ATLAS and ALICE in Slovak LHC Grid

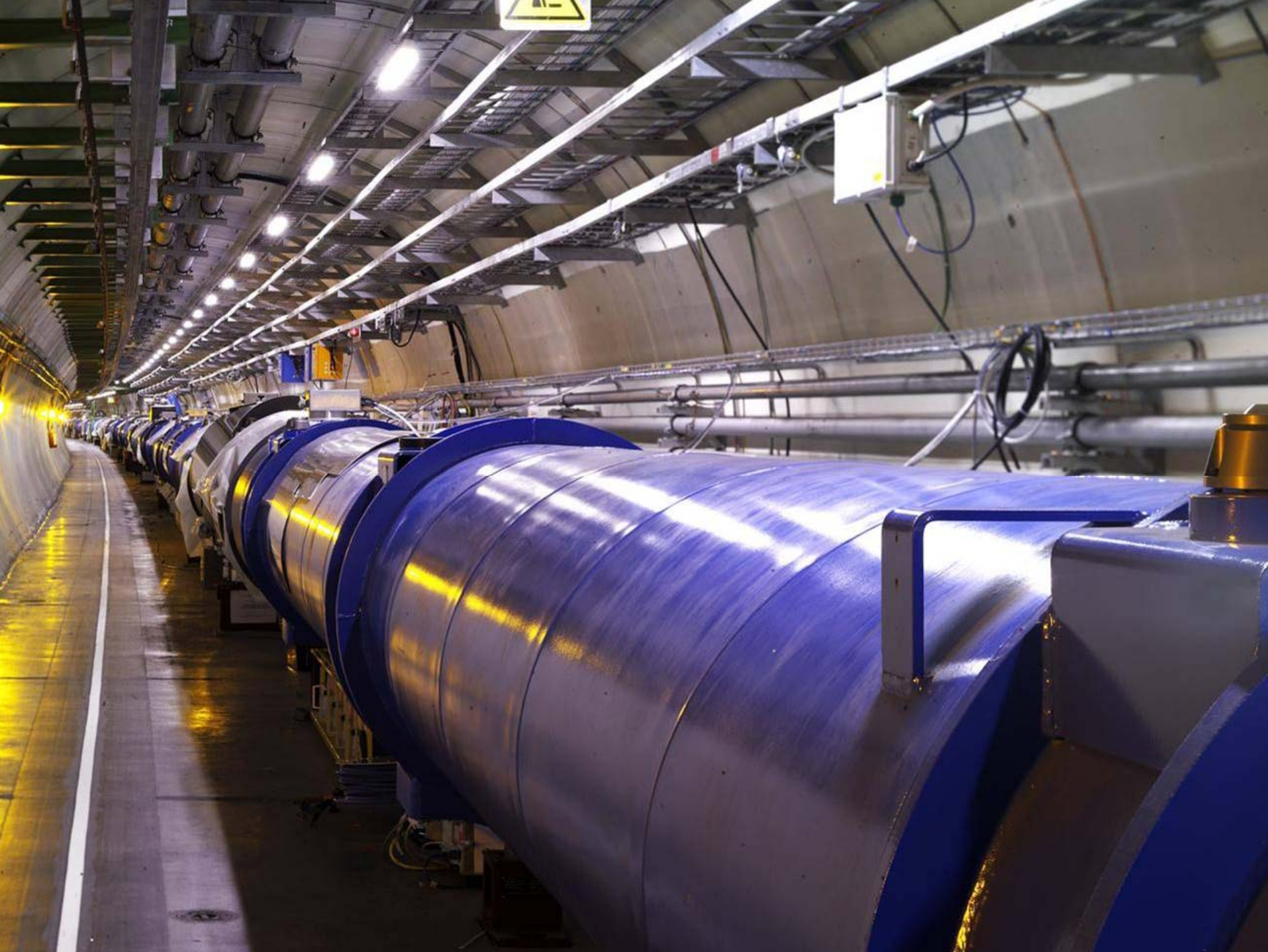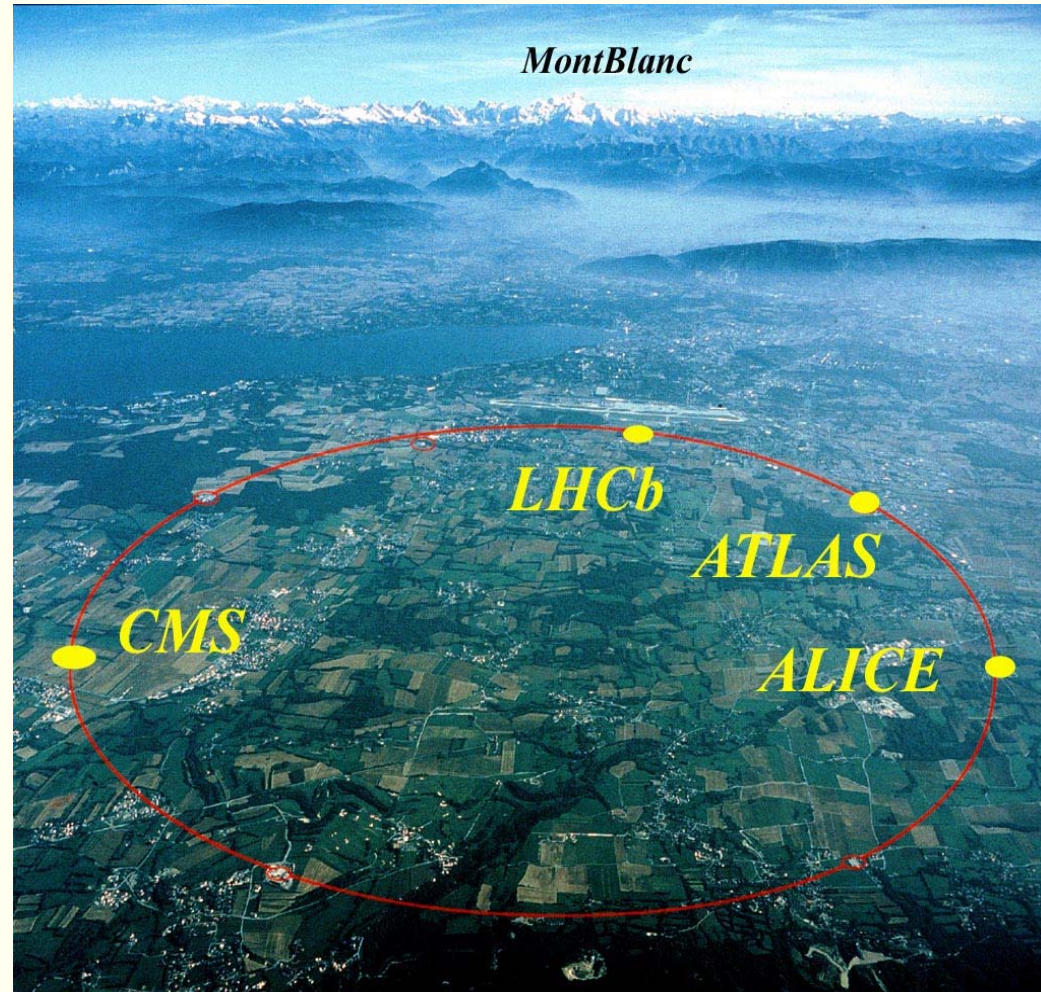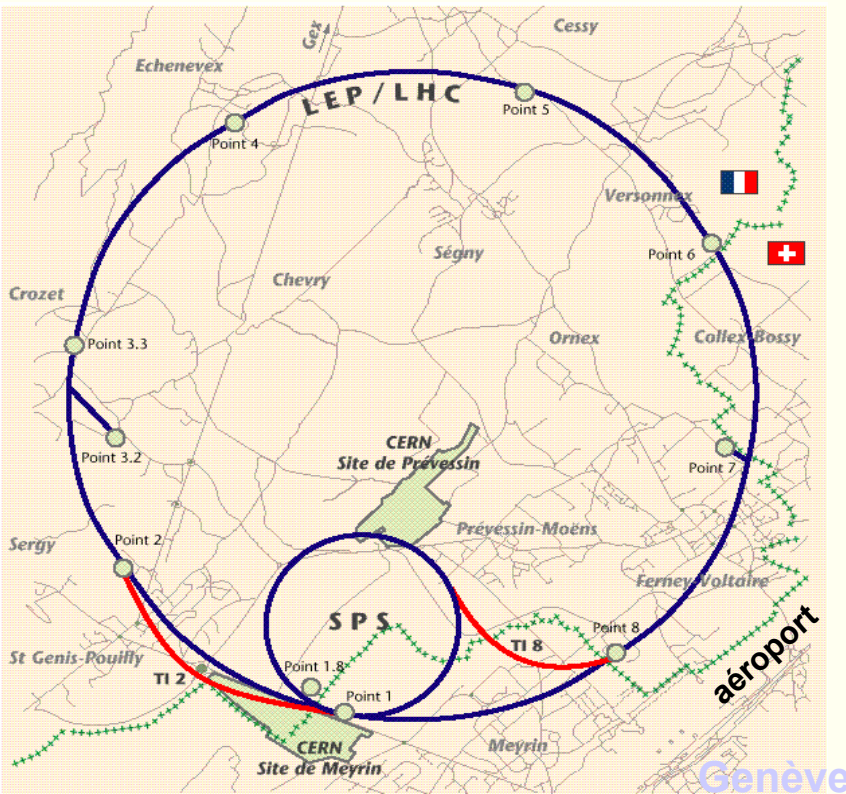Marian Babík, Bratislava 12.3.2008

