

CERN Introduction

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What does « CERN » stand for?

European

Organization for the

Research

Centre



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 composed of many small, bright blue and cyan droplets or bubbles, forming a circular pattern. The overall color palette is dark blue to black, with the tracks glowing in shades of cyan and light blue.

CERN

Who is it ?

Member states

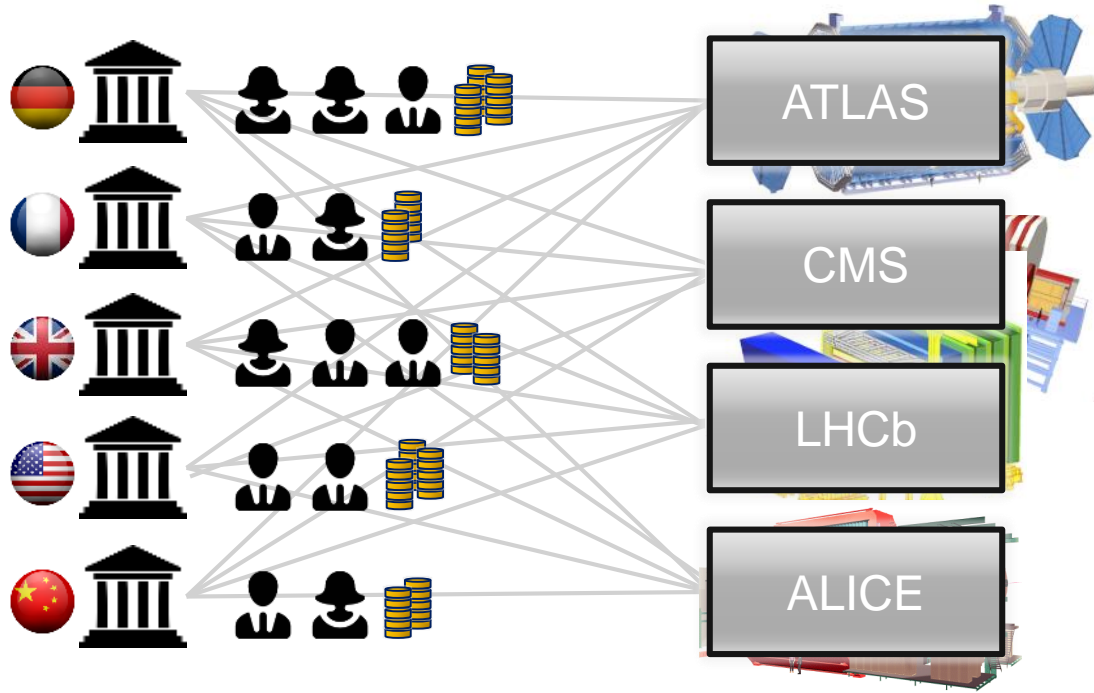


Ca 1 Bn CHF



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

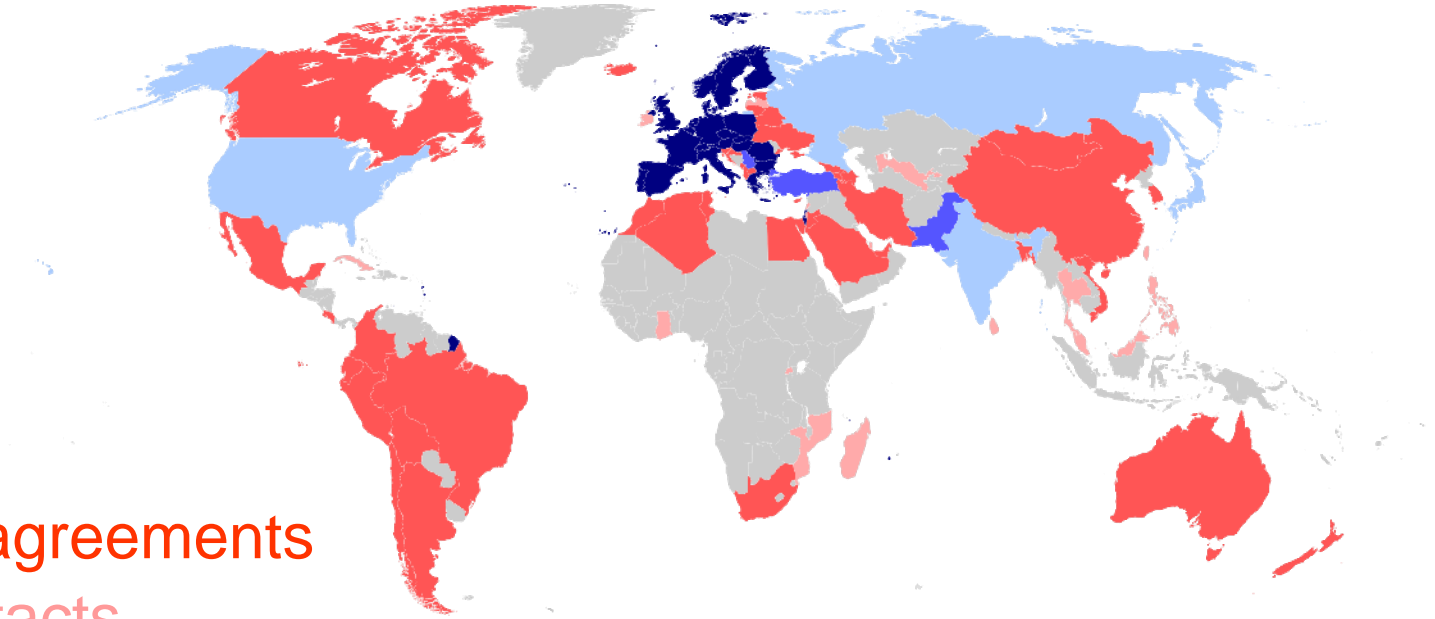


Global collaboration

22 members

3 associates

5 observers

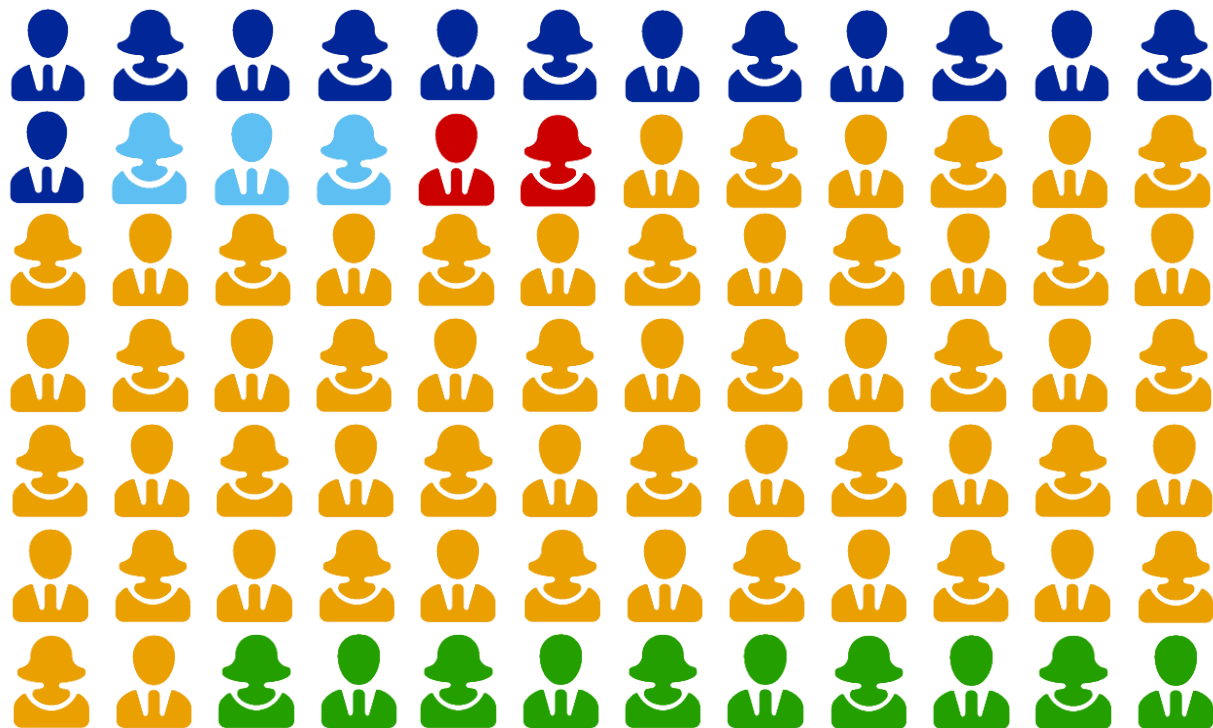


Cooperation agreements

Scientific contacts

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.

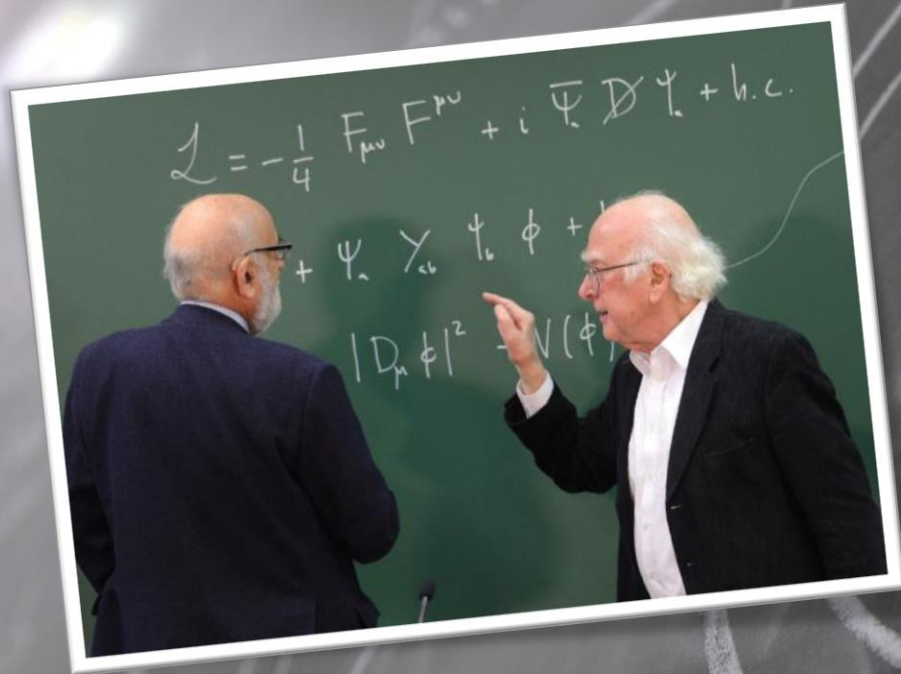
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What for ?

