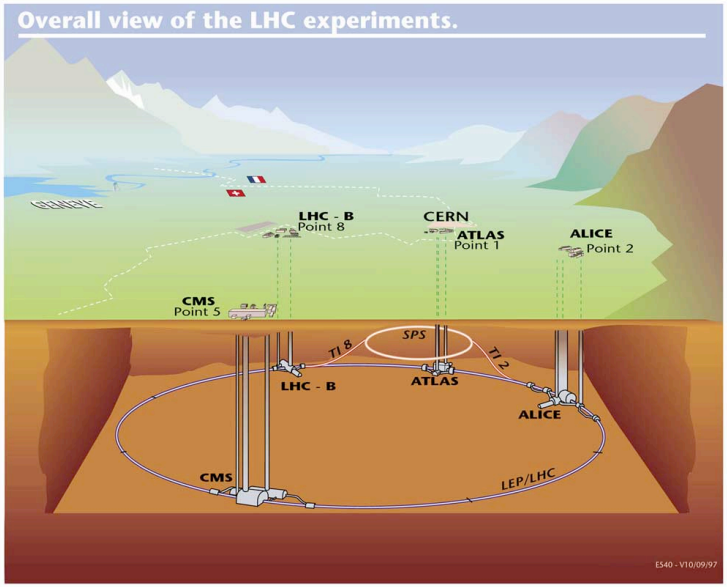
ATLAS on UBELIX

- exploring the fundamental laws of the universe with UniBe's resources.

The Large Hadron Collider (LHC)...



Proton-Proton collisions at 14 TeV will enable new tests of the Standard Model, the present model of elementary particles, and :

- Search for the origin of mass - Higgs particle.
- Search for dark matter - supersymmetry.
- Search for extra dimensions.
- Search for black holes.
- Search for the unexpected.
- ...

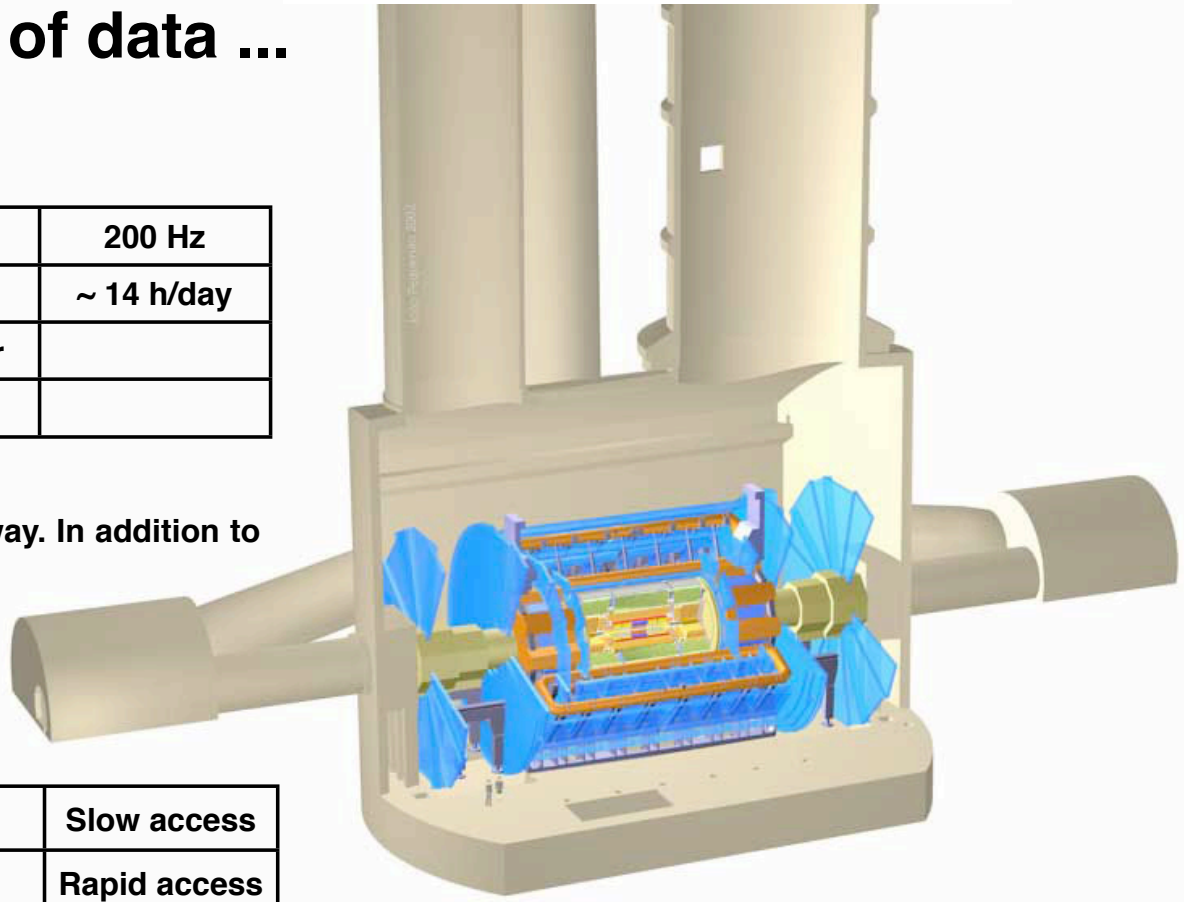
LHC and ATLAS will go autumn spring 2008. The energy density in the collisions will correspond to the density ~10^{-9} s after the Big Bang.

