Status of the SSRF Project

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- Introduction to SSRF project
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- Commissioning

Introduction to the SSRF Project

- Shanghai Synchrotron Radiation Facility (SSRF) is a 3.5GeV 3rd generation light source, it is now under construction at Shanghai Zhang-Jiang High-Tech Park;
- The project is jointly founded by central government, Shanghai local government and Chinese Academy of Sciences, its investment budget of about 150MUSD is equally shared by the three founding partners;
- The SSRF groundbreaking was made on Dec.25, 2004, and its user operation is scheduled to start from Apr. 2009;

The SSRF Construction Schedule

- Dec. 2004 ~ Sept. 2006: Building construction
- Jun. 2005 ~ Mar. 2008: Accelerator equipment and components manufacture and assembly
- Dec. 2005 ~Dec. 2008: Beamline construction and assembly
- Apr. 2007 ~ Jul. 2007: Linac commissioning
- Oct. 2007 ~ Mar. 2008: Booster commissioning
- Apr. 2008 ~ Oct. 2008: Storage ring commissioning
- Nov. 2008 ~ Mar. 2009: ID Beamline commissioning
- Apr. 2009: The SSRF operation begins

SSRF

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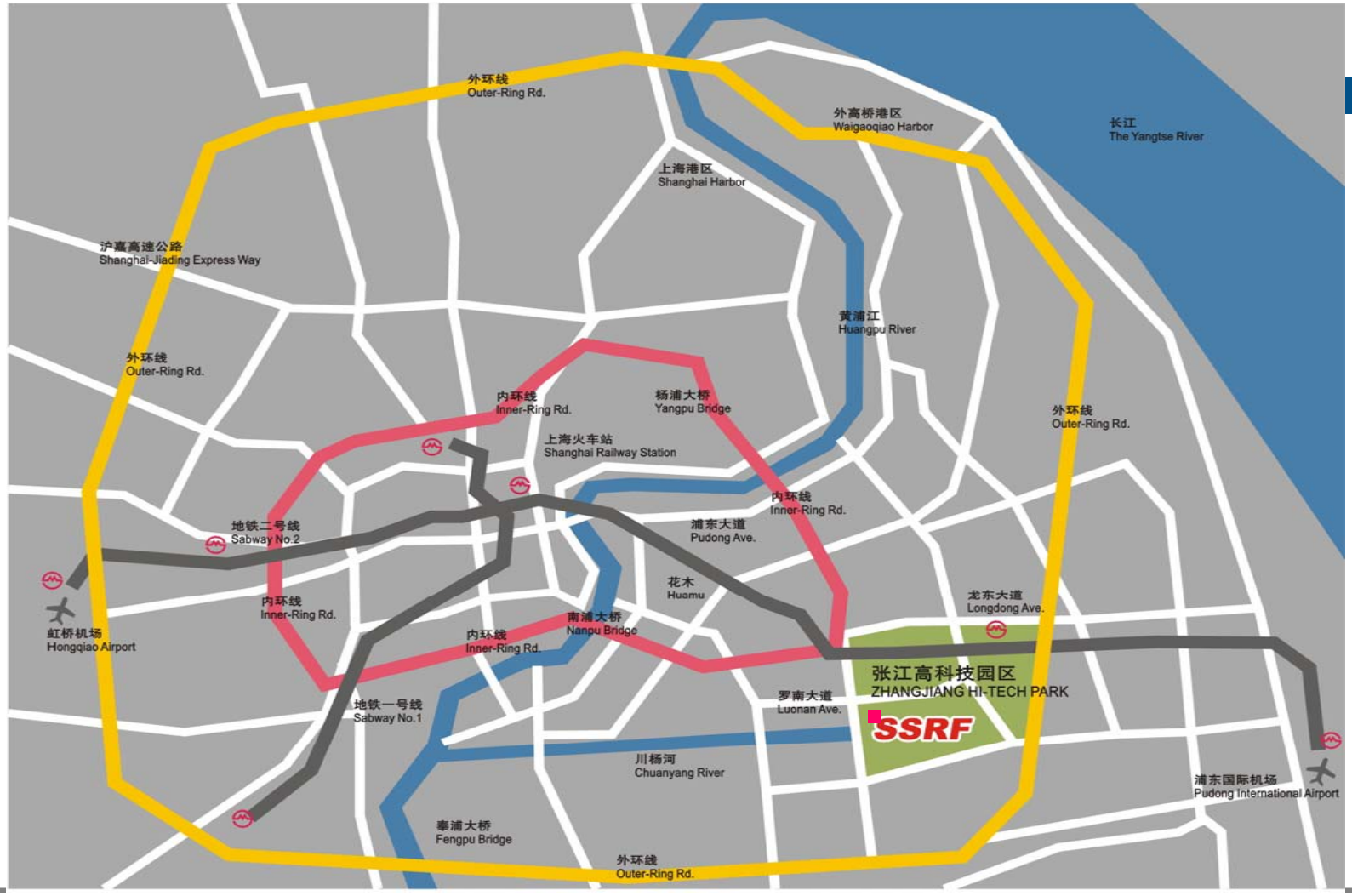
The SSRF Site Location



- **Near downtown Shanghai**
- **New developing area**

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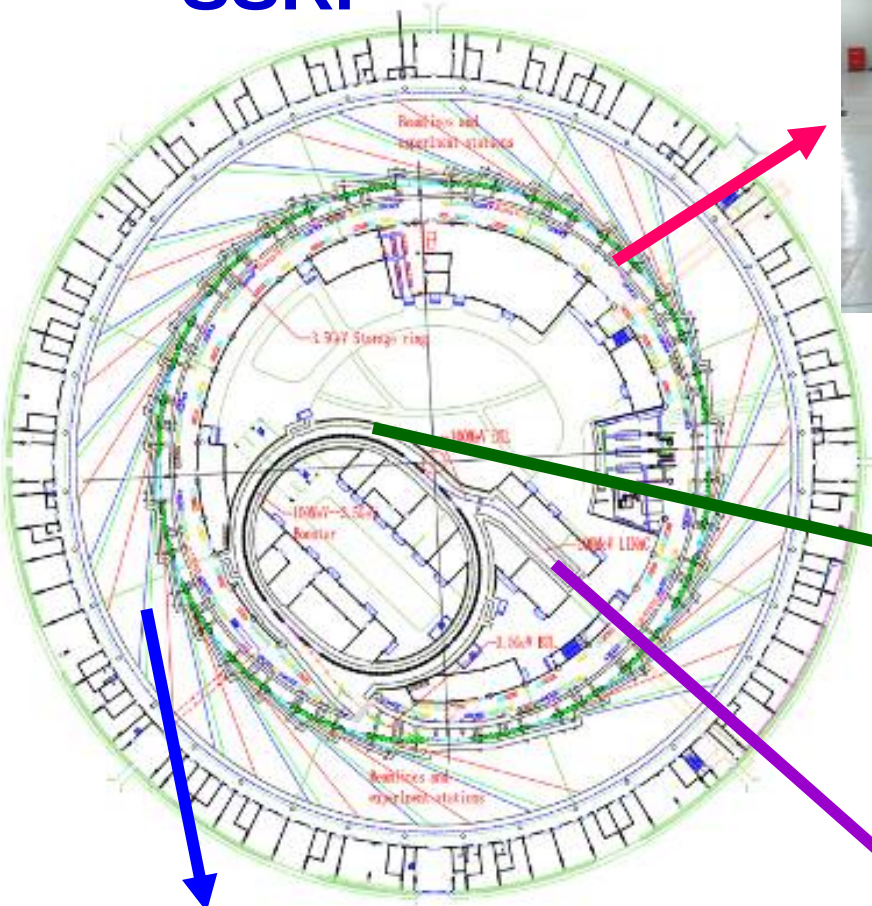
Layout of the SSRF Campus (Design)

