

Why are we here?

Origin of Universe and Ourselves

Katsushi Arisaka

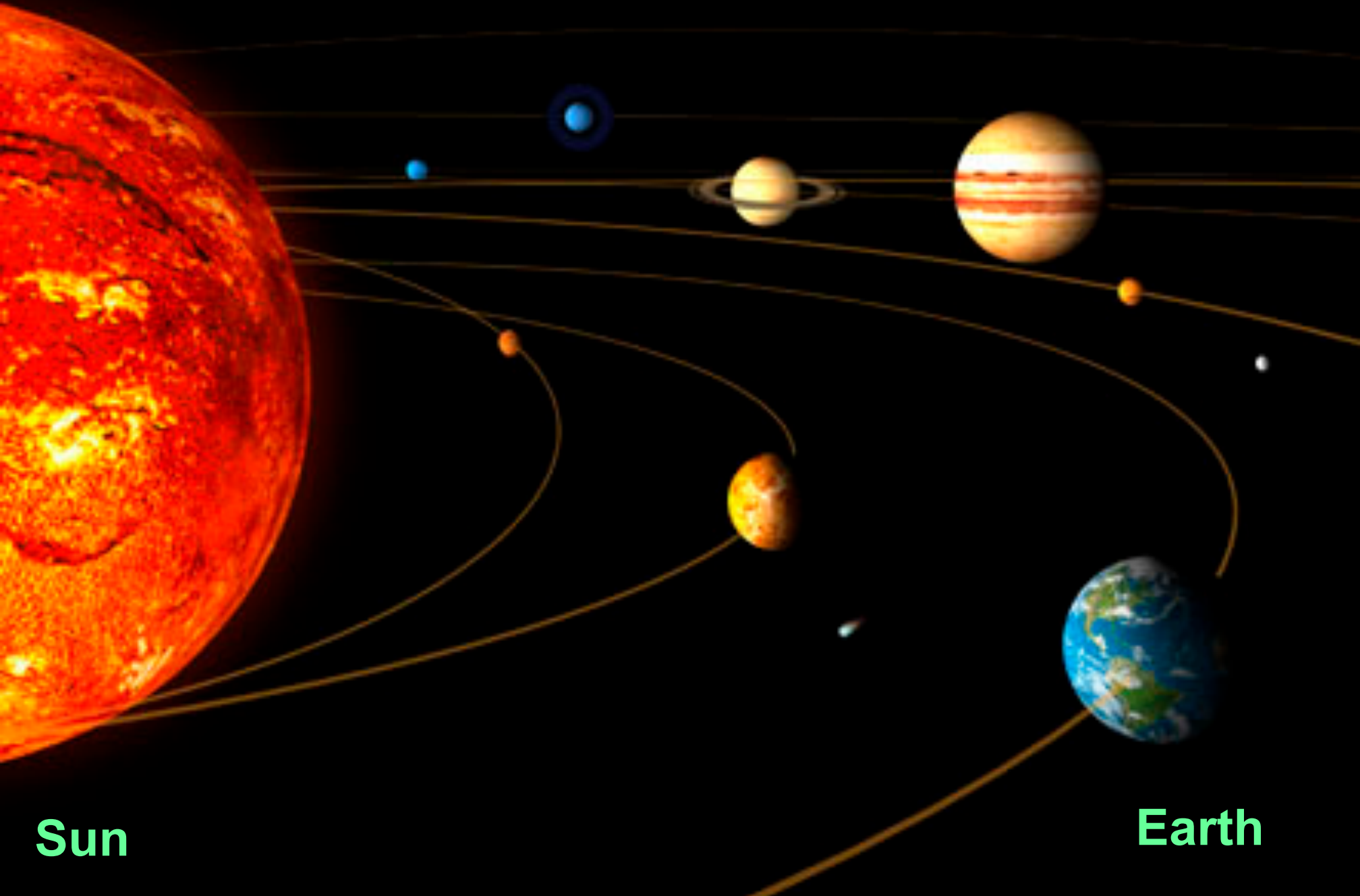
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Department of Physics and Astronomy***

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Why are we here?

Solar System



Sun

Earth

Andromeda

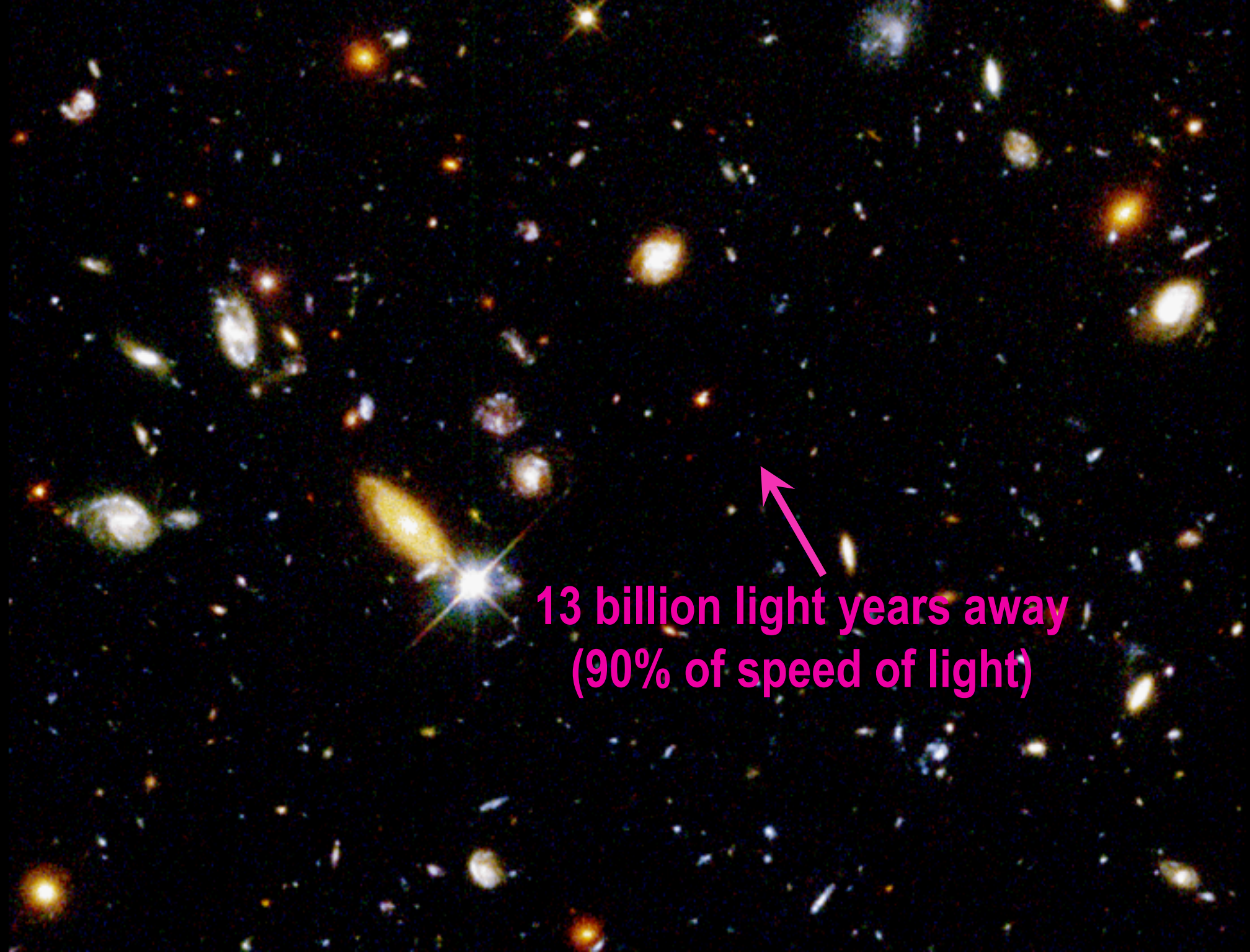


~100 Billions Stars in a Galaxy

Hubble Deep Field

The image displays a dense field of galaxies, including various types such as spirals, ellipticals, and irregular shapes, scattered across a dark background. The galaxies are concentrated in the central and lower-left regions, with some appearing as bright, distinct points of light and others as more diffuse, extended structures. The overall appearance is that of a rich, multi-colored stellar population.

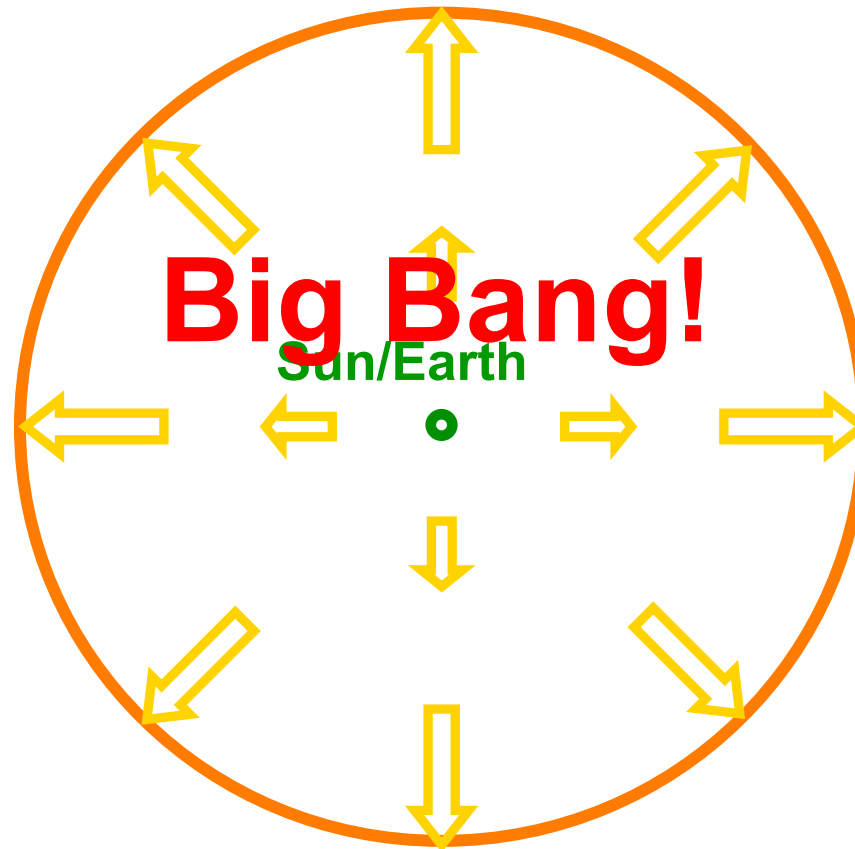
~100 Billion Galaxies



**13 billion light years away
(90% of speed of light)**

Hubble's Law: Expansion of the Universe

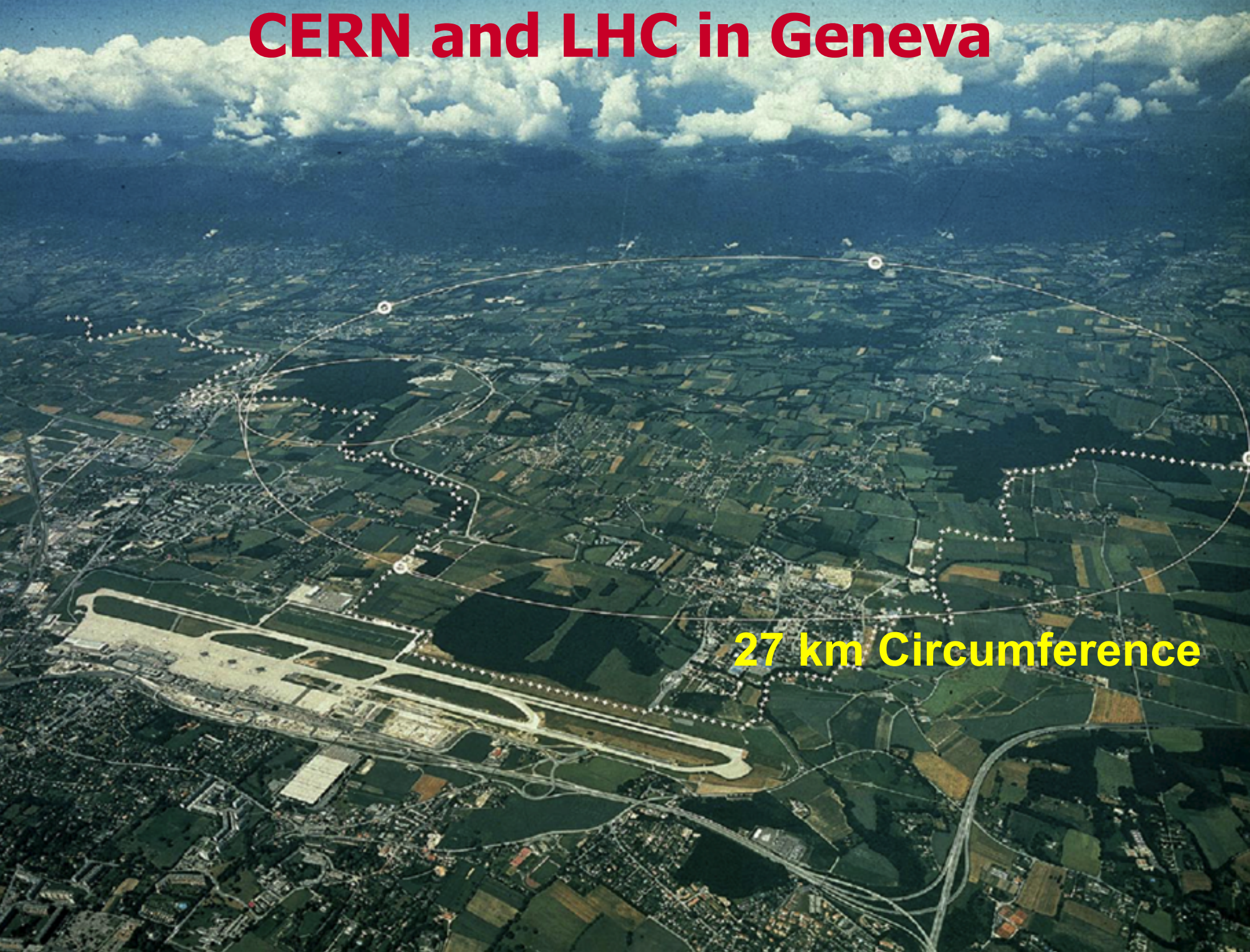
Horizon
of Universe



14 Billion
Light Years

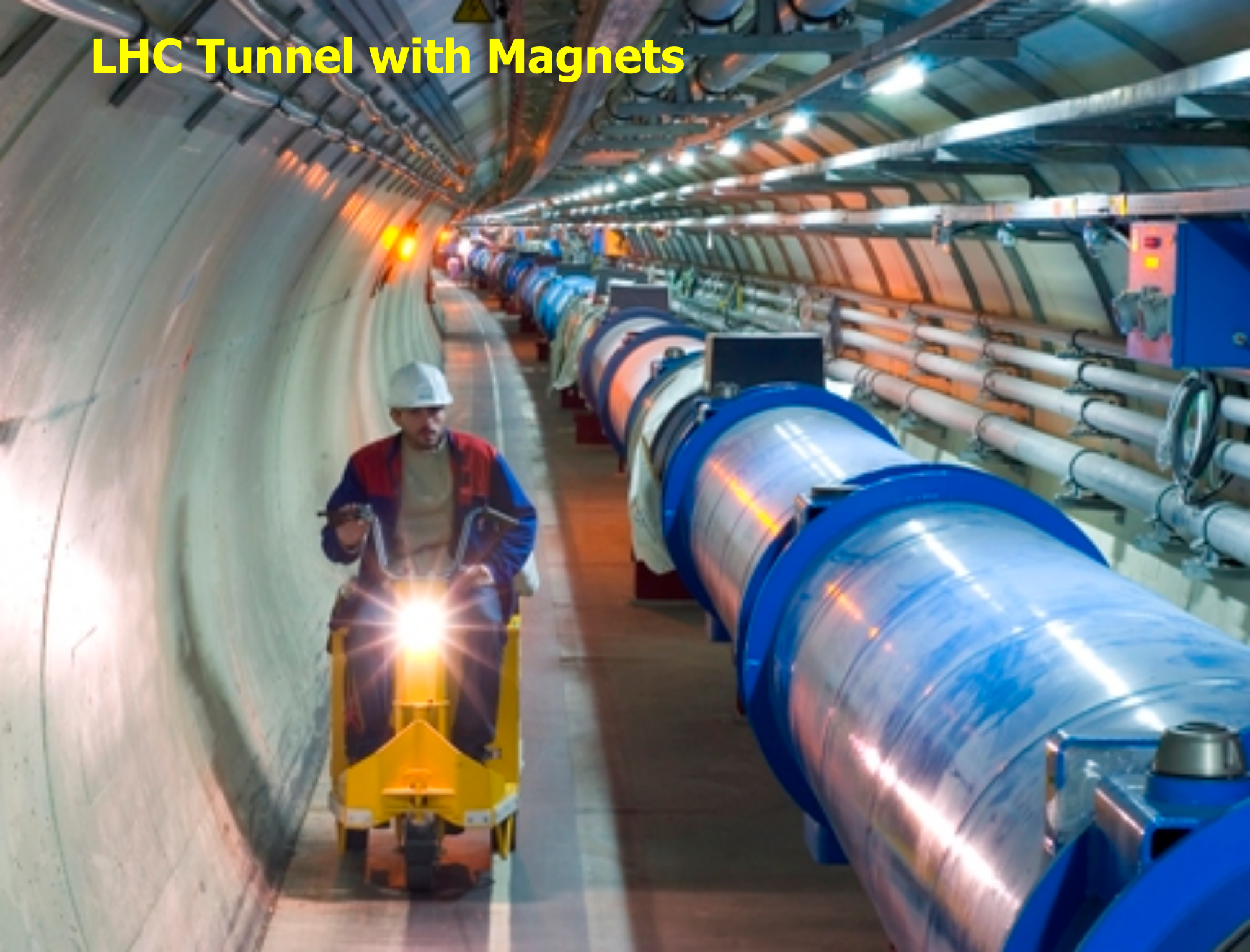
Moving Away
at Speed of Light

CERN and LHC in Geneva



27 km Circumference

LHC Tunnel with Magnets



CMS Collaboration (1993 ~)

(144 Institutions with about 1700 scientists)



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- DSM/DAPNIA, CEA/Saclay, Gif-sur-Yvette
- IRES, IN2P3-CNRS - ULP, UHA, LEPSI, Strasbourg



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- TIFR - HECR, Mumbai



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- Inst. für Teilchenphysik, ETH, Zürich
- Univ. Zürich, Zürich



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- Florida State Univ. - HEPG, Tallahassee
- Florida State Univ. - SCRI, Tallahassee
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- The Univ. of Iowa, Iowa City
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- Univ. of California, Riverside
- Univ. of Rochester, Rochester
- Rutgers, the State Univ. of New Jersey, Piscataway
- Texas Tech Univ., Lubbock
- Univ. of Texas at Dallas, Richardson
- Univ. of California at Davis, Davis
- UCLA, Los Angeles
- Univ. of California San Diego, La Jolla
- Virginia Polytech. Inst. and State Univ., Blacksburg
- Univ. of Wisconsin, Madison



UZBEKISTAN

- Inst. of Nucl. Phys. of the Uzbekistan Acad. of Sciences, Tashkent

electromagnetic calorimeter

solenoid

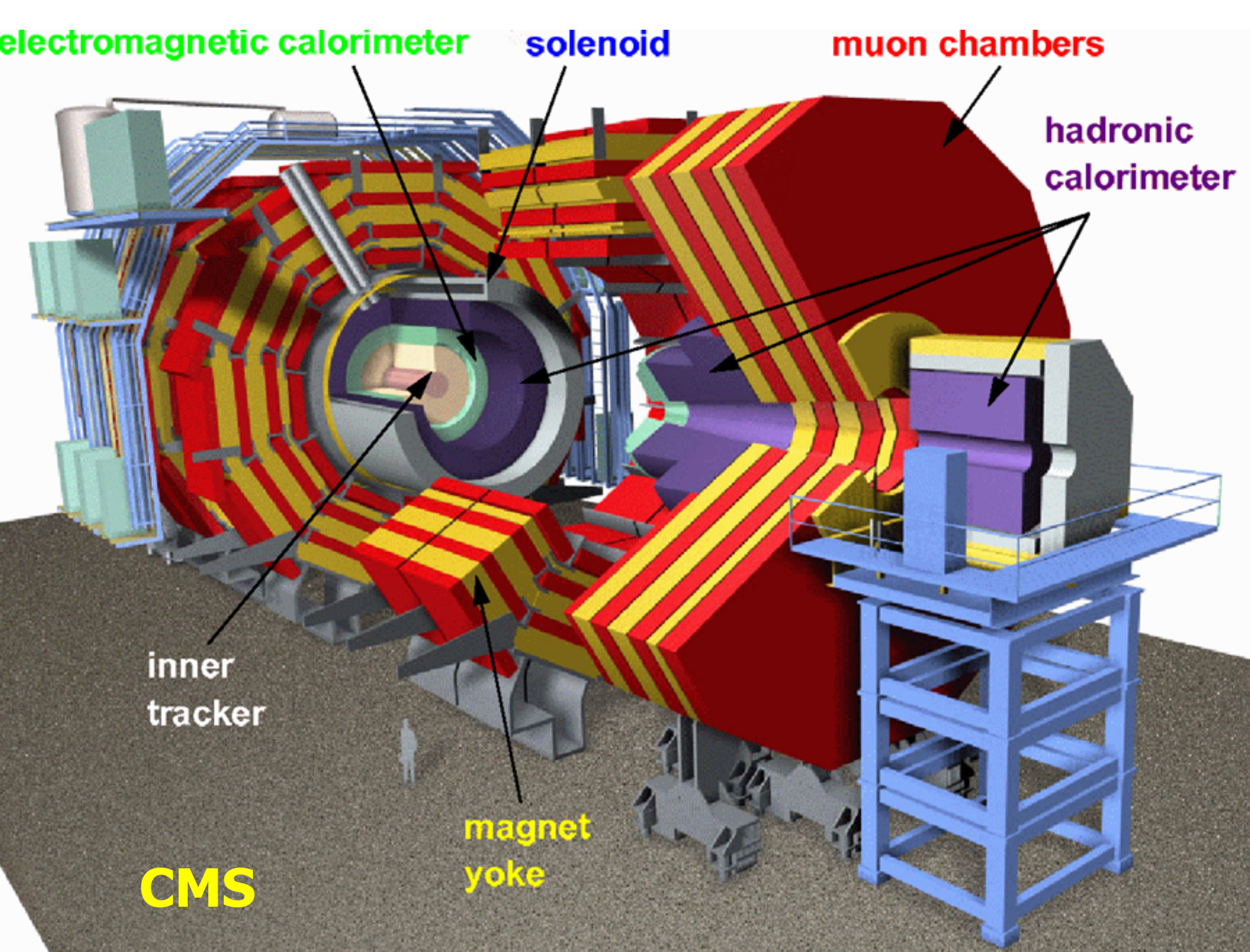
muon chambers

hadronic calorimeter

inner tracker

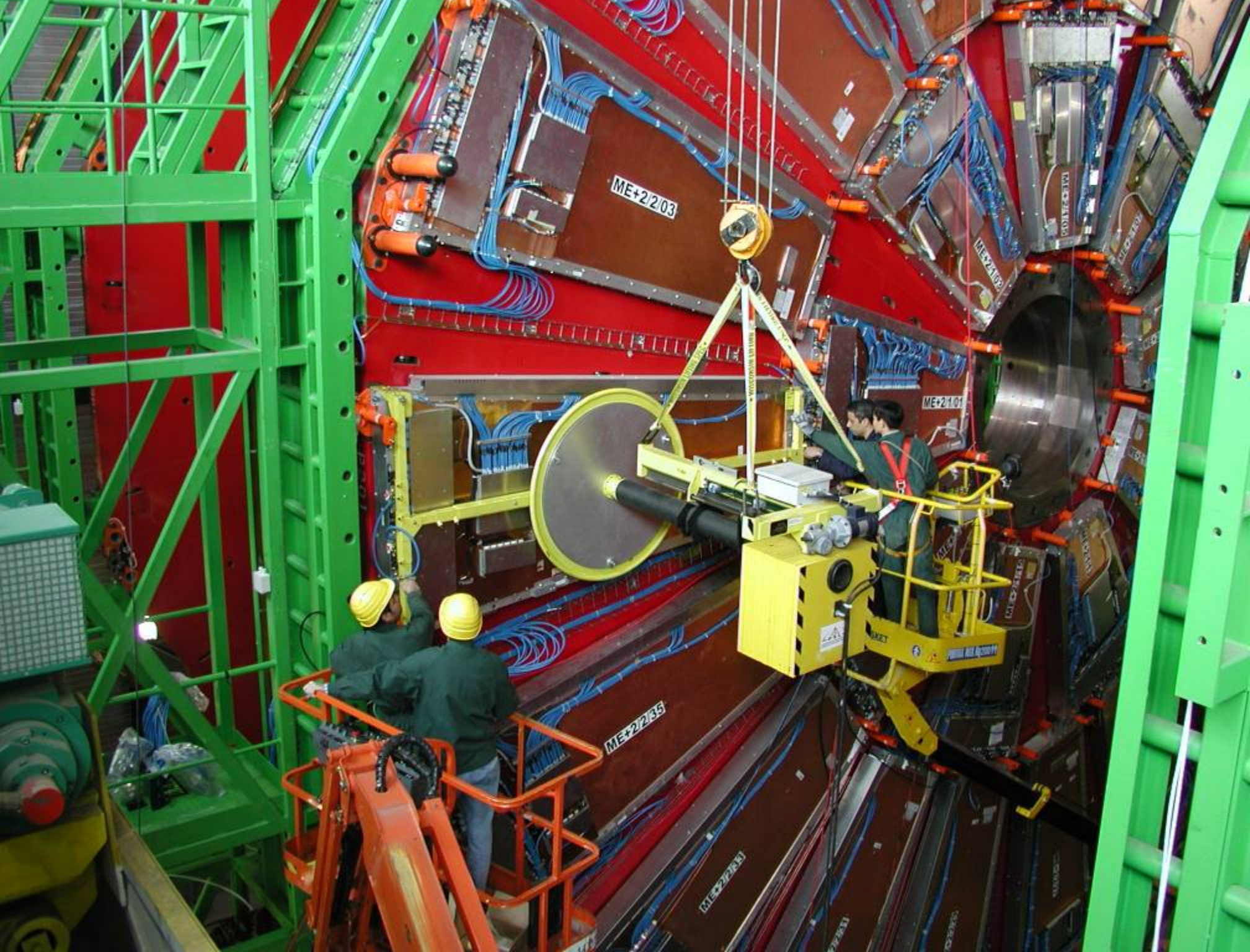
magnet yoke

CMS



CMS Barrel Yoke





ME+2/03

ME+2/01

ME+2/05

ME+2/08

ME+2/10

ME+2/12

ME+2/15

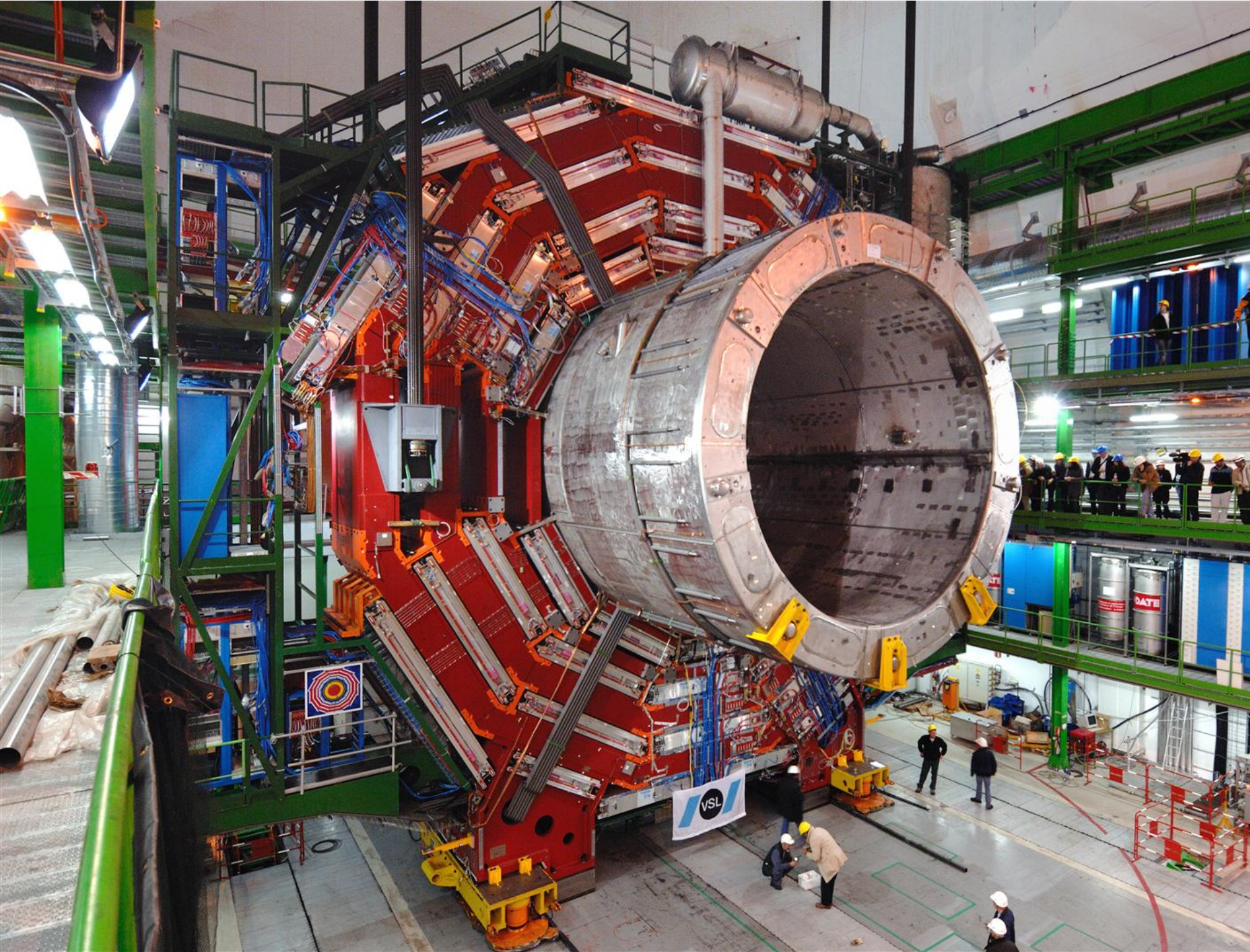
ME+2/18

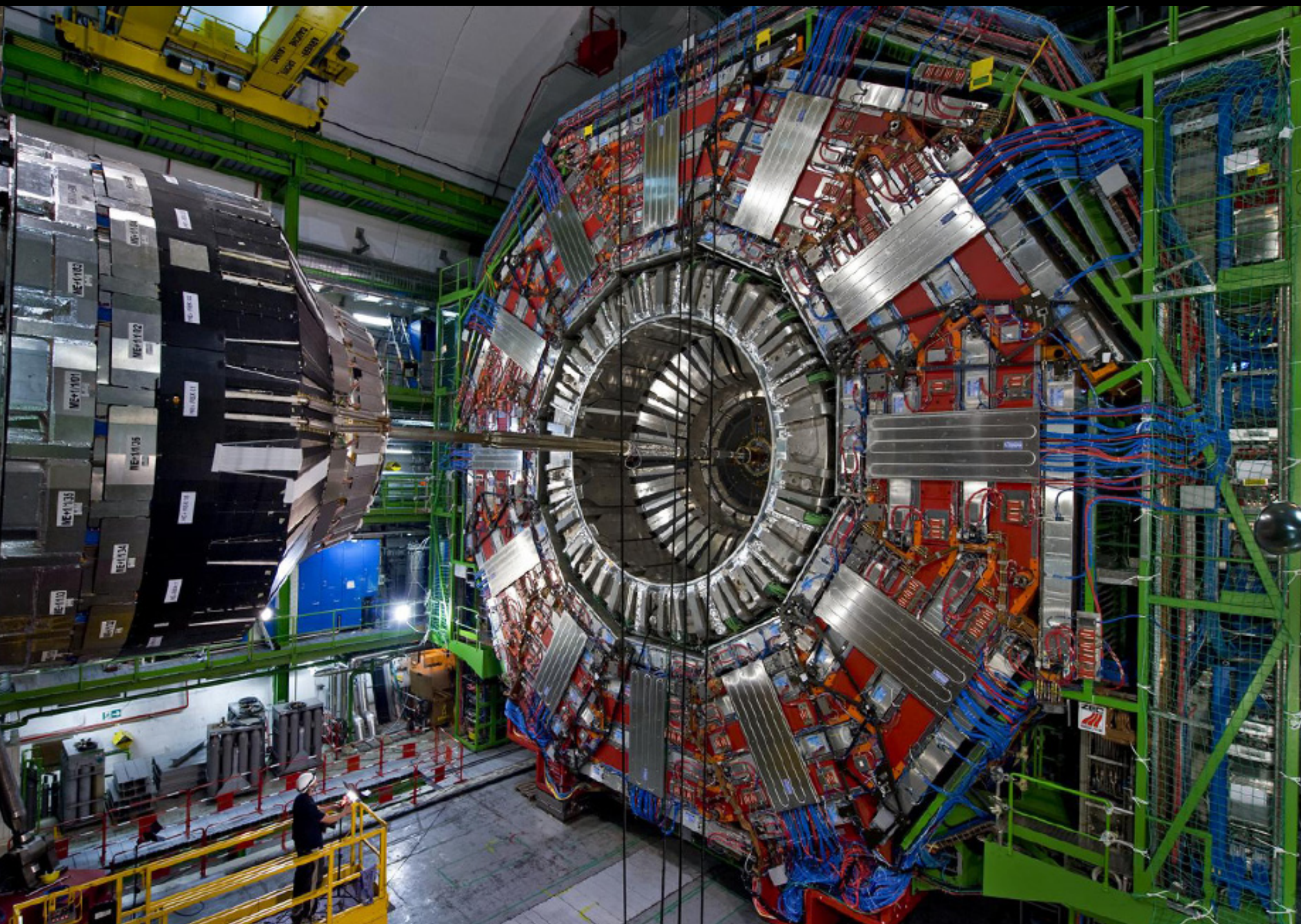
ME+2/21

ME+2/24

ME+2/27

ME+2/30





Newsweek

The Biggest Experiment Ever (And It's European)



Particle detectors
constructed
at Westwood,
now at LHC, CERN



NEWSWEEK.COM SEPTEMBER 15, 2008 PHOTOGRAPH BY MARTIAL TREZZINI-AP

The new CERN collider in Geneva

Albania	LeK 600	Finland	€4.40	Israel	NIS 20.00	Netherlands	€4.40	Slovenia	€3.40
Austria	€4.40	France	€4.40	Italy	€4.40	Norway	Kr 41.00	Spain	€4.40
Belgium	€4.40	Germany	€4.40	Kazakhstan	\$4.40	Poland (incl tax)	PLN 12.30	Sweden	SKr 34.00
Bulgaria	BGL 4.50	Gibraltar	€2.90	Latvia	\$4.40	Portugal Cont	€4.40	Switzerland	SF 7.70
Croatia	KN 22.00	Greece	€4.40	Lithuania	\$4.40	Romania	Lei 11.00	Turkey	YTL 4.00
Cyprus	€2.58/€4.40	Hungary	FL 700.00	Luxembourg	€4.40	Russia	€4.40	Ukraine	\$4.40
Czech Republic	CZK 115.00	Iceland	IKR 390.00	Malta	Lm 1.70/€3.96	Serbia	DIN 240	United Kingdom	£2.80
Denmark	Kr 38.00	Ireland (incl tax)	€4.40	Montenegro	DIN 240	Slovakia	SK 120.00/€3.98	U.S. Forces	\$3.25

Sept 15, 2008 Issue

2/27/2012

17

CMS Experiment, CERN

Data_taken 2009-Nov-07 19:12:36.880368 GMT

Run_no 120015

Event_no 8

Lumi_sec 1

Orbit 584946

Crossing 2603

<http://iguana.cern.ch/isy/>

L1 Triggers:

L1_DoubleHEBitCountsRing1_P1N1

L1_DoubleHEBitCountsRing2_P1N1

L1_ETM20

L1_ETM30

L1_MinBias_HTT10

L1_Mu3QE8_Jet6

L1_SingleEG1

L1_SingleEG10

L1_SingleEG12

L1_SingleEG15

L1_SingleEG20

L1_SingleEG25

L1_SingleEG30

L1_SingleEG35

L1_SingleEG40

L1_SingleEG45

L1_SingleEG50

L1_SingleEG55

L1_SingleEG60

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L1_SingleEG90

L1_SingleEG95

L1_SingleEG100

L1_SingleEG105

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L1_SingleEG125

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L1_SingleEG135

L1_SingleEG140

L1_SingleEG145

L1_SingleEG150

L1_SingleEG155

L1_SingleEG160

L1_SingleEG165

L1_SingleEG170

First Event at LHC – Recreation of the Big Bang! (Nov 7, 2009)

Los Angeles Times

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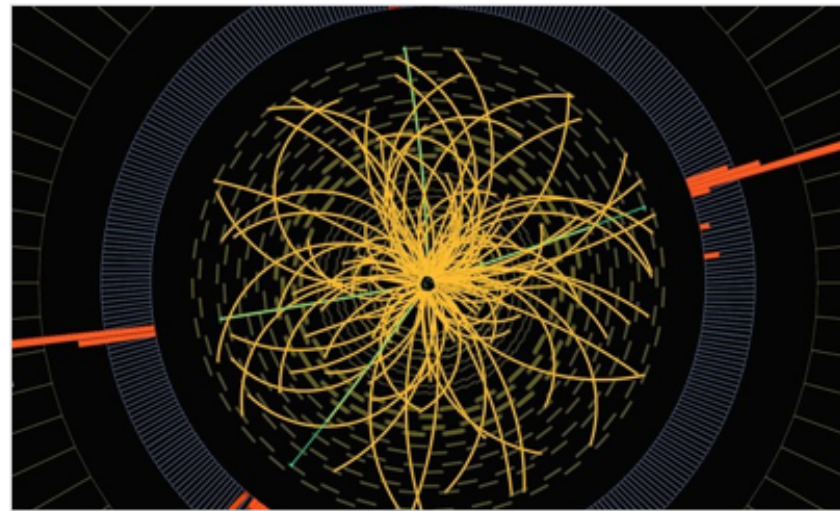
Physicists find 'tantalizing hints' of Higgs boson 'God particle'

Two teams of scientists at the Large Hadron Collider near Geneva say they detected 'tantalizing hints' of the elusive Higgs boson, or 'God particle,' but no definitive proof.

December 13, 2011 | By Eryn Brown, Los Angeles Times

Physicists announced Tuesday that they had detected "tantalizing hints," but not definitive proof, of the long-sought Higgs boson, the so-called God particle that is crucial to physicists' understanding of why mass exists in the universe.

Two large teams of scientists based at the Large Hadron Collider near Geneva separately saw what they believe are telltale tracks of the maddeningly elusive particle in the aftermath of about 400 trillion proton collisions carried out since January.



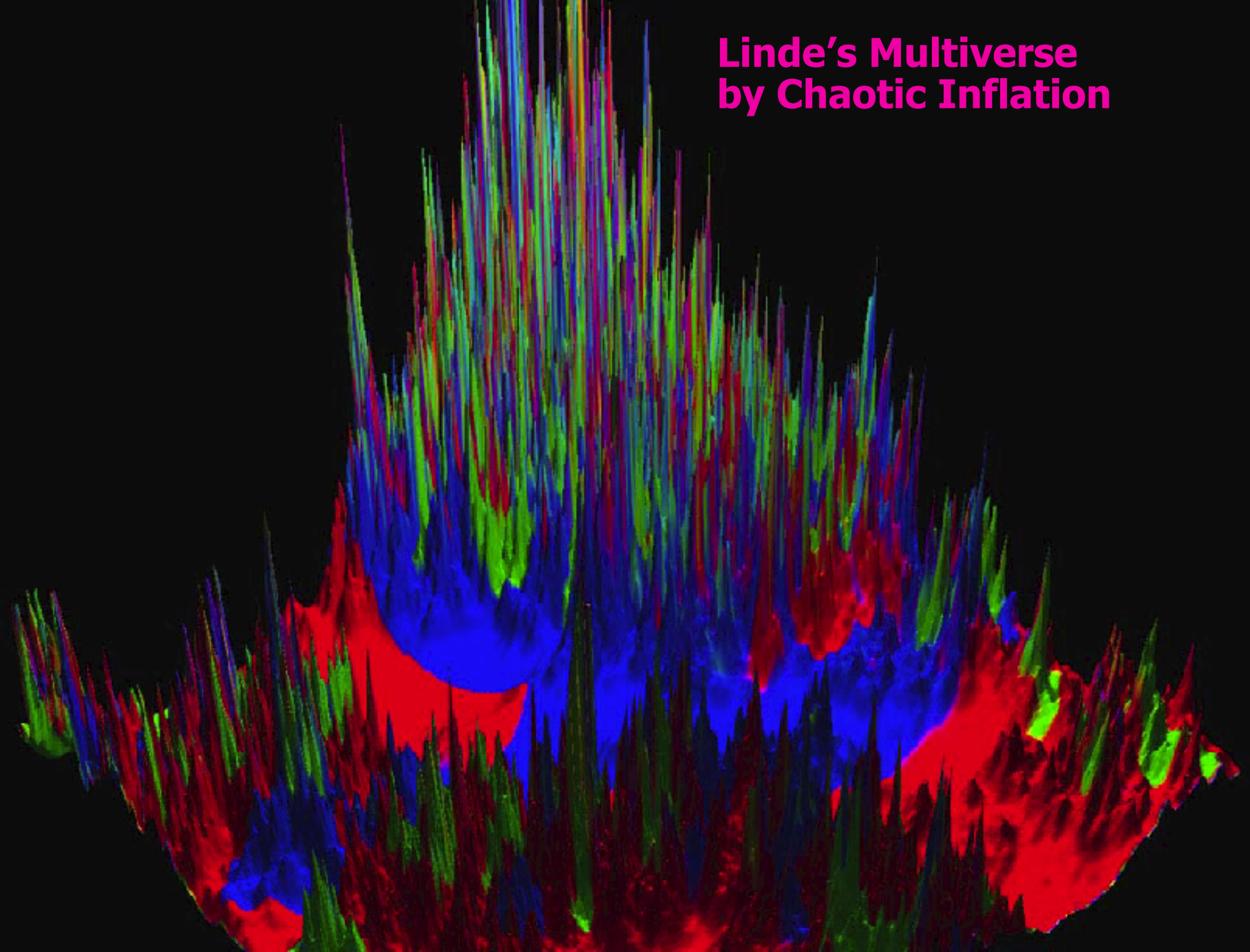
A graphic shows traces of a proton collision measured in a detector at the... (CERN)



Why are we here?

**Are there more than
one Universe?**

Linde's Multiverse by Chaotic Inflation





There may be ~100 Billion Universes.