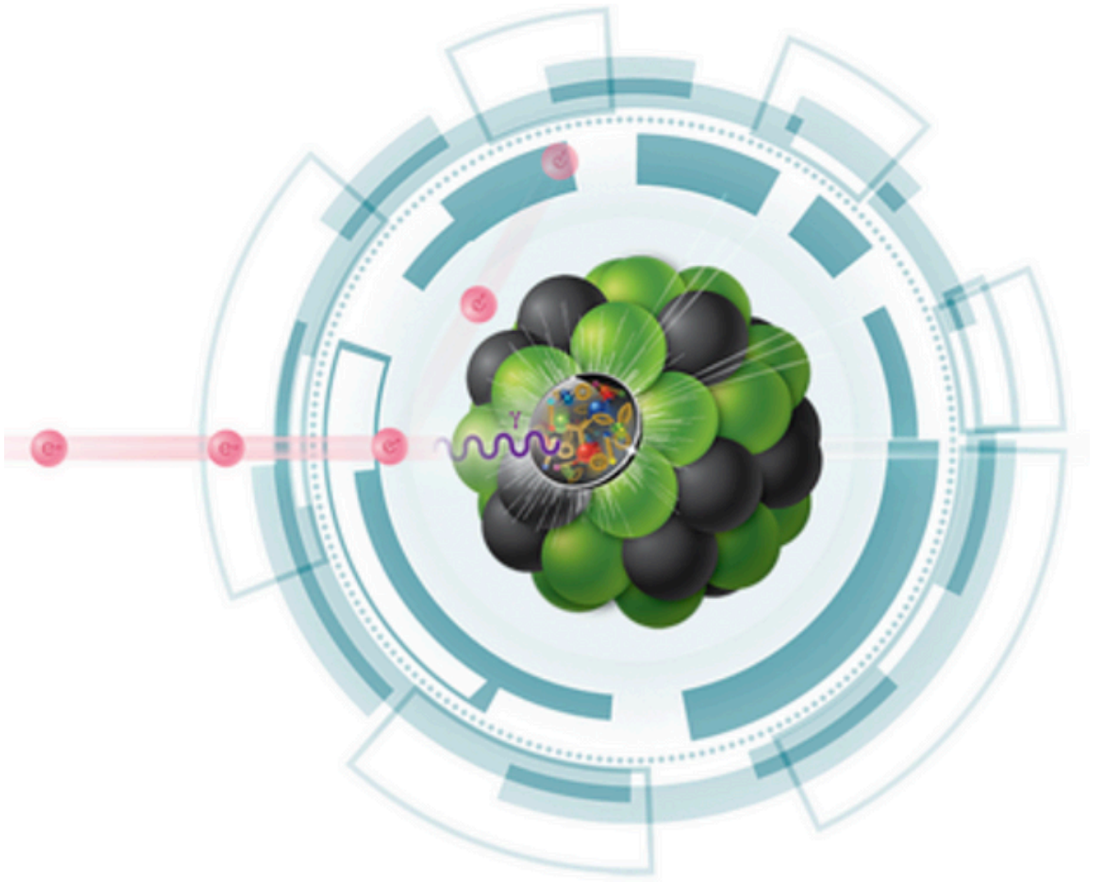
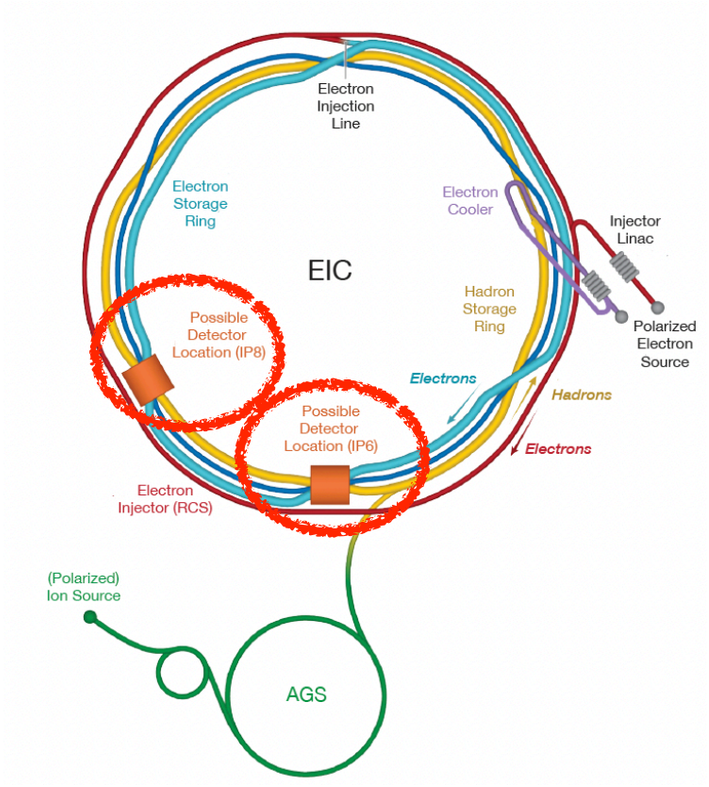
Summary of UK Involvement in ECCE



