ILSF, A Third Generation Light Source Laboratory in Iran

Javad Rahighi and all ILSF Staff

Institute for Research in Fundamental Sciences, IPM, Iranian Light Source Facility, ILSF

Tehran, Iran

Iranian Light Source Facility
The first large scale facility for multidisciplinary Research in Iran

Iranian Scientists and Engineers have demonstrated a good capability to build the laboratory.

The project is executed in max transparency:

Many scientists visit ILSF frequently.
Your involvement is very much welcomed.

ILSF technical reports and the complete Conceptual Design Report can be accessed on our website…..

What is done so far ?

- Conceptual Design of the facility has now been completed.

  The design have been approved by ILSF steering committee in a meeting held last January.

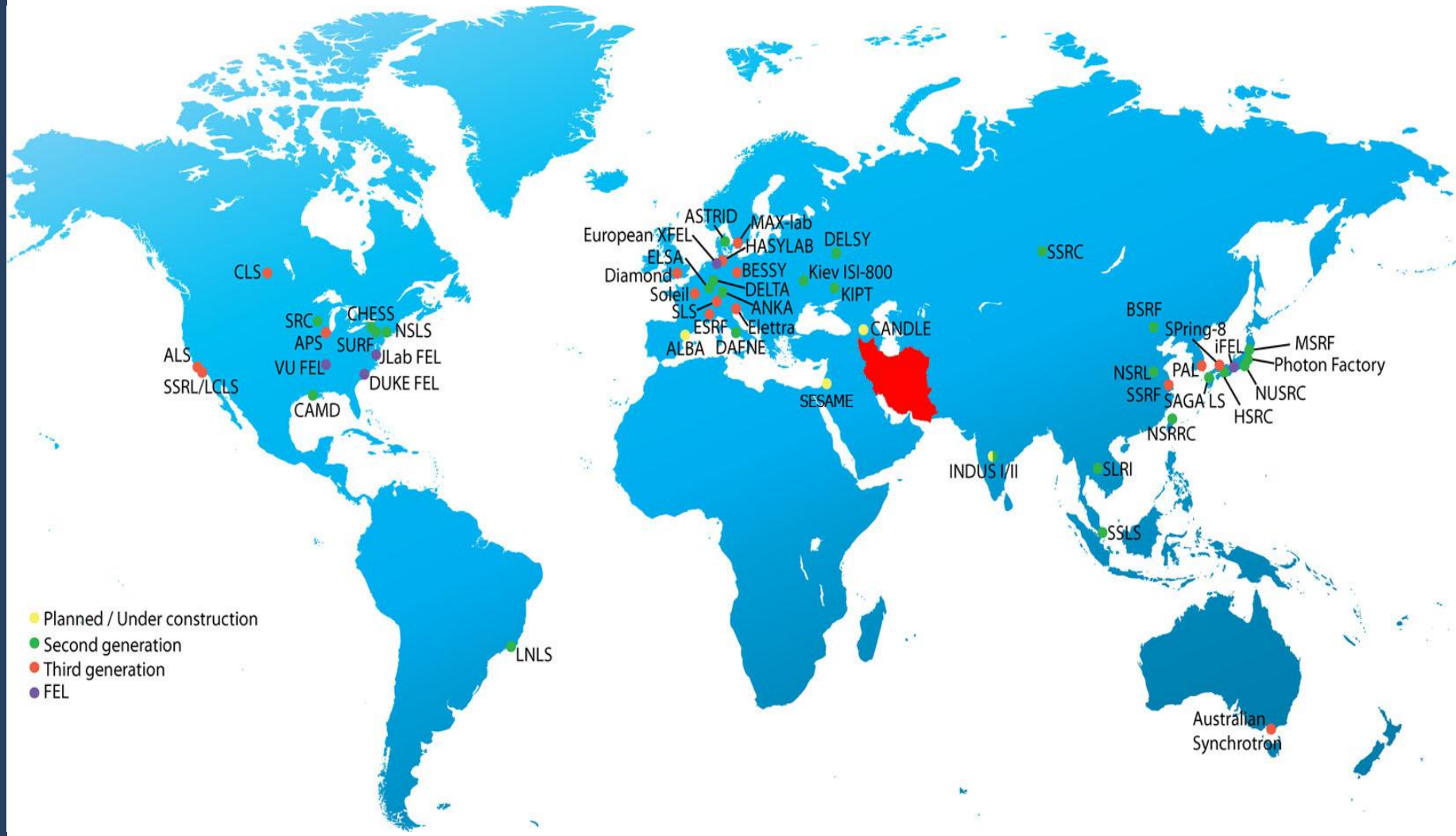
- Some important accelerator prototype components have been developed and built at ILSF R&D laboratory.

- ILSF has been given the go ahead to do the detailed design of the laboratory.