ATLAS and ALICE on Grid

- ATLAS a ALICE are elementary particle detectors, which are going to operate on the world biggest collider LHC in CERN (Switzerland)

- Both devices are beeing built by big international collaborations (ATLAS more than 150 institutions, more than 1300 scientists, ALICE – more than 90 institutions, more than 1000 scientists from 30 countries)

- The Slovak participants are FMPI UK, PF UPJŠ, IP SAS, IEP SAS. (ATLAS – 20, ALICE – 25 people)

- There are a lot of computing activities already running (simulations, data acquisition and analysis software development) and because of international nature of collaborations, the computing is distributed from the very beginning. The series of so called "Data challenge", are running now, where the software components are tested in the increased complexity.

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LHC – the Large Hadron Collider at CERN, Geneva

http://lhc.web.cern.ch/lhc/

Aerial view with location of experiments

3.8 m diameter circular tunnel circumference of ring – 27 km buried 50 to 175 m underground

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LHC experiments

Colliding of two counter rotating proton or heavy-ion beams

Energy of protons – up to 7 TeV per beam. Available energy in p-p reaction is
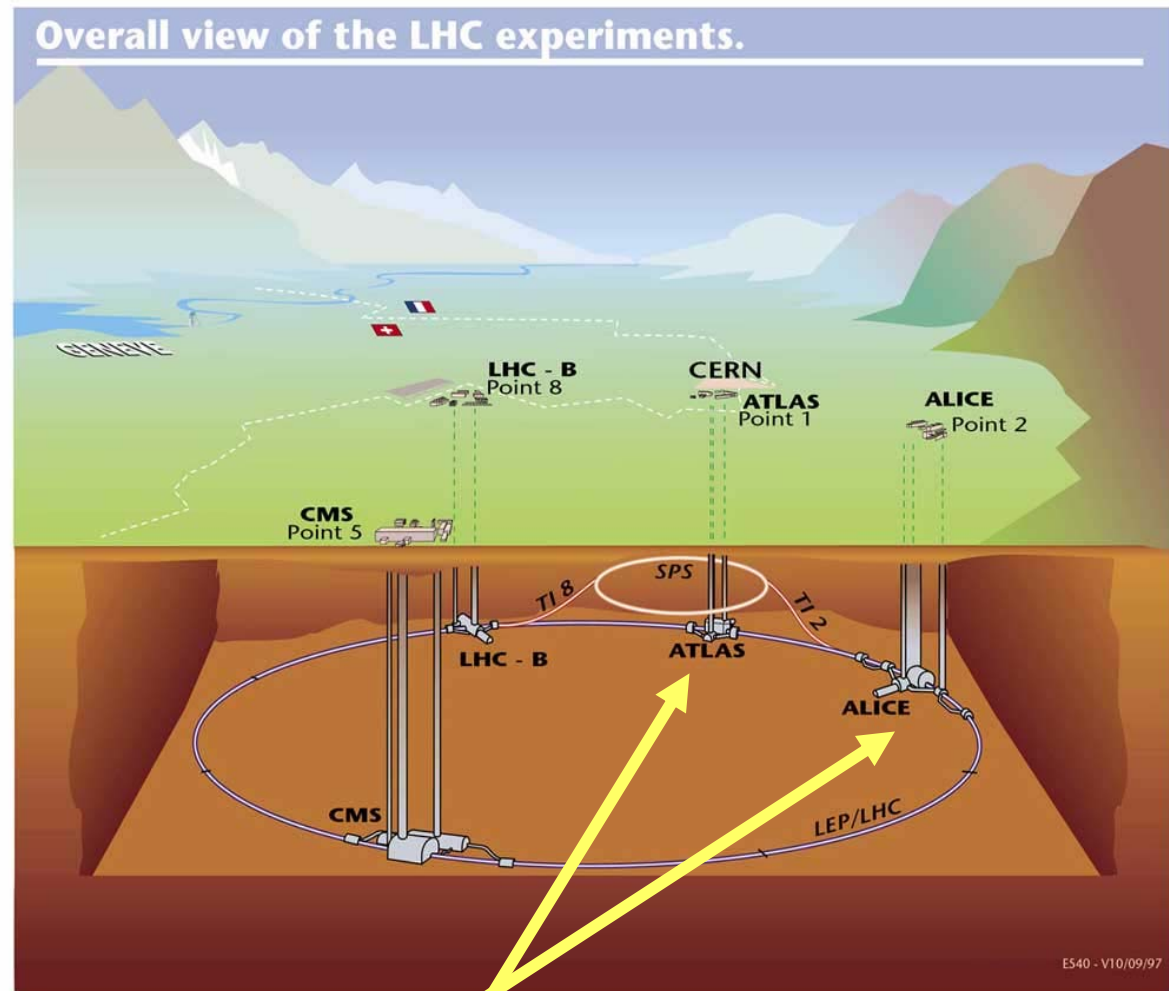
$$\sqrt{s} = 14 \text{ TeV}$$

