

Theory oriented program: motivations and goals

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On behalf of the organizing committee

Welcome !

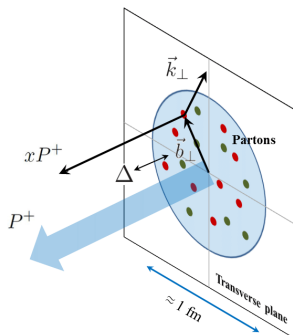
Hadron Physics 2030 is the result of the merge of two projects:

- Multidimensional Hadron Structure (MDHS) whose goal was to kick start the reflexion about the theoretical and phenomenological tools we need to develop in order to exploit at full potentiality EIC data.
- JPhys++ whose goal was to refined the physics case for extending the current facility, toward both a positron beam and then an energy upgrade.

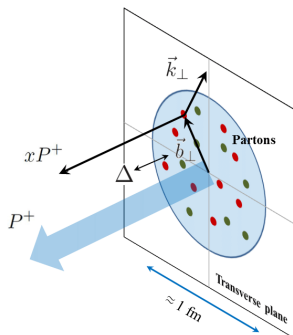
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As IPa is a multidisciplinary institute, the scientific council accepted to support our application, but requiring the two projects to be merged in a single one: Hadron Physics 2030



- 3D picture in Coordinate space
 - ▶ Access to Generalized Parton Distributions (GPDs)
 - ▶ Average position of quarks and gluons
 - ▶ Connection with the energy momentum tensor
 - ▶ Exclusive processes
- 3D picture in Momentum space
 - ▶ Access to Transverse Momentum Dependent Distributions (TMDs)
 - ▶ Average momentum of quarks and gluons
 - ▶ Inclusive processes



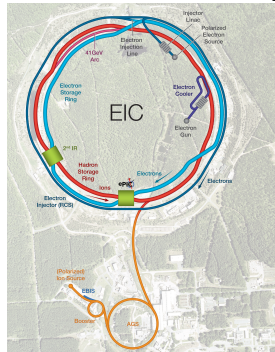
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Connecting experimental data with hadron structures requires many theoretical and numerical developments (choice and description of observables, ill-posed inverse problems, statistical data analysis, etc)

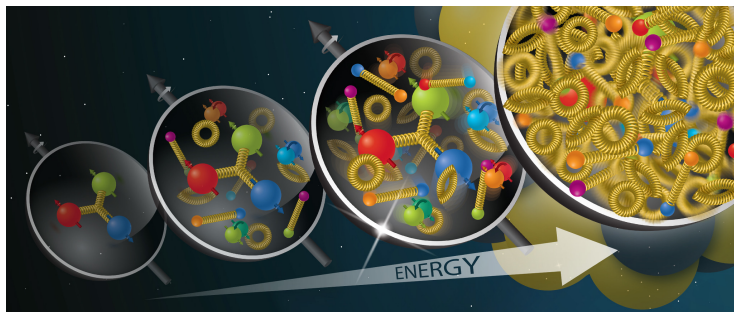
Current Fixed Target Jefferson Laboratory



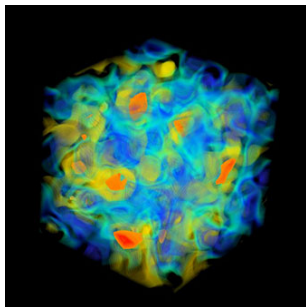
Future Electron-Ion collider Brookhaven Laboratory



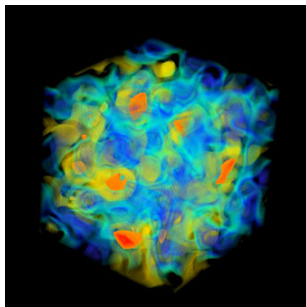
- 2020s : High precision/Low energy measurement at Jefferson Lab
- 2030s : High precision/ High energy measurement at EIC
- UPSaclay is deeply involved in both facilities



- When the energy of the probe grows, the sensitivity to quantum fluctuations with a large number of gluons strongly increases.
- At the EIC, we expect to reach a regime where the nucleon is saturated by gluons.
- This is a real challenge for building 3D maps.



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Connecting the simulation data to hadron structure requires the same effort as for experimental data (perturbative expansion, ill-posed inverse problem, etc).

Challenges

- What are the best strategies to extract GPDs and TMDs from experimental data with a good control on theoretical systematic uncertainties?
- How can large scale simulation improve our understanding of the multidimensional hadron structure?
- With the forthcoming high energy facilities, how to bridge the gap between two distinct regimes of the strong interaction?

Objectives

- Break the walls between the GPDs/TMDs/Lattice/High Energy communities
- Identify common needs between the four different communities
- Trigger the development of common tools and standards
- Define research priorities in view of the construction of the EIC

How does it work ?

morning	Plenary Session
	coffee break
	Three talks or a seminar
lunch break	
afternoon	collaboration/ working time
	tea break
	two or three talks

- Typical day schedule
- One day, one theme (GPDs, Small-x, Lattice, TMDs)
- Today is different with two experimental talks in the afternoon
- Thursday, only one amphitheater is available so the morning talks are shifted to the afternoon

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- Meeting rooms with zoom connections can be booked for collaborative and remote works
- Amphitheater available if a large number of people wants to discuss (except Thursday)

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Advice from IPa

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Once you'll have chose them wisely, they'll know how to do good physics.

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My advice

Take this opportunity to start discussing with people you usually don't (especially if you're a student/postdoc).

IPa has organised for us some social events:

- Monday: buffet at lunch
- Tuesday: Happy hours (cocktail) in the cathedral
- Wednesday: Colloquium (in French) with cocktail
- Thursday: Workshop dinner (registration mandatory and currently opened with Vesna)
- Friday: Free evening

If you have any questions regarding the events, please ask Vesna !

Two main actions need to be performed:

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This second report has of course some consequences:

- We will probably contact you again before summer 2025 to ask you what will have been the scientific impact for you
- We *may* ask *some of* you to write a few pages document
- The final report will be published in “Les cahiers de l’Institut Pascal”.

We hope that this workshop will trigger new ideas, or allow you to improve existing ones. If it ends up in a publication, please mention IPa through in the acknowledgement:

This work was made possible by Institut Pascal at Université Paris-Saclay with the support of the program “Investissements d’avenir” ANR-11-IDEX-0003-01

This allows IPa to justify its scientific impact through the programs it supports, and will allow us to organise other meeting in the future.

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Bottom line

If you want a sequel, make sure to mention IPa !

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Thank you very much !

Thank you
and enjoy our workshop

Back up slides