The Installation for EB Processing of Cables and Wires at "Podolskkabel" Plant (New cable irradiator)

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The crosslinked technologies are applied very widely in industries. While the improved maximum operating temperature was one of the initial attractions of crosslinking, there are other important product advantages as a results of crosslinking the polymers, such as: reduced deformation under load, improved chemical resistance, increased abrasion resistance, improved impact properties, memory characteristics

The most perfect instruments for radiation treatment of insulation cable products are powerful industrial electron accelerators. Optimizing the method of electron beam irradiation of products it is possible to sufficiently improve the irradiation quality and the efficient use of a beam and, thereby, to decrease the cost of the treatment. Well introduced irradiation method will prevent complaints and return from customers. Quality helps to save money.

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ELV accelerators

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The Budker Institute of Nuclear Physics Siberian Branch 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.

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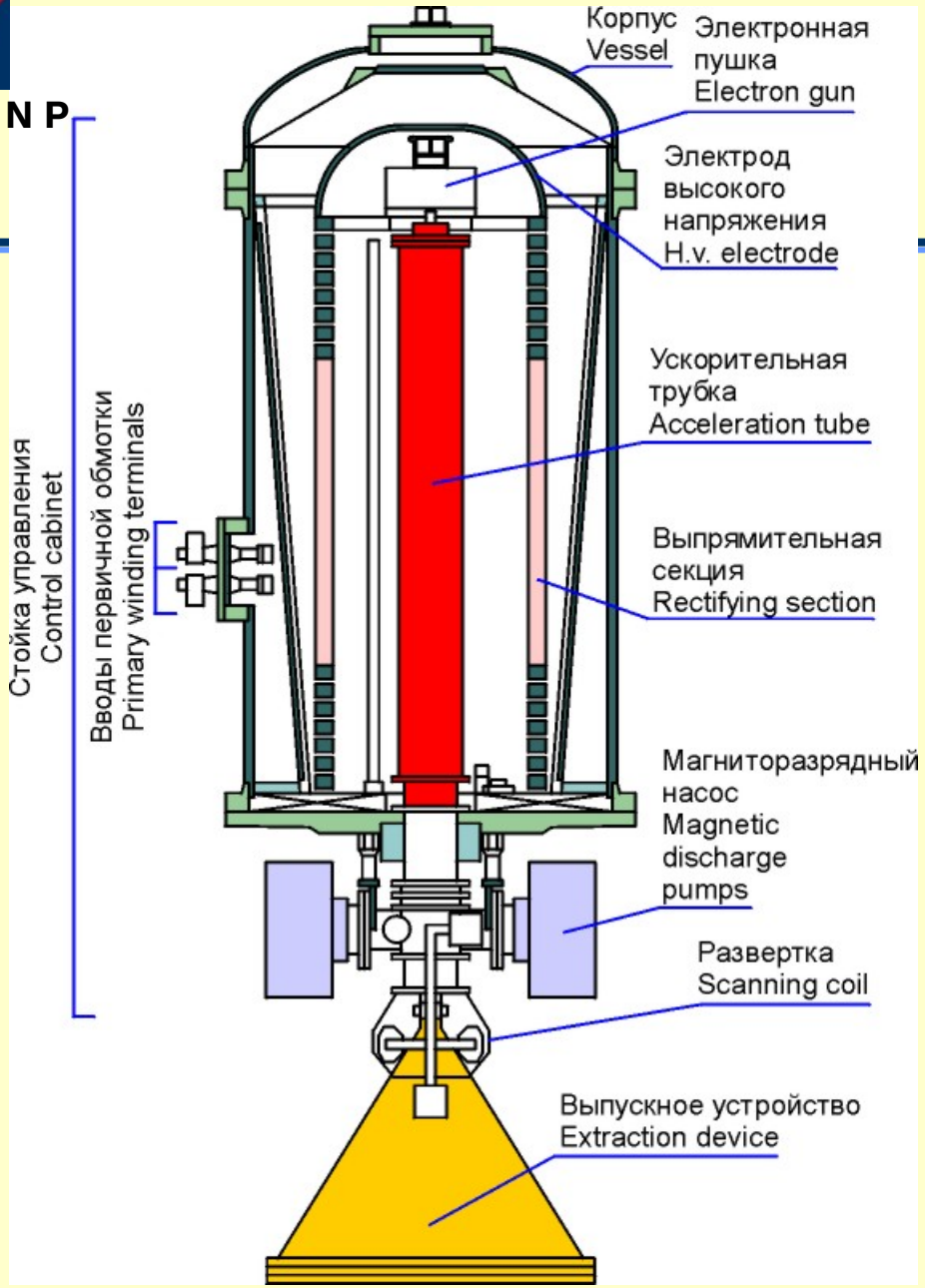

Structure of ELV accelerator

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ELV accelerators

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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 with the control system ELV accelerators are very popular accelerators not only in Russia, but in China, Korea, and etc. By now, over 110 accelerators had been delivered inside Russia and abroad.

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ELV accelerators

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BINP proposes a series 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 100 mA and maximum power of up to 100 kW. Special case is 1 MeV 400 kW beam power electron accelerator.

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Reaction hall ELV-12 accelerator in Dyetec (Taegy)

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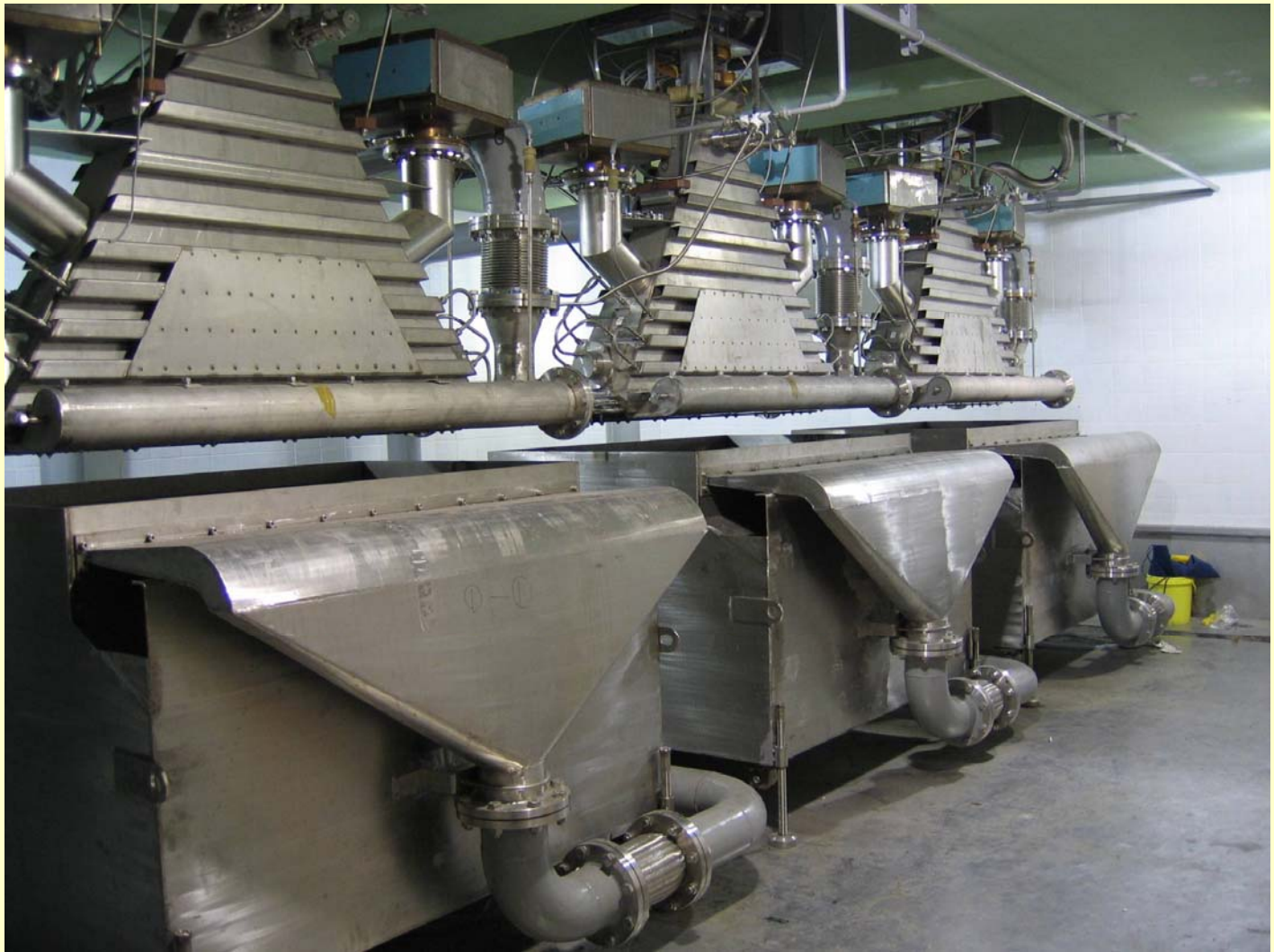

