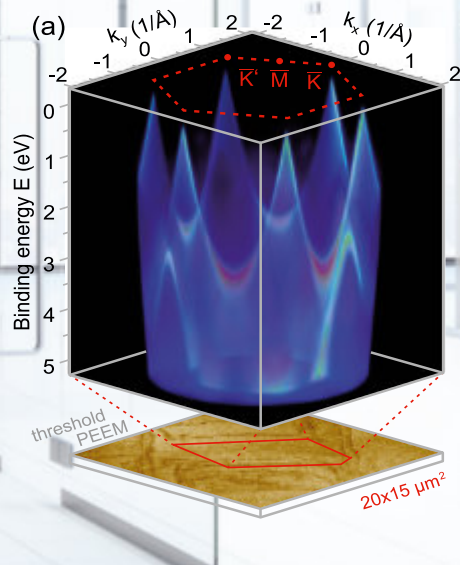


# HIS SERIES



3D ARPES stack of Pb-QFMLG, measured with HIS 14 HD, He I excitation. Courtesy of Ulrich Starke, Max-Planck-Institut für Festkörperforschung in Stuttgart.

Image adapted from (CC-BY 4.0):  
B. Matta et al., Phys. Rev. Research (2022) 023250

- Robust design and ease of operation
- Focussing mirror for small spot
- Low operating pressure ( $10^{-11}$  mbar range)
- He I / He II monochromator
- **NEW:** Ar-I  $\alpha$  radiation monochromator

# HIS 13

## HIGH INTENSITY VUV SOURCE BASE UNIT

- Ease of operation
- Robust design
- Discharge regulation
- Precise alignment with line of sight **viewport**



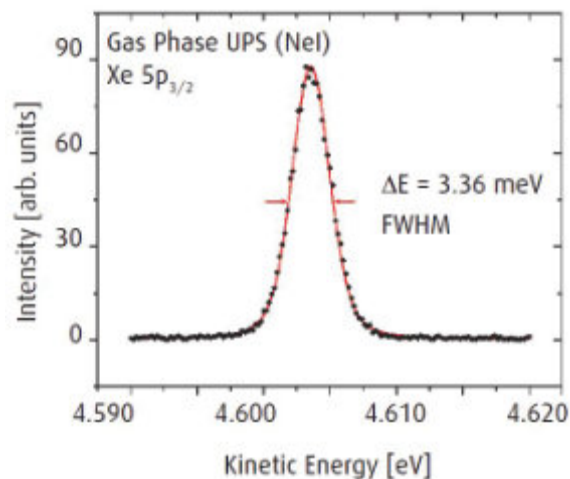
The VUV source power supply with up to 300 mA discharge current, integrated pressure gauge display and fast electronic ignition supports ease of operation and optimized source brightness.



Ease of operation, robust design and a high intensity make the HIS-series the preferred excitation sources for UPS. The source is available with multiple options such as a linear polarizer, 3rd differential pumping stage, focusing mirror for small spot, an attenuator to tune light intensity and a He I and He II monochromator. All options/upgrades can be retrofitted.

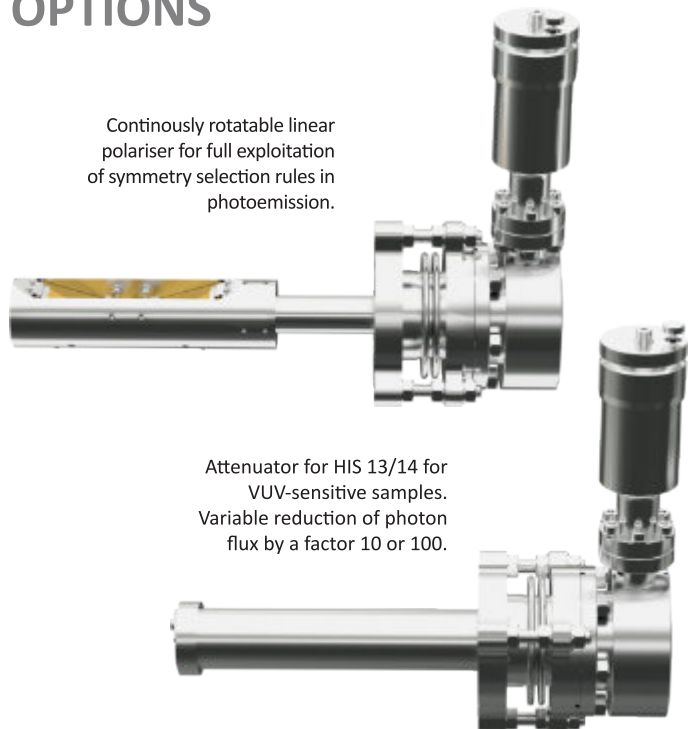
More than 350 installed units stand for reliable quality.

