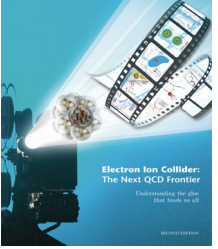
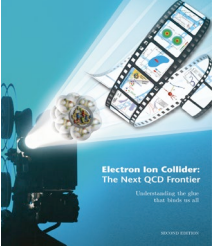





# Lo stato del progetto EIC

- Considerazioni Introduttive
- Il progetto EIC
- Lo stato del progetto
- INFN & EIC

S. Dalla Torre




# Il programma della "Giornata"

**Materie di interesse della collaborazione EIC_NET**

Thu 7/11

14:00

**Sessione chiusa**
*Silvia Dalla Torre*
15:00
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 14:30 - 16:00

16:00 **Coffee break**
*Saletta riunioni - I piano, Dipartimento Interateneo di Fisica - Bari* 16:00 - 16:30

**Sessione chiusa**
*Silvia Dalla Torre*
17:00
18:00
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 16:30 - 18:30

**Aggiornamento informativo con valenza interna ed esterna: Invito esteso a tutti gli interessati**

Fri 8/11

09:00 **Indirizzi di saluto**
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 09:00 - 09:15

**Stato progetto EIC** *Silvia Dalla Torre*
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 09:15 - 09:50

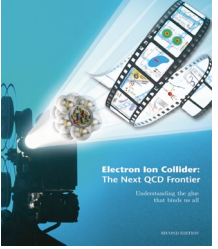
**La fisica a EIC: base-line e nuove prospettive** *Giuseppe Bozzi*
10:00
**Proficua collaborazione coi colleghi teorici**
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 09:50 - 10:35

**Coffee break**
*Saletta riunioni - I piano, Dipartimento Interateneo di Fisica - Bari* 10:35 - 11:05

11:00 **L'attivita' italiana in EIC_NET: strumenti per la simulazione, attivita' di Monte Carlo e studi di fisica** *Roberto Preghenella*
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - B* 11:05 - 11:40
**Giovani alla ribalta**

**L'attivita' italiana in EIC_NET: progetti di R&D** *Andrea Celentano*
12:00
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 11:40 - 12:15

**Conclusioni e fine Giornata Nazionale EIC_NET**
*Aula multimediale INFN - I piano, Dipartimento Interateneo di Fisica - Bari* 12:15 - 12:30






# Lo stato del progetto EIC

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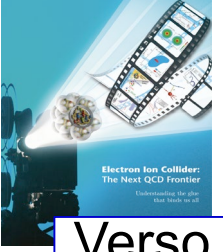



# Il progetto EIC in nuce

- **EIC:** **Electron - Ion Collider**
- **MISSIONE:** **la compresione della QCD**

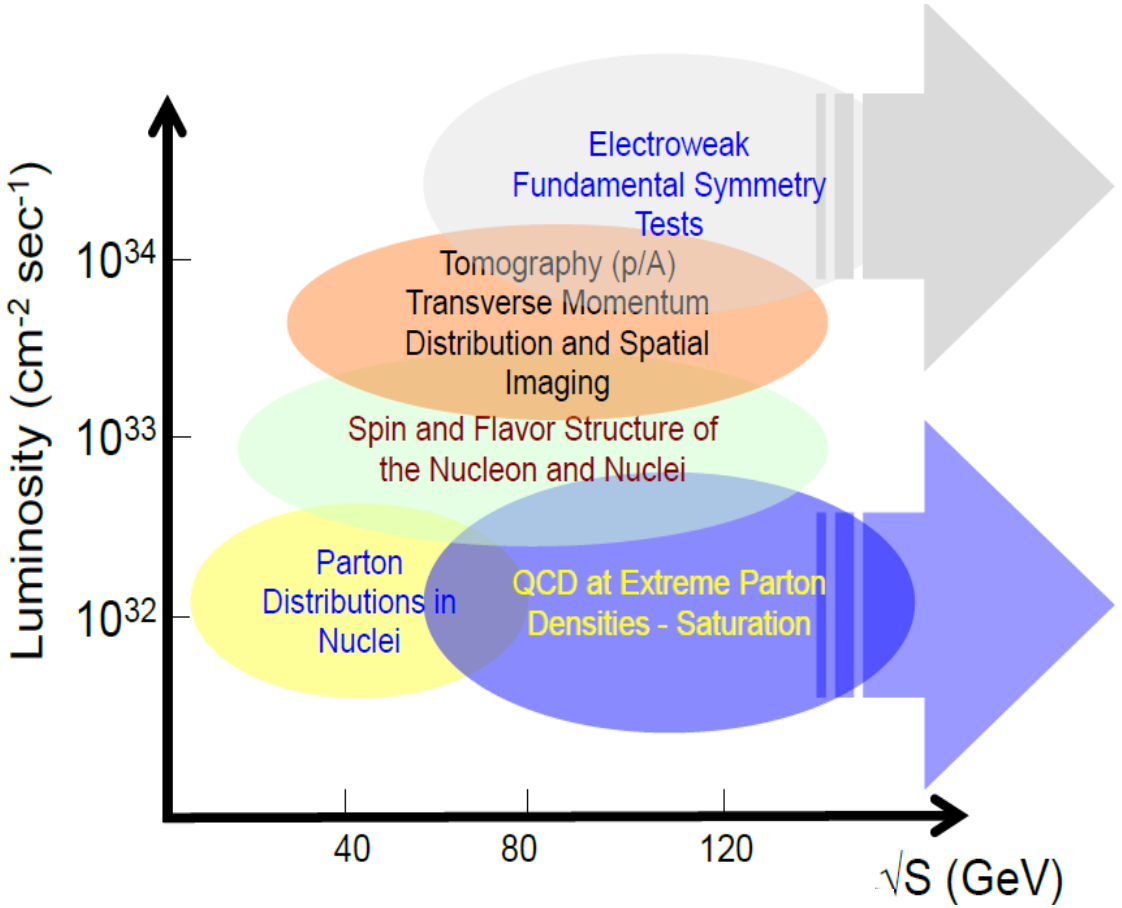
Verso la QCD non perturbativa,
le domande a cui EIC risponderà

- Distribuzione q, g (momento, spazio, spin) nel nucleone?
- Le proprietá del nucleone da q, g e QCD?

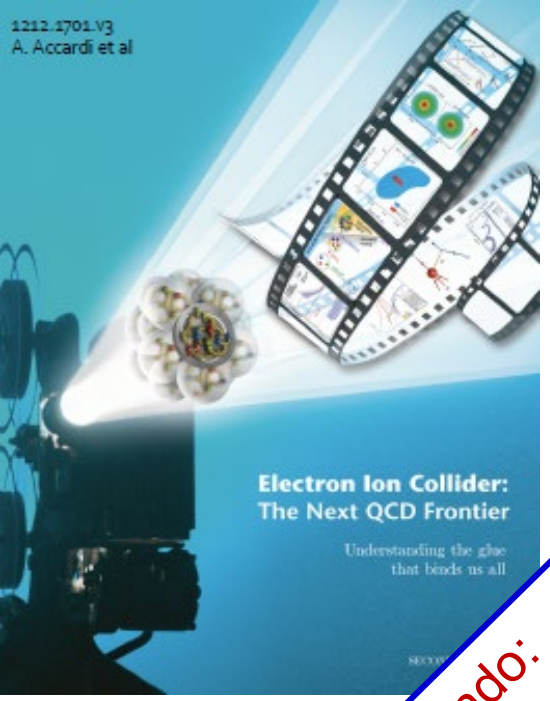
- Distribuzione q, g nel mezzo nucleare denso?
- Densità gluonica nei nuclei? Satura a piccolo $x$?

- l'interazione tra q e g colorati e particelle colorless con il mezzo nucleare?
- Come emergono stati adronici confinati?

