excillum

# Boundaries are meant to be pushed

## Introducing

## MetalJet E1 160 kV

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# Get 10 to 70 times more flux than with conventional X-ray sources

At 700 watts, the new MetalJet E1 delivers 10 times more X-ray flux across a broad spectral range compared to a 30 W conventional tungsten-solid-anode microfocus source with the same 30 µm spot size. In the spectral range of 24-29 keV where the indium and tin characteristic emission lines are present, the flux advantage is as high as 70 times.

**Built for 24/7 continuous performance**

The MetalJet E1 is designed for high-throughput industrial operations with more than 6-month preventive maintenance cycles. This eliminates the need for frequent filament changes as required by conventional tubes.

**Sub-µm positional stability**

Although running at a high thermal load of 700 W, the MetalJet E1 maintains a positional stability of below 1 µm during continuous long-term operation.

**Unprecedented 24 keV indium Kα emission**

For applications requiring focused or collimated high-energy monochromatic radiation, the MetalJet E1 delivers unprecedented power into the 24 keV indium Kα emission lines. See e.g. the $1.9\times10^{10}$ ph/s/mm2 example when combined with Montel-type focusing X-ray mirror (www.excillum.com/products/metaljet/metaljet-with-optics/).

## Features and benefits

- Extreme microfocus source power
- Superior spot quality
- Single (left or right) X-ray window or dual (left and right)
- Minimal maintenance
- User variable size and aspect ratio of spot
- $LaB_6$ long-life cathode
- Very stable X-ray emission and spot position
- User-friendly Graphical User Interface
- Controlled through GUI or TCP/IP protocol
- Adjustable take-off angle
- No external cooling water requirement
- Operated remotely from any computer

## 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]** | 0-700 W | **Min. focus-object distance** | 22.5 mm |
| **Max current** | 4.4 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 700 W.*

*3) Standard deviation.*

## Available target alloys

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

*4) Operation of ExAlloy-G1, ExAlloy-I2 and ExAlloy-I3 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** | 700 W |

| **Energy range** | **Peak brightness** [photons/(s mm² mrad²)] | **Radiant flux** [photons/(s mrad²)] |
|---|---|---|
| 8-15 keV | $1.4 \times 10^{10}$ | $1.3 \times 10^{7}$ |
| Ga Kα 9.22-9.25 keV | $8.9 \times 10^{9}$ | $8.5 \times 10^{6}$ |
| 15-30 keV | $1.5 \times 10^{10}$ | $1.5 \times 10^{7}$ |
| In Kα 24.0-24.2 keV | $4.5 \times 10^{9}$ | $4.7 \times 10^{6}$ |
| 30-60 keV | $8.4 \times 10^{9}$ | $7.8 \times 10^{6}$ |
| 60-160 keV | $8.2 \times 10^{9}$ | $5.9 \times 10^{6}$ |

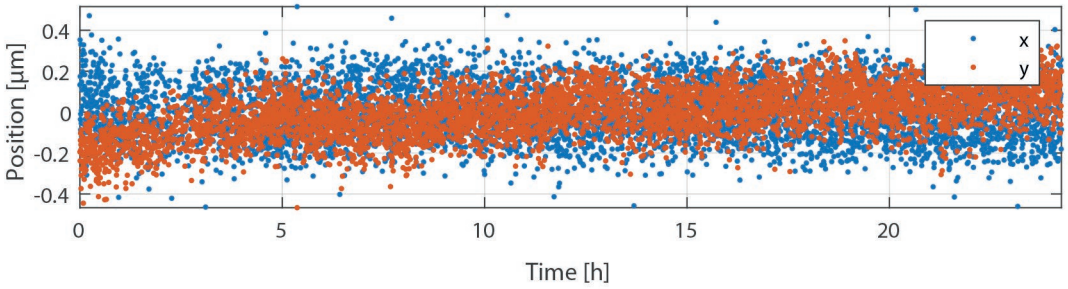
*5) Examples are based on simulations that typically correspond well to experimental validation. Please contact us for details on such simulations vs. experiment validations including experimental method.*

*6) The X-ray spots are realized by various degree of e-beam line focus with a maximum aspect ratio of 4:1. Actual spot size may differ depending on viewing angle and may have different width and height. Please contact us for more details.*

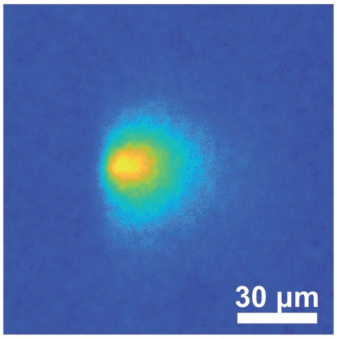
*More detailed data based on other source parameters are available on our website.*

