# EIC User Group Institutional Board Meeting

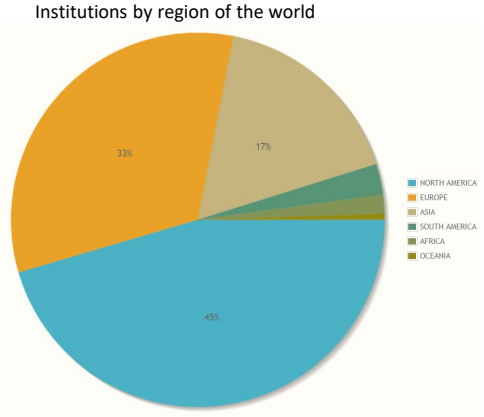
Christine Aidala (U. of Michigan), Andrea Bressan (Trieste)

## Agenda

- Welcome and news - Christine Aidala and Andrea Bressan
- Brief introductions from groups that joined recently
  - Memorial University of Newfoundland (Canada) – Aleksandrs Aleksejevs
- Draft plan for EIC Physics and Detector Conceptual Development and preparation of Yellow Reports – Rolf Ent (JLab)
- Discussion of EIC Physics and Detector Conceptual Development plan

# Composition of the EICUG

- 945 members from 190 institutions in 30 countries
  - 40% of institutions from U.S., 60% international
  - 4 private companies (no IB representation)
  - Growth from 881 members, 187 institutions as of July 2019 meeting in Paris




- 3 institutions have joined since July meeting
  - Indian Institute of Technology Patna (India)
  - Memorial University of Newfoundland (Canada)
  - Universidad de Alcalá (Spain)

# European Particle Physics Strategy Briefing Book – Material relevant to EIC

- Briefing Book for the 2020 European Strategy for Particle Physics Update came out Sep 30: https://cds.cern.ch/record/2691414
- From Introduction - "How to enhance the cooperation between the particle, astroparticle and nuclear physics communities, fully benefiting from the close collaboration between ECFA, APPEC and NuPECC, must be part of the discussions around the European Strategy Update."
- EIC discussed explicitly in Section 4.3 on "Electron-proton collisions (LHeC, EIC, FCC)"
  - **"The development of a broad QCD programme for the 2030s based on synergies and complementarities between different machines and collision systems, pp/pA/AA and ep/eA, should be encouraged."**
- Also mentioned explicitly in Section 3.2.1 on electroweak precision measurements, in context of $\sin^2 \theta_W$
- (More material in backup slides)

# Update of Steering Committee composition

- Effective October 1st, Rik Yoshida started a new position as the High-Energy Physics Division Director at Argonne National Lab

- Rolf Ent has taken over as the EICUG Steering Committee member appointed by JLab

- Douglas Higinbotham has taken over as the JLab IB representative

# Introductions from groups that recently joined

- Aleksandrs Aleksejevs – Memorial University of Newfoundland (Canada)

# Plan for EIC Physics and Detector Conceptual Development and preparation of Yellow Reports

- Presentation of draft plan by Rolf Ent (JLab), on behalf of the Steering Committee

- Discussion points
  - General approach
    - Structure of the Yellow Reports
    - Organization of manpower
    - How to engage as many groups as possible
  - Comments on possible subgroups/subdivisions
  - General timeline
  - General structure and locations of meetings

# Proposed subdivisions

## Detector

- Following the EICUG *Request of Information* call:
  - Tracking
  - Vertexing
  - Calorimetry
  - Particle ID
  - Forward instrumentation / Backward instrumentation
  - IR design / Background studies
  - Ancillary Measurements: Polarimetry, Luminosity
  - Software / Computing
  - DAQ / Slow Controls / Readout
  - Other
- The three areas below have been added as they are important to study and document in the Yellow Reports:
  - Magnetic field options (configuration, strength, impact on machine, IR compatibility)
  - Arguments for 2 complementary detectors
  - Overall design/integration
- After analysis of EICUG *Request of Information* the above scheme can be adjusted if needed.

