XFEL Photocathode Laser Operator Training

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HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

Overview

XFEL Photocathode Laser Operator Training

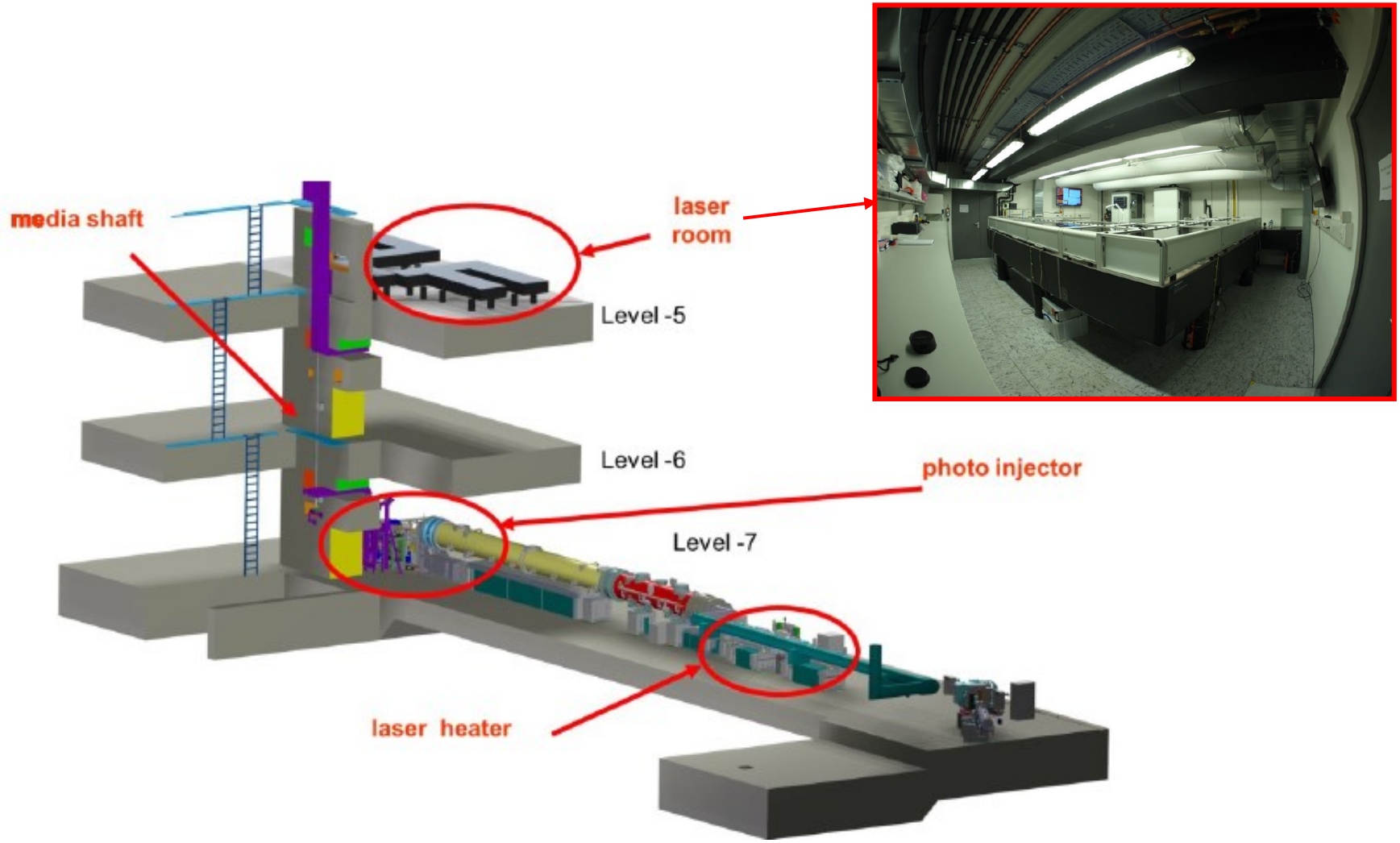
1. **The Laser System**
2. **Status & Troubleshooting via DOOCS**
3. **Control via DOOCS**

The Laser System

The Light

- IR laser light (1030nm) is split into two portions.
- One portion is converted to UV (257nm) via fourth harmonic generation, then used to create electrons from the photocathode.
- Second portion is used as a “Laser Heater”, heating the electron bunch for greater electron energy.
- Picosecond bursts at 4.5MHz, 1.1MHz and 500kHz in bunch patterns and energies as commanded by the Laser Operators (you!)

