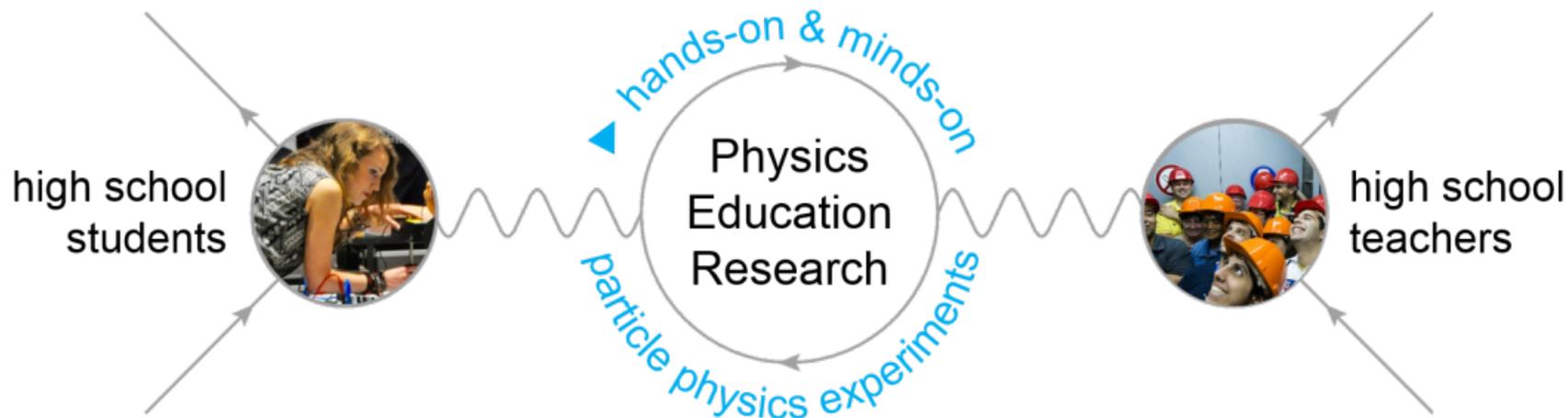


The Big Picture

Salvador Carrillo & Fabiola Vázquez
Universidad Iberoamericana, Mexico city

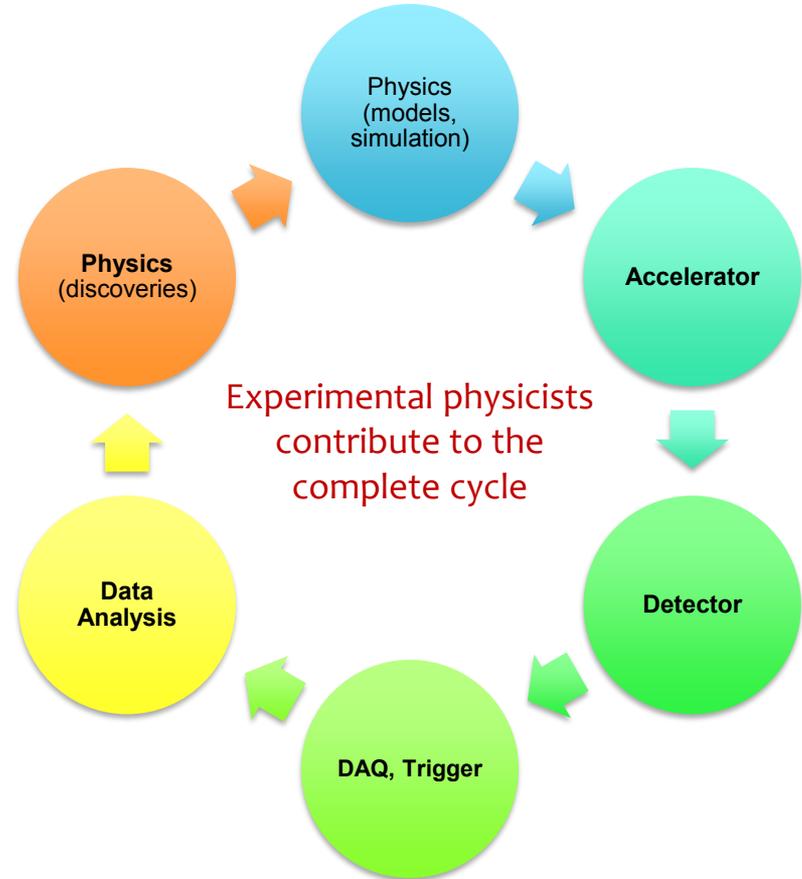
S'Cool LAB Summer CAMP



Why are we learning all these things?

- ✧ You have been learning a lot of what CERN is all about, and about CERN future: The Science behind
- ✧ How can we use this information?
- ✓ This morning activity is designed to put together many of what you have learned up to now and work as a Particle Physics analysing real data and getting some answers and many more questions ...
- The most important point is that we will work as a collaborative group

Today's activity is meant for ...



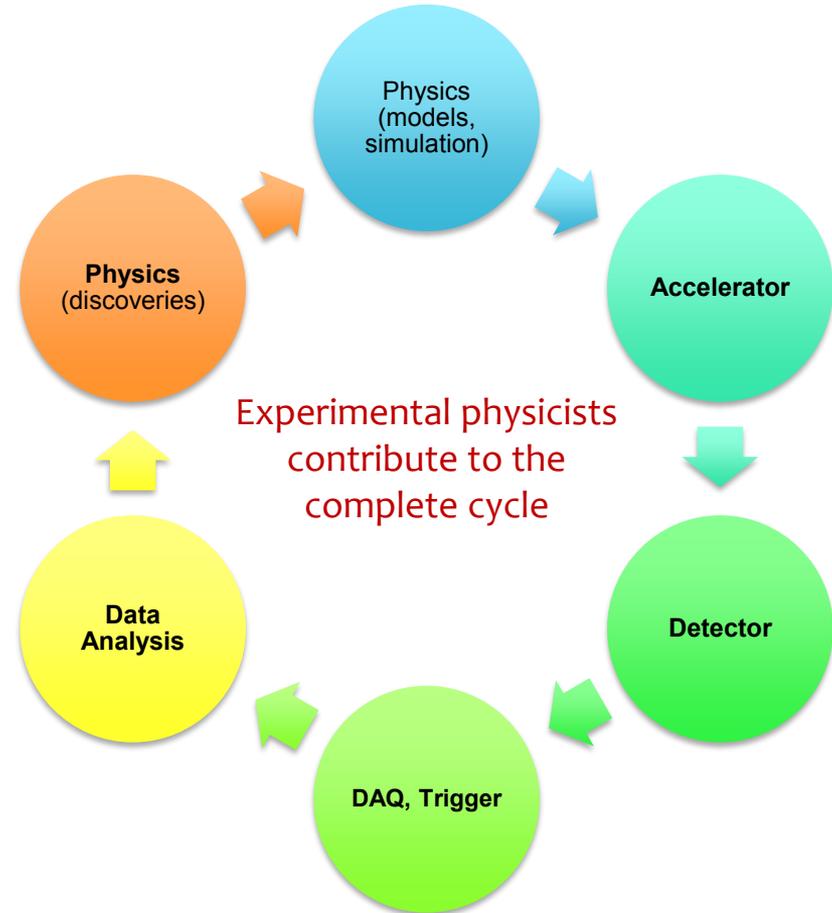
Today's activity is meant for ...

Experimental testing is the key to discover and advance knowledge.

New directions in science are launched by new improved tools much more often than by new concepts.

There is a very close relationship between physics discoveries and developments in instrumentation: Accelerators, Detectors, Electronics and Computing

Development of integrated designs is carried out in close collaboration with physicists, microelectronics experts, mechanical/thermal engineers, material/micro/nano technology scientists...



Today's activity is meant for ...

- CERN Masterclasses are designed to give you a brief passage through what analyzing data is all about:
 - ❑ At the beginning there will be many, many questions and doubts (So you will need some help) Please feel free to make any question.
 - ❑ Later you will get more confident and you will get into the “feeling” of what we want you to be measure.
 - ❑ Later you will be able to analyze data very fast ... but here is where you can stop, and get some time to think about the whole process: “The Big Picture”. This is the very good time to start to think: why am I doing all this measurements? What is this all about?

Today's activity is meant for ...

Now we are going to work as hadrons:

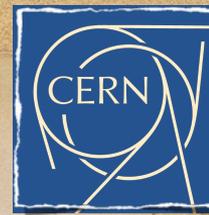
- ✓ Since we will work in pairs we need to choose a “meson” team named by:

quark-antiquark pair

Any combination !
You can repeat

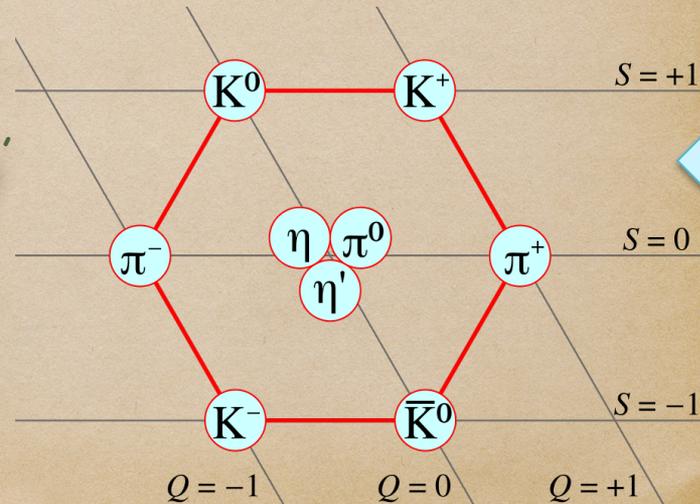


Mesons



- The simplest spin 0 mesons can be organised in a **nonet**, originally called "The eightfold way" as well (because η' wasn't found yet)

- Strangeness +1: **K**
Strangeness 0: **π , η , η'**
Strangeness -1: **K**



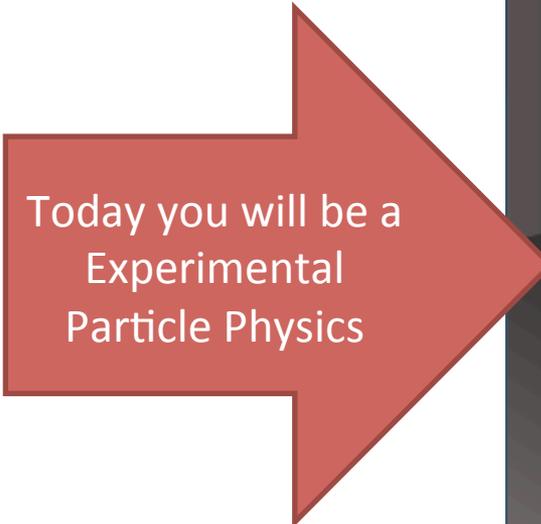
Remember that the Mesons are organised in nonet

Elementary Particles

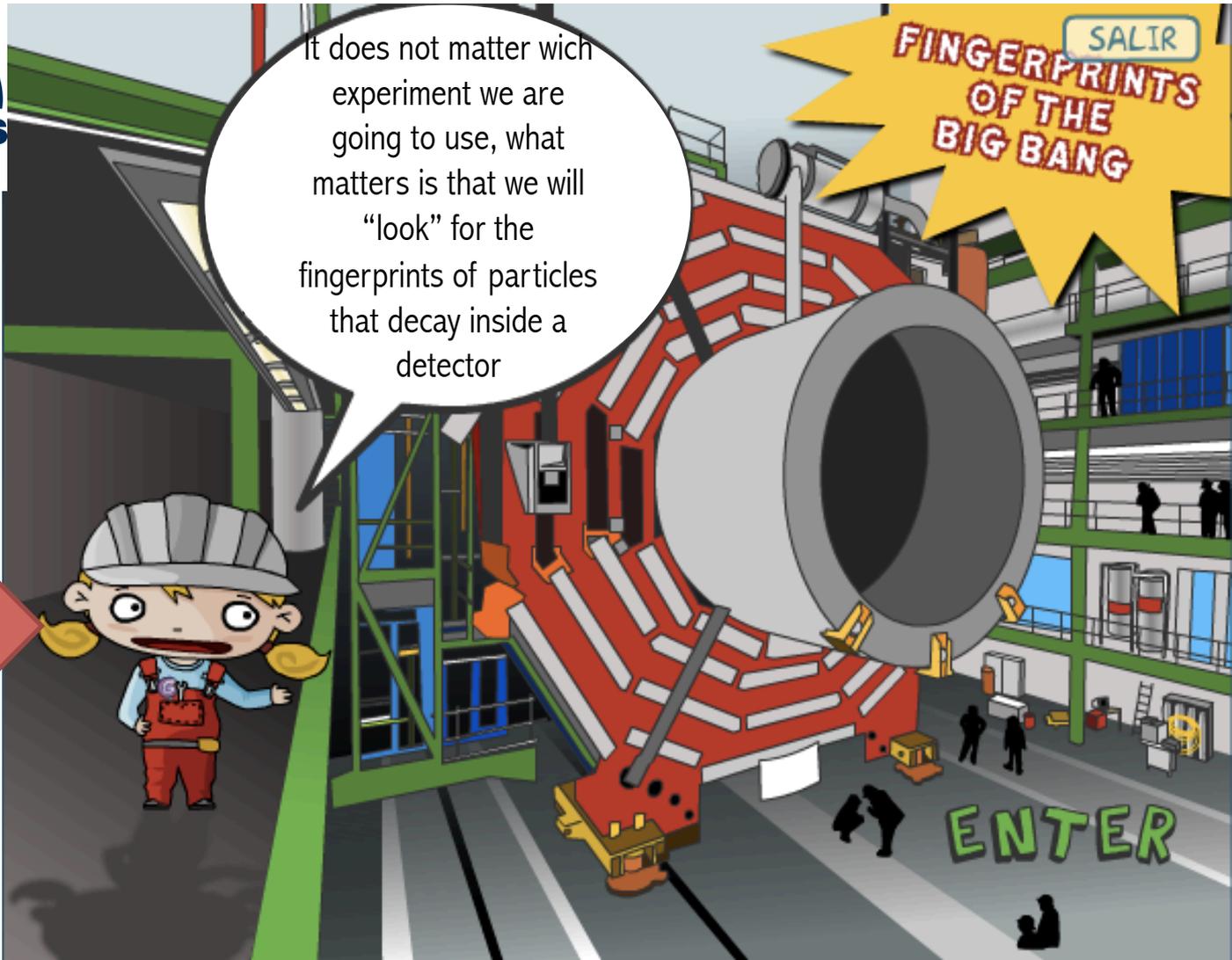
- Two types of matter particles:
 - **Leptons:** electrons, muons, taus, and neutrinos
 - **Quarks:** don't exist alone, but combine to form hadrons (composite particles)

- Four fundamental forces:
 - **Electromagnetic:** exchanged by photon
 - **Weak:** exchanged by W^+ , W^- , Z^0
 - **Strong:** exchanged by gluons
 - **Gravity:** exchanged by graviton

We are going to concentrate our work on:



Today you will be a
Experimental
Particle Physics



It does not matter which experiment we are going to use, what matters is that we will “look” for the fingerprints of particles that decay inside a detector

SALIR
FINGERPRINTS
OF THE
BIG BANG

ENTER



Salvador Carrillo



Fabiola Vázquez





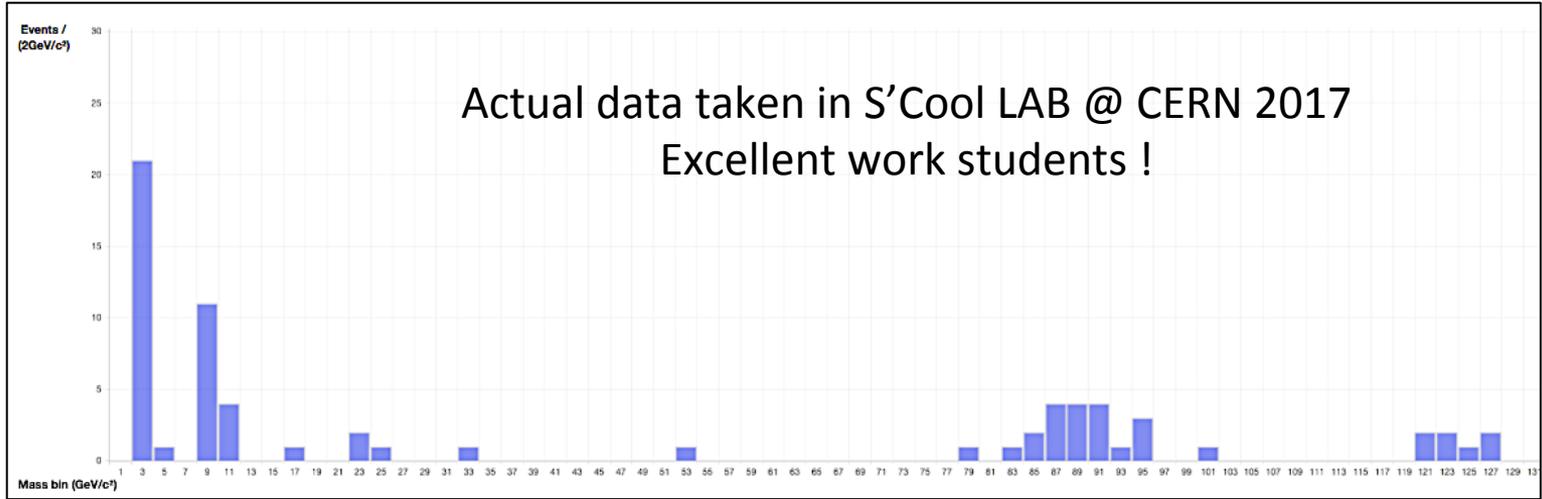
CIMA

CMS Instrument for Masterclass Analysis

Choose your Masterclass	Choose your location	Choose your group
Imn/k	SCoolLabSummerCamp2017	1
Ibero-17Mar2017		2
Zurich-24Mar2017		3
Providence-07Apr2017		4
Pisa-16May2017		5
Jyvaskyla-05May2017		6
SouthBend-24May2017		7
CERN-27Jun2017		8
CERN-07Jun2017		9
Santiago_de_Compostela-Jul2017		10
SaltLakeCity-30Jun2017		11
CERN-21Jun2017		12
Pocatello-14Jun2017		13
Westville-20Jun2017		14
Waubonsee-06Jul2017		15
AachenSchüleruni		16
Gainesville-30Jun2017		17
CERNSCoolLab-01Aug2017		18
CERN-MTP-01Aug2017		19
Nashville-28Jul2017		20
		21
		22

Logos: RWTH AACHEN UNIVERSITY, UNIVERSITY OF NOTRE DAME, CERN, QuarkNet, CMS, NETZWERK TEILCHENWELT, INTERNATIONAL MASTERCLASSES hands on particle physics, IPhG International Particle Physics Outreach Group





Invariant mass GeV/c^2

We do have “clean” events in CMS

- What are the excess seen in this mass histogram
- Can you find the J/Psi? Upsilon? Z^0 ?
 - Any other?
- What about the Higgs?



Total:

Muon	Electron	W	W-	W+	NP	Higgs	Zoo	Sum	e/mu	W+/W-
224	217	67	119	154	96	10	36	482	0.97	1.29

- Is there a preference Electrons vs Muons in Nature?
- How many Higgs candidates you found?
- What is the ratio of W+ vs W- and why?
- What can we do with the Zoo events?

Actual data taken in S'Cool LAB @ CERN 2017
Excellent work students !



BACKUP

