



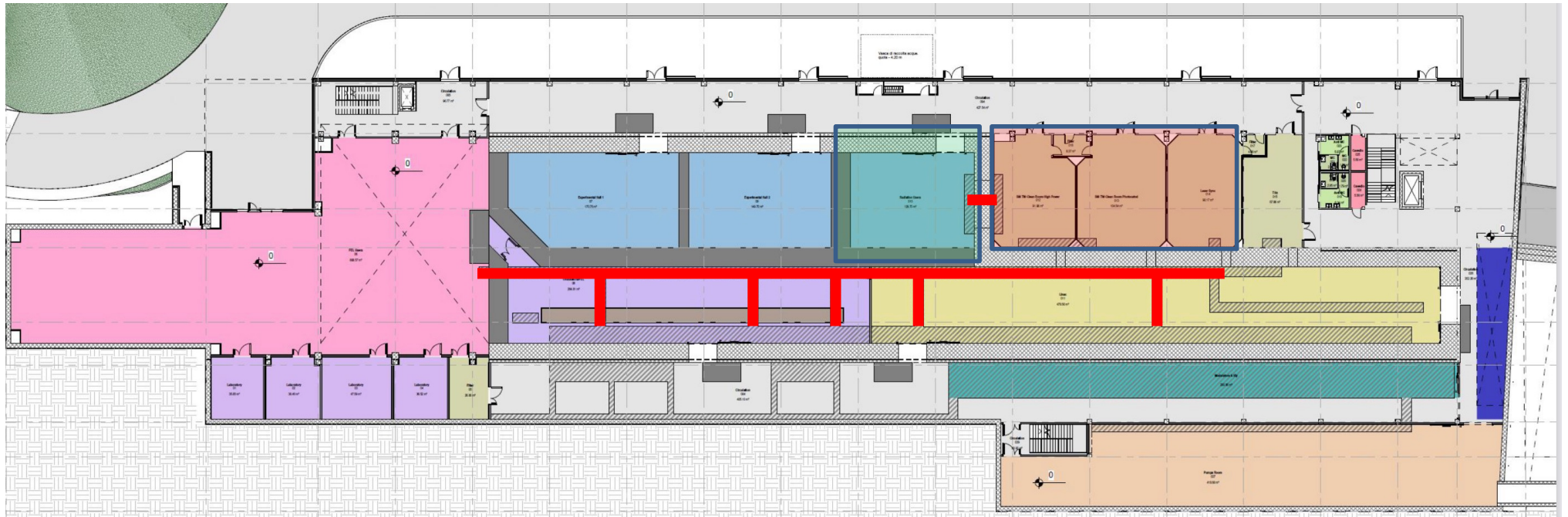
EuPRAXIA@SPARC_LAB High Power Laser System

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On behalf of SPARC_LAB collaboration

- Location inside the building
- High power laser parameters
- An example of the layout
- The laser chain
 - High power laser
 - Photocathode laser
 - Diagnostic beam-lines
- Conclusions

The high power laser system: location



Courtesy S. Incremona

The high power laser system: location

Space is large enough to host two 500TW lasers or 1PW laser.

2 Phases:

1st Phase → 500TW laser will be installed

2nd Phase → second 500TW or upgrade to 1PW

Two 500TW laser could satisfy the 24h/7day operation request.

Two 500TW laser could also work in parallel on different experiments.

Lasers can be useful for a very large number of experiments:

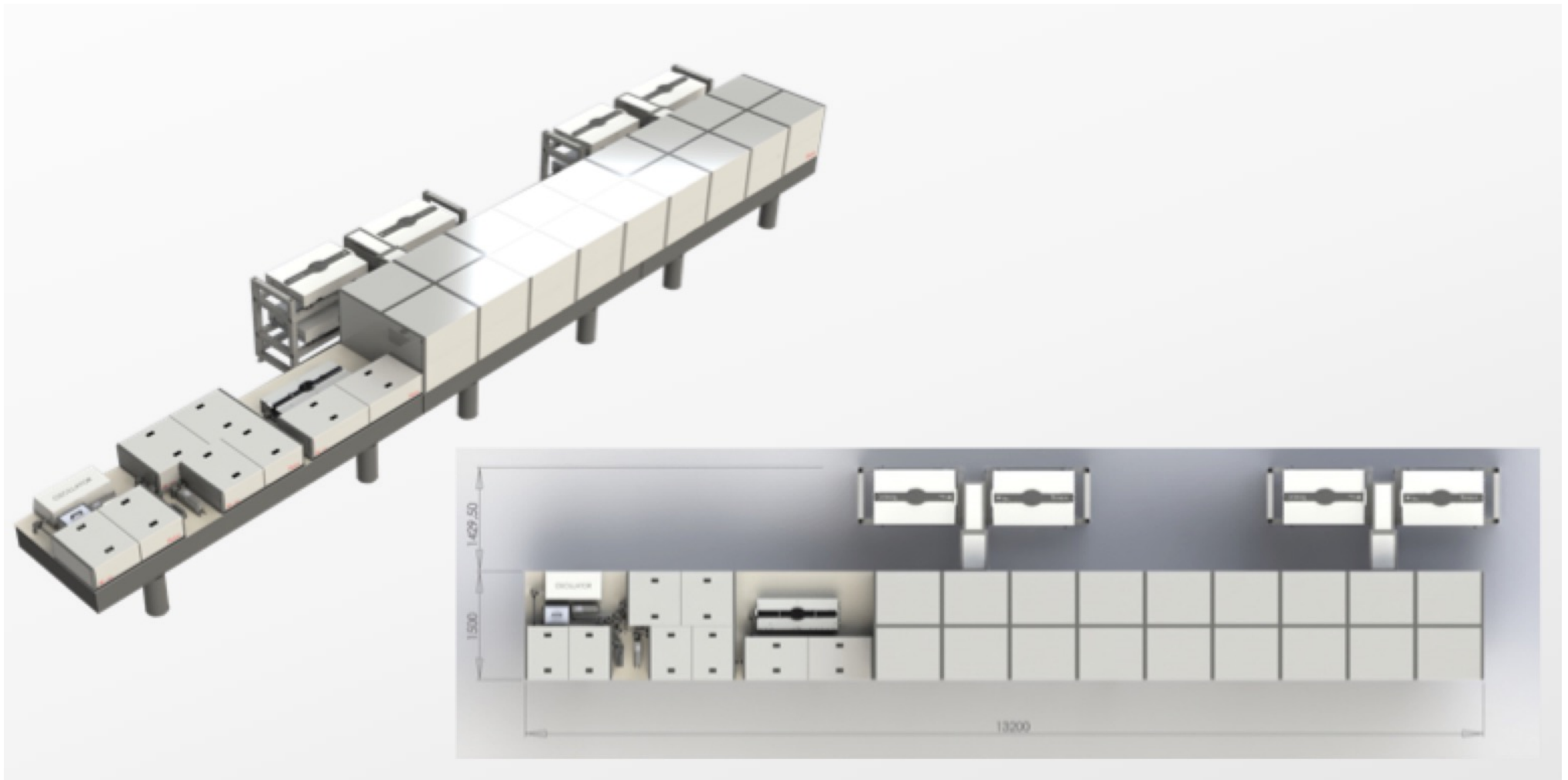
- Laser-driven acceleration;
- Electron acceleration with self injection;
- Proton acceleration;
- Positron production;
- Neutron production;
- Compton scattering;
- High-Energy Physics experiments;
- Astrophysics...

Also in most of these experiments, there is a natural or induced production of secondary radiation sources (betatron radiation, THz, Compton and so on).

