

The background of the slide is a dark blue field filled with numerous small, bright blue particles. These particles are arranged in several distinct, curved paths that resemble particle tracks or the paths of particles in a detector. The tracks are most prominent in the upper right and lower left quadrants, curving towards the center. The overall effect is that of a dynamic, scientific environment.

CERN Introduction

Harri Toivonen

What does « CERN » stand for?

Européan

Européie pour la

Recherche

Recherche



What does « CERN » stand for?

European
Organization for
Nuclear
Research



A background image showing particle tracks in a detector, likely a bubble chamber or cloud chamber. The tracks are glowing blue and cyan, with a prominent curved track on the right side. The overall scene is dark, with the tracks providing the main source of light.

CERN

Who is it ?

Member states

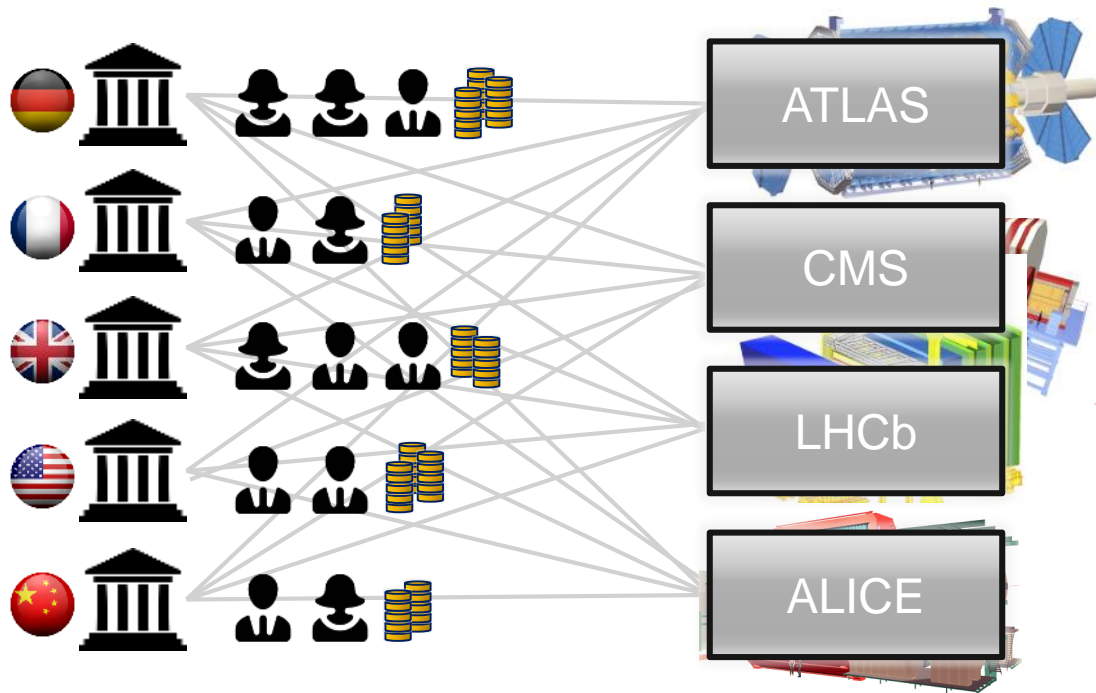


Ca 1 Bn CHF



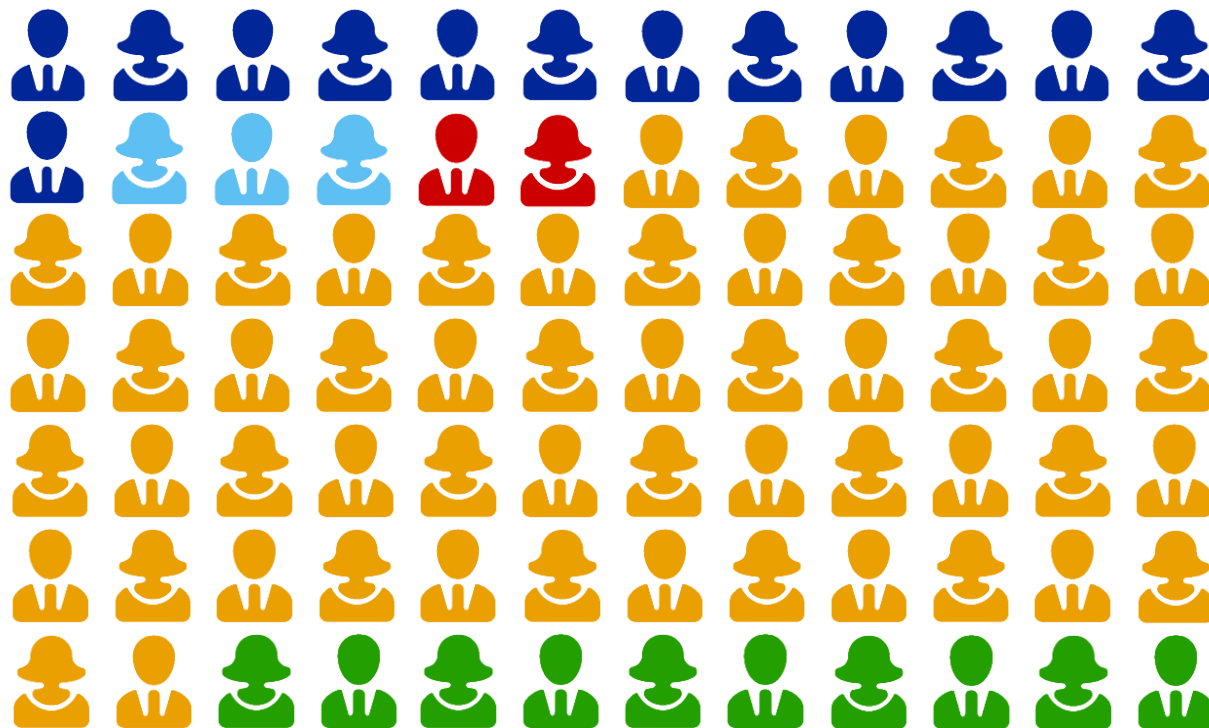
Germany		20.52%	
United Kingdom		14.65%	
France		14.61%	
Italy		11.04%	
Spain		7.61%	
Netherlands		4.74%	
Switzerland		4.03%	
Norway		2.91%	
Poland		2.81%	
Sweden		2.78%	
Belgium		2.74%	
Austria		2.20%	
Denmark		1.75%	
Finland		1.37%	
Israel		1.42%	
Greece		1.32%	
Portugal		1.14%	
Czech Republic		0.98%	
Romania		0.98%	
Hungary		0.61%	
Slovakia		0.49%	
Bulgaria		0.29%	

Collaborations



How many people?

