

# HESEB

## Status and Outlook

Frank Lehner (on behalf of HESEB collaboration)  
DESY



# HESEB Beamline for Soft X-Rays

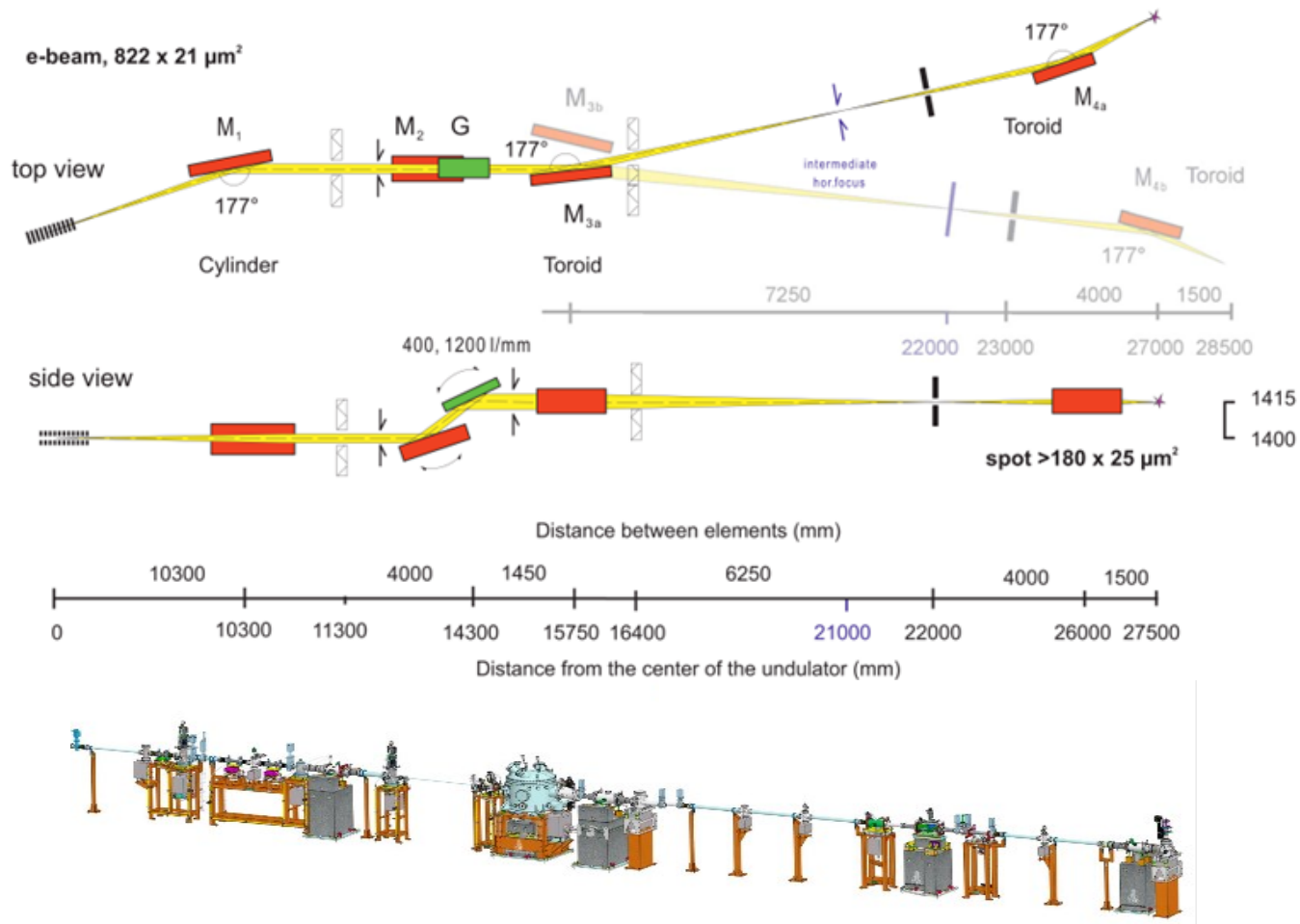
## Project overview

- HESEB consortium / project:
  - Helmholtz research centers: DESY, FZJ, HZB, HZDR, KIT
  - Project duration: 4 years 1/ 2019 – 12/2022
  - Funds: ~3.5 M€ incl. BL scientist, Helmholtz manpower in-kind
- HESEB in its base configuration will allow absorption spectroscopy with polarized soft X-rays
  - A second branch with additional Instrumentation/endstations will come from Turkey ----State of the art photoemission ---  
- TXPES (see talk by Emrah Özensoy)
- HESEB Project:
  - should act as an „anchor“ to seed cooperation between German research institutions/universities and SESAME member communities
  - driven by cost/performance effectiveness in design, installation and commissioning
  - ‚exploit off-the-shelf‘ – procurement and installation through manufacturer: FMB (Berlin)



# HESEB Beamline

## Optics concept /parameters



Parameter	Value
Undulator	UE56, APPLE II, Length: 1,7m, Period: 56mm
Polarization modes	Linear / circular
E_Photon range	~90 – 2000 eV
Photon flux on sample	1E12 1/s
Monochromator	Collimated plane-grating monochromator PGM (BESSY design)
Spot size on sample	180 (h) x 25 (v) um
