



**SOLARIS  
CENTRE**



Radiation Protection and Personal  
Safety System at SOLARIS  
National Synchrotron Radiation Centre

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# Outline

1. Overview
2. Radiation Safety
3. Personal Safety System
4. Conclusions



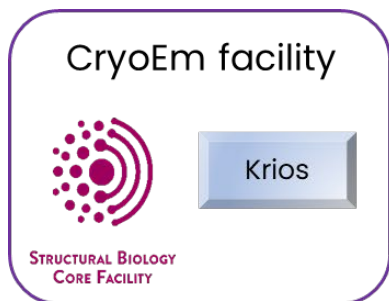
# Overview of Solaris Centre



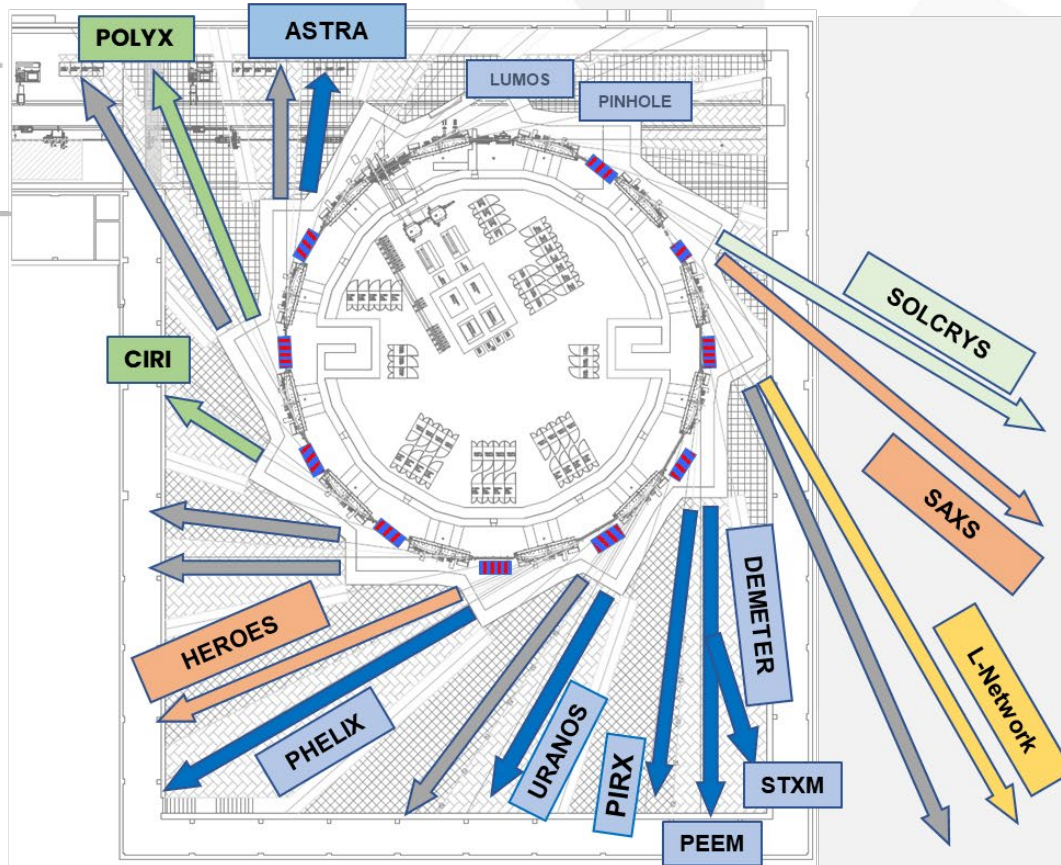
The SOLARIS storage ring main parameters

