The ALBA Project

Lluis Miralles i Verge
Engineering Division Head
CELLS

OUTLINE

- Introduction
- Accelerators complex
- Experimental Beam Lines
- Building and conventional facilities

Introduction

- Brief history of the project
- CELLS structure
- Engineering Division Structure
- Multi-projects management strategy
- Synchrotron Light Source Description

A BRIEF HISTORY:

•1990: 1ST attempt to fund a SR source in Spain
•1992: Generalitat creates a ¨Comissió¨ Promotora.
•1994: Generalitat creates some fellowships to support staff for the preparation of a conceptual design report for a SL source and a Scientific case.
•1996: Meeting with industry in Barcelona (users) and in S. Sebastian (construction).
•1996: The Laboratori de Llum de Sincrotró (LLS) is created as a subgroup of the Institut Física Altes Energies (IFAE). This group was jointly funded between the DURSI and the OCYT and begun to elaborate a Detailed Design Study (DDS) for a Spanish SR source and prepare the case for its construction.
•1998: The DDS was handed in to the relevant authorities.
•2000: The LLS becomes a Consortium in its own right, between the DURSI and the UAB,with the mission to promote the use of SR, the development of SR projects and to Promote the construction of a Spanish SR source.
•2002: The Spanish Government and the Catalan Autonomous Government announce their intention to jointly fund the construction of a Spanish SR source.

History

•2003: The ¨Consorcio para la Construcción, Equipamiento y Explotación del Laboratorio de Luz Sincrotrón¨ (Consortium CELLS) is legally created with two governing bodies: ¨Comisión Rectora¨ and ¨Comisión Ejecutiva¨. The Presidents of the Rectora and Executive Commissions are named. The Director of CELLS is appointed (October 2003). The ALBA facility project is launched.

•2003: October: 1st CELLS user´s meeting in Menorca.

•2003: November: 1st CELLS meeting with industry (sponsored by CDTI+CIDEM)

•2003: Staff from LLS is legally transferred to CELLS (completed by 1-1-2004) and recruitment of other personnel starts, see: www.cells.es). Advertisements for the positions of Division Heads (October 2003) are placed and project starts.

•2004: All senior personnel leading 5 Divisions in post:

Accelerators :	Dieter Einfeld
Science Program/Experiments:	Salvador Ferrer
Engineering:	Lluis Miralles
Controls and Data Acquisition Systems:	Jorg Klora
Administrative Services:	Mariano Sazatornil

•CELLS is a Consortium between the Spanish State Government and the Autonomous Government of Catalunya.

•CELLS is paid on a 50:50 basis between the two partners.

•CELLS was legally constituted in March 2003 but, ¨de facto¨, started its activities in January 2004.

•The current construction (and operational) budget for ALBA is approved in the Forward Look of both Partners.

•The Council approved the construction of the first 7 beam-lines

•In steady state of operations ca. 137 people will be required, every additional beam line will require 6 more staff.

•Total Guideline budged 187 M €

• Commissioning starts end 2009, routine operations on 1st half 2010

CELLS Structure

Organization Scheme of CELLS

Rector Council

Executive Commission

Director

Scientific Advisory Committee

Machine Advisory Committee

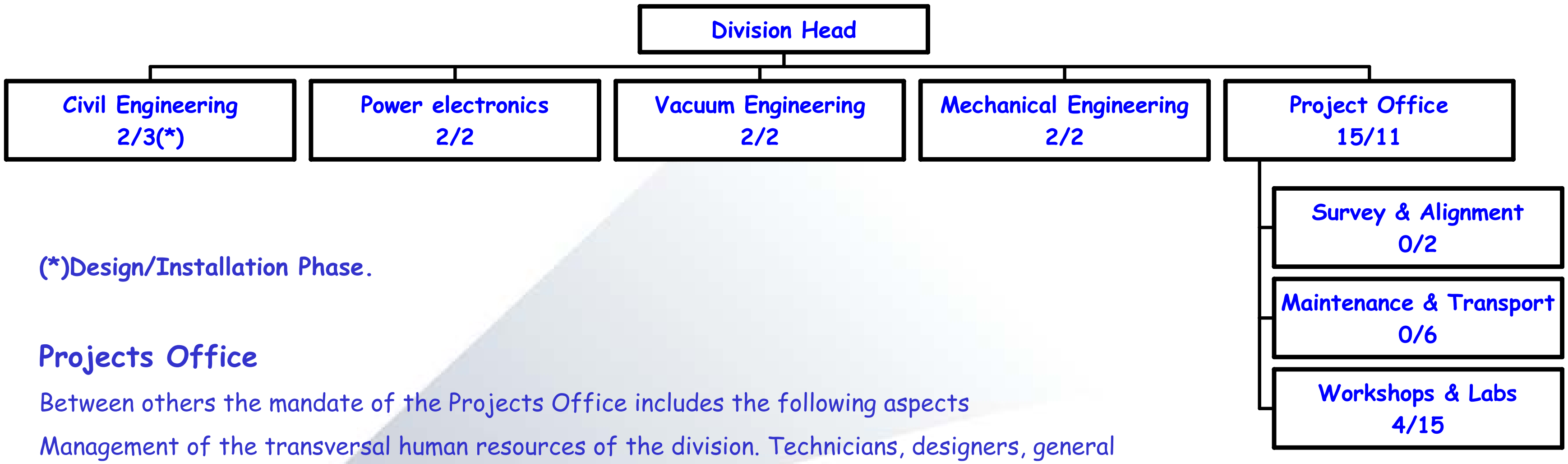
Management Board

Director

- Experiments Division (S.Ferrer)
- CC+DACQ Division (J.Klora)
- Administration Division (M.Sazatornil)
- Engineering Division (L.Miralles)
- Accelerator Division (D.Einfeld)

Engineering Division Structure

CELLS Engineering Support Division Organizational Chart



(*)Design/Installation Phase.

Projects Office

Between others the mandate of the Projects Office includes the following aspects

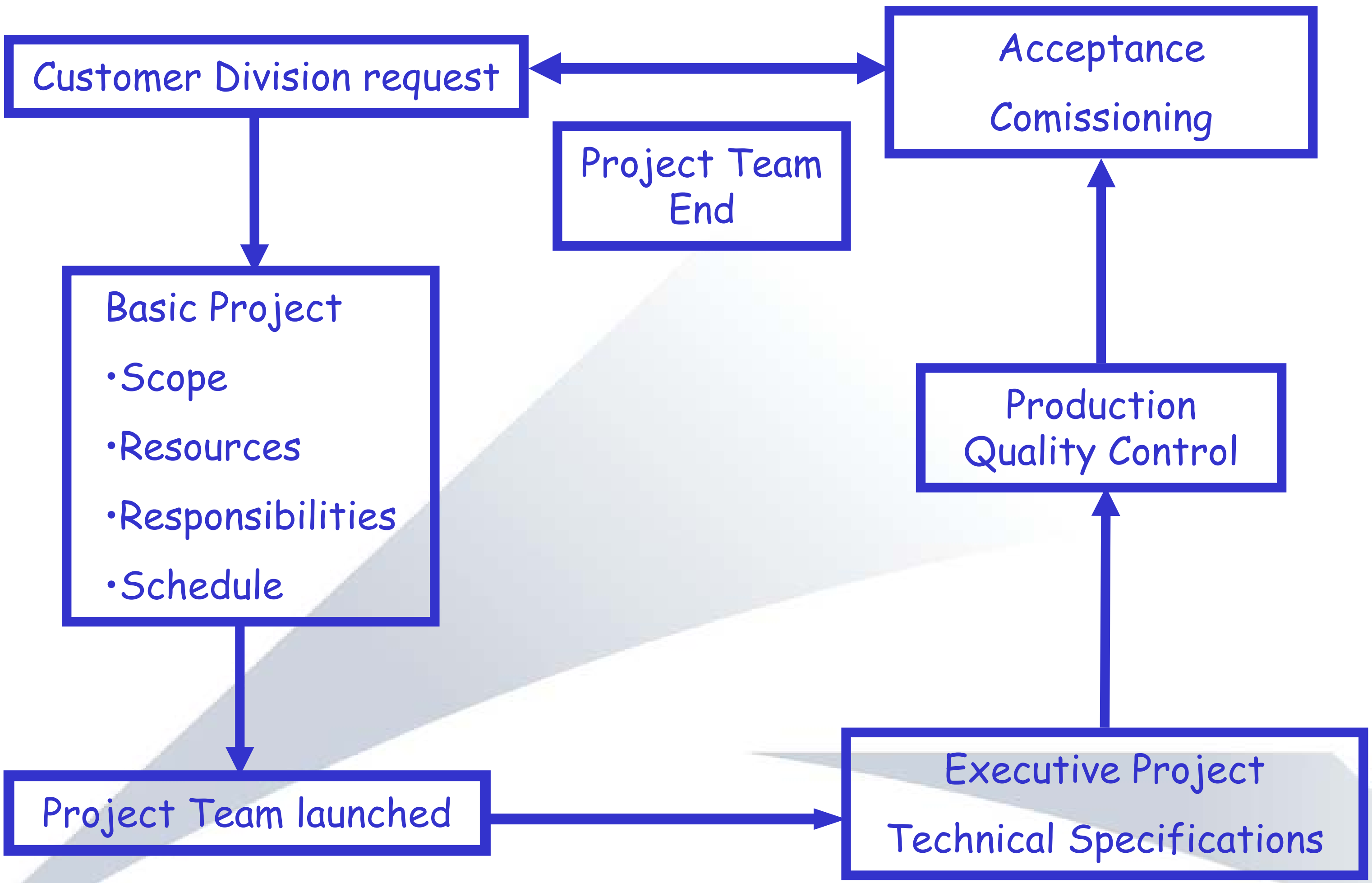
Management of the transversal human resources of the division. Technicians, designers, general calculations specialists and project managers are part of those resources.

- Management of the material resources of the division. Workshops, technical buildings, CAD/CAE generalist equipment, survey equipment are part of those resources.
- Production and follow-up of the master plan of the CELLS project.
- Coordination and follow-up of the activities projects in which the division is involved, being in charge of keeping up to date the schedules.

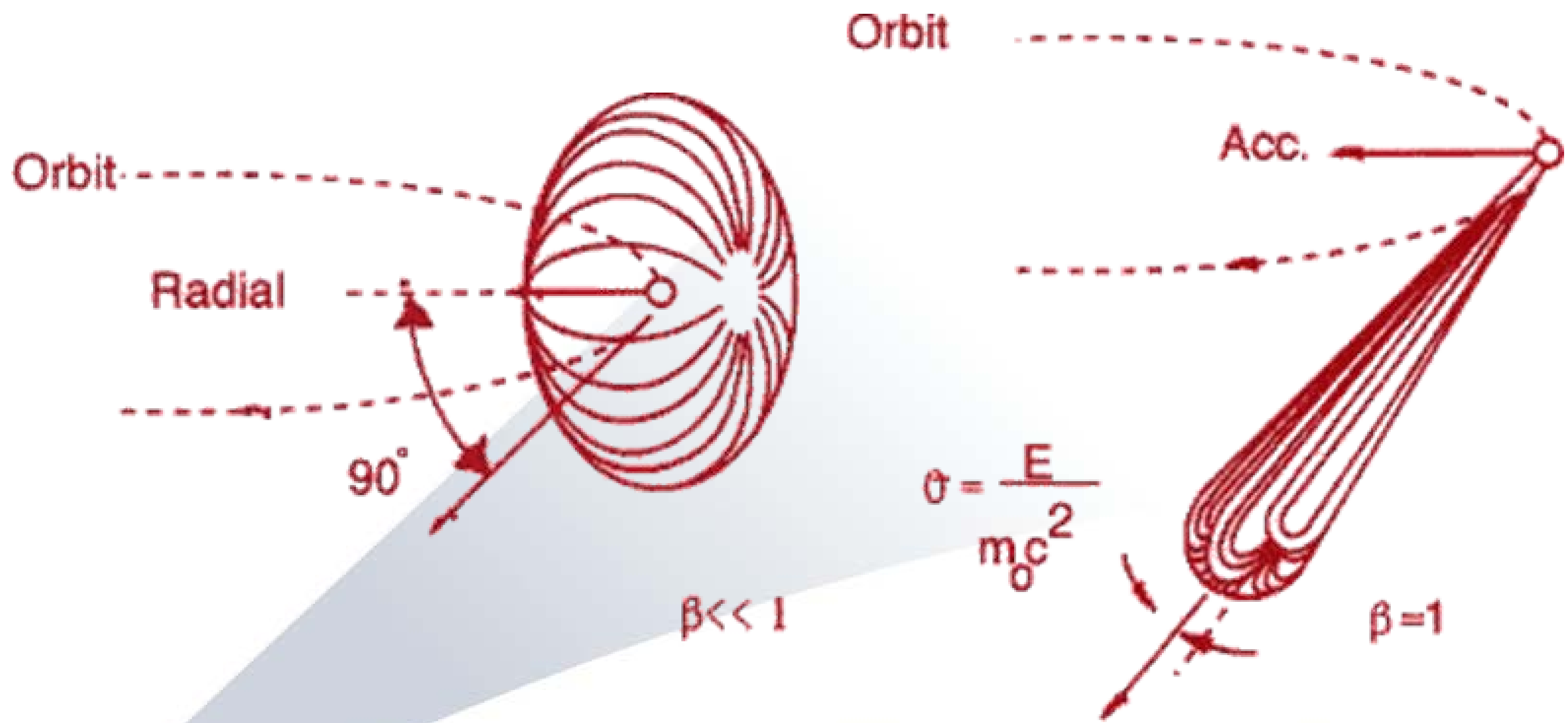
The project office is supposed to be the main responsible for the optimisation of the resources across the division.

Multi-projects Management structure

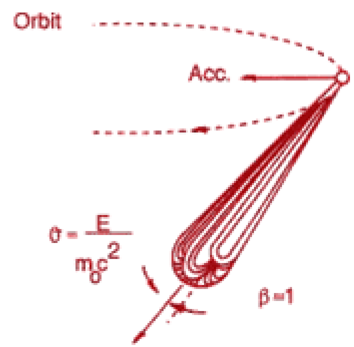
Project Scheme



Synchrotron Light Source Description



Synchrotron Light Source Description



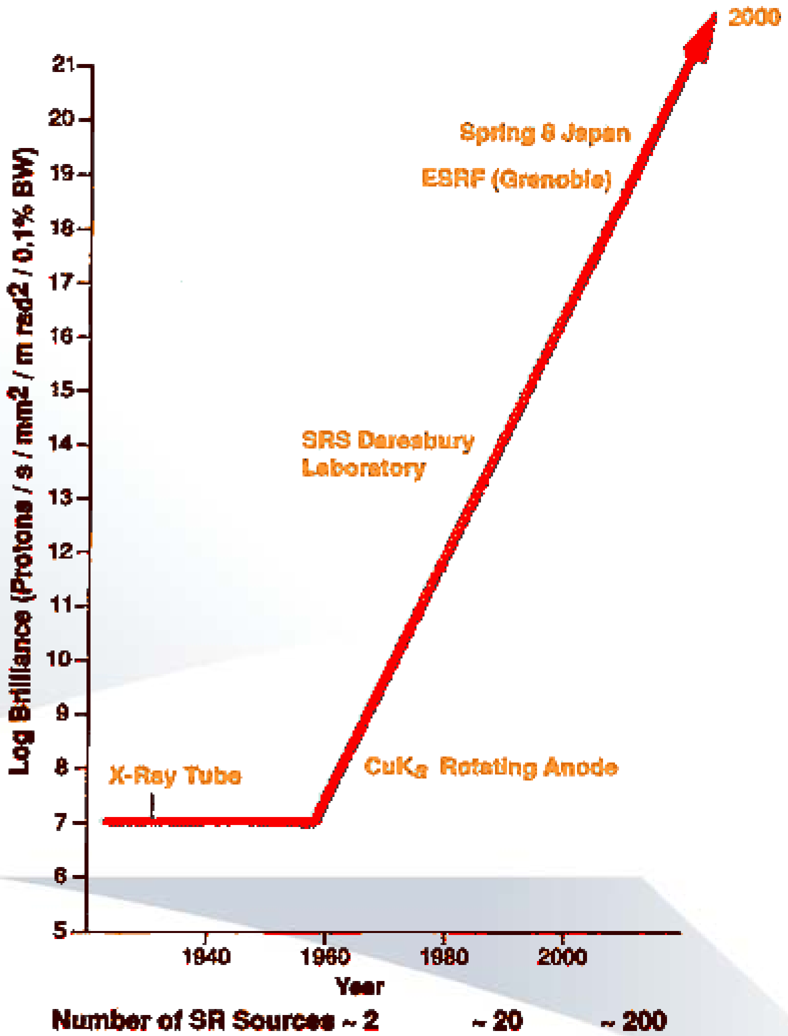
HISTORY OF

X-RAY SOURCES

1960's: First uses of SL

1977: First dedicated SL source Tantalus, U. Wisconsin

1978: Daresbury



Synchrotron Light Definition

The synchrotron light source is the radiation emitted by the electrical charges accelerated in a synchrotron at a rate:

$$dE/dt = -2/3 \cdot e^2 a^2 / c^3$$

(observed 1947)

Power radiated:

$$W(keV/turn) = 8.85\ E^4\ (GeV)\ /\ r\ (m)$$
$$= 26.5\ E^3\ (GeV) \cdot B(T)$$
$$= 87.45\ E^2\ (GeV) \cdot B^2\ (T)\ /\ r\ (m)$$

Synchrotron Light Characteristics

Continuous spectrum, from infrared to X-rays, with

E_{crit} (keV) = 0.665 E^2 (GeV) B(T)

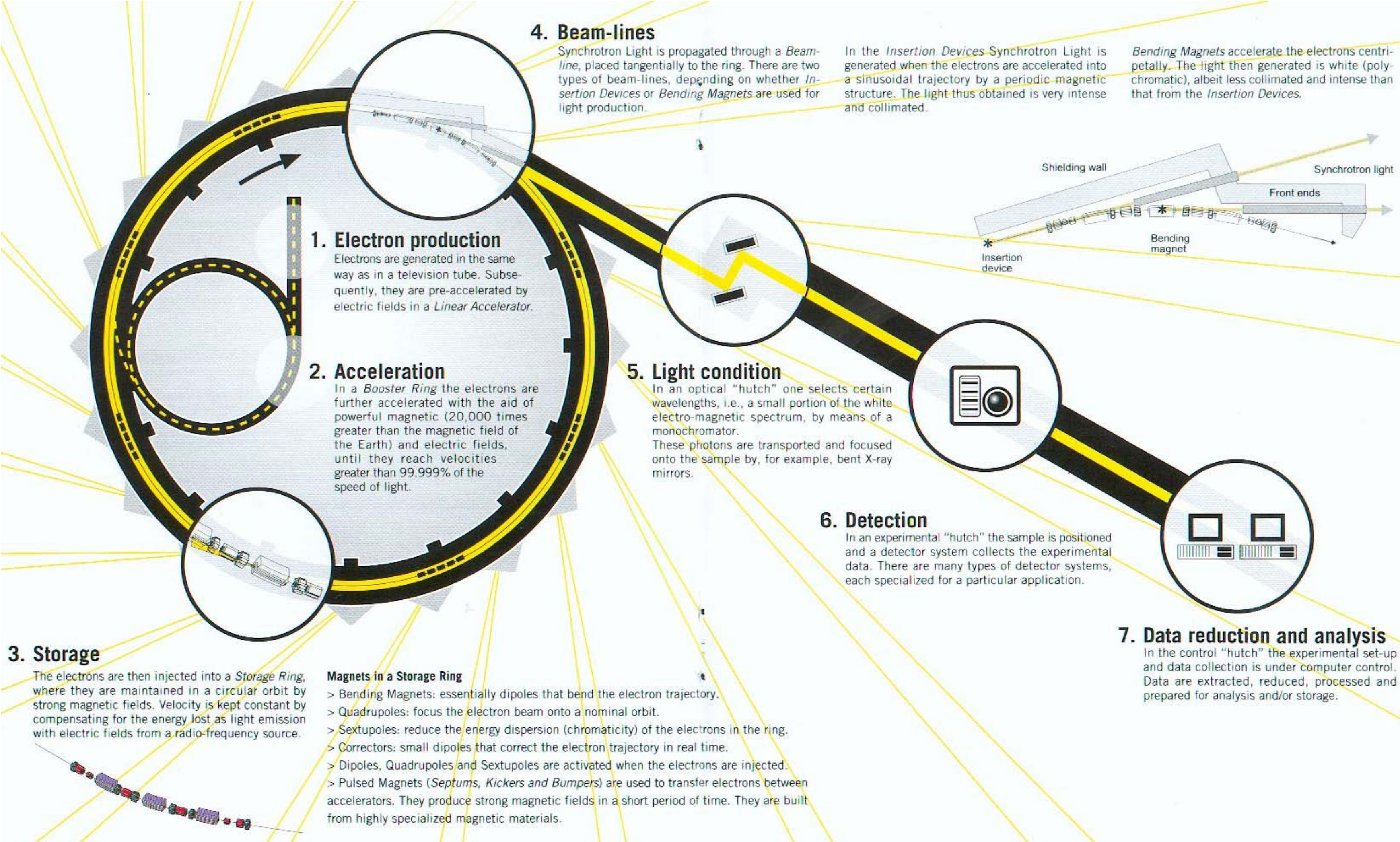
Intense, bunch form

J(rad) = 0.51/E (MeV)

