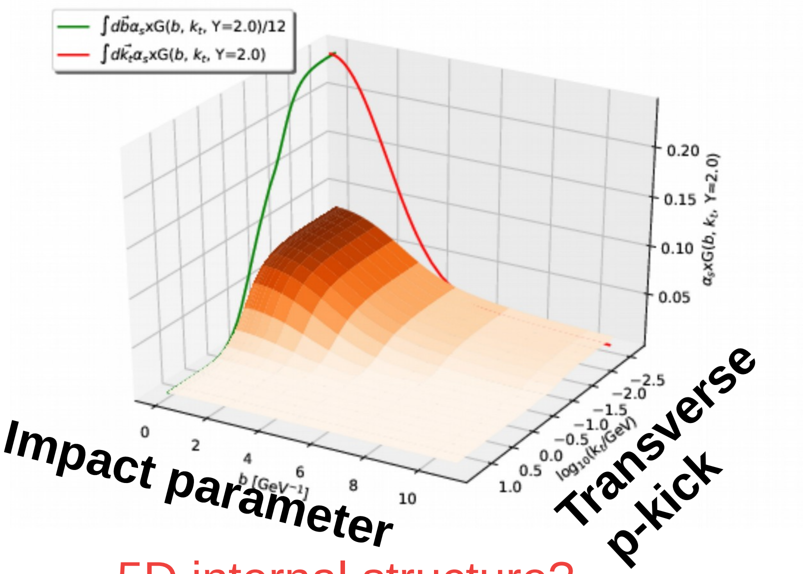
Gluodynamics

P2IO Flagship proposal

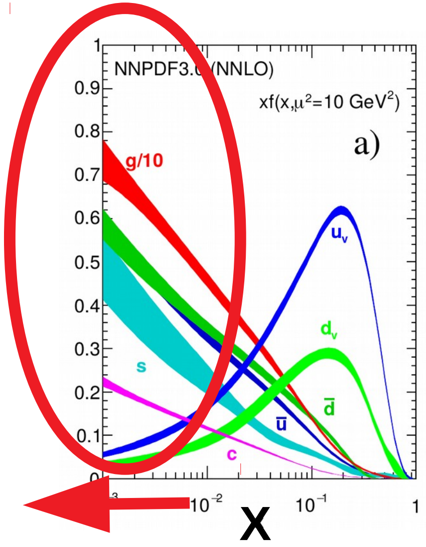
Final selection hearing
14th of November

Michael Winn
for the consortium

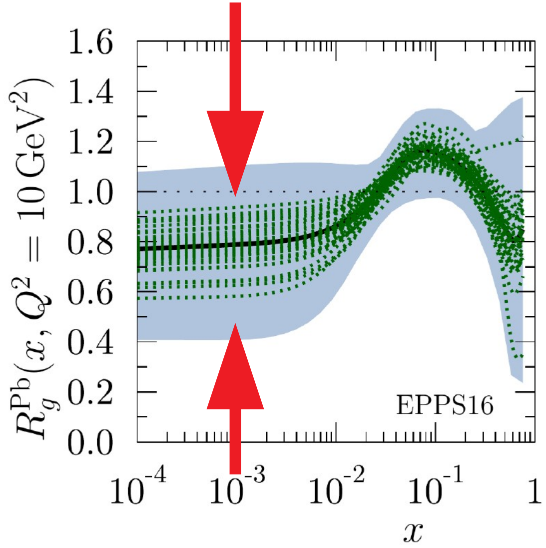
The quest for hadron structure



5D internal structure?



Saturation?



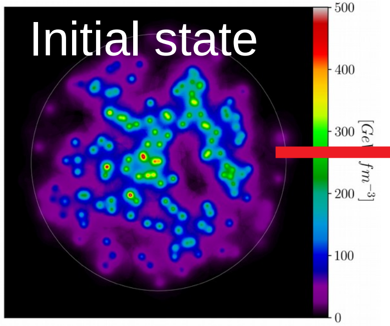
What about nuclei?

Understand the dominant matter constituents: mass, spin, interactions

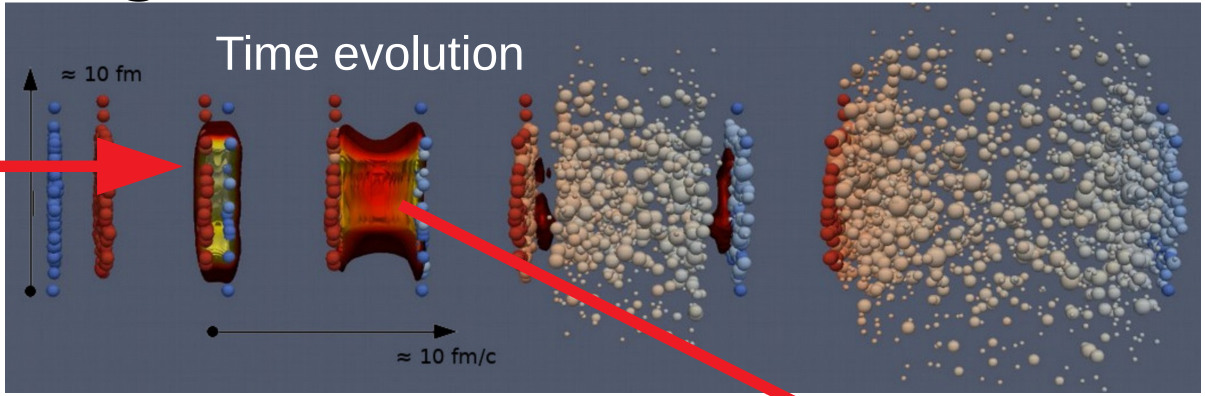
- Multi-dimensional: **gluons** scarcely explored
- Gluon **saturation at low-x**: successful description, but not unique
- **Nuclear structure:** scarce even more for gluons

➢ **new concepts + new tools + precision + new kinematic regimes**

The quest for QCD fluids



Hydro in pPb/pp?
Other effects?

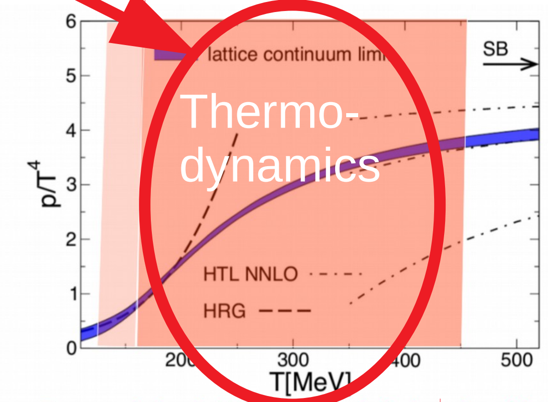


How connect initial state to hydro?