SSRF



3.5GeV Storage Ring

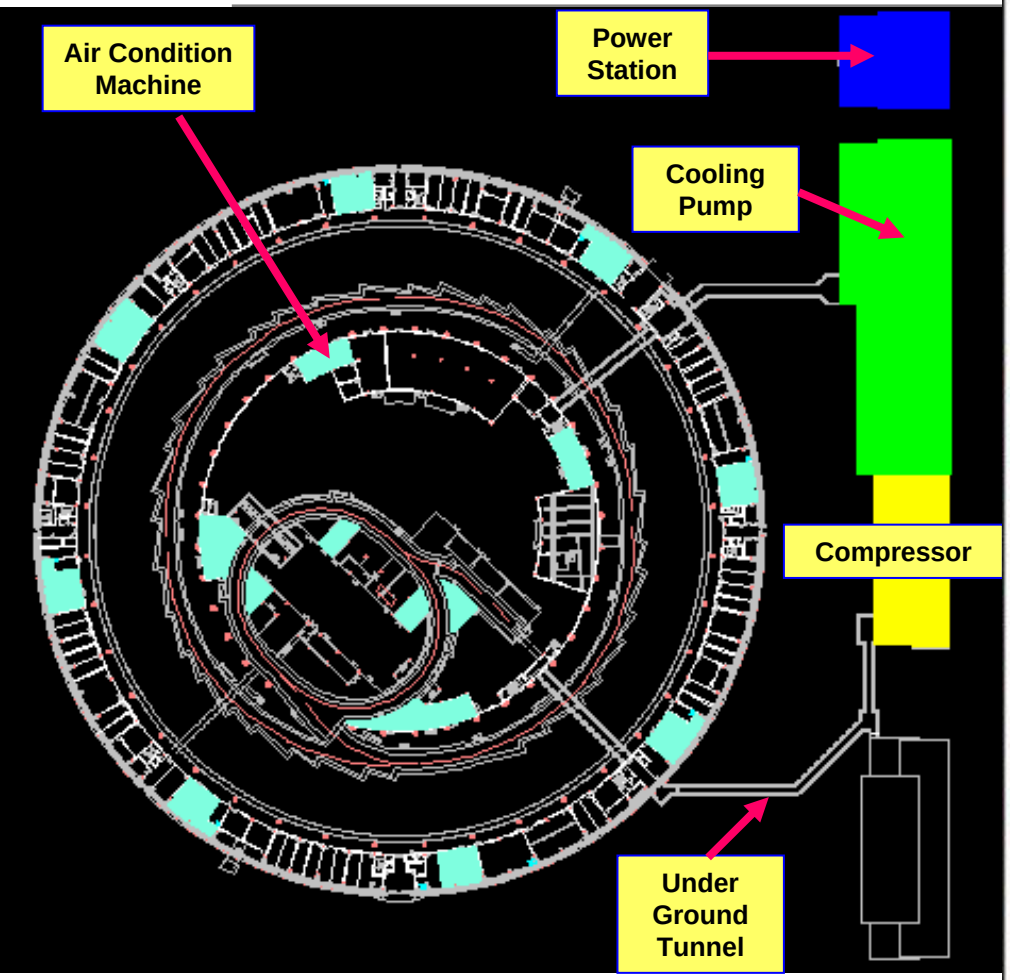
C=432m

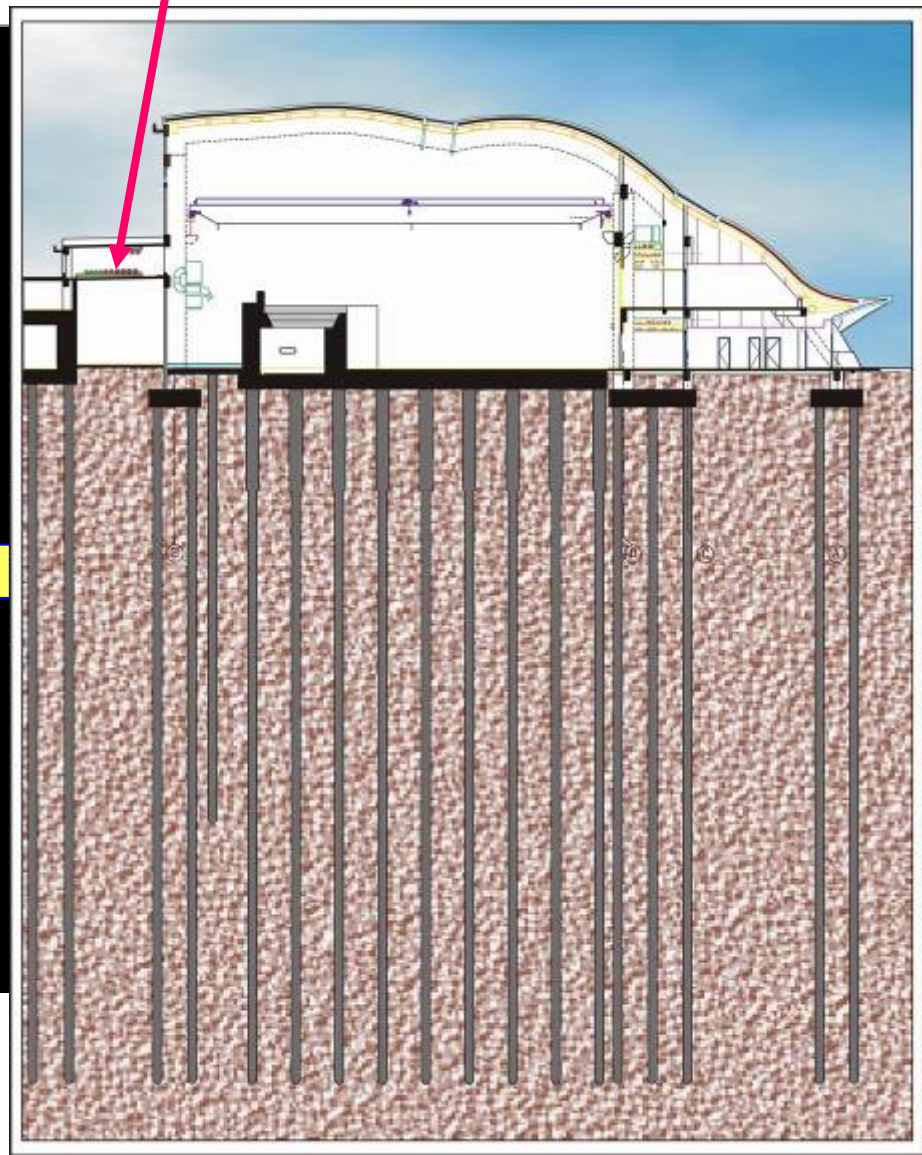
Booster
C=180m

Beamline
and station

150MeV
Linac

Building and Conventional Facility





150MeV Linac

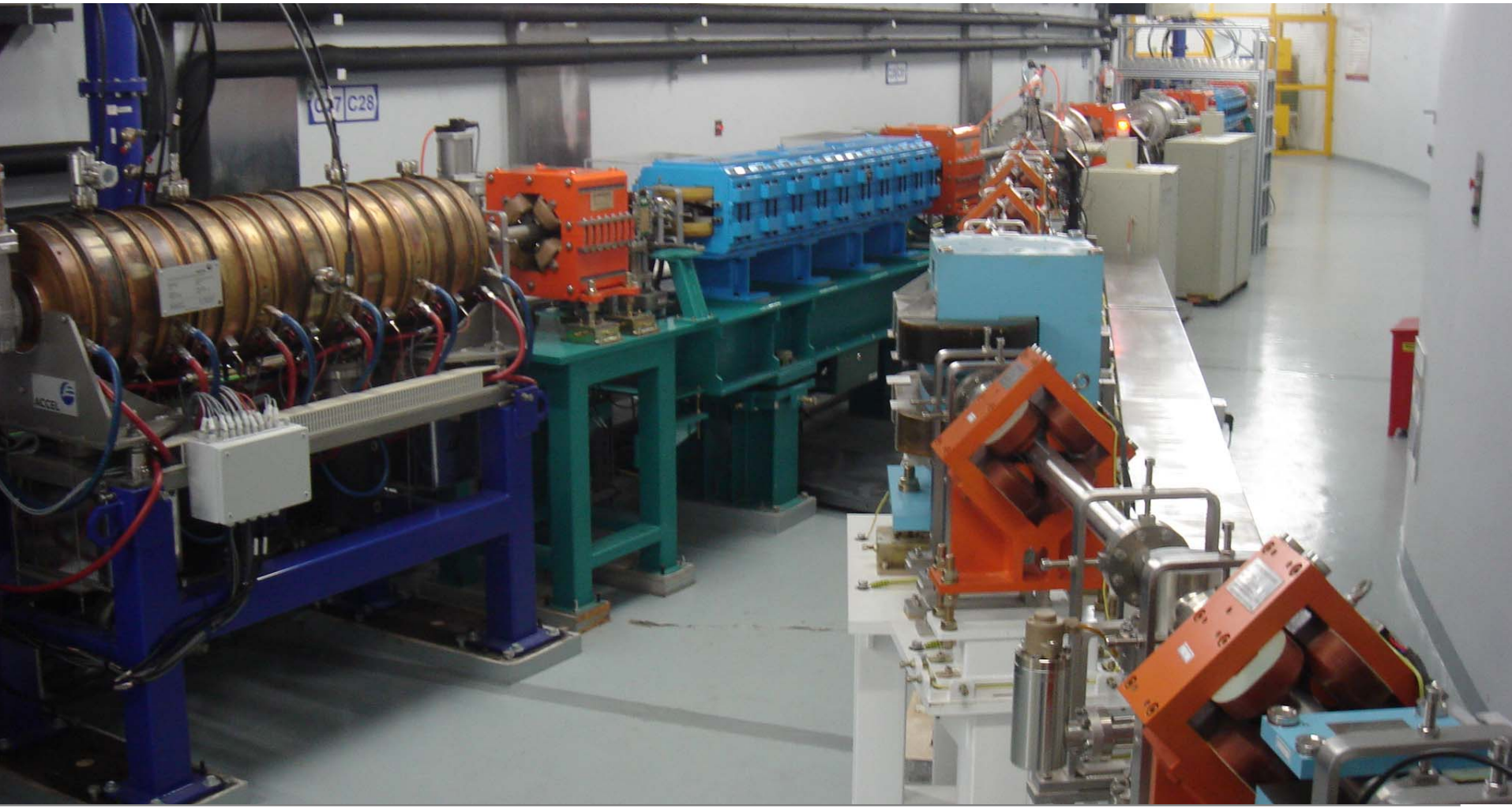
A dedicated Linac for top-up operation and with working frequency of 2998MHz

Main Parameters of the Linac

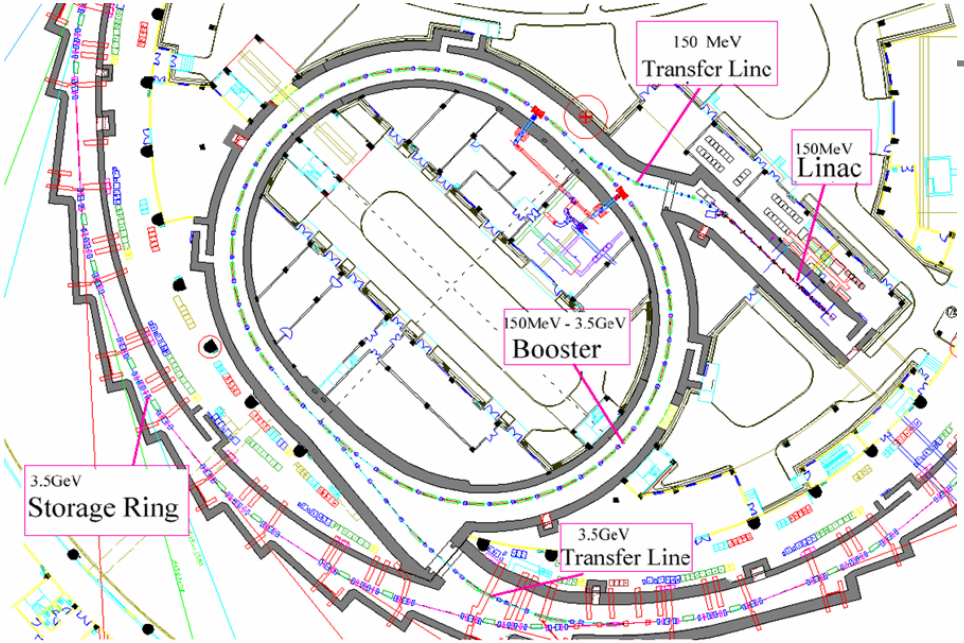
	Designed	Measured
Energy（MeV）	150	152. 162
Current (normal)	1ns，1nC	0.3nS，1.06nC