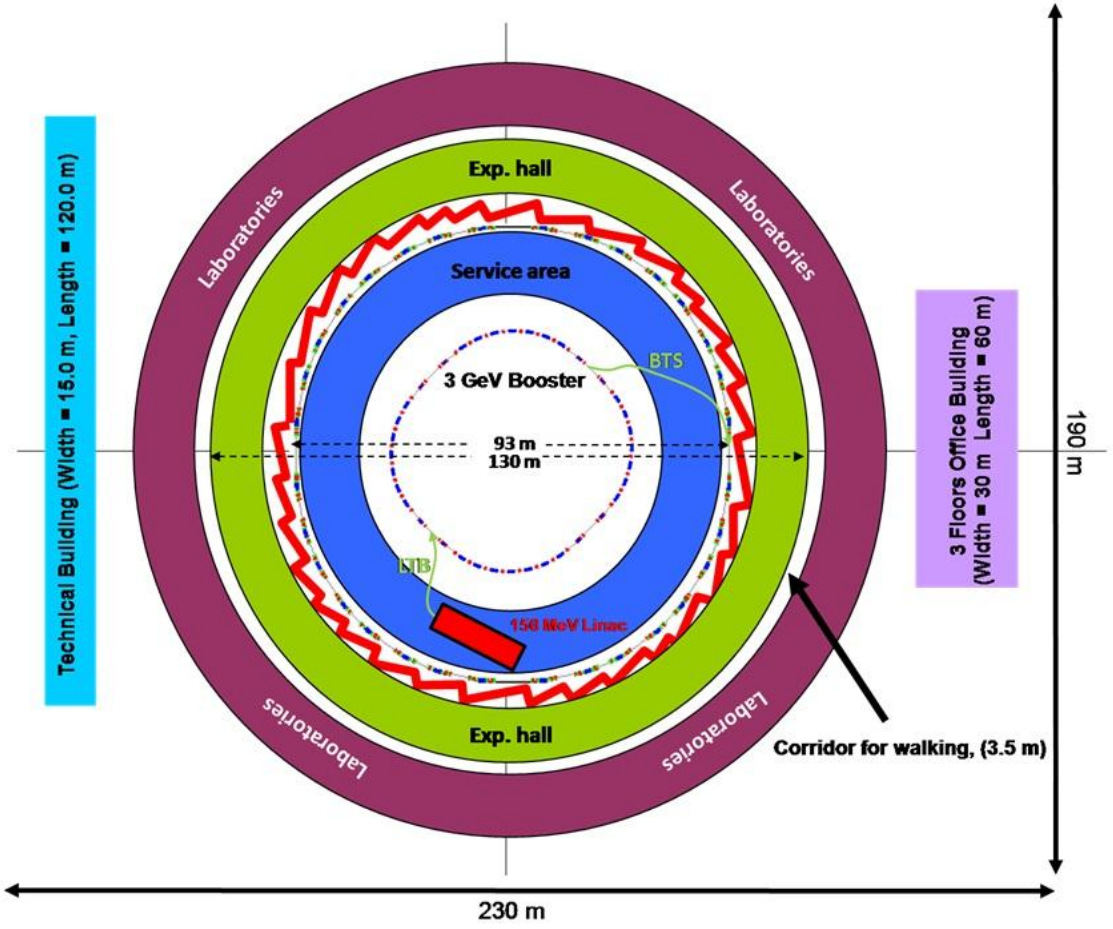
Iranian Light Source Facility

IPM
Institute for Research in Fundamental Sciences

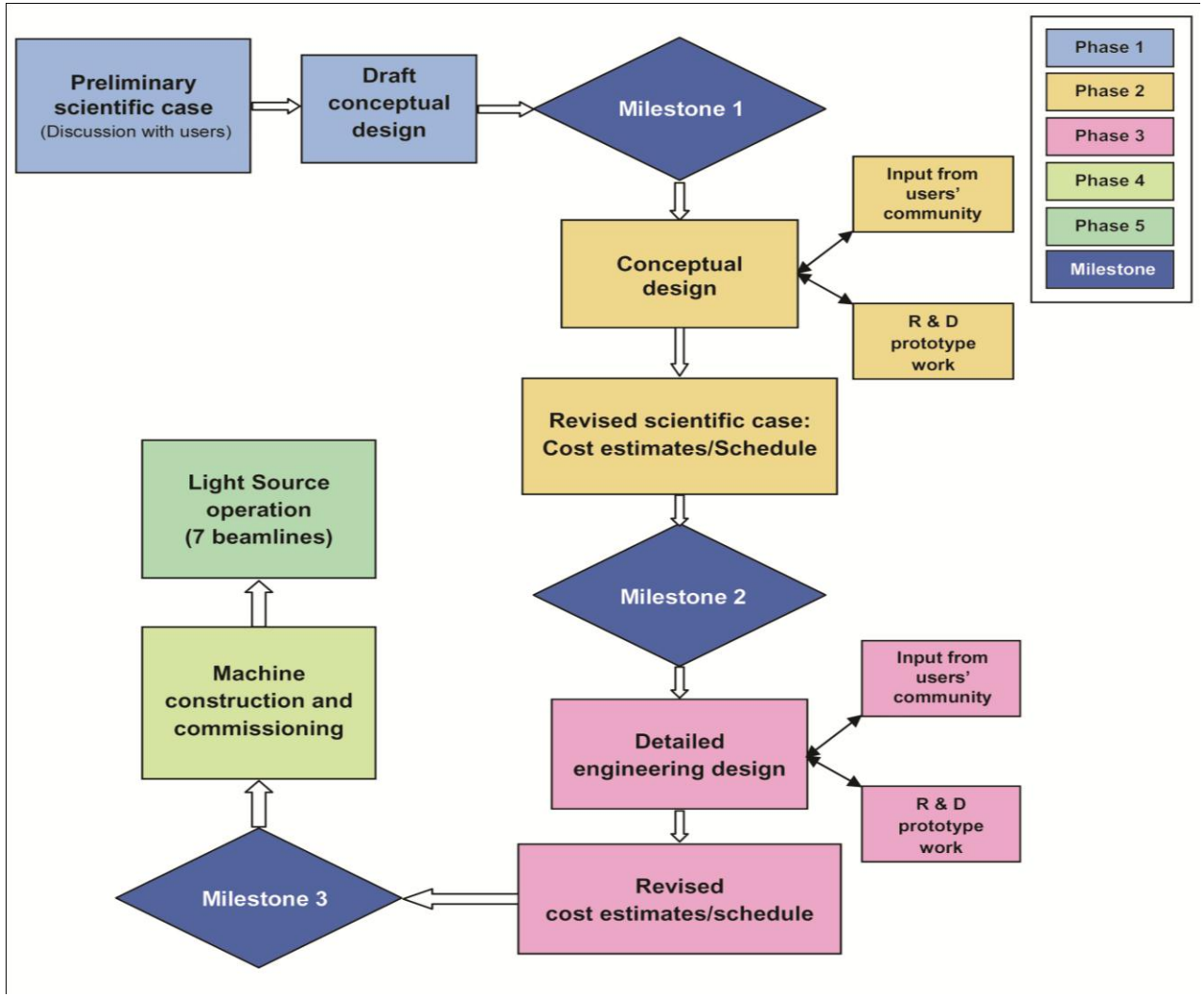
Light source around the world



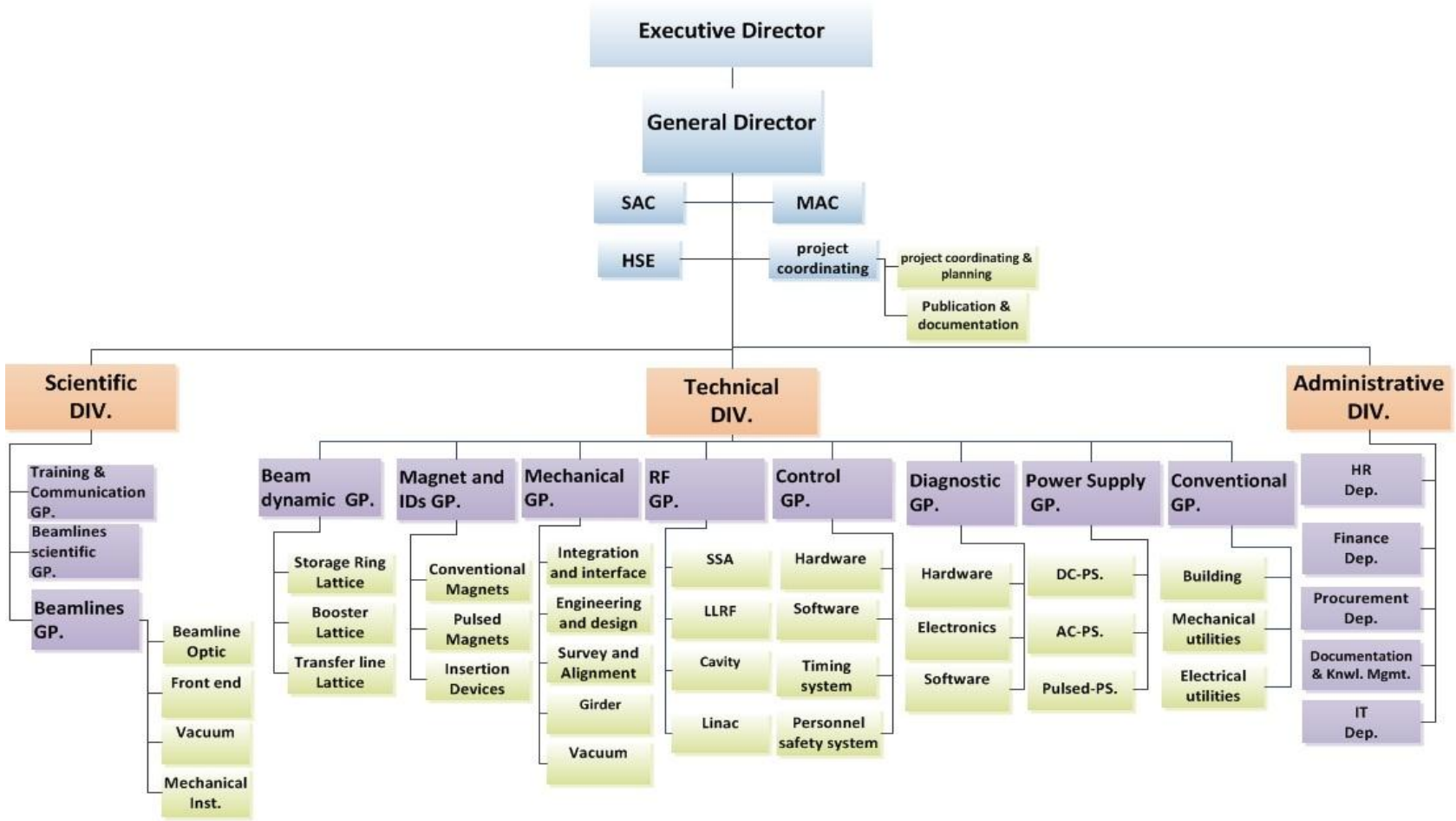
General layout of ILSF accelerator complex



Various stages and milestones of the ILSF project



ILSF Organization Chart



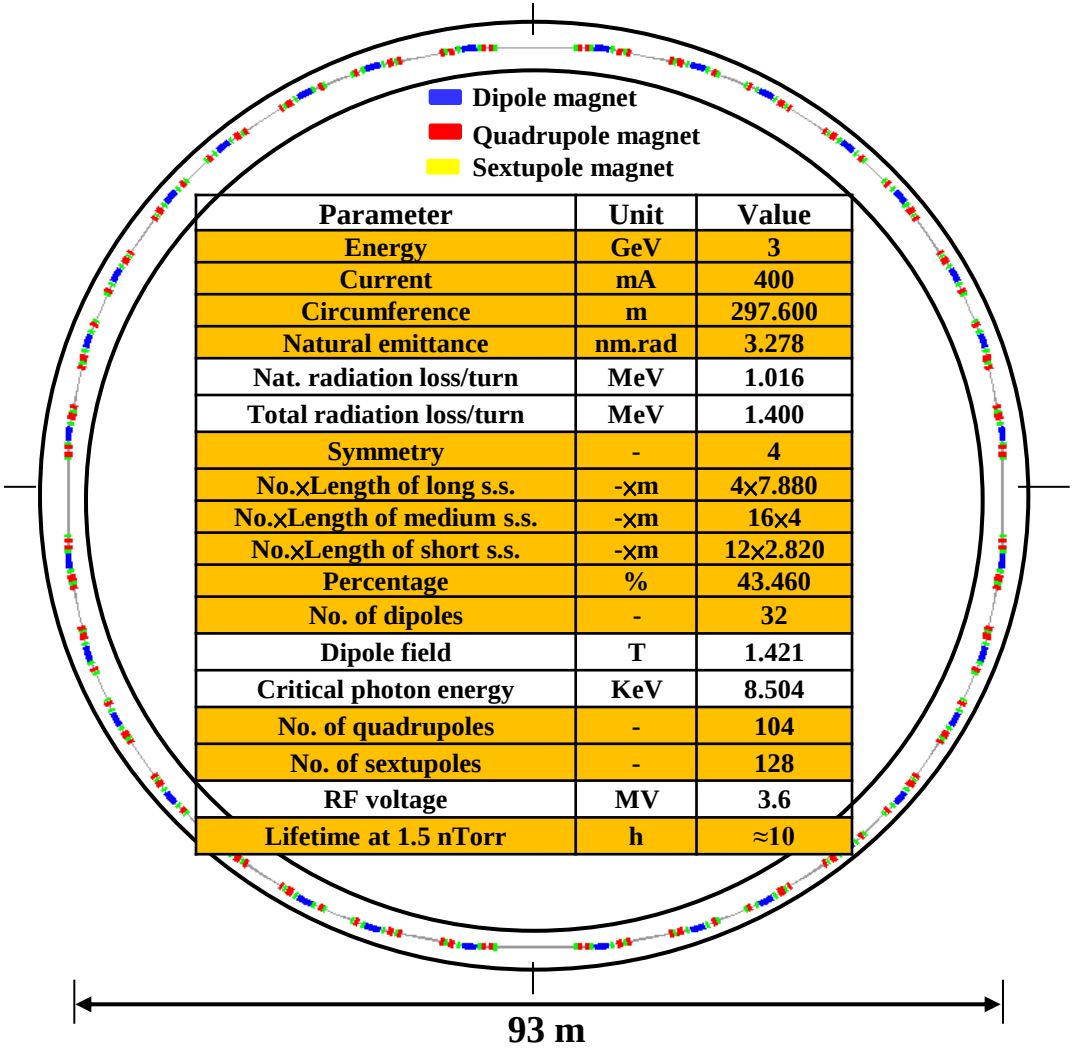
MAC : Machine Advisory Committee
SAC: Scientific Advisory Committee
HSE: Health, safety & Environment
SSA: Solid State Amplifier
LLRF: Low Level Radio Frequency
HR: Human Resource
IT: Information Technology

Design goals of the Iranian Light Source Facility

- High brilliance≈10^{21} photons/s/mm^2/mrad^2/0.1%($\Delta\omega/\omega$)
- High Photon flux density
- High current ≈ 400 mA
- Low emittance < 5 nm-rad

Storage ring

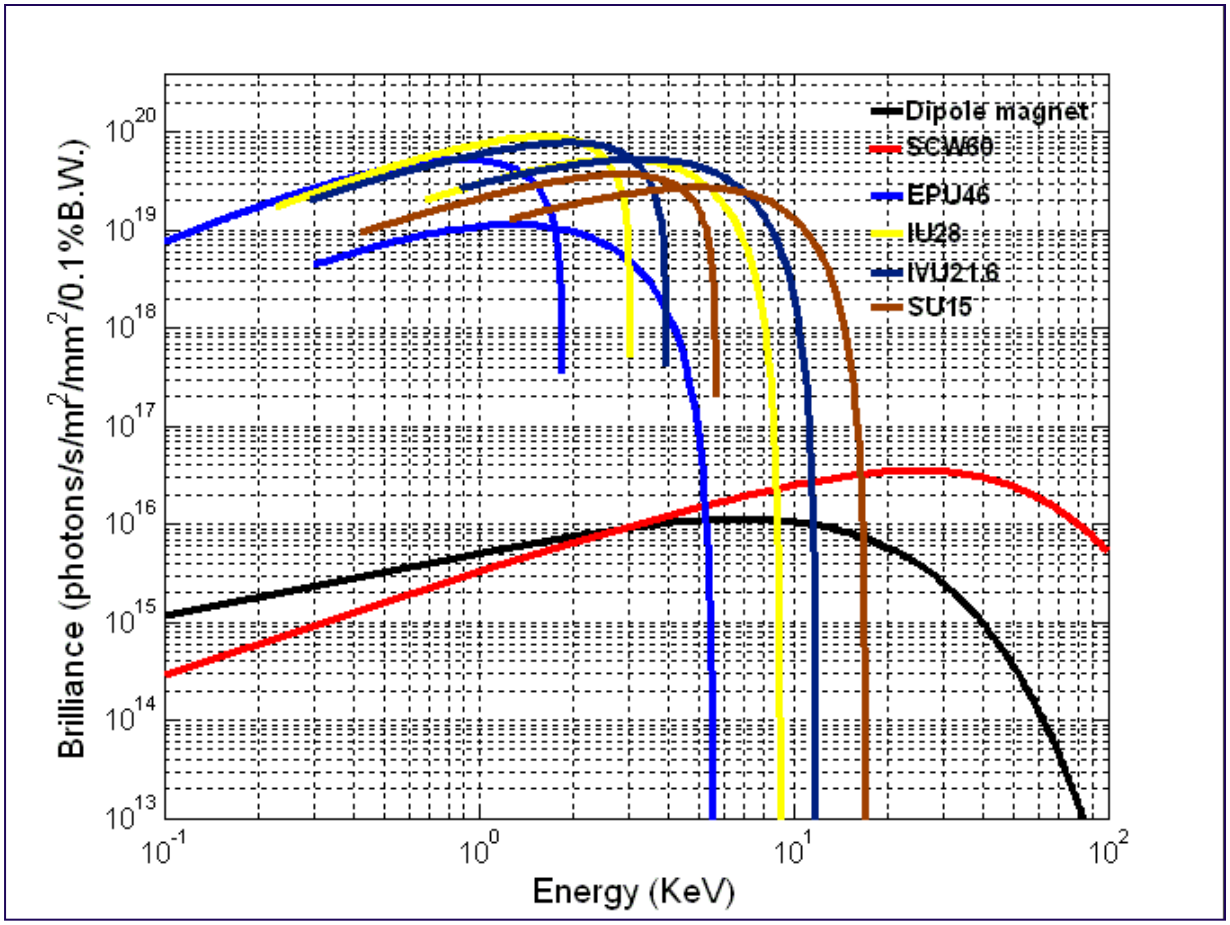
- General layout of the designed ILSF storage ring and its main parameters;