Branches	Two: <ul style="list-style-type: none"> <li>Absorption chamber</li> <li>TXPES</li> </ul>

# HESEB Beamline

## Status / Timeline at FMB

- Optical / BL design finished in summer 2019 / international design review led by Z. Hussain / LBL
- EU-wide tendering over fall/winter 2019; contracted to FMB in Feb 2020
- Final Design Review w/ FMB: Sept 2020, since then production of parts
- FAT - Factory acceptance tests in Sept/Oct 2021, then delivery to SESAME in Nov 2021
- SAT - Installation & site acceptance test planned for Dec 2021 / Jan 2022



PGM mechanics



Steel plates for grouting of BL  
already shipped to SESAME

### In a nutshell:

- good progress at FMB
- a bit of delay at FMB, but not serious
- Prepare now FAT tests (w/ SESAME involvement)

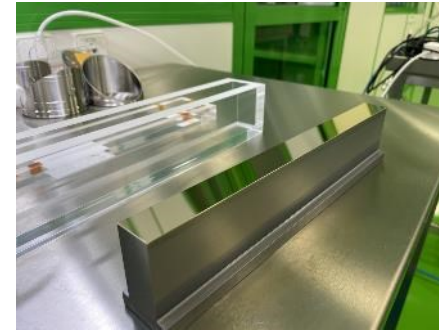


# Mirrors / gratings

## HESEB

- Mirrors M1, M2, M3a/b, M4a were ordered & delivered from ZEISS
  - Precision metrology done at HZB metrology lab (Frank Siewert)
  - All measured parameters in tangential and sagittal direction such as radius of curvature and slope error are within the specifications.
  - One mirror (M2) encountered coating difficulties (Au on Ta buinding layer) and was resent to ZEISS for refurbishment (and is now back)
- Gratings:
  - two planar blaze gratings (groove densities 400 l/mm; 1200 l/mm)
  - being produced at HZB in June 2021 and delivered in September to FMB