- E ancora:
  - Spettroscopia di quark pesanti (e leggeri)
  - Alle più alte luminosità, finestra su BSM
  - Studio di 'initial state' nelle collisioni HI




**→ molto di piu' sulle motivazioni ed il programma di fisica nel talk di G. Bozzi**




per la prima volta al mondo:

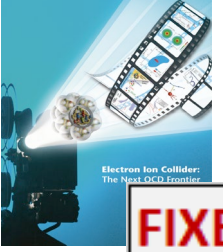
- collisore e *polarizzati* - p/A leggeri *polarizzati*
- collisore eA

# "SPECIFICHE EIC":

- Esplorare un'ampio dominio cinematico
  - ECM: 20 – 100 GeV, estendibile a 140 GeV
- Alta luminosita'
  - fino a $10^{34}$ $cm^{-2}$ $s^{-1}$
- Fasci  e con alta polarizzazione (~ 80%)
- Fasci A leggeri con alta polarizzazione (~70%)
- Ampia varieta' di nuclei: da H a Pb/U
- genuina copertura $4\pi$
  - IR e rivelatore completamente integrati
- Misura e identificazione degli e
- Esperimenti con sistemi PID a grande accettanza (e/h, h-PID)
- Rivelazione di TUTTI I frammenti nucleari

COLLISORE

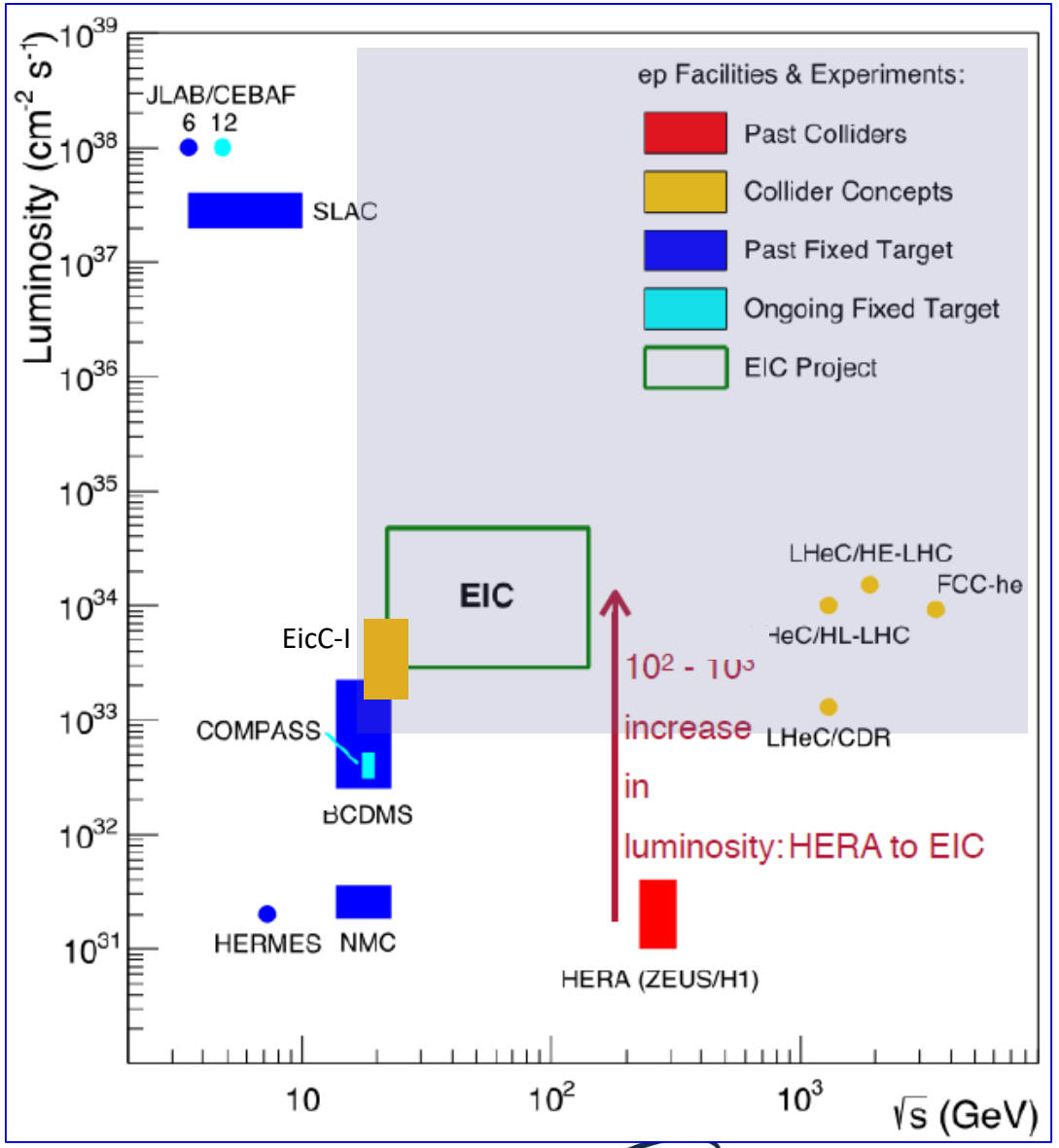
ESPERIMENTO




# la fisica e-i: coniugazione di E e $\mathscr{L}$

PASSATO / PRESENTE

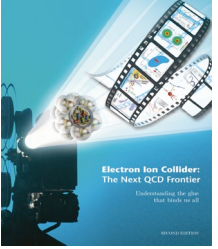
| | | | | |
|---|---|---|---|---|
| **FIXED TARGET, e BEAM** | | | | |
| SLAC | concluded | high $\mathscr{L}$ | polarization | |
| CEBAF | active | | polarization | |
| HERMES | concluded | limited $\mathscr{L}$ | polarization | internal gas jet target |
| **FIXED TARGET, HIGH ENERGY μ BEAM** | | | | |
| BCDMS | concluded | high $\mathscr{L}$ | | access to small x & large Q2 range |
| EMC | concluded | limited $\mathscr{L}$ | polarization | |
| NMC | concluded | | | |
| SMC | concluded | | polarization | |
| COMPASS | active | high $\mathscr{L}$ | polarization | |
| **COLLIDER ep** | | | | |
| HERA | concluded | limited $\mathscr{L}$ | | high energy, access to very small x & very large Q2 range |




FUTURO:

Esplorare la regione alta E - alta $\mathscr{L}$ :

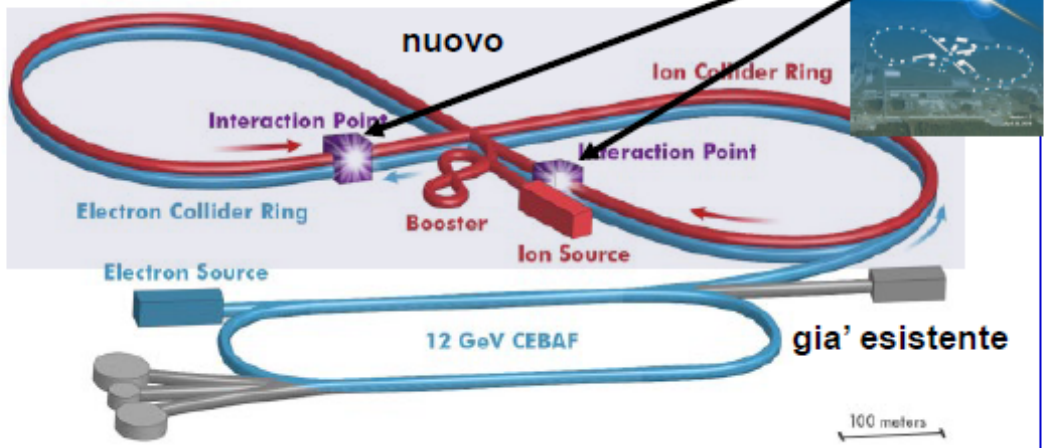
- MISURE DI PRECISIONE
- AMPIE REGIONI CINEMATICHE
  - anche a grande x