=+15'000



2'500 staff

600 fellows & apprentices

500 students

11'000 users

2'000 external companies

A background image showing particle tracks in a detector, likely a bubble chamber or cloud chamber. The tracks are glowing blue and cyan, with a prominent circular track on the right side. The overall scene is dark, with the tracks providing the main source of light.

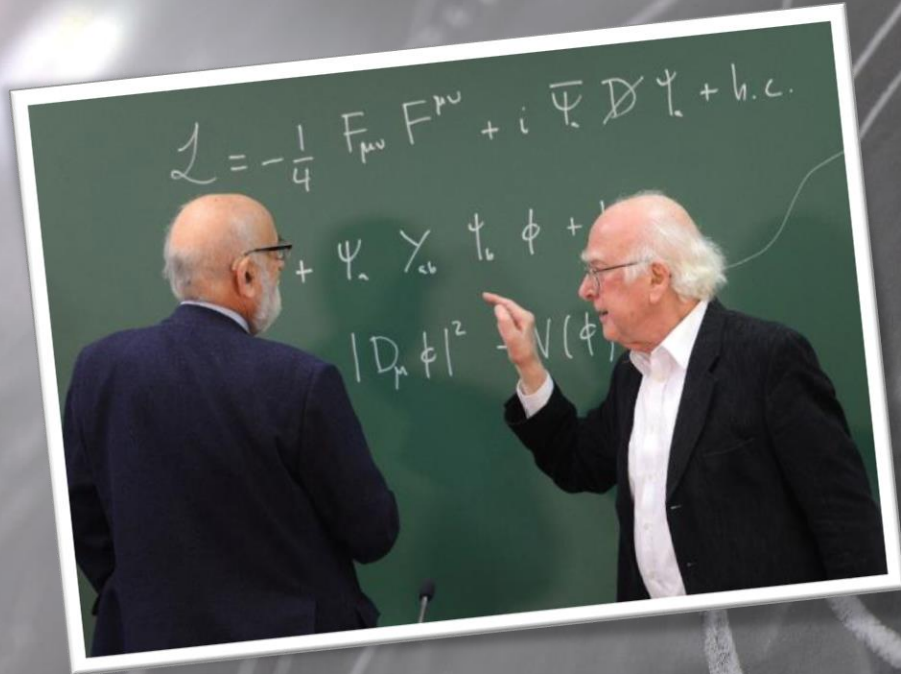
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What for ?

Fundamental research



Answering questions...



Higgs

Higgs ?

Answering questions...



Antimatter ?

Answering questions...

Dark matter ?

Collaborate



Educate



CERN

How does it work ?



Accelerating and colliding



Incredible levels of energy

$$-\frac{\hbar^2}{2m} \frac{d^2\psi}{dx^2} + V\psi = E\psi$$
$$\Phi_e = \frac{1}{2\pi} \int \frac{1}{r} d\Omega$$
$$k = \frac{2\pi}{\lambda}$$
$$v = \frac{\omega}{k}$$
$$F_m = \vec{B} \times \vec{I} l = \frac{\mu_0 I_1 I_2}{2\pi d} l$$
$$E_f = \frac{1}{2} m v^2$$
$$E = k \frac{q_1 q_2}{r^2}$$
$$U = W_{AB} = |E_{PA} - E_{PB}| = |\varphi_A - \varphi_B|$$
$$T = \frac{4 n_1 n_2}{(n_2 + n_1)^2}$$
$$F = \frac{m_1 m_2}{r^2}$$
$$\vec{B} = \mu_0 \frac{NI}{2r}$$
$$v = \frac{nh}{2\pi r m_e}$$
$$\varphi_E = \frac{E_c}{\varphi_0} = k \frac{\varphi}{r}$$
$$R_m = \frac{c}{T}$$
$$k = \pm \sqrt{\frac{2m}{\hbar^2} (E - V_0)}$$
$$K = \frac{p^2}{2m}$$
$$m_0 = \frac{M_m}{N_A} = \frac{M_r \cdot 10^{-3}}{N_A}$$
$$m = N \cdot m_0 = \frac{\varphi}{v_e} \frac{M_m}{N_A}$$
$$E = \frac{E_c}{a} \int_{-a/L}^{+a/L} \sin(\omega t + \phi) dy$$
$$\lambda = \frac{h}{p}$$
$$l_t = l_0(1 + d \Delta t)$$
$$I = \frac{U_e}{R + R_i}$$
$$\omega = 2\pi f$$
$$\frac{\sin \alpha}{\sin \beta} = \frac{v_1}{v_2} = \frac{w_2}{w_1}$$
$$v = \frac{1}{\sqrt{\epsilon \cdot \mu}} = \frac{c}{\sqrt{\epsilon_r \mu_r}}$$
$$E = mc^2$$
$$f_0 = \frac{1}{2\pi} \sqrt{\frac{g}{l}}$$
$$\psi(x) = \sqrt{\frac{2}{L}} \sin \frac{n\pi x}{L}$$
$$E = \frac{1}{2} \hbar \sqrt{k/m}$$
$$\beta = \frac{\Delta I c}{\phi_e} = \frac{\Delta E}{\Delta t} \frac{w_1}{x} + \frac{w_2}{x'} = \frac{w_2 - w_1}{v}$$
$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \iint_S \vec{J} \cdot d\vec{S}$$
$$\vec{J} = \frac{1}{\mu_0} (\vec{E} \times \vec{B})$$
$$\phi = \frac{2\pi \sin^2 \theta}{\lambda}$$
$$\iint_S \vec{J} \cdot d\vec{S} = Q^*$$
$$v_k = \sqrt{\frac{3kT}{m_0}} = \sqrt{\frac{3kT N_A}{M_m}} = \sqrt{\frac{3R_m T}{M_r \cdot 10^{-3}}}$$
$$E = \hbar k^2$$
$$1 \text{ pc} = \frac{1 \text{ AU}}{206265}$$
$$R = \frac{U}{I}$$
$$\psi_2 = U_e I t$$