Parameter	Unit	Value
Energy	GeV	3
Current	mA	400
Circumference	m	297.600
Natural emittance	nm.rad	3.278
Nat. radiation loss/turn	MeV	1.016
Total radiation loss/turn	MeV	1.400
Symmetry	-	4
No.xLength of long s.s.	-xm	4x7.880
No.xLength of medium s.s.	-xm	16x4
No.xLength of short s.s.	-xm	12x2.820
Percentage	%	43.460
No. of dipoles	-	32
Dipole field	T	1.421
Critical photon energy	KeV	8.504
No. of quadrupoles	-	104
No. of sextupoles	-	128
RF voltage	MV	3.6
Lifetime at 1.5 nTorr	h	≈10

Storage ring-Radiation performance

Parameter	Unit	SCW60**	EPU46**	IU28**	IVU21.6*	SU15**
Number of period	-	33	97	160	97	67
Period length	*mm*	60	46	28	21.6	15
$K_y(K_x)$	*T.cm*	19.610	3.264 (2.104)	2.353	1.600	2.100
Magnetic field, $B_y(B_x)$	*T*	3.500	0.760 (0.490)	0.900	0.793	1.500
Length of ID	*m*	1.980	4.462	4.480	2.100	1.005



* TPS design handbook

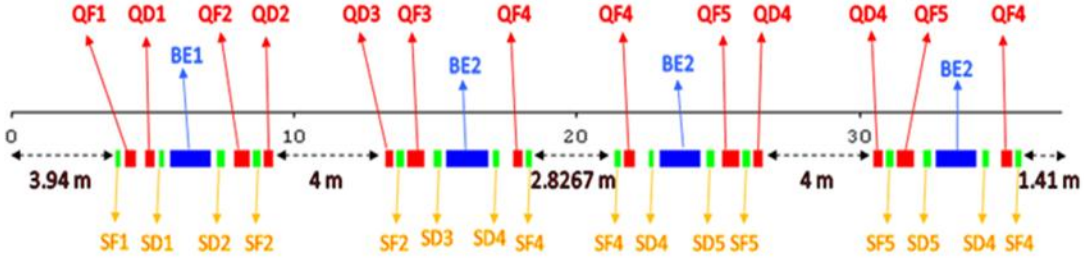
** ALBA insertion devices (http://www.cells.es/Divisions/Accelerators/Insertion_Devices/Ids/)

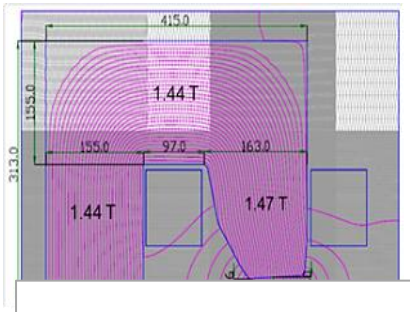
Construction of Prototypes

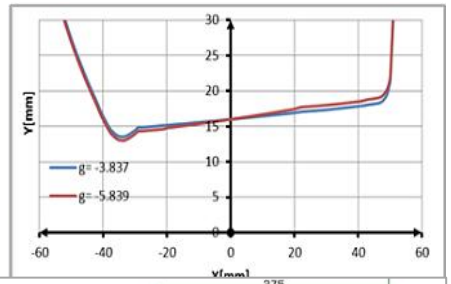
- Booster and Storage Ring Magnets.
- Power Supplies for Booster and SR magnets.
- Radio Frequency Systems,

