

The 2024 CTEQ Summer School



WILHELM UND ELSE
HERAEUS-STIFTUNG



Universität
Münster



U.S. National
Science
Foundation



2024 WE-Heraeus and CTEQ Summer School Report:

WE-Heraeus and CTEQ summer school on QCD and electroweak phenomenology took place near Münster from August 21 to 31. This was truly a global event, with 50+ doctoral students from Europe, the USA, India, and China participating. The school was hosted by the University of Muenster and organized by the Coordinated Theoretical-Experimental Project on QCD (CTEQ) covering topics common to both experimental and theoretical particle physics.

This school provides the participants with a deeper understanding and improved competency of the fundamental ideas, tools, and techniques that serve as the foundation for investigations of current and future experimental facilities. The 2024 CTEQ School addressed the pressing educational needs of junior physicists involved in forefront research investigations. The format of this program fosters student—lecturer interaction. This experience prepares our students for successful careers both within the physics discipline, and beyond.

The schools consist of 9 days of lectures and discussions where students interact closely with distinguished experts with a broad range of expertise. The audience for these schools is primarily the younger generation of physicists—typically advanced graduate students and postdocs, and the group includes students from both experimental and theoretical disciplines.

The school was organized by Prof. Michael Klasen and PD Karol Kovarik (University of Münster), and Prof. Fred Olness (SMU) in concert with the CTEQ School Committee. The local logistics were actively supported by numerous employees of the Münster Institute for Theoretical Physics, and we would like to thank all of them for facilitating an excellent school. We thank the Wilhelm and Else Heraeus Foundation for their generous financial support, and we thank the US National Science Foundation and the University of Münster for additional financial support .

Schedule Overview

2024 CTEQ School Schedule										
21 Aug 2024	22 Aug 2024	23 Aug 2024	24 Aug 2024	25 Aug 2024	26 Aug 2024	27 Aug 2024	28 Aug 2024	29 Aug 2024	30 Aug 2024	31 Aug 2024
Arrive	Day 1	Day 2	Day 3	Day 4	Free Day	Day 6	Day 7	Day 8	Day 9	Depart
8:00 - 8:45	Breakfast	Breakfast	Breakfast	Breakfast		Breakfast	Breakfast	Breakfast	Breakfast	
9:00 - 10:00	Intro 1	Intro 3	Intro 4	Jets 2		PDF 1	PDF 2	nPDF	Top 2	
10:00 - 10:30	Coffee	Coffee	Coffee	Coffee		Coffee	Coffee	Coffee	Coffee	
10:30 - 11:30	Intro MC 1	Intro MC 3	EW/Higgs 1	EW/Higgs 2		EW/Higgs ex1	EW/Higgs ex2	Top 1	Resummation	
11:45 - 13:00	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	
13:00 - 14:00	Intro 2	DIS 1	Jets 1	MC tutorial 2		ML tutorial 1	ML tutorial 2	Top ex1	Top ex2	
14:00-14:30	Coffee	Coffee	Coffee	Coffee		Coffee	Coffee	Coffee	Coffee	
14:30-15:30	Intro MC 2	MC hands-on	DIS 2	MC hands-on		ML hands-on	ML hands-on	xFitter	QGP	
15:30+	MC tutorial 1									
18:00 - 19:00	Dinner	Dinner	Dinner	Dinner		Dinner	Dinner	Dinner	Dinner	
19:00 - 21:00	Recitation	Recitation	Recitation	Recitation		Recitation	Recitation	Recitation	Recitation	
21:00 - 22:00	NightCap	NightCap	NightCap	NightCap		NightCap	NightCap	NightCap	NightCap	

