

11th BGC Collaboration Meeting

Summary of the 2024 Experimental Results at Cockcroft Institute

Presented by

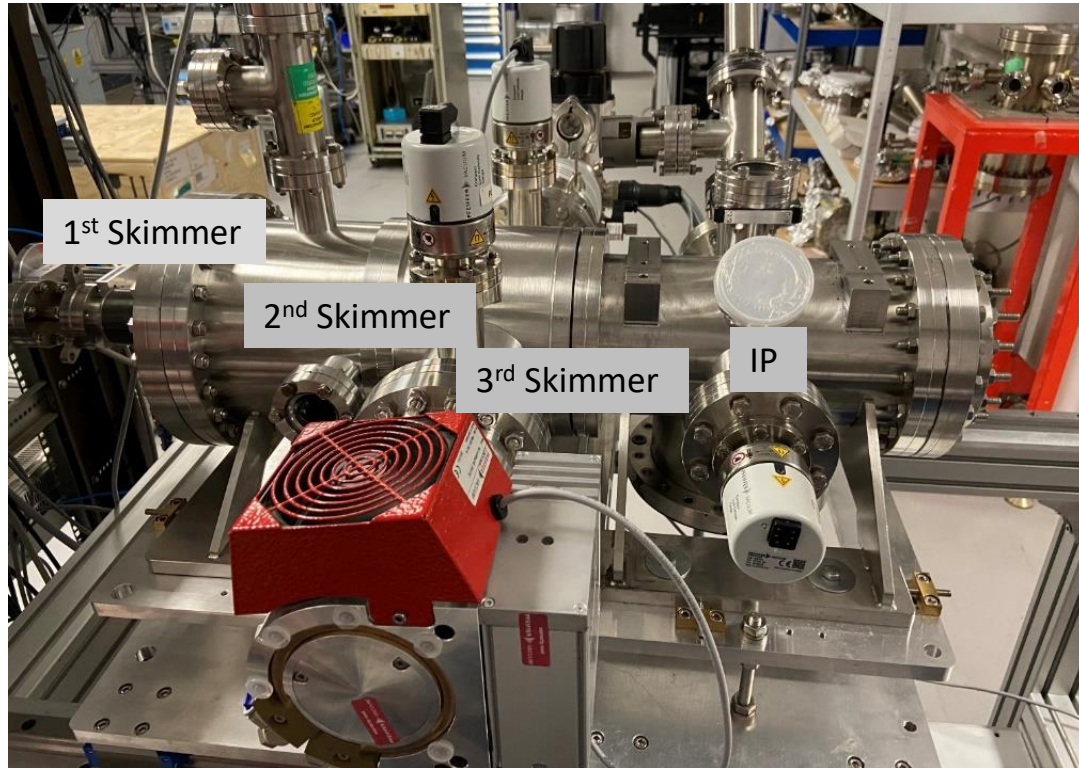
Hao Zhang
Shakti Prasad Sethi

Department of Physics, QUASAR Group, University of Liverpool

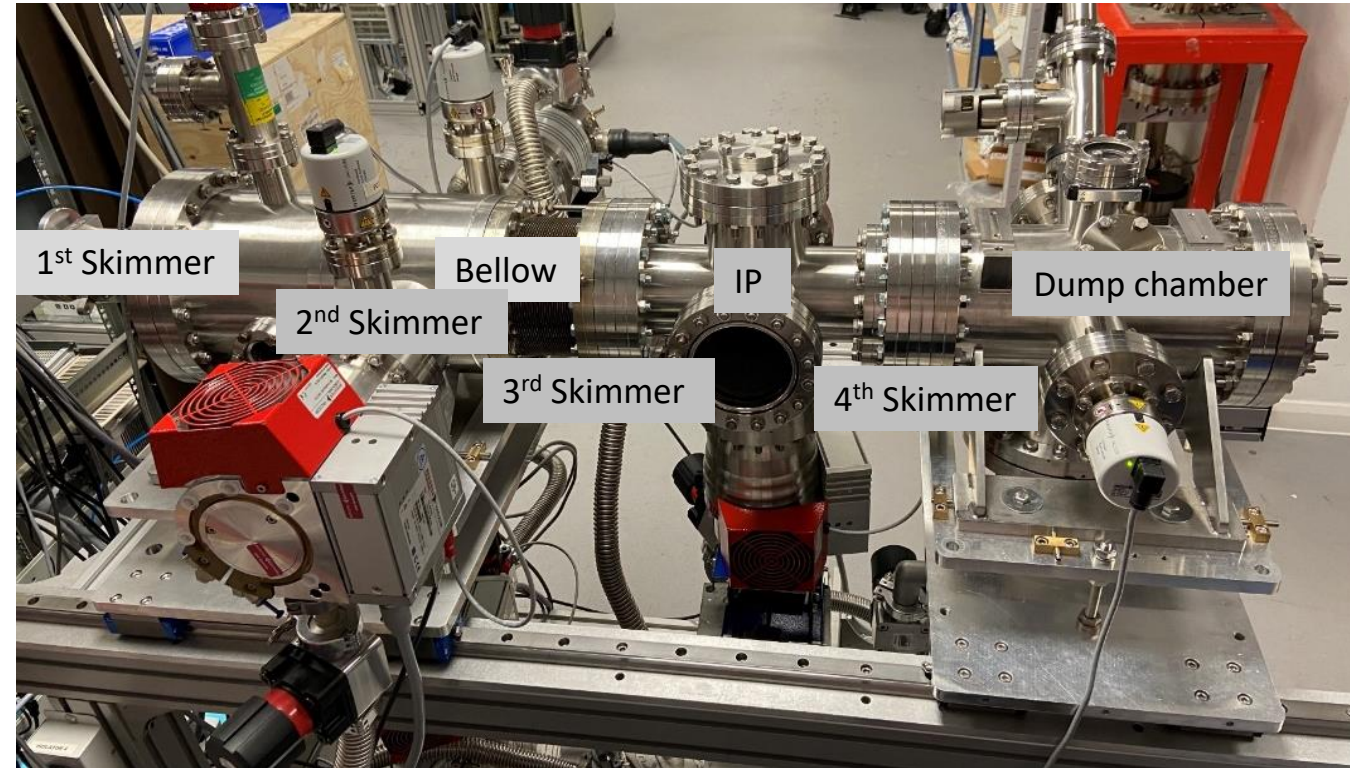
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JEREMY modification setup

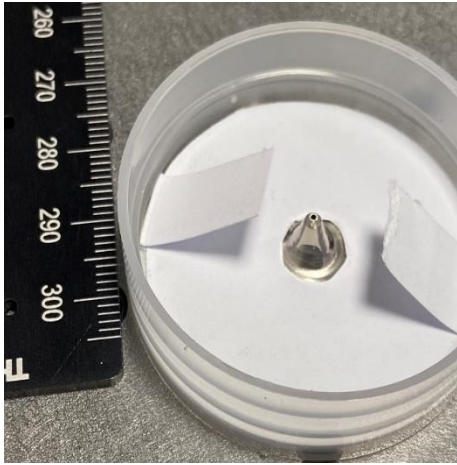


JEREMY Test stand

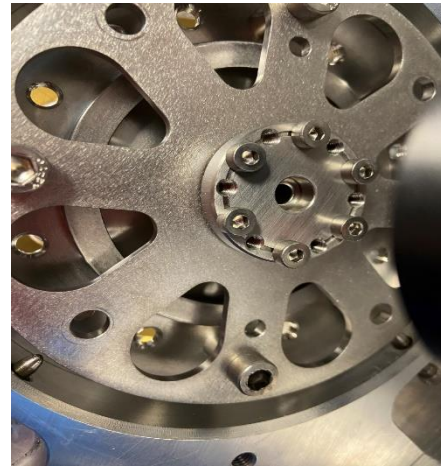


Modified JEREMY Test stand with Bellow, 4th Skimmer and Dump chamber

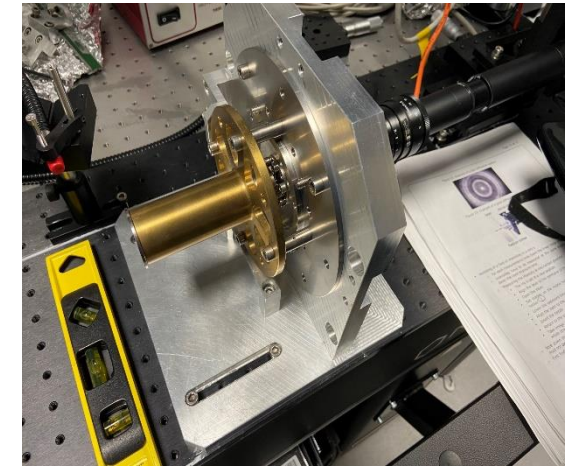
JEREMY setup tested with new 1st skimmers planned