## OPTIONS



The line width of the gas phase spectrum is dominated by the Xe Doppler broadening and the analyser resolution. It proves a line width less than 2 meV of the HIS 13 operated with Ne.

Continuously rotatable linear polariser for full exploitation of symmetry selection rules in photoemission.



Attenuator for HIS 13/14 for VUV-sensitive samples. Variable reduction of photon flux by a factor 10 or 100.

# HIS 14 HD

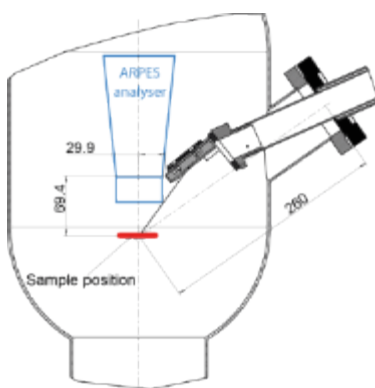
## FOCUSED VUV SOURCE



- Designed for  $\mu$ -ARPES and Momentum Microscopy (e.g. NanoESCA MARIS)
- Small spot down to  $< 180 \mu\text{m}$  FWHM
- Flux  $> 10^{13}$  photons/s/mm<sup>2</sup>

## TYPICAL HIS 14 HD/ANALYSER CONFIGURATION

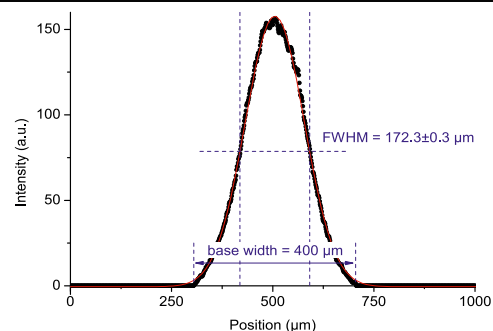
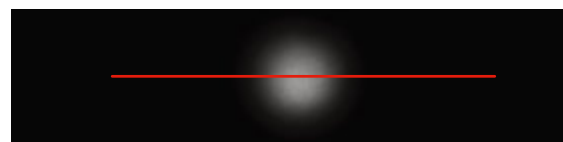
The HIS 14 HD can be installed on a dedicated flange (new systems) or retrofitted to an existing chamber with a flange NW 63 CF or larger. FOCUS will provide the corresponding customized adapter. Please contact us for individual clarification.



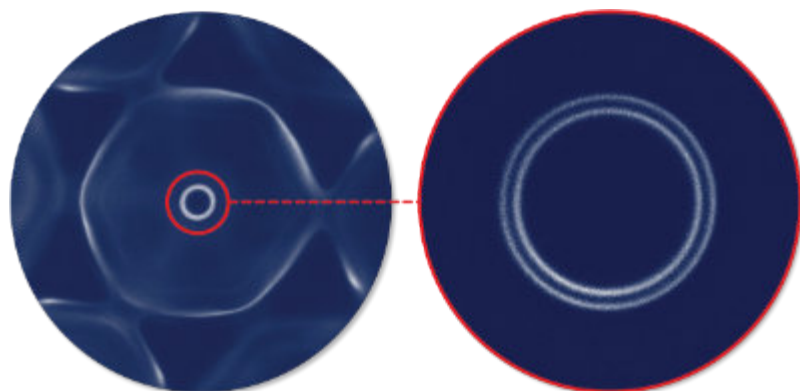
The HIS 14 HD fine focused VUV-lamp is the ideal photon laboratory source for ARPES and PEEM with  $< 180 \mu\text{m}$  spot size, ca. 70 mm working distance (170 mm optional).

The flux density is 50 x higher compared to a non-focused source. A 3rd pumping stage allows for operation in the low  $10^{-10}$  mbar range.