EIC Durham Workshop

R. Montgomery, C. Gwenlan
22/09/21

Introduction to ECCE



Original EOI:

- https://indico.bnl.gov/event/8552/contributions/43193/
- Contact persons: Or Hen (MIT), T. Horn (CUA), J. Lajoie (ISU)

Goals:

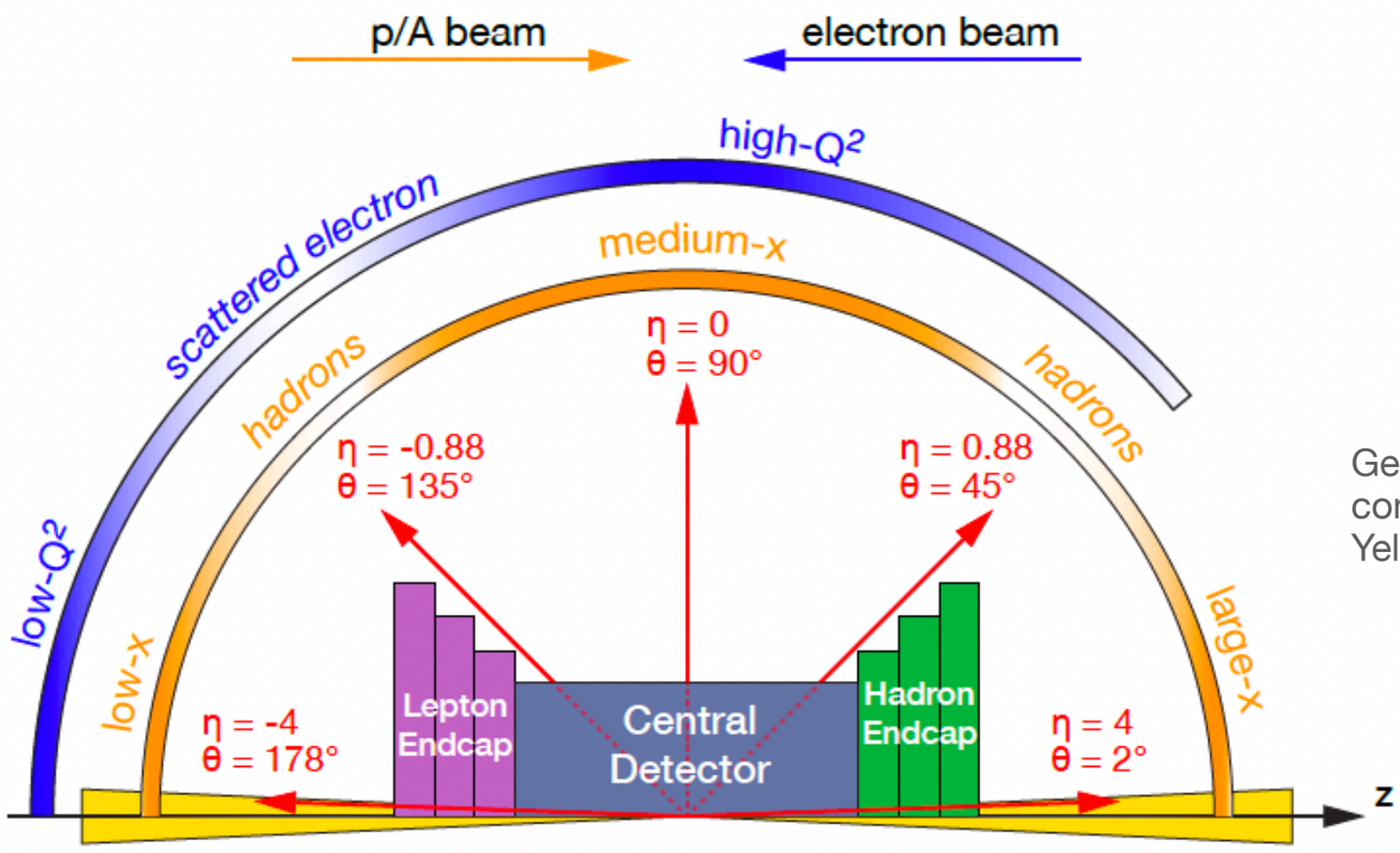
- Develop detector capable of delivering full EIC science program as outlined in Yellow Report (YR) and follow guidance in YR on detector design
- Explore utilisation and/or upgrades of existing detectors and infrastructure that would enable EIC science by meeting YR performance requirements
  - Reduces technical and scheduling risks
  - Cost savings in detectors can be re-invested
- Assemble talent and expertise to develop and build new equipment when required

