

# Radiation Safety System of Shanghai Synchrotron Radiation Facility

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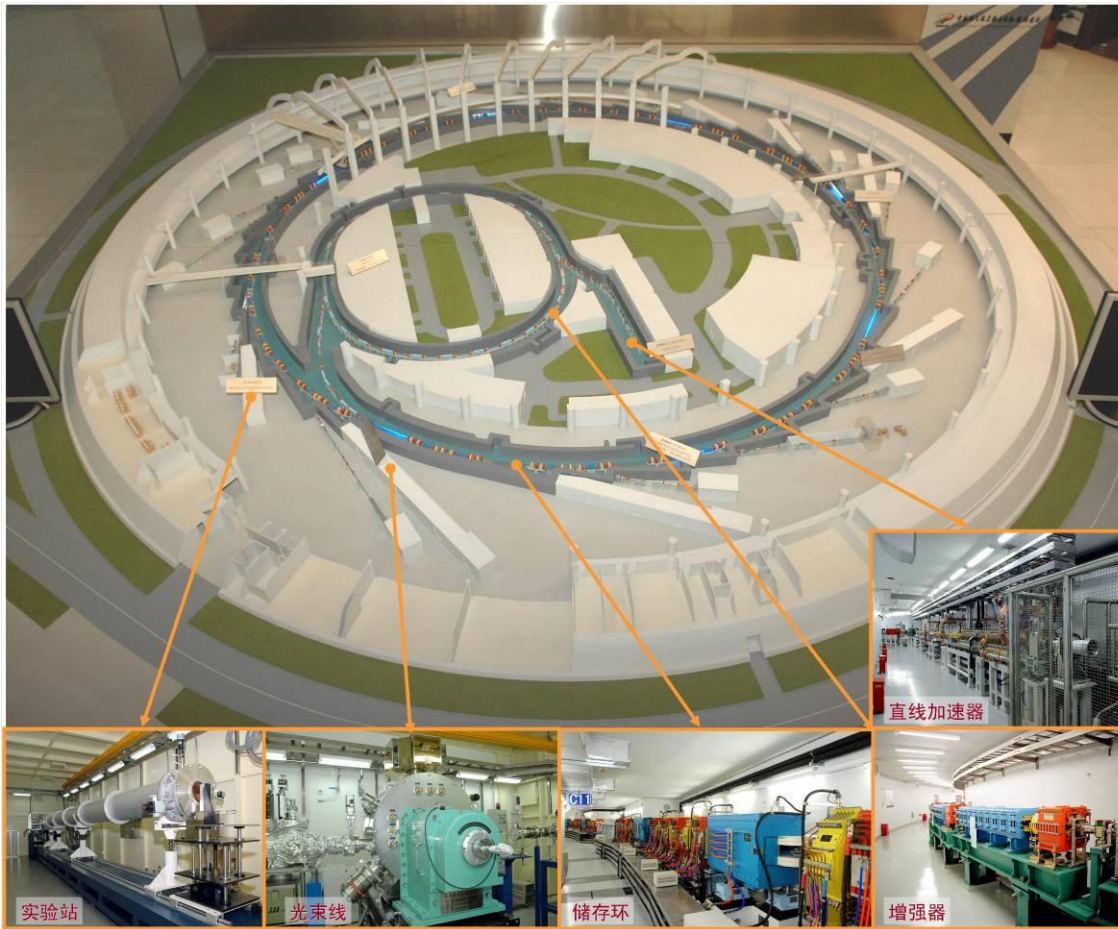
May 21-23, 2009 (Trieste, Italy)



中国科学院上海应用物理研究所

Shanghai Institute of Applied Physics, Chinese Academy of Sciences

# SSRF



- 150MeV LINAC
- 3.5GeV Boost
- 3.5GeV Storage ring
- First 7 Beamlines

# Approval Procedure for Radiation Safety at SSRF

## ■ In the period of project proposal, before construction

( December 2004 )

- **Environmental Impact Assessment Report for SSRF was reviewed and approved by Ministry of Environmental Protection**

(Reply of the State Environmental Protection Administration on the Environmental Impact Assessment of SSRF, National Important Project , No. 环审399[2004] )

- **Pre-assessment of Occupational Hazards for SSRF was reviewed and approved by Ministry of Health**

