DE LA RECHERCHE À L'INDUSTRIE

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THE LASER MEGAJOULE FACILITY: CONTROL SYSTEM STATUS REPORT

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Presentation overview

The LMJ facility

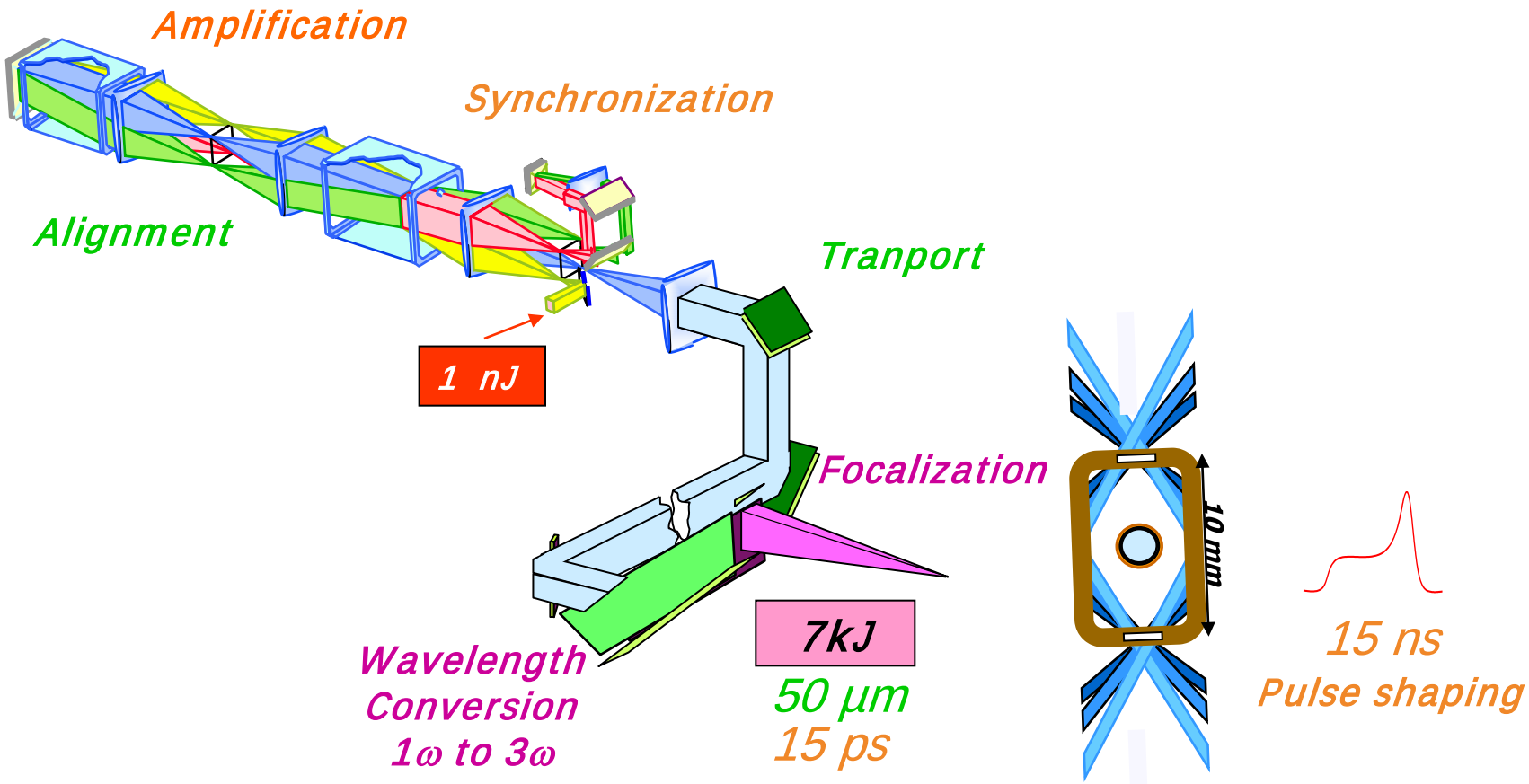
- Main characteristics
- Laser bays
- Target bay
- Control room

Integrated Computer Control System Status

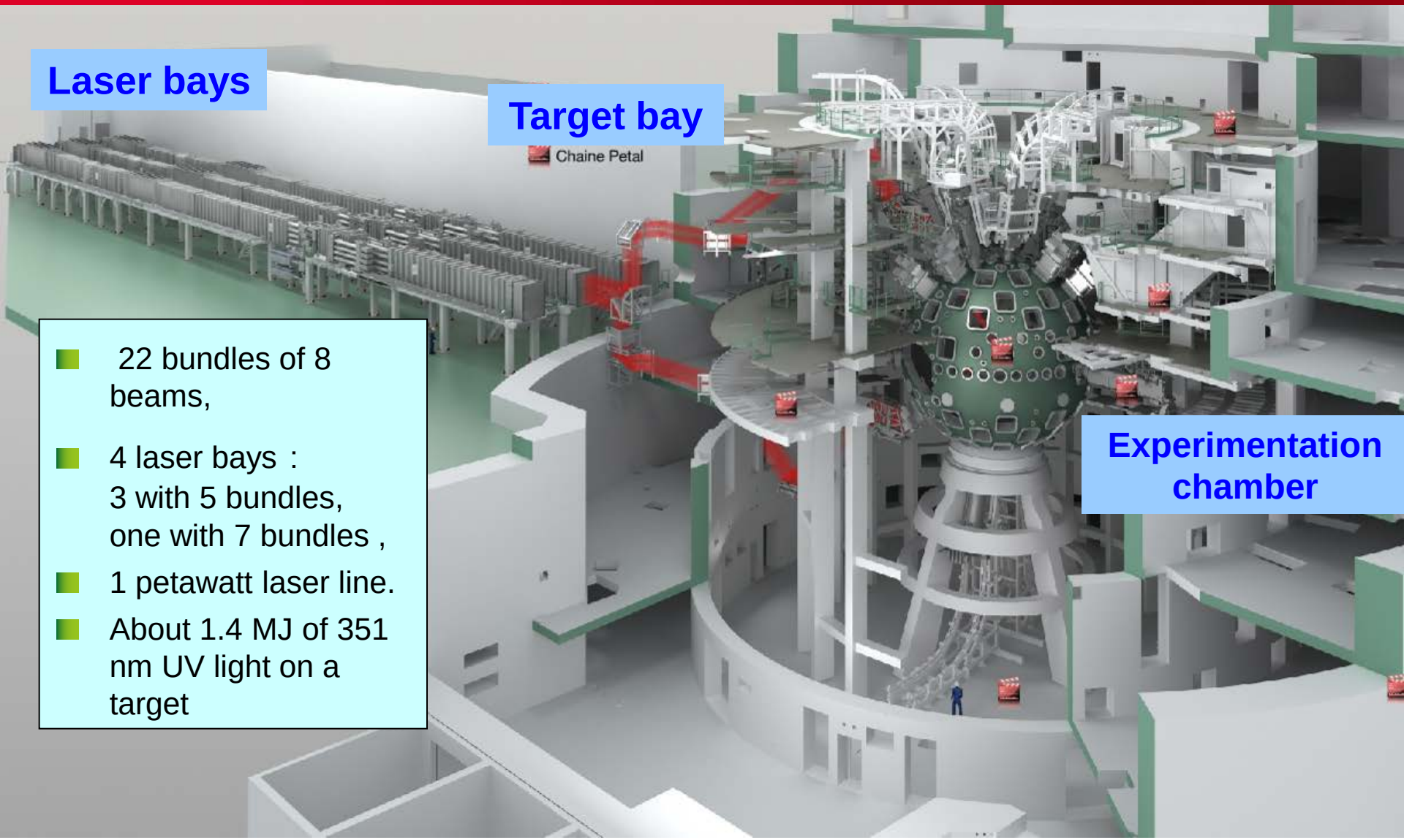
- LMJ Control System functions
- Logical and physical architecture
- Software integration strategy
- Ramp up period commissioning strategy
- Milestones

LMJ baseline

LMJ is designed to deliver about 1.4 MJ of energy on tiny targets for high density plasma physics and fusion experiments

