The Photon Beamline Vacuum System of the European XFEL

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The European XFEL will generate up to 27000 ultra short X-ray pulses per second with a brilliance that is a billion times higher than that of the best conventional X-ray radiation sources. The outstanding characteristics of the facility are unique worldwide. Starting in 2017, it will open up completely new research opportunities for scientists and industrial users.

The installation of the three up to 800 m long x-ray optics and beam transport systems of the European XFEL in underground tunnels started in spring 2014 and will be finished in 2016.
This poster explains designs of gas based devices in the photon vacuum system, the concept of the PLC based control and the challenging handling particle-free assembly of components and avoiding particle transport through the vacuum system.

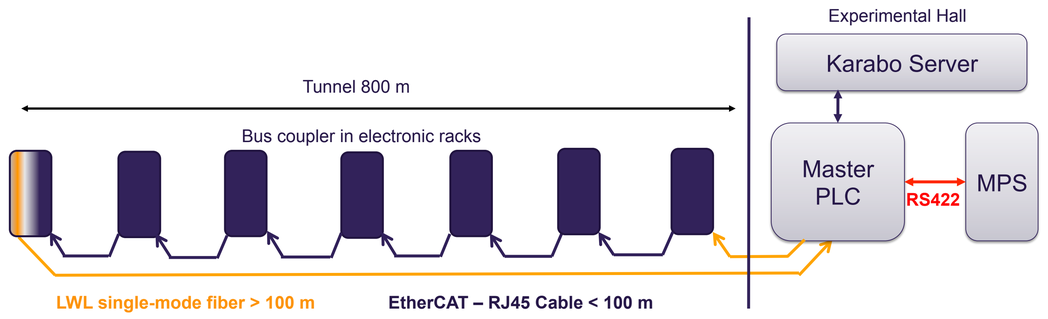
Vacuum Control System

Hardware:

- One Beckhoff PLC for each beamline vacuum system in the tunnel (pumps, gauges, valves, etc.)
- One Beckhoff PLC for optical devices (motion, encoders, temperatures, etc.)
- Extra interface for a controlled shutdown of systems without network

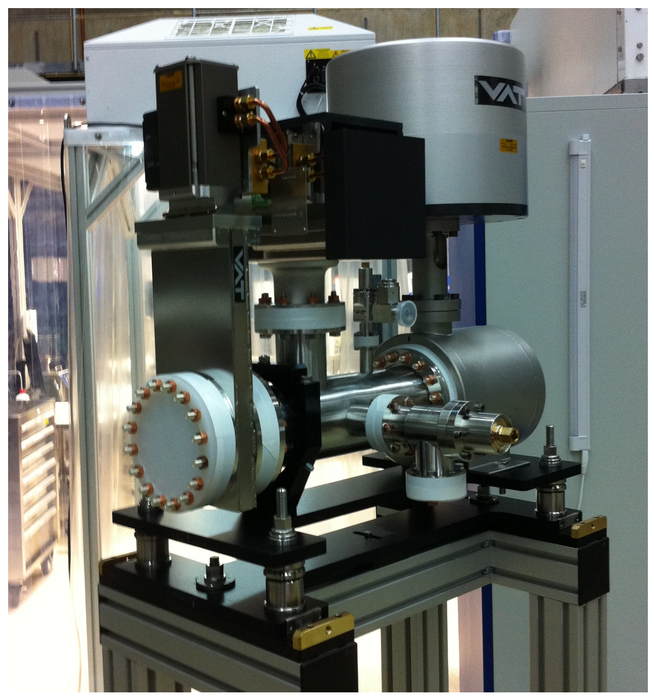
Software:

- The PLC, running with TwinCAT, performs fast logic functions and tasks.
- The PLC is linked to the machine protection system (MPS) for fast shutdown of the accelerator
- For the GUI and database a Karabo (control and analysis software package developed at XFEL.EU) is connected to the PLC.



