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PSI

A. Mozzanica:: Photon Science Detector Group :: Paul Scherrer Institut

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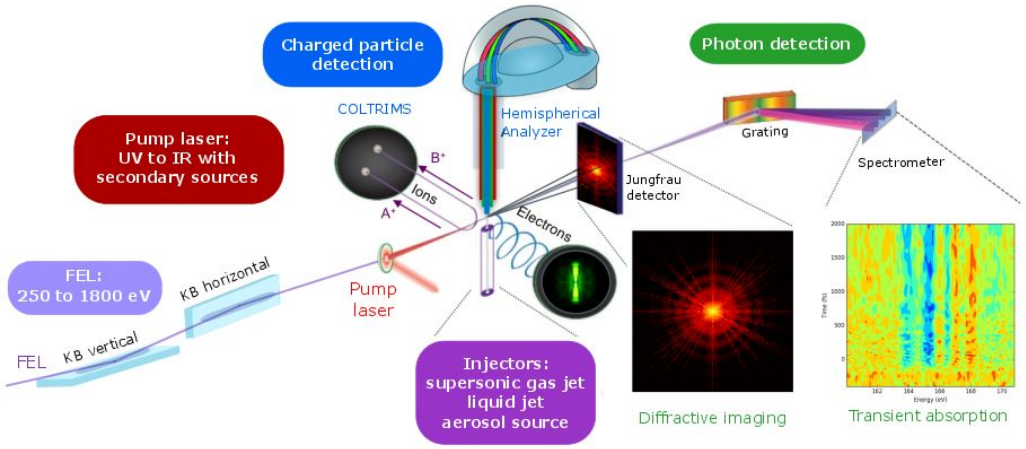
Jungfrau as imaging detector for SwissFEL low energy beamlines.

IFDEPS Virtual Thursdays 2021 :: 8th April 2021

Why JF at the MALOJA endstation?



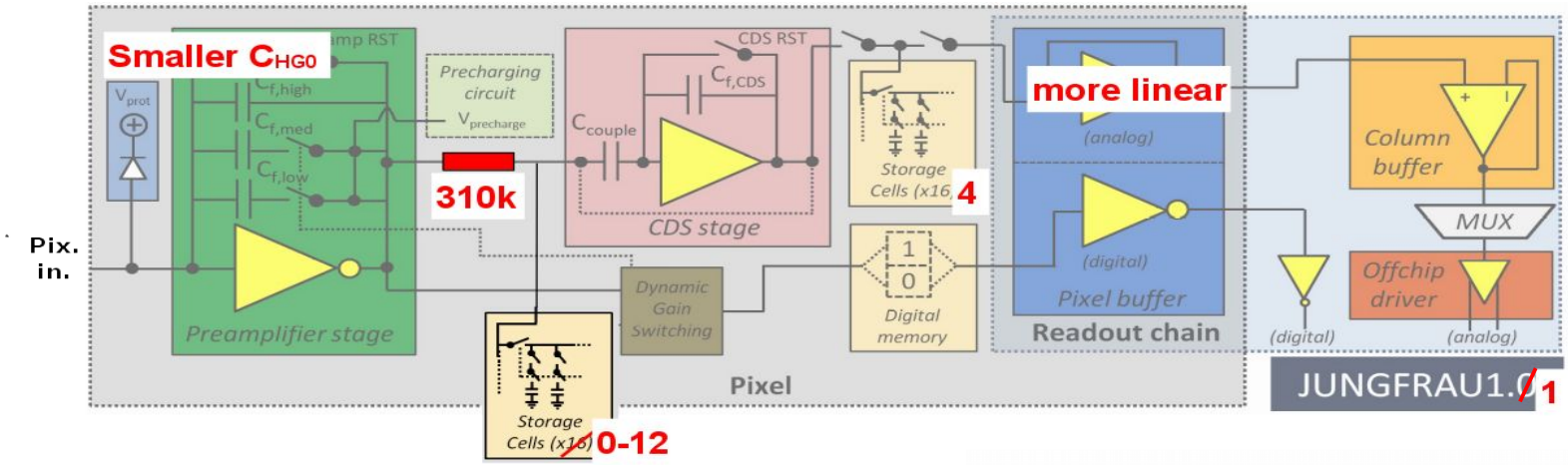
MALOJA is a highly flexible end station; JF covers the needs for a large-area detector for ultrafast (CD) imaging.
Soft to tender energy range: 250eV - 1800eV

JUNGFRAU 1.1 ASIC (lower noise) + sensors with optimized entrance window.