(Reply of Ministry of Health on the Pre-assessment of Occupational Hazards of SSRF, National Important Project , No.卫监督发259[2004])

# Approval Procedure for Radiation Safety at SSRF

- **In the period of construction completed, before commissioning (December 2008)**
  - **Radiation safety at SSRF was reviewed, and Radiation Safety License at SSRF (No.国环辐证[00283]) was issued by Ministry of Environmental Protection, SSRF was allowed to go to commissioning period**
- **Before Project completion inspection ( April 2009)**
  - **Radiation safety and other environmental protection concerned items at SSRF was passed the completion inspection by Ministry of Environmental Protection**
  - **Assessment on Control Effects of Occupational Disease Hazards at SSRF has been executed by Chinese *Center* for Disease Control and Prevention (In-site inspection has been finished), SSRF will accept the completion inspection on Occupational Disease Hazards by Shanghai Public Health Bureau in May.**

# Measure for Radiation Safety at SSRF

## ■ Built a radiation safety system

### ● Radiation shielding

- Shielding design based on the safety design objective, with safety factor of 2
- SSRF Construction Project Management Team decided to increase a thickness of 15cm concrete for the forward wall of the storage ring on the basic design to try the best for a higher safety

### ● Personnel Safety System

- SIL3 PLC has adopted in the PSS
- Design followed the principle of “Fail-safe mode” and “Redundancy”

### ● Radiation monitoring System

- RMB 5 million has been added to upgrade the radiation monitoring system installed in Phase I to make the total detectors increasing from 23 pairs in Phase I to 52 pairs, and additional 7 detectors for low energy gamma, each pair including a gamma detector and a neutron detector, for monitoring the whole facility.
- In Phase II, a independent network will be built for radiation safety system to achieve a higher safety level.

# Measure for Radiation Safety at SSRF

## ■ Radiation Safety Management

- Organization for Radiation Safety Management at SSRF has been set. 20 staff in Department of Radiation Safety are responsible for operation and maintenance of the radiation safety system, radiation monitoring and management, as well as research for radiation protection and the design.
- Regulations on radiation safety management and training have been set both for staff and users.
- Radiation safety training for staff have been carried out inside of SSRF lectured given by the Department of Radiation Safety, and given by specified board, 258 staff have got the training certification issued by Ministry of Environmental Protection.
- Primary Database on Personnel Dose Monitoring and Management and Health Documents for radiation workers have been set up.