# LE 2 OPZIONI per IL COLLISORE

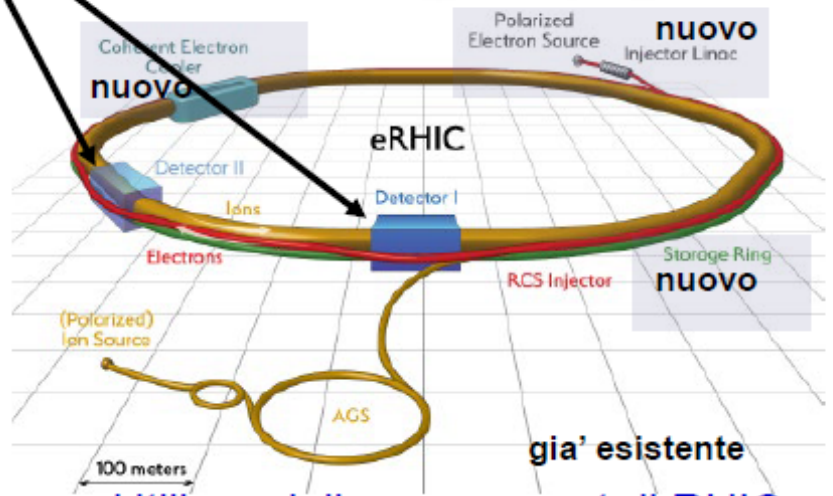
**in entrambe le opzioni 2 punti di interazione**

## JLEIC @ Jlab




- CEBAF (esistente) come iniettore di e polarizzati
- Schema ad "8" dei nuovi anelli: ottimizzato per conservare alta polarizzazione
- energie: √s : 20 to 65 – possibile fino a 140 GeV (dipende dalla tecnologia dei magneti)
- Piena luminosita' gia' in fase iniziale
- Energia incrementata in fasi successive, dove la tecnologia determina l'energia iniziale

## eRHIC @ BNL





- Utilizzo delle component di RHIC:
  - p polarizzati fino a 275 GeV
  - tunnel, sale sperimentali, complesso dell'iniettore h
- Add
  - "Strong p cooling" necessario per l'alta luminosita'
  - Per e: 400 MeV, 10 nC guns at 1Hz linear injector
  - Per e: 18 GeV injector in the same tunnel
  - Per e: 5-18 GeV electron storage ring in the same tunnel
- energie: √s 29-140 GeV
- Intervallo completo di E gia' in fase iniziale
- Luminosita' in crescita in fasi successive

# Acceleratori di EIC: tecnologie e stato 1/2

Both design benefit from existing Nuclear Physics infrastructure and are based on the same accelerator principles:

- **Electron Storage Rings** with frequent injection of fresh polarized beams
- **Hadron storage rings** with strong cooling or alternatively frequent injections

F. Willeke, talk at EICUG 2019: "EIC Accelerator Overview"

## ABOUT e POLARIZATION

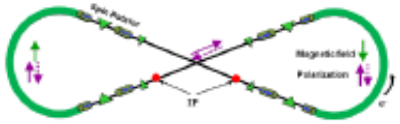
### eRHIC

➔ resonance free acceleration up >18 GeV

in the electron storage ring

on average, every bunch refilled in 2.2 min

### JLEIC



negligible depolarization demonstrated by spin tracking

## ABOUT h POLARIZATION

### eRHIC

presently

**Measured RHIC Results:**

- Proton Source Polarization 83 %
- Polarization at extraction from AGS 70%
- Polarization at RHIC collision energy 60%

empowerment

**Planned near term improvements:**

**AGS**: Stronger snake, skew quadrupoles, increased injection energy

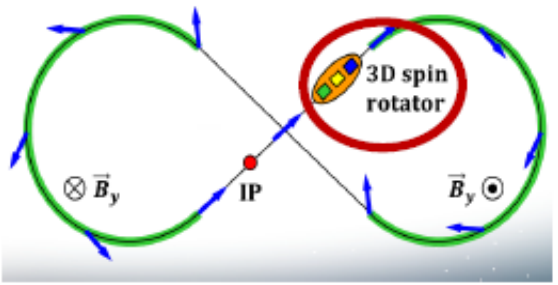
➔expect 80% at extraction of AGS

**RHIC:** Add 2 snakes to 4 existing no polarization loss

➔ expect 80% in Polarization in RHIC and eRHIC

High polarization $^3$He and D beams also foreseen

### JLEIC




spin rotation due to orbit errors

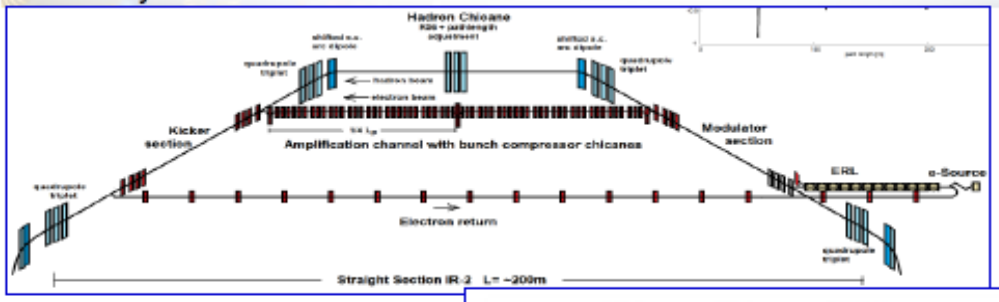
**3D spin rotator:**
**combination of small rotations about different axes provides any polarization orientation at any point in the collider ring**

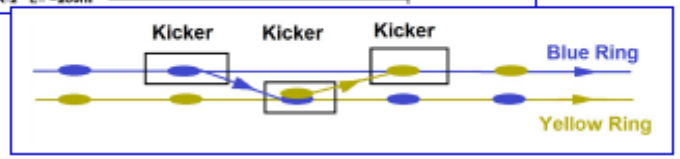
# Acceleratori di EIC: tecnologie e stato 2/2

## STRONG COOLING & HIGH LUMINOSITY

### eRHIC

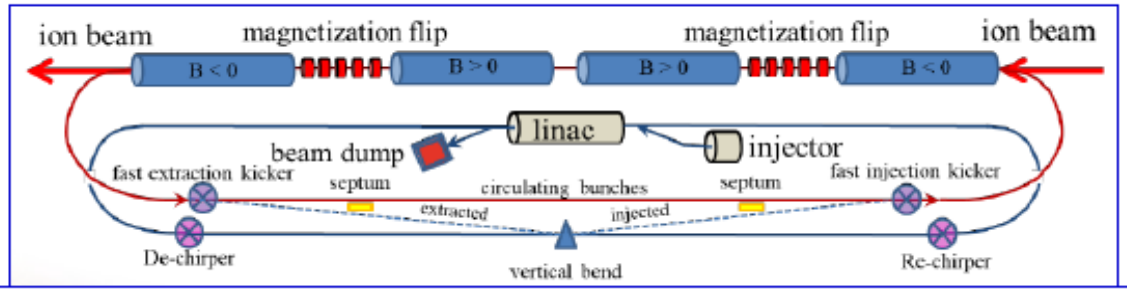
eRHIC has only modest IBS growth rates of t>2h for highest luminosity. It uses micro-bunched electron cooling as an option but does not rely on cooling to operate at highest luminosity as there is an on-energy for frequent injections available which results in an average luminosity which is still 90% of the peak luminosity.




### JLEIC

JLEIC uses a multi-turn magnetized bunched electron beam cooling ring fed by an energy recovery linac to balance IBS growth time between 15 and 40 minutes. This cooling increases the luminosity at lower energies, however JLEIC is not relying in this cooling for reaching NSAC goals, as it can use short fills with rapid turn arounds for achieving high average luminosity quoted as $1 \cdot 10^{34}$ $cm^{-2}s^{1}$.