## Characteristics

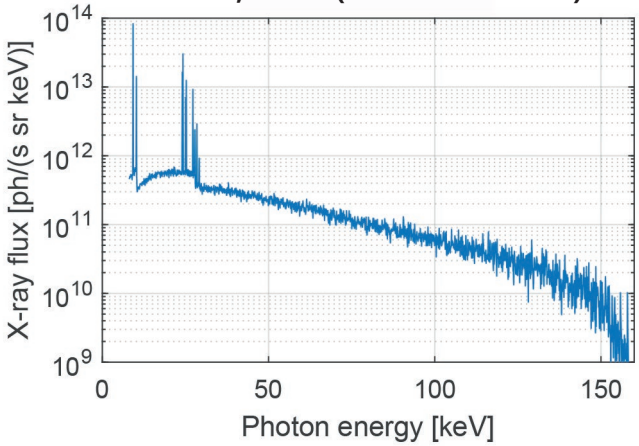
**Spot stability over 24 hours**




**Typical X-ray spot shape**




**X-ray spectrum for ExAlloy-I2 at 160 kV, 700 W (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 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).

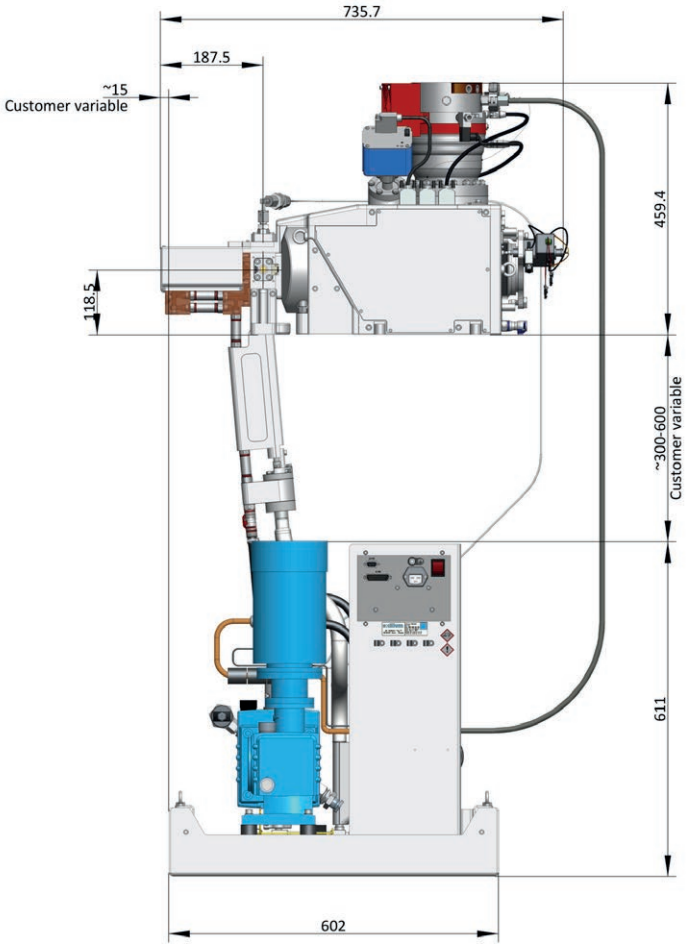
In addition, the MetalJet E1 160 kV consists of several 19" rack mounted parts that can be mounted up to 4 m from the head and pump system.

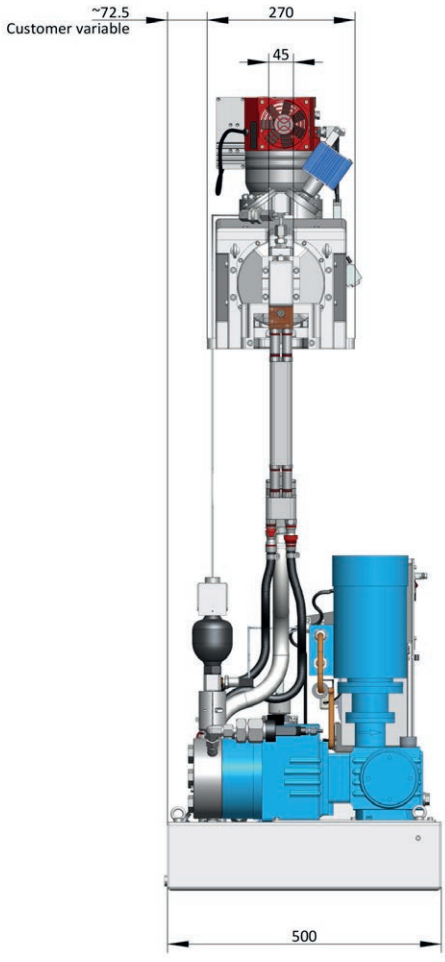
The source can be remotely operated through TCP/IP or directly through the GUI. The GUI can be operated on the source itself if it is equipped with monitor, keyboard and mouse, or on most computer platforms with a TCP/IP connection to the source.

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.

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Revision 2020-07-07