

# Cockcroft Collaboration

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# Status of the collaboration

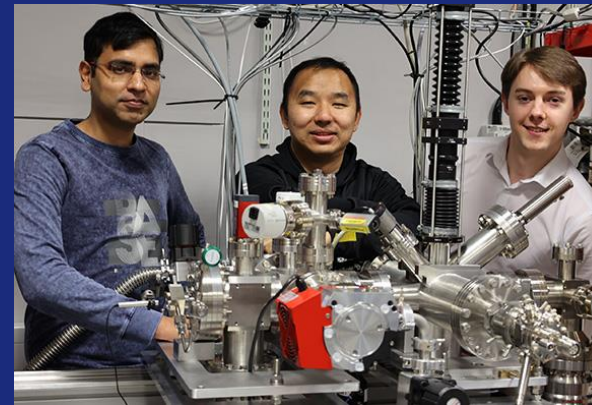
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**We need a group photo!**

- Very challenging two years – many thanks everyone for great focus, dedication and perseverance!
- Annual feedback from CI SAC – *“Gas Jet Monitor R&D is world-leading development”*

# Major milestone reached

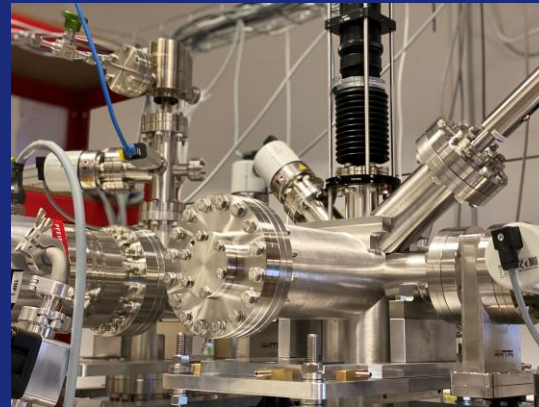
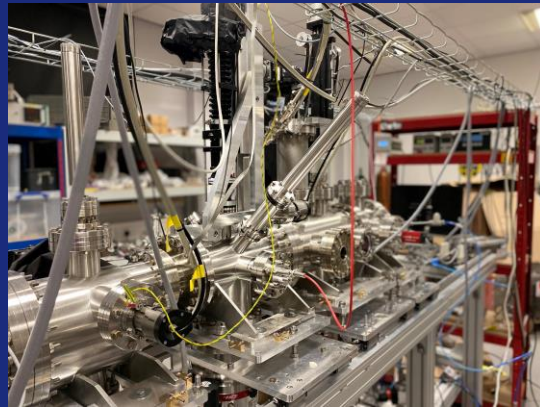
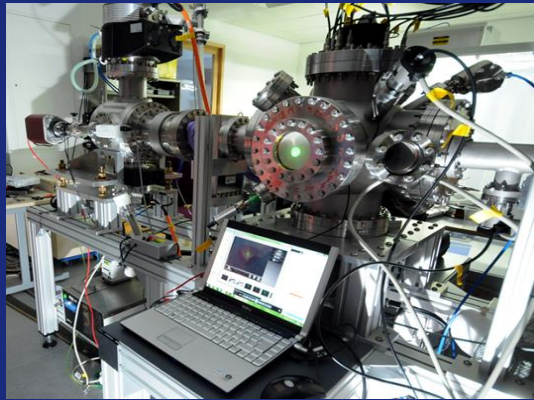
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- Gas jet monitor successfully delivered to CERN after all tests completed at the CI.
- All shock sensors still perfectly fine 😊
- ...it just about fit through the doors!!

# £200k lab upgrades

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- Flexible piping system for gas delivery to experimental setups
- Interlocked laser curtain around existing bench to allow laser/vacuum integration
- Different high spec cameras
- Also improved: optics lab



## Planned journal articles

- **Applied Physics Letters** – “A novel gas curtain beam profile monitor using beam induced fluorescence for high intensity charged particle beams”, positive feedback, not accepted yet...
- Paper on density scan method for *NIM A* or *Vacuum*
- Fluorescence cross section measurements at 7 TeV – world’s first!
- Measuring LHC beam profile during run 3, understanding spatial resolution
- BGC @ e-beam test stand incl full characterization of hollow electron beam
- BGV/BGC opportunities, various applications
- Many more articles on specific studies, simulations and measurements across all setups and projects in planning...

## Planned conference papers

- IPAC
  - Design of a Prototype Gas Jet Profile Monitor for Installation in the LHC
  - A Gas Jet Beam Profile Monitor for Beam Halo Measurement
  - High Resolution Quantum Gas Jet Beam Profile Monitor
  - A Modified Nomarski Interferometer to Study Supersonic Gas Jet Density Profiles
- LINAC *(in Liverpool!)*
  - A quantum gas jet for profile measurements in linear colliders
  - ???
- IBIC *(in Warsaw)*
  - ???

## 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*

## Recruitment

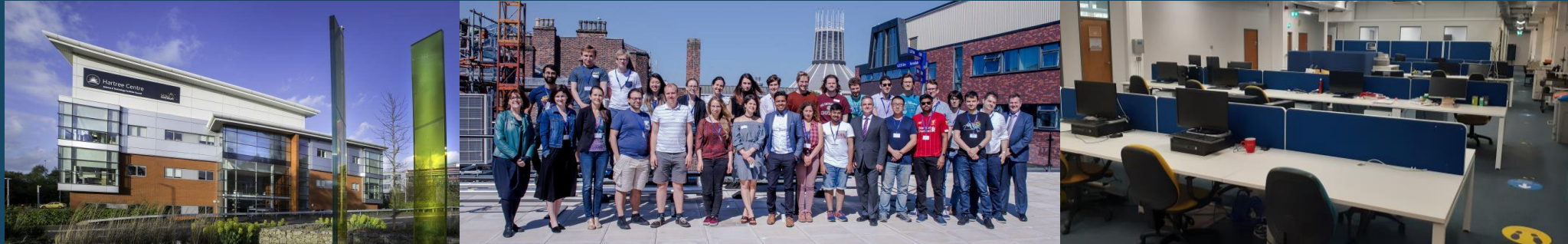
- Dr Hao Zhang appointed to a permanent position as Research Coordinator in the QUASAR Group – **Congratulations!!**
- Narender Kumar will continue work on gas jet through JetDose, current contract until 2024;
- Additional **3-year Postdoc** is being recruited, advert will go out on 1 April, application deadline: 31 April 2022
- Additional **PhD student**: Will Butcher – *Gas jet for in-vivo dosimetry*
- Additional links with CERN-BI through LIV.INNO (*LHC LDM and profile reconstruction through ML*)



# LIV.INNO



# Training environment



- Liverpool has outstanding track record in postgraduate training
  - Cohort-based training in data science, research and innovation, complementary skills, and courses offered by partners
  - Inclusive environment that offers some unique opportunities for CUWIP)
- LIV.INNO students (e.g.

5 Marie Curie ITNs

STFC CDT in Data Science

Lead/partner in EPSRC CDTs

STFC ETCC lead

# Research environment



- LIV.INNO will focus on innovation in STFC science and industry applications
- Perfectly aligned with institutional DIGITAL theme, benefiting from Virtual Engineering Centre, new £12M Digital Innovation Facility, and LJMU's robotic telescope
- Wider impact through placements, outreach symposium, and "DataAid"
- Research & Impact Board will support responsible research and translation

# Support for LIV.INNO



- Excellent commitments from partners and universities:
  - Large number of studentships confirmed;
  - Fantastic placement opportunities and joint projects;
  - Bespoke student areas and training spaces;
  - Centre Manager and admin support.
- At least 12 LIV.INNO students will start this year.



LIV.INNO



# Work plan

Deliverable No.	Deliverable Name	Complete by	Type
D3.2.1	Get-jet monitor engineering design: report that shows proposed design fits specification and can be built	31/12/2021	Document
D3.2.2	Final design: report with final drawing, integration, costs production and commissioning plan	31/09/2022	Document
D3.2.3	Delivery of interaction chambers for integration in Hollow Electron Lens build-up	31/03/2023	Hardware
D3.2.4	Delivery of gas-jet monitor unit 1, pre-tested at CI, for integration in Hollow Electron Lens and testing, participation in commissioning tests	31/03/2024	Hardware
D3.2.5	Delivery of gas-jet monitor unit 2 for integration at CERN, pre-tested at CI	31/12/2024	Hardware



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## Summary & outlook

- Very good progress and excellent results thus far;
- Team has grown considerably over time;
- Publications now in focus, conferences + additional funding;
- Exciting experimental program as well as underpinning simulations to further optimize system;
- Some challenges around HEL and international collaboration.



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