

AD-CMOS Detector

ULTRALINEAR ADAPTIVE DIMENSIONS TRUE PULSE
COUNTING CMOS ELECTRON AND ION DETECTOR

KEY FEATURES

- New ARXPS/NAP-XPS detector
- Parallel true pulse counting
- Linear dynamic range $\geq 10^7$
- Adaptive 1-/2-dimensional operation modes
- 70 mm MCP/fast P43 screen/
fast CMOS camera assembly



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Electron and Ion Detection for Quantitative Surface Analysis

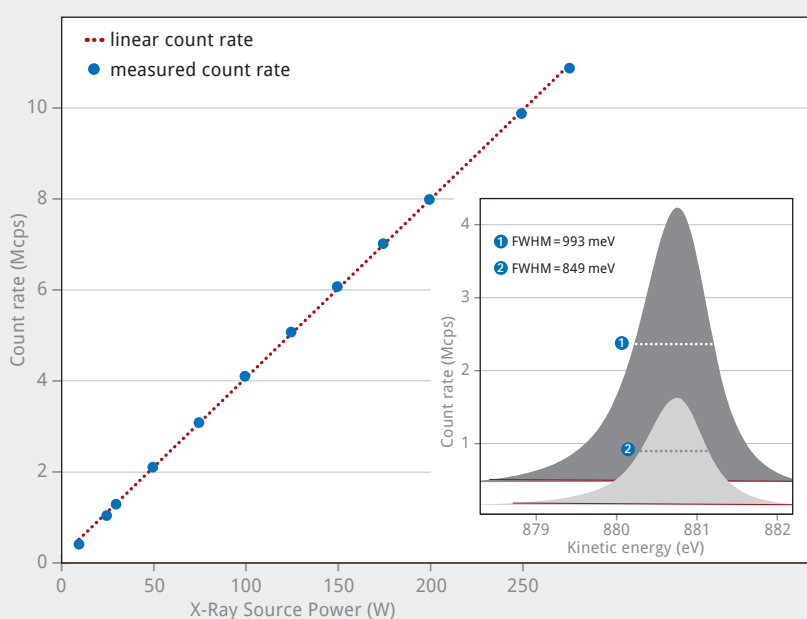
Analytical techniques for non-destructive elemental quantification of surfaces based on electron and ion spectroscopy (XPS, NAP-XPS, HAXPES, ARXPS and ISS/LEISS) are of growing importance in materials science, chemistry, physics and microelectronics. In the last 10 years the major improvements in instrumentation for these methods have been achieved in adding environmental conditions (Near Ambient Pressure XPS), developing excitation sources (Hard X-ray XPS) and improving small spot performance. In all these new fields a reliable and repeatable quantification depends on excellent detection efficiency, high count rate linearity, fast parallel data acquisition, long-term stability and true event counting capabilities of the detector behind the electron analyzers. The novel AD-CMOS detector is far beyond state-of-the-art at an attractive price point.

Detection Principle

The general CMOS detection concept has been developed in the group of Dan Dessau at the University of Colorado for 2D-ARPES analyzers. It is a true pulse counting algorithm converting the analog light signal to discriminated events. The latest improvements in semiconductor technology have greatly increased the capabilities of CMOS sensors, thus offering the extreme sensitivity required for the lowest light situations while providing superior signal-to-noise ratio, resolution, field-of-view and frame rates. For the AD-CMOS detector the sensitivity and linearity was expanded to a larger detection area, enabling state-of-the-art quantitative analysis for X-ray photoelectron, Auger electron and ion scattering spectrometers.

Advanced Detection Technology

The AD-CMOS detector is a new development dedicated to true analytical instruments combining the requirements on high sensitivity, true event counting and linearity for electrons and ions. A conventional multichannel plate stack and phosphorous screen assembly is used to detect electrons. A single electron event detection algorithm is implemented into the analysis software to ensure quantitative count rates with outstanding linearity and acquisition speed. A fast CMOS camera acquires images from the phosphorous screen and the algorithm identifies the impact of electrons and transfers them into an energy channel count. In case angle dependent measurements of electrons and ions (e.g. ARXPS) are needed the pure energy detection can be enhanced by allocating a reasonable number of non-energy channels to the detector. By this, snapshot spectroscopy adapted to the effective energy and angle resolution of the analyzer can be realized for each experiment.



Count rate linearity for Ag 3d_{5/2} at 100 W with Mg K_α and PHOIBOS 150 with AD-CMOS

With several hundreds of energy channels and up to 12 angle channels. Hence, each electron hitting the detector is efficiently registered, counted as an event and allocated to the chosen number of energy and angle channels by converting the analogous signal into discriminated electron events. Thermal noise, background illumination and other sources of noise are efficiently filtered by this method ensuring best signal to noise ratio and unsurpassed quantitative results.

This new technology outperforms current detector technologies, e.g. low sensitivity at low count rates and limited linearity for high intensity signals or high exposure. Furthermore it significantly reduces costs of 2D-detection in XPS/ISS for angle resolved and dependent spectroscopy.

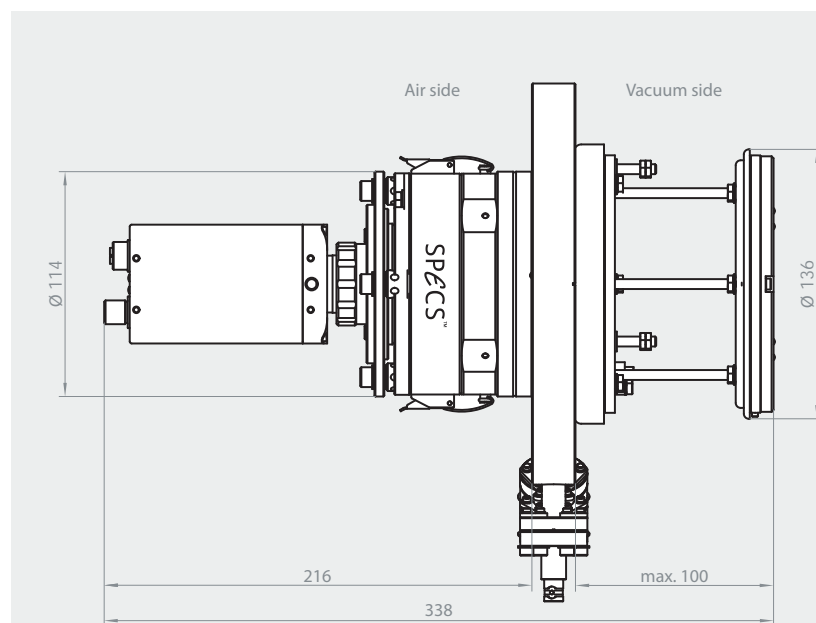
Analyzers and upgrades with AD-CMOS detector

The high dynamic range in a large energy window accompanied by the flexibility to adapt the functionality from 1D- (pure spectroscopy) to moderate 2D-detection (spectroscopy in a reasonable number of angle channels) makes the AD-CMOS detector the perfect and cost efficient match for any new SPECS analyzer designed for (NAP)-XPS, ARXPS, HAXPES, AES/SAM and ISS, especially the PHOIBOS 150, PHOIBOS 150 WAL and PHOIBOS 150 NAP. Upgrades for existing analyzers with the AD-CMOS detector are plug-and-play. By this you significantly improve performance and capabilities of your instrument at an affordable cost point.

Technical Data

Specification	Value
Count rate linearity range	> 10 Mcps
Dynamic range	> 10 ⁶
Max. count rate	> 15 Mcps
Count rate for Ag 3d _{5/2} at 100 W Mg K _α measured with a PHOIBOS 150	1.2 Mcps @ 0.85 eV FWHM 3.6 Mcps @ 1.0 eV FWHM
Energy channels	> 500
Non-energy channels	12, optional
Noise	< 10 cps full detector area
Frame rate	890 fps
Active detection area	70 mm
Phosphorous Screen	P43

Dimensions



AD-CMOS; dimensions in mm

SPECS Surface Nano Analysis GmbH
Voltastrasse 5
13355 Berlin / Germany
www.specs-group.com

T +49 30 46 78 24 0
F +49 30 46 42 083
E info@specs.com

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