Mirror M1 at FMB



Optical Metrology at  
Department Optics and Beamlines

### Measurement Report on mirrors for the HESEB Helmholtz Beamline at SESAME

Grzegorz Gwalt, Frank Siewert  
e-mail: frank.siewert@helmholtz-berlin.de

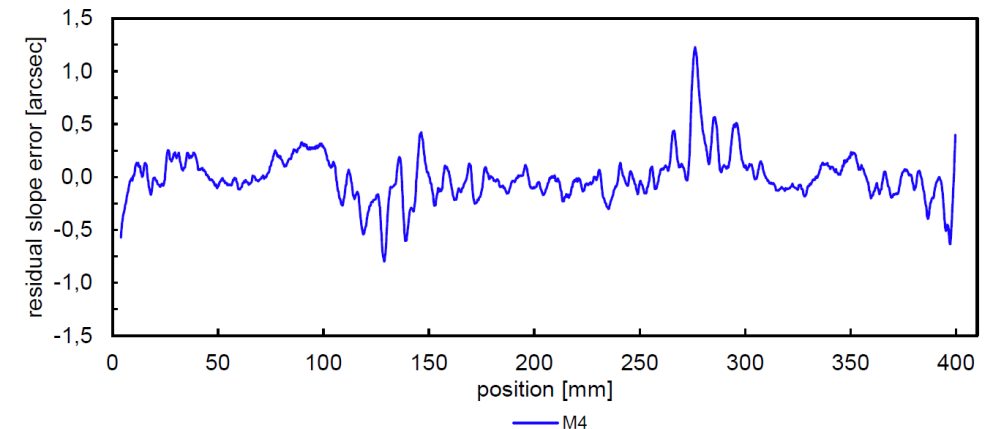
24<sup>th</sup> April 2021

Manufacturer: Carl Zeiss SMT GmbH  
Customer: FMB Feinwerk- und Meßtechnik GmbH

Serial Number: "19-0208-M1"  
"19-0208-M2"  
"19-0208-M3a"  
"19-0208-M4a"

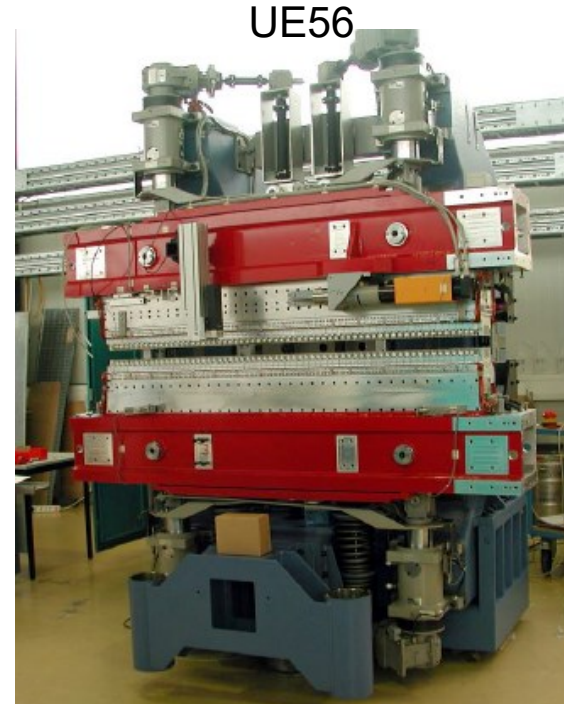
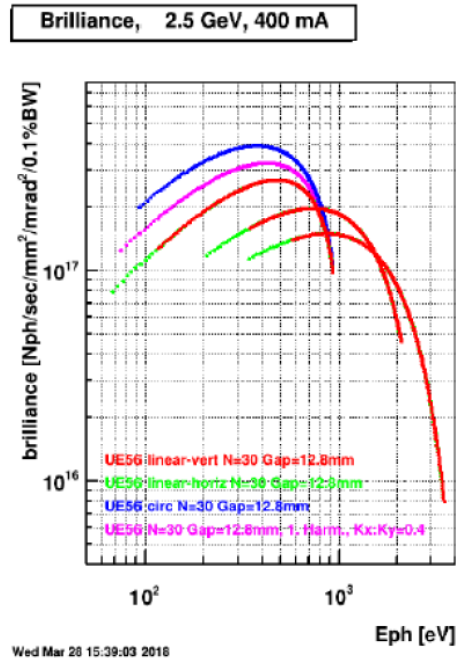
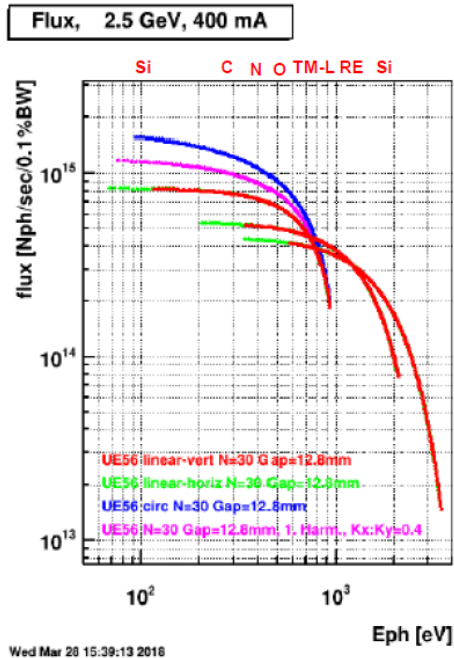
Mirror: M4a