## Physics

- Following the EICUG *Request of Information* call:
  - Longitudinal (spin) nucleon structure
  - 3D nucleon / nucleus structure
  - High density parton physics
  - Beyond Standard Model / Electro-weak physics
  - Hadronization and fragmentation
  - Nuclear Structure / Short-range correlations
  - Origin of nuclear force
  - Collective effects
  - Spectroscopy
  - Origin of mass
  - Other (Entanglement, Jet studies, …)
- Also this subdivision should be adjusted later based upon analysis of the EICUG *Request of Information* input.

# Proposed timeline

- October 10, 2019: Pre-announce effort/plan at quarterly EICUG Institutional Board phone call, fold in input of IB on plan and possible location for workshops.
- October 2019: SC decides on structure, subgroups, and picks conveners. Work with conveners to get tentative dates/locations for workshops.
- October 24, 2019: Pre-announce effort/plan at quarterly EICUG phone call, fold in input of community.
- Early November 2019: Announce final effort/plan through mailing lists, invite/ask for participation for workshops (perhaps by mechanism that people can pre-sign up for some meetings)
- Late November 2019: SC and Conveners decide on subconveners
- December 2019: 2-day Kick-off Meeting
- February/March 2020: 1st Workshop
- May/June 2020: 2nd Workshop
- August 2020: Include session on (short) status reports of main groups (physics, detector and possible accelerator) in EICUG meeting
- September/October 2020: 3rd Workshop
- November/December 2020: 4th Workshop (drafts of subgroup reports should be available at this point)
- January 2021: Final Meeting and assembling of Yellow Reports
- February 2021: review team to look at the reports and comment, independent of editors and authors.
- April 2021: Release of Yellow Reports, assign editors that keep report up-to-date.

# General structure and locations of meetings

- Efforts will start with 2-day kick-off meeting
  - Summarize current status on physics (WP + new efforts) and detector concepts.
  - Summarize software and simulation tools available describing the current detector and interaction region concepts.
  - Split in parallel sessions (physics, detector, optional accelerator) for further organization sessions. Discuss who is doing what, and what are the foreseen timelines and activities of the subgroups.
- Have 3-4 workshops every ~3 months of physics and detector groups alternating between locations ($EIC^2$, CFNS, Universities, West/East coasts, Europe). Workshops should be Video/BlueJeans enabled. Workshop should include plenary and parallel sessions with enough time to actually "work". Meeting location should be able to accommodate break-out/working sessions.
- Final meeting to finalize Yellow Reports
- The SC will support the conveners in requesting financial support from the two EIC centers ($EIC^2$ and CFNS) as well as labs for these meetings.

# Final remarks

- Further input on the preparation of the Yellow Reports or other topics for the IB can be sent to us via e-mail:
  - caidala@umich.edu
  - Andrea.Bressan@ts.infn.it

- Reminder: Next EICUG remote meeting Thursday, Oct 24, 10:00 am U.S. EDT. Plans for preparation of the Yellow Reports, including feedback from today's IB meeting, will be presented.

# Extra

# European Particle Physics Strategy Briefing Book – Other relevant material

- Section 2.3, p. 19 – "Strong interactions play a central role in particle physics today, but the relevant questions are not about the validity of the theory or the search for its possible extensions, because QCD gives a successful and satisfactory explanation of strong interactions. The questions are about how to relate QCD to long-distance phenomena (e.g. confinement), how to characterise the collective behaviours that emerge under extreme conditions (e.g. high temperature or high density), how to obtain reliable predictions in the non-perturbative regime (e.g. hadronic matrix elements) and precise predictions in the perturbative regime (e.g. higher-order calculations). Particularly challenging is the question of deriving from the first principles of QCD a description of phenomena at the interface between low and high energies. An example is understanding how fast-moving quarks and gluons cluster into colour-singlet hadrons. As well as being conceptually challenging, these questions are relevant in practice since they lead to a real limitation in the theoretical prediction of observables in hadronic collisions and flavour physics."