Current (low current)	1ns， 0.2nC	0.3nS， 0.2nC
Energy stability	0.5% (rms)	0.2%
Rakative energy spread	0.5% (rms)	0.2%
Normalized emittance（x)	50 mm-mrad	37 mm-mrad
Normalized emittance (y)	50 mm-mrad	32mm-mrad
Linac Frequncey（MHz）	2997.924	2997.924
Rep. Rate（Hz）	2	2

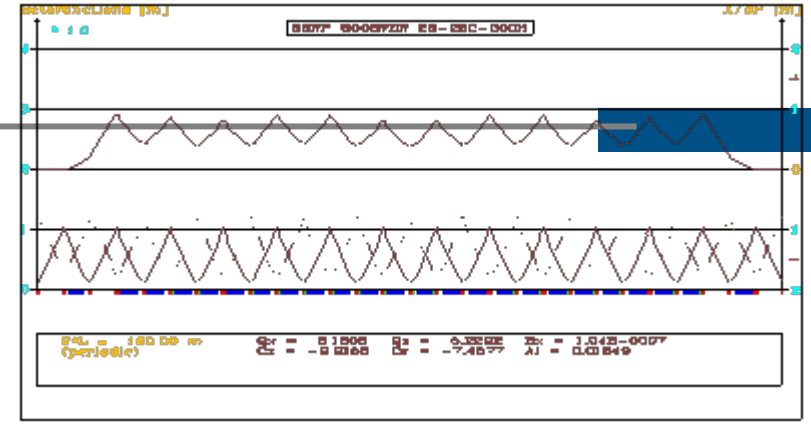
First beam from Linac on May 15, 2007

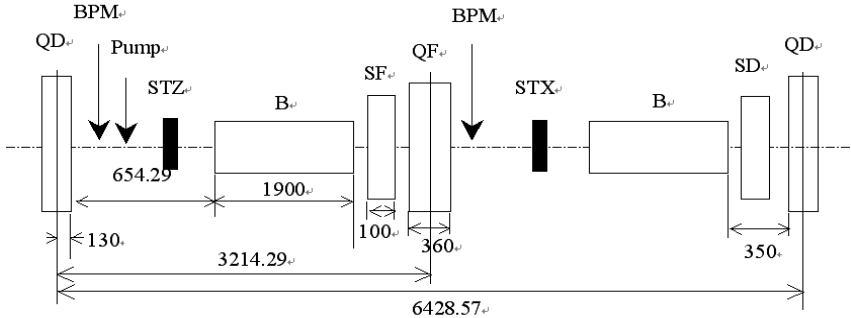
150MeV – 3.5GeV Booster



A full energy booster optimized for top-up injection with repeat rates up to 2Hz;


