

# Radiation Related Issues and Management at CSNS

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# Outline

- **Radiation related issues**
- **Management during operation and maintenance**
- **Summary**

# Radiation Related Issues

PPS: Personnel Protection System  
MPS : Machine Protection System



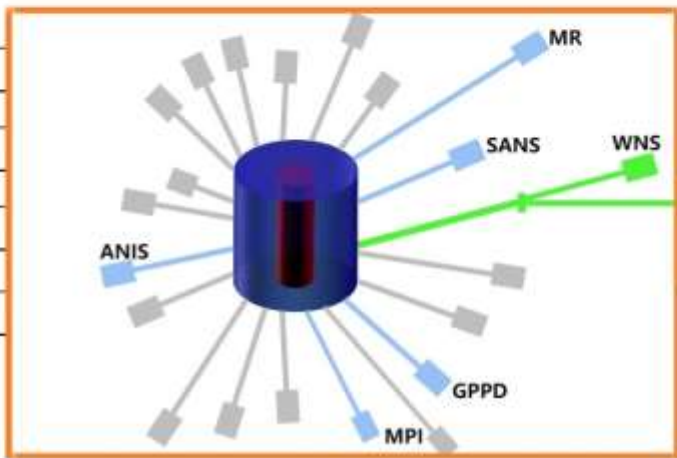
中国散裂中子源 (CSNS) 运行状态



Strong radiation inside the tunnels, target station and scattering rooms of the instruments during operation

Shielding and area control : Reliable and efficient

Concrete + Steel mainly



Concrete + Soil

- PPS Control Area
- Running
- Interlock
- PowerOff
- Not Installed

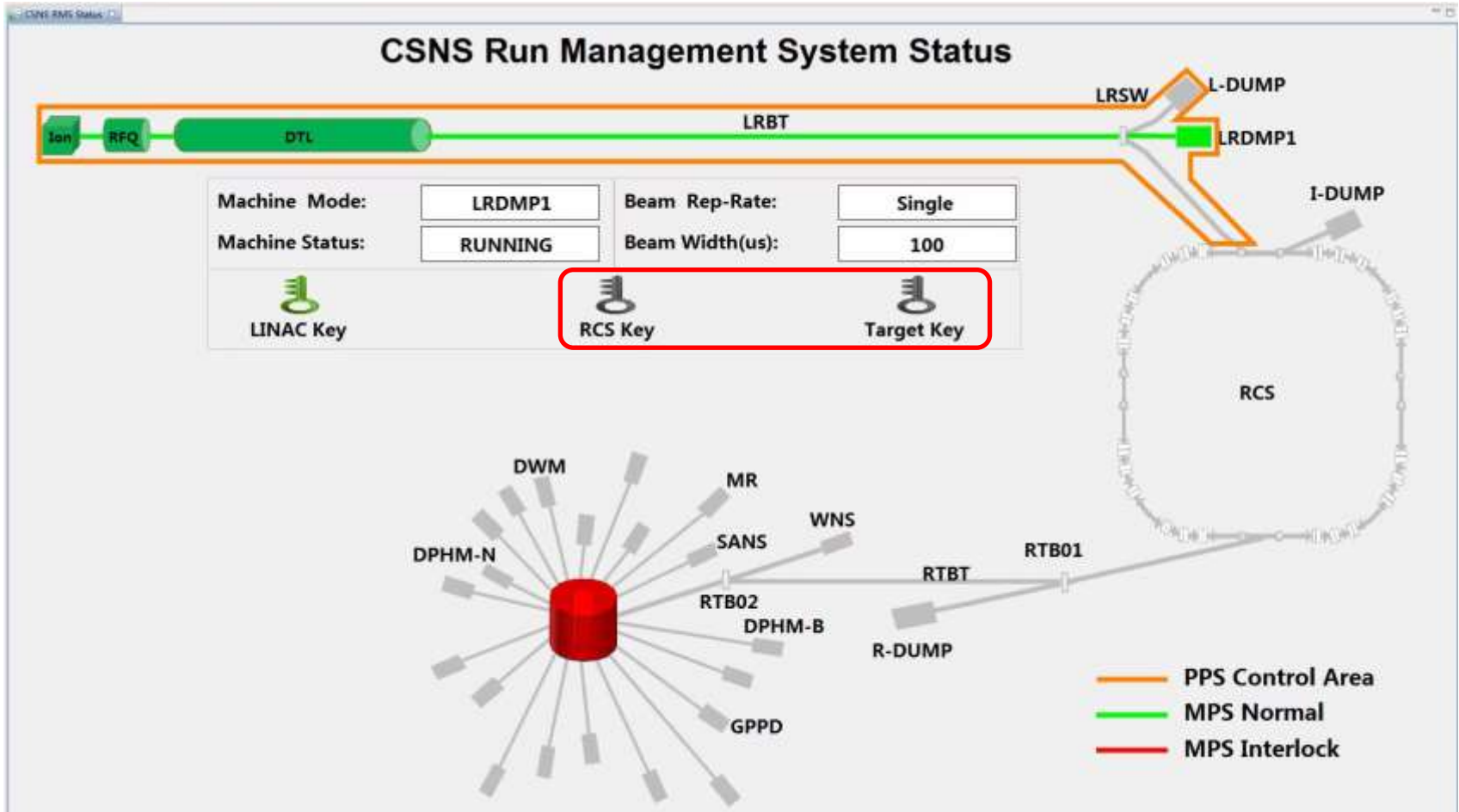
Control and monitoring areas (Accessible neighbored areas to control areas)