F. Siewert, Metrology Lab HZB



# HESEB Beamline

## Undulator UE56 (APPLE II) with variable polarization



ID-Chamber produced at SAES / IT now at SESAME

Meseck, Bahrtdt, Viefhaus, HZB Berlin

Covers the core edges:

- Si L-edge—**semiconductors**
- C-, N-, O- Kedge - **Organics catalysis**
- TM-L-edges **magnetics**
- RE 3d edges **magnetics**
- Al- K-edge, Si-K-edge

### In a nutshell:

- ID chamber, tapered chambers produced & already at SESAME
- Refurbishment of UE56 at HZB almost complete
- training stay of 4 SESAME staff at HZB starting mid August 2021
- Covering all mechanical, installation, beam physics, controls aspects
- Ship then to SESAME in mid September 2021

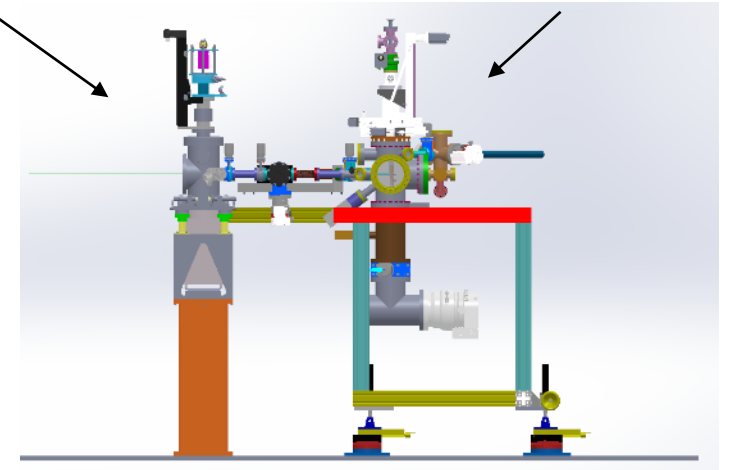
Abdalla Ahmad  
also @TOMCAT / PSI

# HESEB Experimental Chamber

- HESEB project will include experimental chamber on day one
  - Design led by W. Eberhardt / M. Genisel
  - Absorption, CMXD and fluorescence yield studies
  - within 20 um spatial resolution in UHV
  - as well as under elevated pressures of up to 1 atmosphere (He)
  - this is a unique, distinguishing feature of this beamline
- Vacuum chamber already produced at DESY and shipped to KIT
- Many other vacuum parts, flanges already ordered
- Now being set up at KIT for stand-alone tests

