

Design and Implementation Aspects of the Control System at the FHI FEL (MOPPC096)



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FHI - FEL

- Mid infrared FEL (radiation from 4 to 500 microns)
- For investigations of molecules, clusters, nanoparticles, and surfaces
- Up to 200 pC band charge and 50 MeV
- Gridded Thermionic electron source
- Single plane focusing undulator
- Cavity 5.4 m long
- First lasing Februar, 2012



Integration into the facility management

- 24/7 operations of the facilities
- Archiving technical infrastructure data required for off-line analysis
- Permanent monitoring of quality, temperature and flow of cooling water
- Safe shutdown in case of problems

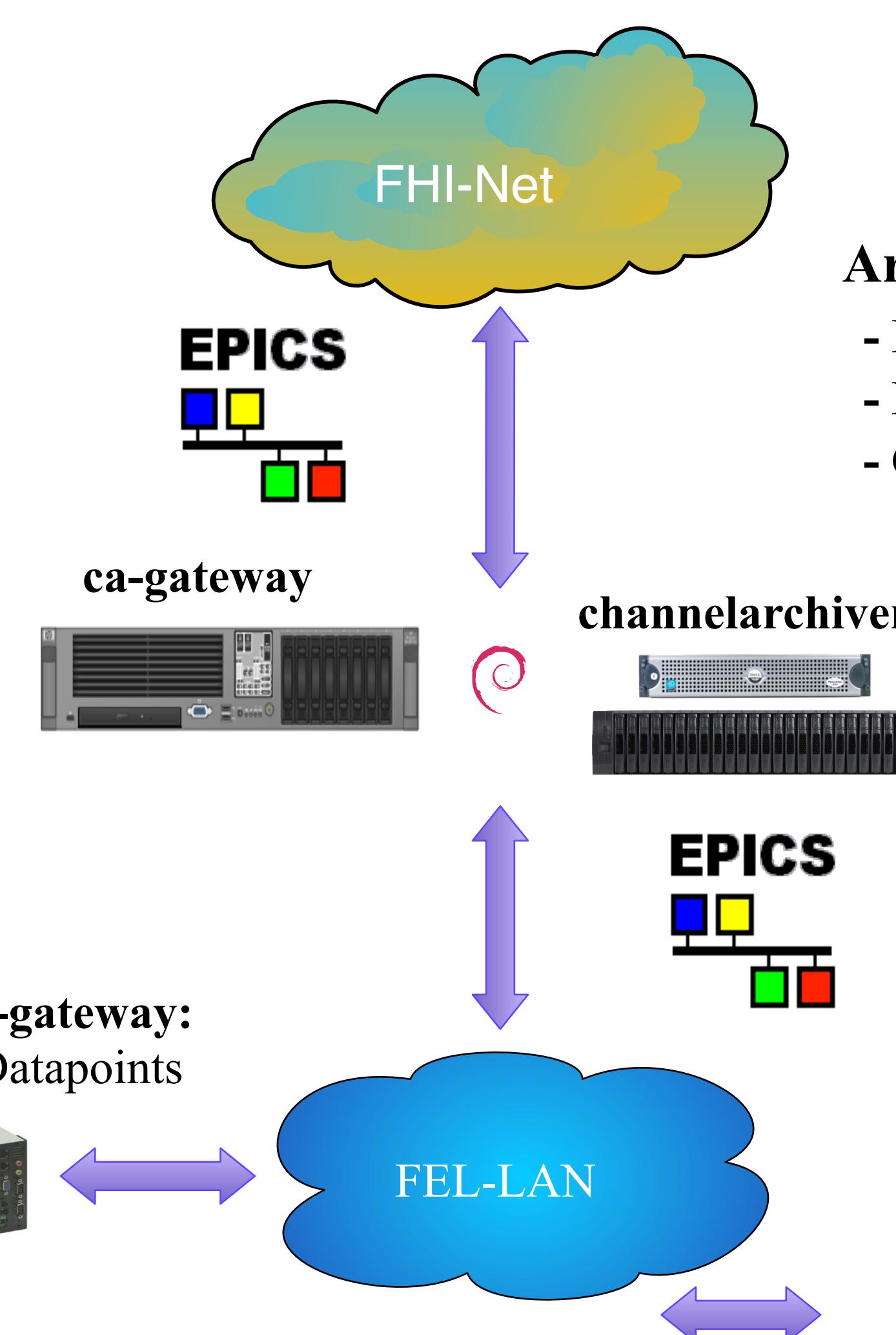
Cavity stabilization

- A feedback system was developed to stabilize the FEL cavity