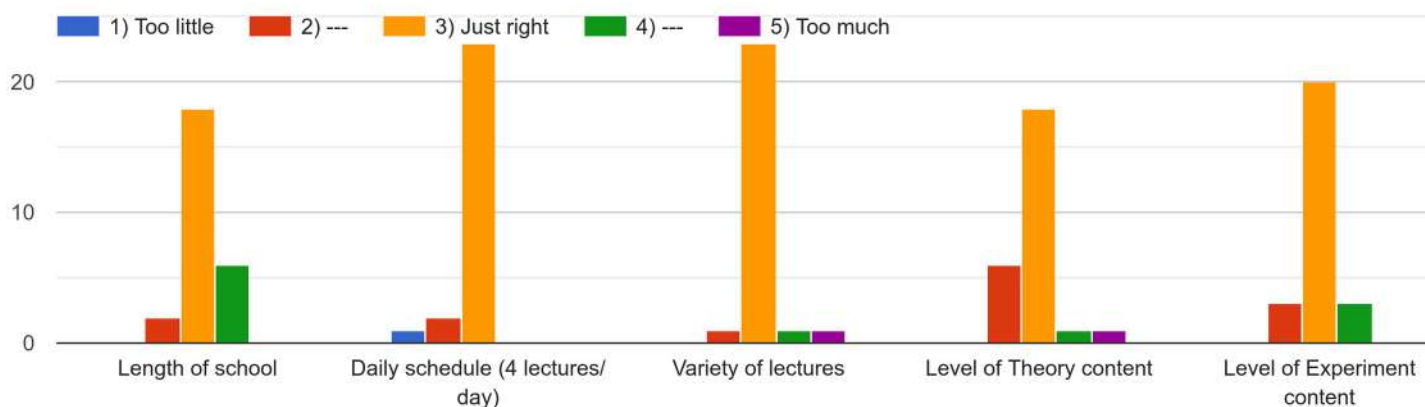
Lecture Topics & Speakers:

Speaker	Topic
Introduction to QCD	D. Soper (U Oregon)
Introduction to Monte Carlo generators	R. Frederix (U Lund)
Introduction to Machine Learning	J. Glombitza (U Erlangen-Nürnberg)
Tutorial on Monte-Carlo generators	T. Jezo (U Münster)
Tutorial on Machine Learning	J. Glombitza (U Erlangen-Nürnberg)
Tutorial on xFitter	S. Glazov (DESY) and F. Olness (SMU)
Deep inelastic scattering	A. Cooper-Sarkar (U Oxford)
Parton distribution functions	E. Nocera (U Torino)
Nuclear PDFs	K. Kovarik (U Münster)
QCD and top physics at the LHC	R. Schöffbeck (Austrian Academy of Sciences)
Jets	S. Marzani (U Genova)
Top quarks	L. Reina (Florida State U)
Electroweak physics at the LHC	J. Haller (U Hamburg)
Higgs and vector bosons	D. Zeppenfeld (KIT Karlsruhe)
Resummation	A. Kulesza (U Münster)
Quark gluon plasma	A. Andronic (U Münster)

Speakers listed in approximate presentation order.

The full Indico page: <https://indico.uni-muenster.de/event/2459/>

Basic School Components:

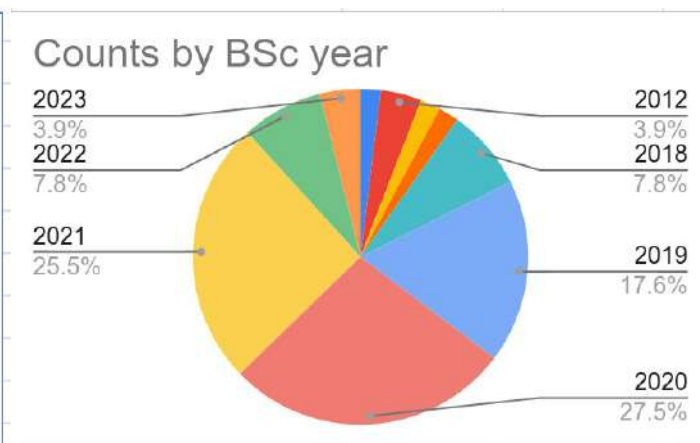
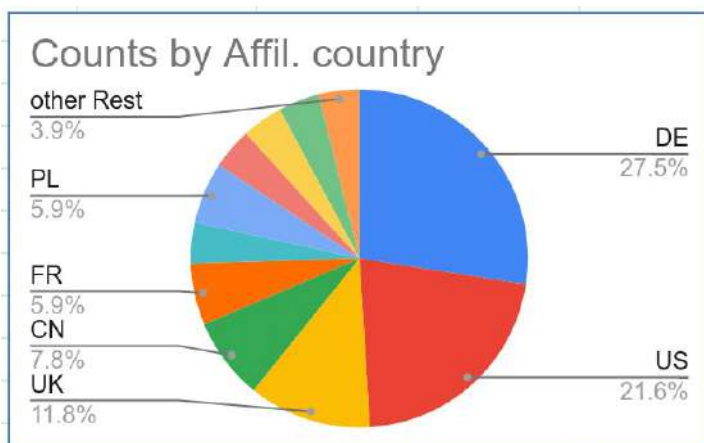