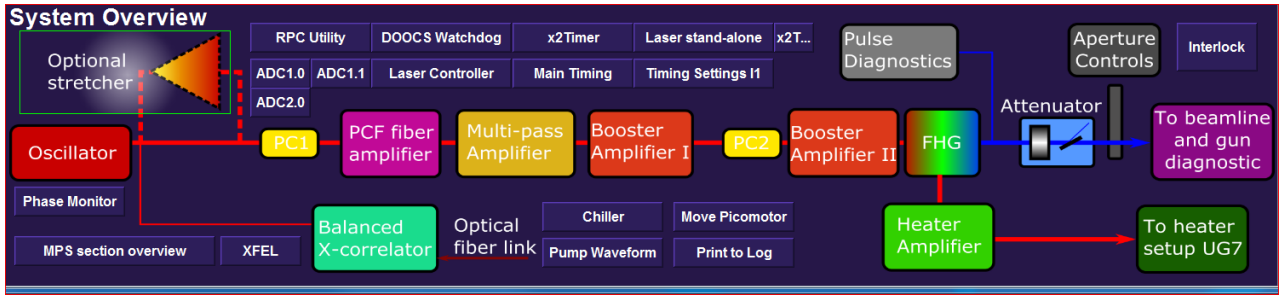
Photocathode Laser Building

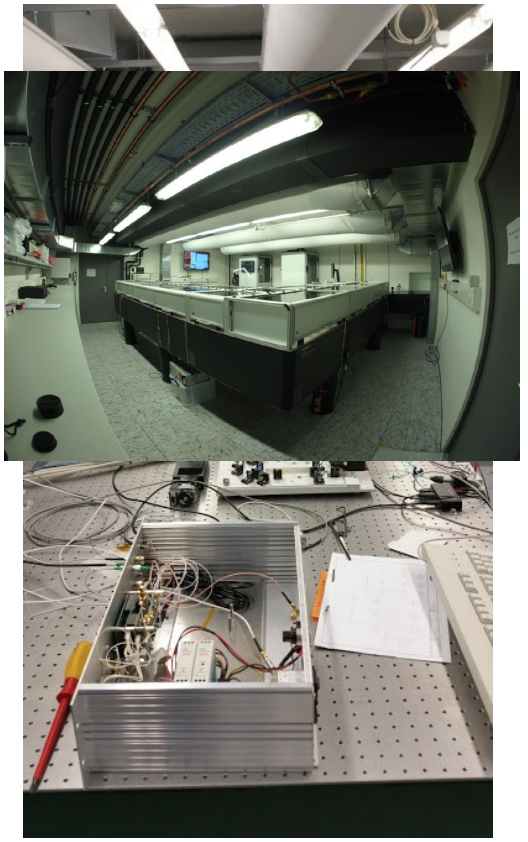


Laser 1 and Laser 2

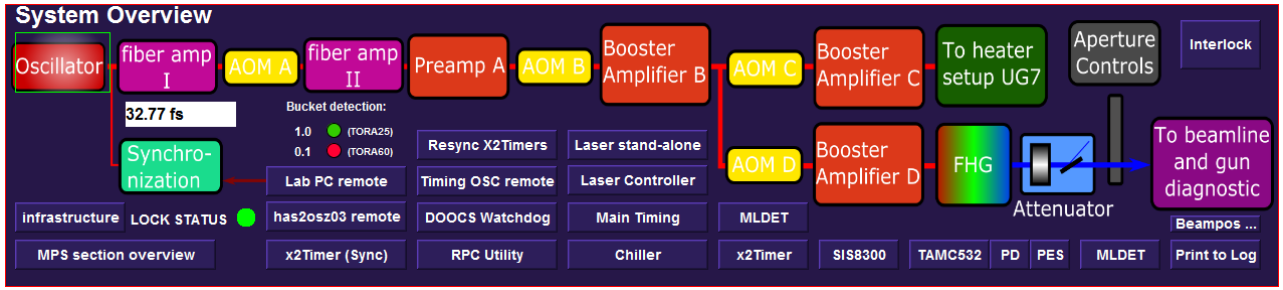
- Two operational laser systems to provide backup and multiplexed simultaneous operation.
- Currently **XlnLas1** provides the light for the laser heater, **XlnLas2** provides the UV light for the photocathode.