- HeNe-laser interferometer is used for monitoring the resonator length
- MAXv motion system controls and stabilizes the relative distance between the two cavity mirrors using motorized micrometer drives on a precision in-vacuum translation stages
- Roll and pitch of the mirrors can also be controlled by using in-vacuum pico motors
- Five mirrors with different out-coupling hole sizes from 0.75 to 3.5 mm



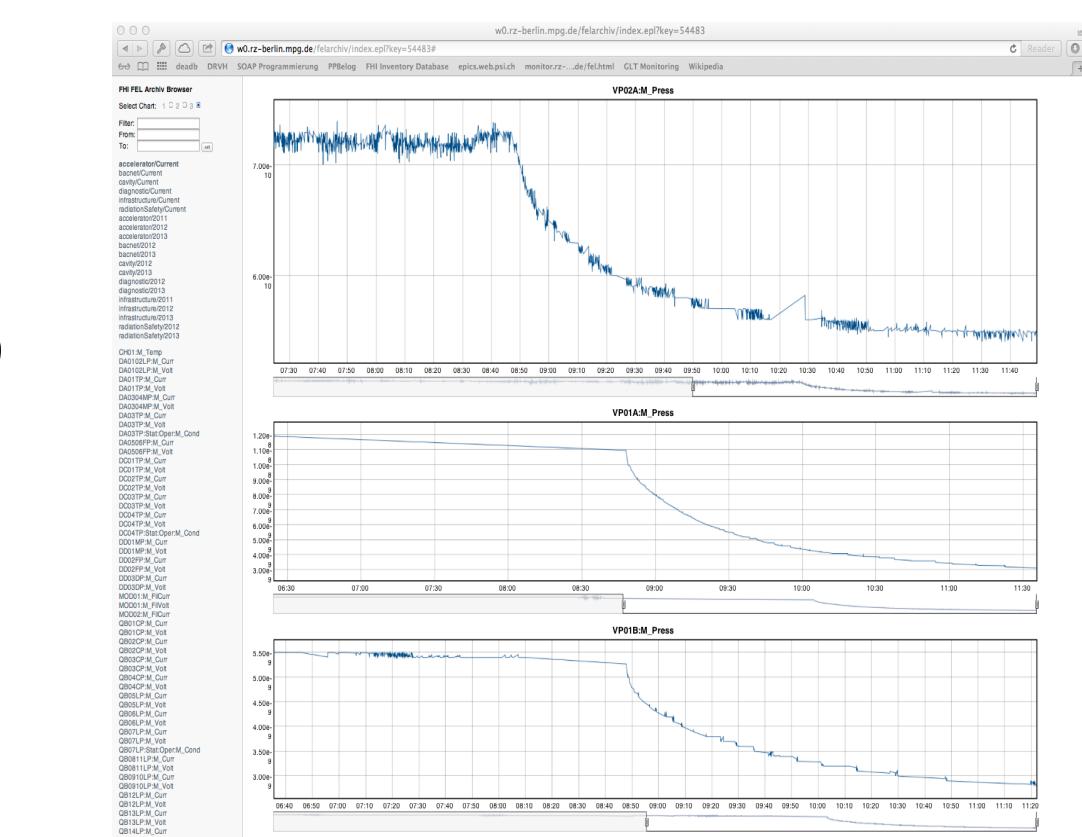
Integration into the FHI environment

- EPICS with channel-access protocol for communication and control
- FEL - LAN is isolated by the use of a gateway system
- Every user can monitor the machine state
- Control access can be given by the operator to the dedicated users
- Access by any software (CSS, Matlab, LabVIEW, KouDA, C, Perl,...)
- Web-access



