EUROPEAN UNION

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Competitiveness Operational Programme (COP)

Extreme Light Infrastructure - Nuclear Physics (ELI-NP) – Phase II

The degradation level of the optical components inside the pumping lasers of HPLS

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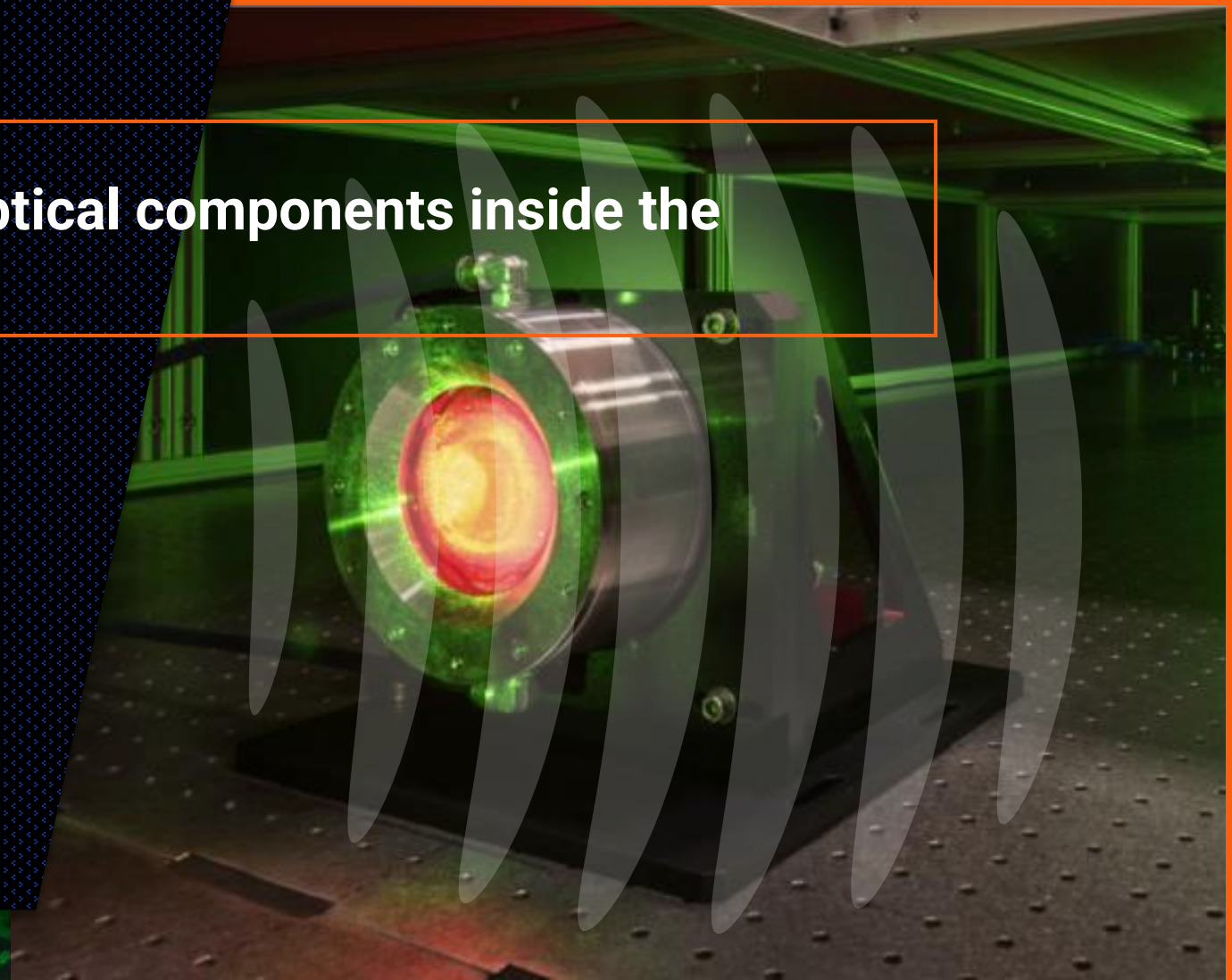
at ELI-NP, Măgurele, Romania