Laser 1



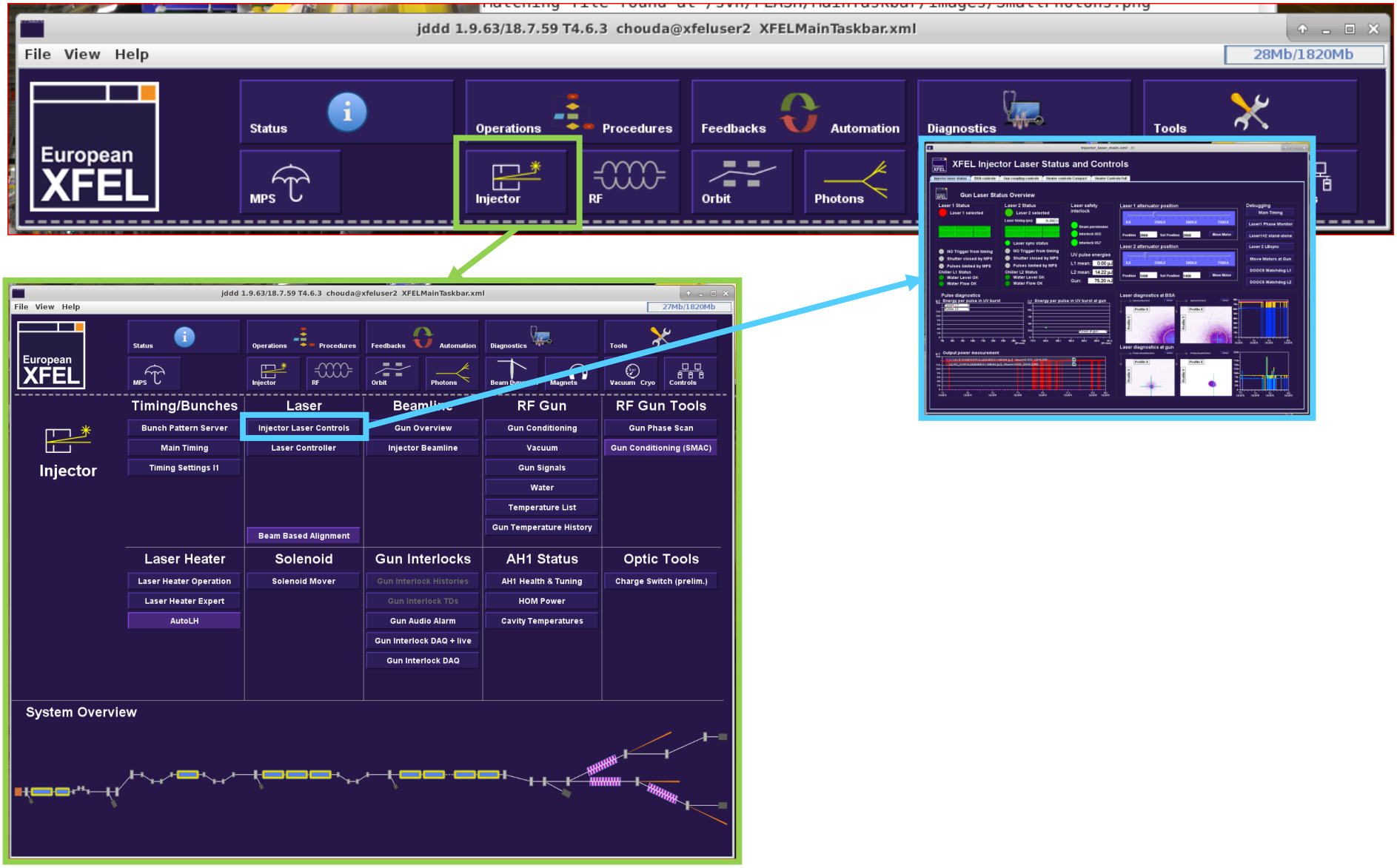


Laser 2



Troubleshooting & Control via DOOCS

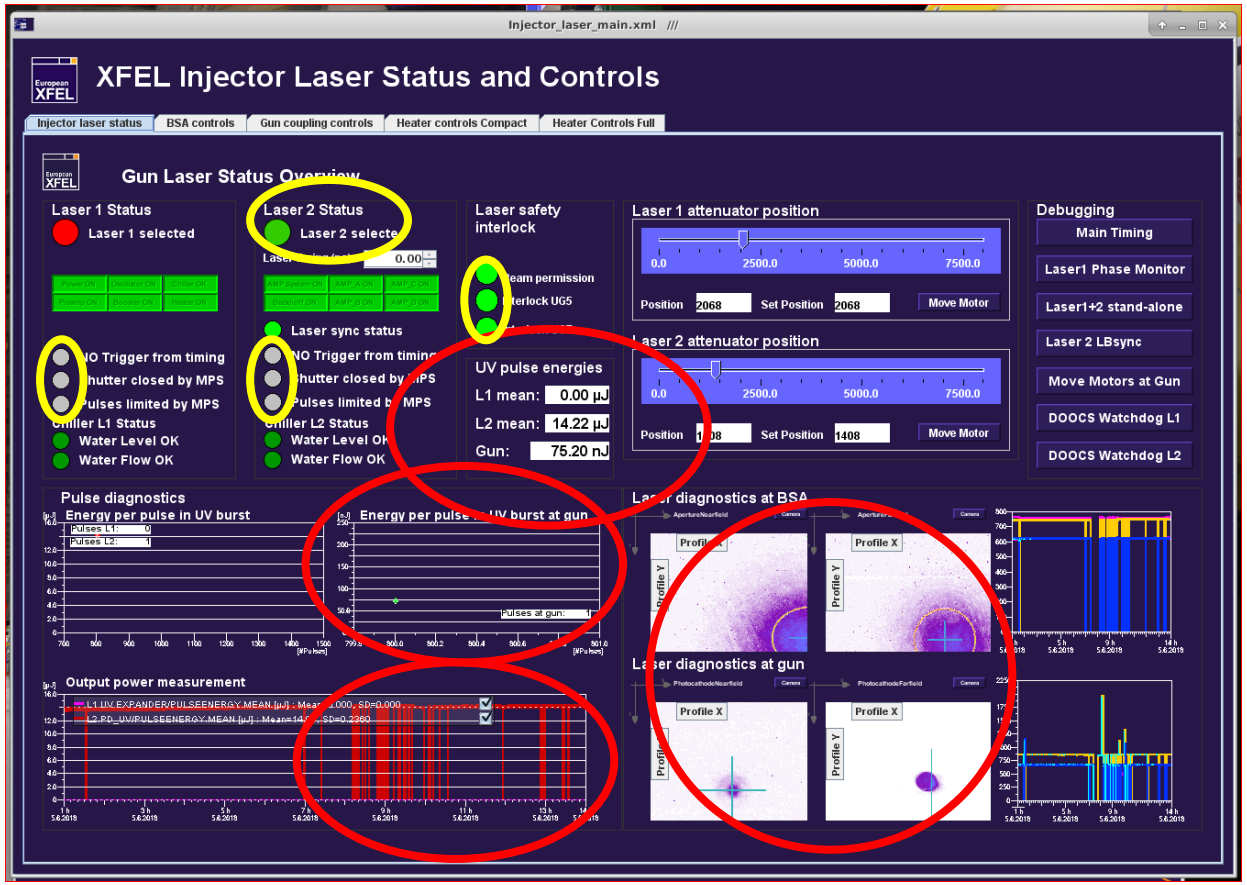
How To Get To The Laser Controls



