國家同步輻射研究中心
National Synchrotron Radiation Research Center

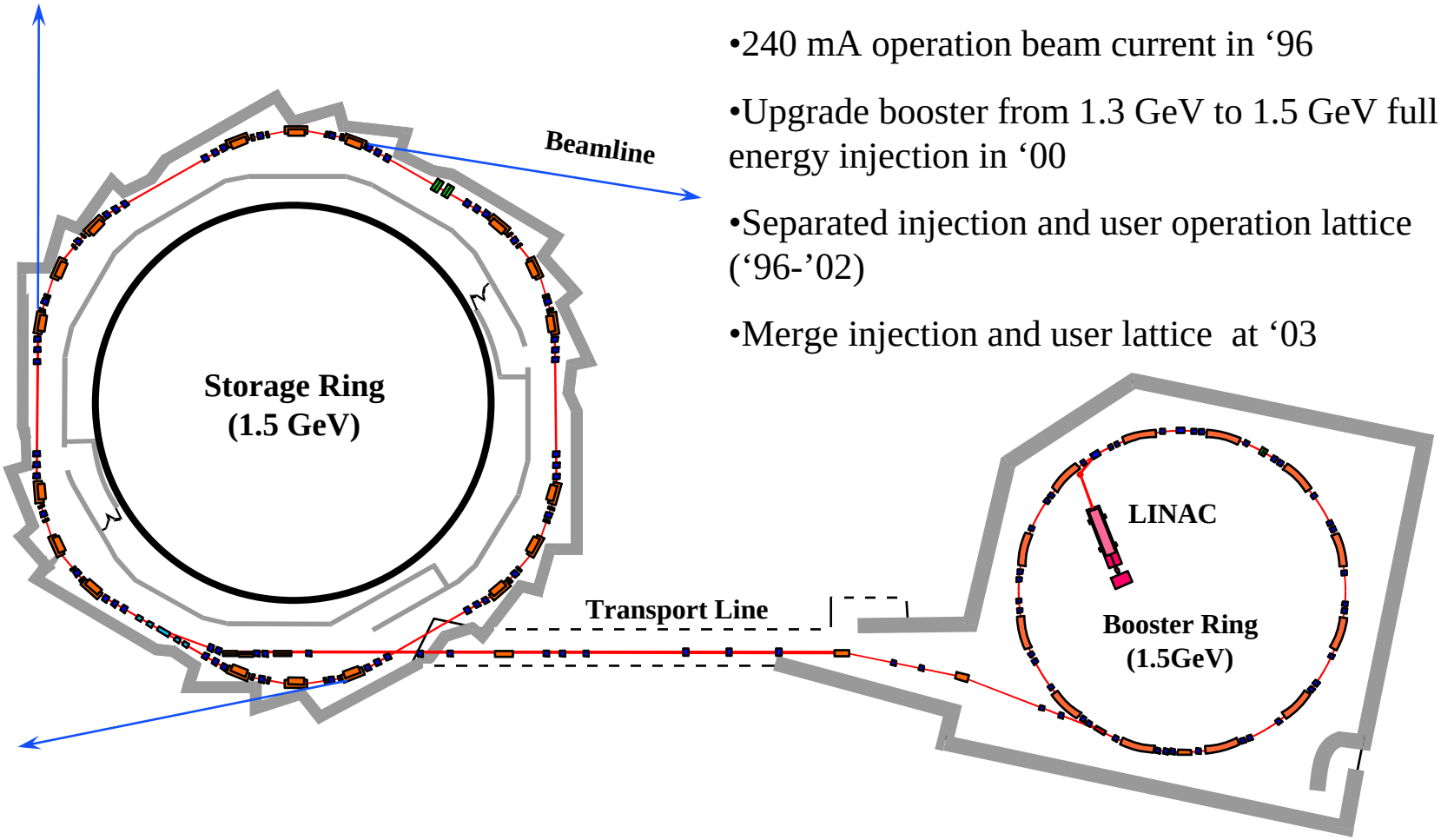
The Development of Accelerator-Based Light Source in Taiwan

G.H. Luo on behalf of
Light Source Division

Workshop on Future Light Sources

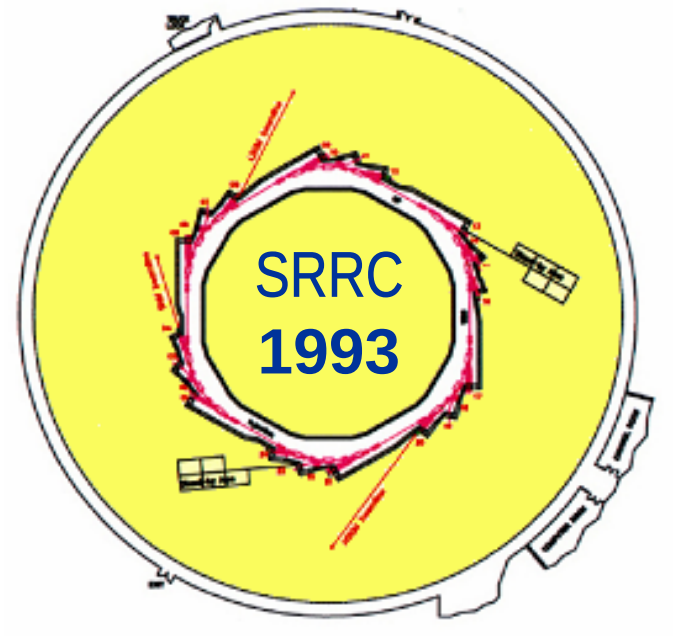
May 18, 2006

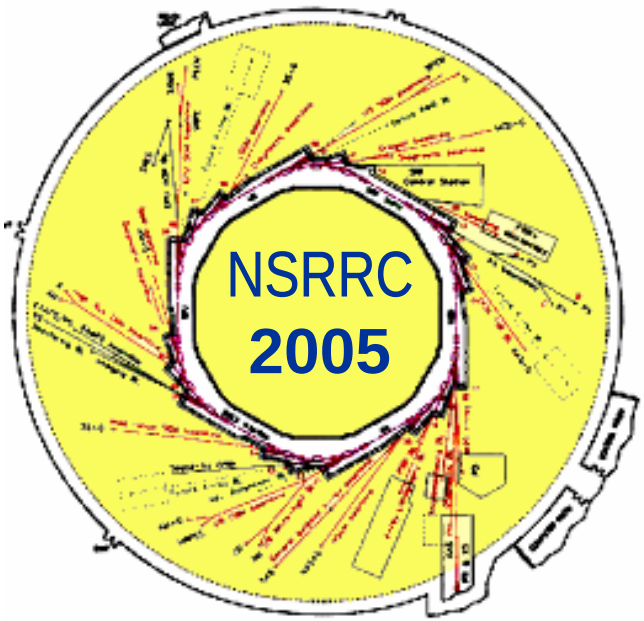
Schematic Layout and Timeline of TLS



- Commission on Apr. open to users on Oct. ‘93
- 1.3 to 1.5 GeV ramping in operation in ‘96
- 240 mA operation beam current in ‘96
- Upgrade booster from 1.3 GeV to 1.5 GeV full energy injection in ‘00
- Separated injection and user operation lattice (‘96-’02)
- Merge injection and user lattice at ‘03

Facility Development



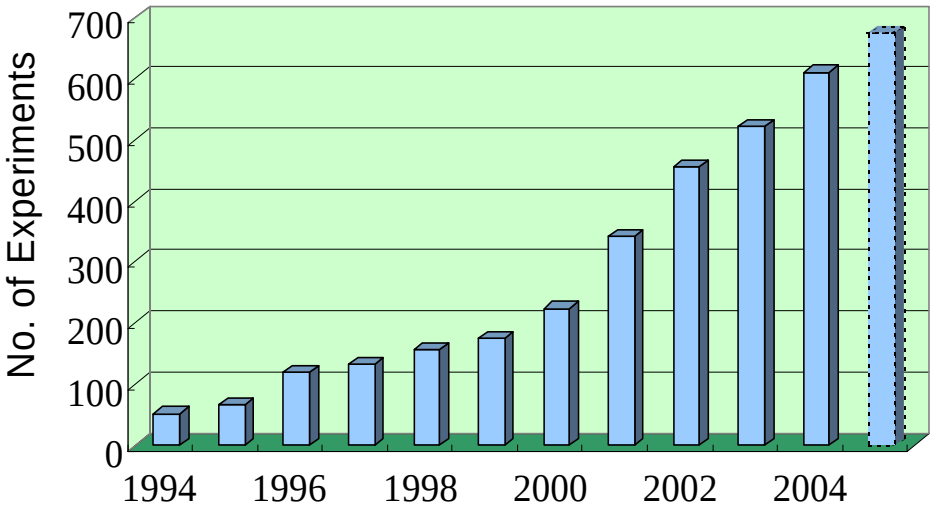


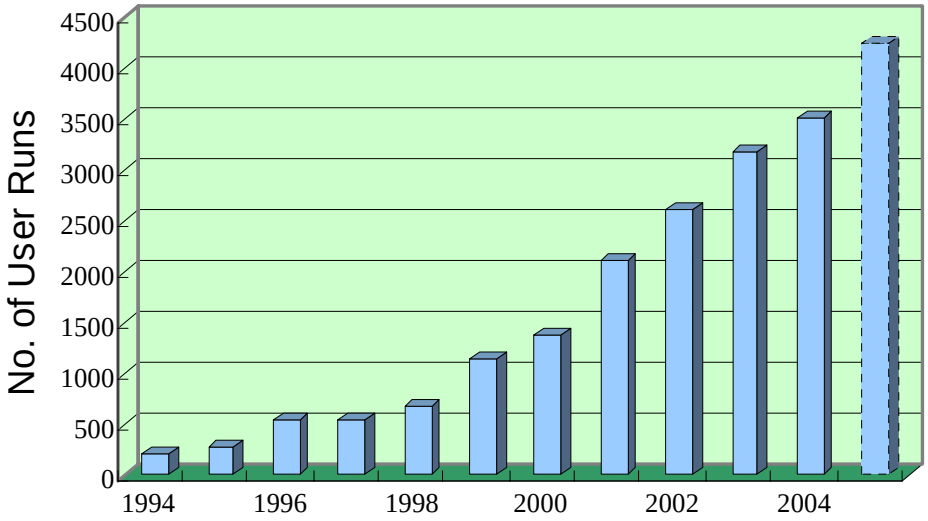
+

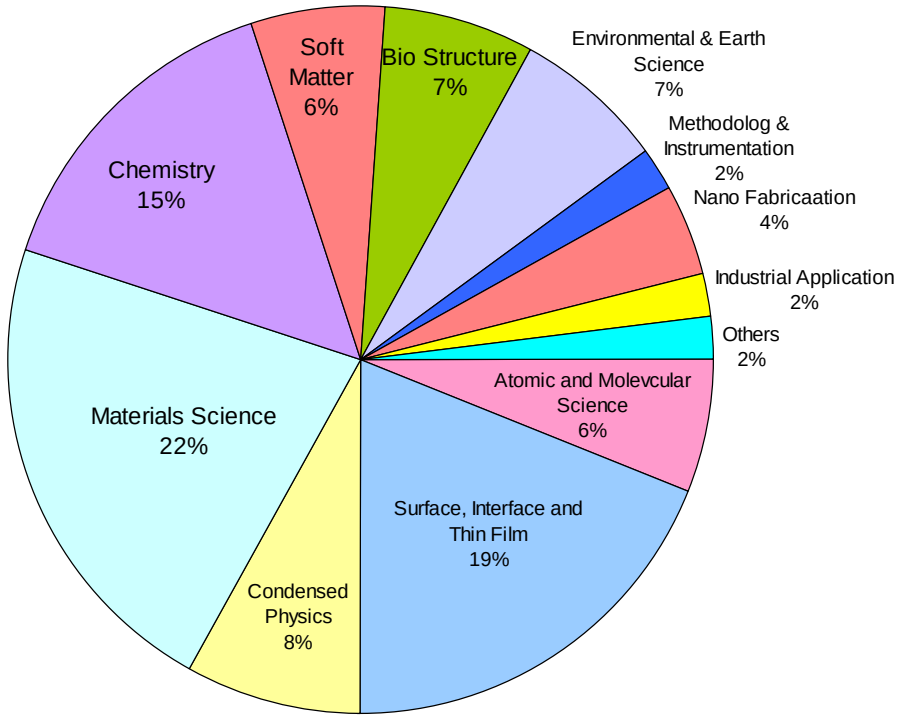
- Light Source: 1.3 → 1.5 GeV
- Insertion Device: 0 → 8
- Beamline: 3 → 27
- End Station: 3 → 54