eli nuclear physics

IFIN-HH



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HPLS architecture

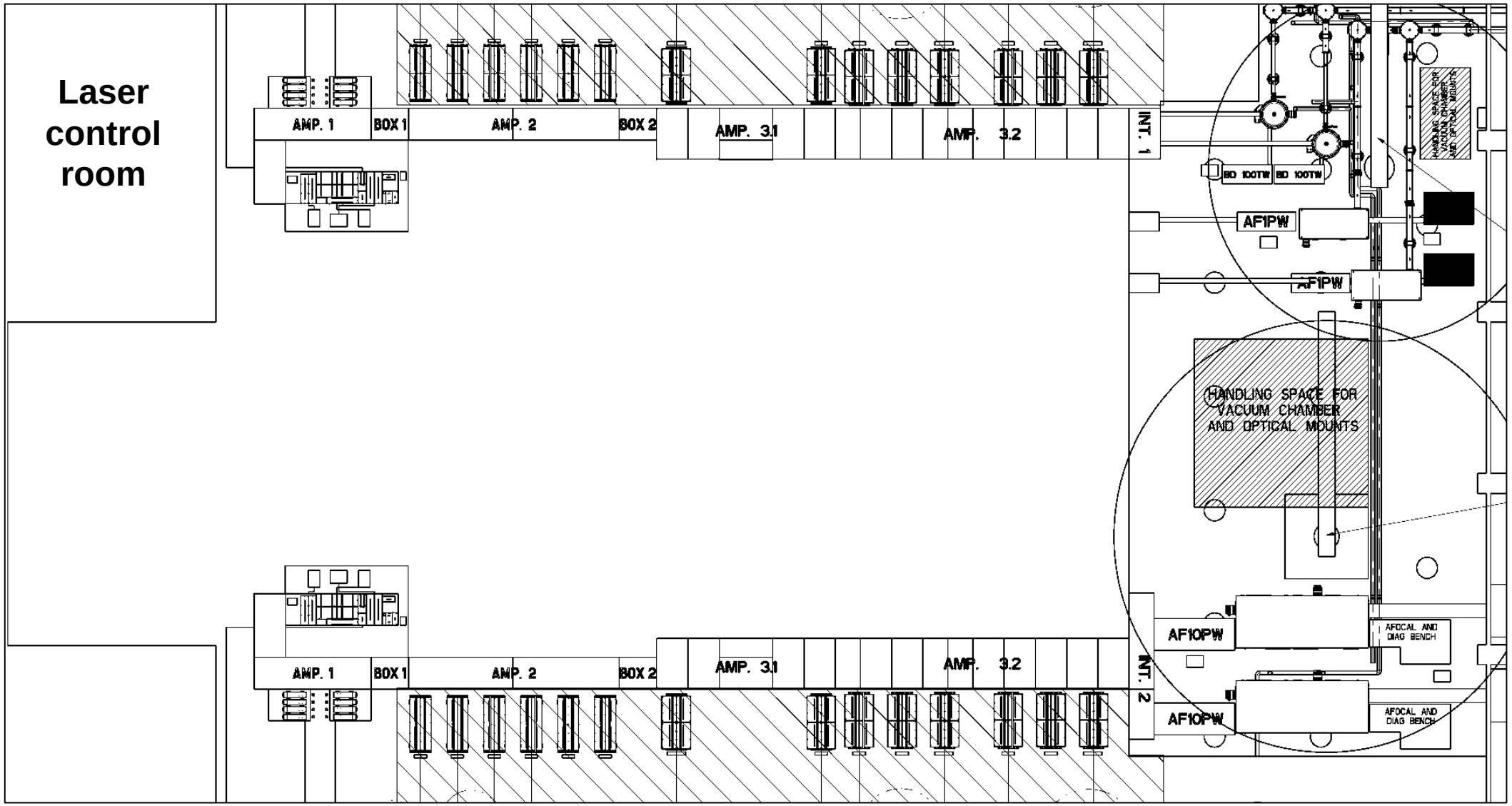
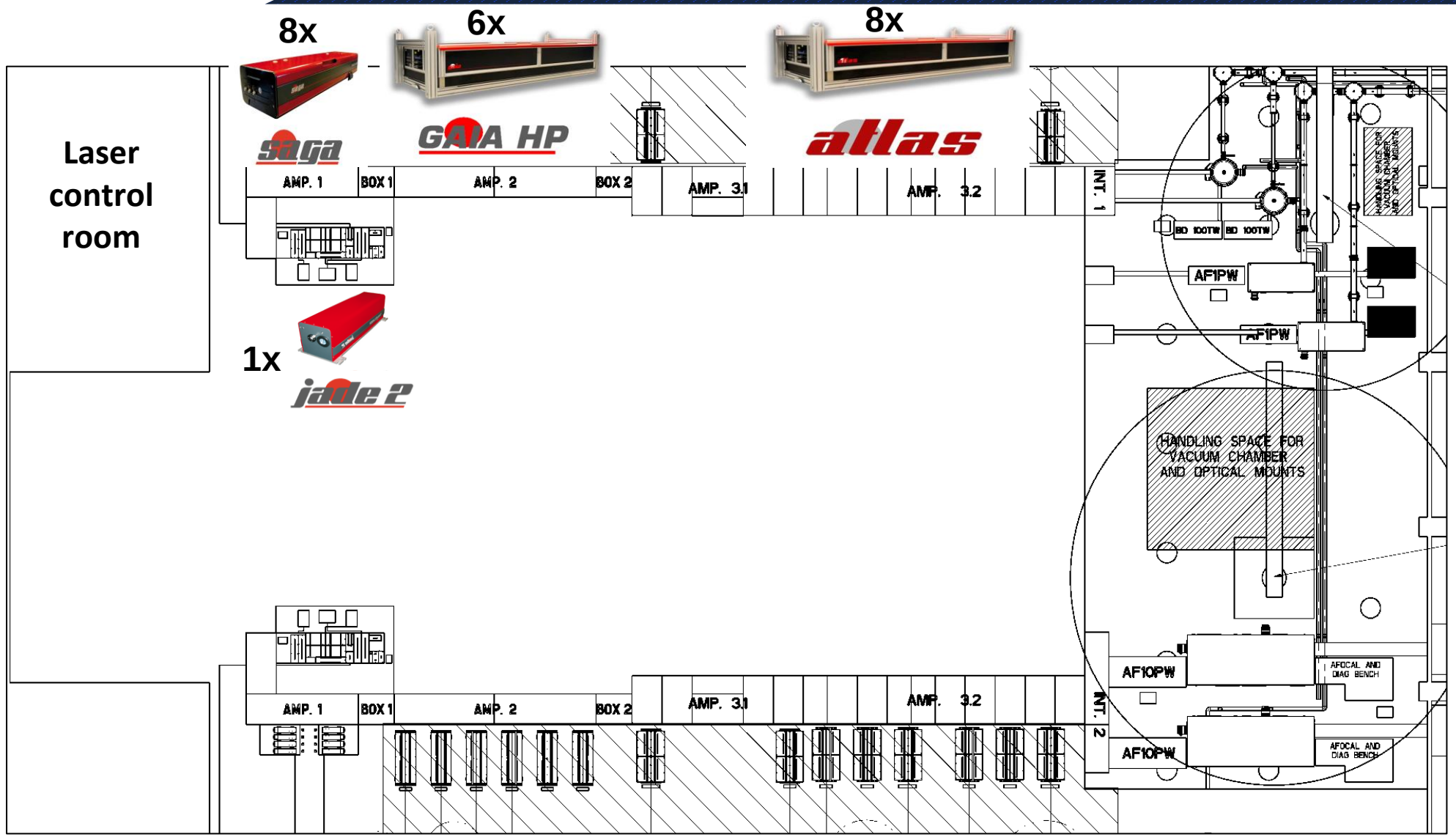


Fig 1. LP-01 – LASER Room

HPLS pumping lasers



Preventive maintenance HPLS pumping lasers

For this type of maintenance, the following measurements are performed:

→ *energy and energy stability (RMS)*
→ *beam profile (near field)*
→ *pulse duration*

…after the following activities are fulfilled:

→ *changing the flash lamps*
→ *verifying the rods* (and changing them if neccesary)
→ *verifying the optical components* (and changing them if neccesary)

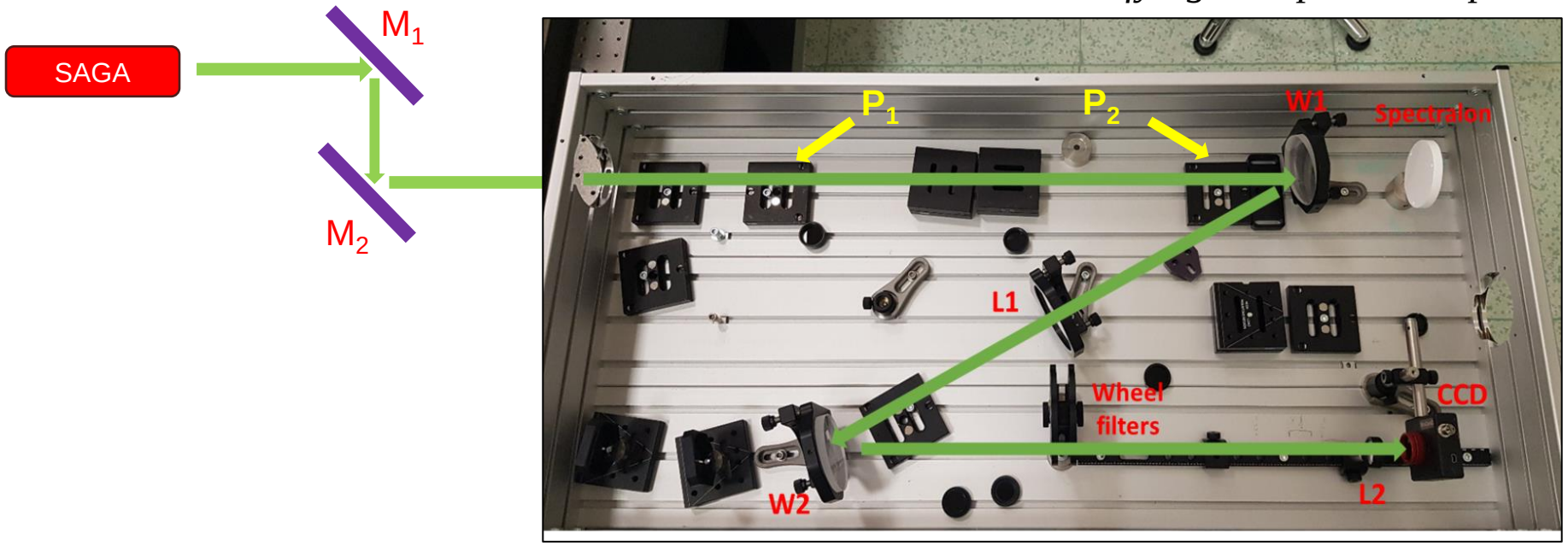


Fig. 2. Pumping laser diagnostic bench

Preventive maintenance HPLS pumping lasers

