Asian Particle Accelerator Conference

APAC'07- Indore, India

Status of SESAME Light Source

H. Tarawneh
On behalf of SESAME Team

Outline:

- **Building construction progress.**
- **Layout and Full Energy Option.**
- **Main SESAME features.**
- **Engineering design progress.**
- **Schedule.**
- **Scientific directions and SESAME ID's.**

Building Construction Progress

Main works completed:

1. Steel, concrete skeleton and roof .
2. Plastering and ceramic tiles.
3. Fire hydrant system.
4. Foundation of the external boundary.
5. Civil works for the electrical substation.

Main works to be completed:

1. Electrical and mechanical work.
2. Crane installation and experimental floor final concrete layer.
3. Electrical Power Station and Power Line.
4. External areas.

Handing over the building

The building completion by the end of March-April 2007.

SESAME Building

(funded by Jordan)

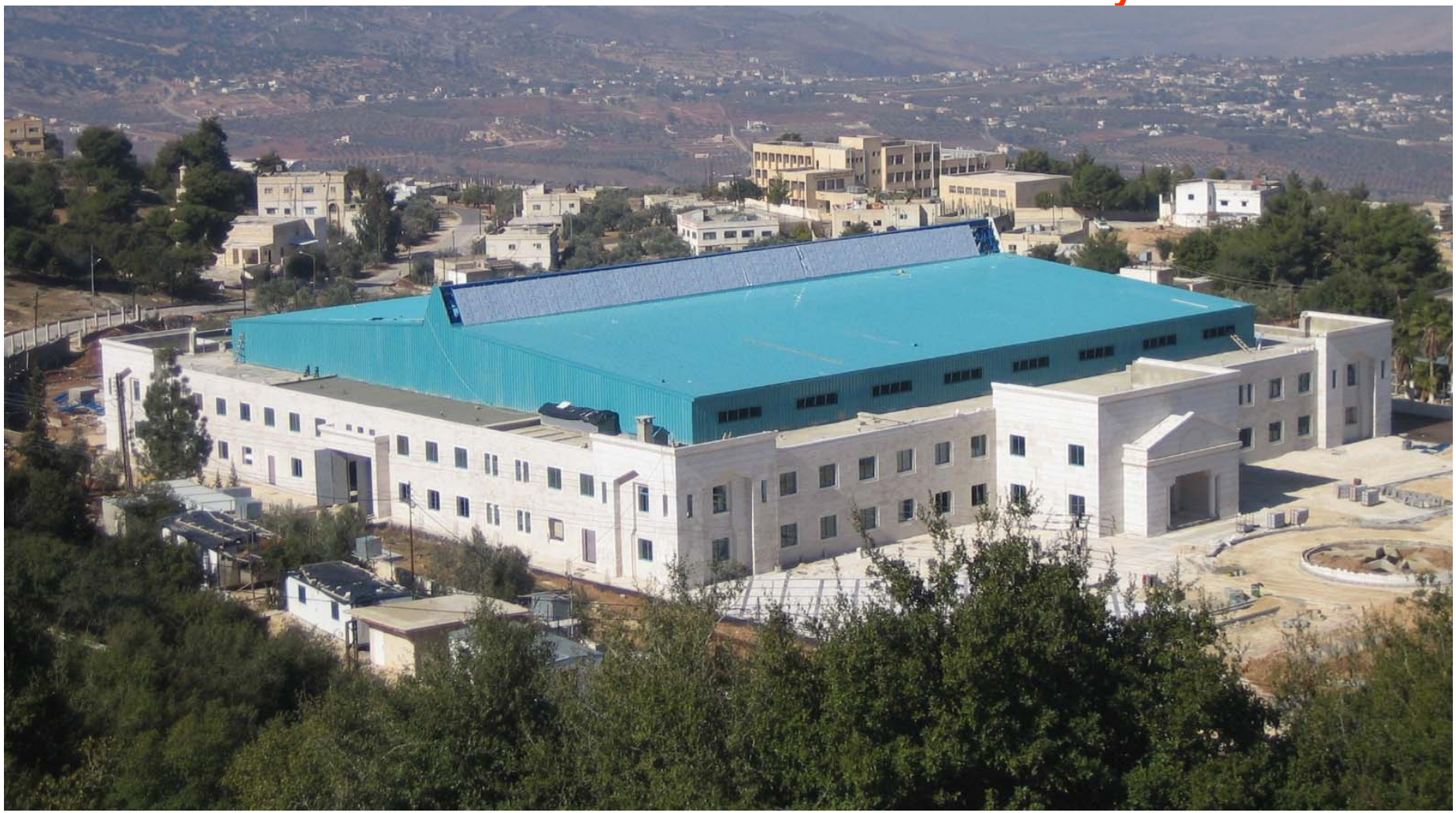
Ground breaking Ceremony
Jan 2003

Completion Date

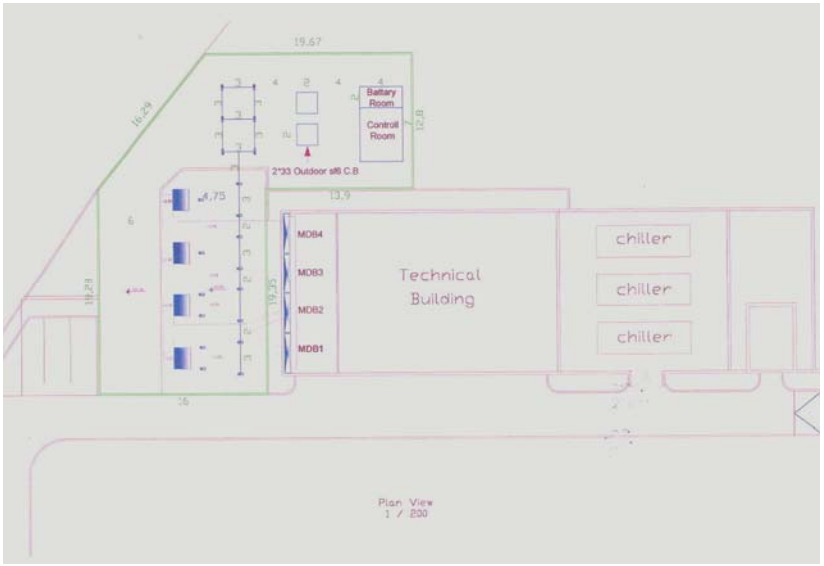