... and the ATLAS experiment ...

... produce a lot of data ...

Event Raw Data	1.6 MB	200 Hz
Operation Time	50 ks/day	~ 14 h/day
	200 days/yr	
Data per Year	3.2 PB	

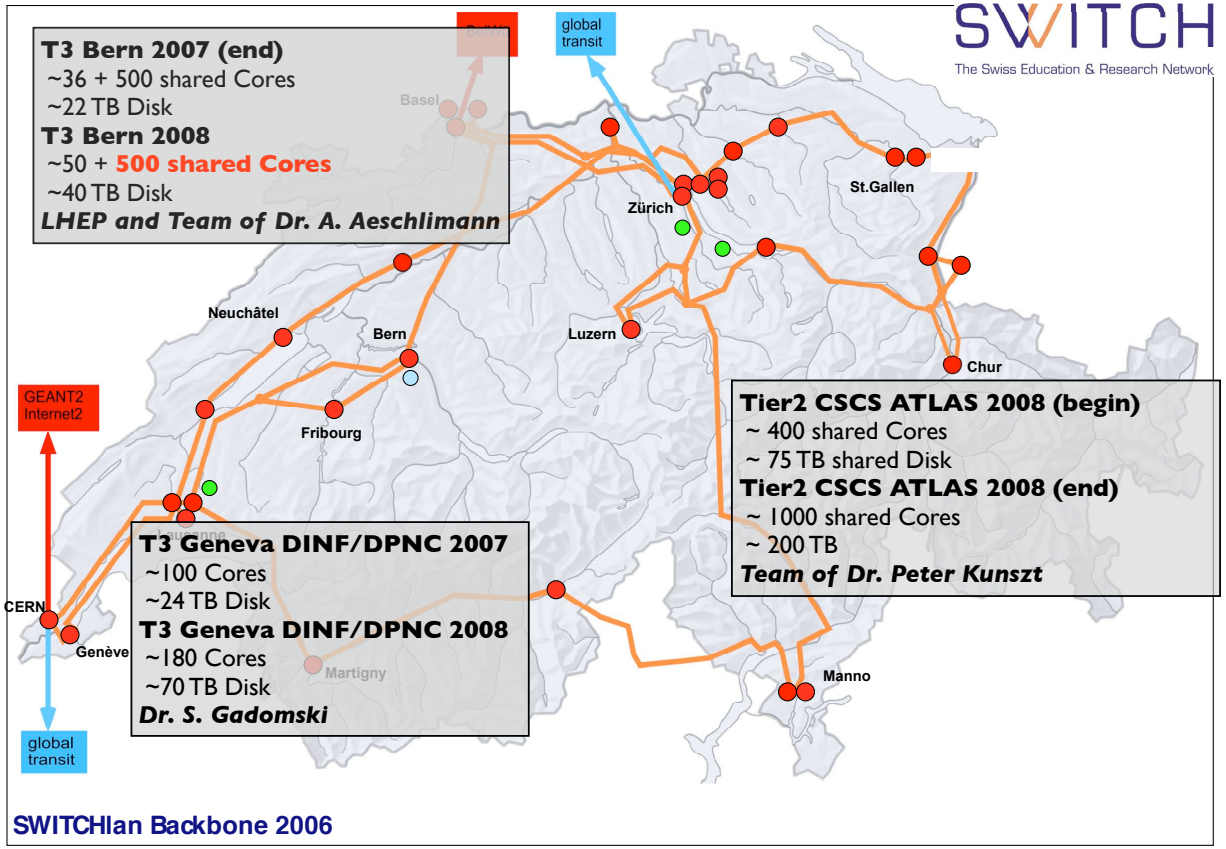
... ~10^9 Hz has to be thrown away. In addition to the 3.2 PB comes simulated data, copies etc ... which give rise to the 2008 computing needs ...