150 MeV
Transfer Line
150MeV
Linac
150MeV - 3.5GeV
Booster
3.5GeV
Storage Ring
3.5GeV
Transfer Line




BPM
QD
Pump
STZ
B
SF
QF
BPM
STX
B
SD
QD
654.29
1900
100
360
130
3214.29
350
6428.57

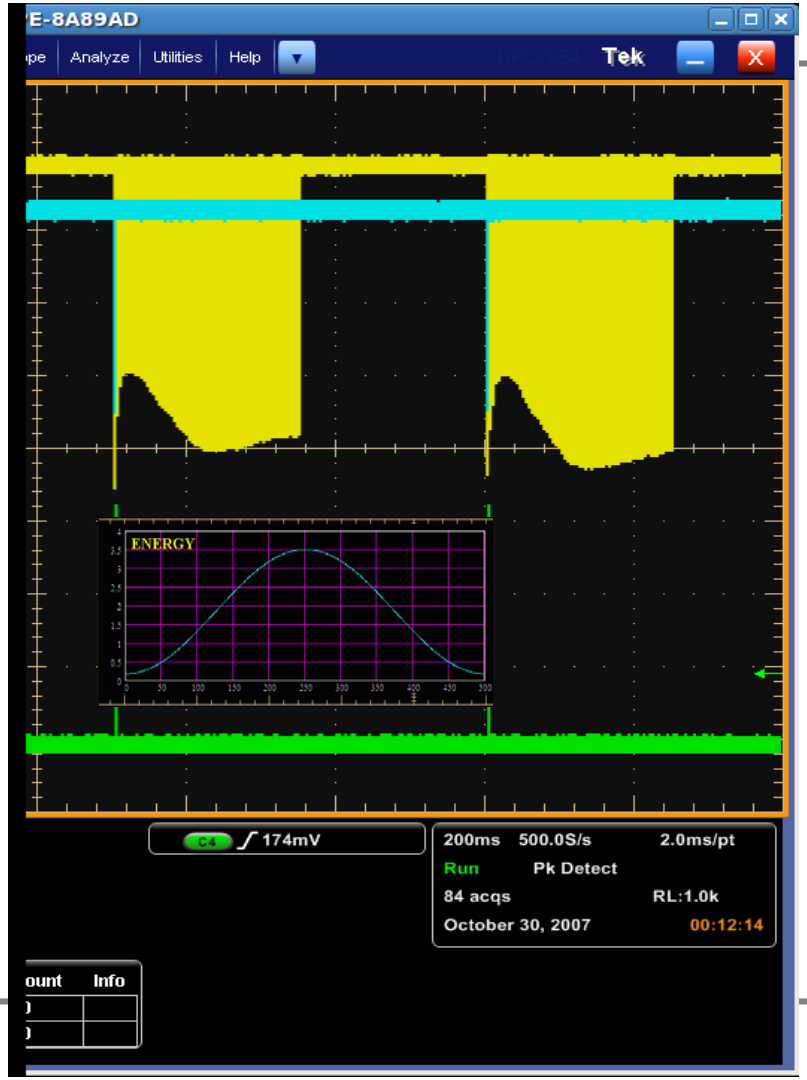
C21
C22

Main Parameters of the Booster

Injection energy	GeV	0.15	
Extraction energy	GeV	3.5	
Beam Current Single/Multi bunch	mA	1.6/15	
Circumference	m	180	
Cell number/Super periods		28/2	
Energy loss per turn at 3.5 GeV	MeV	0.915	
Natural emittance at 3.5 GeV		104	94.6
Betatron tune, ν_H / ν_V		8.181/5.229	8.416/5.389
Nature Momentum spread		7.799×10^{-4}	7.802×10^{-4}
Momentum compaction, α_P		0.01849	0.0176
Damping time, $\tau_{H,V,L}$	mS	4.8/4.6/2.3	4.8/4.6/2.3
RF Frequency	MHz	499.65	
Required RF voltage V_{RF}	MV	1.8	

Booster Installation Started on April 4, 2007

Booster Commissioning



First turn of the booster beam (Oct. 1, 2007)

3.5GeV Storage Ring

Main Parameters of Storage Ring

Lattice Structure	DBA	Low-emittance mode	Normal Mode
Enenrgy	GeV	3.5	3.5
Circonference	m	432	432
Natural Emittance	nm· rad	3.9	11. 2
Current：Multi-bunch（Single）	mA	200~300(5)	200~300(5)
Number of Cells		20/4	20/4
Straights: Length×Number	m	12×4、6.5×16	12×4、6.5×16
$\beta_x/\beta_y/\eta_x$ in middle of 12m straight	m	10.0/6.0/0.15	10.0/6.0/0.0*
$\beta_x/\beta_y/\eta_x$ in middle of 6.5m straight	m	3.6/2.5/0.10	3.6/2.5/0.0*
Betatron Tune Q_x/Q_y		22.22/11.32	22.22/11.32
Chromaticity ξ_x/ξ_y		-56/-19	-56/-19

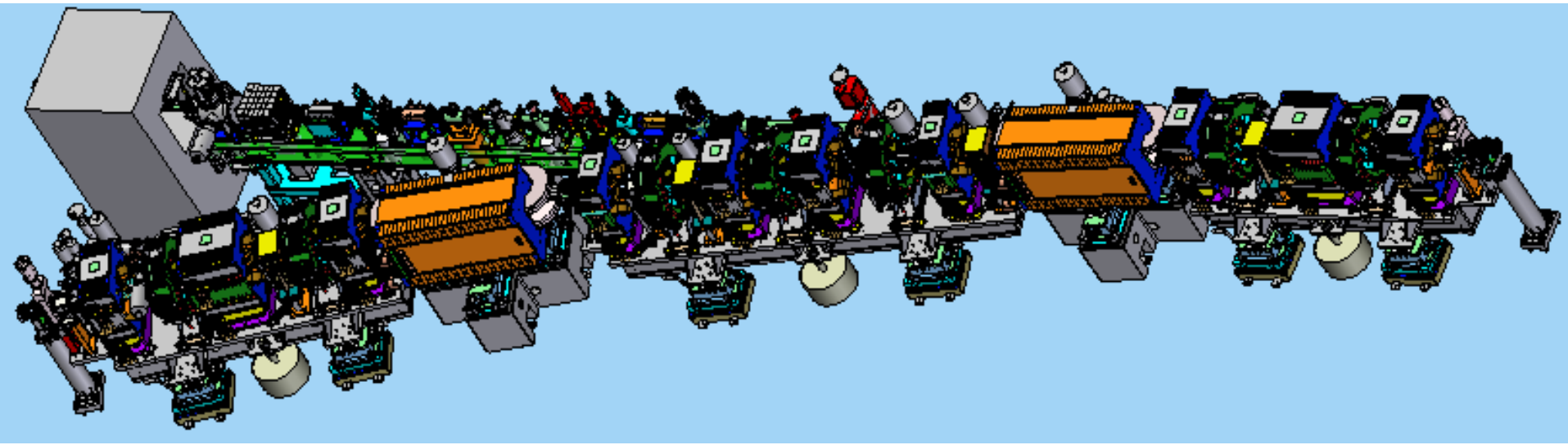
SSRF Storage Ring Mechanical System

- Double-bend achromat sector format
- 19 magnets per sector
- 3 girders and 2 pedestals per sector

