



# Particle Physics Quiz

EPPOG Hands on Particle  
Physics Masterclasses 2011

# Rules of the Game

- Work in groups of 2
- 10 multiple-choice questions + 2 master questions (+ 1 extra tiebreaker for final decision, if necessary)
- ~30 seconds per question
- Answer sheets
  - 2 sections
  - fill in both
  - hand bottom part to your instructor
- Winning teams in each institute will receive a prize from CERN
- But the main aim is to have fun!





# Question 1

Our detector shows a signal *only* in the hadronic calorimeter (no signal in the tracker, electromagnetic calorimeter or muon chambers). Therefore, this signal is most likely

- 1. pion**
- 2. electron**
- 3. neutron**
- 4. photon**

# Question 2

How much of our universe is made of matter or energy, which we do not know about?

- 1. 0.001 %**
- 2. 10 %**
- 3. 45 %**
- 4. 96 %**

# Question 3

How do we see  
“quarks” in a detector?

- 1. Not at all**
- 2. By their characteristic spiral trajectory**
- 3. Via “jets” of hadrons they generate**
- 4. As two individual straight tracks in opposite directions**

# Question 4

The particles carrying the strong force are the

- 1. photons**
- 2. gluons**
- 3. Z- or W-bosons**
- 4. none of the above**

# Question 5

Which was the first particle discovered which is still today believed to be elementary, i.e. not made up of further constituents?

- 1. electron**
- 2. gluon**
- 3. proton**
- 4. photon**

# Question 6

Approximately how many times do the protons in the LHC fly around the accelerator ring in 1 second?

1. 1
2. 100
3. 10 000
4. 1 000 000



# Question 7

Superconducting magnets bend the protons around the LHC ring. What do you think is the temperature of these magnets?

1. Room temperature, 300K
2. Colder than outer space, 1.9K
3. Temperature of outer space, 2.7K
4. 163.2K

# Question 8

Which of the following complements makes a wrong statement?

“The Higgs-mechanism ...

1. ... explains the production of antimatter”
2. ... explains the masses of particles”
3. ... was invented by the British physicist Peter Higgs”
4. ... applies everywhere in the universe”

# Question 9

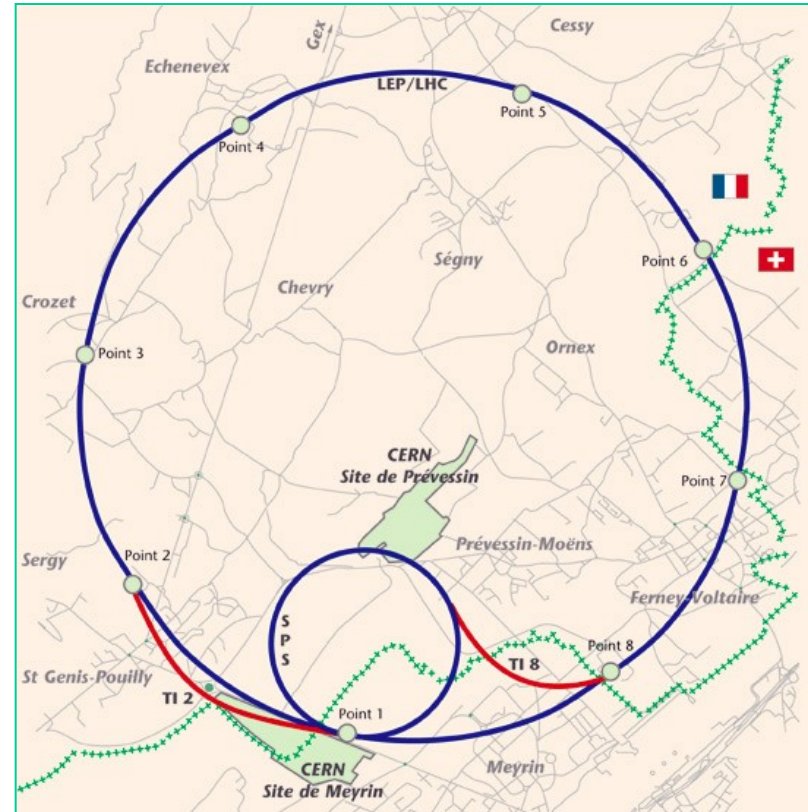
Which of the following technological innovations was invented at CERN (only one)?

1. **mobile phone**
2. **teleporter**
3. **mp3 format**
4. **World Wide Web**

# Question 10

How many kilometers of the LHC are situated in Switzerland (approximately) ?