Taiwan Contract Beamlines at SPring-8

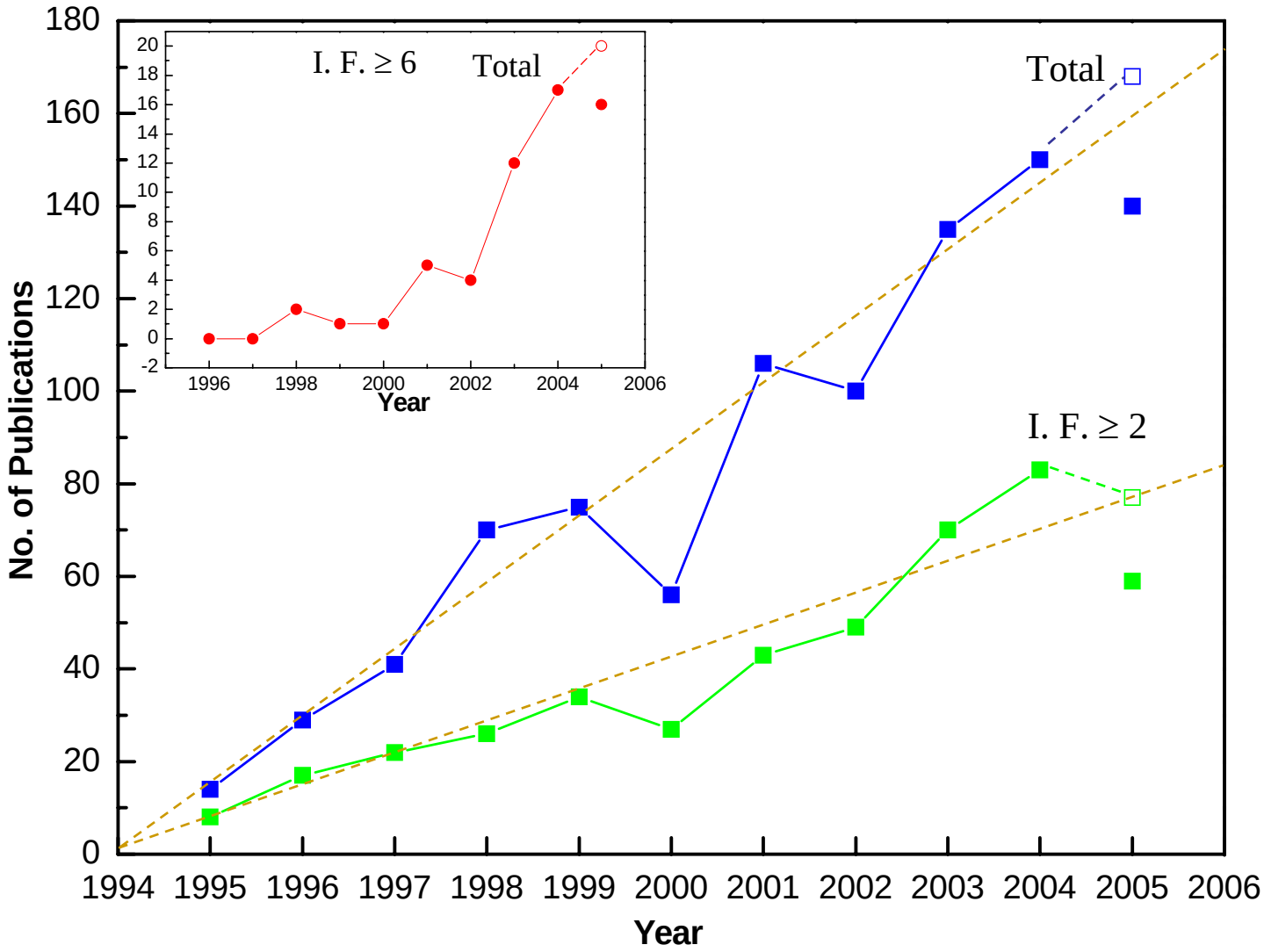
Statistics of Users' Experiments







SCI Publications Based on TLS Experiments



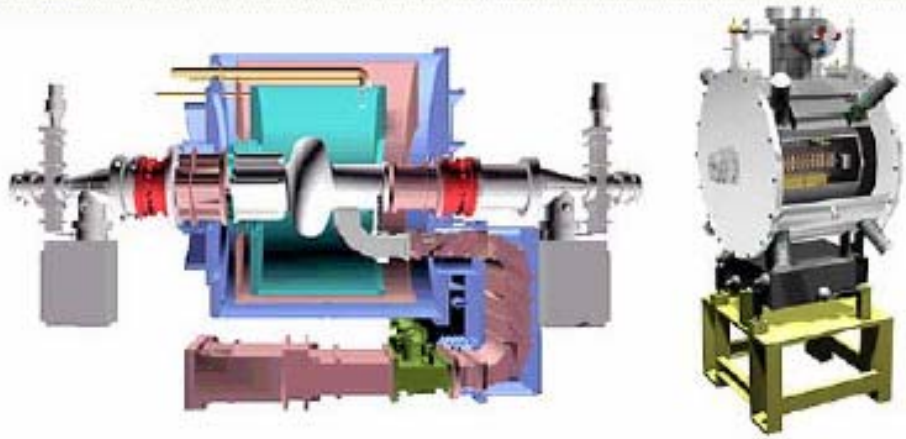
AST 2006
Applications of Superconducting

- News
- Scopes
- Program
- Registration/Accommodation
- Travel Information
- Useful Information

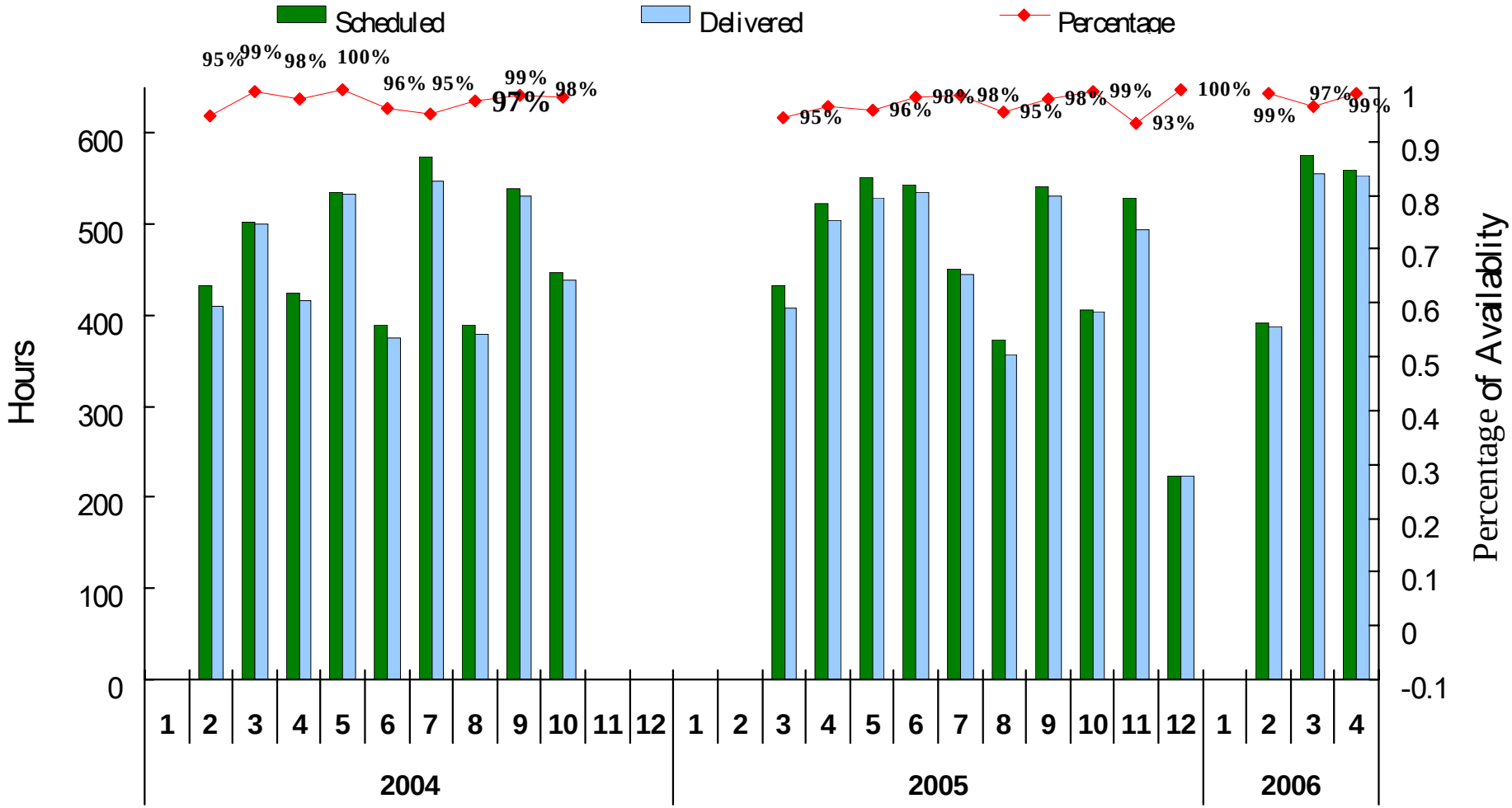
Applications of Superconducting Technology in Synchrotron Light Sources