## Control areas

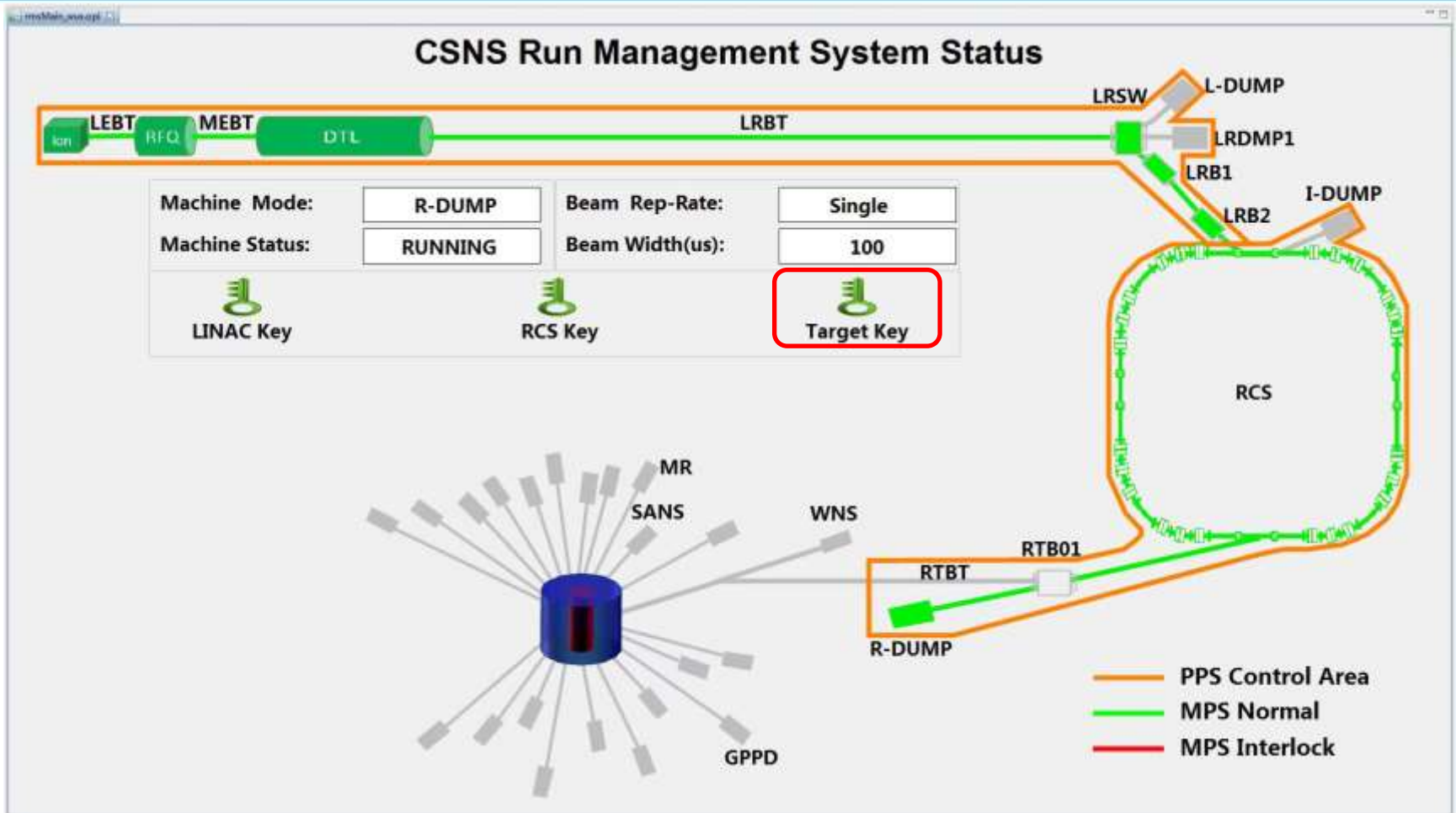
- Accelerator tunnels.
- Part of the target station with strong radiation that is accessible. Hot room for remote handling, water cooling station, shutter driving room.
- Scattering rooms of the instruments.

# Area access control

- **Control areas:**
  - Access only with no possible beams
  - Radiation check before “new” access
  - Access only authorized
  - Access controlled by the PPS
- **Monitoring areas:** (Dose rate < 2.5 $\mu$ Sv/h except the high bay)
  - Access only authorized
  - Access controlled by electronic door guard