F. Willeke, talk at EICUG 2019: "EIC Accelerator Overview"

## INTERACTION REGION

- It needs to fit several essential components into a relatively small area
- Such as: Strong focusing, spin rotators, crab cavities, auxiliary detectors, mask and collimators, diagnostic equipment

### EIC High Luminosity with a Crossing Angle

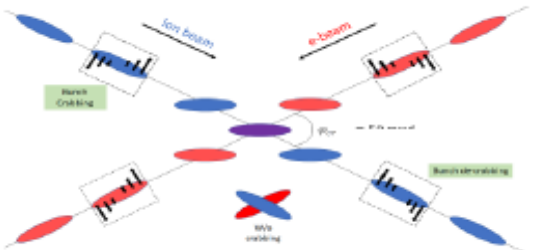
crossing angle is necessary to avoid parasitic collisions due to short bunch spacing, make space for machine elements, improve detection and reduce detector background, q =50 mrad (JLEIC), 25mrad (eRHIC)

However, crossing angle causes
- Low luminosity
- Beam dynamics issues

→ Crab Crossing

Effective head-on collision restored and most severe beam dynamic issue resolved

Both JLAB and BNL developed prototypes which have been tested with beam in the Cern-SpS




Courtesy V. Morozov and Andrei Seryi

## IN SUMMARY (about accelerators)

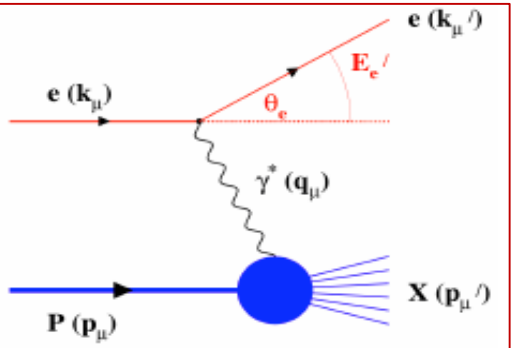
**The two designs rely for the most part on established accelerator technology**

- **Crab cavity, IR magnets, and ERL are close to state of the art**
- **strong hadron cooling is beyond, but is well mitigated**
- **BNL and JLab are committed to working together and with the community to advance the EIC.**

# LE MISURE A EIC

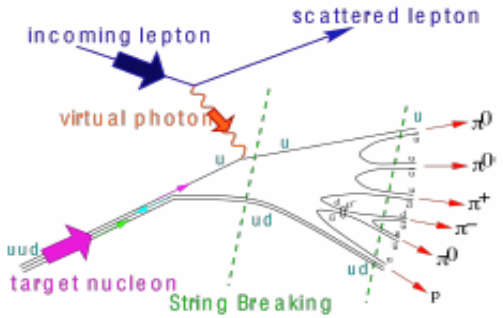
## Inclusive Reactions in ep/eA:

- Physics: Structure Functions: $g_1$, $F_2$, $F_L$
- → Very good scattered electron ID
- → High energy and angular resolution of e' (defines kinematics {x,$Q^2$})



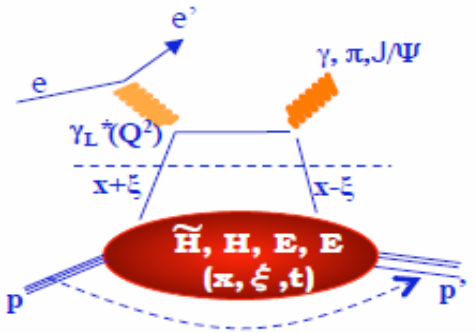

## Semi-inclusive Reactions in ep/eA:

- Physics: TMDs, Helicity PDFs, FFs (with flavor separation); di-hadron correlations; Kaon asymmetries, cross sections; etc
- → Excellent hadron ID: $p^{\pm}$,$K^{\pm}$,$p^{\pm}$ separation over a wide {p, η} range
- → Full Φ-coverage around γ*, wide $p_t$ coverage (TMDs)
- → Excellent vertex resolution (Charm, Bottom separation)

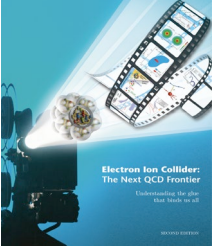



## Exclusive Reactions in ep/eA:

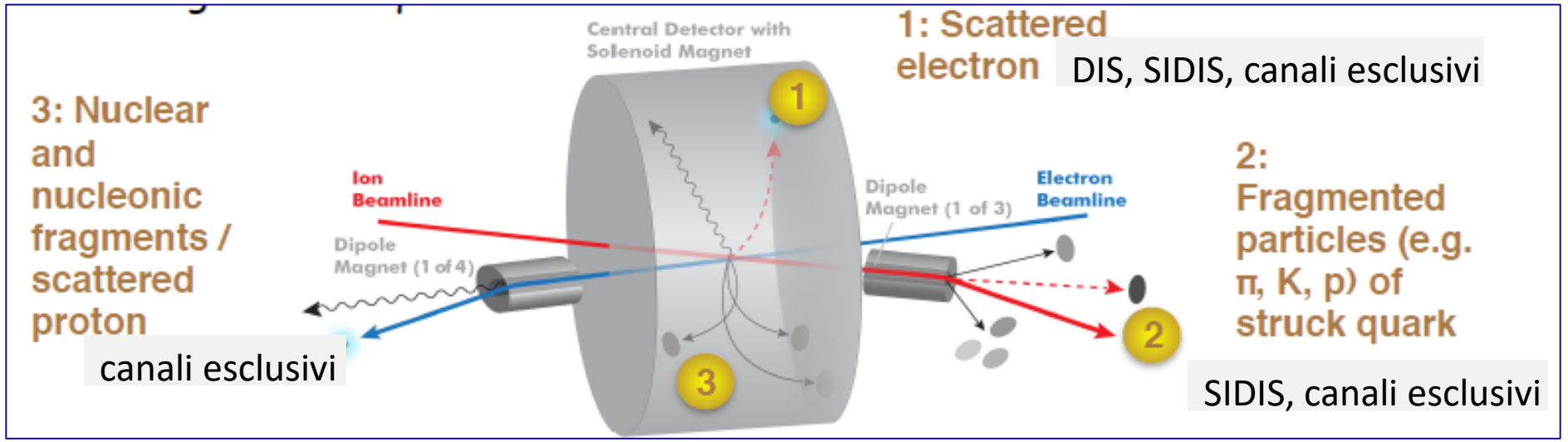
- Physics: DVCS, exclusive VM production (GPDs; parton imaging in $b_T$)
- → Exclusivity (large rapidity coverage; reconstruction of all particles in a given event)
- → High resolution, wide coverage in $t$ → Roman pots
- → (eA): veto nucleus breakup, determine impact parameter of collision
- → Sufficient acceptance for neutrons in ZDC




A. Kiselev, EICUG meeting, July 2016

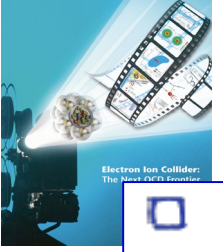



# LE SPECIFICHE PER I RIVELATORI




## Le richieste di base all'apparato sperimentale

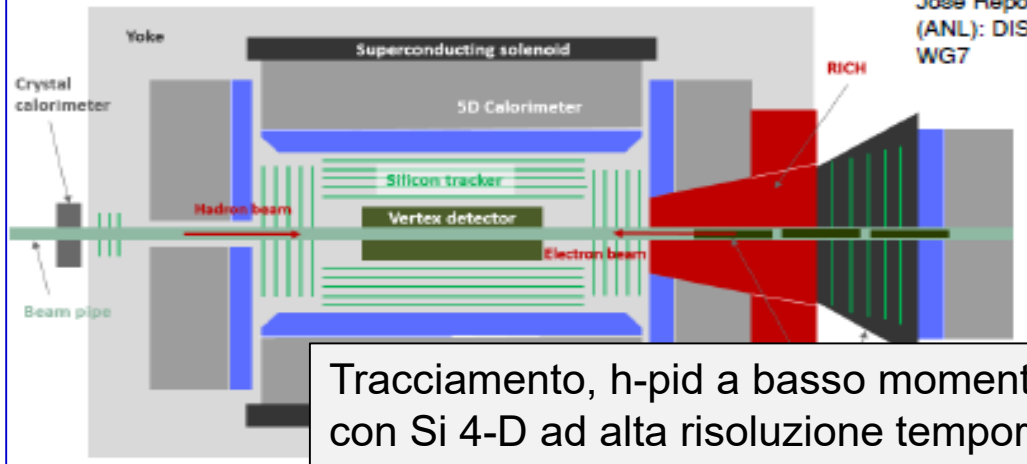
- Accettanza ~ 4 $\pi$ ( $|\eta| < 3.5$) : calorimetria EM e tracciatori
- Apparato leggero: ~5% $X_o$
- Risoluzione in momento: $\Delta p/p$ ~ qualche %
- e-PID con separazione e/h a $10^{-4}$ : ~2-3%/$\sqrt{E}$ ($\eta<-2$), ~7%/$\sqrt{E}$ ($-2<\eta<1$)
- h-PID ($\pi$,K,p) da <1 GeV/c a 50 GeV/c nell'intervallo $|\eta| < 3$
- Risoluzione spaziale al vertice: 10-20 $\mu$m
- Verso l'avanti: p (Roman Pot); tracciamento a piccolo $Q^2$, n in Avanti (ZDC)
- Luminosita' (assoluta e relativa); polarimetria e, A