→ ECCE consortium studying both IP6 and IP8 options, utilising existing BaBar 1.5T solenoid field

  - e.g. original studies into re-use of BaBar solenoid: arXiv:1402.1209

→ ECCE is a cost effective, flexible and optimised detector to meet requirements of full science program!

Introduction to ECCE



General detector concept from Yellow Report

- ECCE detector concept undergoing constant and rapid development
- Detector similar in concept to YR reference detector
  - more developed/advanced in sub-detectors and implementation
- ECCE detector is modelled in detail in geant4 via Fun4All software
- Simulations on-going to converge on final proposal design, e.g. detectors, physics, computing methods…
- For more info see ECCE wiki (https://wiki.bnl.gov/eicug/index.php/ECCE)

ECCE Consortium Structure and UK-based Co-Convenors and Activities

EIC Project POC
Rolf Ent (JLab)

Computing Team
Cristiano Fanelli (MIT)
David Lawrence (JLab)

ECCE Steering Committee
Or Hen (MIT)
Tanja Horn (CUA)
John Lajoie (ISU)

Institutional Board

Diversity, Equity and Inclusion
Narbe Kalantarians (VUU, co-chair)
Christine Nattrass (UTK, co-chair)
Simonetta Liuti (UVA)
Elena Long (UNH)

Computing Working Groups:

- Artificial Intelligence
  William Phelps (CNU/JLab)
- Computing and Software
  Joe Osborn (ORNL)

Detector Team
Doug Higinbotham (JLab)
Ken Read (ORNL)

Physics Benchmarks Team
Carlos Munoz-Camacho (IJCLab-Orsay)
Rosi Reed (Lehigh U.)

Editorial Team
Tom Cormier (ORNL)
Richard Milner (MIT)
Peter Steinberg (BNL)

Detector Working Groups:

- IP8/Equipment Re-use
  John Haggerty (BNL)
- Far Forward/Far Backward*
  Michael Murray (KU), Yuji Goto (RIKEN), Igor Korover (MIT)
- Tracking
  Xuan Li (LANL), Nilanga Liyanage (UVA)
- Calorimetry
  Friederike Bock (ORNL), Yongsun Kim (Sejong U.)
- Particle ID
  Greg Kalicy (CUA), Xiaochun He (GSU)
- Magnetic Field
  Paul Brindza (JLab), Renuka Rajput-Ghoshal (JLab)
- DAQ/Electronics/Readout
  Chris Cuevas (JLab), Martin Purschke (BNL)

*Alex Jentsch, Yulia Furletova (far-forward/backward POC)

Nick Zachariou, University of York

University of Glasgow and University of York contributing to low Q^2 tagger design for backward instrumentation

Physics Working Groups:

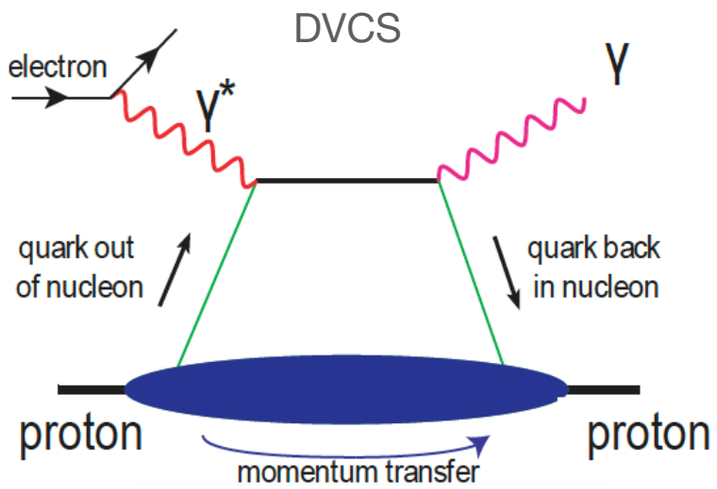
- Simulations
  Cameron Dean (LANL), Jin Huang (BNL)
- Inclusive Processes
  Tyler Kutz (MIT), Claire Gwenlan (Oxford)
- Semi-Inclusive
  Ralf Seidl (RIKEN), Charlotte Van Hulse (Orsay)
- Exclusive
  Rachel Montgomery (Glasgow), Julie Roche (OU)
- Diffractive and Tagging
  Wenliang Li (W&M), Axel Schmidt (GWU)
- Jets and Heavy Flavor
  Cheuk-Ping Wong (LANL), Wangmei Zha (USTC)
- BSM and Precision Electroweak
  Sonny Mantry (UNG), Xiaochao Zheng (UVa)

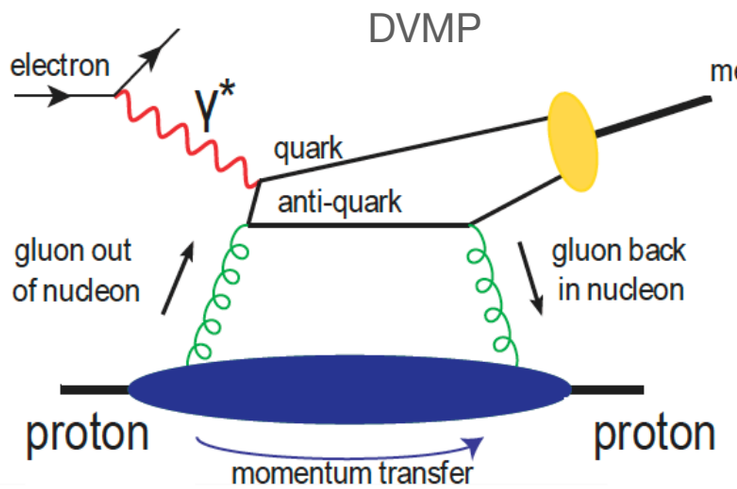
Editorial Working Groups:

- Proposal Editing, Verification and Version Control
- Costing and Management

Co-convenors from UK: leading roles organising efforts of different working groups, contributing to studies and preparing/ directing results of groups for proposal

Exclusive Reactions Working Group





From EIC "NAS Report"

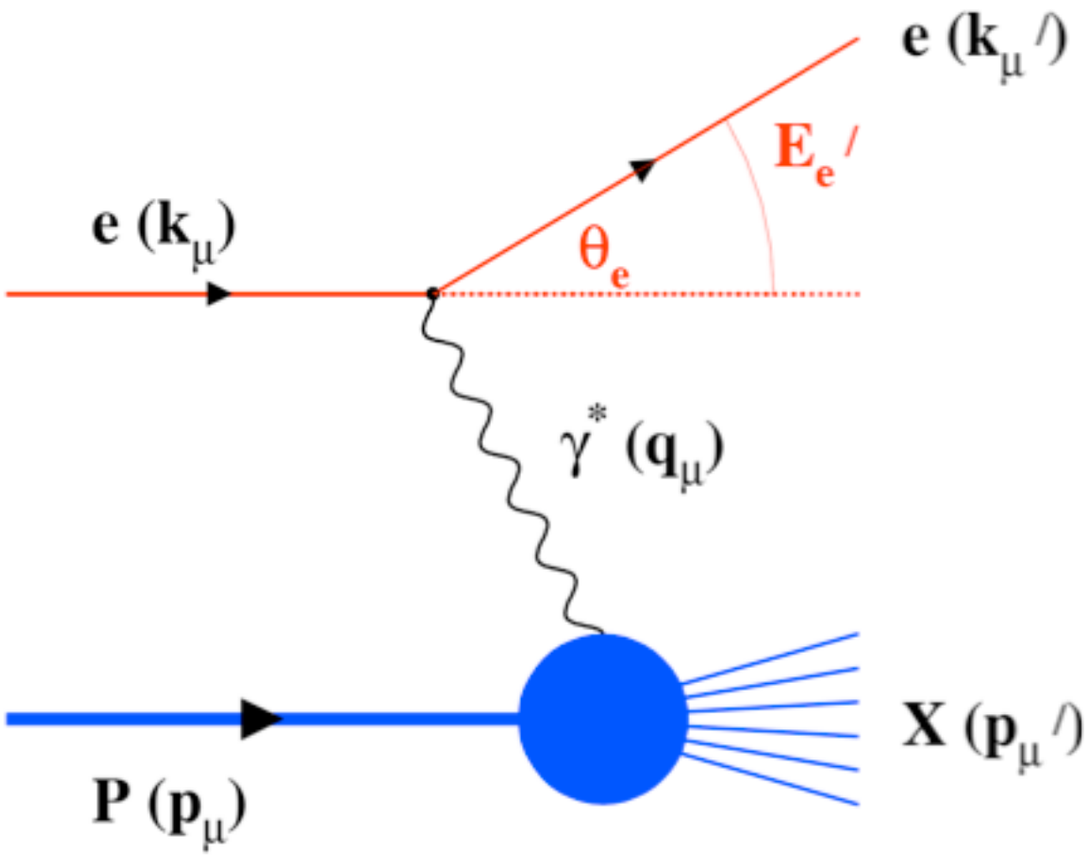
- Co-convenors: R. Montgomery (University of Glasgow), Julie Roche (OU)

- Complete measurements, i.e. scattered lepton, scattered nucleon/nuclei (either intact or dissociated) and any other final particles produced in interaction

- Key physics areas:
  - Spatial imaging of quarks and gluons inside nucleons (nucleon tomography)
  - Deeply Virtual Compton Scattering (DVCS) and Deeply Virtual Meson Production (DVMP)

- Several UK collaborators highly active within this group
- Performing benchmarking of different reactions via Geant4 studies of ECCE performances for physics observables
  - DVCS on eA: R. Montgomery, G. Penman (University of Glasgow)
  - Timelike Compton scattering (TCS) on ep: D. Sokhan, K. Gates (University of Glasgow (and Saclay))
  - DVMP on ep for J/ψ production: S. Fegan (University of York)

Inclusive Reactions Working Group



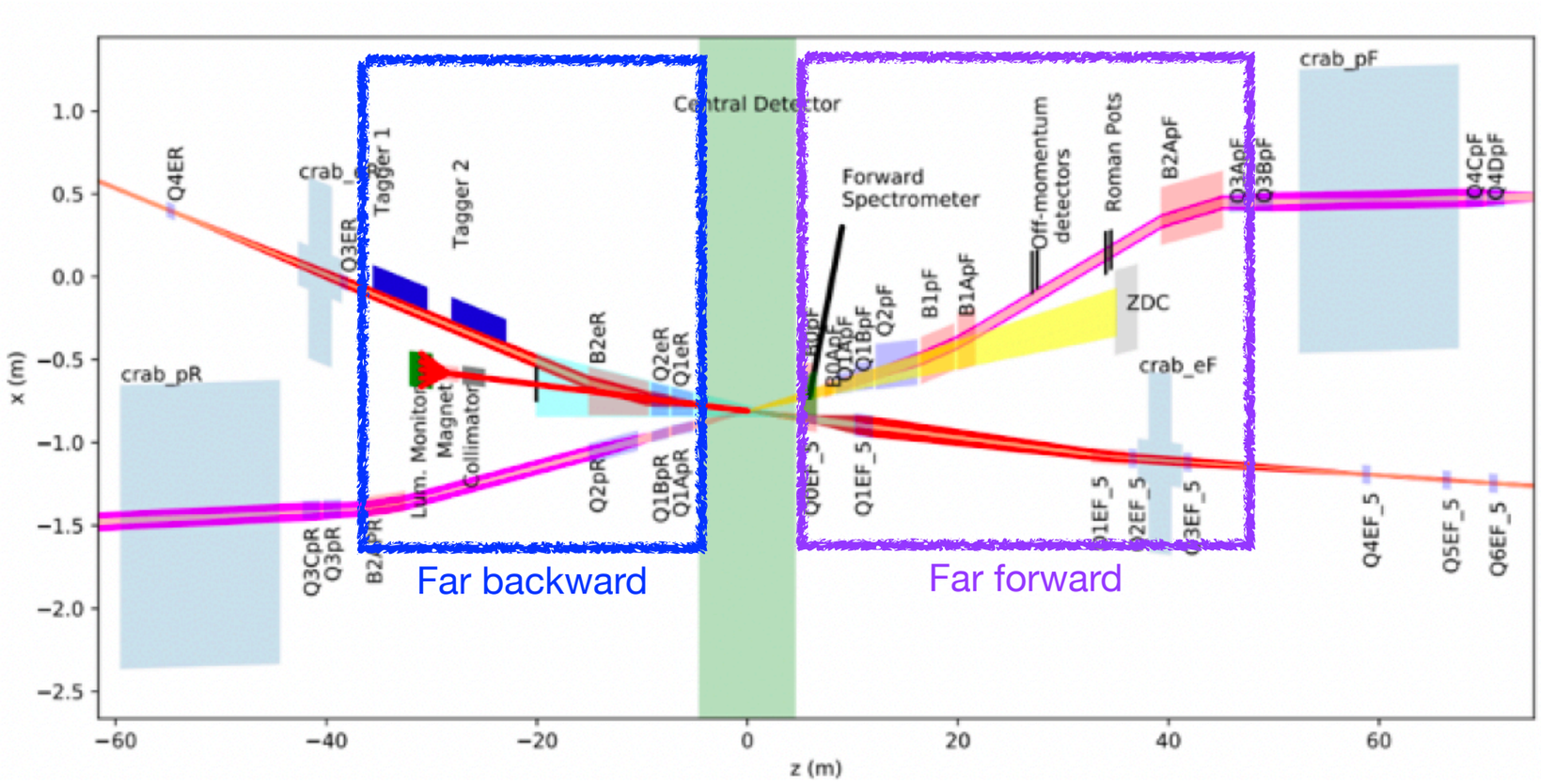
• Co-convenors: C. Gwenlan (University of Oxford), Tyler Kutz (MIT)

• Inclusive neutral- and charged-current DIS – final states requiring only scattered lepton

• Key physics areas:
  • unpolarised parton structure of proton, nuclei
  • proton spin structure
  • synergies with EW and BSM physics

- UK activity from C. Gwenlan on:
- Main observables being studied
  - Double differential DIS cross sections (e.g. $d^2\sigma/dQ^2dx$) for several beam configurations
- Extractions from cross sections being studied
  - structure functions, asymmetries

Far Forward/Far Backward Working Group



General concept from Yellow Report

- Combined far forward/far backward working group
- Far Backward Convenor: N. Zachariou (University of York), organising efforts for the Lumi monitors and the low Q^2 tagger
- Far Forward co-convenors: I. Korover (MIT) and M. Murray (KU)

- UK are active in the design of a low Q2 tagger
- K. Livingston, D. Glazier and S. Gardner (University of Glasgow) and N. Zachariou (University of York) working on design of low Q^2 tagger for ECCE
  - Design based on Timepix ASIC from CERN
  - Working on Geant4 implementation
  - → See talk from K. Livingston today at 10:20am - The UK and Timepix for EIC

Summary

- ECCE studies on-going to converge on final proposal for December submission deadline

- UK institutions very active within detector and physics benchmarking teams
  - Far Forward/Backward Working Group (backward)
  - Exclusive Working Group
  - Inclusive Working Group
  - For more info on these activities, or ECCE in general, please contact co-convenors: Rachel (rachel.montgomery@glasgow.ac.uk); Claire (claire.gwenlan@physics.ox.ac.uk); Nick (nick.zachariou@york.ac.uk)

- ECCE is a very welcoming collaboration for new colleagues interested in participating
  - Still scope and tasks to get involved with, in exciting/interesting activities
    - either before proposal submission or on-going activities beyond submission
      - e.g. detector/physics simulations
  - ECCE Contact people: https://www.ecce-eic.org/contact