

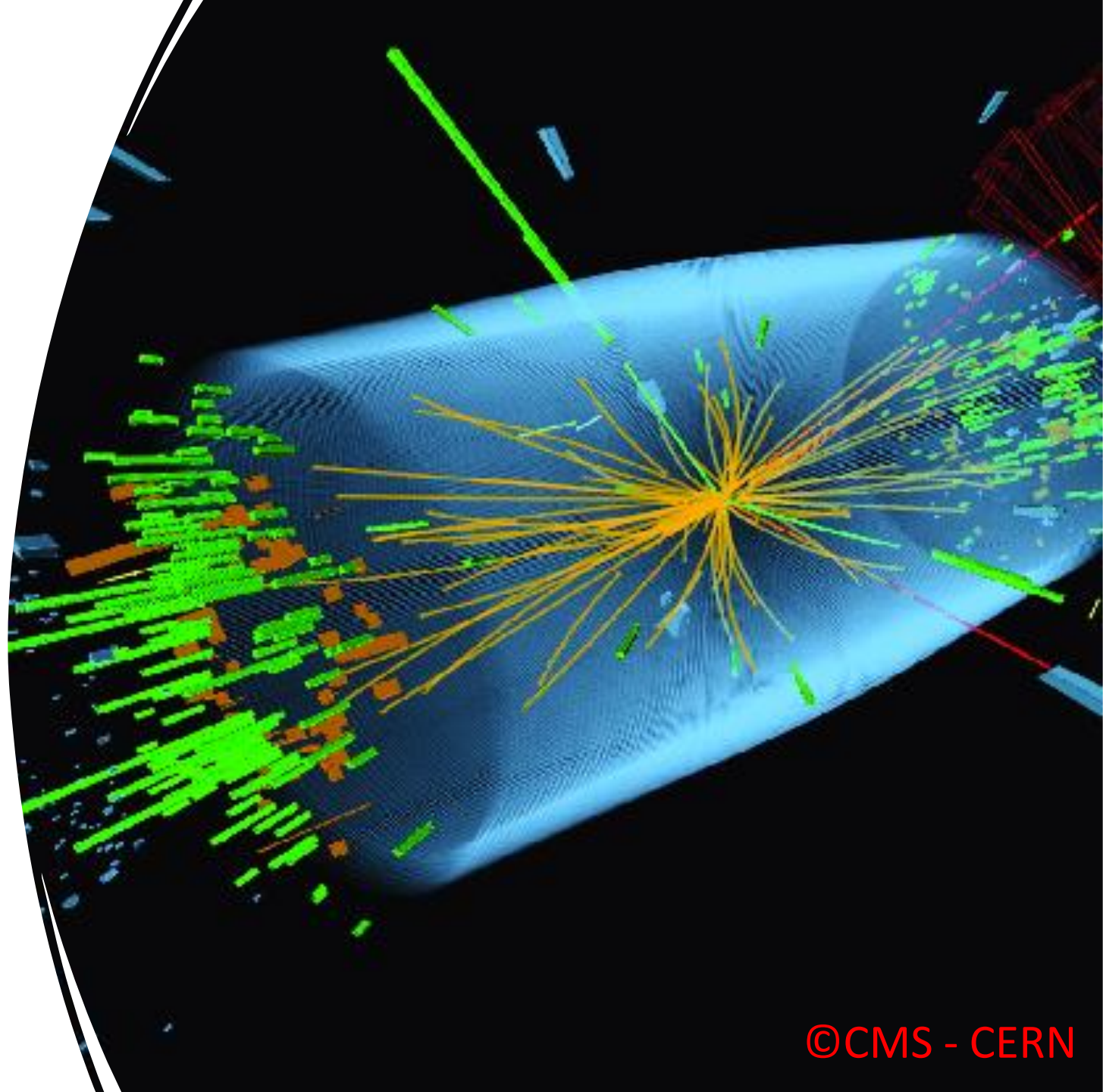
Experimental high  
energy physics  
research:  
Knowledge  
transfer and  
Career readiness

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**Müge Karagöz, PhD**

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

**Jefferson Lab, 10/19/2024**



# Outline

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- 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.