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Treating of waste water

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ELV accelerators are equipped with perfect control system

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ELV accelerators

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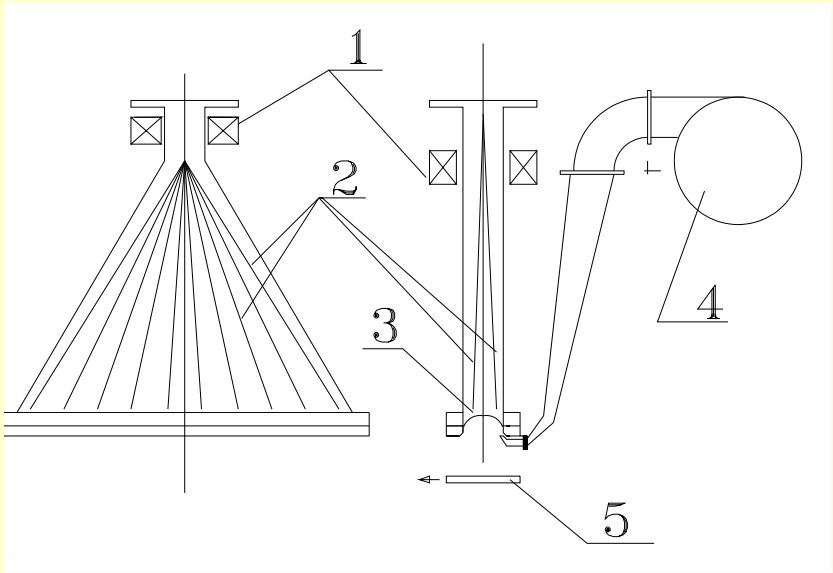

1 –scanning electromagnets, 2 – beam trajectories; 3 – foil of extraction window;
4 – foil cooling fan; 5 – movable target

Beam scanner (Germany)

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ELV accelerators are operating at LG cable (Korea)

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Cable handling system for ELV accelerator in China

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Two side (usual) cable irradiation (China)

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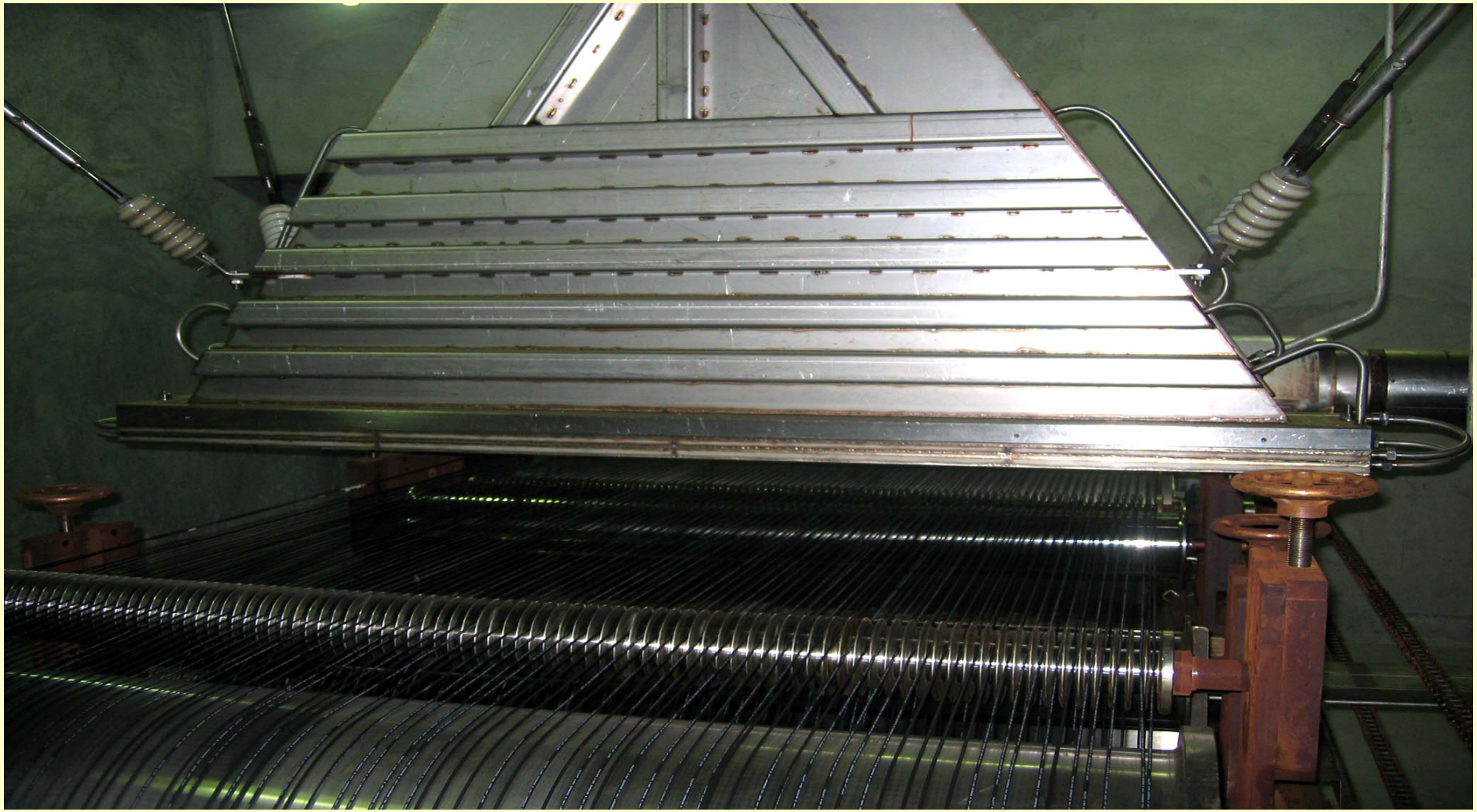

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Treated product (China)

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The cable is irradiated many tens of years and this processing is well-known. Nevertheless we try to modify this one. The modification have concerned:

- Method of irradiation
- Transportation of cables trough irradiation area
- Visualization of EB processing

As a result the improved electron accelerator for cable insulation treatment provided with 4-side irradiation system was put into operation in “Podolskcabel” Ltd.