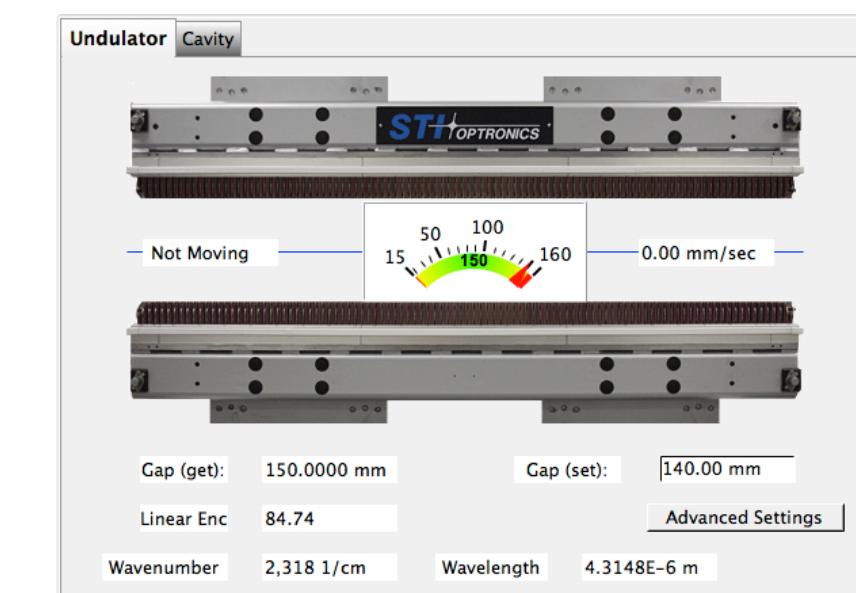
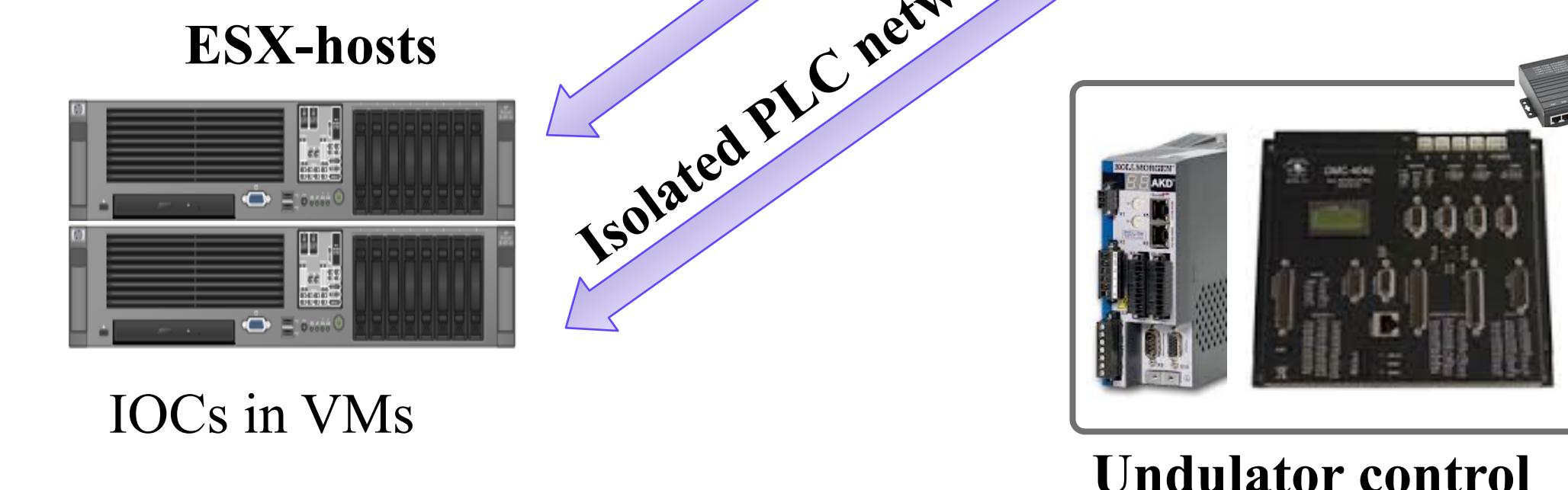
Operator Console

- Based on Control System Studio
- Use of graphical editor software BOY
- Allows viewing or operating the FEL locally or remote



Archiver

- EPICS channelarchiver records PVs
- Data can be viewed/analysed at a later date
- CGI web interface allows off-site retrieve



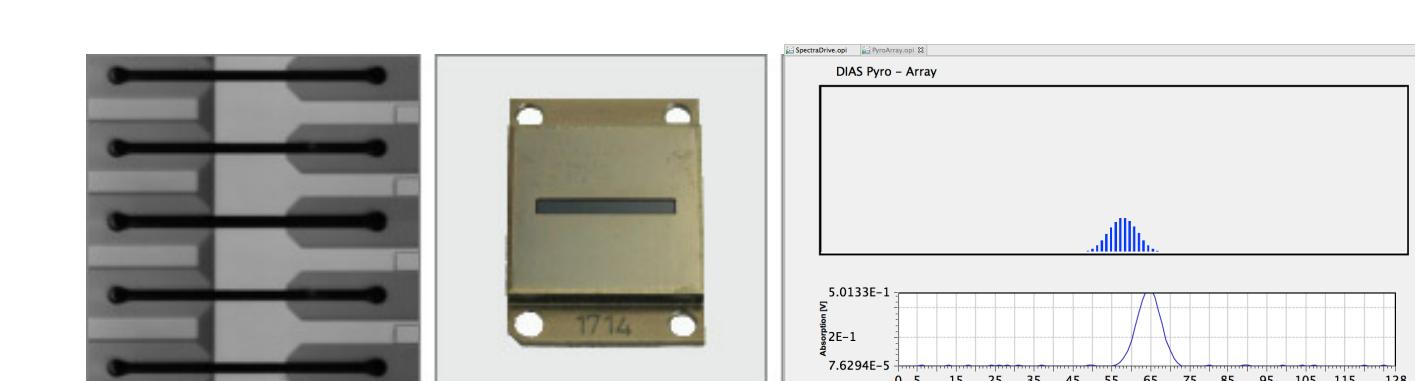
Safety System

- Continuously monitoring electron beam way
- Struck 3316 digitizer compares signals from BPMs, current-transformer toroids and Faraday cup of the beam dump with expectation values
- If comparison fails, RF will be switched off



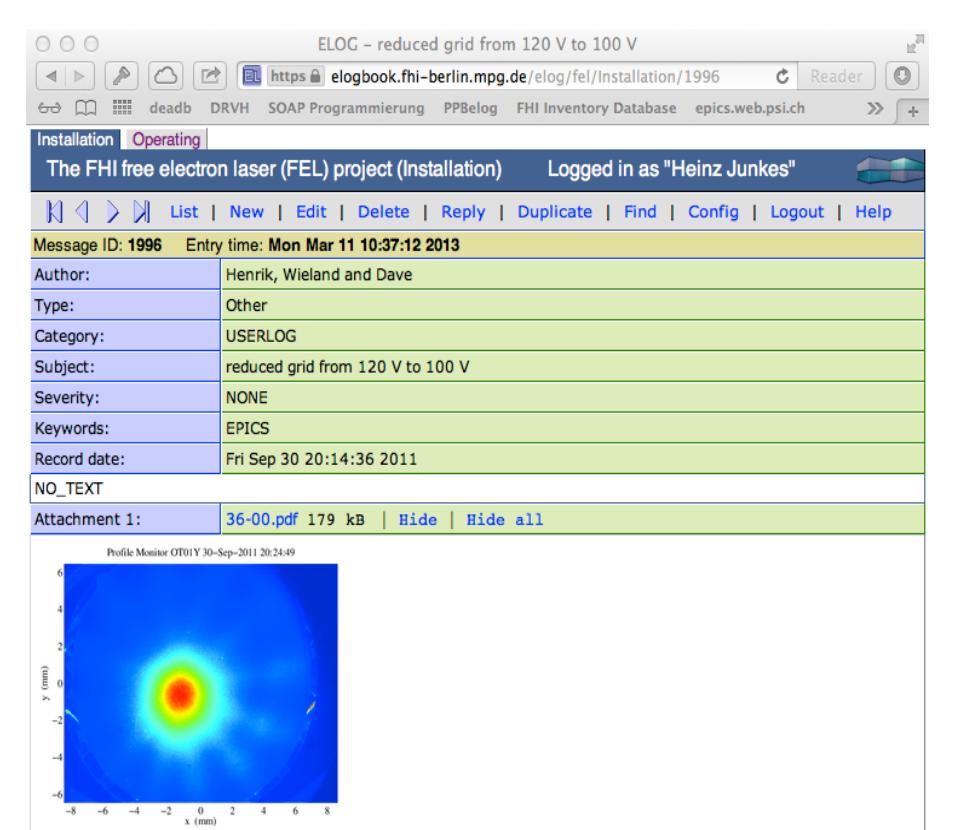
IR Beam Diagnostic

- Acton vacuum monochromator (VM-504, EPICS-controlled)
- In conjunction with Pyroelectric Linear Array
- Allows monitoring the wavelength