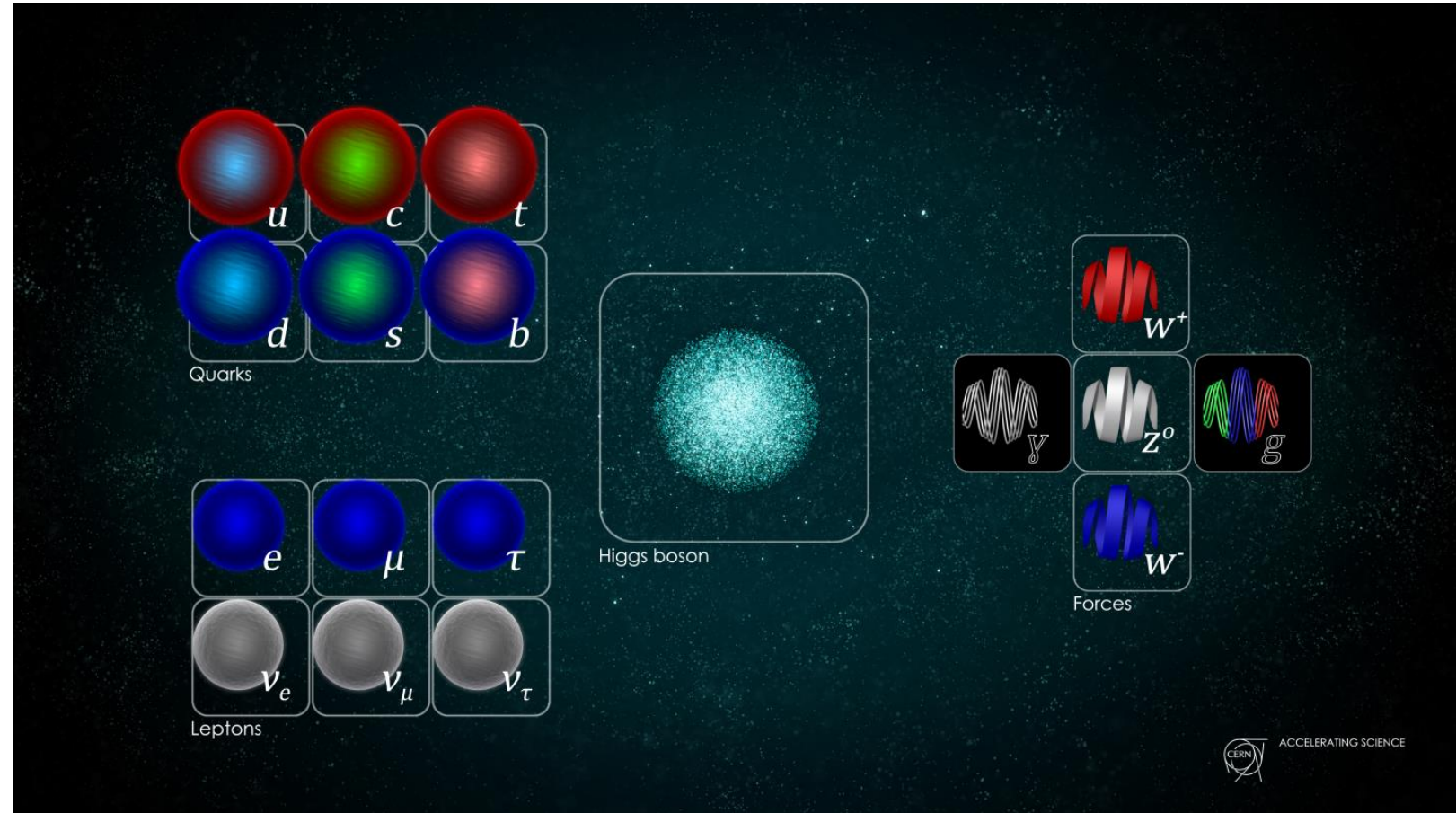
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- An experimental particle physicist, an educator, a leader, and a mother
- Assoc. Prof. Title, Higher Education Council, Turkey, 2006
- Ph.D., Physics & Astronomy, Northwestern University
- M.Sc. & B.S., Physics, Boğaziçi University, Turkey
- Worked 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)



