



EIC EoI by INFN

- call for EIC Expression of Interest
- internal path for the INFN EoI preparation
- content of the INFN EoI
- conclusions

Domenico Elia

Giornata Nazionale EIC_NET 2020



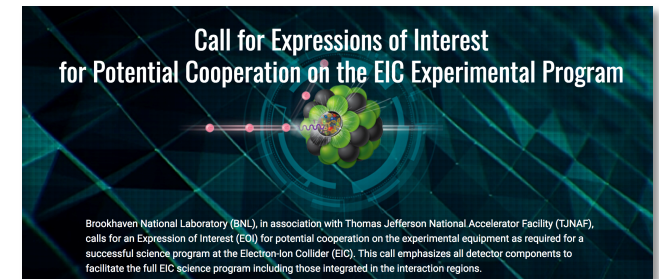
Call for EIC Expression of Interest

First step towards Collaborations at EIC:

<https://www.bnl.gov/eic/EOI.php>

- basics of the “call”:

- ✓ anticipated in March, issued on June 2020
- ✓ by the EIC Project (BNL, in association with JLab)
- ✓ for potential cooperation on the experimental equipment as required for a successful science programme at the EIC
- ✓ will give the EIC Project guidance on the current interest for participating in the EIC experimental programme, including an initial understanding of the full scope of the experimental equipment
- ✓ interested groups to work together with their country, their geographical region, or as a general consortium



Call for EIC Expression of Interest

First step towards Collaborations at EIC:

<https://www.bnl.gov/eic/EOI.php>

- basics of the “call” (cont’d):

- ✓ deadline for submission: November 1, 2020
- ✓ Eoi is non-binding
- ✓ Eoi main purpose is to guide expectations and to better understand the potential EIC experimental equipment scope
- ✓ template questionnaire:
 - it is understood that maybe not all questions can be answered precisely
 - has to be 10 pages long, but appendices can be eventually added
- ✓ all submitted Eoi questionnaires are public (<https://indico.bnl.gov/event/8552/>)
 - possibility to submit a private document to be shared with EIC Project only

Expression of Interest (EOI) Questionnaire

(Use this template for your document. The document can be at most 10 pages long, in this style, font and font size, but you can have appendices and do not have to include the tables in the page count. There is no prescribed format of the document, but you are asked to address the questions below. It is understood that maybe not all questions can be answered precisely, everybody is asked to fill the questions as good as currently possible. All submitted public Questionnaires will be viewable here (<https://indico.bnl.gov/event/8552/>). You can also submit a separate document with certain information you would only like to be viewable by the EIC Project. DEADLINE FOR SUBMISSION: NOVEMBER 1.)

Please indicate the name of the contact person for this submission:
(we ask for one main contact person per submission. You can as needed provide further contacts, but there should be one primary contact)

Please indicate all institutions collectively involved in this submission of interest:
(even if institutions can submit on their own, it is highly encouraged to form groups to work together within their country, their geographical region, or as a general consortium)

Please indicate the items of interest for potential equipment cooperation:
(indicate experimental equipment components, including those integrated in the interaction regions, each separately)

Please indicate what the level of potential contributions are for each item of interest:
(e.g. indicate if contributions are for full in-kind experimental equipment components – we have provided a rough direct cost estimate for many components in an appendix (see slide 10 & 11 at <https://indico.bnl.gov/event/7449/contributions/35863/attachments/272774/1597/EIC.Comp.Det.032020.enq.pdf>), if contributions are for partial in-kind experimental equipment components, if contributions are for in-kind labor contributions, etc.)

Please indicate what, if any, assumptions you made as coming from the EIC Project or the labs for your items of interest:
(e.g., indicate if you include engineering and design activities or assume those to come from the EIC Project, if you assume certain material costs to be covered by the EIC Project, if you rely on existing capabilities at the labs, etc. Try to be as inclusive as you can be.)