Characterize Quark-Gluon Plasma & initial state of strong gluon fields

- Multiscale probes: **quarkonium & jets**
- **QGP** property extraction: **limited by initial geometry & density**
- Fluid-like behaviour in proton-lead/proton-proton:
  - **Hadron structure central**
  - Hadron-hadron & electron-hadron collisions: **unified description?**

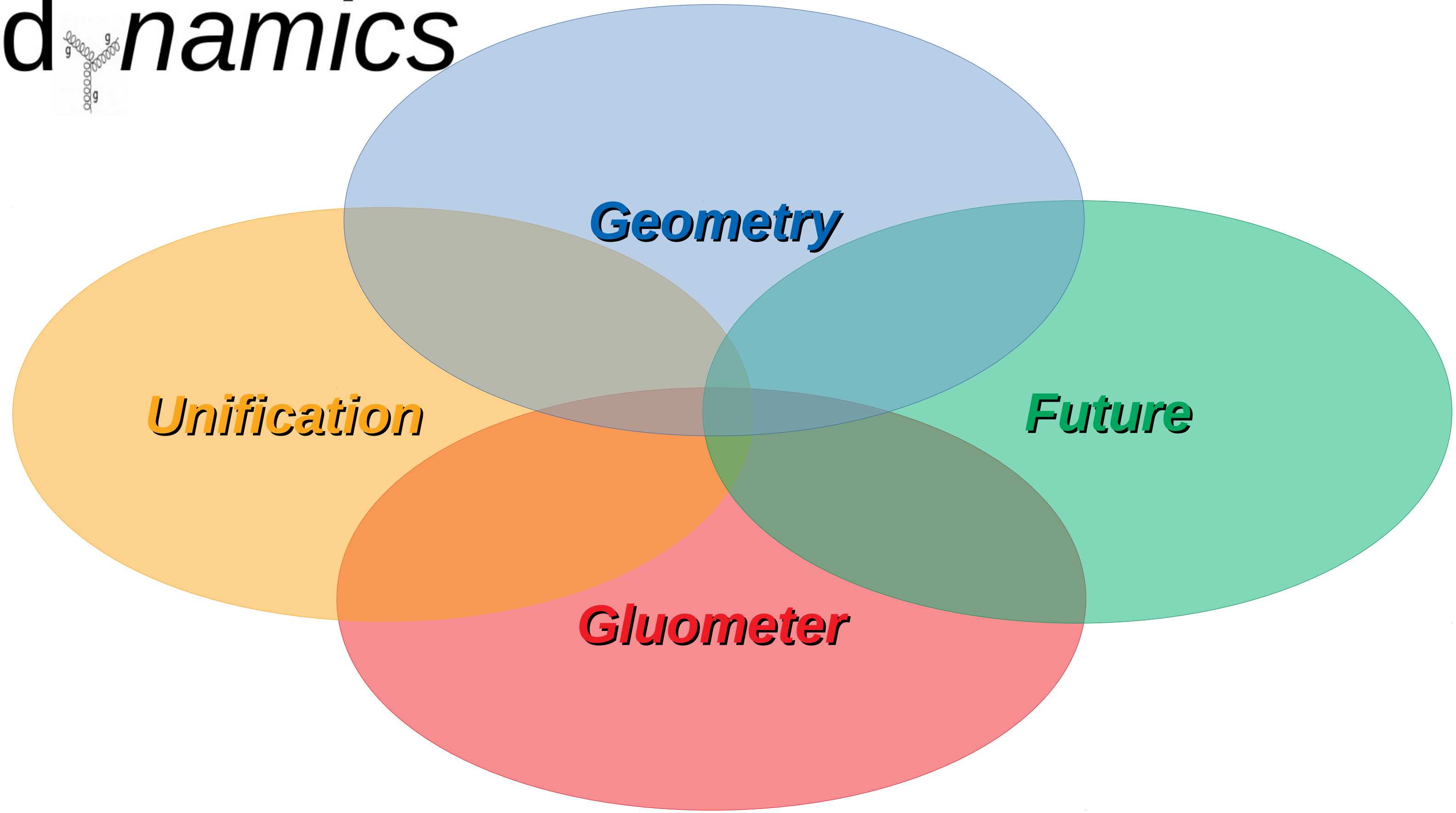
  - **new observables + new concepts + precision + new tools**



T-range probed at the LHC according to hydrodynamic models

Which dof?
Which interactions?

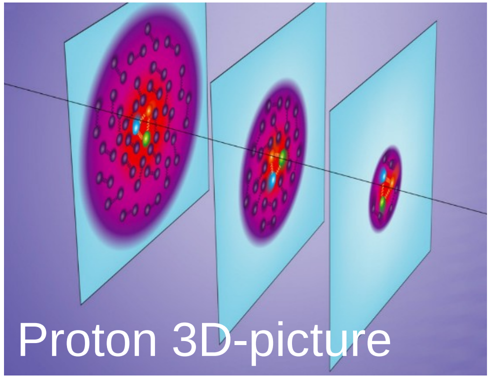
Gluodynamics



Decipher **gluons** as (the) source of **geometry & forces** inside the smallest and **hottest droplets** formed on earth and in the most important **building block of matter, the proton**.

Experiment nucleon structure

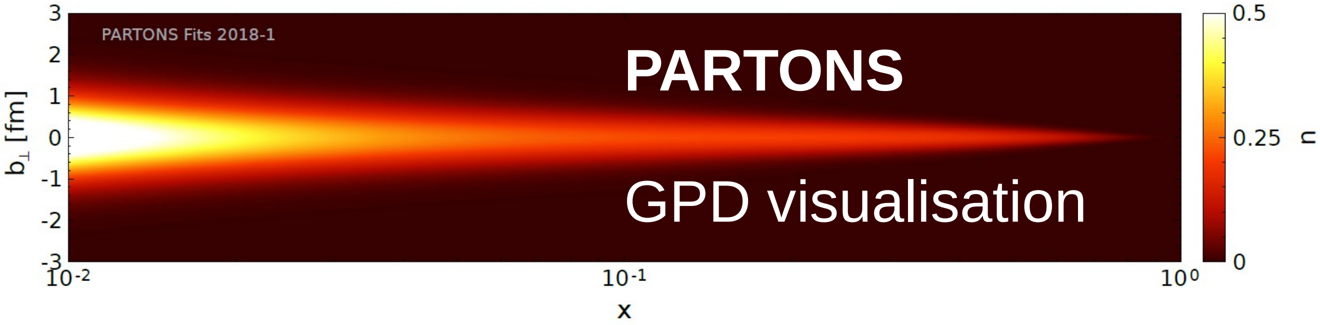
3D nucleon structure via Generalized Parton Distributions with unprecedented precision



- Deeply Virtual Compton Scattering (DVCS) & Deeply Virtual Meson Production (DVMP) at Jefferson Lab with several set-ups:
  - Q^2-Scaling tests of DVCS
  - Proton & neutron DVCS + DVMP unpolarized & longitudinally polarized
  - Transition Distribution Amplitudes introduced by P2IO theorists