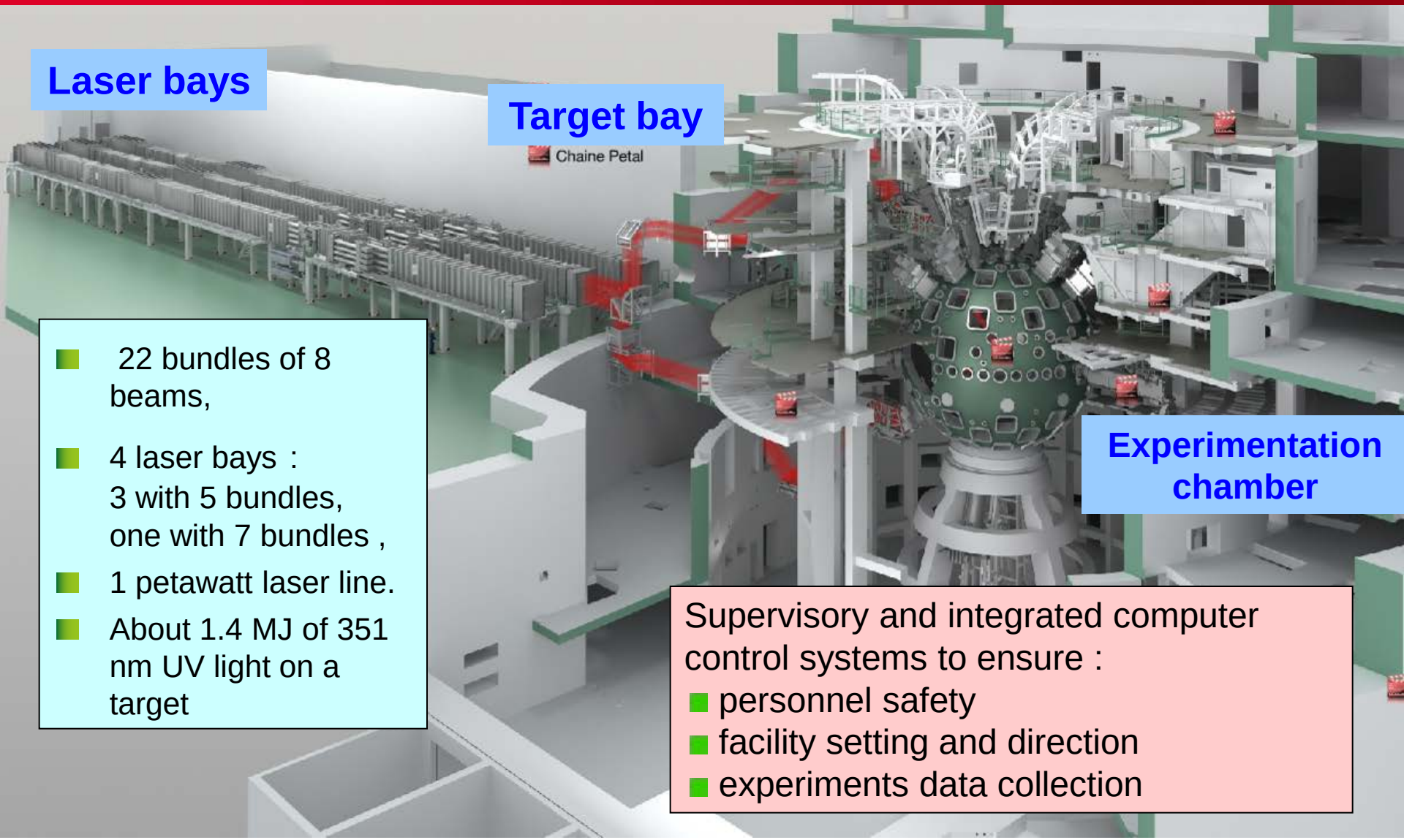


LMJ facility overview



- 22 bundles of 8 beams,
- 4 laser bays : 3 with 5 bundles, one with 7 bundles ,
- 1 petawatt laser line.
- About 1.4 MJ of 351 nm UV light on a target

LMJ facility overview



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Supervisory and integrated computer control systems to ensure :

- personnel safety
- facility setting and direction
- experiments data collection

