

CI update

BGC CI team



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Cockcroft experimental update

- Oliver continue his experiments with JEREMY setup (Thesis work)
 - Gas curtain density distribution scan
 - Background pressure tests
 - Validating the MOGA code
- Shakti works on the pulse jet setup
 - Assemble the pulse nozzle by Parker inc.
 - Prepare the chamber and detail experimental plan.
- Cross-section analysis
 - Initial analysis was communicated through collaboration meeting in Liverpool.

JEREMY & TPMC BG Validation

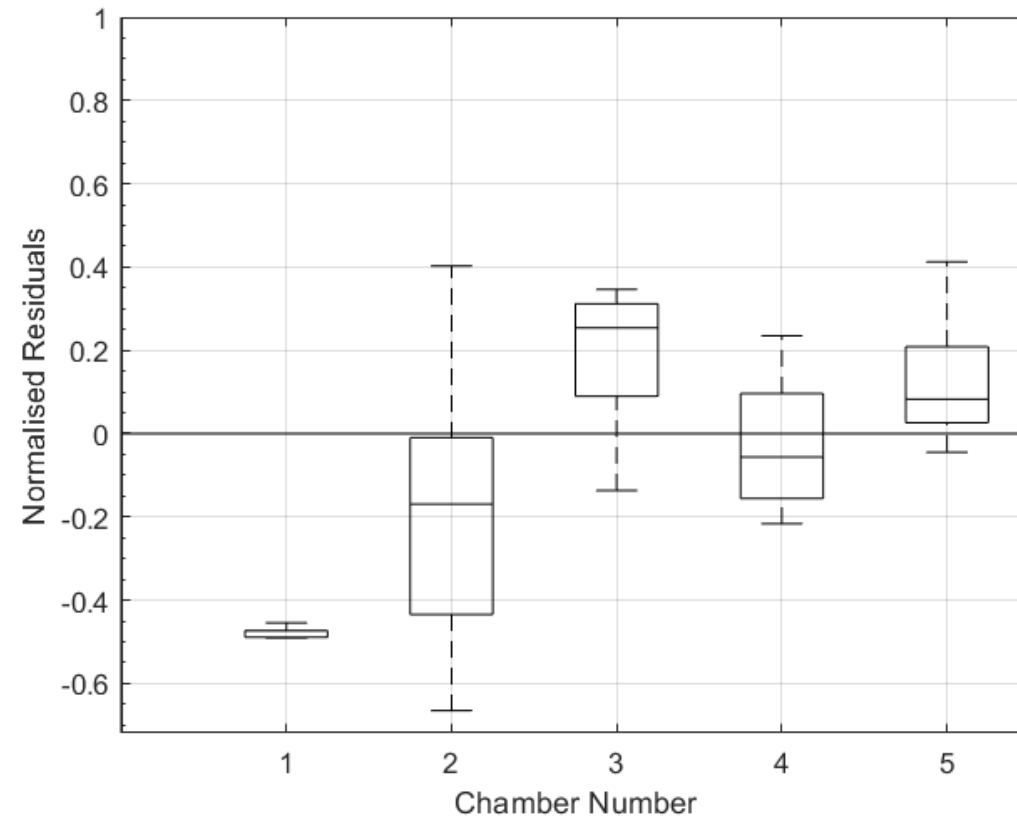
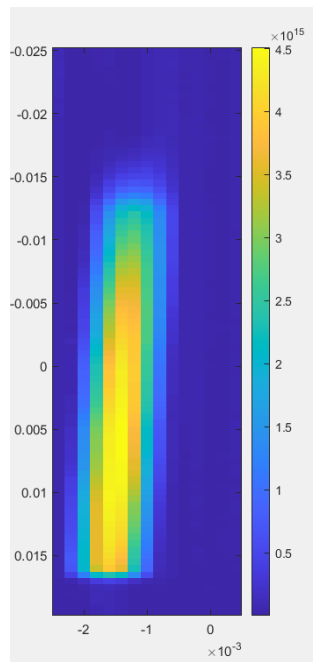
$$\Delta \dot{m}_{Jet} + \Delta \dot{m}_{Effusion} = \dot{m}_{Pumping}$$

1 st Skim	2 nd Skim	3 rd Skim	4 th Skim
400 um	2 mm	0.4x30 mm	4x60 mm

- Primarily thesis content, but increases confidence on MOGA work for future BGC's.