World expert team with ample experience in analysis of exclusive processes

Synergies:
Unification: tools
Future: electron-ion collider



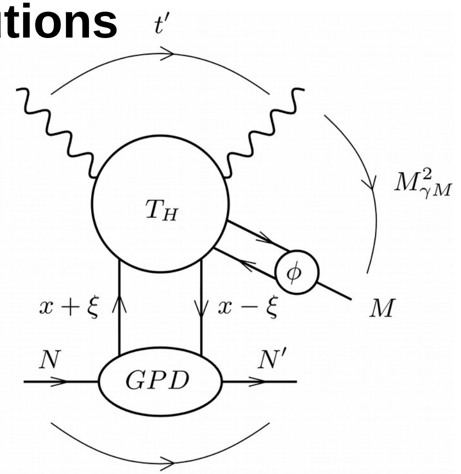
Contributing labs: IPNO, DPhN, LPT
Responsible: C. Munoz (IPNO)
Requested resources: 0.5 PhD, other 0.5 eligible for funding from doctoral school

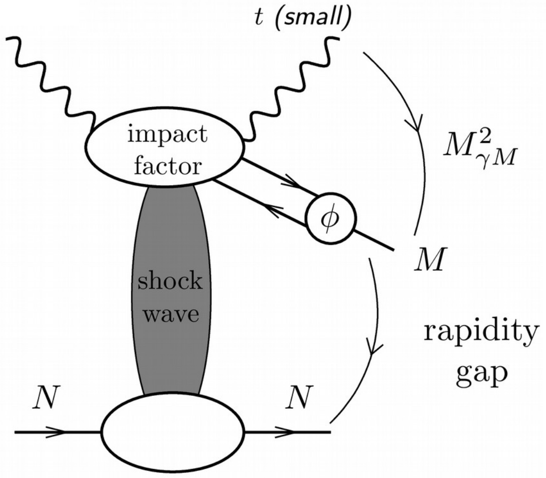
Theory nucleon structure

$\gamma^{(*)} N \to \gamma$ Meson N' : a new way to access Generalized Parton Distributions

- Access to elusive transversity Generalised Parton Distributions
  - NLO & power corrections
  - Predictions for experiment & inclusion in PARTONS
  - Color Glass Condensate description for precision in saturation

Team of world experts with strong links to phenomenology & experimentalists to realise a novel idea from A to Z

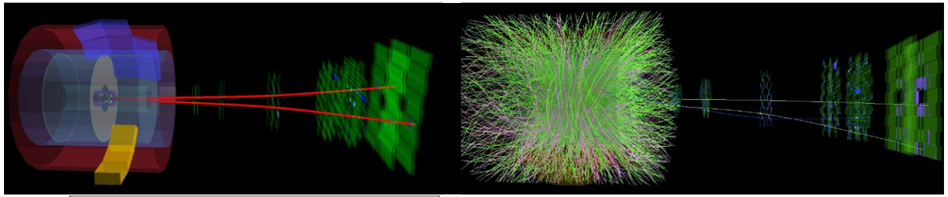




Synergies:
- **Geometry:** experiment nucleon
- **Unification:** tools & space
- **Future:** electron-ion collider

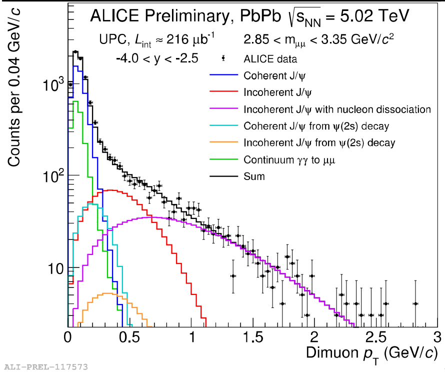
Contributing labs: LPT, CPHT, DPhN, IPNO + interested exp. groups (ALICE, JLAB, EIC)
Responsible: S. Wallon (LPT)
Requested resources: 2 years of postdoc

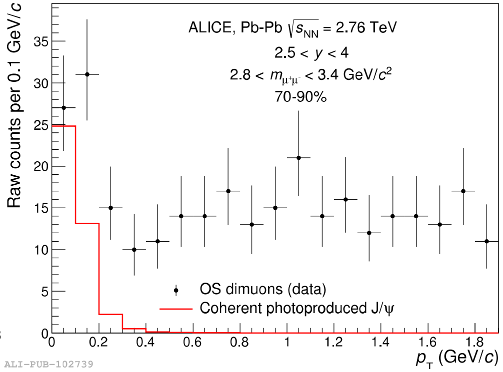
Coherent Photoproduction in peripheral collisions: a new tool to scrutinize nuclear geometry & the QGP



- New information on gluon dynamics in nuclei
  - nuclear GPDs sensitivity investigation
- ALICE unique: forward, mid-, semi-forward rapidity
- Timely: high statistics Pb-Pb Run3 data & continuous data taking mode (TPC + muon)

  - J/ψ cross sections over large rapidity range
  - J/ψ t-slope at central rapidity: Pb geometry





Team of pioneers, instrumentation & analysis experts in close contact with colleagues from JLAB & theory

Synergies:
- **Gluometer:** forcemeter collider
- **Unification:** time, space
- **Geometry:** experiment nucleon

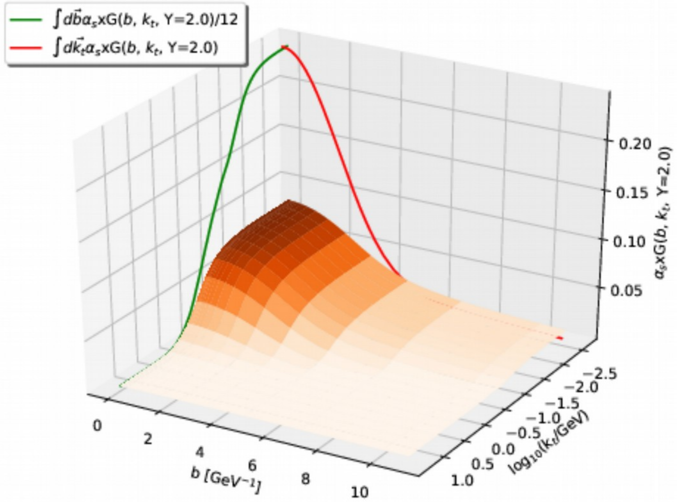
Contributing labs: IPNO, DPhN
Responsible: L. Massacrier (IPNO)
Requested resources: 2 years of postdoc

Unification space

How transverse momentum distributions are correlated with spatial distributions ?