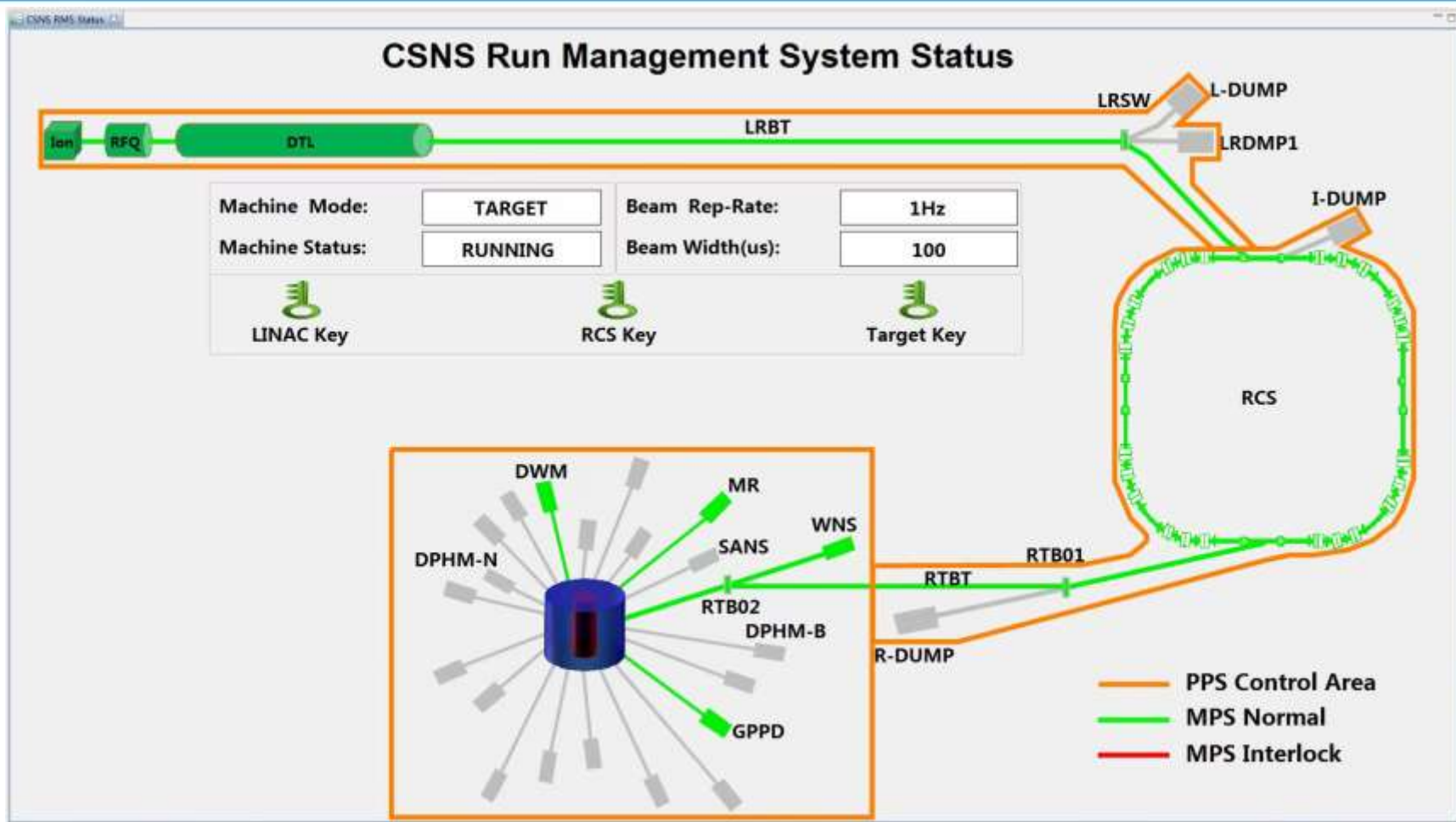


LINAC mode : Beam to RCS forbidden.  
 RCS && Target keys can be taken away



RCS mode : Beam to target station forbidden.  
Target key can be taken away





Target mode : All keys in position

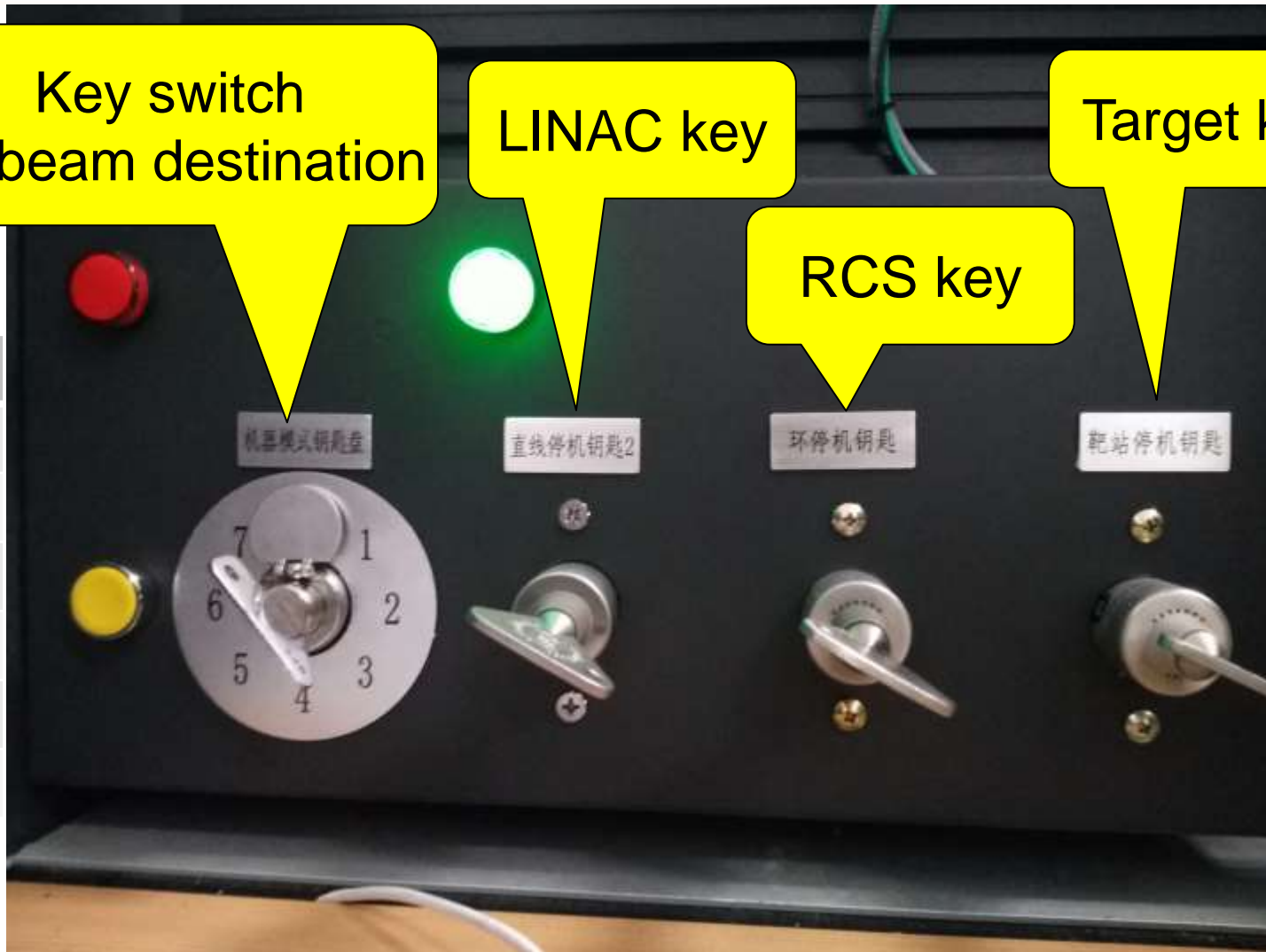
Key switch  
for beam destination

LINAC key

Target key

RCS key

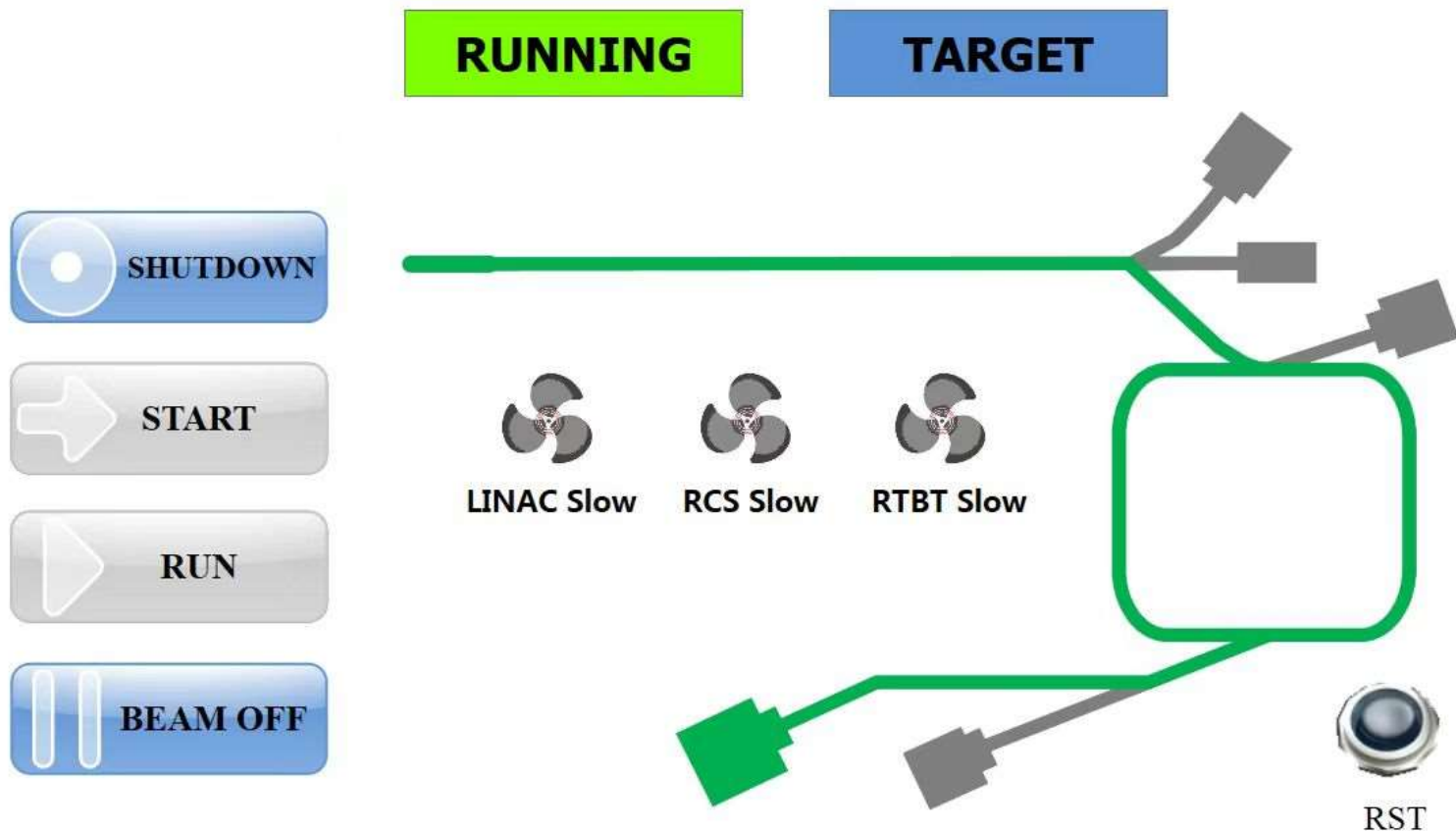
1	Ion souce
2	L-DUMP
3	LRDMP1
4	I-DUMP
5	R-DUMP
6	Target
7	Reserved