PARAMETER	VALUE
Energy	1.5 GeV
Max. current	500 mA
Circumference	96 m
Main RF frequency	99,98 MHz
Max. number of circulating bunches	32
Horizontal emittance (without insertion devices)	6 nm rad
Coupling	1%
Tune $Q_x, Q_y$	11.22; 3.15
Natural chromaticity $\xi_x, \xi_y$	-22.96, -17.14
Corrected chromaticity $\xi_x, \xi_y$	+1, +1
Electron beam size (straight section centre) $\sigma_x, \sigma_y$	184 $\mu\text{m}$ , 13 $\mu\text{m}$
Electron beam size (dipole centre) $\sigma_x, \sigma_y$	44 $\mu\text{m}$ , 30 $\mu\text{m}$
Max. number of insertion devices	10
Momentum compaction	$3.055 \times 10^{-3}$
Total lifetime of electrons	13 h

# The SOLARIS Centre operates in a 24/5 mode (24 hours a day, 5 days a week)



In operation
Under construction, available 2023
Under construction, available 2024/2025
Project application (decision 2023)
Conceptual phase
Slots available for 6 new beamlines



## Radiation Safety at SOLARIS



## Legal acts regulating the activity at SOLARIS:

The authority that supervises the activities of Solaris is National Atomic Energy Agency (PAA)



All the SOLARIS activities concerning radiation protection are compatible with requirements described in formal regulations:

**Act 'Atomic law' of November 29, 2000 (Dz. U. z 2007 r. Nr 142, poz.276) [as amended (Dz.U. 2021 poz. 1941)]**

Responsibilities in radiation protection:

- **Director of SOLARIS**, on behalf of **Rector of the Jagiellonian University**, among others, oversees respecting the requirements of radiation protection.
- **Radiation Protection Officer**, among others, internally supervise respecting the requirements of radiation protection.





## Workers categories at SOLARIS Centre:

Category	Dose limits	Who?	Area classification
Radiation workers category A	20 mSv/year	No workers at Solaris	Controlled area
Radiation workers category B	6 mSv/year	Technical team of Solaris, Radiation Protection Officer	Supervised area
Public	1 mSv/year	Administrative and external workers, users, visitors	Unclassified area

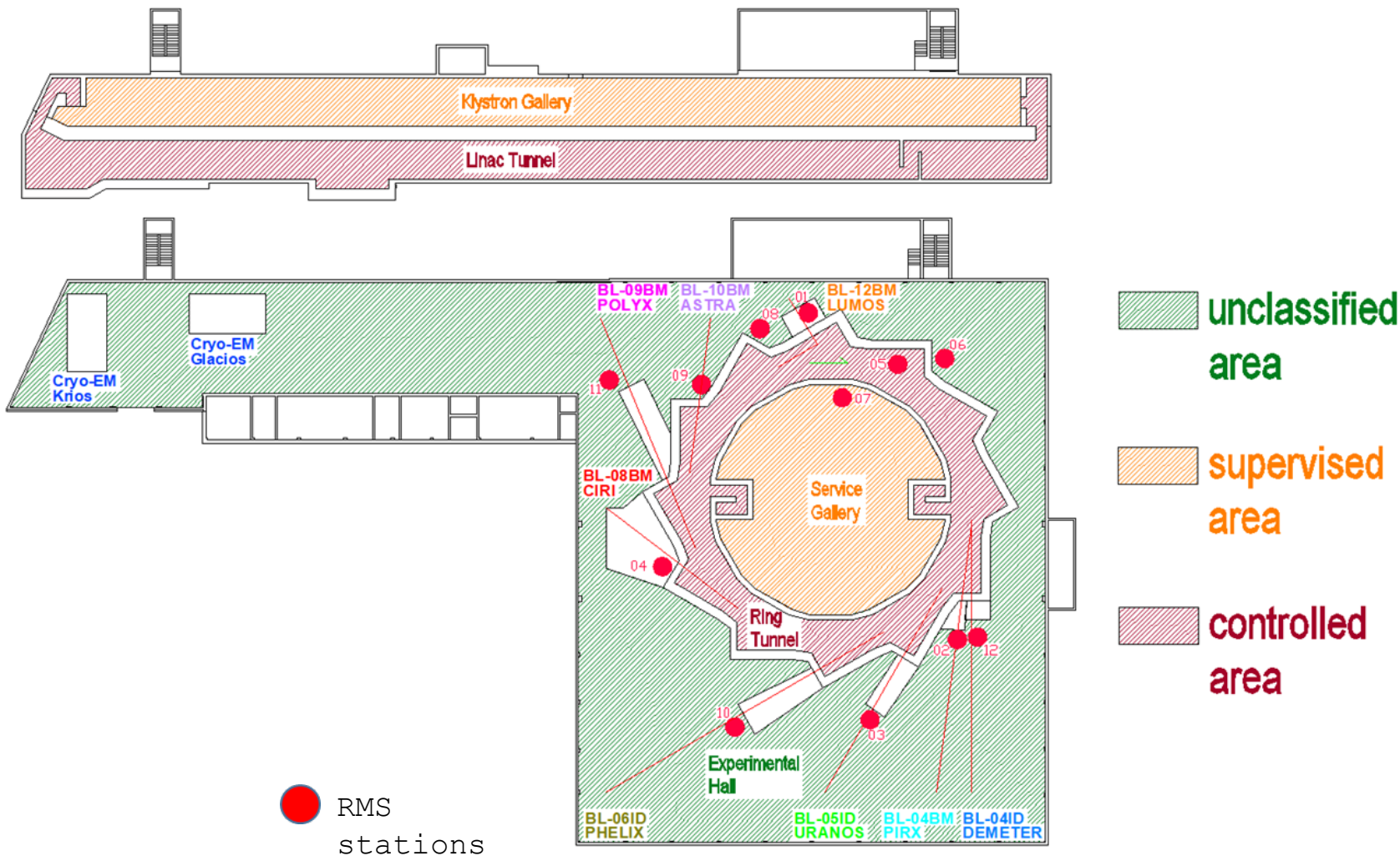
An employee can start working in radiation conditions after receiving a certificate of no contraindications against such work, issued by a qualified doctor.