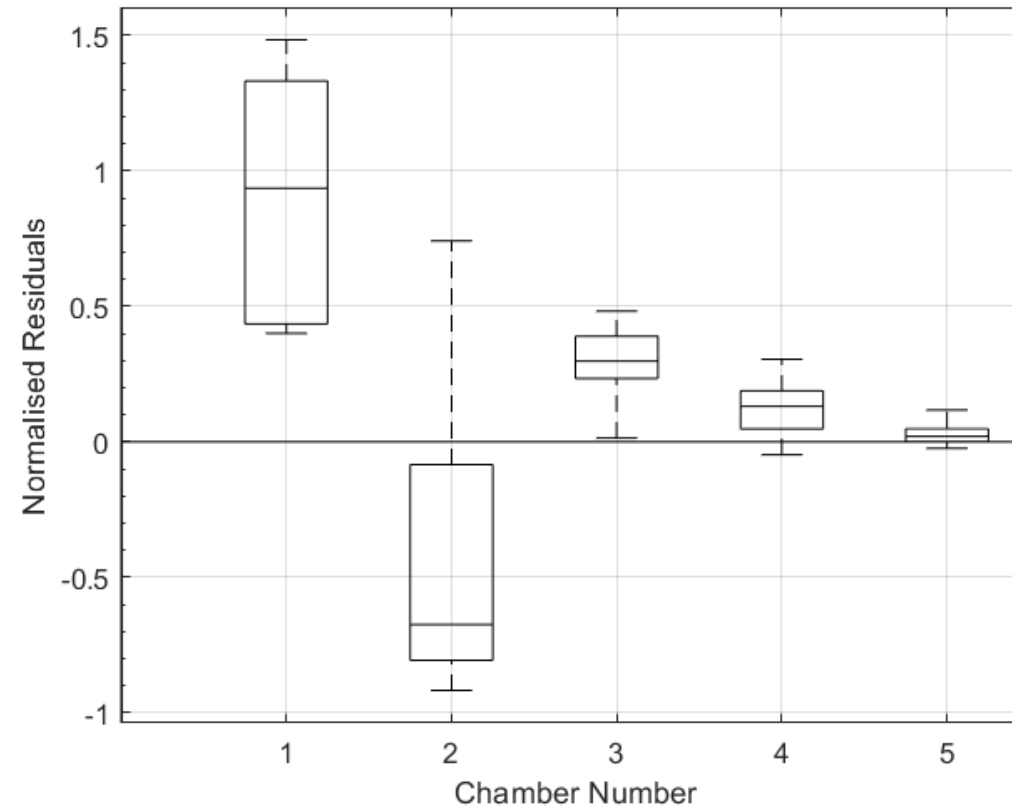
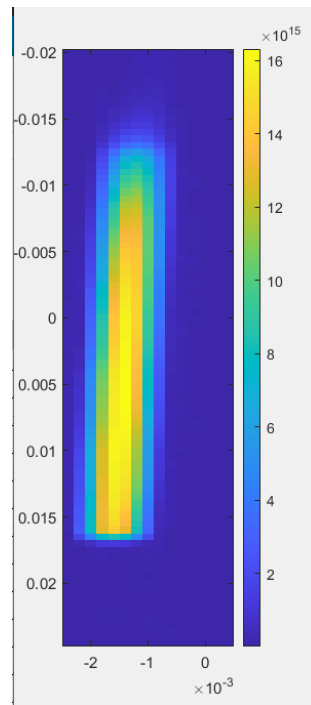
N2

