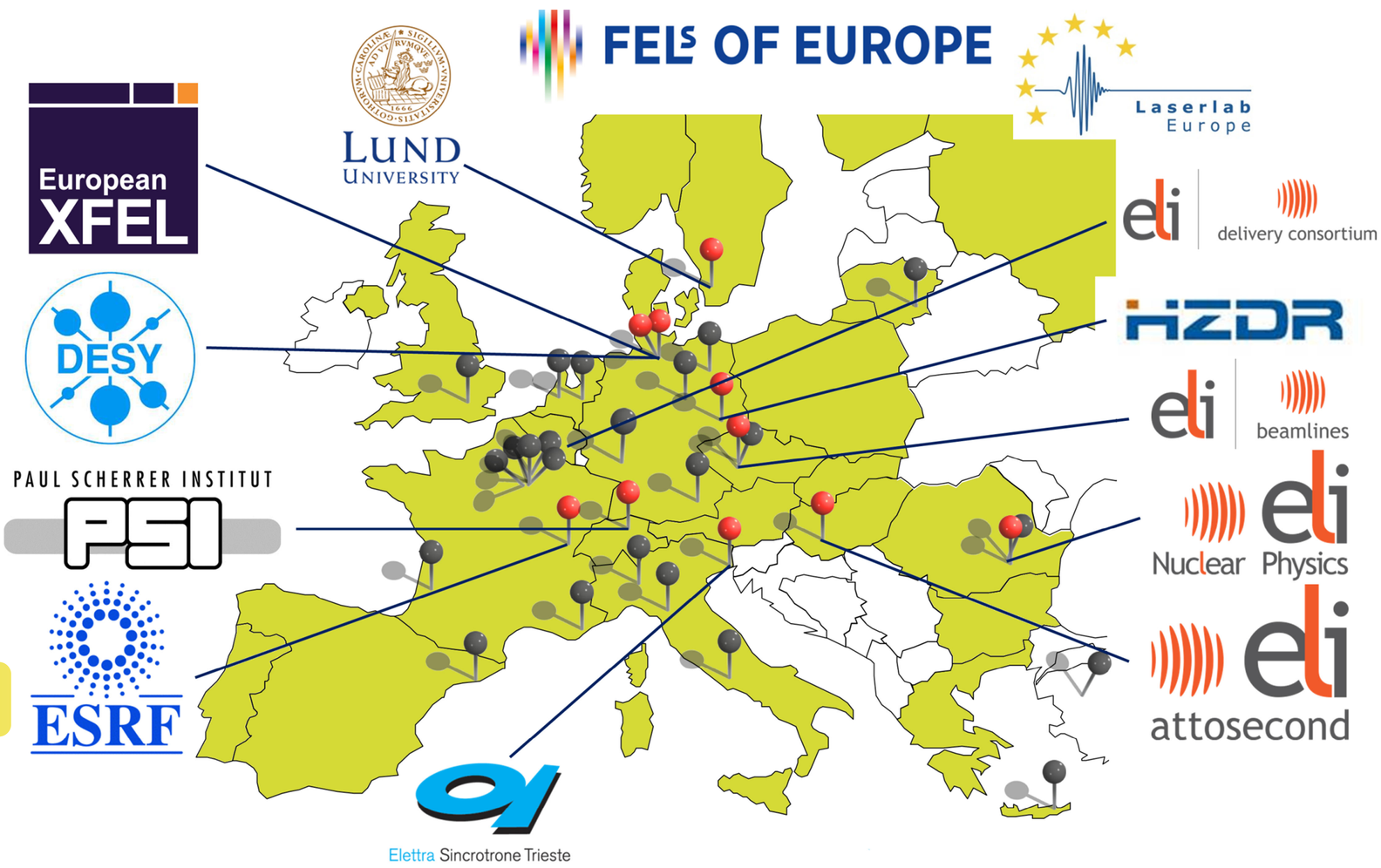
The European Cluster of Advanced Laser Light Sources

Graham Appleby, European X-ray Free Electron Laser Facility, Hamburg, Germany
Catalin Miron, ELI-DC International Association AISBL, Brussels, Belgium
Thomas Tschentscher, European X-ray Free Electron Laser Facility, Hamburg, Germany

EUCALL is a network between leading large-scale user facilities for free electron laser (FEL), synchrotron and optical laser radiation and their users. Under EUCALL, they work together on their common methodologies and research opportunities, and develop tools to sustain this interaction in the future.

