# Collaboration Activities
# Progress on International Involvement
# Strategy for the next LRP
# (a discussion)

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# Collaboration Activities

# EIC Goals: Consensus [….?]

EIC, the machine to study QCD in its full glory

Role of Glue in nucleons and nuclei

- Understand the gluon and quark contributions to the nucleon spin, precisely
- Spatial and transverse momentum distribution of the partons in nucleons leading to the 3-D structure of the nucleon (12GeV → quarks, EIC → for gluons)
- Gluons in nuclei, under extreme conditions (high energies, lowest possible x)

# Activity

To identify the “golden measurements” that will achieve those goals

Study of physics processes: generator → detector simulation → evaluation and identify the best measurement toward the above goals

What are the optimal collider energies & luminosities for these measurements?

What detector functionality will we need?

Communication with the accelerator groups on:

machine-element requirement for high luminosity, polarization & flexibility

and

impact of various IR and machine elements on the physics measurements

# Newly formed Task Forces at the Labs



- EIC ~~Groups~~ Task Forces formed at BNL and Jlab
- Weekly meetings and discussions
- Excellent communication with local accelerator groups leading to ideas for detector in the IR
- Will these become the seeds for collaboration building?

- A new initiative at Jefferson Laboratory through the User's Group Board of Directors (Prof. Zein-Eddine Meziani, Temple U.)
- Other funds being released at the Labs:
  - 6 LDRD (Lab Dir.'s Research Directives) initiated @ BNL
  - Monies being made available for long term (and short term) visitors at Jlab for EIC related work

# Activity toward EIC visibility & appreciation of science

- Almost every major conference this year has had: a major workshop, a highly active working group or a plenary talk on *"EIC-Physics and Status"*
  - A clear indication of high interest and expectation

- Examples: APS-JPS Joint Meeting Hawaii, DIS2009 in Spain, Pan Pacific Spin Symposium, Japan, IWHSS09 in Germany, PAVI09 at Bar Harbor, Maine, EINN09 in Greece, INT Workshop, Seattle
- Near & distant future: DNP in Washington DC Spring'10, INT Program Fall'10

- EIC Collaboration Meetings: May 2009 at GSI Germany, January 2010 at Stony Brook

# Outreach & new physics potential

Outreach

- Peer reviewed papers on theoretical issues of EIC science
- Conference proceedings on machine, IR, detector and physics output from EIC (based on simulations)

New physics possibilities and connections:

- Physics with Electroweak Sector, Parity Violation searches, & Beyond SM project (recent LDRD at BNL to explore this)
- Lots of help from William Marciano, Mike Ramsey-Musolf, Werner Vogelsang (+Krishna Kumar and AD)

- Articles in popular science magazines:
  - CERN Courier: To appear in the November/December'09
  - Scientific American: under preparation

- All EIC write-ups and white-papers archived as EIC Notes on the EIC Collaboration Web pages & at BNL by the EIC-Task Force

# Activities: Communication

- Weekly task force meetings with phone bridges
- Monthly Collaboration-Steering Committee Meeting

- The Working Group Structures setup a couple of years ago, are now outdated, need to re-organize around physics, measurements & detector/IR designs issues: Re-Organization of WGs anticipated in near future
  - (Example: PDFs, Diffraction, heavy flavor physics, EW&BSM)

- "A group of focused few" needed to think about starting to write a white paper-like document for the LRP 2012 process: (help identify holes in various studies, and promote them within collaboration)
  - A suggestion from the recent INT meeting in Seattle.

# Why isn't the collaboration growing (wildly)?



- Our on-going activities
  - Compass @ CERN, hope of its upgrade, Jlab 6-12 GeV, RHIC, RHIC Spin, and their anticipated upgrades

- No direct funding for EIC for University Groups
  - Unlike in Europe, most funds in the University Groups are associated with "present" activities (no formal EIC post docs any where yet, other than National Labs)

- Lack of clear idea of what the fate/location of the EIC in the US might be: especially worrisome for US & non-US institutes
  - they prefer to wait and watch

# International Involvement

# Progress: International Involvement

- European Nucleon Collider (ENC) 3 GeV e x 15 GeV hadron machine at GSI/FAIR using PANDA detector
  - Recently formed a center supported by HELHOLTZ Foundation, hosted the EIC-Meeting in May'09 (Director: Frank Maas)
  - Mutual physics interests may develop in near future: Generalized Parton Distributions (GPDs) and Transverse Momentum Distributions (TMDs)

- LHeC at CERN (100 GeV e on 7 TeV p)
  - Connection obvious in "low x physics"
  - EW & BSM physics recently started for EIC may have connections: **too early to judge**.

Both groups in communication with the EIC Collaboration

# Progress: International Involvement



RIKEN in Japan

- Has a unique center at BNL (Set up by T.D. Lee, Present director: N. Samios)
- Mandate up to 2013, with possible extension to 2018 for RHIC/RHIC-Spin
- There is interest at RIKEN in extending such an arrangement beyond 2018 for the Electron Ion Collider
- Preliminary work on this started through RBRC management, discussion centered around US decisions of location and fate of the project in NSAC's LRP

Other interests: In France, India, but have not made any formal progress on this yet. My task after January'10.

# Strategy for next LRP

# Remember this before strategizing:

- Only 0 or 1 of these colliders can ever be built
- The **only** reason EIC is so highly visible in the NSAC LRP is because RHIC & Jlab communities came together to support the project
- We need to go in to the next LRP with a SINGLE design proposal with full support of the community to make this a construction project

Both eRHIC and eLIC proposals (including their lower energy incarnations [stages]) require significant R&D

- It behooves us NOT to collaborate on all aspects of this project, especially when the people working on it are "few"

# Remember….

- Most past and present colliders were commissioned over a long time (~5 yrs) before they reached their design luminosity (polarization) performance
  - The luminosity goals we have set for ourselves are daunting by any standards, so one should not expect quick miracles with their realization of the "promised" luminosities

# Physics Goals → Science Matrix

Golden **measurement** discussions on going, opinions diverse, but emerging consensus on high level goals:

1. Nucleon helicity structure: "Nucleon Spin Crisis"
   - Widest x-$Q^2$ region, polarization of nucleons
2. 2+1 Dimensional mapping of nucleon (glue) structure
   - Large luminosity, wide x,$Q^2$, t, $\xi$
3. Role of gluons in nuclei
   - Widest x-$Q^2$, low-x detector, and heavy nuclei, highest CM

4. New developments: exploration of EW-BSM physics (?)
   - Highest energy ($Q^2$) and luminosity

# Staged Realization

- Need crisp initial (stage 1) goals & distinct final stage goals
  - Staged realization allows room for accelerator development
  - May enable "Detector Staging" as well
  - Early realization of physics measurements which are less luminosity/energy hungry

- Staged realization potentially also splits the total project costs: an attractive proposition for the EIC Collaboration and the DOE

# Disadvantages of Staged

Risk:

- Lower initial energy & luminosity may limit the attractiveness of physics goals for Stage 1, making it more difficult to justify (depending of course on the cost of initial stage)

- Some collaborators worry that Stage 1 is "all" we get: the next stage being only an "incremental" program and not "transformational"

- Need to understand the pros vs. cons better and get a consensus amongst the collaborators, the lab managements and the funding agencies

# Collaboration's ~~Hopes~~ Expectations and Aspirations

# Aspirations

Proceed assuming a staged realization of the EIC

- Both BNL and Jlab now have a designs for such path
- Golden measurements for each of the energy and species combinations to be flushed out
  - Expect this will happen in the next few months
    - The recent EIC week at INT (Raju's slides) initiated discussions
    - Next year's 2-month INT program : expect to conclude?

Machines, IR (& Detector?) : Towards realization: both stages of the eRHIC and ELIC proposals need to be costed (schedule and costs) and reviewed by an external committee

- Suggested time to do that: Spring-2010

# ~~Hope~~ Expectation

We ~~hope~~ expect that the labs and their user groups:

- Work together towards achieving these goals once above answers are ready, and
- Go together to the NSAC to make the case for this project, no matter which site is finally proposed

- The earlier such clear statements regarding "willingness to work together" are made, by both communities & the Lab managements, the faster we will realize the EIC