1. 3 km
2. 7 km
3. 14 km
4. 27 km



# Master Question 1

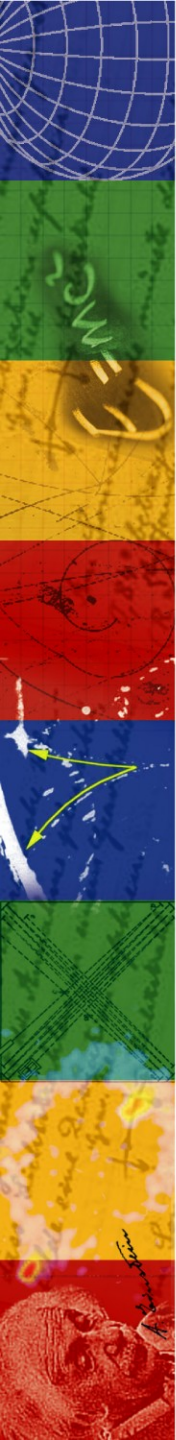
ATLAS and CMS will together produce 400MB of data every second. If written to CD (700 MB, thickness approx. 1 mm) how high a stack would this be in one year?

1. **Stratosphere, 20 000 m**
2. **Mt. Everest, 8 850 m**
3. **Sears Tower, 527 m**
4. **Eiffel Tower, 276 m**

# Master Question 2

Why do tau and mu leptons decay?

1. **Because your physics instructor says so**
2. **Because there are lighter particles they can decay to**
3. **Because they interact with the magnetic field of the experiment**
4. **Because there is so much energy produced in e.g. LEP collisions that they break apart**

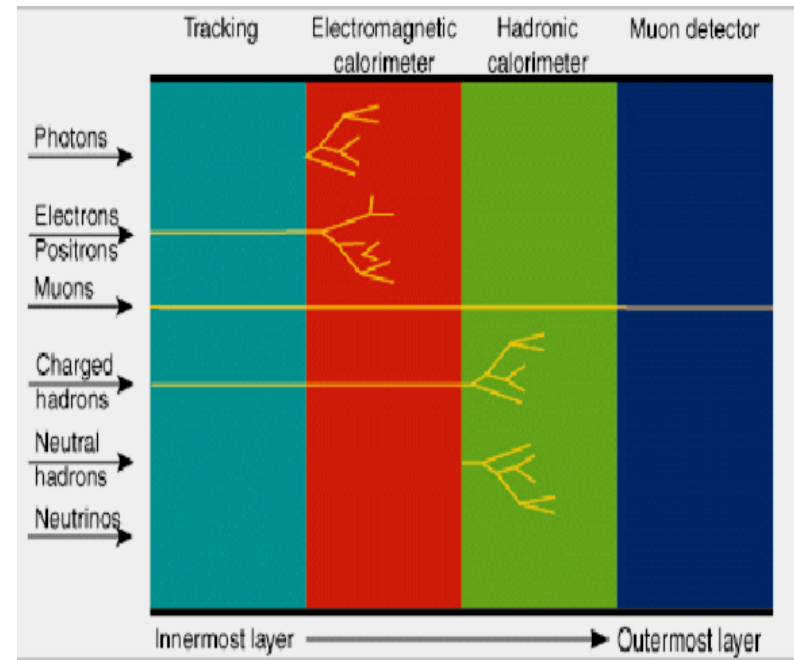


# Quiz Answers

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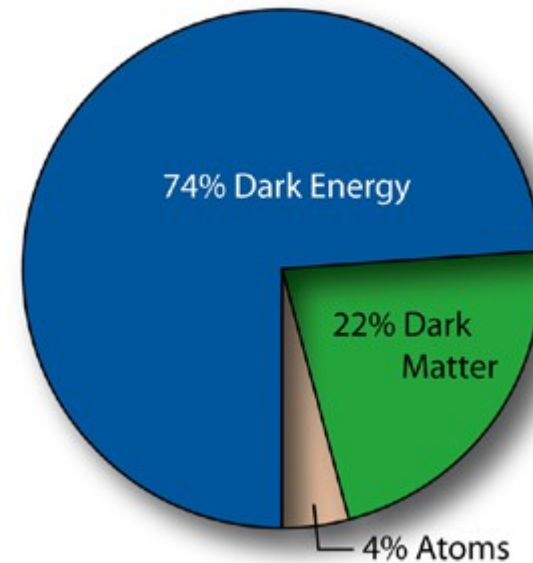