Accelerators chain

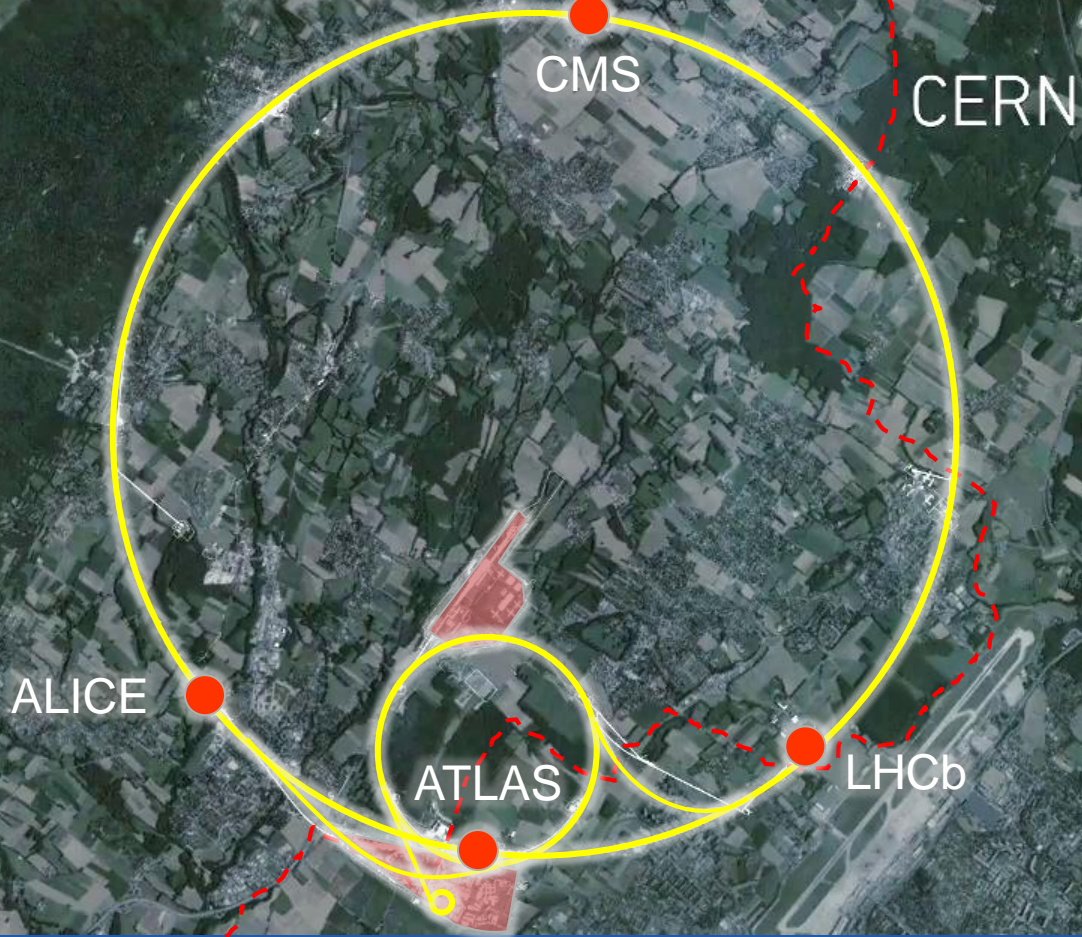



Million of collisions

A 3D rendering of a particle accelerator tunnel. Two red laser beams travel from opposite ends towards the center, where they collide, creating a bright yellow spark. The tunnel is composed of various cylindrical and rectangular components, some of which are semi-transparent, revealing internal structures. The overall color scheme is a deep blue.