Cons:
-)relatively high noise, no single photon resolution at lower E
-)pixel size 75um
-)Q.E. lower than specialized low energy devices.
-)gaps, uniformity

Pros:
-)Large area, modular
-)extremely high DR (>10^5 ph/pix)
-)100Hz +
-)already integrated at SwissFEL
-)short development time
-)availability

Jungfrau 1.1 vs 1.0



Small improvements from JF 1.0:

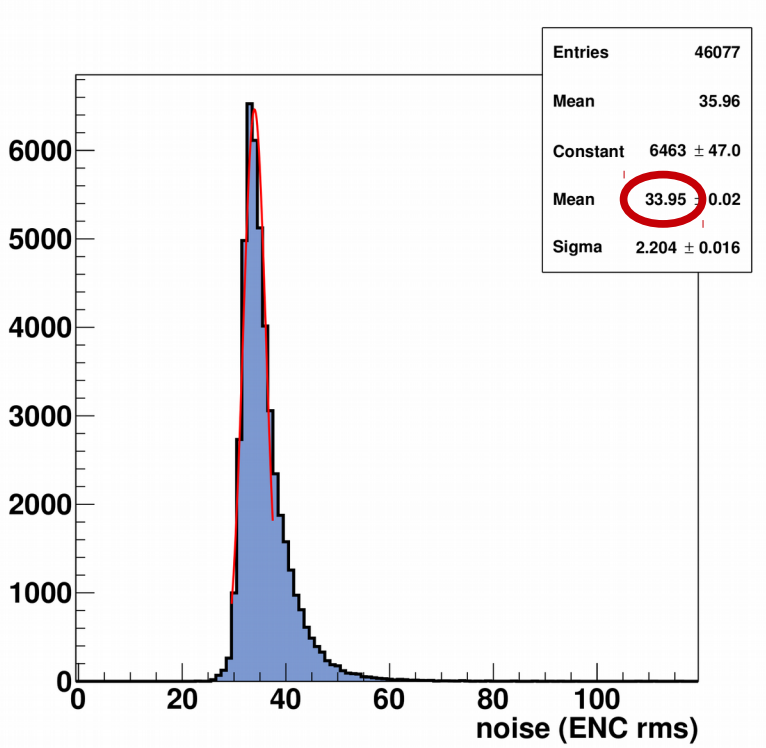
-)better linearity

-)lower noise in HGO(GO):

52(80) e^- rms → 34(60) e^- rms

Min. (offline) threshold 620eV @5σ noise cut (excl. pixels in noise tail).

Min. single photon resolution level is a trade-off between DQE and false hits.



Sensors with „thin“ entrance window.

Produced by FBK, in collaboration with PSI.

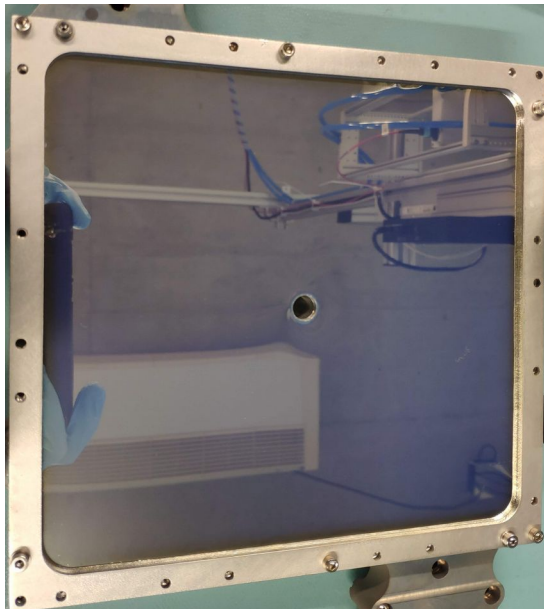
2019 batch: As implant + 200nm Al. layer