- Unification tool: Wigner functions
  - Arise naturally in small-x formalisms
  - study in Mueller's dipole model and/or CGC
  - much-needed modeling and numerical tools

- Anisotropic particle production in p+A and p+p collisions due to:
  - QCD dynamics of the initial state (encoded in TMDs) ?
  - Hydro response to initial geometric anisotropies (GPDs) ?
  - Crucial knowledge of momentum/spatial correlations missing



Gluon Wigner function

- In heavy-ion collisions & - under the hydro paradigm - in small systems
  - Pre-hydro initial conditions described in the language of hadron structure for the first time

World-leading theory communities on all aspects

Contributing labs: CPHT, LPT, IPhT
Responsible: C. Marquet (CPHT)
Requested resources: 2 years of postdoc

Synergies:
Unification: time, tools
Geometry: nucleon and nuclear
Future: electron-ion collider

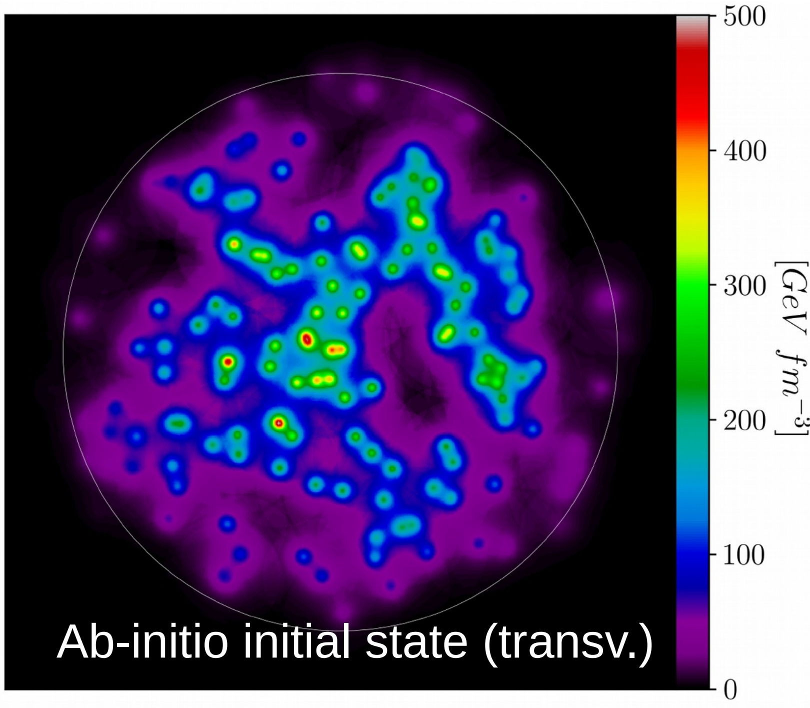
Unification of initial state and hydrodynamic simulations of heavy-ion collisions

- Deliver a 3D event-generator:
  - Generalise recent initial-state model with rapidity dependence
  - Use transport equations to “thermalize” the initial state
  - Interface with hard probes (e.g. jet quenching MC)

- Look into phenomenological consequences:
  - First-principle description of longitudinal correlations
  - Study various fluctuation measures (e.g. mean p_T)

- Exploratory investigation: what imprints of initial fluctuations can be uncovered with jet quenching/substructure ?
  - First calculation of hard/soft correlation in CGC

Pioneering team in close contact with experimentalists



Contributing labs: IPhT, CPHT
Responsible: J.-Y. Ollitrault (IPhT)
Requested resources: 2 years of postdoc

Synergies:
- **Unification:** space, tools
- **Geometry:** experiment nucleus
- **Gluometer:** radiation

Unification tools

Quick, automated & user-friendly calculations for theory and experiment

- Need for state-of-the-art calculations
  - Theory & phenomenology & experiment
  - MC generators for experimentalists
  - Fitting and parameter extraction
- Prerequiste for precision studies as in HEP
- NLOAccess and PARTONS:
  World-leading toolkits at the service of the community
  - Current funding focusing on technical man-power

To establish these software tools as world standards:
Funds for visibility, interactions with experts & dedicated hardware

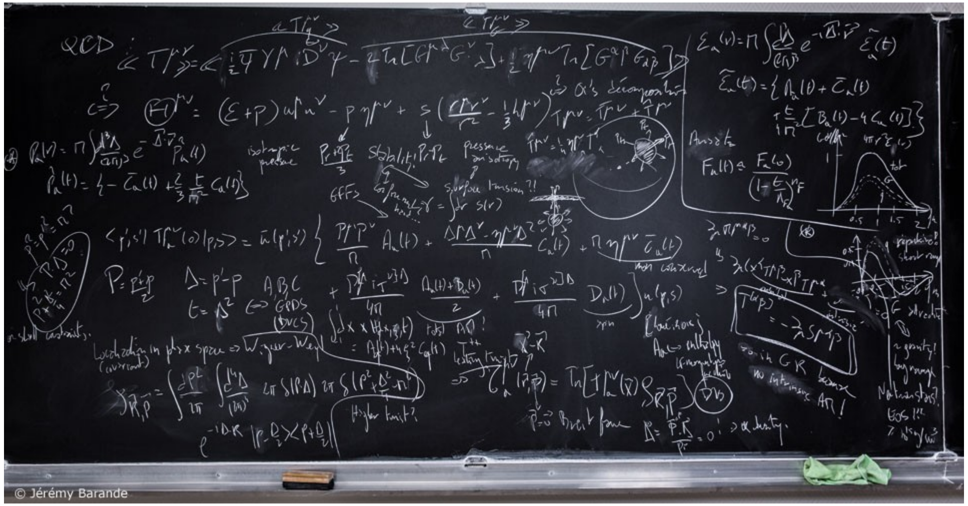
Synergies:
- **Gluometer:** all teams
- **Geometry:** all teams
- **Future:** all teams

Contributing labs: IPNO, DPhN, LPT
Responsibles: J.-P. Lansberg (IPNO), H. Moutarde (DPhN)
Requested resources: support for NLOAccess & PARTONS

Unification cross education

Create a space to learn & to exchange on theoretical & conceptual level

- Teach a new generation & ourselves on research activities at the interface QGP-hadron structure
- Complement local knowledge with worldwide experts
- Format: 3-week lecture series: 1 local + 1 external coupled with general Gluodynamics workshop



Tentative topics: “Transverse momentum dependent distributions” (2020), “Thermalisation: from initial state to hydrodynamics” (2021)

Contributing labs: all
Responsibles: F. Arleo (LLR), F. Gelis (IPhT), C. Lorcé (CPHT), J.-P. Lansberg (IPNO), Hervé Moutarde (DPhN), J.-Y. Ollitrault (IPhT), S. Wallon (LPT)
Coordination: C. Marquet & M. Winn
Requested resources: financial support for guests, budget complemented by GDR QCD and institute visitor budgets

Synergies:
- **Gluometer:** all teams
- **Unification:** all teams
- **Geometry:** all teams
- **Future:** all teams

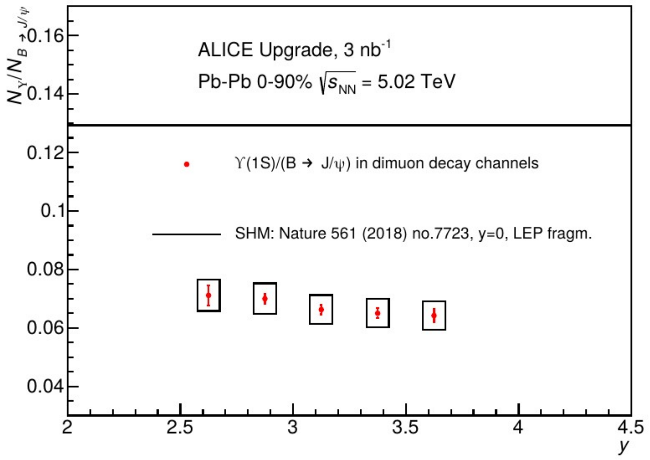
Forcemeter collider

Probing deconfinement: new instrumentation for new observables in the theoretically clean beauty sector