Injector Laser Status & Controls: Status

Common Issues

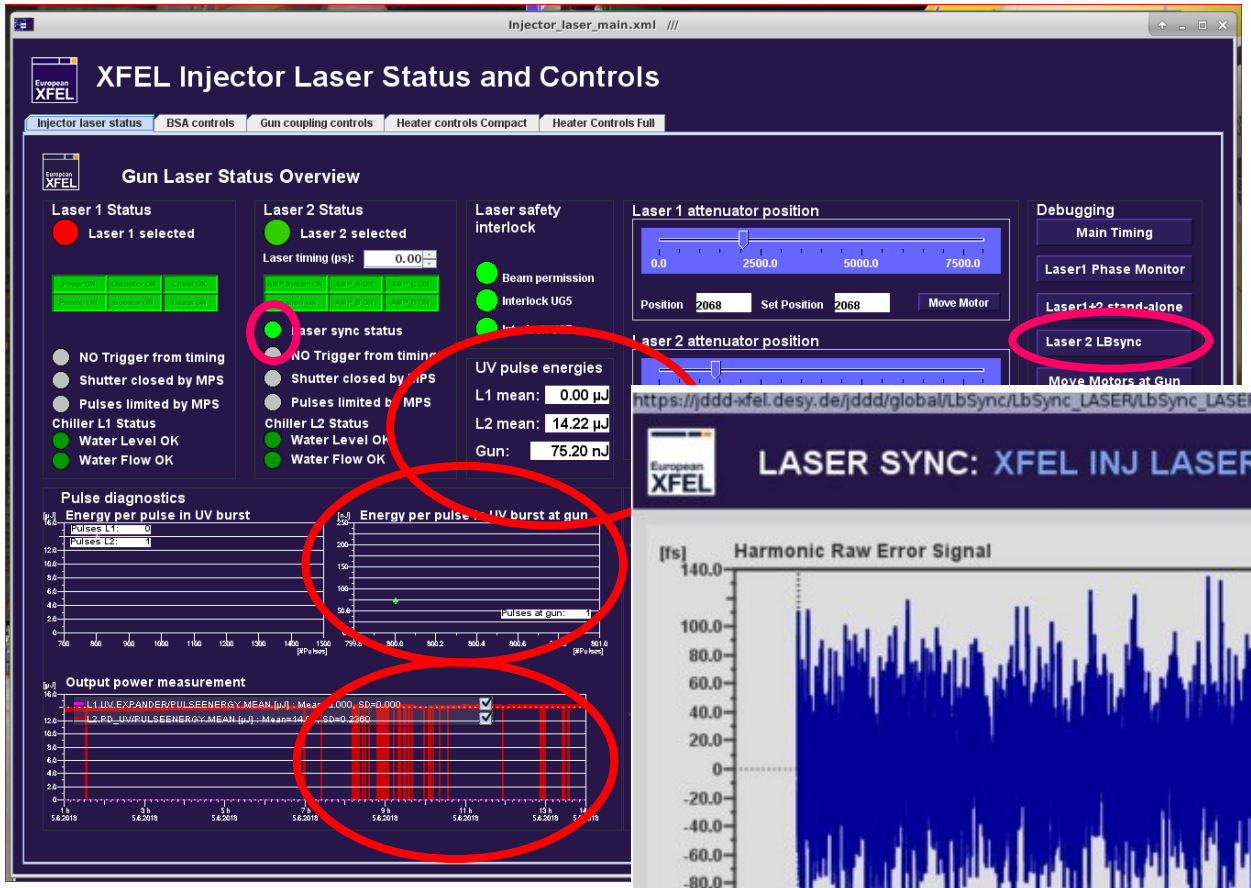
No Pulses?



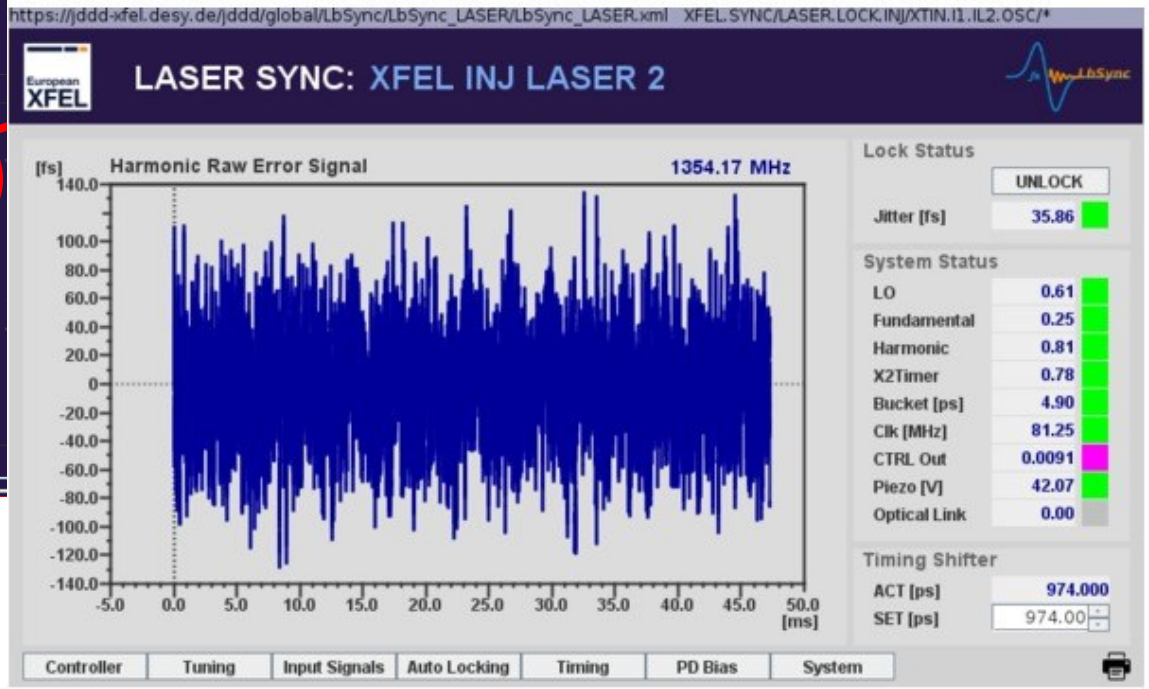
Check shutter, trigger, beam permission and interlock status.