- Section 4.1.1, p. 44 – "Electroweak and Higgs physics at the LHC are entering the precision era, demanding a new level of understanding QCD, including questions related to proton structure and the value of the strong coupling (alpha_s), calculation of higher-order matrix elements, the understanding of multi-scale problems through parton showers and resummations, and effects related to hadronisation. Measurements performed at the HL-LHC of important electroweak parameters like the W boson mass [105] and sin2 theta_W [106] can be significantly improved when more profound (from PDFs to GPDs) and extended (to higher Q2, and both higher and lower x) information becomes available on the proton structure."

- Section 4.1.1., p. 44 – "Beyond the collinear parton model extending our description of the hadron structure, and especially the proton structure, to three dimensions is an overall objective to test QCD and to significantly enhance the physics programme at hadron colliders. Additional experimental efforts are required to address parton Transverse Momentum Dependent (TMD) features and towards measurements of Generalised Parton Distributions (GPDs). Proposals are submitted to make significant progress on this nucleon structure front [ID99, ID111, ID143]."

# European Particle Physics Strategy Briefing Book – Other relevant material

Section 4.3.1 Electron-ion collisions (LHeC, EIC, FCC)

- "Several electron-ion (eA) colliders with per nucleon luminosities ~10^33-10^34 cm^-2s^-1 are projected to start operating in the 2030s. Colliding electrons from an ERL with the HL-LHC or FCC nuclear beams, the LHeC is the most powerful eA facility that one can build in the next decades. It will clarify the partonic substructure and dynamics in nuclei in an unprecedented kinematic range. Also, it will unequivocally probe the new non-linear partonic regime of QCD through density effects in ep and eA, that increase both with 1/x and mass number A. The LHeC will provide an accurate benchmark for perturbative probes, the initial conditions for collective expansion, for the understanding of the prior dynamics and the collective behaviour in pp and pA collisions.

- The EICs in the US [43] and China [116], with c.m. energies below 100 GeV/nucleon, are dedicated to a detailed mapping of nuclear structure and its A dependence in the medium x, lower Q2 region, extending the kinematic (Q2;1=x) range as compared to existing DIS data by up to a factor of 30. The flexible choice of lower energy but polarised beams, while limiting access to small x, is optimal for pursuing a unique proton (and light ion) spin programme. **The development of a broad QCD programme for the 2030s based on synergies and complementarities between different machines and collision systems, pp/pA/AA and ep/eA, should be encouraged.**"

# European Particle Physics Strategy Briefing Book – Other relevant material

Section 4.3.4

- "– It is essential to perform spin studies both at pp and ep machines to test pQCD predictions with a sign change in some spin asymmetries.
- – The characterisation of the quark-gluon plasma suffers from sizeable uncertainties e.g. from our lack of knowledge of nuclear PDFs for quarkonium suppression [119] and charm production cross section in AA collisions [111] or of the initial conditions for collective expansion for the extraction of the QGP transport coefficients [120, 121], and of the role of parton fragmentation and hadronisation in cold nuclear matter [122]. Therefore, it requires novel input on nuclear parton structure, on nuclear multiparton correlations, on parton fragmentation and hadronisation in-vacuum and in cold nuclear matter, which should come from future electron-ion and electron-positron colliders. The observation of long-range correlation effects even in pA collisions demands a detailed investigation of the lightest systems, ep and eA.
- – The development of accelerator technology (energy recovery) for a next energy frontier ep collider is supported by and also invites low energy ERL facility developments. These have fundamental low-energy physics programmes, in particle, astroparticle, and nuclear physics. Intense ~1 GeV electron ERL facilities have a wide range of important applications for material-, bio-, accelerator physics, and other branches of science and technology. The high-quality requirements for superconducting radio frequency are synergetic with developments of electron-positron colliders. The first 802 MHz cavity, for example, has been developed jointly for LHeC and FCC-ee, by CERN and JLab."

Also some of the general material on accelerator R&D, instrumentation, and software is also relevant to EIC community.