Additionally pregnant woman cannot work in the position, in which the unborn children may receive the effective dose higher than 1 mSv.

The number of total employees is 112, and qualified for category B is 93.

In 2022, the average received total effective dose for Solaris employee was **0.4 mSv**.

# Areas classification at SOLARIS:



● RMS stations

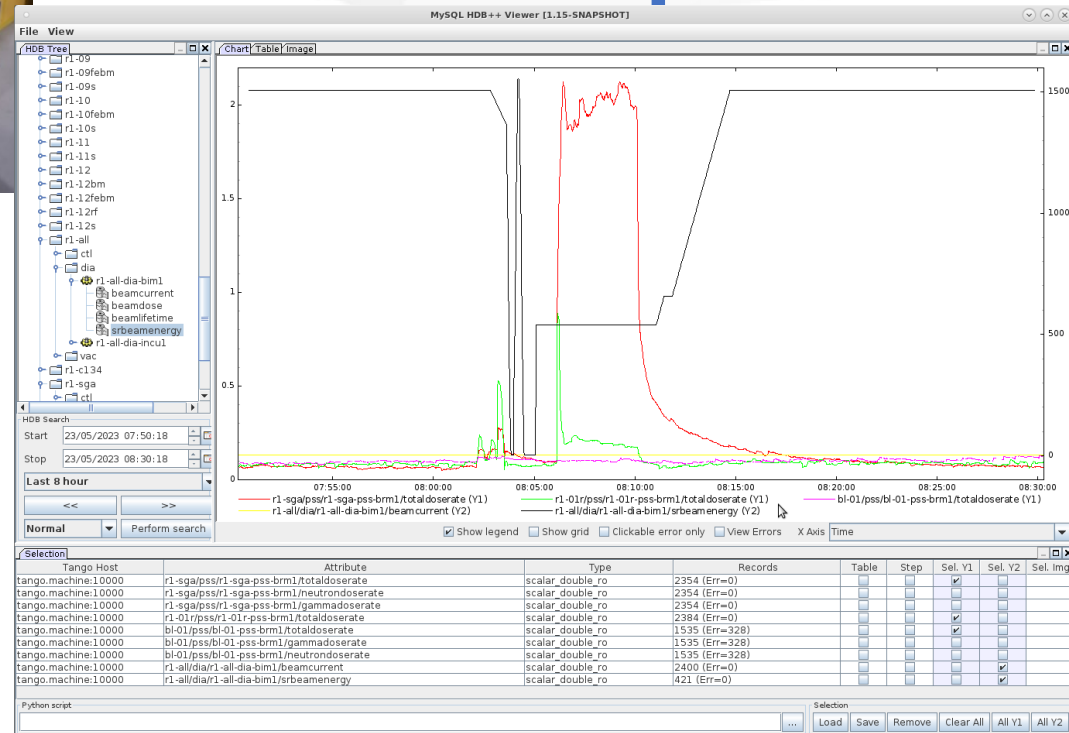
# How is the radiation monitored at Solaris?