Common Issues

No Pulses?

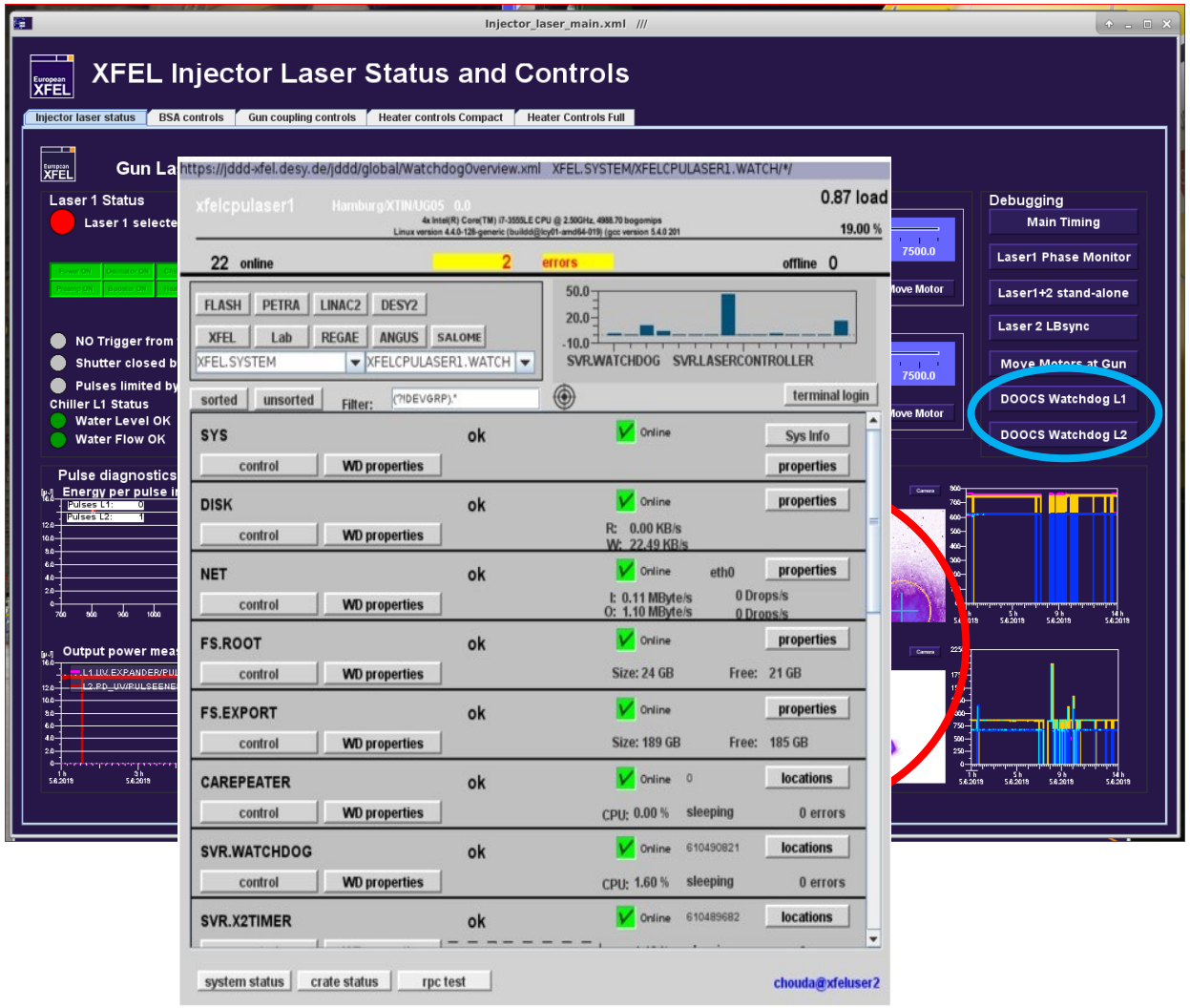


Check lock and sync status.



Common Issues

No Pulses?



Check DOOCS Watchdog.

Common Issues

Call Injector Laser Support

- **Stand-Alone Mode→ was the beam allowed without turning the physical key in UG5?**
- **Beam Drift**
- **Laser is not locked/synchronized**
- **Shutter is stuck**
- **Burst is not flat**

Contact

DESY. Deutsches Elektronen-Synchrotron

www.desy.de

First Contact: Ara Choudhuri, xt. 6347

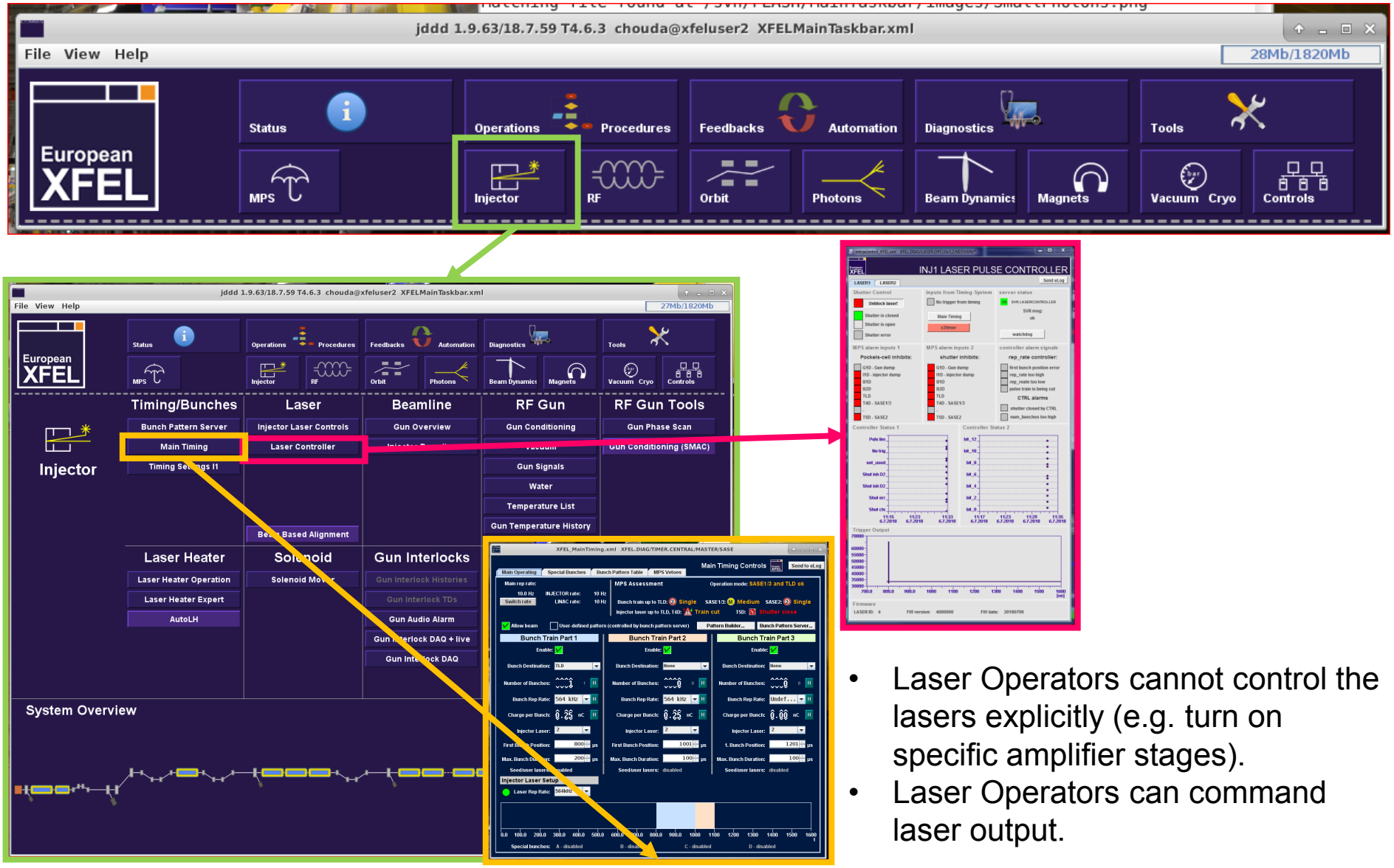
Expert: Lutz Winkelmann, xt. 6385

Deputy: Sarper Haydar Salman, xt. 6083

Laser On-Call: 5581

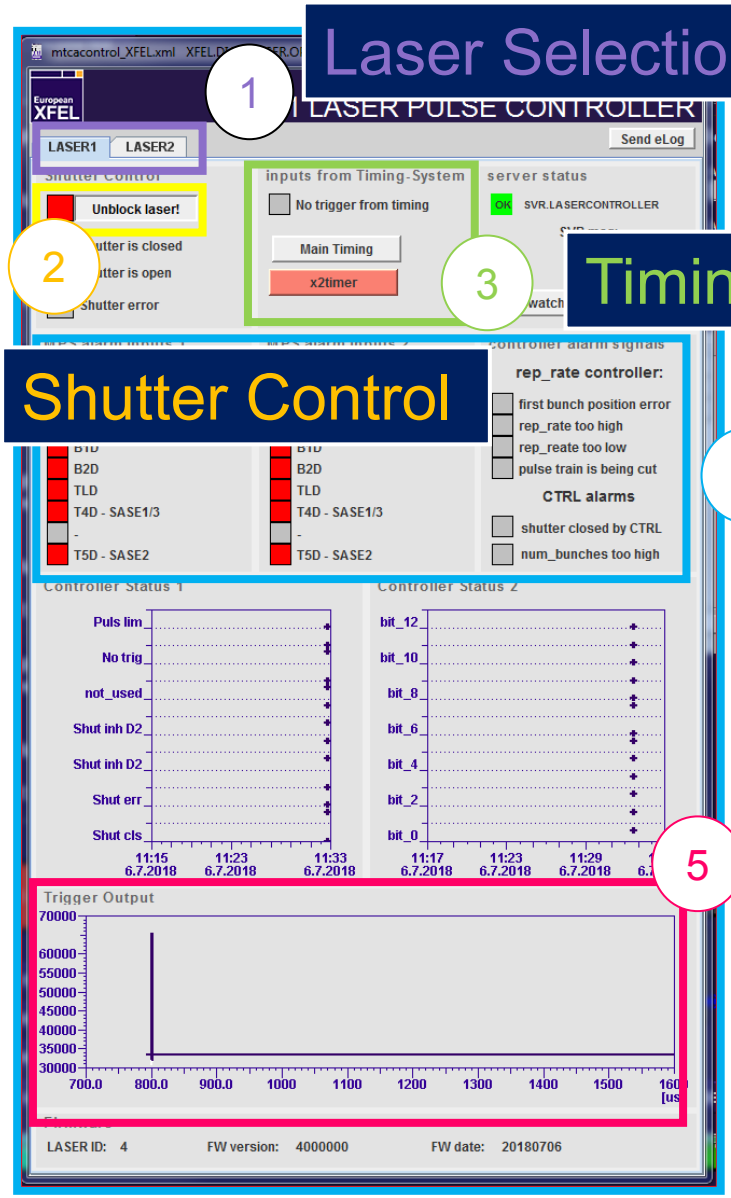
Ticket System: laser-operations@desy.de

Controlling the Laser(s)



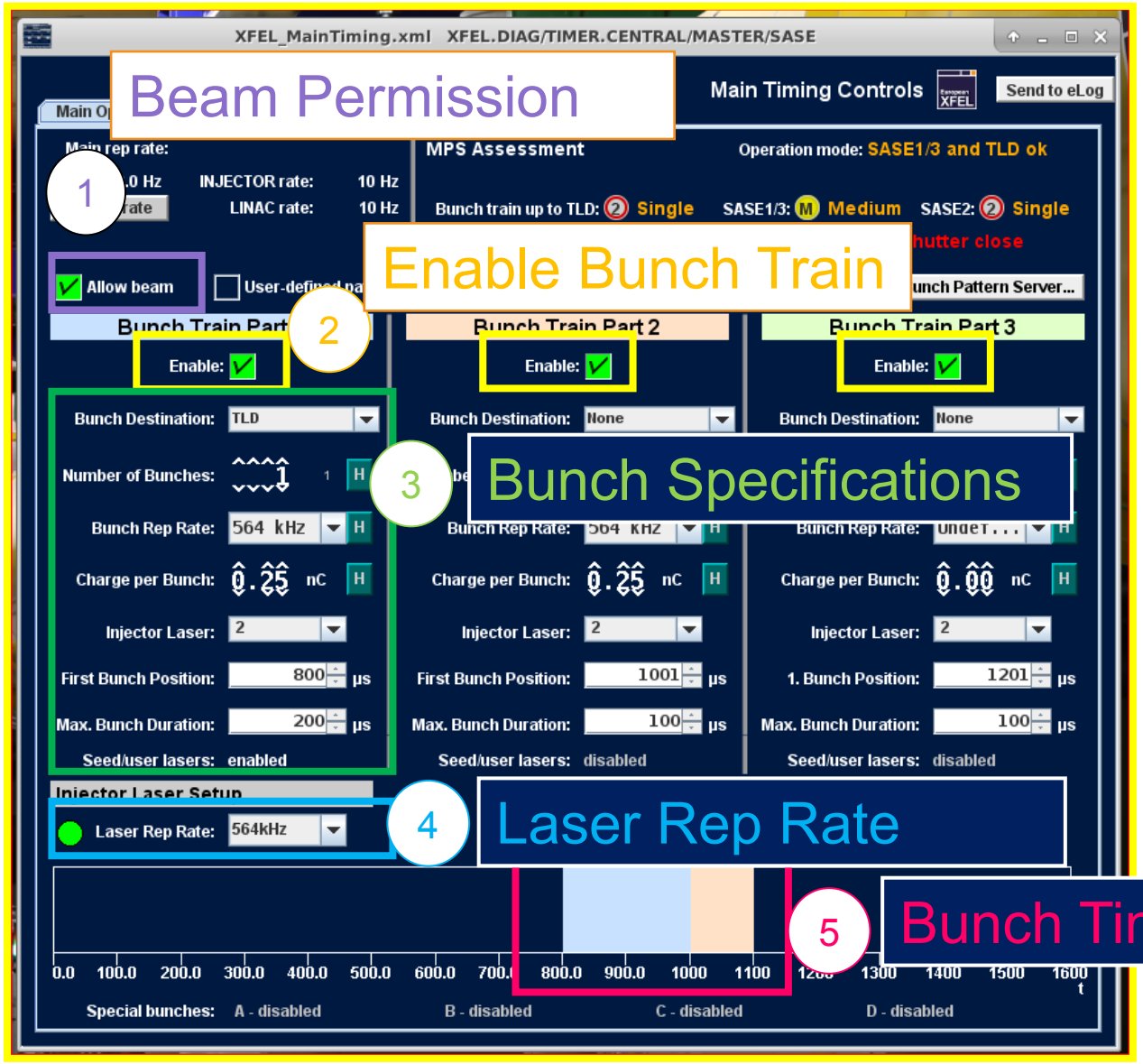
- Laser Operators cannot control the lasers explicitly (e.g. turn on specific amplifier stages).
- Laser Operators can command laser output.