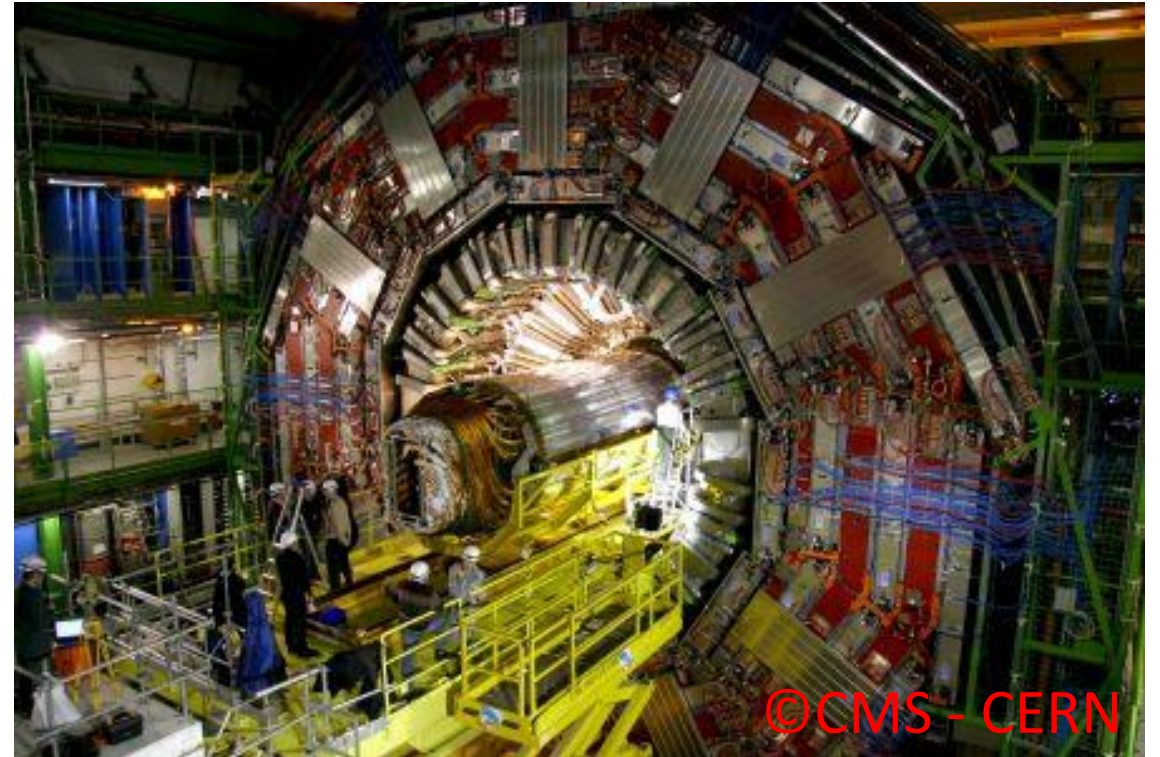
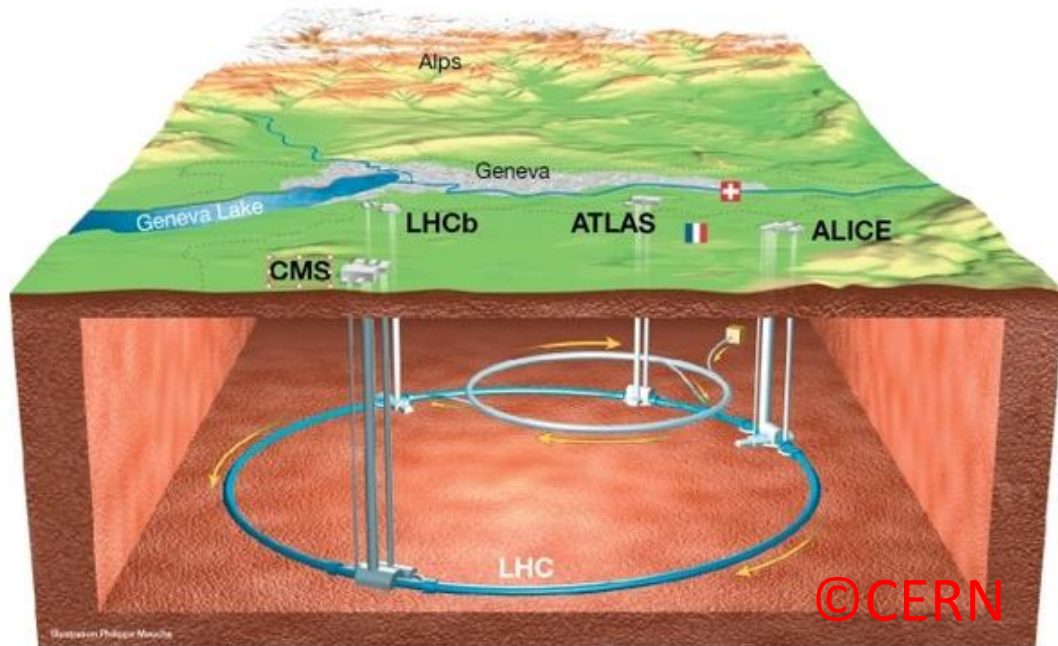
# HEP – Big picture: Why?

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



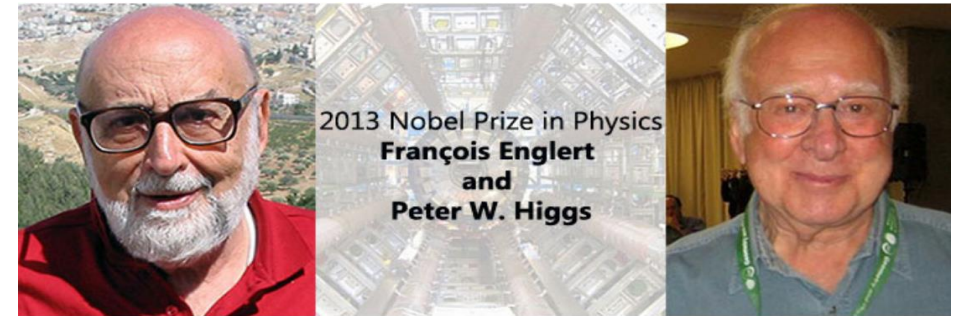
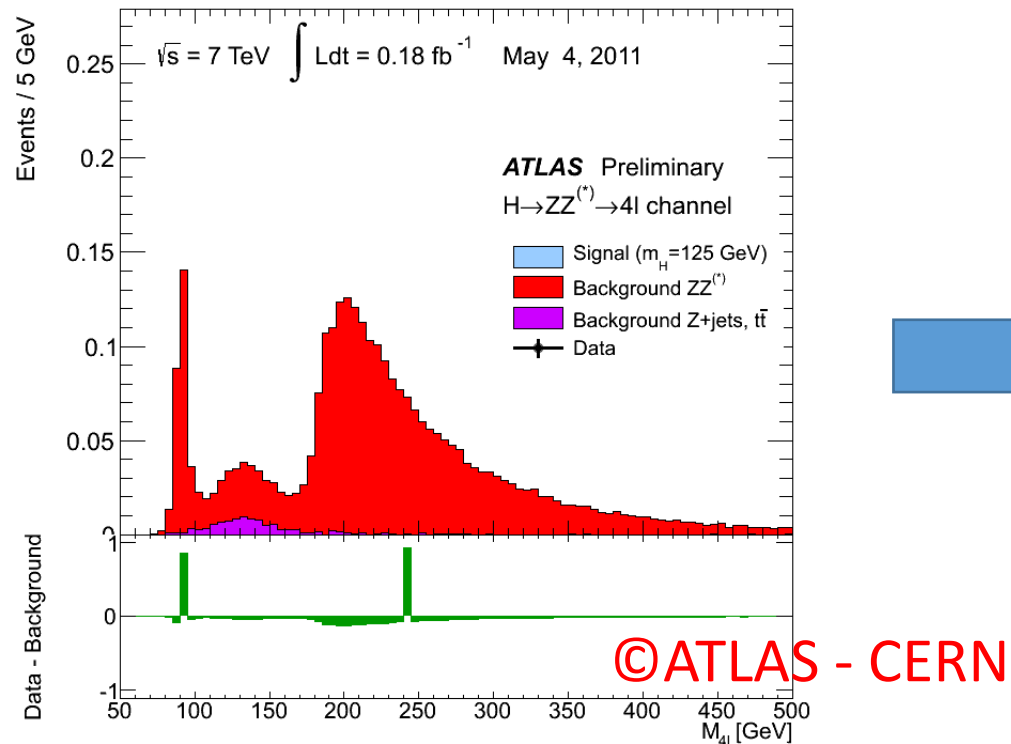
# HEP – Big picture: How?

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



# HEP – Big picture: What?

*Analyze and visualize petabytes of data to get physics output.*



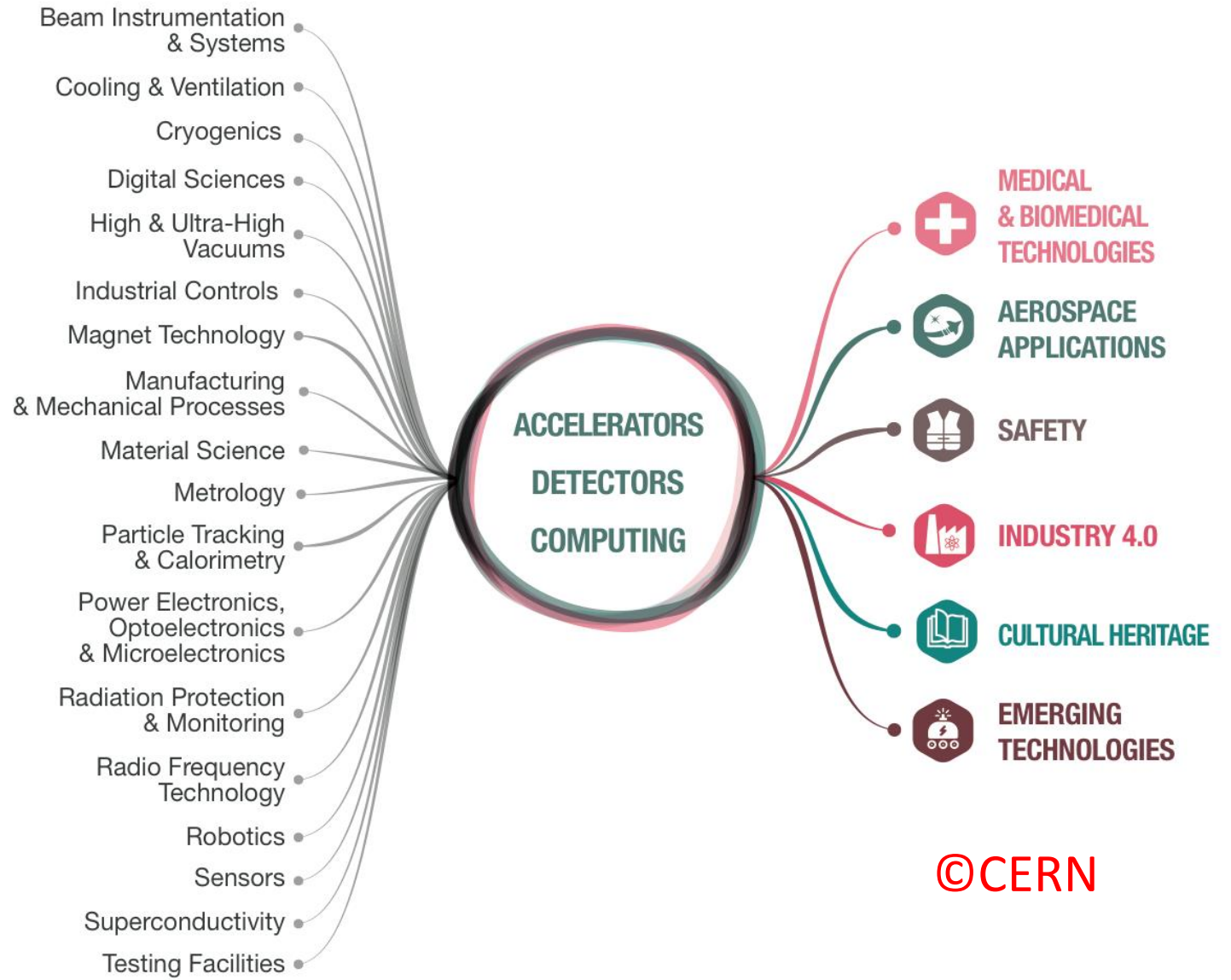
Media credits: Englert Photo: Pricolet via Wikimedia Commons / Higgs Photo: G.-M. Gruel via Wikimedia Commons