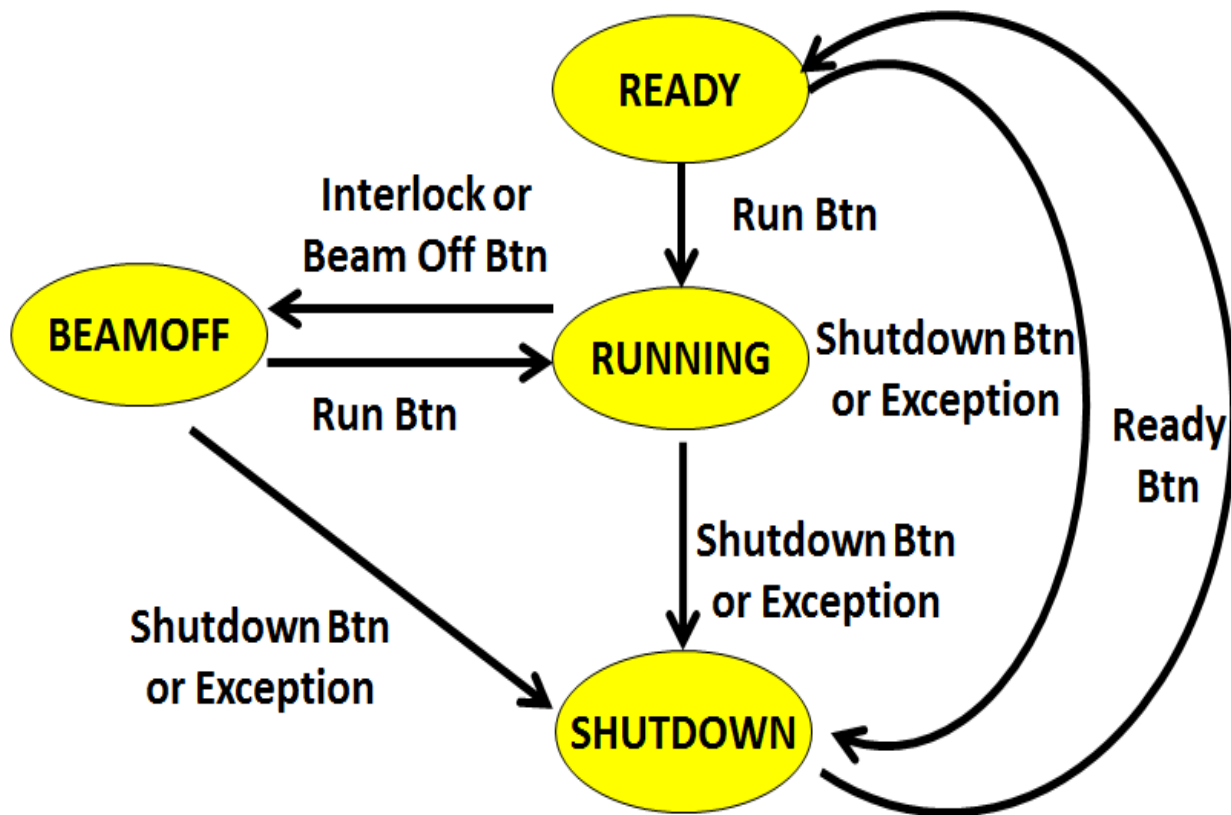
Key switch && area keys



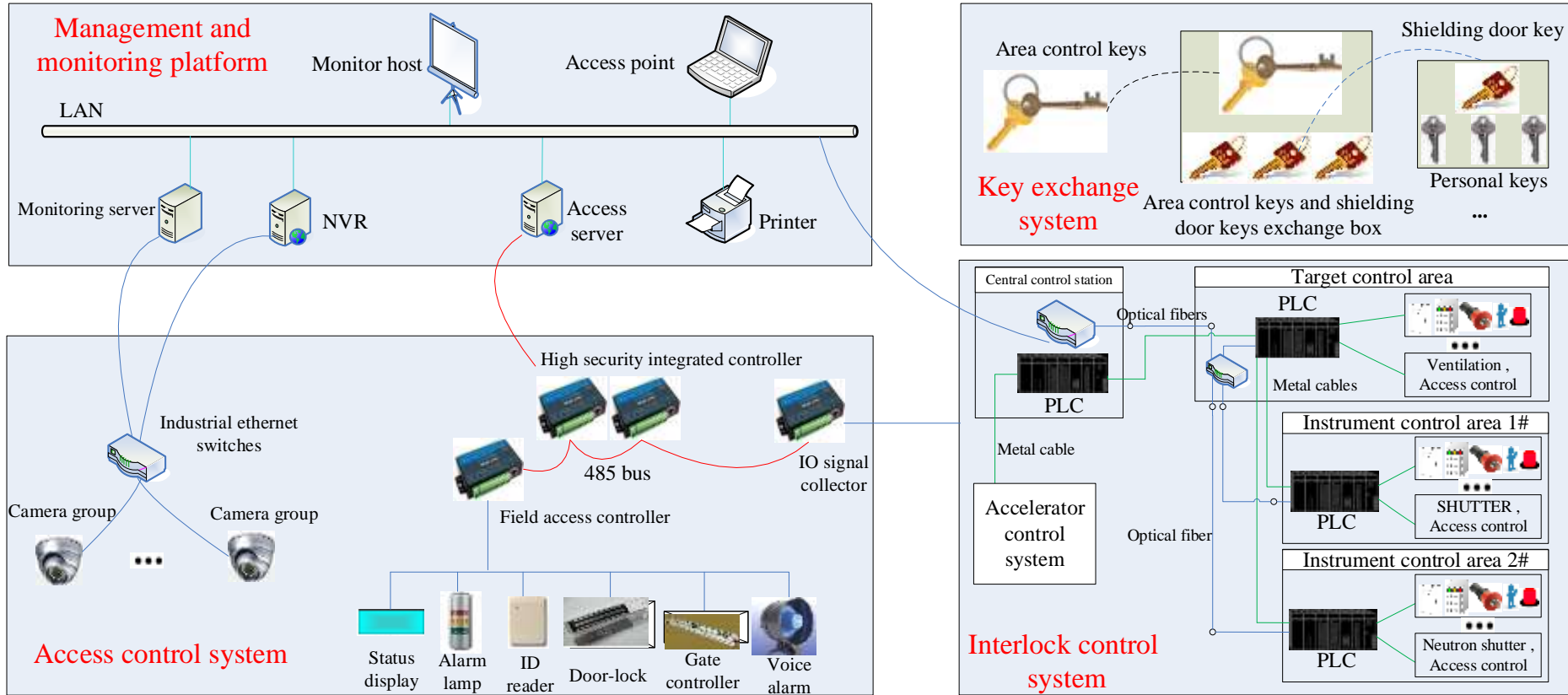
# CSNS Run Management System



OPI of touch panel  
Beam permitted with no PPS and MPS indications.