1. Radiation Station Monitor (13 RMS distributed throughout the facility)



Dose rates and accumulated doses are continuously read locally and in control room in dedicated application

Defined signals are constantly archived

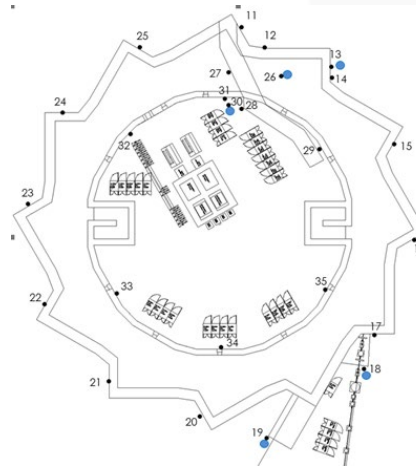


## How is the radiation monitored at Solaris?

- **Personal TLD dosimetry** used by SOLARIS category B employees



- **Environmental TLD dosimetry**



## How is the radiation monitored at Solaris?

- **Portable radiometers:** periodical radiation measurements:



- **Electronic personal dosimeters:** used by employees while accessing supervised or controlled area, available at the Control Room:



# Personal Safety System (PSS):

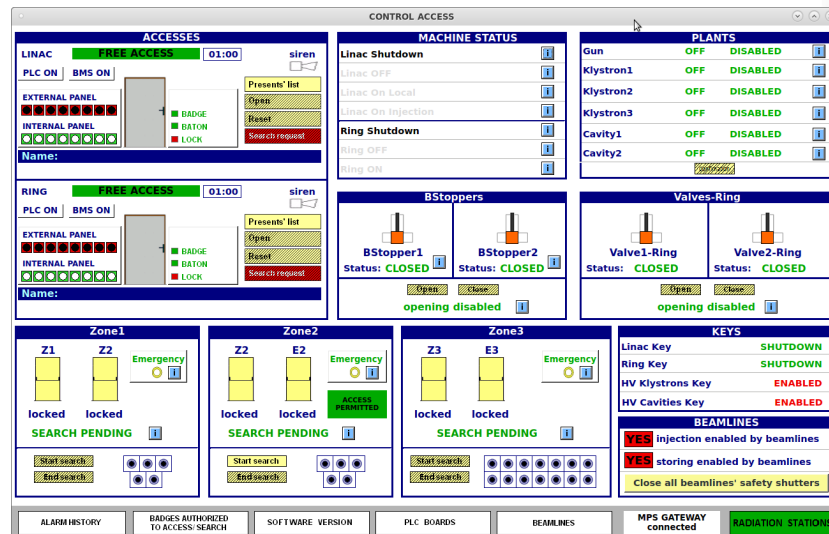
PSS role is to protect people against ionizing radiation at SOLARIS.

## ➤ Synchrotron PSS:

- Switches off the machine in an emergency, after pressing an emergency button;
- Informs about exceeding a radiation alarm threshold;
- Closes the doors which lead to the tunnels.

## ➤ Panel available in Control Room

Door of the ring tunnel



## Personal Safety System (PSS):

**PSS** role is to protect people against ionizing radiation at SOLARIS.

### ➤ Beamlines PSS:

- Every beamline has a  $\gamma$ /X radiation monitoring station connected to the PSS;
- In case of exceeding a radiation, alarm threshold safety shutters are closing.

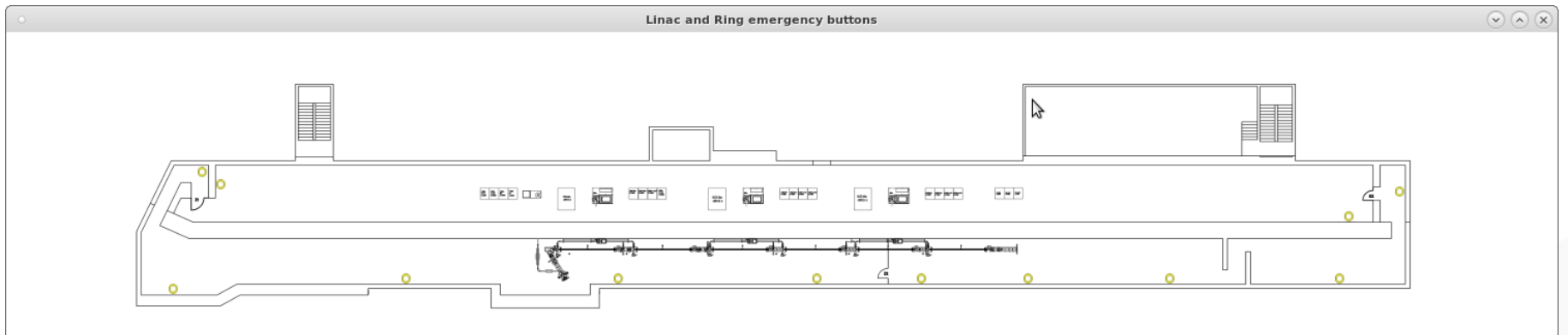


**Users do not have access to supervised and controlled areas, including a lead hutch.**

### ➤ PSS panel outside the hutch:



# Personal Safety System (PSS) :



### CONTROL ACCESS

#### ACCESSES

**LINAC** CONTROLLED ACCESS 00:00 siren

PLC ON | BMS OFF

EXTERNAL PANEL: ● ● ● ● ● ● ● ● ● ●

INTERNAL PANEL: ● ● ● ● ● ● ● ● ● ●

■ BADGE  
■ BATON  
■ LOCK

Present's list  
Open  
Reset  
Search request

Name: \_\_\_\_\_

---

**RING** CONTROLLED ACCESS 01:00 siren

PLC ON | BMS OFF

EXTERNAL PANEL: ● ● ● ● ● ● ● ● ● ●

INTERNAL PANEL: ● ● ● ● ● ● ● ● ● ●

■ BADGE  
■ BATON  
■ LOCK

Present's list  
Open  
Reset  
Search request

Name: \_\_\_\_\_

#### MACHINE STATUS

Linac Shutdown i

Linac OFF i

Linac On Local i

Linac On Injection i

Ring Shutdown i

Ring OFF i

Ring ON i

---

#### BStoppers

**BStopper1** i

Status: CLOSED

**BStopper2** i

Status: CLOSED

Open Close  
opening disabled i

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#### Valves-Ring

**Valve1-Ring** i

Status: CLOSED

**Valve2-Ring** i

Status: CLOSED

Open Close  
opening disabled i

#### PLANTS

Gun OFF DISABLED i

Klystron1 OFF DISABLED i

Klystron2 OFF DISABLED i

Klystron3 OFF DISABLED i

Cavity1 OFF DISABLED i

Cavity2 OFF DISABLED i

#### Zone1

Z1 Z2 Emergency i

locked locked

SEARCH COMPLETED i

Start search End search

---

#### Zone2

Z2 E2 Emergency i

locked locked ACCESS PERMITTED

SEARCH COMPLETED i

Start search End search

---

#### Zone3

Z3 E3 Emergency i

unlocked unlocked

SEARCH PENDING i

Start search End search

