



MetalJet D2+ 160 kV

The World's Brightest Microfocus X-ray Source

The MetalJet D2+ is the latest version in Excillum's line of extreme brightness X-ray sources, following the success of the earlier MetalJet D1 and D2. It is similar to a standard X-ray tube, but features Excillum's unique metal-jet anode technology and advanced electron optics. Within the 5-30 μm spot-size range, it delivers significantly higher brightness than any other available microfocus X-ray source on the market, with an excellent spot quality. This makes it an ideal source for any microfocus application requiring shorter exposure times, higher throughput or better signal to noise. The 160 kV version of the D2+ allows for a higher acceleration voltage and thus a harder X-ray spectrum. The higher X-ray yield at higher energies will benefit anyone interested in the indium emission line at 24 keV or the bremsstrahlung above 20 keV.

Features and Benefits

- Extreme microfocus source power
- Superior spot quality
- Optional dual port mode
- User variable size and aspect ratio of spot
- Very stable X-ray emission and spot position
- Adjustable take-off angle
- Integrated radiation shielding up to 70 kV
- Low total power consumption
- No external cooling water requirements
- Optional shutter
- Minimal and predictable maintenance
- LaB_6 long-life cathode
- Air cooled system
- Operated remotely from any computer
- User-friendly Graphical User Interface

Technical Specification

Target material ¹	Ga or In rich metal alloy	Min. focal spot size	~ 5 μm
Target type	Liquid jet	Emission stability ³	< 1%
Voltage	21-160 kV	Position stability ³	< 1 μm
Power ²	0-250 W	Min. focus-object distance ⁴	18 mm
Max current	4.3 mA	Beam angle ⁵	13°/30°

1) The room temperature liquid metal alloys supplied for the MetalJet source consist mainly of gallium, indium and tin. They have low reactivity and low toxicity but should be handled according to their safety data sheets and local regulations. The currently available anode alloys are ExAlloy G1 with 95% gallium and ExAlloy I1 with 21% indium (see typical emission spectra on next page).

2) The actual power used is dependent on spot-size and voltage. However, maximum output power of the 160 kV high-voltage-generator is 640 W.

3) Standard deviation.

4) Without a shutter (24.8 mm with shutter).

5) Without a shutter (10.5° with shutter).

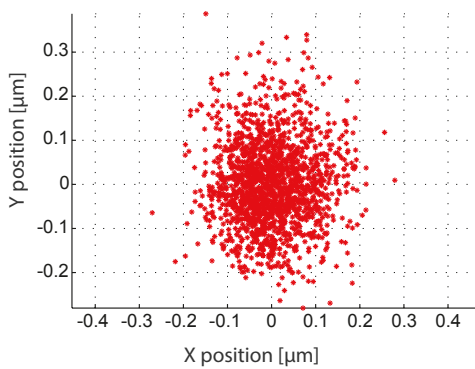
160 kV Performance Examples

Jet material	Nominal X-ray spot size ⁶ [μm]	E-beam power [W]	Ga Kα (9.2 keV) peak brightness [photons/(s mm ² mrad ²)]	Ga Kα (9.2 keV) radiant flux [photons/(s mrad ²)]	In Kα (24 keV) peak brightness [photons/(s mm ² mrad ²)]	In Kα (24 keV) radiant flux [photons/(s mrad ²)]
ExAlloy G1	20	250	2.9×10 ¹⁰	1.3×10 ⁷	5.9×10 ⁸	2.9×10 ⁵
ExAlloy I1	20	250	1.7×10 ¹⁰	6.1×10 ⁶	2.2×10 ⁹	1.1×10 ⁶

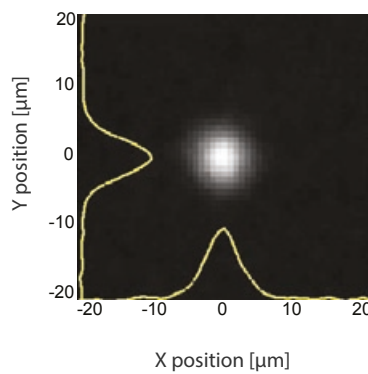
⁶ Actual e-beam spot is 35×9 μm line focus, but the apparent X-ray spot is essentially circular.