25 ns bunch crossing
25 ns entre les paquets

Largest
scientific
experiment
on earth





The most
powerful
magnets

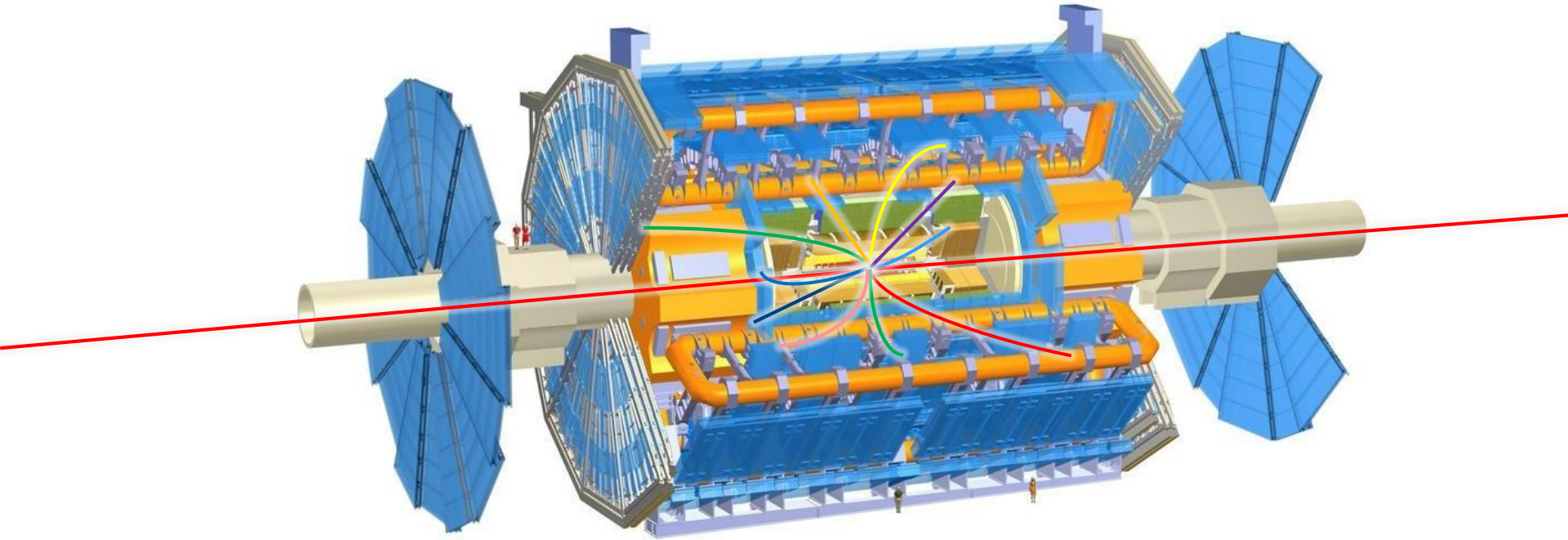


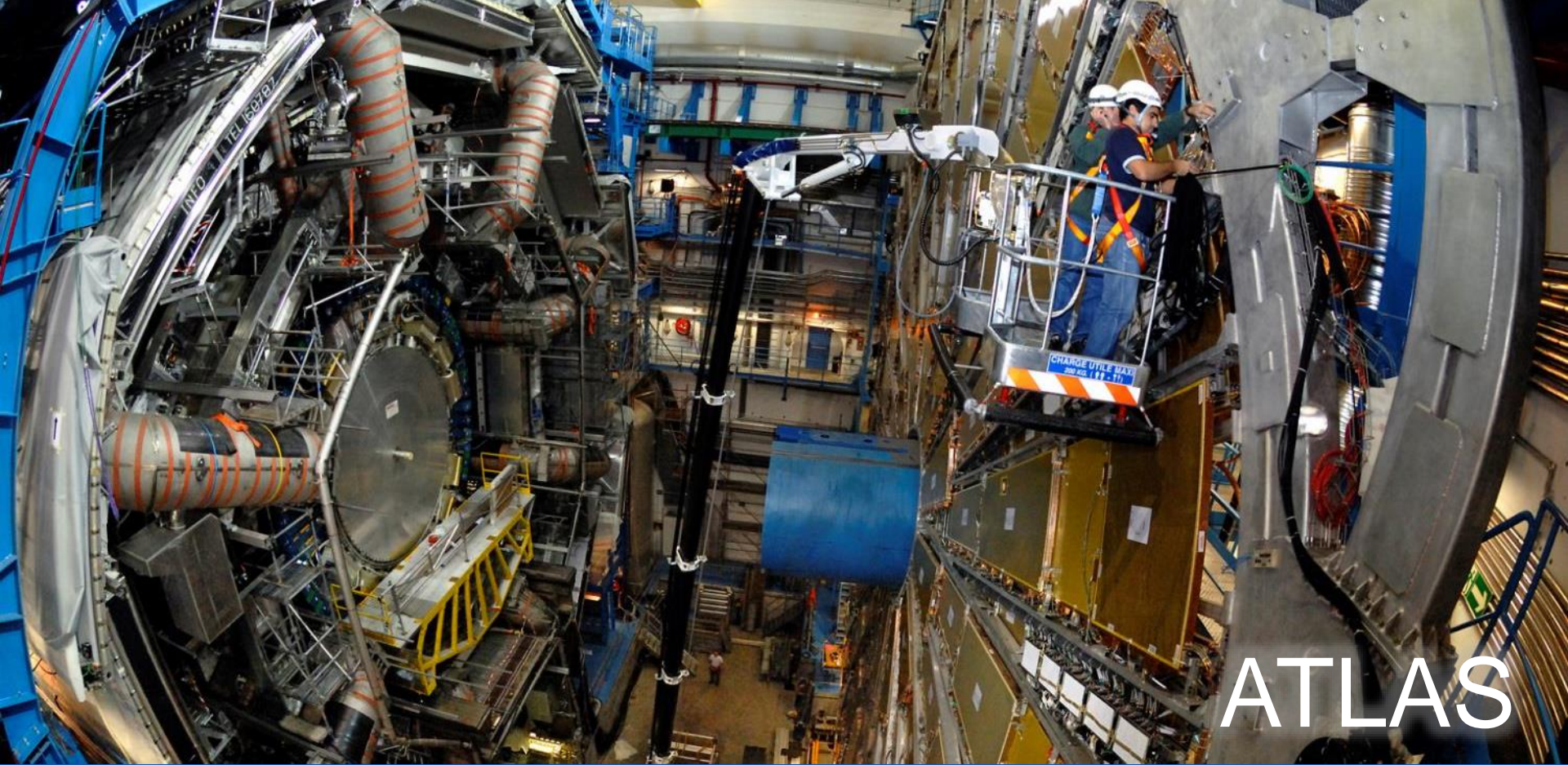
