thin film and

pvsolutions

gencoa

components for sputter
deposition, process control
and plasma treatment

Gencoa offer the following range of products & process technology for the thin film industry developed over the last 20 years

Gencoa Product Portfolio

- Planar Magnetrons
- Rotatable Magnetrons
- Pulsed Effusion Cells
- Active Anodes
- S & Se Sensor
- Remote Plasma Gas Sensing
- Reactive Gas Controllers
- Plasma Pre-Treaters















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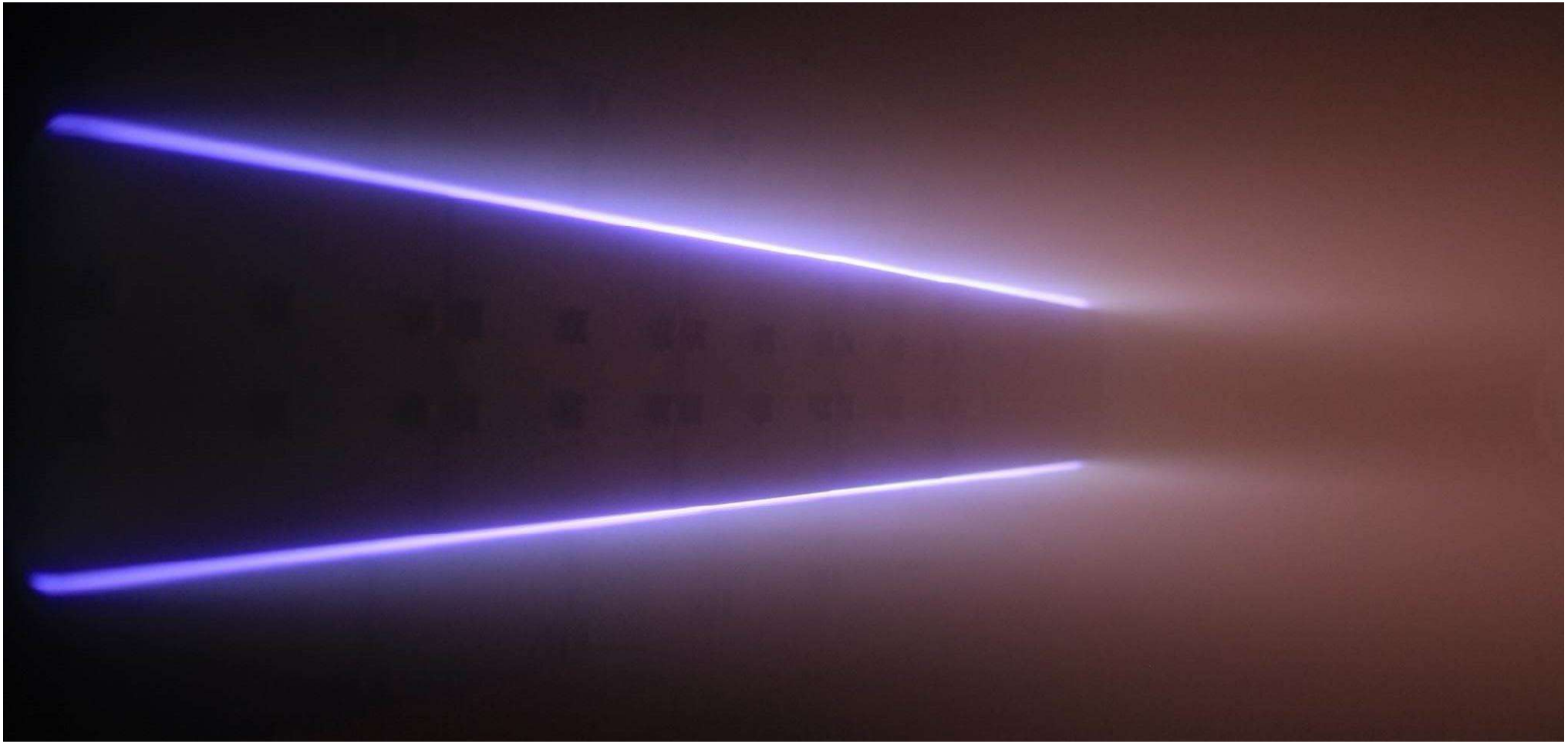
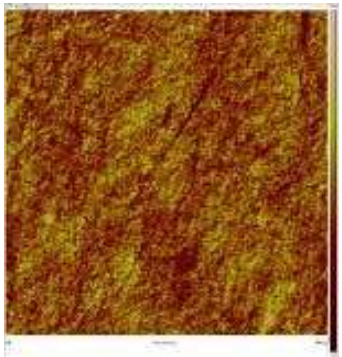
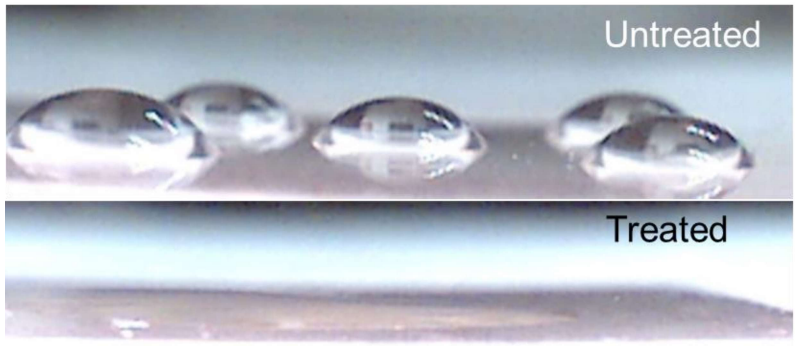
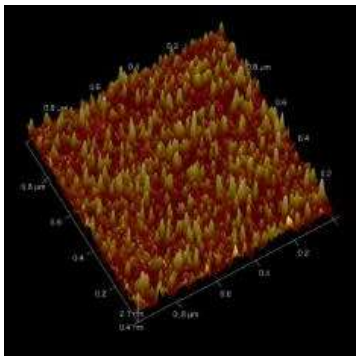
Plasma Treatment Sources









Linear ion sources

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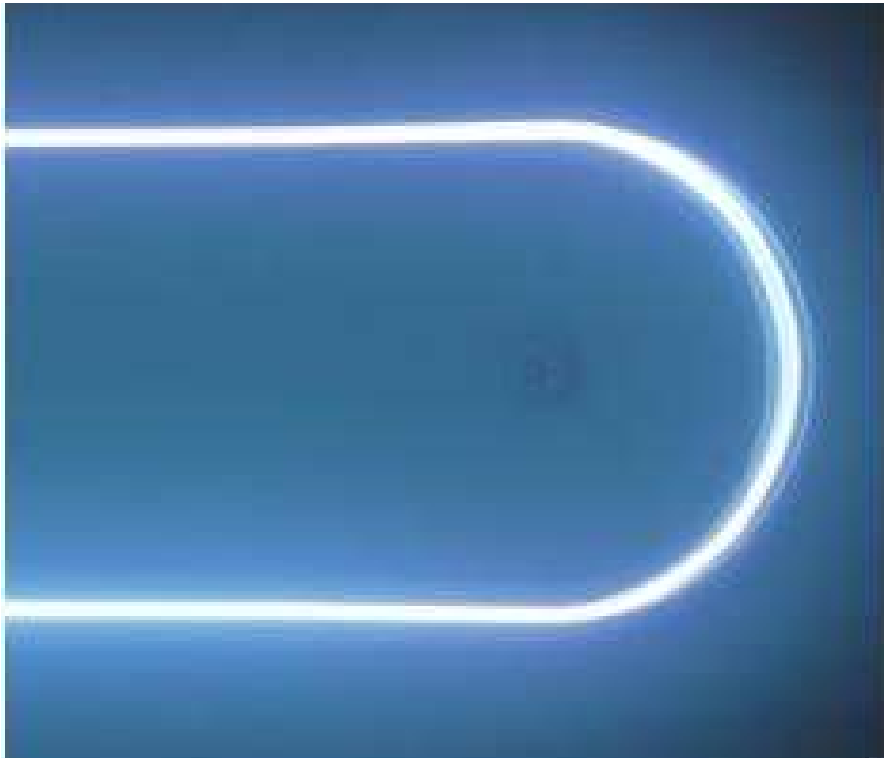

Linear ion sources

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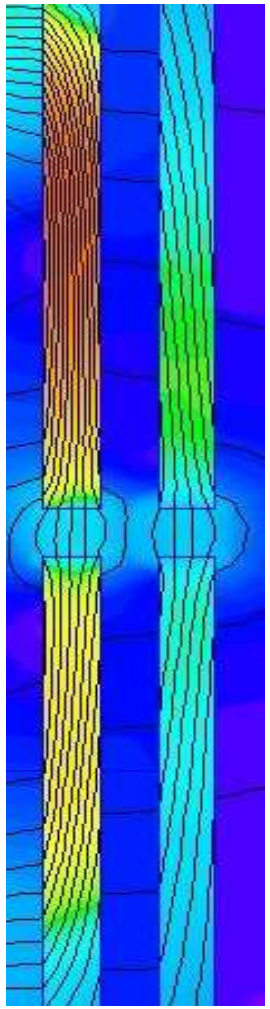
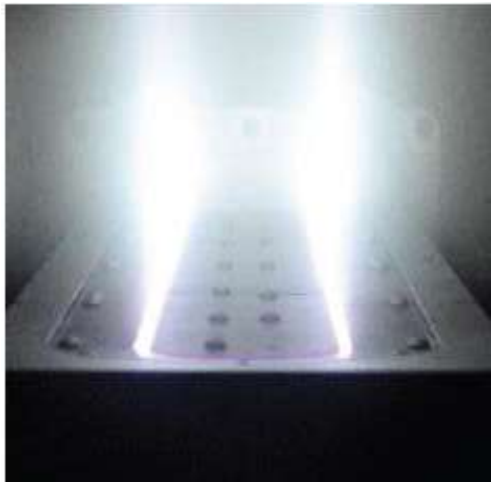
Key Advantages