## State transitions of beam-permit operations



## Structure of the PPS

# Management during operation and maintenance



## During operation

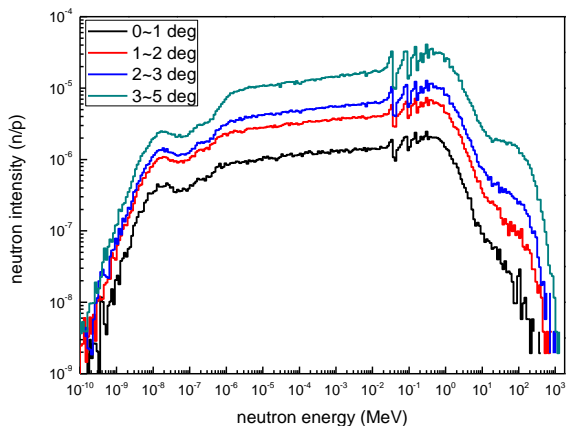
- **Access into accelerator tunnels** : Shutdown mode => 30 minutes strong ventilation => Radiation check with hand dosimeters => Access permitted with no risks
- **Access into part of the target station** : Shutdown mode => 60 minutes cooling => Radiation check with hand dosimeters => Access permitted with no risks
- **Access into the scattering rooms** : Neutron shutter off => Radiation check with hand dosimeters => Access permitted with no risks

## During maintenance

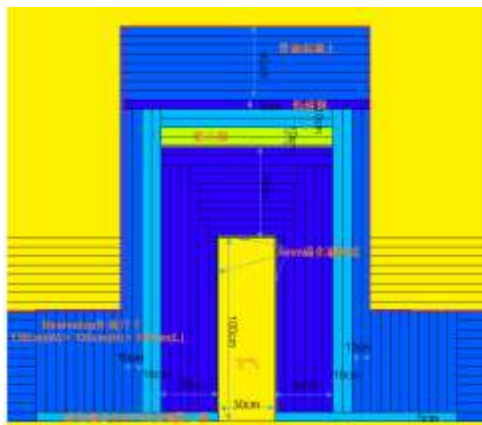
- Check before the first entrance, then periodical or dedicated dose-rate check according to requirements.
- Maintenance tasks in the control areas or near the control-monitoring area interface reviewed, monitored through the whole cycle.
- Persons for maintenance into the control areas strictly controlled.



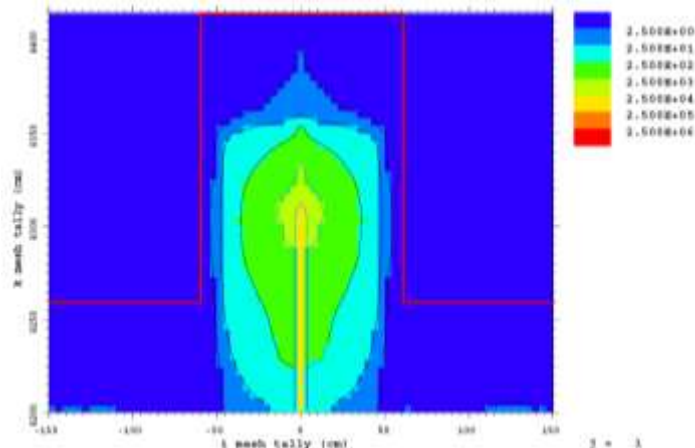
# Shielding and radiation monitoring



Radiation sources



Shielding structure



Simulation results



Shielding construction



Radiation measurement during operation



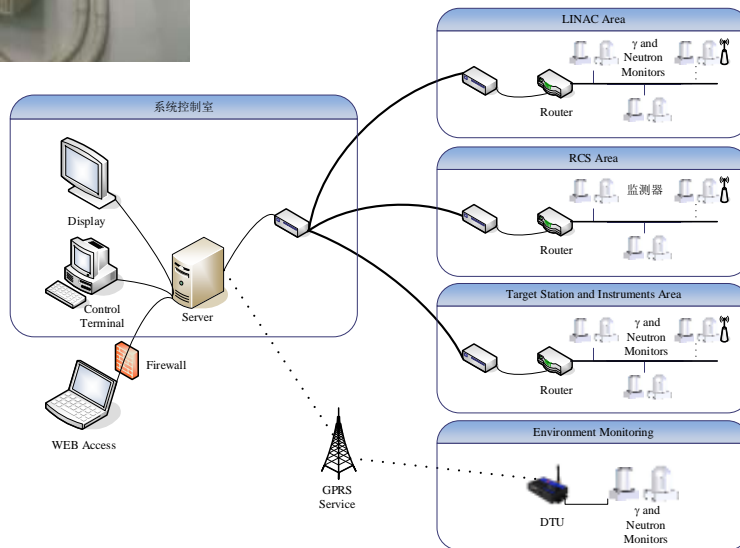
Beam dump of the 9<sup>th</sup> instrument

# Shielding and radiation monitoring

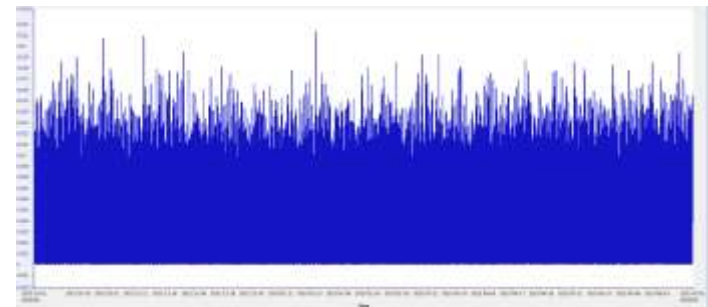
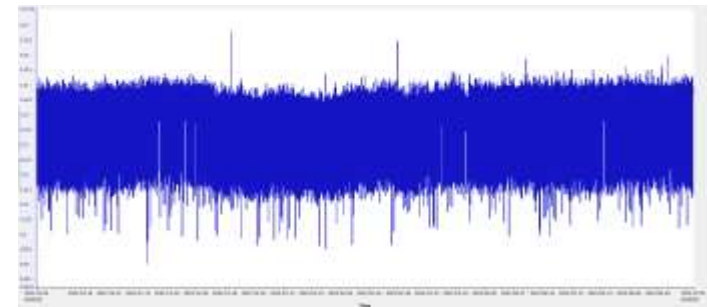
- Field and environment radiation monitoring, 46 sets and 5 sets respectively, both gamma and neutron radiation monitored.