- N2 at 6 bar abs.
(rotated by $\sim 0.8^\circ$)



Ne

- Ne at 6 bar abs.
(rotated by $\sim 0.8^\circ$)



Cross-section study with Ion

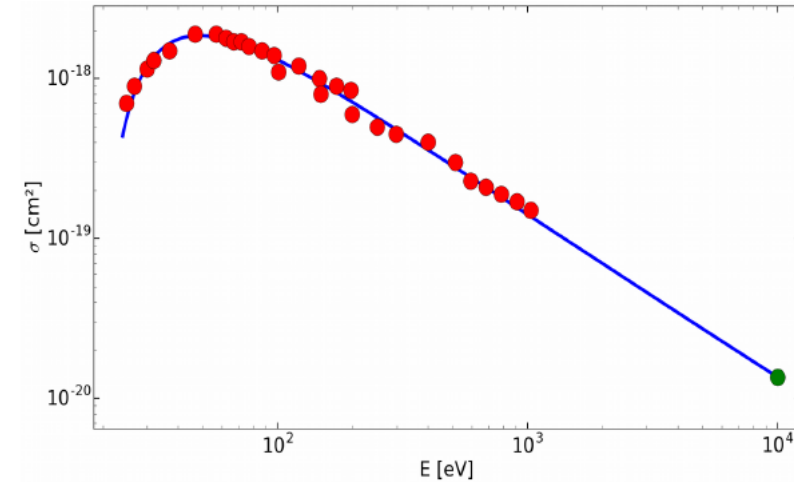
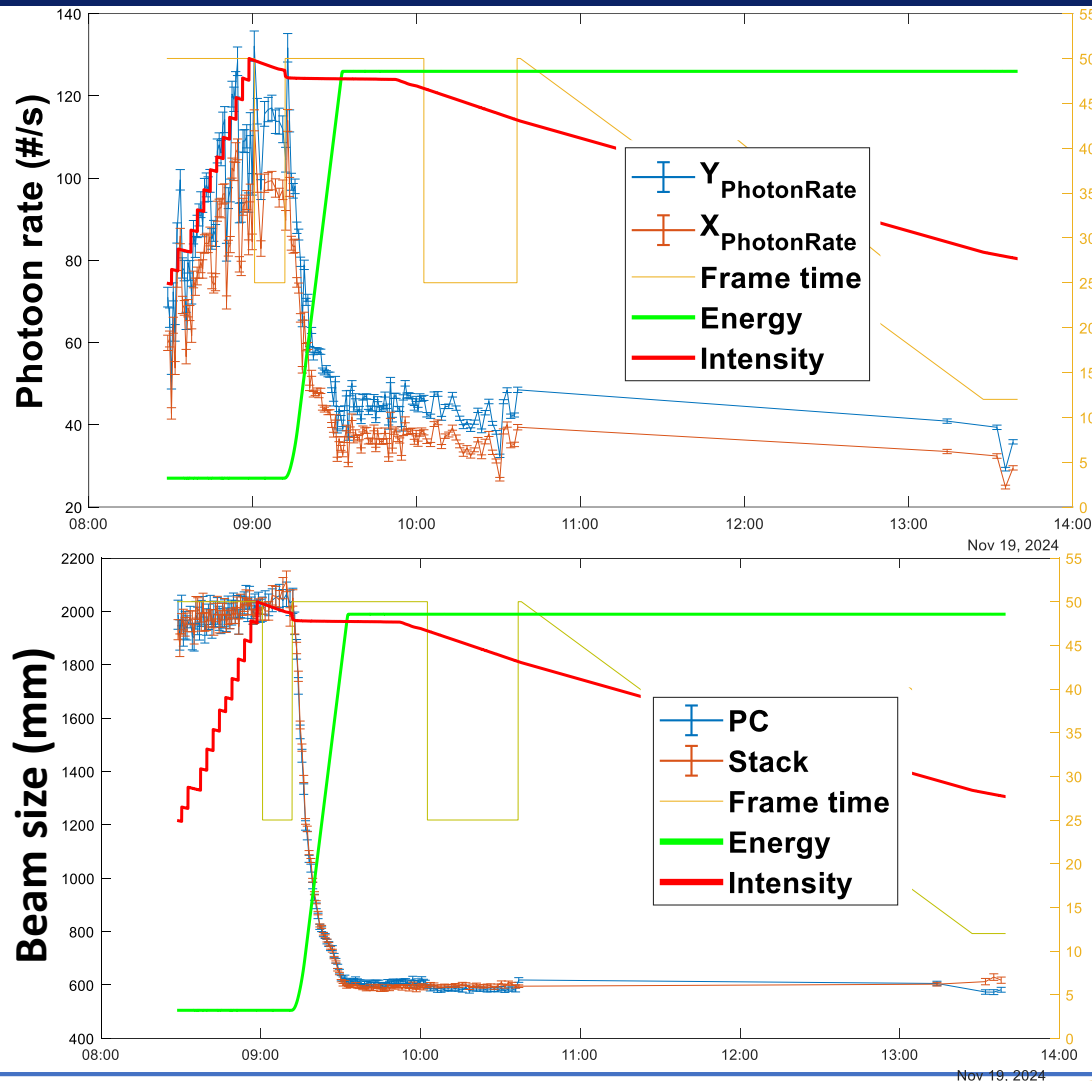