Diagnostics

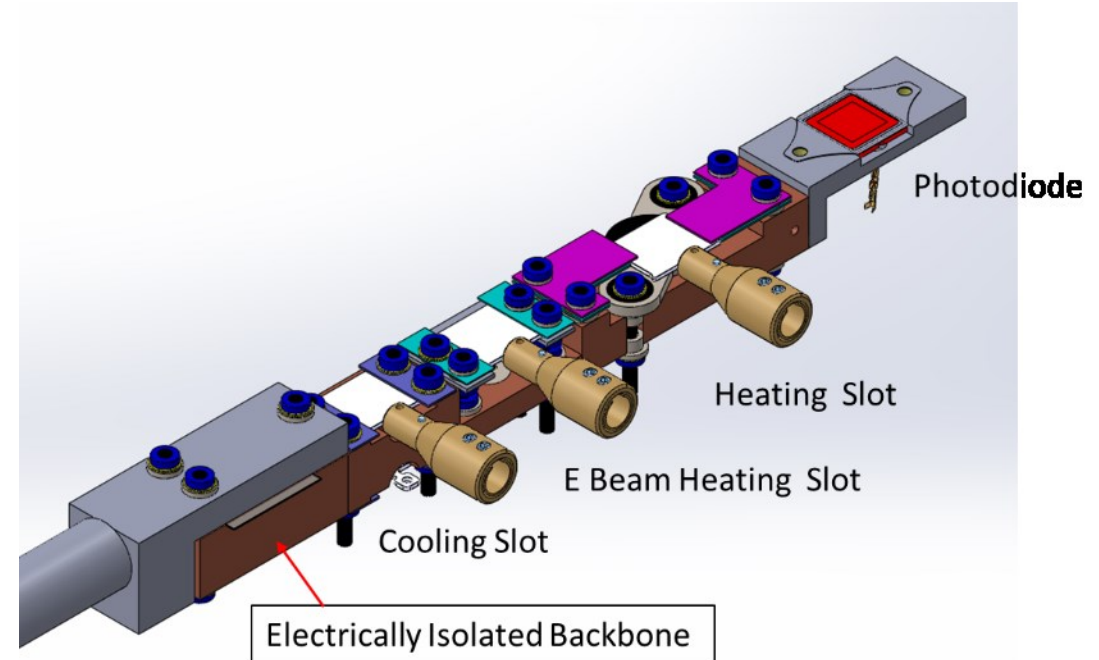
Experimental Chamber



Set up at KIT

# Experimental Chamber cont'd

- HESEB chamber and detector
  - Design of manipulator receptor part on-going, soon to be produced at FZJ
  - Advanced Si drift detector (Bruker) for fluorescence signal to be delivered by mid/end of July
  - use polycapillary optics for fluorescence light to enhance detector acceptance (cooperation with TU Berlin / Prof B. Kanngiesser) => interesting science case within Petra painting conversation project





# HESEB User community building

## Activities and plans

- In the original proposal we prepared/planned various teaming/twinning actions for 2020, incl. a major workshop in March 2020 in Turkey
- However, had to cancel all this due to SARS-CoV2
- In 2020/2021 a bunch of HESEB online seminars/ workshops were and will be organized
- We will also make use of synergies with BEATS, i.e. close coordination, joint events, such as discussions on a joint workshop on archaeology / cultural heritage and on a dedicated event to target Palestine
- HESEB goal is to prepare the ground for a few key experiments on day 1:
  - e.g. XRF on ancient materials from Petra wall paintings

## HESEB - Helmholtz-SESAME soft X-ray beamline



First HESEB workshop on soft X-Rays  
Istanbul, March 30<sup>th</sup> to April 1<sup>st</sup>, 2020

Preliminary agenda and registration:

<https://www.hzdr.de/db/Cms?pOid=58977>

**TU Berlin** Petra Painting Conservation Project (PPCP) **BLiX**  
Berlin Laboratory for Innovative X-ray Technologies

**Birgit Kanggießer**  
Characterisation and Conservation of Paintings on Walls and Sculpture from Nabataean Petra  
June 2016 – June 2019

The image shows two items: on the left, a stone sculpture of a nude female figure standing and holding a large object (possibly a vase or a piece of fabric) in front of her. On the right, a photograph of a wall painting depicting a face with a green and red background. The painting is somewhat faded and shows signs of wear.

**DFG** Deutsche Forschungsgemeinschaft

# Conclusions

## HESEB soft x-ray beamline

- HESEB project is progressing well; BL is becoming a reality at SESAME in Q1/2022
- Prepare now FAT tests in Sept/Oct @FMB before shipping to SESAME
- Experimental Chamber is being set up at KIT (w/ BL scientist Mustafa Genisel)
- User community building activities will increase – also in synergy with BEATS