Laser bays infrastructures

Laser Bay #4

5 bundles

Laser Bay #1

5 bundles

Laser Bay #3

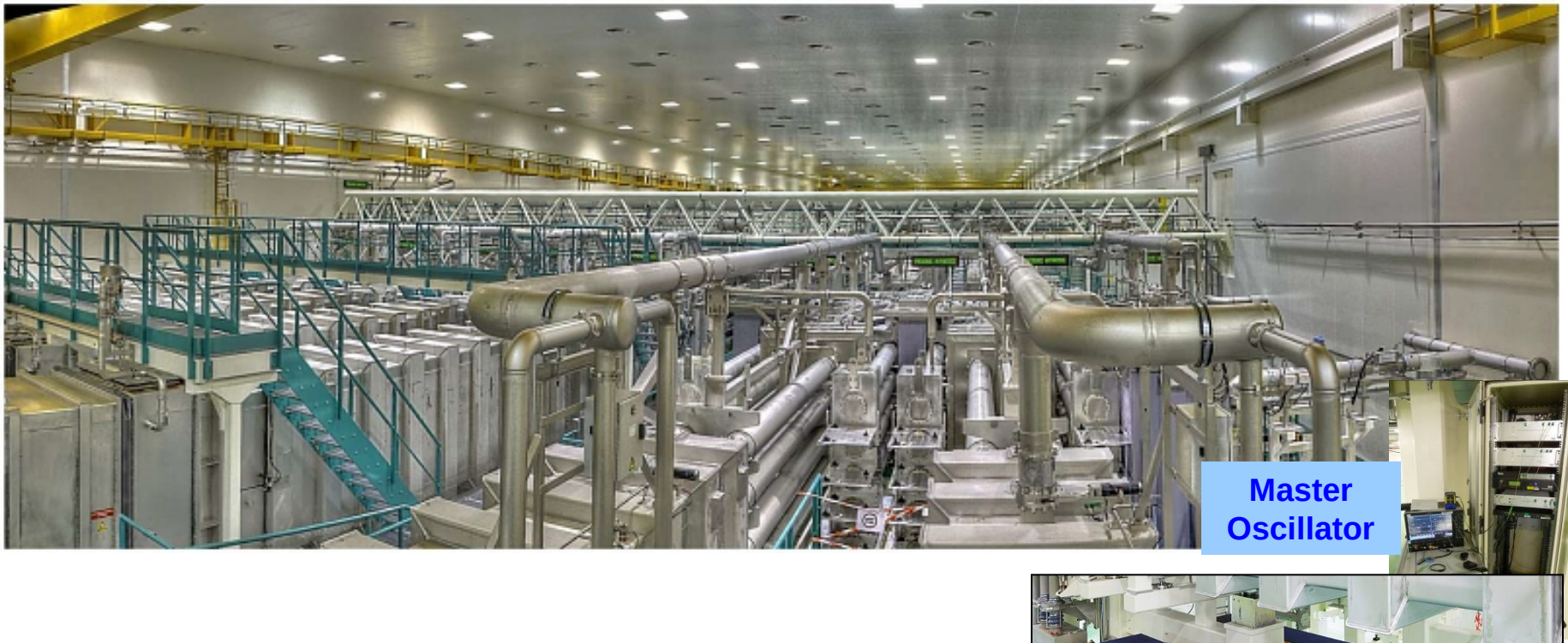
5 bundles

Laser Bay #2

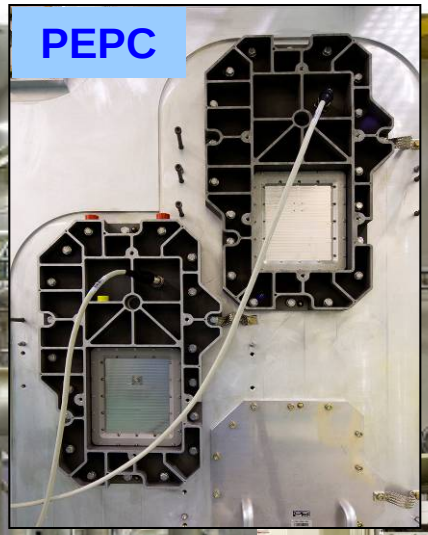
7 bundles + 1 PW laser beam

LMJ 1st bundle Amplifying Section

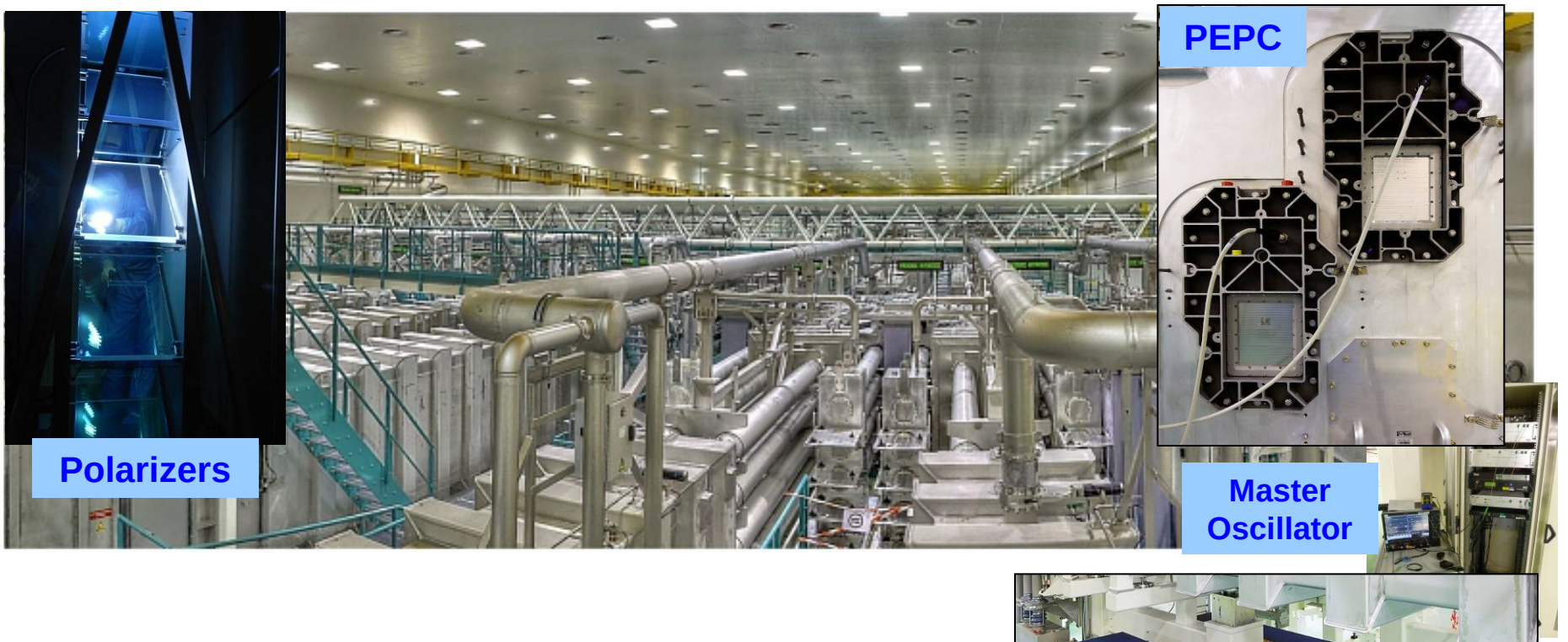
LMJ 1st bundle Amplifying Section



LMJ 1st bundle Amplifying Section

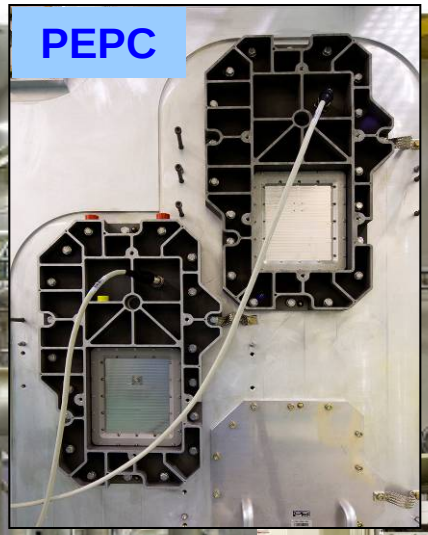


LMJ 1st bundle Amplifying Section



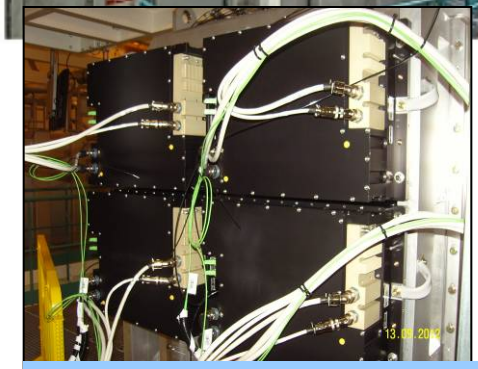
LMJ 1st bundle Amplifying Section

Polarizers

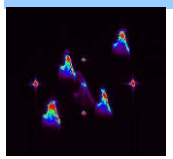


PEPC

Master Oscillator



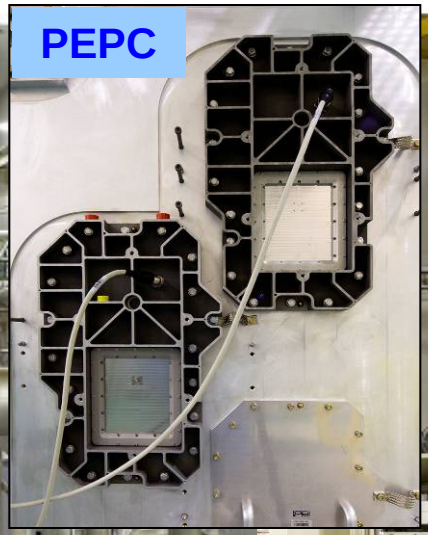
Deformable mirror



PAM

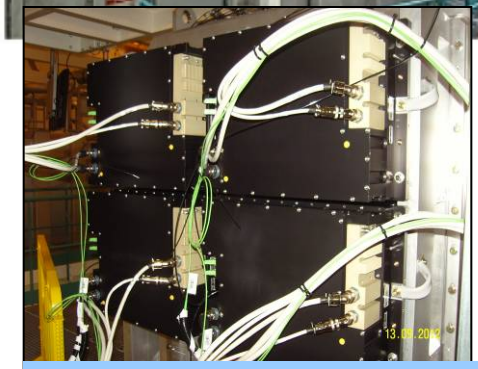
LMJ 1st bundle Amplifying Section

Polarizers



PEPC

Master Oscillator



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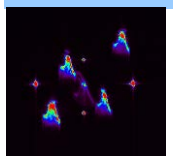
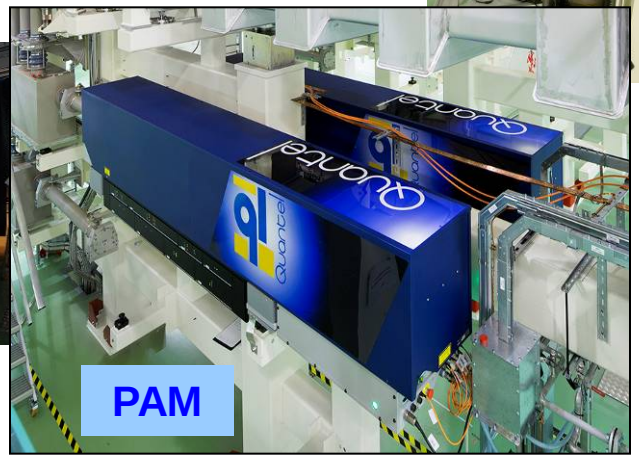


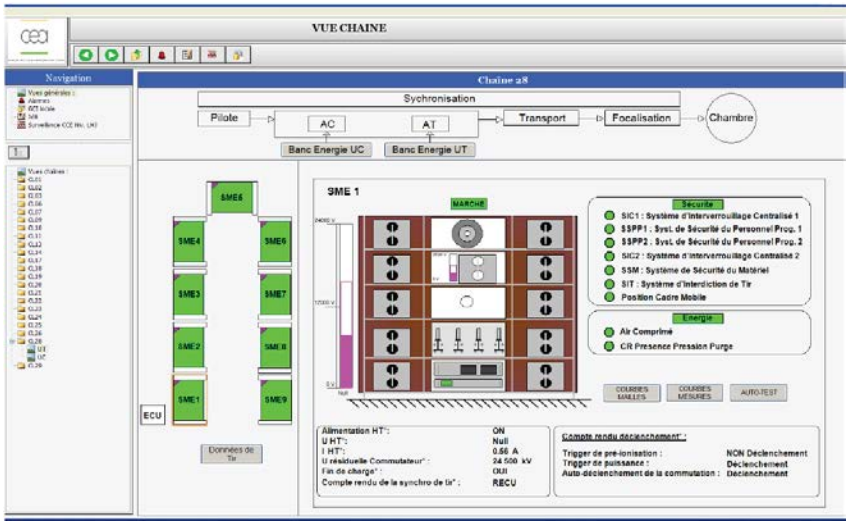
LRUs transfer vehicle



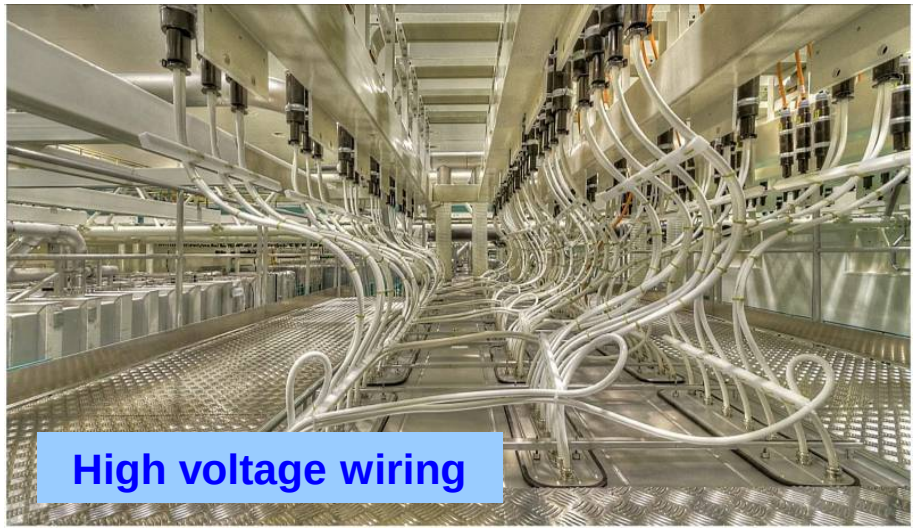
PAM

LMJ 1st bundle Power Conditioning

Power conditioning

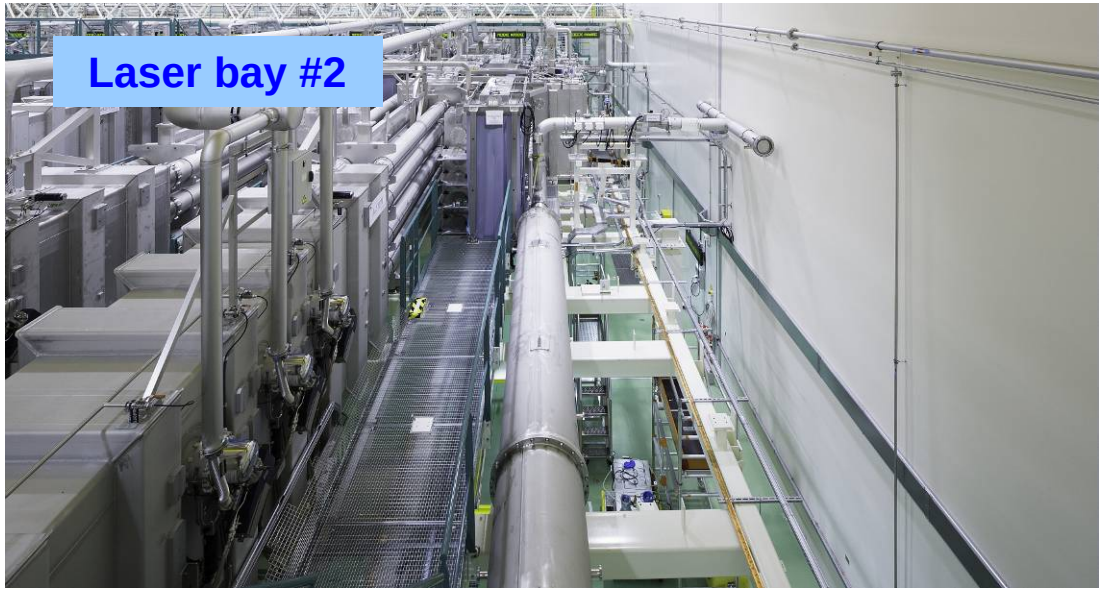


GUI



High voltage wiring

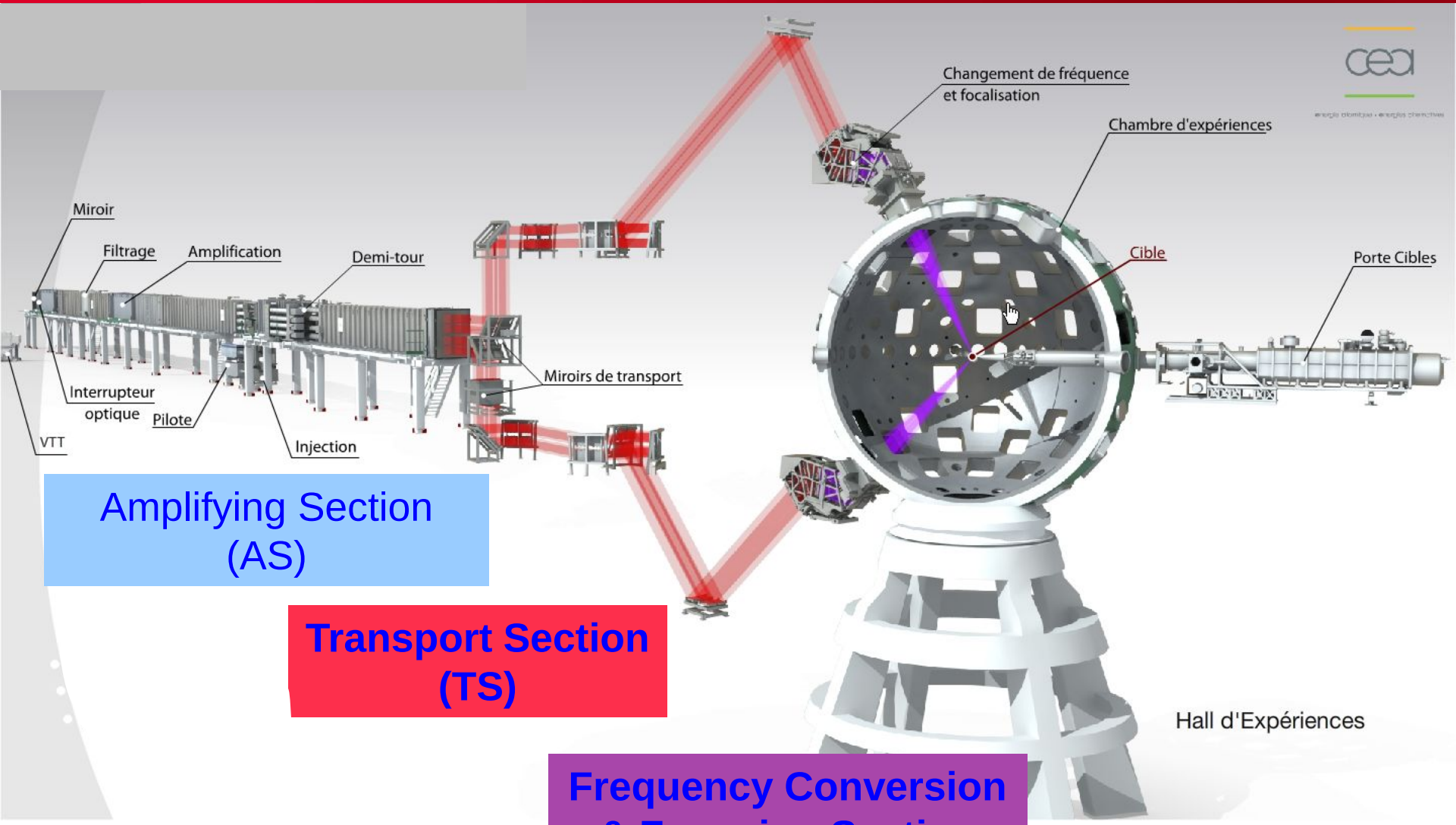
Petawatt Laser line in hall # 2 (PETAL)



