

EIC-related activities in Italy

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INFN physicists & EICUG

- **INFN members in EICUG** (updated on 12 March 2019):
 - **86 (/ 855)** from 15 INFN sites
 - 25 theorists
 - 61 experimentalists
 - for comparison, in **Summer 2016** : 45 (/662)
 - A growing community
 - Several of us interested/at work since years
- **INFN-EICUG members serving within EICUG:**
 - the 15 members of the IB
 - IB deputy-chair: Andrea Bressan
 - member of the SC: Marco Radici

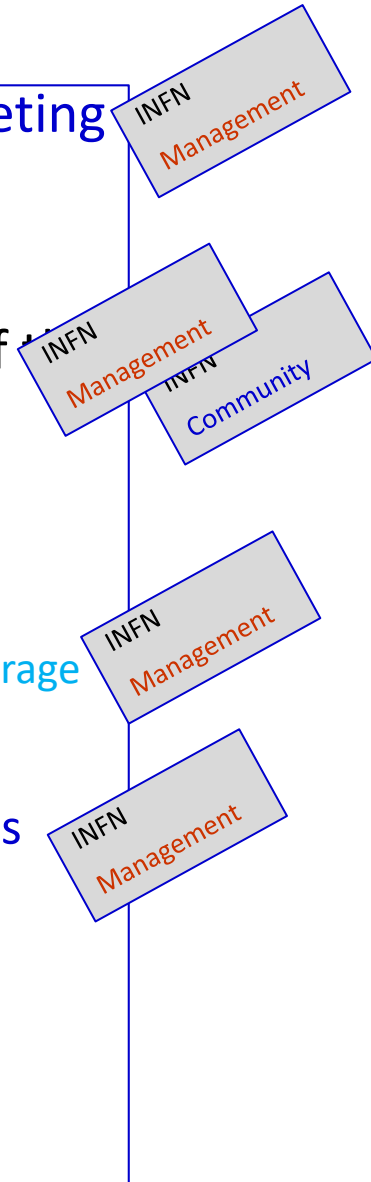
INFN physicists & EICUG

INFN community present and active within the EICUG

- **EICUG2018 – Washington, 30/7-2/8 2018**
 - INFN contributions:
 - International Advisory Committee, 16 members, *2 from INFN*
 - 29 plenary talks, *3 by INFN physicists*
 - 9 conveners of the parallel sessions, *1 from INFN*
 - 43 talk in the parallel sessions, *1 from INFN*
 - 6 talk in the detector workshop, *1 from INFN*

INFN & EICUG, a bit of history

- INFN participation in EIC scientific program is discussed in the periodical bilateral meeting between INFN and DOE:
 - October 2016
 - October 2017
 - December 2018
- **11 May 2017** – a BNL delegation visits INFN headquarters: EIC is the main element of agenda
 - Representatives of the EIC interested community invited
- **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”
- **May 2018** – INFN management visits Jlab, INFN contribution to the EIC project discussed in this context
- **May 2018** – an collaboration of INFN experimentalists interested in EIC is formed
- **10 June 2018** – project EIC_NET approved



INFN experimentalists & EIC

- **The obvious perspective of the experimentalists :**

- When time is mature, enter in **a collaboration targeted to the experiments** where:
 - Contribute to define and enrich the **physics case**, later produce **physics results by data analysis**
 - Contribute to the experimental setup by the design, construction and operation of **relevant pieces of hardware**
- To make all this possible, **get the support of their Institution**

- **For INFN experimentalists this implies an approved INFN PROJECT**

- Presently, it cannot yet be targeted to a collaboration →
targeted to preparatory activities
- **an INFN project** named **“EIC_NET”** dedicated to prepare **INFN participation in EIC** has been proposed and **approved** in 2018 with financial support starting from 1/1/2019

ABOUT THE INFN PROJECT EIC_NET

• **MOTIVATIONS & GOALS**

- Providing a **formal structure** to the INFN community having true and deep interest in EIC
 - Part of the community is **already active in R&D** for the experiments at EIC
 - A path towards an **enlargement** of the INFN community
 - Create **coherence** of the INFN-EIC community
 - A **strong message** abroad
- Support to the internal and external **networking activities** (meetings, conferences)
- **Home support** (financial, access to infrastructures) to the *on-going* and *newly starting R&D activities*

• **SCIENTIFIC REFERENCE**

- **EIC_NET** is reviewed by the **INFN CSN3 (Scientific Committee for Nuclear Physics)**

• **PARTICIPANTS** (present picture)

- **45 experimentalists from 11 INFN units**
 - *Bari, Bologna, Catania, Ferrara, Frascati, Genova, Padova, Roma1, Roma2, Torino, Trieste*
- *Mainly physicists active in ALICE, COMPASS, JLAB experiments*
- PI: Silvia Dalla Torre

Panorama of INFN activities dedicated to EIC

Activities

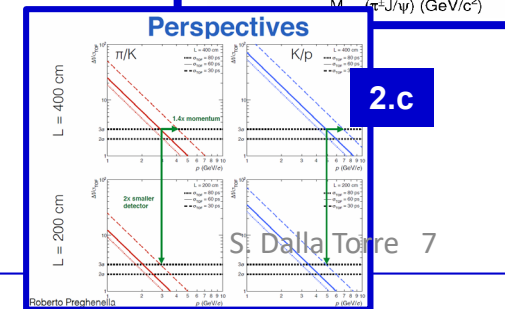
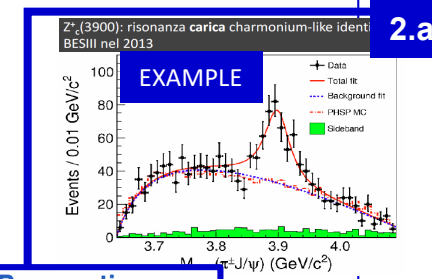
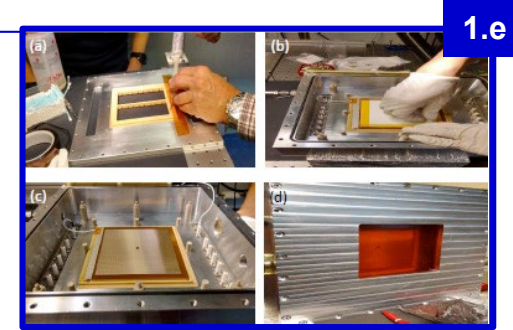
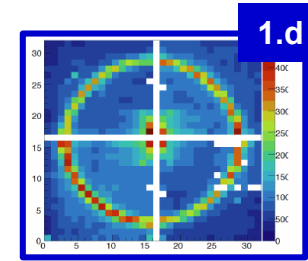
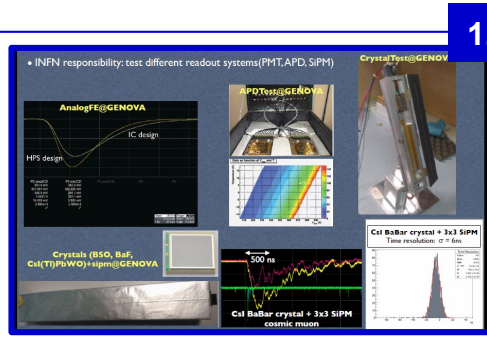
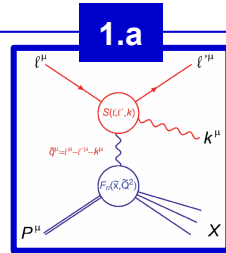
1. Already ongoing

- a) Event generators for the electron-nucleon and electron-nucleus scattering (*Trieste*)
- b) Electromagnetic calorimetry (*Genova, Roma2*)
- c) Streaming RO (*Genova, Roma2*)
- d) R&D for Cherenkov imaging techniques (*Catania, Ferrara, Frasacti, Roma1*)
- e) R&D for gaseous single photon detectors for Cherenkov applications (*Bari, Trieste*)