EUCALL is organised into seven Work Packages (WPs). WP1 and WP2 are for Management and Dissemination while the other five are scientific/technical.



The EUCALL network consists of six FEL and synchrotron sources, and five optical light facilities (red pins), as well as the European clusters FELs of Europe *and* Laserlab Europe (*members indicated by grey pins). Countries benefiting from EUCALL through their partnership with international ESFRI projects are coloured.*

WP3 Synergy

Senior scientists from FEL and optical laser facilities will join together to identify novel research opportunities, methodologies, and technologies at EUCALL's network of radiation facilities.

Strategies will be implemented towards optimum use of the laser light facilities, promotion of innovation, and coordinated user training/experience exchange.

WP4 Simulation of Experiments (SIMEX)

The key objective of **SIMEX** is to develop and implement a simulation platform for users and facility operators to fully simulate experiments at the various light sources. The simulations track the photons on their way from the source through the optics and the interaction region, all the way to the detector. Samples range from weakly scattering biomolecules, density modulations following laser–matter interaction to dynamically compressed matter at conditions similar to planetary cores.

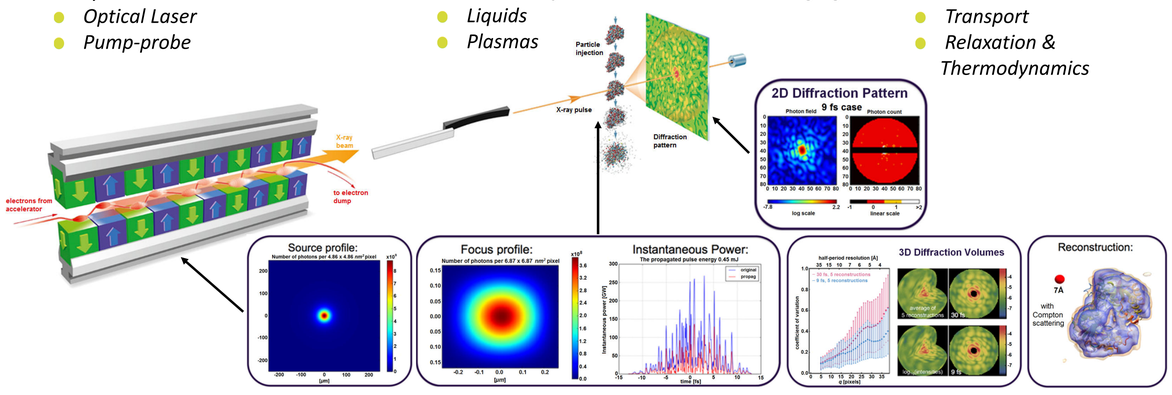
Photon Source
- *XFEL*
- *Synchrotron*
- *Optical Laser*
- *Pump-probe*

Photon Waveguide
- *Lenses*
- *Mirrors*

Target/Sample
- *Single particles*
- *Solids, surfaces*
- *Liquids*
- *Plasmas*

Detection
- *Spectroscopy*
- *Imaging*

Photon Data Analysis
- *Structure determination*
- *Electronic structure*
- *Transport*
- *Relaxation & Thermodynamics*



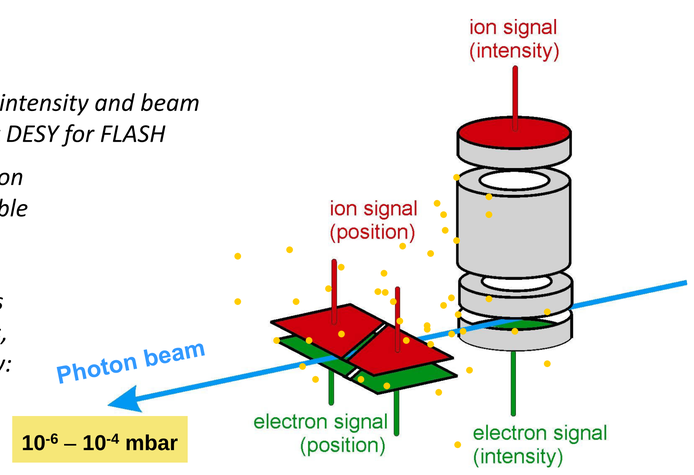
WP7 Pulse Characterisation & Control (PUCCA)

Each of EUCALL's facilities produce intense, ultra-short X-ray pulses whose characteristics change to some extent from pulse to pulse. It is essential to measure the characteristic properties of the light pulses shot-to-shot in a way that does not alter the pulses.

