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Progress at the Variable Polarization XUV Beamline at PETRA III.

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P04 offers unique opportunities for research with soft X-rays at PETRA III, providing highest brilliance and variable polarization from 250 to 3000 eV using only the first harmonic of the undulator.

P04 properties and layout:

> Exceptionally wide range of photon energies
⇒ 1st harmonic only from 0.2 to 3 keV!
⇒ Uncompromising circularly polarized SR

> High stability, low emittance ⇒ diffraction limited

> Large facility ⇒ space for dedicated experiments

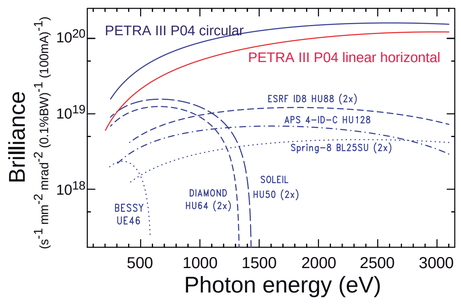


Figure 1: Normalized brilliance of the beamline P04.

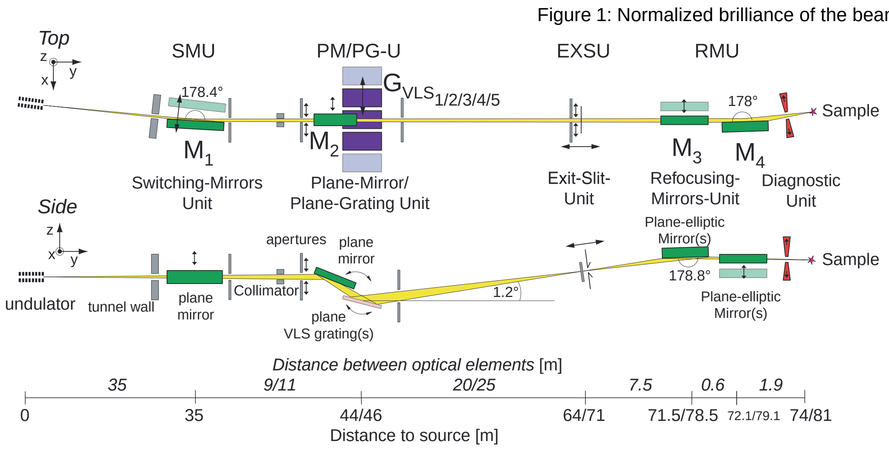


Figure 2: Optical layout of the beamline P04.

P04 performance:

> Photon energy range: (<100) 250 - 3000 eV
> Resolving power: >10^4 (up to >3 x 10^4 @1 keV)
> Photon flux: >10^{12} photons/s (up to 5 x 10^{12})
> Spot size at sample (h x v): 10 x 10 µm² / 50 x 50 µm²
> Polarization (switching rate): circular, linear hor./vert. (<0.1 Hz)

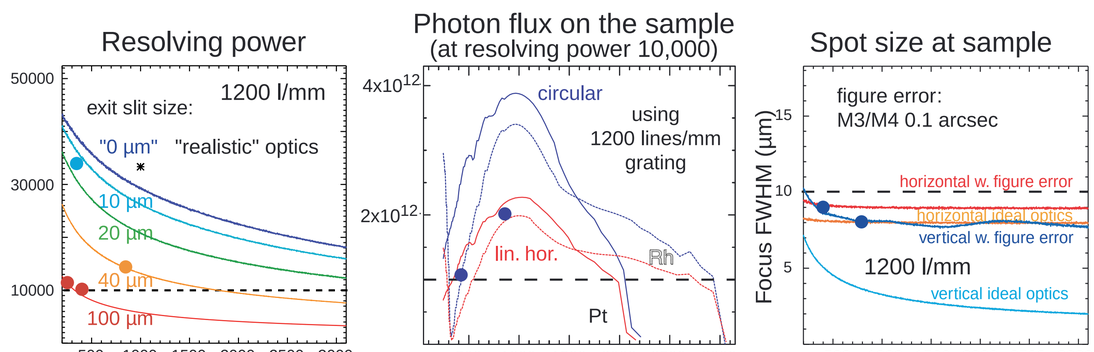


Figure 3: Performance of the beamline P04 (lines: calculated values, circles: measured values).