Please refer to MOPPC095 poster :

PETAL Control System Status

First Bundle Transport and SCF sections

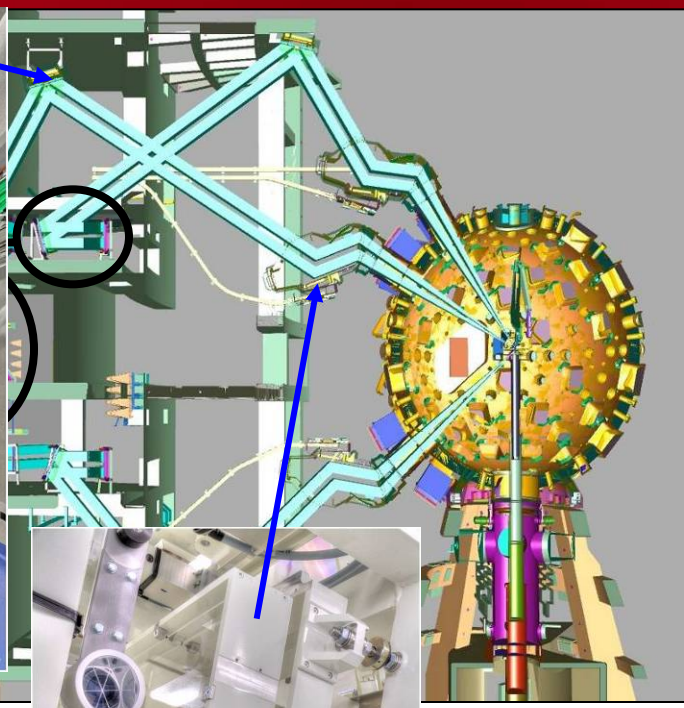


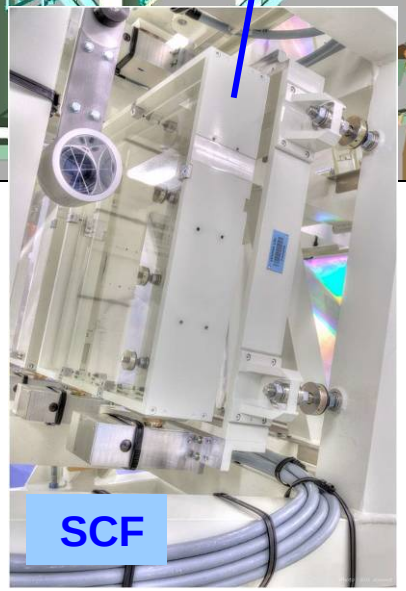
Amplifying Section (AS)

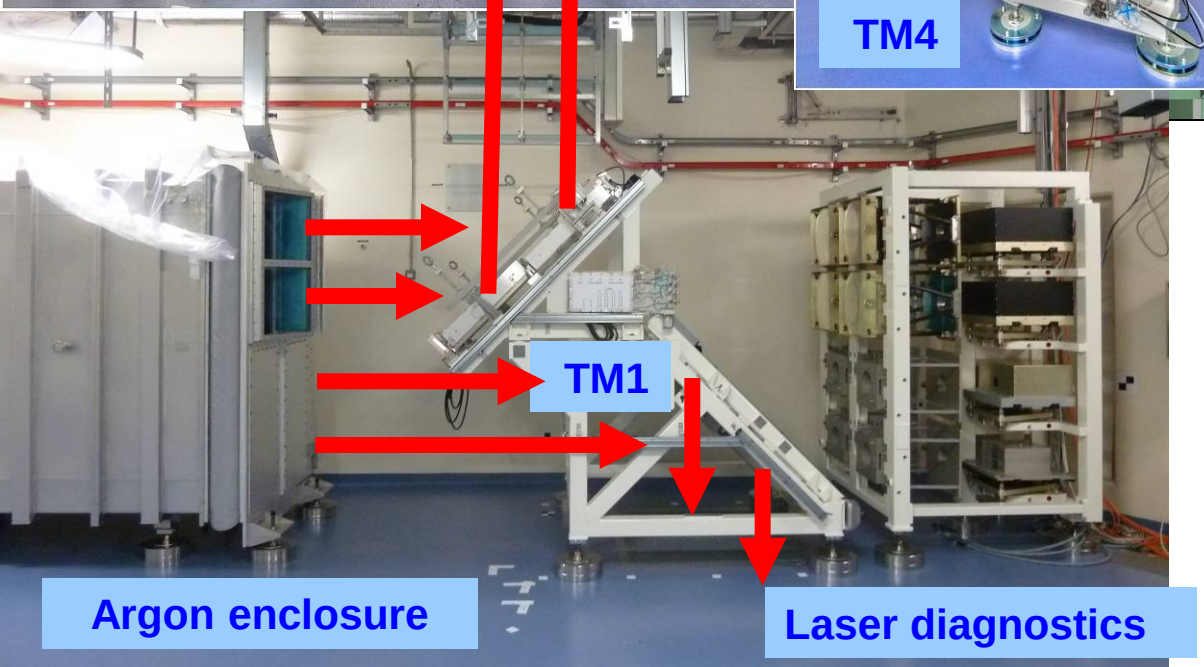
Transport Section (TS)

Frequency Conversion & Focusing Section (SCF)

Beam Transport and SCF Sections : Two quads assembly is in progress in switchyard



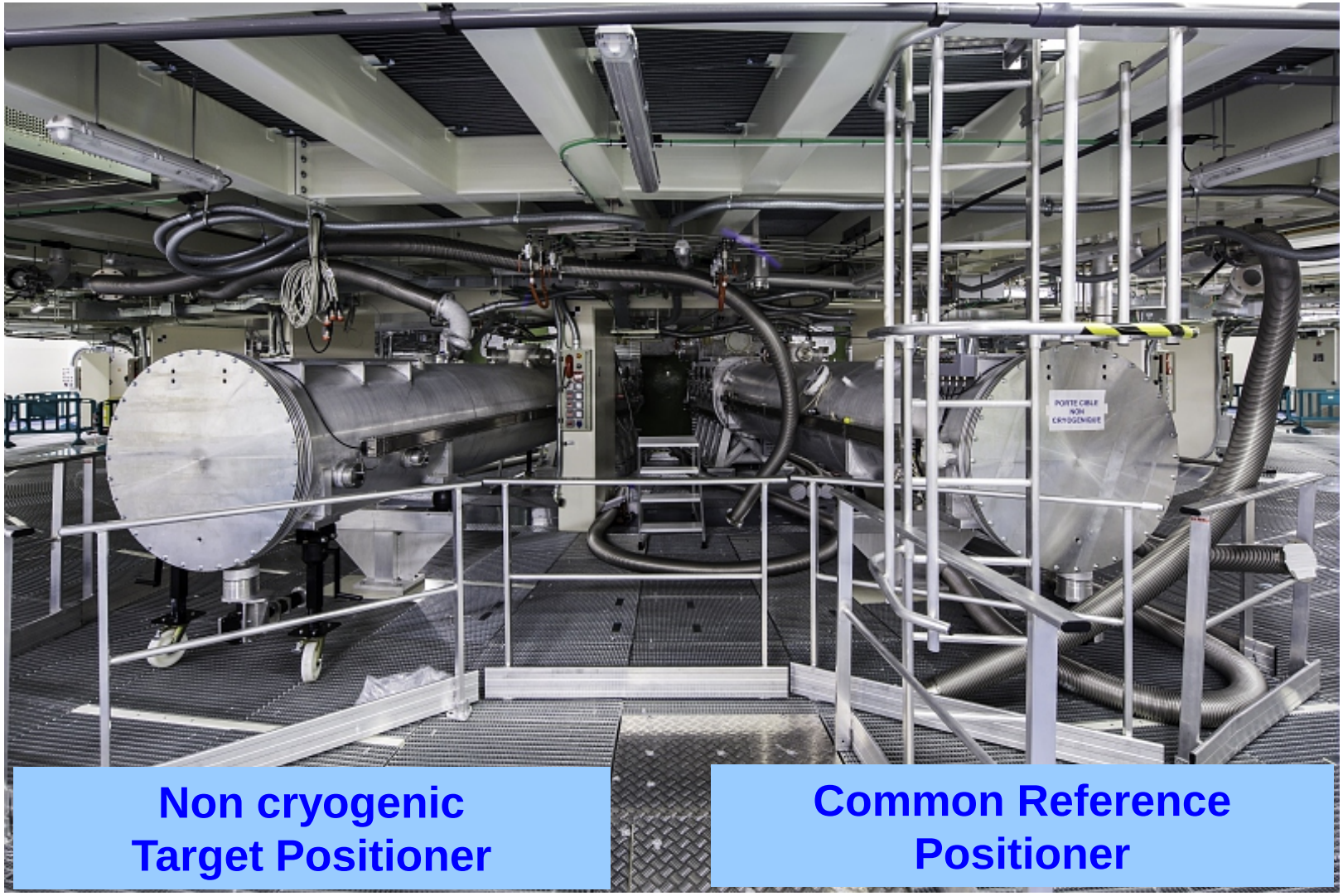




Upper Chamber Nose Assemblies

Chamber Nose Assembly :
Non converted light absorber,
Vacuum window,
Debris Shields
and 3ω calorimeter

