

COMPONENTS FOR SURFACE ANALYSIS

## The State of the Art Energy Analyzer Series

# PHOIBOS 225 HV

- For electron energies up to 15 keV
- Different modes of operation (UPS, XPS and HXPS)
- Ultra high energy resolution in UPS (<1 meV), XPS (<7 meV) and HXPS (<15 meV)
- Angular Mapping ( $\Delta\theta < 0.1^\circ$ )
- CCD, DLD and DLD/SPIN detection available

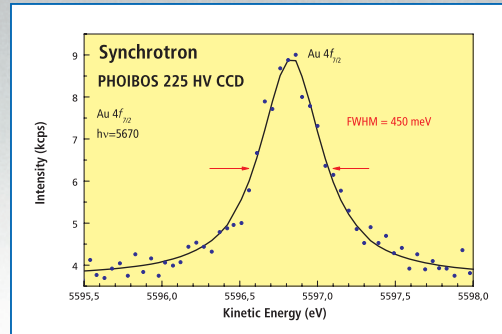


## PHOIBOS 225 HV

Hard X-ray photoelectron spectroscopy (HXPS) is used to study the bulk properties of solids. Due to the low photoionization cross sections at higher excitation energies, special considerations have to be made regarding the instrument. Low dark-count detector units and high stability power supplies are needed. Furthermore the analyzer must work at high retarding ratios to provide a high resolving power within the hard X-ray energy range.

The PHOIBOS 225 is the state-of-the-art hemispherical analyzer development of SPECS. The instrument can handle energies up to 15 keV. Due to the modular design concept this instrument is also the best choice for the UPS range. With this analyzer SPECS sets a new standard. New approaches and technical solutions lead

to an instrument that combines excellent performance with highest reliability for the largest possible variety of experimental conditions.



Au 4f<sub>7/2</sub> core level at hv = 5670 eV. The FWHM of 450 meV includes the monochromator resolution (300 meV), the life time broadening (100 meV) and the analyzer resolution (100 meV).\*

### PHOIBOS

The Greek deity Apollo was often called PHOIBOS Apollo, an epithet that means "bright".

## Analyzer and Lens

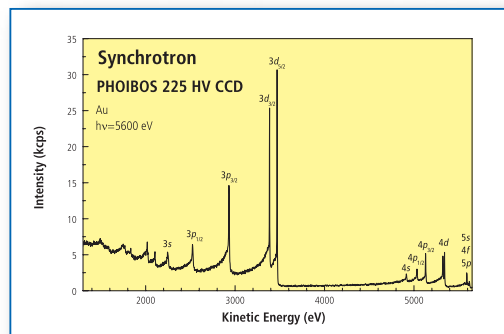
- True 180° hemispherical analyzer with 225 mm mean radius
- Exclusive use of non-magnetic materials inside the double  $\mu$ -metal shielding
- External setting of 8 entrance and 3 exit slits

The PHOIBOS 225 has a mean radius of 225 mm. The Slit Orbit mechanism allows to select one of 8 pairs of entrance slits and one of 3 exit slits via one rotary drive from outside the vacuum. Entrance and exit slits can be operated independently. Each of the entrance positions provides a pair of slits that limits the maximum admitted angle in the energy dispersing direction of the analyzer.

The entrance slits range from 0.09×30 mm<sup>2</sup> to 7×30 mm<sup>2</sup>. A double magnetic shielding reduces the magnetic field to a very low level. The residual magnetic field can be reduced further by using an integrated coil.

The multi element two stage transfer lens has been optimized for high retarding ratios up

to 1000. This enables ultimate energy resolution at high kinetic energies. The lens may be operated in different modes for angular or spatially resolved studies. The standard working distance of 53 mm and the conical shape of the lens front are providing optimum access to the sample.



Photoemission survey spectrum from an Au sample using the KMC-1 beamline at BESSY II (hv=5670 eV).\*

\*Reference:  
Data acquisition at BESSY II, Berlin, Germany in collaboration with Gerhard H. Fecher, A. Gloskowsky, J. Barth, B. Balke and C. Felser (Institut für Anorganische Chemie und Analytische Chemie, Johannes Gutenberg - Universität, Mainz, Germany)

## Power Supply

- Kinetic energies up to 15 keV
- Different modes of operation (40 V, 400 V, 1500 V, 3500 V and 15000 V)
- Fully remote controlled
- Booster for reducing noise and ripple

The Analyzer Voltage Control AVC 15000 is designed to supply all voltages needed to operate the analyzer PHOIBOS 225 HV. The AVC 15000 contains the following units:

The HSA 15000 consisting of high voltage modules supplying the lenses, analyzer hemispheres, the DLD or CCD detector, and the SPIN detector. All HV modules float on the base kinetic energy ranging from 0 to 15 keV.

The Base Energy Control HCN 15M-15000 generates the base kinetic energy of up to 15 keV. The HV Booster HVB 500 is an optional unit and reduces the noise and ripple voltage of the base kinetic energy generated by the HCN 15M-15000 down to 1 ppm.

Ag spectrum measured with a Cu anode using the PHOIBOS 225 HV\*

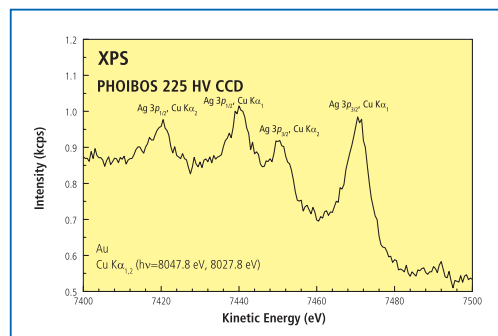
The optional Spin Detector Supply SDS 30 generates the target voltage of up to 30 kV for spin detection.

The ARM Interface Controller ARMIN 10 consists of a micro controller and a set of analog and digital I/O channels. It communicates with the network via the Netport NP 100. All units in the AVC 15000 are remotely controlled by the ARMIN 10.

The Netport NP 100 functions as an interface between the ARMIN 10 and ethernet networks. It provides several ethernet ports and a module for converting the ethernet into an optical ethernet. The optical ethernet is used to communicate with the HSA 15000, because the subunits float on 15 kV.



AVC 15000



## Detection

The analyzer is equipped with a flange-mounted detector assembly. Three detector options are available:

- 2D-CCD detector
- 3D-DLD detector
- Combined Delayline, 9 channel and Micromott-Detector

The 2D-CCD detector features a 12 bit digital Peltier cooled camera with a dynamic range of 1000. The Peltier cooled camera shows a significantly lower thermal noise compared to a standard CCD camera. This makes the 2D-CCD detector most suitable for low count rate applications with long exposure times.

The 3D-DLD detector (one time and two lateral dimensions) with its new hybrid design combines high count rates (segmented delayline) with extremely high temporal resolution (375 ps) and lateral resolution (150 μm). The detector has a very low dark count rate within a large energy range (0 - 15 keV).

The DLD/SPIN detector combines a Delayline, a 9 Channel Segment Detector and a Micromott-Detector for 2D/3D electron and spin detection with sub-ns time resolution.