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Joint-stock company "Podolskcabel" was founded 1941

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Per day cable treatment

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Dose distribution for different method of irradiation

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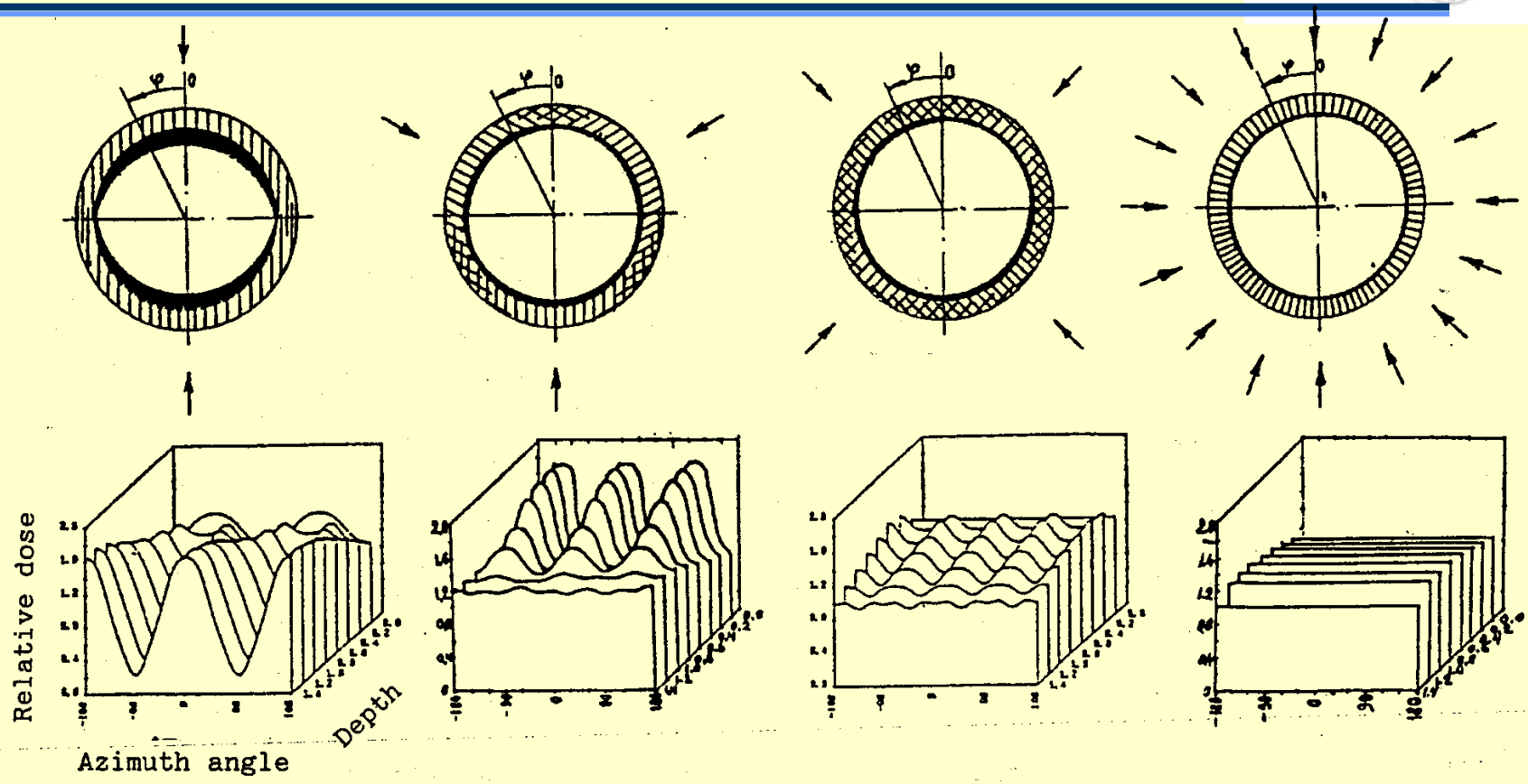

Fig. 2. Dose distribution in cable insulation at 2-sided, 3-sided, 4-sided and rotational (round) irradiation in absence of cable twist.

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Main idea of 4-side irradiation

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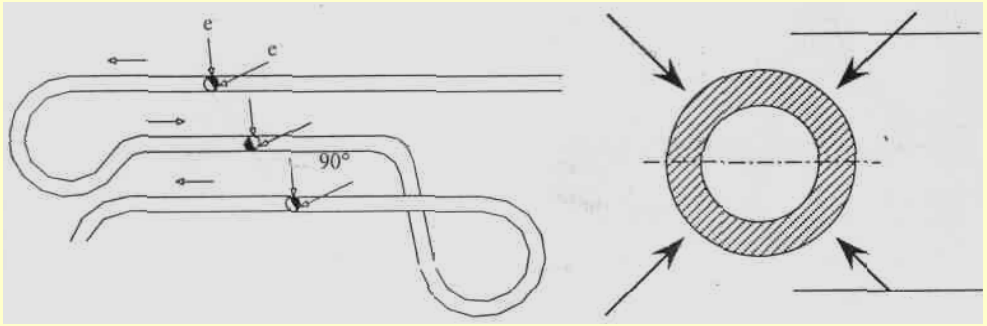

The cable many times passes through area of irradiation. One turn is similar to figure 8. So th cable changes position t 180 degree each turn.

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Four-sided irradiation device

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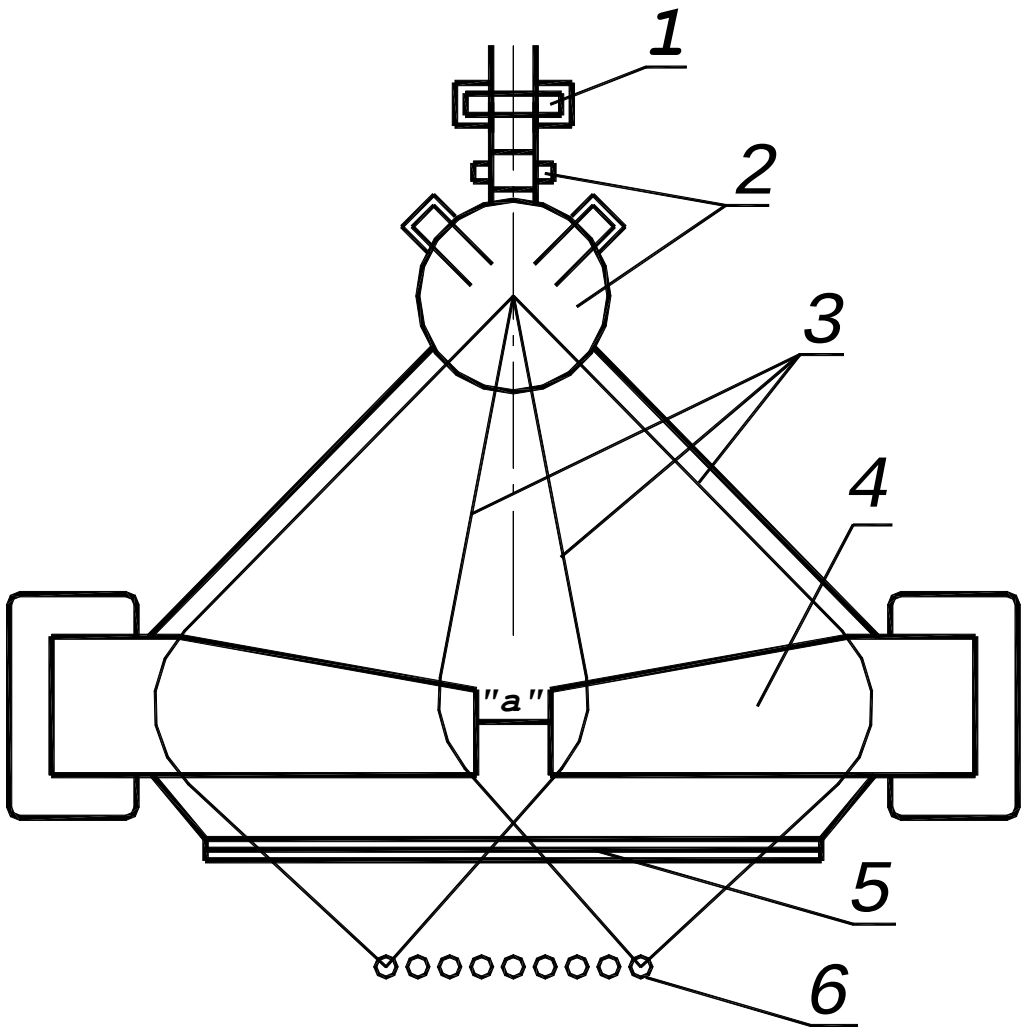

