

INSTITUTE
OF NUCLEAR
PHYSICS



Industrial and technological applications of electron accelerators at the INP

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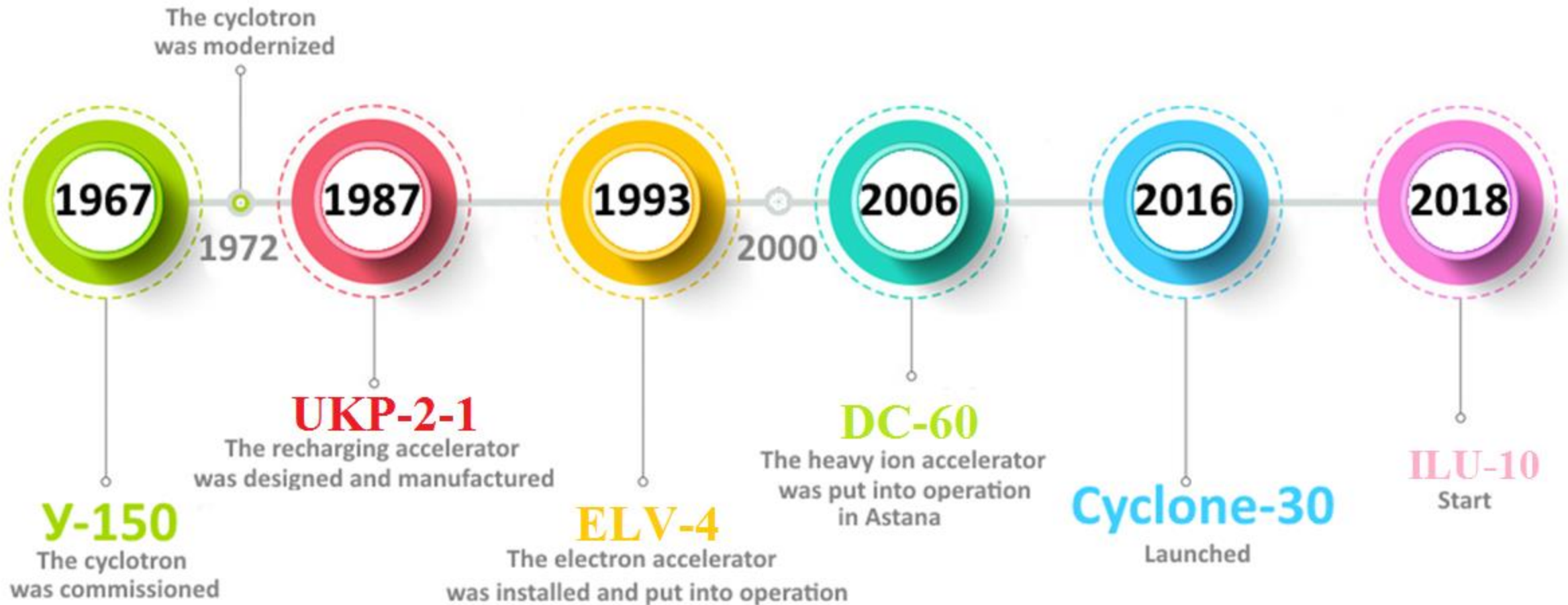
Accelerators Department of the INP

Basic accelerators

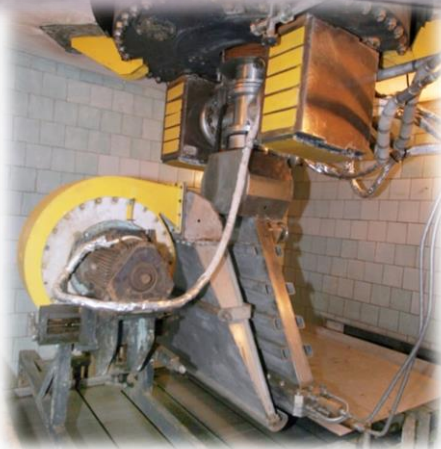
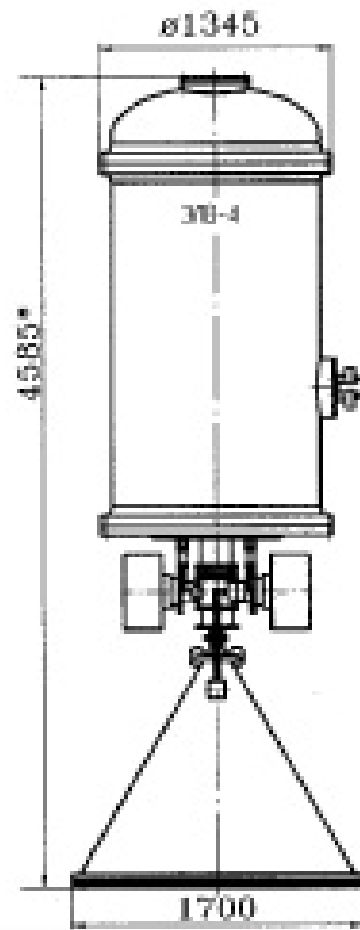
1. Cyclotron U-150M
2. Linear Accelerator UKP-2-1
3. Electron Accelerator ELV-4
4. Cyclotron Cyclone-30
5. Electron Accelerator ILU-10