PUCCA will deliver pulse arrival time monitors with femtosecond time resolution, wavefront sensor and analysis software, and a transparent intensity monitor.

Gas-monitor detectors for online intensity and beam position monitoring developed at DESY for FLASH

- *Based on atomic photoionization → no degradation, indestructible*
- *Low particle density → transparent*
- *From time of flight of electrons photoionised from noble gases, uncertainty of the pulse energy: less than 10%*

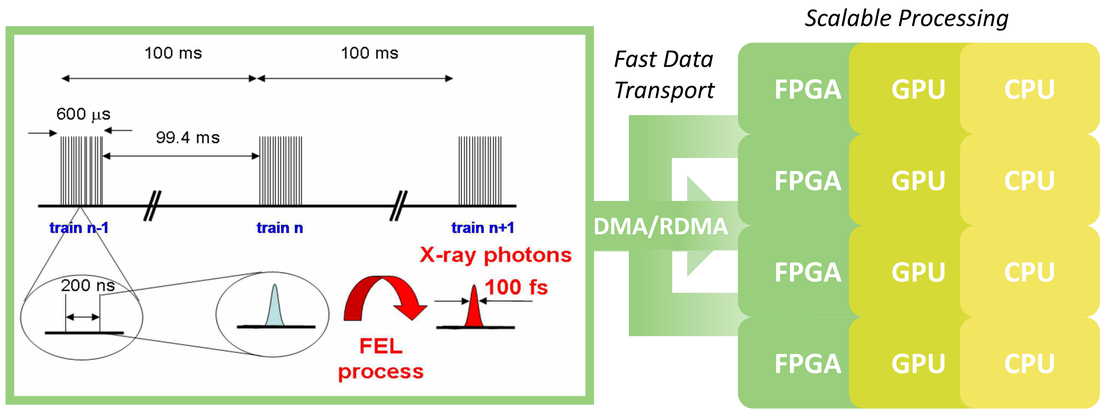


WP5 Ultrafast Data Acquisition (UFDAC)

The high repetition rates and the need for optimised usage of beam-time at optical laser and FEL facilities require higher performance and online data acquisition techniques.

European XFEL will generate pulse trains with up to 2700 pulses separated by 220 ns (600 µs total) followed by idle time of 99.4 ms.

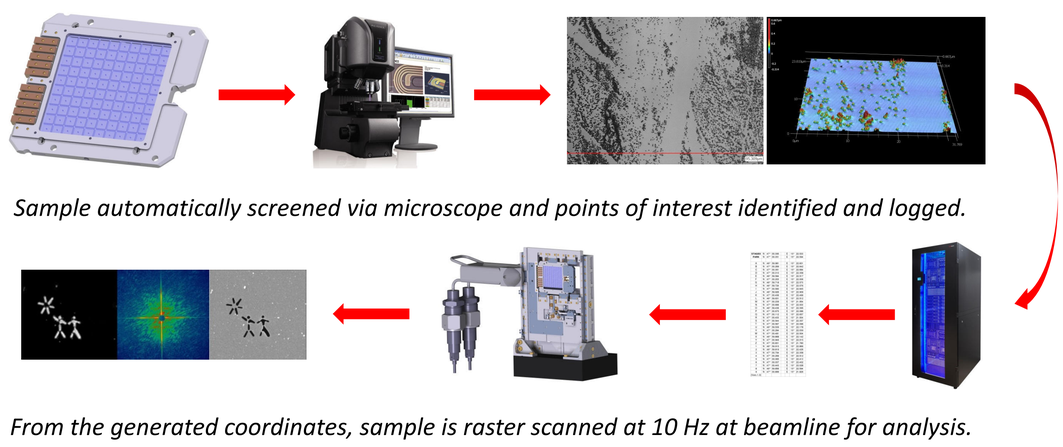
UFDAC will deliver ultrafast online image processing, data transfer and injection, and processing of digitiser data for such demands.



WP6 High Repetition Rate Sample Delivery (HIREP)

Every light source has systems for sample replacement, but no attempt has yet been undertaken to unify sample characterisation and positioning of samples in order to give external user groups unhampered access to the facilities.

HIREP will deliver an integrated concept for decentralised sample characterisation and fast sample positioning at EUCALL's facilities.



Sample automatically screened via microscope and points of interest identified and logged.

From the generated coordinates, sample is raster scanned at 10 Hz at beamline for analysis.

www.eucall.eu / contact@eucall.eu

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