1 – toggle magnet;
2 – scanning system;
3 – electron
rajectories;
4 – banding magnets;
5 – extraction
vindow;
6 – area of irradiation

Magnetic field map

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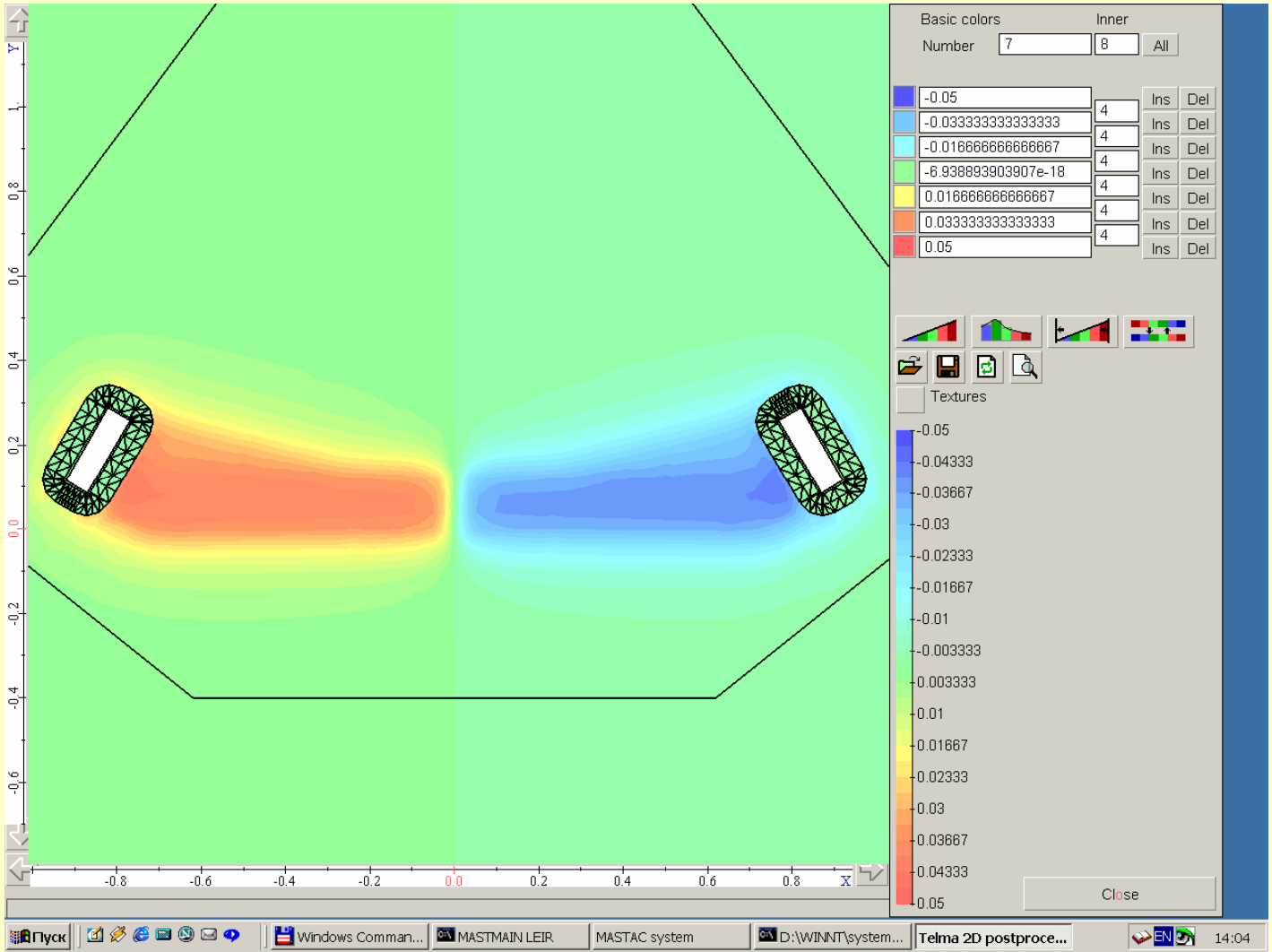

Trajectory of particles (z-x plane)

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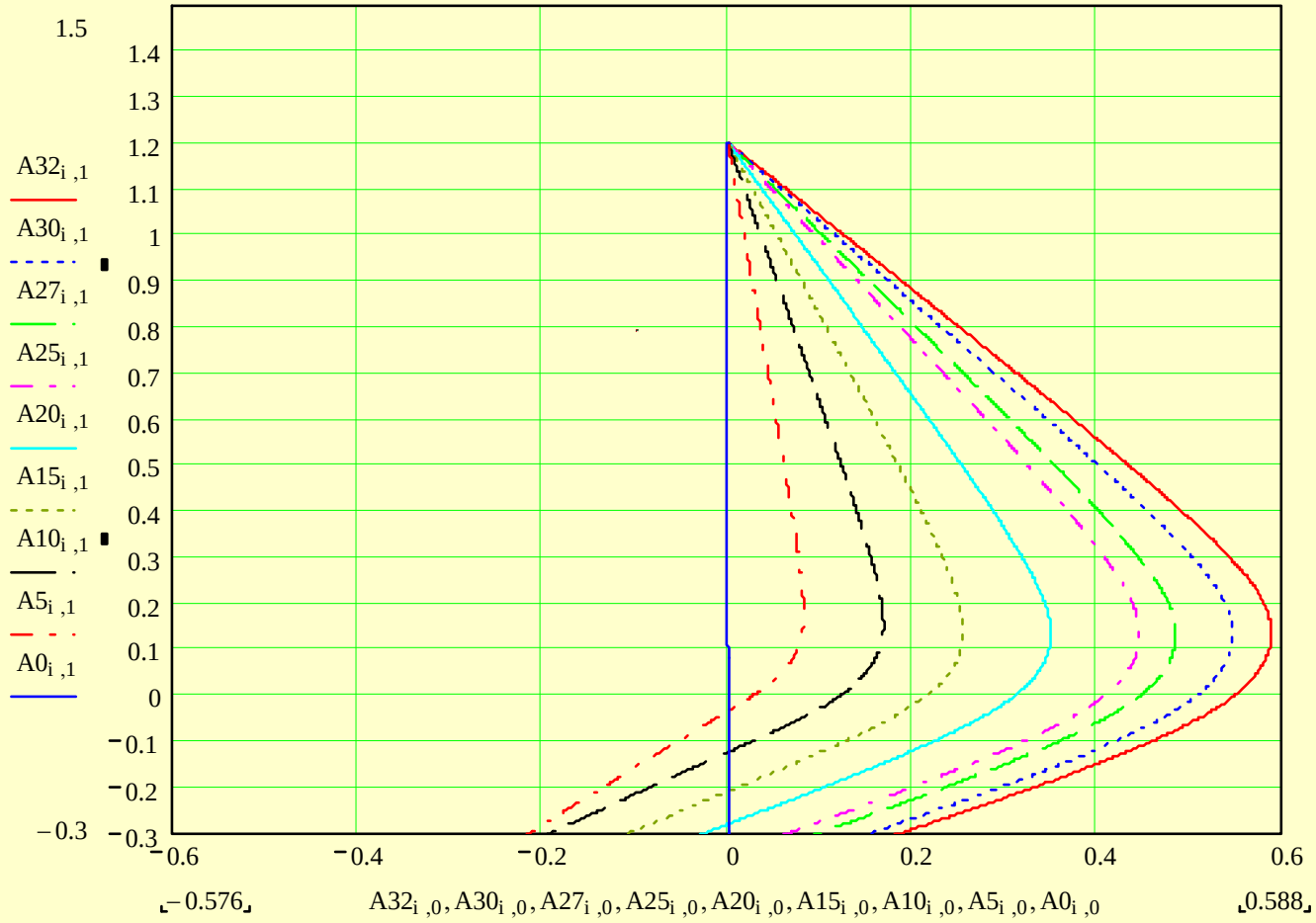