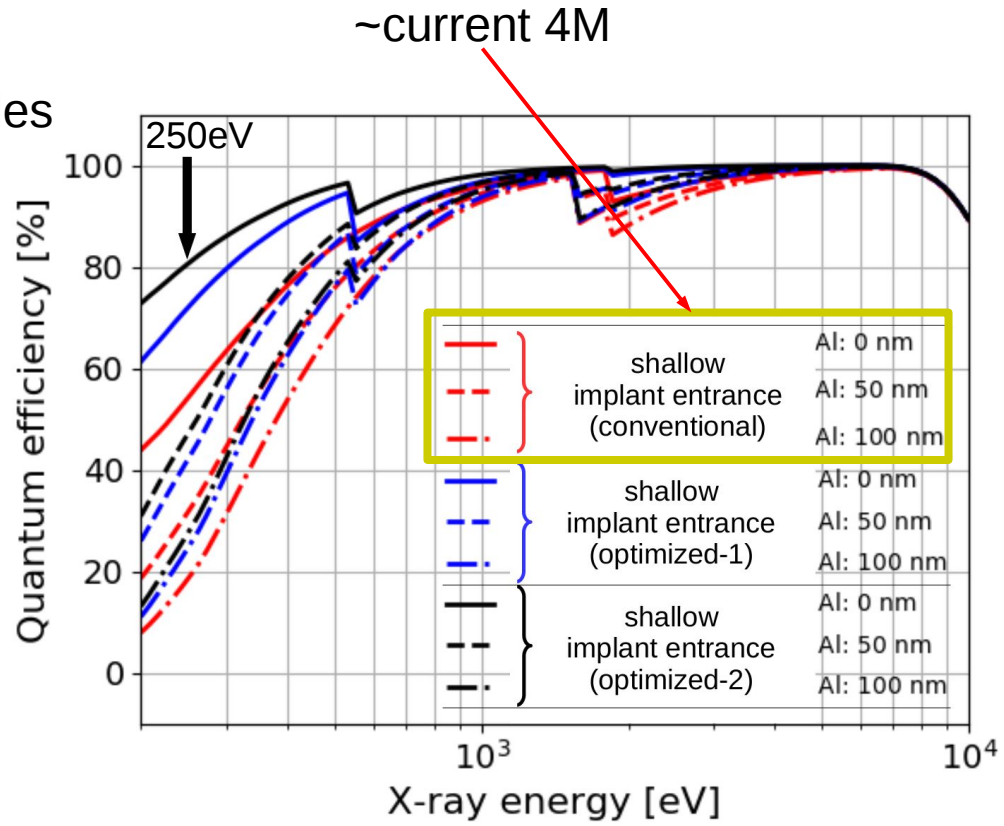
Q.E. plot from simulation

simulation validated with measurements at PTB Berlin

Al has been removed on 2 of 8 modules.

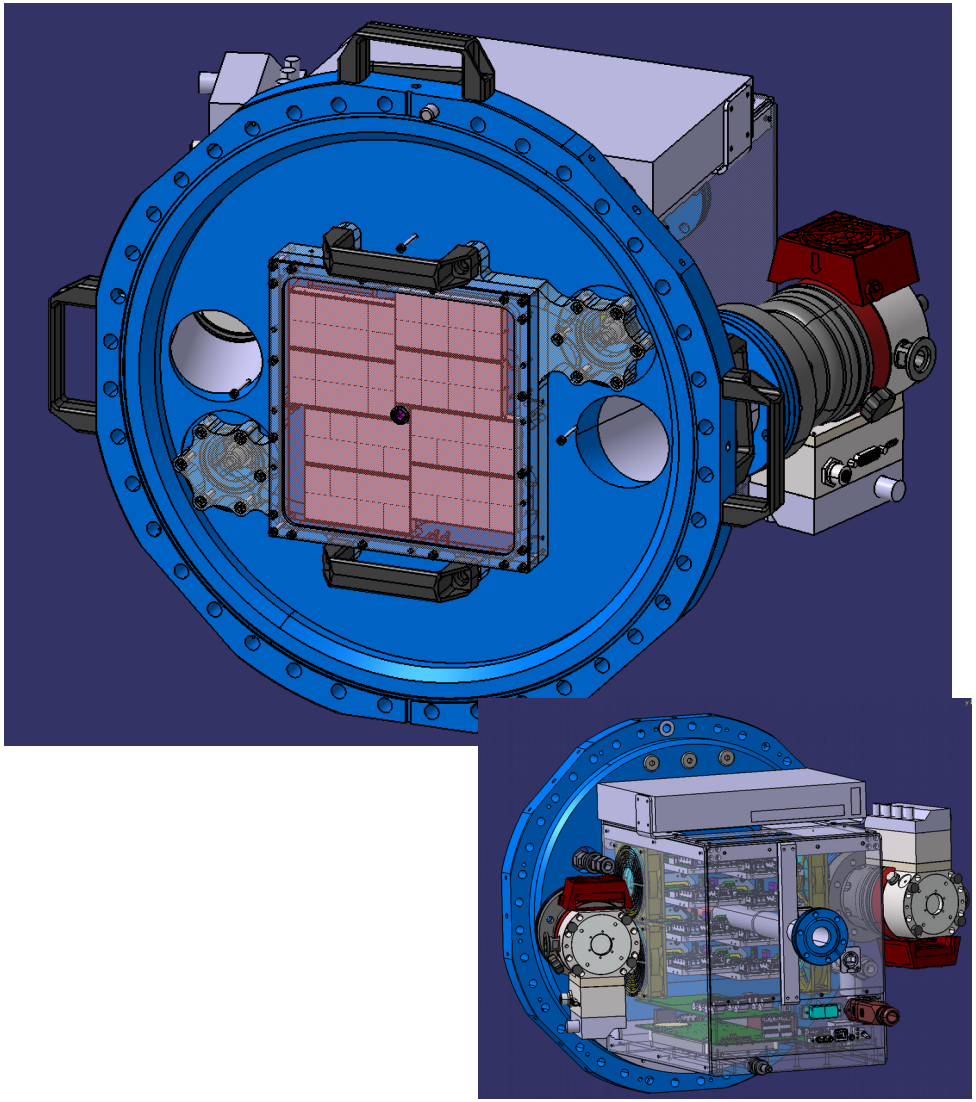
spray protection foil:
500nm Mylar+50nm Al. on both sides
with hole