Tape	16.9 PB	Slow access
Disk	25.4 PB	Rapid access
CPU	50 MSI2k	~35 000 cores

... which requires resources.

Three Swiss sites are facilitating ...



... the Bern and Geneva ATLAS physicists.

UBELIX is a major ...

ATLAS Grid Monitor

2008-05-04 CEST 21:53:03

Processes: Grid Local

Country	Site	CPUs	Load (processes: Grid+local)	Queueing
Denmark	Benedict - Aalborg pr>	52	35+17	56+10
	Steno (DCSC/KU)	1656	81+394	217+0
Norway	EPF (UiO/FI)	20	3+7	14+0
	Hyperion (UiO/USIT)	221	88+122	14+45
	Norgrid@NTNU	39	0+17	0+0
	Titan A (UiO/USIT)	2068	480+969	2+0
Slovenia	SiGNET	322	322+0	113+0
Sweden	Grad (SweGrid, Uppmax)	448	0+0	3+1
	Hive (Swegrid, C3SE)	101	100+0	35+0
Switzerland	Bern ATLAS T3 Cluster	28	24+0	7+0
	Geneva ATLAS T3	152	32+117	53+81
	Manno PHOENIX T2	407	205+65	310+-190
TOTAL	*12 sites*	*5514*	*1370 + 1708*	*824 + -53*

www.nordugrid.org/monitor/atlas, UBELIX with its 500 cores is offline due to the important Lustre upgrade.

... resource for Swiss ATLAS physicists.

ATLAS usage and job patterns

ATLAS Wall time hours on UBELIX :

2006	2007	2008 as of April	2009	2010
62000	43000	45000	?	?

A heavy job :

- 1 Core
- 2 GB Memory
- Input : Tens of files, together a couple of GB.
- Output : Some files, together a couple of GB.
- Time : Less than 24 hours.

For the moment jobs are normally lighter. However, heavy jobs will become more usual. Having hundreds of jobs with some GB input and some GB output is not negligible for the infrastructure -> We are exited about the future performance of Lustre.

Summary

ATLAS and LHEP will do some fundamental discoveries and hopefully change the picture of the universe during the next years.

- **ATLAS and LHEP have large computing needs.**
- **The UBELIX is one of LHEP's main computing resources.**
- **LHEP doesn't want to operate this service, but concentrate on physics.**
- **The LHEP's UBELIX usage will increase.**

So we are grateful to the Informatik Dienste and the University for providing UBELIX.

The Bern ATLAS Group

Prof. A. Ereditato, Prof. Emeritus K. Pretzl, PD H. Beck, Dr. M. Weber, Dr. S. Haug, Dr. K. Kordas, A. Battaglia, C. Topfel, N. Venturi, M. D. Weber.

www.lhep.unibe.ch.

The ATLAS computing activity in Switzerland is organized in the working group *Swiss ATLAS Grid* of the *Swiss National Grid Association* (www.swing-grid.ch)

SwiNG
Swiss National Grid Association

To the left : The UBELIX cluster of the University of Bern in January 2008.