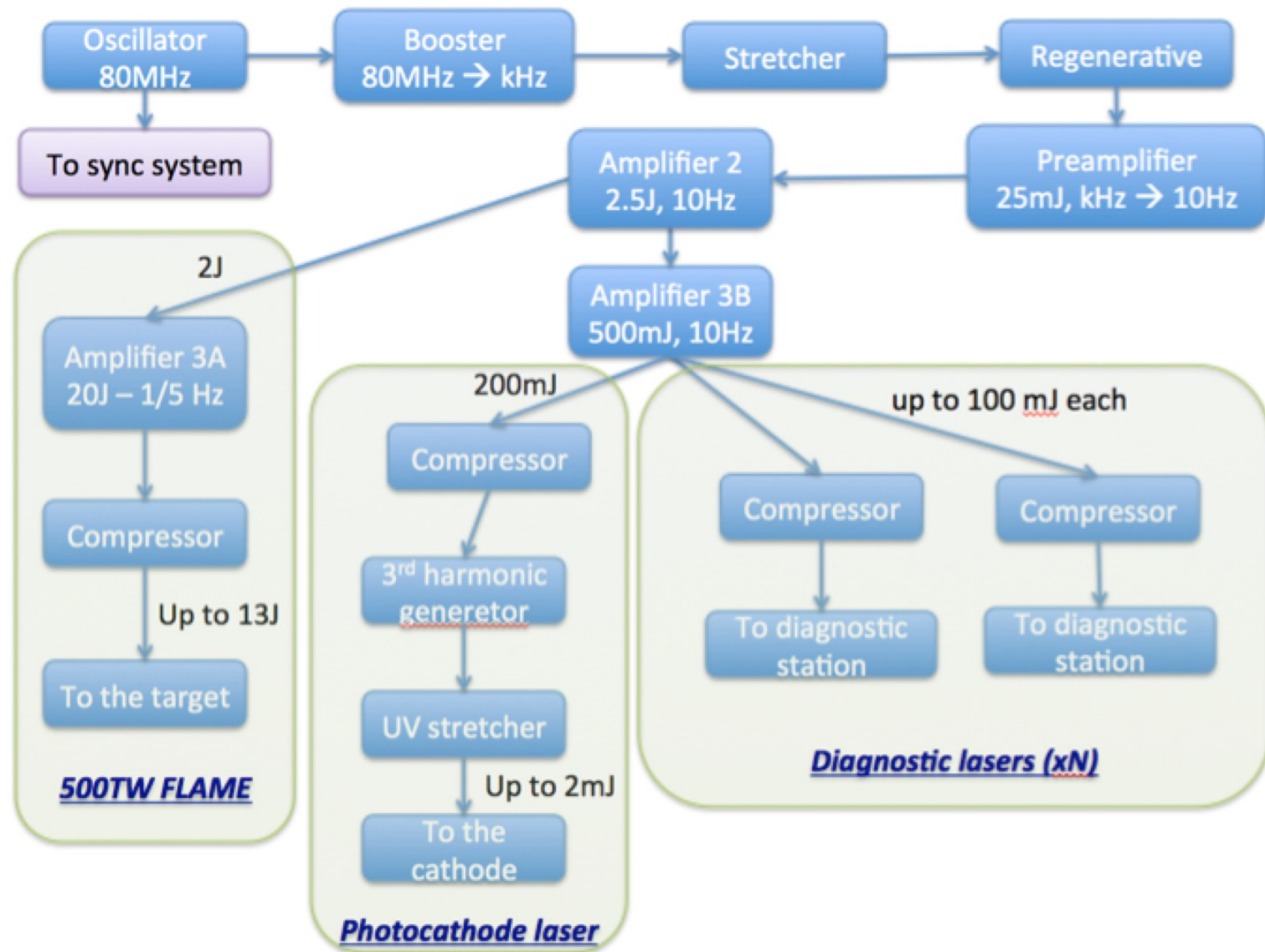
The 500 TW laser system – list of parameters

	Units	value
Central wavelength	nm	800
Bandwidth	nm	60 - 80
Repetition rate	Hz	1 - 5
Max energy before compression	J	20
Max energy on target	J	13
Min pulse length	fs	25
Max power	TW	500
Contrast ratio		10^{10}
Laser spot size at focus (optics dependent)	μm	2 - 50
Peak power density at focus (optics dependent)	W/cm^2	$10^{22} - 10^{19}$

The high power laser system: layout



The high power laser system: scheme of layout



The high power laser system: scheme of layout

Easier operations: we have only one front-end and one oscillator;

Photocathode laser is split from the main laser: most of the parts are common; easier for daily operations;

Diagnostic beam-lines are split from the main laser beam and can be as many as needed. Here as well, all parts are in common for easier operations and maintenance.

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Just to have an idea:

500TW laser beam has a transverse size between 250mm and 300mm.

Due to the large distance between the laser clean room and the FEL user area, is necessary to transport the laser beam uncompressed and, if needed, oversee a space for the compressor in the FEL user area. For 500TW, compressor is roughly 4mx4m and is very expensive due to the large gratings.

We have tried to simplify operations as much as possible by having a common front-end:

- a single oscillator for synch issues;
- photocathode laser split from main high power laser;
- diagnostic beam-lines can be overseen as well.

Common parts help for maintenance and for spare-parts.

Space left is enough for 2x500TW systems or for 1PW system.

There is also a dedicated bunker for laser experiments.

Thank you!!!