The Laser Controller

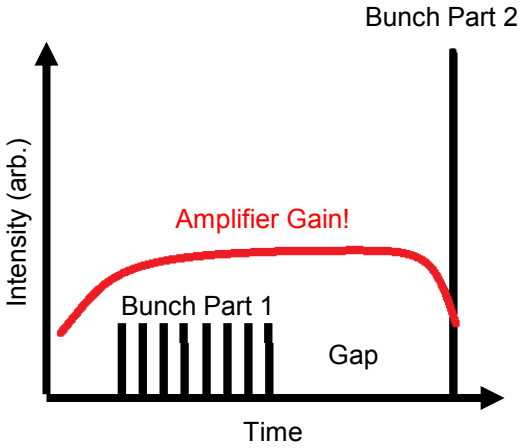


- DON'T open both shutters simultaneously (UV light from both lasers arrives at cathode)
- DON'T Change values in the x2timer

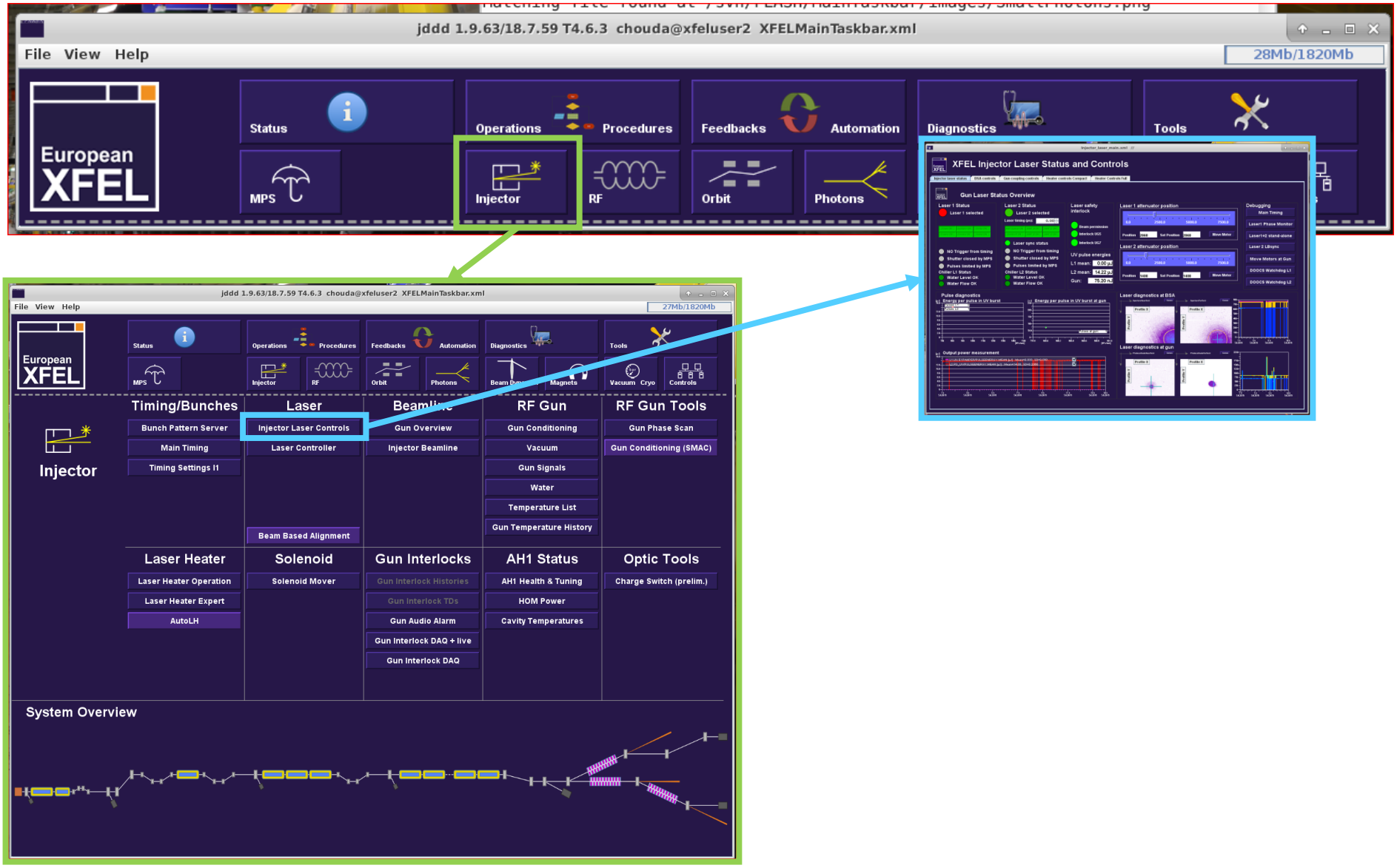
Main Timing



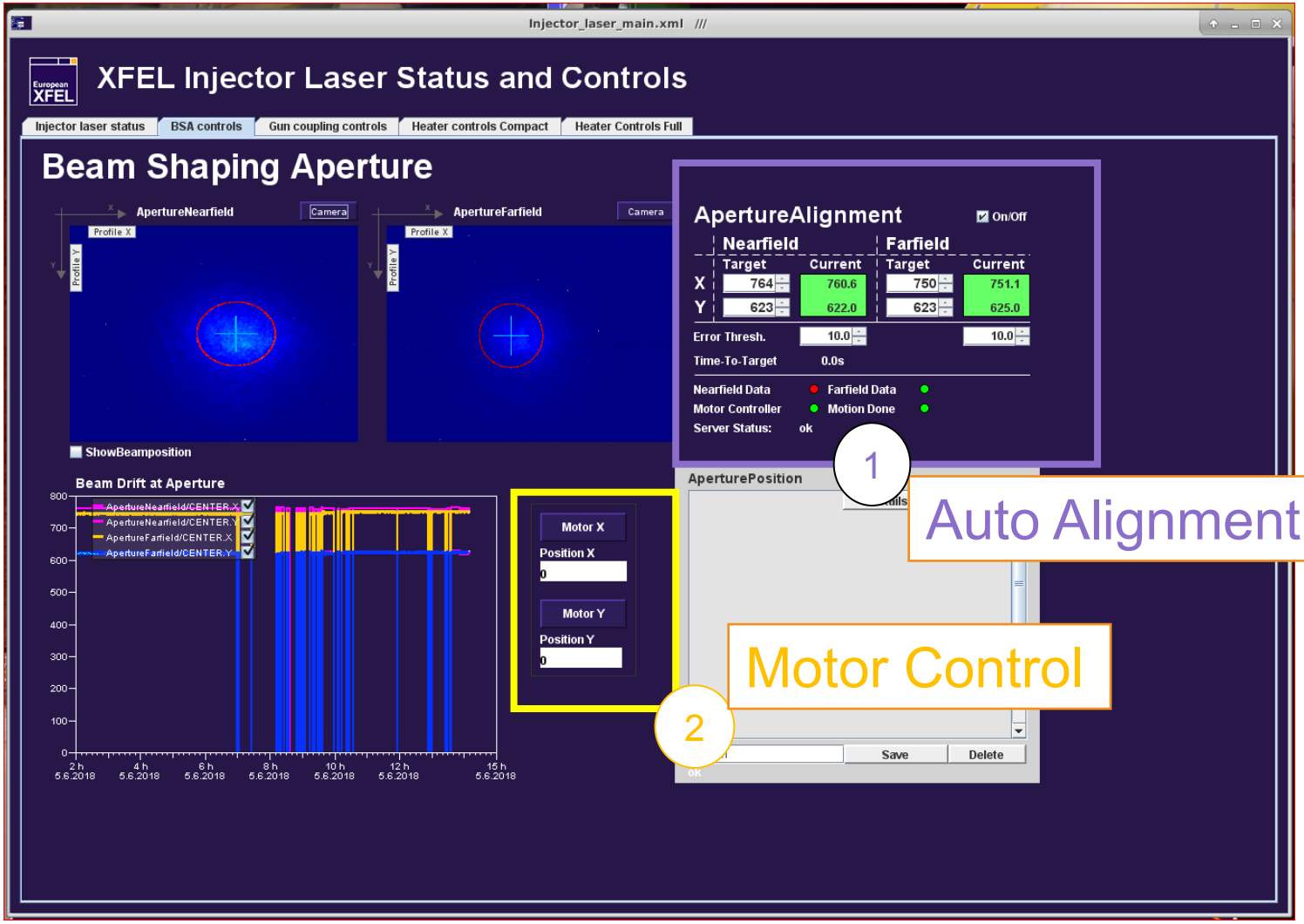
- Keep rep rates consistent across bunch and both lasers.
- DON'T switch lasers through the bunch train.
- DON'T command a bunch pattern with gaps!



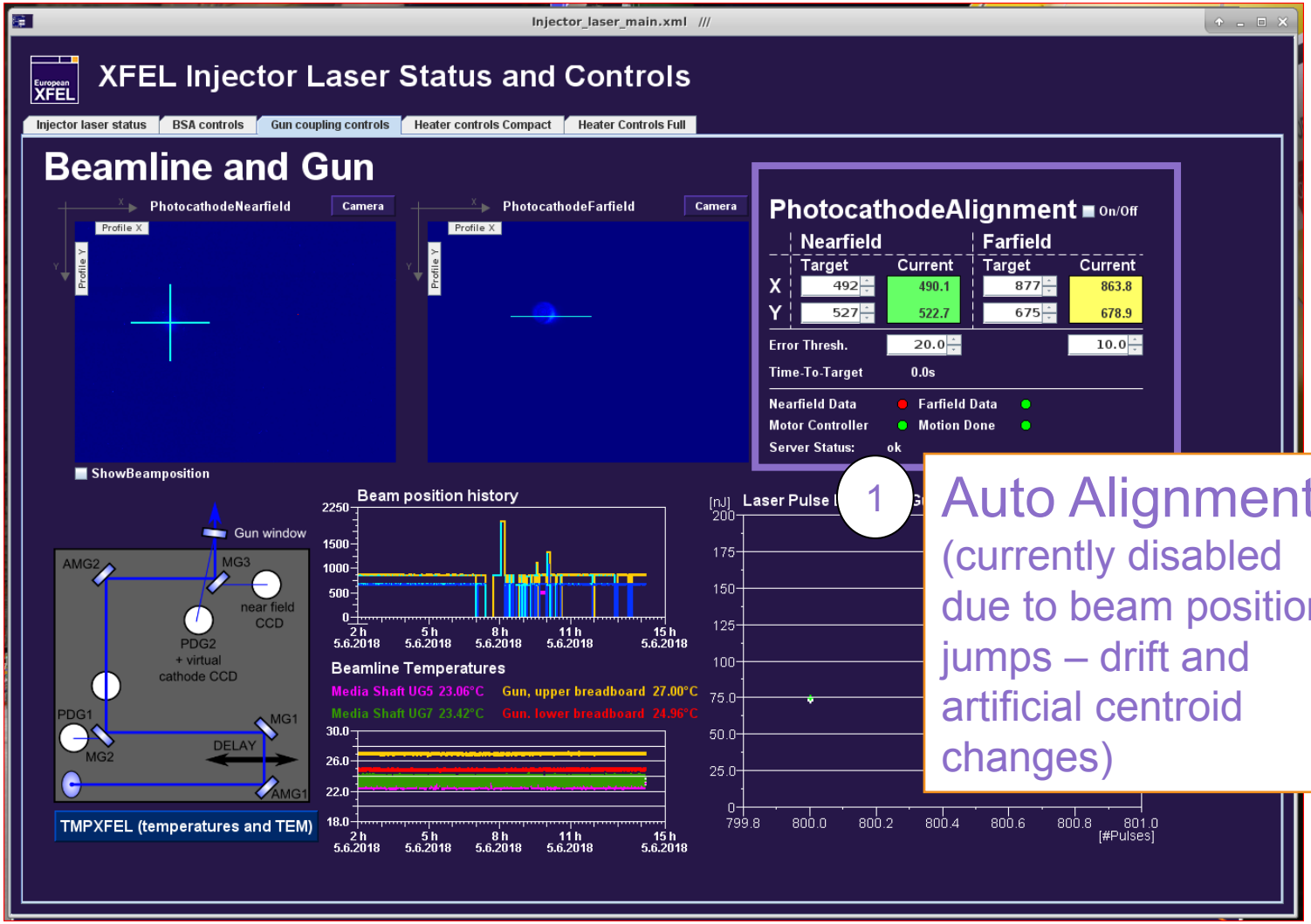
Controls in the Injector Laser Status Panel