(7 x higher wrt Tevatron).

For lead ion (Pb-Pb) collisions energy for pair of nucleons is
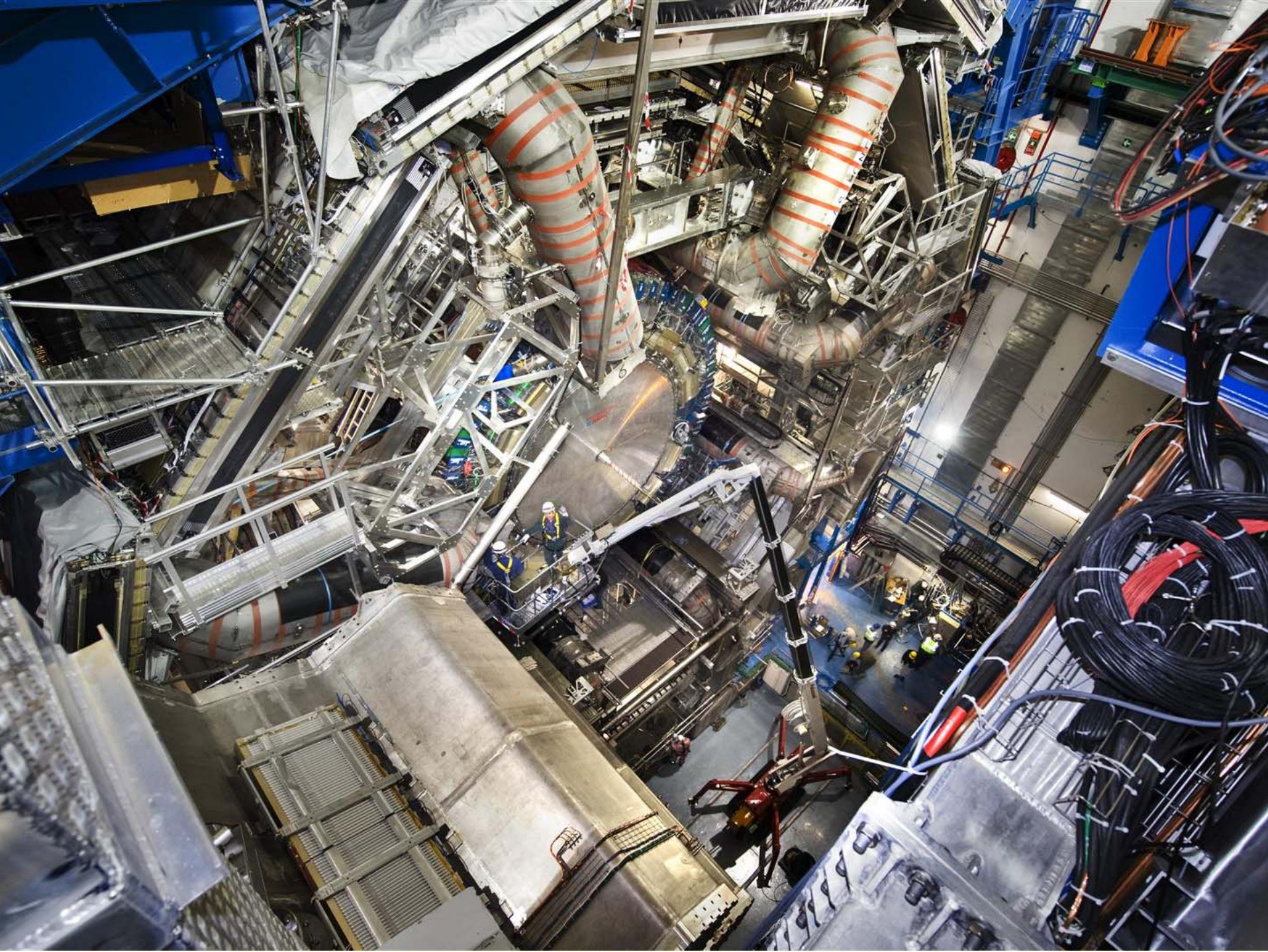
$$\sqrt{s_{NN}} = 5.5 \text{ TeV}$$

(~30 x higher wrt RHIC)

Start of LHC operation :
summer 2008,
ion beams - 2009

Overall view of the LHC experiments.