Back up slides follow ...

Why could black holes be produced at LHC ?

Theoretically very small black holes can be produced if the mass is larger than the fundamental Planck mass and the impact parameter is smaller than the Schwarzschild radius. This can be achieved with extra spatial dimensions :

- **Small extra dimensions only accessible for gravitation.**
- **At small distances gravity then becomes stronger.**
- **So also the radius of black holes.**
- **Since the probability of creating a black hole is proportional to the squared radius, it increases.**

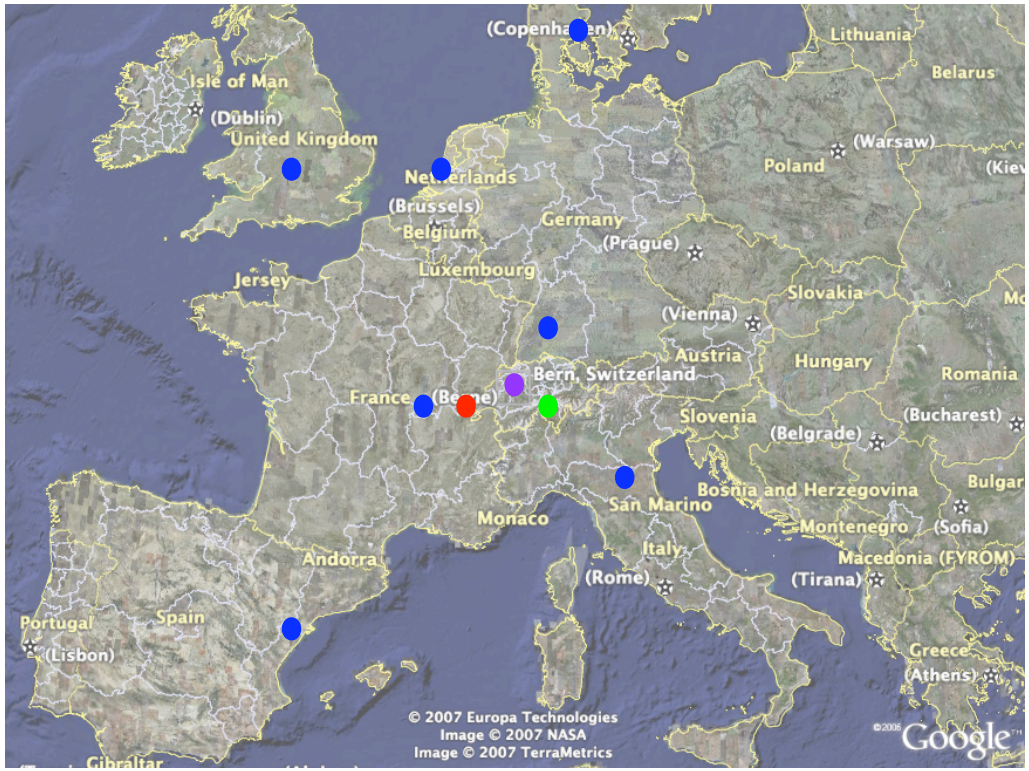
With certain geometries of the universe black holes will be produced at LHC. Things like that are simulated on UBELIX by ATLAS.

The assumed Large Hadron Collider (LHC) operational parameters

Energy	14 TeV	Two 7 TeV proton beams
Luminosity	10^{33} $cm^{-2}s^{-1}$	2008 Luminosity
	10^{34} $cm^{-2}s^{-1}$	2010 Design luminosity
Cross Section	100 mb = 10^{-25} cm^2	
Collision Rate	10^9 Hz	At design luminosity
ATLAS Trigger Rate	200 Hz	Luminosity independent

The ATLAS Computing Model

A distributed hierarchical network based on computing grids



- **Tier 0** - Only one at CERN.
- **Tier 1** - 10 centers
  - 0.1 Raw Data, Tapes, Disks, CPU.
  - Supranational or national computer centers normally with dedicated connections to Tier 0.
- **Tier 2** - Some per Tier 1
  - 0.3 AOD, Disks, CPU.
  - National or regional computer centers.
- **Tier 3** - Some per Tier 2
  - For local analysis activity.
  - Clusters owned by university research groups.
- **Tier 4** - Your laptop.