# GLI SCHEMI DI RIVELATORE

## EIC detector design at JLab and BNL

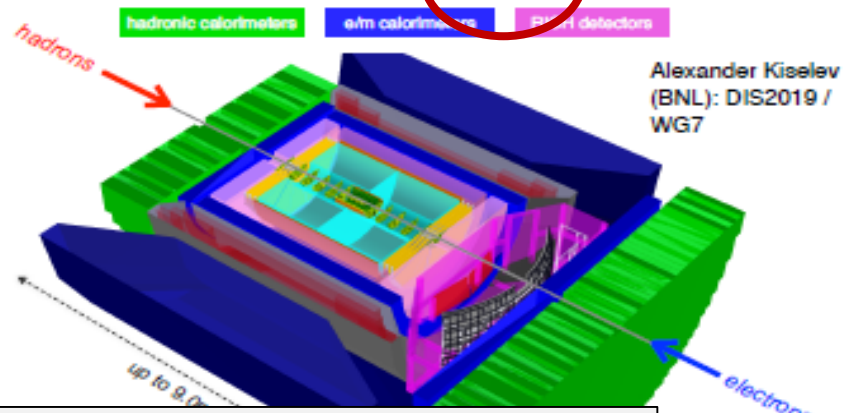
### (a) TOPSIDE at JLab:




Jose Repond (ANL): DIS 2019 / WG7

Tracciamento, h-pid a basso momento e cal em con Si 4-D ad alta risoluzione temporale

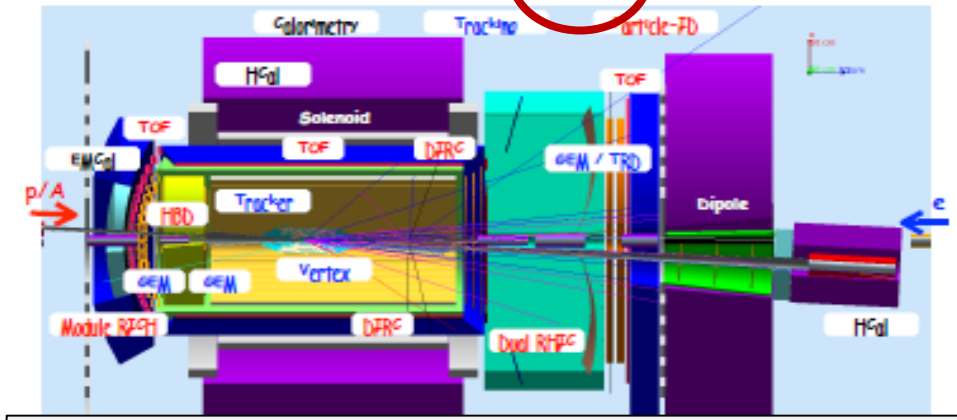
### (c) BEAST detector design at BNL:




Alexander Kiselev (BNL): DIS2019 / WG7

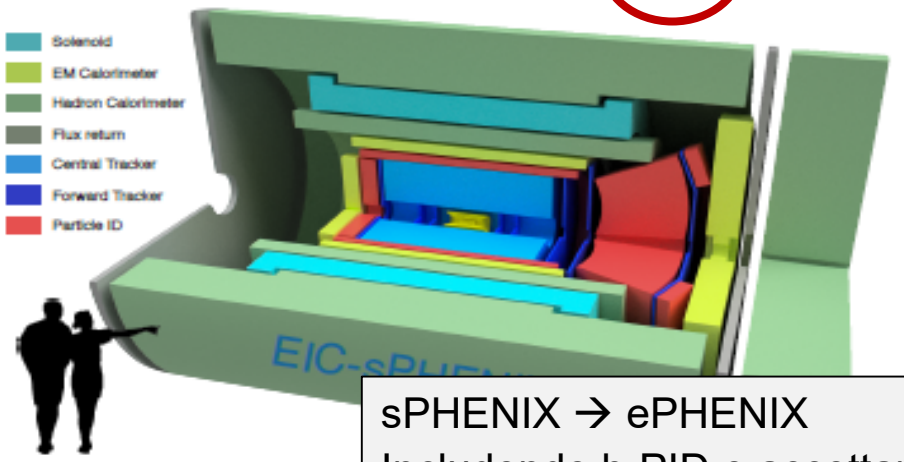
Progetto specifico per eRHIC
Con magnete da 3T e TPC centrale

### (b) JLEIC detector design at JLab:

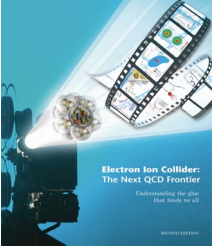



Progetto specifico per JLEIC
Tracciamento con set di MPGD nella regione centrale

### (d) sPHENIX-EIC detector design at BNL:




sPHENIX → ePHENIX
Includendo h-PID e accettanza $4\pi$



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S. Dalla Torre

# EIC – IL CAMMINO DI UN PROGETTO

## Il libro bianco di EIC

**"Electron Ion Collider:**
**The Next QCD Frontier**
**Understanding the glue**
**that binds us all"**

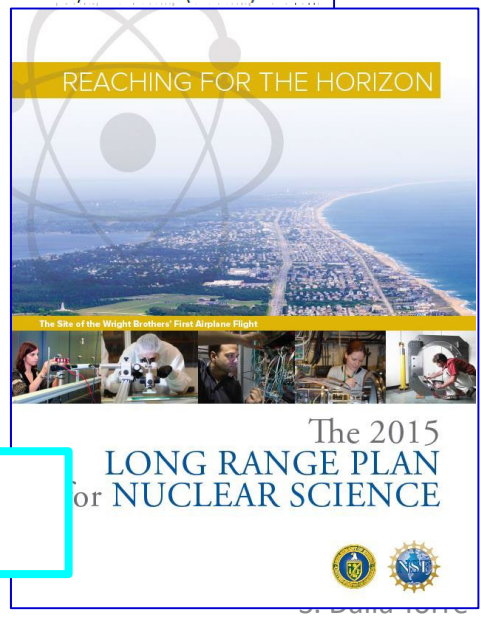
- Prima edizione 2012
- Seconda edizione 2014


**Bottom up**

A. Accardi et al., Electron-Ion Collider: The next QCD frontier, Eur. Phys. J. A52 (2016) 268.

The 2015 Long Range Plan for Nuclear Science

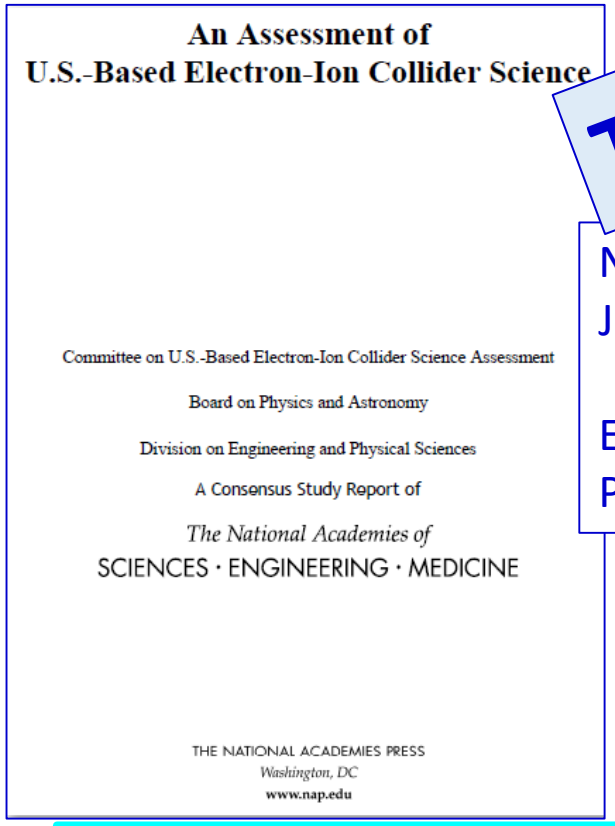
Construct a high-energy high-luminosity polarized electron-ion collider (EIC) as the highest priority for new construction following the completion of FRIB.