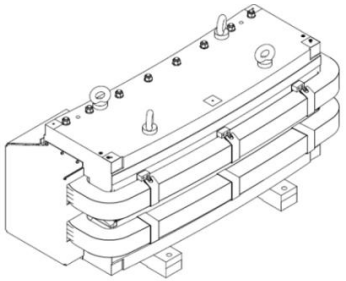
Booster and Storage Ring Magnets

Storage Ring Magnets

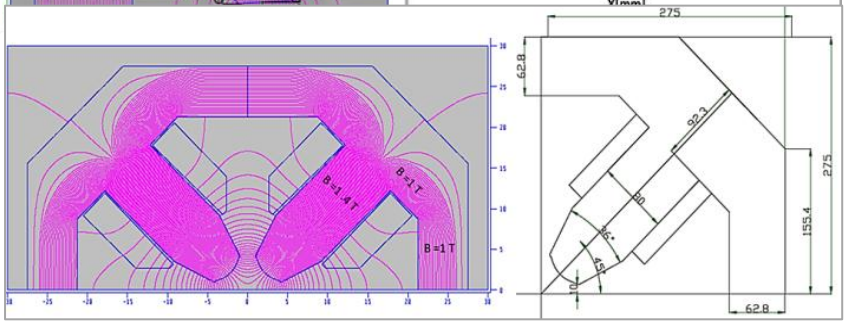


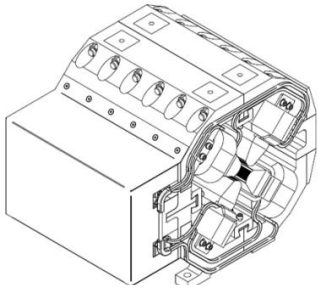




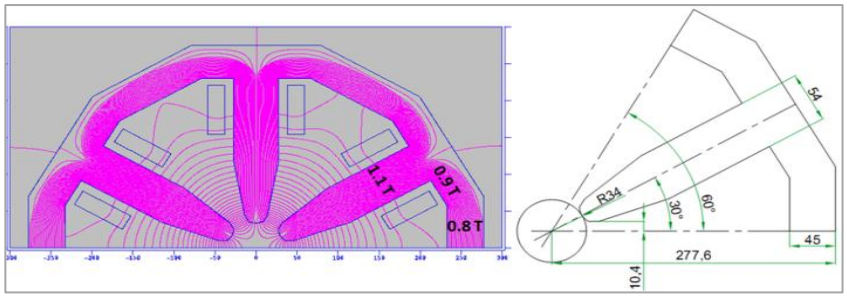


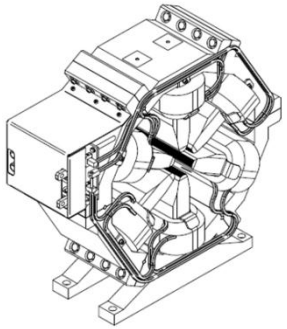
B=1.42 T
B'=3.837-5.839 T/m
gap-=32mm





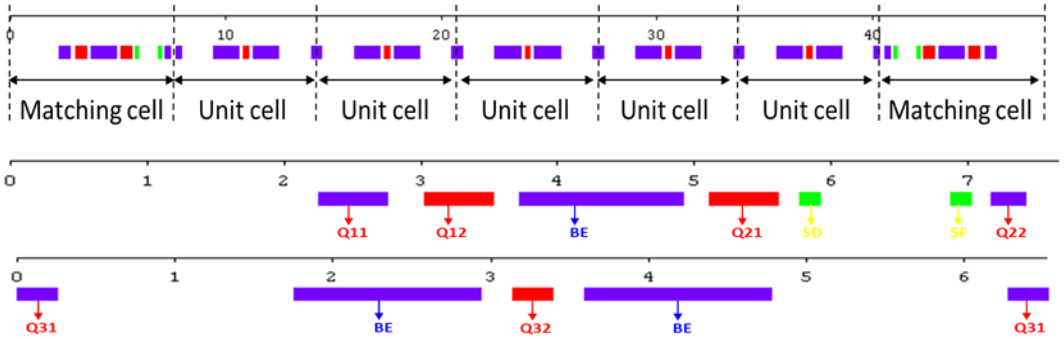
B'=23 T/m
gap-=30 mm

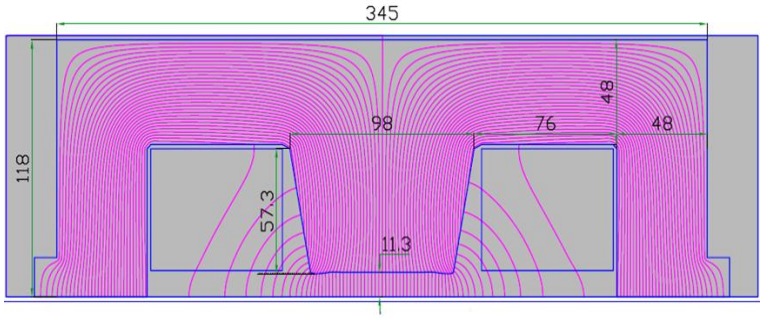


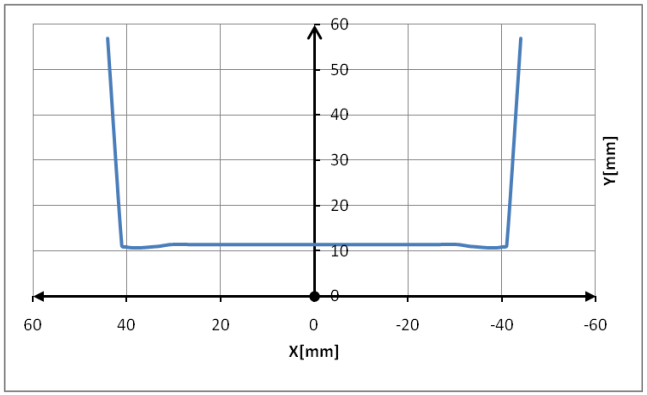


B''=700 T/m2
gap-=34mm

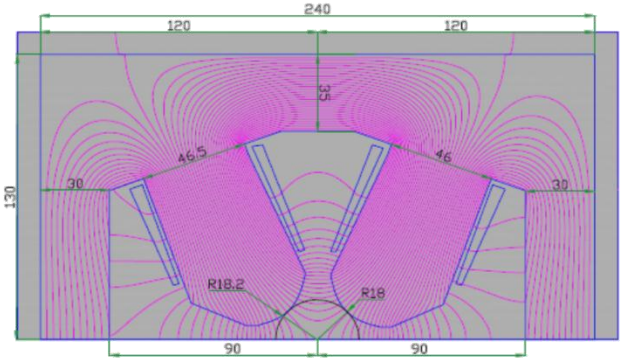
Booster Magnets

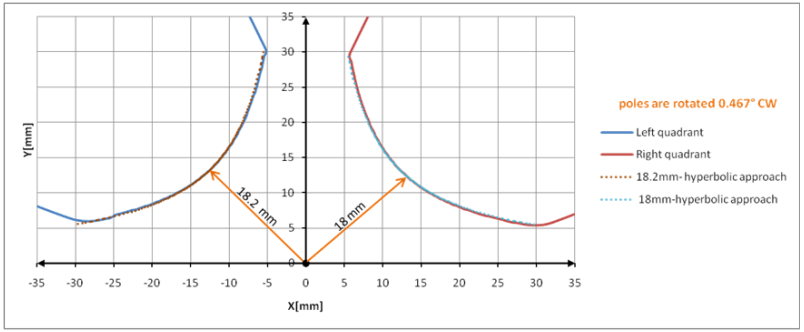






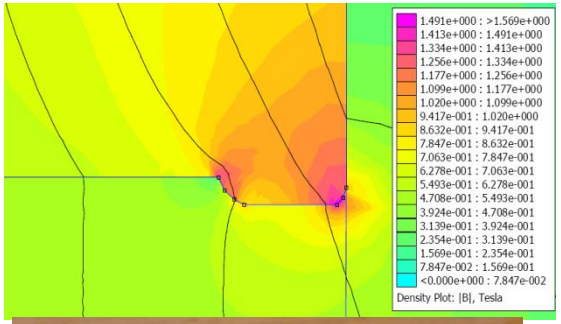
B=1.1 T
B''=16.02 T/m2
gap-=34mm

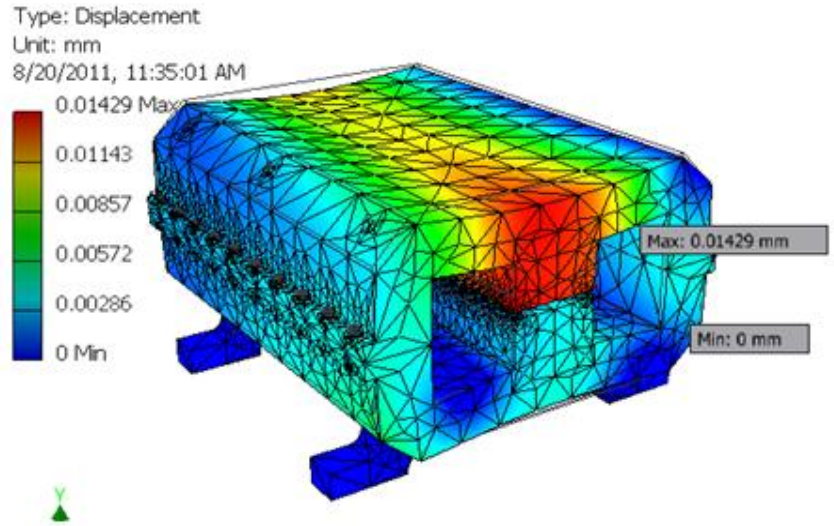




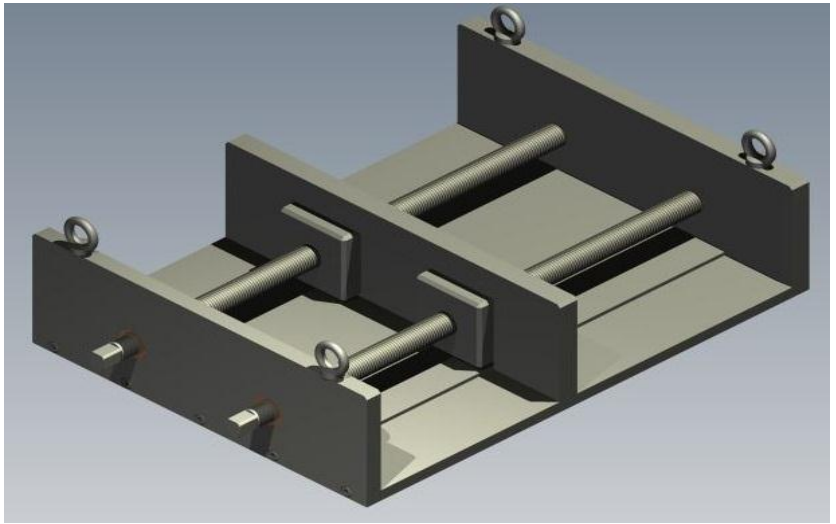
B'=14.93 T/m
B''=3.22 T/m2
gap=18,18.2mm

H-Dipole prototype Magnets



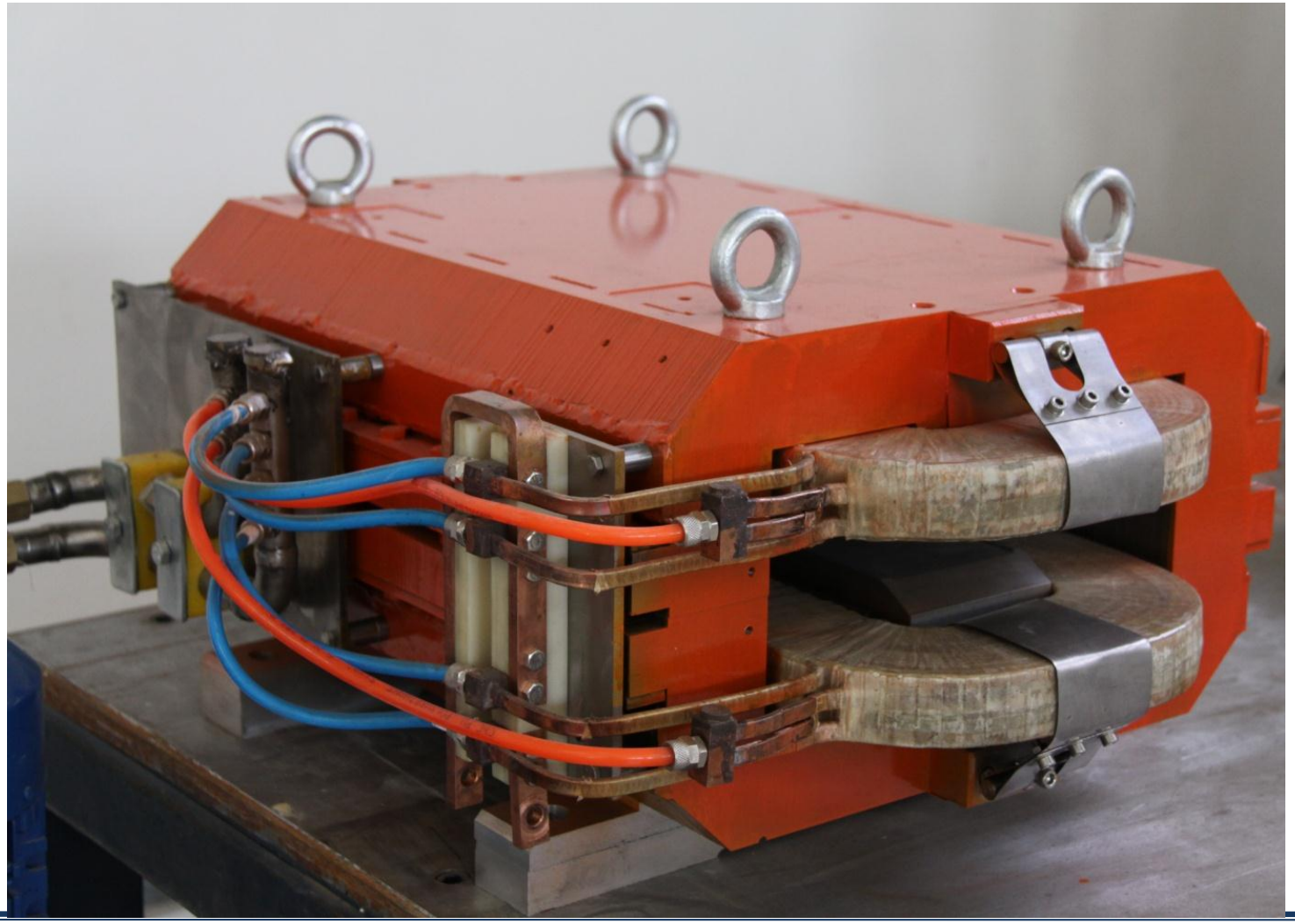


B=0,5 T
L=500 mm
gap-=34mm
Steel type= ST-14

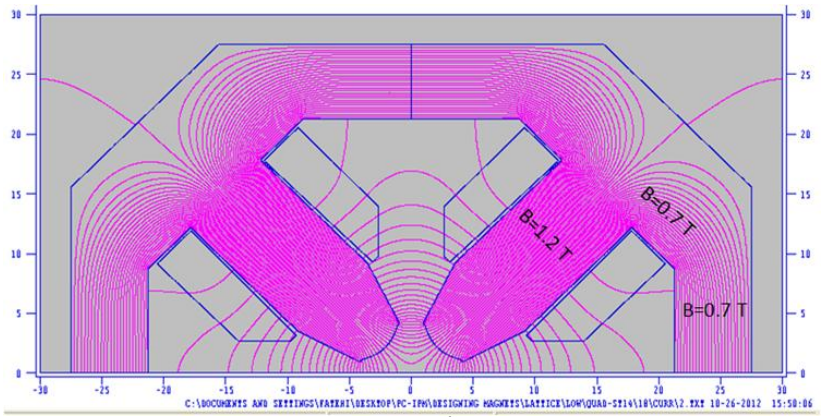


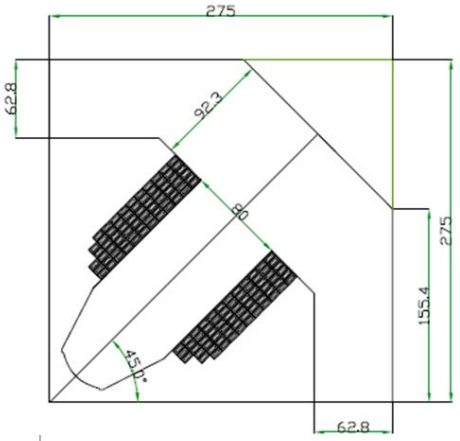
H-Dipole prototype Magnets

First Designed and Constructed Prototype Dipole Magnet at ILSF

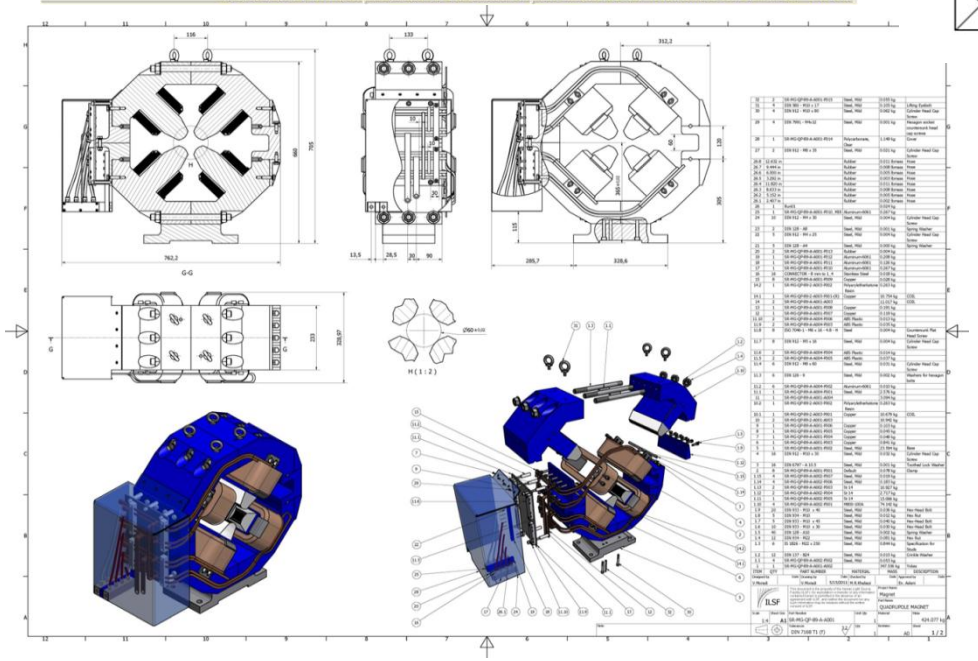


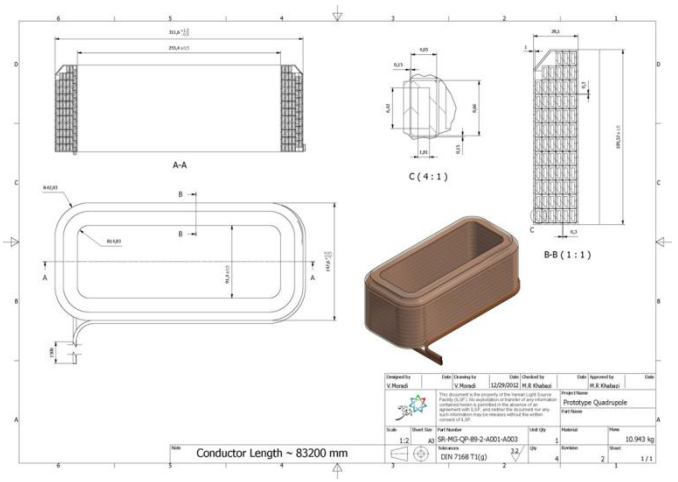
Quadrupole prototype Magnets





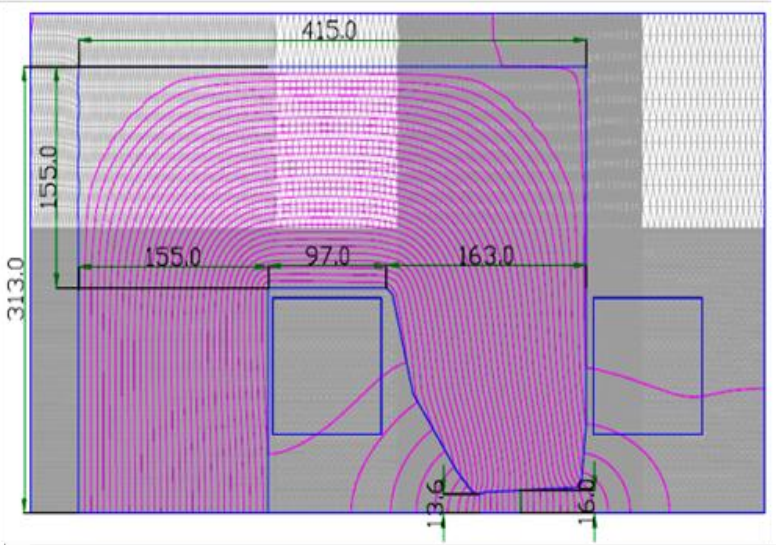
B'=18 T/m
L=233 mm
gap-=30mm
Steel type=M800-100A

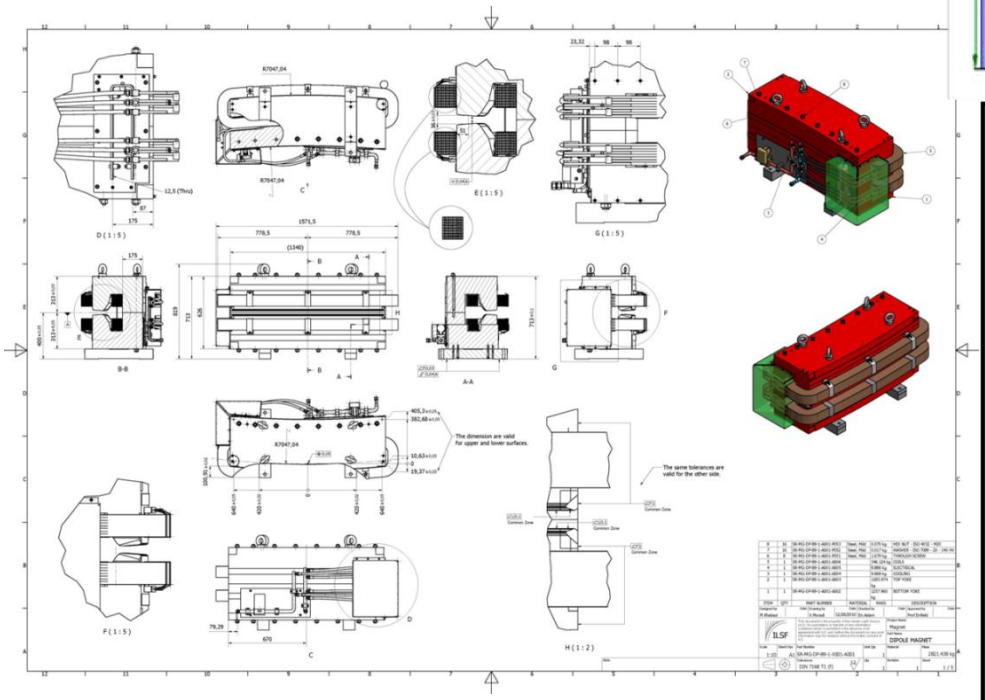


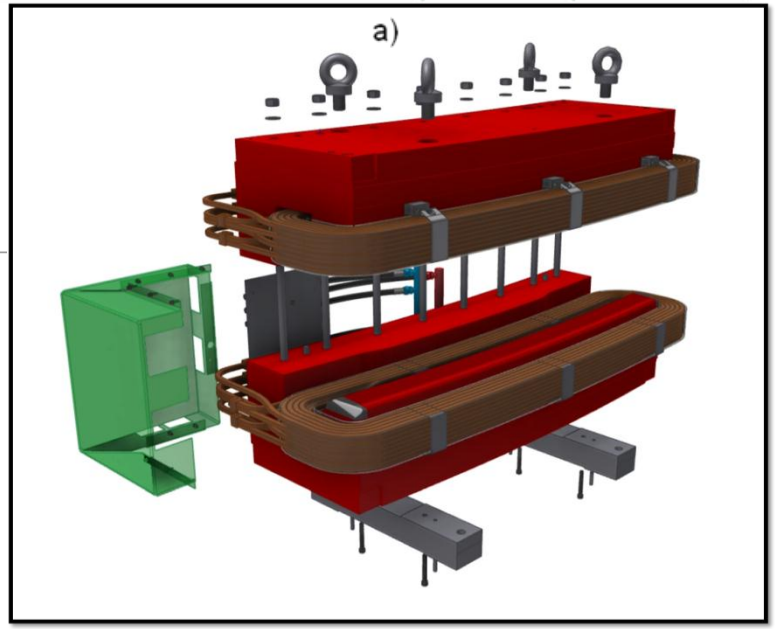


C type-Dipole prototype Magnet

B=1.42 T
L=1.34mm
gap-=32mm
Steel type=M800-100A

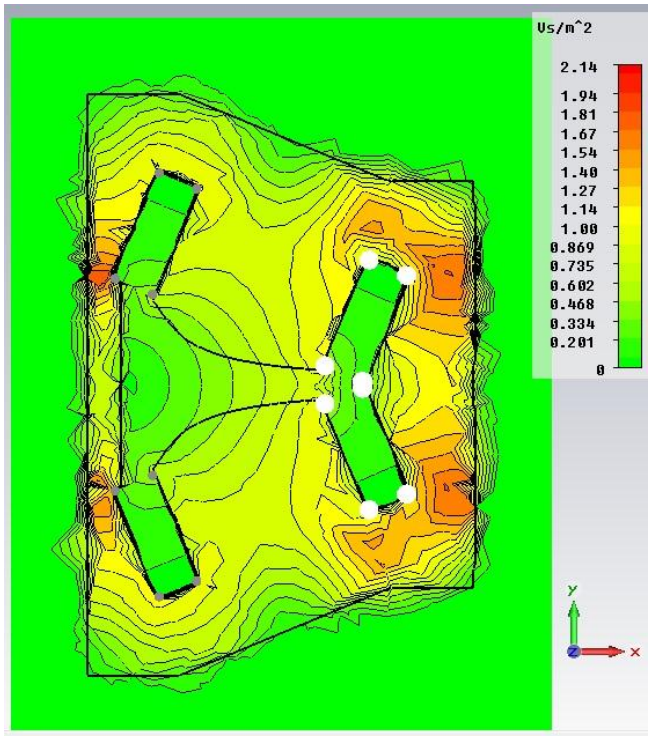


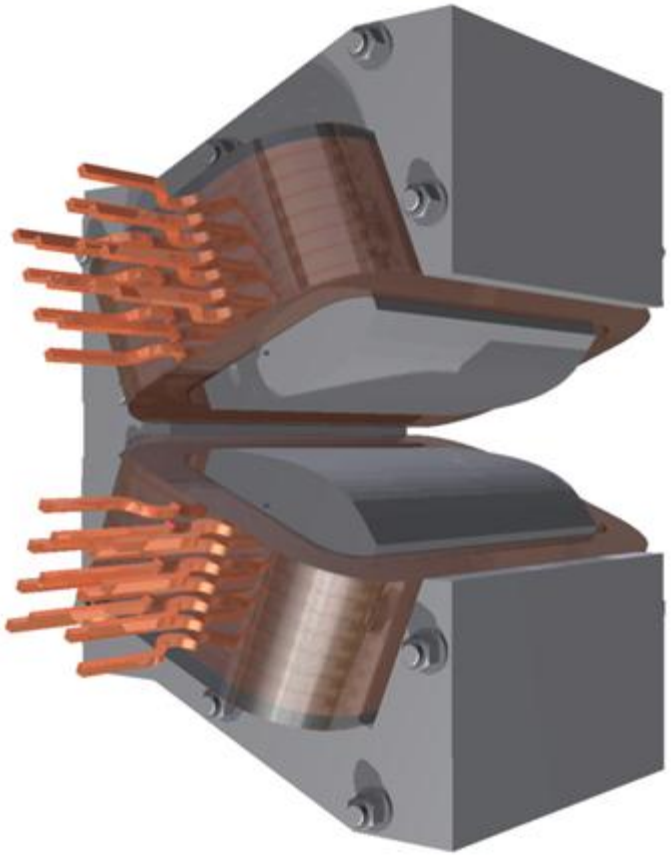




Alpha magnet

Magneto-static simulations



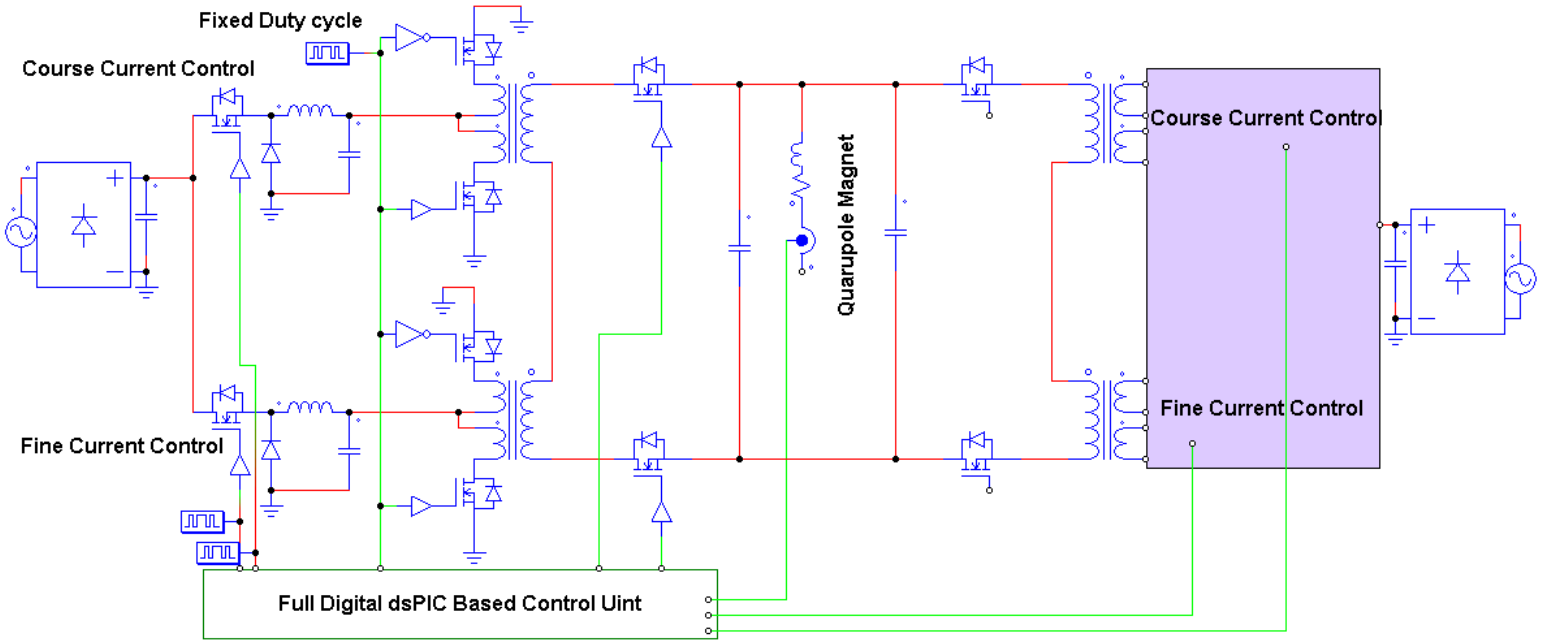


Mechanical drawings

Power Supply Prototype

First Prototype Power Supply Designed and Constructed at ILSF Suitable for Quadrupole:

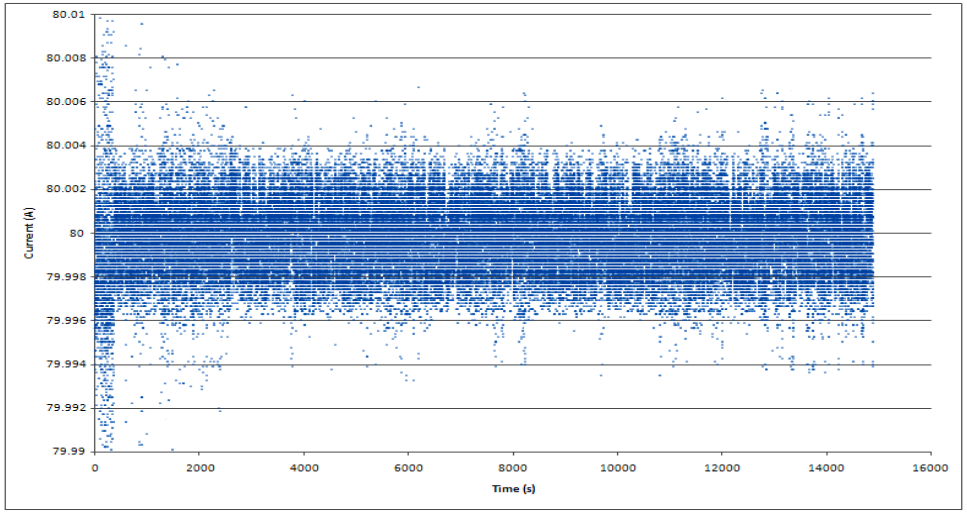
- 24V , 120A
- Full Digital
- Precision Power Supply but Using Low Resolution Digital PWM
- Series Combination of 2 power supplies (coarse and Fine)



IPS-30500

First Prototype Power Supply Designed and Constructed at ILSF

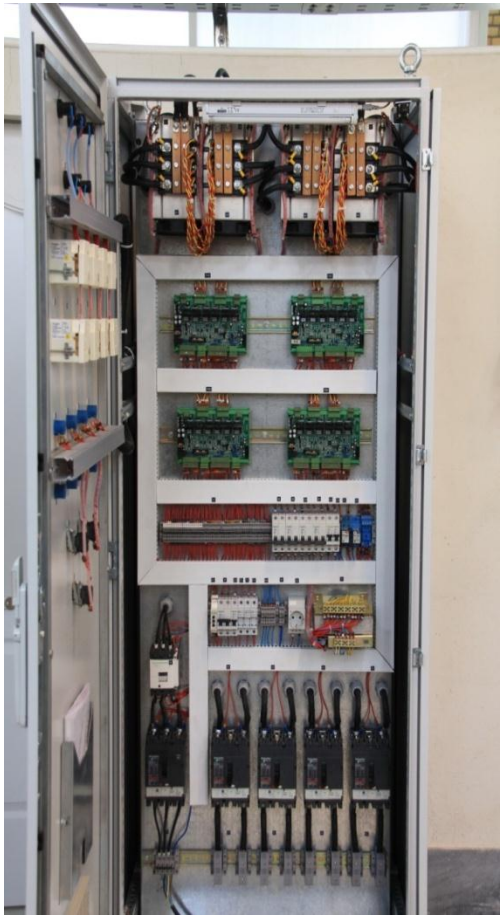
- Maximum output voltage…….+24V
- Maximum output current ……120A
- Maximum output power ……2880W
- Correction power factor ……....0.98
- Maximum power Consumption ……..…3100V.A
- Ripple ……..…Less Than 0.01% full load
- Current regulation ……Better Than 40ppm at full load
- Current measurement……20 bit ADC



IPS-30500

2nd Prototype Power Supply Under Design and Construction at ILSF

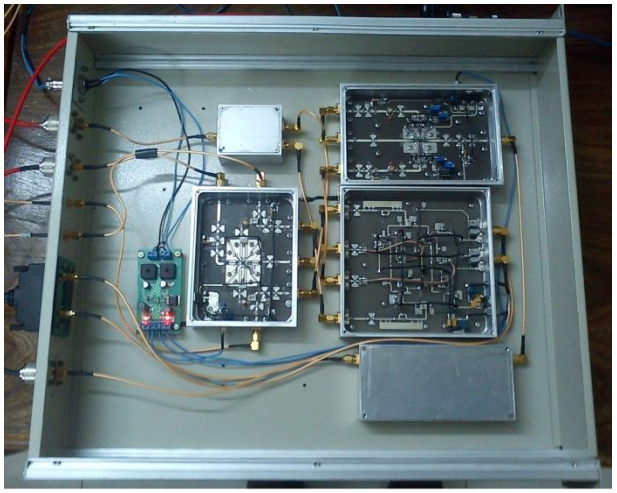
- Ramping Power Supply
- 30V , 520A
- 12kHz IGBT Based Switching Power Supply followed by 12-pulse Thrystor Rectifier
- Full Digital Thrystor Controller
- DSP Based Full Digital PWM Generation



Radio Frequency System

LLRF

- Self-excited loop architecture for the LLRF system.
- The analog/digital hardware is developed and the software is under development.
- The LLRF system is tested using a simple aluminum cavity, and some promising results are obtained.

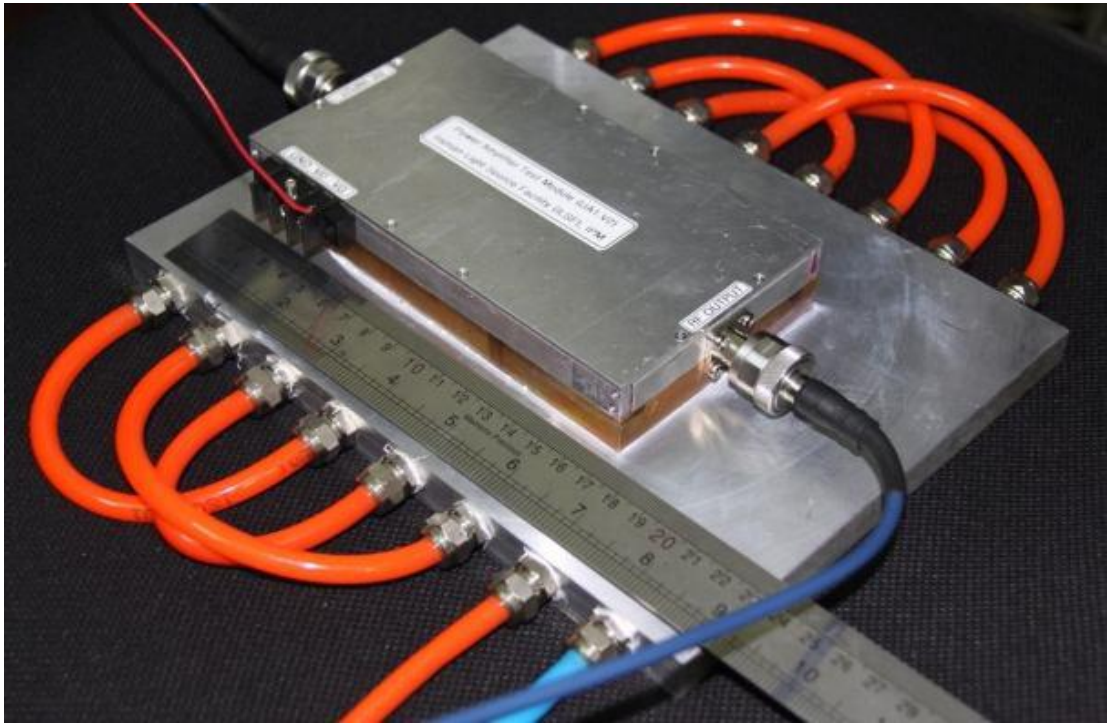


Analog Section

Digital Section

Solid State Amplifier

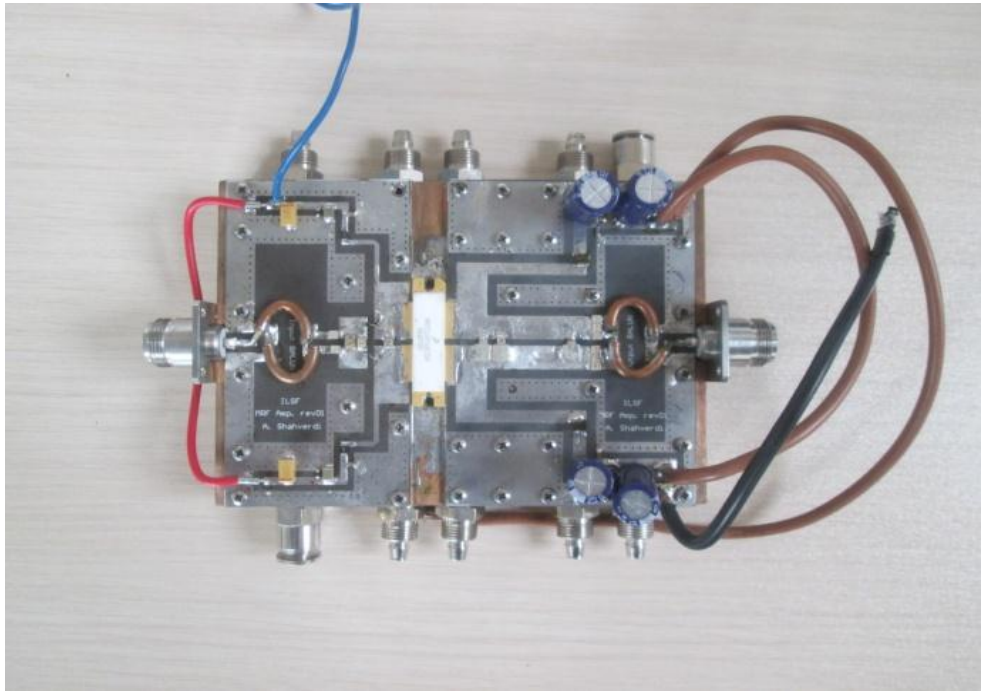
Solid State Amplifier I



Amplifier module based on BLF 578 transistor

Freq.	CW Input power	CW Output power	gain	efficiency
500 MHz	11W	660W	17.8 dB	53%

