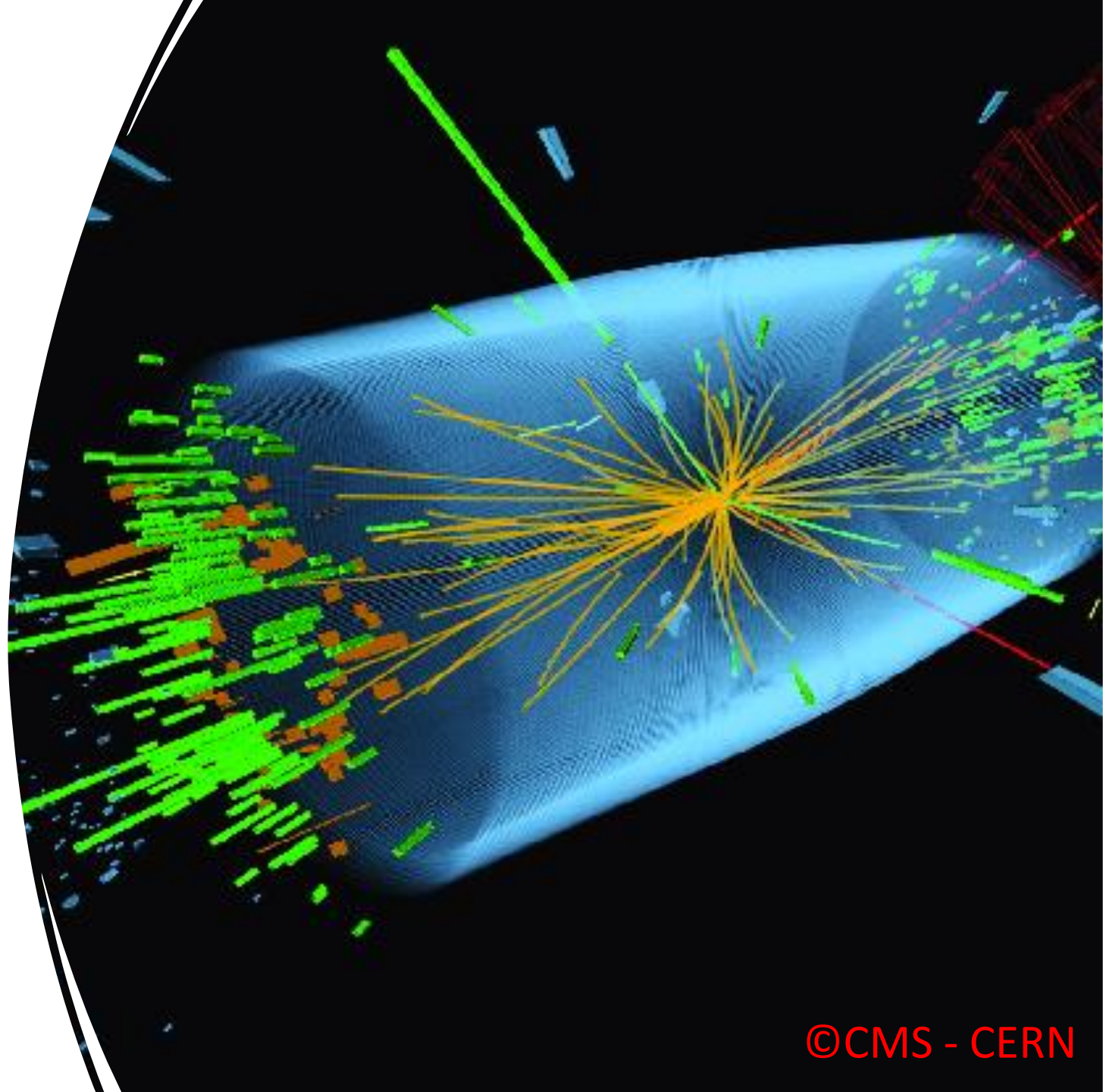


Experimental high
energy physics
research:
Knowledge
transfer and
Career readiness

Müge Karagöz, PhD

**CSAAPT & NCS-AAPT Joint
Fall Meeting,**

Jefferson Lab, 10/19/2024



Outline

- Professional background
- What is experimental high energy physics/particle physics (HEP/EPP)?
- What is HEP good for (career readiness)? 😊
- Conclusions

Disclaimer:

Most points may apply to any research, but I will concentrate on particle physics.