Combined Delayline, 9 channel & Micromott-Detector



2D-CCD detector



3D-DLD detector



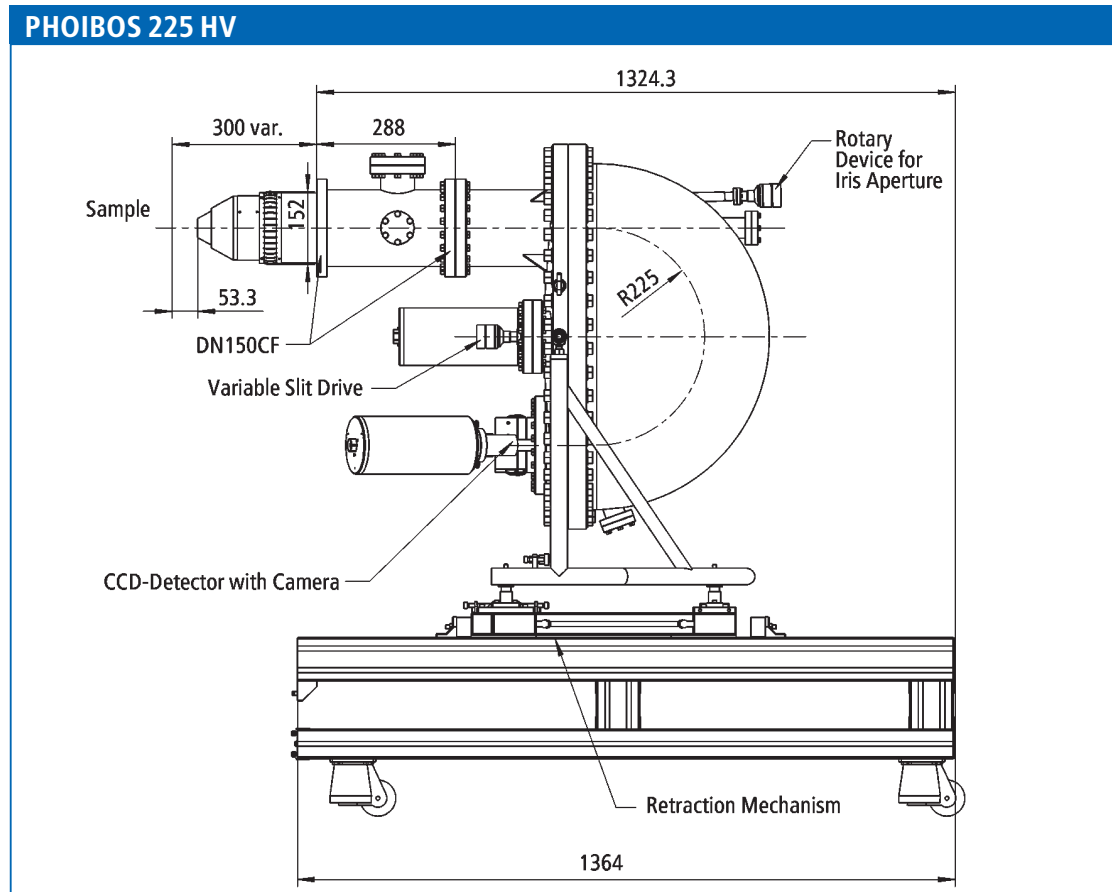
## Technical Data

### Analyzer PHOIBOS 225 HV

Mean Radius	225 mm
Mounting flange	DN 150CF
Energy resolution UPS	< 1 meV
Energy resolution XPS	< 7 meV
Energy resolution HXPS	< 15 meV
Angular resolution	< 0.1°
Spatial resolution	< 50 µm
Slits	8 entrance and 3 exit slits
Shielding	Double µ-metal
Mounting	Mobile frame included
Gasket	COF 700
Weight	250 kg

### Power supply AVC 15 000

Voltage ranges	40 V, 400 V, 1500 V, 3500 V and 15000 V
DAC Resolution	24 Bit
Voltage Setting Accuracy	20 Bit
Voltage Ripple and Noise	< 15 mV <sub>pp</sub> at 15 kV
Temperatur Coefficient	< 1 ppm/K
Long time stability	< 1 ppm over 8 hours
Warmup Time	30 min
HV Connector Cable	Double shielded
HV Connectors	Contains HF noise filters
Protection	Output short circuit and arc protected
Safety	24 interlock switches
Size	600 mm (W) × 1950 mm (H) × 800 mm (D)



11/06 · SPECS reserves the right to alter technical specification without further notice.

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