Field monitors



System structure



History record  
gamma : top  
neutron : bottom

# Shielding and radiation monitoring

- Personnel dose monitoring and management.

Staff < 10mSv/y; Users < 0.5mSv/y; Public < 0.1mSv/y



OSL for gammas and CR39 for neutrons

Personnel dosimeters and alarm

# Shielding and radiation monitoring

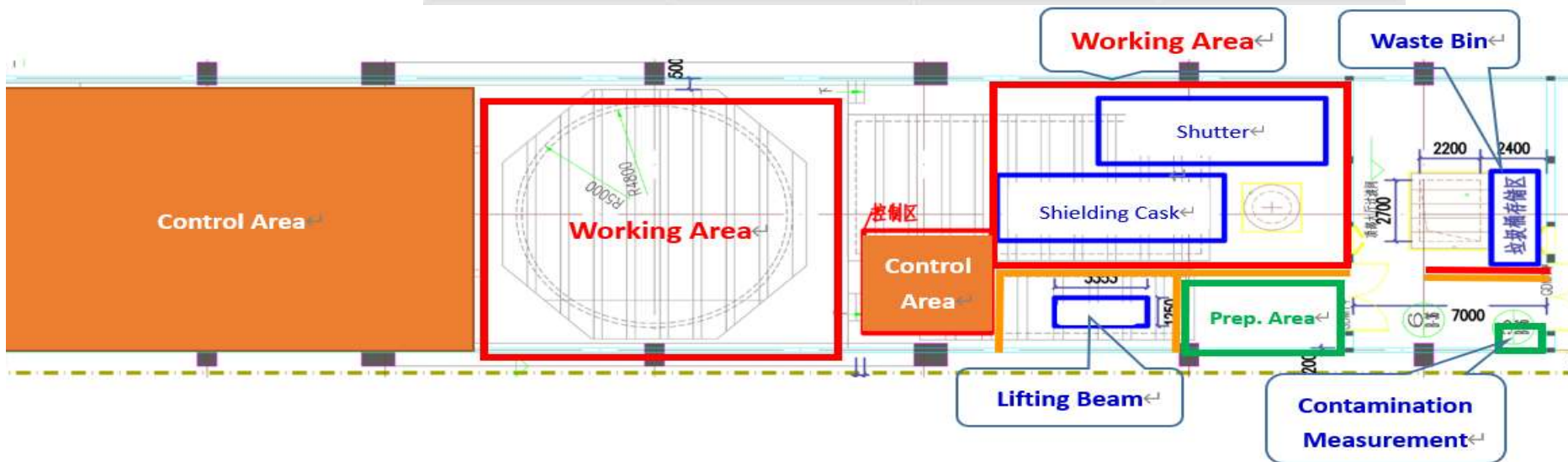
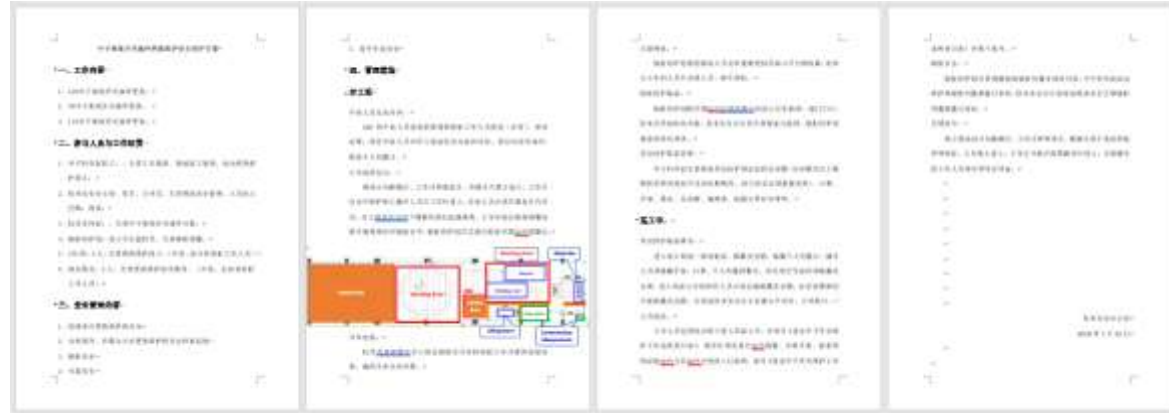


Pulsed neutron radiation monitor

Neutron and gamma dosimeters for field radiation inspection & hand-foot contamination monitor