Spring 2007

Construction supervised by Al Balqa University

January 2007



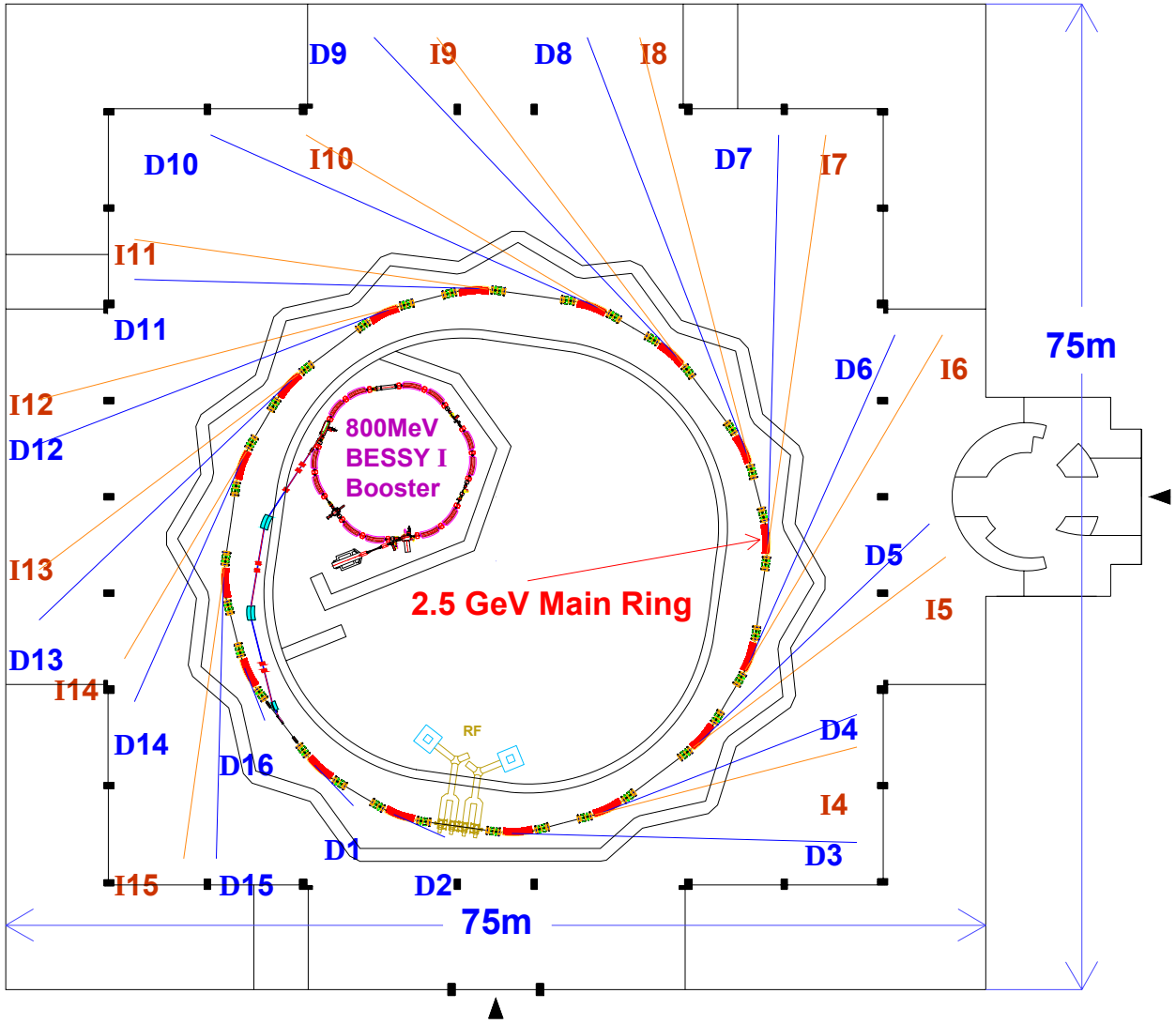
Electrical Power Station



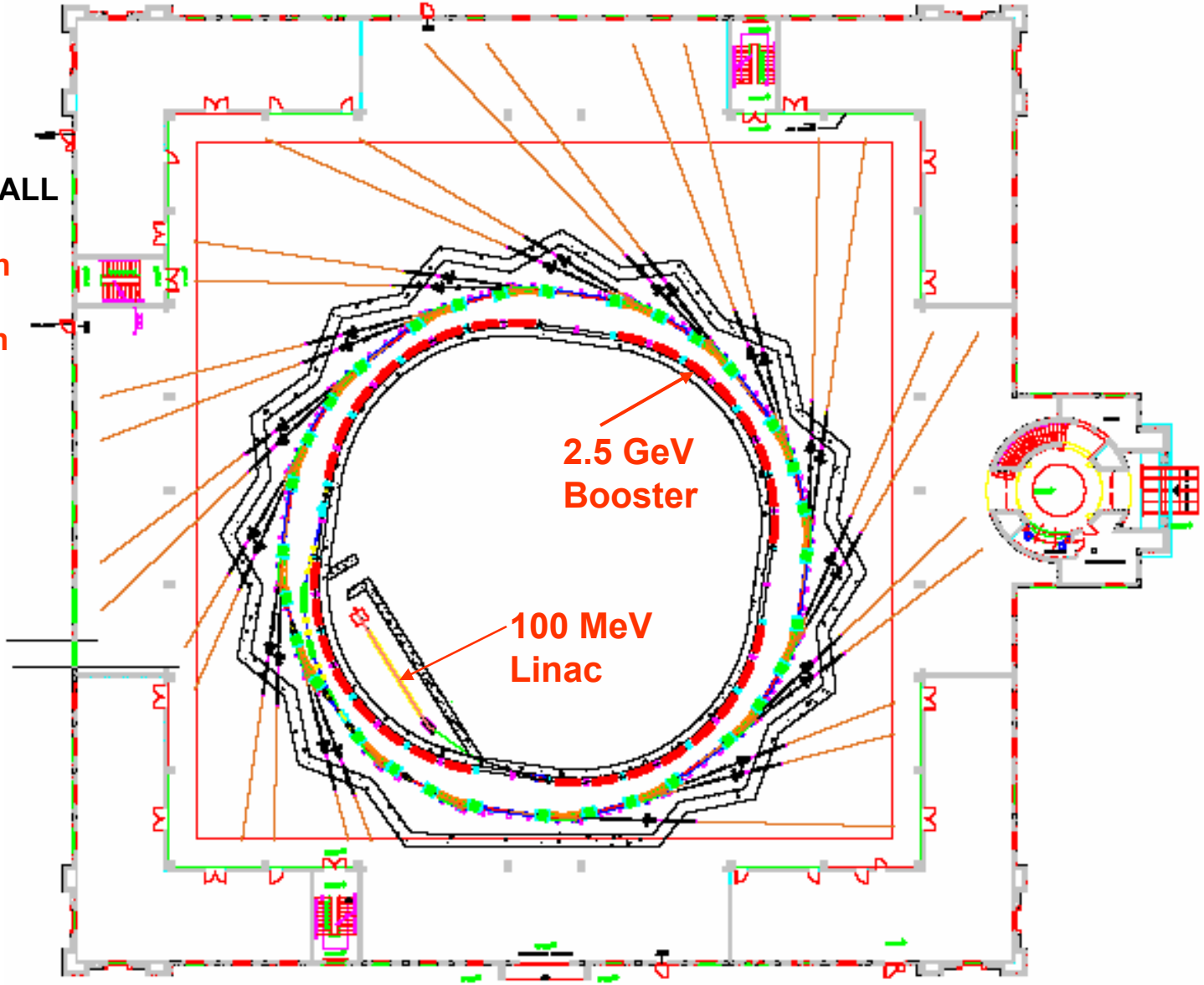
- **Dedicated underground 8 km HV (33 kV) line.**
- **Voltage downgrade from 33 kV to 400 Volt through 4 x 1.5 MVA transformers.**

Experimental Floor Layout

has been frozen



EXPERIMENTAL HALL LAYOUT:
Compatible with Full Energy Injection Option



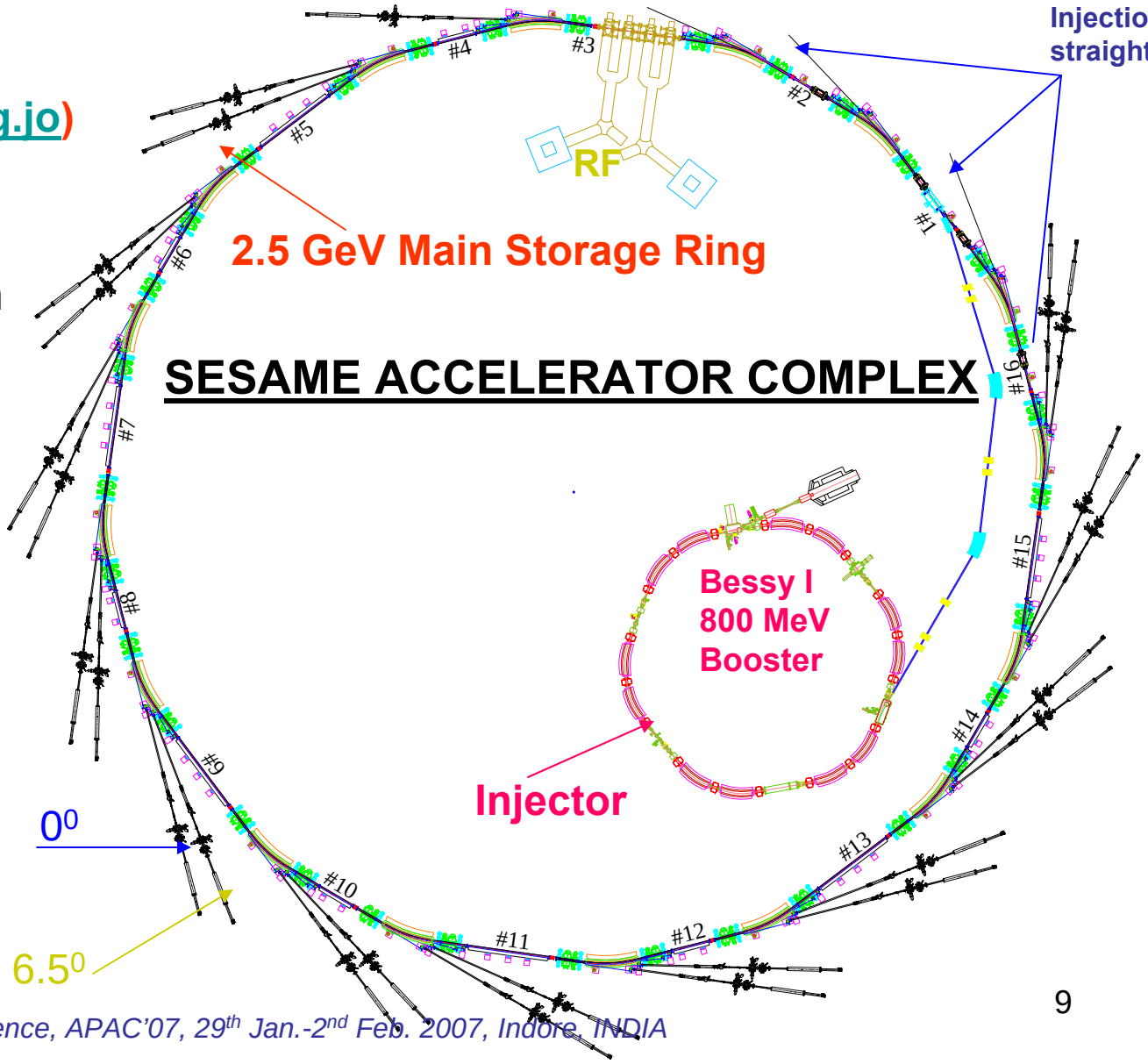
Main Ring Parameters:

(see → www.sesame.org.jo)

Energy = 2.5 GeV
Circumference=133.12 m
Emitt. = 26.0 nm.rad
16 Straights sections
{8 x 4.44 m + 8 x 2.38 m}
Up to 28 Beamlines:

12 Insertion Devices

16 Dipole ports



SESAME

Synchrotron-light for
Experimental
Science and
Applications in the
Middle
East

SESAME DESIGN PARAMETERS – (see → www.sesame.org.jo)		
General Parameters	**Unit**	**Value**
Energy	GeV	2.5
Q_x/Q_y		7.23 / 6.19
Circumference	m	133.12
Number of periods		8
Bending Dipole field	T	1.45545
Bending radius	m	5.72958
Field index n		11
Natural Chromaticities H/V		-15.5 / -19.0
Momentum compaction		0.00829
Energy loss / turn	keV	589.7
Damping times (τ_E / τ_x / τ_z)	msec	2.80/ 2.28/ 3.77
RMS energy spread (σ_E)	%	0.1086
Natural emittances (ε_x / ε_z)	nm-rad	25.74 / 0.2574
Betatron coupling	%	1
RF Parameters		
Frequency	MHz	499.564
Harmonic Number		222
Peak Voltage	MV	2.4
RF acceptance (ε_{RF})	%	1.463
Synchrotron frequency (ν_s)	KHz	37.18
Natural bunch length (σ_L)	cm	1.15
Max. current (200 bunch)	mA	400
(1/e) Lifetime	hrs	16.9

BEAMLINES LIST

NAME/TYPE	Max Length (m)	NAME/TYPE	Max Length (m)	ID STRAIGHT TYPE
D1 IR/DIAGNOSTIC PORT	----	Not available	----	---
D2 IR/DIAGNOSTIC PORT	----	Not available	----	---
D3 DIPOLE PORT	26.9	Not available	----	---
D4 DIPOLE PORT	21.2	I4 INS. DEVICE	23.6	SHORT
D5 DIPOLE PORT	24.7	I5 INS. DEVICE	28.2	LONG
D6 DIPOLE PORT	28.0	I6 INS. DEVICE	32.9	SHORT
D7 DIPOLE PORT	31.9	I7 INS. DEVICE	36.5	LONG
D8 DIPOLE PORT	34.7	I8 INS. DEVICE	36.6	SHORT
D9 DIPOLE PORT	34.3	I9 INS. DEVICE	35.3	LONG
D10 DIPOLE PORT	29.6	I10 INS. DEVICE	33.0	SHORT
D11 DIPOLE PORT	26.9	I11 INS. DEVICE	31.3	LONG
D12 DIPOLE PORT	29.2	I12 INS. DEVICE	31.3	SHORT
D13 DIPOLE PORT	27.2	I13 INS. DEVICE	28.8	LONG
D14 DIPOLE PORT	20.7	I14 INS. DEVICE	21.2	SHORT
D15 DIPOLE PORT	21.9	I15 INS. DEVICE	26.3	LONG
D16 IR/DIAGNOSTIC PORT	----	Not available	----	---

MAIN SUBSYSTEMS ENGINEERING DESIGN

MAGNET : Complete with specification of power supplies (DC) and pulsed magnets.

VACUUM : Layout complete – Detailed engineering in progress with the design of special sections (RF, Injection, ID).