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Four-sided irradiation device

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Four-sided irradiation device with protection

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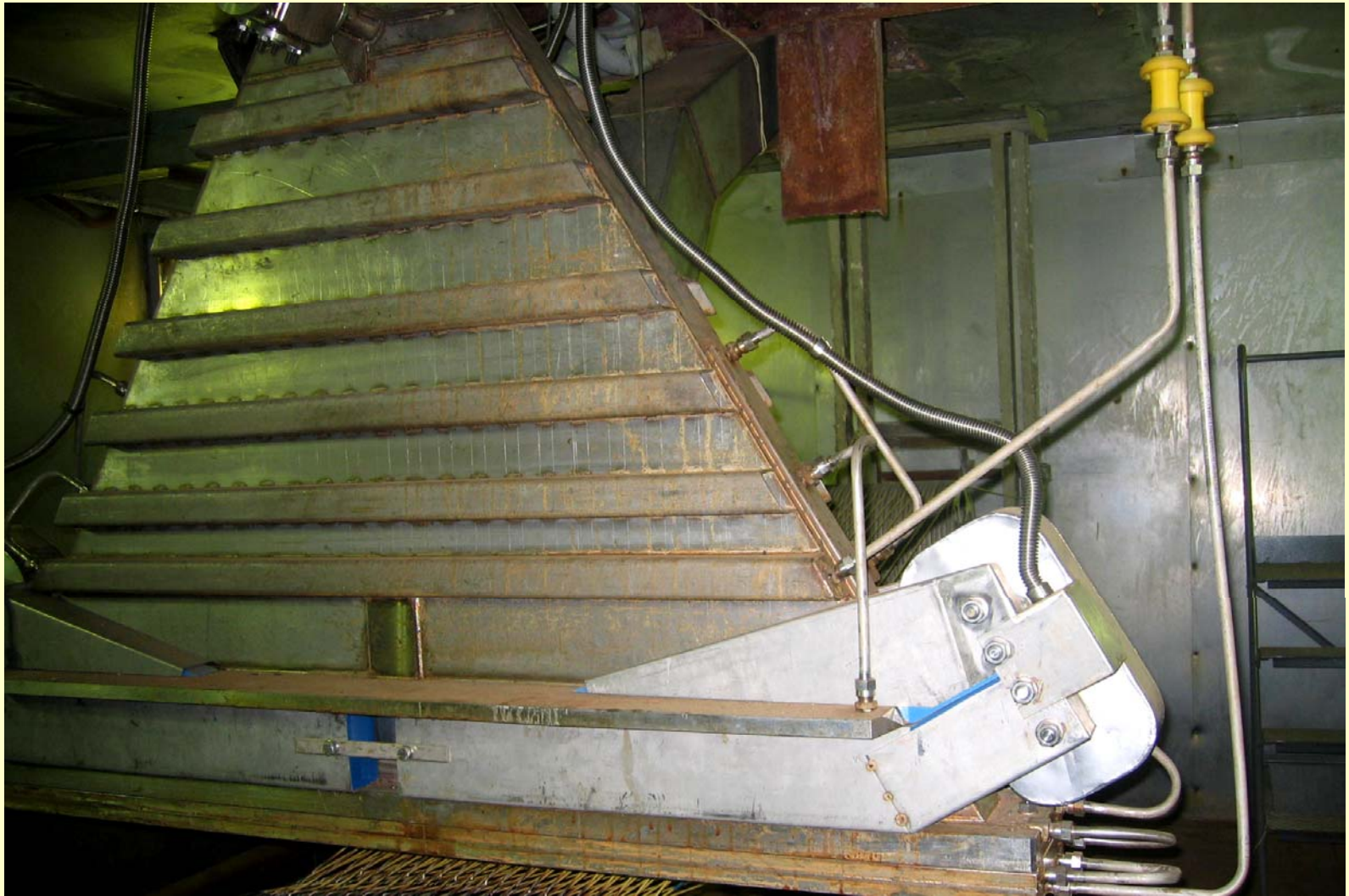

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Linear probes under extraction device during adjustment

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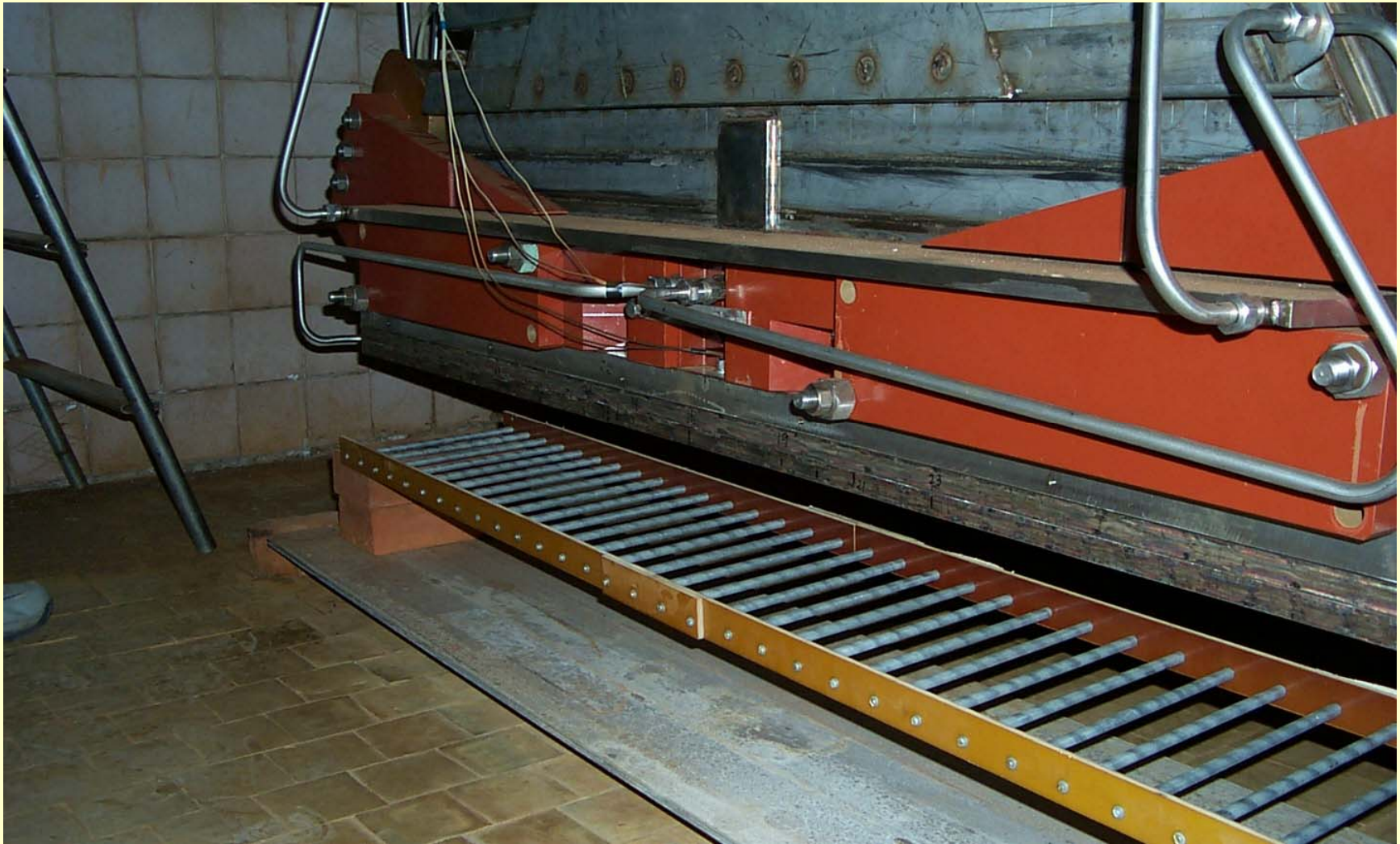