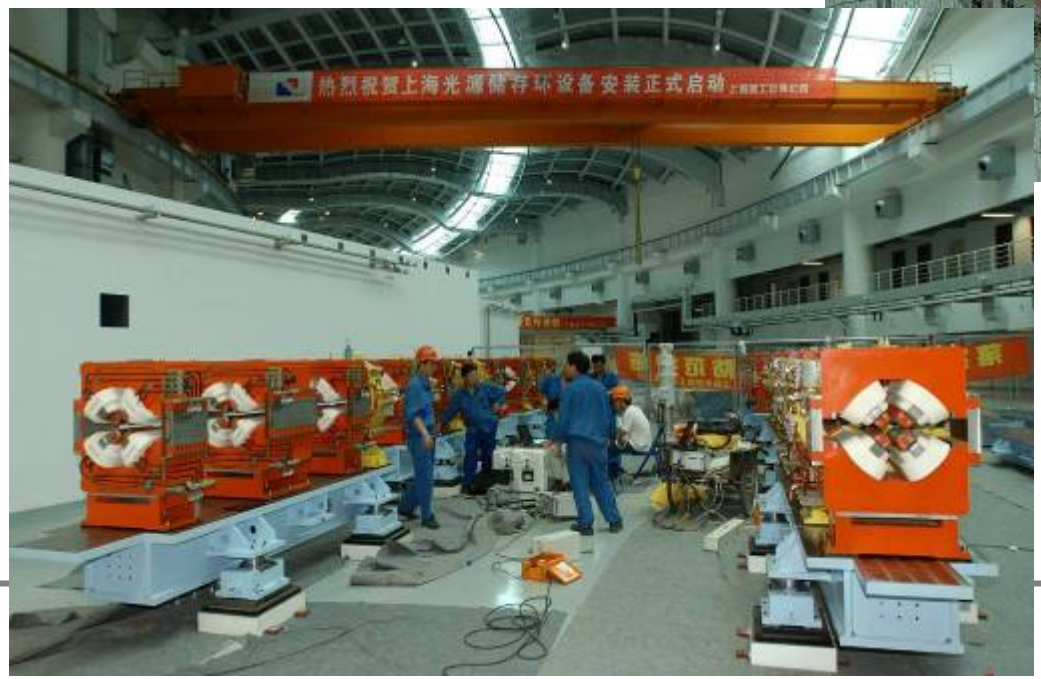
  Long girder – 11 ton

  Short girder – 7 ton

  Dipole – 6 ton



Pre-assembly of Storage Ring Components



Storage Ring Installation started on June 11

Front End Installation started on Nov. 9, 2007

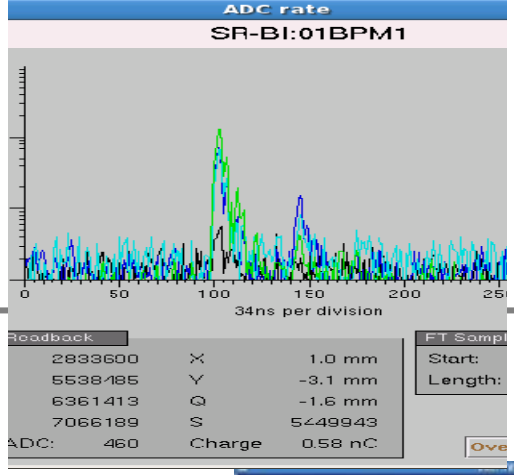
Commissioning Milestone

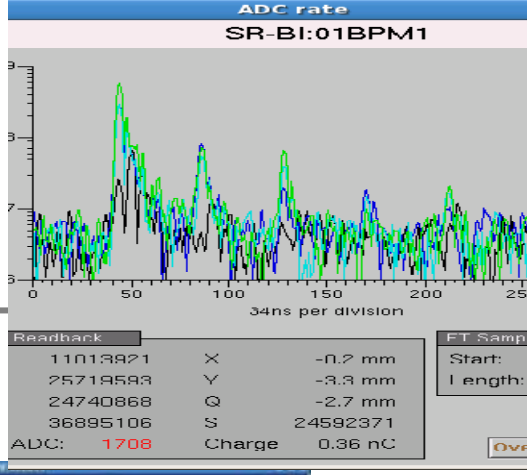
- Dec. 21, 2007 Start, First turn and multi turns
- Dec. 24 Storage
- Dec. 25 5mA
- Jan. 3, 2008 100mA
- Feb. 29 COD 80μm (rms)
- Mar. 16 COD 50μm (rms)

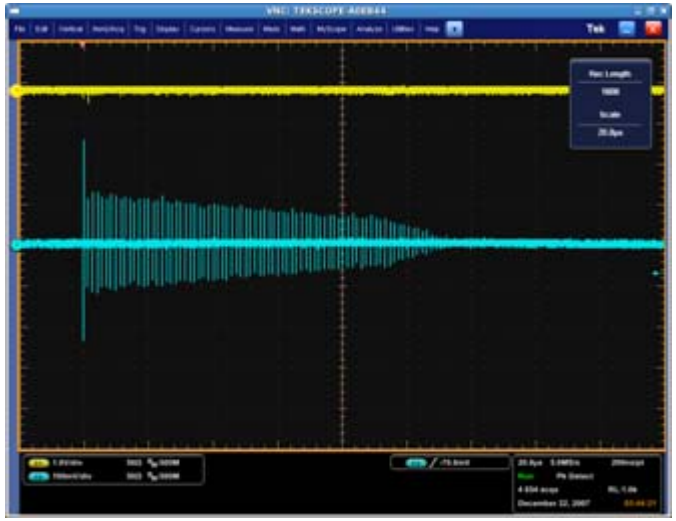
Beam Performance

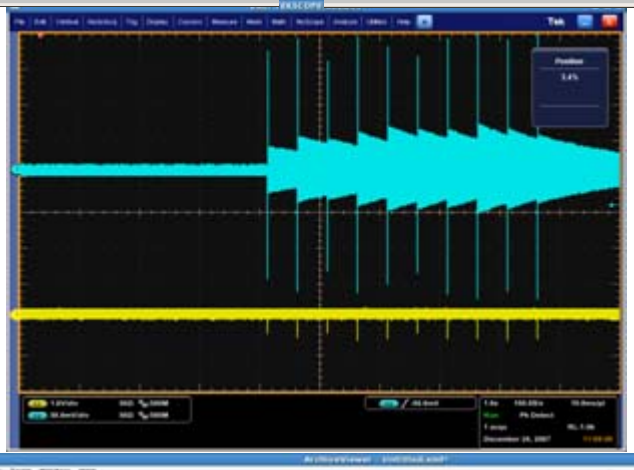
- 3.0GeV, 100mA with 3 RF cavities
- Injection rate: 0.5~0.8mA/s
- Emittance: 2.83nm.rad
- Beam Dose: 140A.h
- Beam life time: ~15h @ 100mA
- Closed orbit distortion: 50μm (RMS) @ 100mA
- Beam stability: ~100μm without feedback