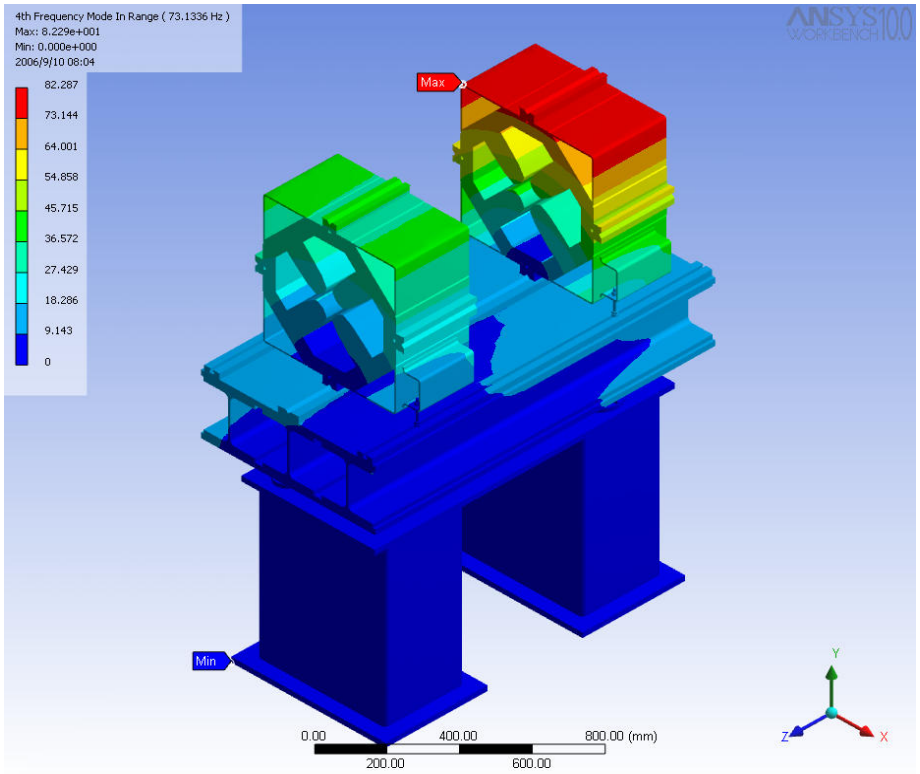
RF: Cavity (4 Cells) ELETTRA type.
RF Power Amplifiers based on 80 kW CW IOT transmitters.

INSERTION DEVICES : Design of 2 ID in progress.

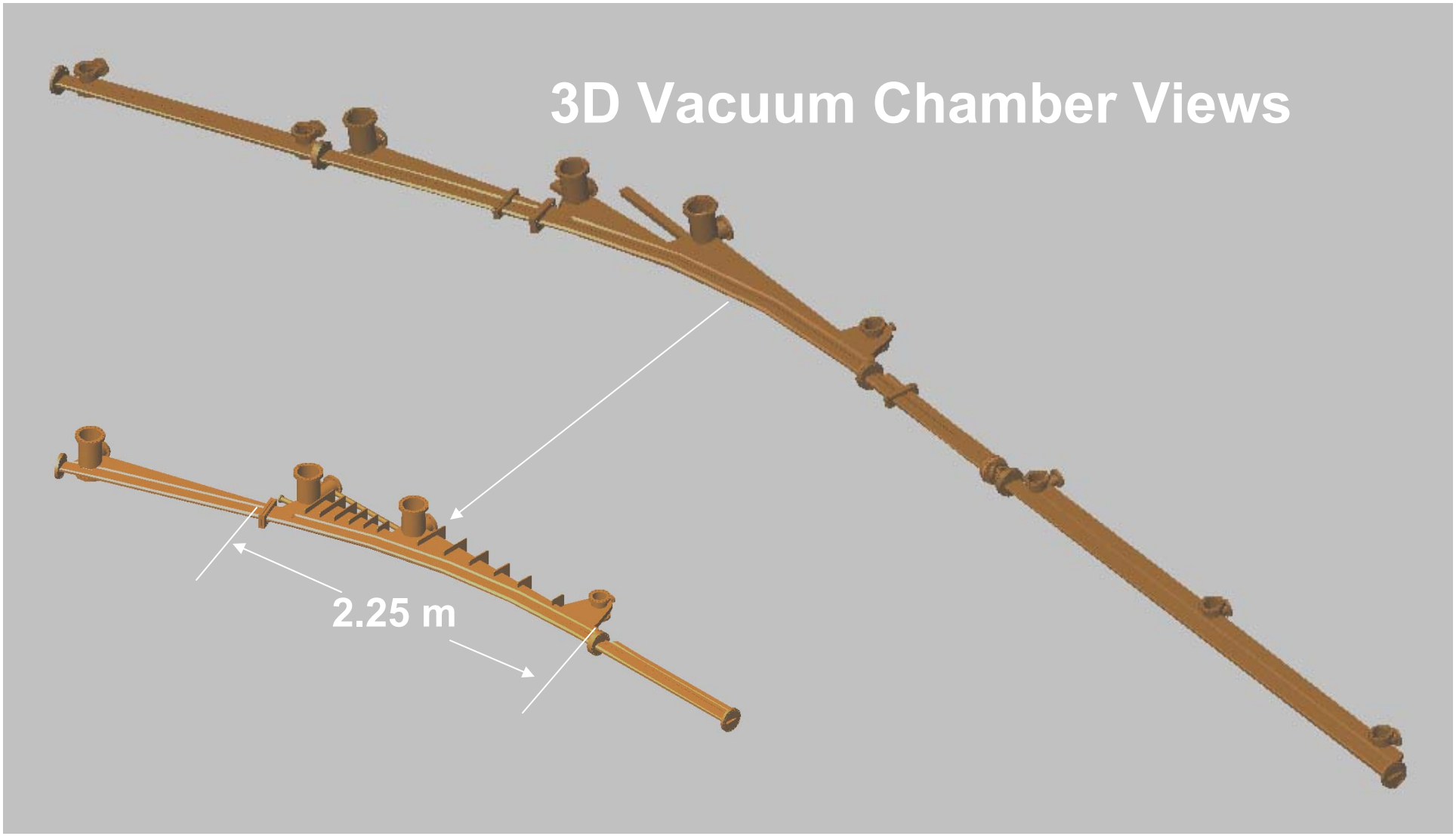
SAFETY and SHIELDING : In progress.