1. Energy & energy stability measurement → SAGA

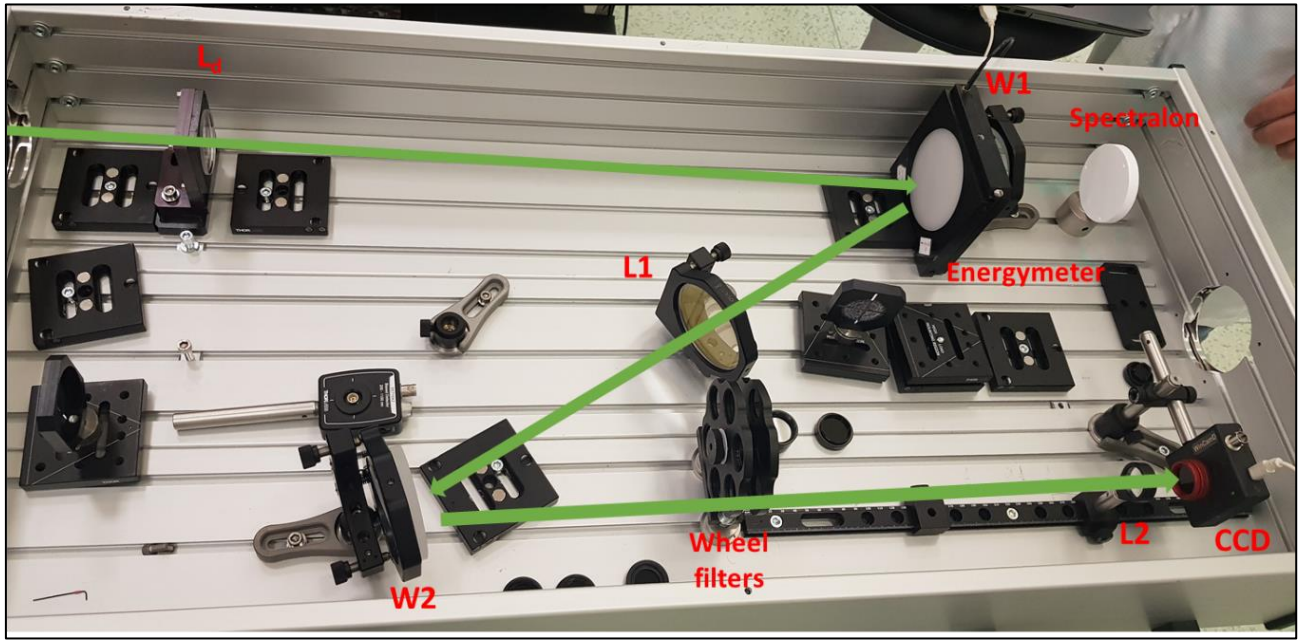


Fig. 3. Pumping laser diagnostic bench

Preventive maintenance HPLS pumping lasers

1. Energy & energy stability measurement → SAGA

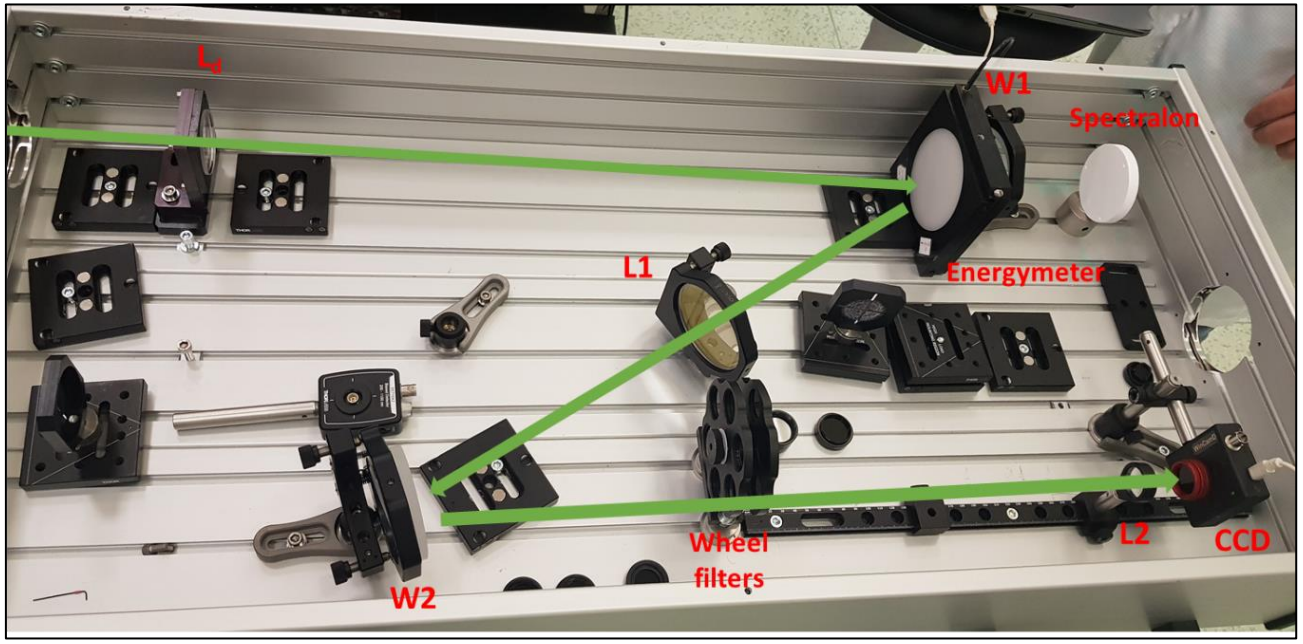


Fig. 3. Pumping laser diagnostic bench

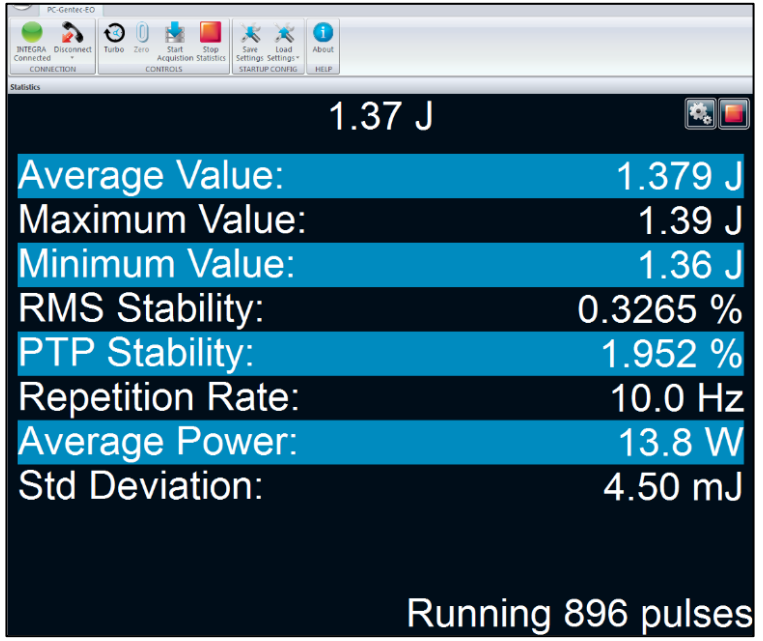


Fig. 4. Gentec software

In Gentec software:
→ λ= 532 nm
→ multiplier = 1.7
→ running pulses > 500

→ Energy → 1.37 J
RMS → 0.32 %

2. Beam profile → SAGA

- The camera software → *DataRay.*
- The trigger used for the camera was taken from the CCD camera of Amp 1.1.