Figure 8: Electron excitation, direct excitation cross-sections of the $2p_1$ level leading to the $2p_1 - 1s_2$ transition of Ne. Data from [15, 16]: red symbols, estimated cross-section: green symbol, fit curve: blue line.

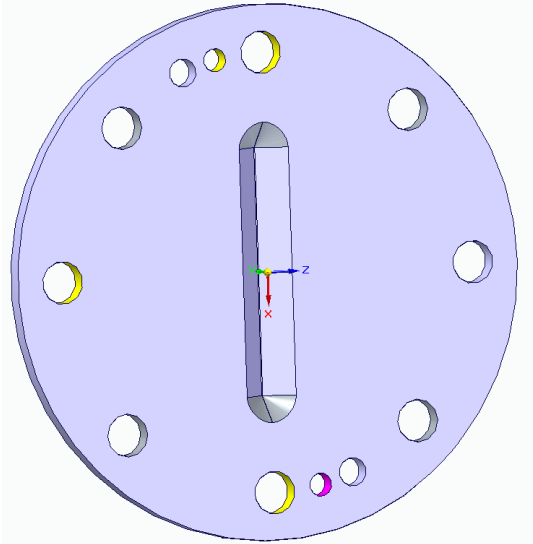
Proton excitation

Cross-section data for the fluorescence at 585.4 nm is available for a few energies up to 1 MeV in [15]. The comparison with the data for electrons strongly suggests that starting with energies of a few hundreds of keV one can apply the principle of equal velocities, which states that electrons and protons of equal velocities will give rise to the same excitation cross-section. Thus one can estimate the cross-section for 7 TeV protons from the one estimated for 3.8 GeV electrons by the above formula. This results in $\sigma_{585}^p \approx 4.7 \cdot 10^{-22} \text{ cm}^2$. However this result is based on an extrapolation over six orders of magnitude and may be affected by a large and hard to estimate error.

