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ELV SERIES ACCELERATORS AND THEIR APPLICATIONS IN RADIATION TECHNOLOGICAL PROCESSES.

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The Budker Institute of Nuclear Physics of Russian Academy of Science are developing and manufacturing of electron accelerators of the ELV-type for their use in the industrial and research radiation-technological installations beginning 1970. The ELV-type accelerators were designed with use of the unified systems and units enabling thus to adapt them to the specific requirements of the customer by the main parameters such as the energy range, beam power, length of extraction window, etc.

Due to high power of electron beam in wide energy range, high efficiency of conversation of electricity power to electron beam power and simple procedure of accelerator control by operator ELV accelerators are the most popular Russian accelerator. They are well known in the world, especially in China and South Korea. By now, over 176 accelerators had been delivered inside Russia and abroad.

ACCELERATORS
ELV

Placements of ELV Accelerators

- 50 accelerators were delivered inside of former USSR
- 77 accelerators were delivered in China
- 19 accelerators were delivered in South Korea
- 2 accelerators were delivered in Japan
- 2 accelerators were delivered in Poland
- 7 Accelerators were delivered in Germany, Chech Republic, Malaysia, Phillipines, Turkey
- 4 Accelerators were delivered to India + 4 accelerators will be delivered in 2020.

Cable handling system for ELV accelerator in China

ELV accelerators are operating at LG cable Korea

Cable irradiation factory (Kolchugino, Russia)

2 In & 2 Out wires treatment by one ELV accelerator in JSC "Electrocable Works, Kolchugino" Speed of each line – 400 m/min

Parameters of the ELV Accelerators

- BINP proposes a number of electron accelerators of the ELV-type covering the energy range from 0.4 to 2.5 MeV with a beam of accelerated electrons of up to 130 mA and maximum power of up to 100 kW. Special case is 1 MeV 400 kW beam power electron accelerator. High energy efficiency of accelerator is 60- 80%. All models have similar concept but differ in overall dimensions, length of accelerator tube, and the number of high-voltage rectifying sections. This makes it easy to adapt accelerators to the requirements of technology. The system of automated control of accelerators and communication with technological lines is constantly developing.

	Energy range, MeV	Beam power, kW	Maximum beam current, mA
ELV-0.5	0.4-0.7	25-65	50-130
ELV-1	0.4-0.8	25	50
ELV-2	0.8-1.5	20	25
ELV-3	0.5-0.7	50	100
ELV-4	1.0-1.5	50	100
ELV-6	0.8-1.2	100	100
ELV-6M	0.75-0.95	160	200
ELV-8	1.0-2.5	100	50
ELV-12	0.6-1.0	400	500

Main application of ELV Accelerators

- Modification of polymer products
- Modification of the polyethylene insulation for the production of thermoresistant wires and cables 0.5-120 mm^2 with the capacity of up to 200 m/min
- The production of heat shrinkable pipes, films and bands with the capacity of up to 1000 kg/h
- The production of prepregand gel
- The production of artificial leather and rubber-technical products with the capacity of up to 1000 m/h
- Curing lacquer-paint coatings on different bases for the building industry of up to 500 m2/h

Favorable properties of EB crosslinked wire and cable insulation

Improved properties:

- Tensile strength increases, especially at elevated temperatures,
- Abrasion resistance
- Thermal resistance
- Stress cracking resistance
- Flame propagation resistance
- Deformation resistance
- Cut through resistance
- Chemical and oil resistance.
- Increased shear and compressive strength