# Bulk shielding and Localized shielding

## •Bulk shielding



## •Localized shielding



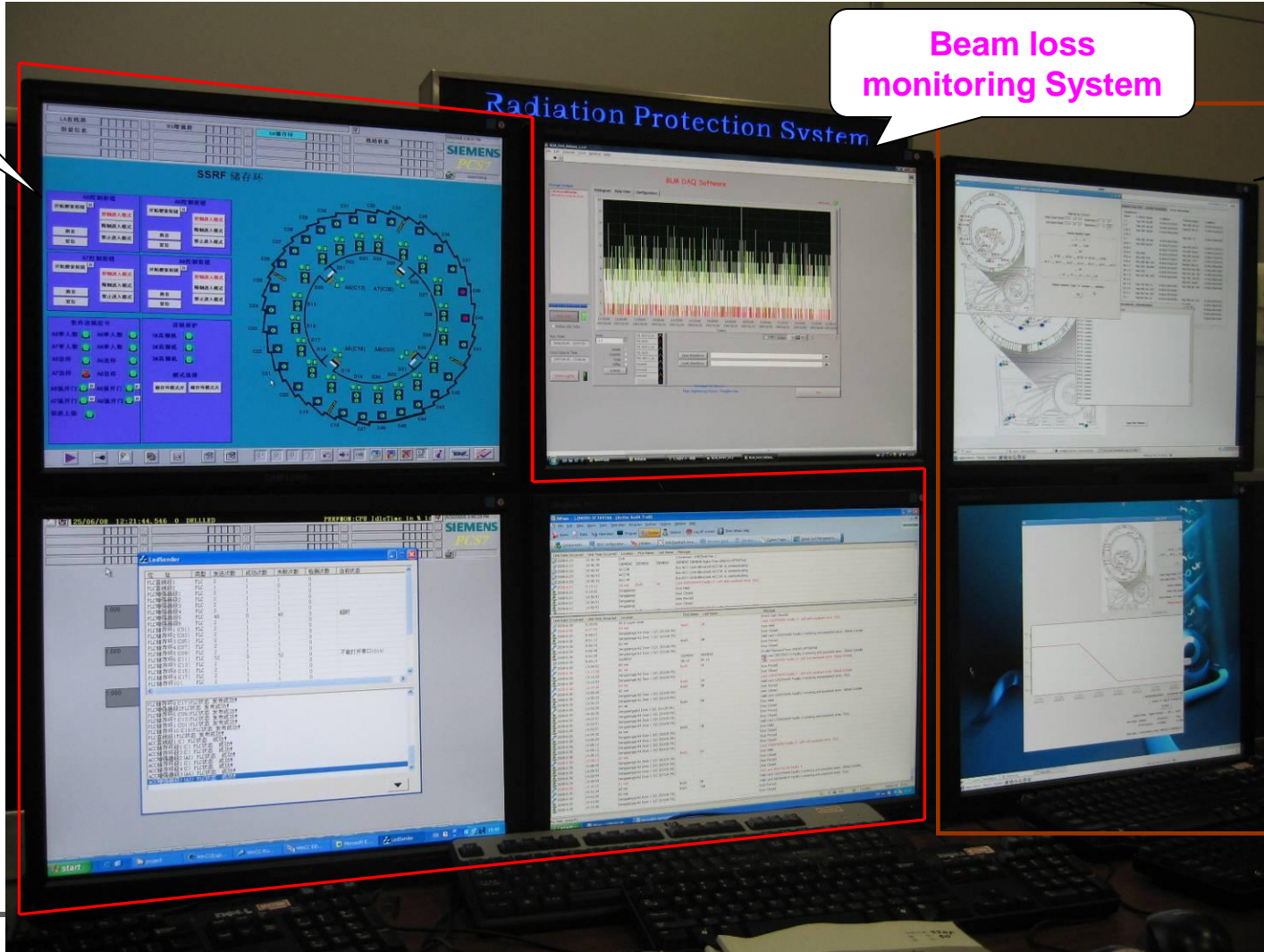
# Hutches and Radiation Protection Doors