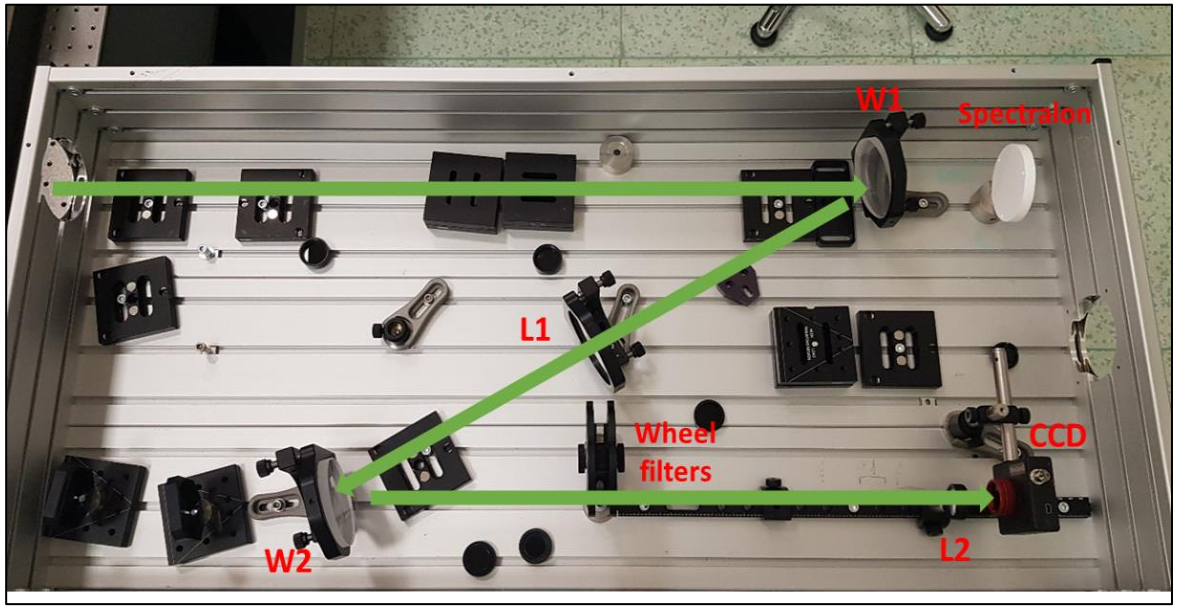


Fig. 5. Pumping laser diagnostic bench

2. Beam profile → SAGA

- The camera software → *DataRay.*
- The trigger used for the camera was taken from the CCD camera of Amp 1.1.