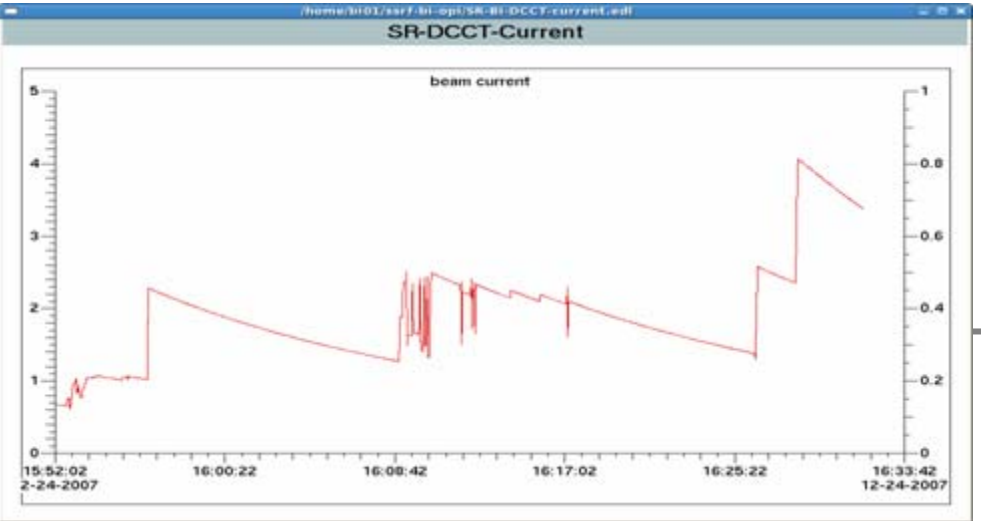
From Injection to Storage

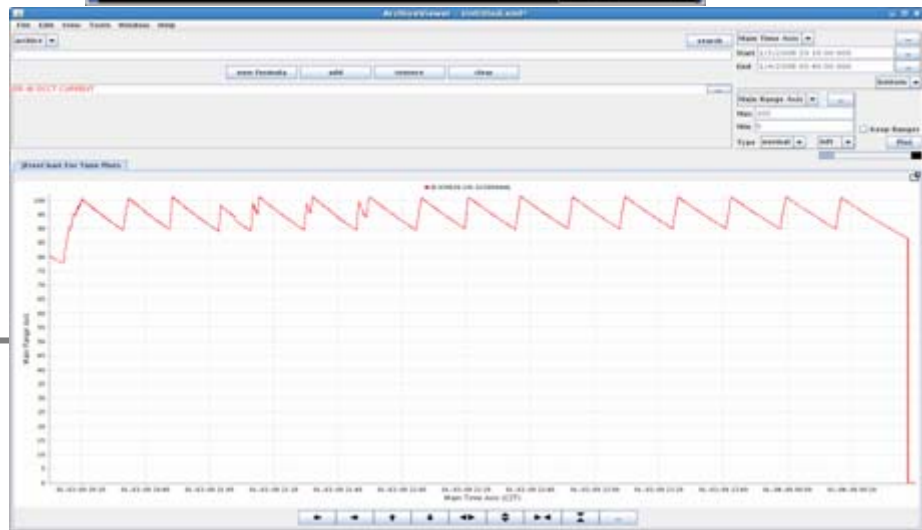


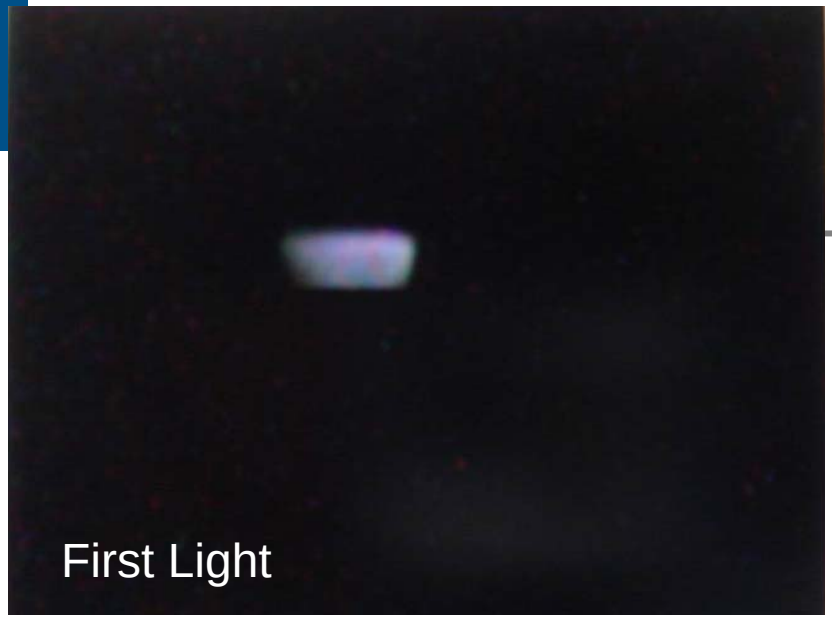


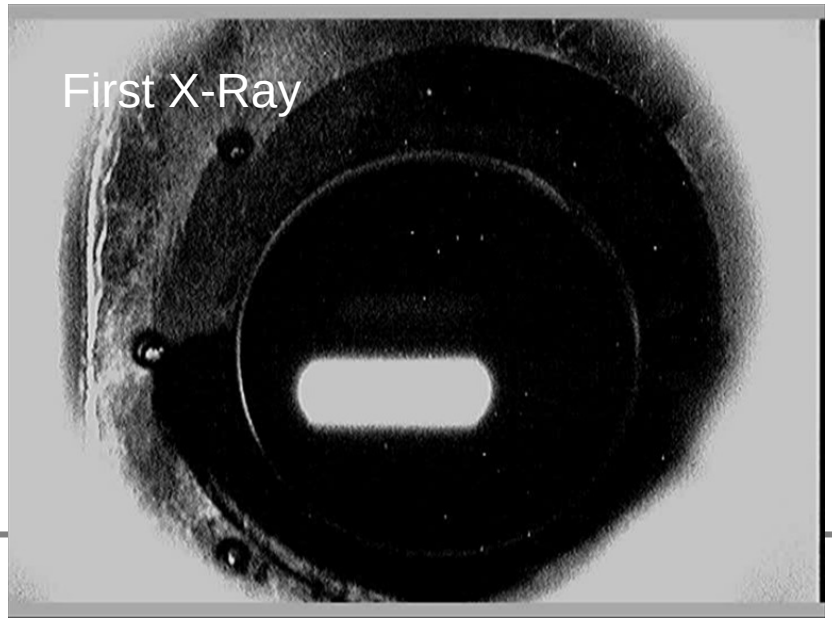