Satellite Workshop of SRI2006
Hsinchu, Taiwan, NSRRC
June 5 - 6, 2006

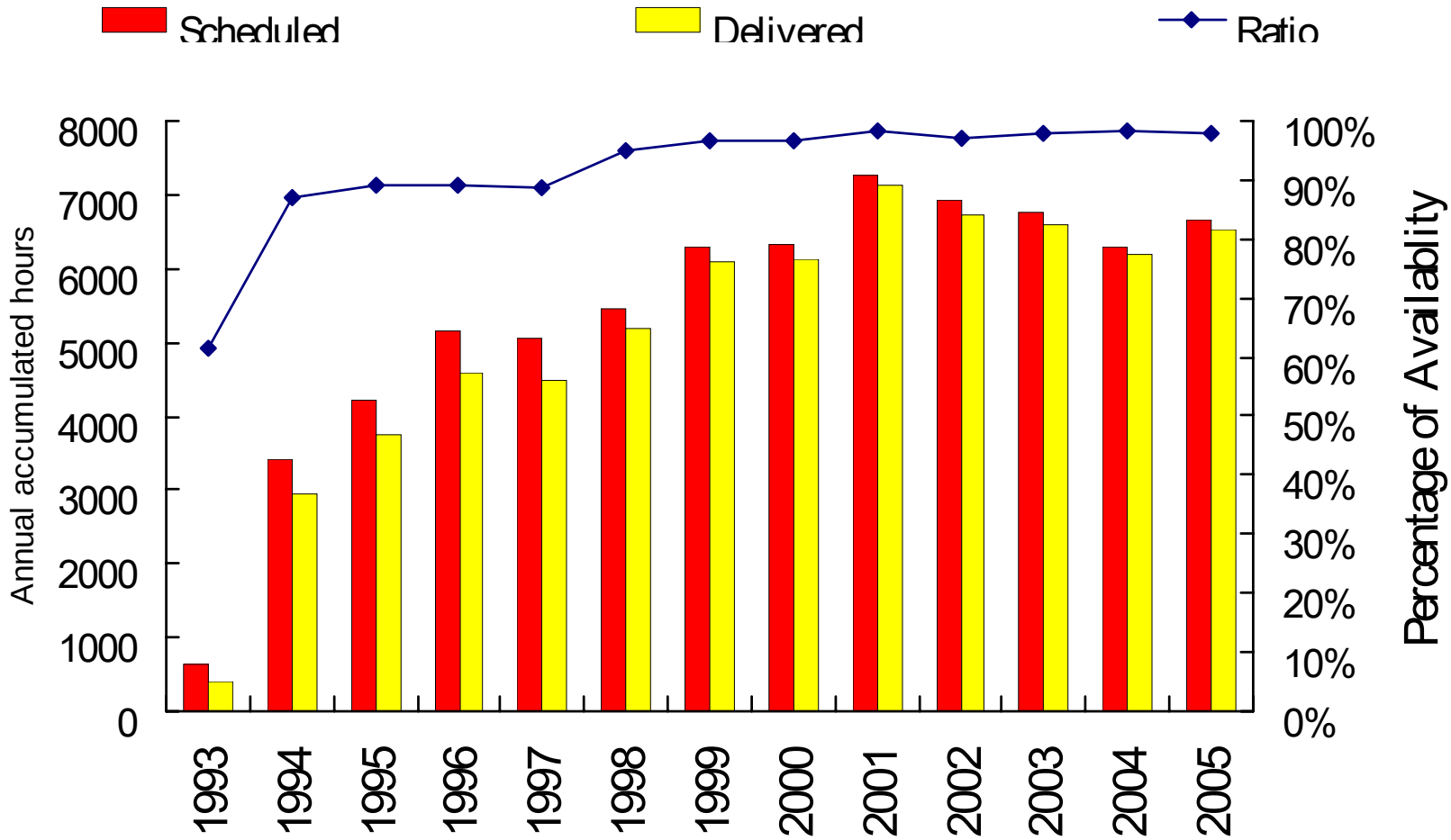
The satellite workshop will focus on the applications of the superconducting radio frequency modules and superconducting magnets used at new generation light sources.



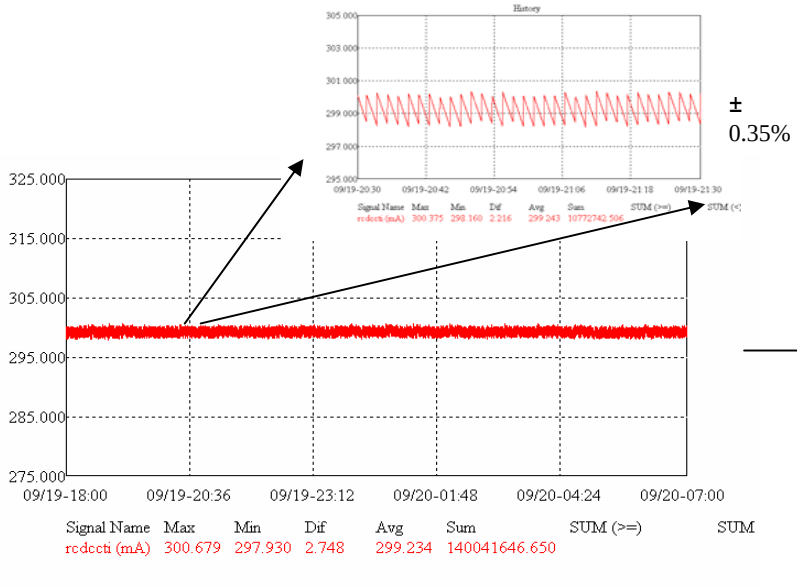
Scheduled and delivered user beam time



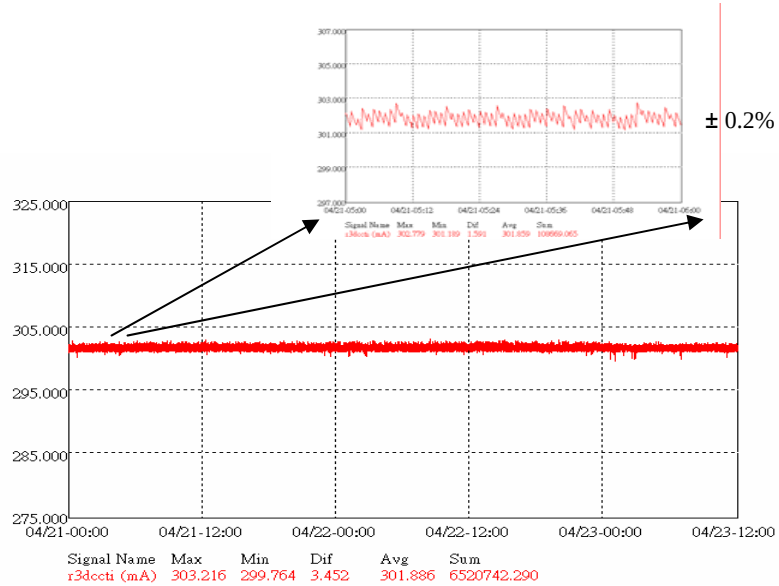
Statistics of TLS annual operation and availability



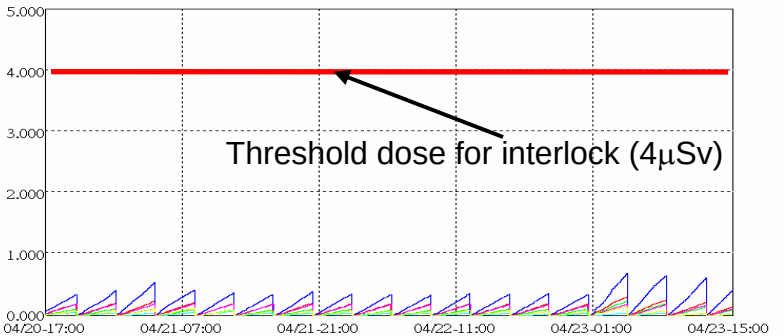
Top up injection



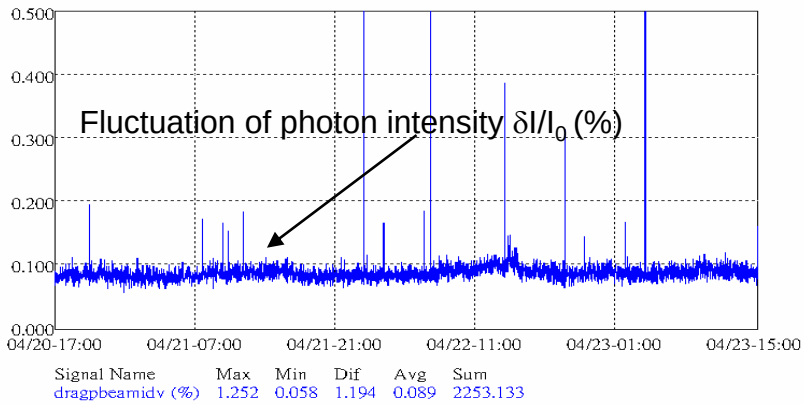
± 0.35%



± 0.2%

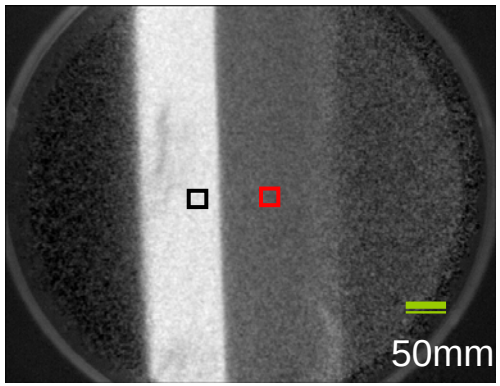


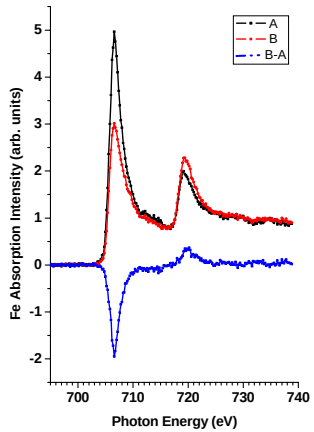
Signal Name	Max	Min	Dif	Avg	Sum						
gS1.1 (uSv/h)	0.310	0.001	0.309	0.106	2663.937	gS4.4 (uSv/h)	0.080	0.001	0.079	0.024	598.205
gS2.2 (uSv/h)	0.240	0.001	0.239	0.060	1513.569	gS5.5 (uSv/h)	0.200	0.001	0.199	0.092	2319.251
gS3.3 (uSv/h)	0.690	0.001	0.689	0.214	5384.123	gS6.6 (uSv/h)	0.150	0.001	0.149	0.042	1057.107



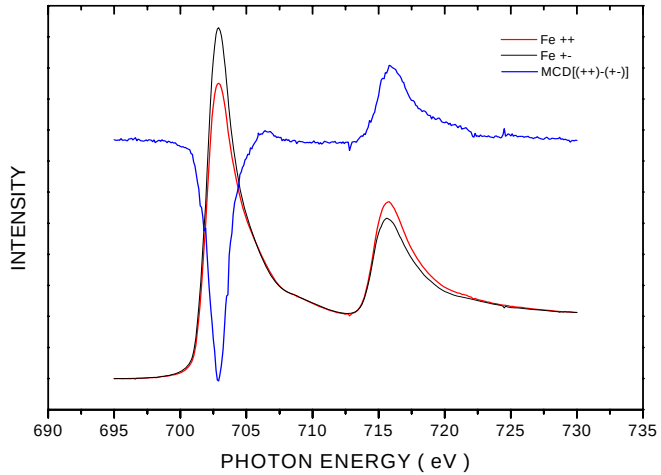
Top-up Injection

BL05B (EPU)

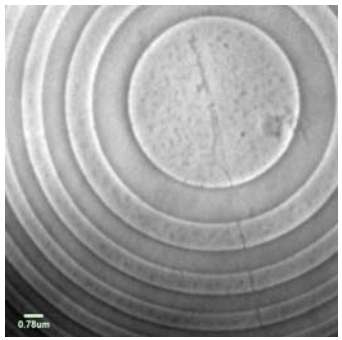




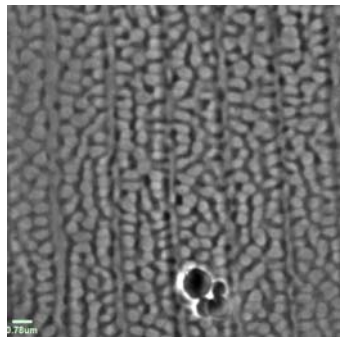
BL11A (Dragon)