700um 1st skimmer



Skimmer mount

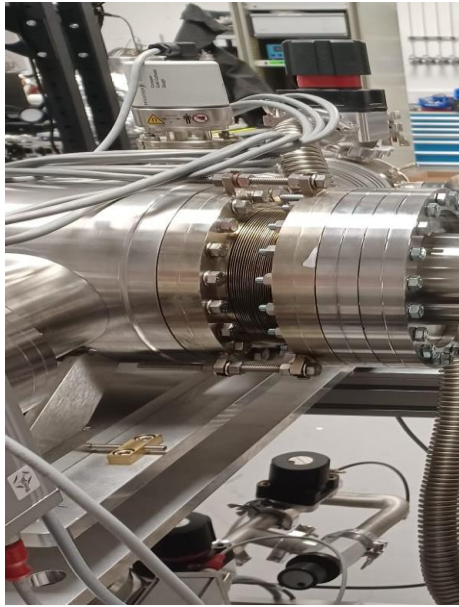


Alignment

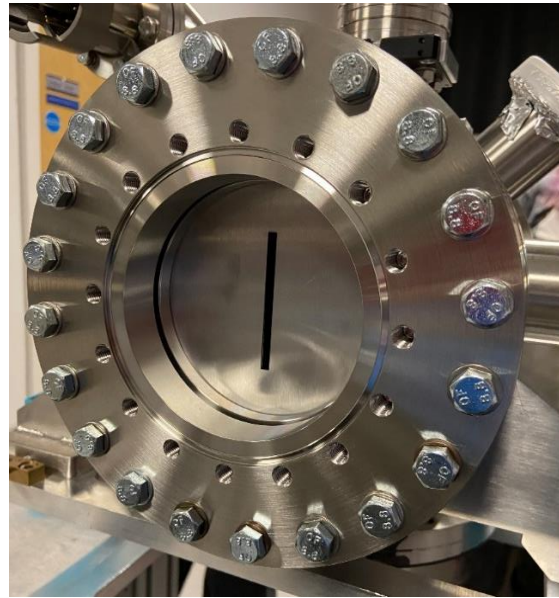
	Nozzle	1 st Skim	2 nd Skim	3 rd Skim
Size	30um	700um	5.3mm	0.1x30mm
Distance	---	4.5mm	31.7mm	183.3 mm

New large 1st skimmers (400um, 600um, 700um, 800um)
30um Flat nozzle used

JEREMY modification with Bellows, 4th Skimmer and Dump Chamber



Bellow



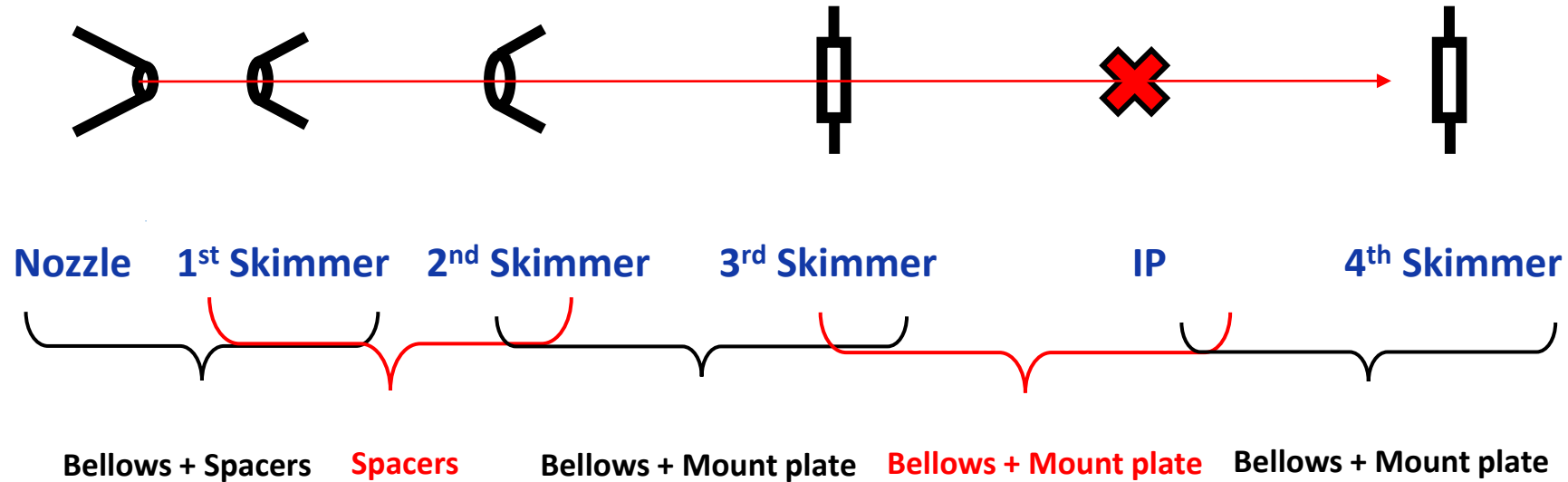
4th skimmer



Dump chamber

	1 st Skim	2 nd Skim	3 rd Skim	IP	4 th Skim	Bellow variation
Size	700um	5.3mm	0.4x30mm	---	4x60mm	
Distance	4.5mm	31.7mm	302.03mm	452.21mm	624.89mm	80x120mm

JEREMY modification New layout options



- Varying bellows is easy, but only one set of bellows between 3rd, IP and 4th so flange changes needed.
- Take a range of BG pressures at different chamber sizes to validate MOGA predictions

Background pressure study with bellow positions at different nozzle skimmer distances

- Nozzle – 1st skimmer distance variation (2-10mm)
- JEREMY setup
Nozzle=0.03mm, 1st skimmer=0.6mm, 2nd skimmer=2mm, 3rd skimmer a=0.4,b=30

Distances in mm			
Nozzle-1st	1 st -2 nd	2 nd -3 rd	3 rd -IP
2-10	24.75	250.33-290.33	150.18

- Modified JEREMY setup with Bellow distances 80mm, 100mm, 120mm between 2nd – 3rd skimmer
Nozzle=0.03mm, 1st skimmer=0.6mm, 2nd skimmer=2mm, 3rd skimmer a=0.4,b=30,4th skimmer a=4,b=60

Distances in mm				
Nozzle-1st	1 st -2 nd	2 nd -3 rd	3 rd -IP	IP-4 th
2-10	24.75	250.33-290.33	150.18	172.68

- *Compare expected BG pressure per chamber, simulation vs measured

Background pressure study with/without bellow positions at different nozzle distance

- JEREMY setup

Nozzle=0.03mm, 1st skimmer=0.6mm, 2nd skimmer=2mm, 3rd skimmer a=0.4,b=30

Distances in mm				Nozzle-skimmer distances	1 st skimmer	2 nd skimmer	3 rd skimmer	IP
Nozzle-1st	1 st -2 nd	2 nd -3 rd	3 rd -IP					
2-10	24.75	250.33-290.33	150.18	2 (No gas)	1.50E-08	7.30E-09	3.80E-09	4.29E-09
				2	3.43E-03	1.10E-04	1.53E-05	1.92E-07
				3	3.53E-03	1.00E-04	1.47E-05	1.91E-07
				4	3.53E-03	9.87E-05	1.40E-05	1.85E-07
				5	3.53E-03	9.77E-05	1.33E-05	1.79E-07
				6	3.53E-03	9.63E-05	1.30E-05	1.72E-07
				7	3.53E-03	9.60E-05	1.30E-05	1.66E-07
				8	3.53E-03	9.57E-05	1.27E-05	1.61E-07
				9	3.53E-03	9.57E-05	1.23E-05	1.57E-07
				10	3.53E-03	9.50E-05	1.20E-05	1.52E-07

- Modified JEREMY setup with Bellow distances 80mm, 100mm, 120mm between 2nd – 3rd skimmer

Nozzle=0.03mm
1st skimmer=0.6mm
 2nd skimmer=2mm
 3rd skimmer a=0.4,b=30
 4th skimmer a=4,b=60

Nozzle skimmer distance 10mm			
Nozzle-1st	2 nd	3 rd	IP
3.53E-03	9.50E-05	1.20E-05	1.52E-07

Nozzle-skimmer (mm)	Bellow distances (mm)	1 st	2 nd	3 rd	IP	Dump
2	80	3.30E-03	1.10E-04	1.40E-05	1.59E-07	1.20E-07
3	80	3.63E-03	1.10E-04	1.40E-05	1.67E-07	1.20E-07
4	80	3.63E-03	1.07E-04	1.33E-05	1.62E-07	1.20E-07
5	80	3.60E-03	1.00E-04	1.30E-05	1.57E-07	1.20E-07
6	80	3.63E-03	1.00E-04	1.30E-05	1.53E-07	1.17E-07
7	80	3.63E-03	1.00E-04	1.20E-05	1.48E-07	1.10E-07
8	80	3.57E-03	9.93E-05	1.20E-05	1.45E-07	1.10E-07
9	80	3.60E-03	9.93E-05	1.20E-05	1.41E-07	1.10E-07
10	80	3.57E-03	9.90E-05	1.20E-05	1.38E-07	1.10E-07
2	100	3.13E-03	1.03E-04	1.40E-05	1.52E-07	1.40E-07
3	100	3.47E-03	1.10E-04	1.40E-05	1.58E-07	1.50E-07
4	100	3.47E-03	9.87E-05	1.30E-05	1.50E-07	1.50E-07
5	100	3.47E-03	9.67E-05	1.27E-05	1.46E-07	1.50E-07
6	100	3.47E-03	9.47E-05	1.20E-05	1.41E-07	1.40E-07
7	100	3.47E-03	9.37E-05	1.20E-05	1.36E-07	1.40E-07
8	100	3.43E-03	9.30E-05	1.20E-05	1.33E-07	1.30E-07
9	100	3.43E-03	9.30E-05	1.13E-05	1.30E-07	1.20E-07
10	100	3.43E-03	9.23E-05	1.07E-05	1.27E-07	1.20E-07
2	120	3.03E-03	1.00E-04	1.37E-05	1.47E-07	1.30E-07
3	120	3.33E-03	1.03E-04	1.40E-05	1.50E-07	1.40E-07
4	120	3.33E-03	1.01E-04	1.30E-05	1.43E-07	1.40E-07
5	120	3.33E-03	9.47E-05	1.23E-05	1.38E-07	1.37E-07
6	120	3.33E-03	9.27E-05	1.20E-05	1.33E-07	1.30E-07
7	120	3.33E-03	9.17E-05	1.17E-05	1.28E-07	1.27E-07
8	120	3.33E-03	9.13E-05	1.13E-05	1.25E-07	1.20E-07
9	120	3.33E-03	9.07E-05	1.10E-05	1.23E-07	1.10E-07
10	120	3.33E-03	9.07E-05	1.10E-05	1.21E-07	1.10E-07

HaloJet

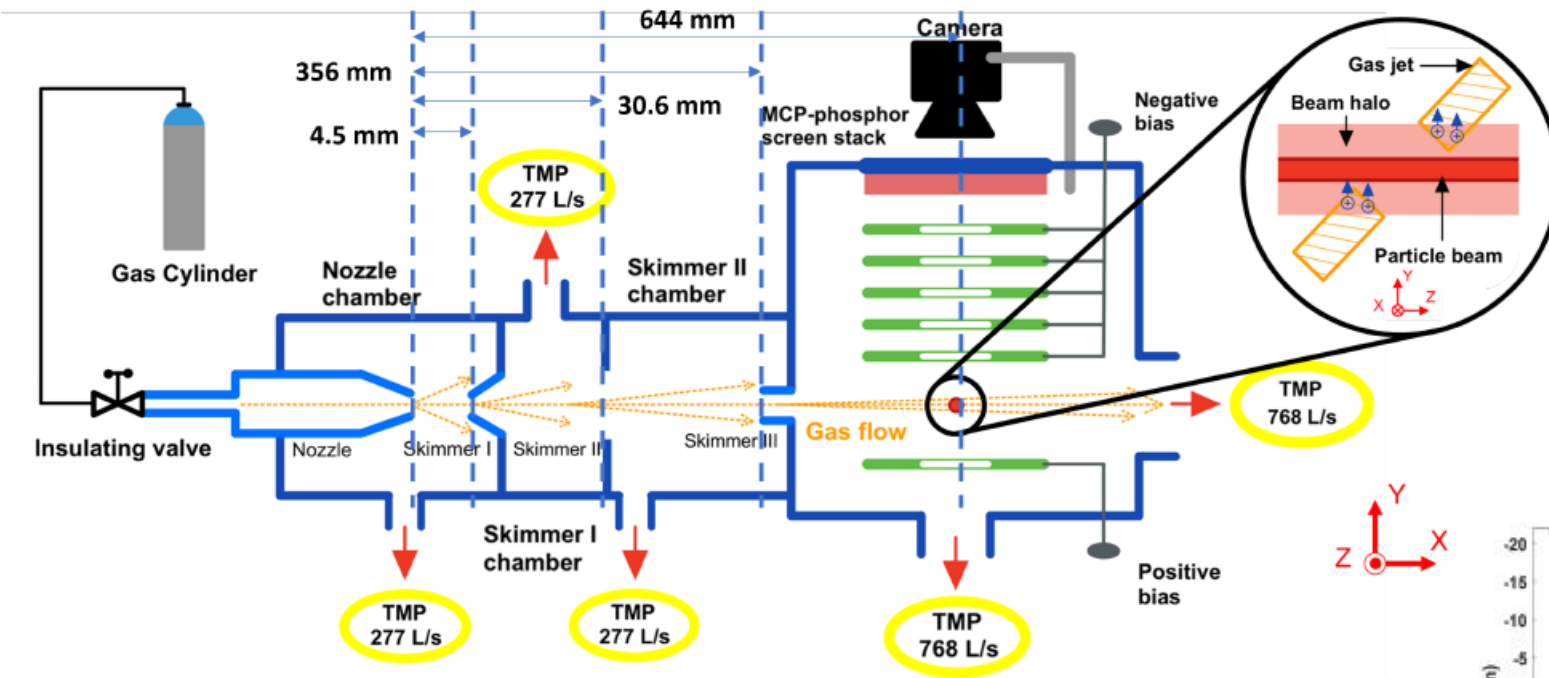


Fig. Principle of a gas-jet based beam profile monitoring

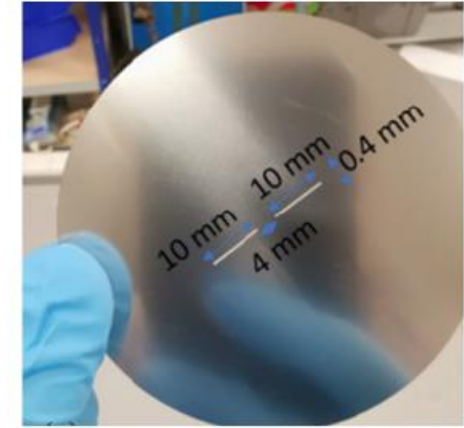


Fig. slotted 3rd skimmer

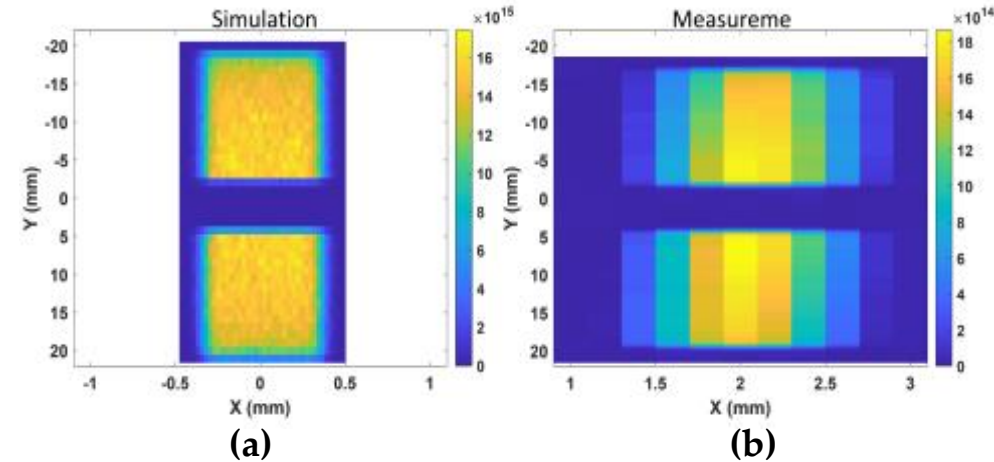
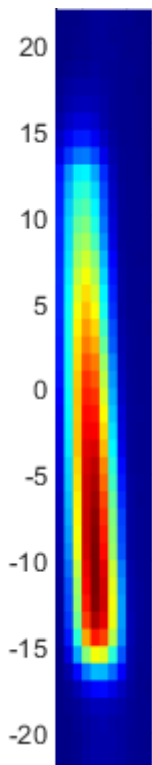


Fig. Number density distribution of the gas curtain, (a) simulation and (b) experiment

Density scan with Rectangular 2nd skimmer compared with Circular 2nd skimmer



Nozzle-1st skimmer distance	1.5mm (initial distance)
Nozzle	0.03
1st skimmer	0.4
2nd skimmer	a=0.5, b=1.8
3rd Skim	a=0.4, b=30
bellows 2-3	80mm
Nozzle-1st skimmer distance	1.5mm (initial distance)
Nozzle	0.03
1st skimmer	0.4
2nd skimmer	2
3rd Skim	a=0.4, b=30
bellows 2-3	80mm