Even further, I will concentrate on high energy physics that involves accelerators.

This is an abbreviated version of an invited talk I gave at the 2023 APS MAS meeting.

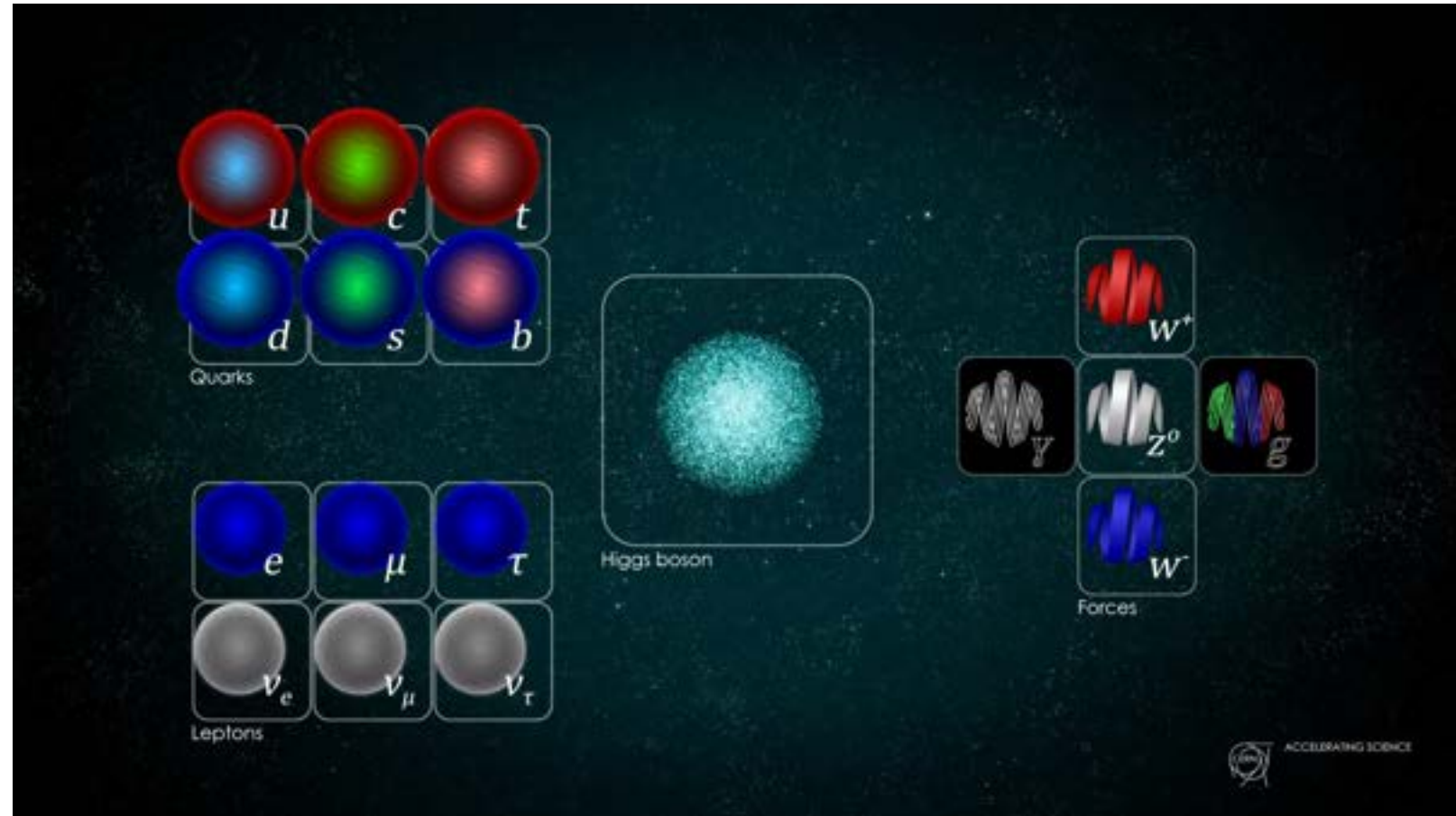
Who am I? – Müge Karagöz, PhD, MInstP, Assoc. Prof.