BL01B (X-ray Microscopy)



15μm

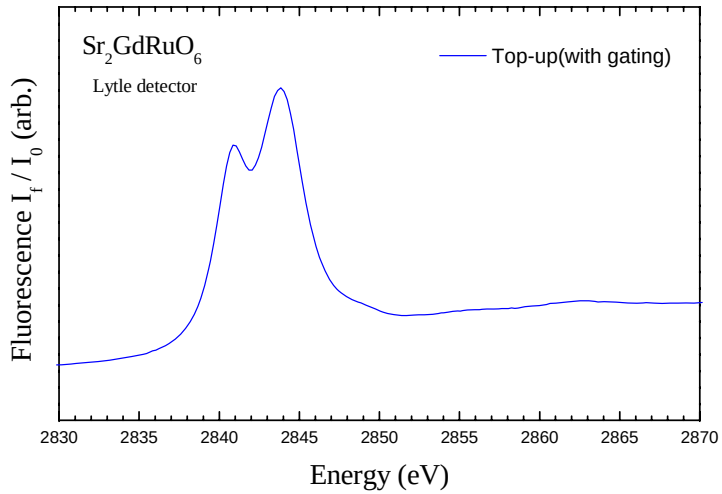


15μm

Plastic zone plate

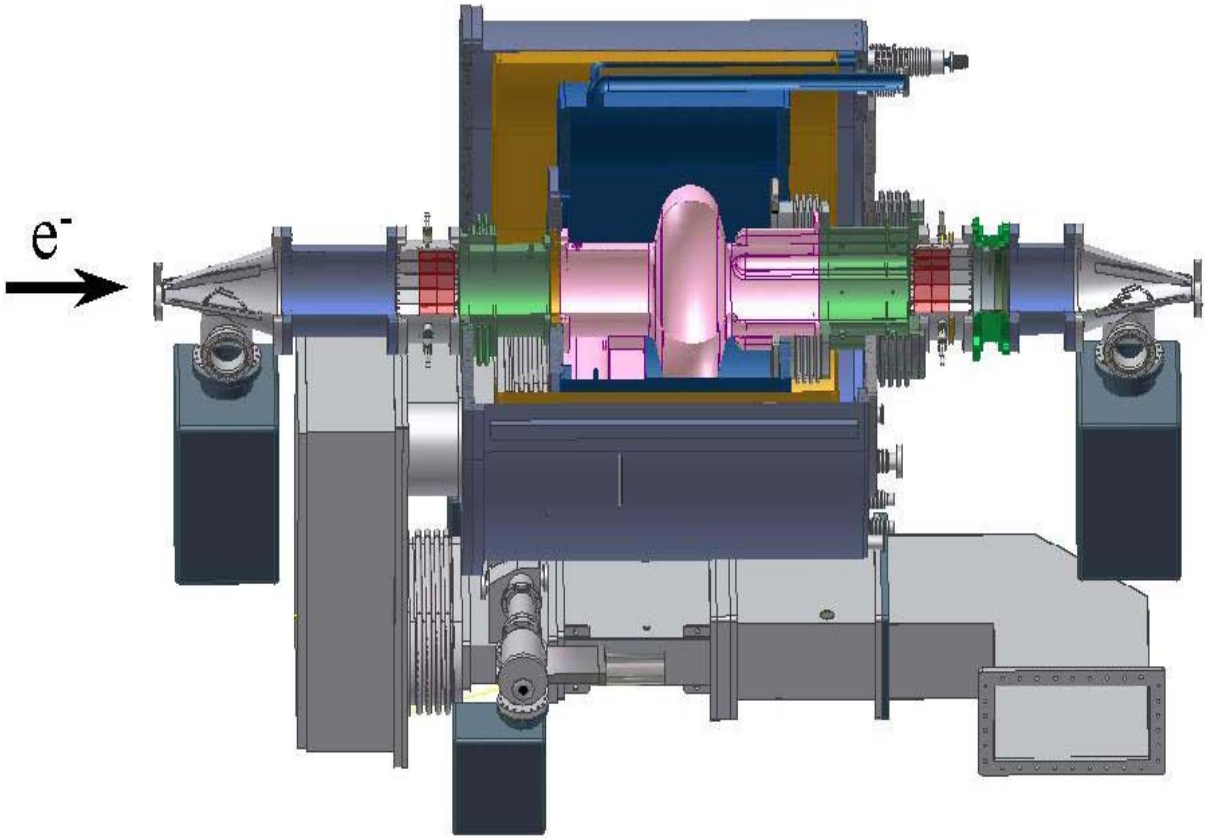
Butterfly, 2D phase contrast.

BL15B



Top-up mode injection has no negative effect on the data quality.

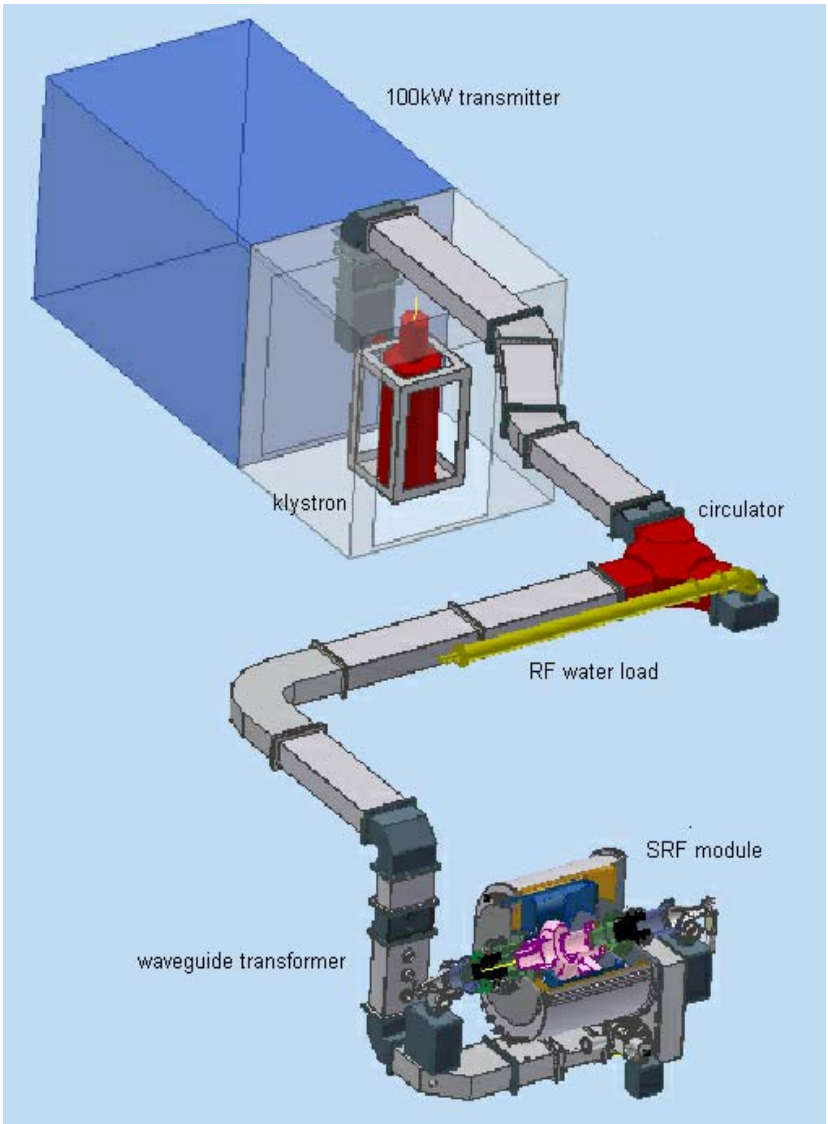
SRF Module for TLS Application

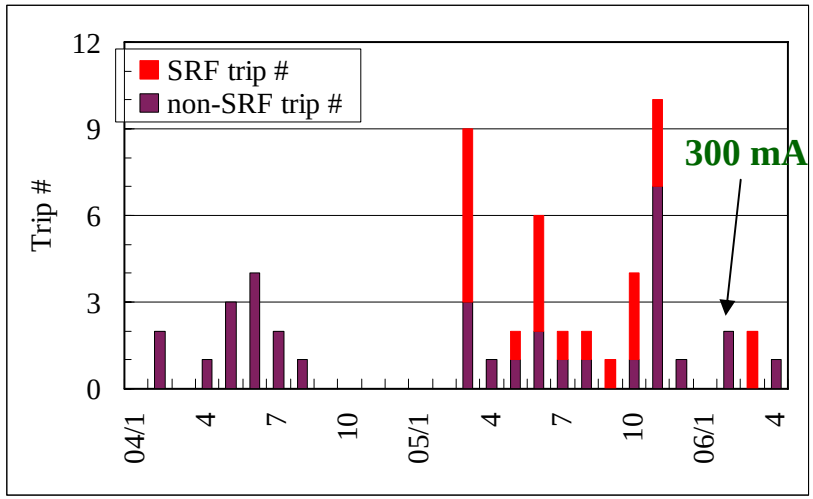


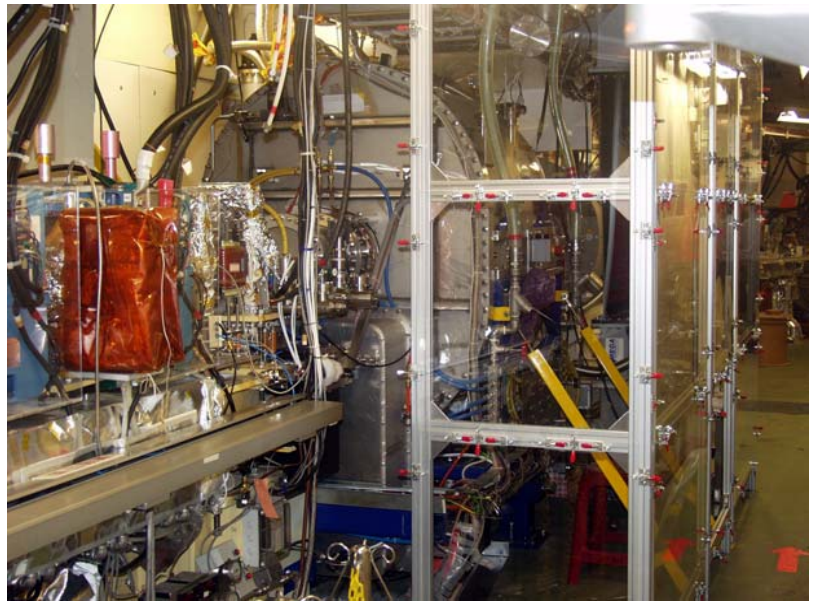
Modifications have been done for NSRRC's SRF modules

- *Magnetic shielding (vacuum vessel 304L →316L, μ→ cryoperm)*
- *Pumping speed*
- *Increase the thickness of coupling waveguide*
- *Superinuslation*
- *Radiation mask*
- *Surface of double elbow (groove→ sandblasted)*
- *Cooling channel of HEX and double elbow*
- *Production process of Ferrite tiles*

