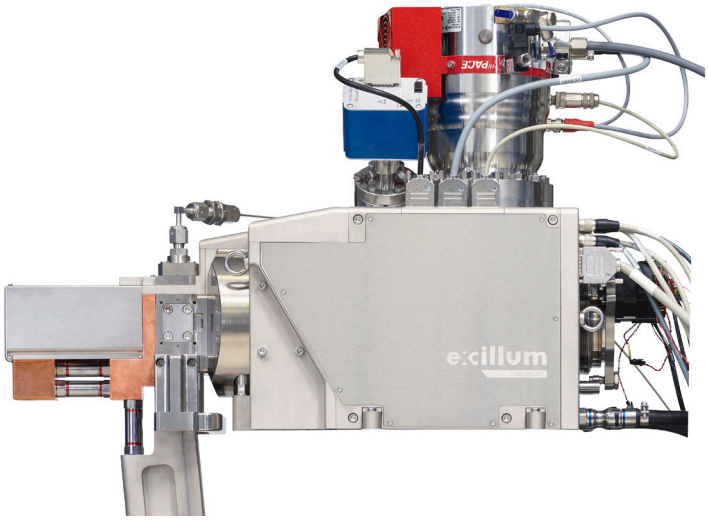
excillum

MetalJet E1+ 160 kV



At 1000 watts, the MetalJet E1+ delivers 17 times more X-ray flux across a broad spectral range compared to a conventional 30 W tungsten solid-anode microfocus source with the same 30 µm spot size. It is designed for high-throughput, 100% duty-cycle operation with up to once-per-year preventive maintenance cycles. The MetalJet E1+ maintains a positional stability of below 1 µm during continuous long-term operation.

Technical specifications

Target material[1]	Liquid metal alloy	**Min. focal spot size**	< 10 µm
Target type	Liquid jet	**Emission stability**[3]	< 1%
Voltage	30-160 kV	**Position stability**[3]	< 1 µm
Power[2]	0-1000 W	**Min. focus-object distance**	22.5 mm
Max current	6.25 mA	**Beam angle**	20°

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.
2) The actual power used is dependent on spot-size and voltage. However, maximum output power of the 160 kV high-voltage generators is 3000 W, software limited to 1000 W.
3) Standard deviation.

Available target alloys

Target alloy	**Gallium** [weight %]	**Indium** [weight %]	**Tin** [weight %]
Ex-Alloy-G1[4]	95	5	-
Ex-Alloy-I1	68	22	10
Ex-Alloy-I2[4]	47	37	16
Ex-Alloy-I3	75	25	-

4) Operation of ExAlloy-G1 and ExAlloy-I2 requires that the MetalJet E1+ source is equipped with a heater system to manage the alloy temperature.

Performance examples[5]

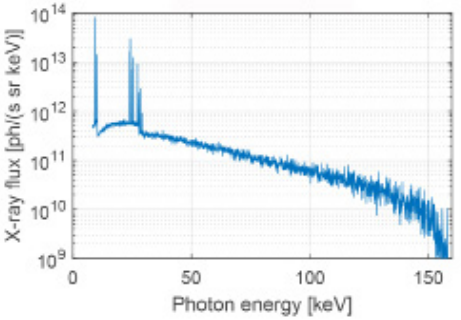
Jet material	ExAlloy-I2
Acceleration voltage	160 kV
Nominal X-ray spot size[6]	30 µm
E-beam power	1000 W

Energy range	**Peak brightness** [photons/(s mm² mrad²)]	**Radiant flux** [photons/(s mrad²)]
8-15 keV	$1.4x10^{10}$	$1.5x10^{7}$
Ga Kα 9.22-9.25 keV	$8.9x10^{9}$	$1.0x10^{7}$
15-30 keV	$1.6x10^{10}$	$1.9x10^{7}$
In Kα 24.0-24.2 keV	$4.9x10^{9}$	$5.7x10^{6}$
30-60 keV	$9.3x10^{9}$	$9.6x10^{6}$
60-160 keV	$9.2x10^{9}$	$7.5x10^{6}$

