

PAUL SCHERRER INSTITUT



Bernd Schmitt :: SLS detector group :: Paul Scherrer Institut

# Detector Development for SwissFEL and SLS

IFDEPS2018 workshop

# X-ray user facilities at the Paul Scherrer Institut



## SLS:

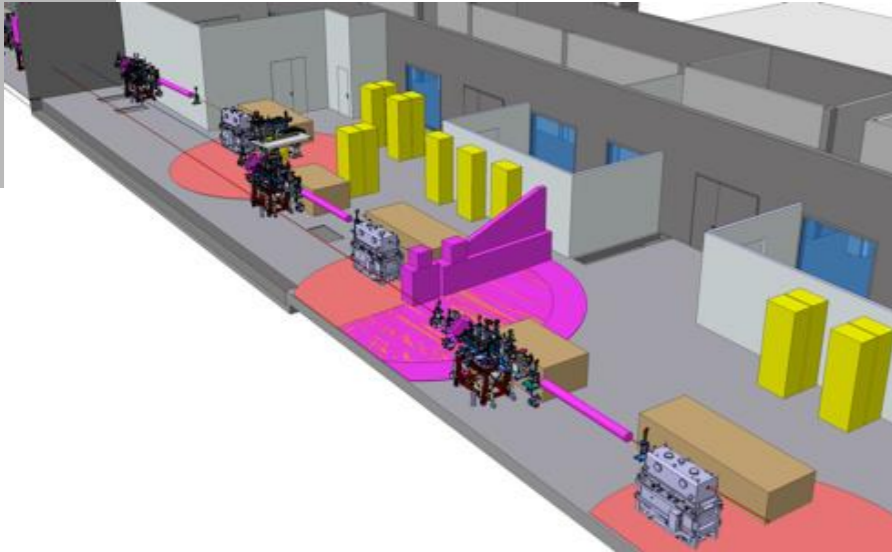
- In operation since 2001
- Upgrade program to reduce horizontal divergence → diffraction limited light source, startup in 2023
- About 2 orders of magnitude more coherent flux
- Higher intensity



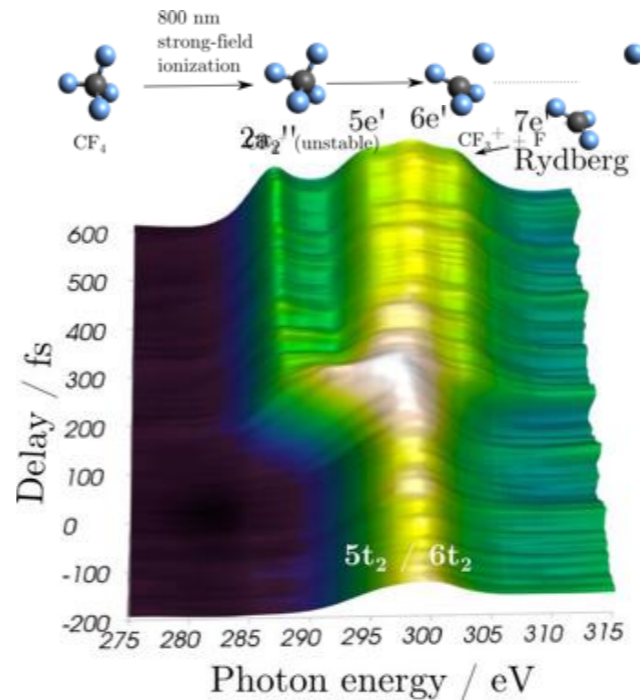
## SwissFEL:

- High energy branch Aramis (2-12.5 keV)
- First user experiments in Nov/Dec 17
- Jungfrau Detectors: 2x 16M, 4.5M, 0.5Ms
- Low energy branch Athos (250eV-2keV)
- First experiments in 2021

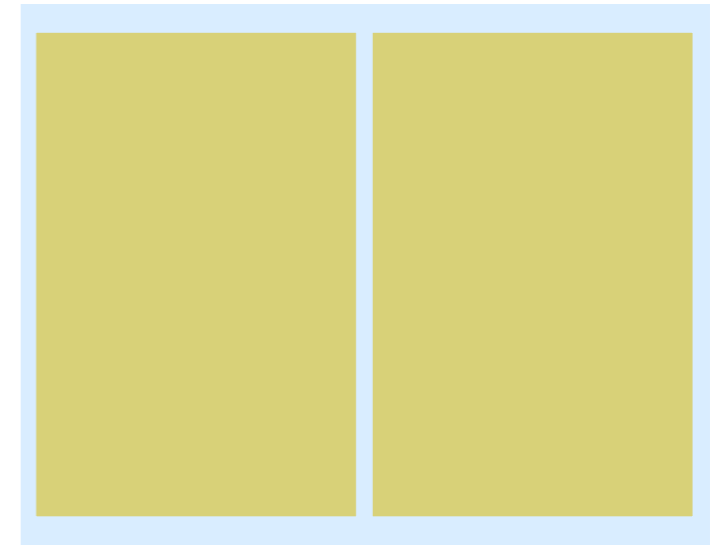
## Beamline



## End-station



## Mönch Detektor



- Soft x-ray: 250-1930 eV
- 3 optical beamlines
- pink or monochromatic beam (cPGM)
- High energy resolution & small focus

- Procurement in 2018
- Production in 2019
- Installation in 2020

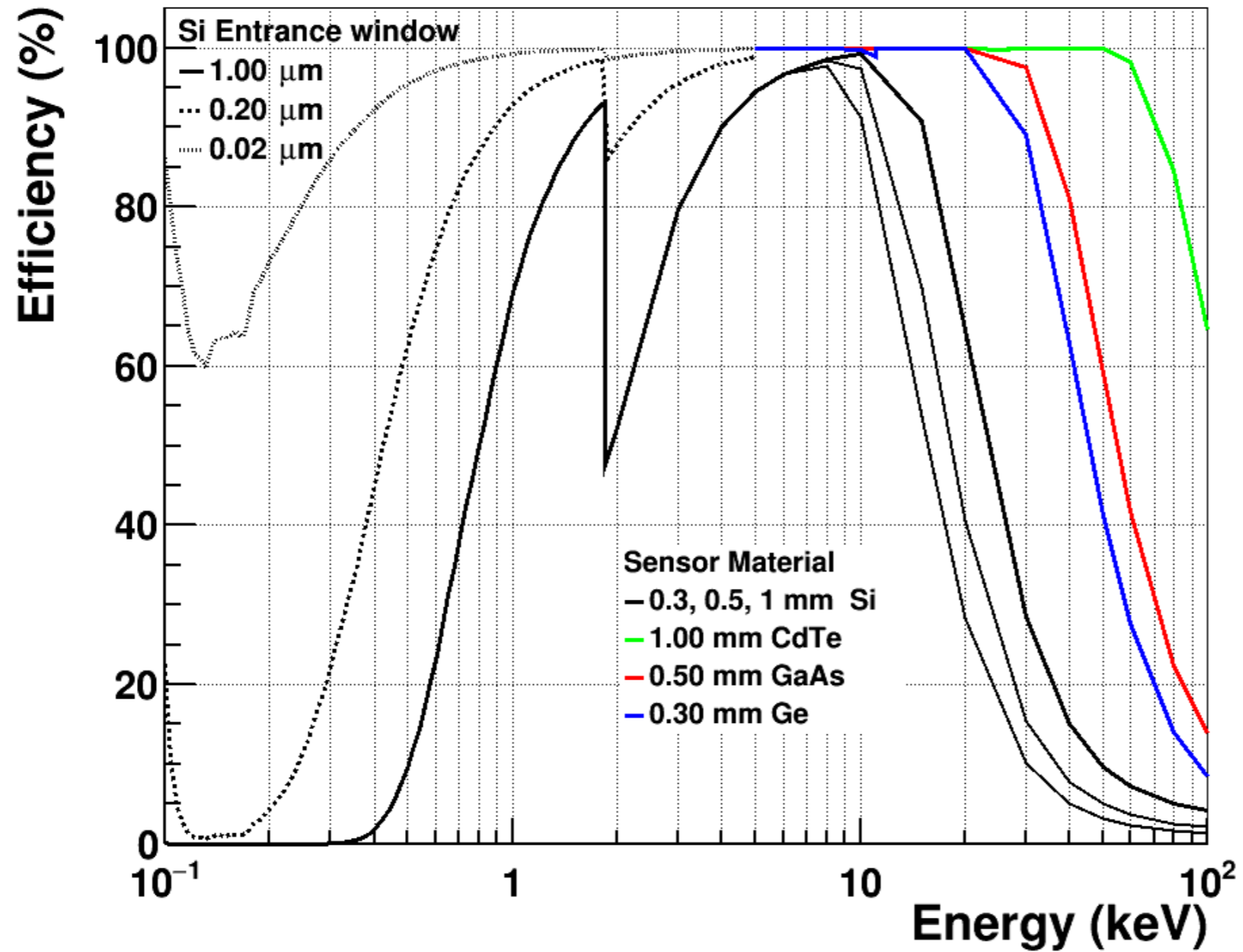
- AMO end-station: FEL X-ray combined with attosecond XUV and IR interferometer (EHTZ-PSI)
- Condensed matter and quantum materials end-station: tr-RIXS

- First experiment in 2021

- Silicon hybrid pixel detector
- 25 micron pixel size
- Low noise: 30 e<sup>-</sup>
- ASIC 2 x 3 cm<sup>2</sup> ⇒ 768 x 1024 pixels ~800k pixel
- Modules up to 4 x 3 cm<sup>2</sup> ⇒ ~1.6M pixel
- Dynamic gain switching

- Ready in 2020

# Sensor quantum efficiency



- Soft X-rays: transmission of the entrance window

# Current development projects

- Eiger:
  - 9M at beamline, work on integration ongoing
  - Need to make more modules
- Mythen III:
  - Mythen II old (11 years), run out of components
  - Know how to do things better:
    - lower noise, smaller threshold dispersion and higher count rate
  - First modules in 2019
- GotthardII (with EUXFEL):
  - Gain switching architecture
  - ADC and memory on-chip to digitize all 2700 bunches in a train
  - Used for diagnostics and energy dispersive detector
  - First modules in 2019

# Current development projects

- Jungfrau:
  - Build the detector systems for SwissFEL
  - Build 10M for PX at SLS
  - Build systems for external groups
- Mönch for Athos and SLS:
  - Small system (160 x 160 pixels) in use in spectrometer at SLS
  - Work on larger system for Athos for SwissFEL and SLS
  - System for startup in 2021
- EigerII:
  - Single photon counting detector for high count rates
  - SLS II in 2023

# Thanks for your attention!



More information: [www.psi.ch/detectors](http://www.psi.ch/detectors)