The highest vacuum



The
coldest
temperature

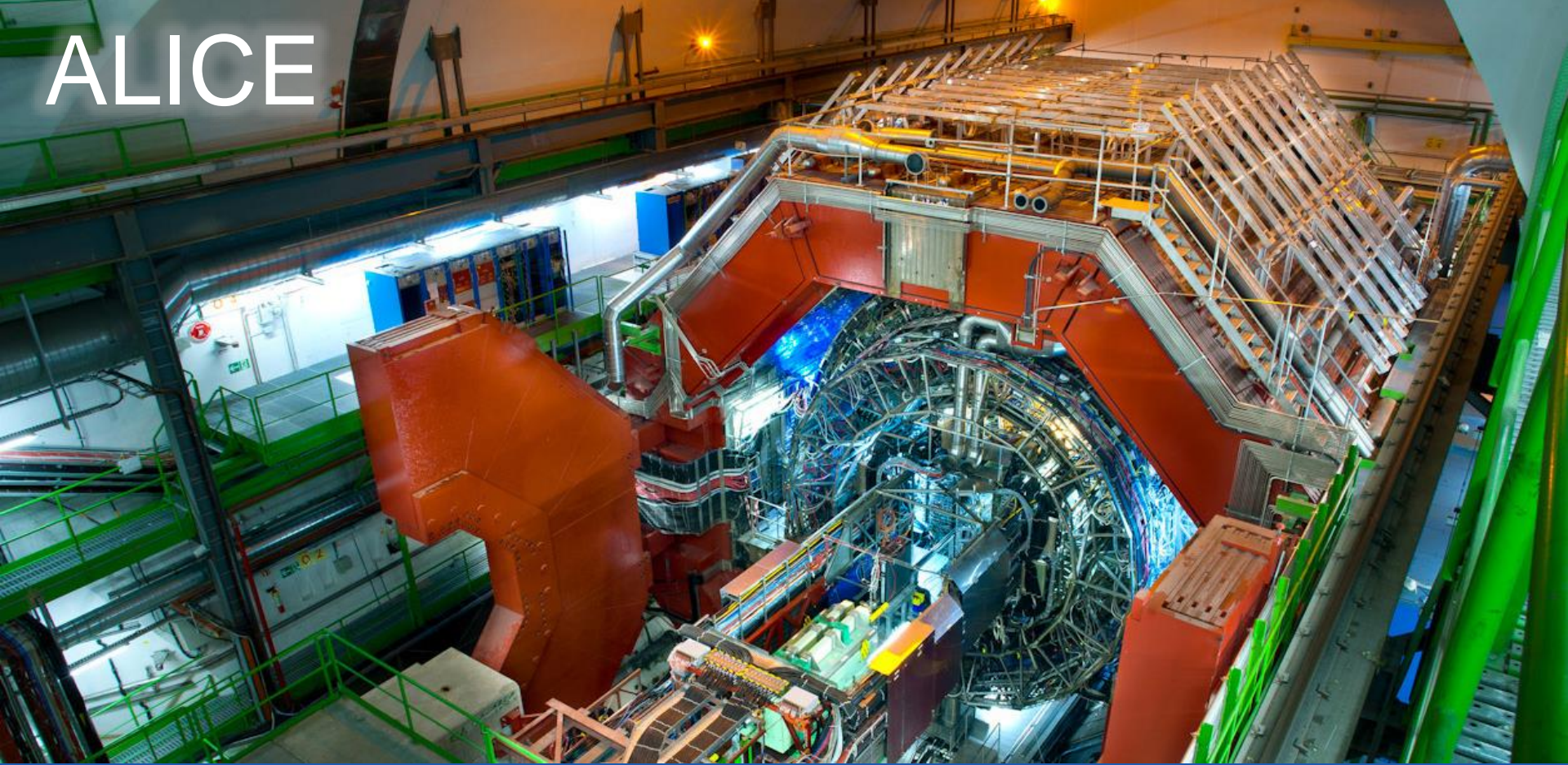
The largest detectors



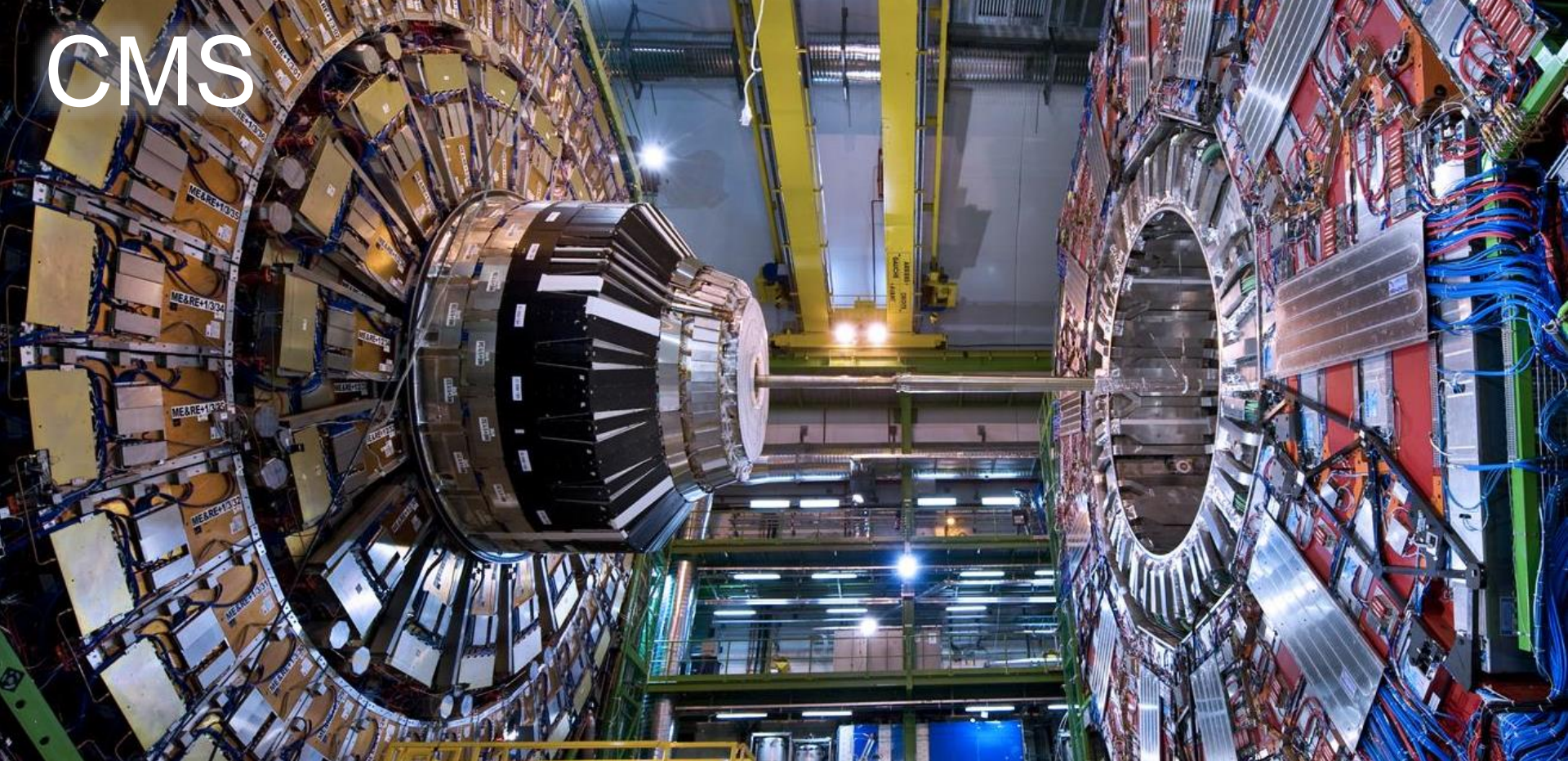


ATLAS

ALICE



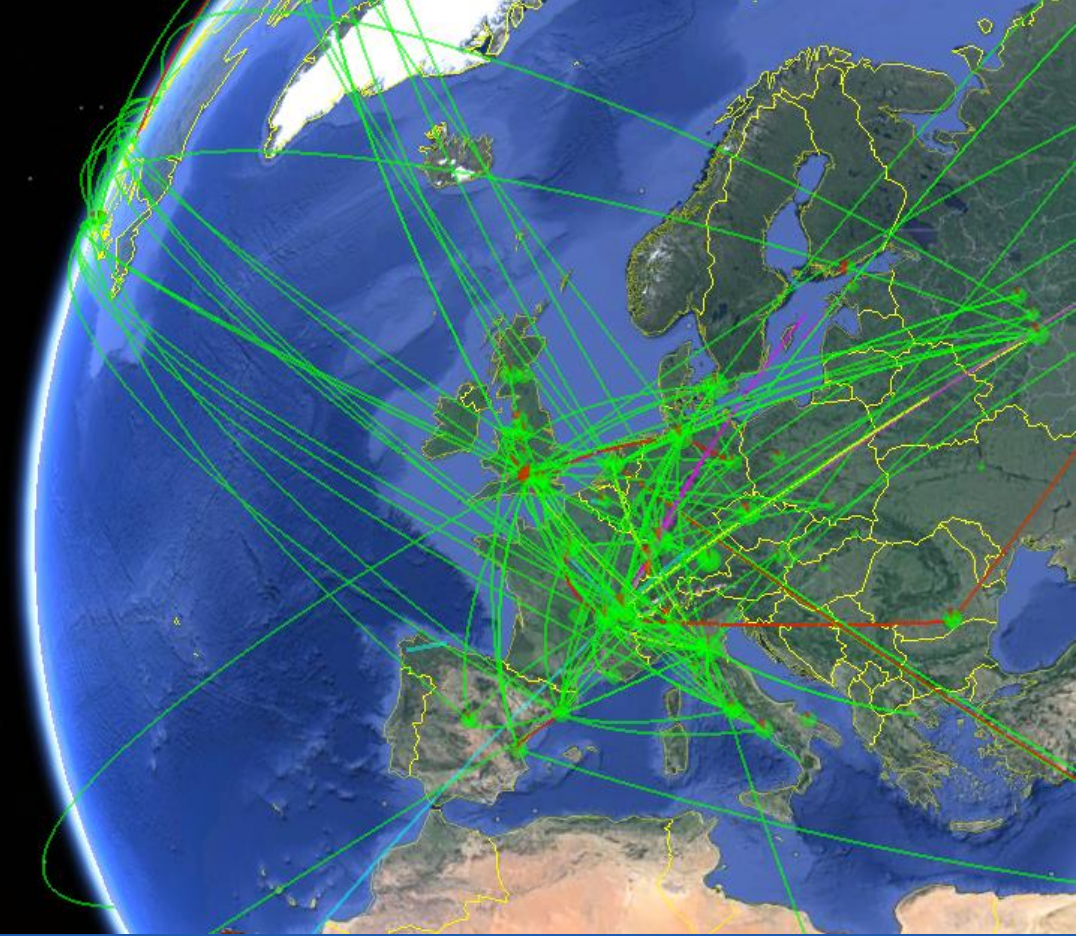