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Measurements of output angles

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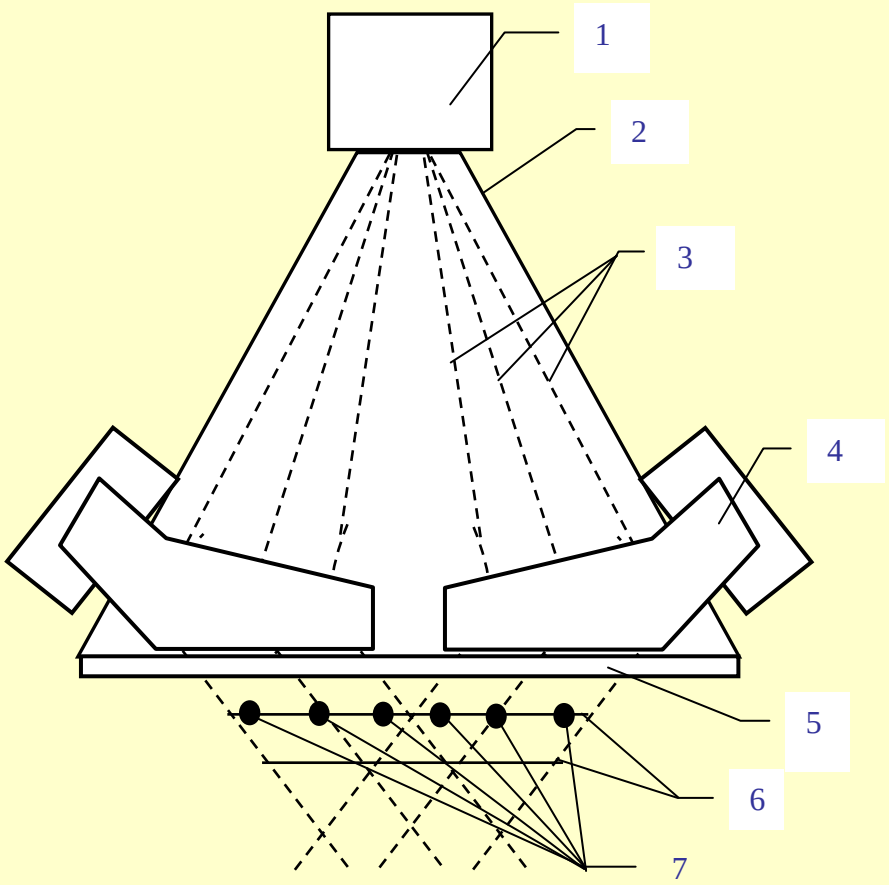

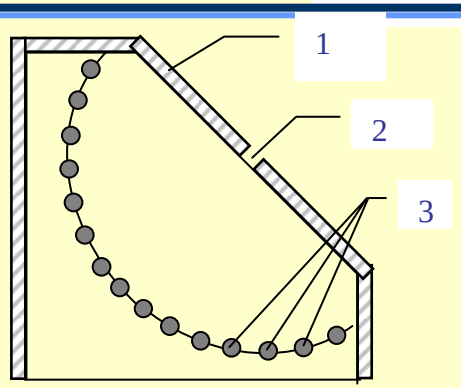

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Cable irradiation

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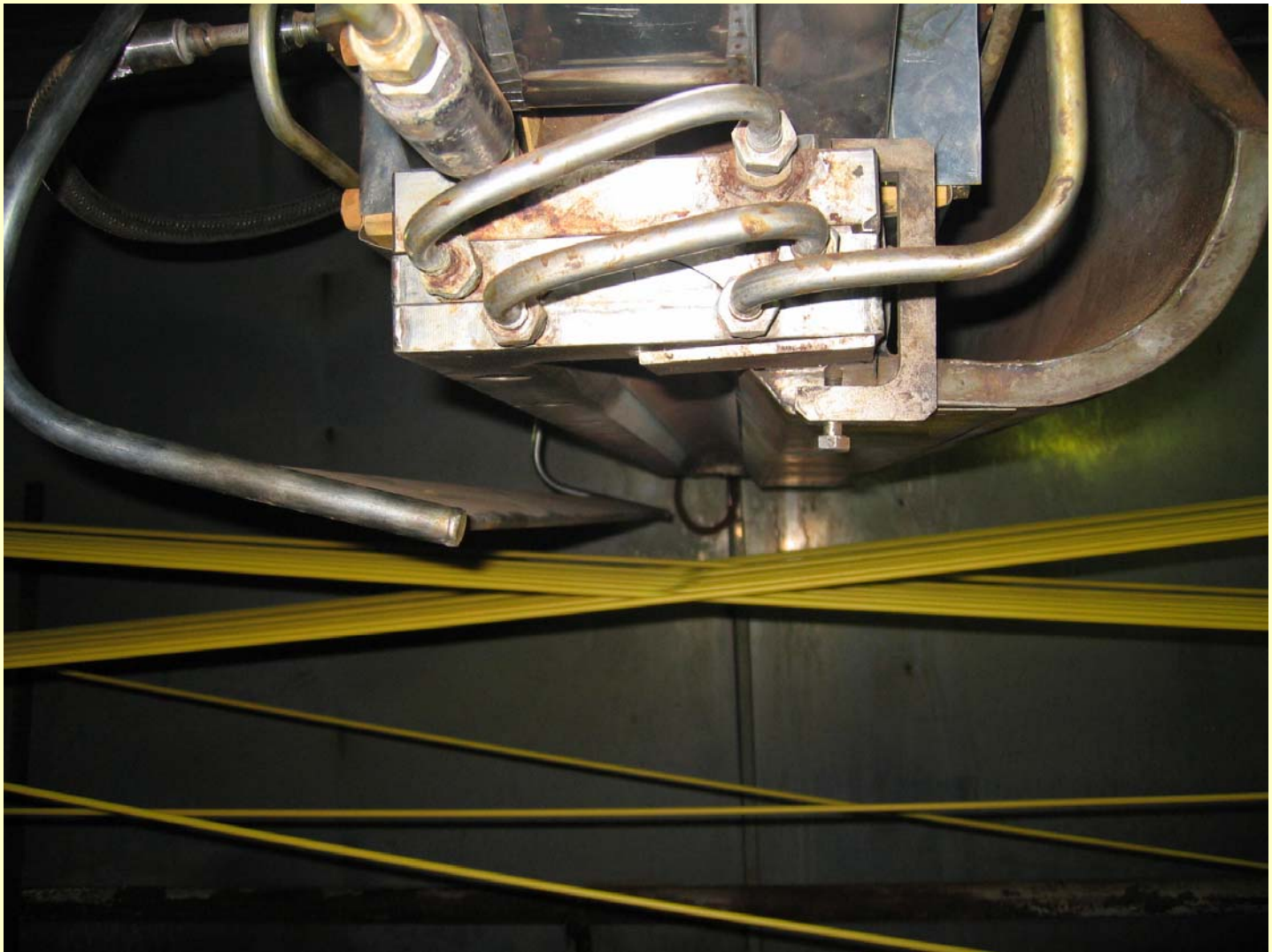

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Comparison of crosslinking after 2- and 4- sided irradiation

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	Gel content on sectors (%) 1	2	3	4	Average value
Two side (usuall) irradiation	**54.8**	**7.1**	**56.6**	**75.0**	**48.3**
	55.5	**22.4**	**59.1**	**68.6**	**51.4**
	66.5	**73.3**	**57.5**	**54**	**62.8**
	49.9	**70.6**	**69.8**	**54.3**	**61.1**
Four side (modified) irradiation	**70.0**	**68.2**	**73.1**	**73.4**	**71.1**
	73.4	**65.9**	**68.4**	**73.1**	**70.2**
	67.1	**70.2**	**67.6**	**67.3**	**68.0**
	71.7	**70.5**	**76.2**	**76.4**	**73.7**