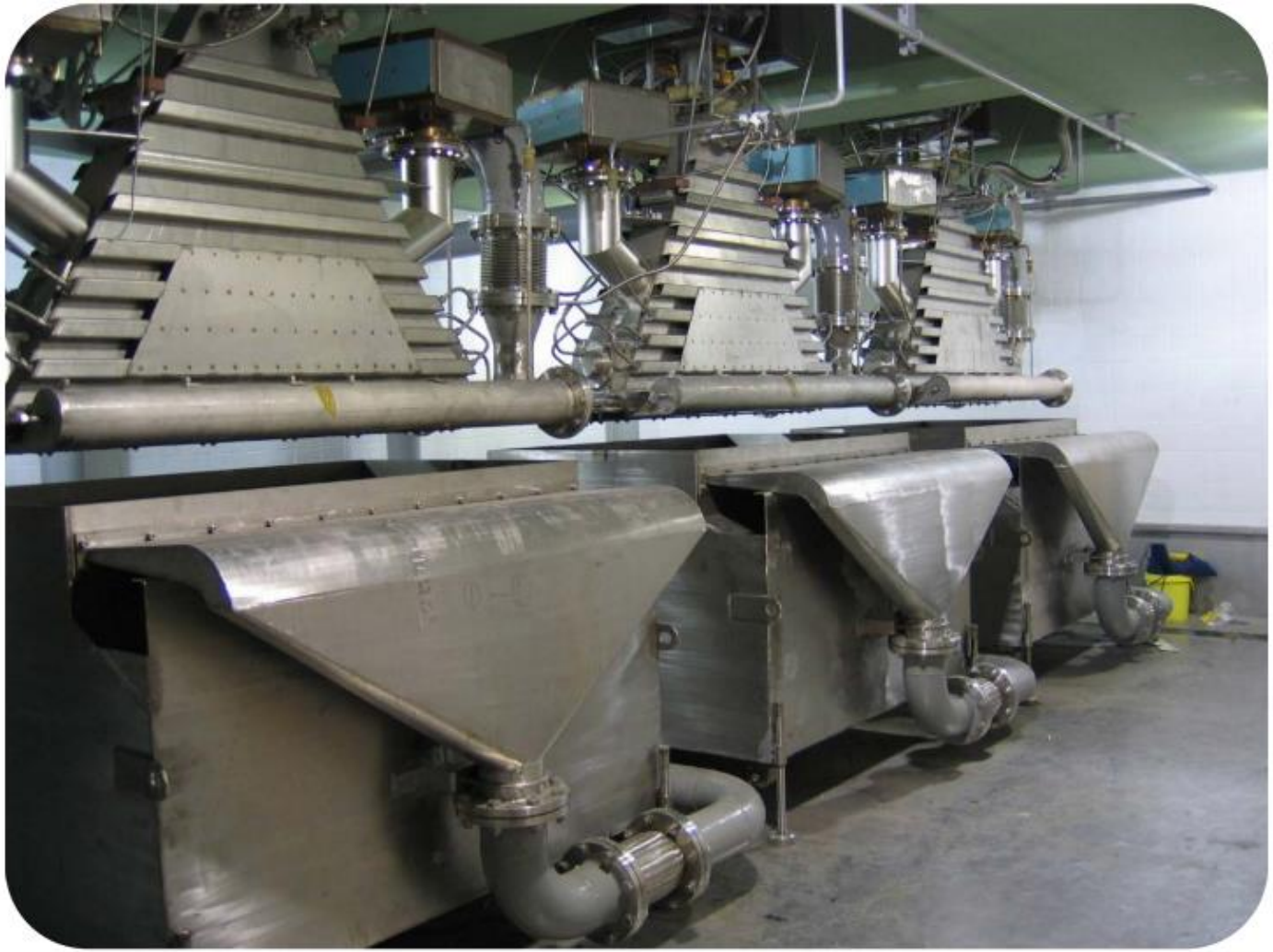
Maximum operating temperature range for wires and cables

Type of treatment	With long-drawn-out operation	up to 100 hours / year	A short time
No treatment	75 °C	-	140°C
Radiation treatment	150°C	200 °C	350°C

