

My path in Physics and a few tips

Loukas Gouskos (CERN)

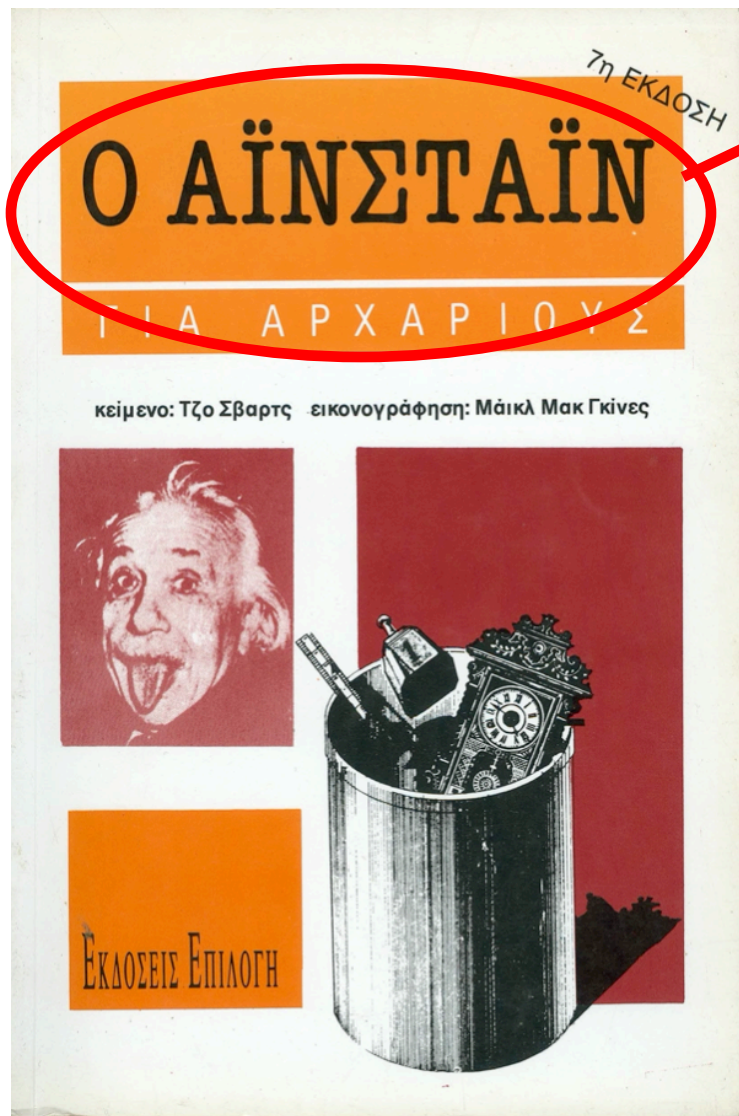
***CMS Job matching event
Nov 29, 2022***

Why we are here

- [Mainly] PhD students and postdocs, who:
 - ◆ Look for the next job in academia [Postdoc, or tenure-track]
 - how to plan, where to put focus, etc..
 - ◆ Not sure if staying in academia is the “right” choice
 - academia vs. private sector
 - ◆ Life outside physics ?
 - [Here I am only sharing feedback from colleagues and friends that made the transition]

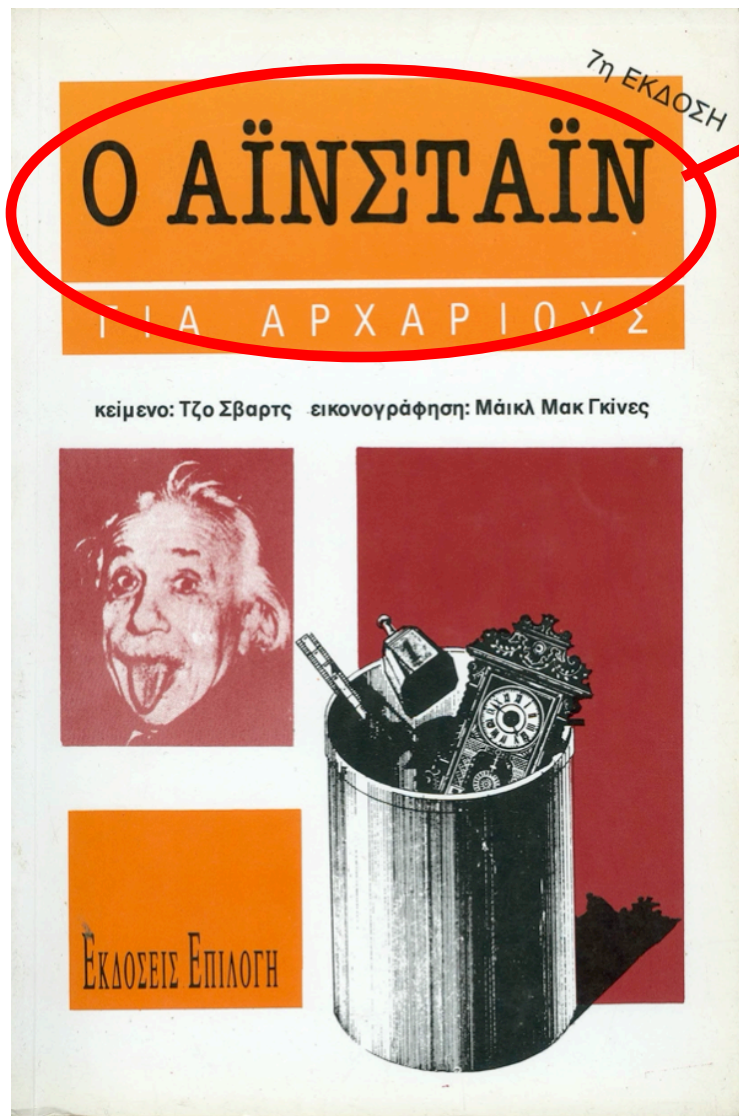
- Disclaimer:
 - ◆ Today I am giving you my perspective and share examples from my journey in HEP
 - based on discussions and mentorship from my supervisors, colleagues and friends
 - I ll do my best to be as unbiased as possible
 - ◆ Clearly, many other views / different stories / different experiences
 - Listen to people → shape your future
 - ◆ Slides are meant to set-the-scene and spark discussion