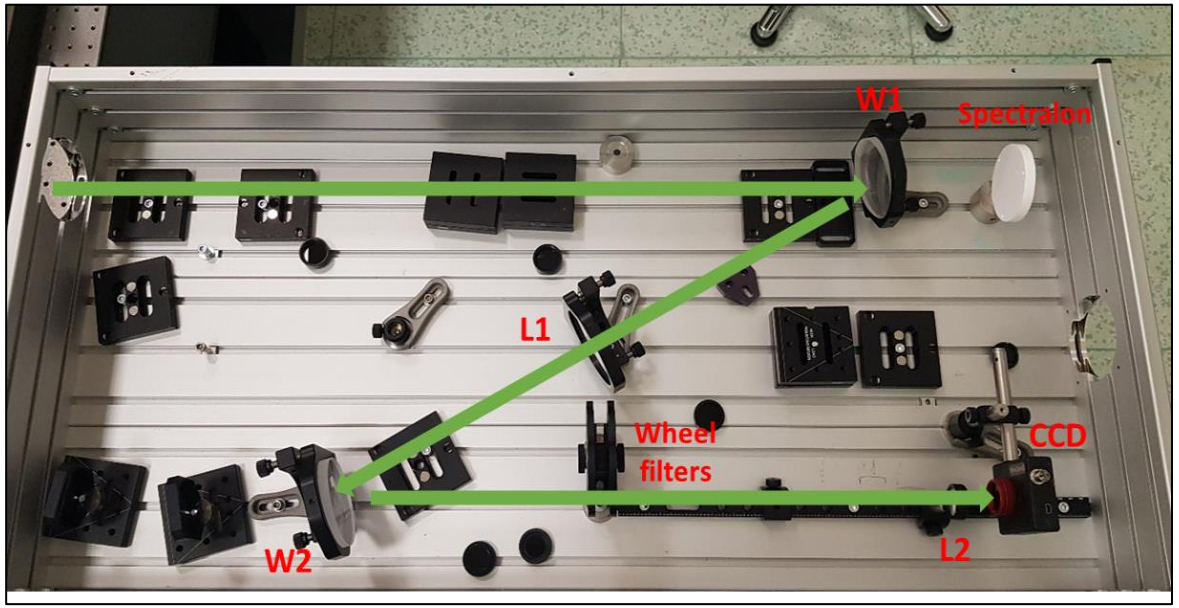


Fig. 5. Pumping laser diagnostic bench

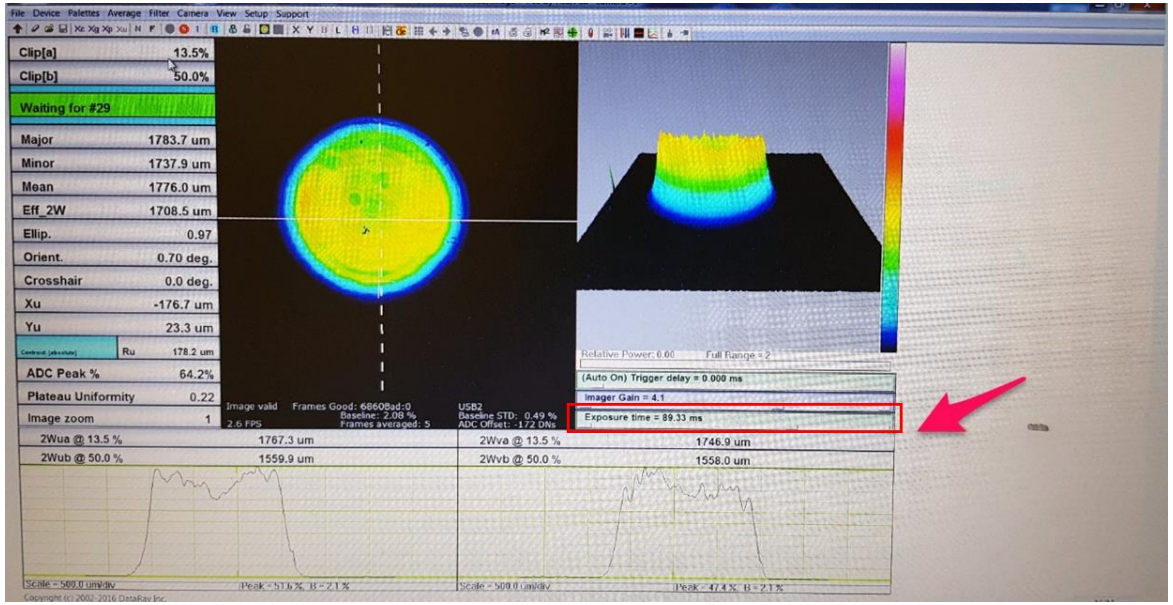


Fig. 6. Beam profile on DataRay software

Fig. 7. Beam profile – photographic paper

3. Pulse duration → SAGA

- The trigger for the photodiode was taken from SAGA's Pockels.

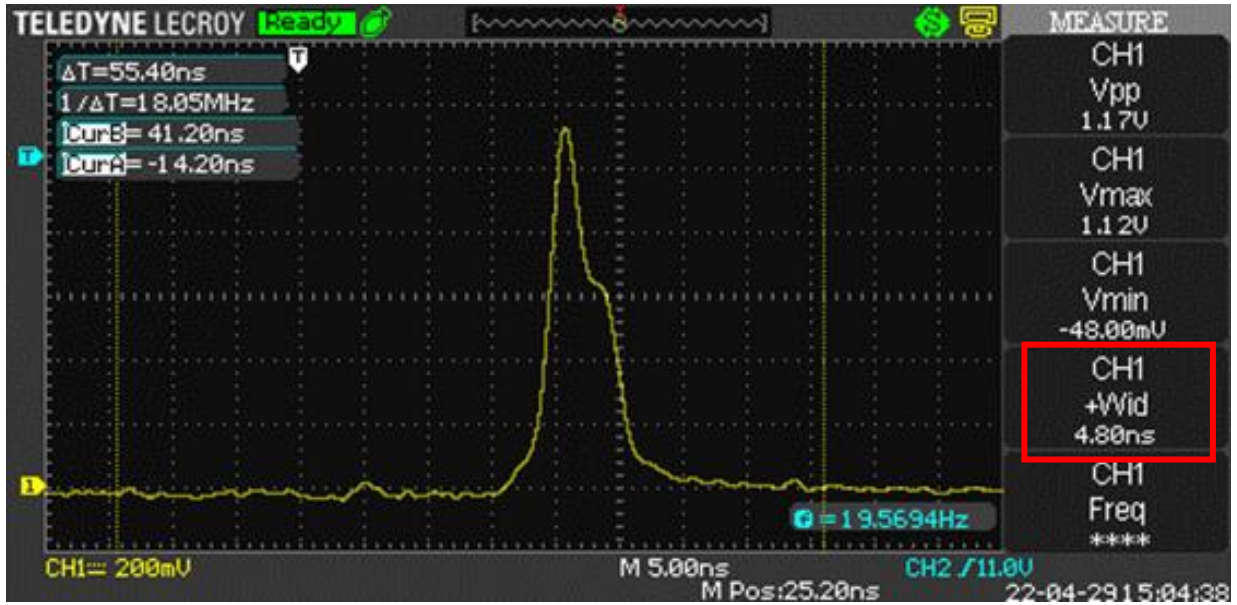


Fig. 8. Pulse duration measured with an oscilloscope

Pulse duration measured	SAGA specification
4,8 ns	4 to 7ns

Preventive maintenance HPLS pumping lasers

→ ***GAIA, ATLAS, JADE pumping lasers***

GAIA:

- energy, beam profile & pulse duration are measured with the same diagnostic bench as SAGA
- measurement of the fluorescence on the Ti:Sa crystal

ATLAS:

- energy → internal measurement (HMI)
- beam profile → photographic paper
- pulse duration → oscilloscope
- measurement of the fluorescence on the Ti:Sa crystal