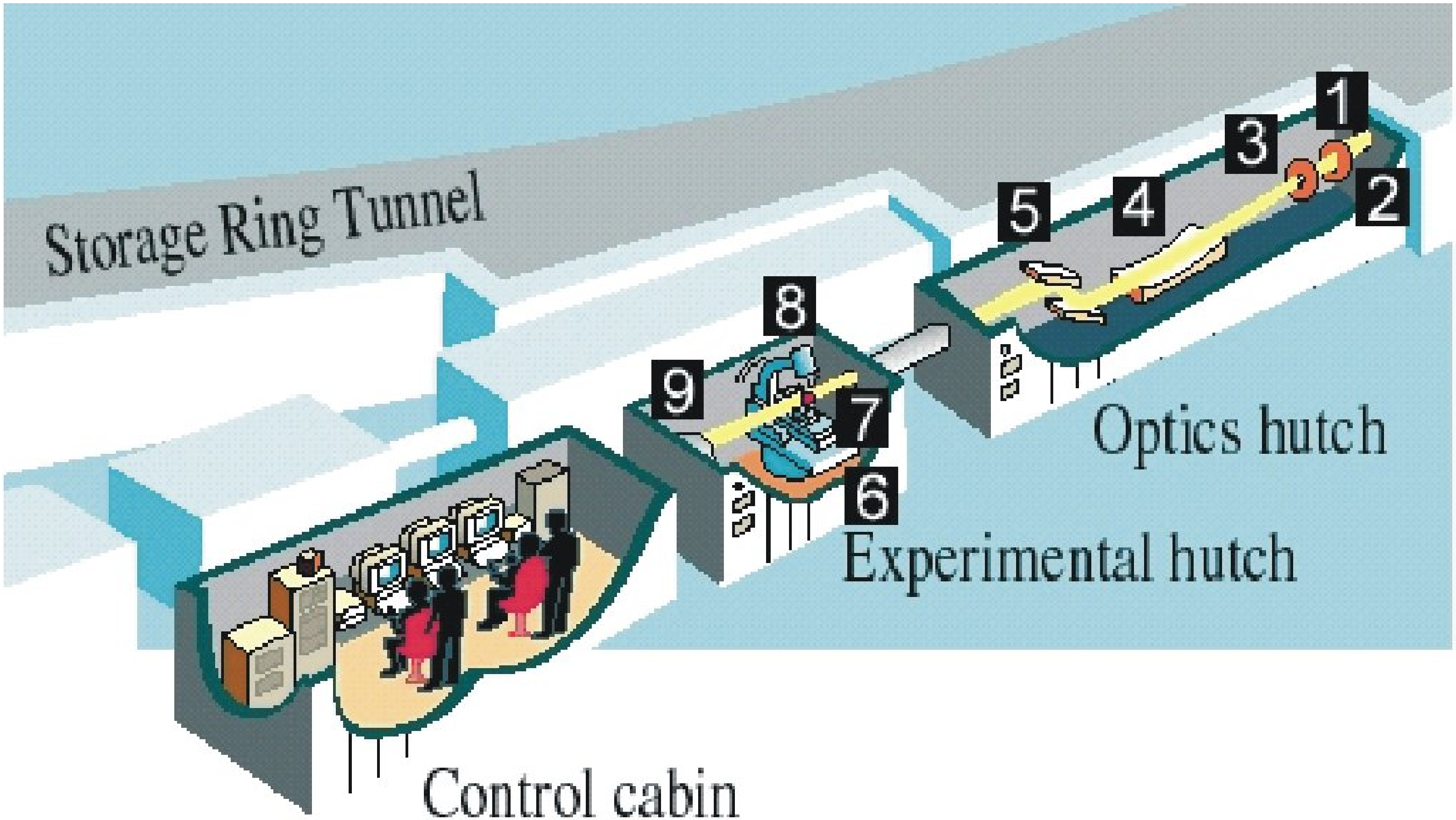
Polarized on the orbit plane

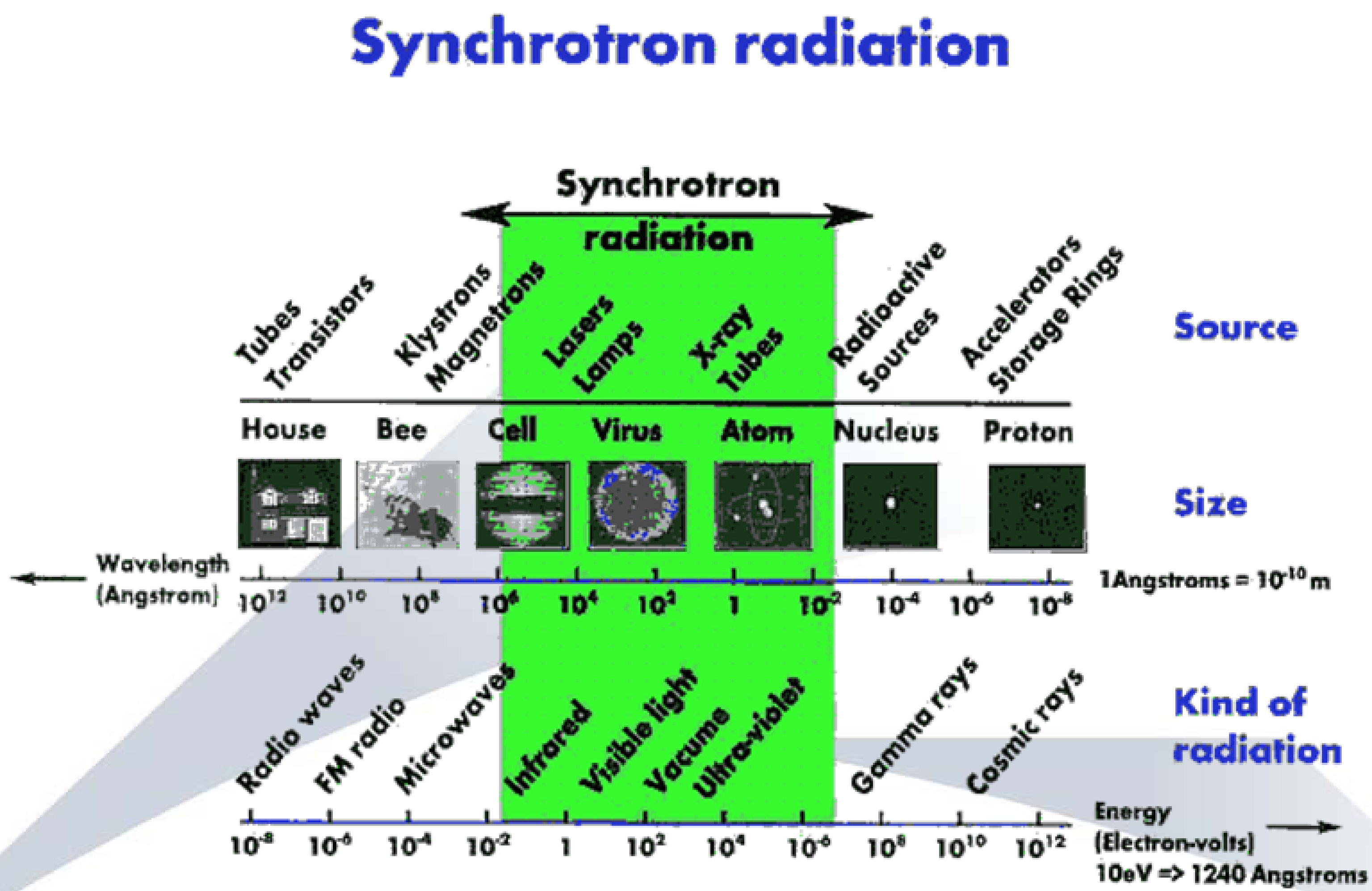
With **time structure**

Synchrotron Light Source Description



Synchrotron Light Source Description




Synchrotron radiation
Synchrotron
radiation
Tubes
Transistors
Klystrons
Magnetrons
Lasers
Lamps
X-ray
Tubes
Radioactive
Sources
Accelerators
Storage Rings
Source
House
Bee
Cell
Virus
Atom
Nucleus
Proton
Size
Wavelength
(Angstrom)
10^{12} 10^{10} 10^{8} 10^{6} 10^{4} 10^{2} 1 10^{-2} 10^{-4} 10^{-6} 10^{-8}
1Angstroms = 10^{-10} m
Radio waves
FM radio
Microwaves
Infrared
Visible light
Vacume
Ultra-violet
Gamma rays
Cosmic rays
Kind of
radiation
10^{-8} 10^{-6} 10^{-4} 10^{-2} 1 10^{2} 10^{4} 10^{6} 10^{8} 10^{10} 10^{12}
Energy
(Electron-volts)
10eV => 1240 Angstroms

Synchrotron Light Source Description

Synchrotron Light sources in Western Europe

City	Facility	E (GeV)	City	Facility	E (GeV)
Karlsruhe	ANKA	2,5	**Grenoble**	ESRF	6
Berlín	BESSY II	1,7	**Orsay**	LURE ACO	0,8
Dortmund	DELTA	1,5	***Orsay***	***SOLEIL***	***2,75***
Bonn	ELSA II	1,5-3,5	**Frascati**	DAFNE	0,51
Hamburg	DESY	4,5	**Trieste**	ELETTRA	1,5-2
	HASYLAB	7-14	***Didcot***	***DIAMOND***	***3***
Aarus	ASTRID I	0,6	**Amsterdam**	AmPS	0,9
	ASTRID II	*1,4*	**Eindhoven**	EUTERPE	0,4
Lund	MAX I	0,55	**Villigen**	**SLS**	**2,4**
	MAX II	1,55	***Barcelona***	***ALBA***	***2,5***

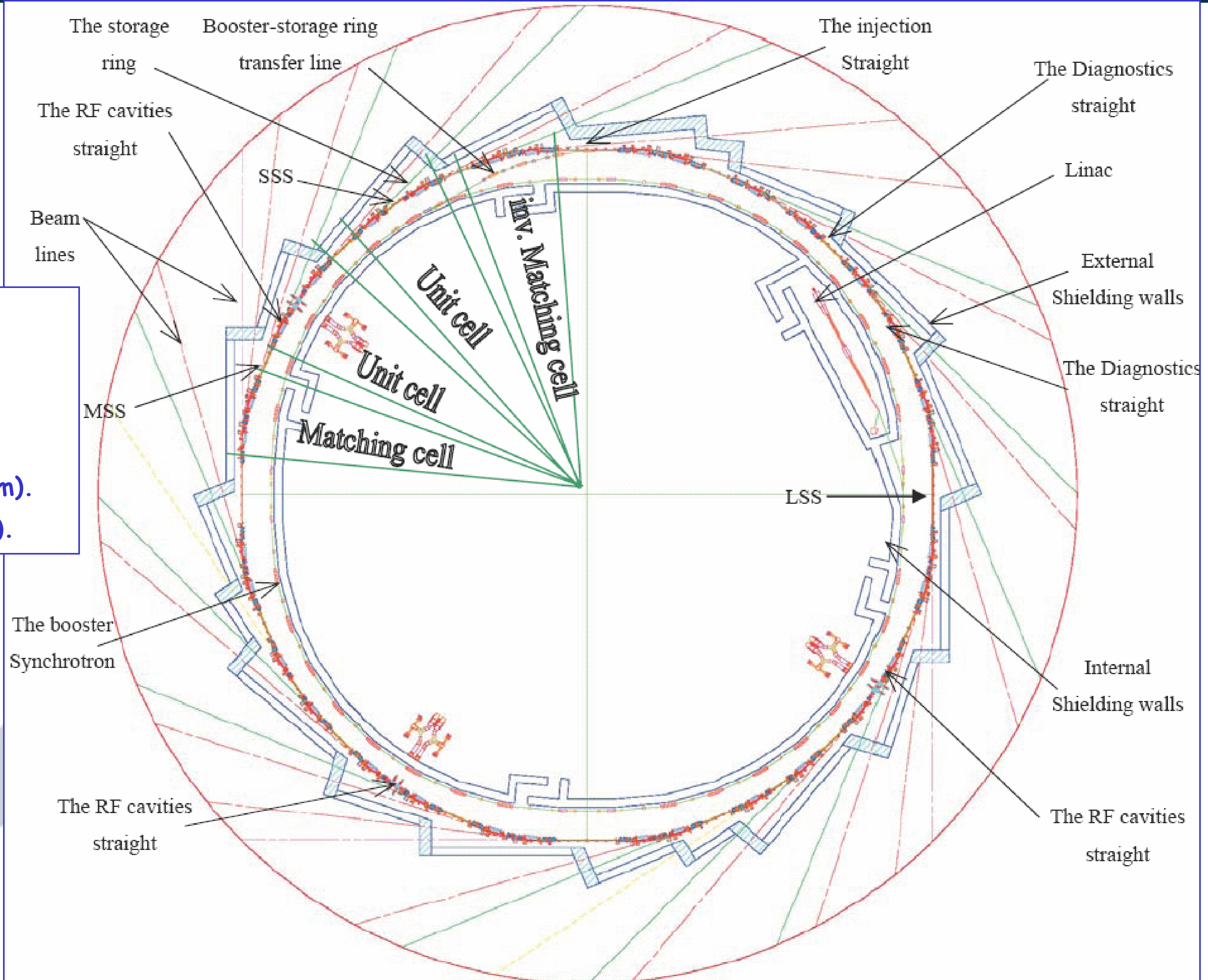
Italic facilities in design or construction
Bold 3rd generation facilities

Accelerators Complex

- Lattice
- Injector
- Storage Ring
- Magnets
- Vacuum System
- Girders
- RF System
- Insertion Devices

Lattice

* 8 unit cells
* 8 Matching cells
* Straights:
  - 4 LSS (8m).
  - 12 MSS (4.2m).
  - 8 SSS (2.6m).

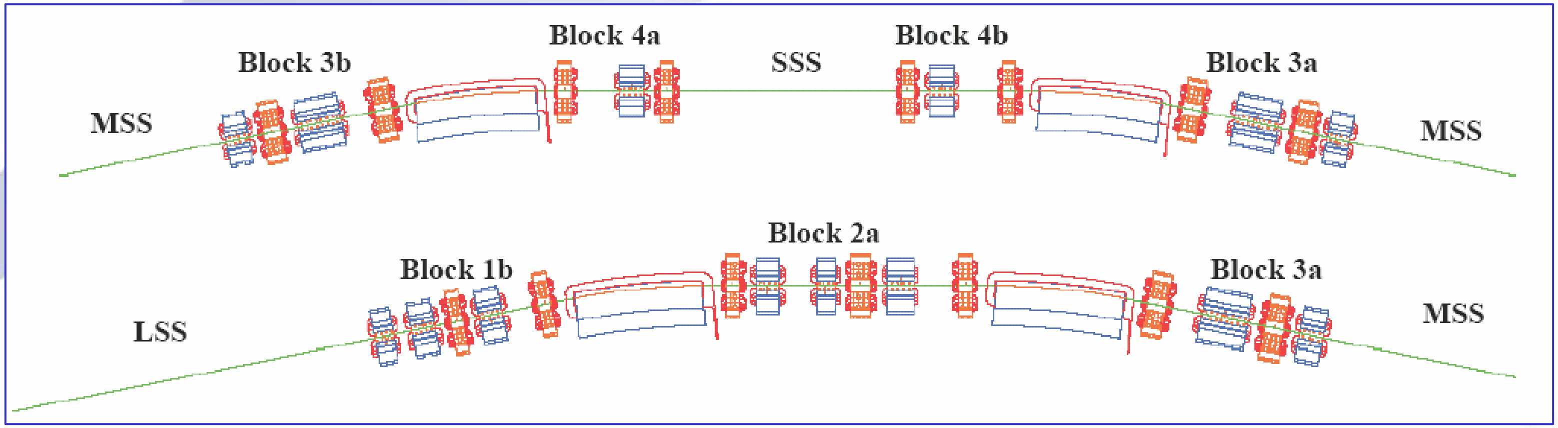


Lattice

Energy	GeV	3.0
Nominal current	mA	250
Design current	mA	400
Horizontal Emittance	nm.rad	4.3
Lattice		Expanded DBA
Storage ring Circumference	m	268.8
No. of dipoles		32
Bending angle	mrad	196.34
Radius of curvature	m	7.047042
Dipole magnetic field	T	1.42
Critical energy from dipole	keV	8.5
Total photon flux at the design current	Ph/sec	$9.7 \cdot 10^{20}$
Total power at the design current	kW	407
Harmonic number		448
Frequency	MHz	500
Momentum Compaction Factor		$8.8 \cdot 10^{-4}$
Chromaticity (Horizontal/Vertical)		-39.8/-25.6

Unit Cell

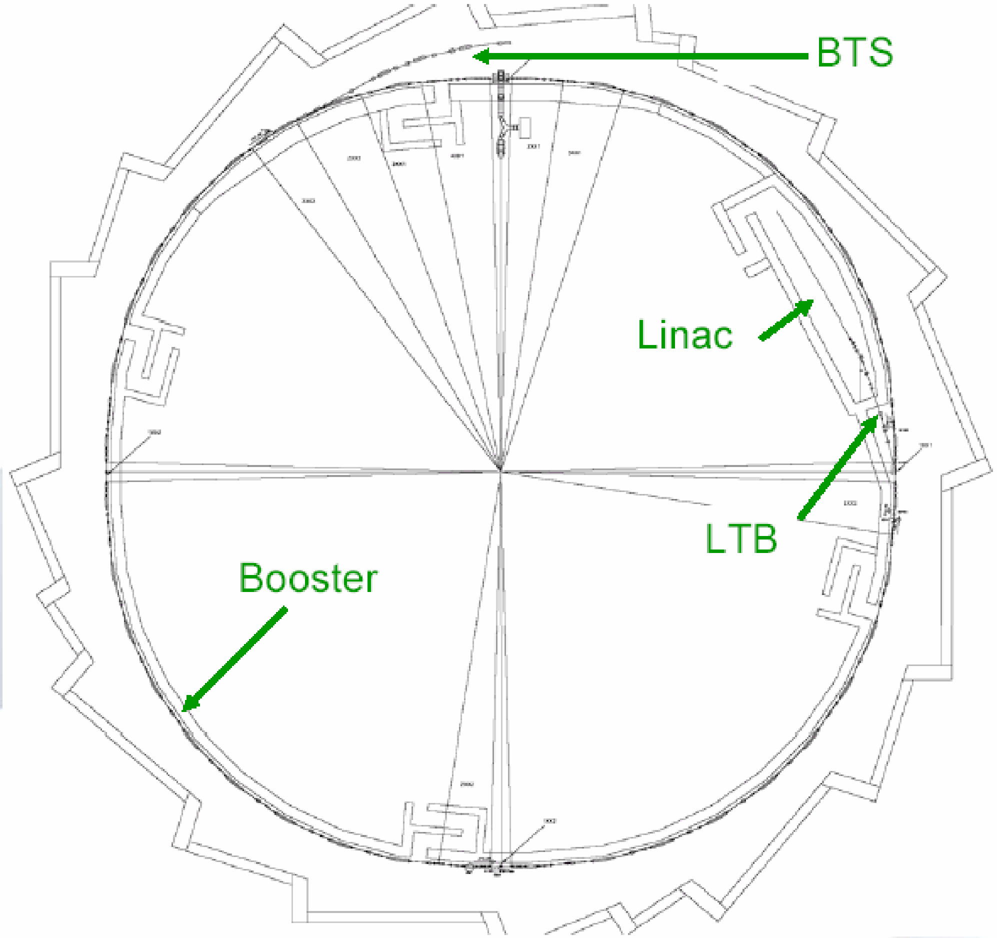
Matching Cell



Injector

Injector consists of:

- 100 MeV Linac
- 3 GeV booster synchrotron
- BTS, LTB transfer lines

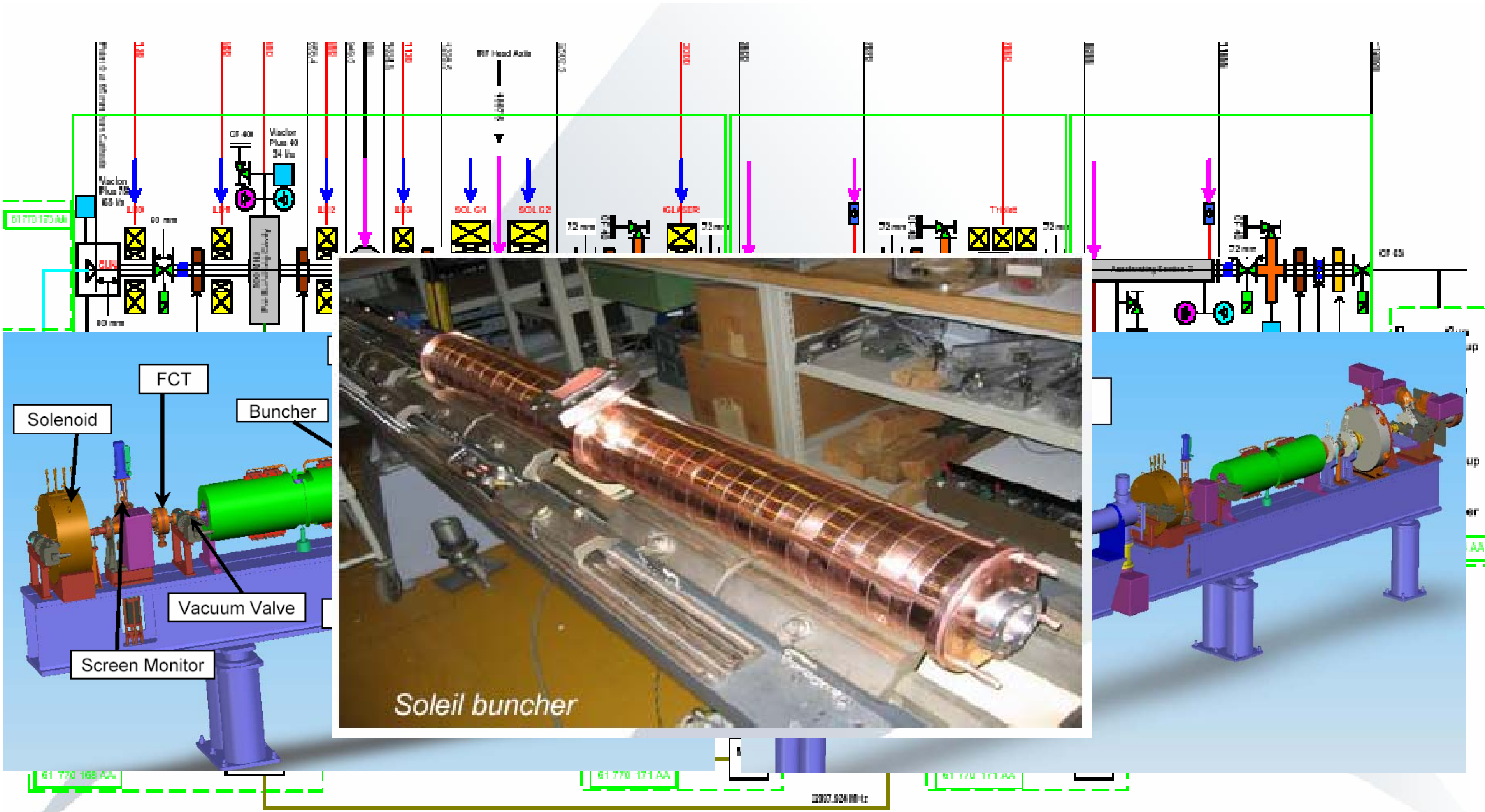


Injector

Linac Technical Specifications

Parameter @ Linac Exit	Single-bunch mode	Multi-bunch mode
Working frequency	3 GHz	3 GHz
Bunch length	< 1ns (FWHM)	0.3 to 1μs
Charge	≥ 2 nC (Old number: ≥ 1.5 nC)	≥ 4 nC (Old number: ≥ 3nC)
Energy	≥100MeV	≥100MeV
Pulse to pulse energy variation	≤0.25 % (rms)	≤0.25 % (rms)
Relative energy spread	≤0.5 % (rms)	≤0.5 % (rms)
Norm. Emittance (1σ)	≤ 30 π mm mrad (both planes) (Old number: ≤ 50 π mm mrad)	≤ 30 π mm mrad (both planes) (Old number: ≤ 50 π mm mrad)
Single bunch purity	Better than 1%	--
Pulse to pulse time jitter	≤100ps (rms)	≤100ps (rms)
Repetition rate	3 to 5 Hz	3 to 5 Hz

Linac Functional Scheme



Injector

Booster characteristics:

• Located in the same tunnel than the Storage Ring.Circumference 249,9 m.

• TME Lattice, emittance 9π nmrad.

• 40 combined function magnets (vertical focusing), 60 quadrupoles (horizontal focusing), and 16 sextupoles.

• Two different vacuum chambers crossections, eliptical (46 x 17,6 mm), circular diameter 29 mm.

• Diagnostics. 44 BPM's, 4 fluorescent screens, 3 SRM, 2 current transformers.