Slovak participation

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ATLAS and ALICE on Grid

- ATLAS

- is a "general purpose" detector, for studying the basic questions of high energy physics as the mass origin, processes which created the matter predominance over antimatter in the Universe, possible signatures of Supersymmetry or other "new" physics, maybe also micro black holes production
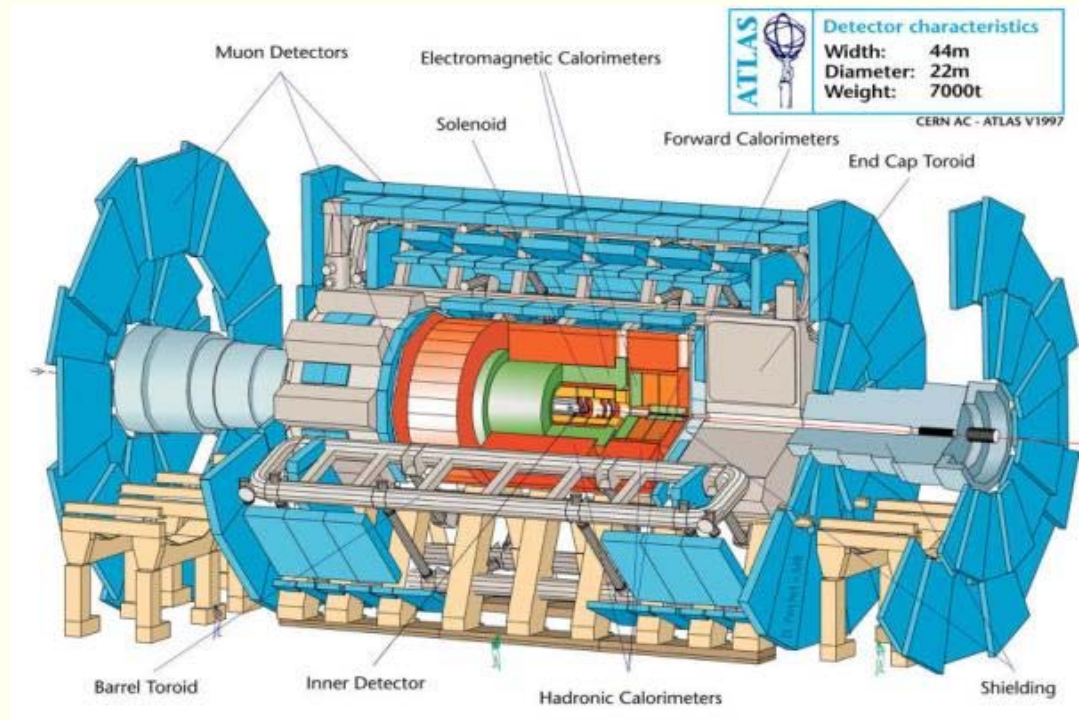
- contains various subdetectors of different technologies (semi-conductors, gas detectors, liquid argon, scintillators,...), which have an extremely big number of readout-channels (only one LAr calorimeter more than 300 000), and produces events in frequency 160 Hz

- all measured (and also simulated) data are entering the reconstruction-calibration-selection-analysis cycle

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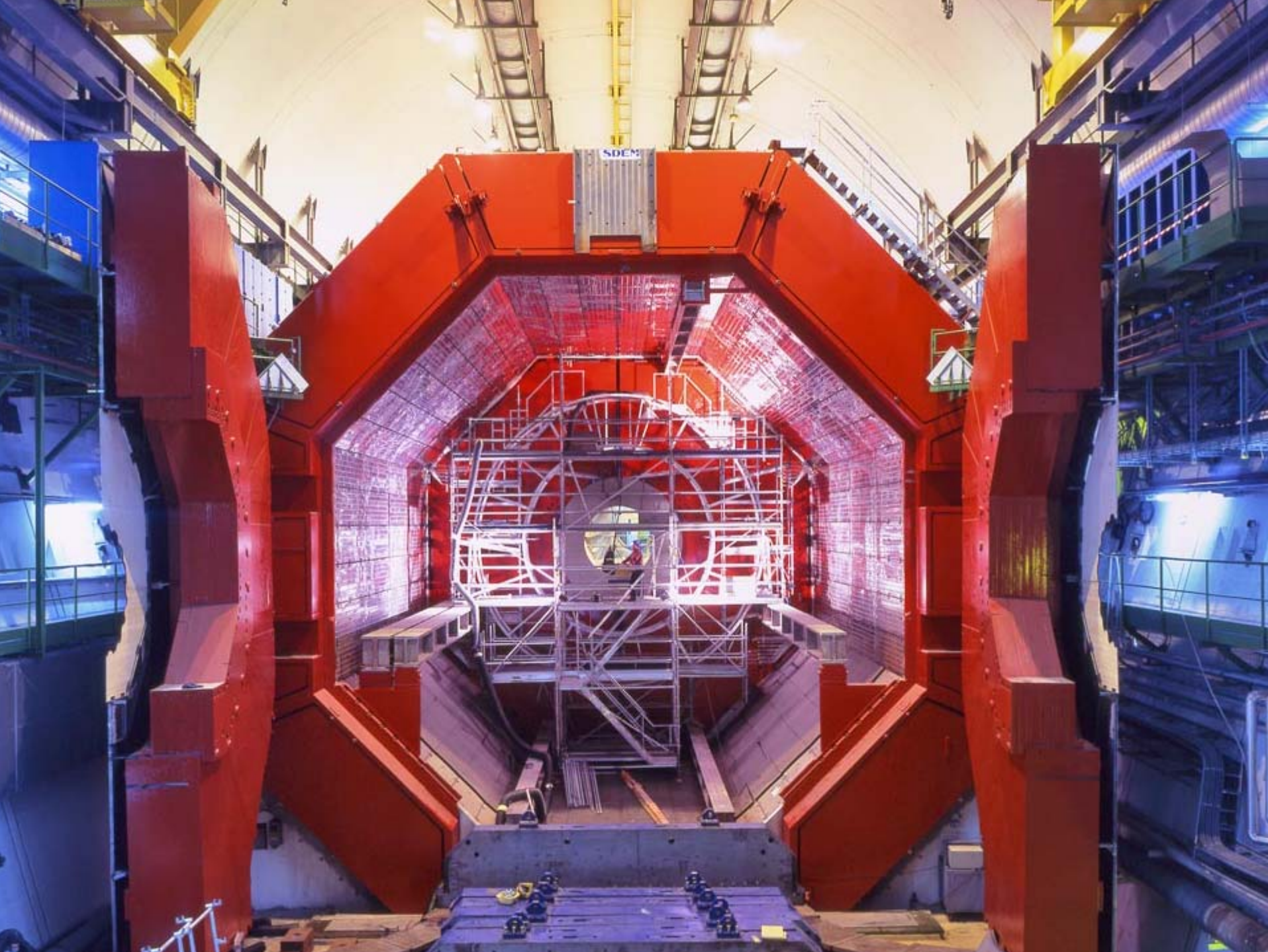
ATLAS and ALICE on Grid