Please indicate the labor contribution for the EIC experimental equipment activities:
(e.g., for each cooperation and/or institution list the number of senior staff, the number of postdocs, and the number of graduate and undergraduate students that you plan to dedicate to



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- further indications/clarifications from the FAQ:
 - ✓ **Q: Where does this step lie on the path to build collaborations that propose detectors?** A: The call for detector proposals will come after an evaluation of the EOI submissions. *The evaluation will guide the call for detector proposals.*
 - ✓ **Q: What exactly will this EOI be used for?** A: The EOI will *inform the EIC Project about what detector scope can be built, e.g., if one or two detectors would be included*, one or two interaction regions, what ancillary equipment to assume, etc. It may be used to *inform with which countries agreements in any kind of form are desired*. It may also be useful for further discussions between DOE and NSF.



Internal path for the INFN EoI

Strategy and timeline:

- initial discussion within EIC_NET in May:
 - ✓ first meeting of Comitato EIC Italia (CEI) on May 27, 2020
 - ✓ aim to define main guidelines for the content:
 - agree to have a single EoI by all the involved INFN groups
 - define a set of hardware-oriented items for the INFN contribution to EIC
 - include mentioning of the main physics interests for the INFN community
 - provide reasonable estimate of manpower and corresponding timelines for availability of the effort, taking into account existing commitments (JLAB, ALICE and COMPASS)
 - mention all existing/expected collaborations with non-INFN groups
 - try to provide a preliminary estimate of the INFN in-kind contribution (both for R&D and construction activities), to be agreed with the INFN management (see next point)



Internal path for the INFN EoI

Strategy and timeline:

- initial discussion within EIC_NET in May:
 - ✓ first meeting of Comitato EIC Italia (CEI) on May 27, 2020
 - ✓ aim to define main guidelines for the content
- frequent exchanges with the management in May/June/July/August:
 - ✓ monthly meetings EIC_NET EB with D. Bettoni, E. Nappi and R. Nania
 - ✓ we thank them for many suggestions/feedback and overall guidance!
- definition of the content in June/July:
 - ✓ further meetings of CEI + interested colleagues from TO /TS ALICE groups
- final EoI document preparation in September/October



Internal path for the INFN EoI

Preparation of the INFN EoI:

- gathered contributions from an “extended” EIC_NET community:
 - ✓ EoI preparation effort lead by EIC_NET
 - ✓ INFN groups currently not in EIC_NET welcome to join at any later stage!
 - ✓ anticipated (potential) interest for EIC by ALICE groups in TO and TS:
 - TO: possible future involvement for vertexing and physics/simulations (S. Bufanino)
 - TS: personal participation from 2021 + link to the ALICE group (G. Contin)
→ Stefania and Giacomo welcome to contribute to the EoI preparation



Internal path for the INFN EoI

Preparation of the INFN EoI:

- gathered contributions from an “extended” EIC_NET community
- editorial effort organization:
 - ✓ preliminary preparation of material from 4 sub-groups:
 - **PID**: S. Dalla Torre + P. Antonioli, M. Contalbrigo, M. Alekseev
 - **VERTEXING**: D. Elia + S. Bufalino, G. Contin
 - **STREAMING R/O**: A. Celentano + A. D’Angelo
 - **SOFTWARE AND COMPUTING**: A. Bressan + D. Elia, R. Preghenella
 - ✓ appendices:
 - INFN: S. Dalla Torre, R. Turrisi
 - PHYSICS: A. Bressan, A. D’Angelo, R. De Vita, R. Preghenella
 - THEORY: M. Radici
 - ✓ final drafting committee: A. Bressan, A. D’Angelo, S. Dalla Torre, D. Elia

Content of the INFN EoI

Overview of the document:

- size and ingredients in the “questionnaire”:

- ✓ 10 pages + 1 table
- ✓ involved institutions (INFN Units + univ.)
- ✓ 4 items for potential equip. cooperation
- ✓ expected manpower & timeline
- ✓ estimate of in-kind contribution

- appendices:

- ✓ INFN
- ✓ Physics interests
- ✓ Theoretical contribution to EIC physics programme