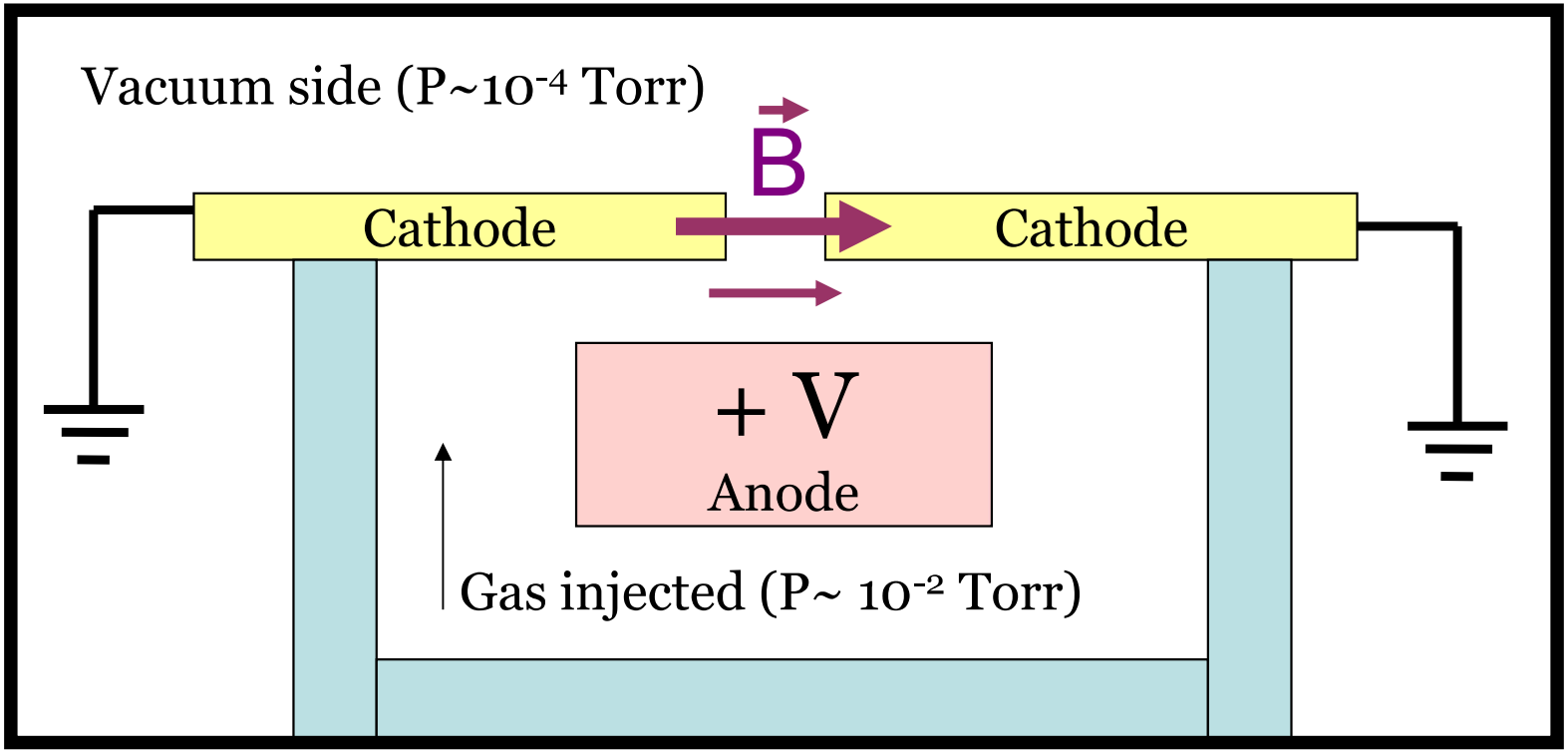
• **GENCOA** inverted magnetron type linear ion source provides the best pre-cleaning solution combined with highly robust components:

• Optimized magnetic fields to produce a collimated plasma beam at standard sputtering pressures.
• Graphite anode and cathode to protect the substrate from contamination and provide long-life components.
• RF standard electrical insulation on all ion sources.
• In-direct cooling of anode and cathode – quick switching of parts – no breaking of water deals.
• Easy switching of parts to provide multiple magnetic traps for lower voltage operation, or a focused beam.
• 300 & 3000 Watt, regulated power supplies with gas adjustment feedback to maintain same current at all times.
• Optional front side beam neutralizing.
• Optional secondary front side gas injection system.

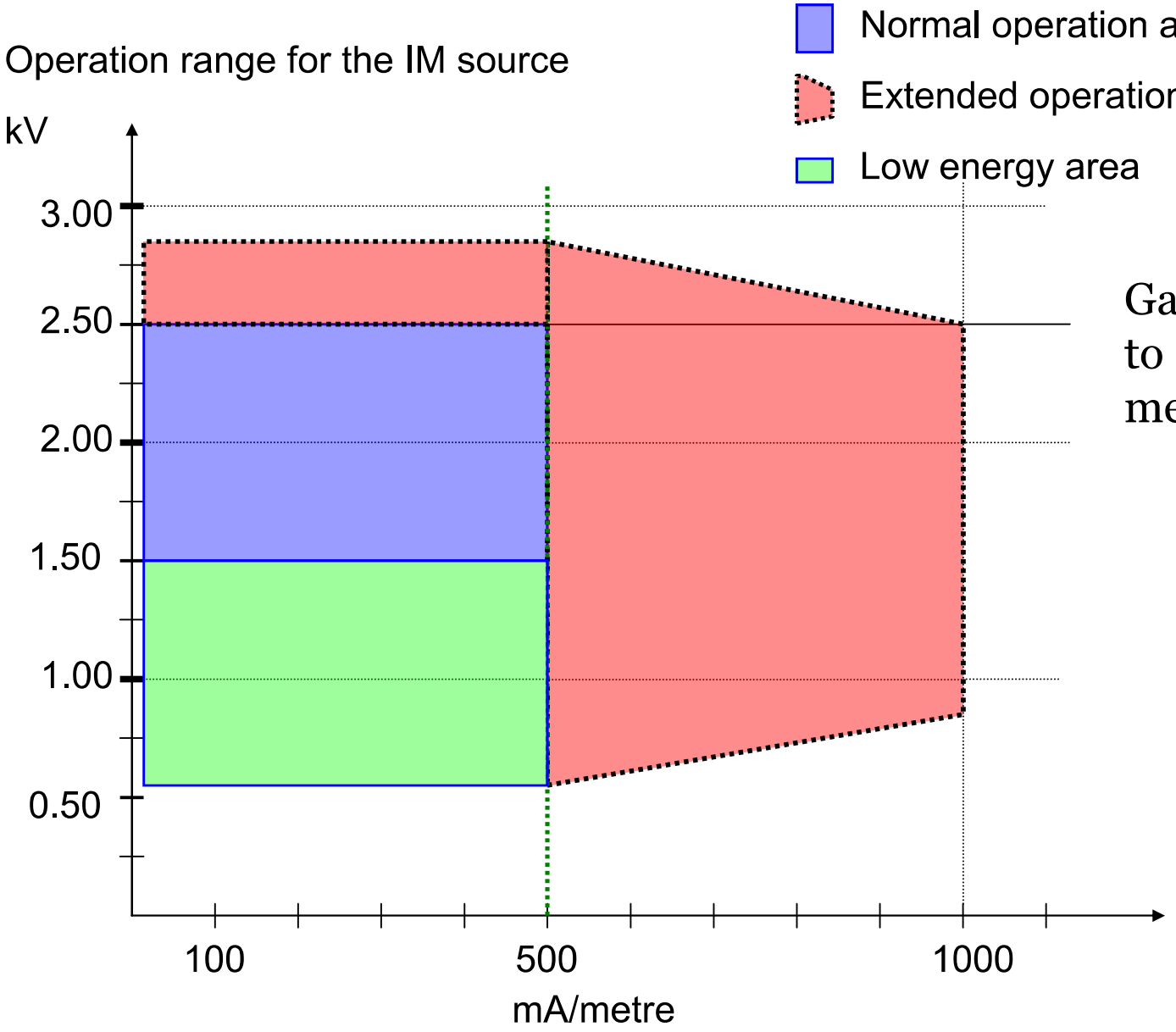
Concept of operation based upon space plasma thruster devices



• A plasma jet is generated by the combined closed magnetic trap, high voltage between anode and cathode, and correct pressure – gas flow through the magnetic trap.



Typically the sources operate at upto 1 Amp per meter length and at upto 100 sccm per meter length



Gas consumption: ~ 25 to 100 sccm argon per metre length

Lengths from 200 to 5000mm beams and internal / external mounting

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External mounting *im*300 with carbon cathode

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Internal mounting *im*400 with metal cathode and cantilever mounting

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Internal mounting *im*600 with carbon cathode and end support mounting

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Internal mounting *im*800 with metal cathode and end support mounting

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Internal mounting *im*800 & 250 with carbon cathode and rear support mounting

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Internal mounting *im*1000 with carbon cathode and end support mounting

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External mounting *im*1500 with carbon cathode

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Internal mounting *im*2500

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Internal mounting *im*4700 worlds longest linear ion source

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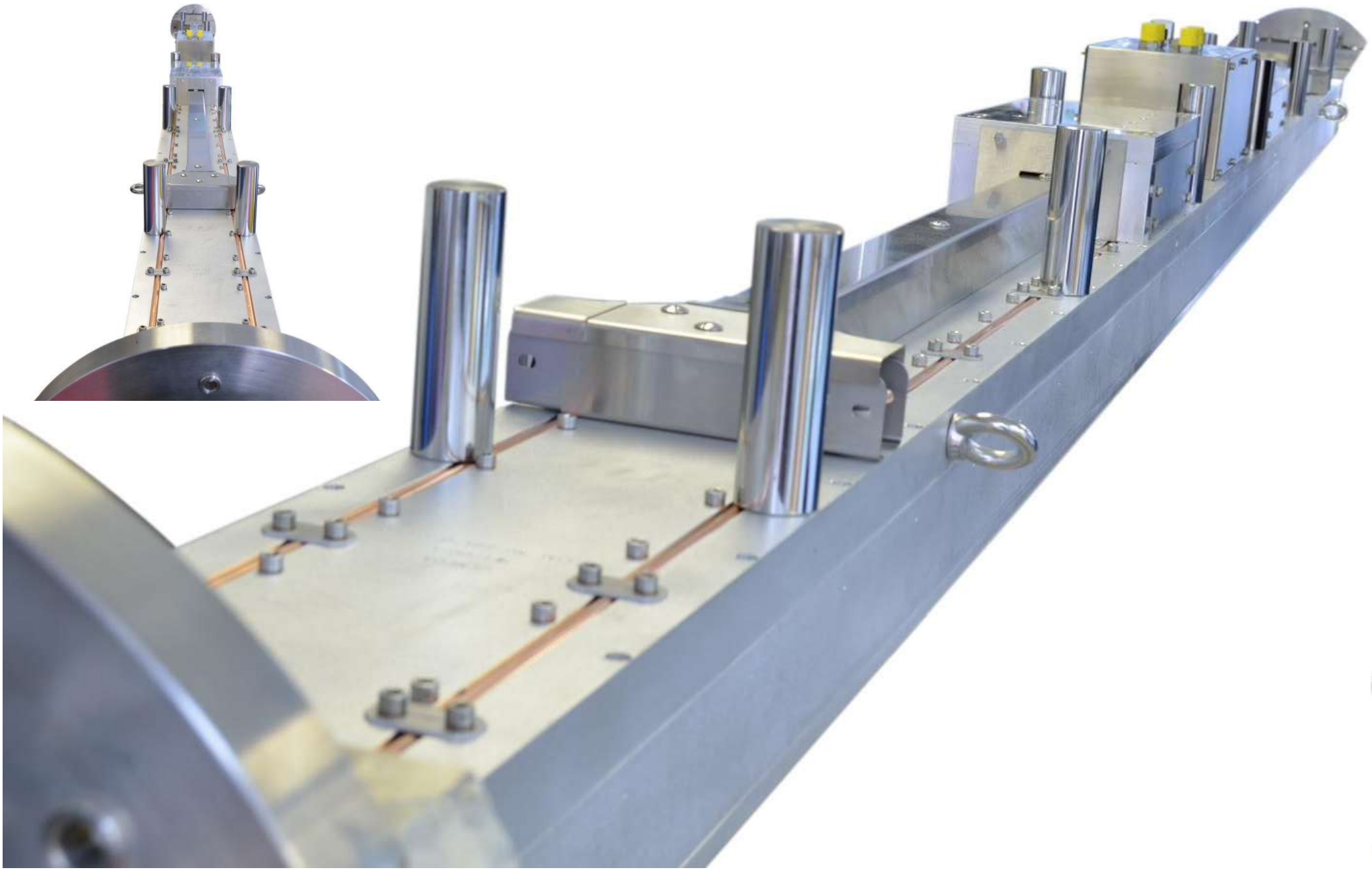

External mounting *im*1500 connection and utility details

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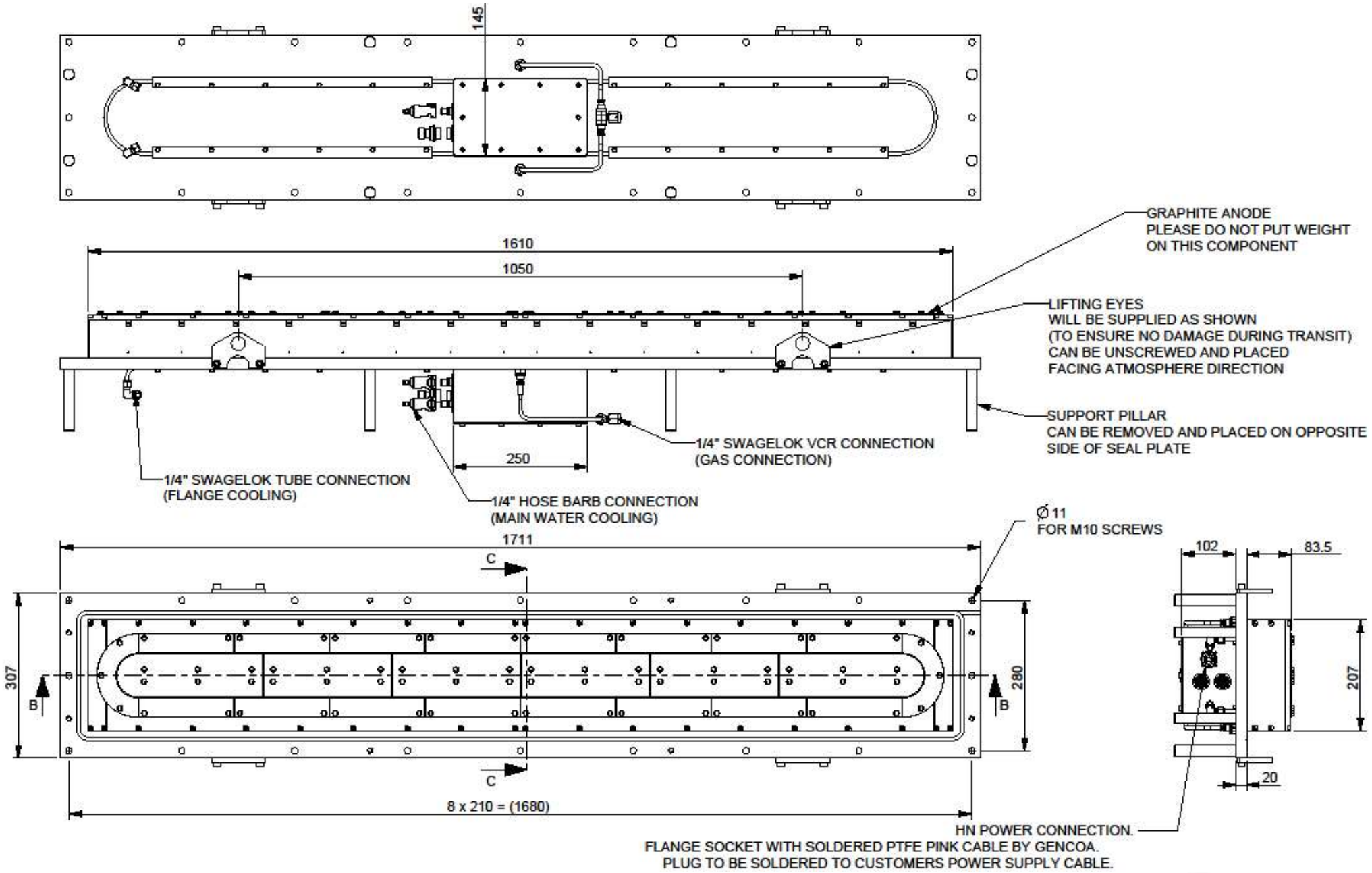
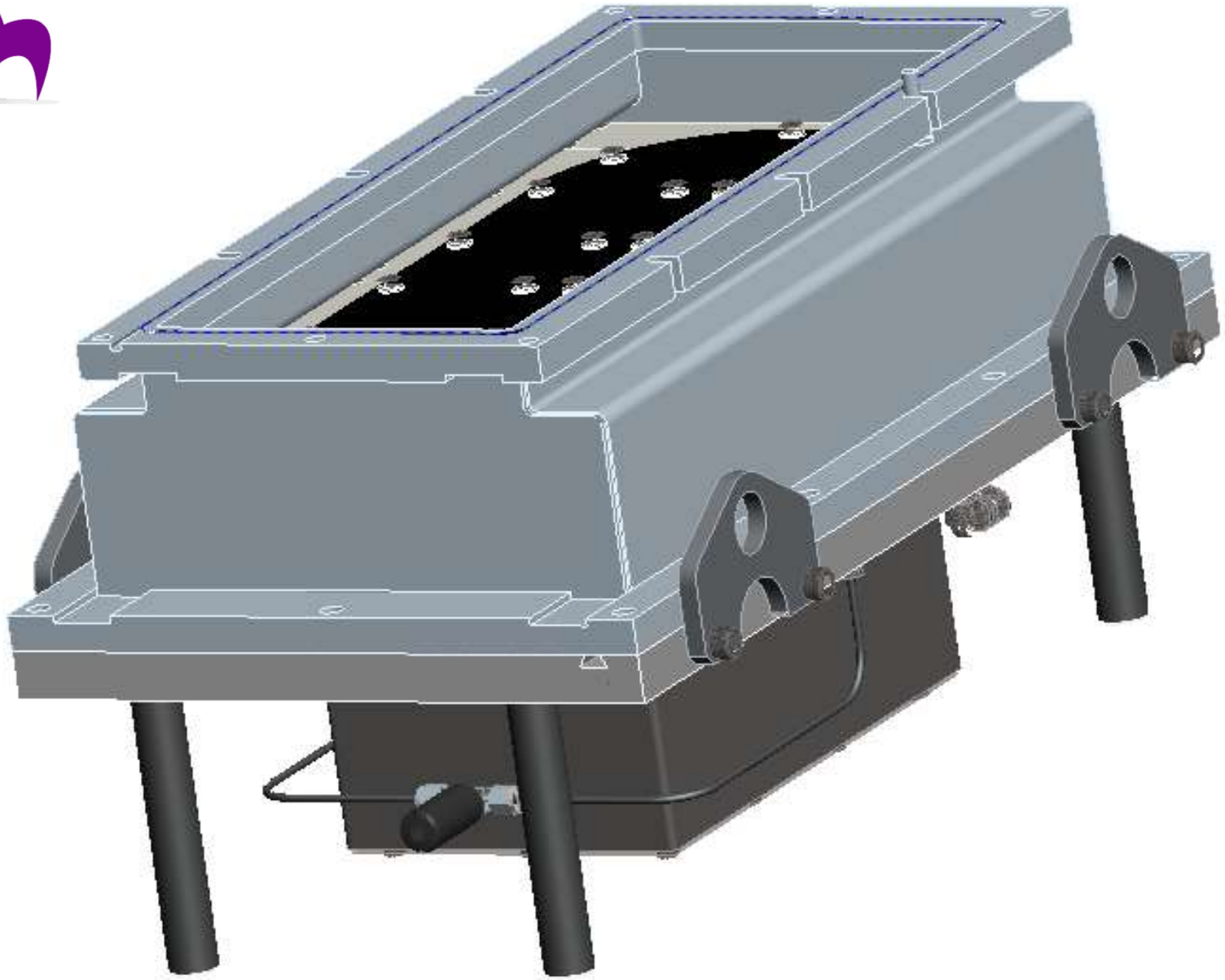
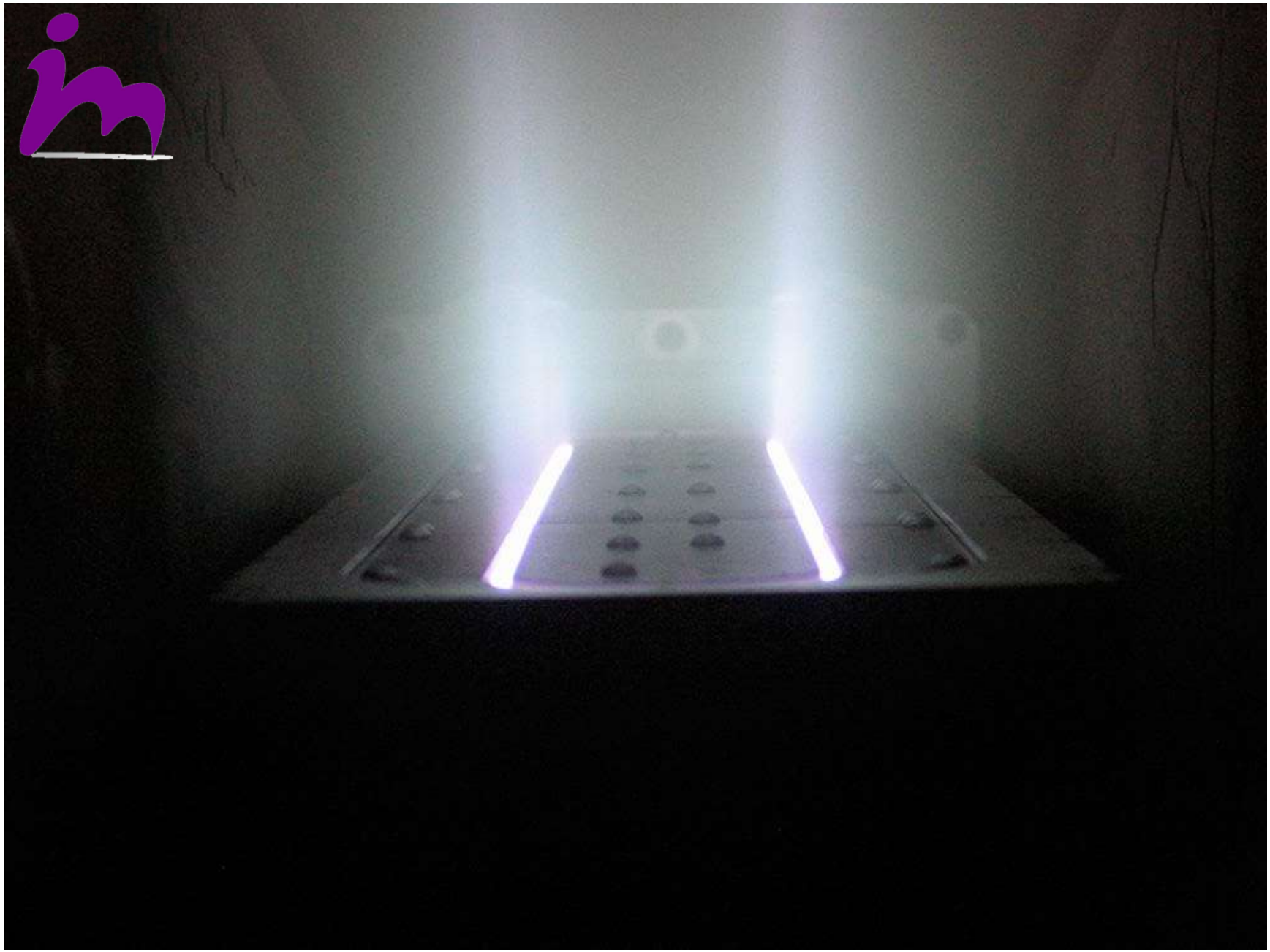


Adaptors available to convert to existing port designs – MRC type shown

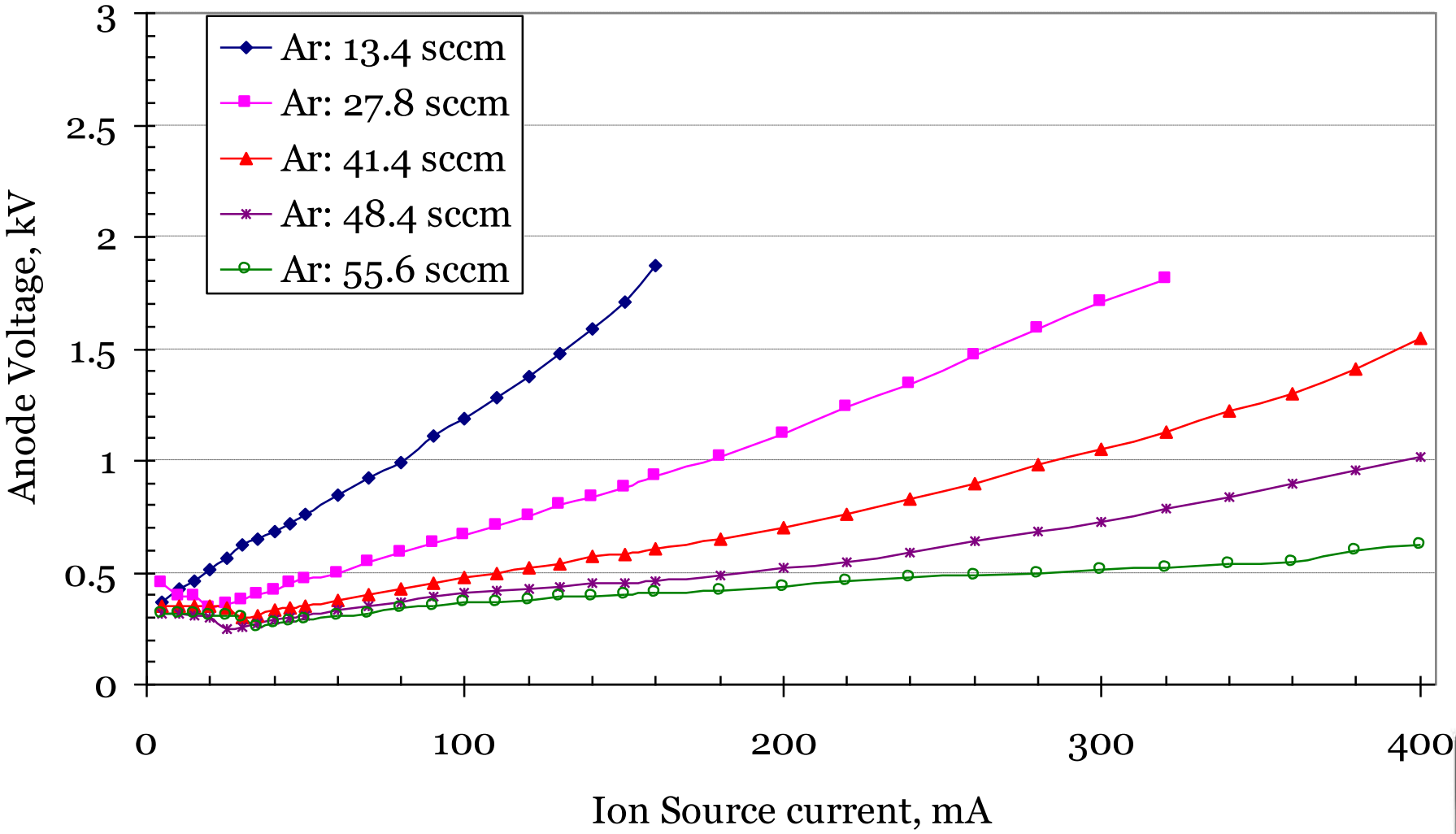


Standard straight beam arrangement



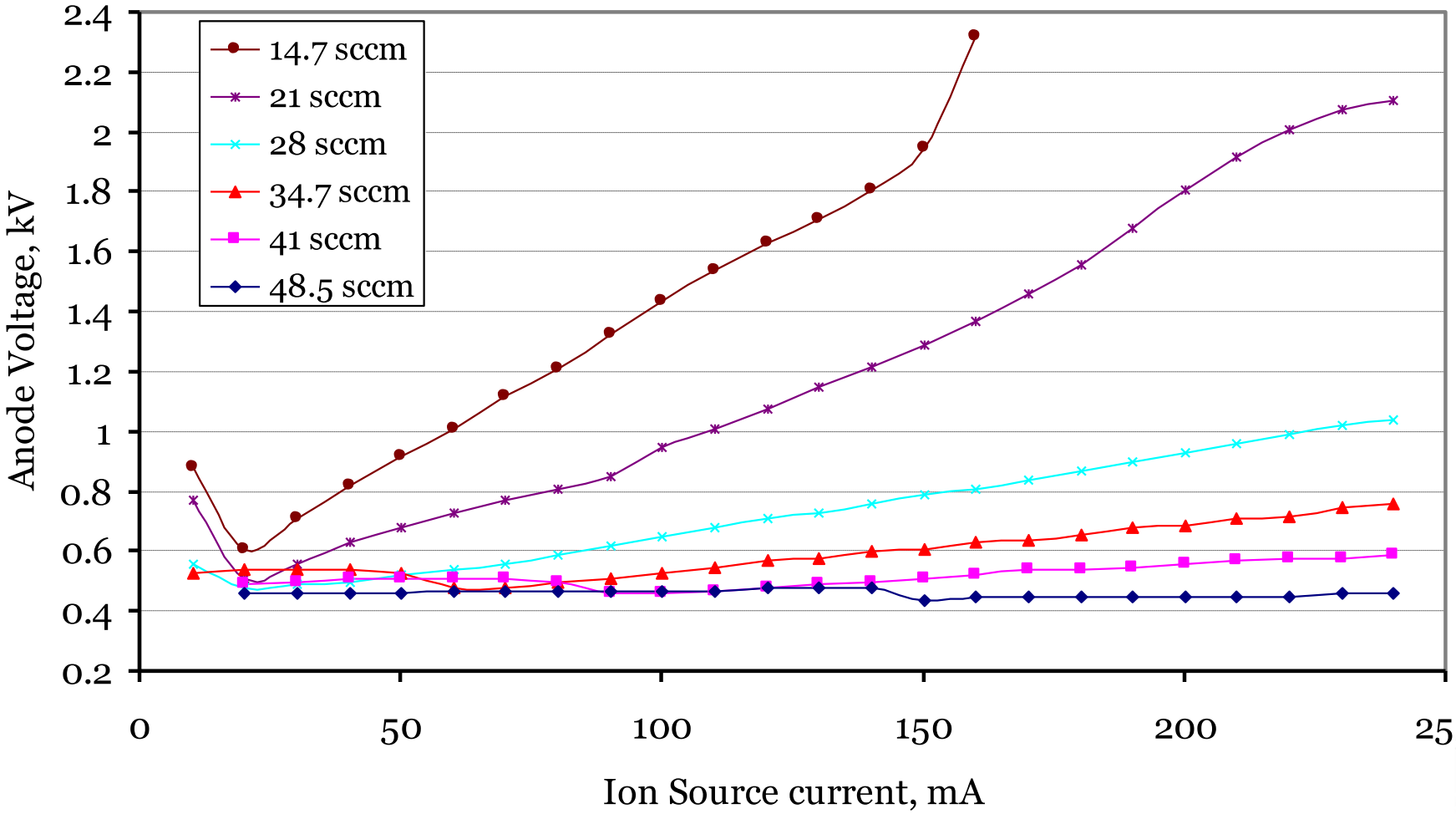
Standard straight and focused beam arrangement

IM800 - Ion Source - Anode Voltage vs Current # graphite on



Typical operating parameters *im*400

IM400 V vs I plot for Ar flow rate (%)



Linear ion sources are typically used to pre-treat before sputter coating

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scalable robust devices based upon DC power

The Gencoa range of linear ion sources are a powerful means to liberate moisture and burn-off hydrocarbons before the sputter coating of the flexible web.
The linear ions sources work at sputtering pressures and with web speeds of <5m/min. For higher speed webs, magnetron based plasma treaters are recommended.
The 3 or 0.3 kW ion source power supply has a unique automatic gas adjustment feature to make operation of the ion source very simple.

The Gencoa im300 and im3000 power supplies automatically regulate the beam energy by automatically adjusting gas flow

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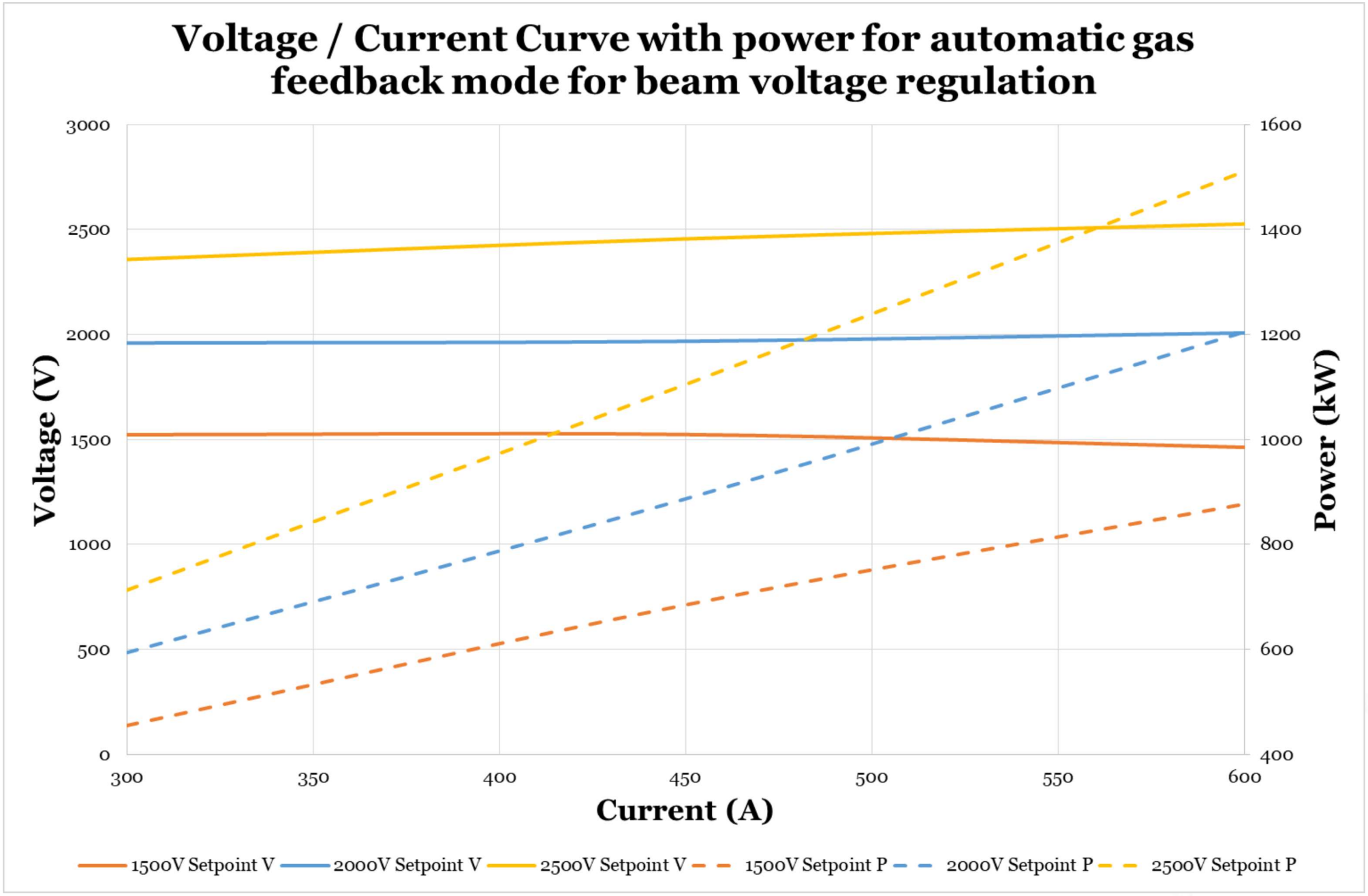