- An experimental particle physicist, an educator, a leader, and a mother
- Assoc. Prof. Title, Higher Education Council, Turkey, 2006
- Ph.D., Physics & Astronomy, Northwestern University
- M.Sc. & B.S., Physics, Boğaziçi University, Turkey
- Worked at multi-national labs (Fermilab/USA, CERN/CH)
- Taught at Oxford/UK, Chaminade/USA, UMD/USA
- Volunteered & worked at K-12 schools, and labs like LIGO/USA
- Non-profit, organization experience (AIP, CSAAPT)



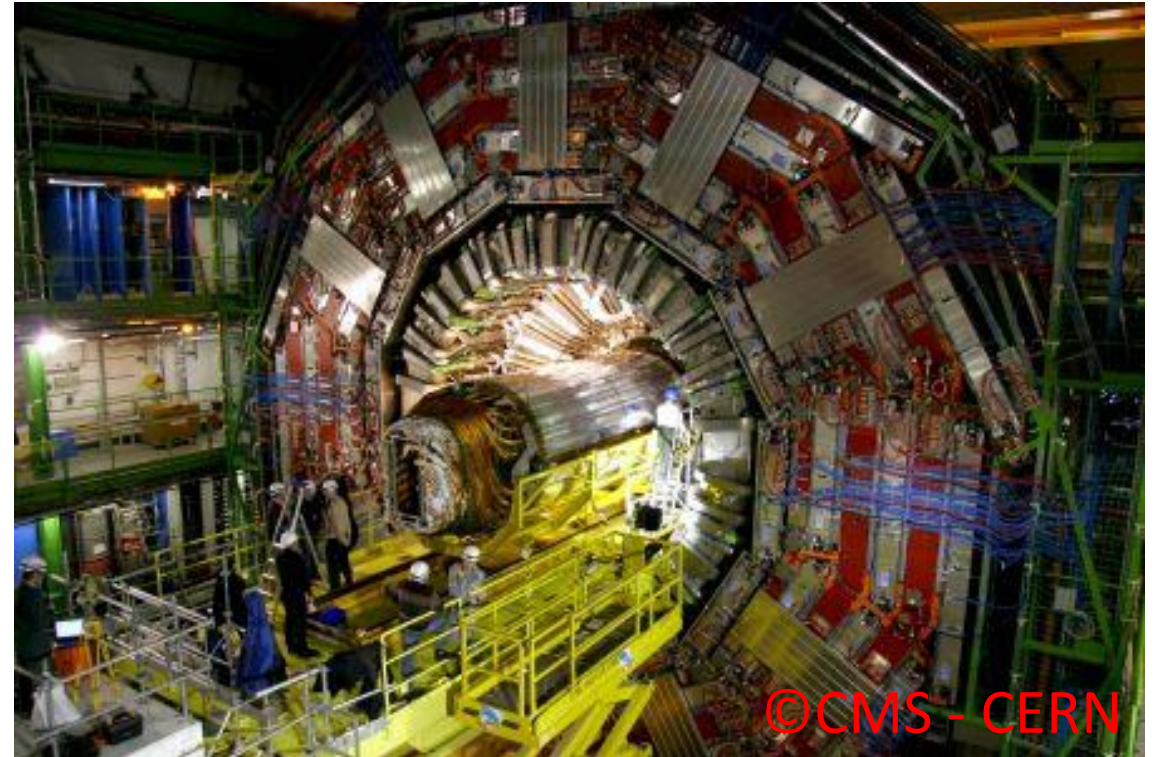
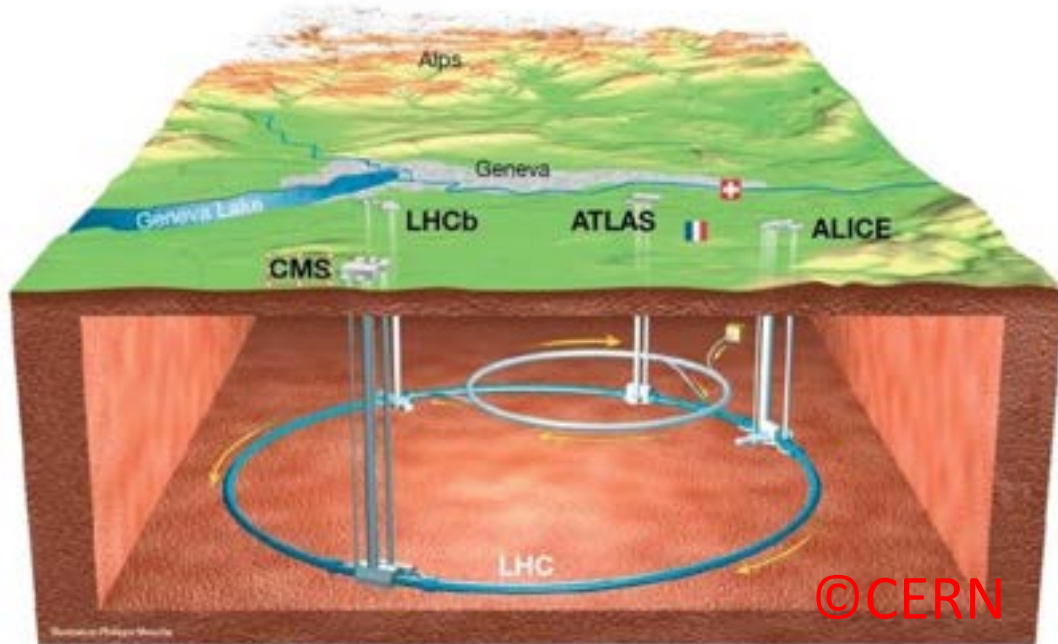
HEP – Big picture: Why?

Explore unknowns of the universe & building blocks of the universe.



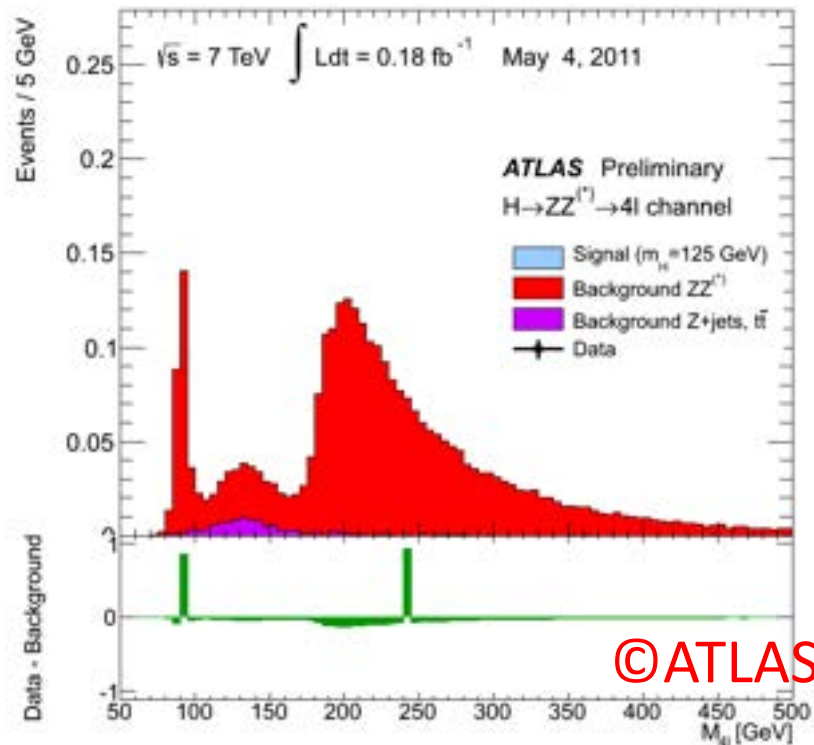
HEP – Big picture: How?

Collide “elementary” particles (e.g., CMS at LHC, CERN).



HEP – Big picture: What?

Analyze and visualize petabytes of data to get physics output.



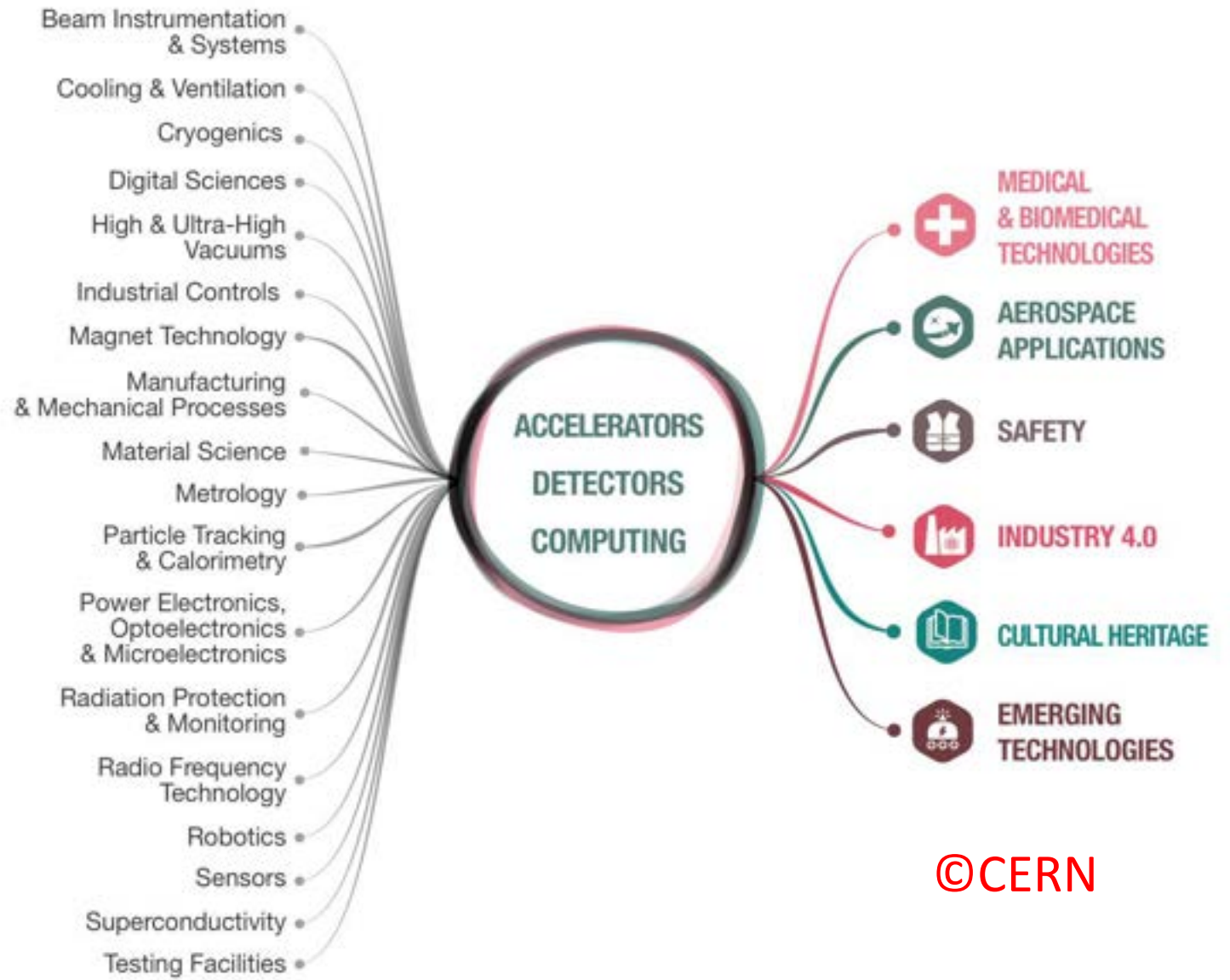
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HEP – Bigger picture: Transferable Knowledge Base

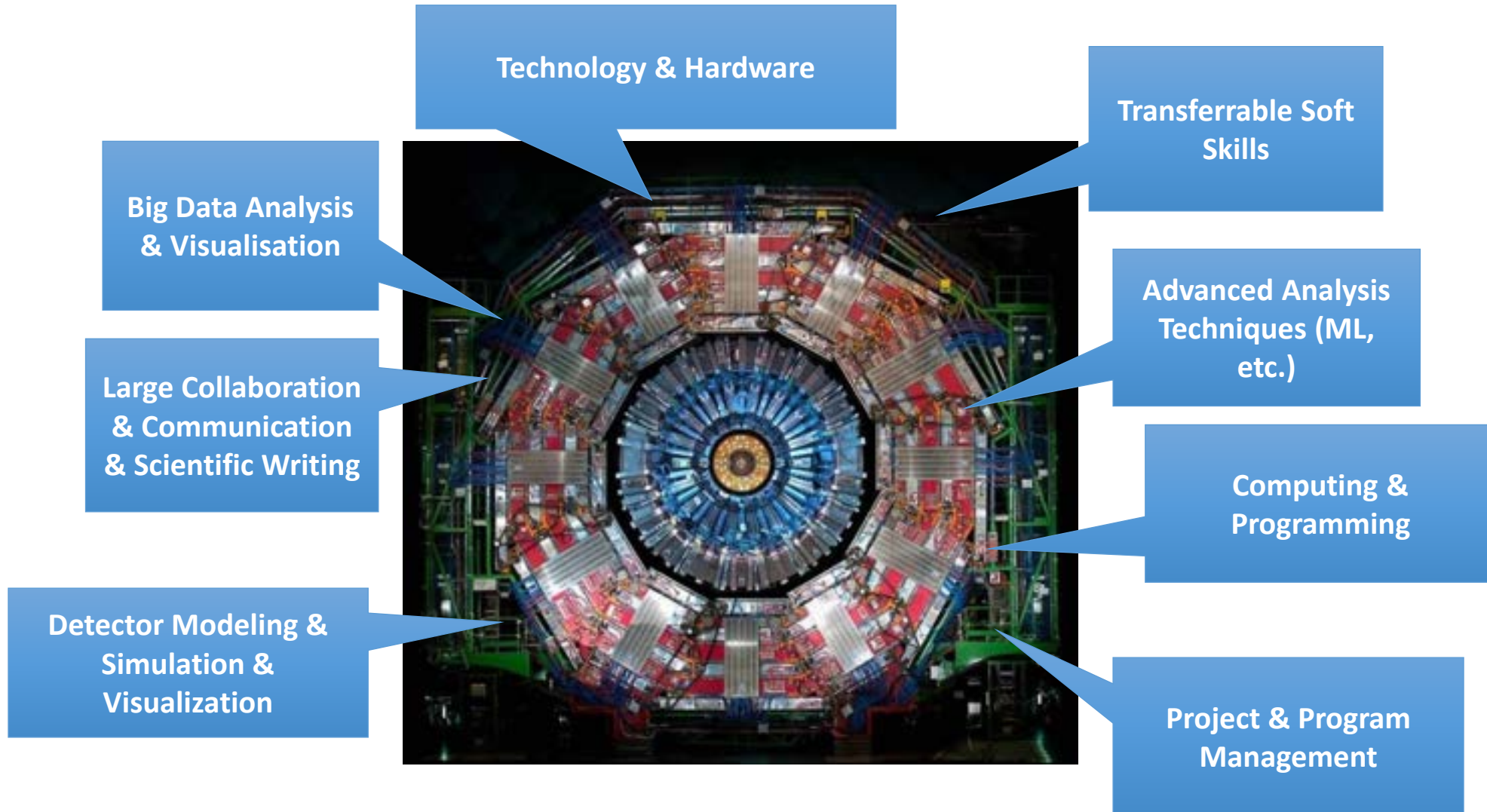
Curiosity-driven science drives tools and skills for practical applications

Creates workforce with transferable baseline knowledge and hard & soft skills



©CERN

Skills – Big Picture



Helping students navigate HEP research



UMD FIRE SPD (R.I.P)
"chameluon"
represents adaptability!

A bit of particle physics basics

No need for extensive theory knowledge base

Secrets of trade of HEP analysis/software world

Critical-thinking, trouble-shooting, and questioning every step

Collaboration to conduct research responsibly

Getting ready for big companies/projects

Reading and writing literature

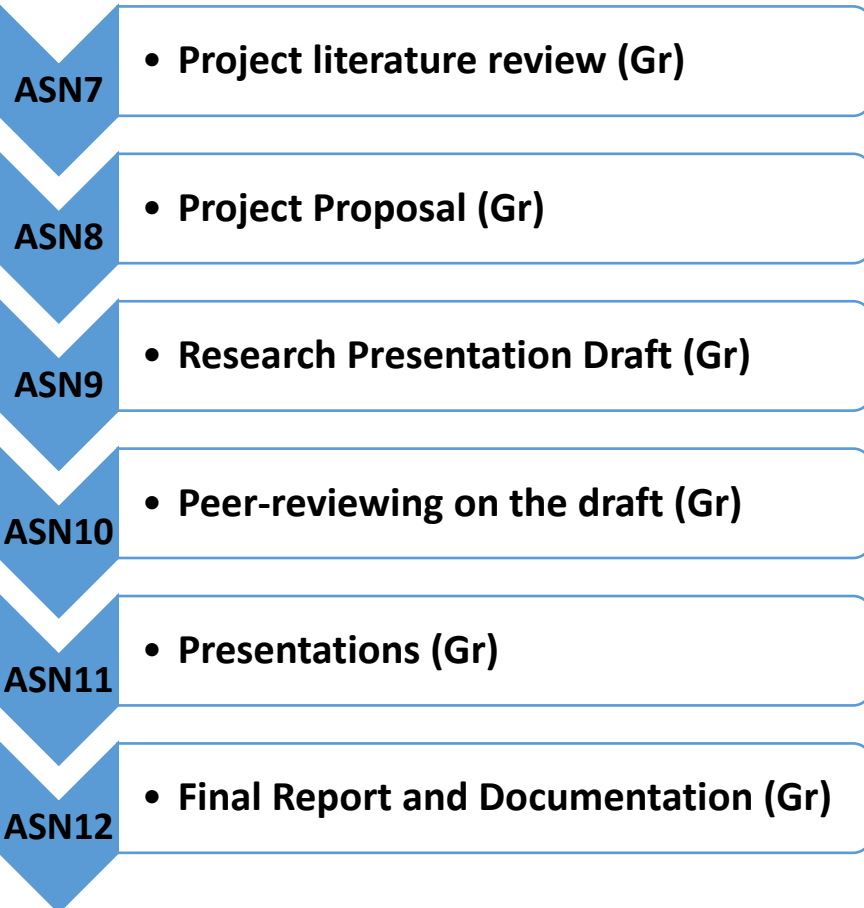
Any discipline needs proficiency in communication