Domenico Elia

Giornata Nazionale EIC_NET / LNF online / 3.11.2020

Expression of interest of the INFN community for the Electron Ion Collider

Expression of Interest (EOI) of the INFN community Questionnaire

Please indicate the name of the contact person for this submission:
Silvia DALLA TORRE, INFN - Trieste (Silvia.DallaTorre@ts.infn.it)

Please indicate all institutions collectively involved in this submission of interest:

INFN, the following Units of the Institute:

Sezione di Bari	Laboratori Nazionali del Sud
Sezione di Bologna	Sezione di Padova
Sezione di Catania	Sezione di Roma 1
Sezione di Ferrara	Sezione di Roma 2
Sezione di Genova	Sezione di Torino
Laboratori Nazionali di Frascati	Sezione di Trieste

The participating scientists are either employed by INFN or associated to INFN and employed by the following Universities: University of Bari Aldo Moro, Polytechnic University of Bari, University of Bologna, University of Catania, University of Eastern Piedmont Amedeo Avogadro, University of Ferrara, University of Genova, University of Padova, University of Roma La Sapienza, University of Roma Tor Vergata, University of Torino, Polytechnic University of Torino, University of Trieste.

Please indicate the items of interest for potential equipment cooperation:

Our potential equipment cooperation covers 4 areas:

- PID in the forward region**
- VERTEXING**
- STREAMING READ-OUT**
- SOFTWARE TOOLS & COMPUTING**

INFN contributions to EIC physics from experimentalists and theorists are discussed in the appendix 2 and Appendix 3, respectively.

In all the areas, INFN groups will collaborate with other Institutions sharing the same scientific goals. Part of the potential collaborators have already been identified:

- PID in the forward region:** Collaboration concerning the R&D, also for synergic aspects, and the constructions is presently foreseen with Banaras Hindu University, Duke University, Georgia State University, Stonybrook University.
- VERTEXING:** Most of the groups interested in vertex detector activities within the EIC community have recently joined the EIC-Vertex Consortium, namely: LBNL, University

BNL, Instrumentation Division, CCNU and other groups that might join at a later stage in construction efforts. We will work in close contact with the Consortium: BNL, JLAB, CUA, MIT, and the software activity of the INFN groups will be coordinated by the EIC-Vertex Consortium.

Expression of interest of the INFN community for the Electron Ion Collider

APPENDIX - INFN groups and Physics at the EIC

The experimental physicist groups from the INFN Units or National Laboratories presenting the EIC have a long history and covered leading roles in the study of the spin content of the proton, in its multidimensional structure, in the study of hadronisation and spectroscopy. They have been and are driving many analyses focused on the measurement of the polarized structure functions and observables that show effects of TMDs, GPDs, on the study of the nucleon structure in diffractive and small-x processes searched for new bound states in the hadron spectra, and on the analysis of the electron-ion collisions.

In the next years, the strong engagement in their ongoing experimental research in COMPASS and ALICE at CERN and in Hall-A and Hall-B at Jefferson Laboratory will continue. INFN has initiatives to either complete or revise the analysis of archived data HERMES and ZEUS experiments at HERA. All these activities constitute a very synergy in preparation for the EIC.

The physics interests and perspectives of the Italian groups participating to the EIC will cover three main subjects, i.e.

- Colour charges in nuclear matter and hadronisation
 - Structure of the nucleon and of the nuclei
 - Spectroscopy (and search for exotic states)
- The present EIC accelerator design and detector concepts, optimized for broad physics reach, fulfil all the requirements posed by the physics items of our main line: we are confident that this policy will be maintained and reinforced over the design construction phases following the current timelines to guarantee the whole physics in a timely schedule.

In the following, we outline our expectations and foreseen activities in preparation to realization.

Coloured charges in nuclear matter and Hadronisation

A large fraction of our community is highly interested and deeply involved in the study of perturbative QCD phenomena with heavy-ion collisions at ultra-relativistic energies currently contributing to the characterisation of the hot QCD matter created in ion-ion with the ALICE experiment at the LHC. They plan to contribute to the EIC Physics as interest in these specific Physics topics:

- search for non-linear QCD phenomena at low-x and high gluon density;
- study of the interplay of fast coloured partons in nuclear matter;
- understanding the hadronisation of heavy-flavoured quarks.

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Expression of interest of the INFN community for the Electron Ion Collider

APPENDIX – about INFN

This Appendix is intended to provide a quick introduction to the Italian National Institute for Nuclear Physics.

INFN (Istituto Nazionale di Fisica Nucleare, National Institute of Nuclear Physics) is the Italian research institute, supervised by the Ministry of Education, Universities and Research, with the mission to perform fundamental research in the field of the fundamental constituents of matter and of the interactions regulating their behaviour. The Institute has complete autonomy concerning scientific goals within the designated mission, regulation, internal organisation and financial management.

INFN origin

It was a Fermi's intuition the need of a national institution dedicated to nuclear physics to make it possible to have been established only after the second world war: the Universities of Rome, Padua, Milan and Turin founded INFN on 18 August 1951 devoting the scientific tradition established during the 1930s by Enrico Fermi and his theoretical and experimental work in nuclear physics.

In the latter half of the 1950s, INFN designed and built the first Italian accelerator synchrotron developed in Frascati, where the first national laboratory was established steps of the initial period are the constitution of a computing centre, built in 1955 strong Italian support to the foundation of CERN, recognized by designating Ettore Majorana CERN Director General.

INFN human resources

INFN fulfils its mandate thanks to a community counting more than 5000 scientists, engineers, 1000 of them employed by INFN, the others from Universities and institutes, who are associated to the Institute activities. Among them, about 1000 Ph.D. post docs are included. The research personnel are assisted by about 600 unpermanental and 300 units of administrative staff.

INFN financial resources

The main source of funding is from the Department of Education, Universities and Research, which amounts to approximately 200 M€ (G70%) per year. It covers the salaries of the staff, the operation costs of the INFN sites and the INFN research infrastructure costs of research equipment and consumables. A further financial source, of the last year, is obtained from European and regional funds, as well as from specific national

Organization

INFN is well present in the territory, with twenty Units (Sections), six Associated Group Laboratories (Laboratori Nazionali di Frascati - LNF, Laboratori Nazionali di Legnaro - LNL, Laboratori Nazionali di Laboratori Nazionali di Legnaro - LNL, Laboratori Nazionali del Sud - LNS).

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Expression of interest of the INFN community for the Electron Ion Collider

APPENDIX - The INFN theoretical contribution to the EIC physics programme

The INFN theoretical activities of interest for the EIC have their main focus on how hadron phenomenology emerges from the interactions generated by the symmetries of QCD, and from the breaking of these symmetries. The main goal is building accurate 3D maps of the internal dynamics of partons and of their mutual interactions in order to shed light on the composition of hadronic masses and spins in terms of elementary constituents, eventually achieving a microscopic understanding of the mechanisms of QCD confinement. Shaping these maps in momentum and coordinate space requires advanced non-perturbative tools: Transverse Momentum Dependent distributions (TMDs), Generalized Parton Distributions (GPDs), Double Distributions (DDs), Distribution Amplitudes (DAs), etc., and related form factors. These non-perturbative distributions are all important and complementary. For example, 3D maps in momentum space from TMDs and in coordinate space from GPDs are not related by a Fourier transform: TMDs and GPDs are different projections of the same mother Wigner function which contains the most complete tomographic information on hadrons, including insight into the partonic orbital momenta.

The INFN theoretical activities are organized under the INFN project NNPIA (National Initiative in Physics of Hadrons) which is structured in five units (Torino, Pavia, Genova, Perugia, Cagliari) with currently 15 staff members, 12 post-doc collaborators and 3 Ph.D. students. There are three main research lines.

NNPIA members are engaged in theoretical and precision studies of the properties of the non-perturbative tools mentioned above, such as proper factorization theorems (in relation to their counterpart in the standard collinear framework), universality, transformation under proper evolution equations, matching of TMD-based calculations to highly accurate perturbative calculations at larger energies, gauge-invariant definition of orbital angular momentum, properties of the energy-momentum tensor and the decomposition of hadron mass, etc.

There is also an intense phenomenological activity on the extraction of TMDs and GPDs of quarks in the proton from virtual photo production data sets provided by positioning fixed-target experiments (HERMES, COMPASS, JLab12) and colliders (EVA/RHIC, RHIC, LHC, BLAC, IHEP). The activities, which are accurate at the 10% level in the reconstruction of soft gluon radiation, are being used to estimate the impact of EIC pseudo-data on the uncertainty of various SIDIS (polarized) observables. In a similar fashion, progress is being made on a realistic description of TMDs and GPDs in light nuclei, which are necessary first of all to explore the medium modifications of parton densities as well as the in-medium fragmentation, but also to extend information on the 3D structure of the nucleon, and in turn to achieve a precise flavor separation of parton densities. All these studies will be especially valuable for the future EIC, particularly in view of the use of light-ion beams.

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Content of the INFN EoI

Main ingredients:

- participating institutions:
 - ✓ 12 INFN Units
 - ✓ including LNF and LNS
 - ✓ connected universities
 - ✓ currently part of EIC_NET

Please indicate all institutions collectively involved in this submission of interest:

INFN, the following Units of the Institute:

Sezione di Bari	Laboratori Nazionali del Sud
Sezione di Bologna	Sezione di Padova
Sezione di Catania	Sezione di Roma 1
Sezione di Ferrara	Sezione di Roma 2
Sezione di Genova	Sezione di Torino
Laboratori Nazionali di Frascati	Sezione di Trieste

The participating scientists are either employed by INFN or associated to INFN and employed by the following Universities: University of Bari Aldo Moro, Polytechnic University of Bari, University of Bologna, University of Catania, University of Eastern Piedmont Amedeo Avogadro, University of Ferrara, University of Genova, University of Padova, University of Roma La Sapienza, University of Roma Tor Vergata, University of Torino, Polytechnic University of Torino, University of Trieste.

Of course, leaves open (and welcome) any further entries at a later stage.

Contributions to the following mentioned items for equipment cooperation are not specifically linked to groups/units to leave us the largest flexibility in defining how to distribute our efforts and/or include additional interests.



Content of the INFN EoI

Main ingredients:

- potential equipment cooperation:
 - ✓ PID in the forward region
 - ✓ VERTEXING
 - ✓ STREAMING R/O
 - ✓ SOFTWARE & COMPUTING

Collaboration with non-INFN Institutions

In all the areas, **INFN groups will collaborate with other Institutions sharing the same scientific goals.** Part of the potential collaborators have already been identified:

- PID in the forward region:** Collaboration concerning the R&D, also for synergic aspects, and the constructions is presently foreseen with Banaras Hindu University, Duke University, Georgia State University, Stonybrook University.
- VERTEXING:** Most of the groups interested in vertex detector activities within the EIC community have recently joined the EIC Silicon Consortium, namely: LBNL, University of Birmingham, Rutheford-Appleton Laboratories, BNL Instrumentation Division, CCNU (Wuhan) and JLAB and ORNL. The Consortium and other groups that might join at a later stage are the INFN natural collaborators in R&D and in construction efforts.
- STREAMING READ-OUT:** INFN physicists will work in close contact with the colleagues of the EIC R&D Streaming Readout Consortium: BNL, JLAB, CUA, MIT, Stony Brook.
- SOFTWARE TOOLS & COMPUTING:** The software activity of the INFN groups will continue in the context of the EICUG Software Working Group.

Includes R&D and construction, in a logically connected evolution (next slides)

- timeline of the contribution:
 - ✓ preparatory phase with R&D activities in 2021-2024
 - ✓ construction phase in 2025- 2029



Content of the INFN EoI

PID in the forward region:

- needs and current main options:
 - ✓ hadron and e/π separation in a wide momentum range (a few to ~ 50 GeV/c)
 - ✓ need for a gas radiator RICH, with complementary approach for low momenta
 - ✓ two main options:
 - dRICH (dual RICH), including two radiators (C-F gas and aerogel)
 - windowless gaseous RICH (radiator providing atmosphere for MPGD-based sensors), to be complemented with a device for low-momentum PID (aerogel or TOF)
- large involvement of the INFN groups (dedicated R&D activities ongoing)



Content of the INFN EoI

PID in the forward region:

- needs and current main options
- contribution to construction:

We plan, during the years 2025-2029, **substantial engagement in the design and construction of the device/devices for PID in the forward region.** This contribution will be performed in the context of the concept that will be selected by the collaboration. In the next four years (2021-2024), we plan to **continue and enlarge the present R&D activity** in order to contribute to the definition of the concept of the forward PID system and, as first step, to the preparation of a corresponding Technical Design Report. The foreseen R&D activities are listed. Some items can be beneficial also to PID devices considered for the barrel and backward regions.



Content of the INFN EoI

PID in the forward region:

- needs and current main options
- contribution to construction
- list of R&D activities:
 - ✓ development of Monte Carlo and software analysis algorithms
 - ✓ aerogel studies
 - ✓ dRICH prototyping
 - ✓ sensor studies
 - ✓ pressurized gaseous detectors

For details on the current R&D activities see Pietro's talk later today



Content of the INFN EoI

VERTEXING:

- needs and current main options:
 - ✓ high-precision vertex reconstruction and access to lowest possible transverse momenta (down to $\sim 50\text{-}100\text{ MeV}/c$) are key to the EIC science programme
 - ✓ two main options for central tracking:
 - hybrid system (silicon vertex + TPC & additional gaseous detectors)
 - all-silicon tracker
 - ✓ MAPS technology meets the requirements for the EIC vertex detector:
 - new-generation MAPS in 65 nm CMOS emerging (eg ALICE ITS3, CERN EP R&D)
 - ALICE ITS3 specs and development timescale compatible with EIC
 - relevant synergies between the two projects
 - potential large impact for the contribution to EIC from the INFN groups



Content of the INFN EoI

VERTEXING:

- needs and current main options
- contribution to construction:

The specific size and areas of the INFN potential cooperation in the construction activities for the vertex detector cannot be completely assessed at this stage. Based on the available resources and expertise in the INFN groups currently involved in EIC and in a projection of the future manpower availability, there are anticipated interests in connection with the following items:

- development of hardware and software tools for the basic functional module test;
- production/assembly of the basic modules and/or staves;
- design and development of the cooling system;
- design and development of the mechanical support structure;
- series qualification tests for chips, modules and other detector assembly components;
- production and analysis of detector performance simulations.

This item list could be confirmed at a later stage according to the development and growing of the interest within the INFN groups currently involved in the ALICE ITS3 project.



Content of the INFN EoI

VERTEXING:

- needs and current main options
- contribution to construction
- list of R&D activities:
 - ✓ detector and physics performance studies with MC simulation of the EIC tracker
 - ✓ techniques and tools for thinning, bending and interconnection of wafer-scale MAPS sensors based on 65 nm CMOS process
 - ✓ pixel-chip sensor test and characterization procedures
 - ✓ solutions for cooling, mechanical support structure and assembly procedure

Details on the current R&D within ALICE ITS3 see Pietro's talk



Content of the INFN EoI

STREAMING R/O:

- needs and current main options:
 - ✓ full CPU software-based triggers replacing standard DAQ
 - ✓ triggerless approach removes the hardware trigger, performs the full on-line data reconstruction and provides precise selections of final states of interest for further high-level physics analysis
 - ✓ what has to be developed/implemented:
 - a powerful station of CPUs, connected by a fast network link to the front-end electronics, receives all data samples, reorganizes the information ordering hits by time, includes calibration constants, and applies algorithms to find specific correlations between reconstructed hits (software trigger), keeping and storing only filtered events
- effort already started in the EIC community with INFN among proponents



Content of the INFN EoI

STREAMING R/O:

- needs and current main options
- contribution to construction:

The INFN groups will **contribute to building-up a triggerless scheme for EIC data acquisition** with particular interest in those detectors that are essential in the event selection. Planning includes working on the **on-line implementation of the calibration parameters**, providing a more precise reconstruction of the kinematical quantities, the **implementation of sophisticated reconstruction algorithms** for a better resolution of close-by tracks and the **improvement in EM/hadron discrimination** for a more efficient background rejection.