Center chamber positioners



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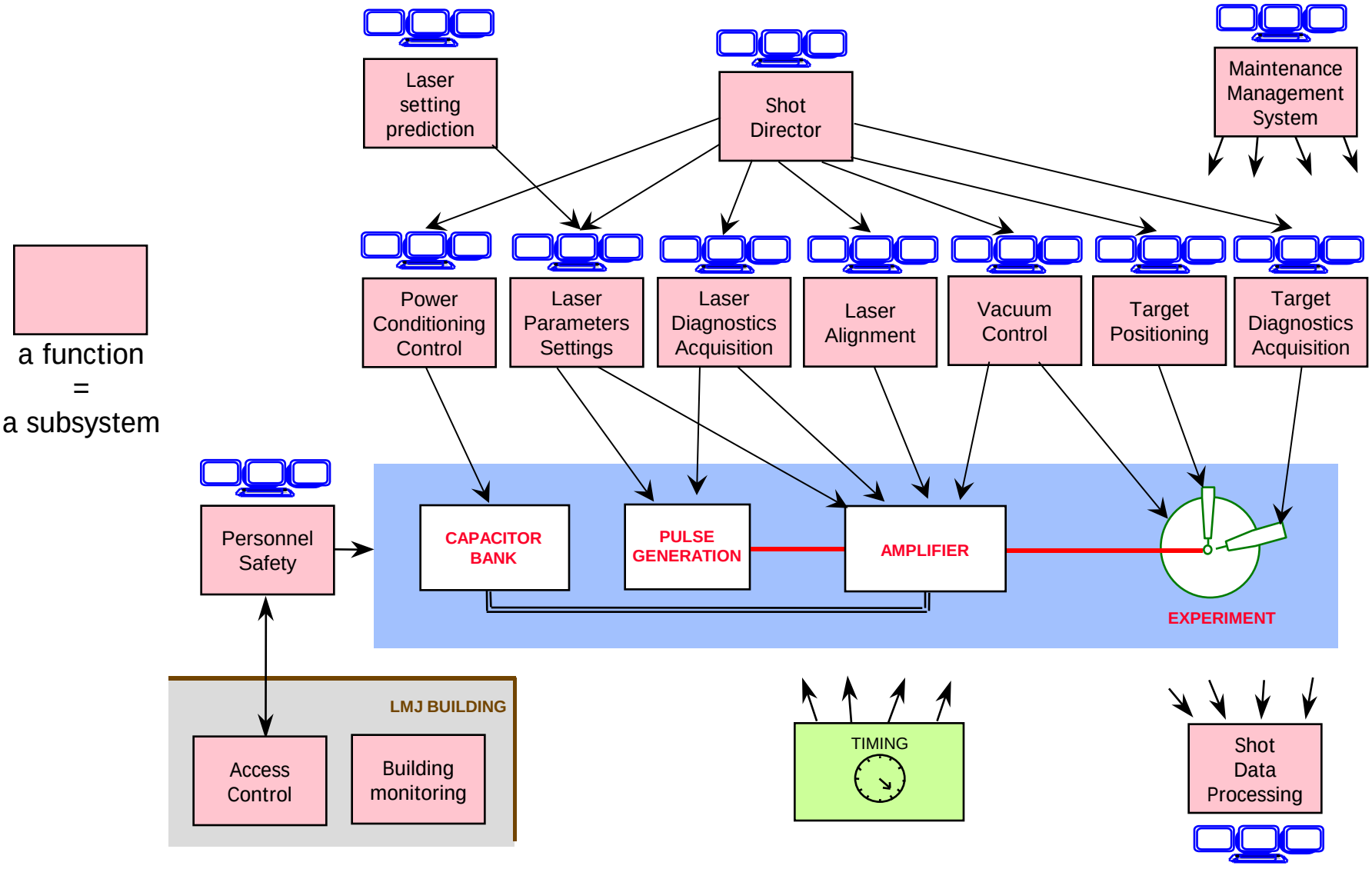
LMJ Control system functions