CMS





LHCb

The largest computing grid

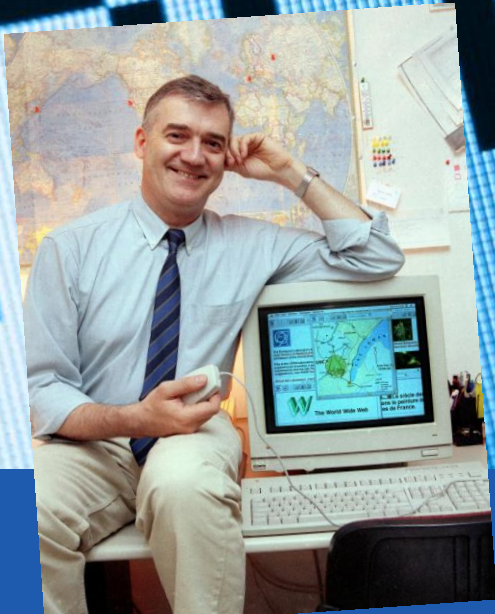


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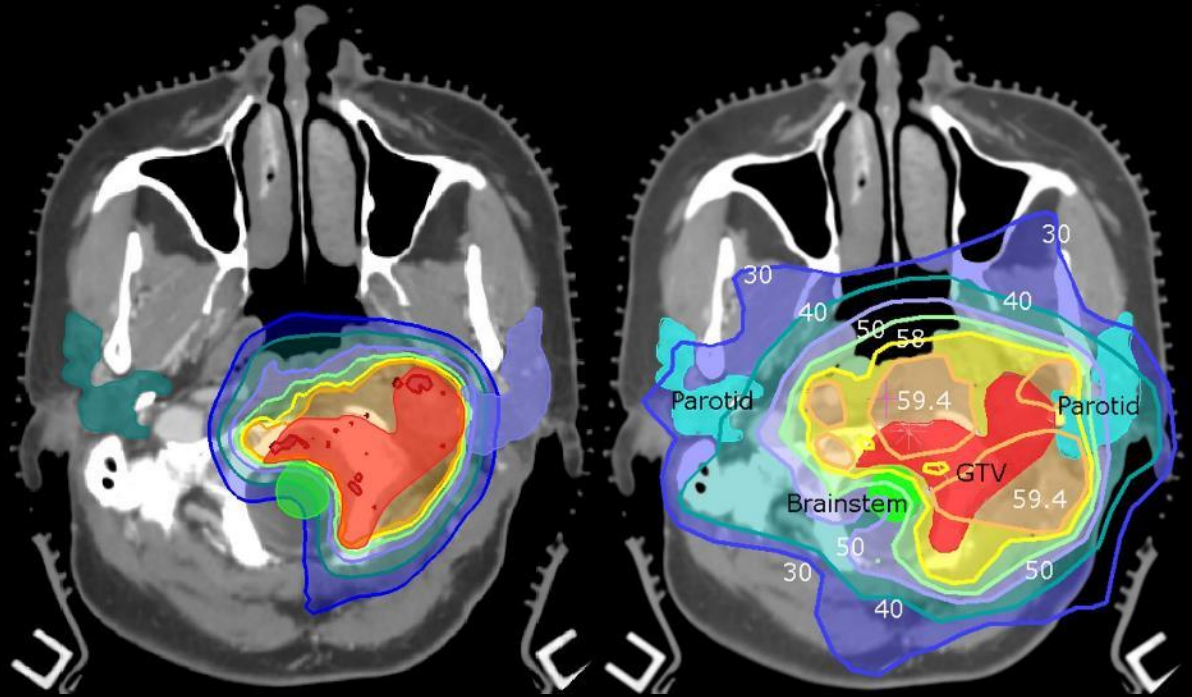
So what ?



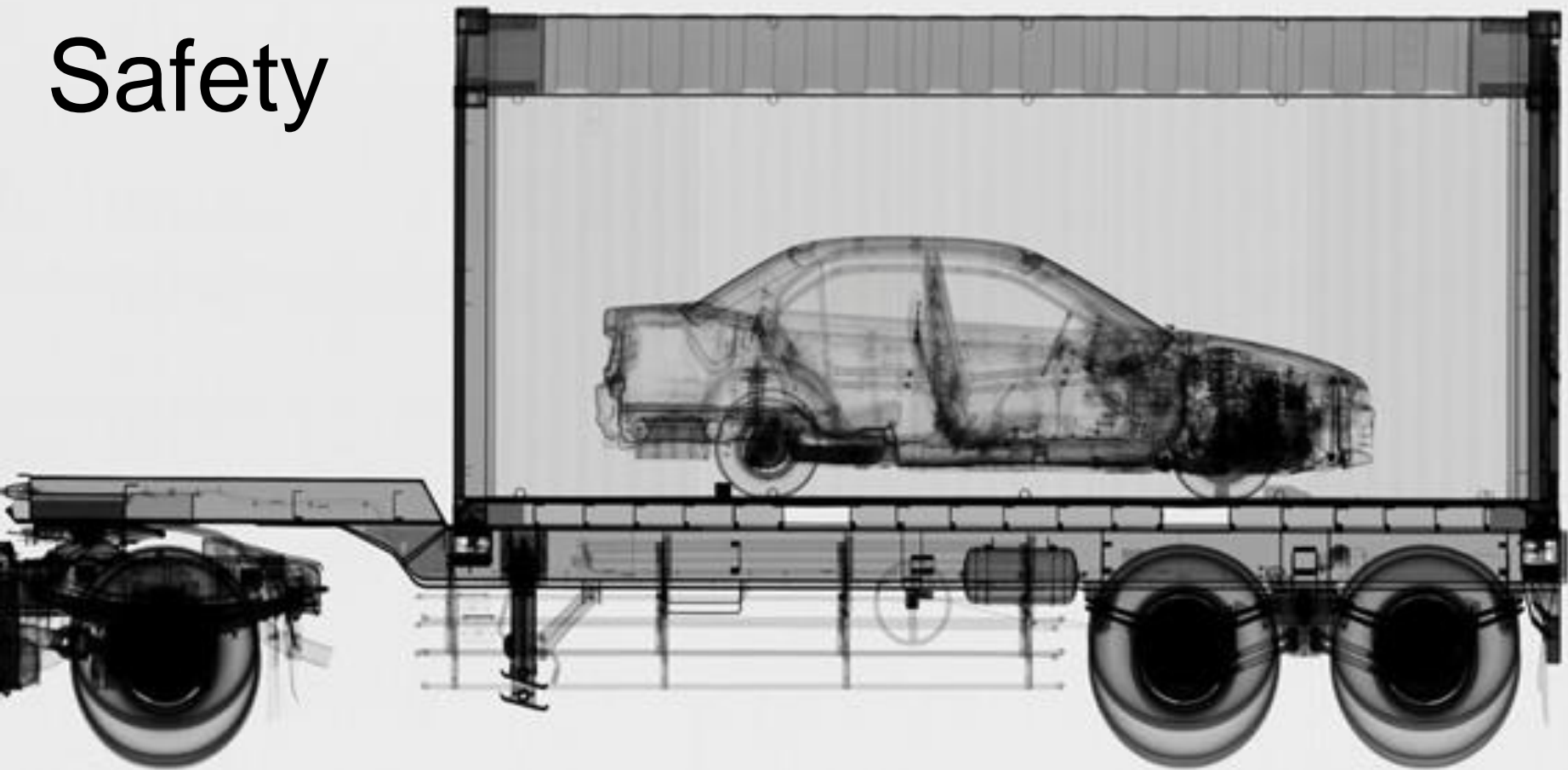
World Wide Web



Medical applications



Safety

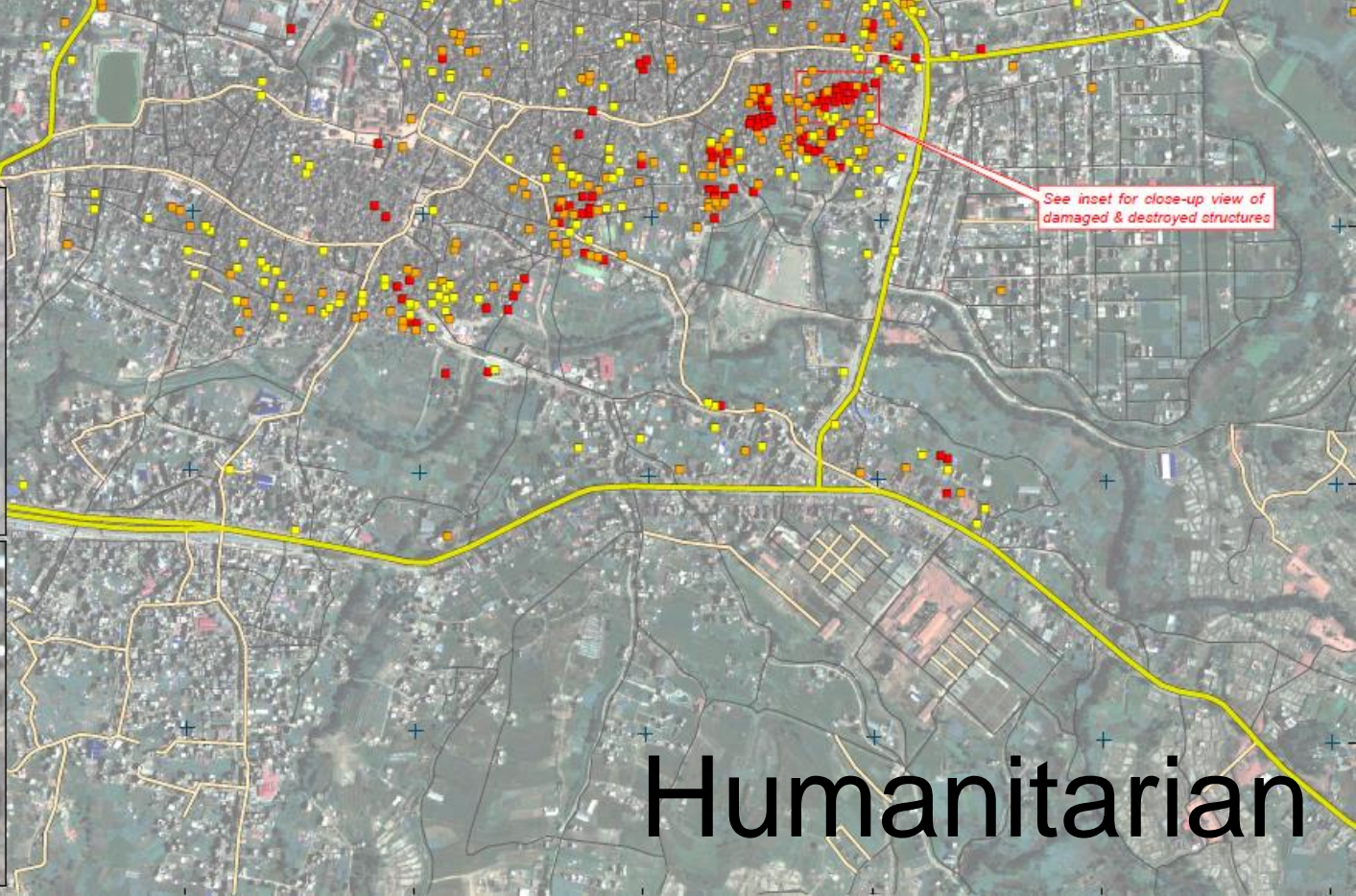


INSET: PRE-CRISIS



Source: Esri, DigitalGlobe,
GeoEye, iCube, Earthstar
Geographics, CNES/Airbus DS,
USDA, USGS, AEX, Getmapping.

INSET: 27 APRIL 2015

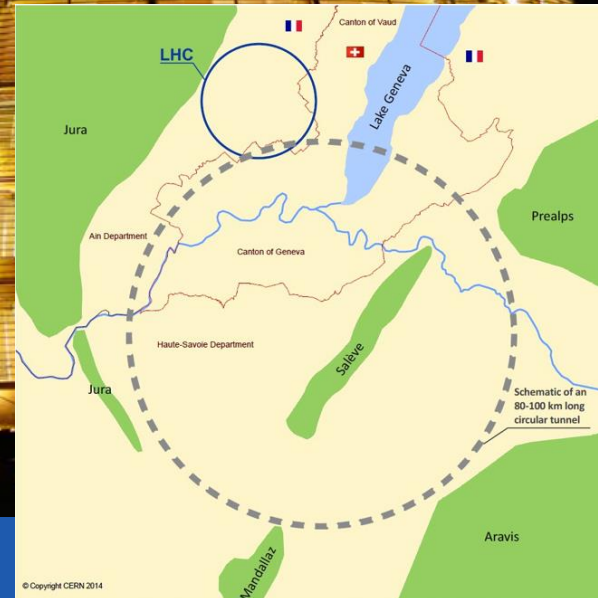
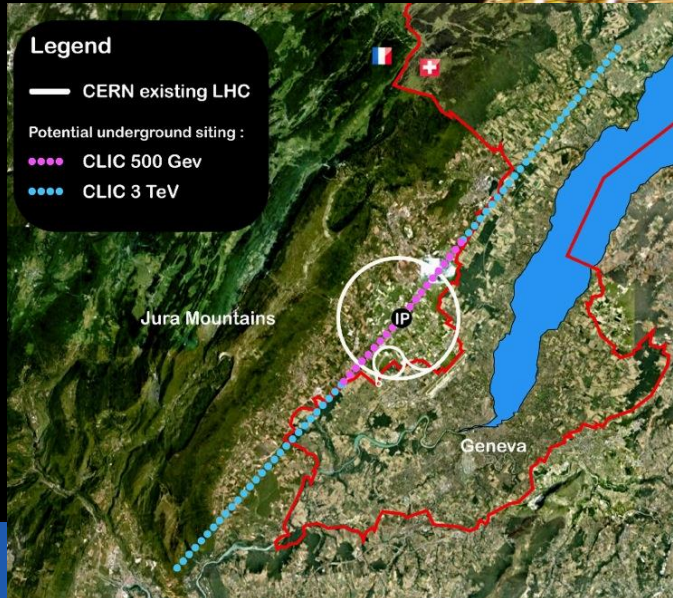


See inset for close-up view of
damaged & destroyed structures

Humanitarian

Future...?

- Compact Linear Collider (CLIC)
- Future Circular Collider (FCC)





www.cern.ch