How I entered the game

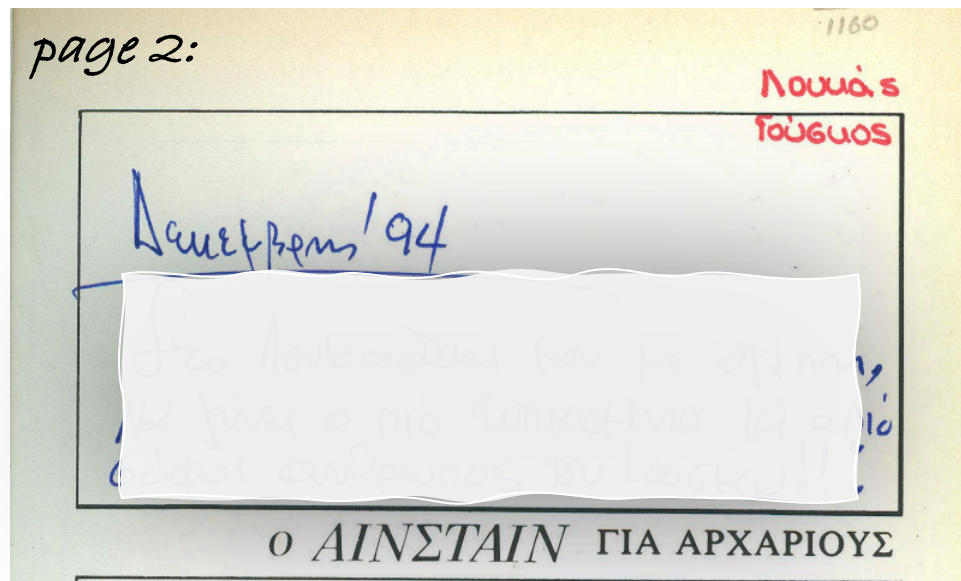


*"Einstein
for beginners"*

How I entered the game



*"Einstein
for beginners"*



Flash back:

- ◆ I was in primary school
 - Impossible to understand the concepts
- ◆ but, the fact that we are trying to explain how nature works triggered me

My path in physics

BSc/MSc
(Uni of Athens)

pre-LHC

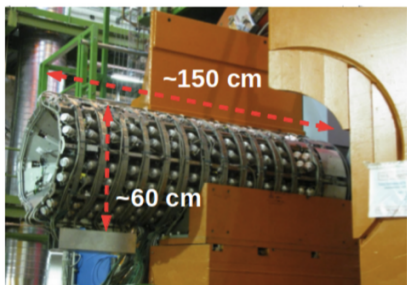


Detector/hardware work:

- ◆ Critical for the success of the experiment
- ◆ Different challenges wrt analysis work
- ◆ Essential ingredient for your CV
[ie. successful job applications]

Detector development

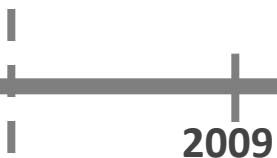
CMS-CASTOR calorimeter
[Simulation, Test Beams,
commissioning, ..]



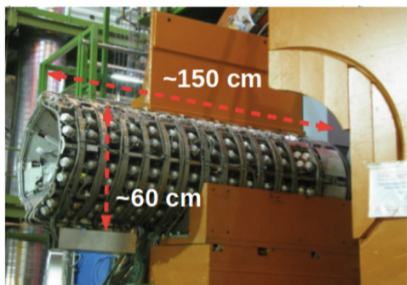
My path in physics

BSc/MSc
(Uni of Athens)

pre-LHC



Detector development
CMS-CASTOR calorimeter
[Simulation, Test Beams,
commissioning, ..]