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

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



Accelerators chain

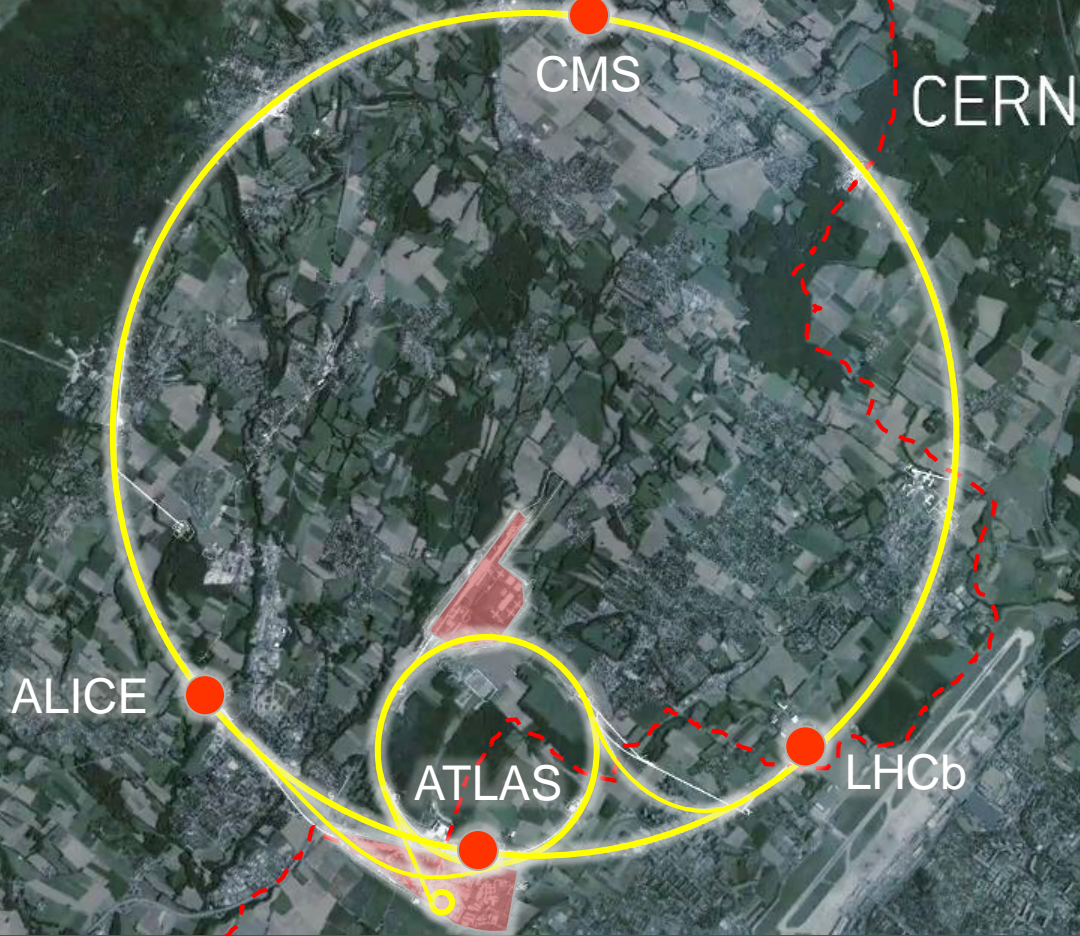



Million of collisions

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 several large, cylindrical sections with various internal structures and components visible. 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

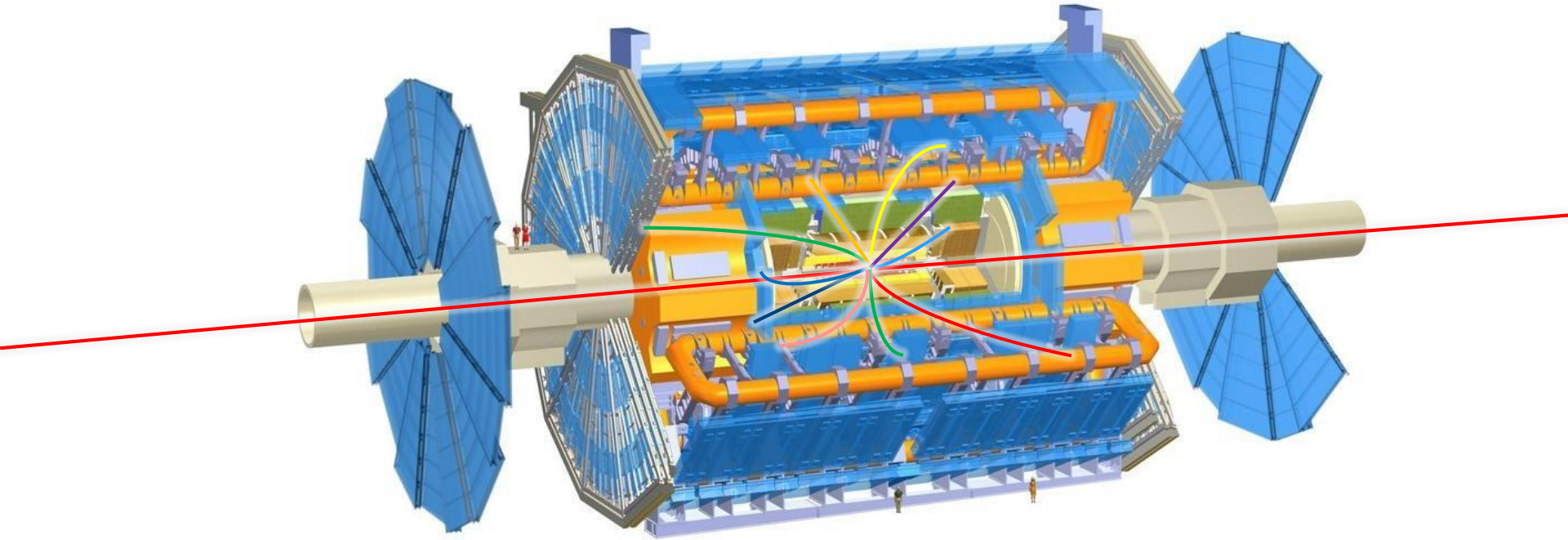


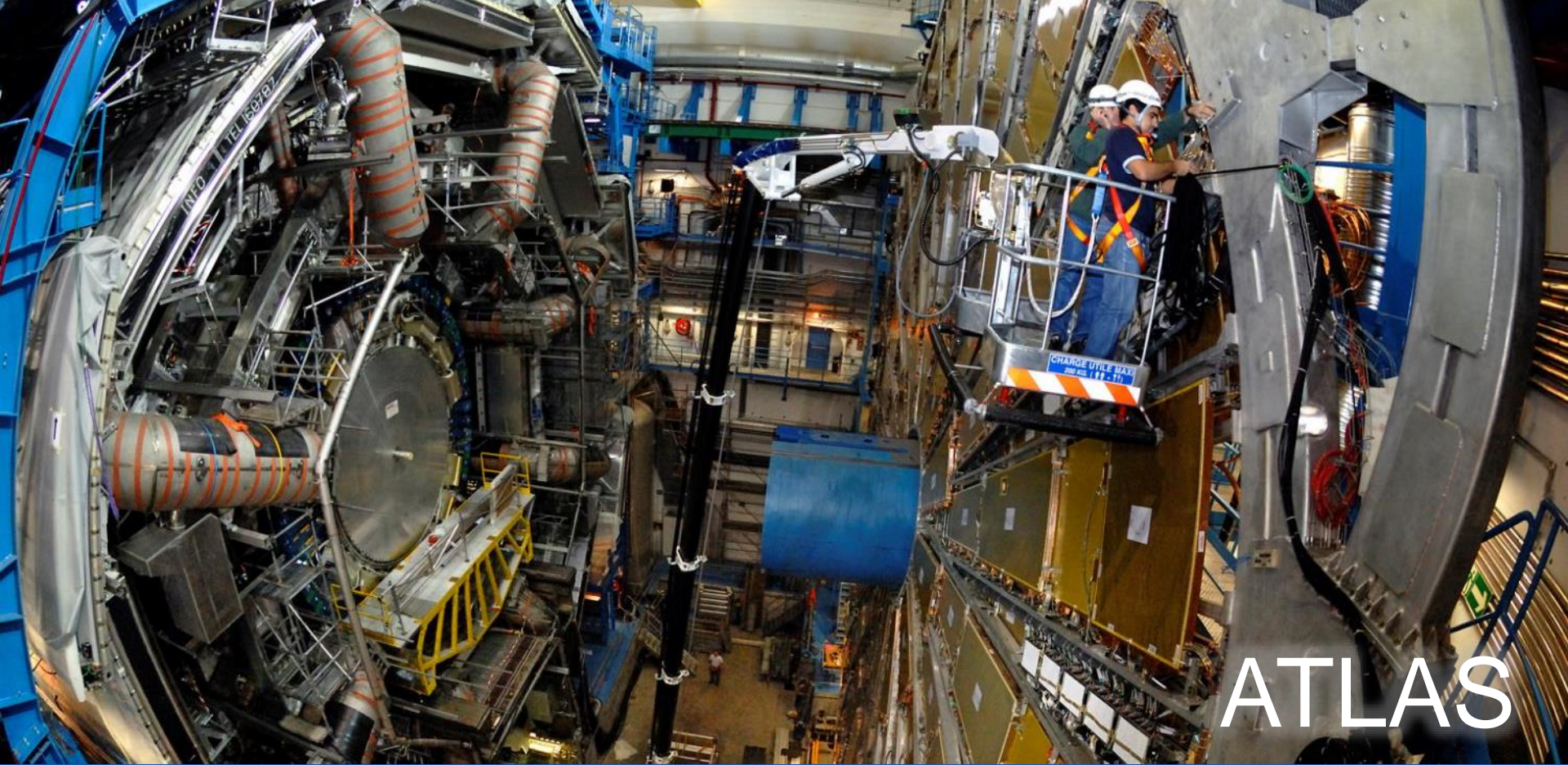
The highest vacuum



The
coldest
temperature

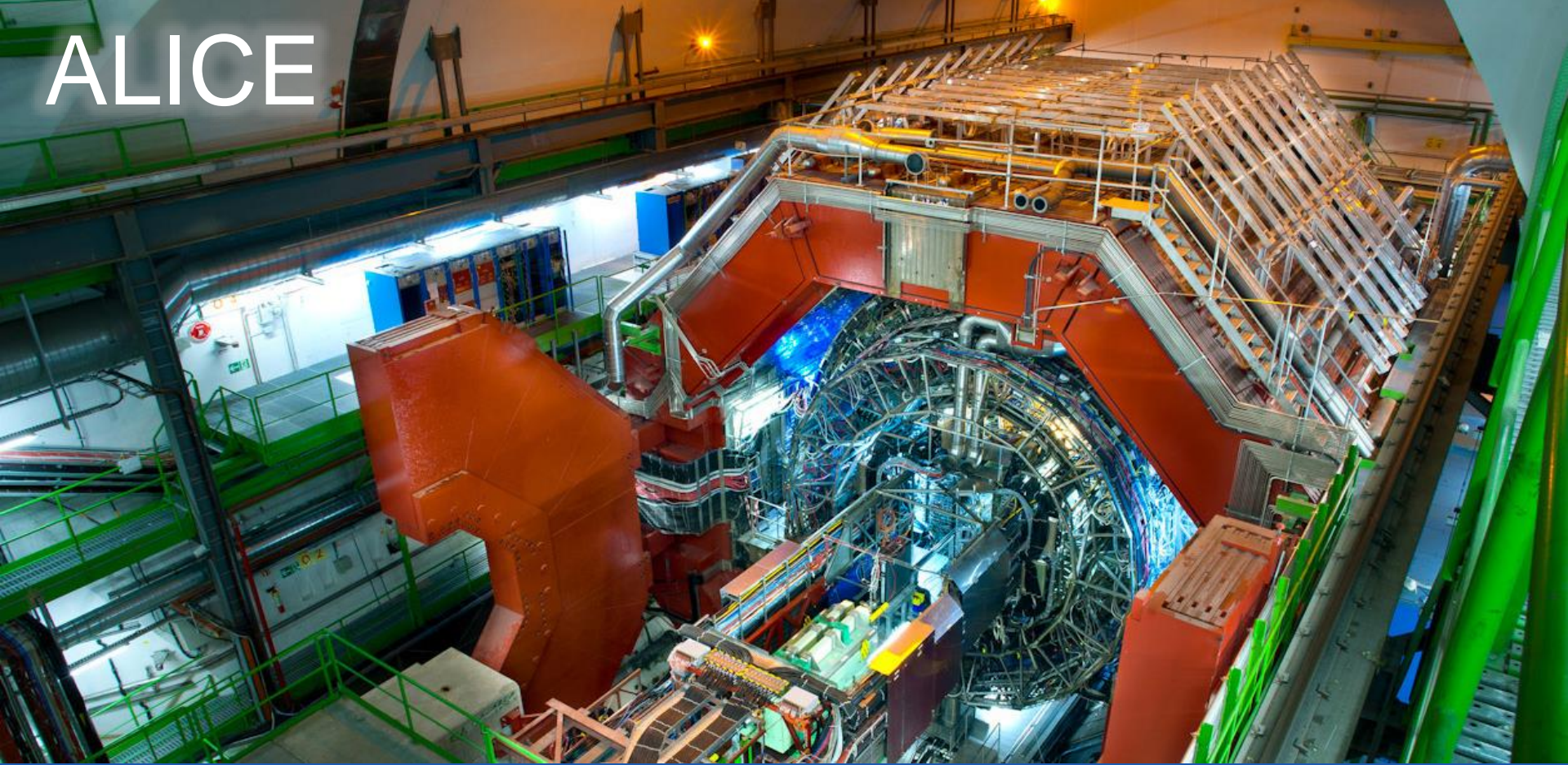