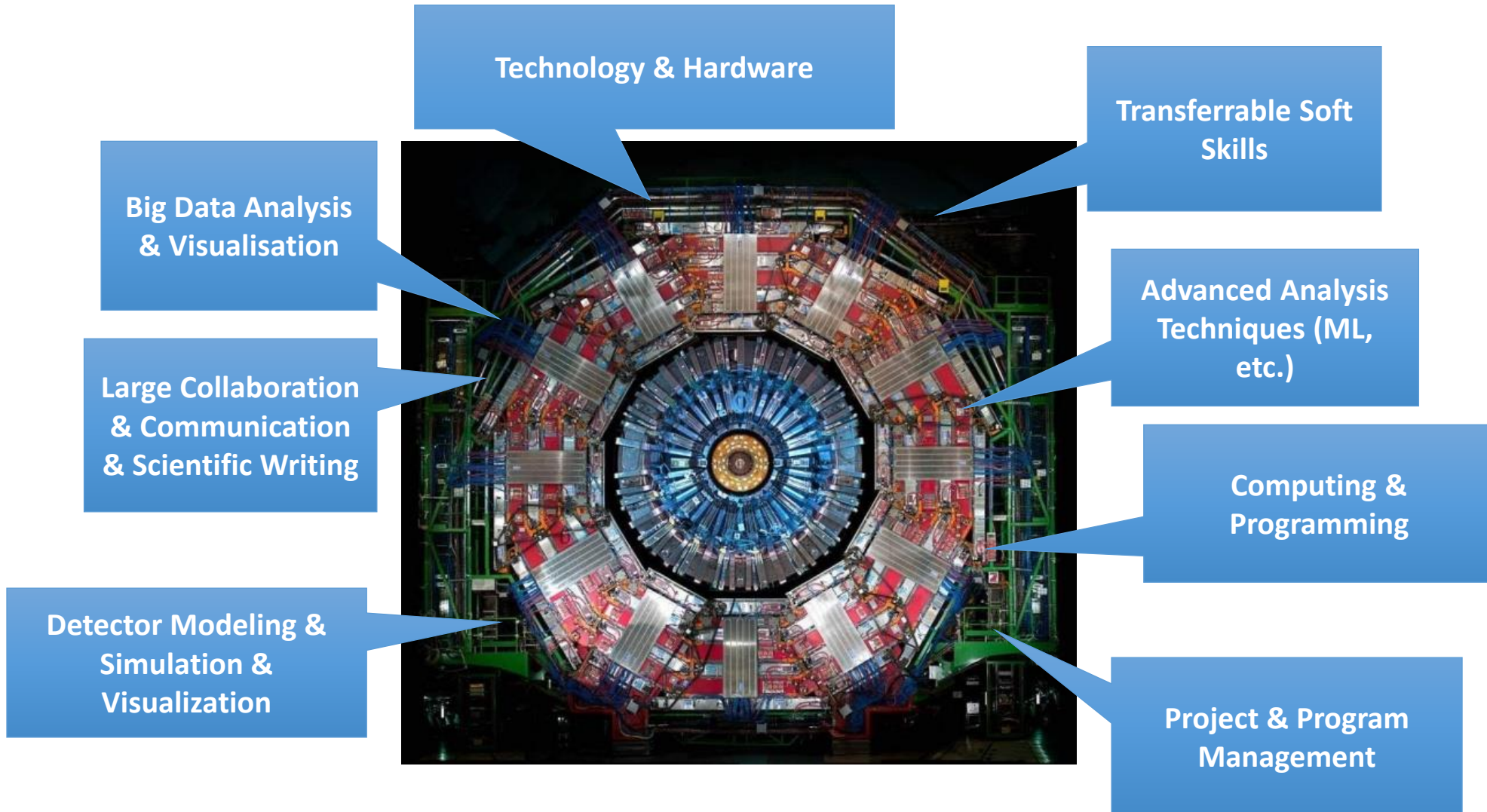
# HEP – Bigger picture: Transferable Knowledge Base