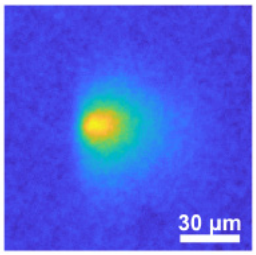
5) Examples are based on simulations that typically correspond well to experimental validation. Please contact us for details on such simulations vs. experiment validations including experimental method.
6) The spot size is measured as the full width at half maximum (FWHM) of the X-ray intensity distribution integrated in the horizontal and vertical directions respectively. The X-ray spots are realized by various degree of e-beam line focus. Actual spot size may differ depending on viewing angle and may have different width and height. More detailed data based on other source parameters are available on our website.

Characteristics

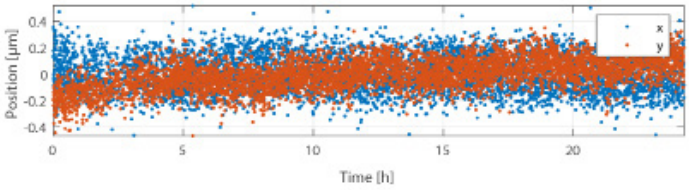
MetalJet E1+ X-ray spectrum for ExAlloy-I2 at 160 kV, 700 W (0.1 keV bin width)



Typical X-ray spot shape

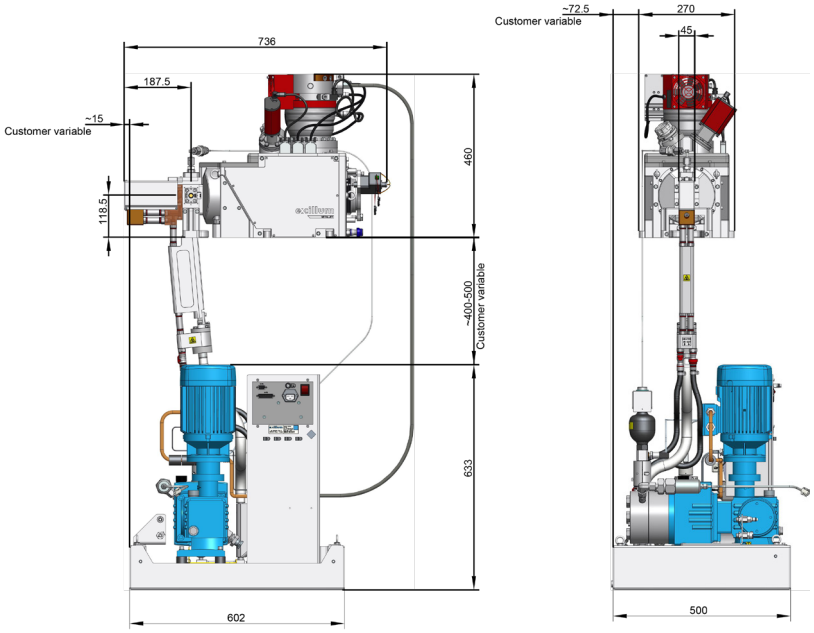


Typical X-ray spot position stability



Installation and operation

The source consists of the head and the pump system with dimensions shown in the drawing. The head must be mounted essentially straight above the pump system. The coupling is semi-rigid, allowing some movement of the source head. Sources operating with ExAlloy G1, ExAlloy-I2 and ExAlloy-I3 are equipped with heater jackets around parts in the alloy recirculation loop (not shown in the drawing). In addition, the MetalJet E1+ 160 kV consists of several 19" rack mounted parts that can be mounted up to 4 m 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, 2.6 kW-3.5 kW (depending on configuration), 50/60 Hz.
Ambient: 20-30 °C (stable within ± 0.5 °C for optimal source stability), max 85% relative humidity.

Safety and compliance

For information about the safety and compliance of all Excillum X-ray sources, please visit our website: www.excillum.com/compliance

Intellectual property

The Excillum MetalJet E1+ 160 kV is partly based on technology developed in of a project that has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 826589. The JU receives support from the European Union's Horizon 2020 research and innovation programme and France, Germany, Austria, Italy, Sweden, Netherlands, Belgium, Hungary, Romania, Israel.

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