Injector

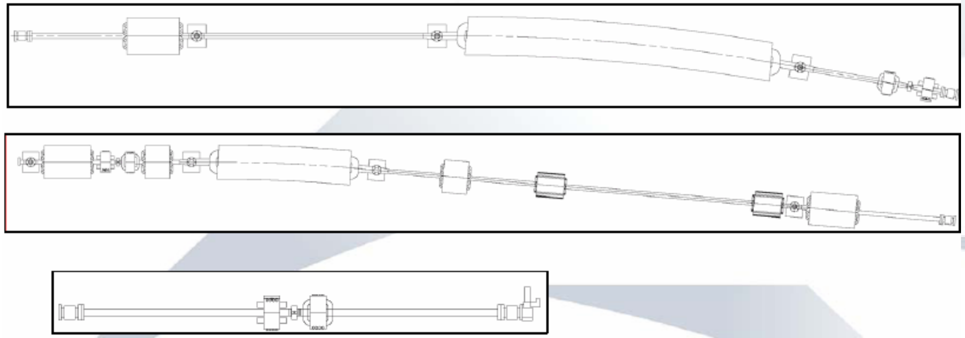
Magnets characteristics

Number	Type	Mag. length	Strength
32	combined dipole	2.0	0.87 T
8	combined dipole	1.0	0.87 T
16	quadrupole	0.180	10 T/m
8	quadrupole	0.340	10 T/m
36	combined quadrupole	0.340	17 T/m
24	sextupole	0.150	400 T/m^2
100	correctors	0.100	0.4 mrad

Vacuum chambers

- 3 types of vacuum chamber

2m long bending + quad	5 m	x32
1 m long bending + quads	3 m	x 8
straight section	2 m	x 4 (inj., RF, diagnostic)



RF System

PETRA 5 Cells

Storage Ring

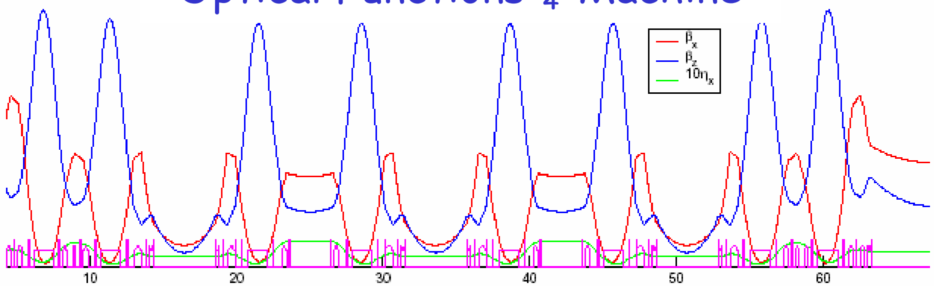
Storage Ring parameters

Name	Value
Circumference (C)	268.8 m
Energy (E)	3 GeV
Horizontal Emittance (ϵ_x)	4.3 nm-rad
Horizontal Tune (Q_x)	18.178
Vertical Tune (Q_y)	8.37
Horizontal Chromaticity (ξ_x)	-39
Vertical Chromaticity (ξ_y)	-27
Momentum Compaction Factor (α_p)	8.8×10^{-4}
Second Order α_p (α_{p2})	2.1×10^{-3}
Energy Spread ($\Delta E/E$)	1.05×10^{-3}
Revolution Frequency (f_0)	1.115 MHz
Horizontal Damping Time (τ_x)	4.1 ms
Vertical Damping Time (τ_y)	5.3 ms
Longitudinal Damping Time (τ_ϵ)	3.1 ms
Horizontal (J_x)	1.3
Vertical Partition Number (J_y)	1
Longitudinal Partition Number (J_ϵ)	1.7
Energy Loss per turn (U_0)	1.01 MeV
Harmonic Number (h)	448

Beam size and divergences

Name	σ_x	σ'_x	σ_y	σ'_y
	[μm]	[μrad]	[μm]	[μrad]
Long ID	266	20	15.6	3.2
Medium ID	132	47	7.4	6.2
Short ID	308	22	15.4	3.2
Bending SP	49	109	32	2.2

Optical Functions $\frac{1}{4}$ Machine



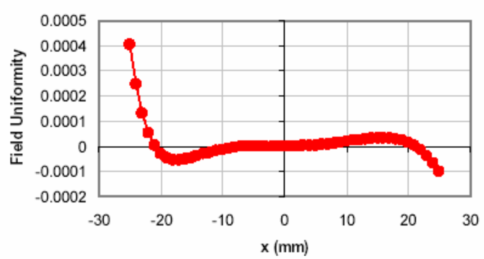
Storage Ring / Magnets

SR Magnets system characteristics:

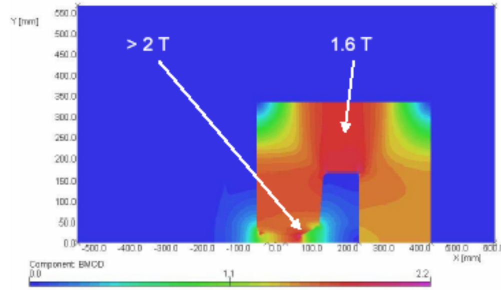
- 32 combined function dipole magnets, 112 quadrupoles and 120 sextupoles.
- The combined dipoles have a central field of 1.42 T and a gradient of 5.56T/m and a central gap of 36 mm. Equipped with trim coils to correct for the right integrated field and gradient.
- Quadrupoles and sextupoles optimised for large gradient minimizing impact on vacuum conductance.
- Sextupoles equipped with additional coils for correction, each pole two additional windings for for vertical and horizontal dipolar correction as well as to introduce skew quadrupole component.
- Each quadrupole will have an independent power supply, sextupoles powered in families (9).

Storage Ring / Magnets

Magnetic field good region, optimised with OPERA-2d

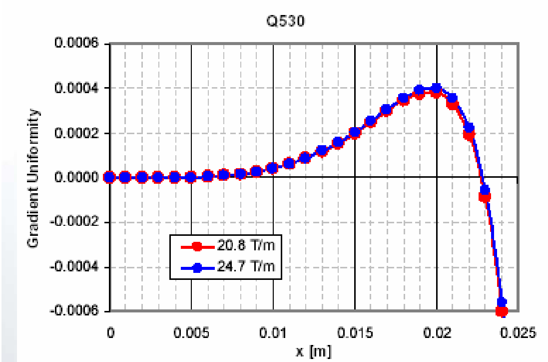


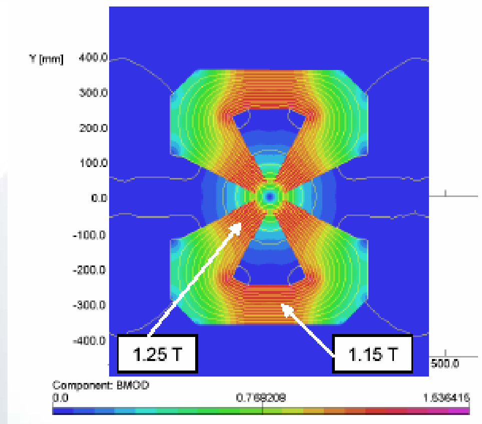
B_0=1.42 T
G_0=5.57 T/m



Dipole combined magnets

OPERA-2d model





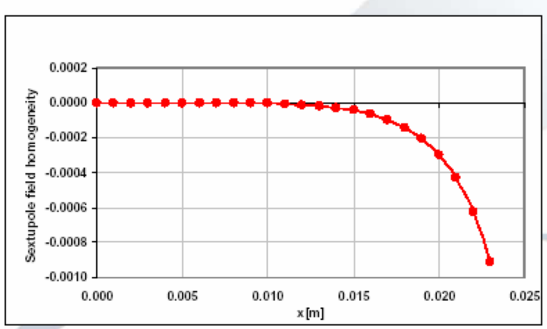
Quadrupoles

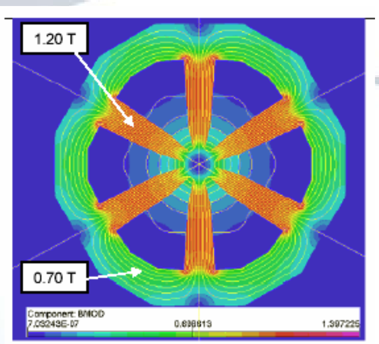
All sextupoles will be equipped with steering coils

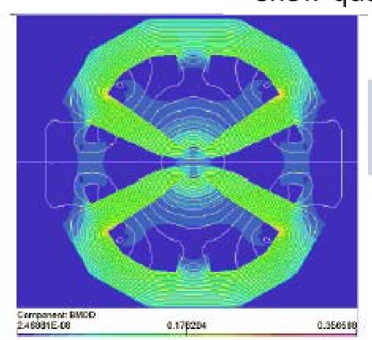
- horizontal steering 0.8 mrad
- vertical steering 0.8 mrad
- skew quadrupole g_x=0.2 T/m

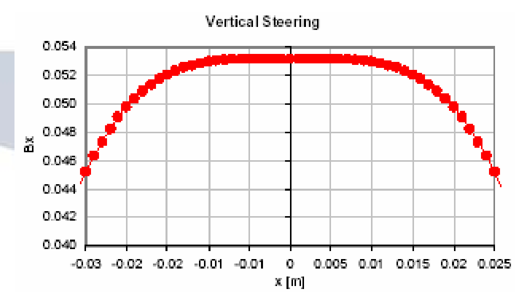
Sextupoles

Good field region from Opera-2d









Storage Ring / Vacuum

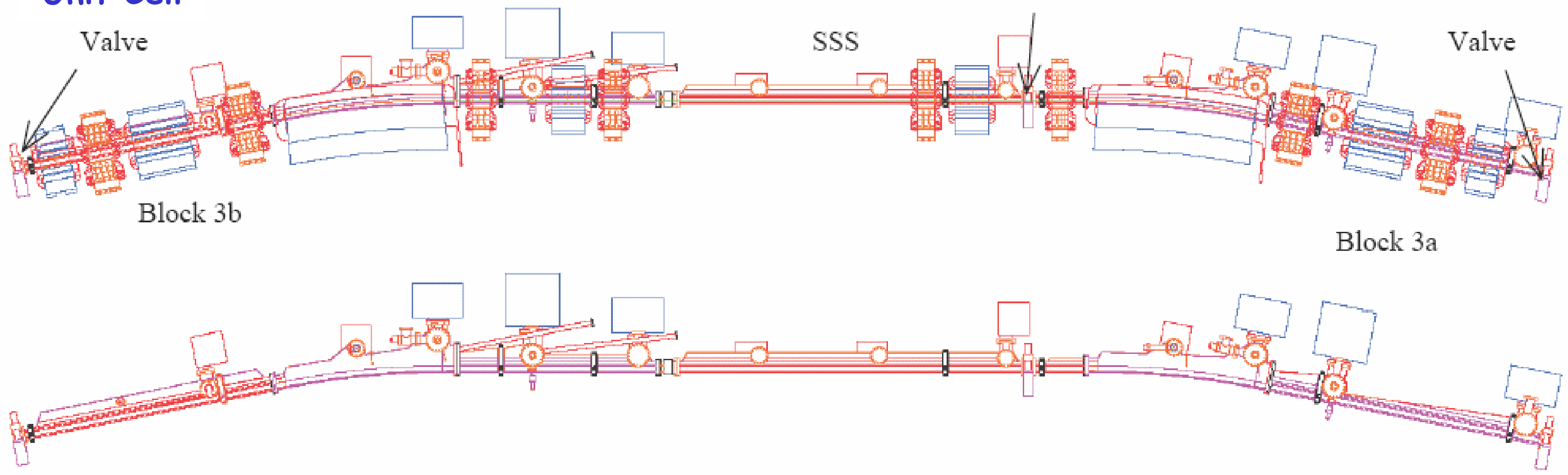
SR Vacuum system characteristics:

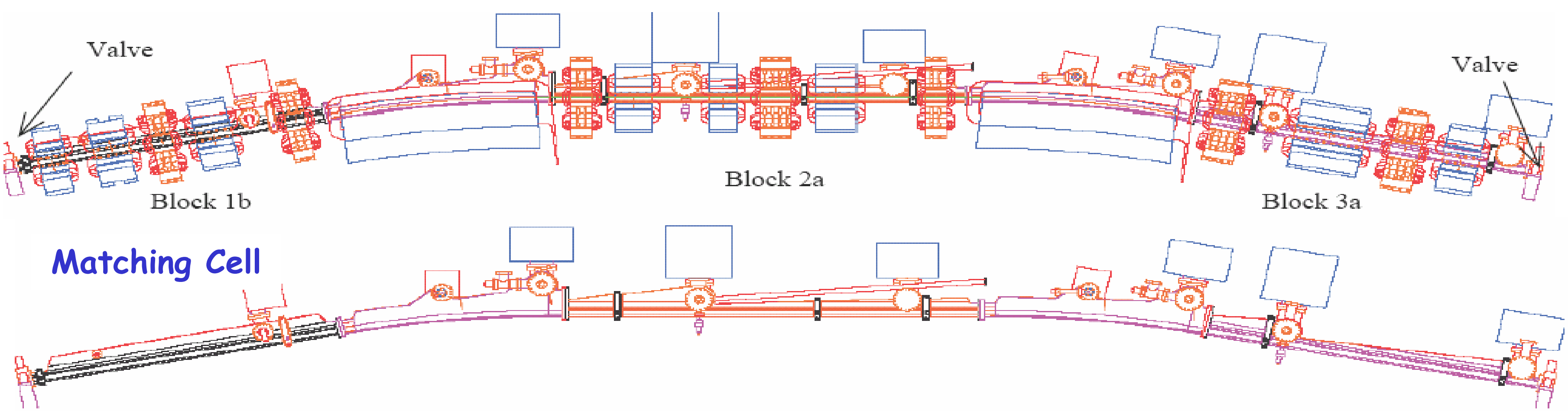
- SR divided in 16 sections by UHV gate valves.
- Stainless steel vacuum chamber, antechamber design. Chamber dimensions, vertical aperture 28 mm, 72 mm width. Slot 15 mm height and 20 mm width.
- Antechamber hosting synchrotron radiation discrete absorbers.
- Pumping by Sputter Ion pumps and NEG pumps, total pumping speed 57400 l/s.
- Average dynamic pressure of around 1.0E-9 mbar, beam lifetime > 15 hours.
- No in-situ bake out foreseen. Vacuum section conditioned ex-situ and installed under vacuum.

Storage Ring / Vacuum

- Stainless steel chamber. Copper/GlidCop absorbers.
- Antechamber + Lumped absorbers.

Unit Cell

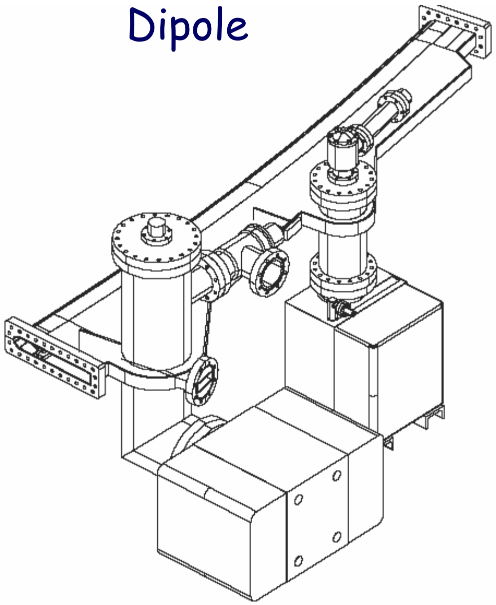




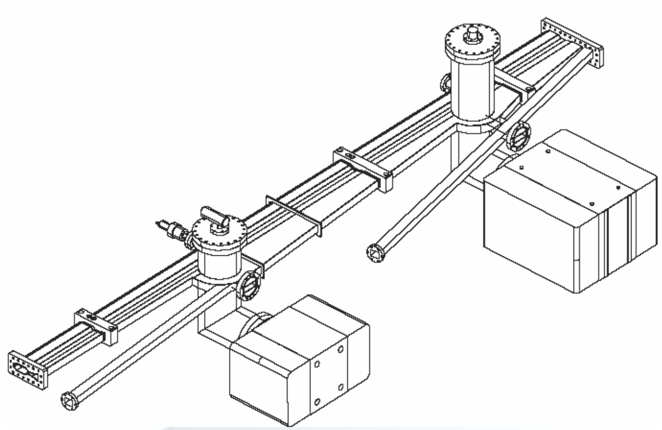
Matching Cell

Storage Ring / Vacuum

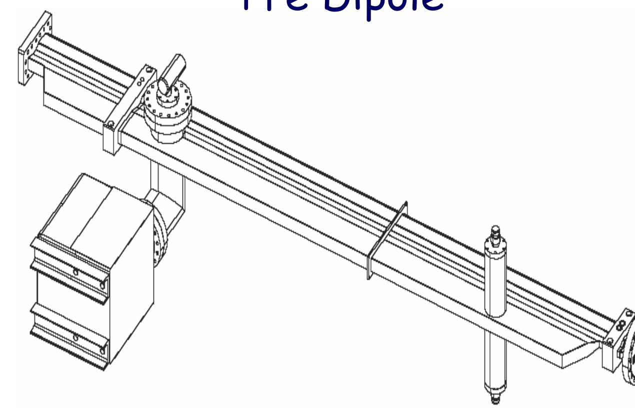
Dipole

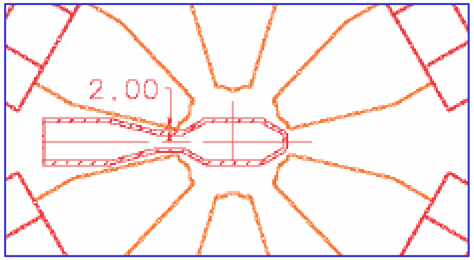


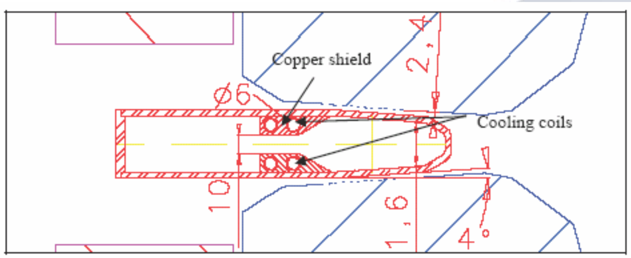
Post Dipole

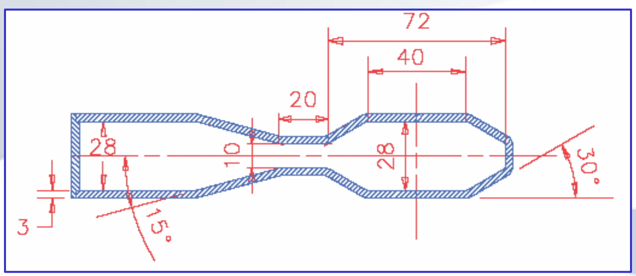


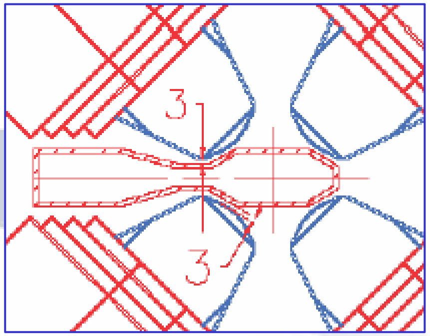
Pre Dipole











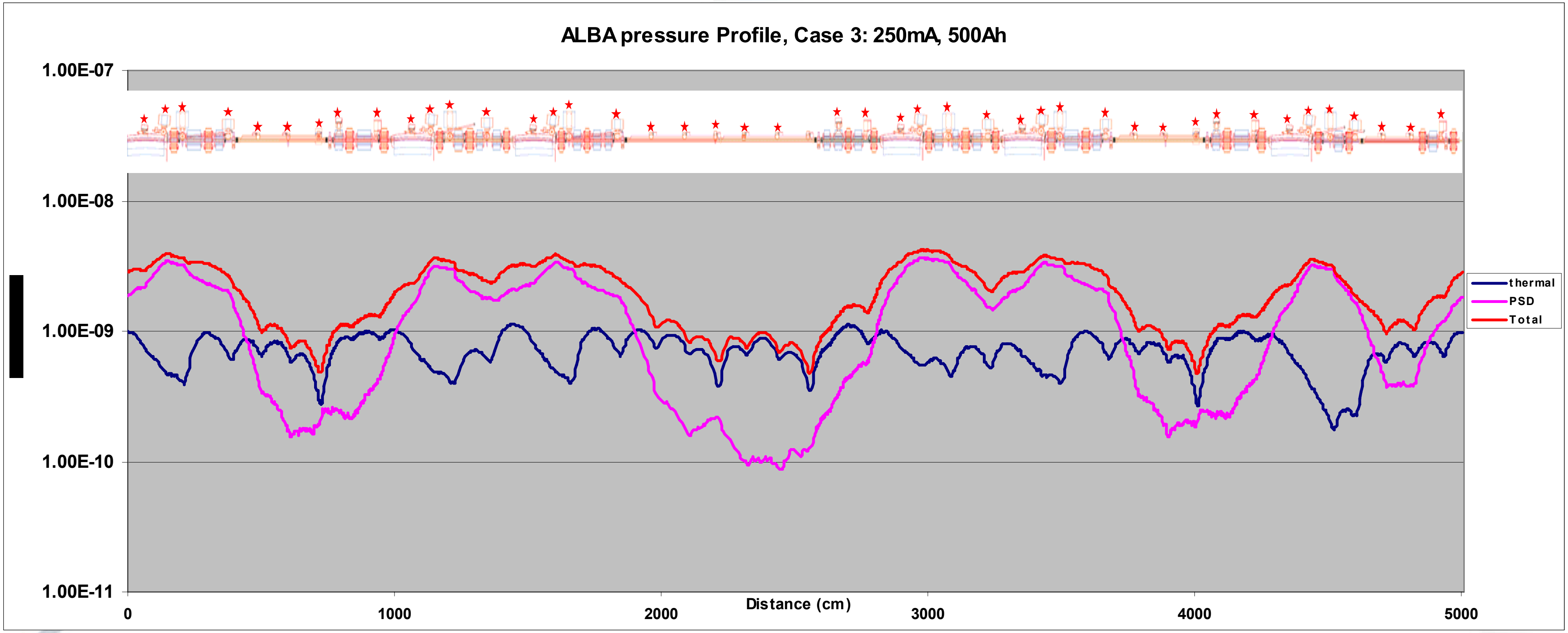
Storage Ring / Vacuum

Dynamic Pressure

E= 3 GeV

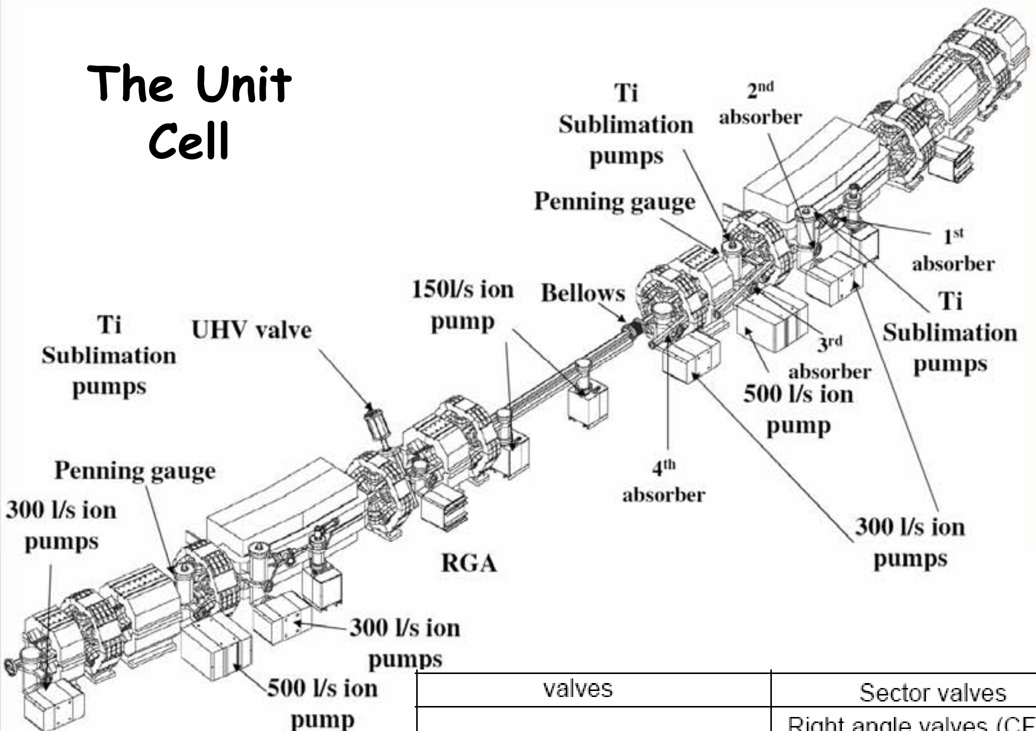
Operation with the nominal current (250 mA) after 500 Ah, $h_{PSD}=2\cdot10^{-6}$ molec/ph.

Total Pressure= $2.0\cdot10^{-9}$ mbar

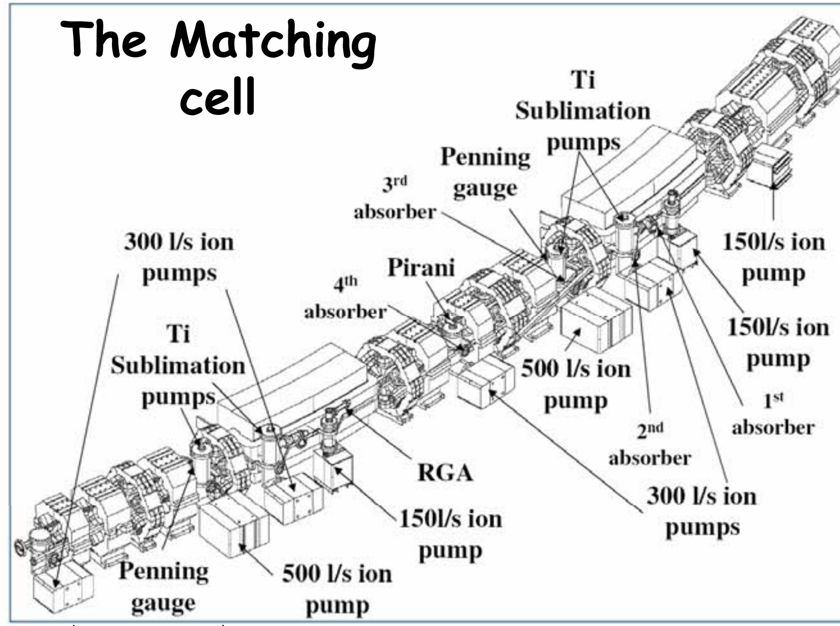


Storage Ring / Vacuum

The Unit Cell



The Matching cell



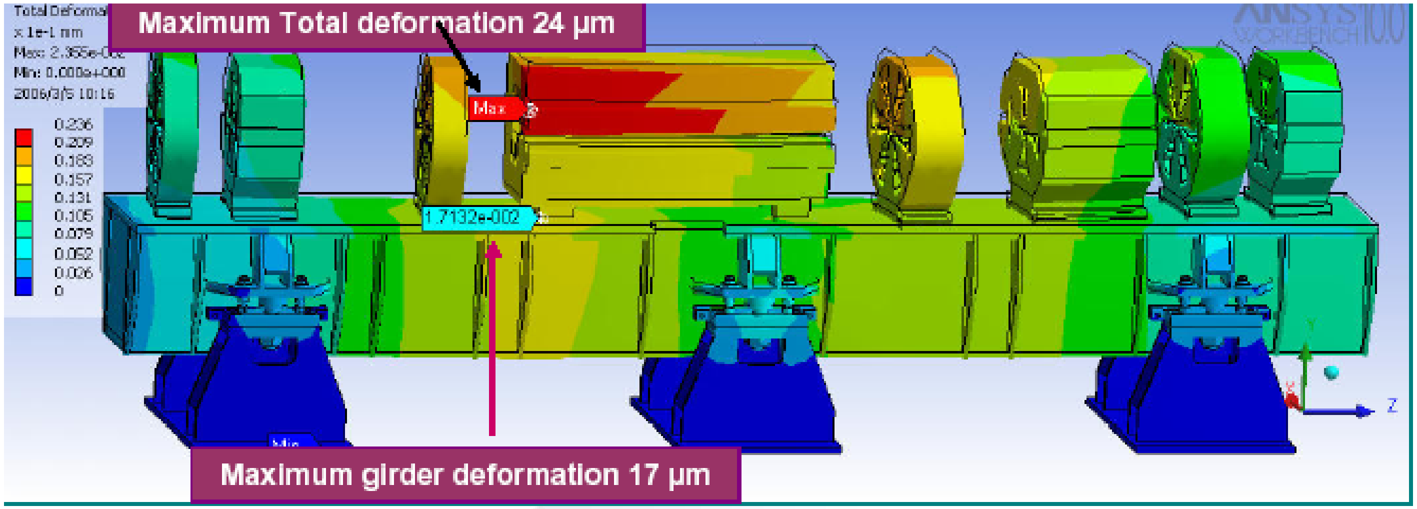
valves	Sector valves	43
	Right angle valves (CF 63)	55
	Right angle valves (CF 40)	35
Ion pumps	150l/s	129
	300l/s	70
	500l/s	38
Ion pumps controller	One pump per HV channel	118
TSP		64
TSP controllers		64
NEG pumps		32
NEG pumps controllers		32
Pirani		31
IMG		52
Gauges controllers		26
Fixed RGA		19
Leak detector		3
Roughing stations		5

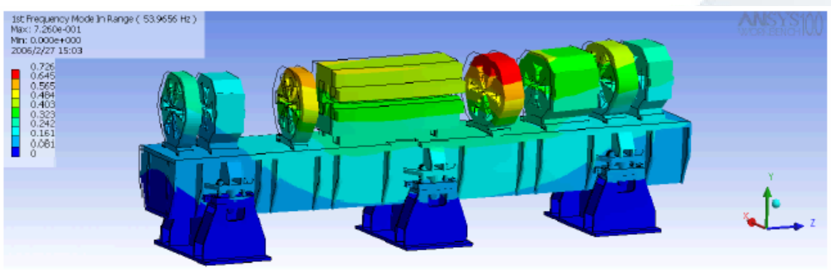
Storage Ring / Girders

SR Girder system characteristics:

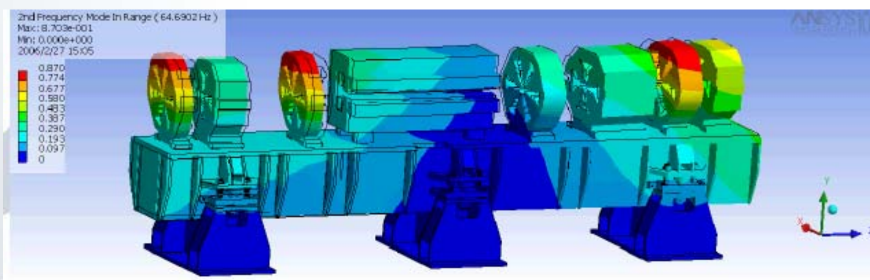
- Design criteria, high stiffness and high eingenfrequencies.
- Mounting dipole and surrounding quadrupoles on the same girder compensates the effects of the reverse focusing magnets.
- In the case of the ALBA lattice girders up to 6m long are necessary..
- Implementing 3 pedestals, 6 feet, first eigenfequency is calculated at 40Hz.

Storage Ring / Girders

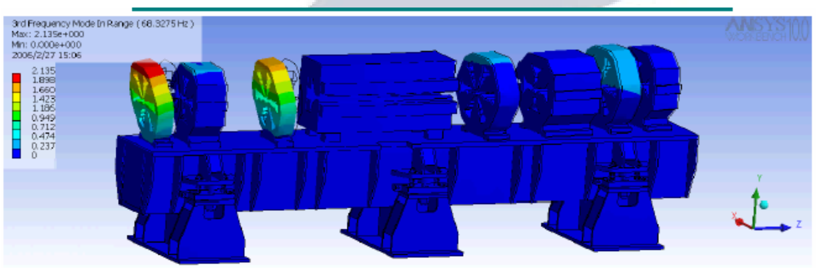




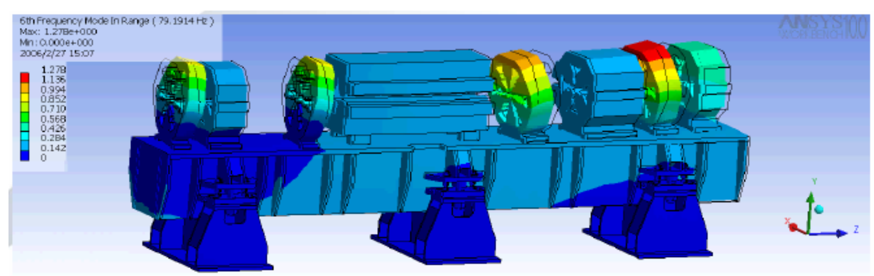
1st Frequency 54 Hz (rotation around longitudinal axis with girder bending)



2nd Frequency 67 Hz (twist)

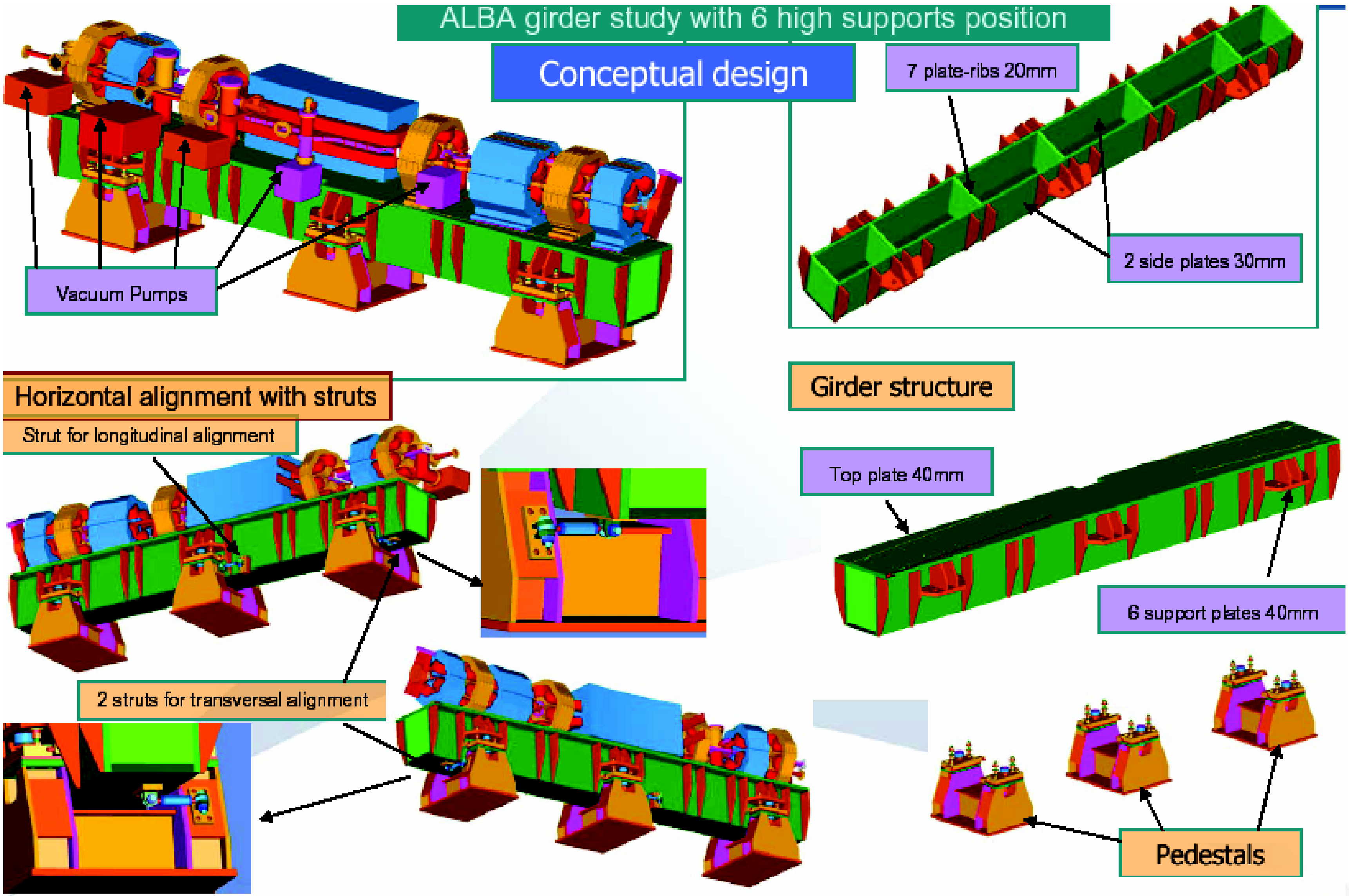


3rd Frequency 68 Hz, 4th Frequency 71 Hz, 5th Frequency 77 Hz (vibration of magnets)



6th Frequency 79 Hz (magnets and girder vibration along longitudinal axis)

Storage Ring / Girders

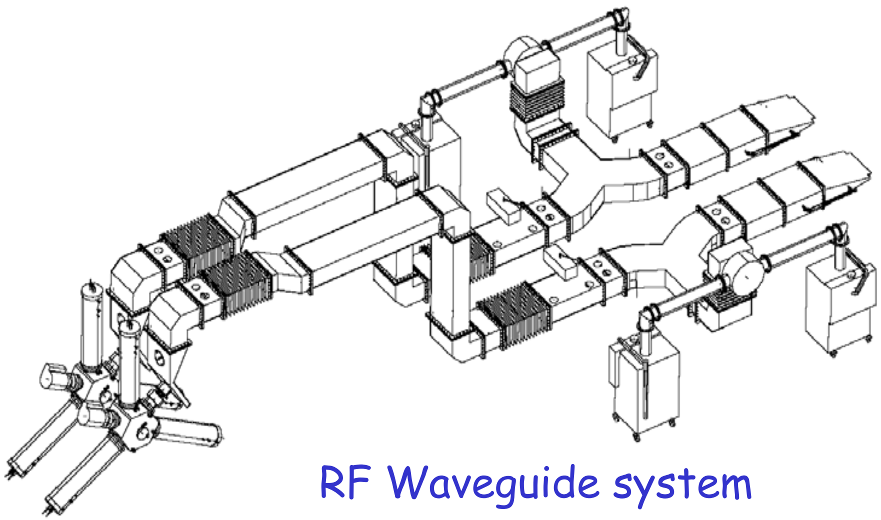


Storage Ring / RF System

SR RF system characteristics:

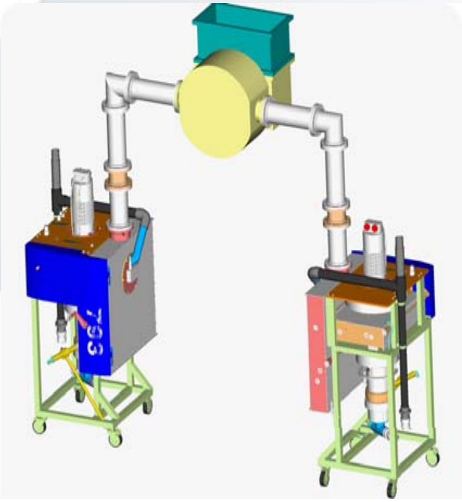
- SR energy loses, 1300 MeV/Turn
- 500 Mhz, 3% acceptance at 3.6 MV
- Composed of six 160 Kw plants. Each palnt two 80 Kw transmitters, combined through a Cavity Combiner (CaCo) to feed an individual single cell resonant cavity.
- Main cavity is a normal conducting HOM damped type, BESSY design.
- Fitting in a short straight section.

Storage Ring / RF System

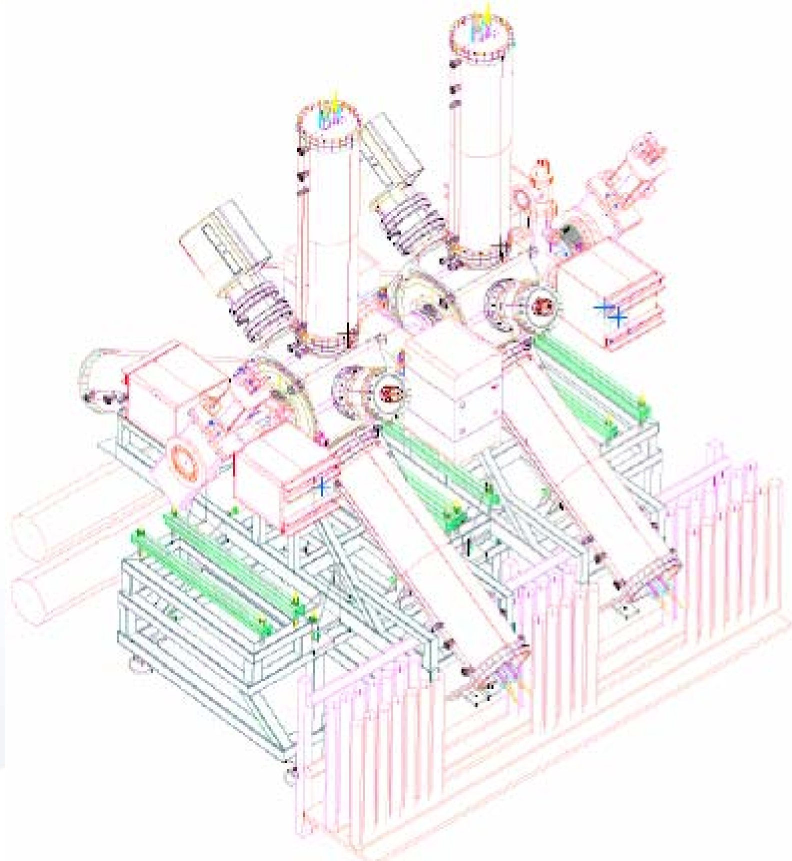


RF Waveguide system

RF Voltage	3600 kV
Beam current	400 mA
Losses (inc. IDs)	1300 keV/turn
Beam power	520 kW
CAVITY	
Insertion Length	~500 mm
Number	6
Frequency	500 MHz
Shunt Impedance	>3.1 Mohm
Voltage/cavity	600 kV
Input power coupler	160
Cooling capacity	>80
TRANSMITTER	
Tube type	IOT
Number	2 × 6
Total Power	960 kW



CaCo



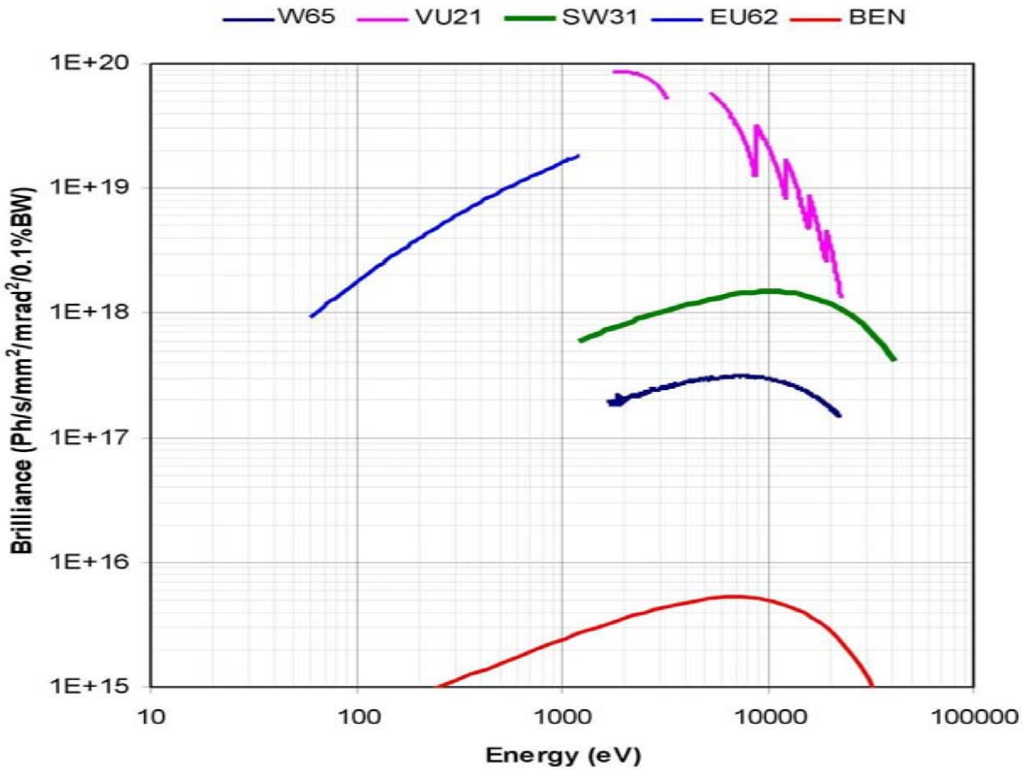
2 RF Cavities set up

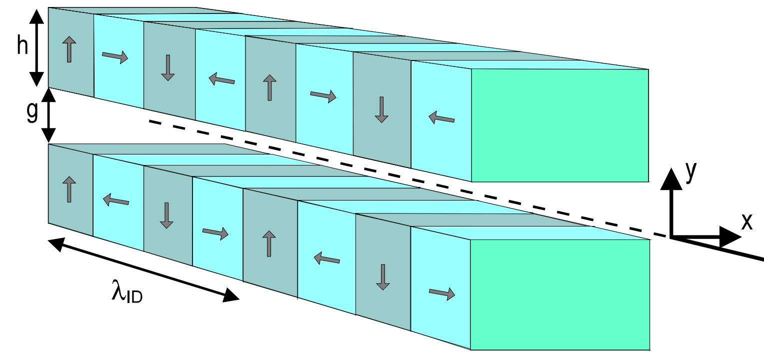
Storage Ring / Insertion devices

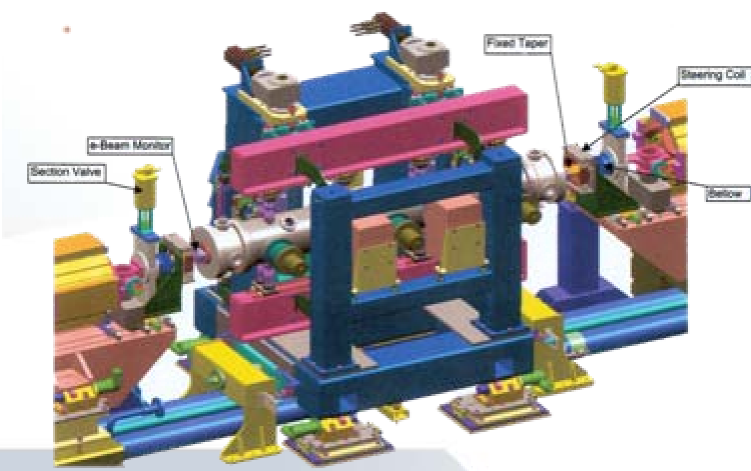
SR Insertion Devices system characteristics:

- Seven beam lines will be built, six of them based on insertion devices.
- Magnetic conceptual design completed for all except the conventional wiggler.
- 1 SC wiggler, 2 In-vacuum undulators, 2 APPLE II undulators, 1 conventional wiggler.

