

CMS: INVESTIGATING THE DEEPEST QUESTIONS IN THE UNIVERSE

1 AT THE BORDER BETWEEN FRANCE AND SWITZERLAND, THE EUROPEAN CENTER FOR NUCLEAR RESEARCH: CERN.



2 100M UNDERGROUND VAST CATHEDRAL-SIZED CAVERNS HOUSE FOUR GIGANTIC PARTICLE DETECTORS FOR THE WORLD'S BIGGEST SCIENTIFIC TOOL: A MASSIVE PARTICLE ACCELERATOR, 27 KM AROUND, THE LHC: LARGE HADRON COLLIDER.

3 THE PROTONS IN THE LHC ARE ACCELERATED TO 99.9998% OF THE SPEED OF LIGHT IN TWO BEAM LINES, MOVING IN OPPOSITE DIRECTIONS.

THESE ANCESTRAL PARTICLES SURVIVE FOR ONLY THE TINIEST FRACTION OF A SECOND BEFORE THEY DISINTEGRATE INTO CASCADES OF MORE FAMILIAR PARTICLES. SCIENTISTS NEED ULTRAFAST, ULTRAPRECISE DETECTORS, AND STATE-OF-THE-ART CUSTOM MADE ELECTRONICS TO SEE THE CASCADE...THEY NEED CMS: THE COMPACT MUON SOLENOID.

4 THOUSANDS OF POWERFUL SUPERCONDUCTING MAGNETS STEER THE PROTON BEAMS AROUND THE HUGE RING AND THEN FOCUS THEM TO LESS THAN THE WIDTH OF A HUMAN HAIR... READY TO CRASH AGAINST EACH OTHER. THESE SUPERCONDUCTING MAGNETS RUN AT -271°C : EVEN COLDER THAN OUTER SPACE. THE LHC IS THE BIGGEST CRYOGENIC SYSTEM EVER MADE.

5 THE COLLISION GENERATES SO MUCH ENERGY THAT PARTICLES EXIST SINCE THE BIG BANG (14 BILLION YEARS AGO), LIKE THE HIGGS PARTICLE, REAPPEAR BRIEFLY.

9 CMS HAS BEEN ASSEMBLED IN LAYERS FROM MILLIONS OF PARTS WITH WATCH-MAKING PRECISION. EACH LAYER OF DETECTORS HAS A SPECIAL JOB TO DO: TO IDENTIFY AND MEASURE AS MANY PARTICLES AS POSSIBLE.

10 A TOTAL OF 1 TERABYTE OF DATA IS GENERATED IN CMS EVERY SECOND, EQUIVALENT IN VOLUME TO STORING THE NAMES AND ADDRESSES OF EVERY LIVING HUMAN BEING.

11 TO CRUNCH AND SWALLOW ALL THIS INFORMATION IS JUST NOT POSSIBLE. POWERFUL ELECTRONICS FILTERS THE DATA SIGNALS SO THAT, EVERY SECOND, ONLY THE RESULTS FROM THE 100 MOST INTERESTING COLLISIONS ARE STORED.

7 CMS IS LIKE A 12,500 TONNE DIGITAL CAMERA WITH 100 MILLION PIXELS THAT TAKES A 3D PICTURE OF THE LHC COLLISIONS 40 MILLION TIMES PER SECOND!

8 LOOKING AT A SLICE THROUGH THE DETECTOR.

12 A HUGE COMPUTING NETWORK, THE GRID, SENDS THE CMS DATA OUT ALL OVER THE WORLD...

13 A PHYSICS STUDENT SAT AT THEIR PC ANYWHERE IN THE WORLD CAN HARNESS THE POWER OF THOUSANDS OF PCs OVER THE GRID...

14 TO SEARCH FOR RARE COLLISIONS AND NEW PHYSICS...