# Control Desk of Radiation Safety System in the Central Control Room

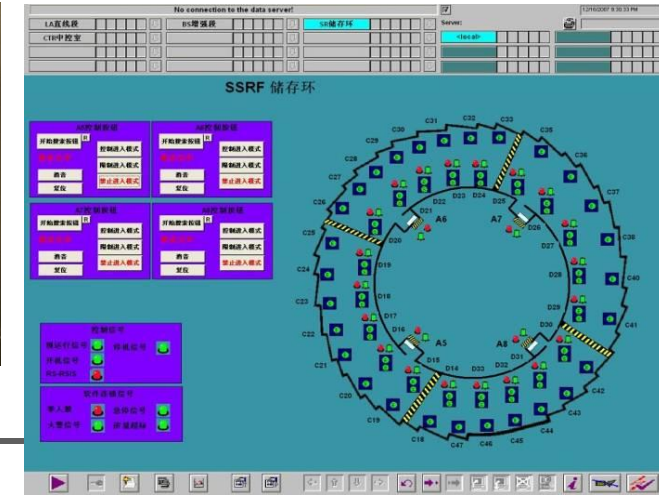
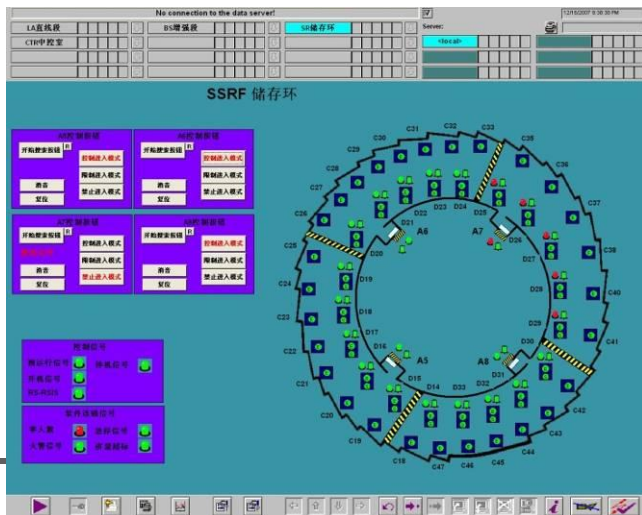
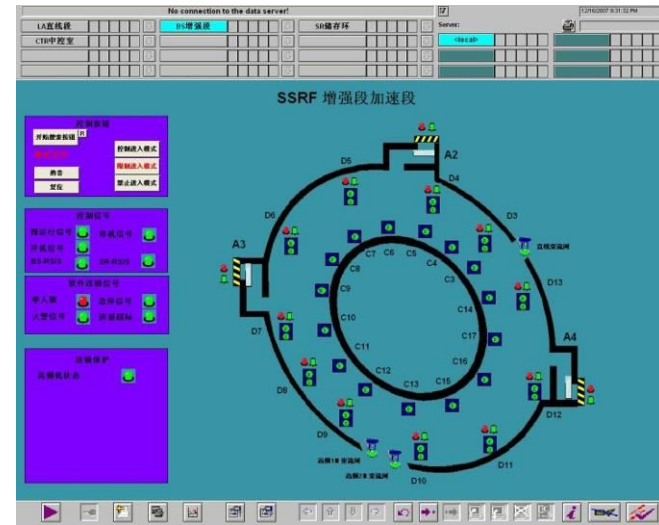
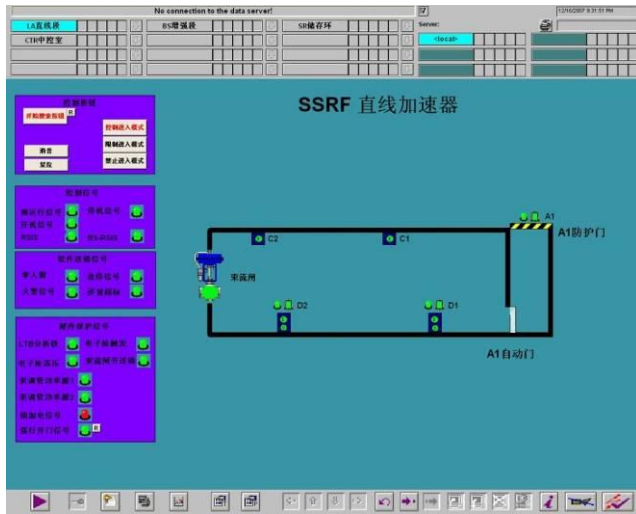
PSS