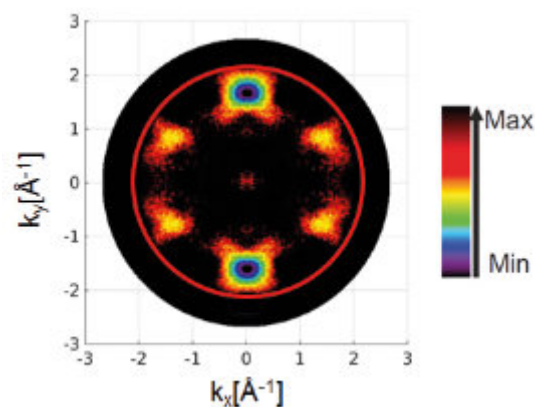
The source is mounted on a CF 63 ID or CF 100 ID flange.



Beam spot profile of HIS 14 HD with  $< 180 \mu\text{m}$  FWHM.



Au (111) Rashba split surface state measured with HIS 14 HD using He I excitation, measured with the NanoESCA MARIS momentum microscope.



$k_x$ - $k_y$  map of the HOMO of NTCDA on Cu (111)

Dwell time 45 min

Courtesy: Prof. Christian Kumpf, FZ Jülich GmbH, PGI-3

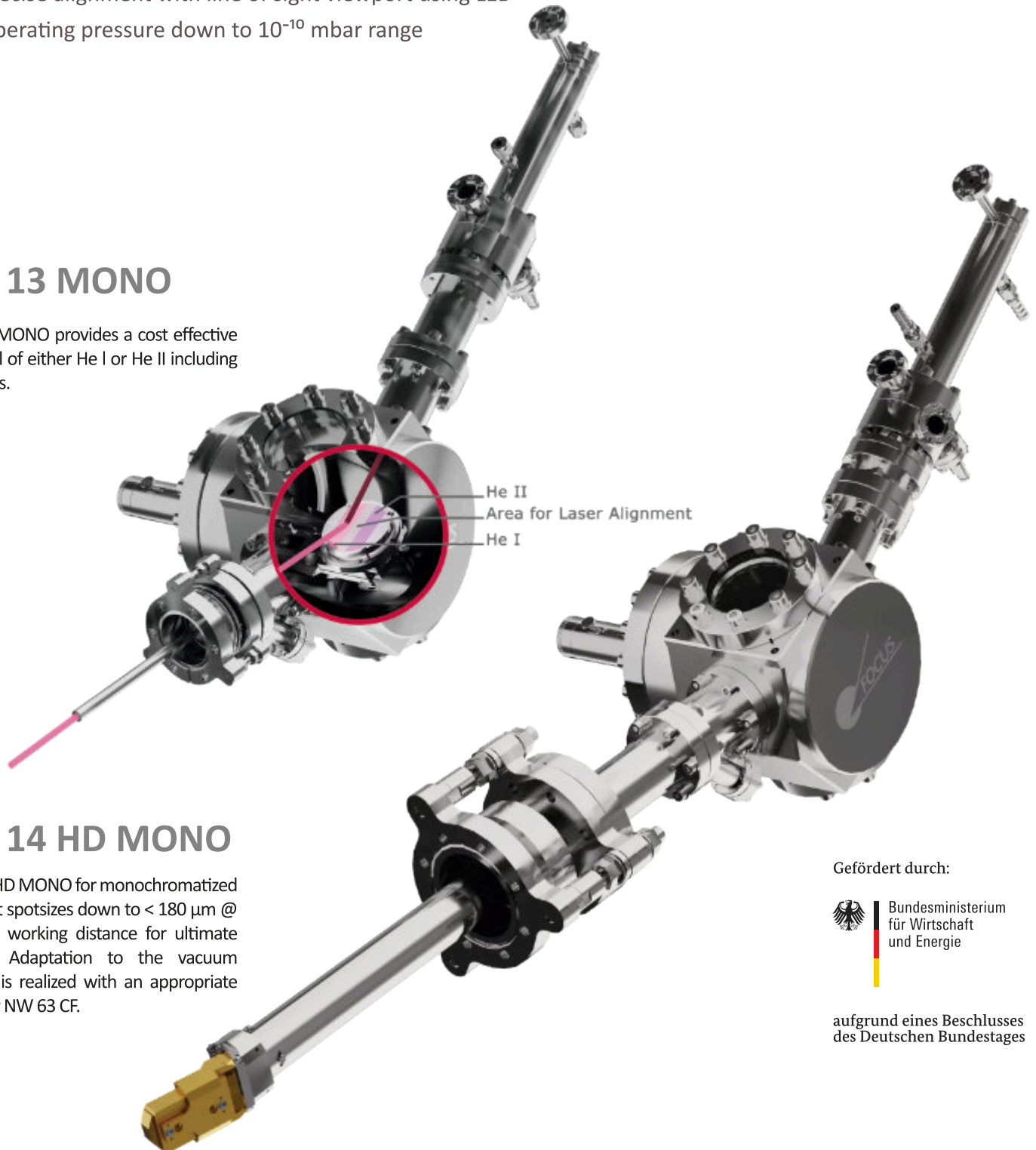


# VUV MONOCHROMATOR FOR HIS SERIES

- Dispersive element with 20% transmission for He I and He II