Participants Demographics:

Year Label	master	master	phd	phd	phd	postdoc
Min. years after BSc	1	2	3	4	5	6
number of students	51	49	45	32	18	9

Counts by Theo./Exp.	theory	experiment	%experiment
number of students	38	13	0.25

Counts by gender	female	male	%female
number of students	12	39	0.24



Overall impression of the school:

Complete and unedited comments

- Overall impression was very good, I think enough of the talks were relevant and helpful for my research.
- I was impressed by the QCD, DIS talks as well as the monte-carlo tutorials, POWHEG and machine learning, which would be quite useful for my research.
- Of course not all topics are equally connected to my research, however, they were mostly interesting and helpful for the overall understanding of QCD. Just repeating and thus refreshing things from QCD lectures probably everybody had in the past was already helpful.
- The school was very well organized and the hotel was very nice. The PDF lectures were directly relevant to my research, and I learnt a lot in the other lectures also.
- I enjoyed the school very much. In particular, the theory lectures on Jets, PDFs and top physics were great and also directly related to my research interests.
- Outstanding
- Very nice summer school and overall talks were very useful as a groundwork for newly entering graduate school. I wish I could have attended this at my early career path.
- Awesome
- Very good quality of the speakers overall. Some talks were very relevant for my research
- The school was very good and instructive
- Very nice! I think the talks about MC are useful for my research.
- I enjoyed the school a lot and I appreciated having both theorists and experimentalists presenting their topics.
- I really enjoyed the school, but I would have liked more of the lectures to go into more technical detail.
- I was really impressed with the school. The professors are very knowledgeable. The course on QCD, DIS and PDFs has been really useful for me.
- Although most of the talks are not directly related, they are very relevant.

- The school has been amazing both from the organization point of view and from the academic engagement. I really appreciated all the QCD lectures about factorization and resummation, from which I learned a lot in a topic not treated in detail during my University courses, as well as the EW presentations regarding top physics together with the application of EFT for BSM purposes.
- I've learned a lot about topics I knew nothing about before. So I find the school really impressive. Not so many talks were relevant to my research, but I enlarged my knowledge.
- Overall I'm extremely happy with the school. The lectures were all interesting and especially the tutorials were useful and easy to follow. The only suggestion I have for the next schools is to reorganise a bit the schedule, since there were many half an hour breaks leaving very little free time after the afternoon lectures. Even just removing the break before lunch and making 20 mins breaks would be more optimised.
- Very well organized and lectures quality was high.
- Excellent
- I am nearing the end of my PhD, so I found many of the introductory lectures contained information that was not new to me. Despite this, the school was a useful overview of physics topics which I will need to include in my thesis and it is always helpful to hear new perspectives on ideas. Overall, I enjoyed the school and found it helpful, but I would recommend it to a younger student.
- I learned a lot from the physics content. The MC tutorials and lectures were very useful, but after these, I learned the most from informal conversations
- Very Good. The program was well structured and very informative, providing an overview to all of the key topics of the field. The variety of the lectures was very helpful, for people to get an overview and to find their individual areas of interest.
- The school was very well organized. The theory lecture by Dave Soper in combination with the recitation sessions was particularly interesting for me and my research.
- The fokus on QCD and especially top quarks was useful for my own research.
- "I really enjoyed the school. The variety of the talks was very nice and the speakers were really good. There were several talks that were directly relevant or very closely related to my research.
- My favorite part of the school were the evening recitation sessions. I felt that I was able to have detailed conversations with people and gain insights beyond what was presented in the talks. "

Group Photos:

