Manufacture and Alignment of the BGC Skimmer and Nozzle Assembly

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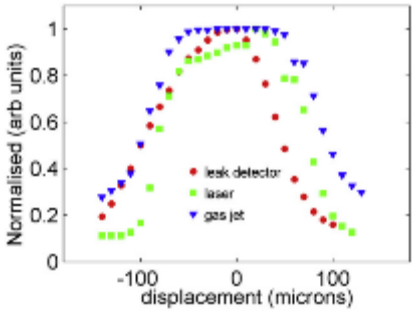
BE-BI-ML

Nozzle and Skimmer Assembly

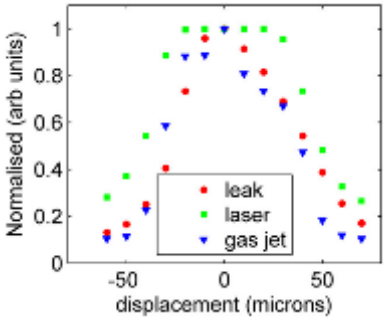
Aiming within <50µm alignment range

Pins used to align the three critical parts

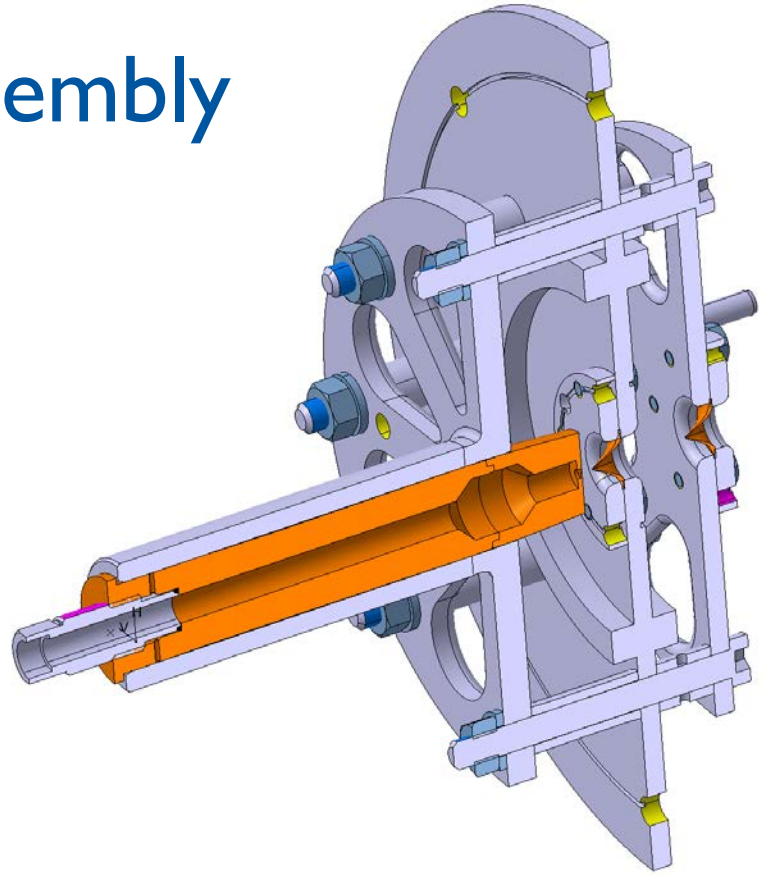
Central skimmer position fixed



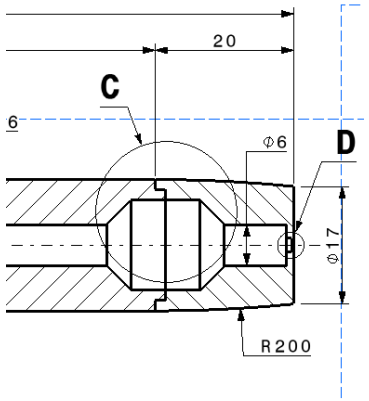
X axis

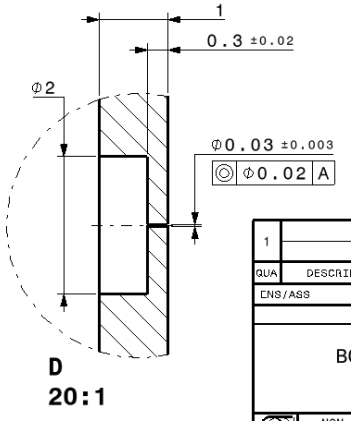


Y axis



Nozzle



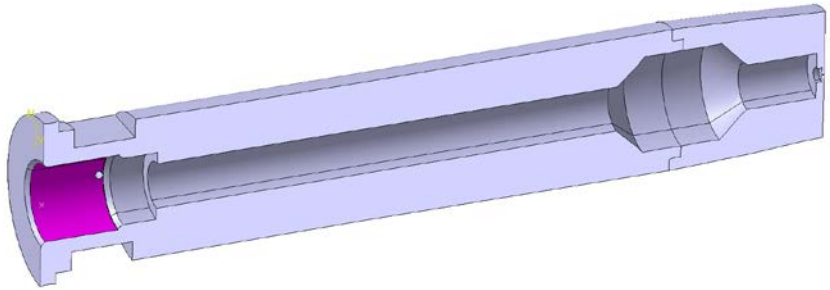


To be machined in 2 parts at CERN

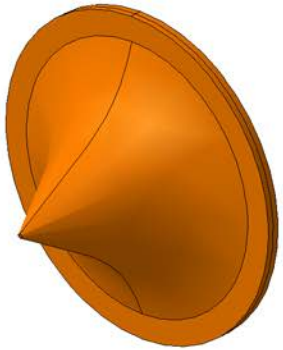
- Full depth weld to join parts
- Re-machined external diameter.

30µm hole manufacture

- Previously drilled in platinum foil, clamped between 2 Al plates.
  - Manufacturer unknown
- Laser Micromachining, UK
- Vuichard, Fr/CH



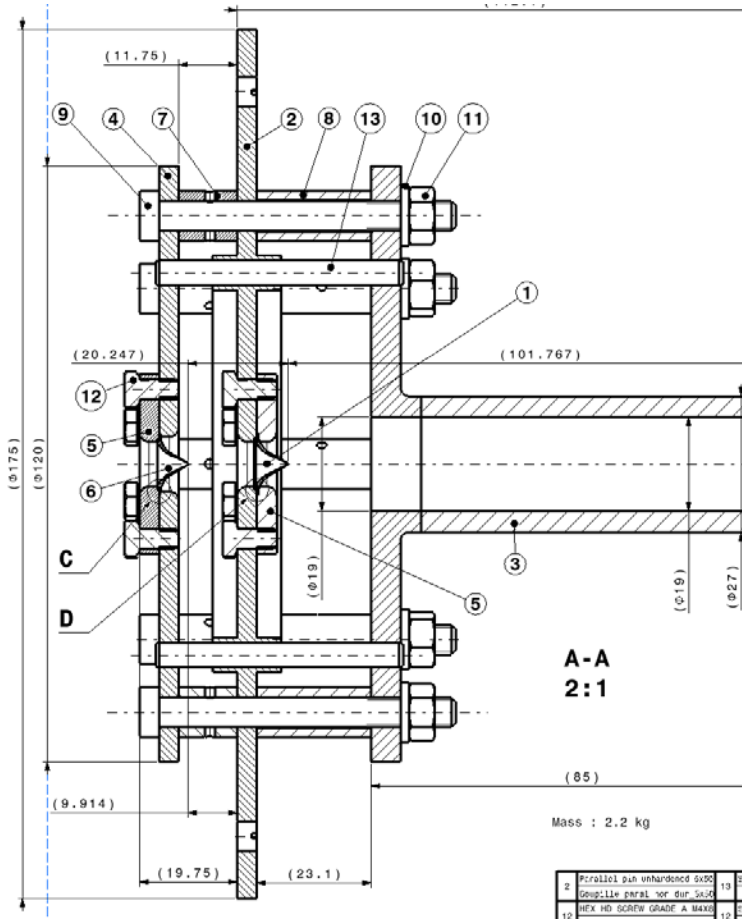
Skimmer 1 & 2



0.18 and 0.4mm diameters

Previously manufactured by

- Beam Dynamics Inc, US
- Any feedback welcome
- New skimmers have been purchased 10/06



Skimmer 3

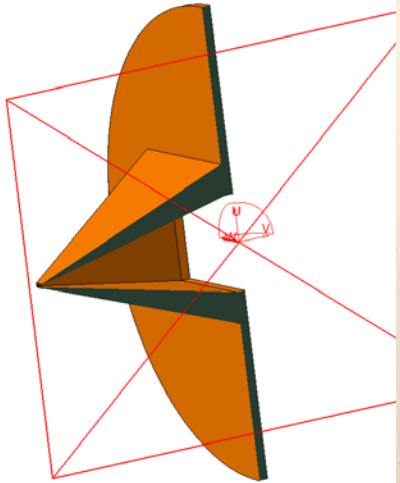
Rectangular, 0.4*4mm

Previously manufactured by

- CRDM rapid prototyping
- TJW polishing

New Skimmer

- IPAC poster about 3D metal printing
- Will contact manufacturers to discuss



WEPVA043

Study of the suitability of 3D printing for Ultra-High Vacuum applications

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[3]AGS Fusion, 35 Route du champ Bioley, Izernore, France.

Intro

In the recent year additive manufacturing (3D printing) has revolutionized mechanical engineering by allowing the quick production of mechanical components with complex shapes. So far most of these components are made in plastic and therefore can not be used in accelerator beam pipes. We have investigated samples printed using a metal 3D printer to study their behavior under vacuum. We report on our first tests showing that such samples are vacuum compatible and comparing pumping time.

Example of 3D printed pipes

Beam pipes printed by two different manufacturers (4 samples each): BV proto (left) and AGS fusion (right). Samples are cut off the support.

Samples tests

Manufacturer	Part name	Surface finishing	He leak test	Limit pressure (Penning)
BV Proto	BV1	Sawing at one end	Raw: 1×10^{-7} mbar l/s Sawed: $> 1 \times 10^{-6}$ mbar l/s	1.7×10^{-8} mbar
	BV2	Minor processing with hand tools	$> 1 \times 10^{-5}$ mbar l/s	8.6×10^{-8} mbar
	BV3	Lathing of both flanges	No leak detected	1.2×10^{-8} mbar*
	BV4	Lathing of both flanges and the internal surface	No leak detected	1.2×10^{-8} mbar*
AGS Fusion	AG1	Wire-cutting at one end	Raw: 3×10^{-7} mbar l/s Wire-cut: $> 1 \times 10^{-5}$ mbar l/s	8.5×10^{-8} mbar
	AG2	Wire-cutting at one end	2×10^{-7} mbar l/s Wire-cut: $> 2.8 \times 10^{-7}$ mbar l/s	1.2×10^{-7} mbar
	AG3	Lathing of both flanges	6.2×10^{-8} mbar l/s No leak detected	1.5×10^{-8} mbar*
	AG4	Lathing of both flanges and the internal surface	No leak detected	9.6×10^{-8} mbar*
Vacom	Reference	Conventional	No leak detected	1.8×10^{-8} mbar*

* This is equivalent to the limit pressure of the test stand.

Static vacuum pressure

The samples have been pumped and then left under static vacuum for several hours.
All samples where the flanges have been machined show no significant difference with respect to the reference sample and the test stand left alone.

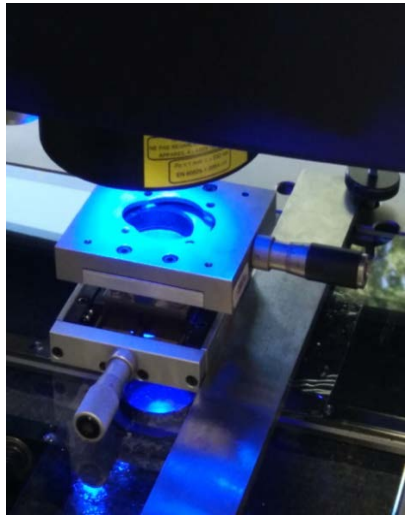
Alignment

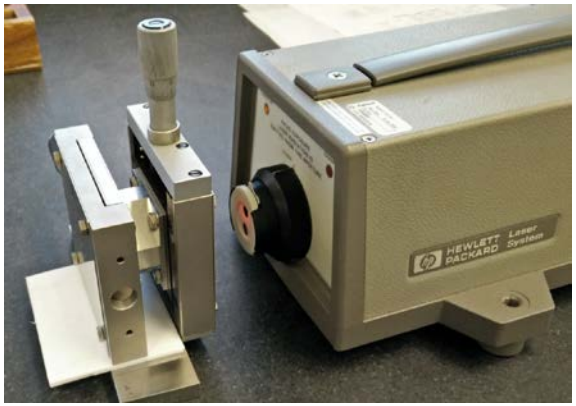
Previous study by Ana Miarnau

Alignment of two 50µm holes at CERN with metrology team

Original BGC alignment

Ensure documentation of everything





Drawing approval

All drawings ready to be signed

- Have begun checking all the drawings
- Hope to have signed before design review
- Manufacture to begin ASAP
- Discuss with Cockcroft Institute

References

Slide 1: Gas dynamics considerations in a non-invasive profile monitor for charged particle beams *Vasilis Tzoganis, Adam Jeff, Carsten P. Welsch*

Slide 4: Poster at IPAC, *provided by Hao Zhang*

Slide 5: Alignment of Beam Gas Curtain (BGC) test plates *Ana Miarnau*

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