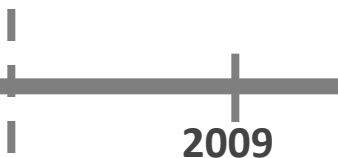
Challenge:

- ◆ A growing scientist (a student) in big collaboration with many smart and knowledged colleagues
- ◆ It can be overwhelming – do not lose motivation
- ◆ Take the time to learn things in depth, do not be afraid to ask questions
- ◆ Mistakes/failures: It's OK – learn from them and use them as extra motivation to work harder

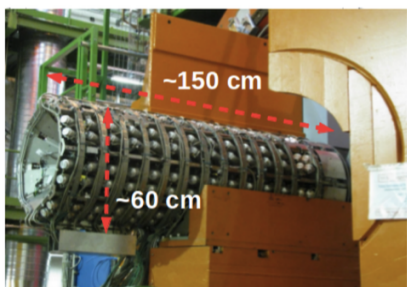
My path in physics

BSc/MSc
(Uni of Athens)

pre-LHC

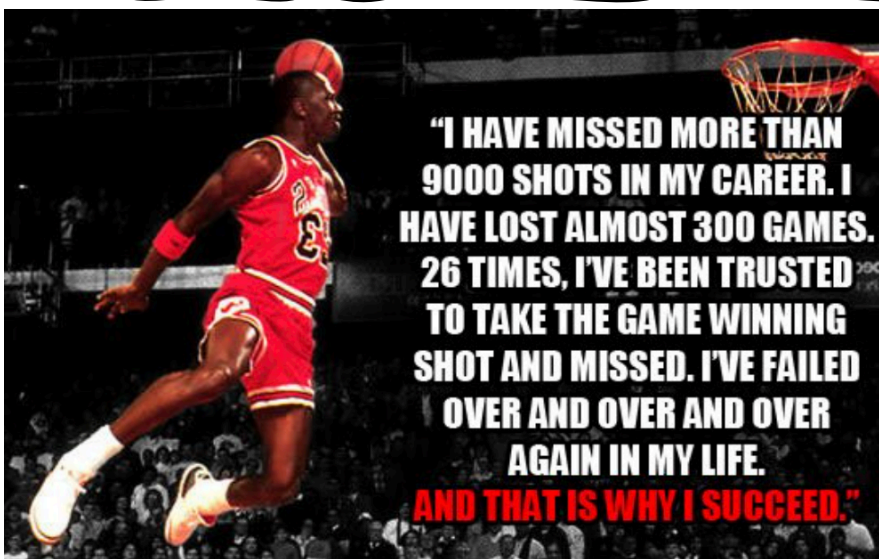


Detector development
CMS-CASTOR calorimeter
[Simulation, Test Beams,
commissioning, ..]



Challenge:

- ◆ A growing scientist (a student) in big collaboration with many smart and knowledged colleagues
- ◆ It can be overwhelming – do not lose motivation
- ◆ Take the time to learn things in depth, do not be afraid to ask questions
- ◆ Mistakes/failures: It's OK – learn from them and use them as extra motivation to work harder



My path in physics

BSc/MSc
(Uni of Athens)

PhD
(Uni of Athens)

pre-LHC

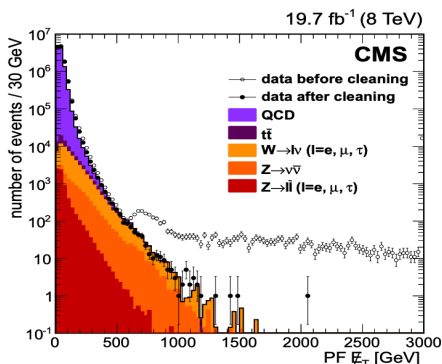
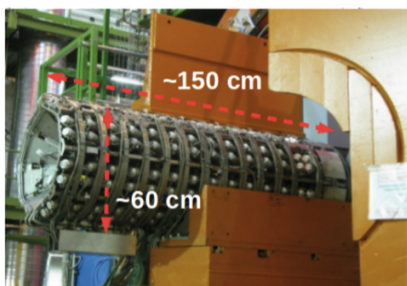
LHC-Run1

2009

2014

Detector development
CMS-CASTOR calorimeter
[Simulation, Test Beams,
commissioning, ..]

Physics analysis
- Search for SUSY
Inclusive & Natural
Object reconstruction
- particularly PF MET



Detector → Physics analyses:

- ◆ A different world / different challenges / different skills
- ◆ Multiple groups pursuing the same physics channel
 - learn to collaborate [not always smooth]

As a PhD:

- ◆ Showcase that you can do research
 - and see if you like doing research
- ◆ It's your thesis: be proud of it
 - Choose a topic that you find intriguing, explore your ideas
 - but careful: aim for evolutions [i.e. small solid steps] **not** revolutions
- ◆ You **ll** [probably] reach your limits
 - key: not to lose your target/interest

My path in physics

BSc/MSc
(Uni of Athens)

PhD
(Uni of Athens)

PostDoc
(UC, Santa Barbara)
LPC DR (2019)

pre-LHC

LHC-Run1

LHC-Run2

2009

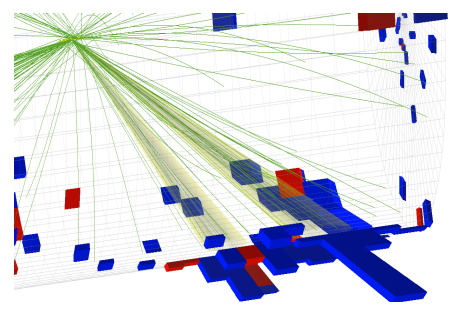
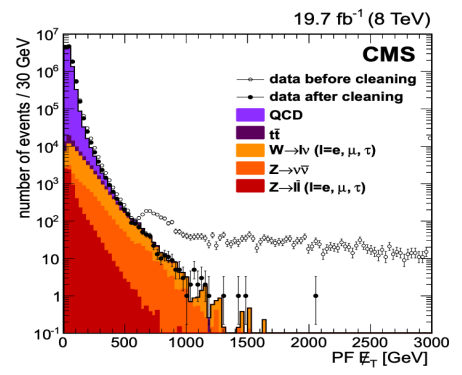
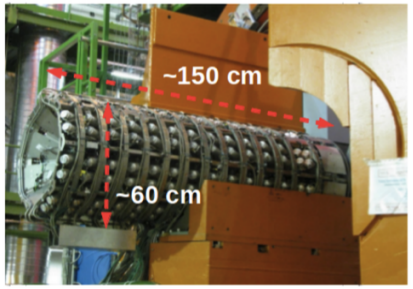
2014

2019

Detector development
CMS-CASTOR calorimeter
[Simulation, Test Beams,
commissioning, ..]

Physics analysis
- Search for SUSY
Inclusive & Natural
Object reconstruction
- particularly PF MET

Physics analysis
- SUSY: top squarks
- Higgs: H-c coupling
Object reconstruction
- MET, Jet tagging w/ML
[CMS Prize (2019)]
"Far" future: FCC-hh



MET convener
[2016-18]

LHC iML
coordinator
[2018-19]

As a PostDoc:

- ◆ You have already proven you can do research
 - Nest step: become a Leader
- ◆ coordinate a group
- ◆ bring new research ideas and directions
- ◆ Roles of responsibility in the experiment
- ◆ Get visibility
 - This stage is the last step before the permanent position

My path in physics

BSc/MSc
(Uni of Athens)

PhD
(Uni of Athens)

PostDoc
(UC, Santa Barbara)
LPC DR (2019)

Research Fellow
(CERN)

Research Physicist
(CERN)

pre-LHC

LHC-Run1

LHC-Run2

LHC-Run3

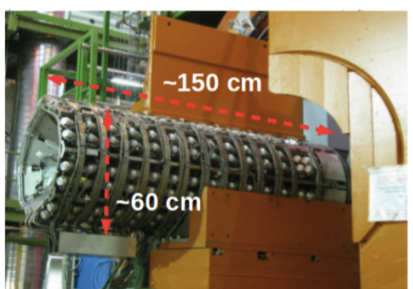
2009

2014

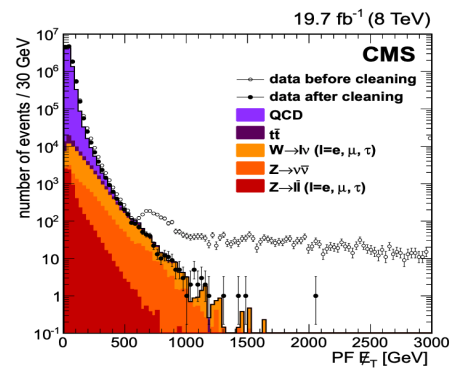
2019

2021

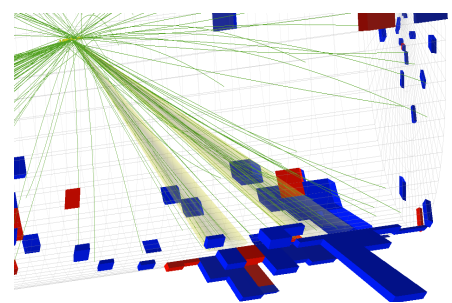
Detector development
CMS-CASTOR calorimeter
[Simulation, Test Beams, commissioning, ..]



Physics analysis
- Search for SUSY
Inclusive & Natural
Object reconstruction
- particularly PF MET



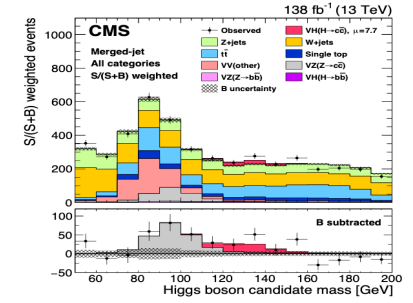
Physics analysis
- SUSY: top squarks
- Higgs: H-c coupling
Object reconstruction
- MET, Jet tagging w/ML
[CMS Prize (2019)]
“Far” future: FCC-hh



MET convener
[2016-18]

LHC iML
coordinator
[2018-19]

Physics analysis
- Higgs (H-charm)
- DiHiggs (4b channel)
Object reconstruction
- Jet tagging w/ML
CMS Phase 2 upgrades
- Reconstruction & Lab
“Far” future: FCC-ee



CMS PH office
Cross-POG
[2020-22]

CMS H to bb
convener
[2020-22]



My path in physics

BSc/MSc
(Uni of Athens)

PhD
(Uni of Athens)

PostDoc
(UC, Santa Barbara)
LPC DR (2019)

Research Fellow
(CERN)

Research Physicist
(CERN)

pre-LHC

LHC-Run1

LHC-Run2

LHC-Run3

2009

2014

2019

2021

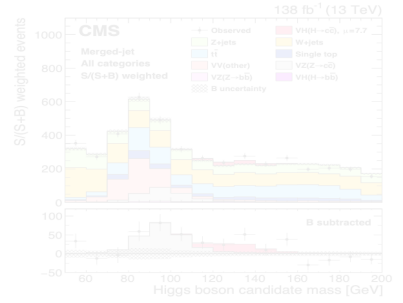
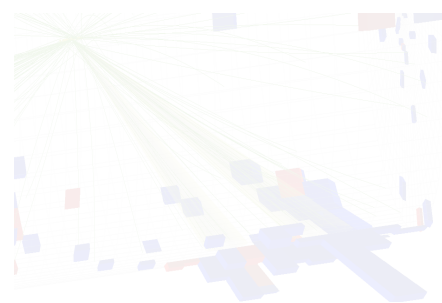
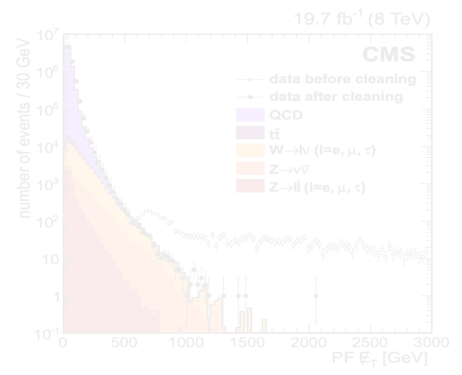
Interplay between detector development, physics object reconstruction, physics analyses and "far" future

Detector development
CMS-CASTOR calorimeter
[Simulation, commissioning, ..]

Physics analysis
- Search for SUSY
Object reconstruction
- particularly PF MET

Physics analysis
- SUSY: top squarks
Object reconstruction
- MET, Jet tagging w/ML [CMS Prize (2019)]
"Far" future: FCC-hh

Physics analysis
- Higgs (H-charm)
Object reconstruction
- Jet tagging w/ML
CMS Phase 2 upgrades
- Reconstruction & Lab
"Far" future: FCC-ee



MET convener
[2016-18]

LHC iML
cordinator
[2018-19]

CMS PH office
Cross-POG
[2020-22]

CMS H->bb
convener
[2020-22]

Few more tips/Lessons learned

- Develop as a scientist both in terms of *depth* and in *breadth*
 - ◆ A well-rounded profile allows to you to identify priorities of the field engage with high-profile/high-importance physics topics, have vision..
 - At the end → enjoy science
 - ◆ And of course: Boost your chances for a tenure position

- Learn to complete things

- ◆ Another challenge that we usually face

- More exciting:
Conceive an new idea
[eg., a new variable, a new analysis approach],
then: prove that it has potential
 - Less exciting: go through the end
[from conception → proof of principle → final result]



- It can be tedious but we need the “end product” → public result

- ◆ But be aware:

In which detail you need to study things: precision vs. effort/time

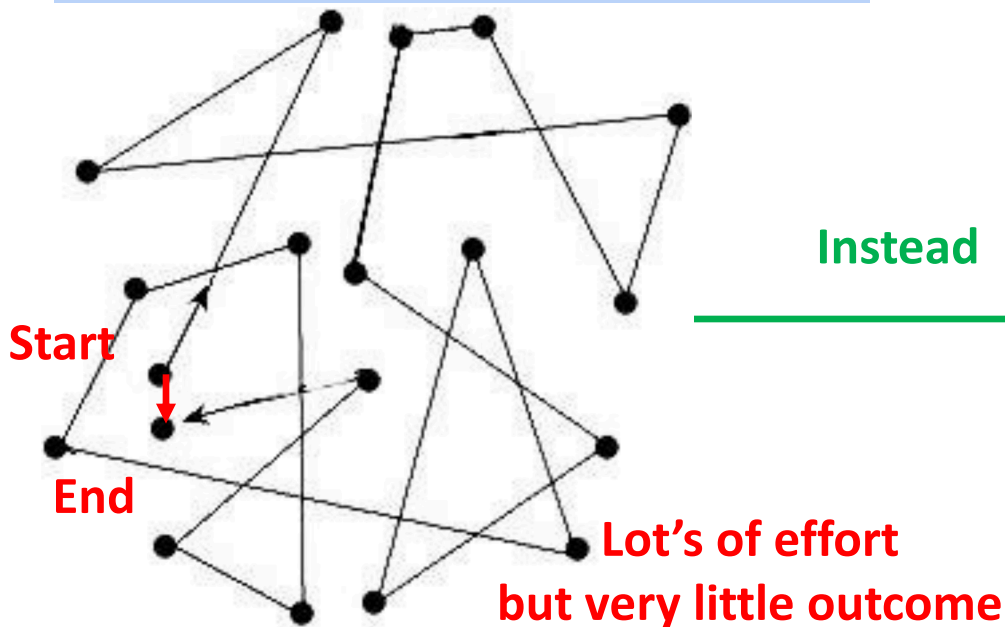
- eg., Search for SUSY in the tails of ME_T ; few BKG events → $O(100\%)$ stat uncertainty
 - Does it make sense to develop a BKG estimation strategy with $O(\%)$ precision?

Few more tips/Lessons learned (II)

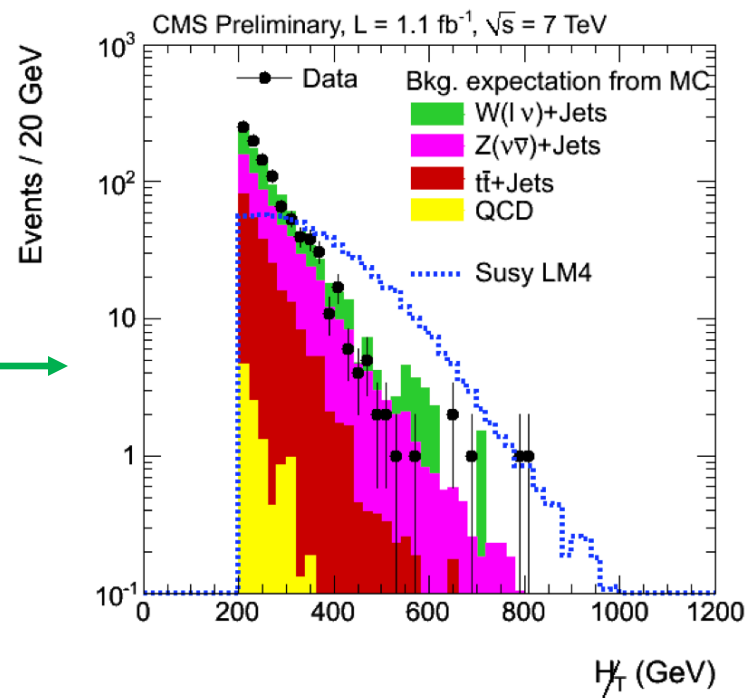
- Plan and think strategically
 - More difficult at the beginning [BSc/MSc/PhD] gets easier with experience
 - Instead of bouncing around several projects [Brownian motion]
 - Identify [a few] topics w/ high physics impact & get stock of your achievements

Brownian motion

[Large H_T but very little MH_T] ☹️



Large H_T and MH_T 😊



- Recruiters know you can execute things [MSc, PhD], what will make you stand out from the other applicants is **vision/expand the scope of the group**

Few more tips/Lessons learned (III)

- Aim for constant progress vs. time in HEP:

“slope matters”

- ◆ It’s important to show consistency

- clearly not easy: our field is very demanding, challenging and competitive

- ◆ What helped me keep focus?

[most of the time...]

- Not forget the reasons I entered the field
- Also: the skill-set we are developing
 - a very versatile set of skills for both academia and private sector
 - we are on top of the developments in multiple fronts [beyond pure physics..]

- NB: Work-life balance is important

- ◆ There will be long periods of flat-out work

- the other periods: keep a normal pass, try to clear your mind, have a hobby
 - a tired mind makes mistakes 😊



Few more tips/Lessons learned (IV)

- Giving talks:
 - ◆ Consider every talk you give as a “job interview”
 - ◆ **Rule 0a:** Practice, practice, and.. practice
 - tedious, time-consuming, boring, but pays off! Just do it!
 - ◆ **Rule 0b:** Never-ever include a plot/equation/statement in your talk that you are not 100% sure what is showing
 - Be on top of things gives you confidence; and this is evident to the audience

- Following talks:
 - ◆ Ask questions, engage in the discussions
 - Advantages [beyond the obvious ones]: get people to know you, potential to join forces with other colleagues on a exciting new project, build connections

- Teaching [easier when a PostDoc at a University than in a Lab]:
 - ◆ Science moves forward by transferring knowledge
 - Try not miss opportunities to share your knowledge
 - ◆ It's essential for your full development as a scientist

Next stage in your career: Job applications

- Stay in academia vs. moving to industry/private sector
 - ◆ There is no “good” or “bad” choice, rather what suits you best and makes you happier

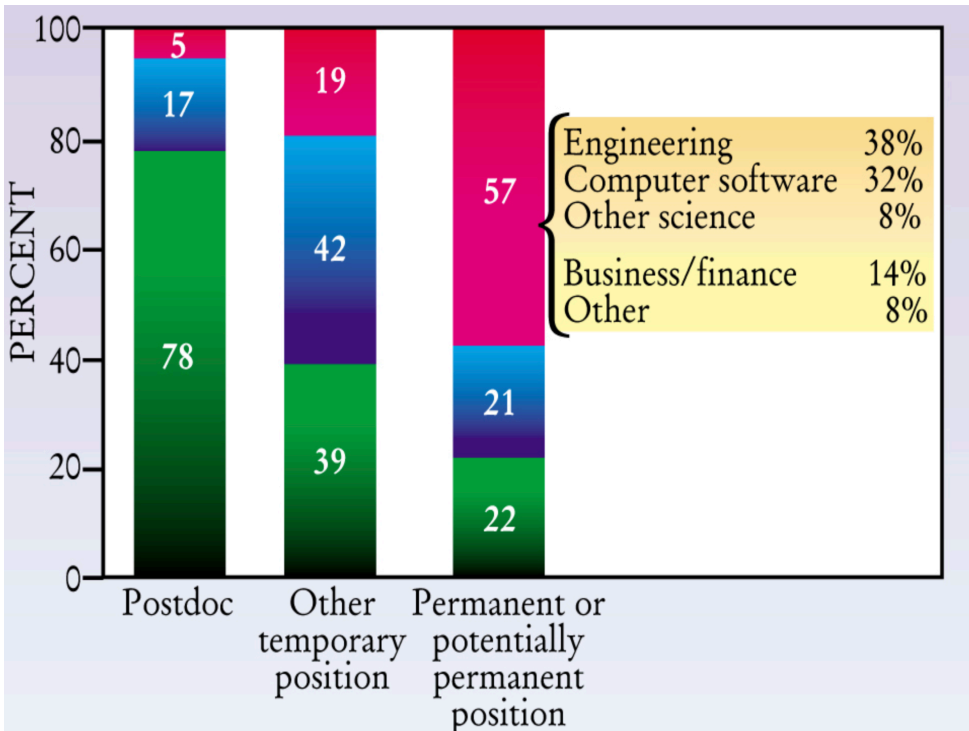
- Academia: Lab vs. University
 - ◆ Tenure := security
 - Lab: must align with priorities of the Lab; much more freedom at a University
 - ◆ University: Teaching and writing of grant proposals
 - less time for “hands-on” work on research
 - ◆ Lab: More engaged with the developments
 - Little to no teaching duties, writing of proposals, etc..
 - Some times harder to recruit students and postdocs

- Industry/private sector:
 - ◆ tenure: much less secured
 - ◆ normal working hours
 - ◆ Different topics of focus [eg, self-driving cars; then: improved medicine, ...]
 - ◆ [Significantly] higher salary than the majority of the jobs in academia

Next stage in your career: Job applications (II)

- However: positions in academia are getting fewer than in the past
 - ◆ Many colleagues transitioned to industry

PhD obtained in 1998

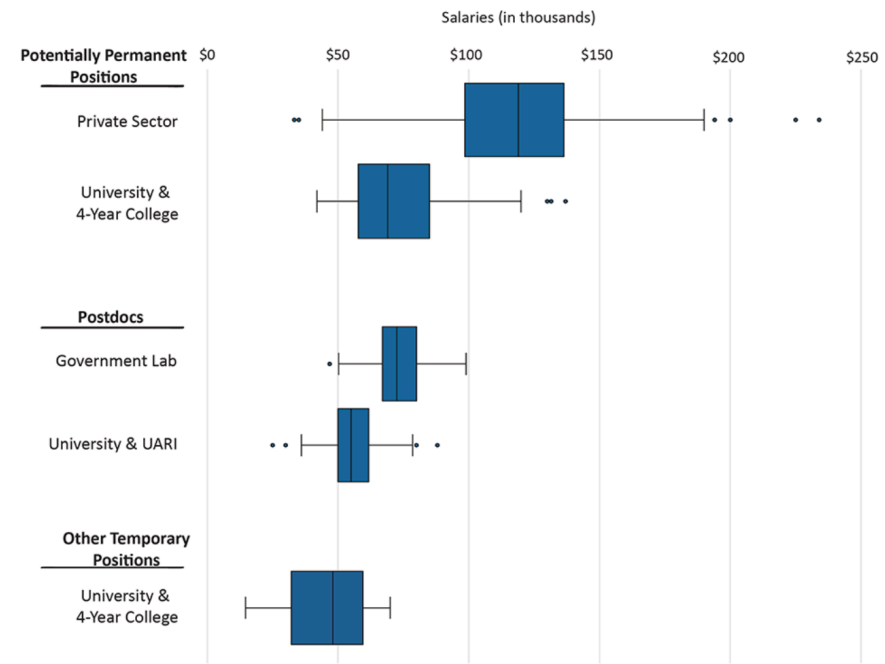


Engineering	38%
Computer software	32%
Other science	8%
Business/finance	14%
Other	8%

■ Employment primarily in physics—same subfield as dissertation
■ Employment primarily in physics—different subfield from dissertation
■ Employment primarily in other fields

Salaries

Starting Salaries for New Physics PhDs, Classes of 2019 & 2020 Combined

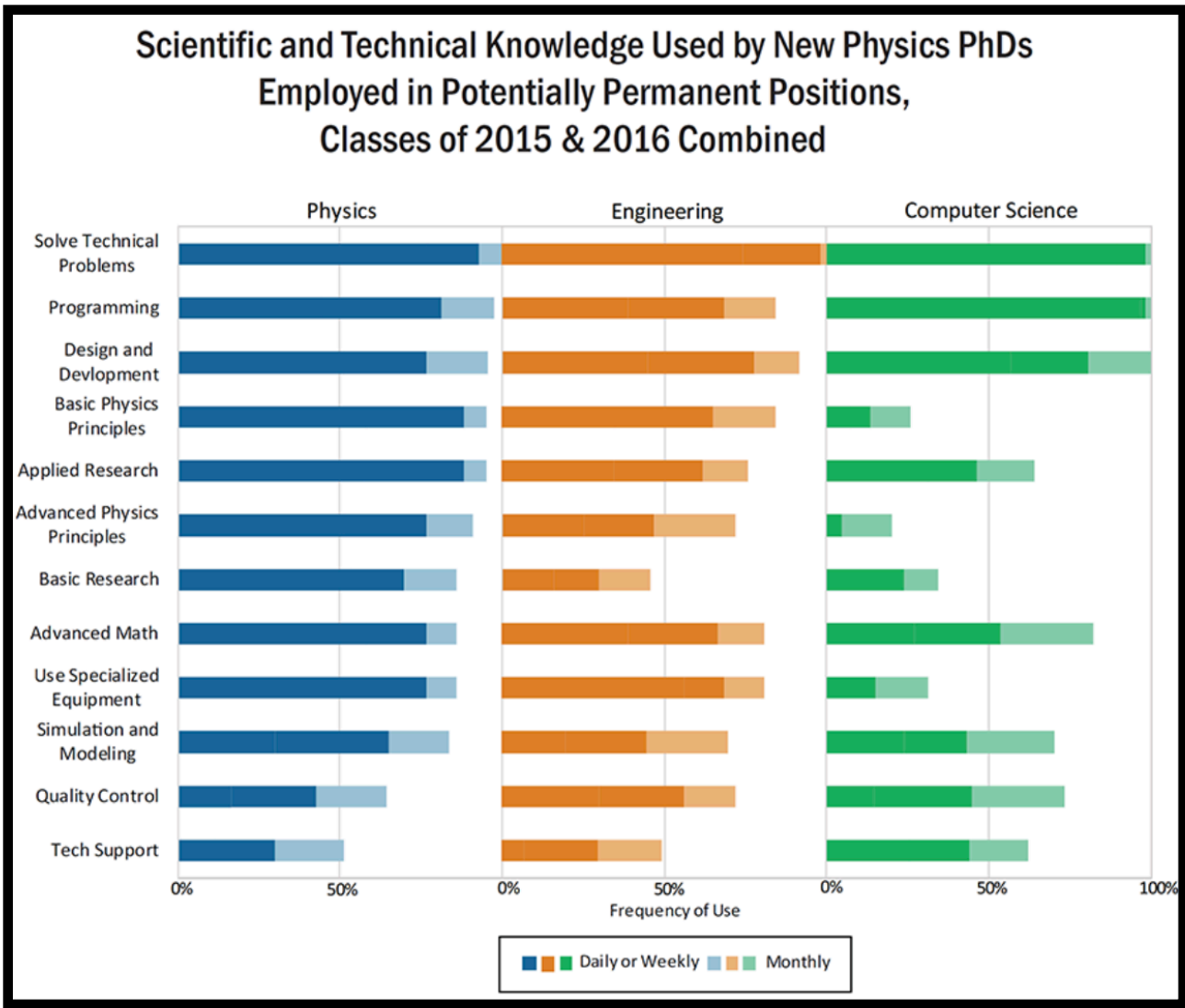


Data represents only US-educated PhDs who remained in the US after earning their degrees. The full starting salary range, excluding outliers, is represented by the lines extending to each side of the box. The box represents the middle 50% (25th to 75th percentile) of the salaries. The vertical line within the box represents the median starting salary for the sector. The dots outside of the bars are statistical outliers. Government Lab includes federally funded research and development centers, e.g., Los Alamos National Laboratory. UARI is university affiliated research institute. The data for PhDs holding potentially permanent positions in academia include salaries based on 9-10 and 11-12 month commitments and have not been adjusted. Data are based on respondents holding potentially permanent positions in the private sector (192) and in universities and 4-year colleges (37), postdocs in government labs (101) and universities and UARIs (277), and "other temporary positions" in universities and 4-year colleges (17).

- I have not heard a single person regretting/missing academia

Next stage in your career: Job applications(III)

- And we have the skills to be successful in different fields



Job applications: last word

- Independently if you are applying for a job in academia or industry
 - ◆ **Tailor** the application material to each job
 - ◆ **Contact** directly the recruiter
 - Learn more about the job, what are they looking for
 - ◆ **Prepare extremely well the interview**
 - First of all: Congratulations!
 - reaching this stage is a success
 - Then: Prepare an exciting story to tell, highlight the challenges and how you managed to solve them, it's your opportunity to showcase your skills
 - Demonstrate your innovative thinking
 - remember: they want to hire people that are independent, think out-of-the-box and are able to expand the program of the university, lab, company
 - ◆ **Ask questions! You should also see yourself fit in the group and have aligned interests**

- Remember: getting a job is a process
 - ◆ It may require a few turns; It's normal and do not get disappointed 😊



Discussion...

- I am more than happy to chat with you further
Feel free to contact me: Loukas.Gouskos@cern.ch