Plasma surface treatment

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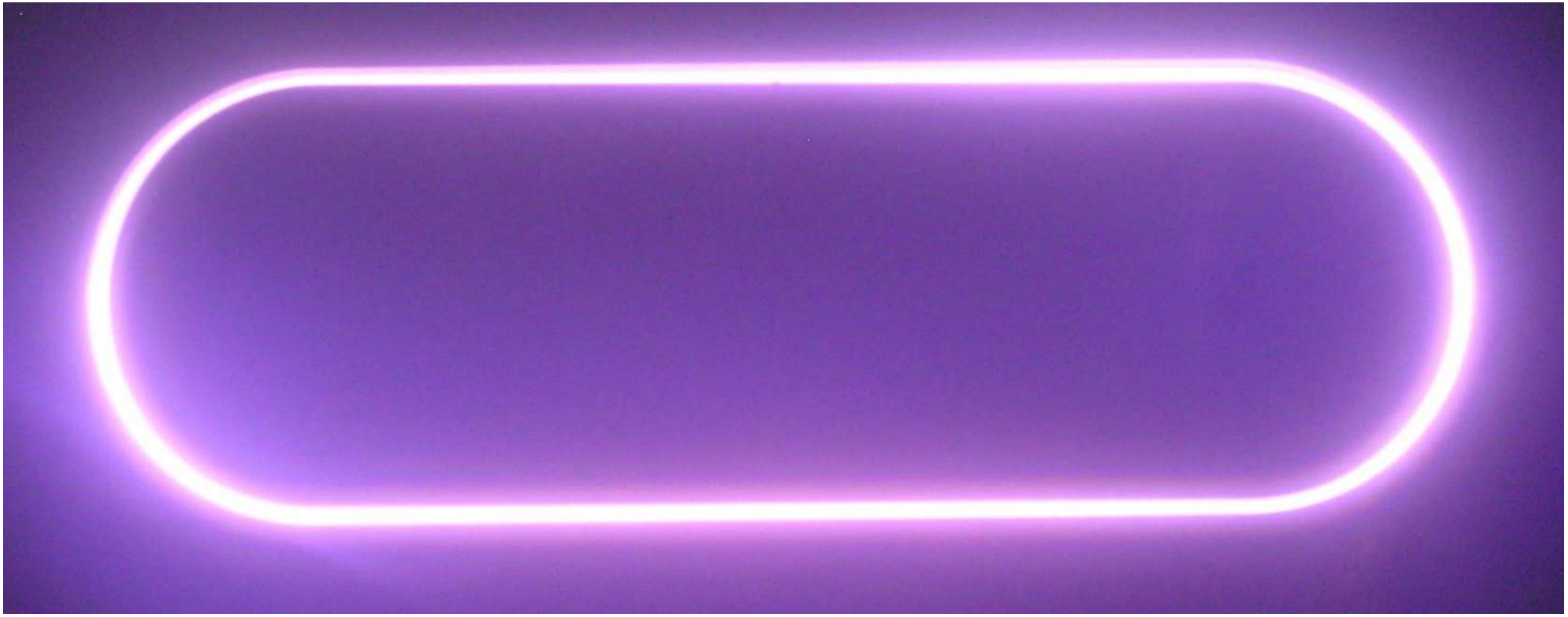
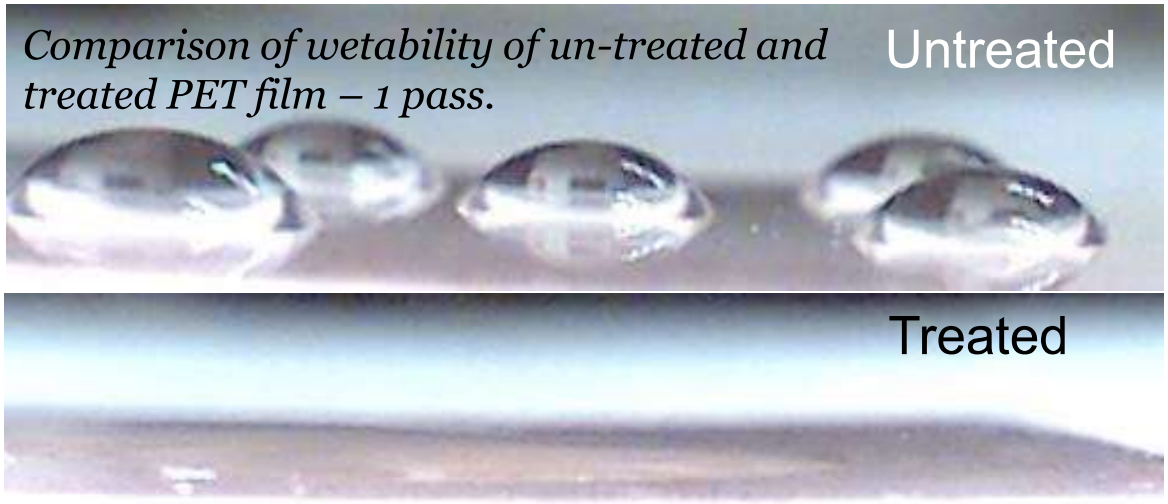
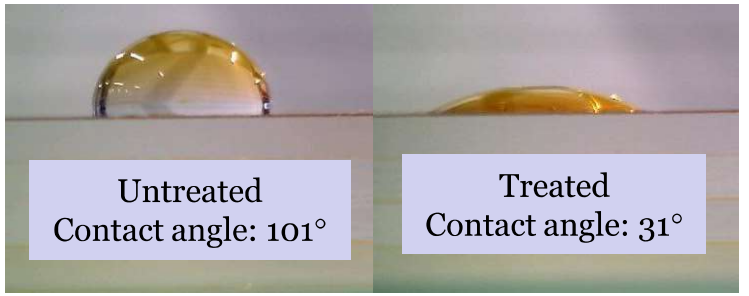


Comparison of wetability of un-treated and treated PET film – 1 pass.



Comparison of wetability of un-treated and treated Polyimide PI film – 1 pass.



Plasma surface treatment of glass with single pass at 1m/min in front of and

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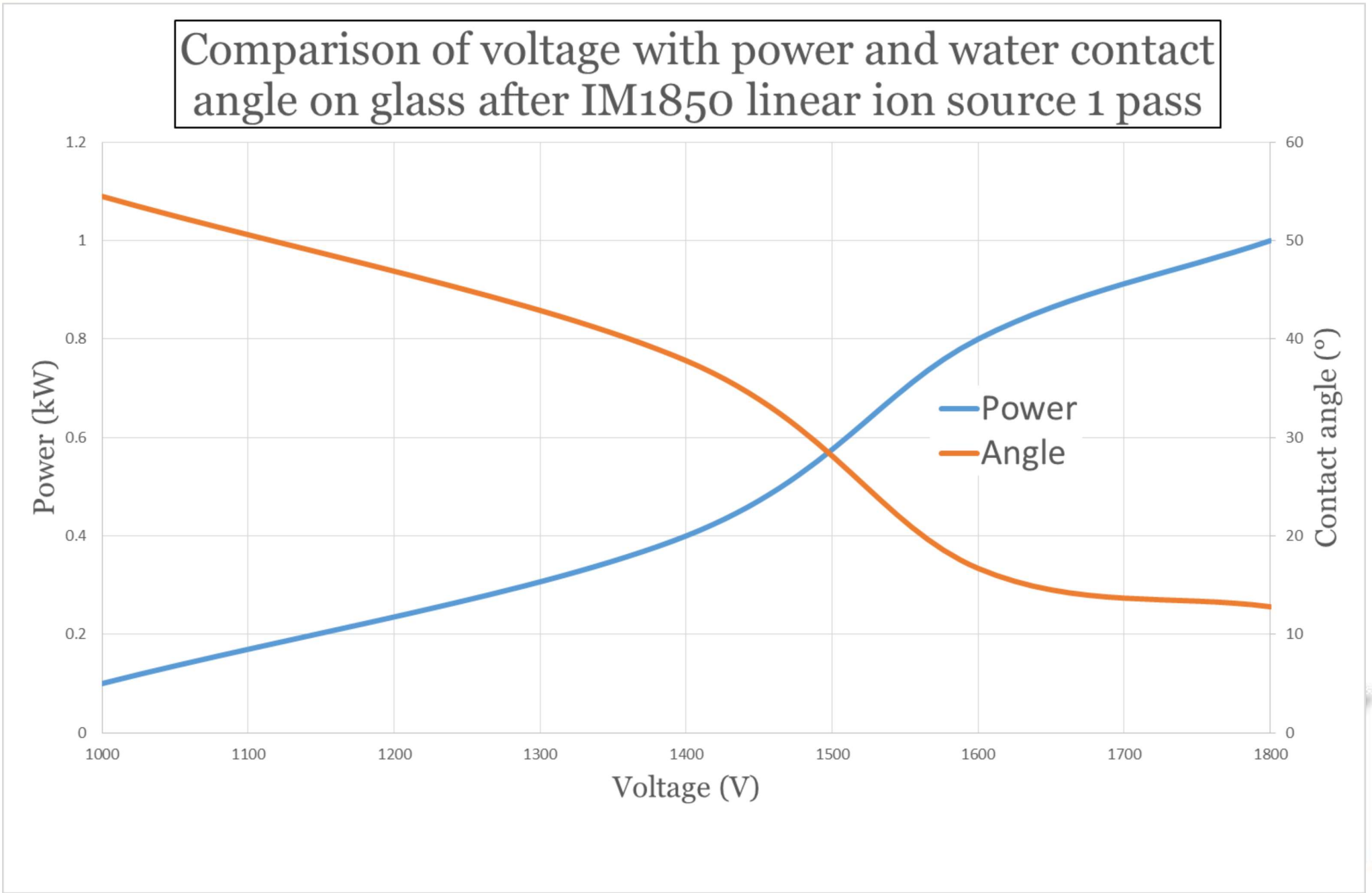
argon ion beam with 40 sccm gas flow



Typical etch rates for different materials

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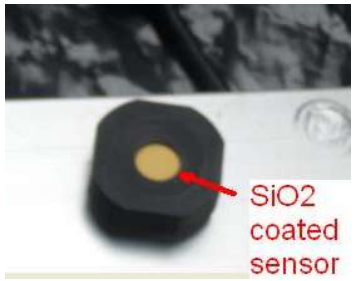

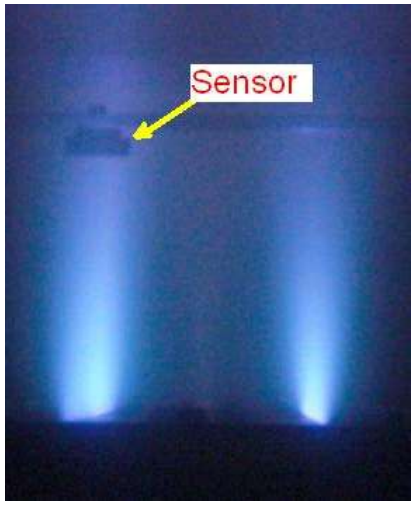

Polymer etch rates:
Gas: O2
IM400: 200 mA beam @ +1.5 kV
Substrate in rotation at equivalent 600mm/min linear speed (80 passes)
Example of polymer: silicone
Etching rate ~ 20 A/pass
Example of polymer: acrylic
Etching rate ~ 38 A/pass

Example of metal Ti:
Etching rates: 0.5-1 A/pass (170 mA @ +1.82 kV)

Oxide etch rates:
Gas Ar
IM600, 300 mA beam @ +1.6 kV
Example of oxide: SiOx
Etching rate: 5 nm/min static (over 8 mm diameter substrate, total time 23 mins)

Ariño Duglass | Universidad Zaragoza

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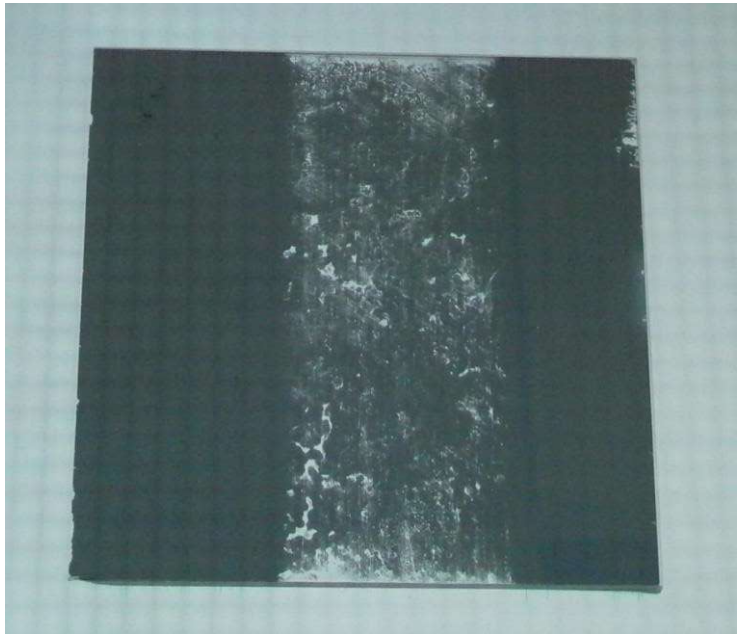
Ion pre-treatment is a powerful means to improve coating adhesion and device performance

Elcometer abrasion test (ISO 11998)

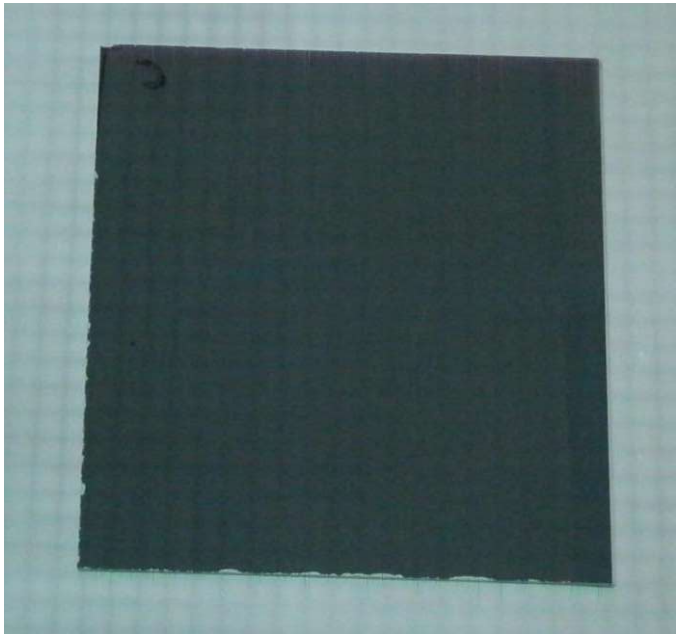
- Abrasion resistance of coatings
- Rubbing in wet conditions
- Load: 100 gr.
- No. Cycles: 500
- Comparative results of coating with and without ion beam pre-treatment

Results of single pass plasma pre-treat

Sample without ion-beam pretreatment



Sample treated by ion beam



Comparison of tempered glass with and without the use of a single pass plasma pre-treat with linear ion source

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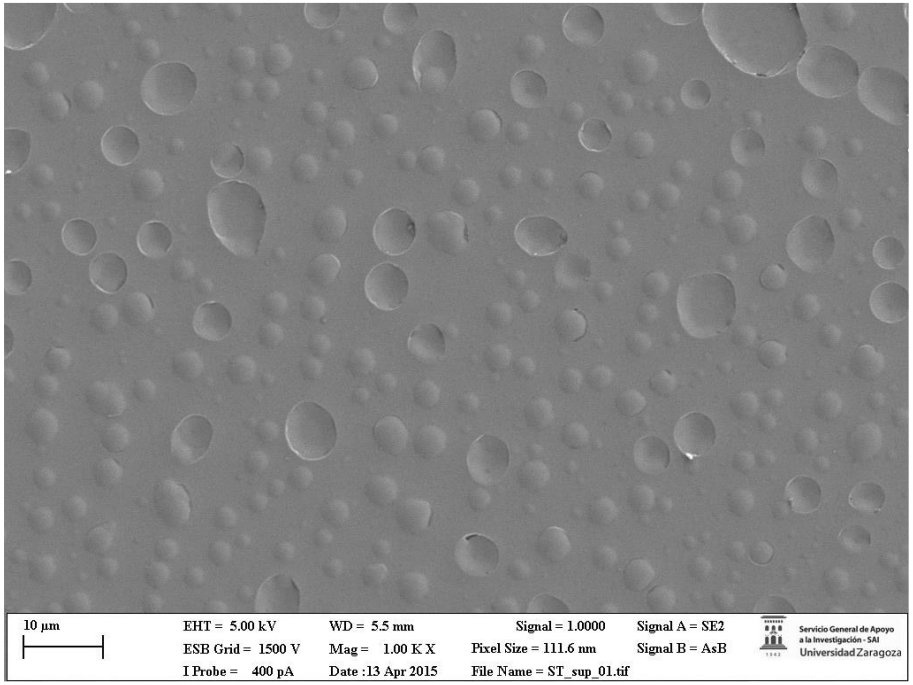
Parallel on-axis in-lens secondary electron detection

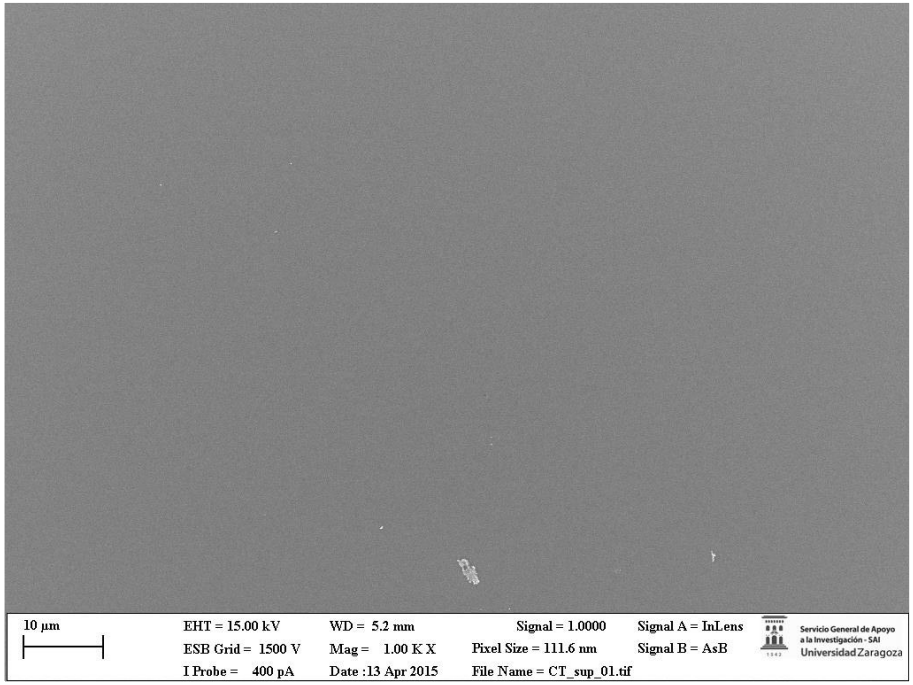
Sample not treated by ion beam



Samples without ion beam pretreatment show a hazy reflection.

Due to small bubbles (5 mm) in the coating.

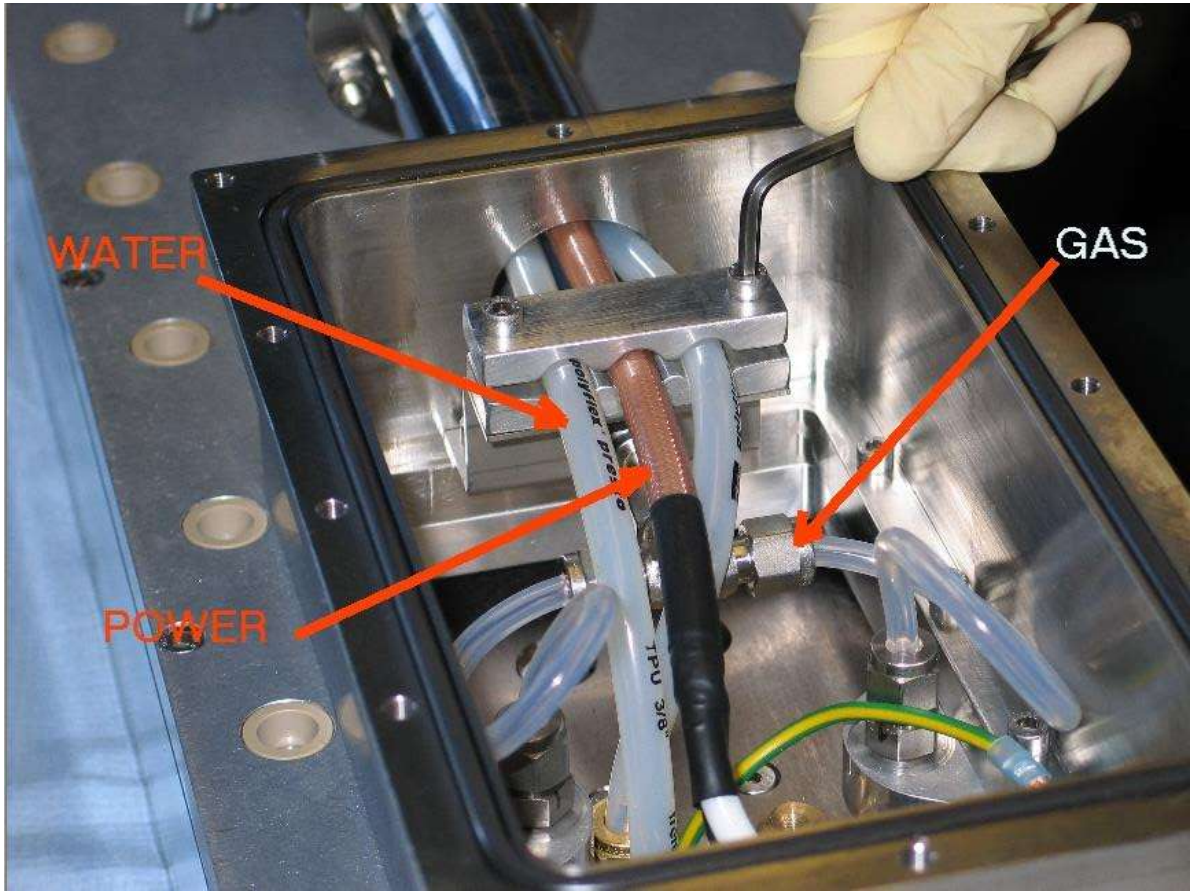
Sample with ion-beam pre-treatment



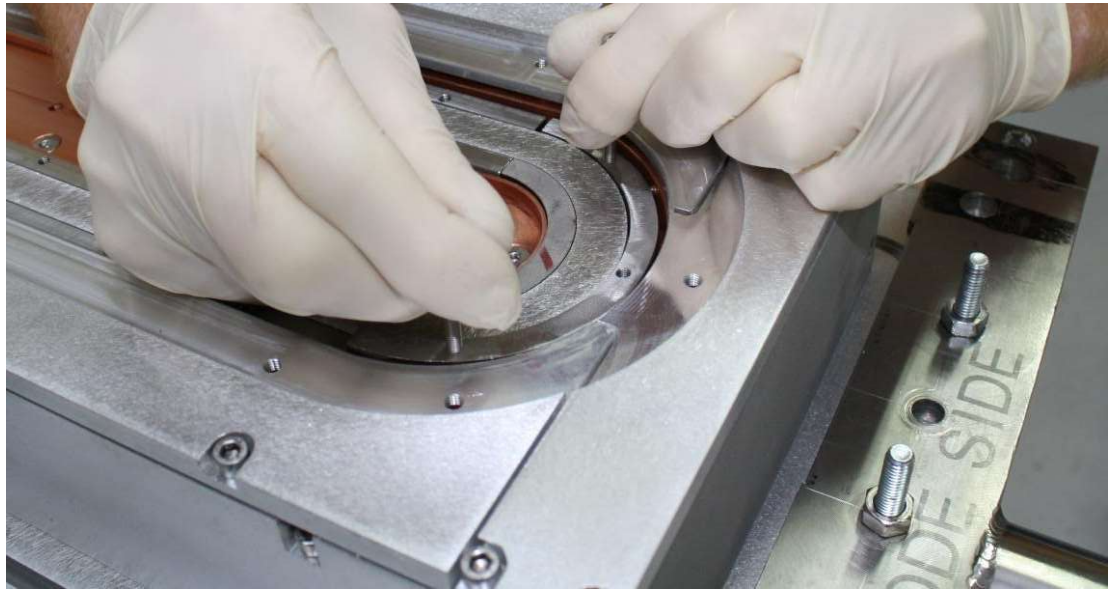
After the tempering process no visible defects were detected on the coating.

SEM analysis confirm the good state of the coating.

Robust mechanical design, easy to access and connect



Long operating lifetime, very easy to service and maintain



No water or vacuum seal broken during anode / cathode change, typically 2 hours for full conversion from straight beam to focused beam mode.

Gencoa provide a unique customer built power supply that automatically regulates the gas flow for ease of operation (300 & 3000 w)

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Output voltage	Up to 2500V (3000V ignition voltage)
Output current	2 A @ 2000V, short circuit 2.5A
Output Power	4000W @ 2000V
Output polarity	Positive
Regulation Mode	Current 0-2.5A
Output connector	Fischer, type 105, 10kV rating for RG213 coax cable
Mains input	3x400Vac +/- 10% 50Hz (L1,L2,L3 PE)
Dimensions	Standard Rack 19” 4U=177mm High
Weight	12kg
Cooling	Forced air cooling
Working temperature	15-35°C

*IM*300 power supply for smaller sized linear ion sources 500mm long or lower power longer beams

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ITEM	Description
Footprint	3UI rack mount L=240mm H=178mm D=300mm
Supply	220 AC or 110 ac switch selector inside max 600va
Voltage strike	Greater than 3kV, positive
Nominal voltage	2500V – 200mA - 500Watts
Short circuit current	Minimum 400mA
Inverter frequency	36kHz
Power input connector	Computer type 1P + N + GND or 2P + N + GND (additional earth recommended)
Regulation mode	Current 0 to 400mA – 0.5 mA resolution
Analog inputs	AD and DA converters with 12 bits resolution
Output connector	Panel Mount SHV Connector
Mass flow controllers outputs	2 channels, analog 0 to 5V (setpoint), supply +/-15V, max supply power 10 Watts. Only to be used with Gencoa's Speedflo to MFC cable (ready for MKS1179A type)
MFC interface	2x9 pin standard GENCOA pinout
Display	Touch screen display, 240x 128 pixel
Data entry	Touch screen + encoder on front panel
Interlock /remote	25 pin D-type interlock, remote ON/OFF, beam_good bit, output is ON bit
RS232 interface	9 pin female, see below for accessible data
Regulation mode	Internal:Costant gas flow or gas feedback (costant voltage) External:R232 or analog user port

Schematic of the ion source with power supply and automatic gas regulation

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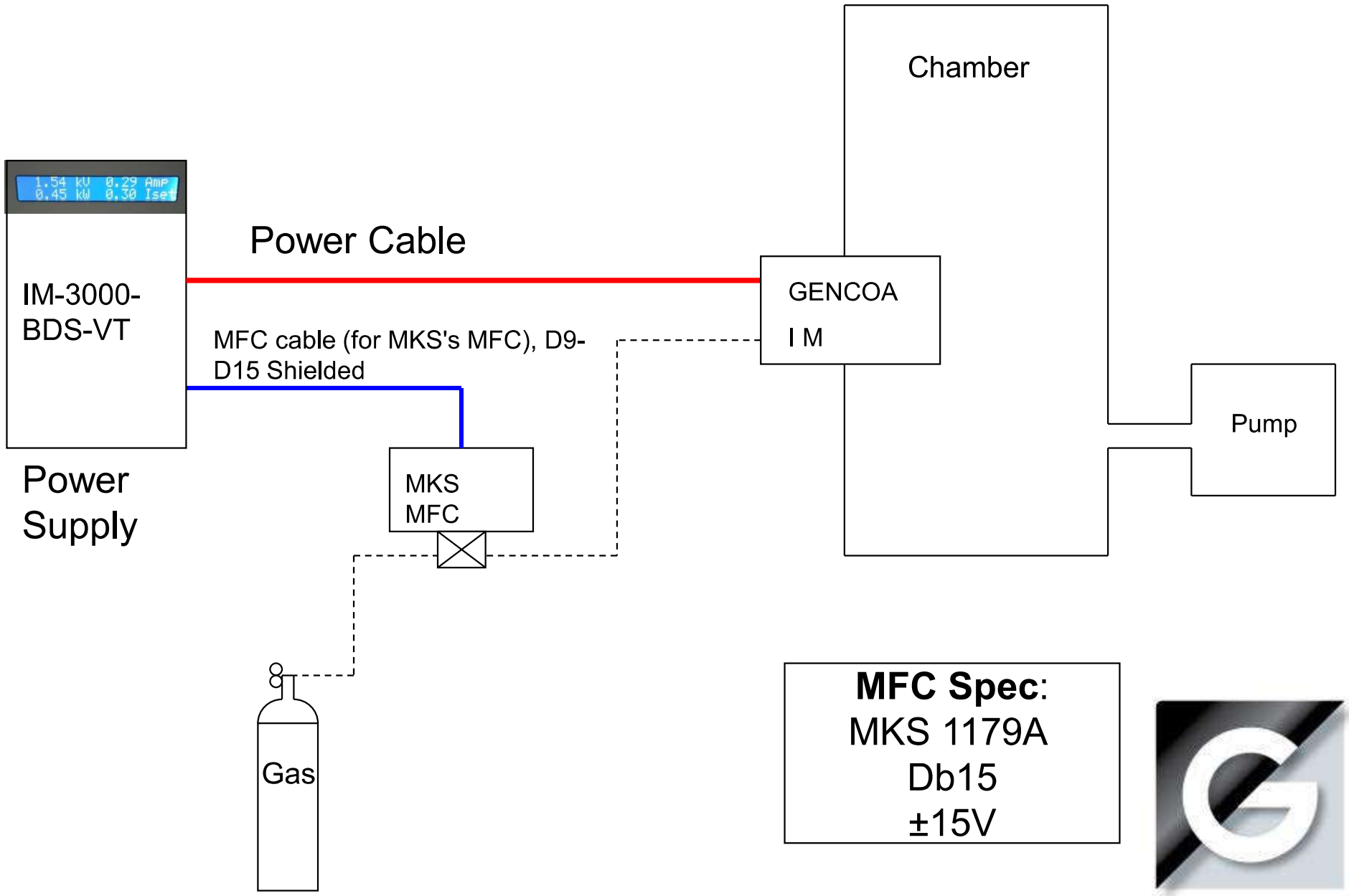
Removes beam variation – I & V regulated



Schematic of the ion source with power supply and automatic gas regulation

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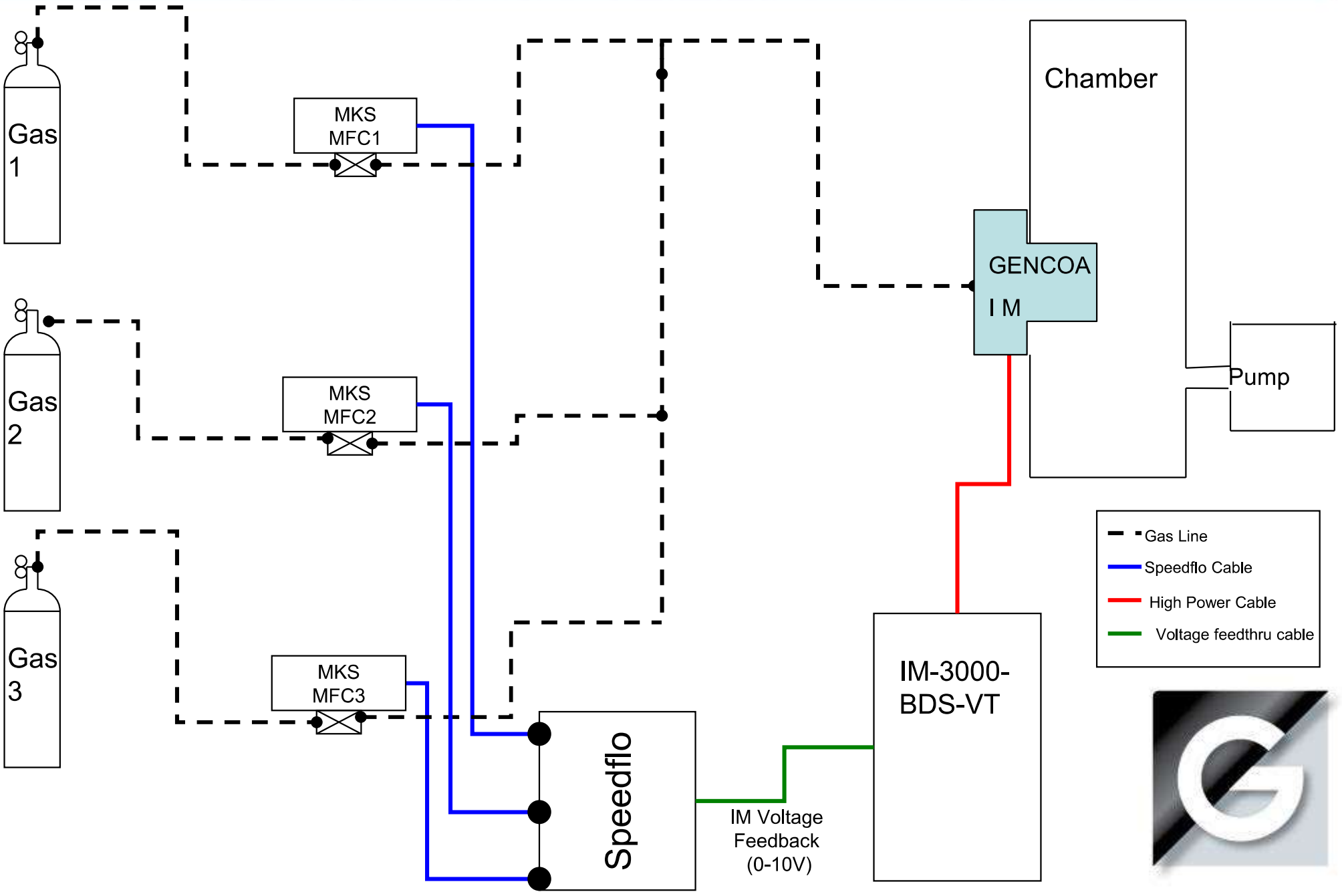
Of more than 1 gas type – needs speedflo mini



IM600 at 300mA - gas Ar - Example of voltage tracking feature via auto control of gas

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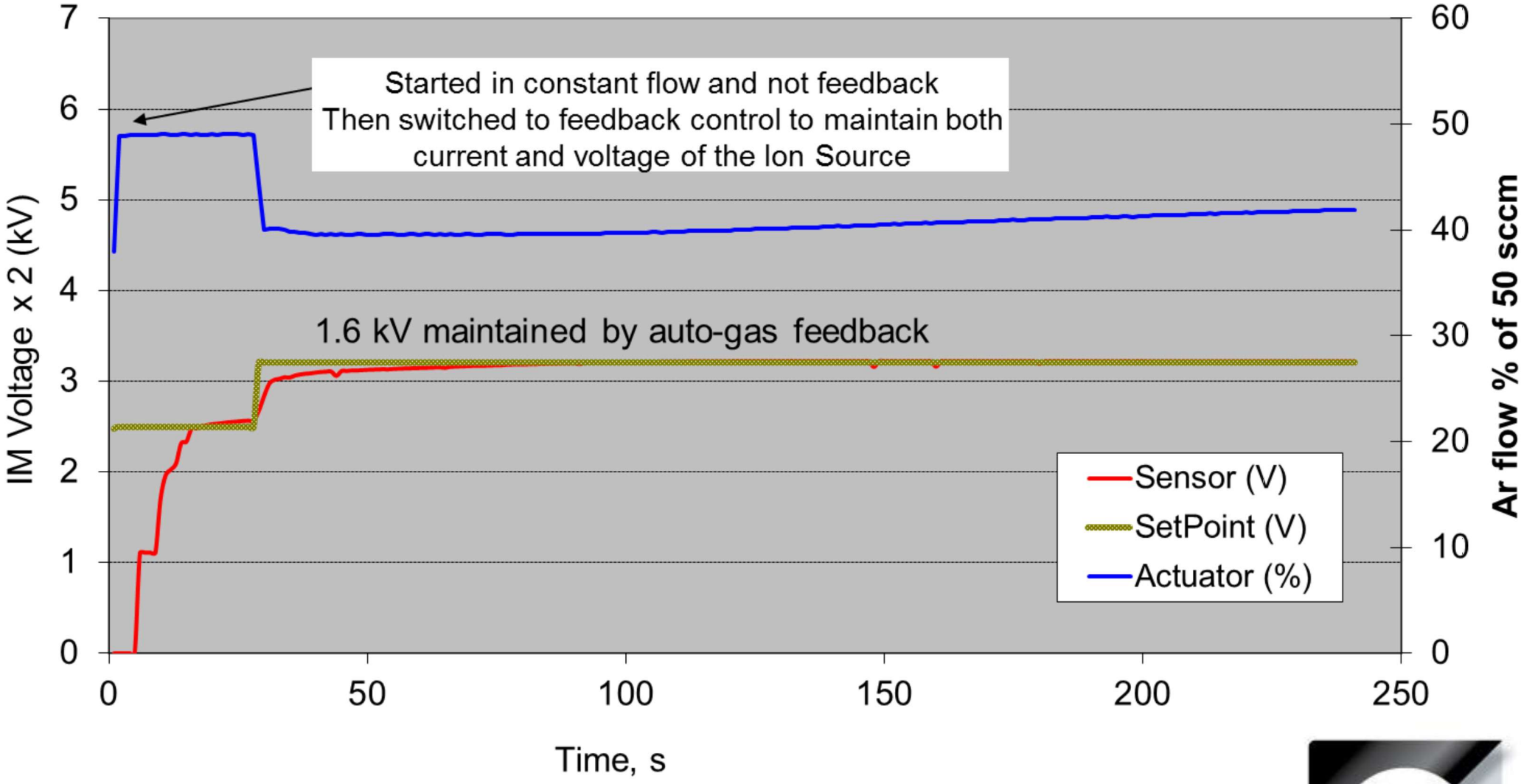
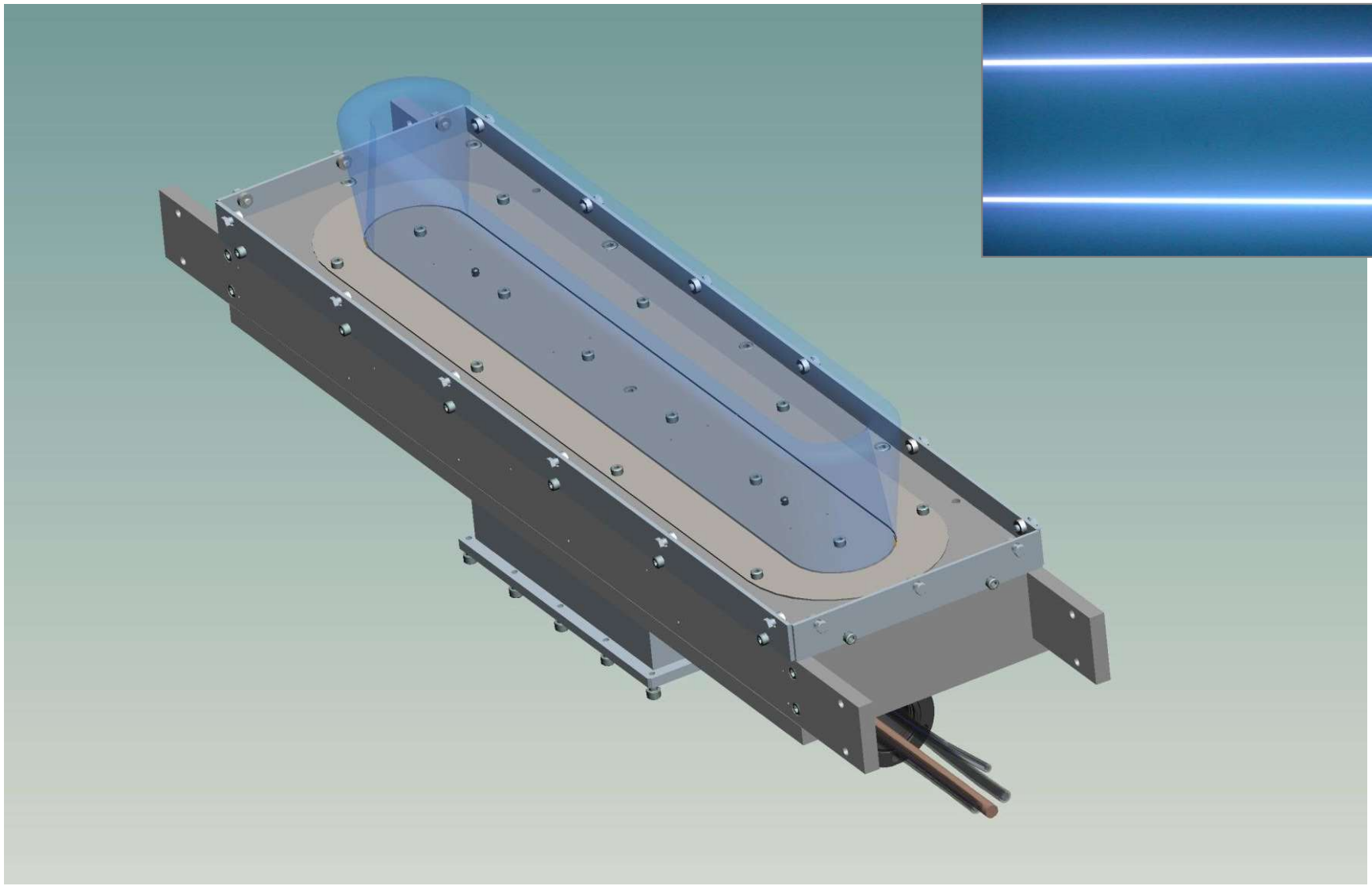


Any length of plasma beam is available and a variety of mounting options



Also available as a circular ion source with 75mm diameter beam

Gencoa IM75 plasma source for ***Research and Development***

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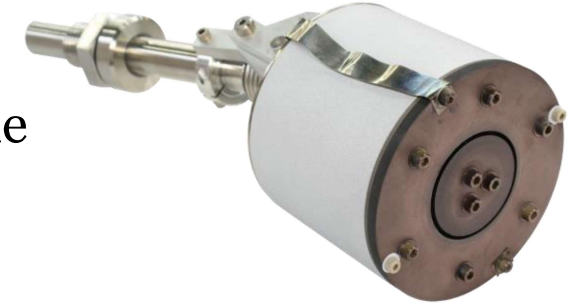
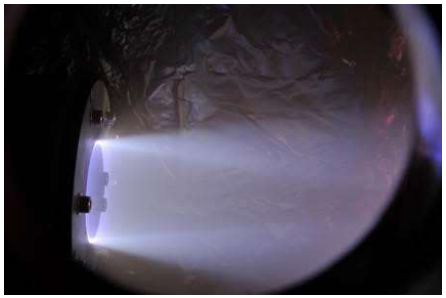
A multi-functional plasma beam

- A powerful new tool for thin film research.
- Fits into the space of a typical magnetron and has head tilt adjustment.
- Self neutralized plasma - no substrate surface charging.
- Variable plasma energy.
- Automatic gas feedback control via the IM300 power supply (any gas).
- Robust design with no maintenance.
- Can replace RF substrate etching.
- Multiple uses - ion assistance, patterning, pre-cleaning, coating stripping, PECVD





The full range of Gencoa Plasma Generation and Pre-treatment Products

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Plasma Treatment Product Categories:	**Application / use**
DC Linear ion sources	Low speed web & glass
DC magnetron based plasma treaters	Low to High speed / power
AC type plasma cleaning sources	Low to High speed / power
AC type gas activation sources – O2 plasma generation for reactive gas reactions	Low to High speed / power
Hipims^{+} *positive beam ion etching*	Etching of metallic substrates
Positive pulsed power inverted magnetron metal strip etching source	Etching of metallic plate or web

DC, AC and *Hipims*$^{+}$ power supplies included in plasma source packages (magnetron based PSU can be customer supplied)
DC power mode is less expensive than AC as a single cathode is used
AC power mode requires 2 electrodes and uses magnet enhancement for higher plasma density – AC better arc suppression than DC – AC better suited to environments with high 'moisture' content
Hipims^{+} positive ion etching technology covered by Gencoa patent application

Standard straight and focused beam arrangements

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Different kinds of plasma sources from Gencoa