Solid State Amplifier II



Amplifier module based on MRFE6VP61K25HR6 transistor

Freq.	CW Input power	CW Output power	gain	efficiency
500 MHz	10 W	700 W	18.4dB	54%

Solid State Amplifier III

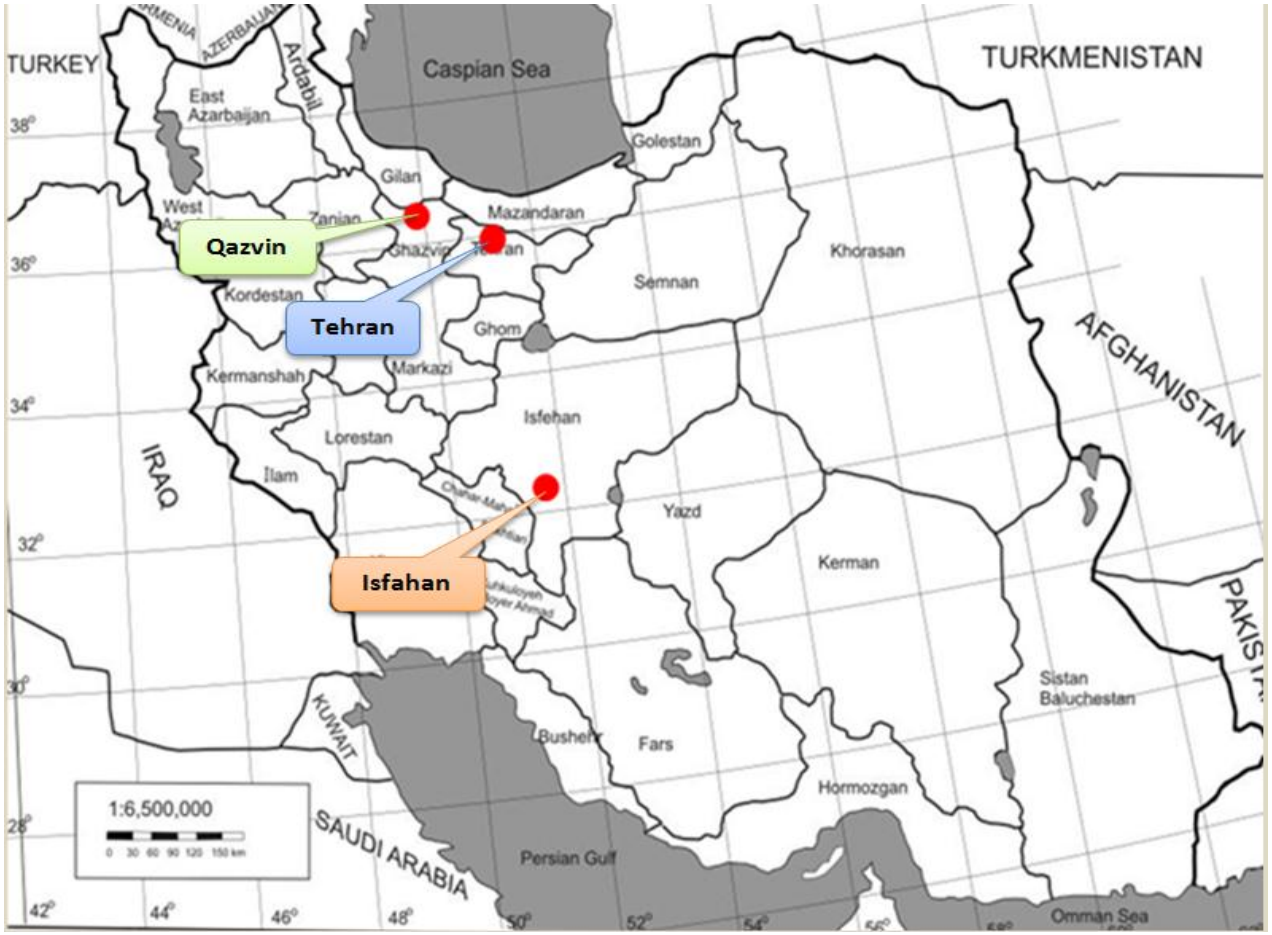
Amplifier Initial design of 8:1 radial power combiner (without heat sink)

Number of Inputs	Input CW power	Output CW Power	Insertion Loss	Isolation
8	600W	4.7 KW	0.1 dB	16 dB

First Day ILSF Beamlines

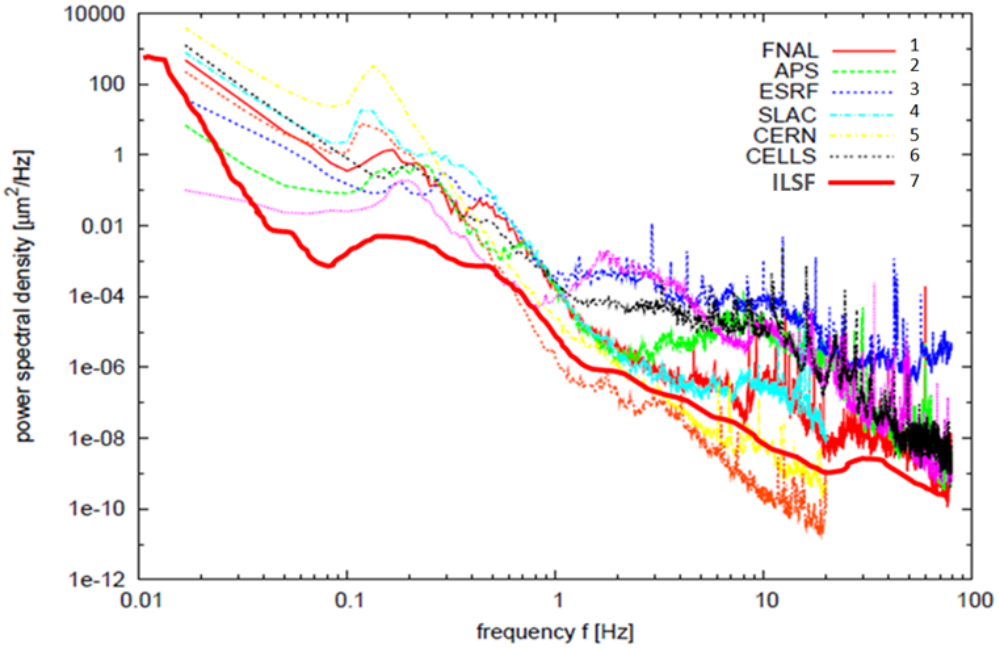
No.	Beamline		Source	Energy Ragne (eV)	Photon Flux (p/s)	Resolution/ Resolving pwer	Spot size (mm)
1	Powder Diffraction		Bending Magnet	6-30 k	10^{12}	10^{-4}	100×100
2	Single Crystal X-ray Diffraction for small molecules		In-Vacuum Undulator	5-25 k	10^{13}	10^{-4}	50×50
3	EXAFS		Wiggler	3-35 k	10^{13}	10^{-4}	Few mm
4	Gas Phase photoemission (XPS, AES, ARPES)		Electromagnetic Undulator	15-1000	10^{11}	10000	
5	Solid-State Electron Spectroscopy		Electromagnetic Undulator	10-1500	10^{12}	10000	
6	Spectroscopy	SPEM (+ARPES) PEEM (+XMCD)	Helical Undulator	10-2000	10^{13}	>8000	Few mm
7	Macromolecular Crystallography		Wiggler	3-25 k	10^{12}		

Site selection


TURKEY
ARMENIA
AZERBAIJAN
Ardabil
East Azarbaijan
Caspian Sea
TURKMENISTAN
Golestan
Gilan
West Azarbaijan
Zanjan
Mazandaran
Qazvin
Ghazvin
Tehran
Khorasan
Semnan
Kordestan
Ghom
AFGHANISTAN
Markazi
Kermanshah
Isfahan
Lorestan
IRAQ
Ilam
Yazd
Isfahan
Kerman
PAKISTAN
Sistan Baluchestan
KUWAIT
Bushehr
Fars
Hormozgan
SAUDI ARABIA
Persian Gulf
Oman Sea
1:6,500,000
0 30 60 90 120 150 km
38°
36°
34°
32°
30°
28°
42°
44°
46°
48°
50°
52°
54°
56°

Iranian Light Source Facility Plan

Comparison of measured displacement power spectral density at Qazvin site and other projects



1- FNAL: Fermi National Accelerator Laboratory, U.S. Department of Energy, http://www.fnal.gov

2- APS: Advanced Photon Source, U.S. Department of Energy, http://www.aps.anl.gov/

3- ESRF: European Synchrotron Radiation Facility, France, http://www.esrf.eu/about

4- SLAC: Stanford Synchrotron Radiation Lightsource, Stanford University, http://www-ssrl.slac.stanford.edu/

5- CERN: Conseil Européen pour la Recherche Nucléaire, or European Council for Nuclear Research, http://public.web.cern.ch

6- ALBA, Spain, http://www.cells.es/

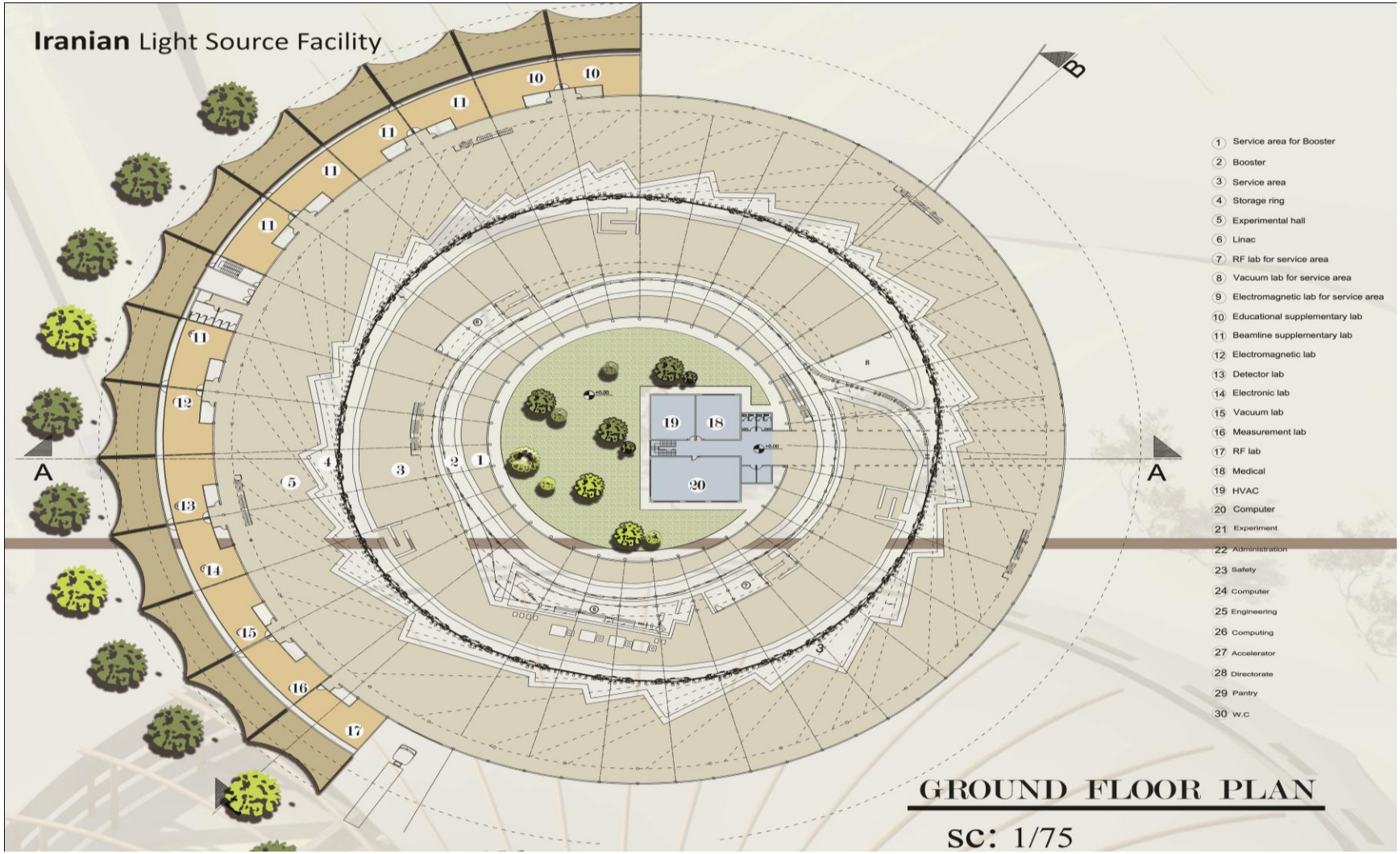
7- ILSF: Iranian Light Source Facility, Iran, http://ilsf.ipm.ac.ir