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The samples of cables that use components treated by electron beam

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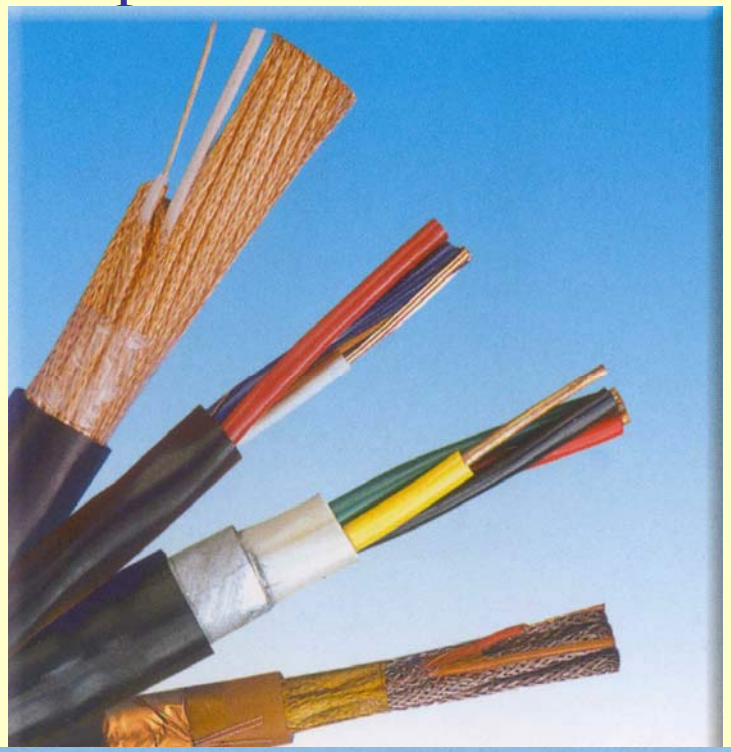
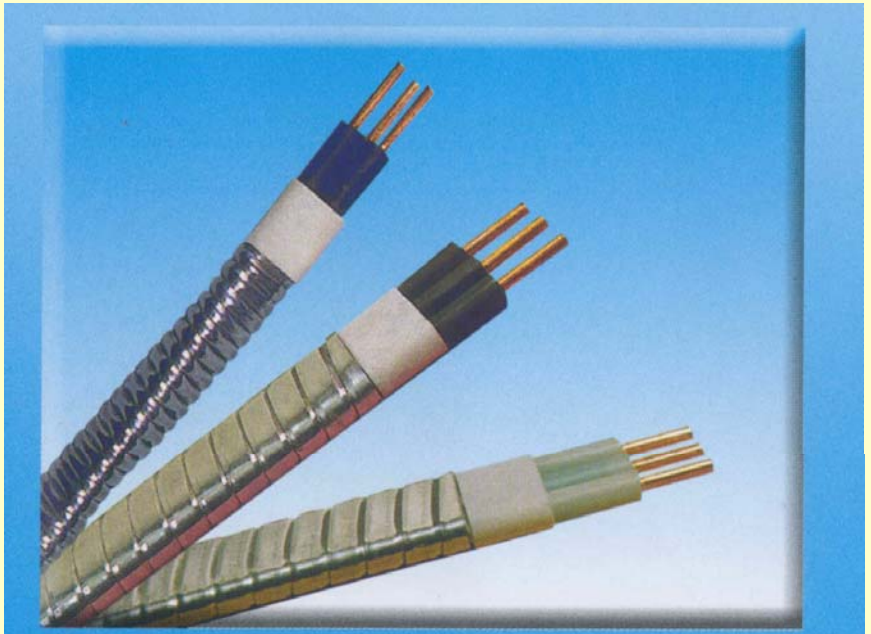
Cables for nuclear power station



► Кабели специальные для АЭС марок КПоЭВнг, КПЭТИнг.

Cables for bore-hole oil pumps



► Кабели для погружных нефтенасосов на рабочую температуру:
до 90°С – КПБП, КПБК;
до 120°С – КППБПТ, КППБКТ.

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Underbeam transportation system

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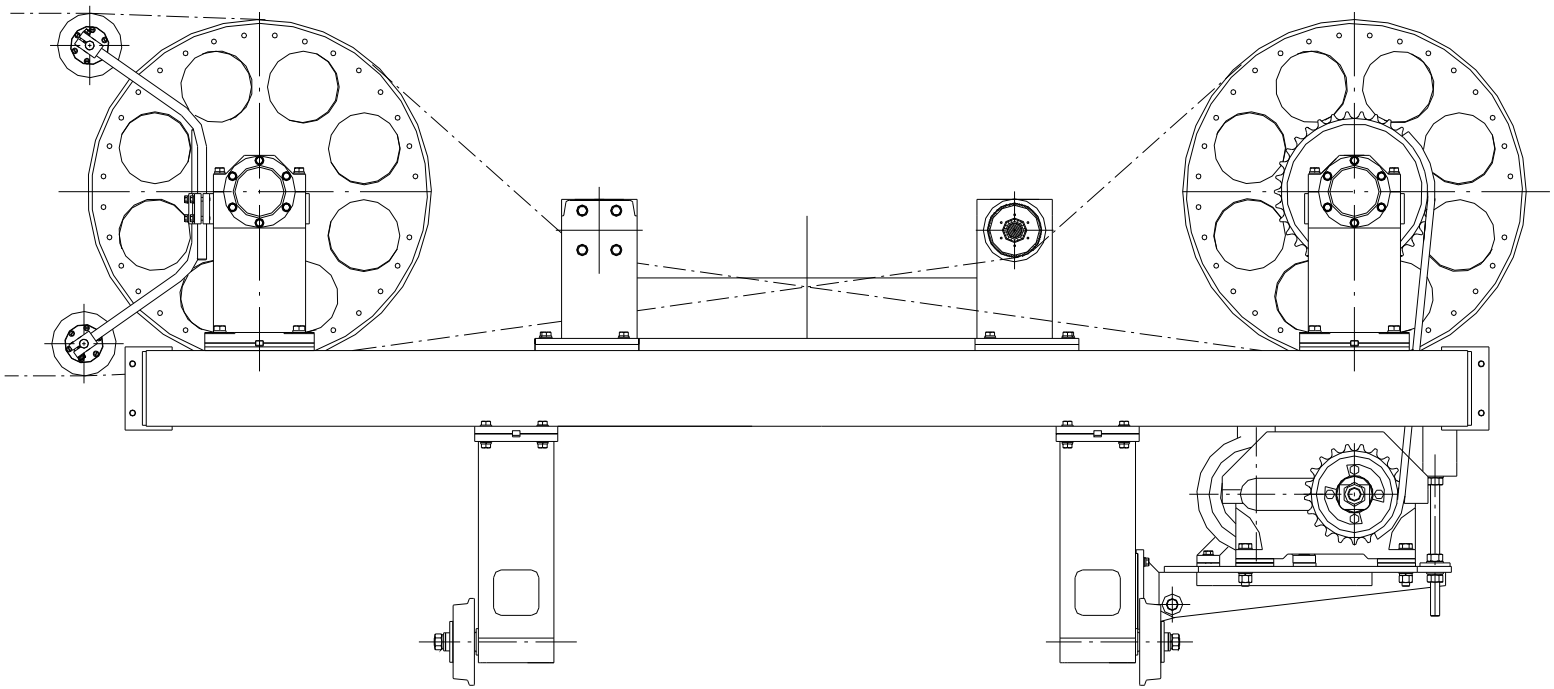