The Swiss ATLAS Grid Infrastructure in 2006

Cluster	WN Cores	Storage/TB	OS	Middleware
Bern ATLAS Cluster (T3)	36	10	SLC4/SuSE	ARC
Bern UBELIX Cluster (T3)	288 (shared)	-	Gentoo	ARC
Geneva (T3)	96	24	SLC3/SLC4	ARC
Manno Phoenix (T2)	30 (shared)	10 (shared)	SLC3	ARC/LCG
Sum	450	44		

- Heterogenous with respect to hardware, operating system, and middleware.
- This freedom due to the NorduGrid's "Advanced Resource Connector" (ARC) - www.nordugrid.org.
- On the outsourced Tier 2 cluster the LHC Computing Grid (LCG) middleware (no OS freedom) - lcg.web.cern.ch/LCG/.

The Swiss ATLAS Computing Prototype, CERN-ATL-COM-SOFT-2005-007.

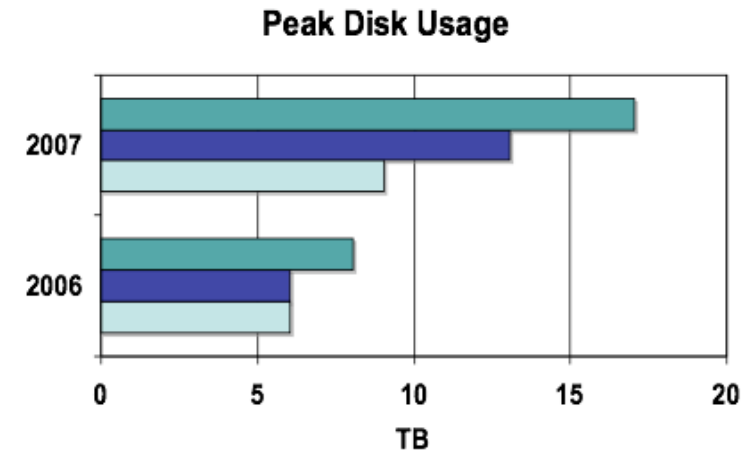
Usage

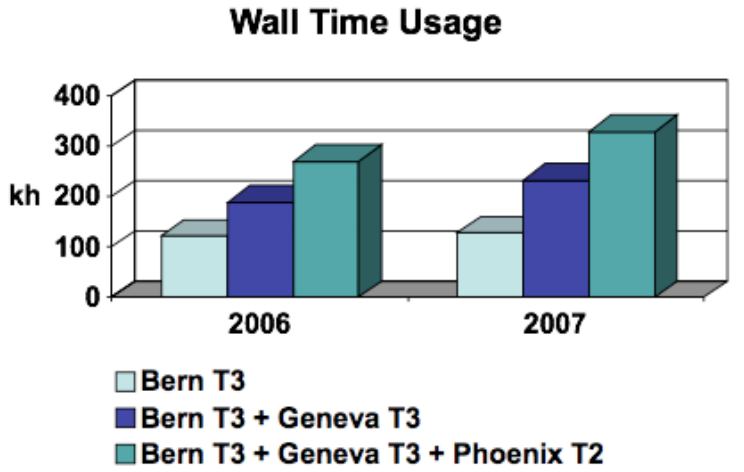
Table shows ATLAS 2006 wall time hours.

Cluster	Production	ATLAS User Jobs	Total	Comment
Bern ATLAS Cluster (T3)	55000	5000	60000	
Bern UBELIX Cluster (T3)	8000	54000	62000	
Geneva (T3)	-	-	62000	Only Total available
Manno Phoenix (T2) via LCG	66000	-	66000	
Manno Phoenix (T2) via ARC	13000	-	13000	
Sum	142000	59000	263000	

For 2007 as of June :

Bern ATLAS T3	Bern UBELIX T3	Manno Phoenix T2	Geneva	Sum
60000	15000	43000	NA	118000





ATLAS 2006/7 Usage of Swiss Resources