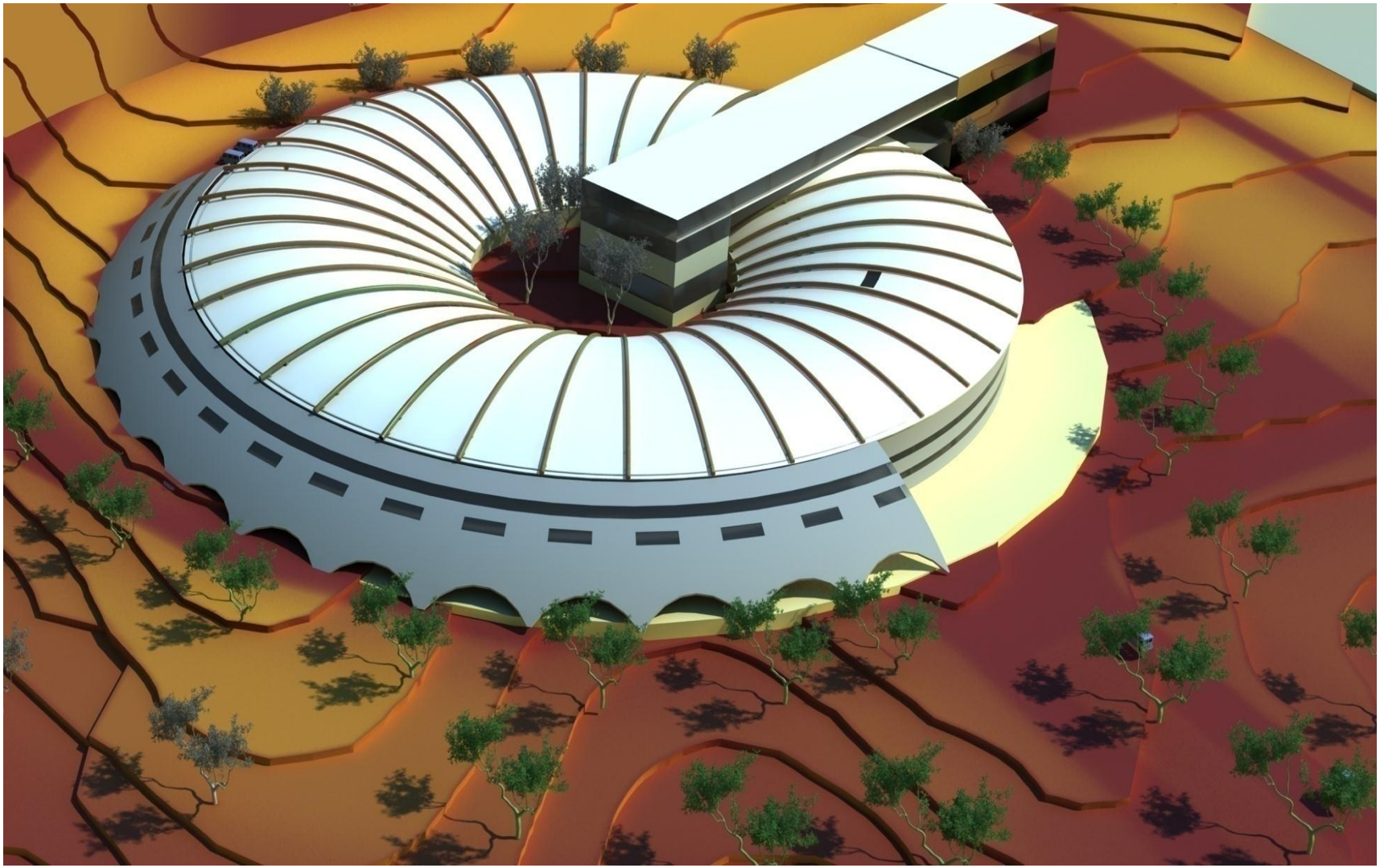
Geotechnical tests

In situ tests for measurement of soil mechanical and physical parameters

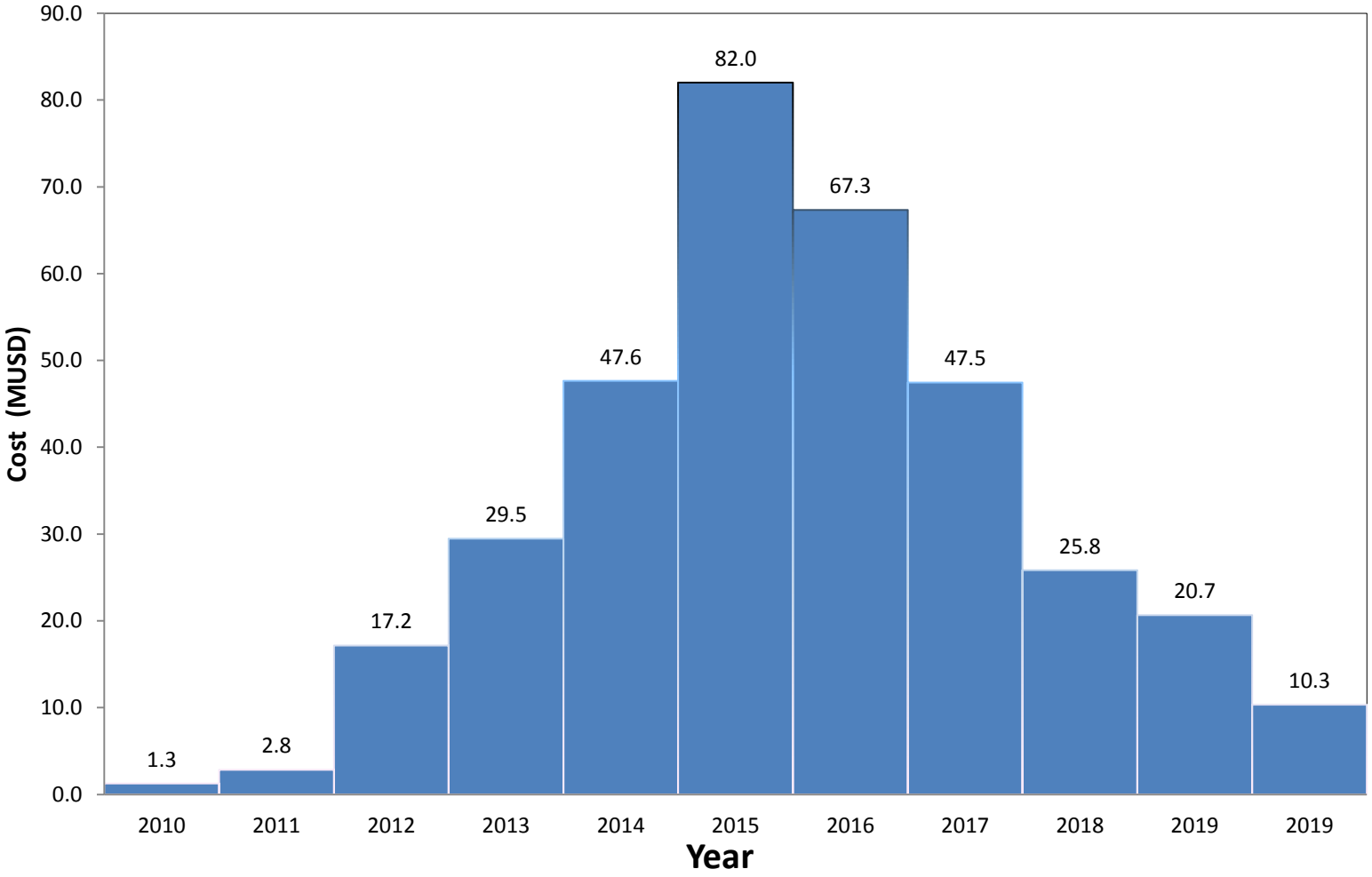
In laboratory tests for measurement of soil mechanical and chemical parameters

ILSF main building plan





ILSF Cost Estimate



Iranian Light Source Facility

IPM
Institute for Research in Fundamental Sciences

lightsources.org

Contact Us

Search GO

About Lightsources | News Center | For Users | Education | Media | Science | Light Sources of the World

Iranian Light Source Facility (Iranian Light Source Facility)

The Iranian Light Source Facility (ILSF) is an open project fully complying with the international scientific standards. All the design and progress reports will be presented at local and international conferences and published in international journals accessible to scientists all over the world. To realize this project, the intention is to work and collaborate with other light sources around the world. Users from abroad shall be welcome to set up their experiments in this new facility upon the acceptance of their proposals by the appropriate review boards. The layout and performance of the planned facility shall be based on the most recent advances and significantly improved with respect to other facilities which were planned many years ago and realized only recently.

The Iranian Light Source Facility shall consist of a 3-GeV storage ring with a circumference of roughly 300m

At present the ILSF-team is working on the conceptual design report (CDR), which should be finished by the end of 2011. After CDR, the different components have to be designed in detail and a report that includes the technical specifications has to be drawn up. The technical specifications shall be the basis for call for tender. The call for tender process is finished with the signing of the contract. It is assumed that most of the components have to be purchased abroad. The so-called design phase should be finished by the end of 2013. The production of all components should be completed by the end of 2015. At the end of 2015 the Linac should already be commissioned. The installation phase is from 2016 to 2018. The booster should be commissioned in 2017 and the storage ring in 2018. The users of ILSF should be able to start their operations at the end of 2018

Information about Iranian Light Source Facility

Iranian Light Source Facility

Website:
http://ilsf.ipm.ac.ir/
Address:
Iranian Light Source Facility (ILSF)
Institute for Research in Fundamental Sciences (IPM)
P.O. Box 19395-5746,
Tehran
Iran

Tel: +98 21 2281 3738
Fax: +98 21 2281 3722
email: ILSF@ipm.ir

Iranian Light Source Facility Links

Acknowledgments

Many thanks to :

Dieter Einfeld
Helmut Wiedemann
Albin F. Wrulich
Ernst Weihreter


Thank you for your
kind attention