CONVENTIONAL FACILITIES and CONTROL SYSTEM : In progress.

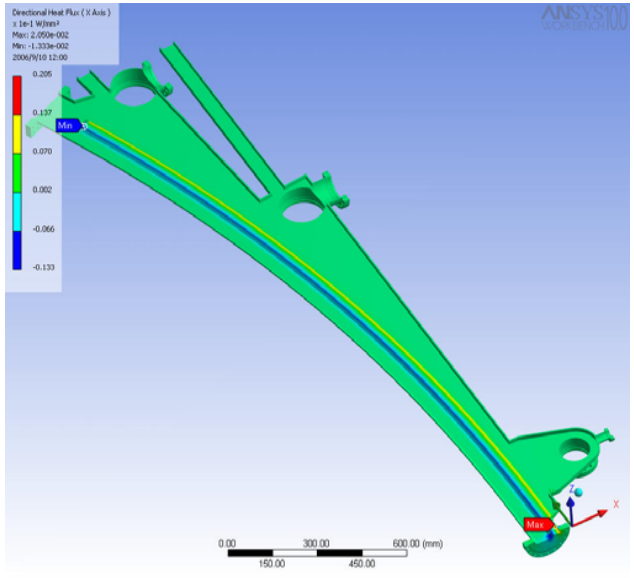
MAGNET GIRDER SYSTEM



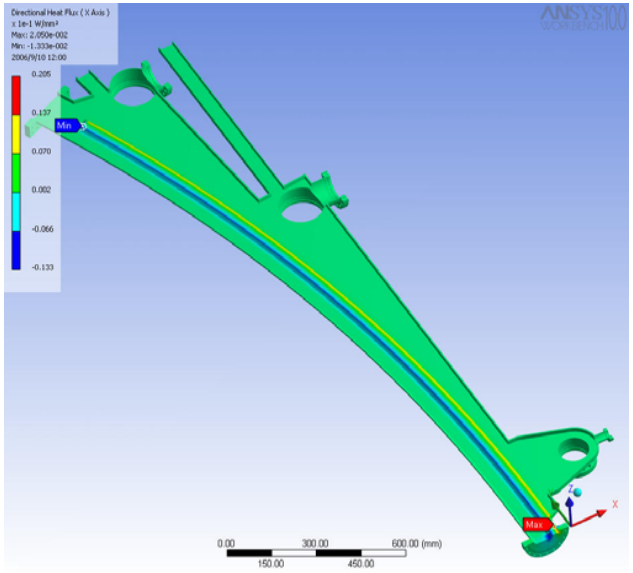
Modal Analysis of Magnets Girder System Assembly (FEA Study)


3D Vacuum Chamber Views
2.25 m

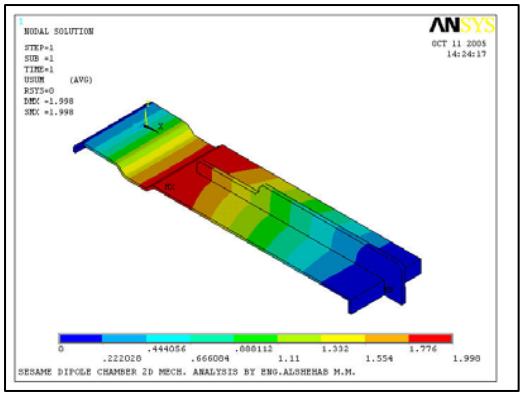
Thermal load, vacuum load and ribbing FEA analysis of Vacuum Chamber



