Some facts about ALICE in 2 pages

(based on information by Jurgen for Open Days 2004, updated)

Collaboration

- almost 2000 collaborators from 175 Institutes in 40 countries
- Largest contribution (institutes/members): Italy, Germany, France, CERN group

Size

16 m high, 26 m long, total weight 10,000 tons (heavier than the Eiffel tower, which is about 7300 tons. Larger than CMS and heavier than ATLAS (but CMS is heavier, ATLAS is larger).

Cost

- total material cost: two hundred Million Euros
- remark on total cost: distributed over 10 years and 1000 participants, cost per physicist per year comparable to other experimental natural sciences (i.e. these experiments are expensive, but pooling of resources and given the time-profile, they are not more expensive than in other disciplines)

Life cycle of the ALICE experiment

- started ALICE around 1990. Major milestones:

1990- 1994: First 3-4 years spent on conceptual design and optimisation and getting a collaboration/funding together
1993 – submission of Letter of Intent
1994 - 2000: 6 years of R&D to develop new technologies 'at or beyond state-of-the art'
2000 - 2006: 6 years of construction
2006 – 2008: 2 years of assembling and installation
2009 to 2018:10 years of running (two years stop, 2013-2015, for the LHC energy upgrade)
age of the experiment today: 26 years
After LS2, data-taking until ~ 2035 (LHC current schedule) => > 40 years life of ALICE !!

Detectors (run1 and run2)

- 19 different detector systems

(Below some are mentioned, the list is not complete!)

Tracking
TPC : the biggest TPC in the world; heart of ALICE (together with ITS)
5 m diameter, 5 m length, gas volume 90 m3; 600 000 channels

ITS : 9.8 million channels (pixel); 33 120 channels (drift) 2.7 million channels (strip)
smallest: pixel cells, 50 micron (1/2 human hair) x 500 micron

Particle Identification detectors:
TRD 715 m2, 1.2 million channels (largest ALICE system: TRD chambers some 600 m**2)
TOF 160 m2 surface, 1638 MRPC, ~ 160 000 channels
HMPID : proximity Cherenkov

Calorimeters
PHOS 17290 PbWO4 crystals
EMCAL lead-scintillator sandwich; the heaviest ALICE detector: ~200 tons
furthest away from the vertex: ZDC's (ca 100 m in the tunnel)

Upgrade during LS2

TPC; MWPC for TPC readout replaced by GEMs (Gas Electron Multipliers)
ITS replaced by new ITS with 7 layers, smaller diameter beam-pipe, all pixels (billions of channels); monolithic silicon technology (sensor + readout on the same Si wafer)
MFT : Muon Forward Tracker, silicon tracker same technology as new ITS, added before gaseous chambers of muon spectrometer
FIT : new forward detector replaces T0, V0 etc

Total power consumption

about 10 Mega Watt
- each of the two magnets (L3, muon Dipole) has about 4 megawatt, rest in electronics
- a typical household uses on average 1 kW (10,000 kWh/year), i.e. 10 MW corresponds to a small city of 10,000 households !
Total power consumption of CERN : 200 MegaWatt, equivalent to the consumption of Canton de Geneve (0.5 million population)

Magnetic field
L3 solenoid 0.5 Tesla (5000 Gauss); muon dipole 0.7 Tesla (7000 Gauss). Earth field: 0.5 Gauss (L3 10 000 higher intensity than terrestrial magnetic field)
(LHC magnets 8.3 Tesla, superconducting)

Some numbers from the DAQ
During Run2, (2015-2018) 4-6 PB/year were recorded (proton run); 5 PB from the PbPb run of 2018

Spin off from ALICE research
- several new detectors 'invented' which are used in other (also non-CERN) experiments, eg TOF, HMPID, PHOS, pixels, Altro-chip, ..
- medical application of pixel detectors and PBW04 (PHOS) crystals,
- IT applications (the GRID),
- know-how transfer to industry (eg Altro chip, MANAS chip in India, micro-cables for silicon chips),
- several patents

Physics of ALICE (simplified)
(please consult our various ALICE leaflets / web pages for more information)

- study the 'primordial' matter that made up the universe shortly (1/millionth of a second) after the big bang
- QGP: transition from 'elementary' (pointlike) particles to the 'matter' of composite particles (protons-neutrons) which make up the nuclei of the visible Universe (stars,planets,people)
- melt matter (Pb-nuclei) by heating them up to 100,000 times the Temperature of the sun's interior (sun core temperature: 15 Million Kelvin)
- energy released in one collision is tiny: corresponding to 2 mosquito's colliding (a drop of 1 g from 2 cm). But very concentrated (to the size of a single Pb nucleus). By the time the matter reaches a tiny fraction of an atom's size, it has already cooled down and converted to normal 'ordinary' matter.
- There are many particles in each beam, the stored energy corresponds to a full Jumbo jet (400 tons) at 154 km/hour.
- Challenge: Reconstruct what happened from the 'ashes'
- number of particles created in a central Pb-Pb collision: about 40,000
- number of collisions per second: up to 10 000 Pb-Pb, 600 million in proton -proton
- could this potentially be dangerous ? No, the same thing is happening frequently when a high energy cosmic ray hits the earth (or the moon).
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