The MALOJA 4M detector

- Mounted at the end of the experimental chamber, on a CF400 flange.
- a 400mm gate valve keeps the detector in vacuum (1e^{-6} mbar) while main chamber is vented
- Interaction point to focal plane 19cm
- Active area ~16x17cm^2
- Beam pipe hole Φ=10mm
- Allows beam transport to downstream SAXS detector with “minimal” dead cone

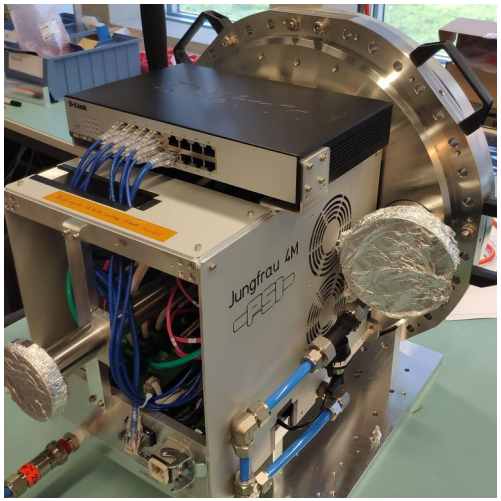


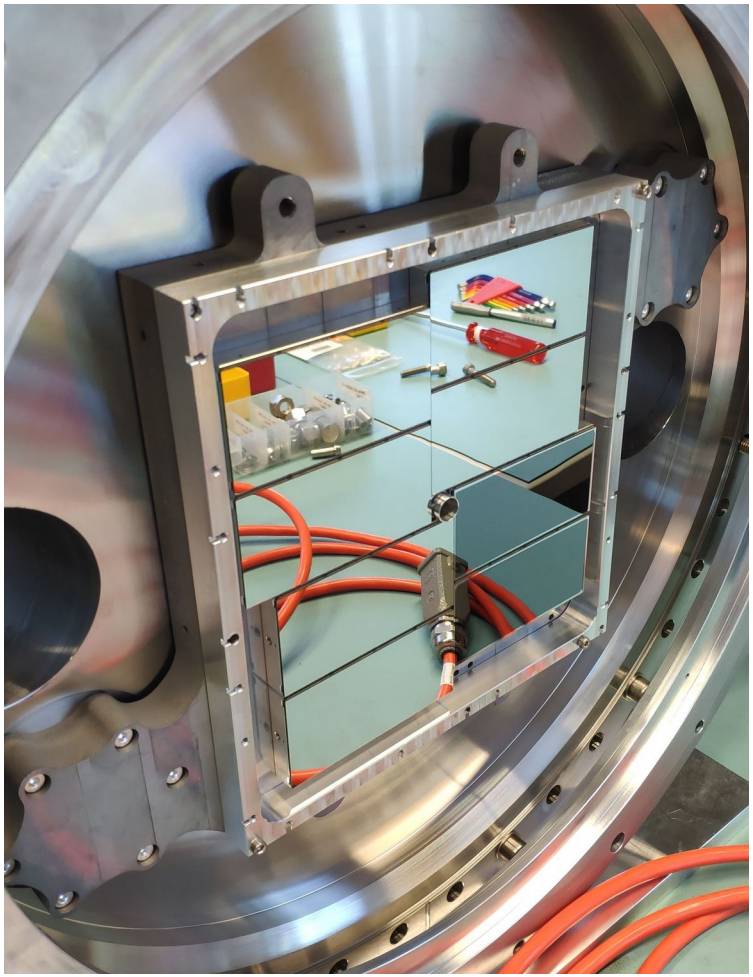
The MALOJA 4M detector - status

- Detector ready to be transferred to the beam-line
- First light on 19.5

OUTLOOK

- gain operational experience with low energy photons
  - calibration, stability, uniformity
- test with iLGADs sensors when available





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Thank you