Thermal Load Due to Radiation Heat



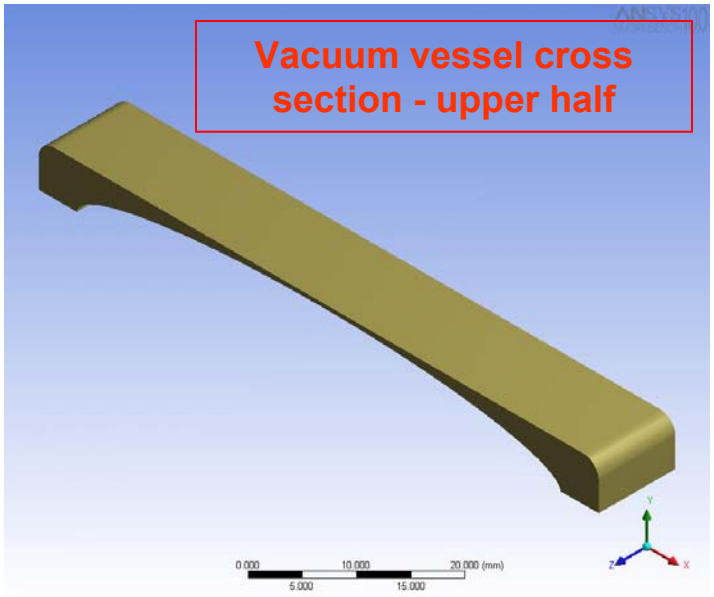
Chamber Deformation Due to Vacuum Load

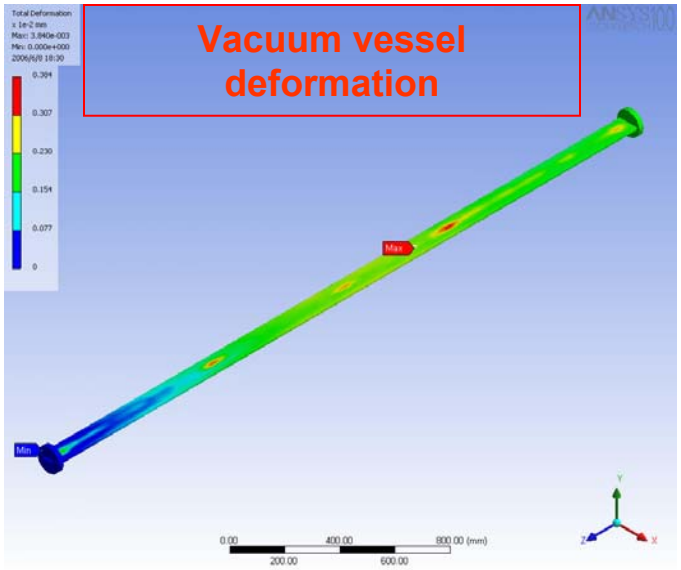


Vacuum Chamber Ribbing Study

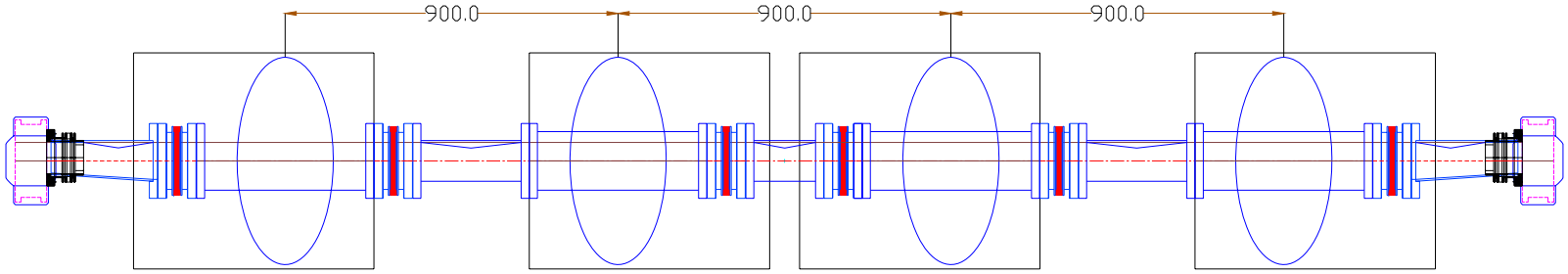
HMW Vacuum Chamber with 10.5 mm Vertical Aperture.

- Deformation and buckling analysis for the vacuum vessel due to vacuum loading.
- Different materials and geometries have been considered.
- Stainless steel with 1.5 mm internal thickness seems optimal.

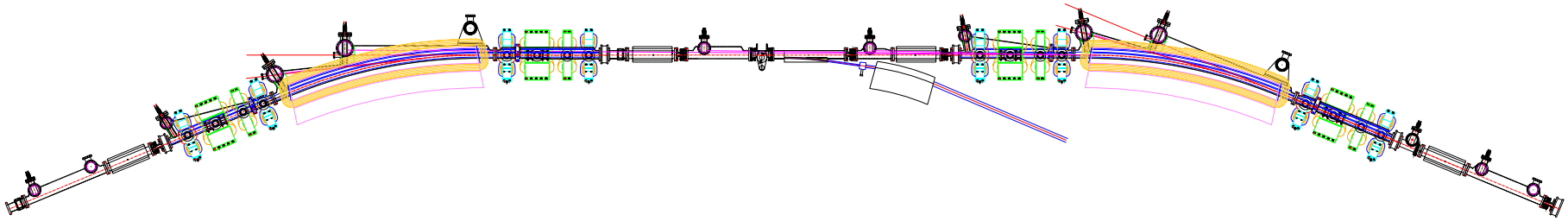




RF STRAIGHT SECTION



INJECTION SECTIONS



Scientific Directions

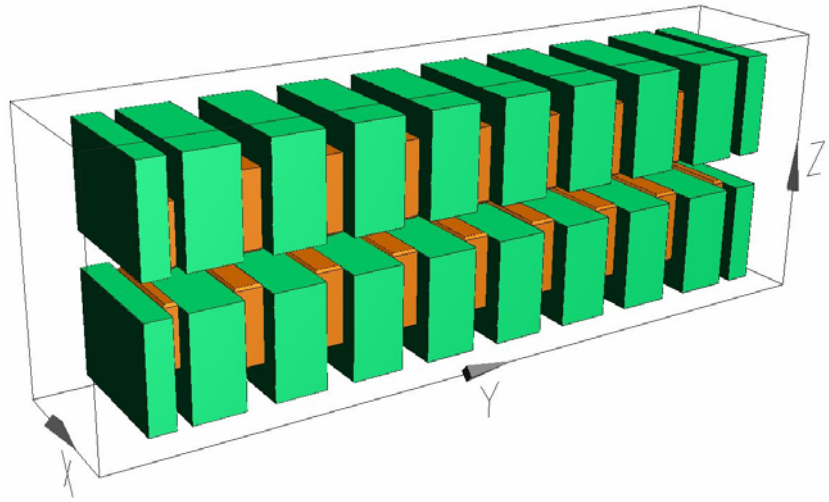
- Biological and Medical Sciences.
- Material Science, Physics and Chemistry.
- Environmental Sciences.
- Archaeology.
- Industrial Applications.