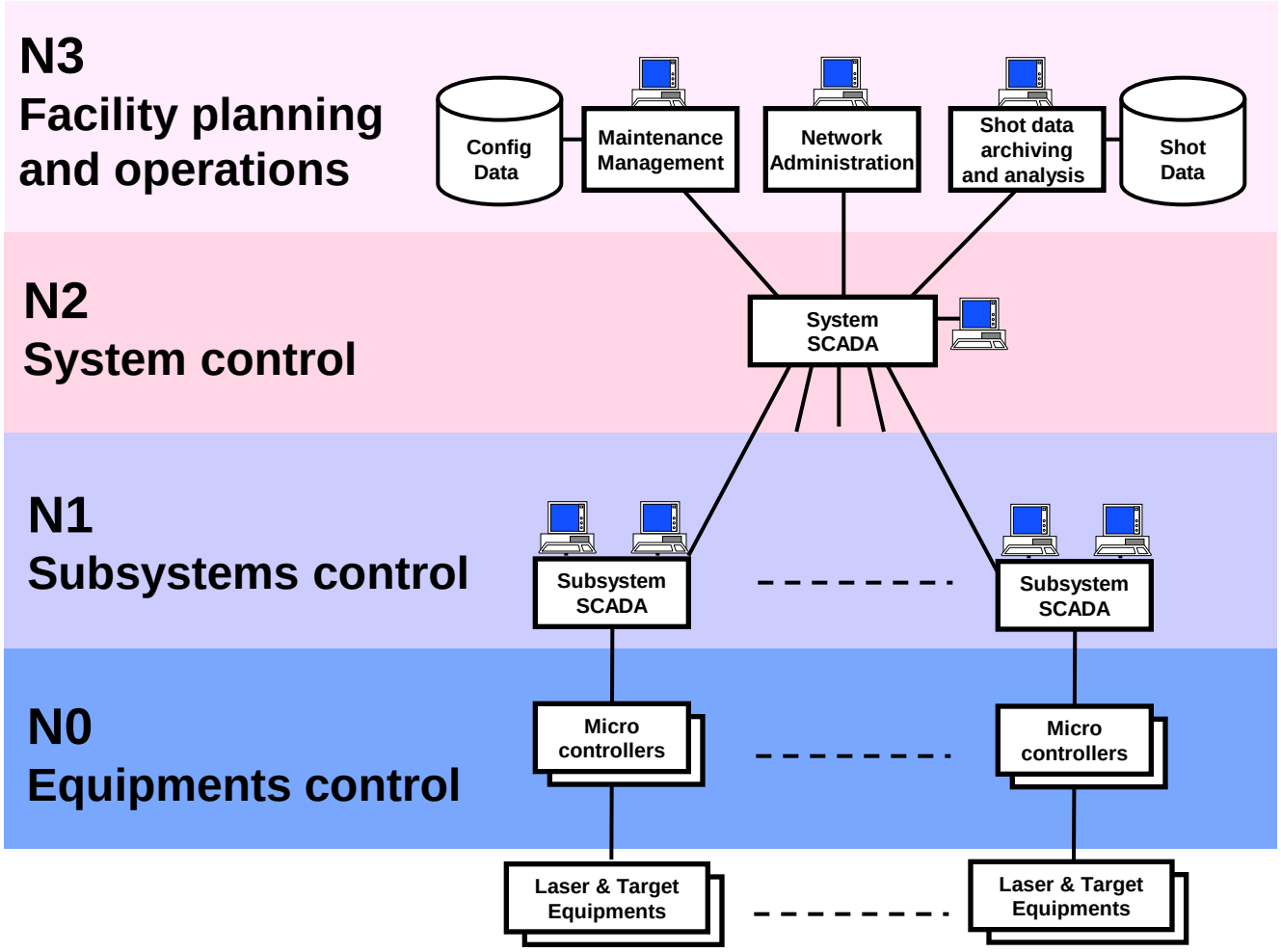
Control system architecture

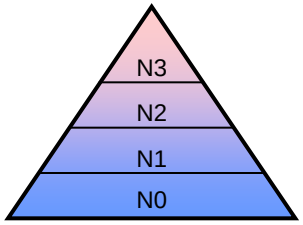
Control Points
500 000

Alarms
100 000

Real or virtual Processors
500

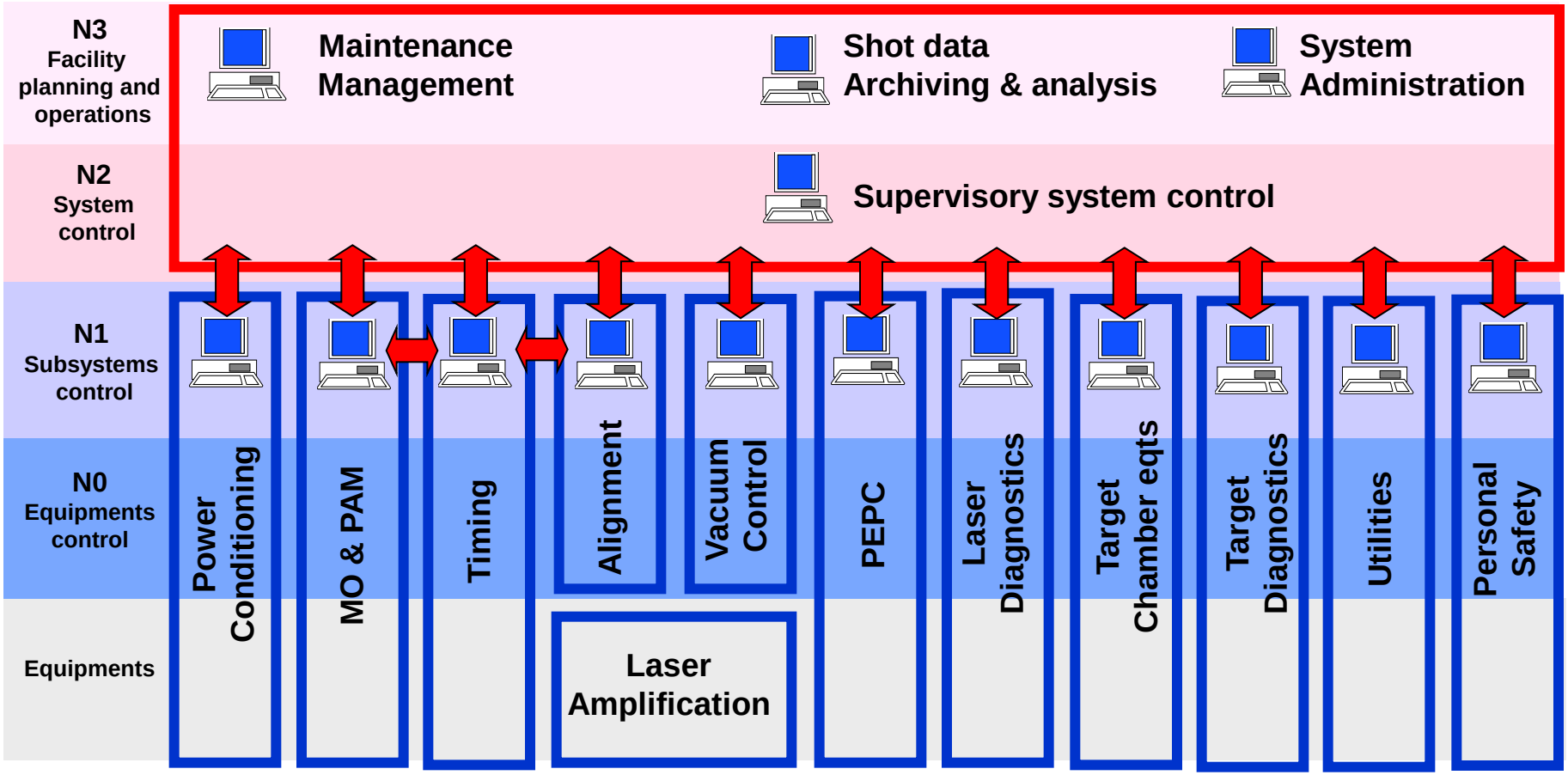
Shot data
~1 GB / shot
2 years on line





Common Information Model - 1

Contracts management



Communication protocol

Logical & Physical architecture

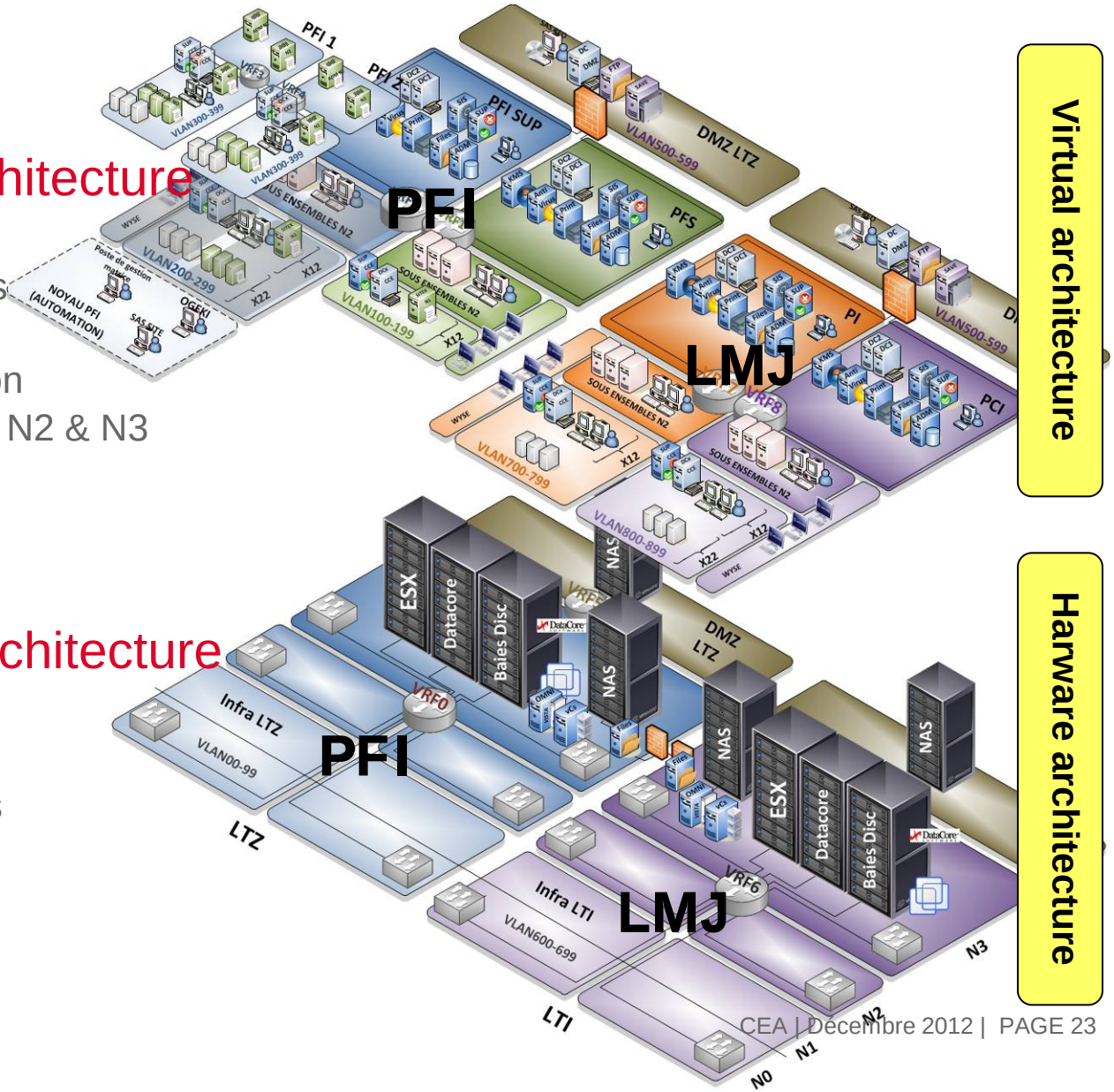
Logical architecture

- ~500 virtual machines
- VMware ESX
- Network administration
- Supervisory level N1, N2 & N3

Physical architecture

- ~15 hi-perf Servers
- Core network devices
- 100 To of disk space

PFI = Software Integration PlatForm



LMJ computer room

← Uninterruptible Power Supply (UPS)

>1 hour of autonomy

By-pass on main power for maintenance

IT housing →

Hot corridor infrastructure

CRAC supplied with chilled water

LMJ computer room

← Uninterruptible Power Supply (UPS)