#### KEYS

Linac Key ENABLED

Ring Key ENABLED

HV Klystrons Key ENABLED

HV Cavities Key ENABLED

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#### BEAMLINES

YES injection enabled by beamlines

YES storing enabled by beamlines

Close all beamlines' safety shutters

ALARM HISTORY

BADGES AUTHORIZED TO ACCESS: SEARCH

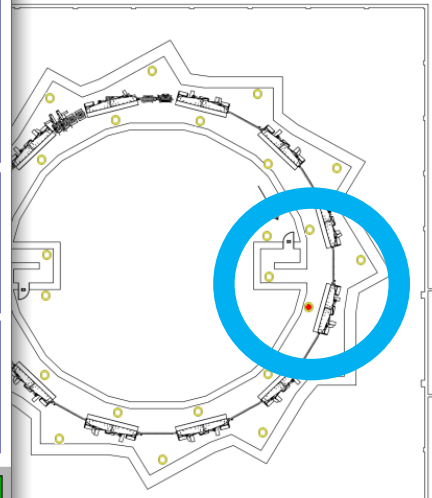
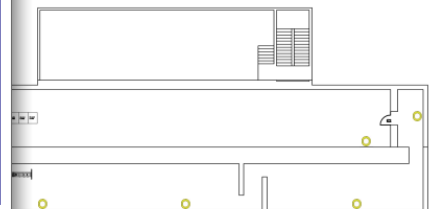
SOFTWARE VERSION

PLC BOARDS

BEAMLINES

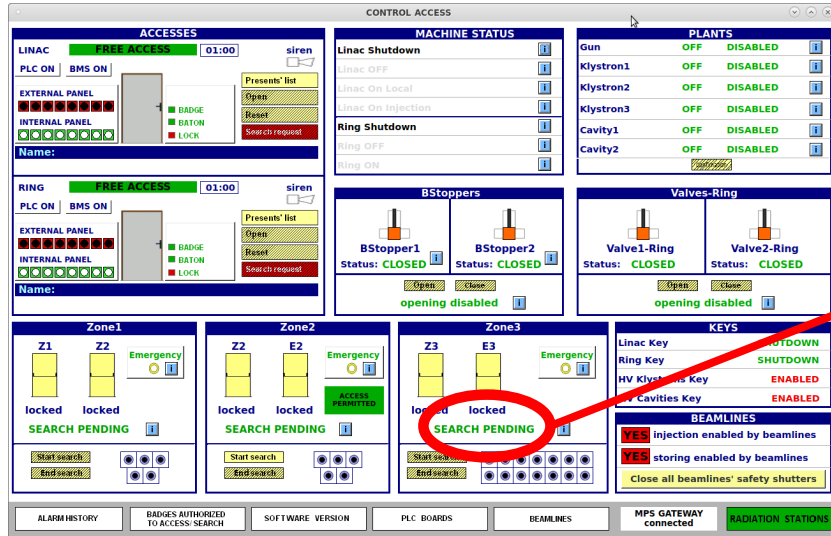
MPS GATEWAY connected

RADIATION STATIONS





# Search training



## Information light signals:

In the experimental hall, there are light columns which give information on the current status of the storage ring:

There are also three tables indicating the synchrotron status on walls of the experimental hall:

**SYGNALIZACJA ŚWIETLNA  
PIERŚCIENIA AKUMULACYJNEGO  
STORAGE RING LIGHT SIGNALS**

	<b>WIĄZKA ZAKUMULOWANA STORED BEAM</b>
	<b>WSTRZYKIWANIE ELEKTRONÓW INJECTION</b>
	<b>BRAK WIĄZKI RING STANDBY</b>
	<b>WYŁĄCZENIE PIERŚCIENIA STORAGE RING SHUTDOWN</b>



# SOLARIS Centre Team

## SOLARIS Centre team

Director of the SOLARIS Centre	▼
Department of Finance and Administration	▼
Department of Accelerators	▼
Scientific Department	▼
Technical Department	▼
Department of Control Systems & IT	▼
Radiation protection & health and safety officers	▼
Communication Section	▼

### Radiation protection & health and safety officers

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AUTOMATION SECTION

CONTROL SYSTEMS AND SOFTWARE SECTION

Thank you for your attention!!!