*Curiosity-driven science drives tools and skills for practical applications*

*Creates workforce with transferable baseline knowledge and hard & soft skills*



# 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

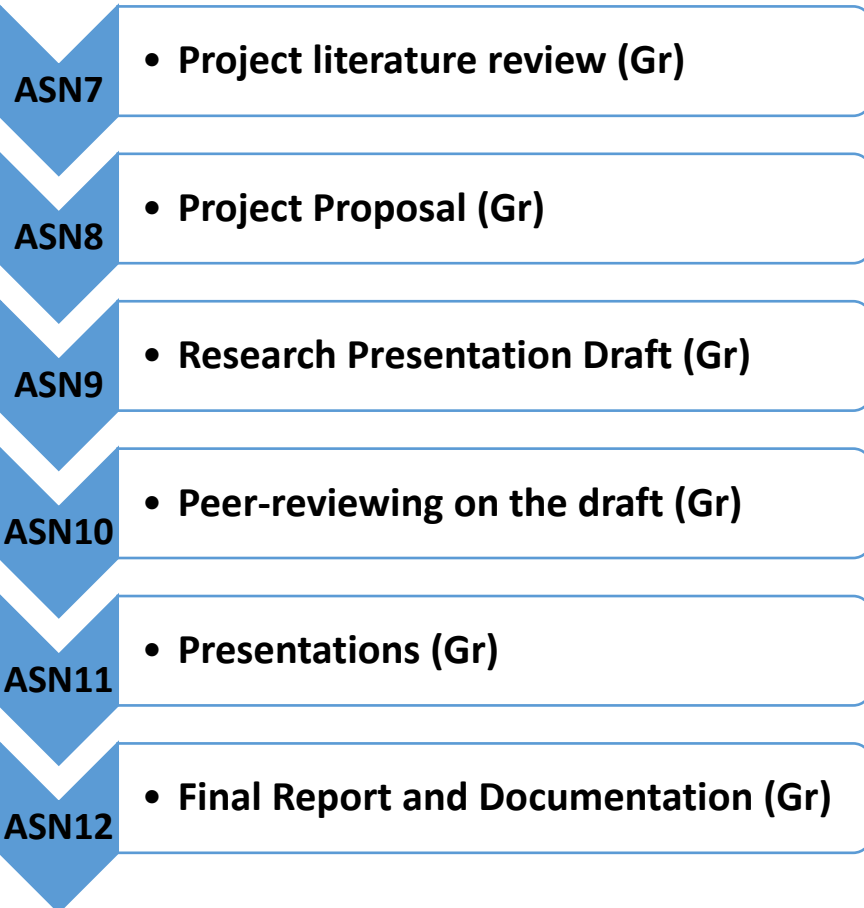
**Any discipline needs proficiency in communication**