>1 hour of autonomy

By-pass on main power for maintenance

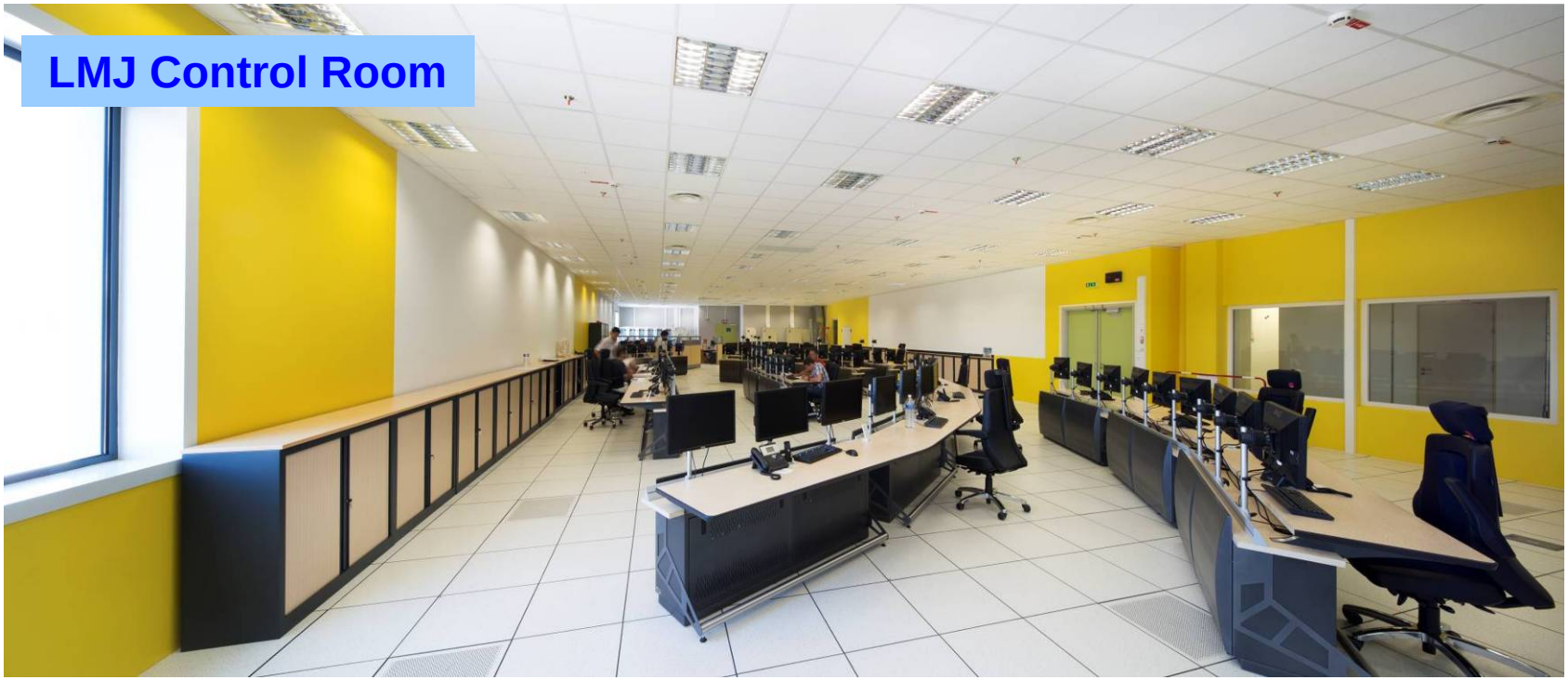
Data Center Cooling Technologies

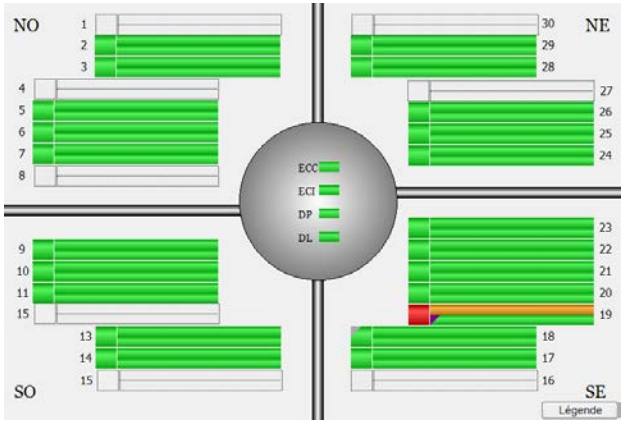
IT housing →

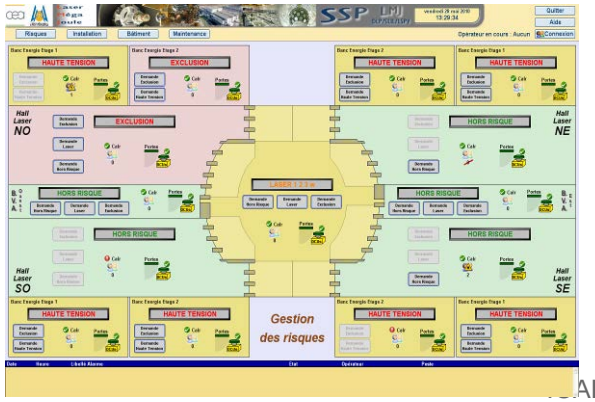
Hot corridor infrastructure

CRAC supplied with chilled water

LMJ Control Room

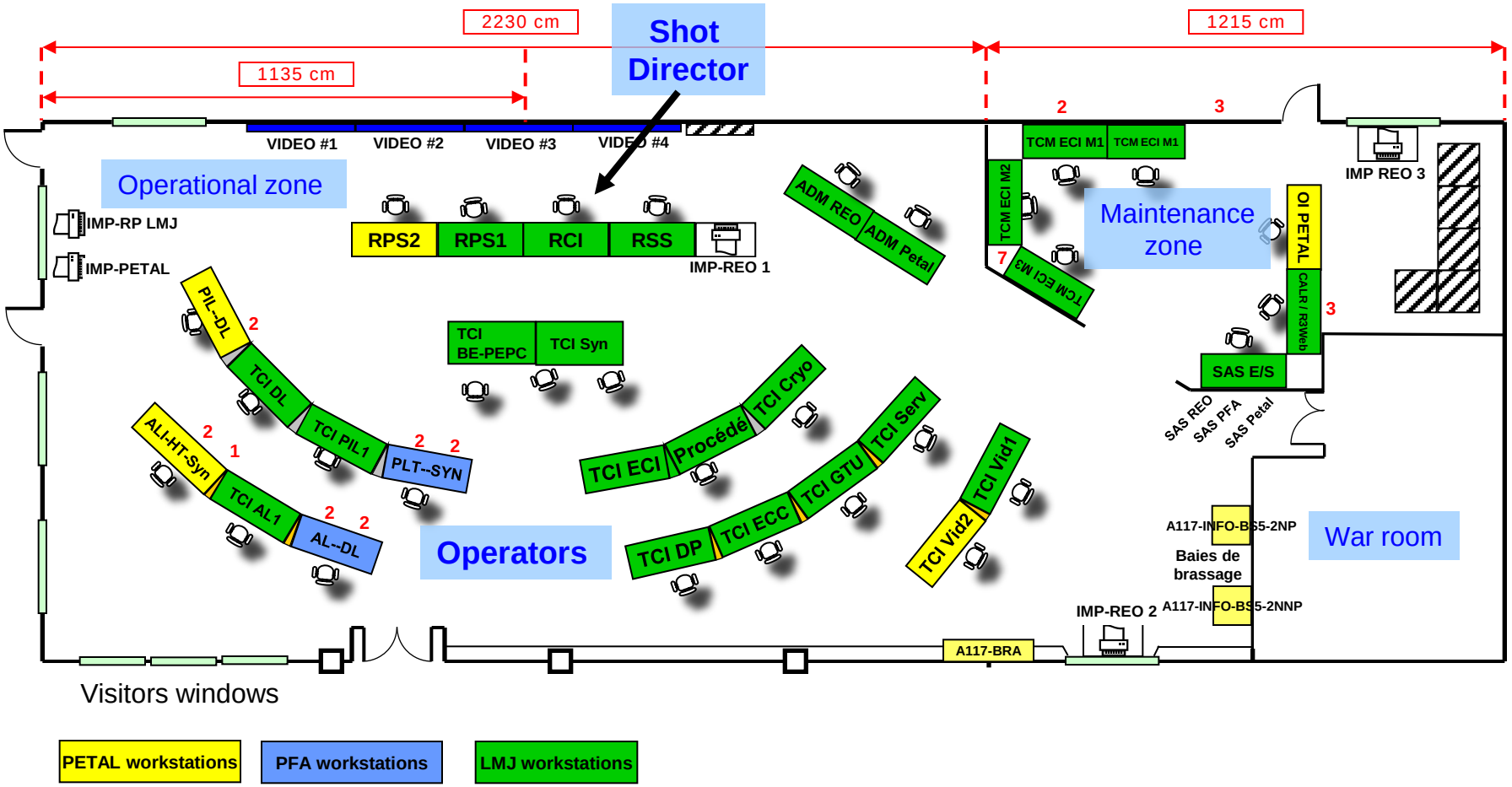






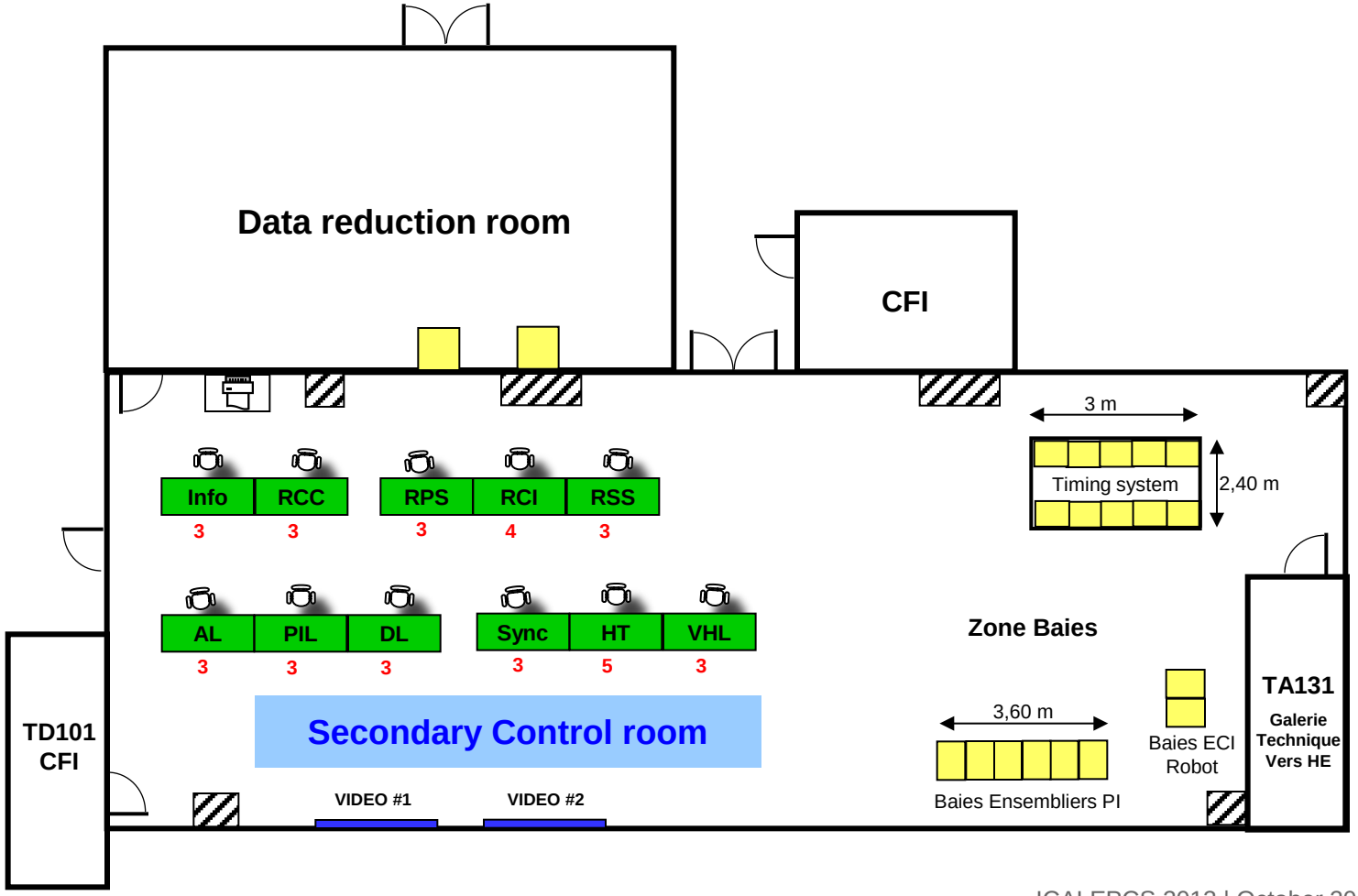
Examples of GUI's

Control room organization



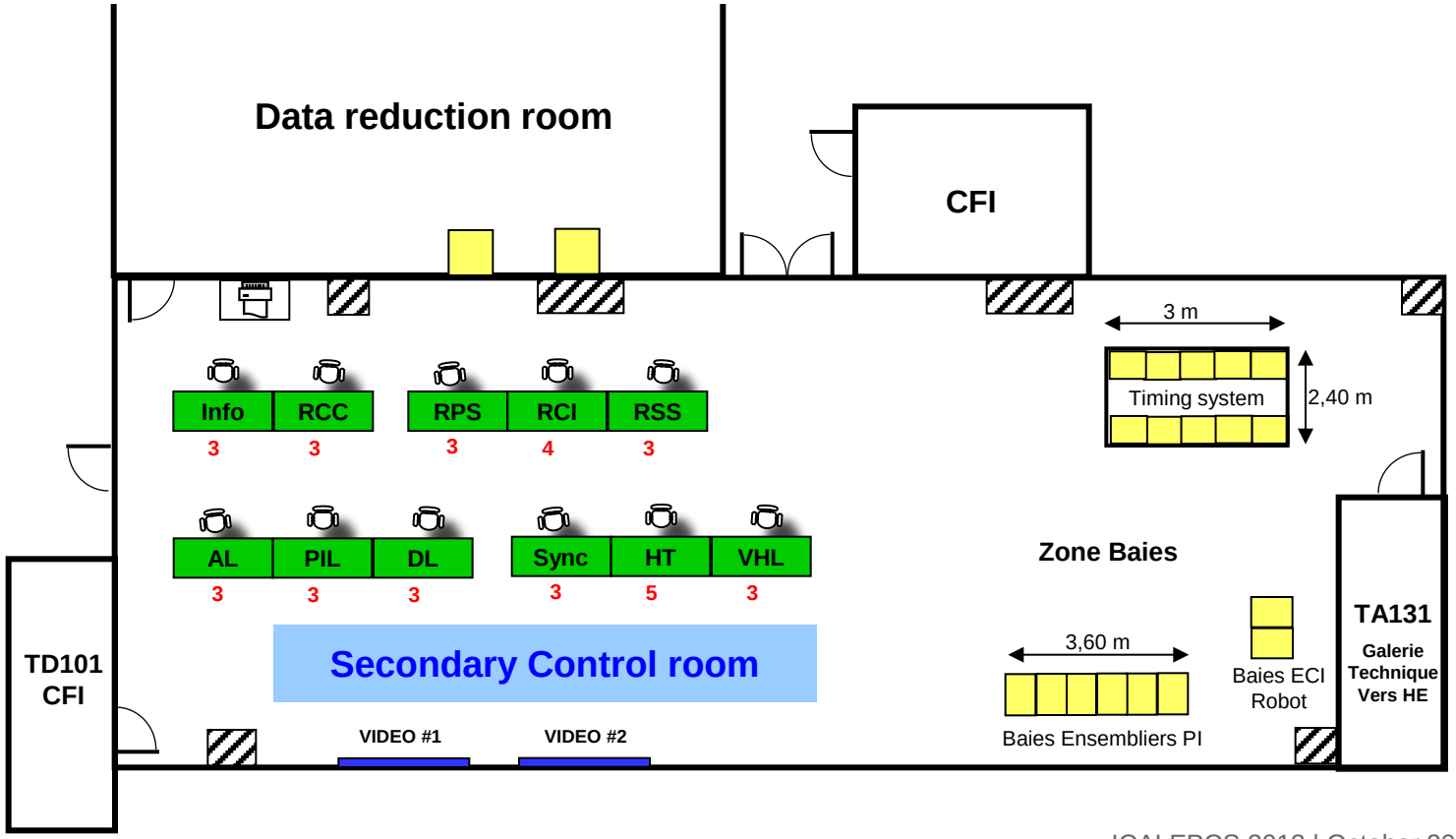
Plan au 1/150e (1 cm = 150 cm)

Secondary Control Room

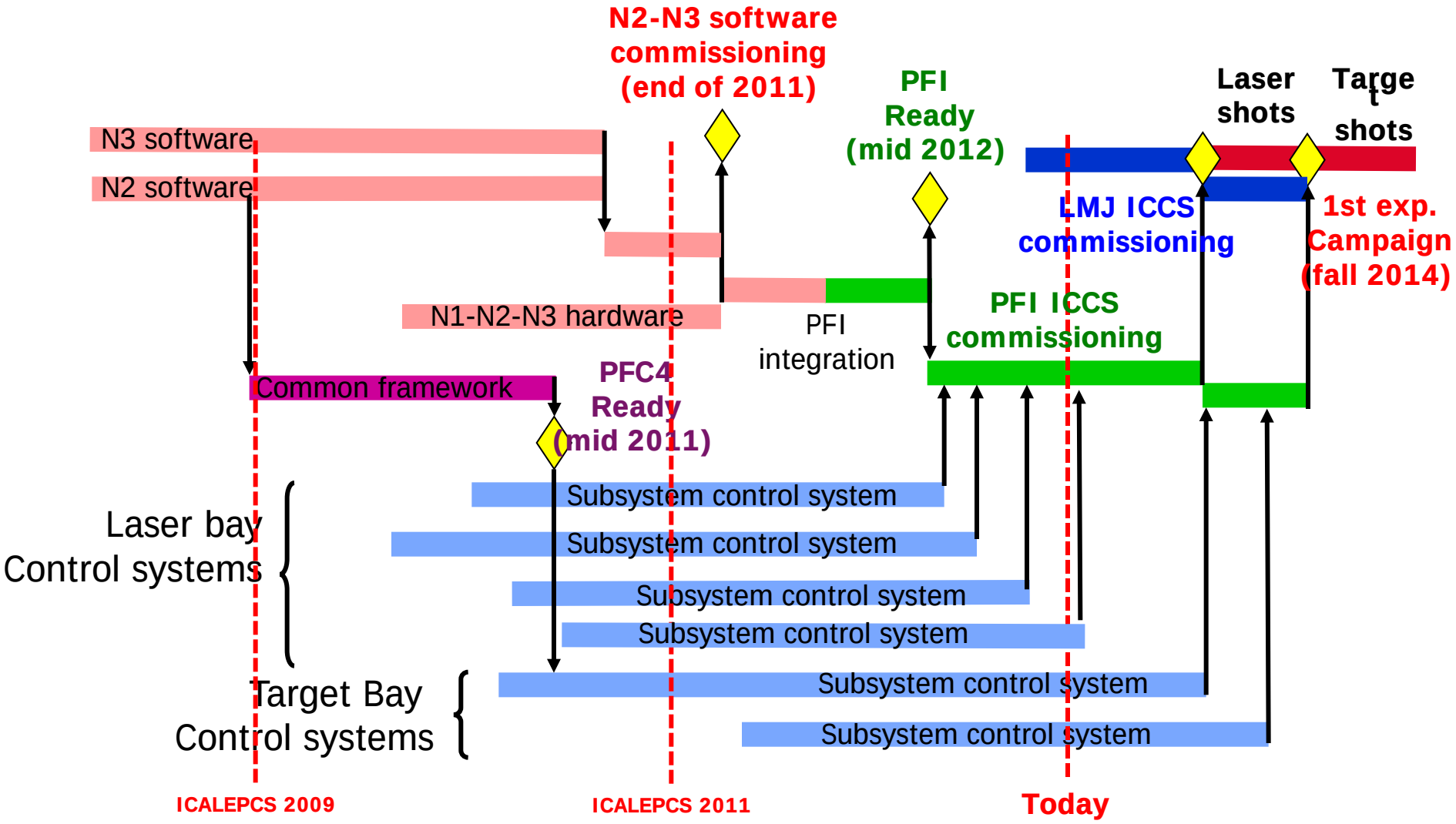


Secondary Control Room

The secondary control room allows new laser bundle commissioning during use of the commissioning bundles for shots and fusion experiments from the main control room