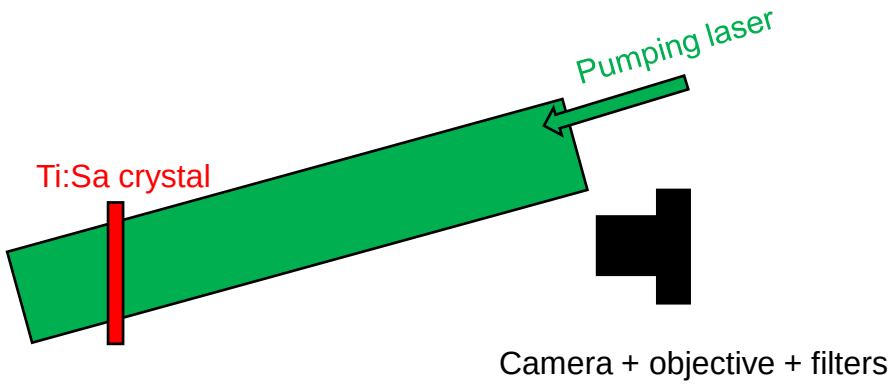


Fig. 9. Fluorescence on the Ti:Sa crystal

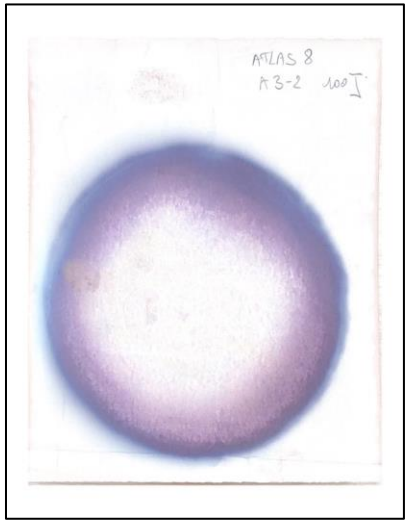


Fig. 10. Beam profile on photographic paper

Fig. 11. Beamlets spacing

Corrective maintenance HPLS pumping lasers

Unexpected issues during beamtime can occur and the possible causes might be:

→ *aging of flash lamps*
→ *damage of rods*
→ *damage of the optical components*
→ *damage of other components*

Fig. 17. Flash lapms

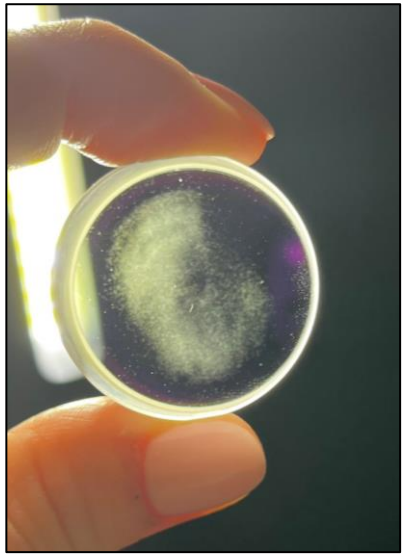


Fig. 16. GAIA LBO crystal

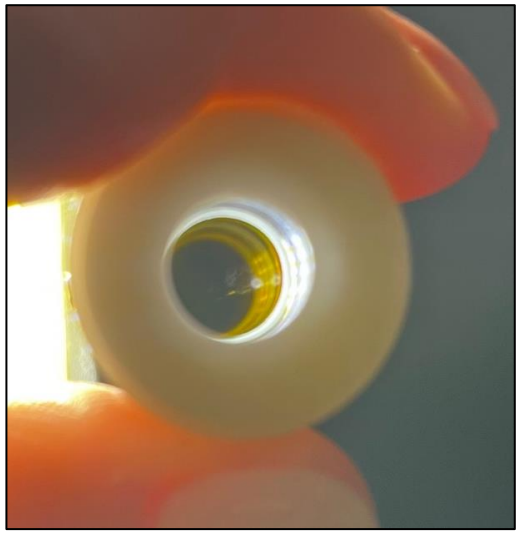


Fig.12. Pockels cell

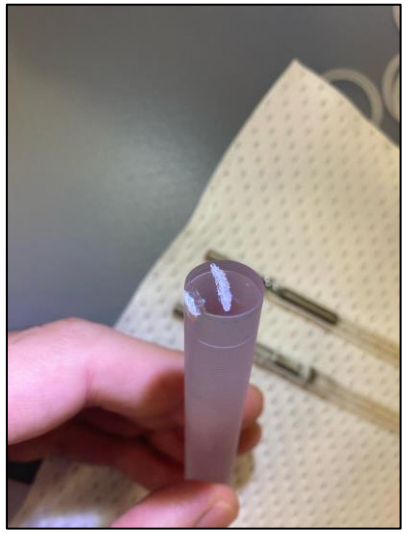


Fig. 13. SAGA rod

Fig. 14. Window image relay Amp 1.2

Fig. 15. Pumping chamber diffuser (ceramic)

Conclusions and future perspectives

Conclusions:

- ✓ Successful beamtime delivered towards 100 TW, 1 PW and 10 PW experiments
- ✓ Delivering the first 10 PW beam on target
- ✓ Successful operation of both HPLS arms at the same time for internal/external users
- ✓ Unexpected issues might occur anytime during the beamtime even after we went rigorous maintenance to the pumping lasers and fast intervention is needed

Future perspectives:

- ❖ To develop even further our teamwork and knowledge on the system
- ❖ To provide the best quality beams for our future users

Aknowlegdements

LSD team & Thales team


Thank you for your attention!