Building transferable soft skills

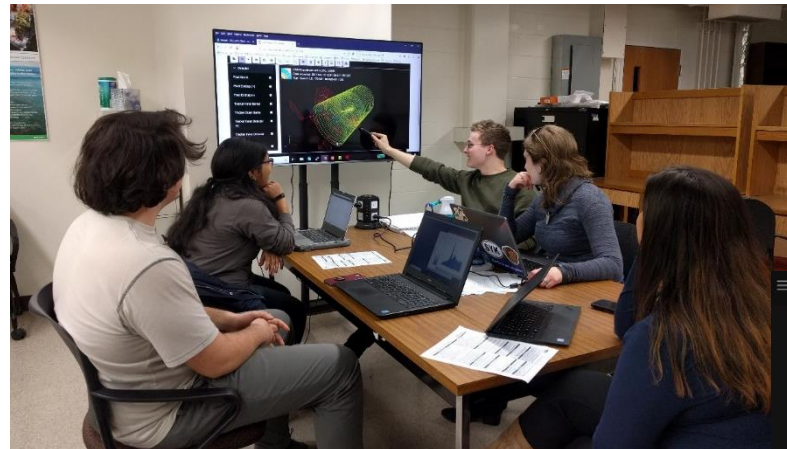
**Stamina, accountability, and adaptability to push through**

# Professional skills through projects

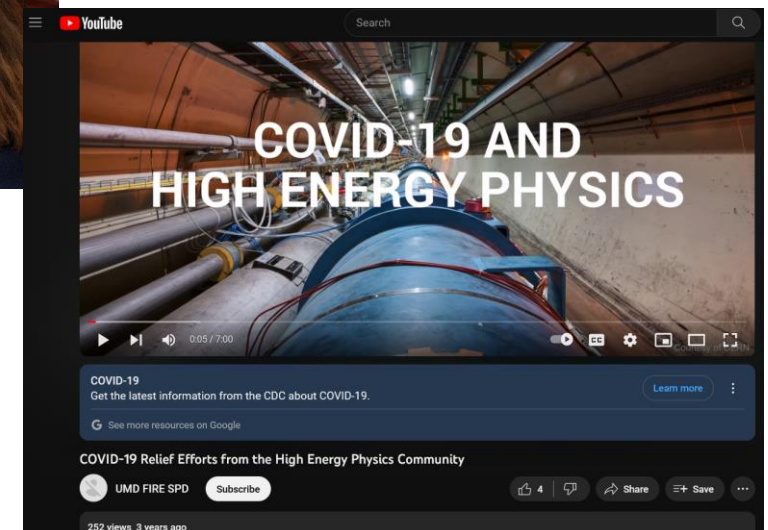
## Sample Research Project Timeline



It's all about teamwork!



True even for videos!

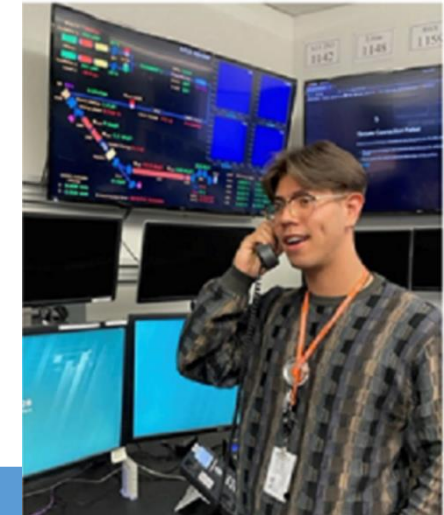


# Can you work in HEP with a BS degree?



**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

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

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

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

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

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

# Questions?

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- General inquiries:  
[dr.muge.karagoz@gmail.com](mailto:dr.muge.karagoz@gmail.com)
- Thank you!

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