Storage Ring / Insertion devices







ID	Field	Period	Min.-gap	Length
SC-W-32	2.1 T	32 mm	11 mm	1.95 m
IVU-21	0.87 T	21 mm	5.5 mm	2.0 m
EU 62	0.88 T	62 mm	15.5 mm	1.5 m
EU 71	0.93 T	71 mm	15.5 mm	1.675 m
W 65	1.55 T	65 mm	11.5 mm	2.0 m

In-Vacuum
Undulator

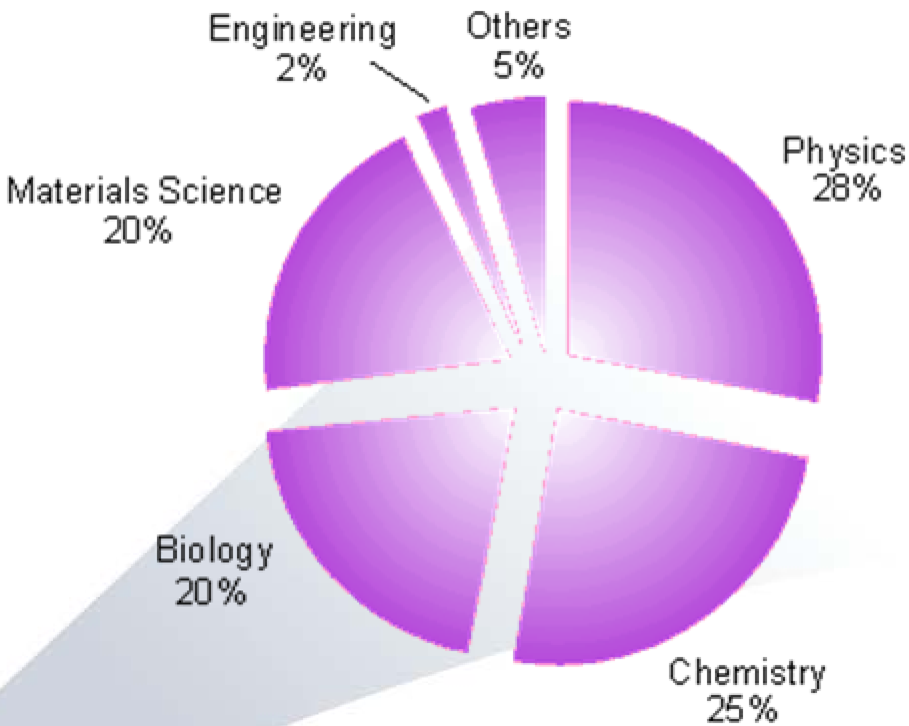
Experimental Beam Lines

- Scientific Applications
- Beam lines program

Application fields

- Physics
- Chemistry
- Material Science
- Surface Engineering
- Life Sciences
- Medicine
- Lithography i Micro-production
- Pharmacy industry

Experimental Beam Lines / Applications



Experimental Beam Lines / Applications

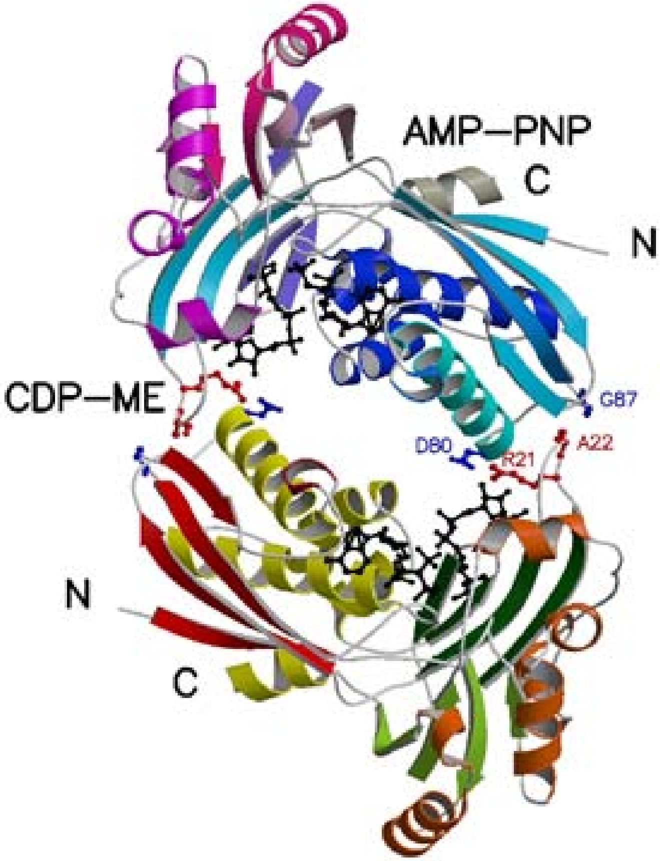
- Structural Molecular Biology
  - Definition of protein structures and viruses for the design of new drugs.
- Environmental molecular Sciences
  - Chemical structure investigation of soils and water contaminants for developing methods for their elimination, storage and treatment

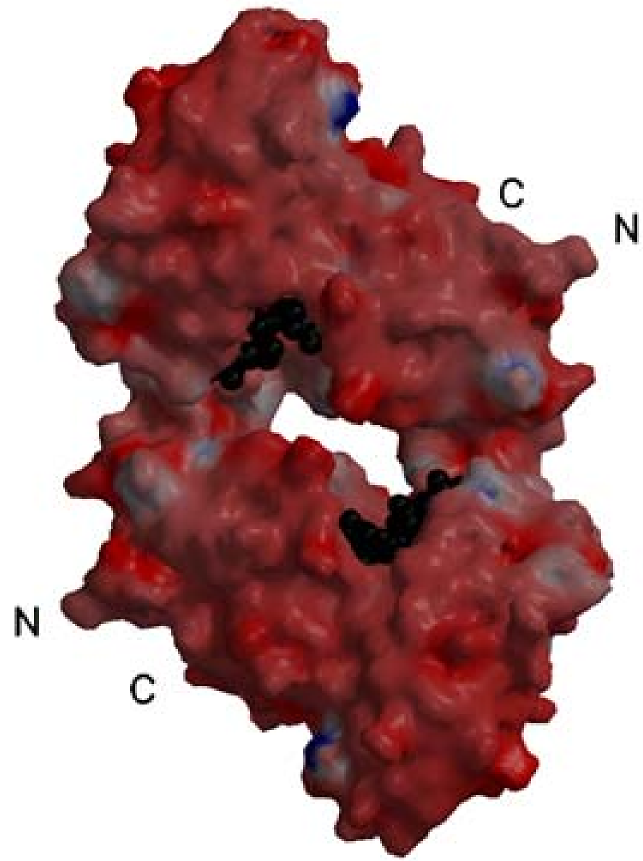
Experimental Beam Lines / Applications

- Material Science
  - Investigation of structural and electronic characteristics od a wide range of materials, i.e. polymers and semiconductors.
- Diagnosis and therapy
  - X rays use to minimize risk and collateral damage to tissues.

Experimental Beam Lines / Applications

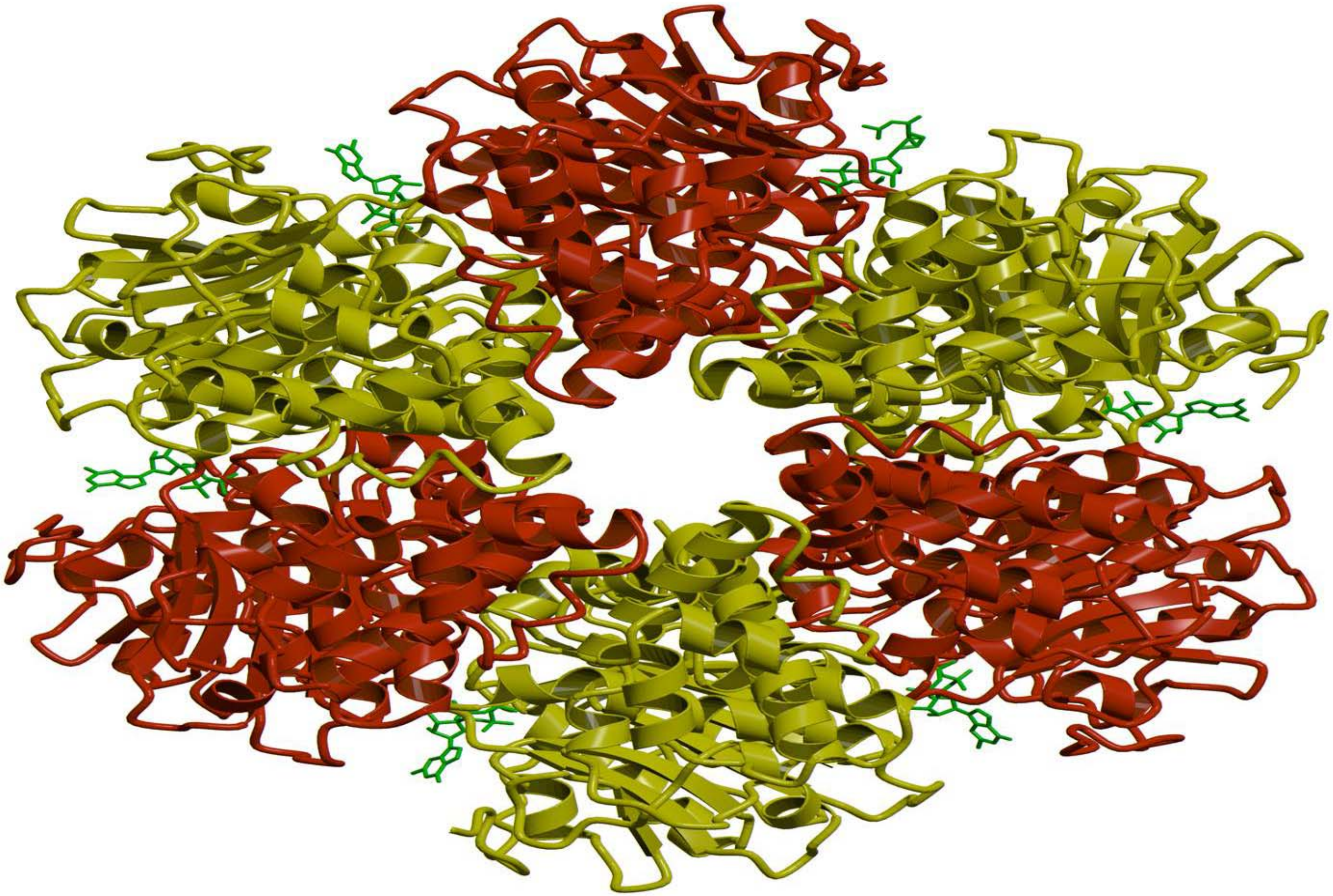
Enzim structure fundamental (CDP-ME kinase) for the development of new drugs for the bacteria diseases i.e. malaria, tuberculosis, sexual transmission.





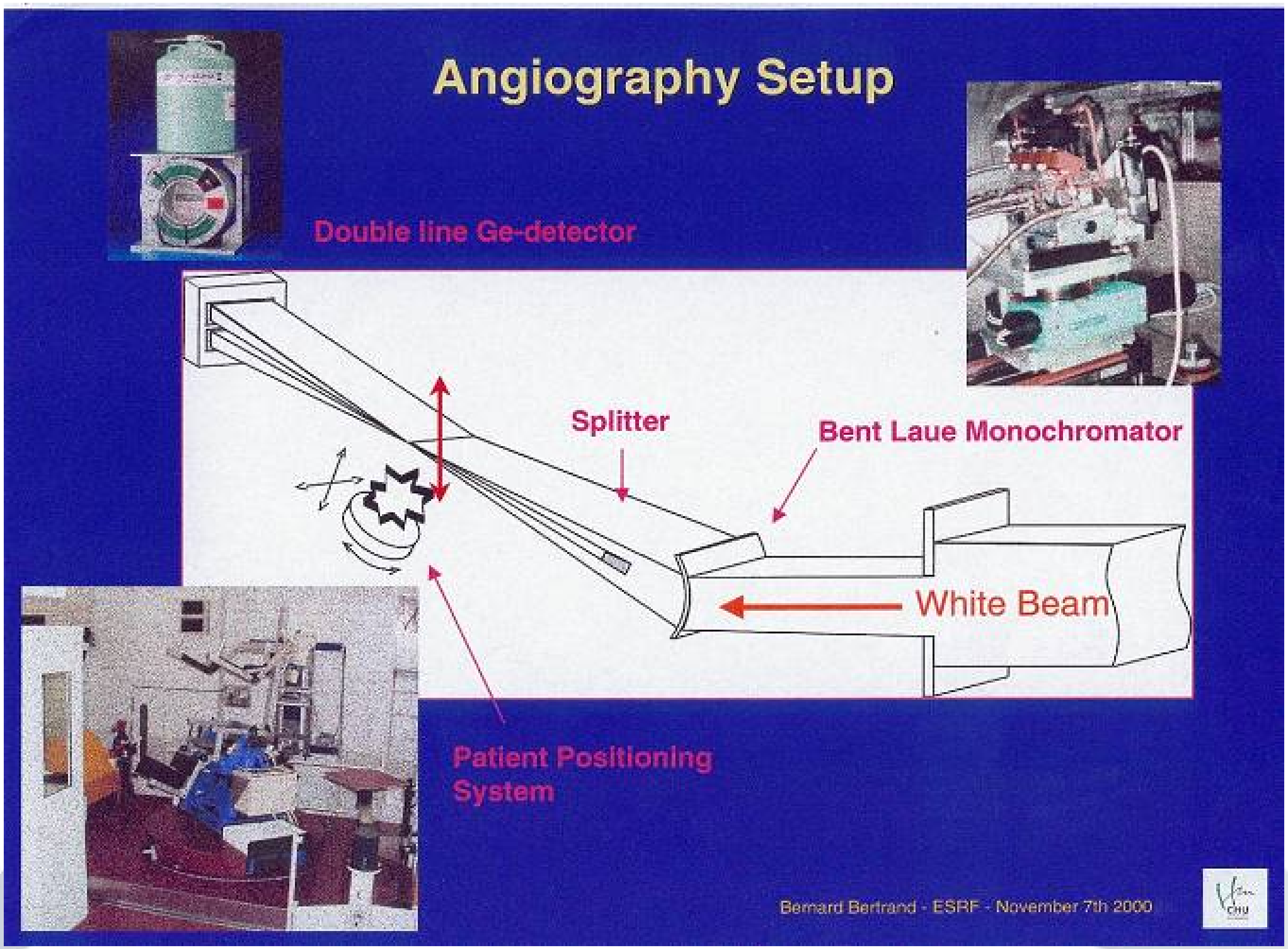
Experimental Beam Lines / Applications

TrwB, a protein involved in the transference of ADN between bacteria and the resistance to antibiotics . Enormous protein hexameric, 20.000 atoms. (BM14, ESRF, Miquel Coll)




0,1 mm

Experimental Beam Lines / Applications

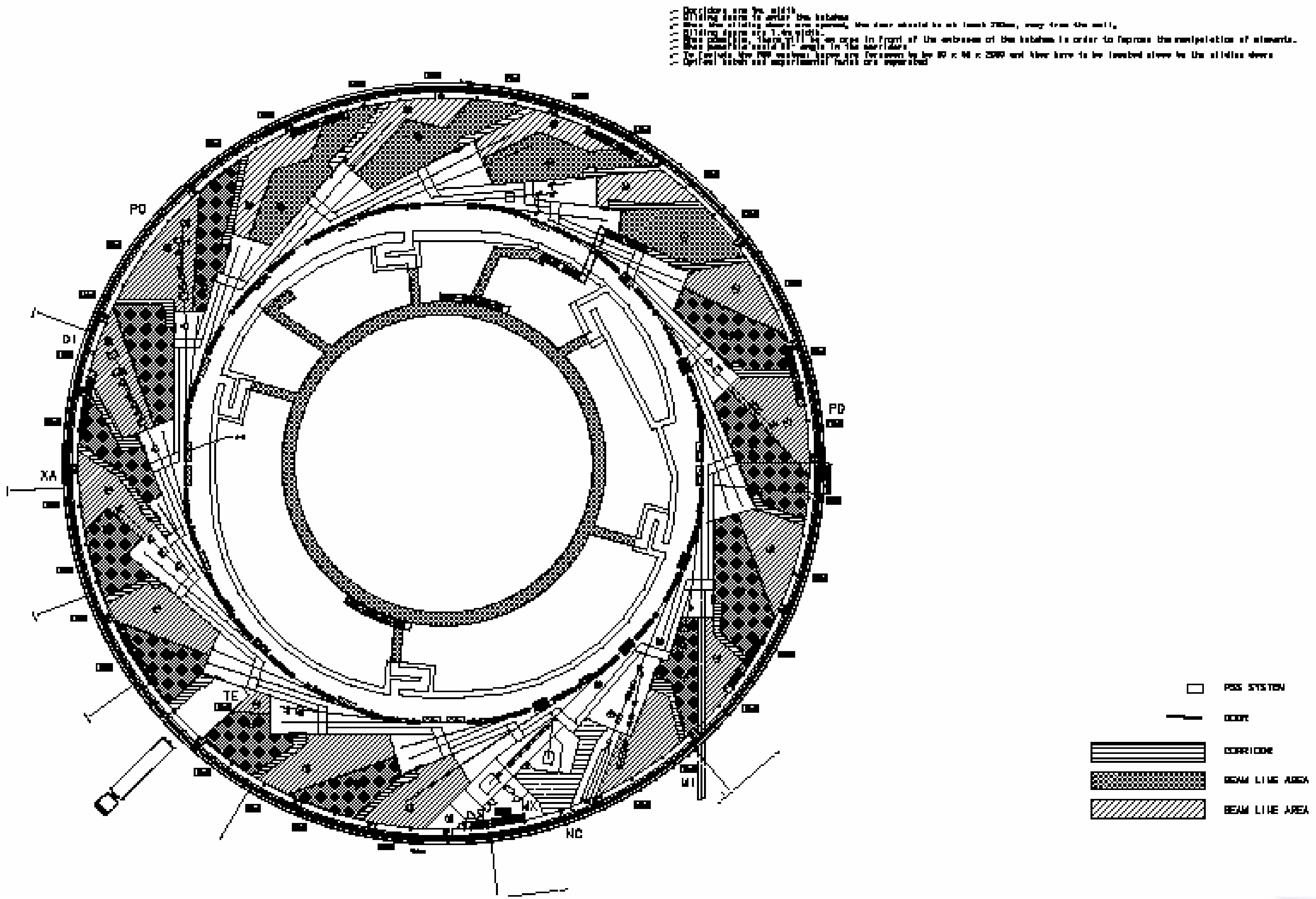


Experimental Beam Lines / Applications

The number of ALBA´s initial beam-lines has now increased to 7, namely:

- Soft X-ray BL for polarisation dependent spectroscopies and microscopies (Magnetism, Mat. Sci.).
- BL for electron and soft X-ray emission spectroscopies (¨dirty or real surface¨ Surface Science).
- BL for high resolution powder diffraction with micro-focus option (Mat. Sci.).
- High brilliance XAS (Chemistry,Biology, Mat. Sci.).
- Non-crystalline diffraction with micro-focus option (Biology+Mat. Sci.).
- Crystallography of very large macromolecules (Biology).
- X-ray microscopy BL (Biology).

Experimental Beam Lines / Applications



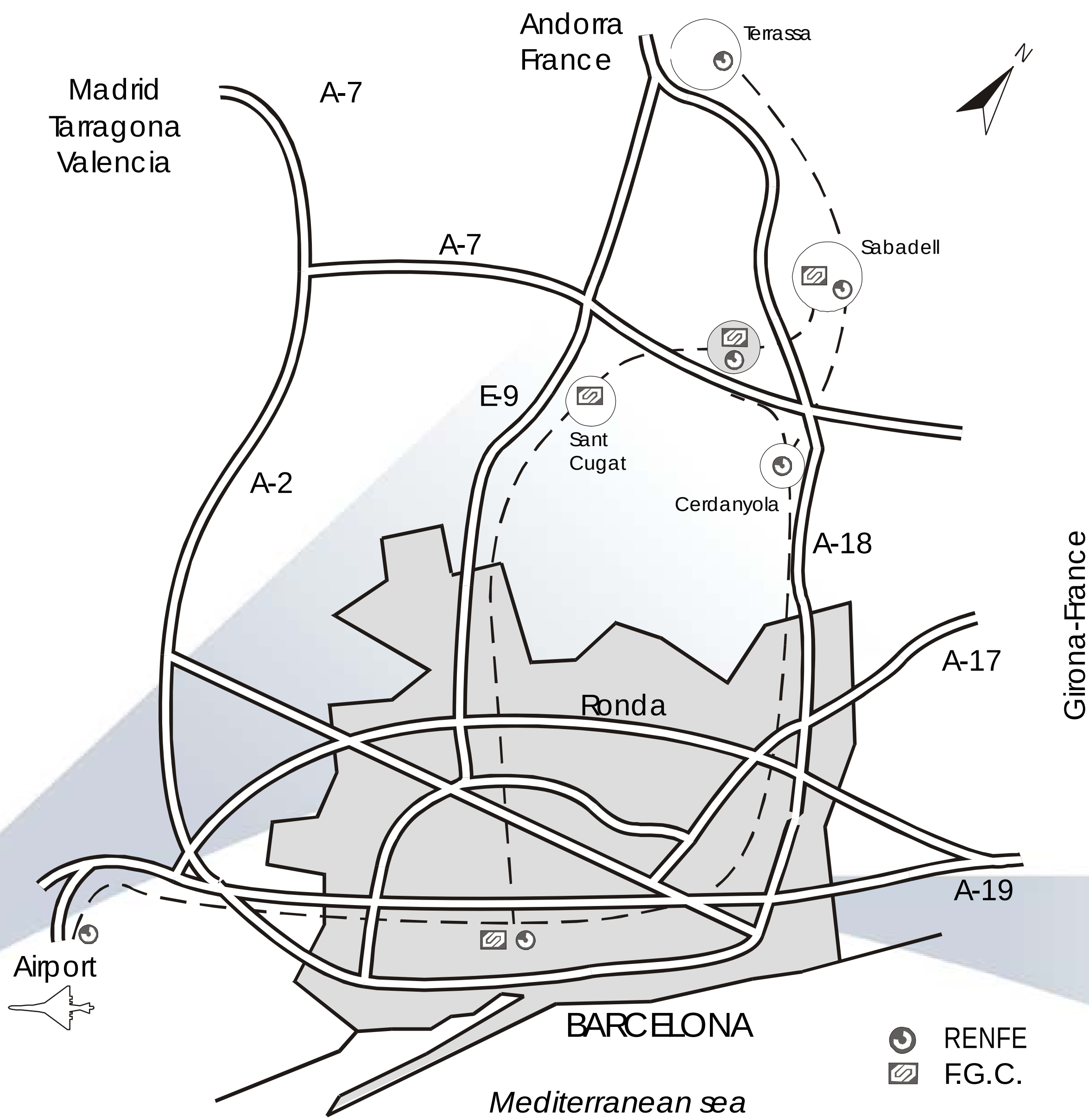
Building and conventional facilities

- Site
- Stability
- Facilities description

Site

ALBA: A Spanish Synchrotron Light Source

Site



Andorra
France
Terrassa
Madrid
Tarragona
Valencia
A-7
A-7
Sabadell
E-9
Sant
Cugat
Cerdanyola
A-2
A-18
Girona-France
A-17
Ronda
A-19
Airport
BARCELONA
RENFE
F.G.C.
Mediterranean sea

Site

Site

Stability

- The building is an integral part of the synchrotron
- Fundamental requirement: STABILITY
  - Mechanical
  - Thermal
  - Electrical

Stability

Mechanical stability and vibrations

Table 5. Floor stability requirements (only in the critical floor area)

Circular ring in which requirements are applied	
Inner diameter	60 m
Outer diameter	120 m

Charges on the circular ring	
Total static charge	10.000 Tm
Distributed static charge	1,5 Tm / m^2
Maximum charge on a point	5 Tm / m^2
Dynamic charge	2 Tm

Floor differential displacements	
Slow relative displacements	< 0.25 mm/10 m/ year
	< 0.05 mm/10 m/month
	< 10 •m/10 m/ day
	< 1 •m/10 m/ hour
Maximum differential displacement over the whole perimeter	< 2.5 mm/ year

Floor deformability because of charges	On the application point	At 2 m
Static charge of 500 kg	6 µm	1 µm
Dynamic charge of 100 kg		1 µm

Vibrations		
Vertical amplitudes	< 4 µm	From 0.05 – 1 Hz
	< 0.4 µm	1 – 100 Hz
Horizontal amplitudes	2 µm	

Stability

Temperature stability : 23°C ± 0.5°C/0.2°C

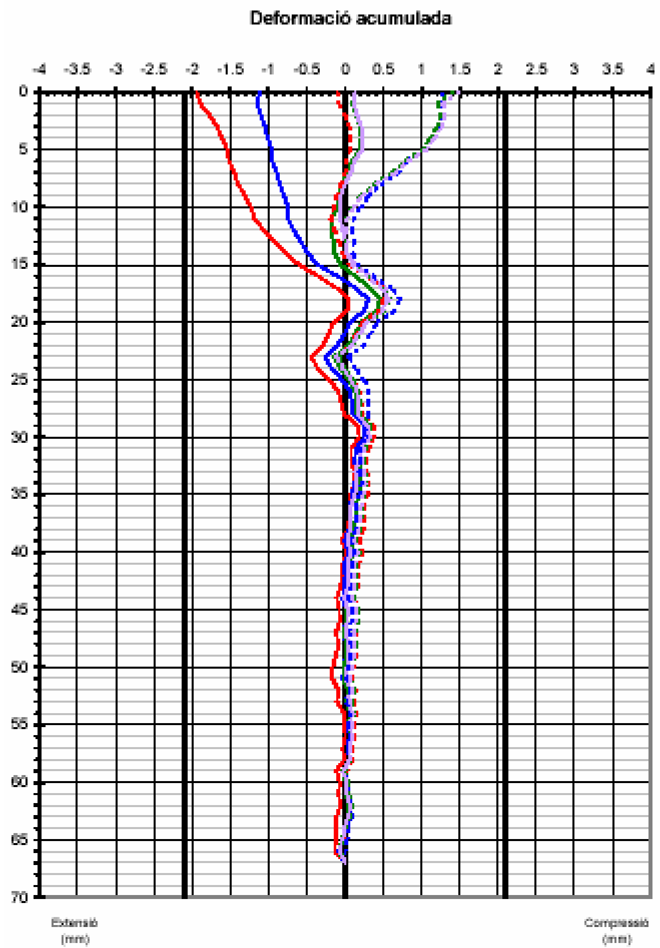
Ground quality : 0,2 Ω maxim

Installed electrical power: 12 MW

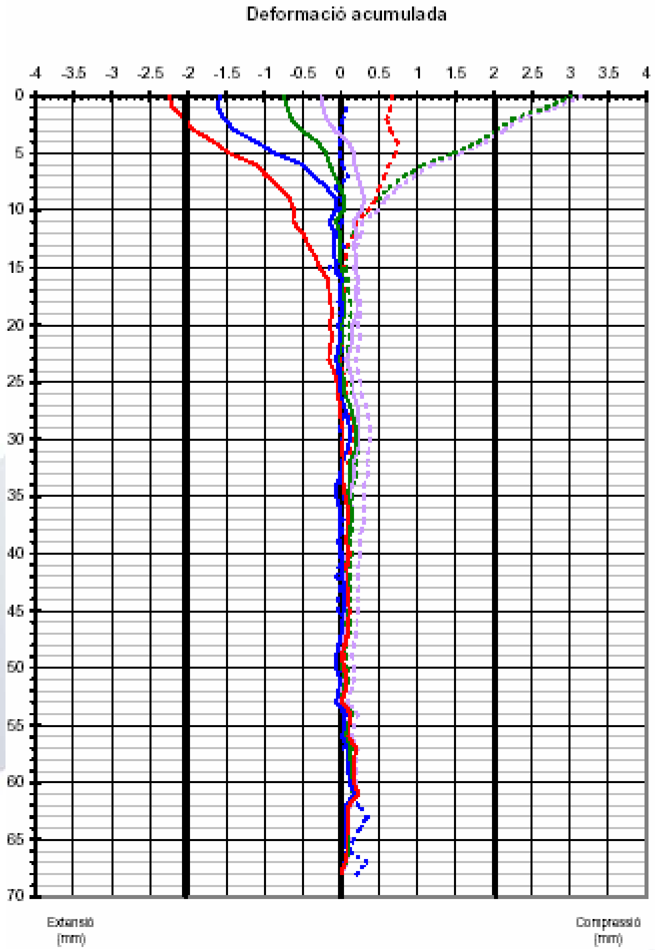
Microcuts:
- > 0.6 s, maxim 1 per year
- 0.4 - 0.6 s, ΔV > 12%, maxim 3 per year
- < 0.4 s, ΔV > 8%, maxim 3 per year

Stability

Deformations, TUB M1A



Deformations, TUB M3A



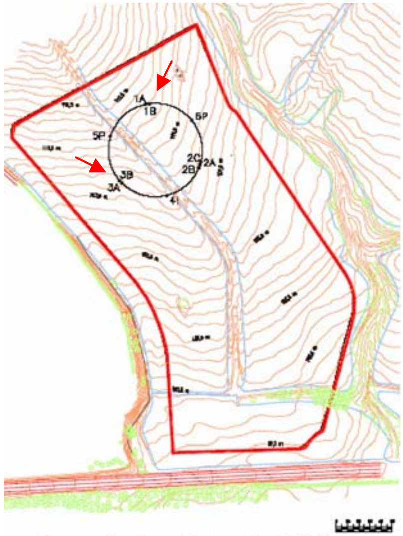


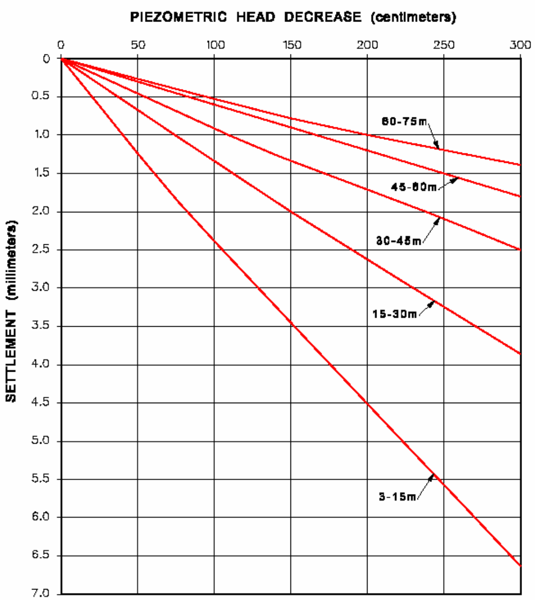
Figure 1: Location of the Installed Field Sensors

TUB: M3A

Mesura de referència:

Mesura		Data
0	solid black line	16/06/04
19	dashed violet line	09/09/05
20	dash-dot green line	26/09/05
21	dashed blue line	26/10/05
22	dashed red line	30/11/05
23	solid violet line	30/12/05
24	solid green line	25/01/06
25	solid blue line	02/03/06
26	solid red line	10/04/06

Stability



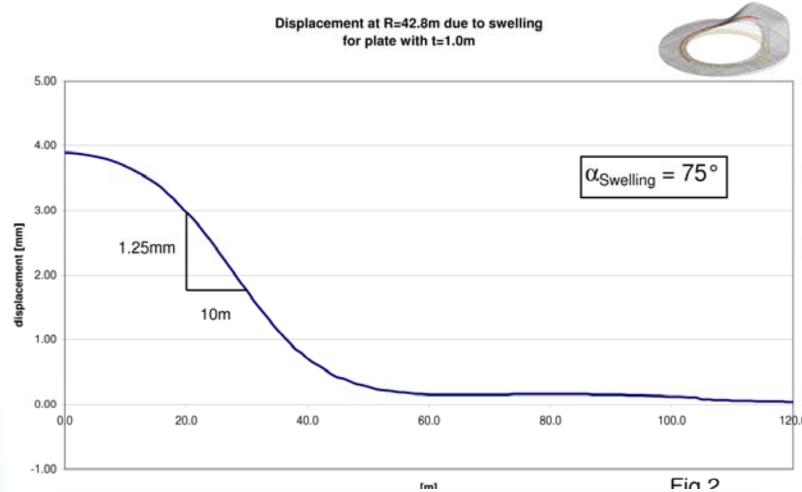
LEGEND

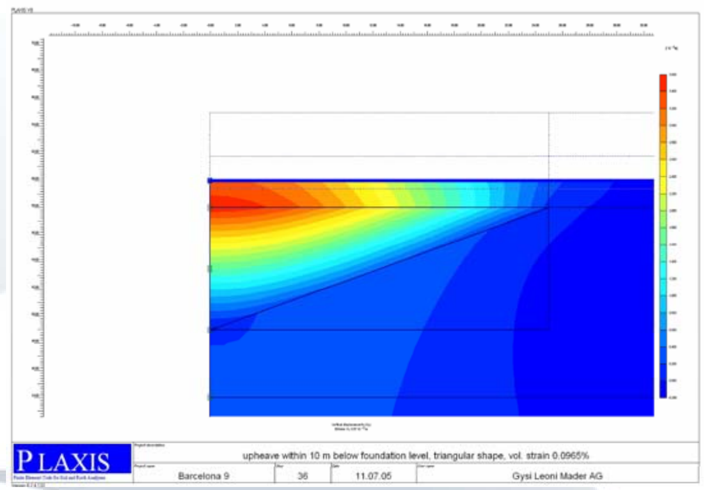
60-75m Ground depth interval

ESTIMATED SETTLEMENTS DUE TO PIEZOMETRIC HEAD DECREASES

(For different depth intervals of the ground)

FIGURE 3



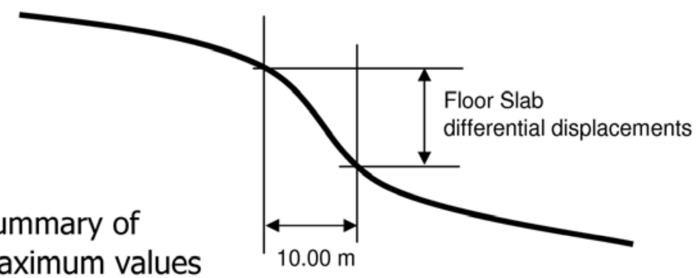


Stability

Floor Slab differential displacements (mm/10m)

	Slab thickness	alpha = 45°		alpha = 75°		alpha = 135°	
		Trajektory R = 42.80 m	Tangential to the trajektory	Trajektory R = 42.80 m	Tangential to the trajektory	Trajektory R = 42.80 m	Tangential to the trajektory
Model H&S	**t = 1.00 m**	1.25	1.50	1.25	1.30	1.30	1.50
	t = 1.80 m	1.10	1.30	1.20	1.15	1.10	1.30
	t = 8.00 m	0.60	0.40	0.60	0.50	0.55	0.50

		t = 1.80 m	***t = 1.00 m***
PLAXIS	equal upheave	1.70	1.95
	triangular uph	1.35	1.50
	upheave 2 m	2.00	
	upheave 5 m	1.85	
	upheave 10 m	1.40	1.70
	upheave 15 m	1.20	



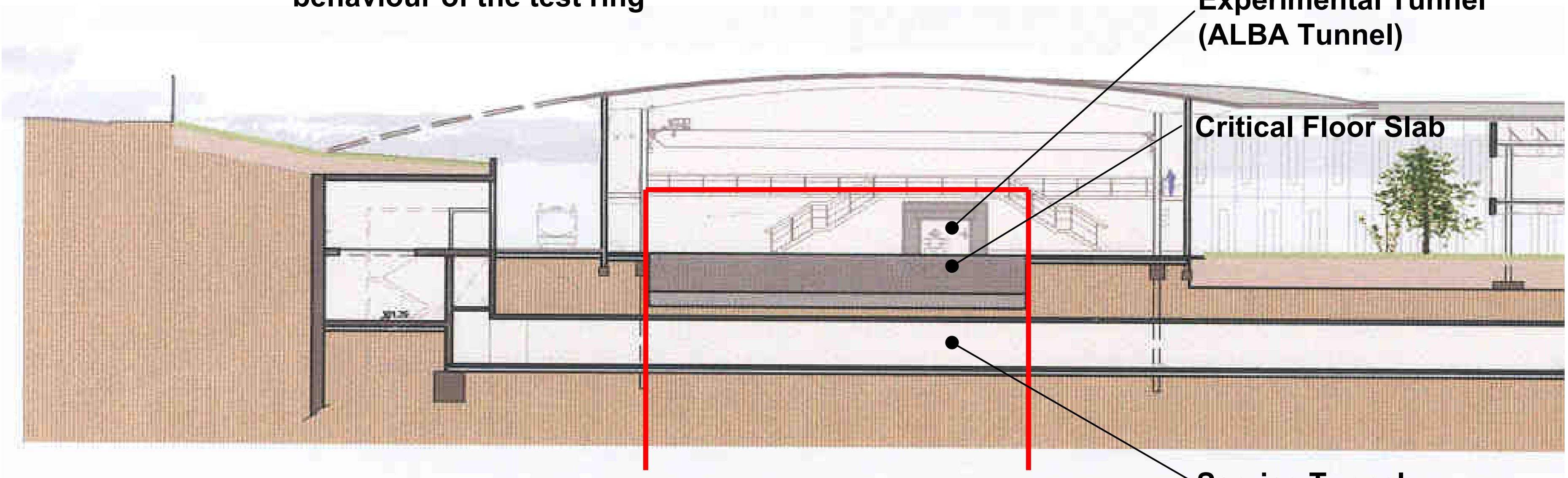
Summary of
Maximum values

Stability

Vibrations

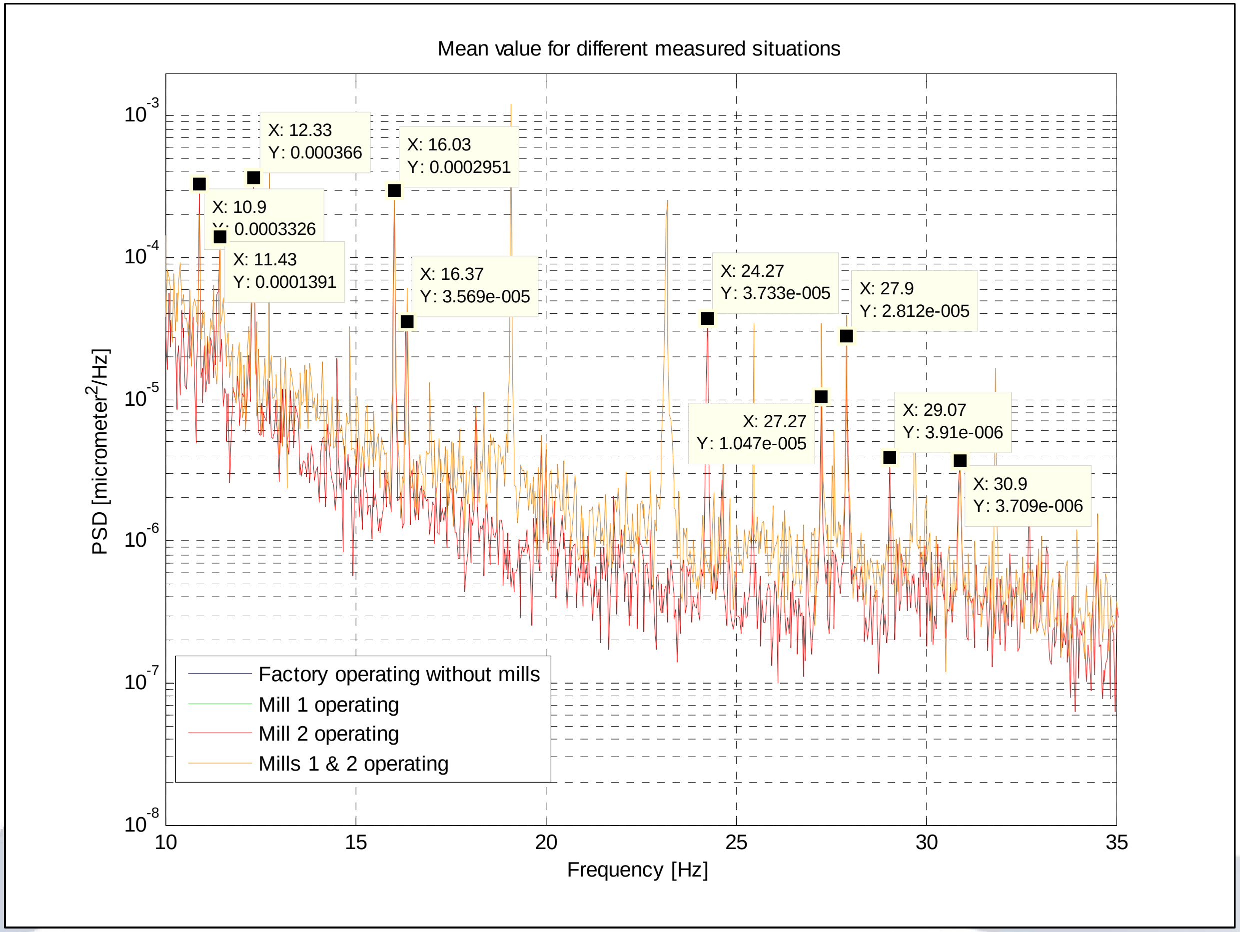
Vibrations, affecting the behaviour of the test ring

Design

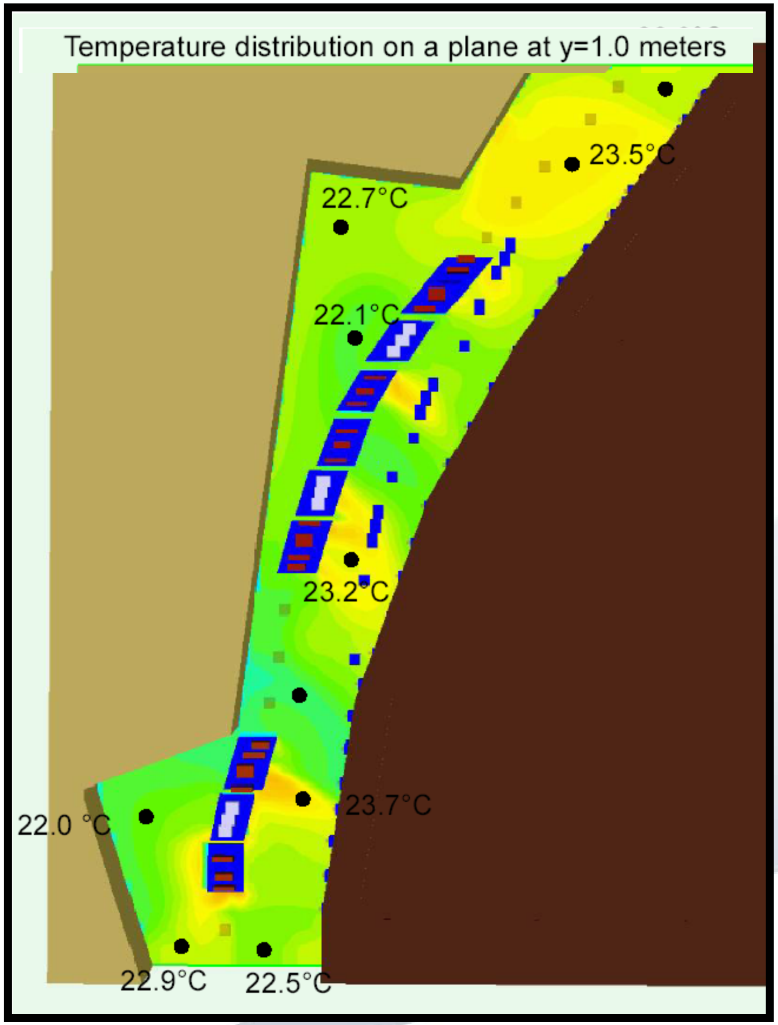


Stability

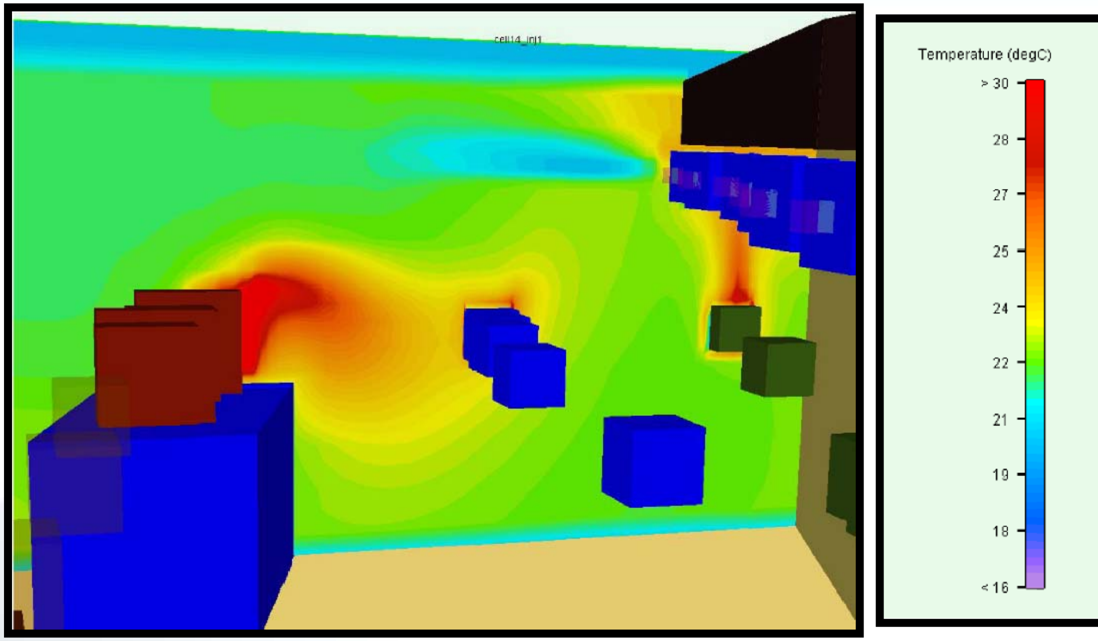
1.2 Frequency identification of the signal induced by the Ceramic Factory



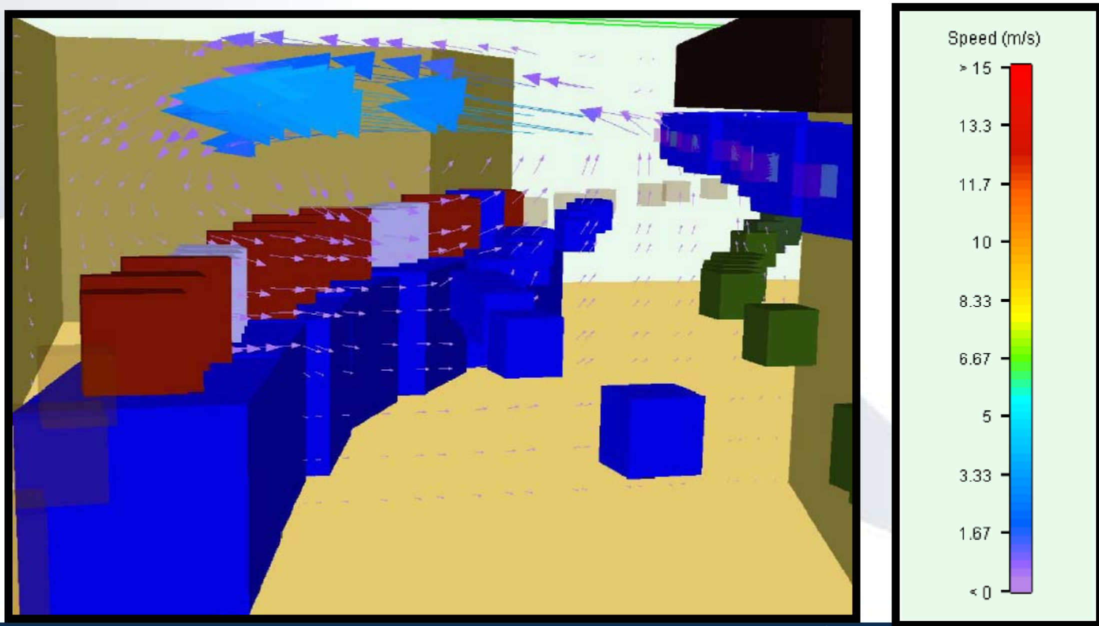
Stability



Temperature distribution on a plane at y=1.0 meters
23.5°C
22.7°C
22.1°C
23.2°C
23.7°C
22.0 °C
22.9°C
22.5°C



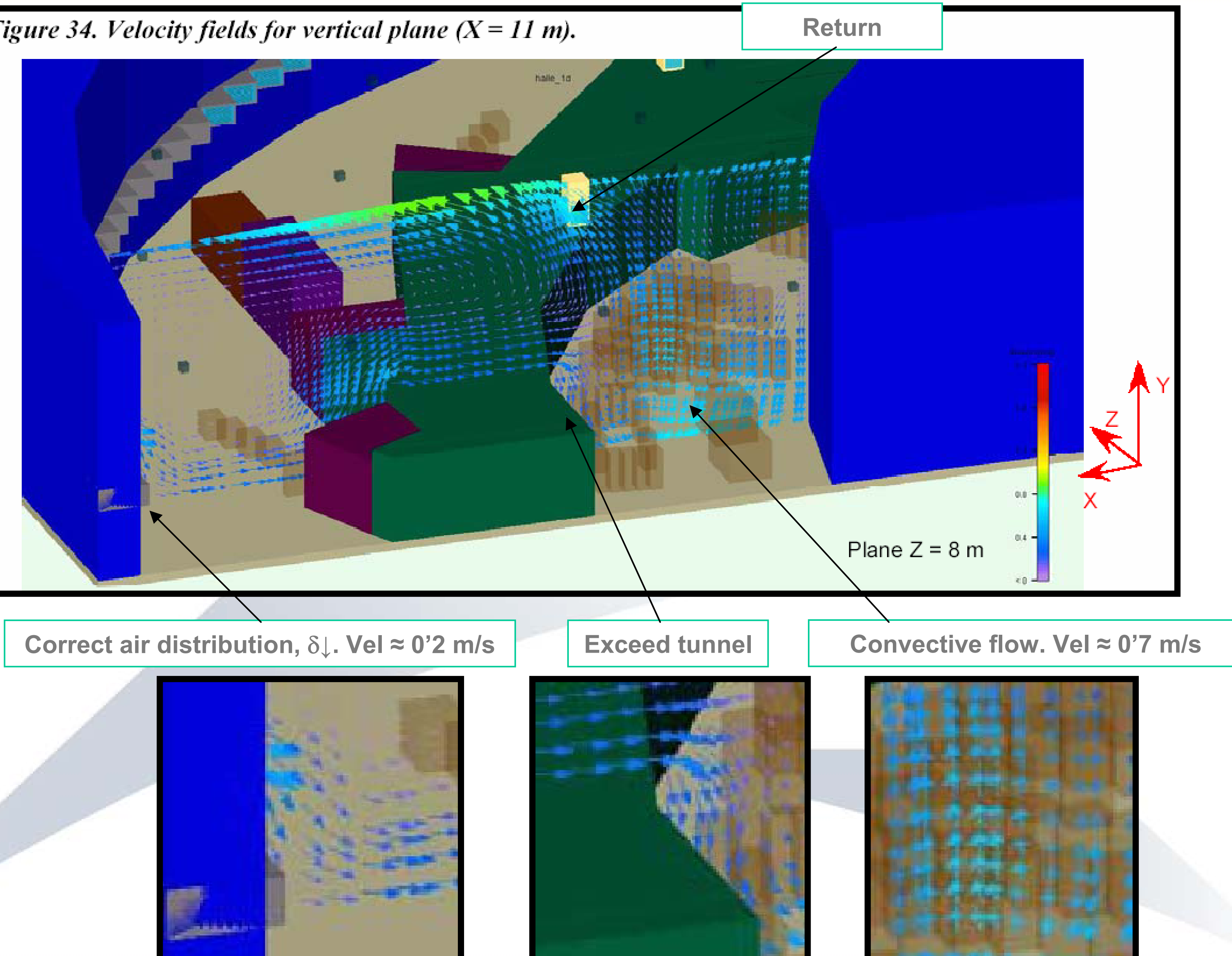
Temperature (degC)
> 30
28
27
25
24
22
21
19
18
< 16



Speed (m/s)
> 15
13.3
11.7
10
8.33
6.67
5
3.33
1.67
< 0

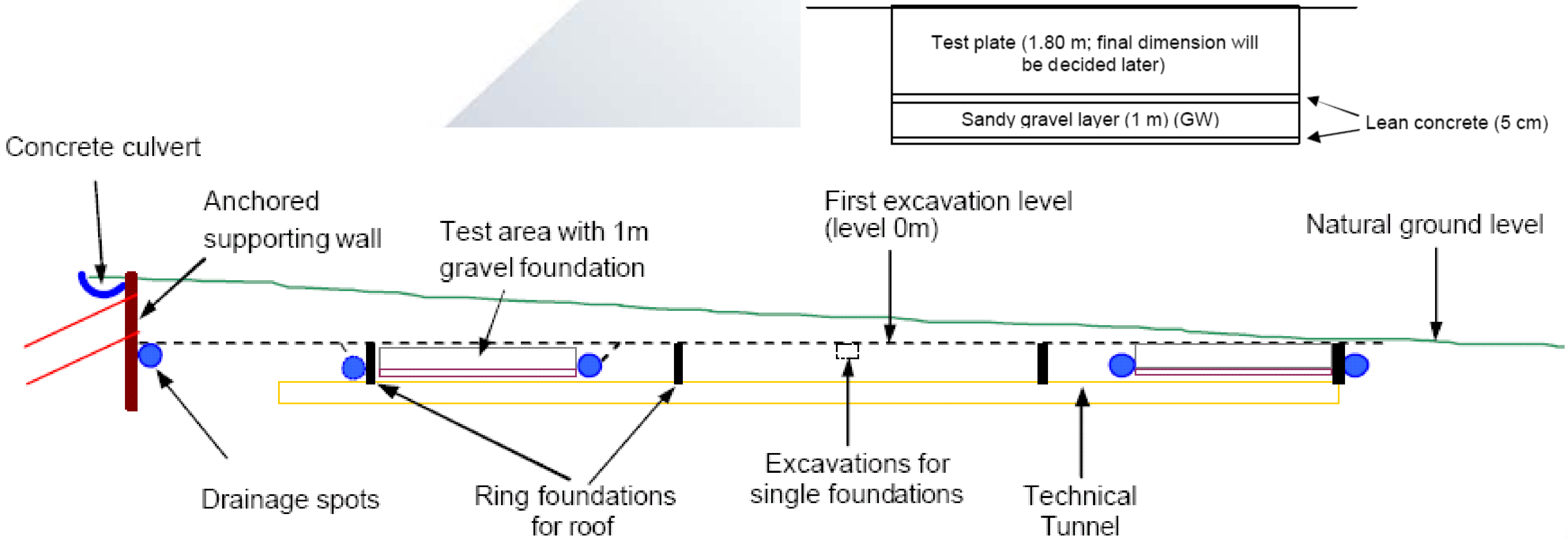
Stability

Figure 34. Velocity fields for vertical plane (X = 11 m).

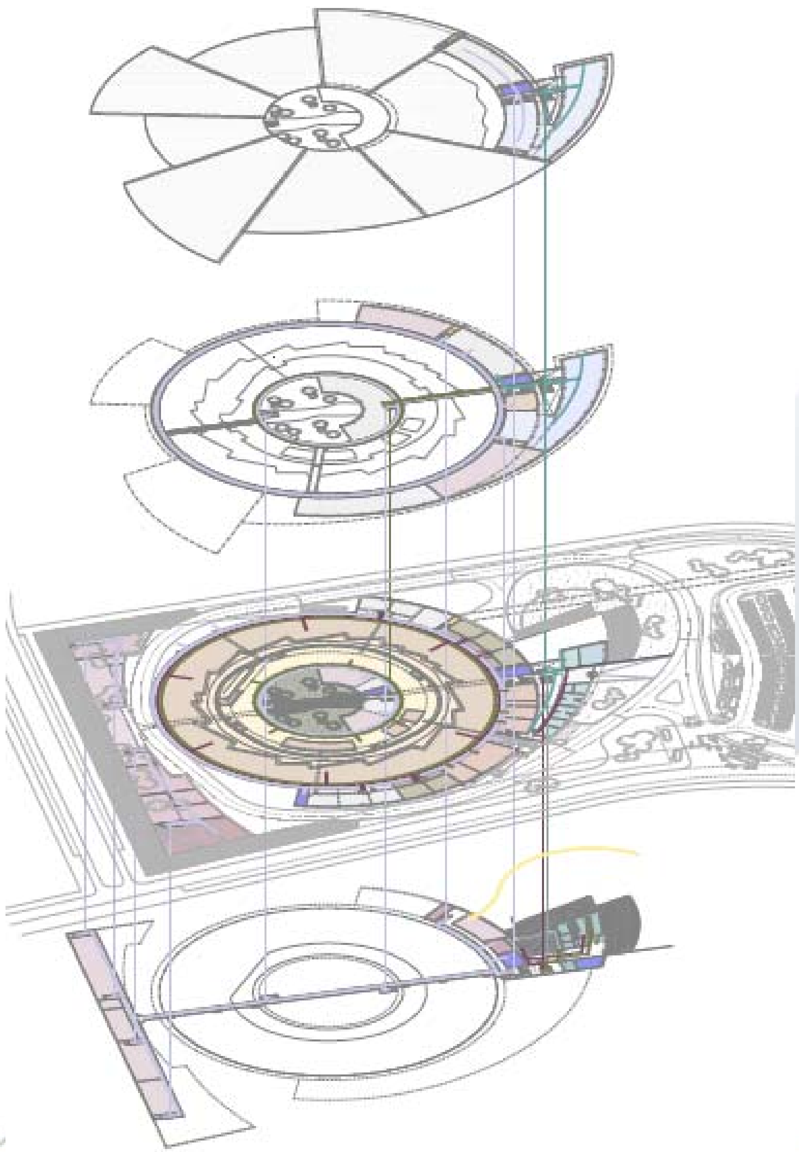


Facilities description

- **CRITICAL AREA** (70 – 120 m diameter)
  - A stiff test plate directly founded on the subsoil is so far the most promising solution.
  - The vibration criteria in the low frequency range are very stringent and will govern the suitable solution.
  - Based on the results of the Geotechnical investigations performed, it can be concluded that the deformation potential is low.



Facilities description



SECOND FLOOR

OA: offices – free suitable for offices

FIRST FLOOR

OA: offices – free suitable for offices

MB: mechanical rooms – control room outer ring – free suitable central courtyard

GROUND FLOOR

OA: Entrance – offices - meeting and show rooms

MB: ALBA tunnel – Exp hall – Service area - Laboratories - Mechanical rooms – loading area

TB: cooling & heating plant – workshops - storage

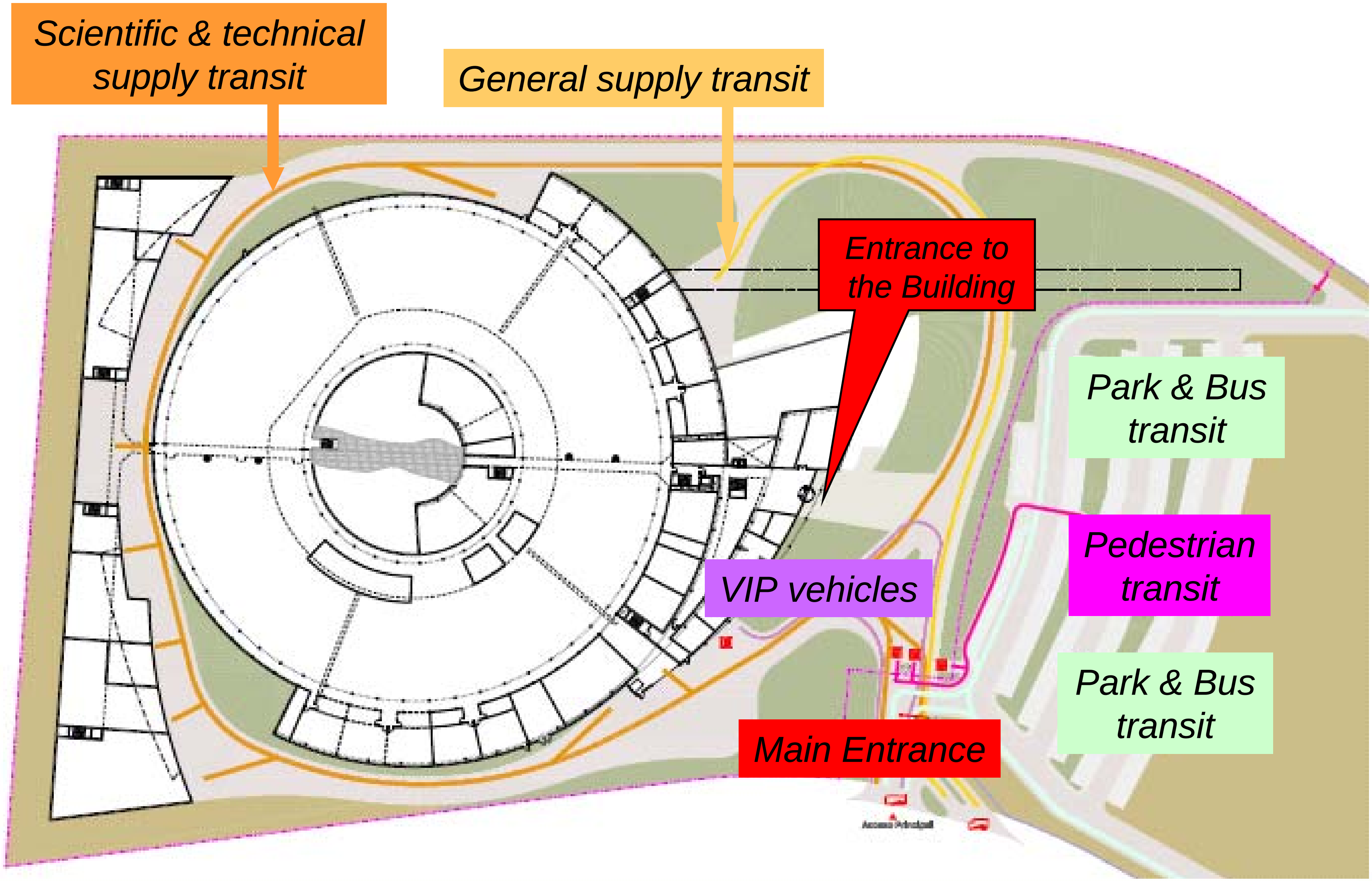
BASEMENT

OA: Foyer – Auditorium – Cafeteria - Stores

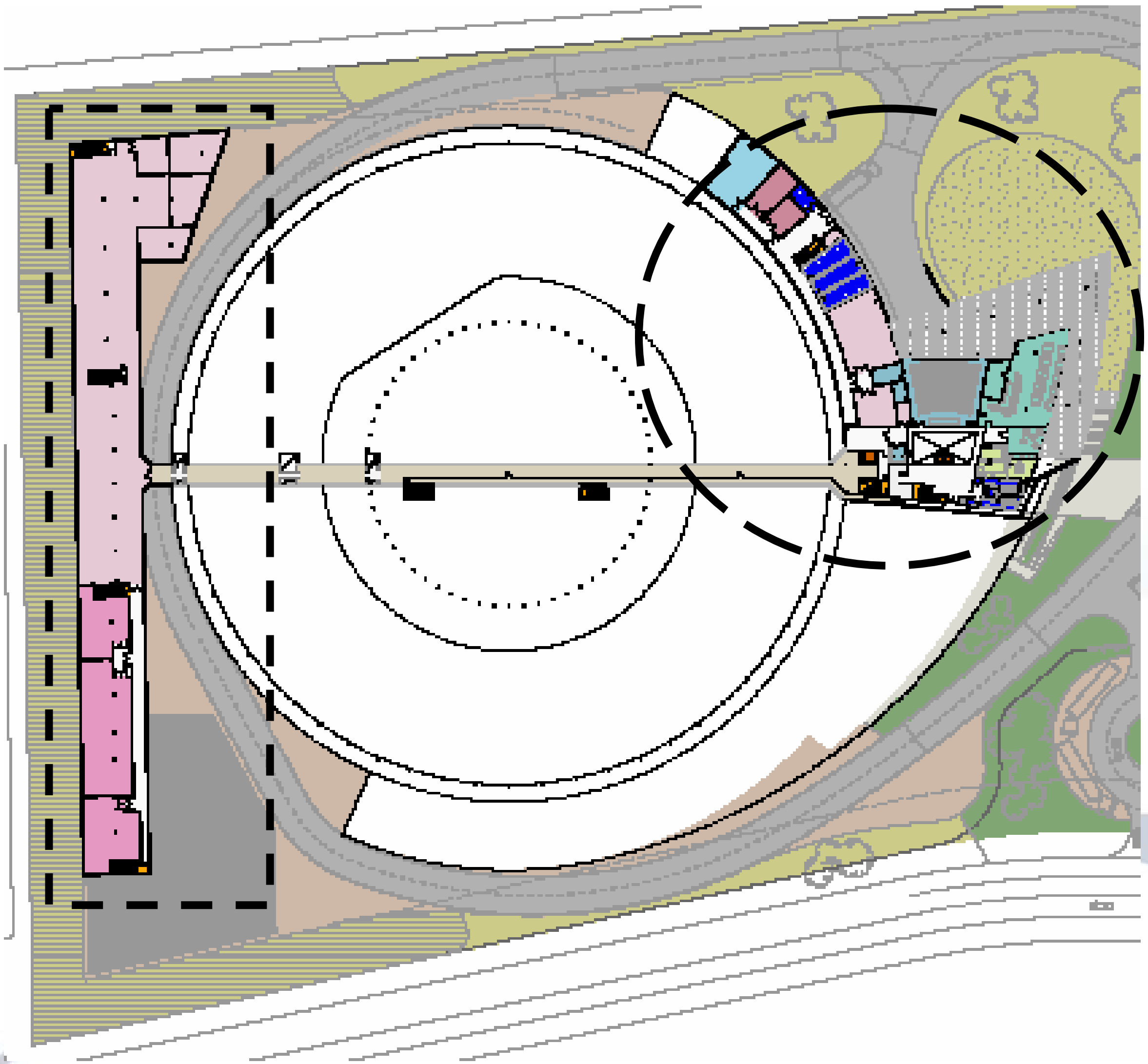
MB: Service tunnel

TB: Tanks – Water Treatment – Dynamic UPS

Facilities description



Facilities description

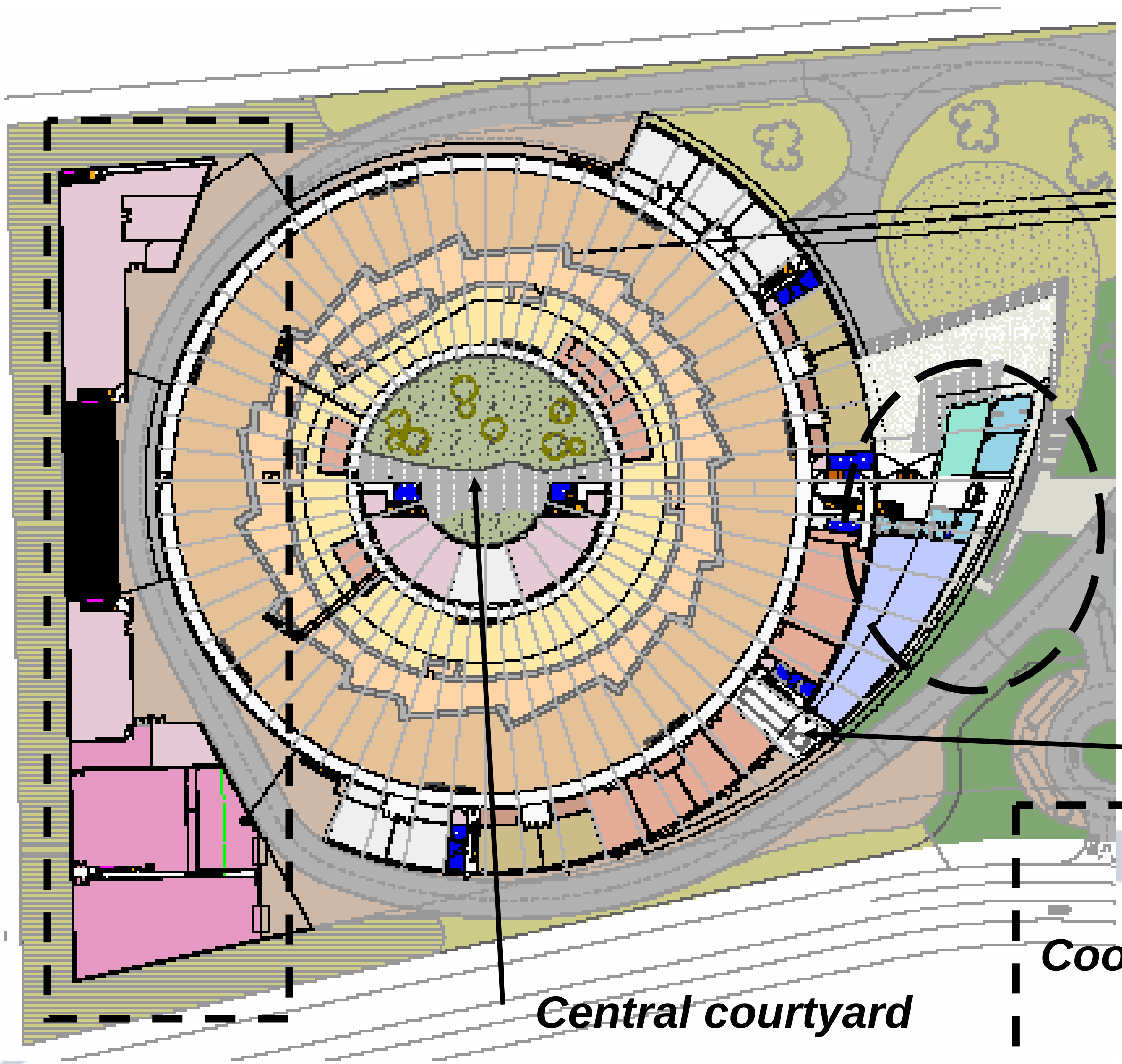


Cafeteria – Vending
Auditorium (200 p.)
Compacts archive
Medical service
Changing room
Waste store