- ALICE

- is a detector dedicated to heavy ion physics, study the physics of strong interactions,under extrem conditions: high energy densities, pressure, when the new state of matter – quark-gluon plasma (QGP) should appear. These questions are principal for the understanding of details in theory of strong interactions (QCD) with the consequences in other fields – cosmology, astrophysics also

- complex system of subdetectors, which allows simultaneous study of different QGP signatures, which are seen in the properties of hadrons, electrons, muons, photons and strange particles produced in heavy ions collisions. It contains more than 15 mil. detector elements

- apart of heavy ion collisions (Pb-Pb), it will study also proton-proton (p-p) and proton-nucleus interactions

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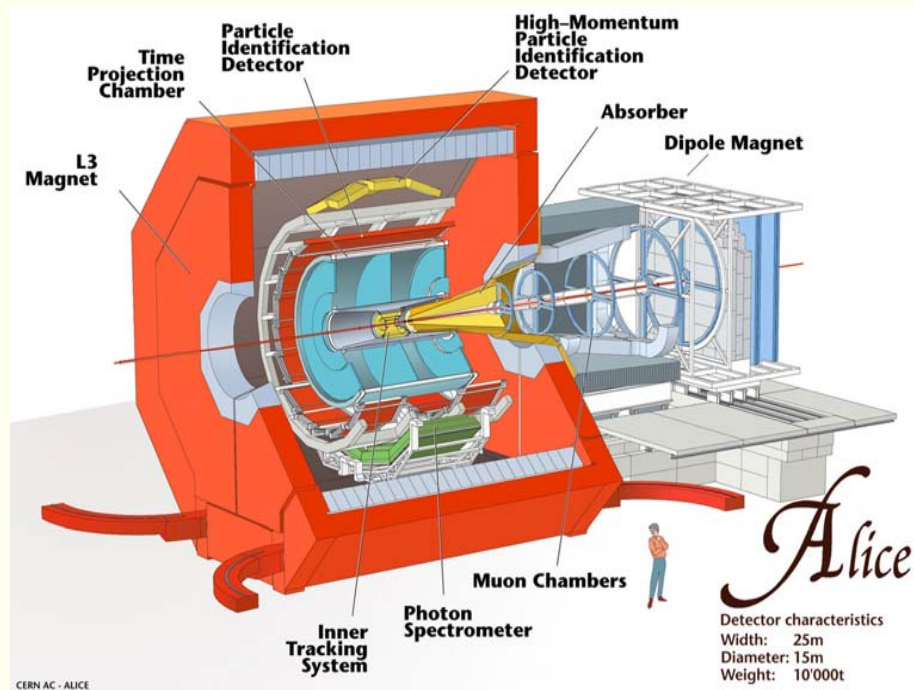
TPC IROC production in Bratislava

Bratislava TPC group produced 26 IROC (inner read-out chambers) of excellent quality

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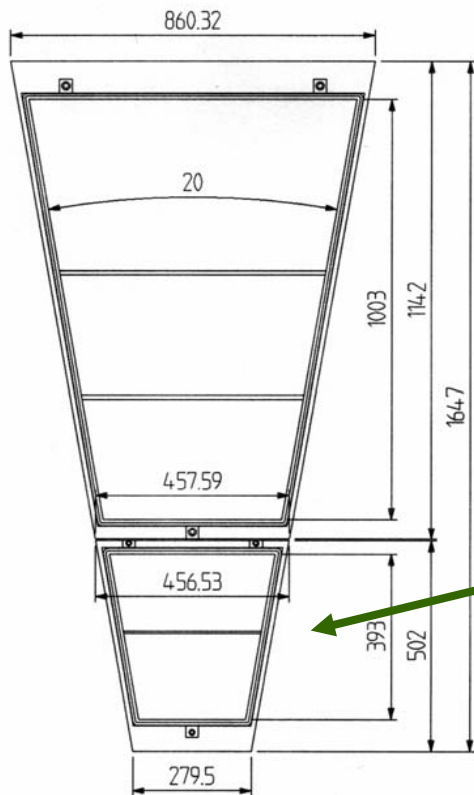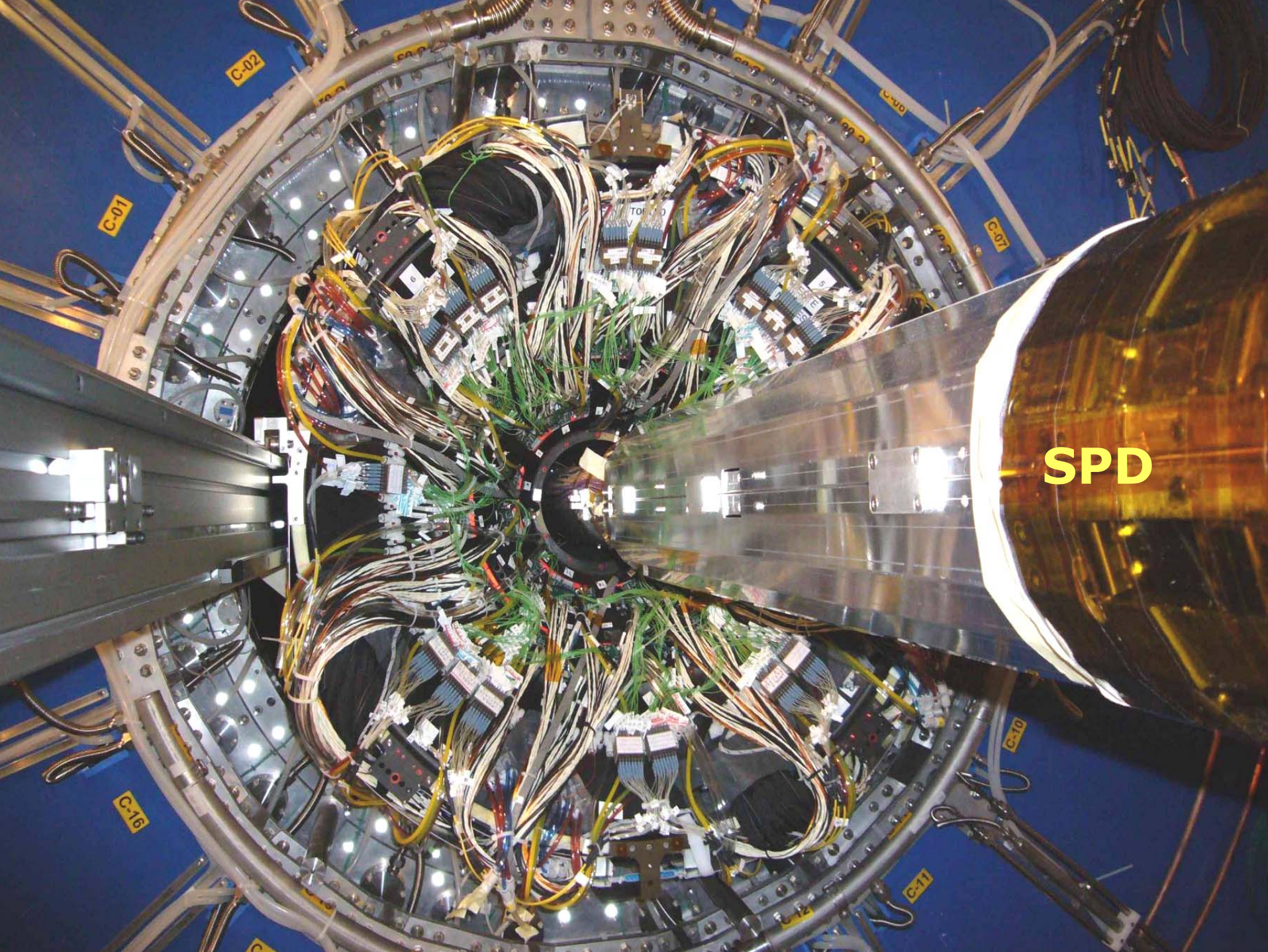
ATLAS and ALICE on Grid

