

AT140 Neutron calibration facility



Reference AT140 Neutron calibration facility is designed to simulate and transmit neutron flux density, ambient and individual dose equivalent rates of neutron radiation during calibration, verification and testing of neutron radiation monitors and dosimeters.

Operating principle

Operating principle of facility is based on the use of $^{238}\text{Pu-Be}$ and ^{252}Cf radionuclide sources. The facility implements irradiation pattern with fixed irradiator and calibration bench on linear travelling platform, as well as with "open" geometry.

All operations for radiation sources transfer from source magazine to working position and calibrated instruments positioning in radiation beam are automated. Automatic functions of facility are remotely controlled from operator room.

Control system with alarm and interlock functions and radiation monitoring system provides safety operation of facility.



Application

Metrology support of neutron radiation monitors and dosimeters:

- Verification and calibration in metrology service facilities
- Setting-up and graduation of measurement instruments in the process of development and production

Features

- Magazine drum receives up to 3 neutron sources
- Creates fast and slow neutrons field in collimated beam of UKPN sets
- Creates fast neutron field in "open" geometry using shielding cone according to ISO 8529-2
- Programmable control of source travel inside irradiator
- Programmable control of moving platform positioning in fully automatic and manual mode
- ϕ and Z servo motors are used for moving sources inside irradiator, and servomotor X is used for moving the plate
- Lasers and bar gauges are used for detector centring in radiation beam
- Reads data from calibrated measurement instruments using video surveillance system or instrument interface
- Available alarm and interlock system ensures safety
- Three power outlets (230 VAC, 50 Hz) with insulated neutral on moving platform for verified instruments
- Measurement of radiation environment in working chamber and adjacent rooms using SRK
- Video surveillance of room with working chamber
- Intercom system for operator communication
- Safe braking and trip limiting of moving platform
- Emergency power source is available
- Source are loaded into facility using transfer container and manual electrically operated catch
- Control system based on PC and operator panel with automatic calibration functions
- Layout design and calculation of radiation parameters for client's premises



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Specifications

Neutron source, type, peak neutron flux

- IBN-8 ($^{238}\text{Pu-Be}$) $5 \cdot 10^7$ neutron/s
- NK252N11 (^{252}Cf) $5 \cdot 10^8$ neutron/s

Generated ranges:

- Fast neutron fluence rate $2.5 - 3.5 \cdot 10^3$ neutron/(s·cm²)
- Slow neutron fluence rate $1 - 1.4 \cdot 10^3$ neutron/(s·cm²)
- Ambient dose equivalent rate and individual dose equivalent rate of neutron radiation $3.5 - 4.0 \cdot 10^3$ μSv/h

Basic relative error

- Neutron fluence rate 5%
- Ambient dose equivalent rate and individual dose equivalent rate 7%

Radiation beam axis height (1500±30) mm

Source height positional accuracy ±2 mm

Working distances interval R 0.5 – 3 m

Reproducibility of moving platform position on X coordinate <0,5 mm

Absolute error of detector position in radiation beam ≤0.002R

Speed of platform travel 0.9 mm/s – 26 cm/s

Travel range of platform workbench:

- Vertically from floor level 1140 – 1480 mm
- Horizontally
- Along radiation beam axis ±50 mm
- Across radiation beam axis ±140 mm
- Around vertical axis with 15° increments (For pivot table) 360°

Initialisation time ≤1 min

Continuous run time ≥24 h

Power supply (230 ±23) V, (50±1) Hz

Power consumption:

- Facility 1000 W
- Auxiliary equipment 400 W

Operation temperature range 15°C – 35°C

Relative air humidity ≤80%

Dimensions and weight:

- Irradiator 1200x900x2950 mm; 350 kg
- Calibrating bench base frame 5060x860x320 mm; 70 kg
- Moving platform 1010x855x1820 mm; 170 kg
- Transfer container Ø654x684 mm; 300 kg
- Operator station equipment (footprint) 3500x1500 mm; 200 kg

Design and specifications are subject to change

Complete set

- Remotely-controlled irradiator:
 - Irradiator
 - Control unit
 - Control panel
 - Accessories including source holders and tools for source holder assembling, retrieving magnet, transfer container and lift
- Calibration bench:
 - Base frame
 - Moving platform
 - Control unit
 - Control panel
 - Gamma background generating device
 - Video surveillance system for measurements
 - Laser targeting system
 - Accessory set for unit performance monitoring
 - Holding stand for detection units
 - Water phantom of 300x300x150 mm size
- Alarm and interlock system
- Radiation monitoring service
- Video surveillance system
- Uninterrupted power supply
- AC power adapter
- Desktop computer
- "UDG software solution"
- Accessories kit
- Spare parts kit
- Calibration procedure
- User's manual

Laboratory corresponds to the following regulations:

GOST 8.521-84 (Sets for calibrating neutron radiation. Methods of verification)

GOST 12.2.091-2012 (IEC 61010-1:2001) (Safety requirements)

GOST 27451-87 (Ionizing radiation measuring means)

GOST R IEC 61326-1-2014 (IEC 61326-1:2012) (Electromagnetic compatibility)

NP-038-11 (Safety of radiation sources)



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