ELV-12 Accelerator

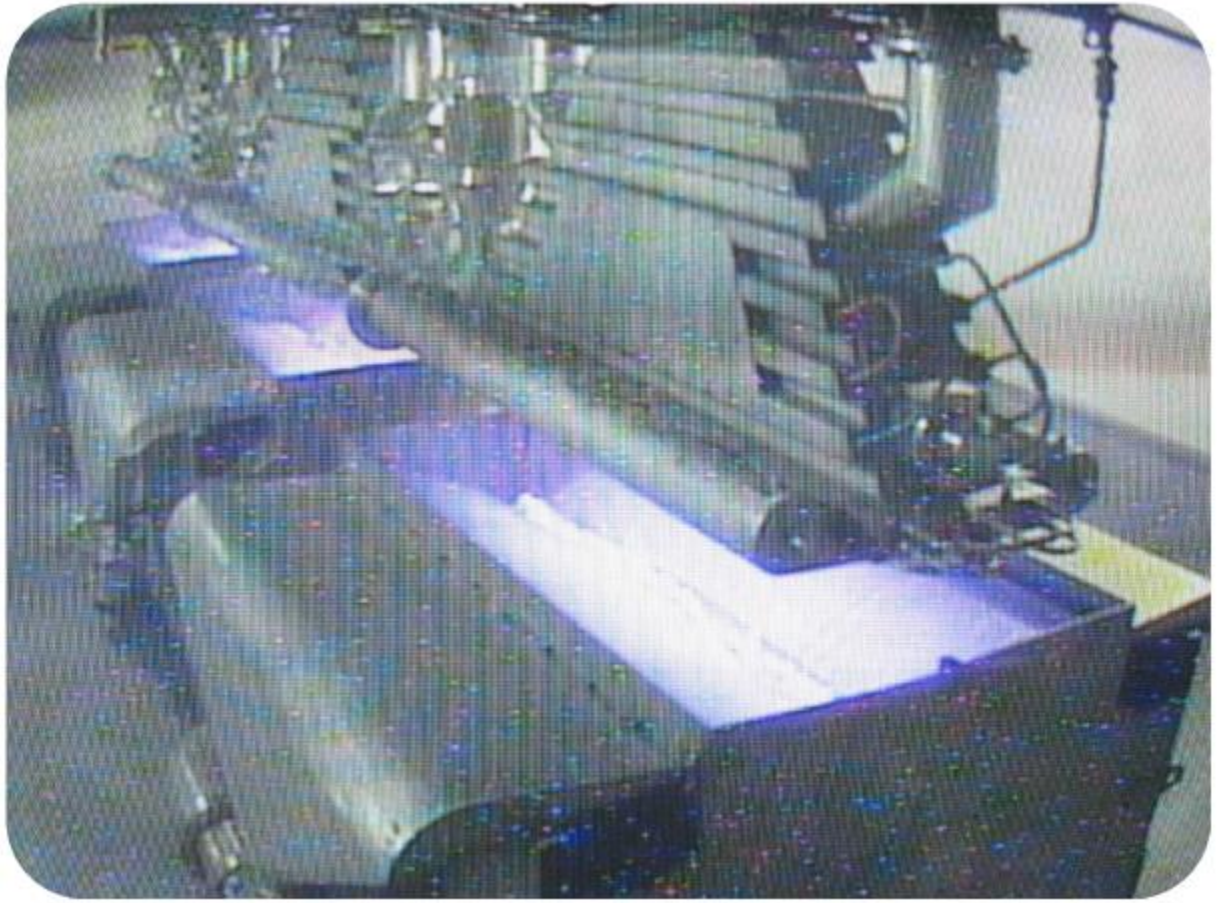
The energy range from 0.6 to 1 MeV. Beam current 500 mA. Beam power 400 kW.

Reaction hall ELV-12 accelerator in Dyetec (Taegy)



http://www.inp.nsk.su/sites/promusk/eng

ELV-12 Accelerator



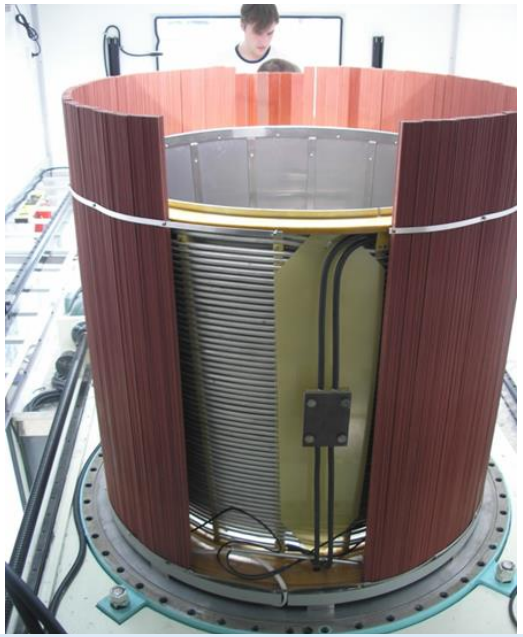
Irradiation treatment process

Grain dezinsectization

2 ELV accelerators were delivered to China for grain disinsection. Productivity is 1000 tonn per hour

Mobile Accelerator (EB-Tech, South Korea)

- 20 kW mobile accelerator
- 30 mA beam current
- 0.5 MeV Energy
- All equipment in two trailers
- Waste water and gas treatment



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Concentrated beam extraction to atmosphere

Accelerator parameters: Energy 1.4 MeV, Beam current 70 mA, Beam power 100 kW. The beam diameter at the exit from the extraction device is 3 mm.

Producing of SiO2 nano-powder

Evaporation of natural sand

Productivity – tens killograms per hour

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