Expected data flow during first two years of experiments:

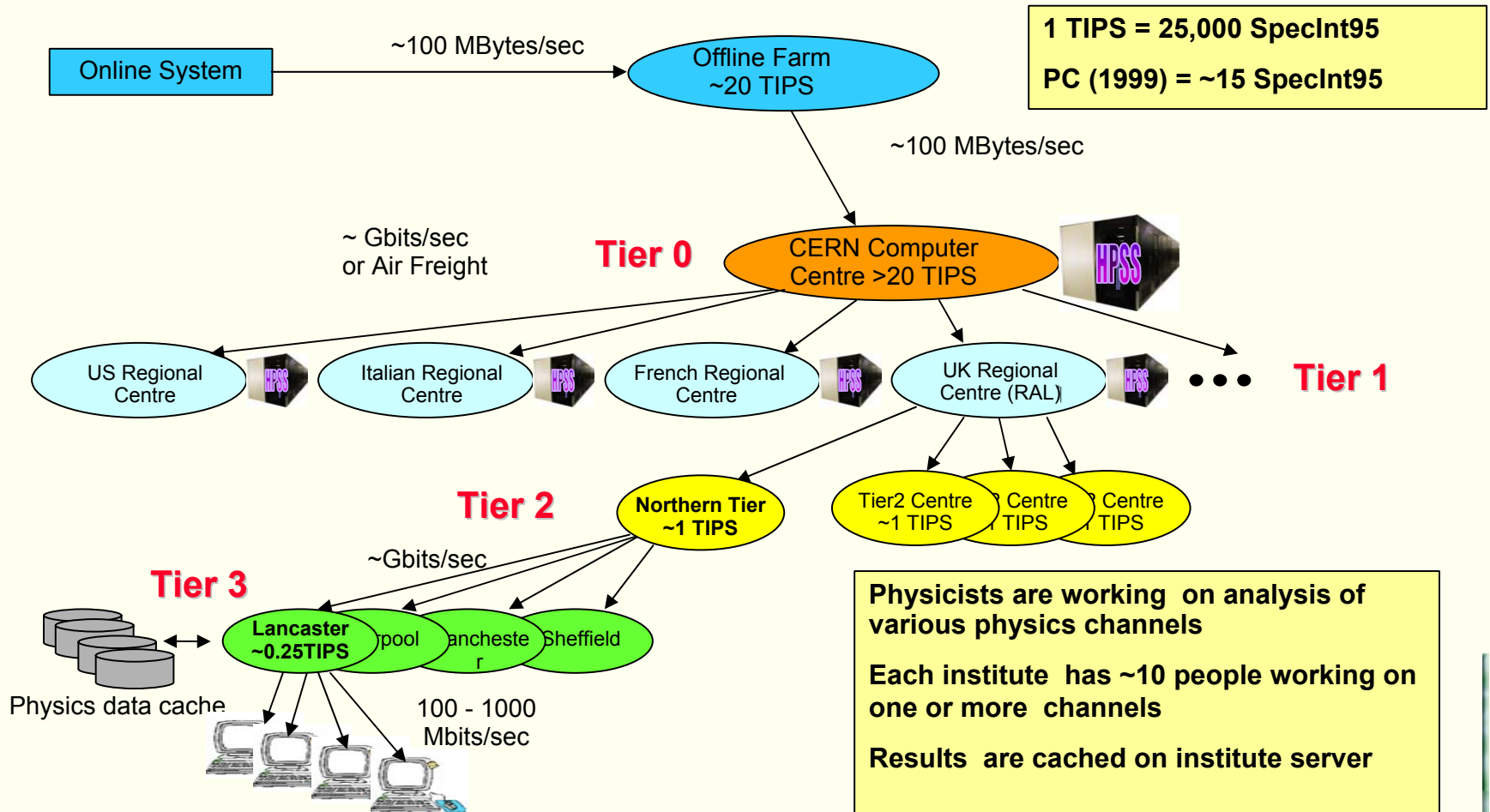|	ATLAS	ALICE
Event frequency	140 Hz	30 Hz (100 Hz in p-p)
Event size	1.6 MB	86.5 MB (2.5 MB in p-p)
Number of stored ev.	$0.8*10^9$/year	$1*10^9$/year
Number of simul. ev.	$10*10^9$/year	$0.5*10^9$/year
Reconstr. time	0.64 kSI95 s/ev	300. kSI2K s/ev
Simulation time	3.00 kSI95 s/ev	20. MSI2K s/ev (at most)

Total:

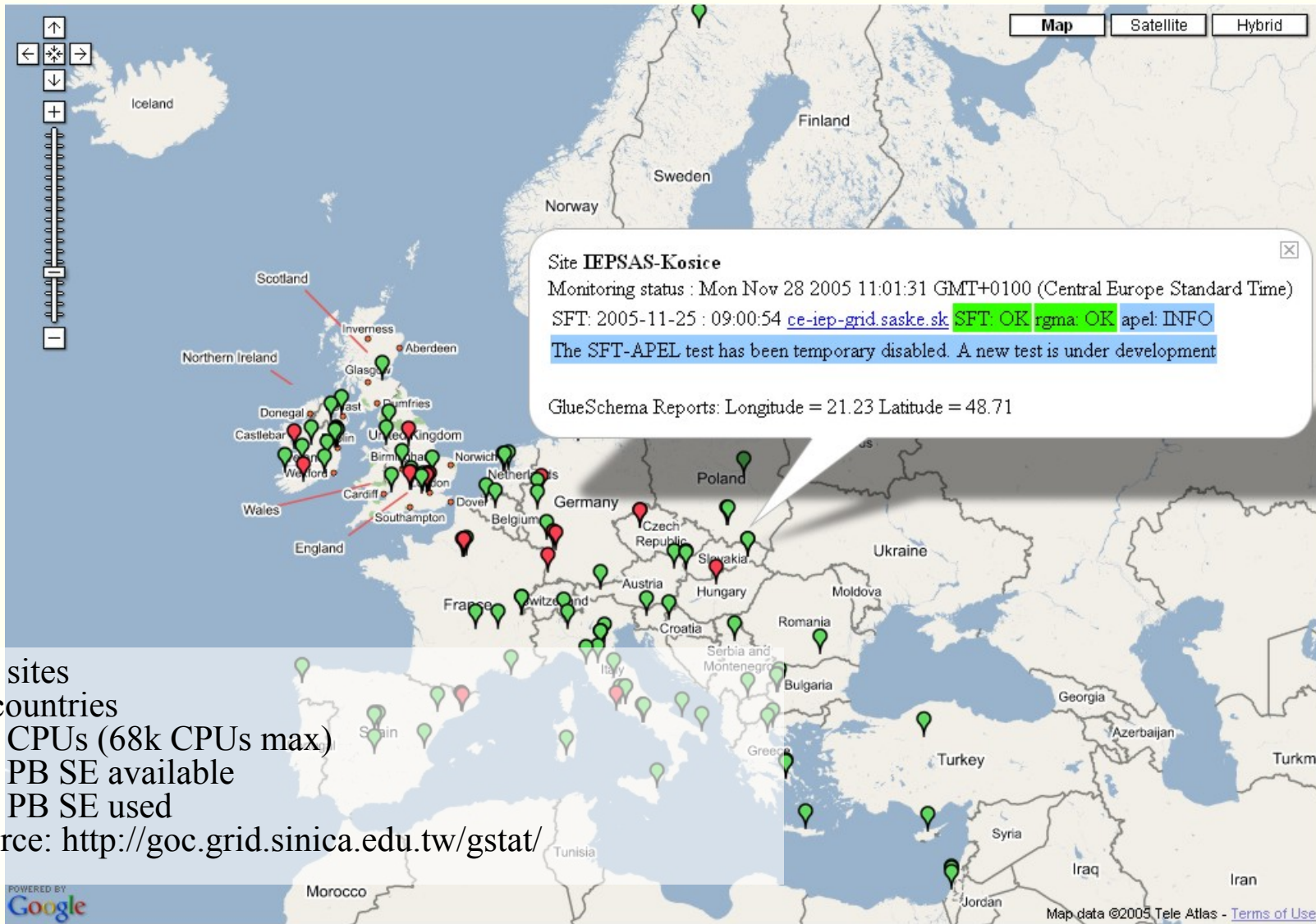|	ATLAS	ALICE
Data storage	43 PB/year	10.2 PB/year
CPU	64.8 MSI2K	30.4 MSI2K

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ATLAS and ALICE on Grid

- Software frameworks could run standalone, but in the same time they have interface and possibility to use grid components (GLOBUS, EGEE).

- Both were used in testing of different grid testbeds, and it is planed to use the grid technologies, when available and more stable.

- Both experiments started to use part of the Slovak budget assigned to them for two farms (Bratislava-Košice), where the LCG/EGEE software + experiment specific software will be installed, with the aim slowly converge to "standard Tier-2" grid center (the precise definition of it is not know at the moment, it will evolve with the finalization of the experiments Computing Models), where our tasks could be solved

- The goal is to have 100 CPU and 35-55 TB disk storage in both farms at 2009 (according project included in the report 25449/2004 discussed by the government). We try to be able to be part of the official computing core of the experiments, which will decrease the necessity of direct payments

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ATLAS and ALICE on Grid

- LHC Computing model (example of structure for UK):

1 TIPS = 25,000 SpecInt95

PC (1999) = ~15 SpecInt95

Online System → ~100 MBytes/sec → Offline Farm ~20 TIPS

~100 MBytes/sec

Tier 0 — CERN Computer Centre >20 TIPS — HPSS

~ Gbits/sec or Air Freight

Tier 1 — US Regional Centre (HPSS) · Italian Regional Centre (HPSS) · French Regional Centre (HPSS) · UK Regional Centre (RAL) (HPSS) · · ·

Tier 2 — Northern Tier ~1 TIPS · Tier2 Centre ~1 TIPS · Centre TIPS · Centre TIPS

~Gbits/sec

Tier 3 — Lancaster ~0.25TIPS · erpool · anchester · Sheffield

Physics data cache

100 - 1000 Mbits/sec

Physicists are working on analysis of various physics channels

Each institute has ~10 people working on one or more channels

Results are cached on institute server

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249 sites
50 countries
47k CPUs (68k CPUs max)
289 PB SE available
141 PB SE used
Source: http://goc.grid.sinica.edu.tw/gstat/

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FMPHi-UNIBA site

Site **FMPhI-UNIBA**
Monitoring status : Mon Nov 28 2005 11:01:31 GMT+0100 (Central Europe Standard
SFT: 2005-11-25 : 09:00:53 lcgrid.dnp.fmph.uniba.sk SFT: OK rgma: OK apel:
The SFT-APEL test has been temporary disabled. A new test is under development