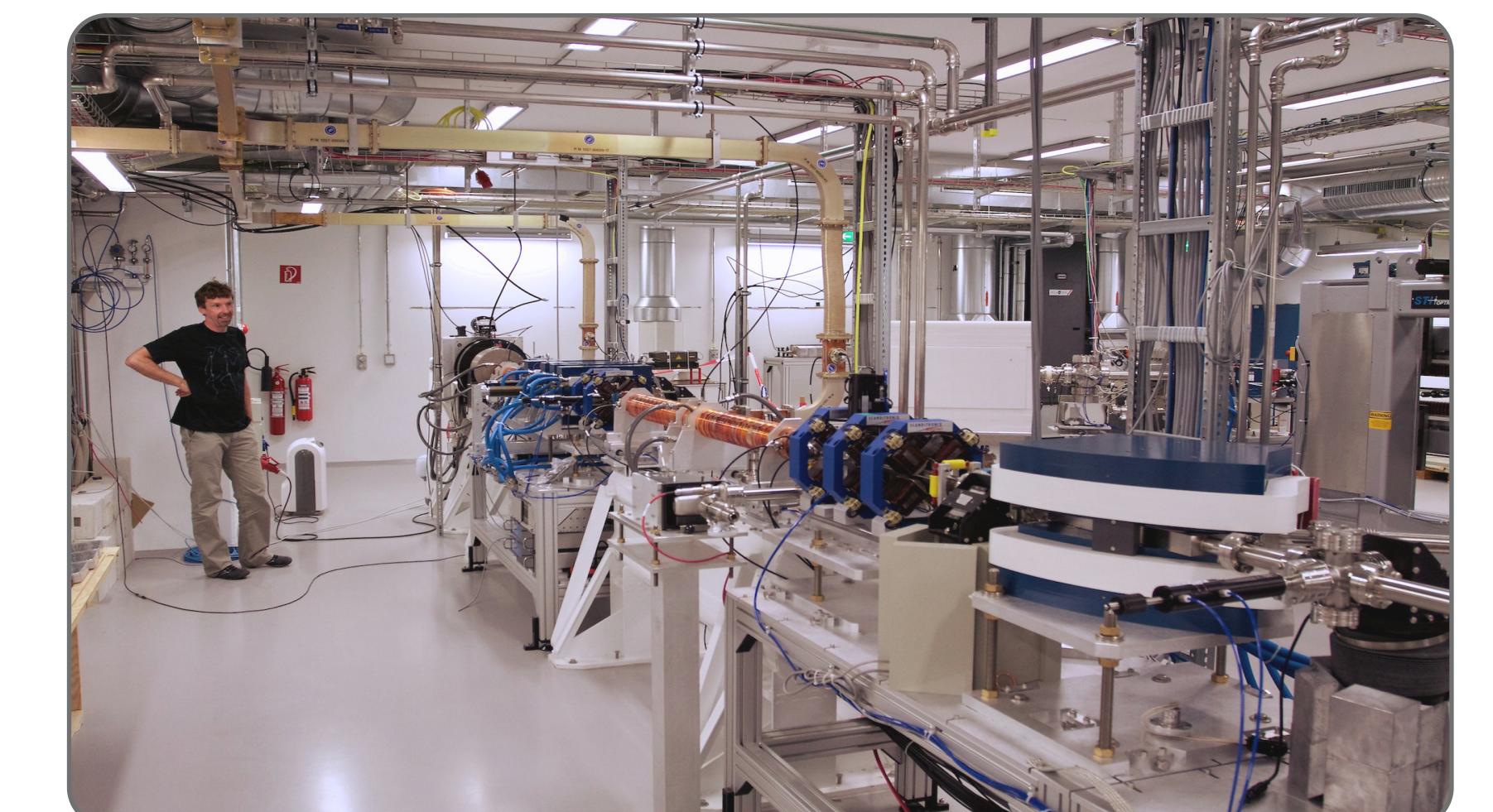
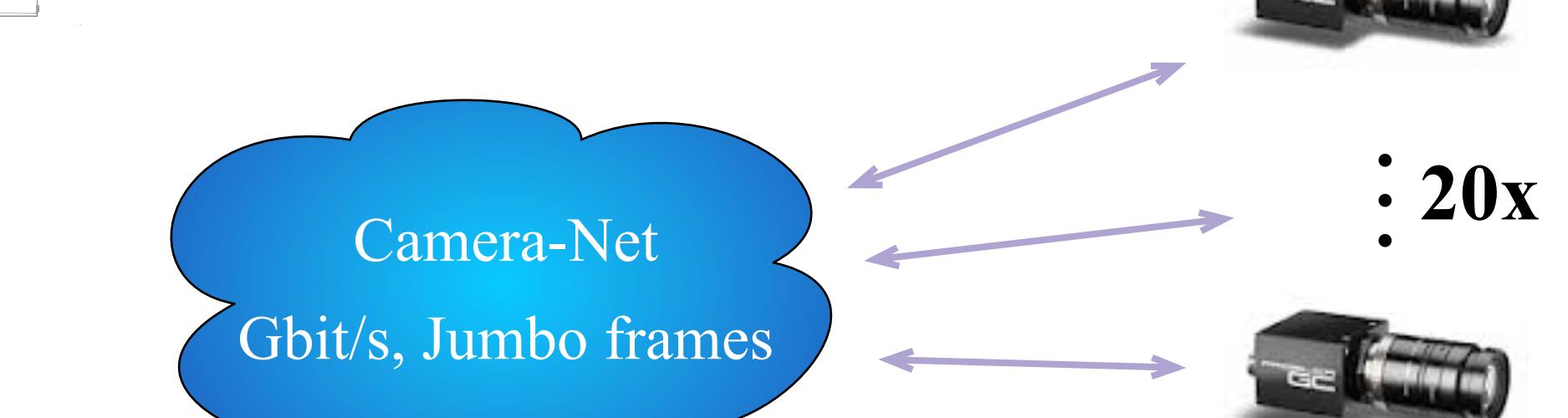


Documentation / Development Environment

- ELOG is standard electronic logbook at the FHI
- Extended by a low level postscript service
- FEL logbooks for installation, operation and user
- All software and applications under revision control (Mercurial)
- Publicly accessible repository server
- Ssh remote access
- NX remote desktop



GigE-cameras
proSilica GC650



User experiment: Conformer Resolved IR-Spectroscopy on Biomolecules

- The function of protein depends on its 3-dimensional structure and shape
- The study of proteins in the gas phase yields information about isolated molecules and gives insight into intramolecular interactions that govern the protein's structure
- The gas-phase techniques mass spectrometry (MS), ion mobility spectrometry (IMS), and IR-spectroscopy yield complementary information about the molecule

References

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