- Patented zone plate arrangement
- Precise alignment with line of sight viewport using LED
- Operating pressure down to  $10^{-10}$  mbar range

## HIS 13 MONO

HIS 13 MONO provides a cost effective removal of either He I or He II including satellites.



## HIS 14 HD MONO

HIS 14 HD MONO for monochromatized smallest spotsizes down to  $< 180 \mu\text{m}$  @ 70 mm working distance for ultimate ARPES. Adaptation to the vacuum system is realized with an appropriate adapter NW 63 CF.

Gefördert durch:



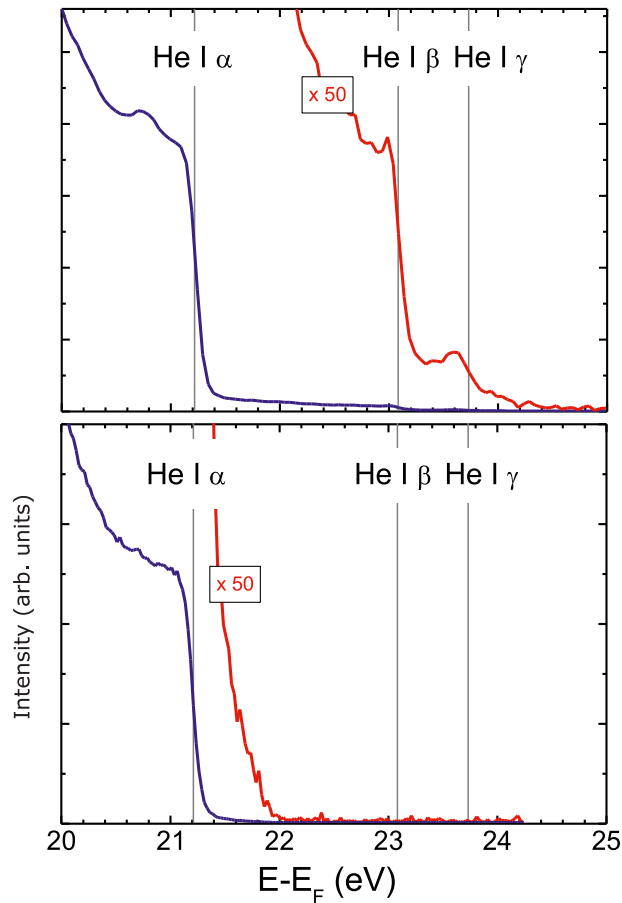
Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages

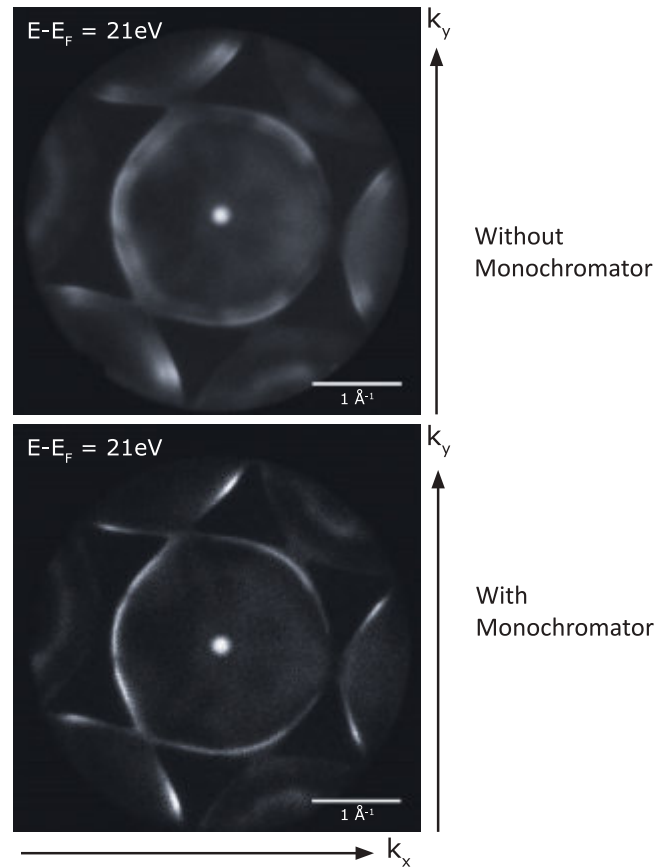
The working principle of the monochromator is based on a reflection zone plate which separates the different wavelengths via diffraction in a patented design. The zone plate provides  $> 20\%$  transmission for He I and He II. With a linear motion drive each of 3 different zone plate areas can be positioned in the beam path for monochromated He I and He II illumination or for simple optical alignment.

The unique optical alignment with a laser (included) uses the view port at the rear of the source and hence allows to control the full length of the optical path up to the spot position on the sample.

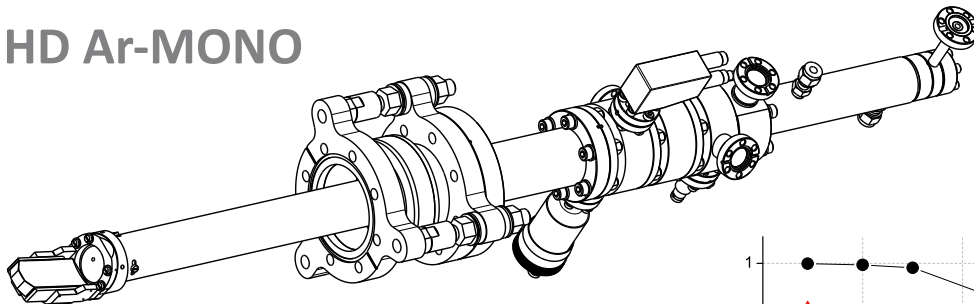
Photo electron spectra of  
W (100) using FOCUS CSA



Momentum microscopy of Ag (111)  
using FOCUS IEF-PEEM

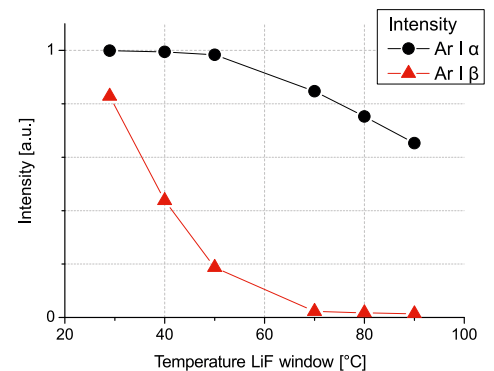


## HIS 14 HD Ar-MONO



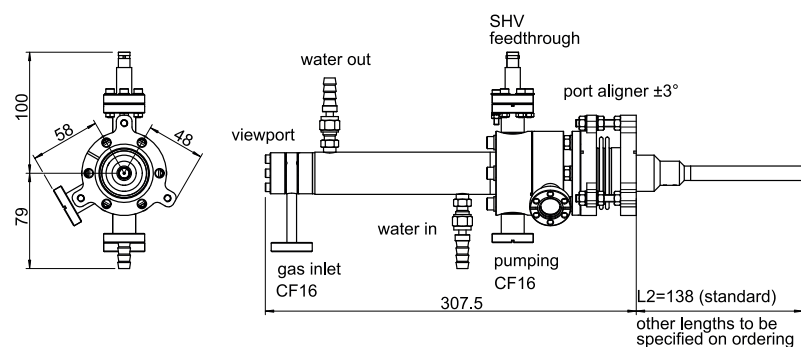
- Ar I radiation: two strong lines with small difference of 0.21eV
- Ar I  $\alpha$  radiation with a photon energy of 11.62 eV is transmitted and Ar I  $\beta$  radiation is suppressed by a heated LiF window (see graphic)
- Regulated heating electronics
- Retractable for standard use with He radiation
- For HIS 13 and HIS 14