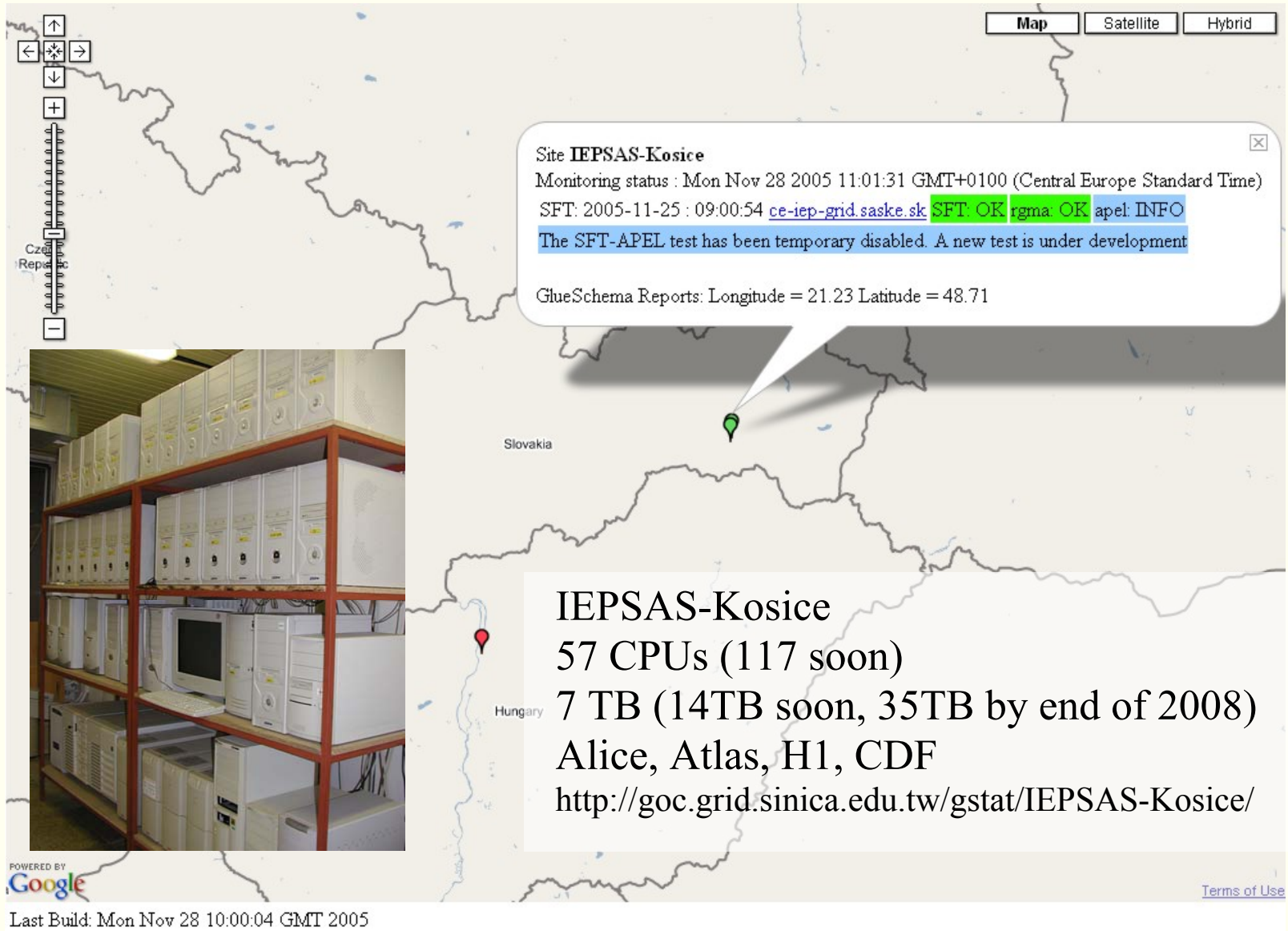GlueSchema Reports: Longitude = 17.0712 Latitude = 48.1528

Slovakia

POWERED BY
Google

Last Build: Mon Nov 28 10:00:04 GMT 2005

FMPhI-UNIBA
42 CPU
2 TB
Alice, Atlas
http://goc.grid.sinica.edu.tw/gstat/FMPhI-Bratislava/

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IEPSAS-Kosice site

IEPSAS-Kosice
57 CPUs (117 soon)
7 TB (14TB soon, 35TB by end of 2008)
Alice, Atlas, H1, CDF
http://goc.grid.sinica.edu.tw/gstat/IEPSAS-Kosice/

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ATLAS and ALICE on Grid

- Expected Slovak contribution - Tier-2 (participation on core computing + home physics activities according current definitions of Tiers):

	ATLAS	ALICE
Contrib.:		
Slovak particip. in exp.	0.5 %	1 %
CPU	320 kSI2K	450 kSI2K
Disk Data storage	160 TB	190 TB
Tape data storage	0 TB	0 TB
Network connectivity	~ 1 Gb/s	~ 1 Gb/s

Our activities (analysis of selected physics channels):

Number of jobs	20 / day	
Number AO ev. in job	10^6	
Processing time AO	2.5 SI95 s/ev	expected
CPU	0.6 kSI95	similarly as
Data storage	20 TB	ATLAS

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ATLAS and ALICE on Grid

- Current Slovak contribution – Alice Tier-2/Atlas Tier-3 (participation on core computing + home physics activities):

	ATLAS	ALICE
Contrib.:		
Slovak particip. in exp.	0.5 %	1 %
CPU	123(250) kSI2K	123(250) kSI2K
Disk Data storage	4(35) TB	4(35) TB
Tape data storage	0 TB	0 TB
Network connectivity	~ 1 Gb/s	~ 1 Gb/s

Last year (overall)

CPU Time	196k CPU hours
Number of jobs	63k/ year
CPU	248 kSI2K
Data storage	8 TB

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ATLAS and ALICE on Grid

- We will invest a substantial part of our time to the implementation and testing of the grid infrastructure being built

- We are, of course, open to collaborate with other institutions, and we could transfer our know-how, which will hopefully grow quickly, having in mind strong support from our collaborations.

- We hope to continue to get the support from Slovak grid experts in the II SAS, our experience is so far very positive

- Our priority is to keep interoperability with LCG/EGEE components and experiment specific software, to be able to fulfill the obligations in our collaborations.

- Building the grid farms for HEP in Slovakia will have also good impact to education, the students will be able to learn physics, and to do "real physics work" there

- Let me conclude, that the Grid computing is the only road for us in the future, and we are heavily interested in the building of Grid infrastructure in Slovakia

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