

# WG3 QCD at short distances : experiment, theory and tools

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Assemblée Générale du GDR-QCD, Oléron, France

# Who are we?

- **Émilien Chapon** (CEA/Irfu - Saclay):
  - Experimentalist in the ATLAS collaboration (also former member of CMS)
  - Precision measurements of electroweak observables (also formerly QGP and nuclear PDFs)
- **Jean-Philippe Lansberg** (IJCLab -Orsay):
  - Theorist
  - Quarkonium production: QCD corrections & pheno
  - Fixed-target programme at the LHC: physics case & pheno
  - + TMD factorisation, DPS, nuclear PDFs, GPDs ...
- **Laure Massacrier** (IJCLab - Orsay):
  - Experimentalist in the ALICE collaboration (also former member of LHCb)
  - Quarkonium production in all systems (pp, pPb, PbPb, UPC) and QGP physics
  - Fixed-target programme at the LHC: physics performance, implementation

# QCD at short distances: evolution of the WG

- In previous **GDR-QCD**, the WG focused on **jets** and **quarkonia**
- Strengthen the focus on **perturbative** QCD
- Aim to widen the scope to include intrinsic aspects of **pQCD techniques and tools** w/o restricting to a specific set of observables:
  - Computations with **multi loop** corrections
  - Inclusion of effect at **all orders (resummation)**
  - **Automation** of such computations
  - Merging and matching techniques to **interface** them to **event generators**
  - Definition of **new experimental observables**
- Build a **community** following the example of the lattice QCD community
- Keep the specificity of a strong implication of the **heavy-ion community**
- **New opportunities** of collaboration between theorists working on pQCD at colliders and LHC & EIC experimentalists

# Main objectives of the WG

- Foster TH-EXP contacts among people working on predictions and measurements where pQCD is particularly relevant
- Forum for theorists working on pQCD (explore areas where there's an overlap):
  - quarkonium  $\longleftrightarrow$  resummation / event generators
  - amplitudes  $\longleftrightarrow$  multiloop computations  $\longleftrightarrow$  pheno predictions
  - boundary pQCD / non-perturbative effects / TMD
  - common numerical/algorithmical challenges
  - HI  $\longleftrightarrow$  TH (e.g. jet substructure, quarkonium flow at high  $p_T$ ...)
- A forum to gather people working on QCD-related topics from different experiments and different communities (discuss tension among results, combination of measurements...)
  - Interface with IRN Terascale (groupement de recherche dedicated to experimental and theoretical search for new physics at the TeV scale)

# Events organized in 2021

- Workshop quarkonia as tools 2021, 22-26 Mar. 2021 (Online):  
<https://indico.cern.ch/event/983750/>
- Aussois Quarkonium & QCD meeting, 20-26 Jun. 2021 (Aussois):  
<https://indico.cern.ch/event/1041993/>
- Official Kick-off meeting of the Working Group during a joint STRONG 2020 WP/ GDR workshop: 31May - 4th Jun. 2021 (Orsay/Online):  
<https://indico.ijclab.in2p3.fr/event/7201/>
  - review of the state of the art, identify main common interests in French Community
  - Hands-on sessions on computing tools and platforms: POWHEG, HELAC-onia, MadGraph, NLOACCESS, PARTONS....
- Joint seminar of the GDR QCD, IJCLab QCD transverse group and labex P2IO gluodynamics project, 12th Oct. 2021 (Orsay/Online):  
<https://indico.ijclab.in2p3.fr/event/7602/>
  - $\eta_c$  prompt hadroproduction (theory + experiment)

# Events already organized in 2022

- Workshop “Quarkonia as tools“, Aussois, 9-15 Jan. 2022  
<https://indico.cern.ch/e/OniumTools2022>
- 40% of the participants are GDR members
- 3 online tutorials for tools were opened for registration to GDR members (zoom connexion provided) : FeynOnia , NLOaccess (Helac-Onia + MadGraph), EPOS
- Was also possible to follow the morning talks remotely

# Events planned in 2022 and ideas for 2023

- 1- day workshop dedicated to experimental QCD measurements at high- $p_T$  ATLAS/CMS/CDF, MC tools and recent theoretical developments, in Sept. 2022 at IJCLab Orsay (+online?) => **Joint event with IRN Terascale**
- “Heavy Flavour“ programme of 3 weeks at Institut Pascal (Orsay), 3-21 October 2022, with a 1-week workshop: <https://indico.ijclab.in2p3.fr/event/7656/program> => **1 day dedicated to the GDR during the programme/workshop (combined event between WP1 (DPS, MPI) and WP3 (pQCD));** + 2 additional days of satellite meeting with the gluodynamics P2IO labex project
- QCD@LHC conference, 28 Nov.-2 Dec. 2022, IJCLab, Orsay: <https://indico.cern.ch/event/1150707/>
- ~ 3 days of lectures for students as satellite event of Quarkonium as Tools 2023

**Thank you for your attention!**

**...and do not hesitate to contact us!**

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