

$\alpha_s(2022)$ closure

$\alpha_s(2022)$ workshop

ECT* (Trento), 31st Jan.–4th Feb. 2022

David d'Enterria (CERN)

Stefan Kluth (MPP)

Giulia Zanderighi (MPP)

alpha_s(2022) workshop in a nutshell

- Discuss latest developments & prospects in $\alpha_s(m_Z)$ determinations via:
 - (i) **Lattice QCD & Quarkonia**: **Mo. afternoon**
 - (ii) **DIS & global PDF analyses**: **Tues. afternoon**
 - (iii) Hadronic final states at the **LHC**: **Tues. afternoon**
 - (iv) Hadronic final states in **e^+e^-** (+ “leftovers”): **Wed. afternoon**
 - (v) Hadronic **tau** decays: **Thurs. afternoon**
- **PDG $\alpha_s(m_Z)$ averaging** discussion: **Friday afternoon**
- Snowmass'22 White Paper preparation:
 - All mornings (individual/team work per contribution)**
 - Topical discussions at the end of each day (18:30- 19:00)**
 - Friday afternoon (if needed)**
- **Lively & interesting** discussions throughout the week!
- Useful **CERN-Mattermost channel to keep minutes** of the presentations and to allow participants to **ask questions or post comments**:

https://mattermost.web.cern.ch/signup_user_complete?id=eznq7eakkt8hxridybt5ef60

Snowmass'22 “Precision QCD” Report

- The US Particle Physics Community Planning Exercise (a.k.a. “Snowmass”) is organized by the APS-DPF every ~10 years to provide an opportunity for the entire particle physics community to come together to identify and document the vision for the future of particle physics in the US and its international partners. It aims at defining the most important questions for the field of particle physics and identify promising opportunities to address them.
- The Snowmass'22 exercise is organized into several “Frontiers” divided themselves into various Topical Groups (TG) that will provide reports based on independent White Papers submitted by the relevant subcommunities. This workshop is part of the “Energy Frontier” group “EF05: QCD & strong interactions: Precision QCD” <https://indico.fnal.gov/category/1139/>
- The EF05 group conveners (Michael Begel (BNL), Stefan Hoeche (FNAL), Michael Schmitt (Northwestern)) made a call for Letters of Intents in 2020. There were 4 Lols related to α_s (see backup). The conveners appointed David d'E. to lead the edition of the α_s WP. We profit from the α_s (2022) workshop to collect all relevant contributions from the experts.
- Major milestone deadline to submit topical White Papers: March 15, 2022. Preparation and review of topical group report will follow, leading toward the Energy Frontier report (right before the July 2022 meeting in Seattle), and then the final Snowmass report.

This is a hard deadline: Only if our WP is presented by then can be included in the TG report

Snowmass'22 α_s White Paper

■ Each contributor is requested to **provide 1–3 pages of text/tables/figures** (there is no hard limit on number of pages, but please try to be concise) summarizing their workshop presentation with relevant bibliography and, in particular, **addressing the following questions** :

1) Overarching questions: **What is the current state-of-the-art and the ultimate theoretical & experimental precision for your favourite α_s extraction method? What do we need to achieve such ultimate precision?**

2) **Theory**: What is the situation with the **higher-order corrections** (pQCD, mixed QCD-EW) for your favourite observable? What is the **impact of non-pQCD corrections/uncertainties?** (Are there **new techniques** to reduce them?) Provide your **personal wish-list in data/theory developments needed** to reach your ultimate α_s precision.

3) **Experiment**: What are the **current leading syst./stat. uncertainties** for your favourite observable? What are the expected future syst./stat. **reductions with current & future (e+e-, e-p, p-p) machines?** (Are there **new observables** being considered?) Provide your **personal wish-list in data/theory developments needed** to reach your ultimate α_s precision.

■ **Overleaf document**: <https://www.overleaf.com/7195461193bsjbtgrvvsbw>

About ~10 (partial) contributors during the week: 3 in PDF section, 2 placeholders in lattice Section, 1 in the EWK Section,...

■ **Hard deadline** to submit contributions: **25th February, 2022 (3 weeks from now!)**

***Thanks for your contributions
to a successful meeting &
White Paper preparation.***

**See you in-person hopefully
in the upcoming
 α_s (202X) workshop!**

Backup slides