Content of the INFN EoI

STREAMING R/O:

- needs and current main options
- contribution to construction
- list of R&D activities:
 - ✓ construction of one or more prototypal systems to test different options, including the full-chain systems: front-end, interface boards to the data transport network, on-line data analysis and selection software
 - ✓ definition and measurement of laboratory and test-beam benchmarks and identification of the physics observables to be used for the validation
 - ✓ streaming read-out tests on existing detectors

More on the current R&D activities in the Pietro's talk



Content of the INFN EoI

SOFTWARE TOOLS & COMPUTING:

- **current links and needs:**
 - ✓ early contribution by INFN to Software Working Groups activities
 - ✓ need for user-centered designed software tools for EIC, prospects for using frontier computing technologies (D/M-Learning and Quantum Computing)
 - **areas of potential contributions:**
 - ✓ workflows (eg EIC Software on federated resources)
 - ✓ MC generators and integration of TMD effects
 - ✓ detector simulation and reconstruction tools (ongoing, connected to the INFN interest in sub-detectors and streaming r/o)
- expect to benefit of the INFN computing infrastructure and its evolution



Content of the INFN EoI

Main ingredients (cont'd):

- level of potential contribution and expected timeline:
 - ✓ proposed as an overall estimate, i.e. not connected to the different items
 - provides necessary flexibility for best tuning of the effort at a later stage

IN-KIND CONTRIBUTION & MAN-POWER timeline:

- PHASE 1 (2021-2023)
current manpower: ~10 FTE
- PHASE 2 (2024)
increase: ~20 FTE
- PHASE 3 (2025-2029)
regime: ~45-55 FTE (~100 participants), ~10 FTE technicians

R&D (2021-2024): ~ 1 M USD
Construction (2025-2029): ~ 7-8 M USD



Content of the INFN EoI

Main ingredients (cont'd):

- level of potential contribution and expected timeline:

TABLE 1 – Labor and investment for R&D and construction in period 2021-2029.							
Years	Labor, scientists	Labor, technical personnel	In-kind investment R&D	In-kind investment constructions	Travelling	Manpower	Investment, TOTAL
	(FTE)	(FTE)	(USD)	(USD)	(USD)	(USD)	(USD)
2021	10		minimal		minimal	0.4 M	0.4 M
2022-2023	10		1 M		0.3 M	1.6 M	2.9 M
2024	20						
2025-2029	50	10		7-8 M	0.7 M	12 M	19.7 - 20.7 M
Investment 2021-2029, TOTAL			1 M	7-8 M	1 M	14 M	23-24 M



Content of the INFN EoI

Main ingredients (cont'd):

- final additional information felt to be helpful:
 - ✓ Synergies with other experimental programmes
 - ✓ Experties and previous experience
 - ✓ Available infrastructure
 - ✓ CERN support:

CERN support

We would like to underline the relevance and the support to our activity that will come from having the EIC experimental activity as a CERN “**recognized experiment**”. CERN is the European “national” laboratory, a unique point of accumulation of scientific and technological know-how facilitating both the R&D and the construction activities. The possibilities offered to recognized experiments include easy access to CERN scientific information and to CERN sites, possibility to organize meetings at CERN, access to test beams, access to technological laboratories, workshops and other services.



Conclusions

- **EIC EoI call:**
 - ✓ guidance for EIC Project on current interest for the experimental programme
 - ✓ needed to better understand the potential experimental equipment scope
- **EIC EoI by INFN:**
 - ✓ common effort of the EIC_NET community + other interested groups
 - ✓ prepared in close connection with the INFN management
 - ✓ includes contributions on selected items where consolidated expertise exists
 - ✓ relies on realistic projection/evolution of the manpower
 - ✓ anticipates potential in-kind contribution in line with “usual” INFN engagement
- **Looking forward to the next steps!**

Backup





Call for EIC Expression of Interest

First step towards Collaborations at EIC:

E. Aschenauer and R. Ent, 2nd EIC YR meeting, Pavia, 20.5.2020:

