WG3 QCD at short distances : experiment, theory and tools

Emilien Chapon, Laure Massacrier, Melih Ozcelik

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)

- **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

- **Melih Ozcelik** (IJCLab - Orsay):
  - Theoretician
  - precision & phenomenology: higher-order perturbative QCD corrections, non-perturbative linear power corrections, QCD factorisation

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 ⟷ resummation / event generators
  - amplitudes ⟷ multiloop computations ⟷ pheno predictions
  - boundary pQCD / non-perturbative effects / TMD
  - common numerical/algorithmical challenges
  - HI ⟷ 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 organised in 2023

- 3 days of lectures for students as satellite event of Quarkonium as Tools 2023 (9th-12th January Aussois): https://indico.cern.ch/event/1213416/overview
- Joint session at the IRN Terascale meeting (24–26 April 2023, LPSC Grenoble, https://indico.in2p3.fr/event/28562/) together with their "Methods and Tools" WG

MadGraph and NLO Access		*Dr Carlo FLORE*
Grand Amphi, LPSC Grenoble		13:45 - 14:05
QCD corrections for precision measurements of W/Z at the LHC using POWHEG		*Emanuele Re*
Grand Amphi, LPSC Grenoble		14:10 - 14:30
Combined EW+PDF fits		*Juan Salvador TAFOYA VARGAS*
Grand Amphi, LPSC Grenoble		14:35 - 14:55
TMD/PDF extraction for precision W/Z measurements at the LHC		*Valerio Bertone*
Grand Amphi, LPSC Grenoble		15:00 - 15:20
Round table -cont-		
Grand Amphi, LPSC Grenoble		15:25 - 15:50
Farewell (famous last words...)		*Ana M. Teixeira, Marie-Helene Gen*
Grand Amphi, LPSC Grenoble		15:50 - 16:00

Discussion with IRN conveners to produce a database with available theoretical tools, github to share codes among communities

- QCD evolution workshop 2023 (22–26 May 2023, IJCLab, https://indico.cern.ch/event/1239374/)

Events organized in 2023 and early 2024

- GDR QCD workshop on coherence/incoherence in hadronic & diffractive collisions at DIS and at hadron colliders - IJCLab - 11-12 Oct 2023: https://indico.in2p3.fr/event/30433/
- NLOAccess annual meeting (20 - 24 Nov 2023): https://indico.cern.ch/event/1269836/
- Quarkonia as tools 2024 (07 Jan 2024 - 13 Jan 2024): https://indico.cern.ch/event/1324160/ + Satellite meeting (14 - 17 Jan 2024) on resummation/factorization after Quarkonia as Tools: https://indico.cern.ch/event/1290502/

Remaining events planned in 2024

- Synergies between LHC and EIC for quarkonium physics (15 - 19 Jul 2024, ECT Trento): https://indico.ectstar.eu/event/219/
- Discussion on possibility for an IRN terascale joint meeting in fall of 2024
- Joint seminar theory + experiment:
  - Quarkonia in Run 3 LHC + wishlist for theorists?
  - Wmass + QCD corrections ?

Thank you for your attention!

...and do not hesitate to contact us!

Contacts: laure.massacrier_at_ijclab.in2p3.fr, melih.ozcelik_at_ijclab.in2p3.fr, Emilien.Chapon_at_cern.ch

Back up

Events organised in 2022

- Quarkonium as Tools 2022 (9th-15th January, Aussois): 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
- "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/

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 plateforms: 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/
  - η_c prompt hadroproduction (theory + experiment)