BGC 4.1 for EBTS

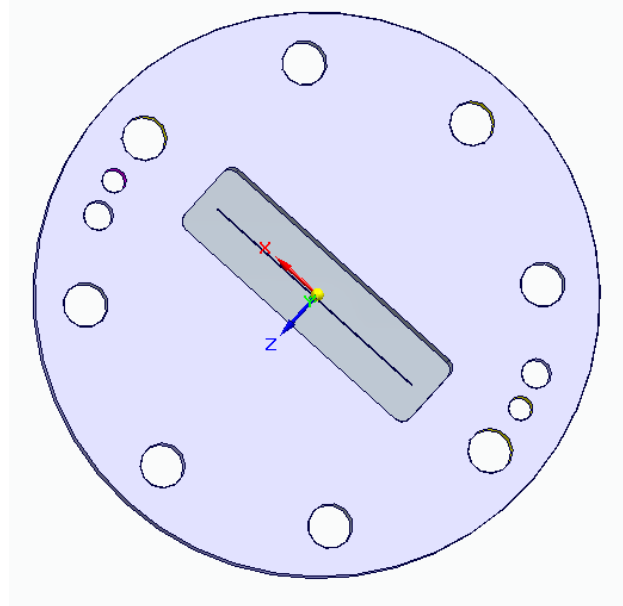
- Chambers
 - In end of February due to the shortage of ss316LN materials.
 - Weekly meeting setup with Manufacturer
- Other mechanical parts
 - Mid of February.
- Pumps are ready
 - Using pumps from JEREMY for Tests at CI.

Difficulty with 3rd skimmer



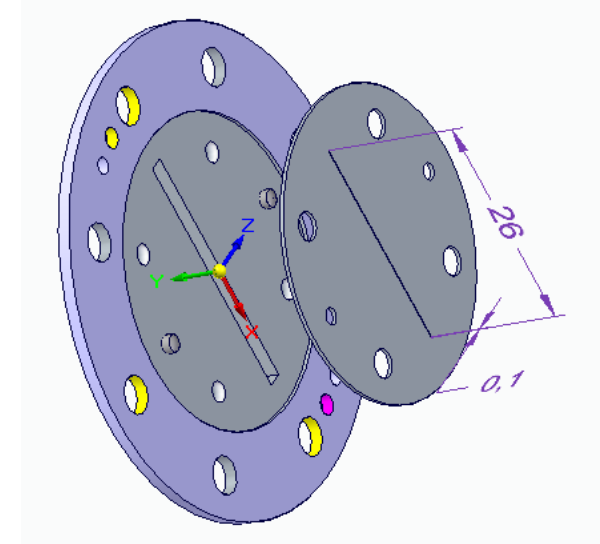
Original design from v3

- Hard to do with CNC machine



Modified design from v3

- Try to combine CNC and advanced machining such as Laser and chemical etching
- Still challenge



Two parts design

- CNC machine the holder
- Slits on sheet metal done by Laser or chemical etching (achieved before)
- Any potential cons?

RESULTS

The following figures show the results obtained.

All parts were measured using a Vision Engineering Swift-Duo (UKAS accredited) measuring system.