Il progetto e' compattamente appoggiato dalla comunita' di fisica nucleare in USA

**Nel 2017 il DOE ha richiesto formalmente il parere del NAS** *(the National Accademy of Science-Engineering-Medicine)*

**Top down**




NAS report, July 2018:

EXTREMELY POSITIVE

The committee unanimously finds that the science that can be addressed by an EIC is compelling, fundamental, and timely.


# EIC – VERSO L'APPROVAZIONE

Top down

- Il prossimo passo: CD0

(Critical Decision 0)

- CD0 nel 2019 ? Un opzione realistica

https://www.energy.gov/cfo/downloads/fy-2020-budget-justification

Volume 4 - DOE/CF-0154: EIC development part of the most recent DOE FY2020 Congressional Budget Request:

Pg. 10: "Funding is requested in FY 2020 for the start of R&D and conceptual design for a proposed U.S.-based Electron Ion Collider."

Pg. 276: "Other Project Costs (OPC) funding to support high priority, critically needed accelerator R&D to retire high risk technical challenges for the proposed U.S.-based EIC. Subsequent to the FY 2018 National Academy of Science Report confirming the importance of a domestic EIC to sustain U.S. world leadership in nuclear science and accelerator R&D core competencies. Critical Decision-0, Approve Mission Need, is planned for FY 2019."

- Il prossimo passo: CD0

(Critical Decision 0)

- CD0 nel 2019 ? Un opzione realistica

Ad oggi le due camere USA hanno indicato lo <u>stesso</u> stanziamento per EIC nel 2020:

- **$1M for a TEC start (project start) and**
- **$10M for OPC or "Other Project Costs" such a pre-conceptual R&D**

Il budget finale nasce dal confronto fra le 2 proposte →

il CD0 e' a portata di mano

**Fisica fra circa 10 y !**


# EIC – VERSO L'APPROVAZIONE

- Il prossimo passo: CD0

(Critical Decision 0)

- CD0 nel 2019 ? Un opzione realisti

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most
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Reques

Pg. 10: "
requested
start of R&
design for
based Electr

0, Approve Mission Need, is planned for FY 2019."

- Il pr

onfronto fra le 2

il CD0 e' a portata di mano

**Fisica fra circa 10 y !**

**Il DOE ha palesato l'intenzione di accompagnare il CD0 con la scelta del sito; un panel ad hoc e' al lavoro ed ha gia' audito le delegazioni delle 2 sedi:**

**il progetto sta rapidissimamente spostandosi sull'asse reale**

# L'INTERNAZIONALIZZAZIONE DEL PROGETTO

- **"in camera meeting" su EIC a Londra 3 agosto 2019** **(notizie da E. Nappi)**

Top down

- istituzioni e agenzie di ricerca rappresentate:
  CFI, Canada: CNRS/IN2P3 France; CEA, France; INFN, Italy; DoE, USA;
  RIKEN, Japan; NRF, South-Africa; STFC, UK

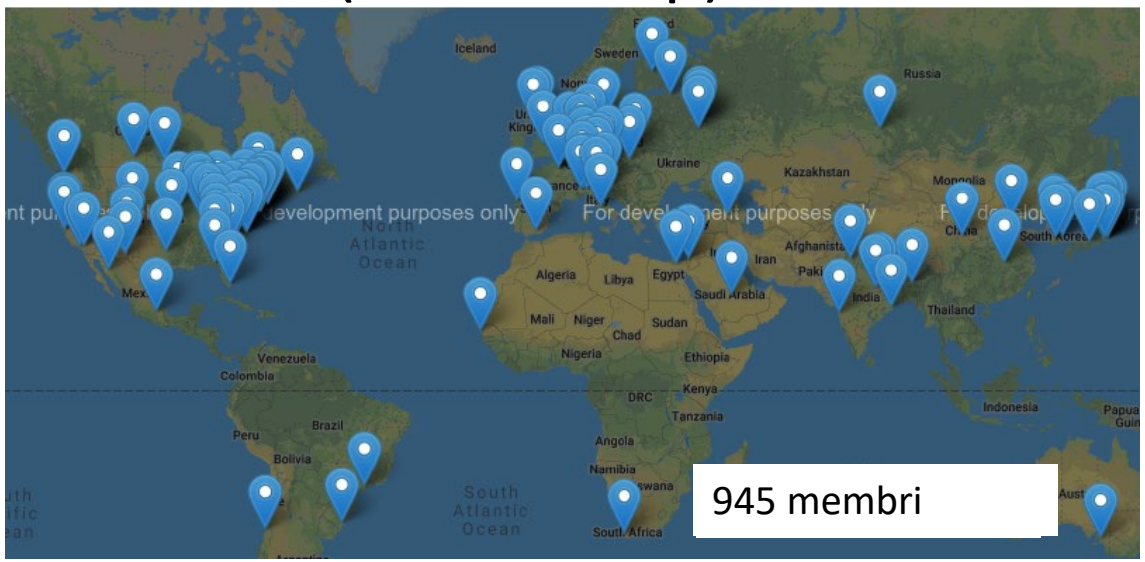
- **Istituzioni / agenzie dichiaratesi pronte a collaborare (oltre DoE):**
  **CFI, CNRS/IN2P3, CEA, INFN**

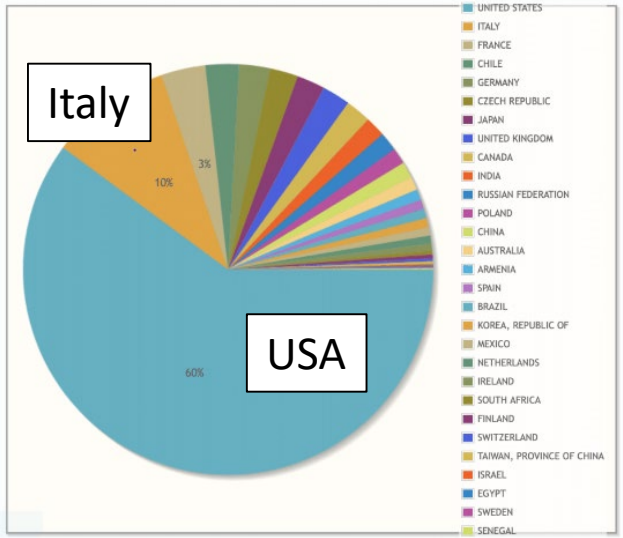
- **Tempistica (tentativa del DoE):**
  - CD0 e' atteso nel 2019; [ufficializzazione progetto]
  - CD0 accompagnato dalla **scelta del scelta sito**
  - inizio costruzioni di acceleratori nel 2026

- **Formato della collaborazione internazionale:**
  - il DOE lavora ad "Accordo Quadro" da far sottoscrivere alle agenzie di finanziamento, per l'Italia il MIUR

# L'EIC User Group (EICUG)

## The EICUG (User Group)



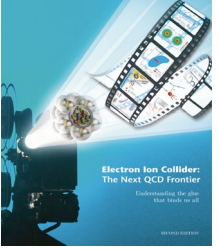




**Una comunita' in rapida crescita**

**Luglio 18: 788**
**Luglio 19: 873**
**Ottobre 19: 945**

- **Una comunita' attivamente impegnata**
  - Meeting annual di EICUG
  - La conferenza annuale dedicata (POETIC - Physics Opportunities at an ElecTron-Ion Collider)
  - I gruppi di lavoro
  - E altro ancora …

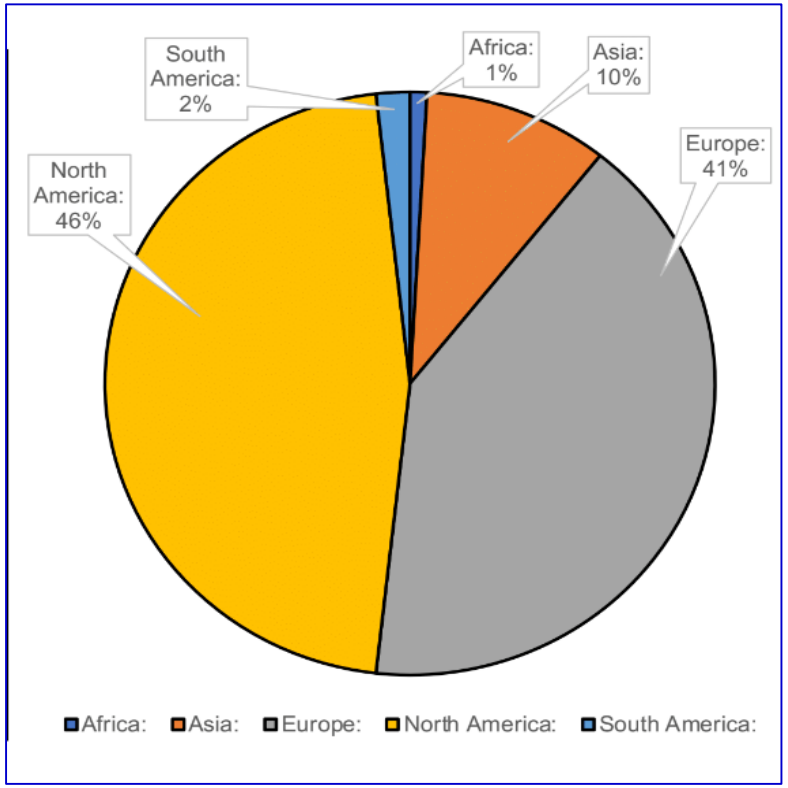

**Bottom up**

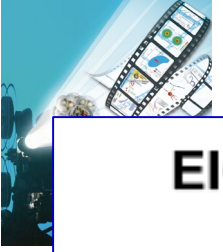



# IL SURVEY DI EICUG

**Bottom up**

- **Lanciato quest'estate, da compilare a cura dei gruppi in EICUG**
- **Campi da riempire**
  - Istituzione / dimensione gruppo
  - Interesse fisica del gruppo
  - Interesse rivelatori del gruppo
  - Infrastrutture disponibili localmente
- Analisi delle risposte in corso
- I gruppi EIC_NET hanno attivamente risposto





# YELLOW REPORT

Bottom up

## EIC Physics and Detector Concepts: The Path to a Yellow Report

- Quantify **physics measurements** for existing or new physics topics and implications for detector design ("Physics/Detector Group") — 4 conveners
- Study **detector concepts** based on the requirements defined above, and quantify implications for the physics measurements ("Detector/Physics Group") — 4 conveners
- Study opportunities for **accelerator physics experiments** at a future EIC ("Accelerator Physics Group") — 2 conveners

## Proposed Physics/Detector Sub-Groups

**Proposal after folding in IB meeting input and analysis of EICUG Request of Information:**

1. Inclusive/Semi-inclusive Structure Functions and PDFs (F2, FL, g1, etc.)
2. 3D spatial imaging of nucleon/nuclear structure
3. 3D momentum imaging of nucleon/nuclear structure
4. High density parton physics
5. Beyond Standard Model / Electro-weak physics
6. Particle transport in matter and hadronization
7. Nuclear Structure / Short-range correlations
8. Jets and Heavy Flavors
9. Origin of nuclear force
10. Collective effects
11. Spectroscopy
12. Origin of mass
13. Diffractive Physics

Contributions from groups already active within the program "generic R&D for EIC" expected

## Proposed Detector/Physics Sub-Groups

- First order we plan to follow 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

*and subconveners needed;*
*in total ~30 people per WG → ~10% of EICUG members:*
*moving towards a proto collaboration*

# YELLOW REPORT

Bottom up

## Timeline

| | | |
|---|---|---|
| 2019 | October | Information gathering stage |
| | Early November | Announce effort/plan and conveners |
| | December 12 + 13 | Kick-off Meeting* @ MIT (EICUG SC, Conveners, …) |
| 2020 | March 19-21 | First workshop near NY (Temple or Stony Brook) |
| | May 22-24 (TBC) | Second workshop at Trieste (TBC), Italy |
| | August 3-7 | Status reports at EICUGM @ FIU – Miami, FL |
| | September 17-19 | Third workshop at CUA – Washington, DC |
| | November 19-21 | Fourth workshop at UCB – Berkeley, CA<br>or Final Meeting (assembly of Yellow Report(s) |
| 2021 | January | (optional) Final Meeting |

& weekly video meetings

INFN TRIESTE

# YELLOW REPORT

EIC_NET offers of contribution

**dall' e-mail a EICUG Steering Committee dai responsabili locali EIC_NET**

**...**
**After an internal (initial) survey, these is a tentative list of subgroups to which we can contribute:**

**Physics:**

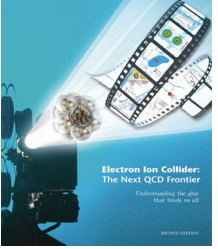
**3D nucleon / nucleus structure, in particular TMDs**
**Spectroscopy, possibly with an improved title**
**diffractive physics , wherever it is included**

**Detectors:**

**Vertexing**
**PID**
**DAQ**

**...**

**Bottom up**






# Lo stato del progetto EIC

- Considerazioni Introduttive
- Il progetto EIC
- Lo stato del progetto
- INFN & EIC

S. Dalla Torre

# INFN & EIC, un po' di storia

- INFN participation in EIC scientific program is discussed in the periodical bilateral meeting between INFN and DOE:
  - October 2016 October 2017 December 2018

INFN Management

- 11 May 2017 – a BNL delegation visits INFN headquarters: EIC is the main element of the agenda
  - Representatives of the EIC interested community invited

INFN Management

INFN Community

INFN Community

- 19-22/7/2017 – EICUG meeting in Trieste
  - E. Nappi: "INFN consider EIC an important opportunity for the hadronic physics community and encourage partnerships and collaborations with the other Institutions involved in the project"

INFN Management

- May2018 – INFN management visits Jlab, INFN contribution to the EIC project discussed in this context

INFN Management

- May 2018 – an collaboration of INFN experimentalists interested in EIC is formed

INFN Community

- 10 June 2018 – project EIC_NET approved

INFN Management

- 3 August 2019 – London, "in camera meeting" : INFN ready to collaborate

INFN Management

- August-September 2019 – EICUG starts activity towards a future TDR: EIC_NET groups answer to the survey, offer concrete contributions for the YR in preparation

INFN Community

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INFN Community

Management

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INFN Community

EFFECTIVE SYNERGIES OF TOP-DOWN & BOTTOM-UP ACTIONS

# EIC NET : EVENTI EIC IN ITALIA

- **EICUG2017, annual meeting of EICUG**

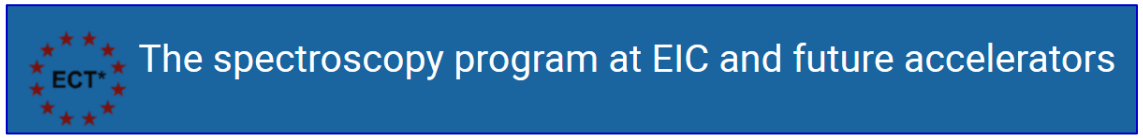
**(https://agenda.infn.it/event/13037/ )**

  - Trieste, 18-22 Luglio 2017


- **The spectroscopy program at EIC and future accelerators**

**(** https://indico.ectstar.eu/event/29/ **)**

  - Trento, 19-21 December 2018




- **EIC software meeting**

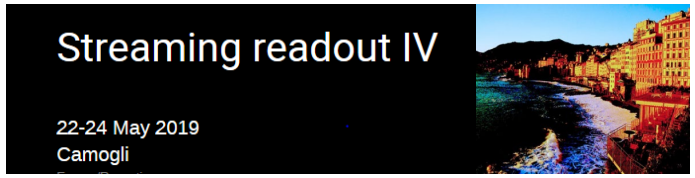
**( https://agenda.infn.it/event/17249/ )**

  - Trieste, 20-21 May 2019


- **Meeting of the EIC Streaming Readout consortium**

**(** https://agenda.infn.it/event/18179/overview **)**

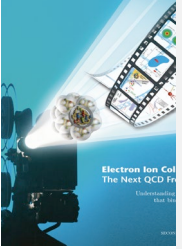
  - Camogli, 22-24 May 2019




- **Giornata nazionale EIC_NET**

( https://agenda.infn.it/event/20360/overview )

  - ***Bari, 7-8/11/2019***



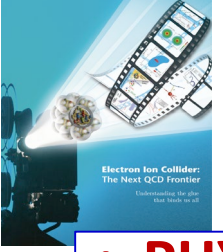
# EICUG2019 – Parigi, 22-26/7/2019

- La struttura del meeting:
  - In totale, 3 giorni di sessioni plenarie
  - In totale, 1 giorno di sessioni parallele (ed una poster session), 4 in tutto su fisica e rivelator
  - Riunione dell'Institutional Board

- La partecipazione INFN e EIC_NET:
  - Partecipanti: 20 INFN ( / 151)
    - 16 da EIC-NET
    - 3 teorici
    - Il nostro referee Leonello Servoli *(grazie, Leonello, per l'impegno ed il tempo dedicati!)*
  - International Advisory Committee: 16 membri di cui 2 INFN (1 EIC_NET)
  - 29 plenary talk, di cui 5 INFN (3 EIC_NET)
  - 9 convener delle sessioni parallele, di cui 1 INFN (EIC_NET)
  - 44 talk in sessioni parallele, di cui 2 INFN (1 EIC_NET)
  - 1 sessione di *"tutorial" per le simulazioni* per EIC: 2 organizzatori di cui 1 INFN (EIC_NET)

====

https://indico.in2p3.fr/event/18281/

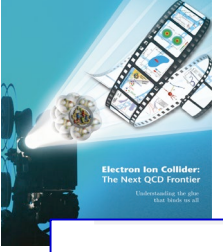



# ATTIVITA' EIC_NET

- **PHYSICS**
  - **Event generators for the electron-nucleon and electron-nucleus scattering** ***(Trieste)*** — continuation
  - Building-up the **physics case for hadron spectroscopy at EIC** ***(Genova, Roma2, Bologna)*** — new
  - Simulation studies to ***extract diffractive structure functions (Torino)*** — new
- **MONTE CARLO STUDIES**
  - **Simulation studies for physics and detectors** ***(Bari, Bologna, Torino)*** — new
  - **Particle identification** at EIC by a **Time-of-Flight detector** ***(Bologna)*** — new
- ***DETECTOR R&D***
  - **Electromagnetic calorimetry** ***(Genova, Roma2)*** — continuation
  - **Streaming RO** ***(Genova, Roma2)*** — continuation
  - **R&D for Cherenkov imaging techniques** ***(Catania, Ferrara, Frasacti, Roma1)*** — continuation
  - **R&D for gaseous single photon detectors** for Cherenkov applications ***(Bari, Trieste)*** — continuation

***una buona miscellanea di continuazioni e nuove attivita'***

**Per saperne di piu': le relazioni di R. Preghenella e A. Celentano**




# EIC_NET e il support al di la' dell'INFN

From USA

In collaboration with Colleagues from USA within the program:

**"Generic R&D for EIC"**

STATUS: **On-going support**

- **eRD1** "Calorimeter Consortium"
  - **Genova, Roma 2**
- **eRD6** "Tracking & PID detector R&D towards an EIC detector"
  - **Trieste**
- **eRD14** "ID Consortium for an integrated program for Particle Identification (PID) at a future Electron-Ion Collider"
  - **Ferrara, Roma 1**
- **eRD20** "Developing Simulation and Analysis Tools for the EIC"
  - **Trieste**
- **eRD23** "Streaming Readout for EIC Detectors"
  - **Contact persons:** M. Battaglieri (from INFN) and J.C. Bernauer
  - **Genova, Roma 2**

From EC

**STRONG-2020**

- project **STRONG-2020 financed by the EU community**, 2 WPs:
  - JRA4 "3D structure of the nucleon in momentum space" (Cagliari, Pavia, Torino, Trieste) *[Theorists & Experimentalists]*
  - JRA14 "Micropattern Gaseous Detectors for Hadron Physics " (Trieste)

STATUS: **APPROVED**

**AIDA++**

- Proposal being assembled for a new EC call (following AIDA, AIDA2020):
- EoI 24 " ***Photon detectors for hadron particle identification at high momenta with compact RICHes*** " (Bari, Trieste)

STATUS: **Proposal preparation**

From ITALY

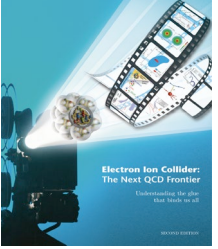
- PROGETTI GRANDE RILEVANZA (Projects of Large Relevance) 2018

  (Ministry of Foreign Affairs )

**"A triggerless DAQ for the Electron Ion Collider (EIC)"**

- **INFN Participants**: Genova, Roma1, Roma2
- **Participants from abroad** : MIT
- **STATUS: APPROVED !**


STATUS: **APPROVED**




# I teorici INFN & EIC

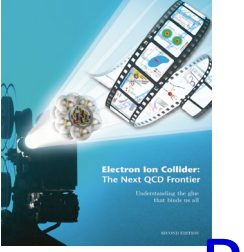
Theoretical Hadronic Physics in Italy organized in INFN project NINPHA:

**NINPHA National INitiative in Physics of HAdrons**

located in: TOrino, PaVia, GEnova, PeruGia, RoMa1, CAgliari

INFN theoretical activity for EIC
within a more general project related
to hadron physics at large

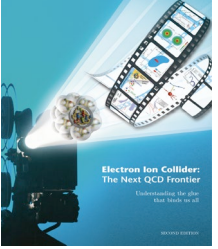

- Main goal:
  - full 3D mapping (in momentum and position space) of confined parton dynamics inside the nucleon
  - understand how partons make up hadrons through QCD
- Research items:
  - properties of 3D partonic distributions (TMDs, GPDs, GTMDs, Wigner): factorization th.'s, evolution eq.'s, universality, matching with fixed-order pQCD, calculations, relation to partonic (orbital) angular momentum, etc..
  - phenomenological extraction of PDFs / TMDs from global fits of exp. data
  - modeling of TMDs, GPDs, GTMDs; support to experimental activities (JLab12)
  - models of double parton distributions; studies of double parton scattering and search for new physics at LHC
  - study of proton polarizabilities in Compton scattering; support to experiments (Mainz)
  - quark models of baryon and meson wave functions; study of spectrum of meson hybrids and X, Y, Z resonances; support to spectroscopy activities at JLab
- Other activities:
  - co-organization of various workshops, particularly at ECT*(Trento) and INT (Seattle)
  - members of IAC / conveners in many workshops and conferences (Light-Cone, MENU, DIS, QCD Evolution, EuNPC, Transversity, EICUG meetings..)
  - Pasquini (PV) member of IAC at CFNS (Center for Frontiers in Nuclear Science)




# PROIEZIONE TEMPORALE

## RIASSUMENDO

- Per il progetto EIC
  - CD0 e scelta sito nei prossimi mesi
  - Inizio costruzioni macchina 2026
- Per la comunita' internazionale (EICUG)
  - Preparazione dello YR nel 2020
  - Formazione delle collaborazioni nel 2021
- Per EIC_NET
  - Continuazione dell'attivita' preparatoria fino al 2021 incluso
    - EIC_NET si e' dato uno statuto interno per garantire il suo processo di gestione
  - Dal 2020 in modo maggiormente focalizzato grazie all'impegno per il YR
  - Nel 2021 : costruire la transizione da EIC_NET a "EIC_exp"
  - Nel 2022: parte "EIC_exp"




# CONCLUDENDO

- Il progetto EIC
  - **Vicinissimo all'approvazione**
- Lo stato del progetto
  - **Importanti avanzamenti nell'ambito acceleratore**
  - **Inizia l'avventura del disegno concreto dei rivelatori (stesura YR)**
- INFN & EIC
  - **Comunita' nazionale determinata, attiva, entusiasta**
  - **In sintonia e col support del management (azioni top-down e bottom-up sinergiche)**