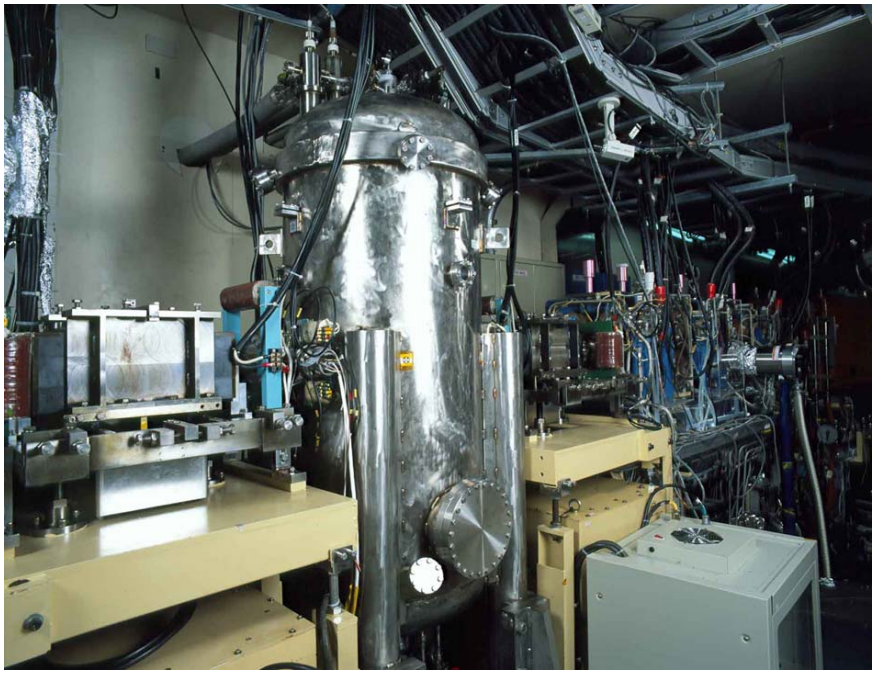
Continuous Improvements of RF Reliability



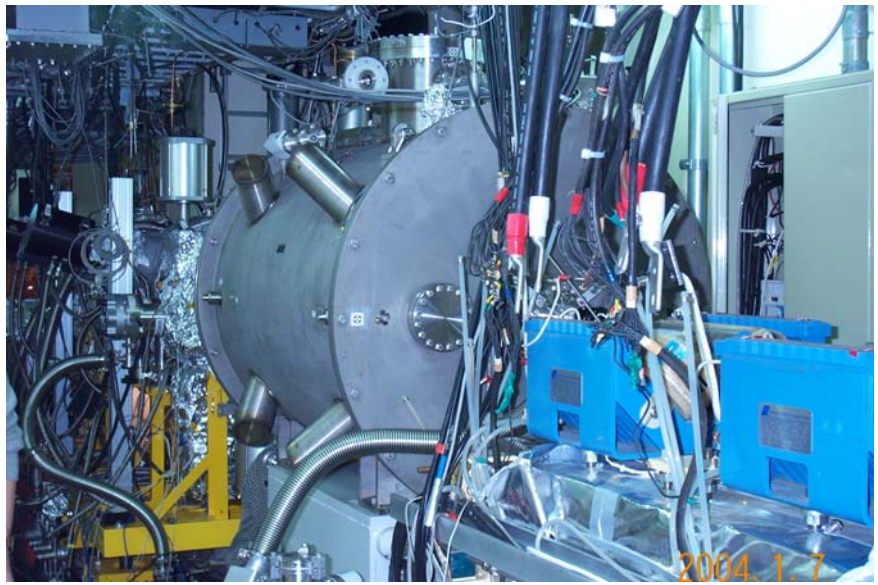




Superconducting Insertion Devices



Superconducting Wavelength Shifter (6 T, SWLS)

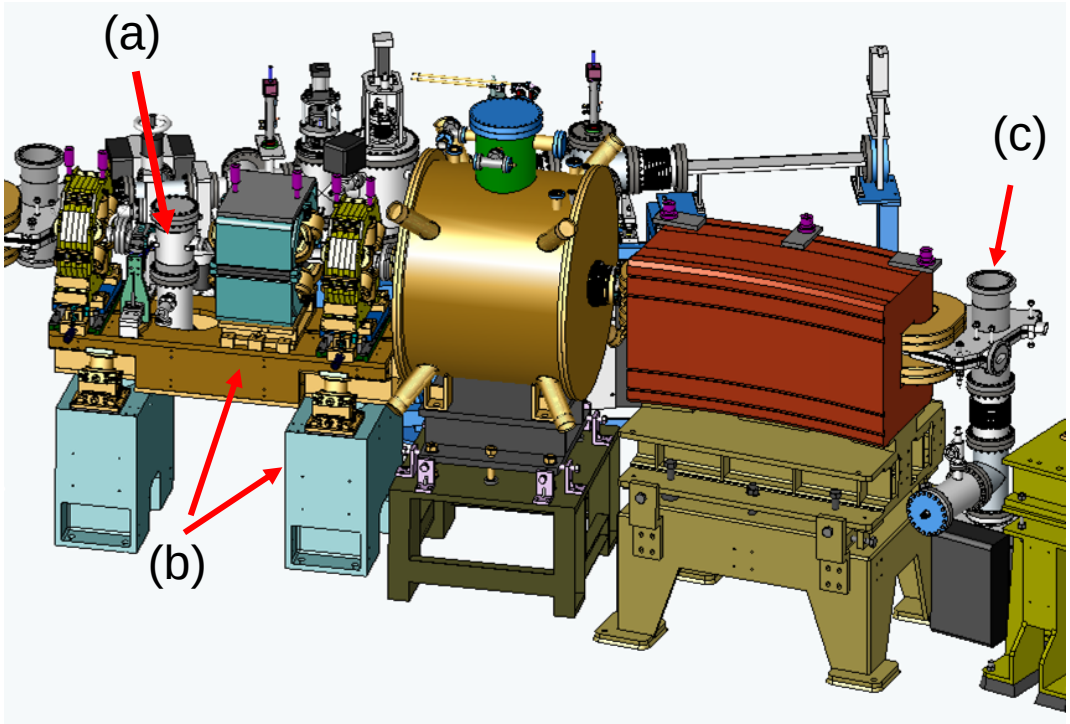


Superconducting Wiggler (3.2T, SW6)

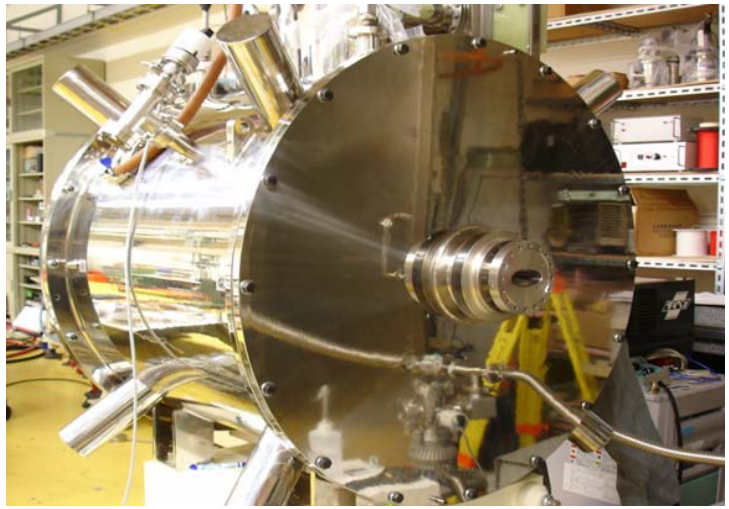
IASW Construction Project

- Three in-achromat superconducting wigglers (IASW) to be installed in 2005 ~ 2006 to produce intense X-rays for advanced biology and materials research.
- Photon flux at 20 keV will be 10 times higher than W20 and comparable to SPring-8's bending magnet at 5 ~ 20 keV.

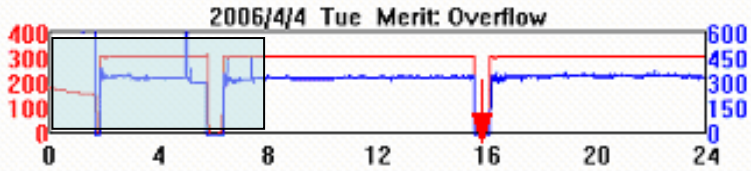
IASW Construction Project



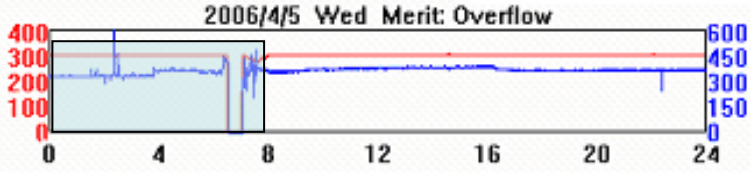
(a) vacuum chamber for straight section
(b) girder
(c) vacuum chamber for arc section

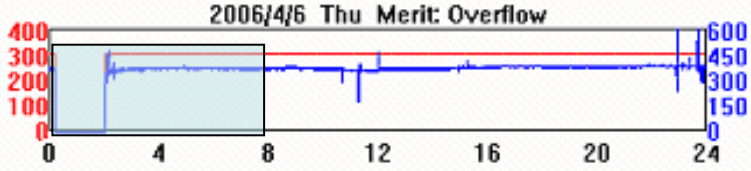


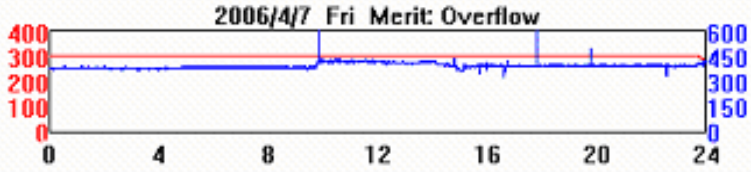
IASW under construction

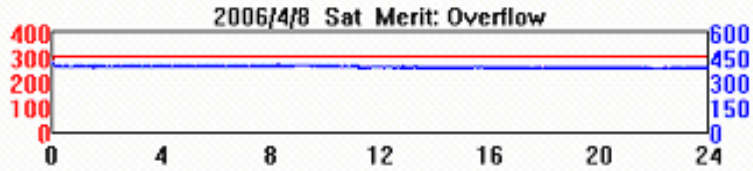


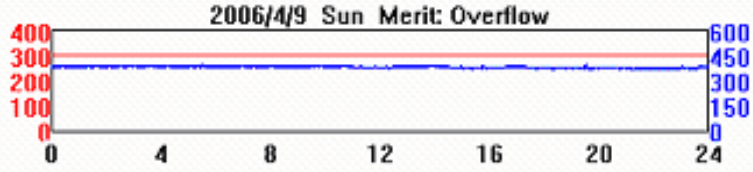
beam loss due to 15% power dropped

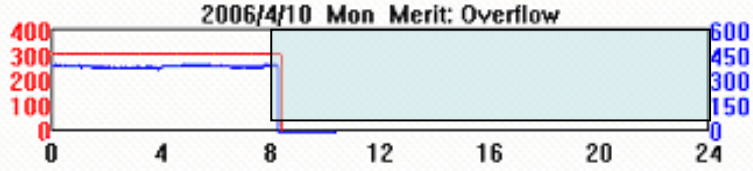








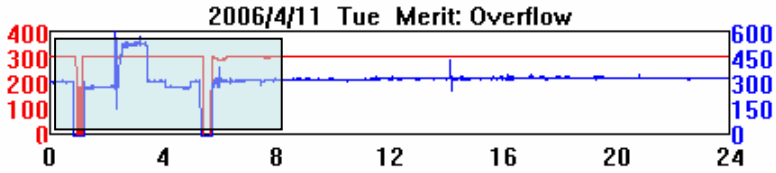


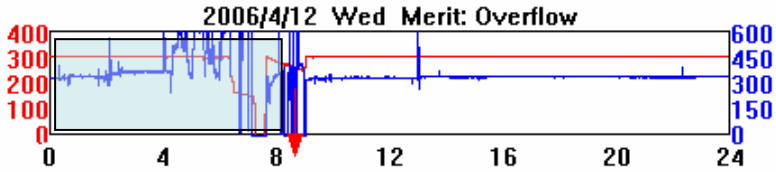


Beam Current[mA]
Life Time[min]

