

Cockcroft Collaboration

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Status of the collaboration

We need a group photo!

- What a year!! Integration in LHC, animation, measurements with protons and lead ions, invited talk at IBIC. **WOW!!**
- Annual feedback from CI Scientific Advisory Committee (11/2023):
 - *SAC congratulates CI on the very successful HL-LHC phase 2 such as the delivery (...) of the gas jet monitor.*
 - *SAC encourages CI to request funding to continue the CI achievements of HL-LHC phase 2 into the commissioning/operational phase.*

Major milestone reached



- Gas jet monitor successfully installed in the Large Hadron Collider.
- Fantastic work by all involved – very emotional moment 😊
- Successful measurements with both, proton and lead ion beams (above)...paper/s in preparation.

Quantum Helium Atom Microscope



- Quantum technologies showcase
- Great work by Sandy, Constantinos and Narender
- Maybe opportunity also in CERN's quantum initiative?



- *'Optical transition radiation measurements of a high intensity low energy hollow electron beam on electron beam test facility'*, O. Sedlacek, et al.
- *'Optimization of a gas jet-based beam profile monitor for high intensity electron beams'*, O. Stringer, et al.
- *'Imaging a high-power hollow electron beam non-invasively with a gas-jet-based beam profile monitor'*, H. Zhang, et al.
- *'Development and testing of quantum gas jet beam profile scanner'*, N. Kumar, et al.
- *'Characterization and analysis of supersonic gas jets using interferometric measurement methods'*, A. Webber-Date, et al.

Planned journal articles

From 2022 plans:

- “A gas curtain beam profile monitor using beam induced fluorescence for high intensity charged particle beams“, Appl. Phys. Lett. 120, 174101 (2022)
- “Characterization of a supersonic molecular beam for charged particle beam profile monitoring“, Vacuum 208 (2023) 111701

Submitted:

- “Beam Gas Curtain monitor Phase II: vacuum studies for LHC integration and operation“, Phys Rev AB (2023)

Planned:

- Simulation and experimental studies into a supersonic gas jet curtain for beam profile monitoring, in preparation for Vacuum or Nucl Instr Meth A (delayed,...needs more data @ CI)
- EBTS results @ COOL23 – now expand to full article in Nucl Instr Meth A or Rev Sci Instr?
- Measurements at 7 TeV with protons and lead ions – PRL or PRX
- V3 with full technical details – Phys Rev AB (Ondrej’s thesis!)
- Cross section measurements – Phys Rev C?
- Gas jet applications: Microscopy, medical accelerators (DCF), plasma targets, nozzle-skimmer optimization, simulations,...

Planned conference papers

- **IPAC24** (will have an industry booth!)
 - Gas Jet Based Beam Profile Monitor for the Electron-Beam Test Stand at CERN
 - First measurement of the LHC proton and lead ion beam profiles using the beam gas curtain monitor
- **IBIC24**
 - Systematic study into LHC proton and lead ion beam profile measurements using the beam gas curtain monitor
- HLLHC Meeting – presentations across full range of studies to date
- **IBIC25** (*Liverpool*)
 - We hope you can all come and join us! 😊



Funding successes

- *HLLHC-UK phase I, STFC PPRP, £185k + CI + CERN*
- *HLLHC-UK phase II, STFC PPRP, £766k + CI matching funding*

- *Quantumjet – STFC IPS project, £110k*
- *qHAM – Helium atom microscope, Innovate UK, £50k*
- *JetDose – in-vivo dosimetry, STFC CLASP, £330k*

Funding plans

- Gas jet R&D should be part of Cockcroft Institute Core Grant proposal
- In discussion with STFC on HLLHC phase III (exploitation)
- FCC/EIC/ESS/etc

- Medical applications: Online dosimetry and LhARA

- Quantum scanner and microscope

- Simulations HPC

Recruitment

- **Postdoc** will start on 1 January 2024 with focus on simulations, ML/AI: Dr Qi Ding
- **EuPRAXIA-DN Fellow** will start 1 January 2024: Farhana Thesi MP
- Additional **2-year Postdoc** is being recruited, advert out with deadline on 7 January 2024 (<https://bit.ly/3sEPRjR>)
- Additional **PhD student** to start in 2024 between ULIV and CERN within LIV.INNO framework (2+2) (<https://shorturl.at/knqYZ>)



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Summary & outlook

- What an amazing and eventful year!! Many thanks to everyone for the fantastic collaboration.
- Team keeps growing – please give a warm welcome to our new starters!
- Publications now in focus: Journals and conferences
- Plans in place for additional funding to secure continuation
- Need to discuss and agree future use and program



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