- Quarkonium: hydrogen atom of QCD - probe of deconfinement
  - Beauty theoretically cleaner than charm
  - Production reservoir not measured for $p_T > 0$ GeV/c

- Unique opportunity with ALICE MFT Run 3:
  - $\Upsilon \rightarrow \mu\mu$ /B($\rightarrow$J/$\Psi \rightarrow \mu\mu$) in PbPb
  - $B_c \rightarrow 3\mu(+\nu)$ for $p_T > 0$ GeV/c to study recombination with beauty or DY as new control at LHC energies

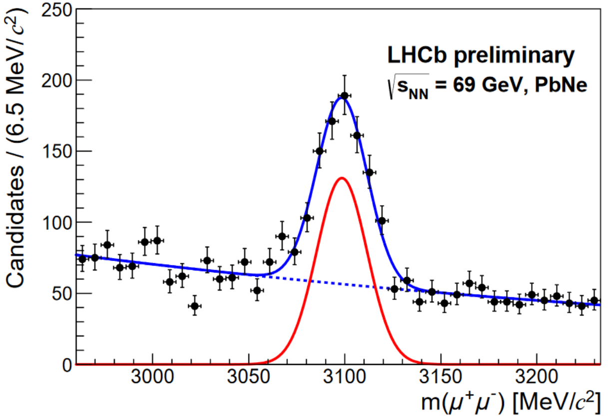
Expert team with experience & responsibility in ALICE as convenors/project responsibles



Synergies:
- **Gluometer:** forcemeter & radiation
- **Unification:** tools, time
- **Geometry:** nuclear geometry
- **Future:** hadron collider

Contributing labs: DPhN, IPNO
Responsible: M. Winn (DPhN)
Requested resources: 2 years postdoc

Probing deconfinement: precise & complete set of open & hidden charm without recombination

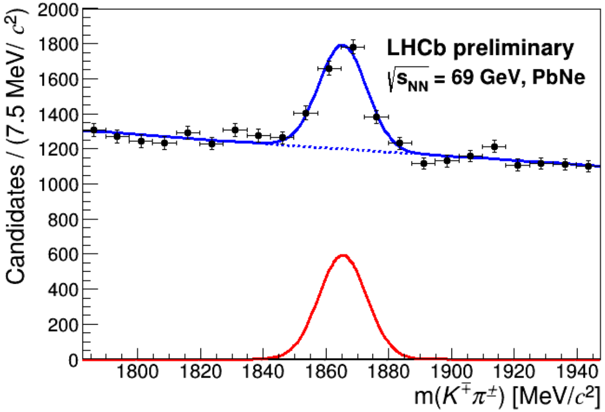


- LHC fixed-target complementary to collider:
  - No recombination for charm
  - Different temperature & baryo-chemical potential
- LHCb: large rapidity range, longitudinal boost, precise tracking+PID
- Comprehensive measurements in p-Nucleus & Nucleus-Nucleus:

  pA: nuclear parton distributions (via NLOAccess), absorption & comovers

  AA: probing deconfinement

Pioneers & expert team with experience
& responsibility as convenors
& synergy with collider simulations



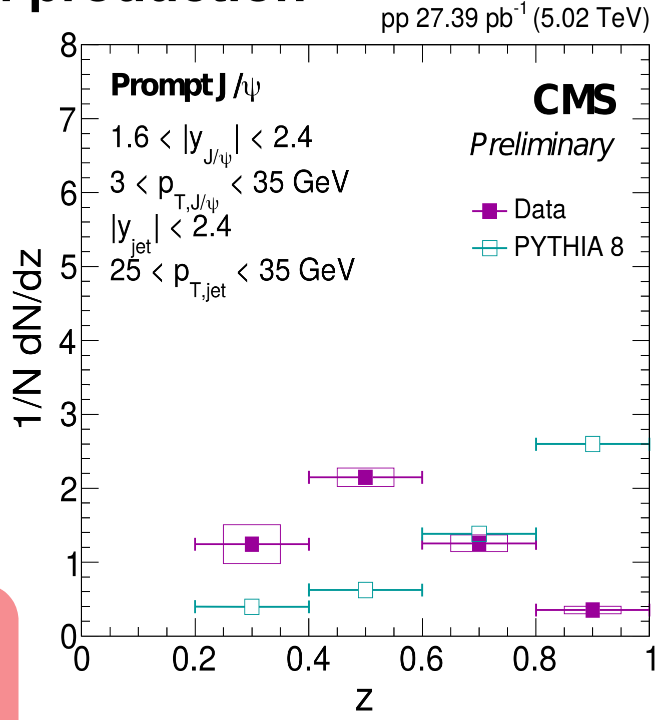
Synergies:
Future: hadron collider
Gluometer: forcemeter collider
Unification: tools

Contributing labs: LLR, LAL
Responsible: F. Fleuret (LLR)
Requested resources: 1 year postdoc,
one year available from CNRS starting soon

Determine relevance of gluon radiation for quarkonium production

- LHC: a heavy-quark jet factory
  - Unique laboratory to study in-medium gluon radiation
- CMS: ideal for these studies
  - Excellent muon & jet performance also in PbPb collisions
- Measurement of fragmentation of jets into J/Ψ:
  - An opportunity to explore boundary between J/Ψ dissociation & jet quenching

World experts on jets & quarkonia with embedded theory support



Synergies:

Gluometer: forcemeter collider

Unification: tools, time

Contributing labs: LLR, IPhT
Responsible: M. Nguyen (LLR)
Requested resources: 1 year postdoc,
one year available from STRONG 2020 or ANR (ColdLoss)

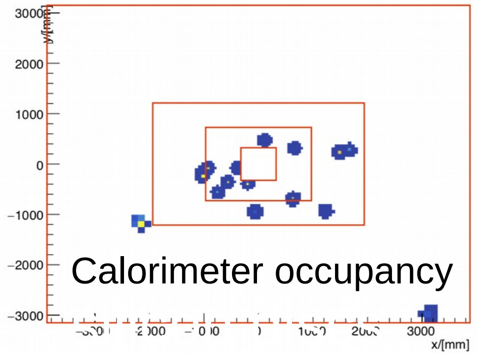
Future hadron collider

A calorimeter in LHCb@HL-LHC for heavy-ion collisions

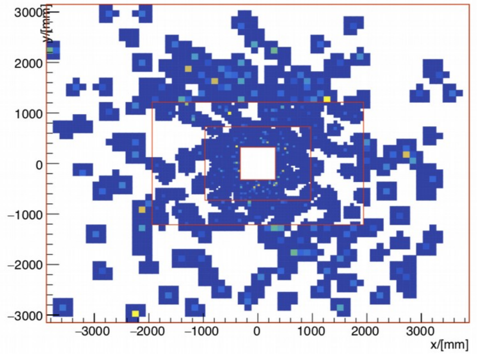
- LHCb upgrade II: unique QGP physics opportunity
  - Longitudinal boost for vertexing & PID
- Photons & electrons:
  - Key signatures: thermal radiation & radiative quarkonium decays
  - Calorimeter performance key
- Upgrade TDR: optimize parameters for heavy-ions & exploration of reconstruction optimisation using FPGA
- Full heavy-ion simulations with upgrade II detectors