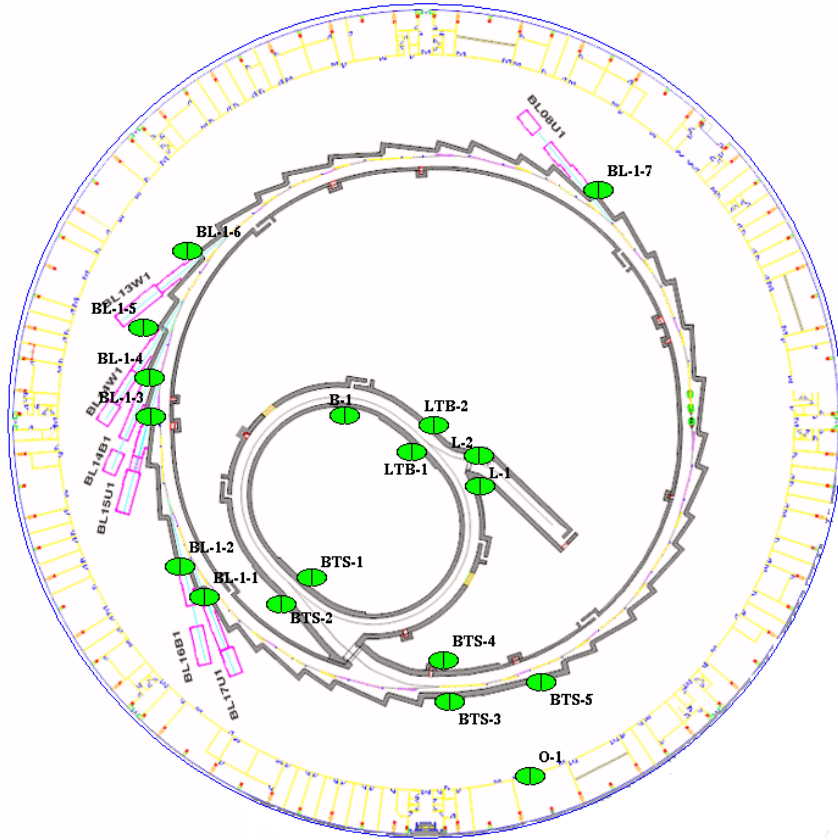
Beam loss monitoring System

Radiation monitoring system

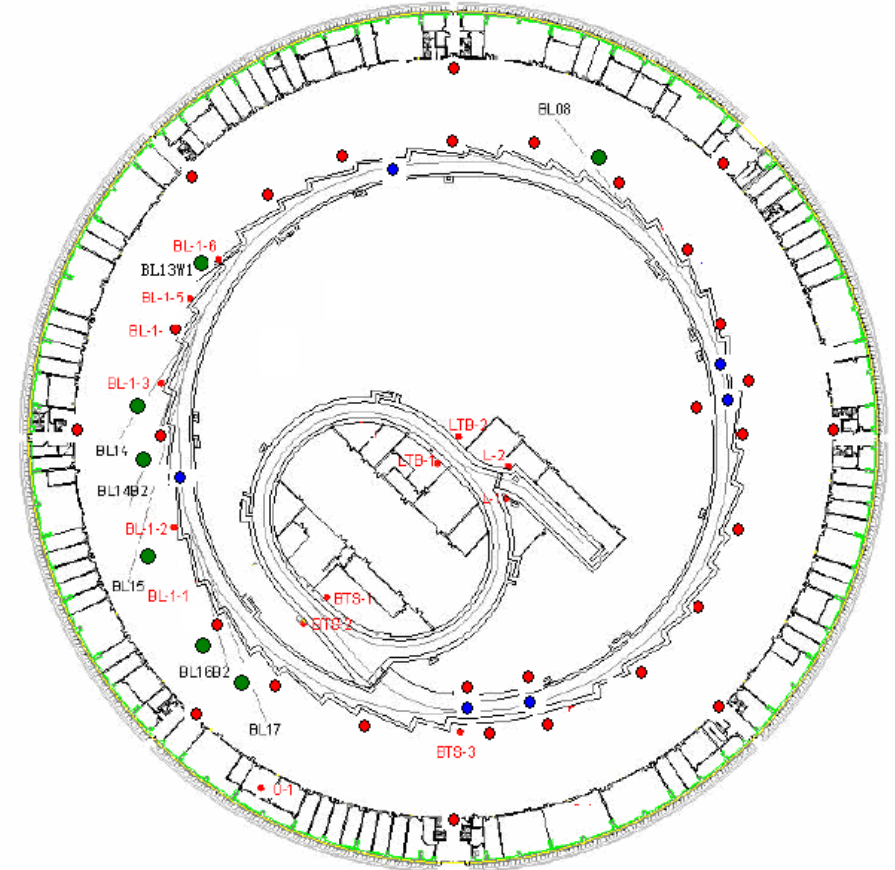
# Personnel Safety System



## (For workplace)



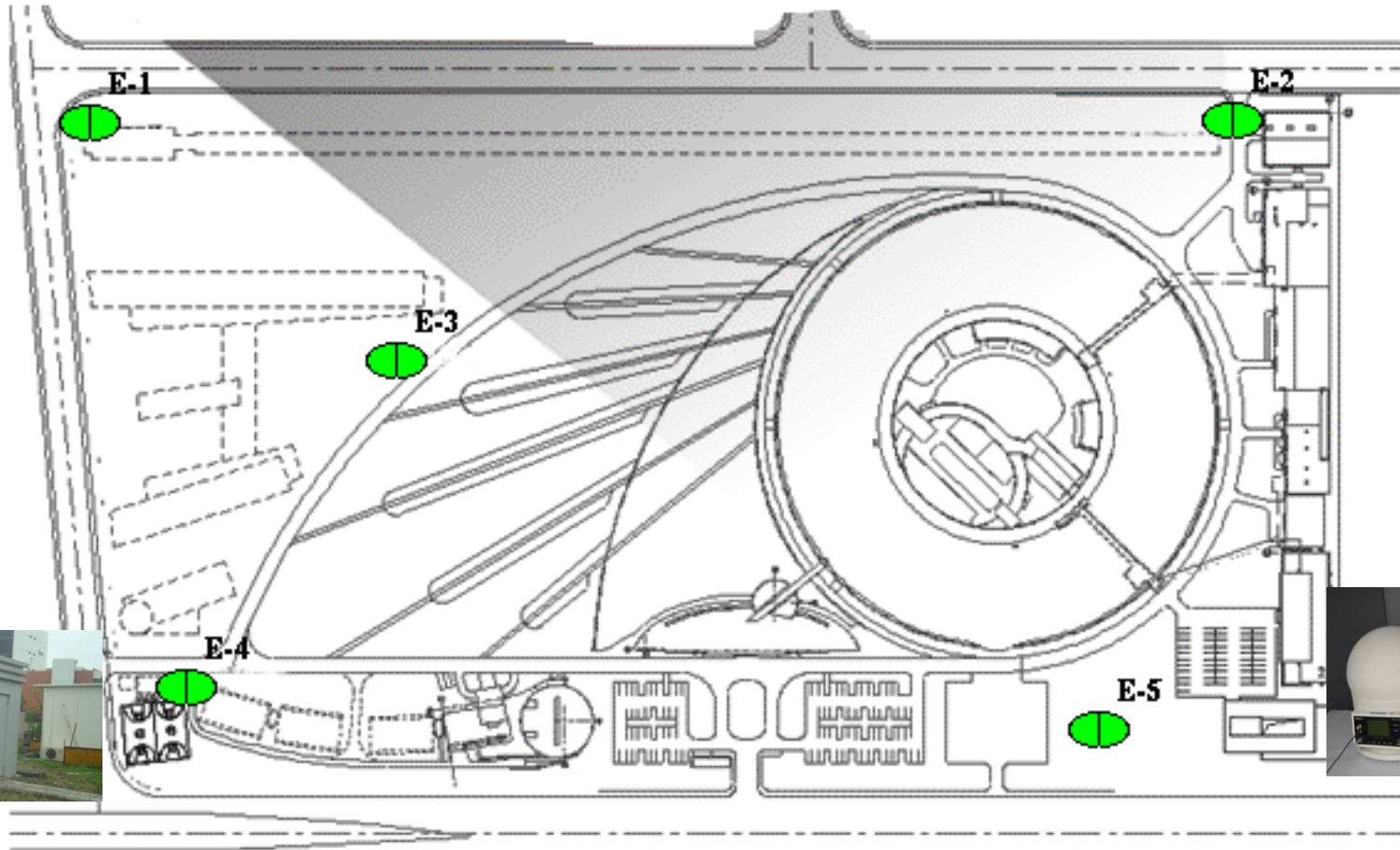
**Phase I: 18 pairs of detectors**  
( each pair includes 1 gamma detector  
and a neutron detector)