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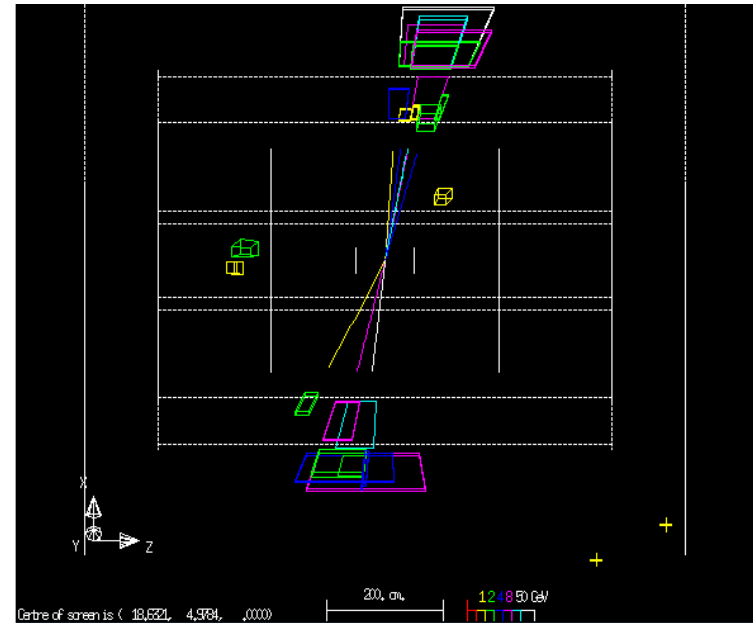
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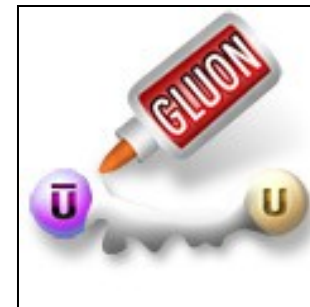
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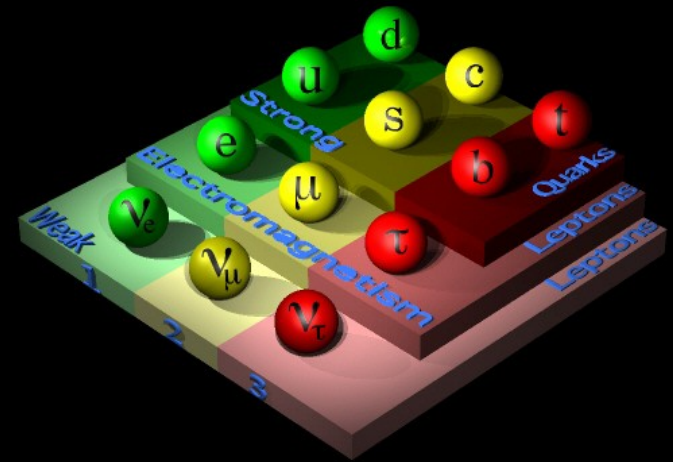