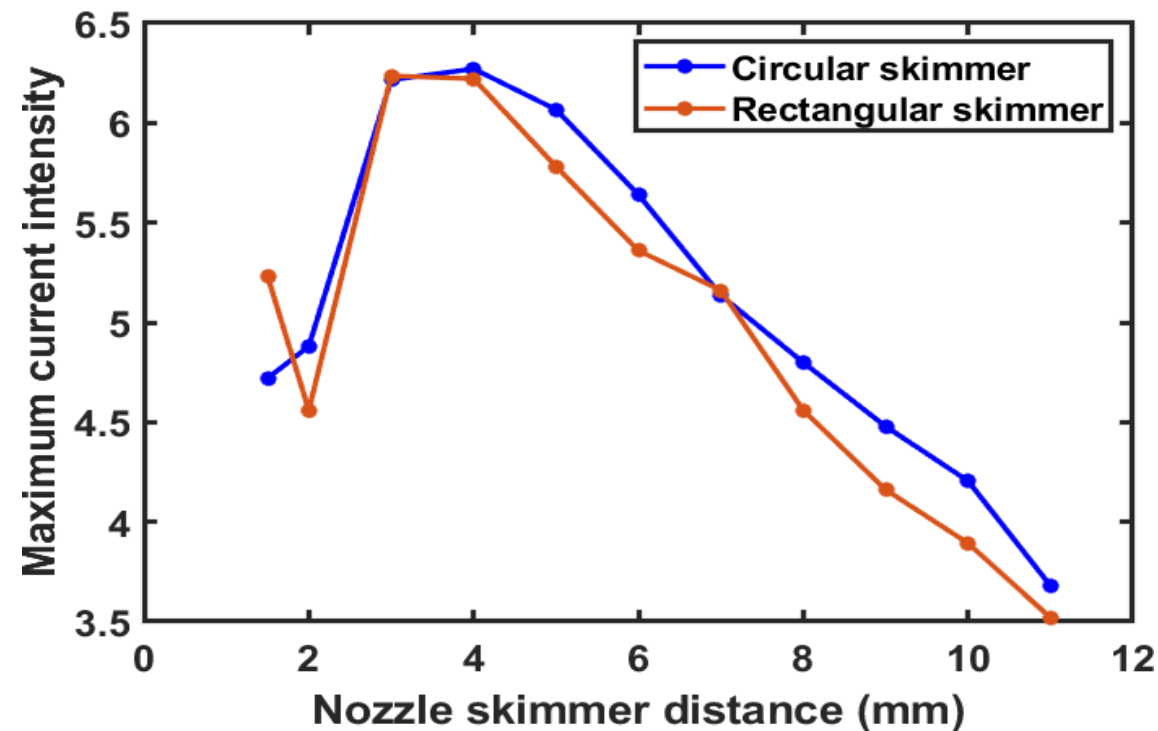
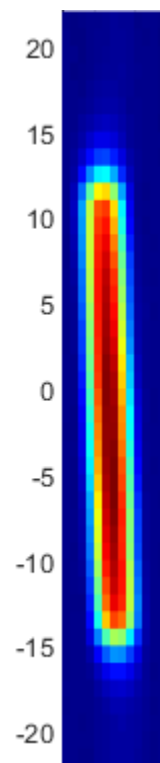


Fig. Density scan of circular and rectangular skimmer

2D profile of circular 2nd skimmer

2D profile of rectangular 2nd skimmer

Chamber pressure at nozzle skimmer distances

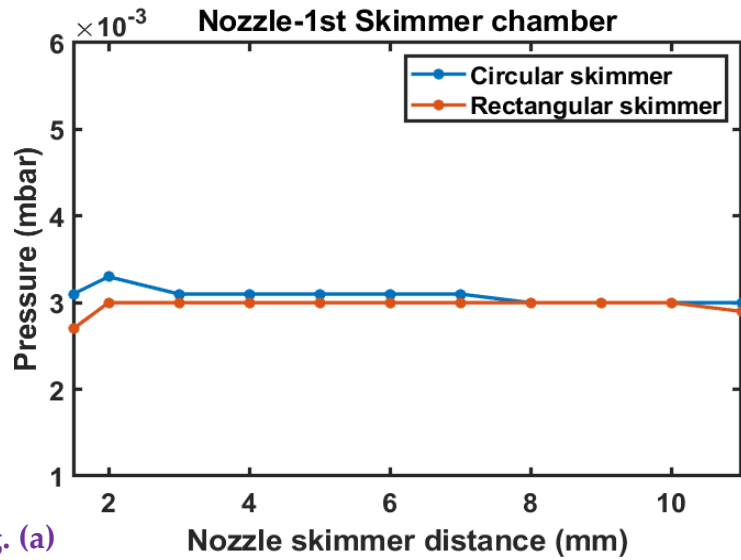


Fig. (a)

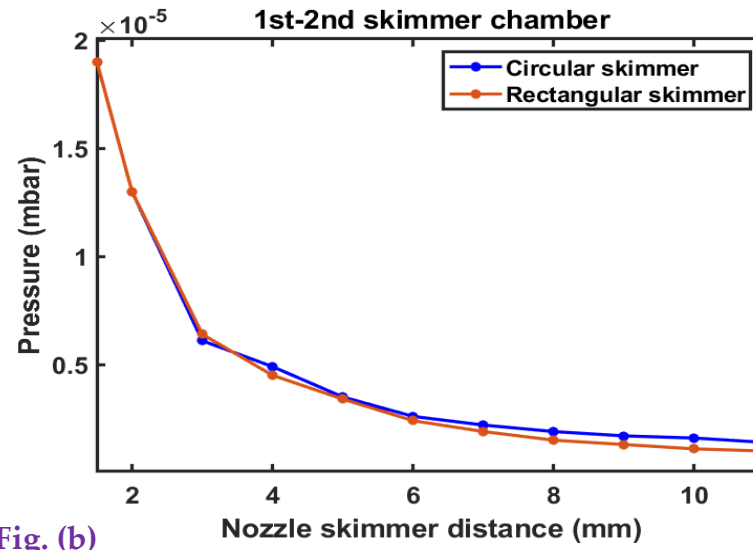


Fig. (b)