The largest detectors



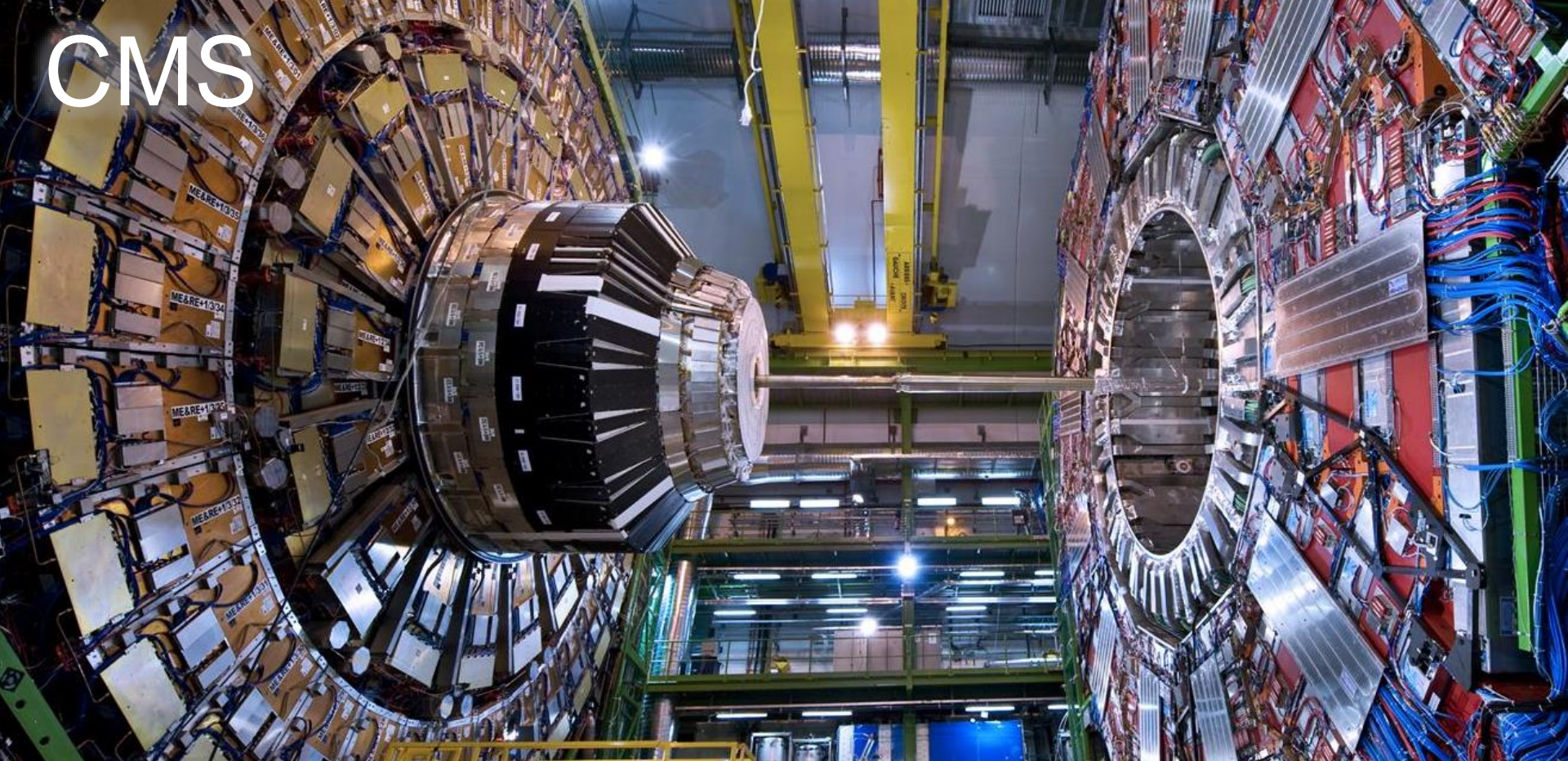


ATLAS

ALICE



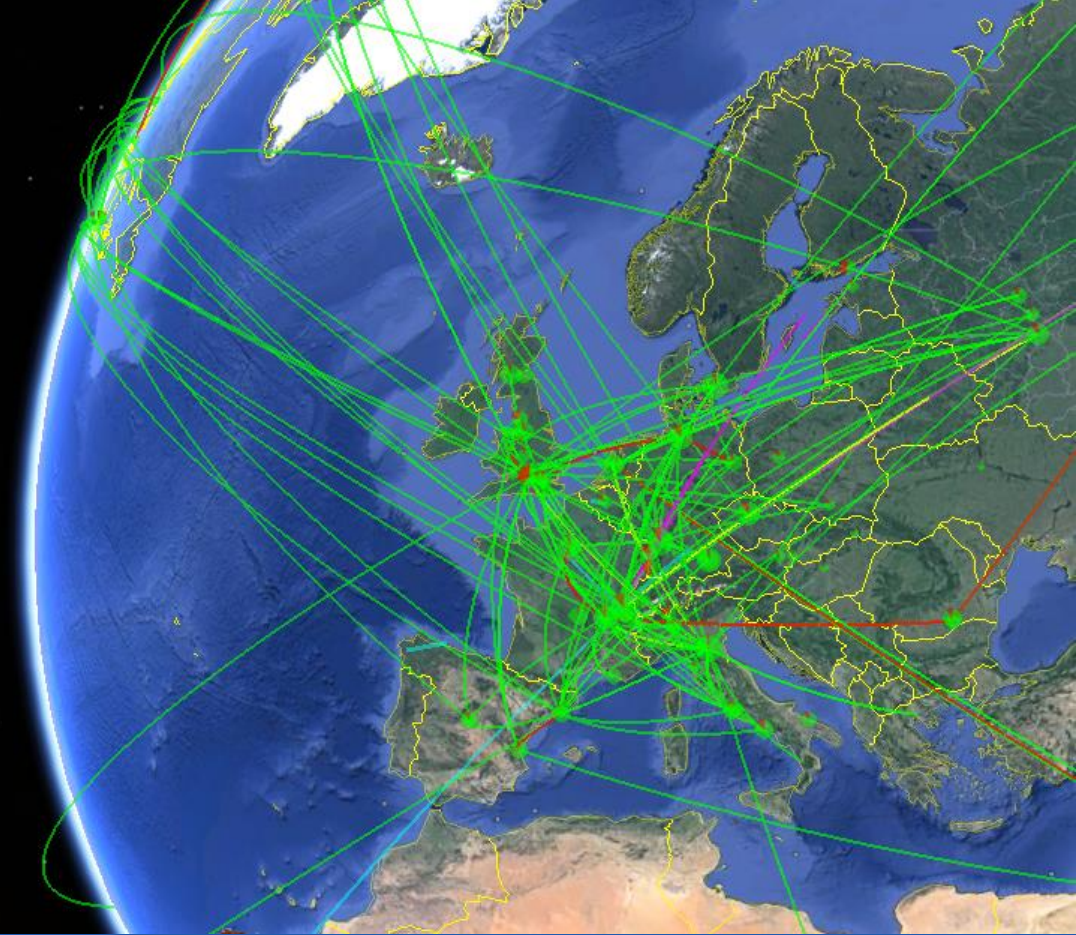
CMS





LHCb

The largest computing grid