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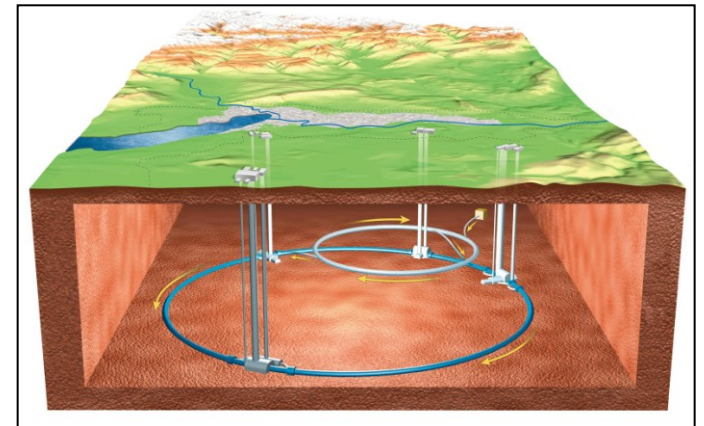
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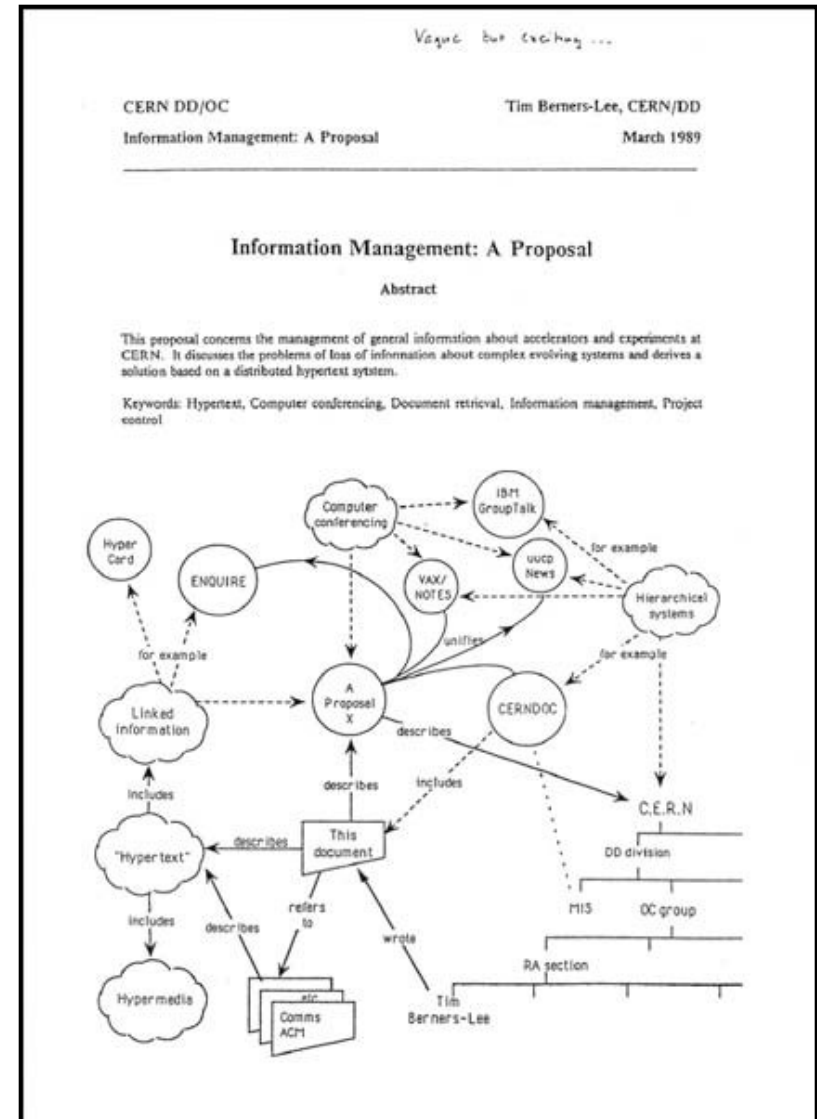
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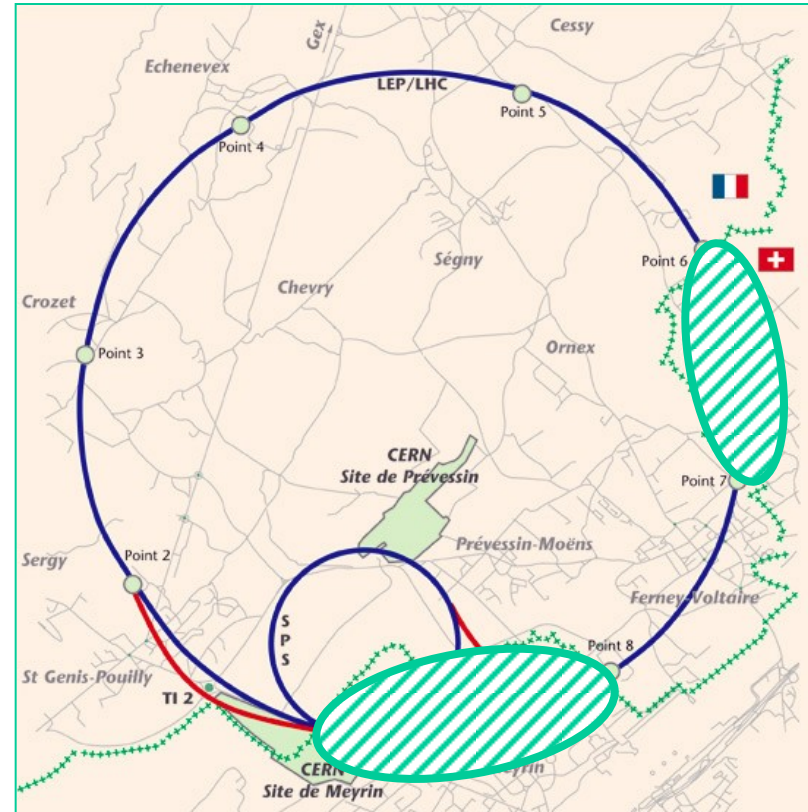




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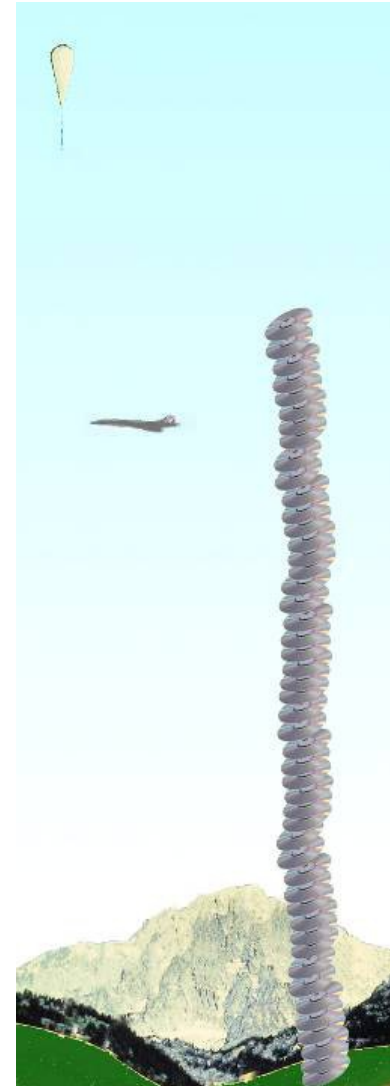
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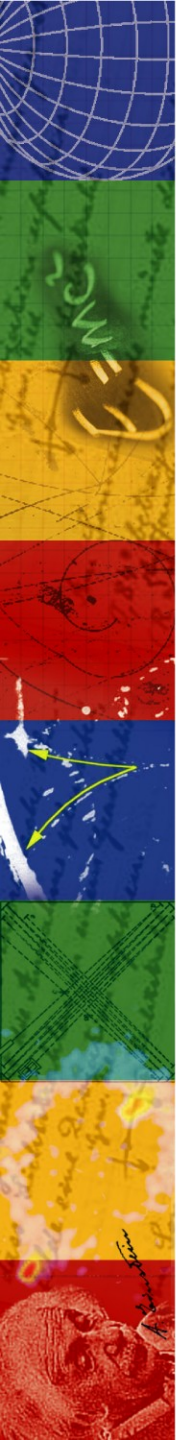
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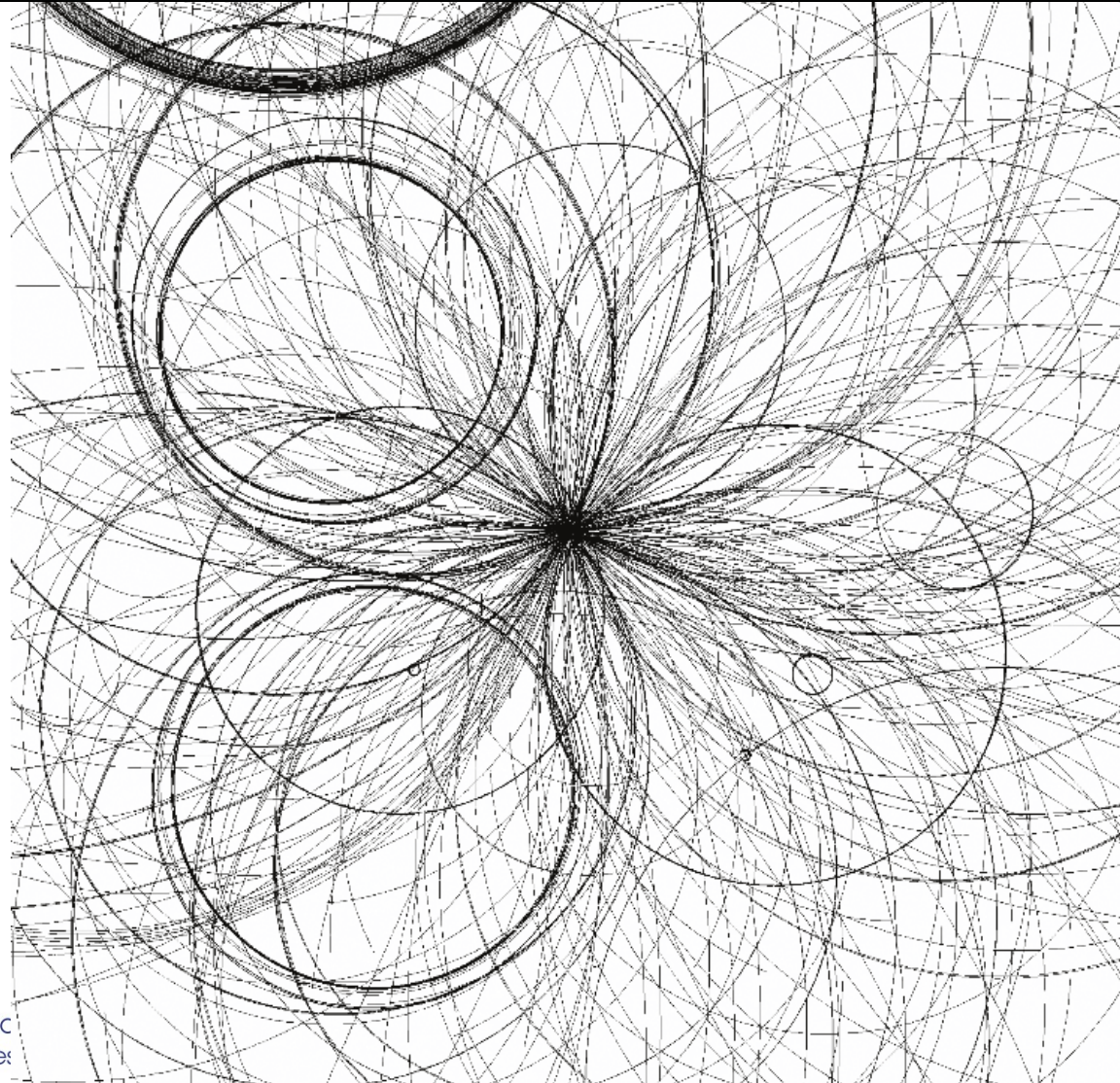
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# Final Tiebreaker

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Identify the 4 tracks coming from a heavy Higgs Boson in the following event. 1 point for every right track!



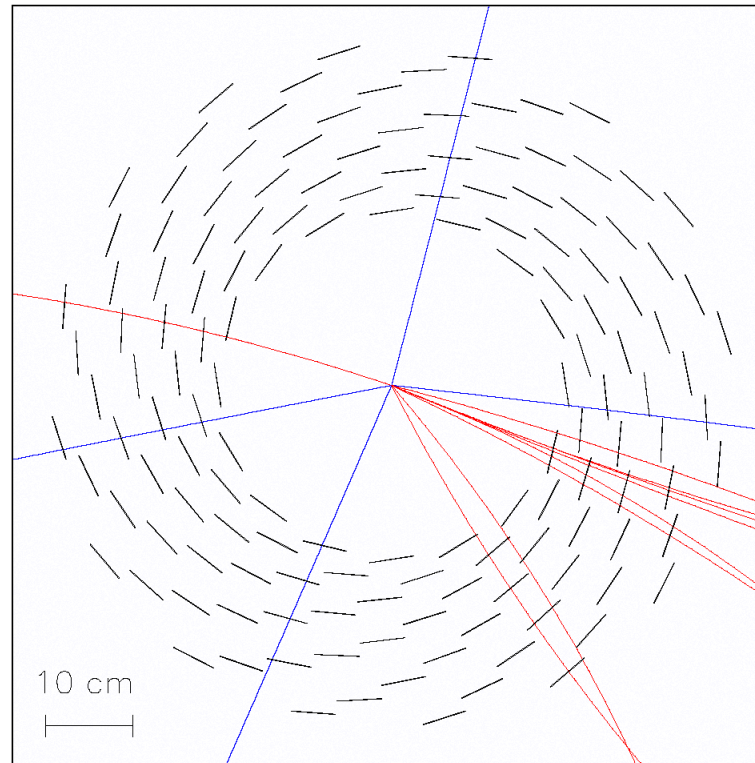
# Final Tiebreaker Answer

Identify the 4 tracks coming from a heavy Higgs Boson in the following event. 1 point for every right track!

## *Solution*

Reconstructed tracks of  $p_t > 2 \text{ GeV}$ .

Among them well visible 4 muons from the higgs decay.



The solution is possible if detector occupancy  $\sim 1\%$

→ microstrip area  $\sim 1 \text{ mm}^2$

→  $> 10^7$  readout channels