**Phase II: 47 pairs of tectors and  
7 detectors for detecting low  
energy gamma**

## Detector distribution in workplace

# Radiation Monitoring System (For environment)



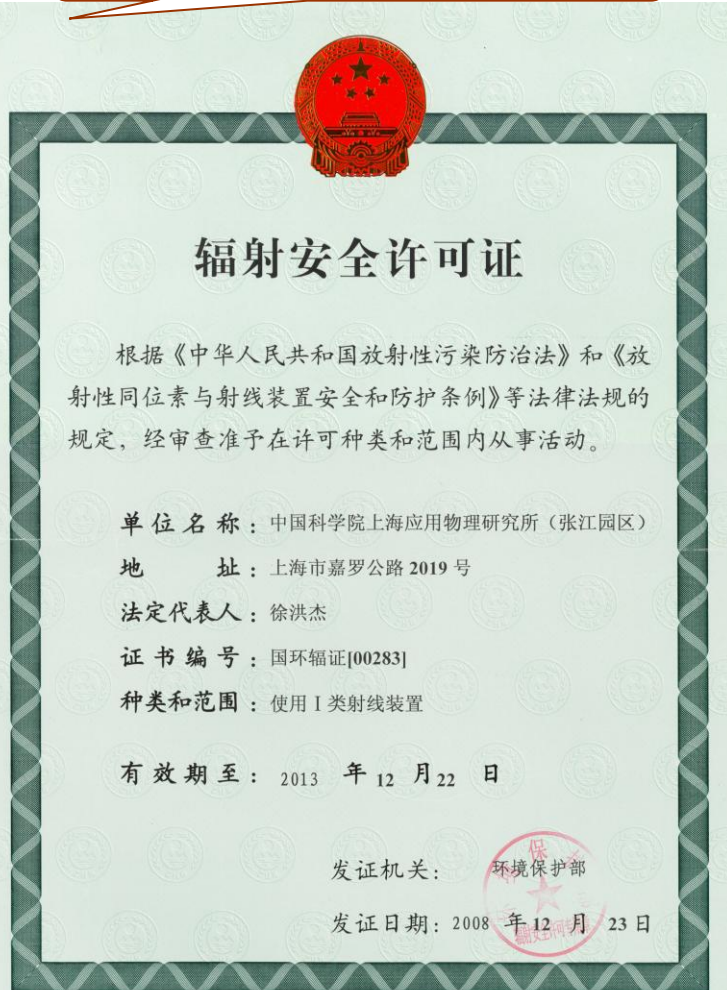
## Detector Distribution in Environment

## Some survey meters and personnel dosimeters used at SSRF



# Radiation Safety License

2008.12.23 issued



国家环境保护总局制

# Completion inspection by Ministry of Environmental Protection

2009.4.2 inspected

## Experts' review comments

验收组（委员会）验收意见：

2009 年 4 月 2 日，环境保护部组织专家在上海市对中国科学院上海应用物理研究所上海光源国家重大科学工程（以下简称上海光源）进行了竣工环境保护验收。验收组听取了上海光源项目组对上海光源概况和试运行辐射防护情况的介绍、上海市辐射环境监督站对该项目的验收检测报告的介绍、以及上海市环境保护局监督检查情况的介绍，对环境保护设施及其他环境保护措施进行了现场检查和审议，形成验收意见如下：

- 1、上海光源建设项目工程审查、审批手续完备，技术资料与环境保护档案资料齐全；环境保护设施与建设项目主体工程同时设计、同时施工、同时投入运行；
  - 2、该工程的辐射防护和环保措施等，已按照环境影响报告书批复的要求完成，符合国家相关标准的规定；
  - 3、该工程制定了安全规章制度、岗位操作规程和辐射监测计划，有相应机构和人员负责辐射安全管理和监测工作；
  - 4、该工程落实了环境影响报告书规定的各项生态保护措施，建设项目建设过程中受到破坏并可恢复的环境已按规定采取了恢复措施；
  - 5、该工程项目由上海市辐射环境监督站进行了环境保护竣工验收监测，内容包括试运行时场所和环境辐射剂量、噪声、电磁辐射、空气质量以及周围土壤和地下水中放射性核素，检测结果满足国家有关标准的要求，预计该项目运行后对工作人员的辐射剂量和周围生态环境的影响是可以接受的。
- 综上所述，验收组同意该项目通过项目竣工环境保护验收。

验收组长（签字）

吴传兵

2009 年 4 月 2 日

# Radiation monitoring results during Commissioning

Background level radiation under decay operation mode : Storage ring 3.5GeV, beam current 200mA

(101 monitoring positions inside of SSRF campus and 32 positions outside have been monitored)

☞ **X、 $\gamma$  radition dose rate**

**66-129 nSv/h**

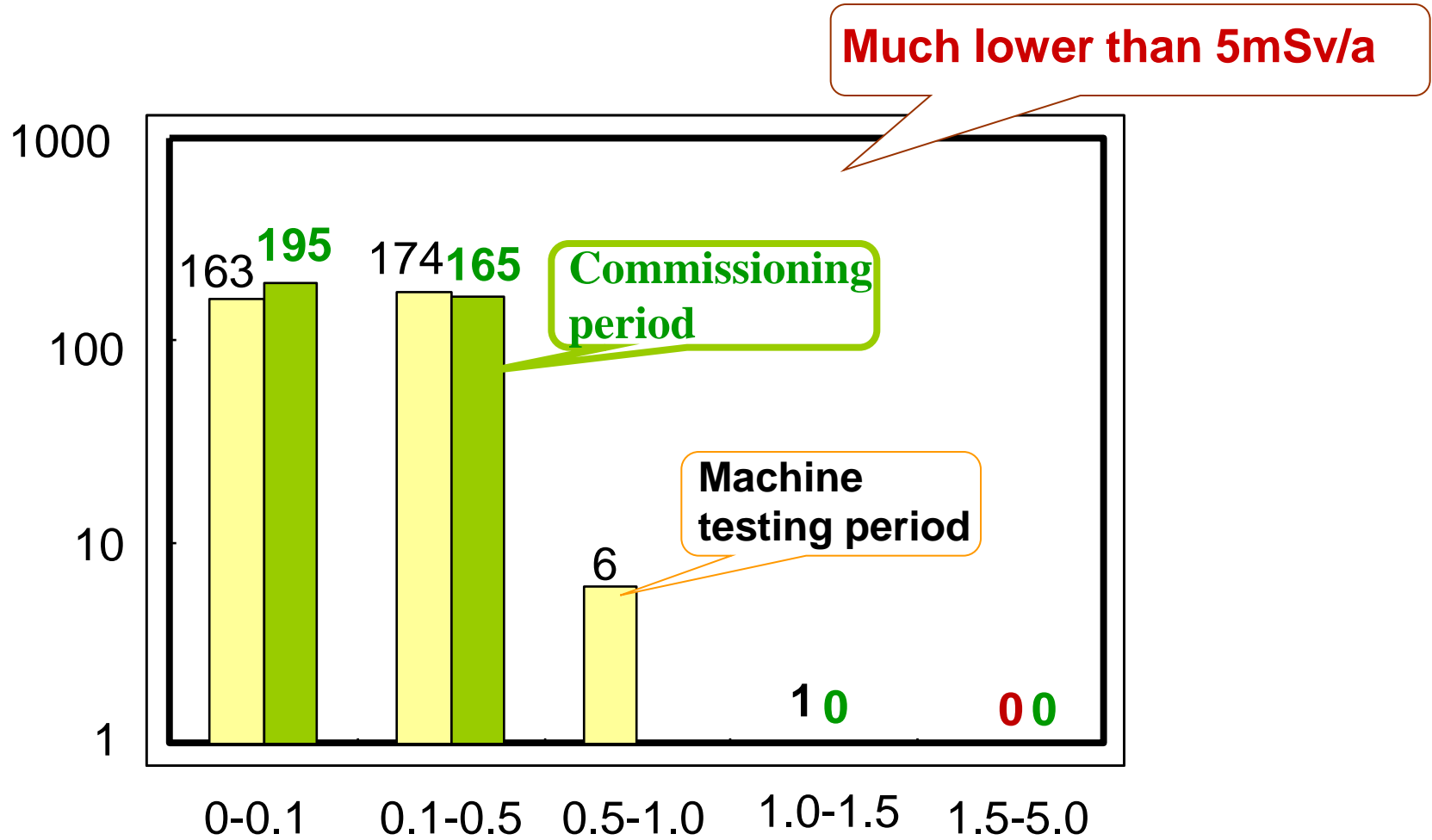
☞ **Neutron dose rate**

**1.2-3.9 nSv/h**

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# Personnel Dose

Number of person monitored



Annual Effective Dose ( mSv)



# Design Objective of Radiation Safety

International recommendations	National Standards
ICRP Pub.60(1990)	GB 18871-2002
<p><b>Occupational exposure</b> Annual effective dose &lt; 20 mSv</p> <p><b>Exposure for the public</b> Annual effective dose &lt; 1 mSv</p>	<p><b>Occupational exposure</b> Annual effective dose &lt; 20 mSv</p> <p><b>Exposure for the public</b> Annual effective dose &lt; 1 mSv</p>

## ■ Design objective of radiation safety at SSRF

- Occupational exposure: one-fourth of the National Standards ;
- Exposure for the public: one-tenth of the National Standards
- Execute ALARA ( As Low As Reasonably Achievable )

# Summary & Conclusion

- 👉 Radiation Safety System of SSRF has been built as scheduled
- 👉 The Radiation safety system works well during the past year
- 👉 Radiation Safety License for SSRF has been issued for user operation
- 👉 Measured radiation dose at SSRF is low than design objective

Radiation Safety System is important and effective to ensure a low exposure dose at SSRF



***Thank you for your attention !***

***Welcome to SSRF!***

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