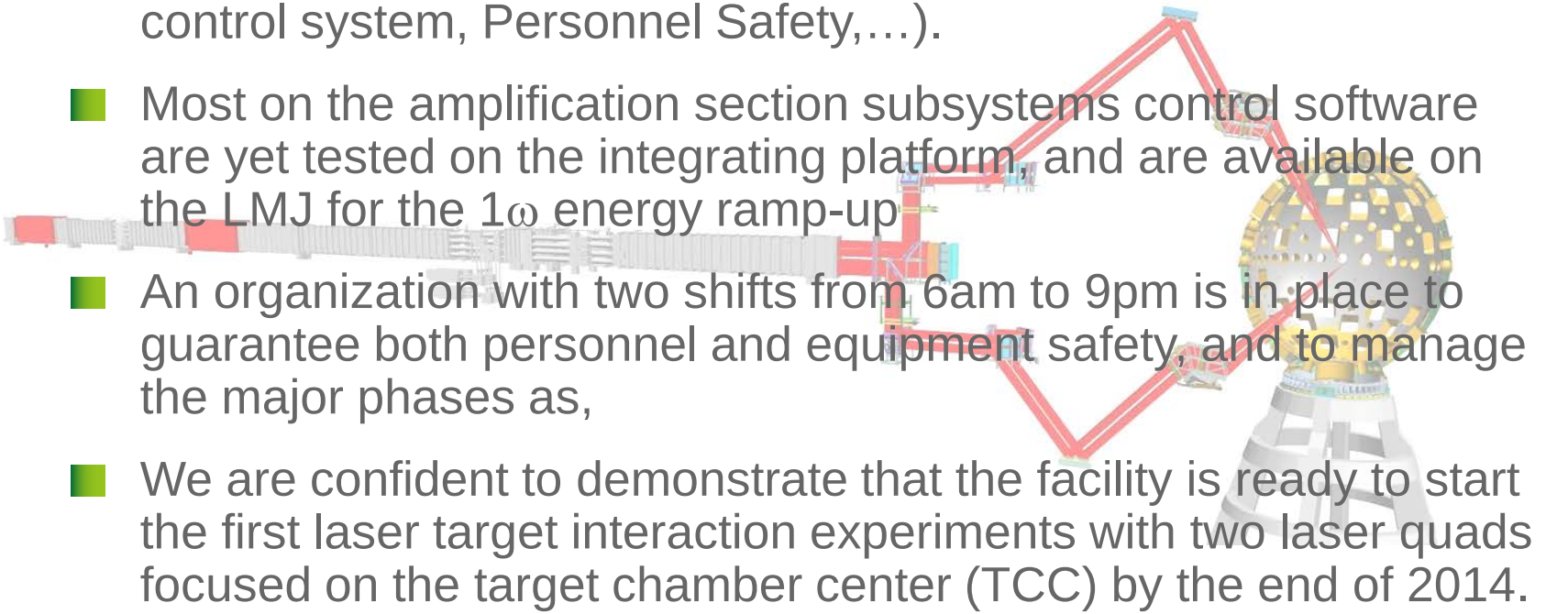


Control system milestones



Summary, where we are today…

- All equipments for the first bundle commissioning will be mounted by the end of 2013 (1ω and 3ω alignment system, computer control system, Personnel Safety,…).
- Most on the amplification section subsystems control software are yet tested on the integrating platform, and are available on the LMJ for the 1ω energy ramp-up
- An organization with two shifts from 6am to 9pm is in place to guarantee both personnel and equipment safety, and to manage the major phases as,
- We are confident to demonstrate that the facility is ready to start the first laser target interaction experiments with two laser quads focused on the target chamber center (TCC) by the end of 2014.



For more information : www-lmj.cea.fr