For more information about the concept see: M. Budke and M. Donath, APL 92, 231918(2008)

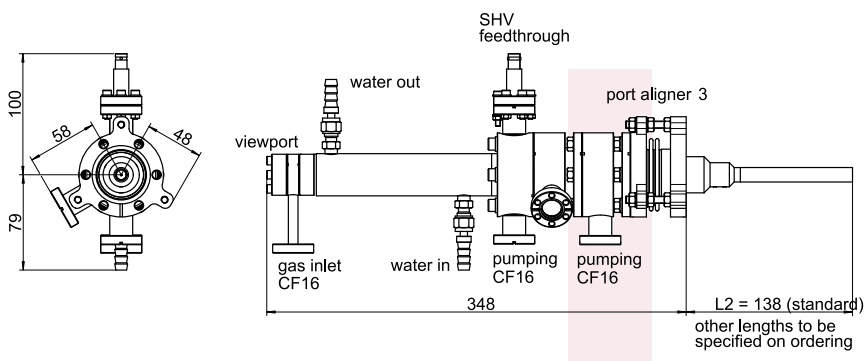


Intensity of Ar I  $\alpha$  and Ar I  $\beta$  as a function of the LiF-window temperature.

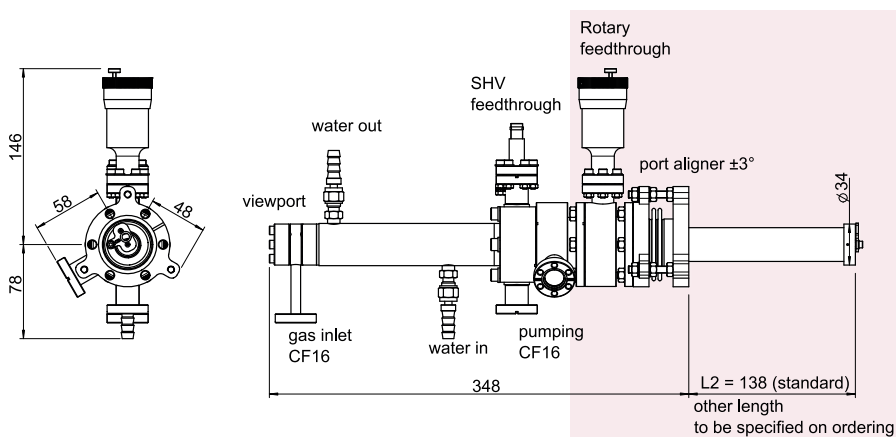
# TECHNICAL INFORMATION



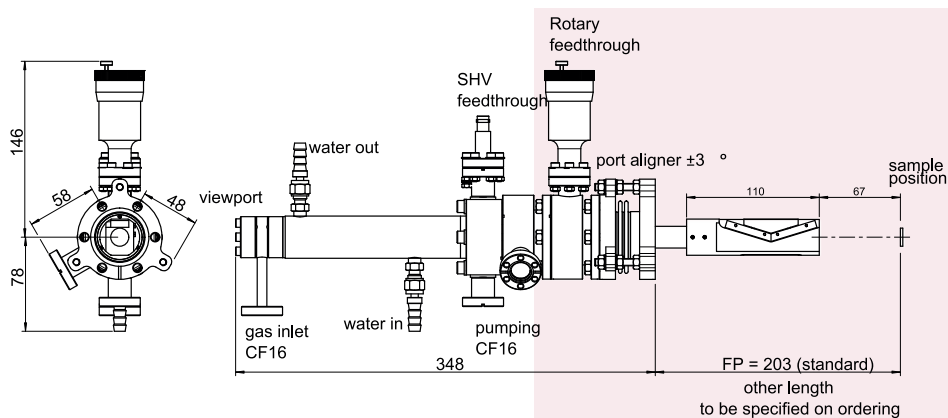
HIS 13 standard VUV source which can be combined with the options listed below. All options can be retrofitted in a factory upgrade at FOCUS GmbH. Please contact us for detailed information. The standard 2-stage differential pumping allows for a system pressure of  $10^{-8} - 10^{-9}$  mbar during operation for Hel.



The third pumping stage reduces the pressure to the mid  $10^{-10}$  mbar range depending on capillary diameter.



Attenuator for HIS 13/14 for VUV-sensitive samples. Even though most application in photo electron spectroscopy aim for maximum intensity there are opposite requirements when working on VUV-sensitive samples as for example organic materials. The Attenuator for HIS 13/14 allows for a variable reduction of photon flux by a factor 10 or 100.



Continuously rotatable linear polariser for full exploitation of symmetry selection rules in photoemission. The mirror arrangement provides a 1:1 projection of the capillary opening.

# HIS 14 HD 200



Technical drawing of the Cryo-EM instrument layout. The drawing shows the relative positions and dimensions of various components. Key dimensions include a total length of 572, a section length of 92, and a distance of 448 from the port aligner to the sample position. The sample position is defined by a 30° angle and a distance of 160. Other labeled components include water out, SHV feedthrough, gas inlet CF16, water in, pumping CF16, viewport, and port aligner.

The HIS 14 HD 200 and HD 250 are designed for an extra large working distance of up to 220mm. They also allow for a NW40CF mounting flange as shown in the drawing.

The schematic diagram illustrates the layout of the sample environment. Key components and dimensions are labeled as follows:

- Dimensions:**
  - 567 (Total length of the main chamber section)
  - 361 (Length of the sample arm section)
  - 305 (Length of the sample arm section, excluding the final 50 units)
  - 50 (Final segment length of the sample arm)
  - 30° (Angle of the sample arm relative to the horizontal)
- Components:**
  - viewport
  - gas inlet CF16
  - water out
  - water in
  - SHV feedthrough
  - pumping CF16
  - port aligner
  - sample position

The HIS 14 HD Ar-Mono provides an easy tool for obtaining monochromatized VUV-light from Ar gas. This is realized via a heated LiF window that can also be shifted out of the optical path to work with other gases.

# SPECIFICATIONS

HIS series						
Useful gas discharge lines:	He I/II, Ne I/II, Kr I/II, Xe I/II, H (Lyα, Lyβ)					
Photon line width	< 2 meV ( He I radiation)					
Pumping	2-, 3- or 4- stage differential pumping					
Operating pressure	Down to 10 <sup>-11</sup> mbar range (depends on pump configuration)					
Adjustment & Discharge control	Via backside viewport					
Cooling:	Water cooling					
Bake out temperature:	Up to 250°C					
Plasma Ignition:	Automatic					
Capillary (mm):	0.8/1.2/1.7 (standard)					
Configuration dependent specifications						
	HIS 13	HIS 13 MONO	HIS 14 HD 100	HIS 14 HD 100 MONO	HIS 14 HD 200	HIS 14 HD 200 MONO
Photon Flux HeI (HeII) ph/s/mm²	> 7.5·10 <sup>11</sup> * (1.5·10 <sup>11</sup> )	> 1.5·10 <sup>11</sup> * (3·10 <sup>10</sup> )	> 1.0·10 <sup>13</sup> (2·10 <sup>12</sup> )	> 1.0·10 <sup>12</sup> (4·10 <sup>11</sup> )	> 2.5·10 <sup>12</sup> (5·10 <sup>11</sup> )	> 2.5·10 <sup>11</sup> (1·10 <sup>11</sup> )
Light spot diameter:	working distance depending	working distance depending	< 180 μm (capillary dependent)		< 360 μm (capillary dependent)	
Insertion depth:	Customized (to be defined)					
Photon flux ratio:	–		> 50 times		> 12.5 times	
	unfocused source		compared to an unfocused source			
Working distance	typ. 50 - 100 mm		ca. 70 mm		ca. 170 mm	
Mounting flange	CF 40	CF40	CF 63 or CF100	CF63 or CF100	CF 40	CF40

[www.focus-scientific.com](http://www.focus-scientific.com)

\* For working distance of 70 mm.  
Higher flux for smaller distances.

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