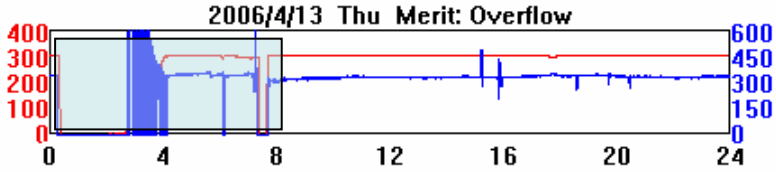
Available[Working day] use ratio:99.29%

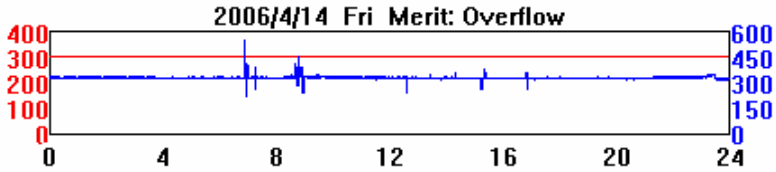
Tue 8:24[95.05%]	Sat 0:24[100.00%]
Wed 8:24[100.00%]	Sun 0:24[100.00%]
Thu 8:24[100.00%]	Mon 0:8[100.00%]
Fri 0:24[100.00%]	

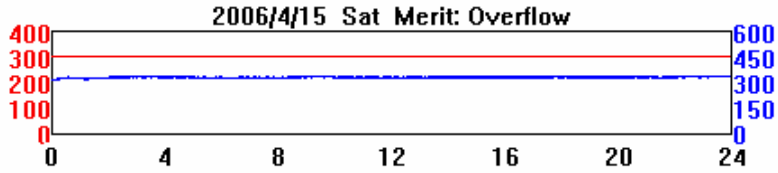


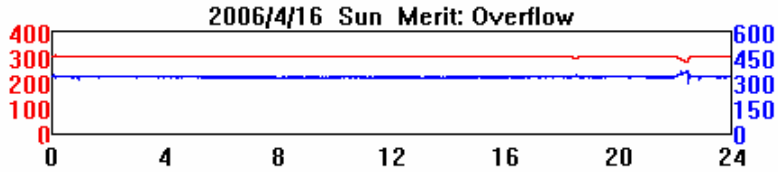


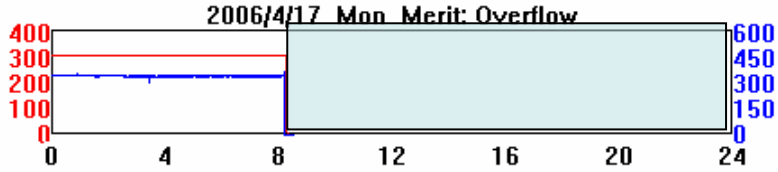
Beam parameter adjusted due to incorrect orbit.







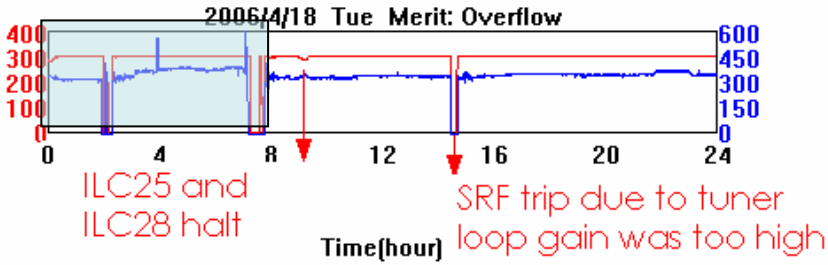


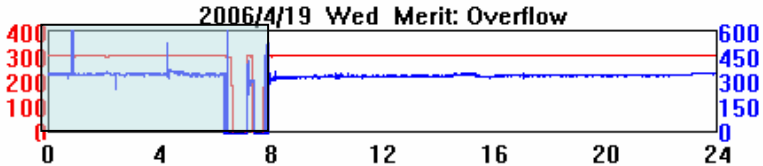


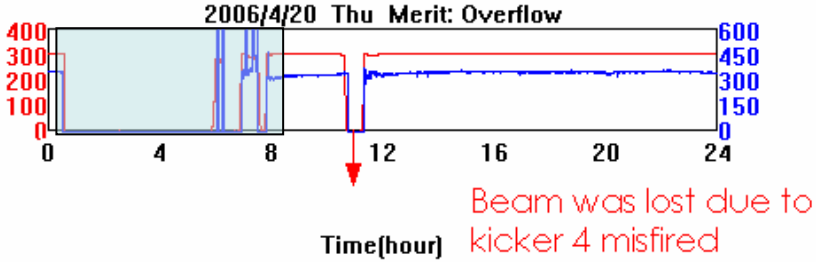
Beam Current(mA)
Life Time(min)

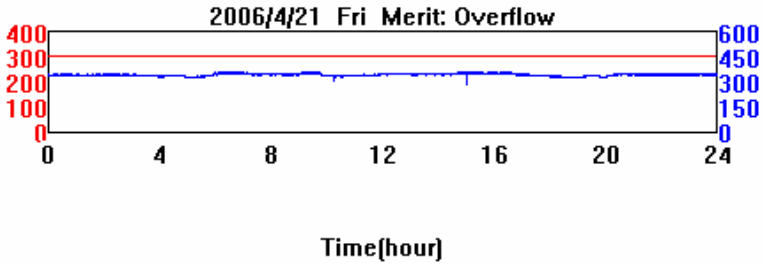
Available(Working day) use ratio:99.02%

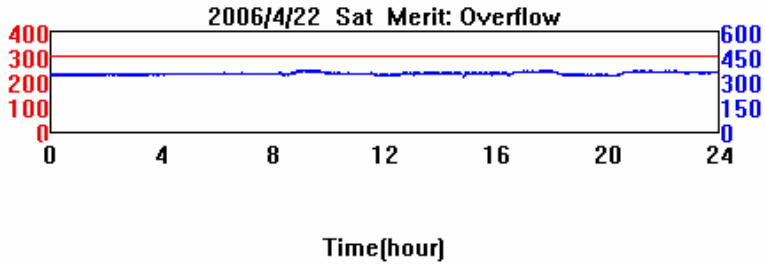
Tue 8:24(99.95%)	Sat 0:24(100.00%)
Wed 8:24(93.37%)	Sun 0:24(100.00%)
Thu 8:24(99.79%)	Mon 0:8(100.00%)
Fri 0:24(100.00%)	

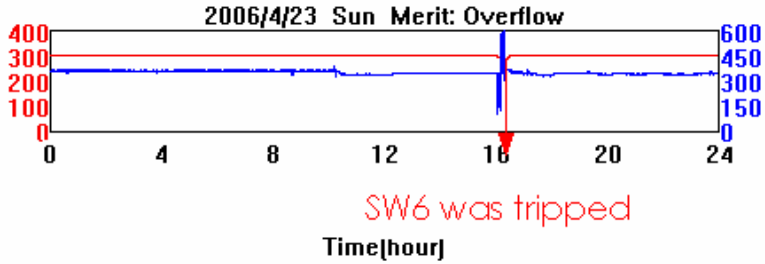


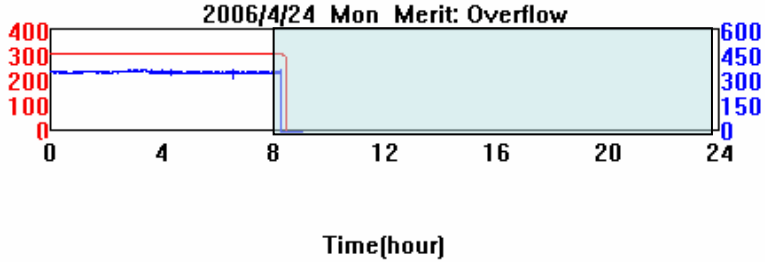












Beam Current(mA)
Life Time(min)