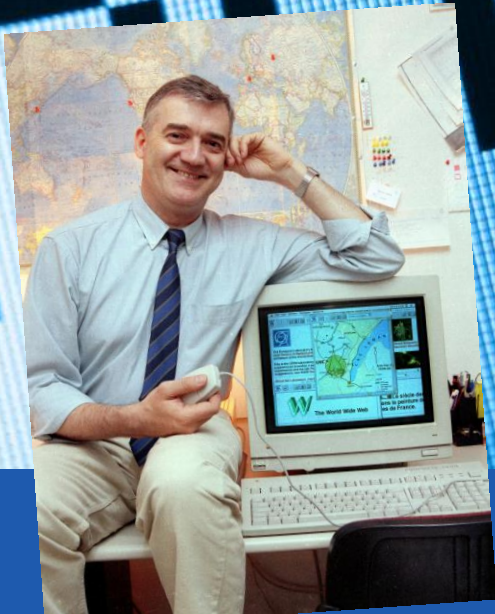


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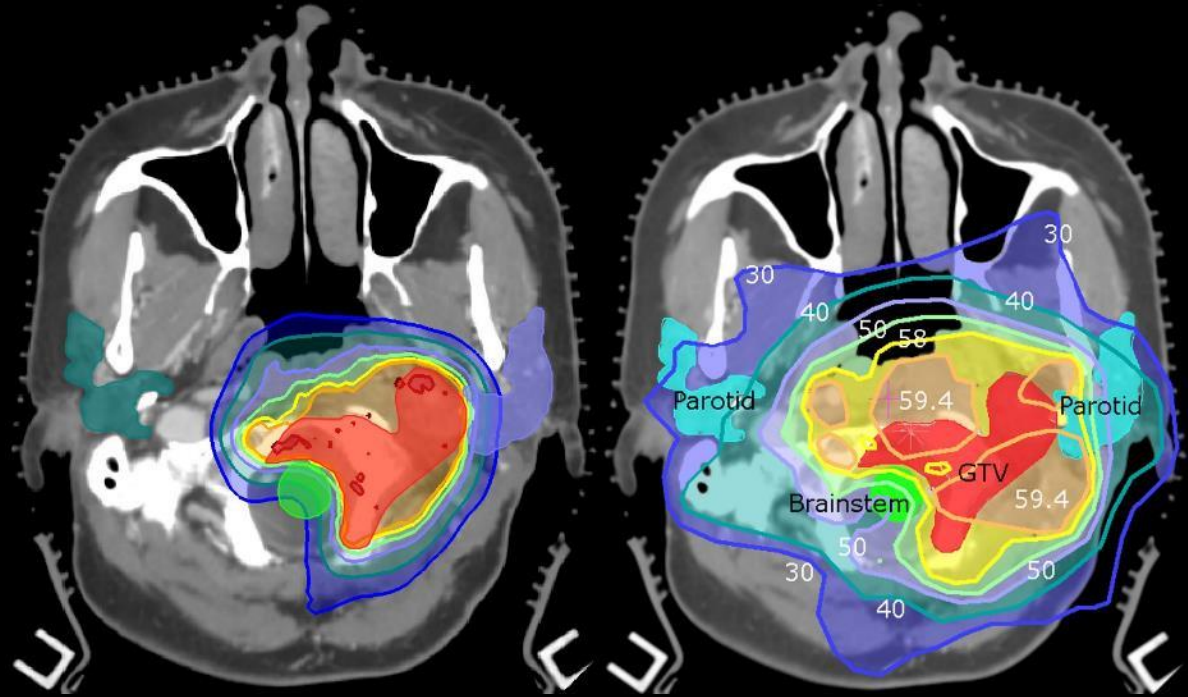
So what ?