Underbeam transportation system

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36 mm^2

Single core

Underbeam transportation system

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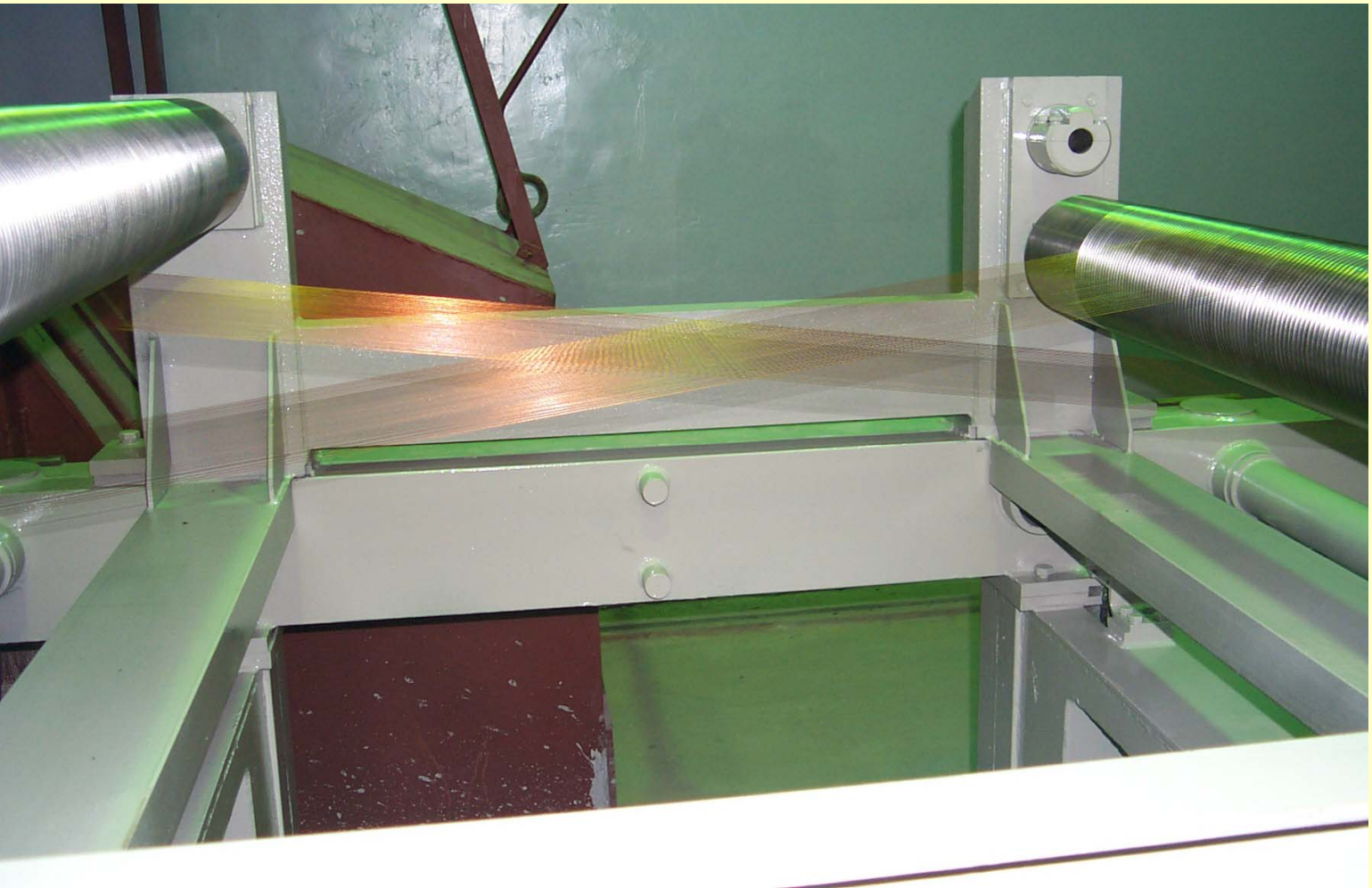

0.12 mm^2

Underbeam transportation system

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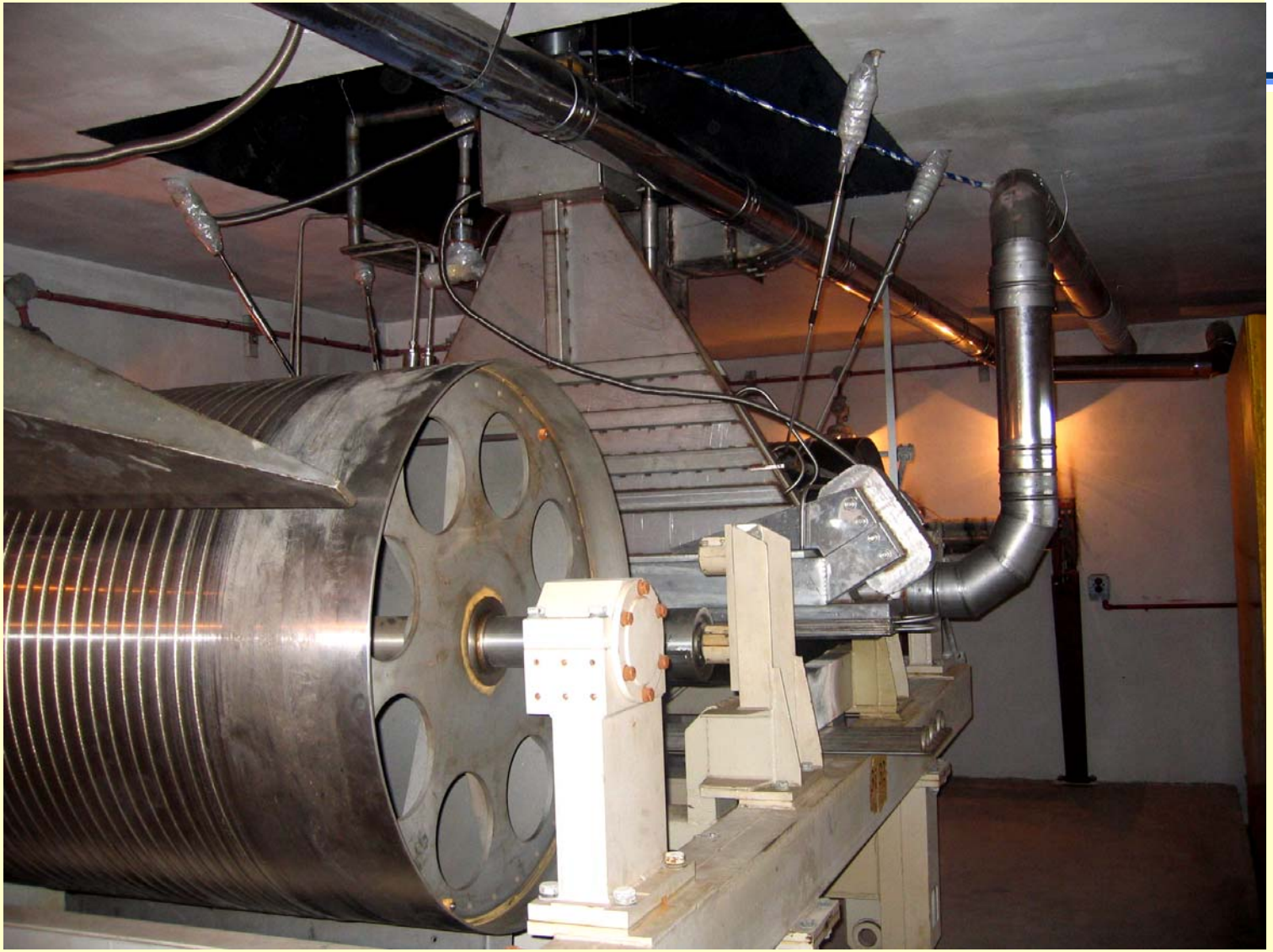

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Monitor for operator

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Thank you for your attention

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