontal reactor channel



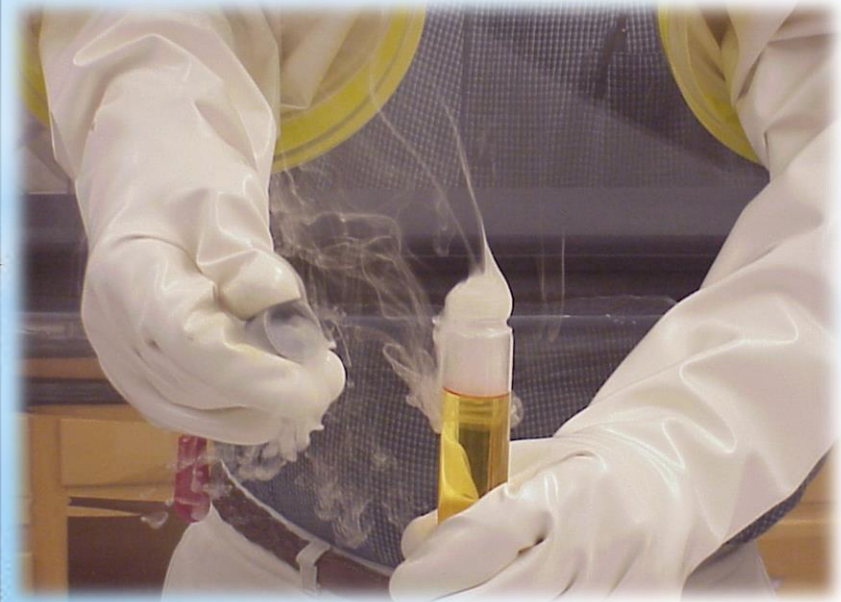
Measurements of mass, charge and energy distribution division, fission fragments. New data on the yield of fission fragments of ^{235}U and ^{239}Pu in the strong asymmetry at different excitation energies

WITHIN THE FRAMEWORK OF THE STCU GRANT AND UNDER SUPPORT OF LLNL NEW WELL EQUIPPED RADIOANALYTICAL CENTER IS CREATED



ONE OF THE MAIN TASKS OF THE CENTER IS IDENTIFICATION AND CHARACTERIZATION OF NUCLEAR, RADIOACTIVE, EXPLOSIVE AND OTHER DANGEROUS MATERIALS

MOBILAB



- Customs and border control
- Reaction on emergency situations (fire protection services, MIA, medical emergency services)
- Control over wastes
- Dosimetry and safety with identification of isotopes
- Ecological monitoring of location
- Tasks on nonproliferation of nuclear weapons
- Monitoring of nuclear materials transportation

SAFE & SECURE STORAGE OF RADIOACTIVE SOURCES IN UZBEKISTAN



IIN-3M FOTON PULSE REACTOR

Thermal Power, kW	15
Fuel	UO ₂ SO ₂
Fuel type	Liquid
²³⁵ U loading, kg	4.2
Enrichment ²³⁵ U, %	90
Reactor vessel height, cm	250
Reactor vessel diameter, cm	43
Fast neutron flux density	1×10^{12} n/(cm ² s) 26



THANK YOU FOR YOUR ATTENTION!