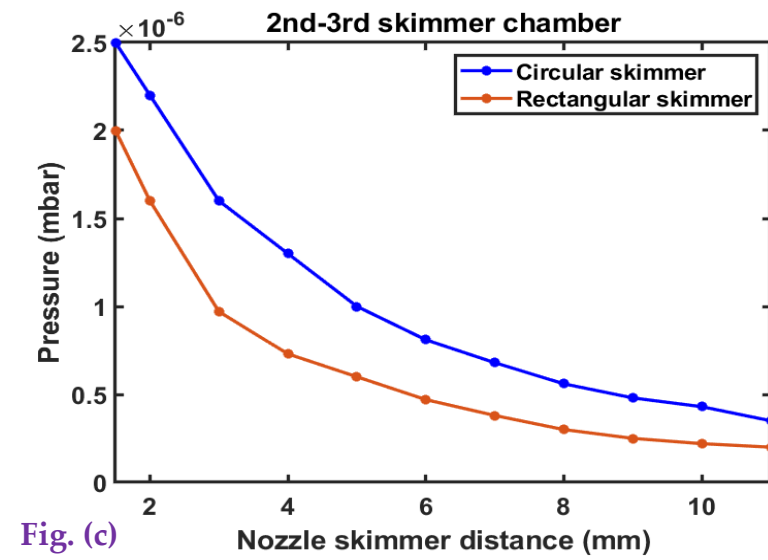


Fig. (c)



Fig. (a)-(e), represents the chambers pressure of circular and rectangular 2nd skimmers of the JEREMY setup

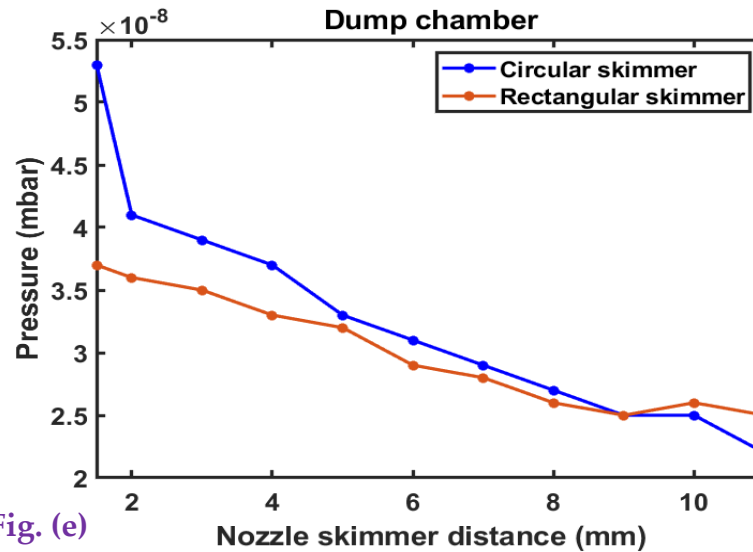


Fig. (e)

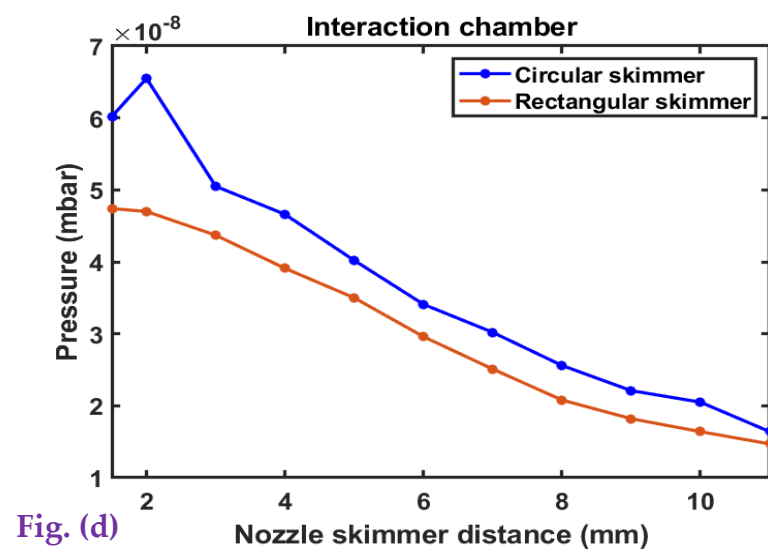


Fig. (d)

Summaries

- Gas jet calibrated with circular and rectangular 2nd skimmer.
- Background pressure measured at different bellows distance for 0.4mm and 0.7mm 1st skimmer.
- HaloJet experiment performed using slotted 3rd skimmer in the Version 2 setup, and the work also presented at IBIC 2024.
- Pulse jet (Gated injection) experiment for density measurement is planned.

THANK
YOU

Gas Jet group

Carsten Welsch

Hao Zhang

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Shakti Prasad Sethi

Photon rate