# Maintenance management

Regulations  
&  
Instructions



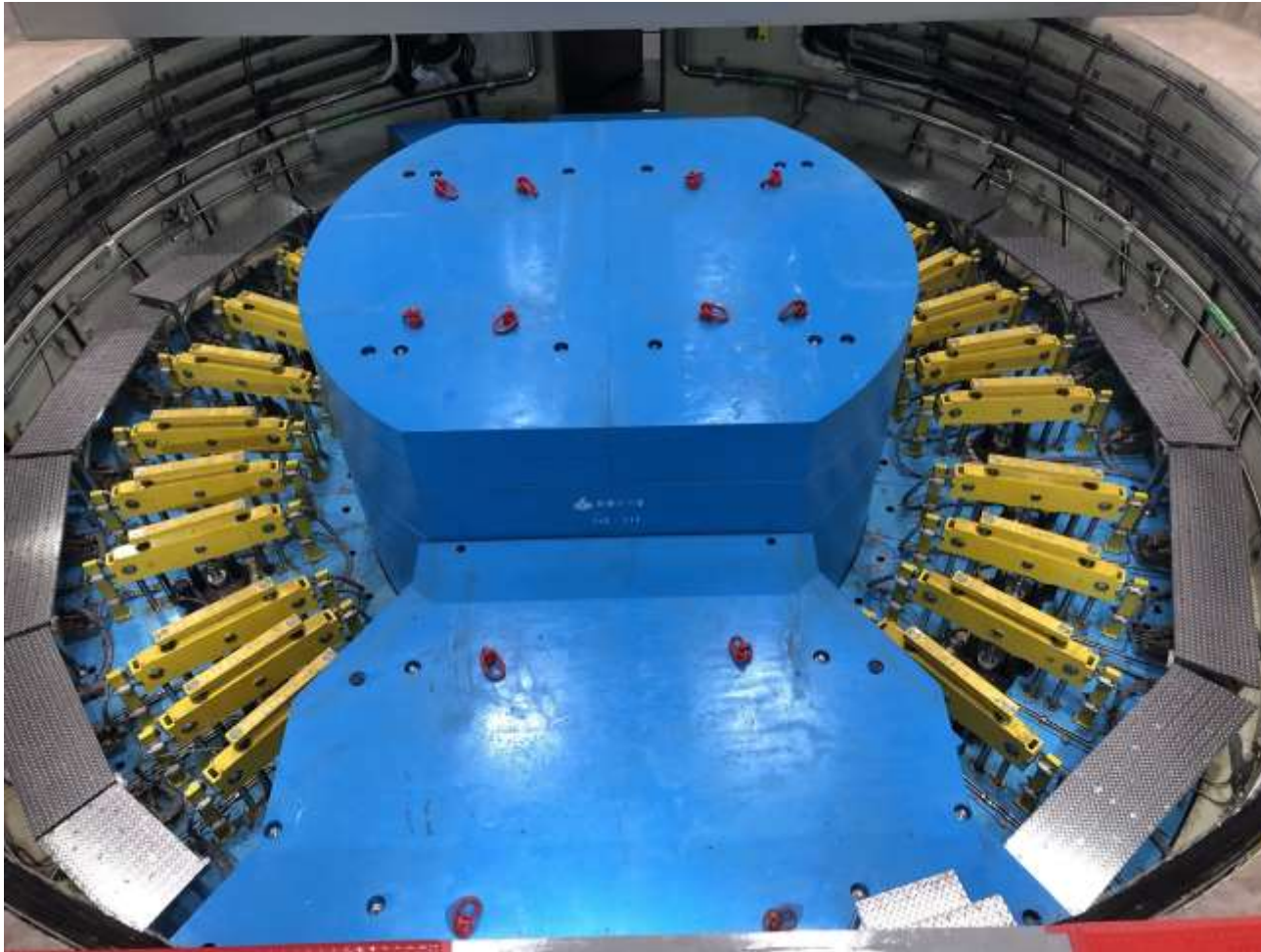
Shutter insert replacement from shielding block to neutron guide or vacuum pipe for new instruments

# Maintenance management



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Shutter insert replacement from shielding block to neutron guide or vacuum pipe for new instruments

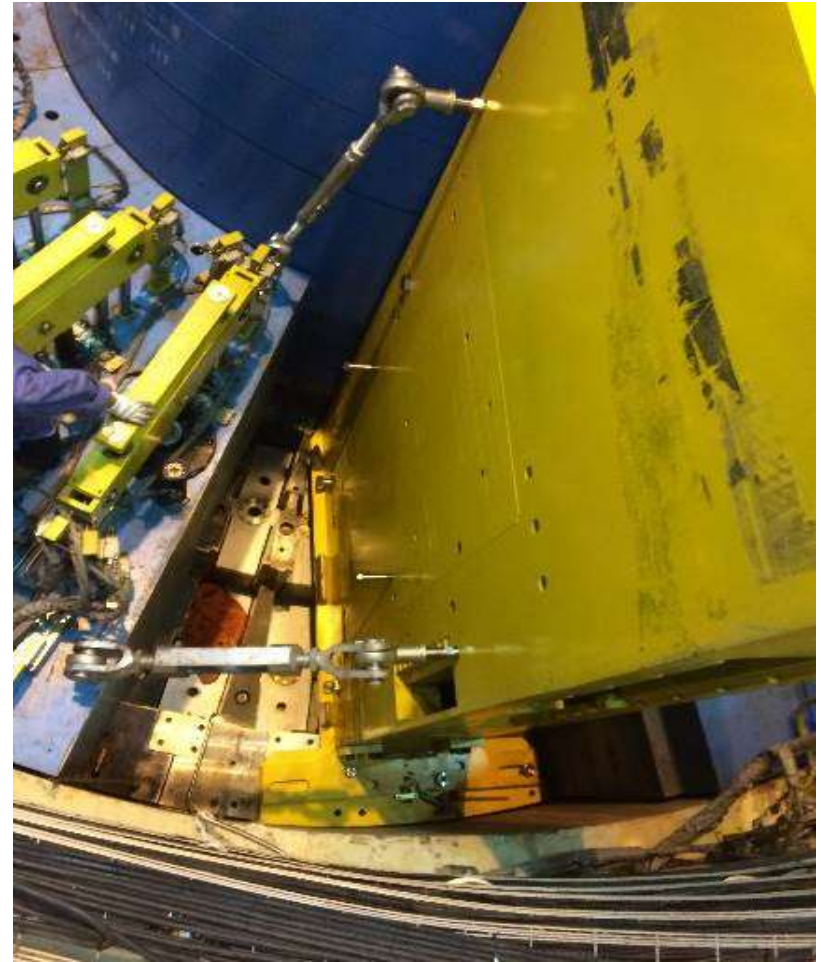
# Maintenance management



Shutter insert replacement from shielding block to neutron guide or vacuum pipe for new instruments



# Maintenance management



Shutter insert replacement from shielding block to neutron guide or vacuum pipe for new instruments

# Training and check-up



# Summary

- Radiation related issues are the key issues for CSNS, the radiation risks are well controlled with both proper design and management.
- Persons involved in the CSNS operation and experiments increases rapidly, training and field check-up is very important to ensure the safety.

**Thank you!**