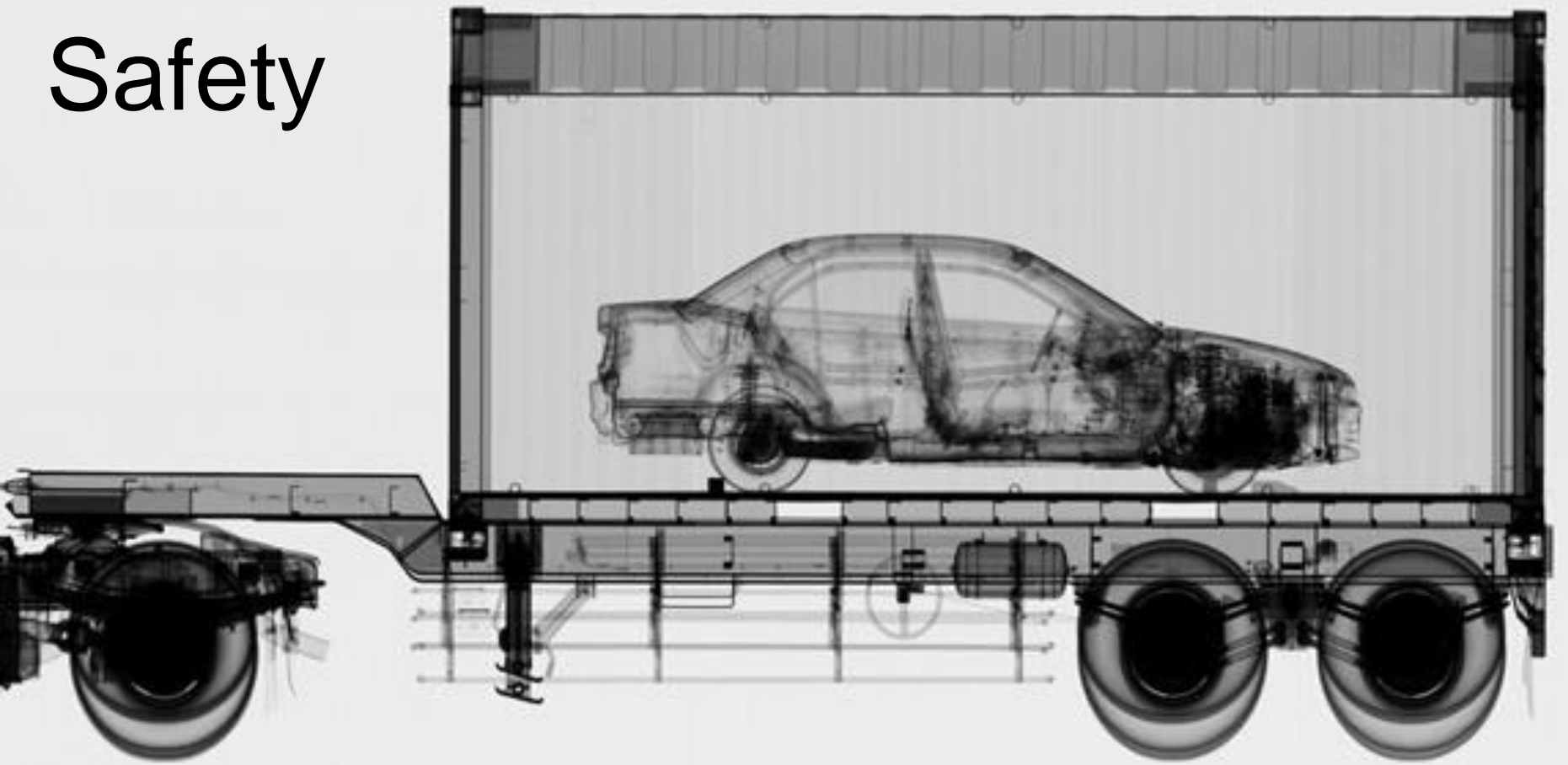
World Wide Web



Medical applications



Safety

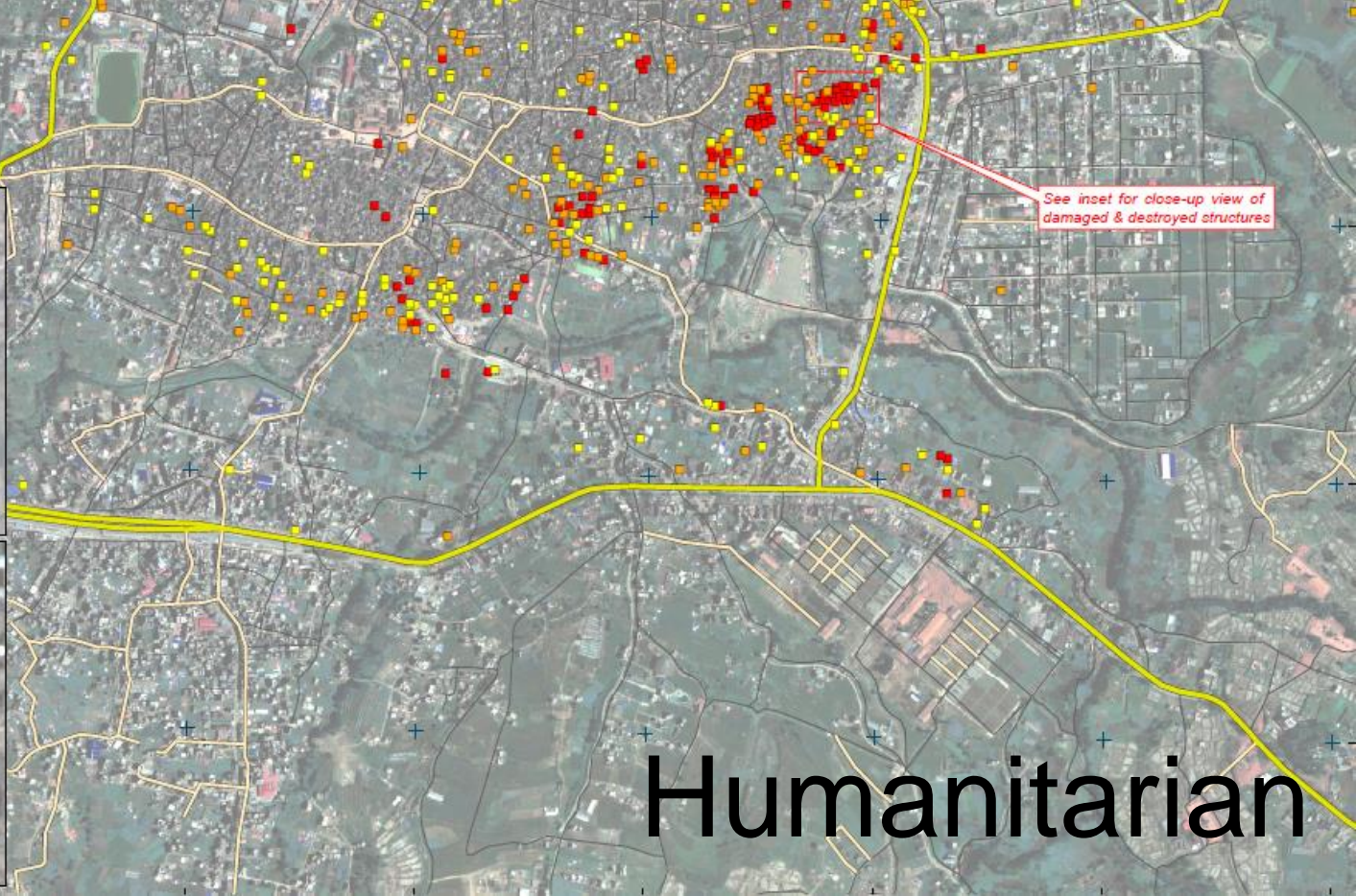


INSET: PRE-CRISIS



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

INSET: 27 APRIL 2015