LHCb simulation & calo core team & its technical support, synergy with LLR fixed-target & LAL flavour physics programme

Present $L = 2{\times}10^{32} cm^{-2} \cdot s^{-1}$



Upgrade II with $L = 1.5{\times}10^{34} cm^{-2} \cdot s^{-1}$



Synergies:
Gluometer: all teams
Unification: time, tools

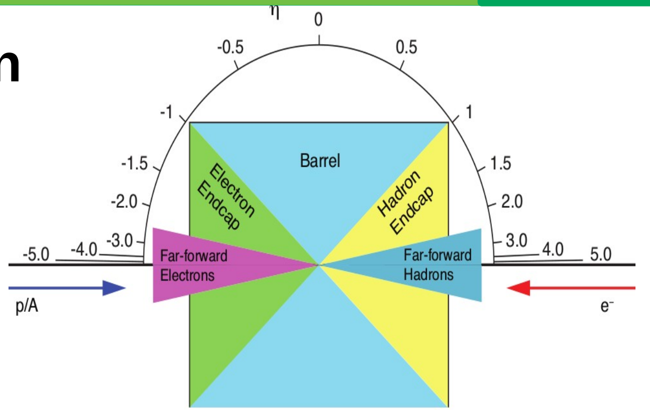
Contributing labs: LAL, LLR
Responsible: P. Robbe (LAL)
Requested resources: 2 years postdoc + FPGA-based prototypes

Future electron-ion collider

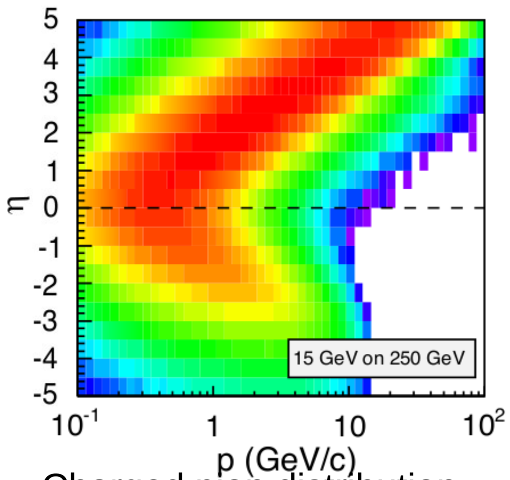
Establish P2IO as key contributor to detector conception

- Electron-Ion Collider: gluons in the nucleon & in nuclei with precision
  - P2IO involved with experiment, phenomenology & theory
- Contribute to the crucial design phase with P2IO physic cases
  - Realistic physics simulations for specifications: trade-off PID & tracking
  - Design optimisation Micromegas-based tracking EIC UG Yellow report
  - PID algorithms for compact TPC
  - feedback to R&D efforts at Irfu & IPNO

IPNO: leading R&D for precision forward calorimetry
Irfu: leading in design & dev. of gaseous tracking for central & forward



Schematic detector layout

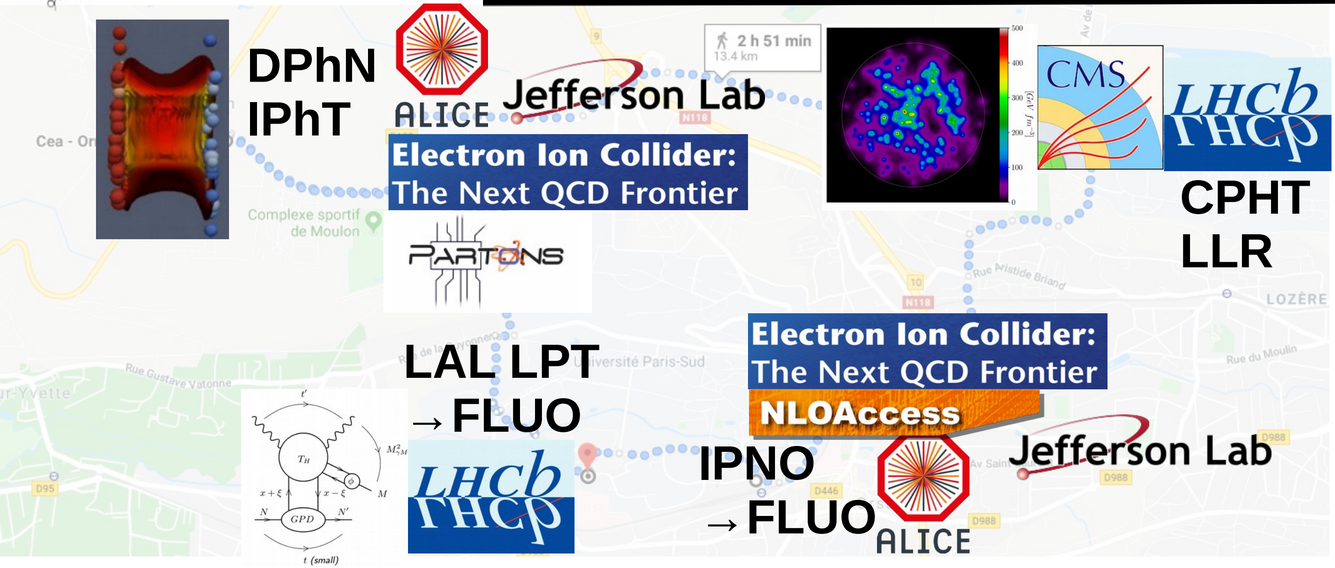


Charged pion distribution

Contributing labs: DPhN & DEDIP, IPNO
Responsible: F. Bossu (DPhN)
Requested resources: 2 years postdoc

Synergies:
Geometry: all teams
Unification: space, tools

Gluodynamics in P2IO: a unique chance



- Worldwide **uniquely rich & complementary QCD research** in P2IO
- **Interfaces** between communities & theory-experiment:
  - **Important now & more in future**: UPC, TMD/GPD–GCG, initial-state–hydro, CGC–jets/quarkonium
  - Require fresh minds & means to exchange & to exploit these links
- Gluodynamics very timely:
  - The spark to exploit the full potential
  - Trigger lasting connection with young researchers

Gluodynamics

Longterm vision for P2IO QCD

- Past & present: **leading** in **hadron structure & QGP physics**

- **Sustain & improve impact** in difficult environment
  - Increasing number of actors
  - Decreasing number of world-leading facilities
  - Increasing size & cost of facilities

- **Gluodynamics**
  - Conceptual, experimental & synergetic foundation for post-2030 era
    - Future instrumentation at the LHC for QCD
    - Future instrumentation at the Electron-Ion Collider
    - Towards a single community for hadron and QGP structure

Gluodynamics

Conclusions

- New & old open **questions in QCD research**: exciting opportunities
  - Particularly at interfaces between hadron structure & QGP research
- **P2IO**: ideal for a world-leading contribution with unique expertise
- **Gluodynamics**
  - Spark for links + contribution to the frontier in QGP & hadron structure in view of gluons
- **Long-term vision**
  - A new research field to investigate hadron & QGP structure
    in a universal paradigm at the next generation of QCD facilities

QCD matters!