Service tunnel

Electrical Station
Electrical Control Room
Tanks
Pumps and exchangers

Facilities description



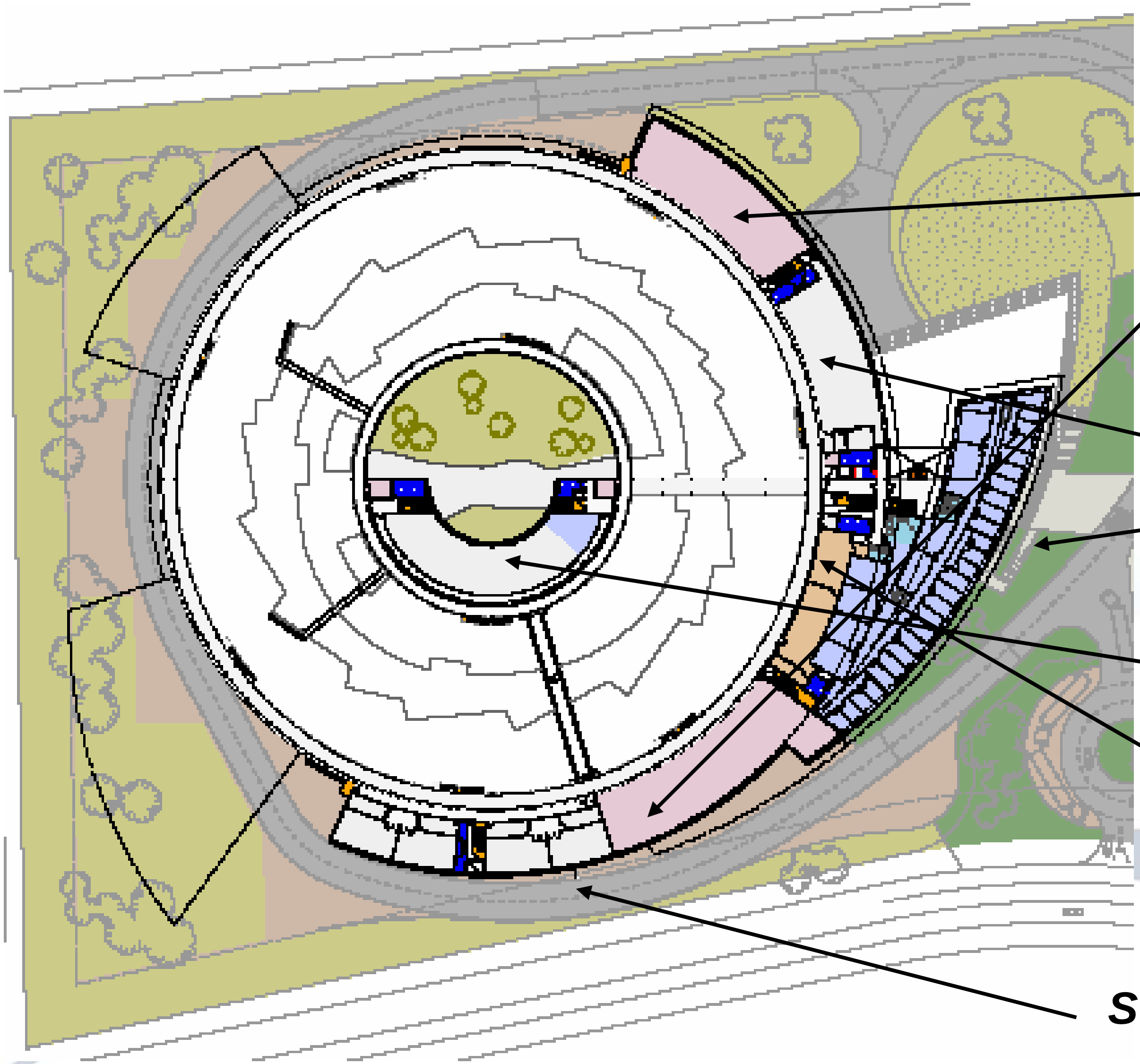
Experimental Hall
ALBA Tunnel
Beam Lines
Laboratories:

- ***BL Labs***
- ***ID + magnets***
- ***Vacuum lab***
- ***Comp & communic.***
- ***Metrology lab***
- ***Electronics lab***
- ***Detectors lab***
- ***RF lab***

Entrance – Hall
Office Area – 400 m2

Workshops – 750 m2
Storage – 600 m2
Cooling Plant & Cooling Towers
Dynamic UPS
Utilities

Facilities description



Technical Area
2 * 500 m2

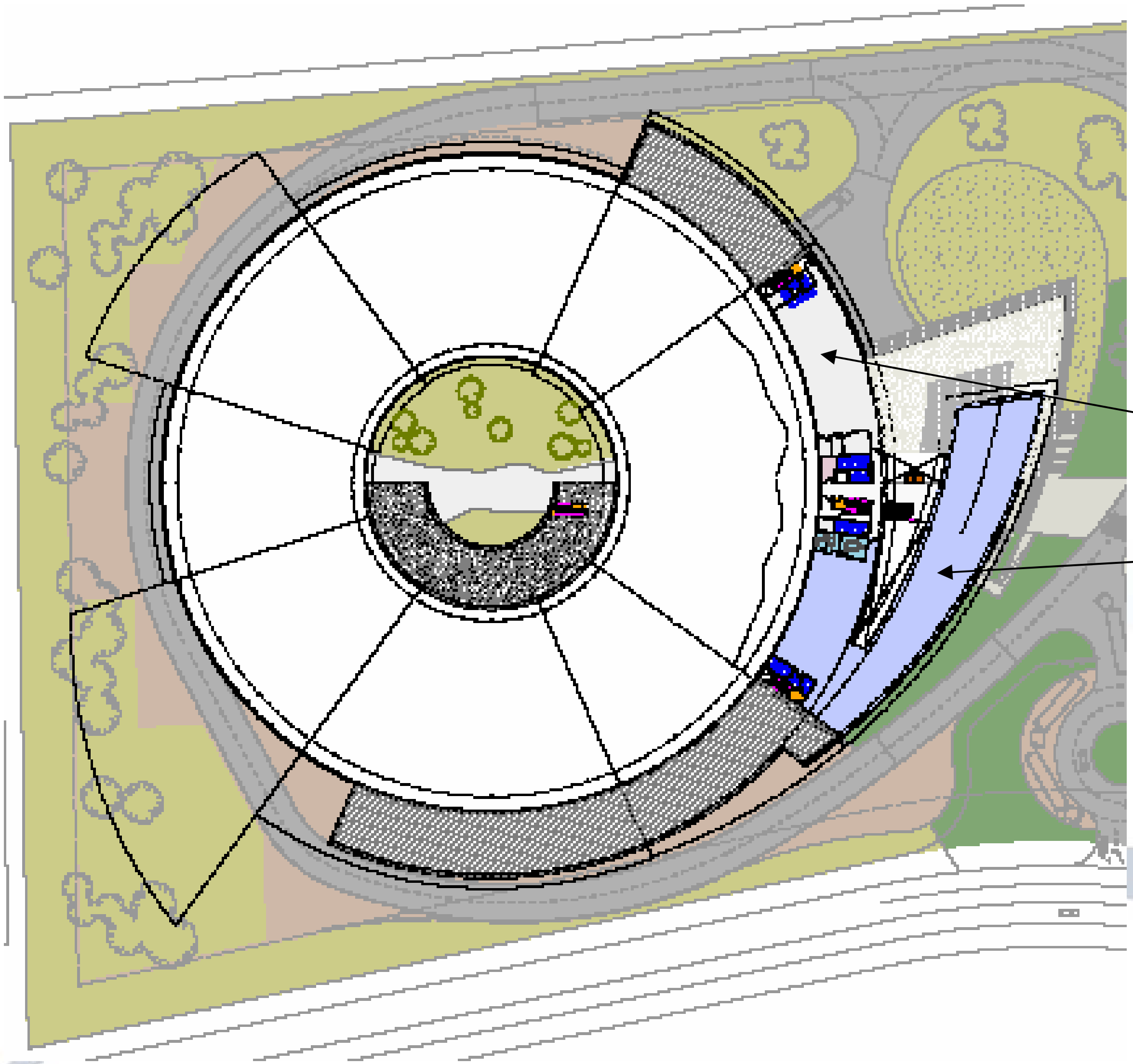
Office Area
400 m2 (Phase 2)
1.100 m2 (Phase 1)

Central courtyard

ALBA Control Room

Free suitable for
Supplementary labs. Phase 2

Facilities description

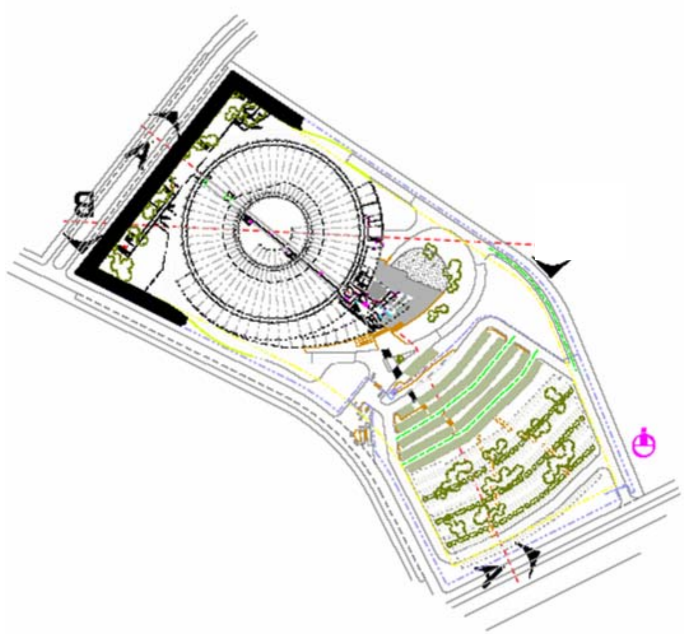


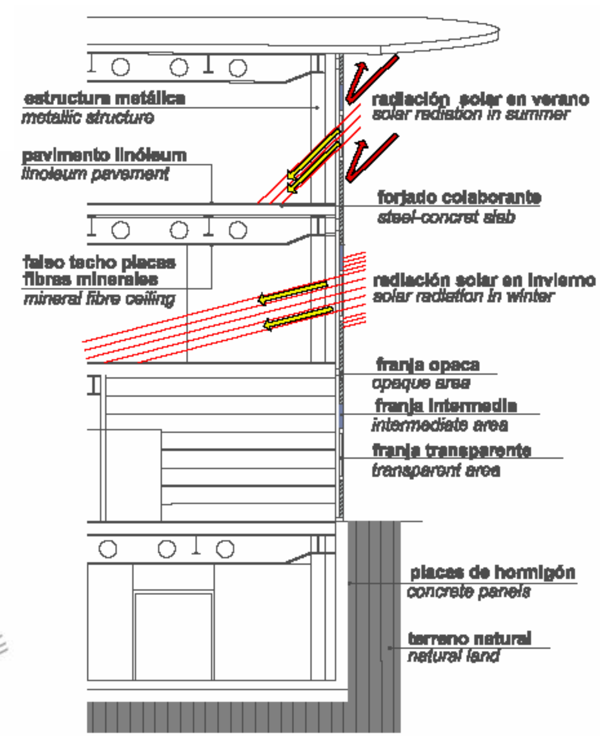
Office Area

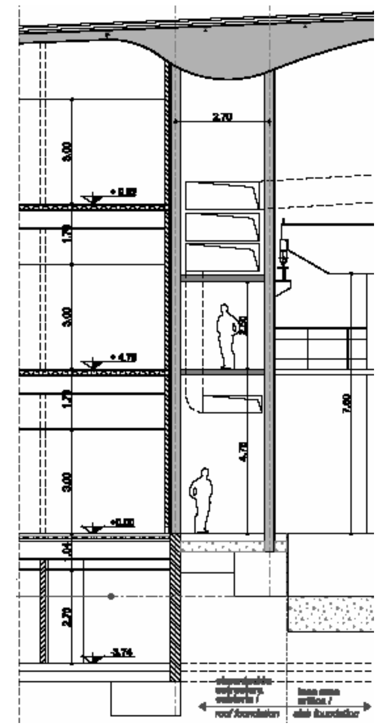
400 m2 (Phase 2)

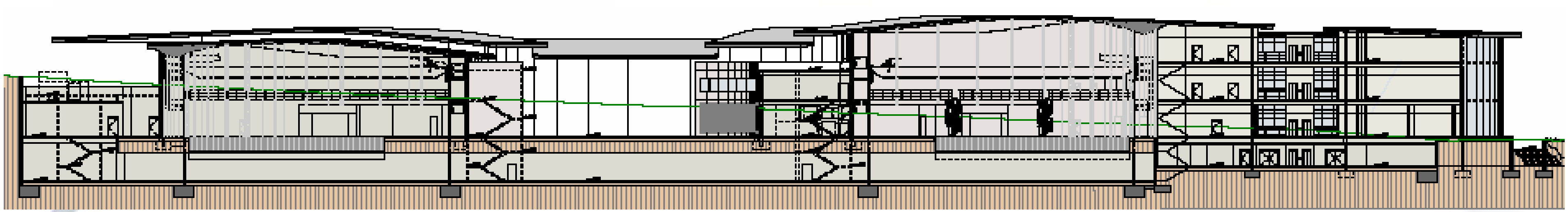
1.100 m2 (Phase 1)

Facilities description

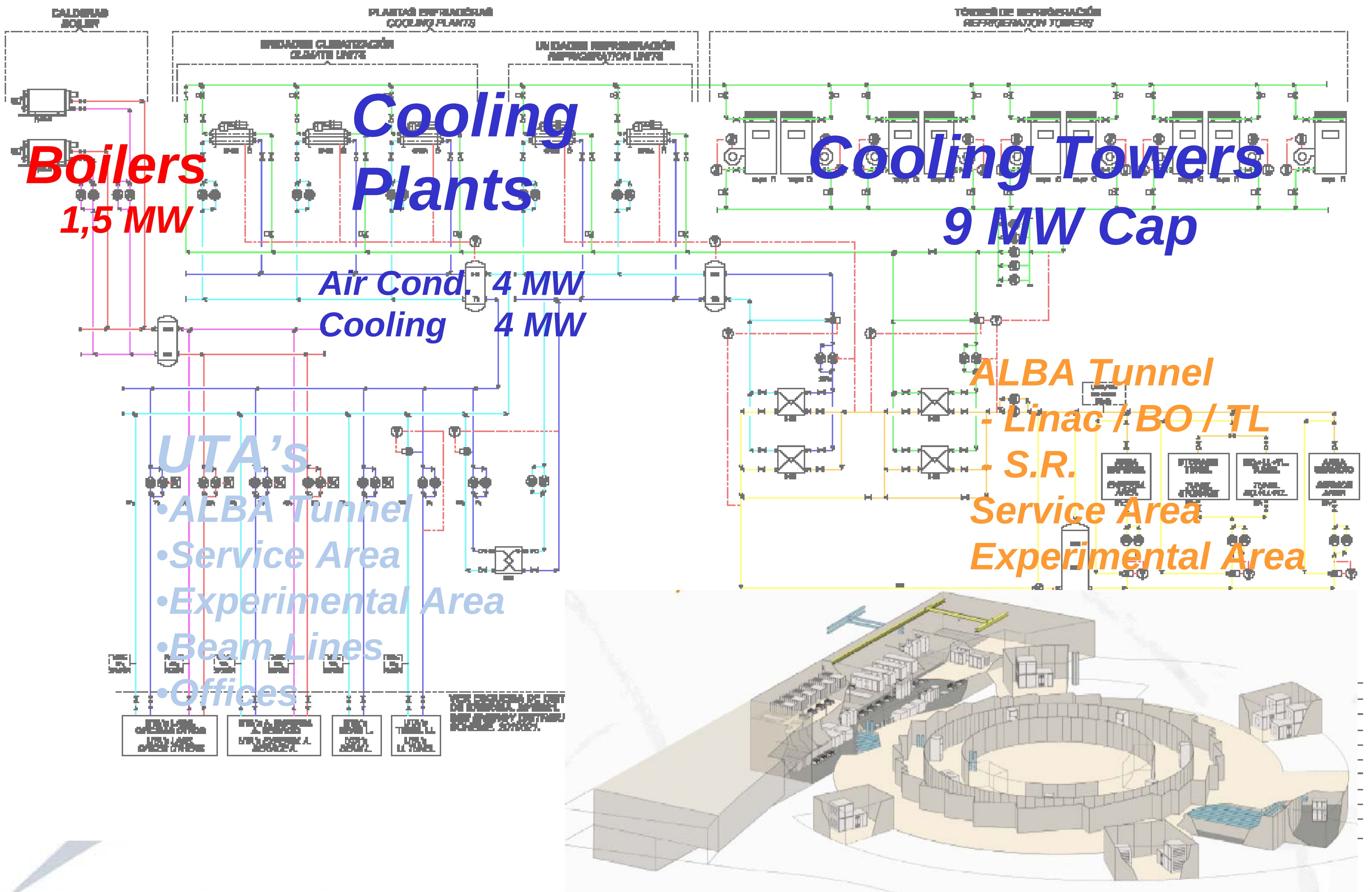




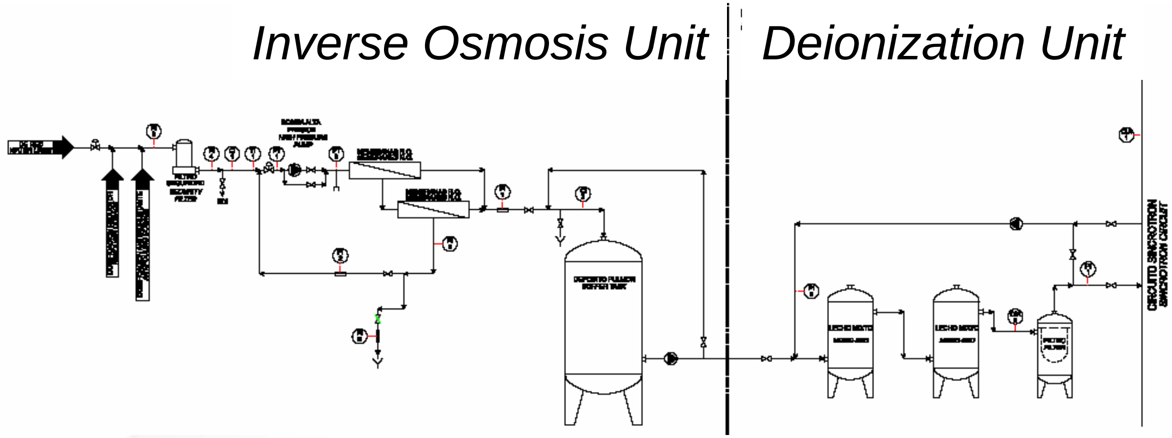




Facilities description

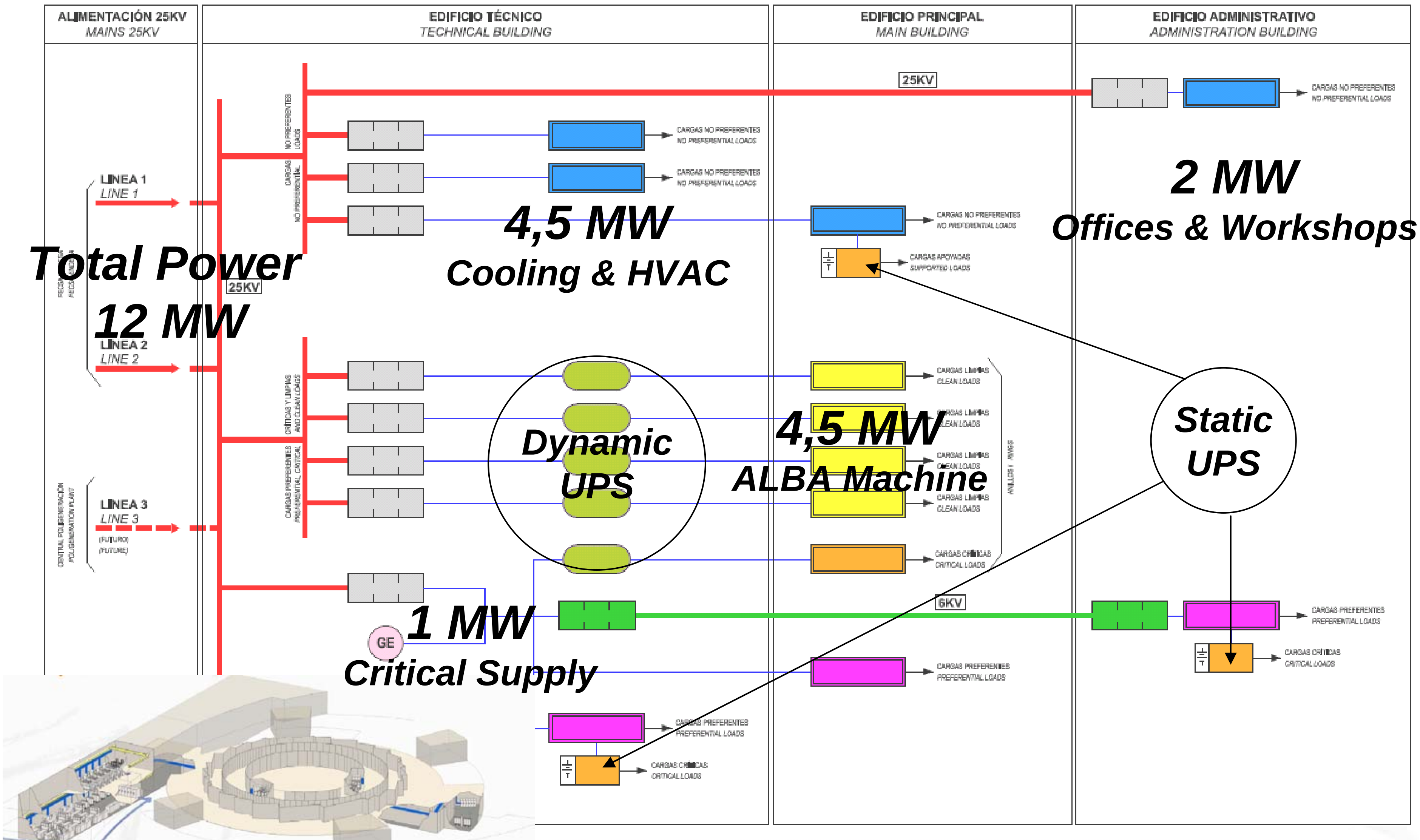


Facilities description



- **Demineralised water.**
- **Natural gas.**
- **Gas oil.**
- **Compressed air.**
  - Distribution loops: perimeter laboratories and beam lines - Storage ring -Booster and Linac - Service area -Technical Building
- **Gas nitrogen.**
  - Supply from a liquid nitrogen tank to laboratories and beam lines.
- **Other fluids.**
  - Space will be foreseen for possible future installations of other gases as liquid nitrogen or recuperation of helium gas.

Facilities description



Facilities description

- In accordance with national rules.
- Safety and Control Integrated System:
  - Fire Detection
  - Fire Extinguishing (mobile, fixed, outdoor hydrants, automatic plus water/pumping system)
  - Intrusion detection
  - Access control
  - Visits control
  - Closed TV system
  - Technical control
  - HVAC monitoring and protection
  - Electrical Power monitoring and protection
  - Emergency Plan
  - Waste management

THANKS FOR YOUR ATTENTION