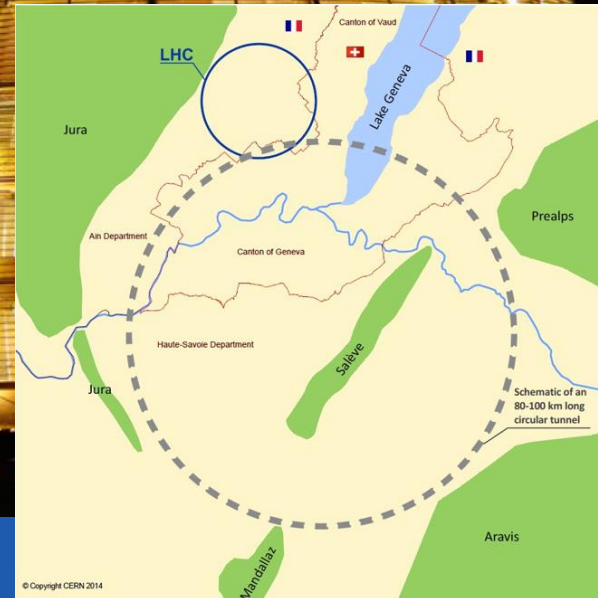
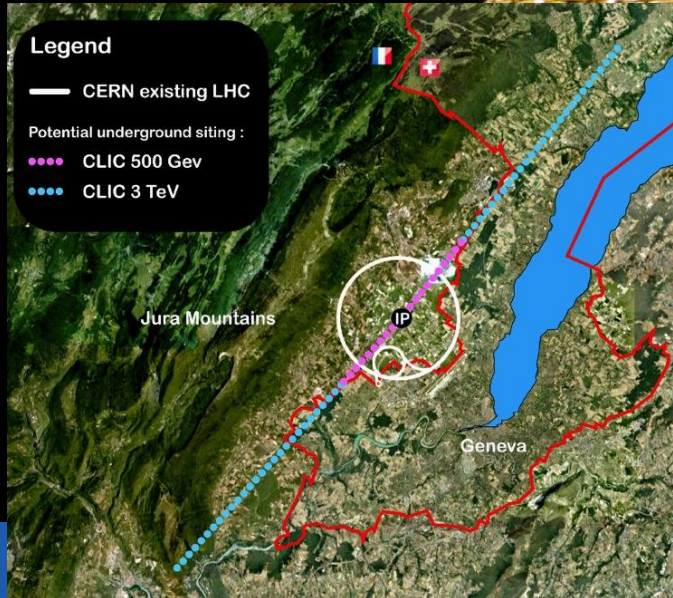


See inset for close-up view of
damaged & destroyed structures

Humanitarian

Future...?

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





www.cern.ch