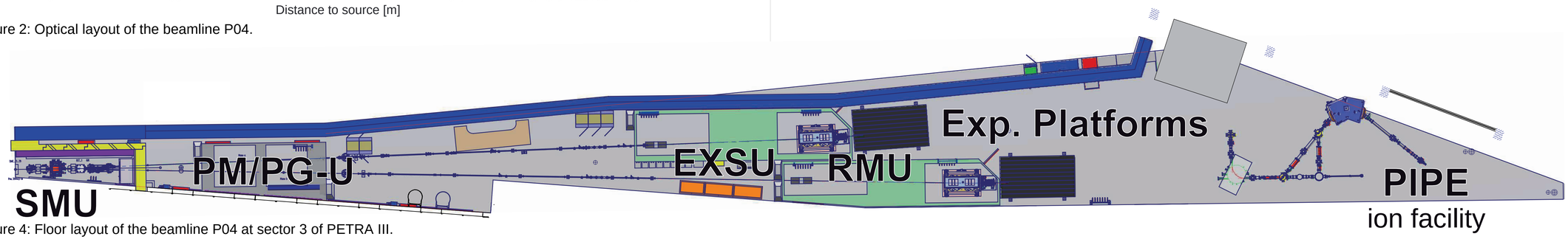


Figure 4: Floor layout of the beamline P04 at sector 3 of PETRA III.

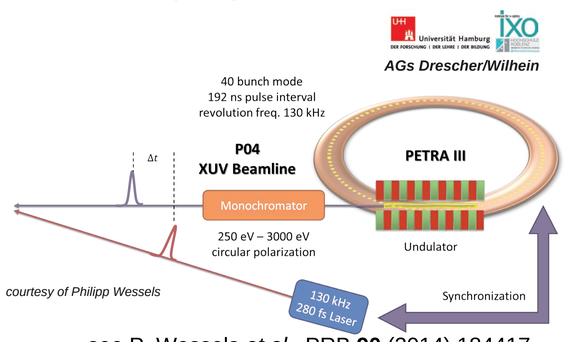
P04 endstations provided by user consortia (BMBF funding):

Research Fields at P04:

> Dilute gas phase targets
> Soft X-ray Diffraction
> Magnetic Spectroscopy/Imaging
> High-resolution Photoemission
> Time-resolved Spectroscopy/Microscopy

Laser Setup for ps-time-resolved Studies

AGs Drescher/Wilhein

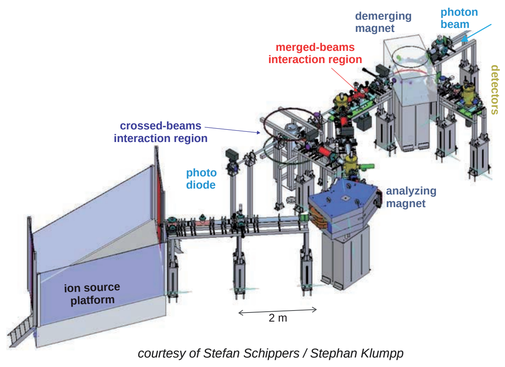


courtesy of Philipp Wessels

see P. Wessels *et al.*, PRB **90** (2014) 184417

Photon-Ion spectrometer at PETRA III (PIPE)

AGs Müller/ Rühl/ Dörner/ Martins, Wurth

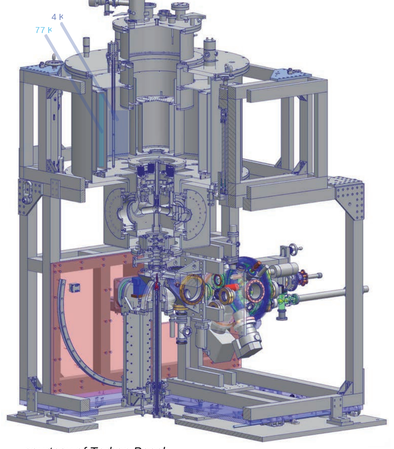


courtesy of Stefan Schippers / Stephan Klumpp

see S. Schippers *et al.*, JPB **47** (2014) 115602
and A. Müller *et al.*, PRL **114** (2015) 013002