2. To be started in 2019

- a) Building-up the physics case for hadron spectroscopy at EIC (*Genova, Roma2*)
- b) Simulation studies for physics and detectors (*Bari, Bologna*)
- c) Particle identification at EIC by a Time-of-Flight detector (*Bologna*)

Moderate INFN financial support for all this starting in 2019



FURTHER APPLICATIONS FOR FINANCIAL SUPPORT WITHIN 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 !**

Ministero degli Affari Esteri
della Cooperazione Internazionale

Grande Rilevanza
Stati Uniti d'America
Physics and Astrophysics

Identificativo: PGR00034

Area di ricerca: Physics and Astrophysics
Titolo (in Italiano): Un sistema di acquisizione triggerless per l'Electron Ion Collider (EIC)
Titolo (in altra lingua): A triggerless DAQ for the Electron Ion Collider (EIC)
Parola chiave #1: streaming readout
Parola chiave #2: electromagnetic calorimeter
Parola chiave #3: hadron physics

FURTHER FINANCIAL SUPPORT from ABROAD

In collaboration with Colleagues from USA within the program:

“Generic R&D for EIC”

- **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**

EIC-related events in Italy

- **EICUG2017** (<https://eicug2017.ts.infn.it>)

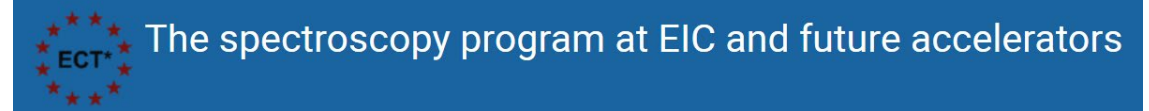
- Trieste, 19-22 July 2017



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

(<https://indico.ectstar.eu/event/29/>)

- Trento, 19-21 December 2018



- **EIC software meeting**

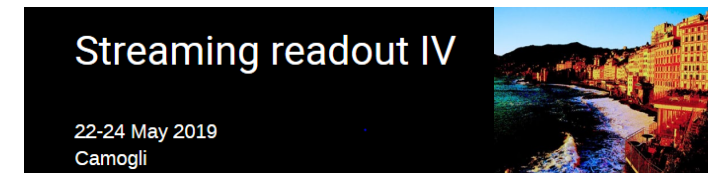
- Trieste, 21-22 May 2019



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

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

- Camogli, 22-24 May 2019



INFN theorists & EIC

input kindly provided by
Marco Radici



Theoretical Hadronic Physics in Italy organized in INFN project NINPHA:

NINPHA National Initiative in Physics of Hadrons

located in: **TO**rino, **PaV**ia, **GE**nova,
PeruGia, **RoMa**1, **CA**gliari

National Coordinator: E. Boglione (TO)

Population (end 2018):

TO	3 staff	1 post-doc	1 PhD
PV	4 staff	3 post-doc	4 PhD
GE	3 staff	1 post-doc	1 PhD
PG	3 staff		1 PhD
RM1	1 staff	1 post-doc	1 PhD
CA	3 staff	2 post-doc	1 PhD

=====
Tot 17 staff 8 post-doc 9 PhD



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

INFN funds: 42 k€ from CSN4 for 2019 + 2 (non Italian) post-doc's (RM1, CA)

Other funds: ERC Consolidator 3DSpin (Univ. PV + INFN, P.I. Bacchetta - PV)

Related project 3DGlue (Univ. PV, post-doc Celiberto - PV)

Marie-Curie GLUECORE (INFN, post-doc Echevarria - PV)

participation in Horizon2020 project STRONG2020 (just approved)



INFN theorists & EIC

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- **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)

INFN & EIC, in conclusion

- **Wide and motivated community**
- **Preparatory activity officially recognized and supported by INFN**
 - both on the experimental and theoretical side
- **The first need of this INFN community:**
 - **Concrete US steps towards EIC approval, site selection and construction planning within a reasonably short time-scale**
to avoid losing momentum