Avoiding Particle Contamination on Optics

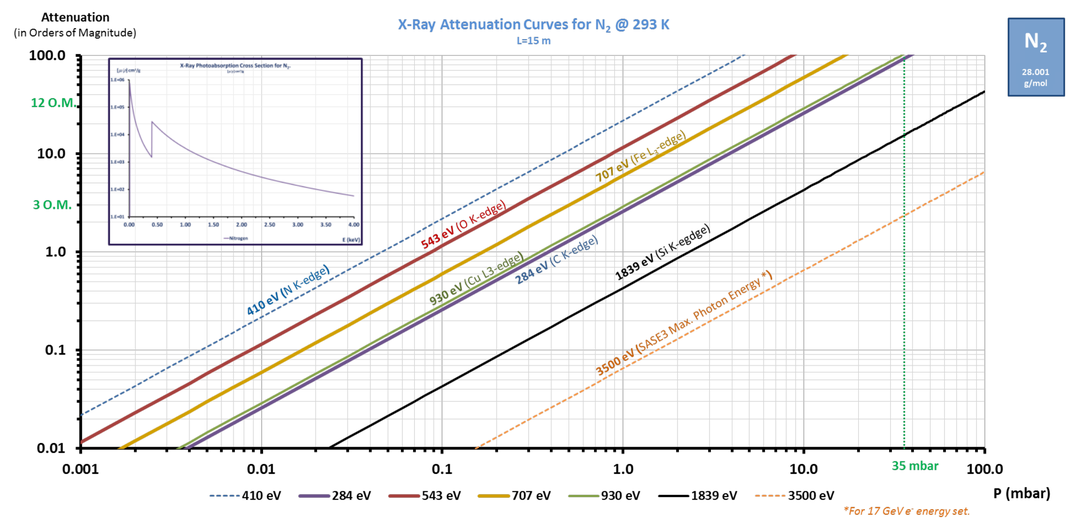
- Particle free areas ±30 m around mirrors and gratings
- Preassembly of components in cleanroom class ISO5
- Venting of the vacuum system only through particle filters with gas stream away from mirrors
- Small, mobile cleanroom tents for beam pipe installation in the tunnel
- Large, permanently installed cleanrooms at sensitive optics
- Installation of fast safety valves upstream the distribution mirrors (closing time 10 ms)
  - To avoid particle transport towards the mirror
  - To prevent venting the entire beamline
  - Only one instrument of a beamline will be affected in the case of an air inrush, the other remains operational

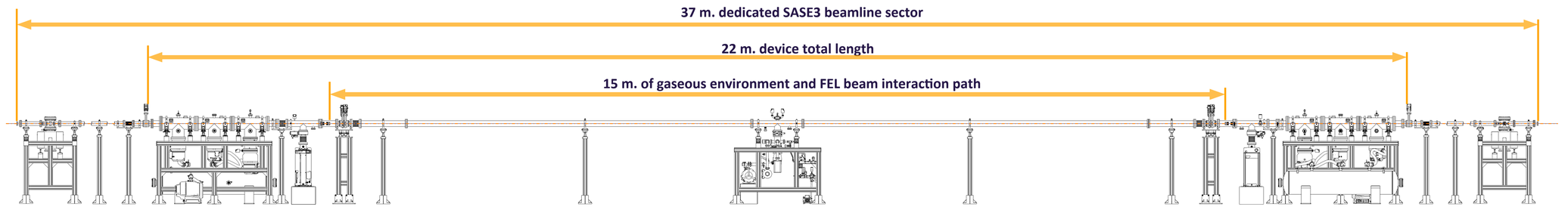


SASE3 Gas Attenuator: Initial set of specifications

During the first operational phase of the European XFEL facility, the gas attenuator device will provide the following perfomances figures and capabilities.

Capabilities	Status
Operative photon energy range	**From 260 to 3500 eV** *(acc. to SASE3 especifications)*
Min. controllable attenuation factor	**0.01 O.M.**
Min. attainable attenuation factor	**From 3 O.M** *(independently from gas type or photon beam energy)* **to 10 O.M.** *(for especific experimental conditions).*
Available gases	**Nitrogen and Xenon** *(Ar, Ne, or Kr still under discussion)*
Max allowable pressure in the gas cell	**15 mbar** *(for N_2).*
Gas purity check and RGA systems	Yes
Configurable gas manifold system *(i.e. gas mixtures)*	Yes
Variable aperture system for the 1st D-P stage	Yes
Integration with photon beam diagnostics	Yes





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