XAS/XMCD Setup with mK-Cryostat

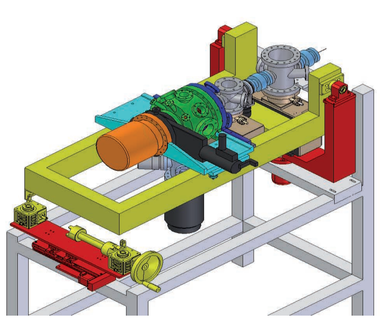
AG Wurth



courtesy of Torben Beeck

Setup for Soft X-ray Holographic Imaging

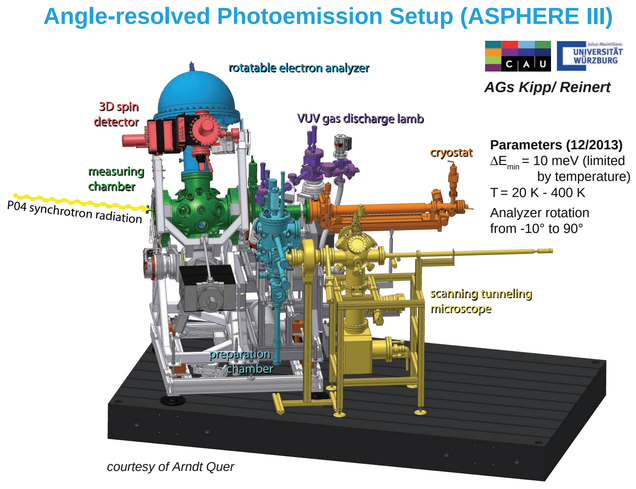
AGs Oepen/Grübel



courtesy of Judith Bach / Robert Frömter

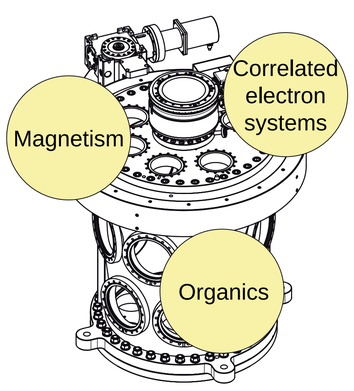
Angle-resolved Photoemission Setup (ASPHERE III)

AGs Kipp/ Reinert



courtesy of Arndt Quer

Soft X-ray Diffractometer (SXD)



courtesy of Christian Schüßler-Langeheine

P04 progress during shutdown

During the shutdown several components have been improved, among them:

> a new power slit system in front of the plane mirror/grating. This will better define the x-ray beam in order to minimize distortions of the x-rays impinging on the grating. (both for the first and second branch line)

> a complete new software for the PM/PG-U allow to address only an “energy axis” instead of two axis of rotation for mirror and grating respectively. This enables fast and accurate “on-the-fly”-scanning (with up to 20 eV/s!).

> new exit slit blades and an improved calibration of the camera which is used to measure the size of the exit slit (<1µm precision).

> installation of alignment lasers which can operate independently from the front end laser in order to ease alignment of setups even while the other branch is using x-rays.

P04 outlook

During 2015 several new components are forseen:

> the missing horizontally focusing mirror for the experimental platform (before commencing user operation).

> the complete second beamline branch line which is vital to ease the set up and simultaneously increase beamtime efficiency (final dates depend on optics).

> a complete new development for the switching mirror which will then allow for true variable polarization including all linear polarized modes.
This mirror will be internally ℓN_2 cooled due to high heat load. (final dates depend on optics).

Upgrades on the endstation side will include a sub-µm-focus at the new second branch line.
For this scheme an intermediate focus is re-focussed into a dedicated photoemission endstation (BMBF funding).

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