Development of radiation technologies based on accelerators at the INP



Electron Accelerator ELV-4



| Parameter | Value |
|----------------------|-------------|
| Electron energy | 0.8-1,5 MeV |
| Beam power | up to 40 kW |
| Average beam current | up to 40 mA |
| Power consumption | 60 kW |

Production of hydrogel applications at INP



Basic types of cosmetic hydrogel dressings



Cosmetic hydrogel dressings «AQUA DRESS»



Medical hydrogel dressings AQUA DRESS

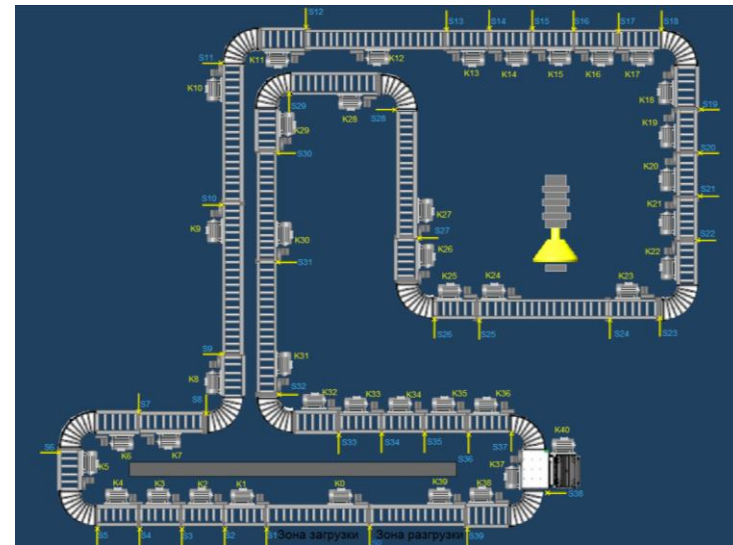
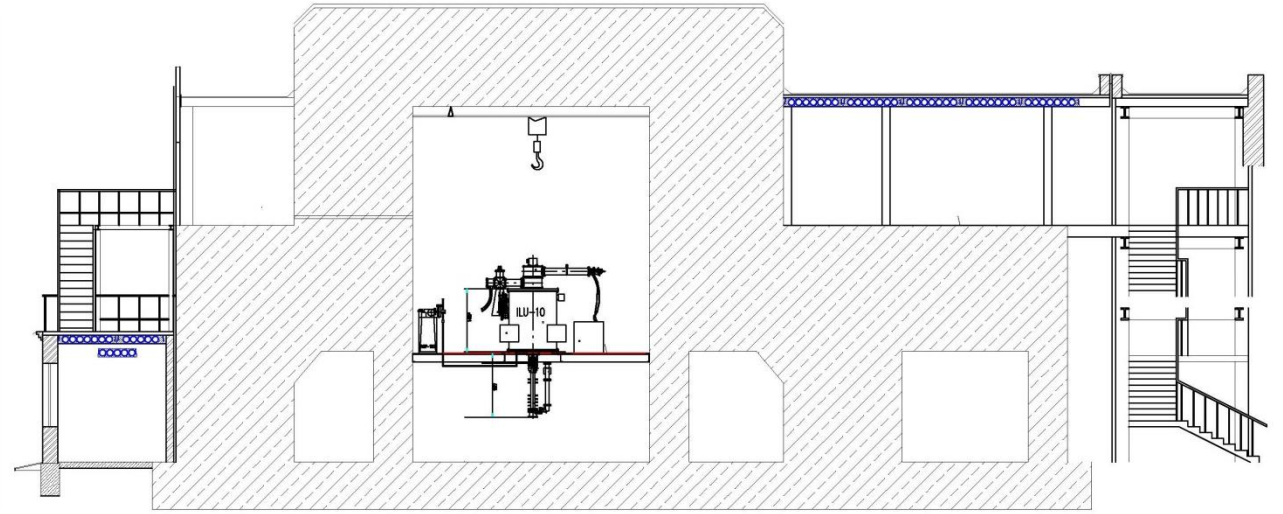


10 essential features of bandages

"AQUA DRESS"

- reduces pain;
- is a barrier to bacteria from the outside;
- provides oxygen access to the wound;
- prevents the formation of hypertrophic scars;
- makes it possible to easily bring the medicine to the wound without removing the dressing (by moistening the outer surface of the dressing with a solution of drugs);
- shows good adhesion to healthy skin and wound without a tendency to stick, which makes it possible to change the bandage painlessly;
- during the change of the dressing, secretions, fibrin and necrotic tissue are removed from the wound, leaving intact granulation;
- it is elastic, soft, but strong enough, thanks to which it can be used in places of the body that are difficult to fix - joints, palms, face, etc .;
- it is transparent, which allows you to control the treatment without removing the dressing;
- does not cause allergies.

Radiation sterilization facility



Pulse Linear electron accelerator ILU-10



| Parameter | Value |
|----------------------|-------------|
| Electron energy | 5 MeV |
| Beam power | 50 kW |
| Average beam current | up to 10 mA |
| Power consumption | 100 kW |



Electron Beam (Sterilization and decontamination)

Medical devices

**STERILIZATION
DOSE: 15 – 25 kGy**



- Surgical suture materials
- Catheter
- Syringes
- Personal protection equipment
- Tubing
- Bandages
- Beakers and lab ware
- Drain pouches
- etc.

Hydrogel dressings

**STERILIZATION
AND
POLYMERIZATION
DOSE: 25 kGy**



Herbal raw materials

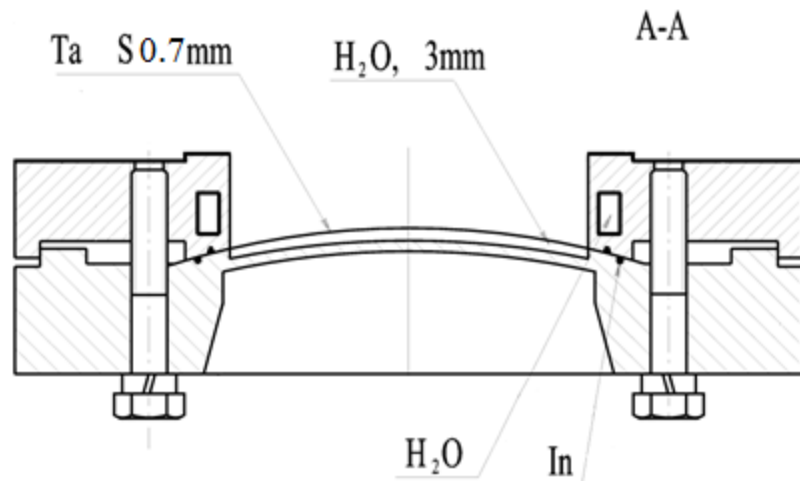
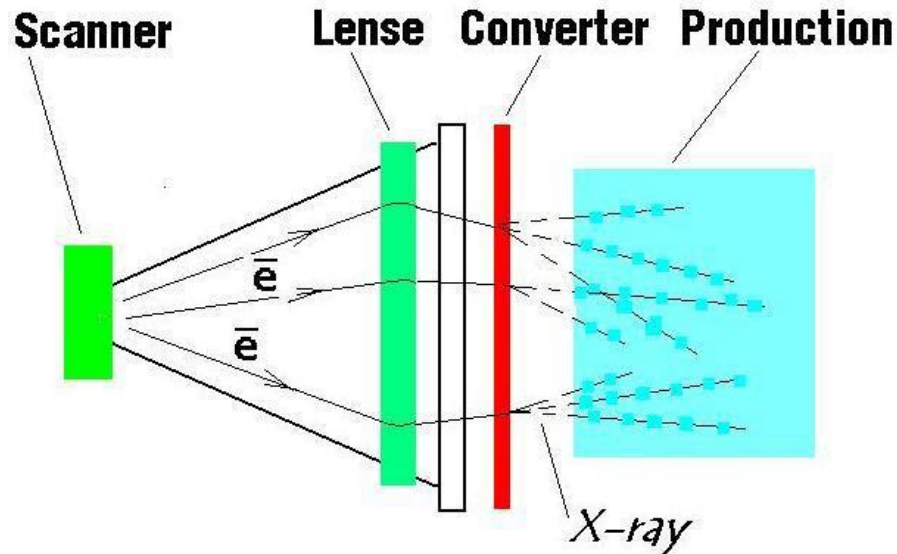
**DECONTAMINATION
DOSE: 5-10 kGy**



X-Ray converter

Conversion rate X-Ray/Ebeam

| E, MeV | Ta thickness, mm | 60 deg | 360 deg |
|--------|------------------|--------|---------|
| 5 | 0,7 | 8.3% | 12% |



Experiments:

Radiation stimulation of agricultures – 5-20 Gy

Food irradiation – up to 10 kGy

Hydrogel sorbents crosslinking – 0.1 –10 kGy

Enhancement of colorless topaz – 5 –200 MGy



Authorization of the practice



The Quality Management System for Medical Devices of the INP has been assessed and found to be in compliance with the Standard **ISO 13485:2016**

applicable to

Electron beam sterilization of medical devices, sterilization on the electron beam accelerator

Productivity per shift:

➤ the 90 cubic meters ($\approx 986,000$ pieces/per shift, 11 tons)



**MEDICAL PRODUCTS: DRESSINGS,
SYRINGES, NEEDLES, BLOOD
TRANSFUSION SYSTEMS, PROBES,
CATHETERS, SURGICAL SUTURE
MATERIAL (CATGUT, SILK), HYGIENE
BAGS, OBSTETRIC KITS AND
DISPOSABLE UNDERWEAR, RUBBER
GLOVES, ETC.**

THANK YOU FOR YOUR ATTENTION!

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