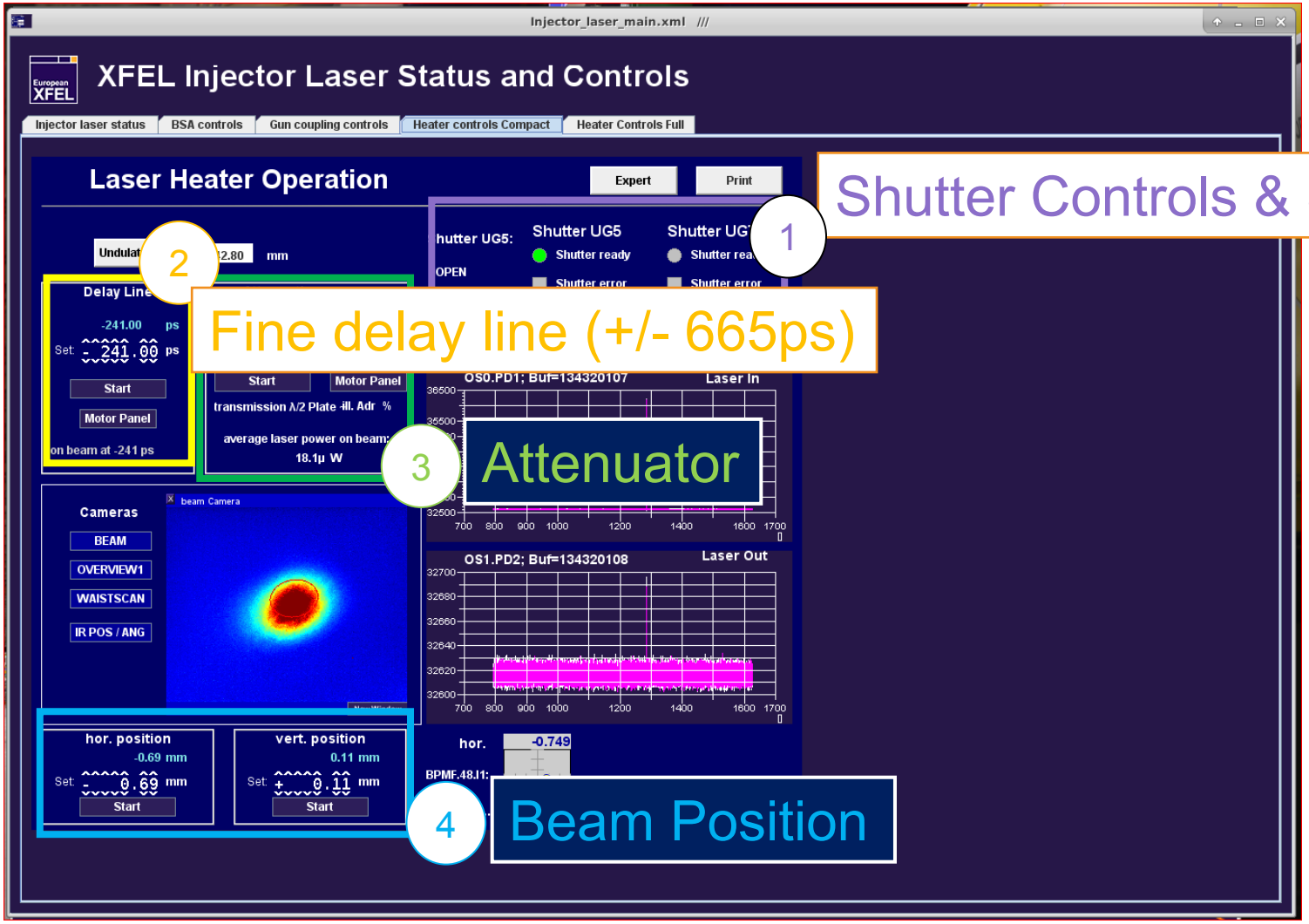
BSA Controls



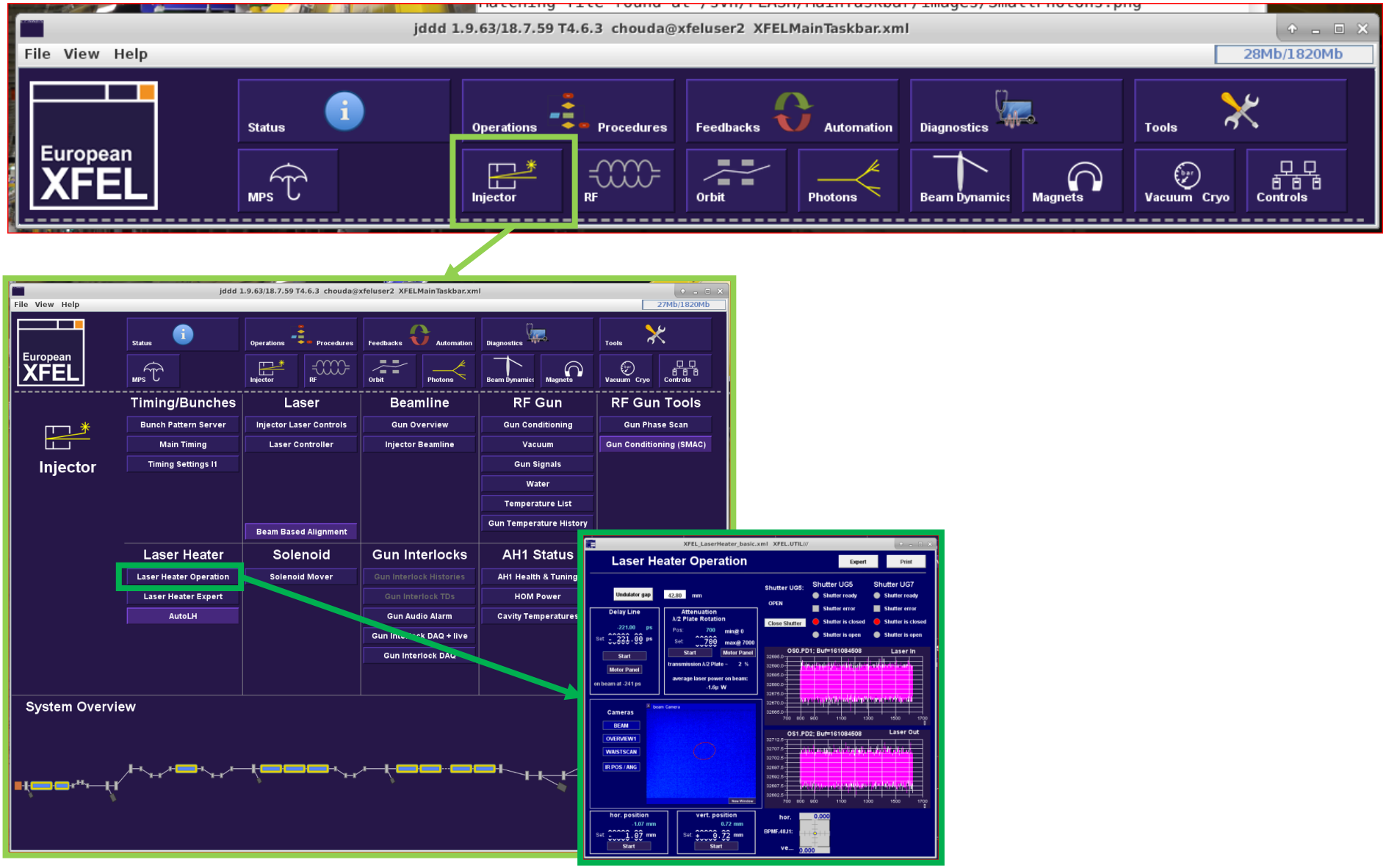
Gun Coupling



Laser Heater



Another Way of Getting to the Laser Heater…



Demo (if possible

How-To

- Block and Unblock Laser
- Change UV pulse energy
- Change Repetition Rate, Number of Bunches
- Scan gun phase/match laser 1 timing → out of scope
- Change beam position on cathode

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