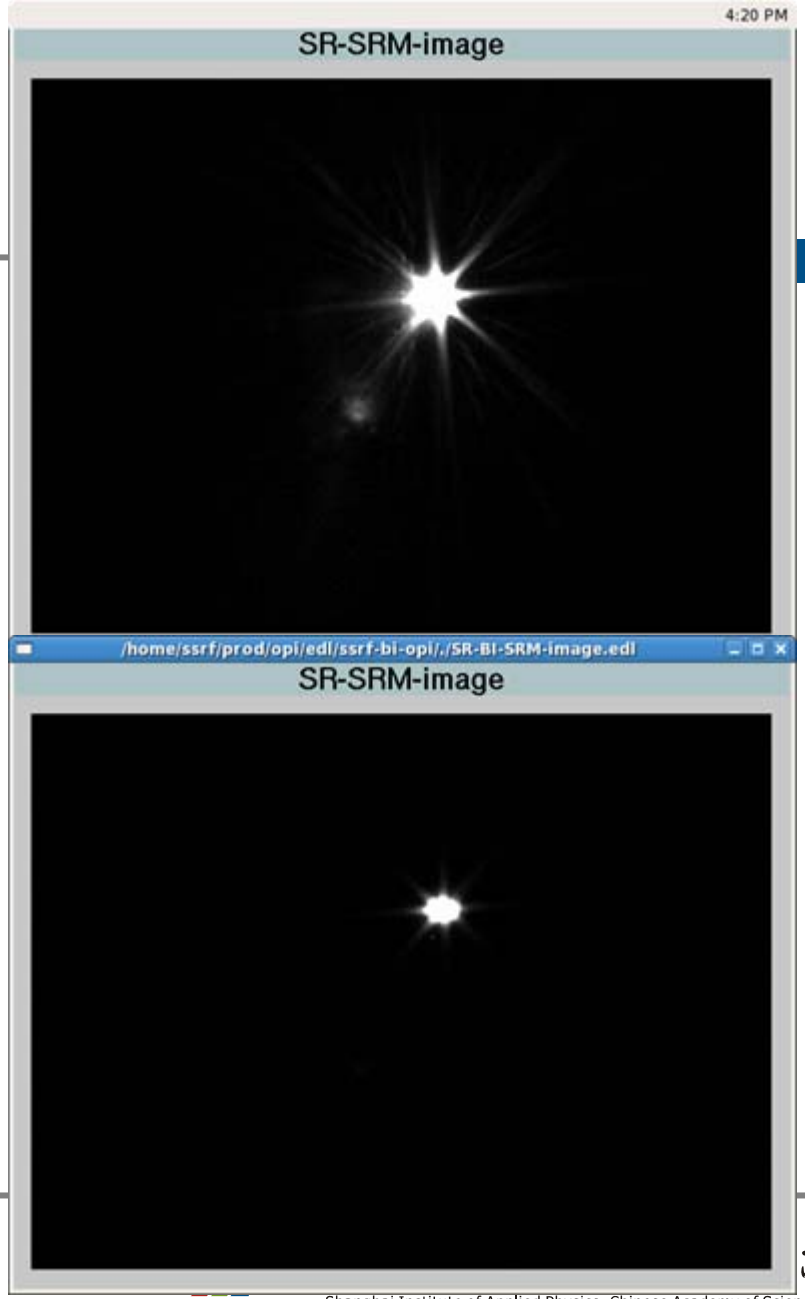







First Light


First X-Ray

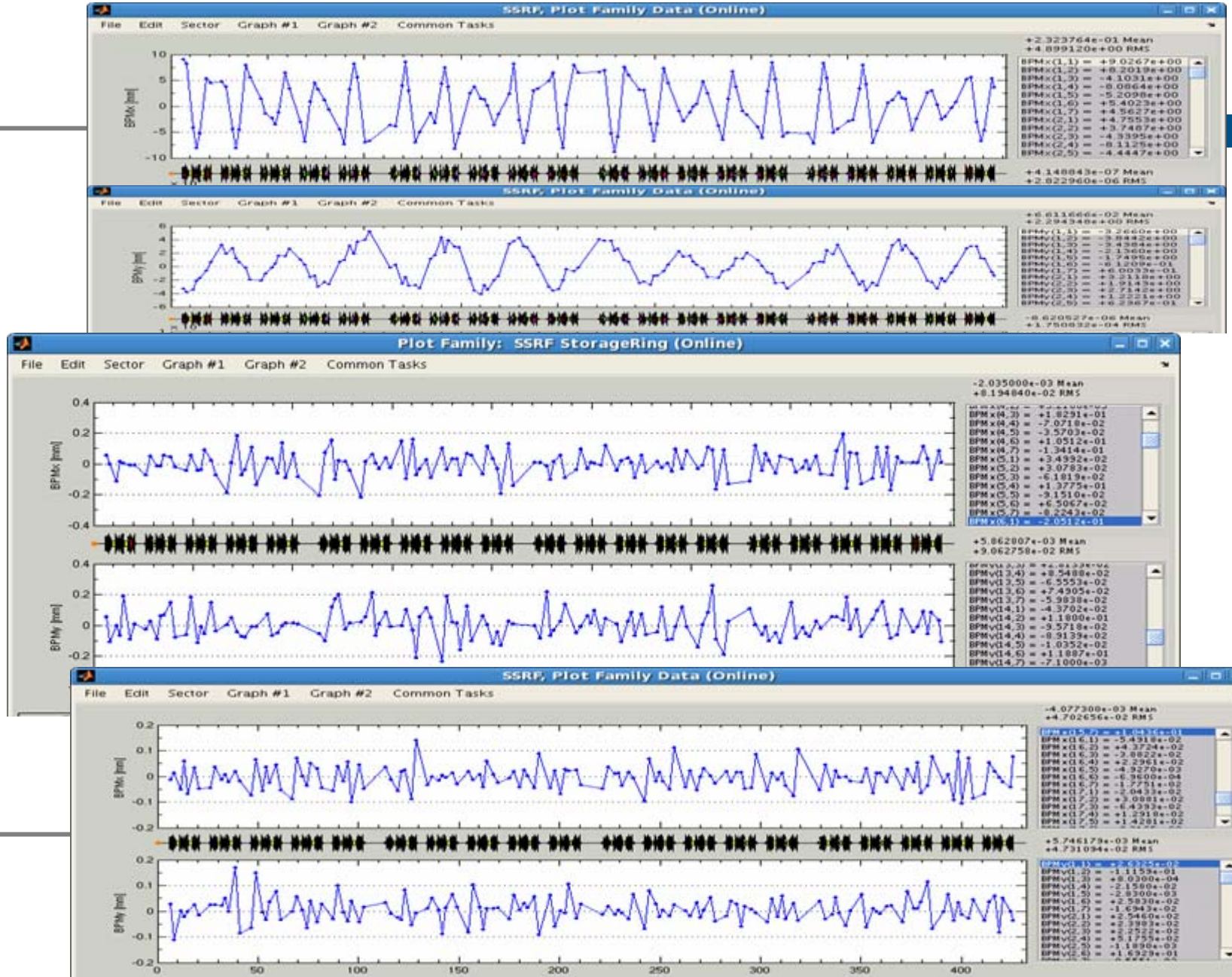

4:20 PM
SR-SRM-image
/home/ssrf/prod/opi/edl/ssrf-bi-opi/./SR-BI-SRM-image.edl
SR-SRM-image

Closed Orbit Distortion

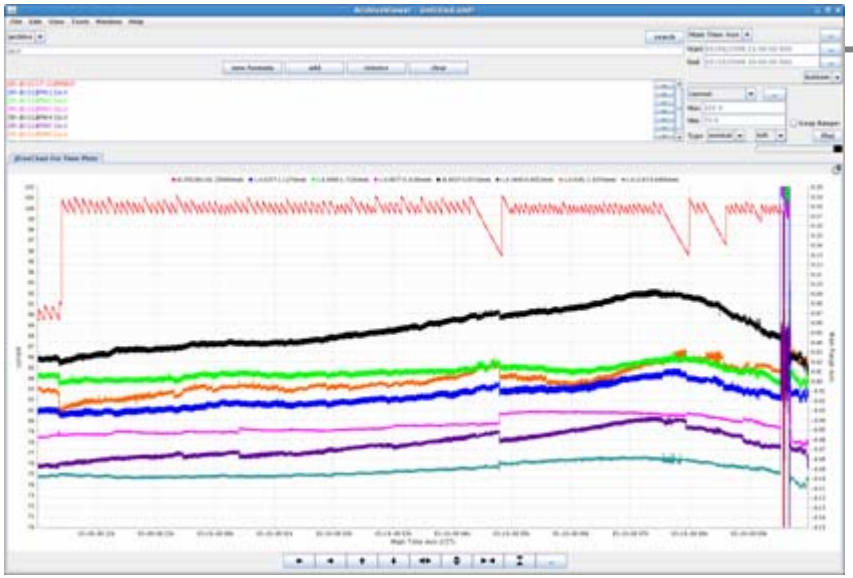
Bare Orbit

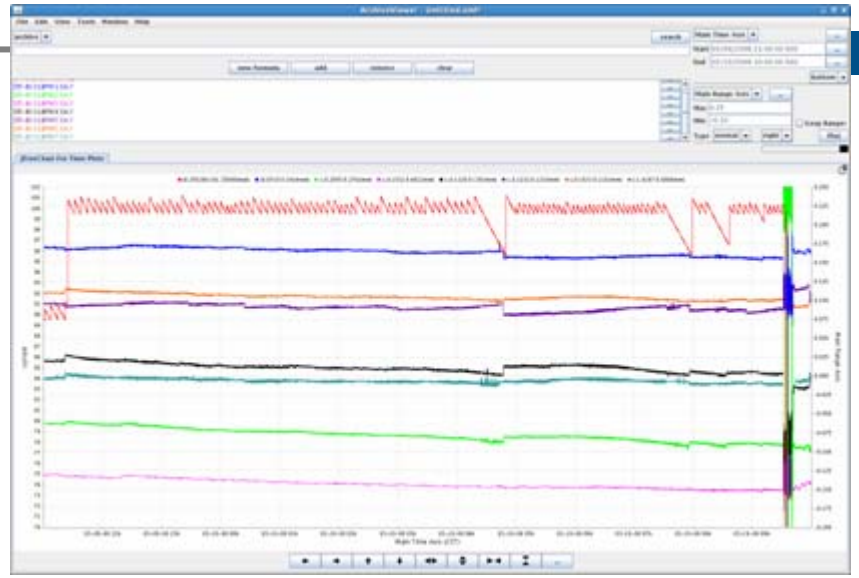
80μm COD

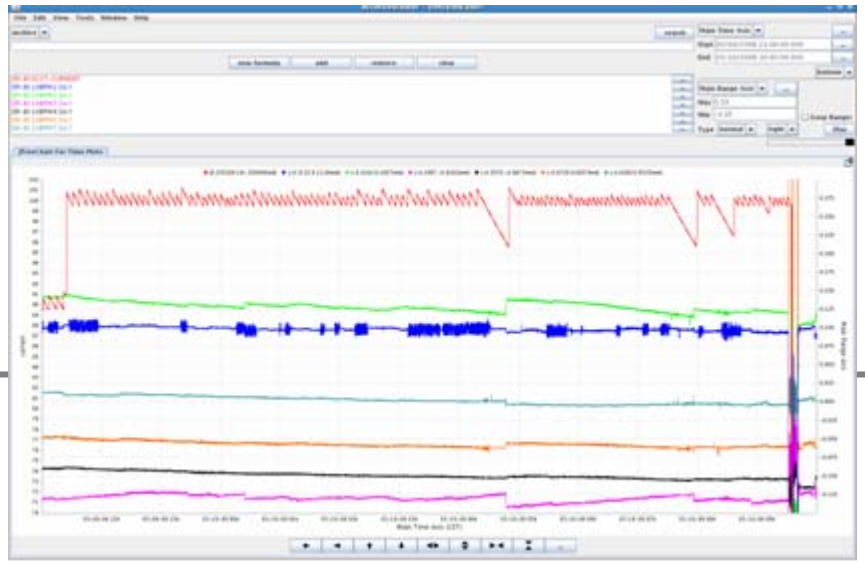
50μm COD

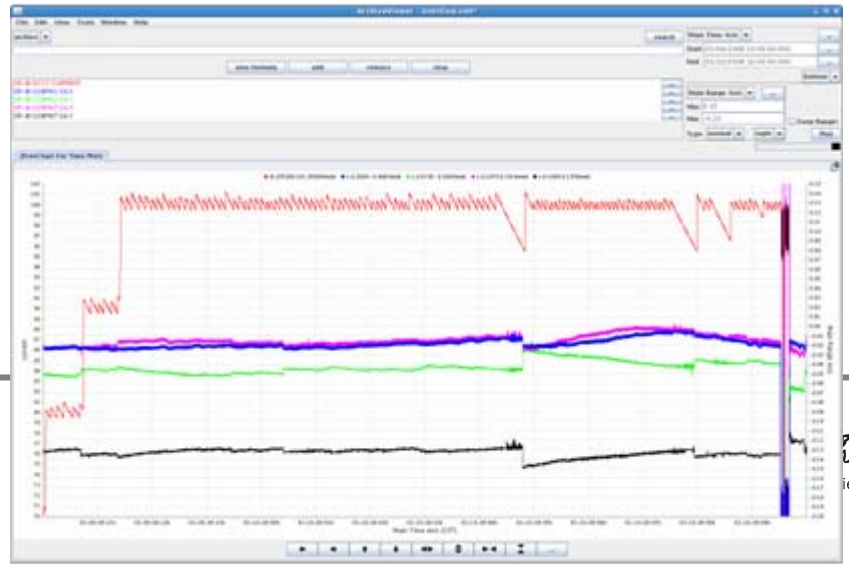


Beam Orbit Stability Test with and without SOFB









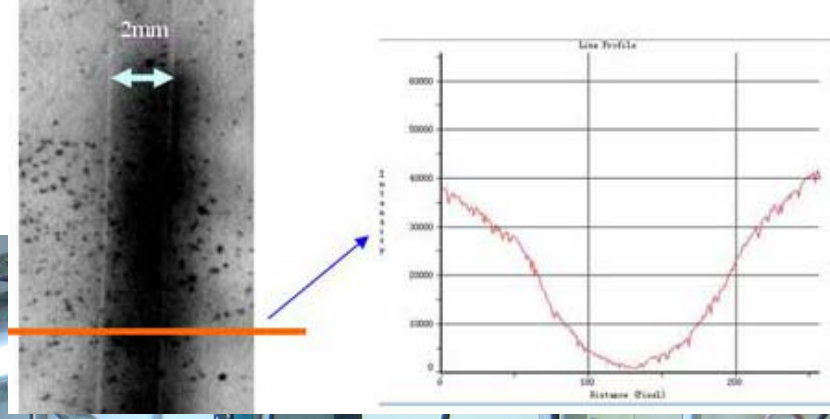
Beamlines for Phase I

- Macromolecular Crystallography (IVU.) (Dec. 2008)
- High-Resolution Diffraction

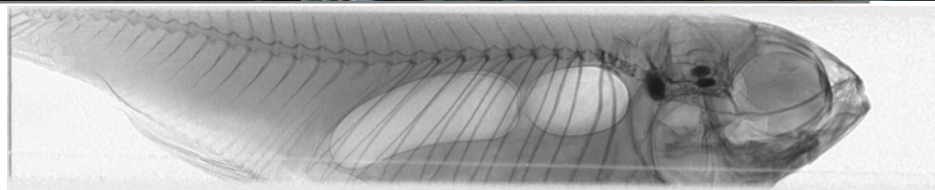
  June 4, 2008 Commissioning
- X-ray Absorption Fine Structure Spectroscopy (W.)

  (Oct. 2008)
- Hard X-ray Micro-focus and Application (IVU) (Dec. 2008)
- X-ray Imaging and Biomedical Application (W) (Oct. 2008)
- X-ray Scattering May 9, 2008 Commissioning
- Soft X-ray Microscopy (EPU) (Dec. 2008)

X-ray Scattering Beamline



May 9, 2008 Commissioning Start



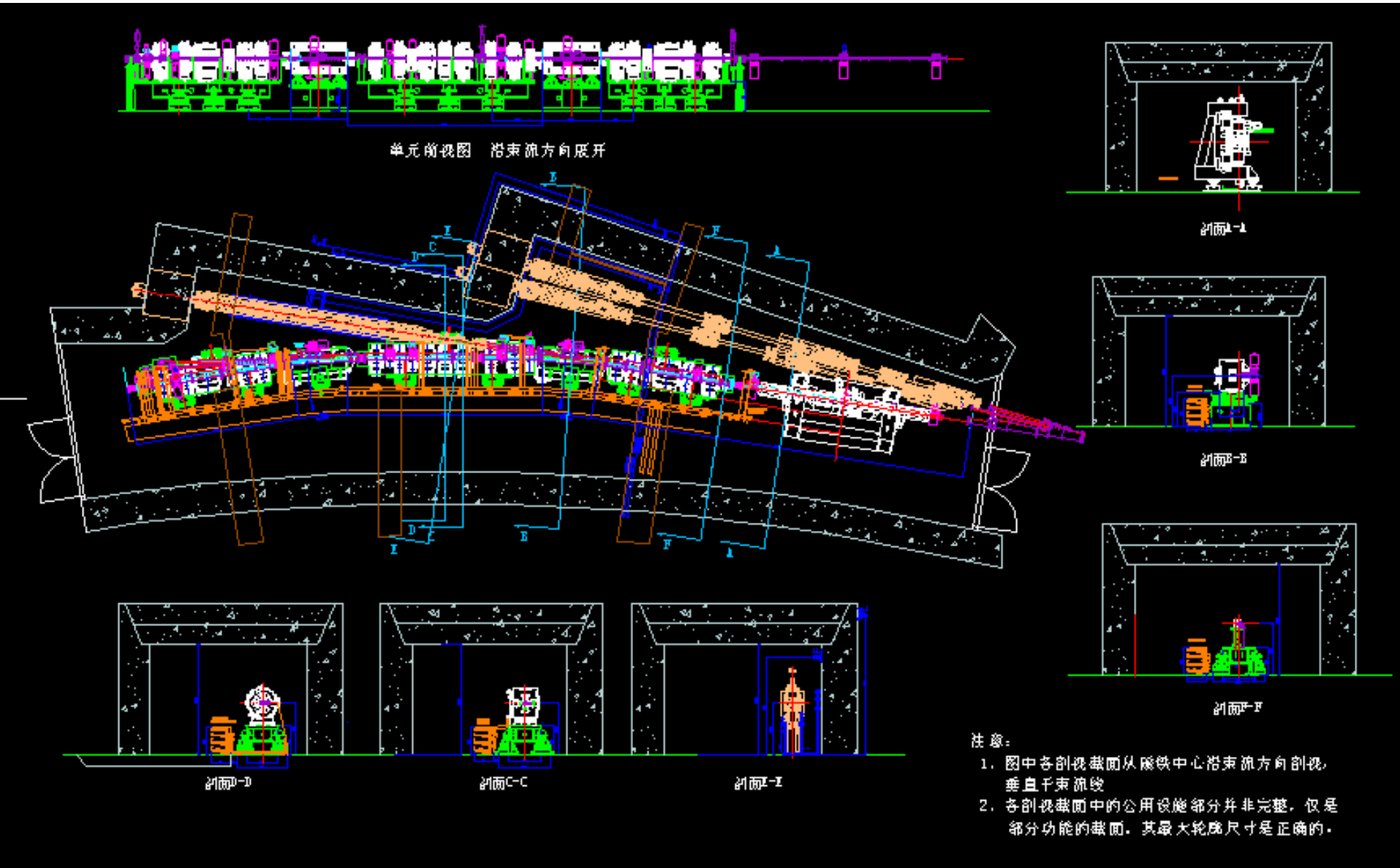
Commissioning Plan

- First stage: Dec. 2007 ~ June, 2008
  3.0GeV, 100mA with 3 RF cavities.
  Beam lines from bending magnet.

- Second stage: July, 2008 ~ Aug. 2008
  3.5GeV, with 2 SC RF cavities.

- Third stage: Sept. 2008 ~ Mar. 2009
  3.5GeV, >200mA, with 2 SC cavities.
  Beam lines from ID.

Thank you ！


单元前视图 沿束流方向展开
剖面A-A
剖面B-B
剖面F-F
剖面D-D
剖面C-C
剖面E-E
注 意：
1. 图中各剖视截面从隧道中心沿束流方向剖视，垂直于束流线
2. 各剖视截面中的公用设施部分并非完整，仅是部分功能的截面。其最大轮廓尺寸是正确的。