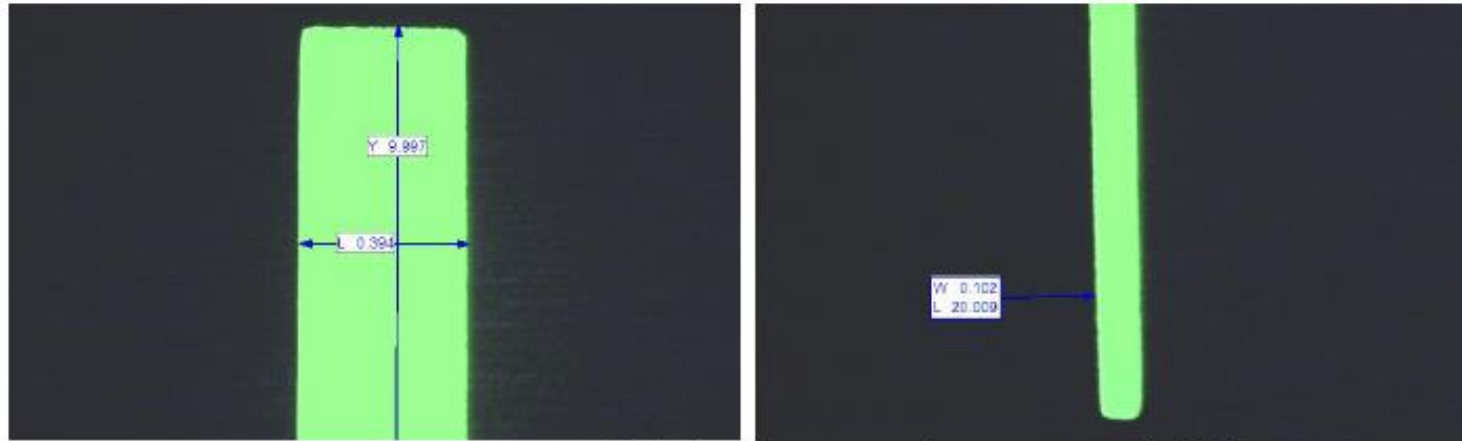


Figure 1. Measurement of 3rd Skimmer part with 10 x 0.4mm slit (left) and 3rd Skimmer part with 20 x 0.1mm slit (right).

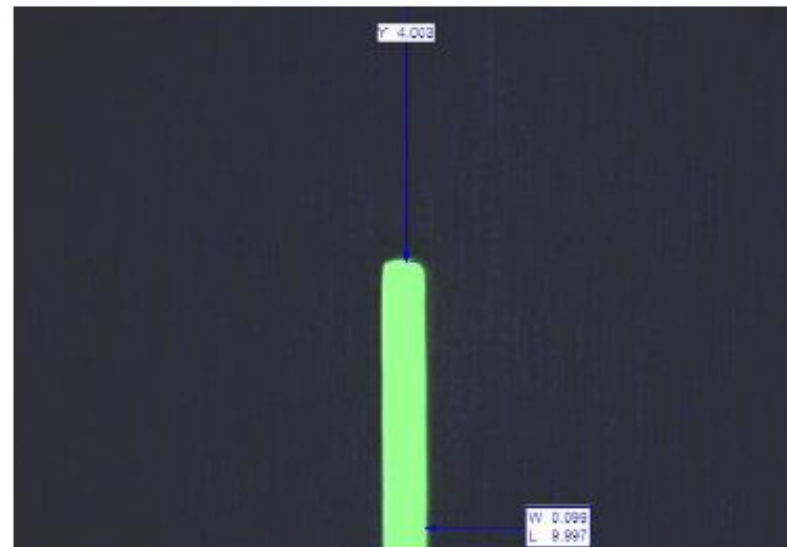


Figure 2. Measurement of 3rd Skimmer_2 part with 10 x 0.1mm slits.

Planned journal articles

- **2024:**

- “Beam gas curtain monitor: Vacuum studies for LHC integration and operation”
 - lead by Christiana lead, published in PRAB
- “Simulation and experimental studies into a supersonic gas jet curtain for beam profile monitoring”,
 - mainly about the simulation method,
 - analytical calculation for continuum flow + quitting surface for transition + Monte Carlo simulation for molecular beam tracking.
 - Lead by Hao, in preparation for Vacuum or Nucl Instr Meth A, delayed.
- “Measurements at 7 TeV with protons and lead ions”, Delayed
 - lead by Ondrej and Hao, in preparation for PRL.
- BGC@EBTS results from 2023, Delayed
 - lead?
 - Potentially Nucl Instr Meth A or Rev Sci Instr.

- **2025:**

- “MOGA simulation”
 - lead by Oliver, potentially Vacuum.
- “V3 with full technical details”
 - Mechanical design and gas flow test
 - Optical system and resolution test
 - LHC measurements in details (Visible and UV)
 - Phys Rev AB, Lead? Danielle and Hao? (Initially Ondrej, but full- time job now)
- “Cross section study”
 - lead by Hao/Shakti/Oliver, Phys Rev C?

Plan

- Starting the pulse jet work
- BGC 4.1 test
- Continue cross-section analysis
 - Cross check the CI code with Timber data
 - Proton data