SESAME Phase One Beamlines

	Beamline	Energy Range	Source Type	Science Areas
1	MAD Protein Crystallography	5 – 15 keV	In vacuum undulator	Structural Molecular Biology (SMB) (Biomedical)
2	PES/ Photoabsorption Spectroscopy	50 - 2000 eV	Elliptically Polarizing Undulator	Atomic, Molecular & Condensed Matter Physics
3	SAX/ WAXS	8 - 12 keV	Undulator	SMB, Materials Science (Biomedical, Physics, Chemistry)
4	XAFS/ XRF	3 - 30 keV	2.1 Tesla MPW	SMB, Materials Science, Environmental Science, Archaeological Sciences
5	Powder Diffraction	3 - 25 keV	2.1 Tesla MPW	Materials Science, Environmental Science, Archaeological Science
6	IR Microscopy	0.01-1 keV	Large Aperture Bending Magnet	SMB, Materials Science, Environmental Science, Archaeological Sciences

2.1(*) Tesla HMP Wiggler

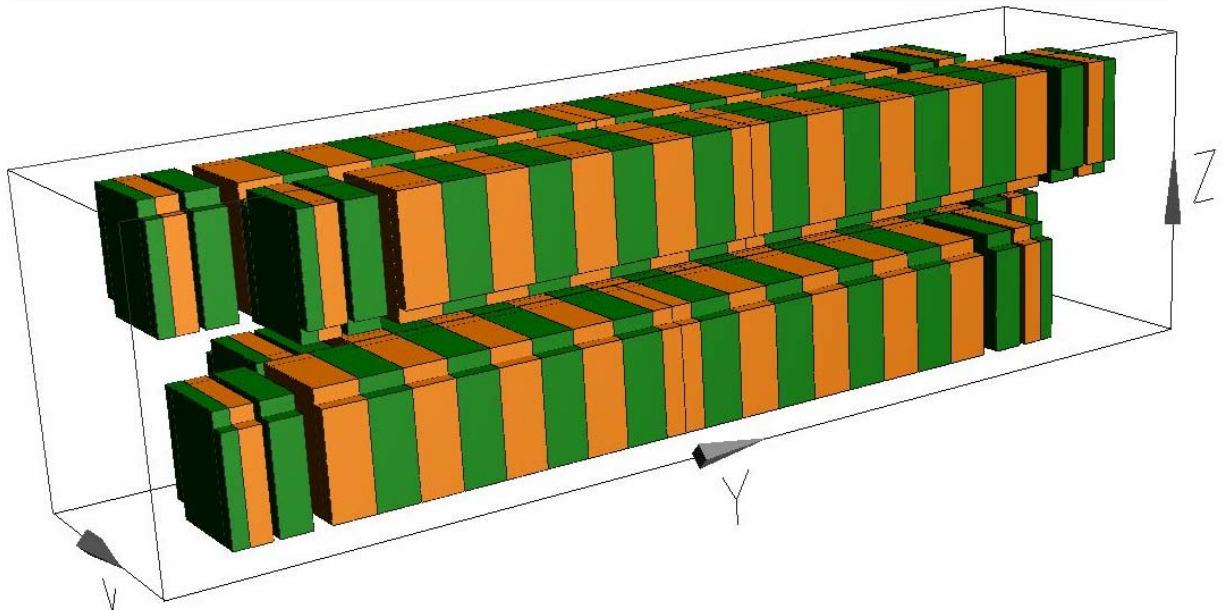
Period length, mm	**160**
Peak Field, Tesla	**2.10**
The deflection parameters {max. K}	**31.37**
Minimum gap, mm	**14.5**
Number of periods	**19**
Total length, m	**3.092**
Total number of full-size poles	**78**
Total number of full-size PM block	**80**
Main PM block dimensions [mm^3]	**140×52×100**
End PM block dimensions [mm^3]	**140×26×100**
Main pole dimensions [mm^3]	**100×28×80**
End pole dimensions [mm^3]	**100×14×66**



(*) At this field value the SESAME emittance goes from 26 nm.rad to 26.5 nm.rad !

Elliptically Polarizing Undulator (EPU)

Magnet period [mm]	**60**
Number of periods	**28**
Magnetic gap [mm]	**13**
Max. gap between adjacent assemblies [mm]	**1**
PM material	**NdFeB with B_r=1.22T**
Block dimension	**15 mm × 40mm × 40mm**
Cuts dimension	**5 mm × 5 mm**



SESAME ACCELERATOR CONSTRUCTION SCHEDULE

(G. Vignola - July 2006)

ACTIVITY	START DATE	END DATE
Machine Detailed Design	Jan 2005	Jun 2007
Component Procurement		
Call for tender for all the Subsystem	Jan 2007	Jul 2008
Contracts for all the Subsystem	Apr 2007	Oct 2009
Prototypes Construction and Acceptance	Apr 2007	Jul 2008
Subsystem construction	Apr 2007	Apr 2010
Installation (*)		
Installation of Microtron and Booster in the new building	Jun 2007	May 2008
Commissioning of Microtron and Booster	Jun 2008	Jun 2009
Floor preparation, Utilities and Main Ring installation	Jun 2007	May 2010
Commissioning of Main Ring	Jun 2010	Sep 2010
Beamlines commissioning	Oct 2010	----------

(*) Subject to building beneficial occupancy by May 2007.

THANK YOU