Building transferable soft skills

Stamina, accountability, and adaptability to push through

Professional skills through projects

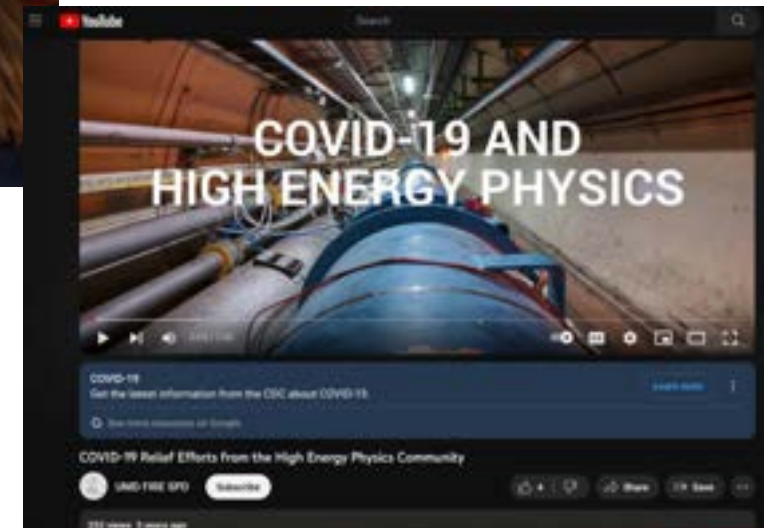
Sample Research Project Timeline



It's all about teamwork!



True even for videos!

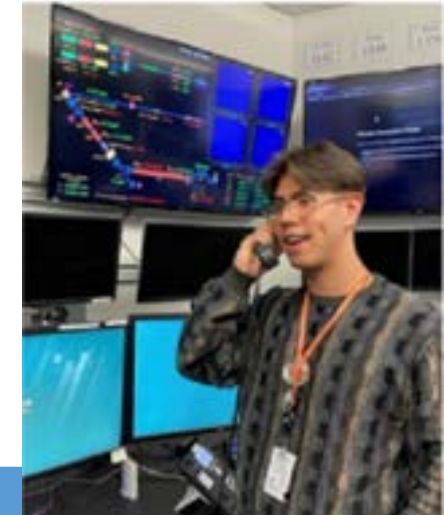


Can you work in HEP with a BS degree?



Rhea Khatri
Manager & Technician,
CUA HEP Lab
Physics BS, UMD

- Rhea currently works as the lab manager technician at the HEP lab at the Catholic University of America. She is working on building silicon sensor modules for the CMS detector, to be installed in the Phase 2 Upgrade.



Alex Bien
Accelerator Systems
Operator, SLAC
Physics BS, UMD

- Alex currently works at SLAC national accelerator laboratory, on a team of operators, physicists, and engineers responsible for monitoring and optimizing the performance and safety of accelerator systems.

Can you do non-HEP things with a HEP PhD?



Jared Yamaoka
Quantum/Data
Scientist, MD
PhD on Tevatron data



Bill Foster
Congressman, IL
PhD on IMB data



**Elina Berglund
Scherwitzl**
Entrepreneur, Sweden
PhD on LHC data

Conclusions & Advice to give to students

HEP/EPP research gives these to students: Collaboration & community, project development, peer-reviewing, resource-sharing, mentoring, and hands-on learning.

Do not fall into the impostor syndrome trap – if you have done physics (especially HEP research), you have gained valuable skills for career readiness.

Learn many skills, and learn every new skill with an open mind. You decide how much you get out of any experience.

It is easy to fall into pitfalls even with the best intentions. Aim to constantly revise (“experiential learning”).

Check out [AIP Statistical Research](#) group reports, if you are curious about career and workforce stats in physics and astronomy.

Questions?

- General inquiries:
dr.muge.karagoz@gmail.com
- Thank you!

Acknowledgements: UMD FIRE, UMD Physics and CMS, the whole HEP community, and my amazing past students.