Gluodynamics

Back-up: Delivrables

WP	Delivrable	Description	Finalisation	Contact
I	nucleon-ex 1	DVCS off proton/neutron (CLAS12)	T2–2023	C. Muñoz
I	nucleon-ex 2	L/T Rosenbluth separation DVCS (Hall C)	T4–2023	C. Muñoz
I	nucleon-ex 3	UPC pPb (in)coherent	T2–2022	M. Winn
I	nucleon-theo 1	$\gamma^{(*)} N \to \gamma M N'$: NLO & CGC	T4–2021	S. Wallon
I	nucleon-theo 2	$\gamma^{(*)} N \to \gamma M N'$: power corrections & applications	T4–2023	S. Wallon
I	nucleus-ex 1	forward PC coherent	T1–2023	L. Massacrier
I	nucleus-ex 2	semi-forward/central PC coherent	T4–2023	L. Massacrier
II	uni-space 1	GPD input in hydro initialization for small systems	T4–2021	C. Marquet
II	uni-space 2	QCD correlations between momentum and spatial anisotropies	T4–2023	C. Marquet
II	uni-time 1	3D ab-initio initial state generator	T4–2021	J.-Y. Ollitrault
II	uni-time 2	impact of initial stage on high-p_t v_2	T4–2022	J.-Y. Ollitrault
II	uni-tools 1	Inclusion in NLOAccess of codes from the project	T4–2023	J.-P. Lansberg
II	uni-tools 2	Inclusion in PARTONS of codes from the project	T4–2023	H. Moutarde
III	force-collider 1	non-prompt J/ψ and Υ PbPb measurements	T4–2022	M. Winn
III	force-collider 2	B_c PbPb or DY measurement	T4–2023	M. Winn
III	force-fixed-target 1	$J//\psi$ and D^0 measurement in p-Ne & Pb-Ne Run 2	T2–2021	F. Fleuret
III	force-fixed-target 2	$J//\psi$, $\psi(2S)$, χ_c and D^0 measurement in Run 3 p-A and Pb-A	T4–2022	F. Fleuret
III	radiation 1	high-p_T quarkonium + jet Run 3 measurement	T4–2022	M. Nguyen
IV	hh collider 1	framework TDR calorimeters	T4–2021	P. Robbe
IV	hh collider 2	realistic heavy-ion simulations for LHCb Upgrade 2	T1–2022	P. Robbe
IV	e-h collider 1	CDR EIC detector	T4–2021	F. Bossu
IV	e-h collider 2	realistic simulations for exclusive reactions at the EIC	T1–2022	F. Bossu

Back-up: Milestones

Delivrable	Milestone	Finalisation
nucleon-ex 1	preliminary result: DVCS BSA proton	T4–2022
nucleon-ex 1	data-taking: CLAS12	T1–2023
nucleon-ex 1	publication: DVCS CLAS12	T2–2023
nucleon-ex 2	data taking: NPS in Hall C	T1–2022
nucleon-ex 2	publication: Hall C data	T4–2023
nucleon-ex 3	feasibility: incoh. J/ψ pPb UPC	T2–2021
nucleon-ex 3	publication: UPC J/ψ pPb Run 2	T2–2022
nucleon-theo 1	publications: LO processes	T1–2021
nucleon-theo 1	publications: NLO & CGC LO	T4–T021
nucleon-theo 2	publication: phenomenology	T2–T022
nucleon-theo 2	publications: power corrections	T1–2023
nucleon-theo 2	publication: NLO/CGC integration in PARTONS/NLOAccess & feasibility CLAS12/LHC/EIC	T4–T023
nucleus-ex 1	publication: PbPb forward rapidity low-p_T J/ψ excess polarization (Run2 + potentially Run3)	T1–2022
nucleus-ex 1	publication: Excess for other quarkonia and J/ψ excess in most central PbPb collisons (Run 3)	T1–2023
nucleus-ex 2	software dev. & feasibility, potential publication of semi-forward low-p_T J/ψ excess	T1-2022
nucleus-ex 2	publication: low-p_T J/ψ excess at midrapidity as function of centrality, t-slope	T3–2023
uni-space 1	publication: eccentricity fluctuations in small systems	T4–2020
uni-space 1	publication: small-systems hydro with GPD input	T4–2021
uni-space 2	publication: Wigner distribution from dipole cascade	T4–2022
uni-space 2	publication: anisotropies of particle production in small systems	T4–2023
uni-time 1	publication: CGC energy-momentum tensor with GPDs	T4–2020
uni-time 1	publication: longitudinal correlations and conserved charges/p_T fluctuations	T2–2021
uni-time 1	publication and code: 3D model	T4–2021
uni-time 2	publication: energy density/particle production correlation in CGC	T4–2021
uni-time 2	publication: high-pt v_2 with soft/hard correlation	T4–2022
uni-tools 1	software: access via NLOAccess to codes for the project	T3–2020
uni-tools 1	software: projects codes online in NLOAccess	T4–2023
uni-tools 2	software: interface between GPD models in PARTONS and uni-space 1 & open source access to fit results on 3D nucleon structure	T4–2021
uni-tools 2	software: GPD and TMD models from Wigner distributions & inclusion in PARTONS of project codes	T4–2023
force-collider 1	software development: for Run 3	T2–2021
force-collider 1	preliminary result: non-prompt J/ψ PbPb	T2–2022
force-collider 1	publication: Υ/(non-prompt J/ψ) PbPb	T4–2022
force-collider 2	feasibility: DY/B_c	T4–2021
force-collider 2	publication: DY or B_c	T4–2023
force-fixed-target 2	data taking: proton-nucleus 2021	T3–2021
force-fixed-target 2	data taking: Pb-nucleus 2021	T4–2021
force-fixed-target 2	publication: charm production with Run 2 data	T2–2021
force-fixed-target 2	publication: charm production with Run 3 data	T4–2022
radiation 1	data taking: PbPb 2021	T4–2021
radiation 1	publication: 2021 data	T4–2022
hh-collider 1	software development: simulation set-up for heavy-ion conditions	T4–2020
hh-collider 1	optimisation: detector layout heavy-ions in HL-LHC phase	T4–2021
hh-collider 1	framework TDR: contribution calorimeters LHCb Upgrade 2	T4–2021
hh-collider 2	realistic heavy-ion simulations for LHCb Upgrade 2	T1–2022
eh-collider 1	requirement definition TPC	T2–2020
eh-collider 1	design choices: for TPC and optimisation for CDR	T2–2021
eh-collider 2	realistic simulations for exclusive reactions at the EIC	T2–2021

Table 4: Detailed overview of milestones for the different delivrables.