Characteristics

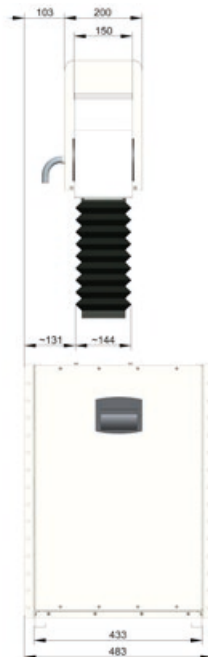
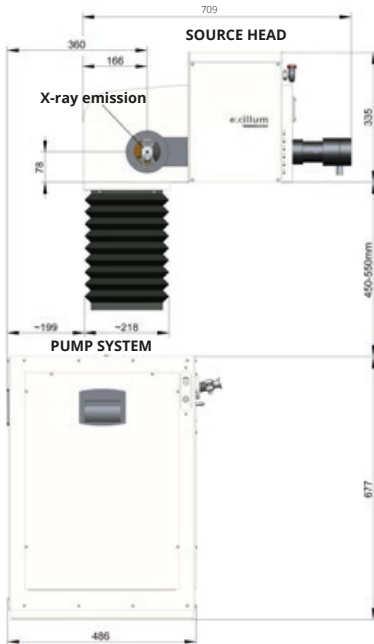
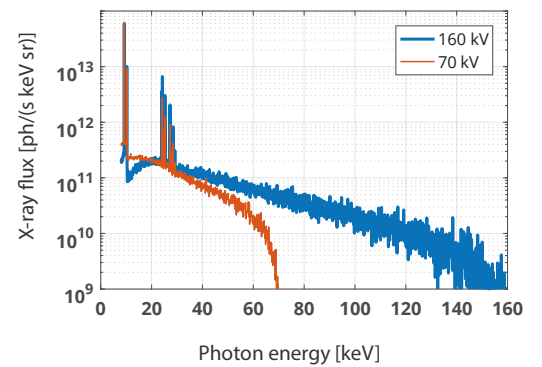
SPOT STABILITY OVER 24 h



SPOT SHAPE EXAMPLE



EMISSION SPECTRA AT 250 W, 20 μm, ExAlloy I1 (0.1 keV bin width)



Installation and operation

The source consists of the head and the pump system with dimensions shown in the drawing. The head has to be mounted essentially straight above the pump system. The coupling is semi-rigid, allowing some movement of the source head.

In addition, the MetalJet D2+ 160 kV consists of two 4U (176 mm height) 19" rack electronics boxes and a floor standing air/water chiller (69×36×62 cm), that can be mounted up to 4m from the head and pump system.

The source can be remotely operated through TCP/IP or directly through the GUI. The GUI can be operated on the source itself if it is equipped with monitor, keyboard and mouse, or on most computer platforms with a TCP/IP connection to the source.

The source cannot be operated as a standalone unit and must be integrated into a system providing the proper interlock connections.

Mains: AC, single phase, 200-240 V, 16 A, 50/60 Hz.

Ambient: 20-30°C (stable within ± 0.2°C for optimal source stability), max 85% relative humidity.

Safety & Compliance

Excillum's X-ray sources are compliant with the Machinery Directive 2006/42/EC, RoHS Directive 2011/65/EU and Low Voltage Directive 2014/35/EU. Excillum's X-ray sources are a sub-assembly and therefore excluded from the EMC Directive 2014/30/EU, hence also conform to the definition of partly completed machinery and so should not be CE marked. Our X-ray sources are intended for system integration into customer equipment. The system integrator is solely responsible for final certification and safety compliance. X-rays emitted from the source are harmful for the human body and it is the sole responsibility of the system integrator to comply with all regulations and to protect all personnel during operation. The X-ray source may be subject to local government radiation hazard regulations.