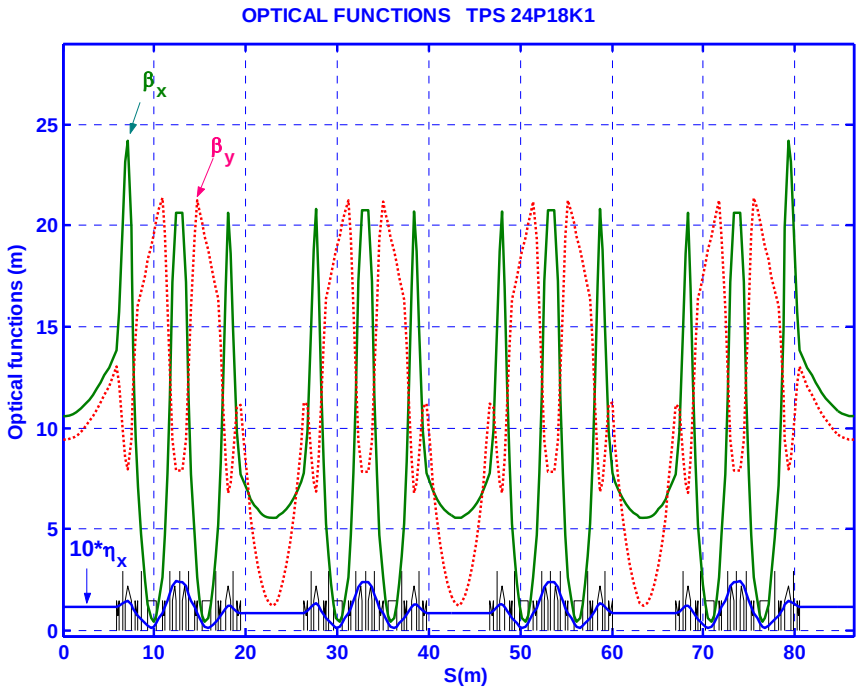
Available(Working day) use ratio:98.34%

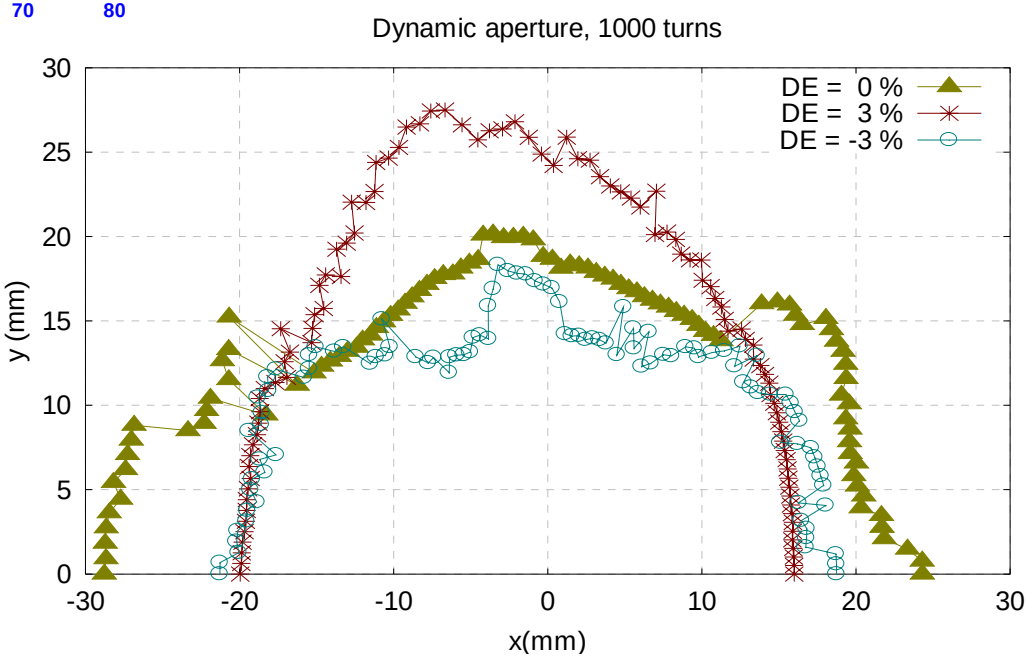
Tue 8:24(98.11%)	Sat 0:24(100.00%)
Wed 8:24(96.28%)	Sun 0:24(98.72%)
Thu 8:24(95.24%)	Mon 0:8(100.00%)
Fri 0:24(100.00%)	

Basic Parameters of TPS

Electron Energy	3 ~ 3.3 GeV
Current	400 mA at 3 GeV or 300 mA at 3.3 GeV (Top-up injection)
SR Circumference	518.4 m (h = 864 = $2^5 \cdot 3^3$, dia.= 165.0 m)
BR Circumference	499.2 m (h = 832 = $2^6 \cdot 13$, dia.= 158.9 m)
Lattice	24-cell DBA
Straight-section	11.72 m x 6 (σ_v = 12.7 μm, σ_h = 172.3 μm) 7 m x 18 (σ_v = 4.5 μm, σ_h = 126.5 μm)
Bending-section	12
Emittance	1.7 nm-rad at 3 GeV (Distributed dispersion)
Coupling	1 %
RF Frequency	500 MHz
RF Max. Voltage	6.4 MV (4 SRF cavities)
RF Max. Power	720 kW (4 SRF cavities)
Site	NSRRC in Hsinchu Science Park, Taiwan
Building	223 m OD (700 m circumference) 139 m ID (437 m circumference)

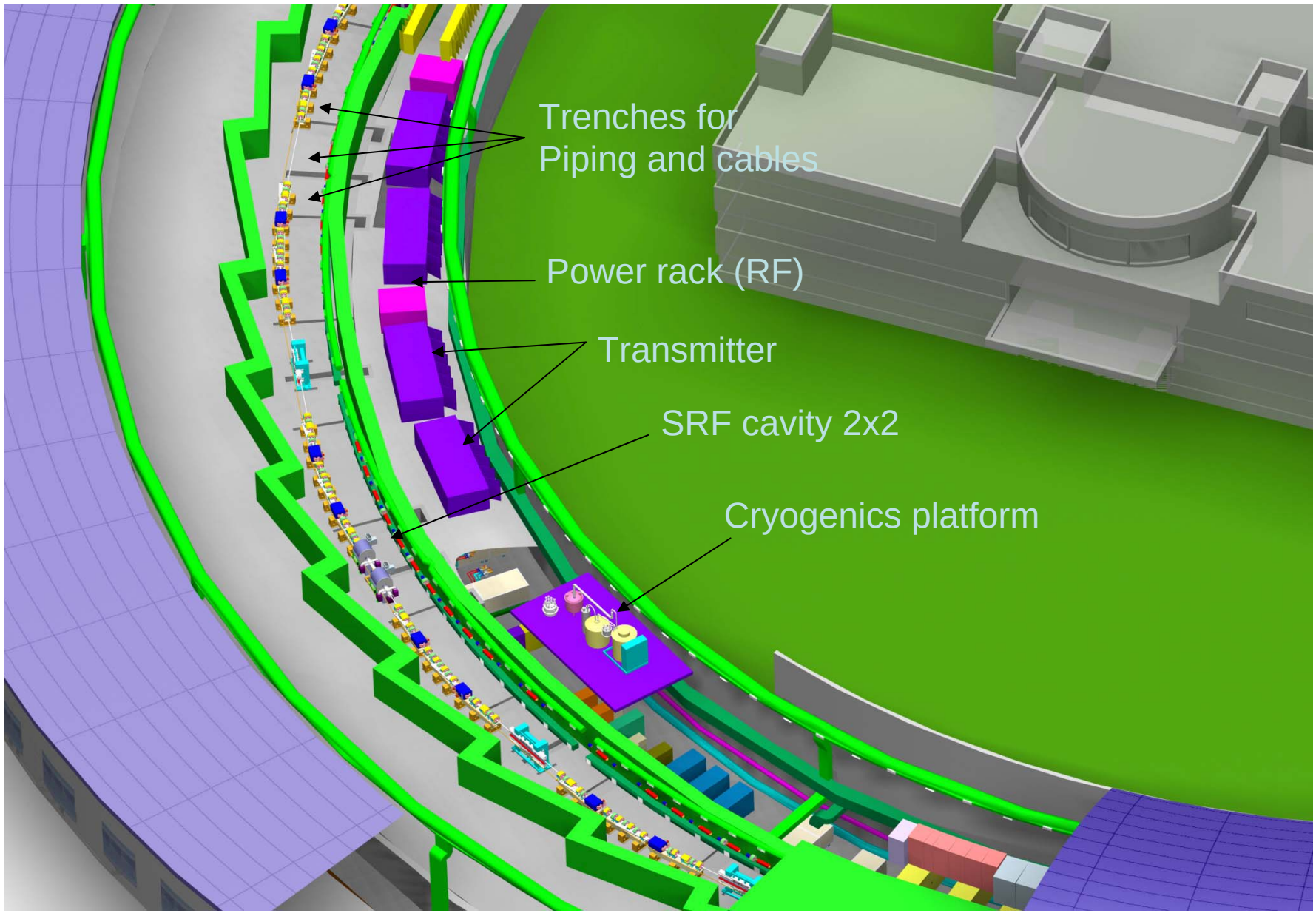
TPS Optical Functions

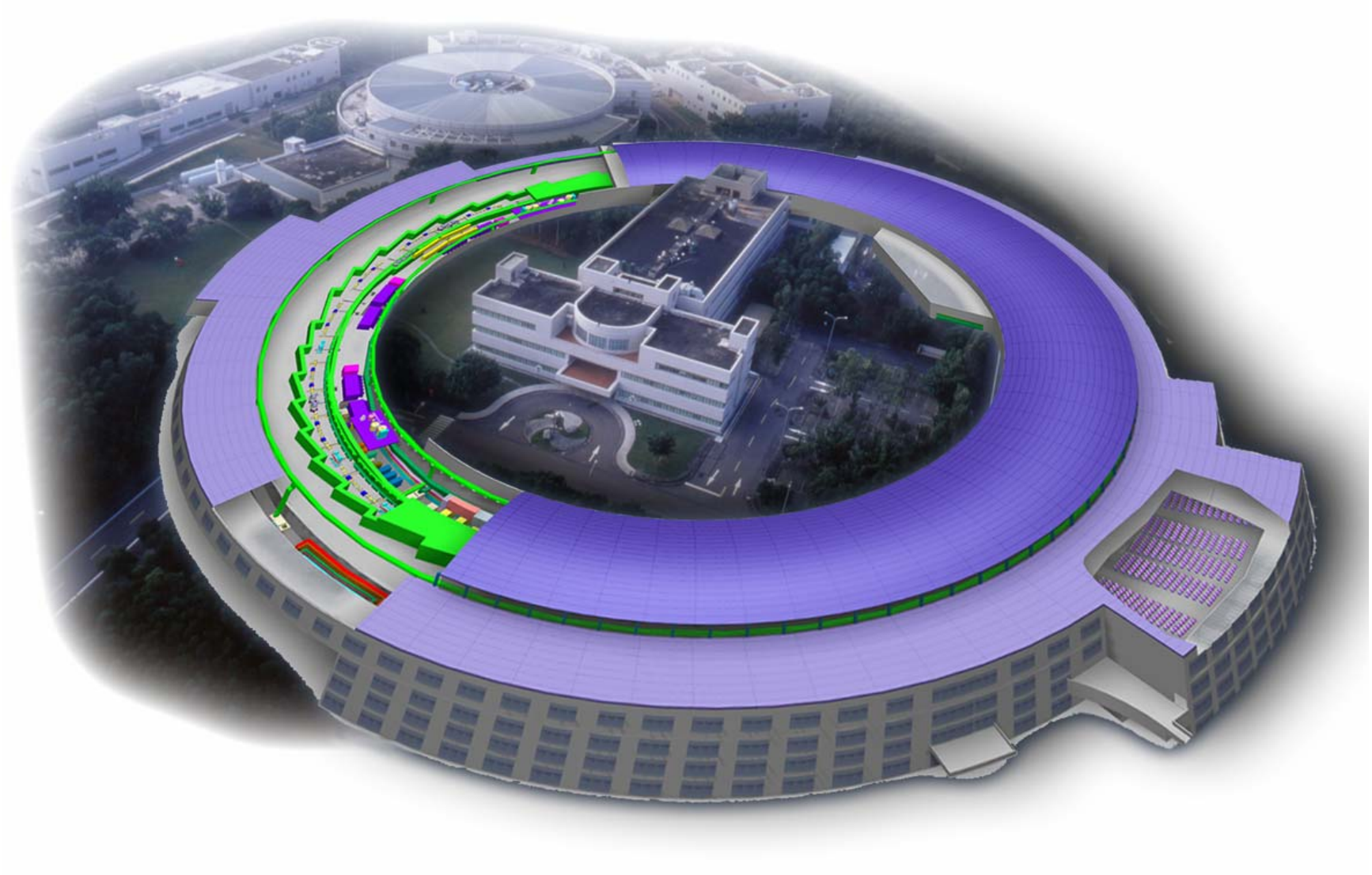




Dynamical aperture for on-energy ad off-energy particles at long straight center

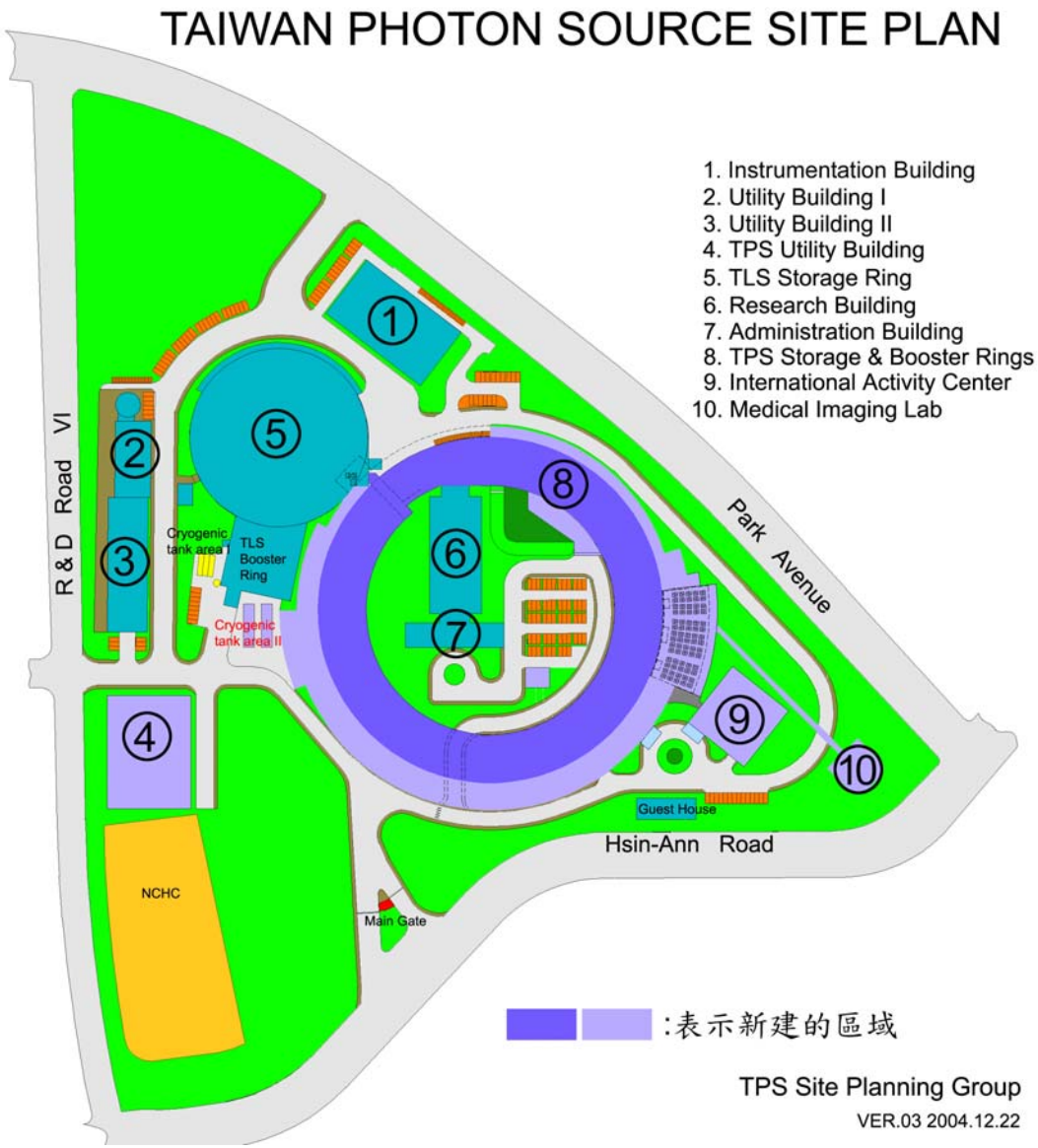
RF Straight Section and Liquid Helium Supply System



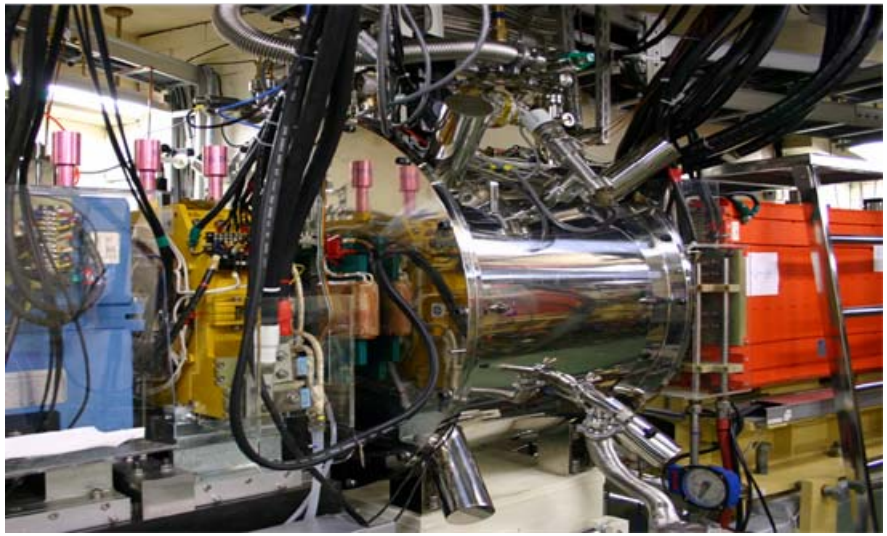


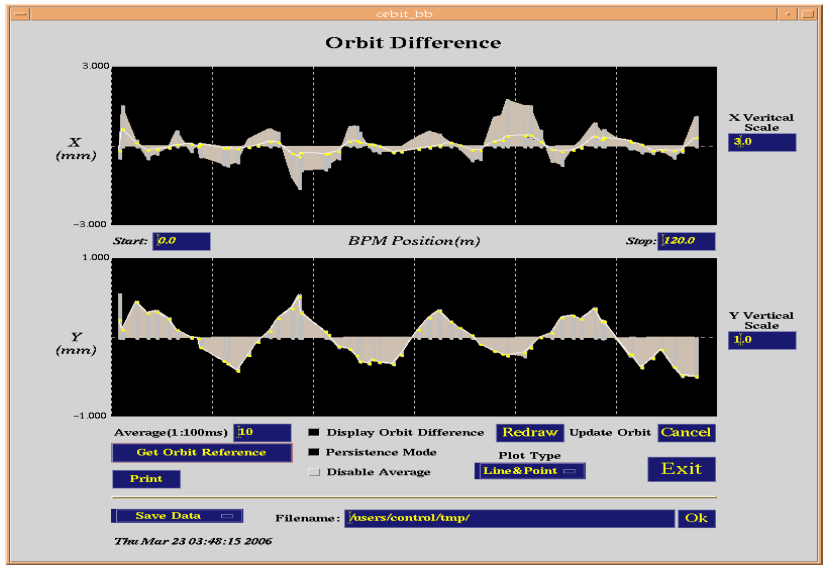
One of the Brightest Synchrotron X-ray Sources in the World

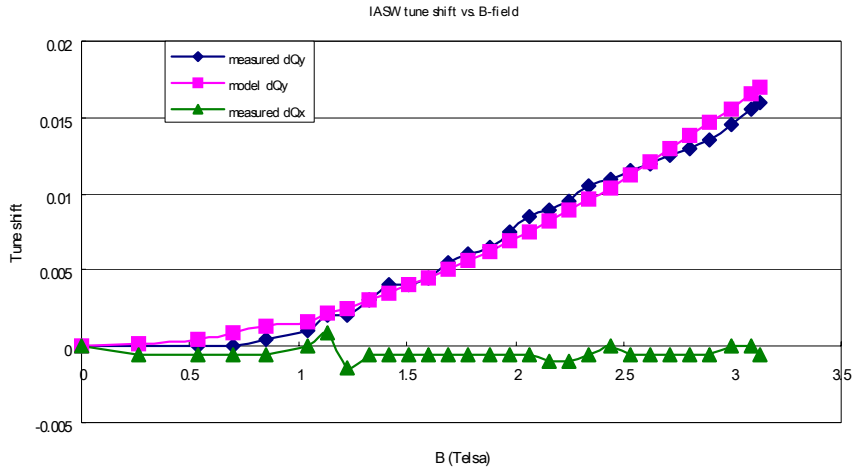
TPS Site Plan



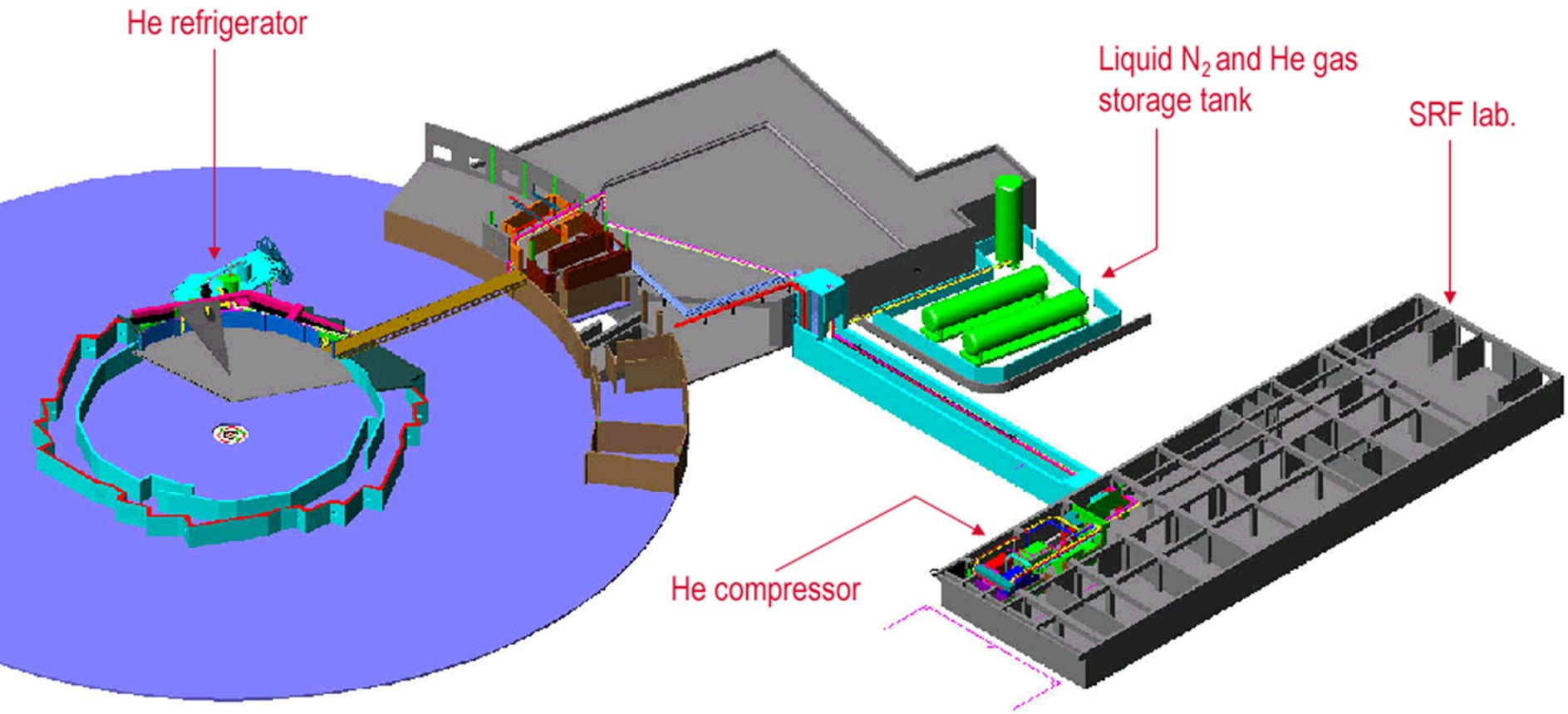
IASW project







Layout of Cryogenic System




主壓縮機一
回收壓縮機一
成分分析儀
主油氣過濾器


Buffer tanks #4, #5
Buffer tanks #1, #2, #3
Tank of Liquid Nitrogen


Refrigerator 1
Refrigerator 2
Dewar 1
Dewar 2