Gluodynamics

Back-up: Involved personal

Institute	Name	Role		WP	FTE
CPHT	Cyrille Marquet	PI, WP leader	theo	**II**,IV,I	60 %
	Stéphane Munier	Contributor	theo	I,II	25 %
	Cédric Lorcé	Contributor	theo	I,II	25 %
	Bernard Pire*	Contributor	theo	I,II	50 %
IPhT	Jean-Yves Ollitrault	WP leader	theo	II	60 %
	Edmond Iancu	Contributor	theo	II	10 %
	Francois Gelis	Contributor	theo	II	20 %
	Gregory Soyez	Contributor	theo	II,III	10 %
	Jean-Paul Blaizot*	Contributor	theo	II	15 %
IPNO	Christophe Suire	Contributor	ex	**I**, III	30 %
	Laure Massacrier	WP leader	ex	**I**,III	30 %
	Carlos Muñoz	WP leader	ex	**I**,IV	60 %
	Bruno Espagnon	contributor	ex	I	20 %
	Jean-Philippe Lansberg	WP leader	theo	**II**,I,III	25 %
	Laure-Amélie Couturier	Contributor	comput.	II	15 %
	Vicent Lafage	Contributor	comput.	II	15 %
	Raphael Dupré	Contributor	ex	I	10 %
	Dominique Marchand	Contributor	ex	I	20 %
	Silvia Niccolai	Contributor	ex	I	60 %
	Zaida Conesa del Valle	Contributor	ex	I,III	20 %
DPhN	Michael Winn	PI, WP leader	ex	**III**, I, IV	60 %
	Francesco Bossu	WP leader	ex	**IV**,I	50 %
	Hervé Moutarde	WP leader	theo	**II**,I	30 %
	Franck Sabatié	Contributor	ex	I,IV	10 %
	Maxime Defurne	Contributor	ex	I,IV	30 %
	Javier Castillo	Contributor	ex	III,IV	25 %
	Alberto Baldisseri	Contributor	ex	III,IV	15 %
	Andrea Ferrero	Contributor	ex	III	15 %
	Stefano Panebianco	Contributor	ex	III,IV	15 %
	Andry Rakotozafinadrabe	Contributor	ex	III,IV	15 %
DEDIP	Maxence Vandenbroucke	Contributor	ex	IV	20 %
	Stephan Aune	Contributor	ex	IV	15 %
LAL	Patrick Robbe	WP leader	ex	**IV**	50 %
	Yasmine Amhis	Contributor	ex	IV	10 %
	Daniel Charlet	Contributor	ex	IV	10 %
LLR	Frédéric Fleuret	WP leader	ex	**III**, IV	60 %
	Matt Nguyen	WP leader	ex	**III**	50 %
	François Arleo	Contributor	theo	III	15 %
	Raphael G. d. Cassagnac	Contributor	ex	III	20 %
	Emilie Maurice	Contributor	ex	**III**, IV	50 %
LPT	Samuel Wallon	WP leader	theo	**I**,II	60 %

Table 2: The list of involved permanent personal at the P2IO Laboratories. (*: Emeriti)

Institute	type	years	theo/ex	WP	primary supervisor	FTE
CPHT	**postdoc P2IO**	T4–20 - T3–22	theo	**II**,I	C. Marquet	100%
	postdoc X	T1–20 - T4–21	theo	**II**,I	C. Marquet	50%
IPhT	**postdoc P2IO**	T1–21 - T1–22	theo	**II**,III	J.-Y. Ollitrault	100%
IPNO	**PhD P2IO**	T4–20 - T3–23	ex	**I**	C. Muñoz	50%
	postdoc P2IO	T2–21 - T2–23	ex	**I**,III	C. Suire	100%
	PhD	T4–20 - T4–23	ex	**I**,III	L. Massacrier	100%
	PhD	T4–21 - T3–23	ex	I	C. Muñoz	100%
	PhD	T1–20 - T3–20	theo	II	J.P. Lansberg	30 %
DPhN	**postdoc P2IO**	T1–21 - T4–22	ex	**III**,I	M. Winn	100%
	postdoc P2IO	T2–20 - T1–23	ex	**IV**,I	F. Bossu	100%
	PhD	T1–20 - T3–22	ex	I	M. Winn	50 %
	PhD	T1–20 - T3–22	ex	III	J. Castillo	50 %
LAL	**postdoc P2IO**	T2–20 - T1–23	ex	**IV**,III	P. Robbe	100%
LLR	**postdoc P2IO**	T1–22 - T1–22	ex	III	M. Ngyuen	100%
	postdoc P2IO	T1–21 - T1–22	ex	**III**, IV	F. Fleuret	100%
LPT	**postdoc P2IO**	T1–21 - T4–22	theo	I	S. Wallon	100%

Table 3: The list of involved non-permanent personal at the P2IO Laboratories including requested personal in bold.

Gluodynamics

Back-up: Request by topics

WP		Institutes	Contact	budget/kEuro
Geometry	nucleon-ex	**IPNO**, DPhN	C. Muñoz	55
Geometry	nucleon-theo	**LPT**, DPhN, CPHT	S. Wallon	110
Geometry	nucleus-ex	**IPNO**, DPhN, IPhT	L. Massacrier	110
Unification	uni-space	**CPHT**, LPT, IPhT	C. Marquet	110
Unification	uni-time	**IPhT** CPHT	J.-Y. Ollitrault	110
Unification	uni-tools	**IPNO**, **DPhN**	J.-P. Lansberg & H. Moutarde	20+20
Unification	cross education	**CPHT**, **DPhN**, **IPhT**, **IPNO**, **LLR**	C. Marquet & M. Winn	3+3
Gluometer	force-collider	**DPhN**, IPhT, LLR, IPNO	M. Winn	110
Gluometer	force-fixed-target	**LLR**, LAL, IPNO	F. Fleuret	55
Gluometer	radiation	**LLR**, IPhT	M. Nguyen	55
Future	hh collider	**LAL**, LLR, DPhN	P. Robbe	120
Future	e-h collider	**DPhN**, IPNO	F. Bossu	110
Future	conf./workshops	**CPHT**, **DPhN** & all	C. Marquet & M. Winn	10+10

Table 5: Financial requirements for the project with topical structure.

Back-up: Request by institutions

Site	Institute	Purpose	Budget/kEuro	Institute sum
Orsay	IPNO	personal	165	185
		support NLOAccess	20	
	LAL	personal	110	120
		hardware	10	
	LPT	personal	110	110
Saclay	IPhT	personal	110	110
	Irfu/DPhN	personal	220	253
		support PARTONS	20	
		conference/workshops	10	
		lectures	3	
Palaiseau	CPHT	personal	110	123
		conference/workshops	10	
		lectures	3	
	LLR	personal	110	110

Table 6: Financial requirements per institute and site. The total budget amounts to 1,011,000 Euros.