ECFA
European Committee for Future Accelerators

ECFA

The European Committee for Future Accelerators

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Warsztaty fizyki i astrofizyki cząstek

Warszawa, 11 grudnia 2009

Plan seminarium

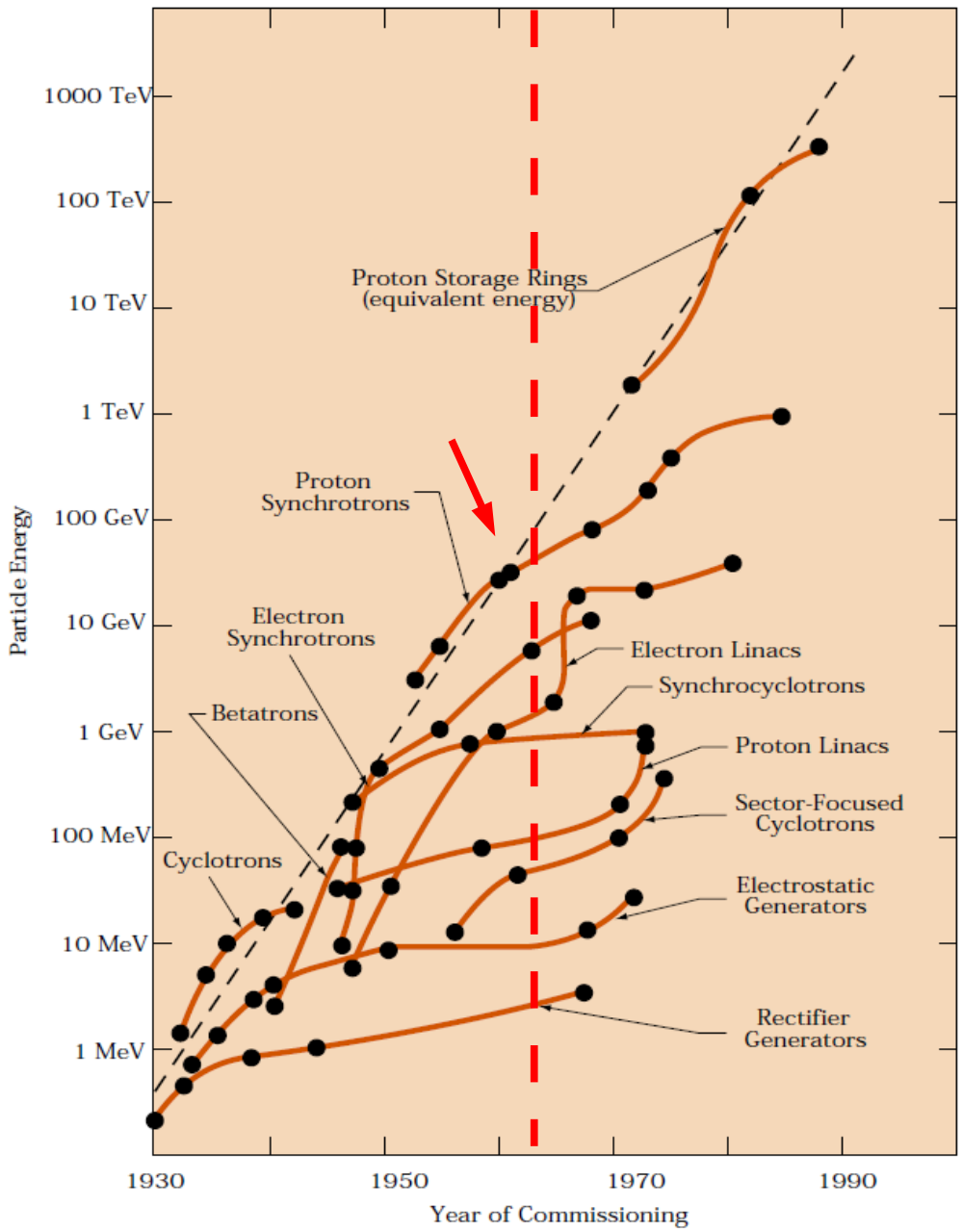
ECFA
European Committee for Future Accelerators

- Historia ECFA
- Cele działania
- Struktura i zadania
- Restricted ECFA w 2009
- Plenary ECFA w 2009
- Podsumowanie

History

Strong focusing:

- 1959: PS @ CERN
  - 25 GeV
- 1960: AGS @ BNL
  - 33 GeV
- 1961: AdA @ Frascati
  - first e^+e^- collider



History

The strong-focusing alternating gradient proton synchrotrons at CERN and at Brookhaven (USA) represent the highest and most sophisticated stage so far reached in accelerator technology. The very successes achieved through the use of high-energy accelerators, however, have raised new problems which are not capable of solution at the machine energies presently available. To achieve "super-high energies", new machines capable of accelerating particles to energies effectively greater by orders of magnitude than those achieved by the CERN PS are needed.

Unfortunately such machines take many years to design and build...

CERN Courier, February 1964.

History

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...Chairman of the CERN Scientific Policy Committee, Prof. Powell of Bristol University, together with the Director-general of CERN, Prof. Weisskopf, convened a meeting of leading high-energy physicists in **January 1963**. This meeting, which constituted itself into the European Committee on Future Accelerators (ECFA), appointed a small working party under the chairmanship of **Prof. E Amaldi** (University of Rome) to prepare a comprehensive report on the desirable programme of large accelerator construction for Europe and its financial and manpower implications...

CERN Courier, February 1964.

ECFA terms of reference

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1. AIMS (2008 revision)

- **Long-range planning** of European high-energy facilities - accelerators, large-scale facilities and equipment - adequate for the conduct of a valid **high-energy research programme** by the community of physicists in the participating countries and matched to the size of this community and to the **resources** which can be put at the disposal of high-energy physics by society. Duplication of similar accelerators should be avoided and international collaboration for the creation of these facilities should be encouraged if essential and efficient for attaining the purpose.
- Equilibrium between the roles of **international and national laboratories** and university institutes in this research, and a close relation between **research and education** in high-energy physics and other fields.
- Adequate **conditions for research** and a just and equitable sharing of facilities between physicists, irrespective of nationality and origin, as conducive to a successful collaborative effort.

ECFA terms of reference

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2. ACTIVITIES

To achieve these aims ECFA can engage in - among others - the following activities:

1. regular **meetings** of Restricted and Plenary ECFA;
2. ad hoc **symposia and conferences** sponsored or organized by ECFA;
3. **study groups**, set up by ECFA, or jointly with other organizations, for special problems;
4. **demographic studies** of the high-energy physics community and resources in the ECFA countries, repeated at regular intervals.
5. monitoring of the ongoing implementation of the European Strategy for Particle Physics in the CERN Member States under activity (d), presentation of corresponding status reports to the European Strategy Session of Council.

3. STATUS

ECFA is **advisory** to **CERN** Management, CERN Council and its Committees, and to other organizations, **national or international**.

ECFA terms of reference

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4. PARTICIPATING COUNTRIES

Traditionally, physicists from the countries which were **Members of CERN** in 1966 participate in ECFA. CERN is also considered as a "country". Plenary ECFA may on request extend participation to physicists from other countries. Any participating country is free to leave ECFA on six months' notice given at a Plenary ECFA meeting. Admission of a **new participating country** is decided by Plenary ECFA.

5. STRUCTURE

ECFA consists of:

- Plenary ECFA,
- Restricted ECFA,
- Chairman and Secretary and
- permanent or ad hoc working groups.

Plenary ECFA

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Plenary ECFA consists of:

- Chairman (Prof. T. Nakada) and secretary (Prof. P. Hansen)
- Member state representatives (~80)
- From CERN:
  - Director-General Prof. R. Heuer
  - D. for Research and Computing Prof. S. Bertolucci
  - Prof. Ph. Bloch
- Ex-Officio Members
  - DESY Prof. J. Mnich
  - INFN Prof. M. Calvetti
- Observers:
  - President of Council, Chairmans of the SPC, FC, NuPPEC.
  - Israel, Russian Federation, U.S.A., EPS, ESF, JINR

Poland:
Prof. J. Kalinowski
Prof. P. Malecki
AFŻ

Plenary ECFA

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- normally holds two meetings per year
  - one at CERN
  - one at EPS-HEP Conference or DESY/Frascati
- meetings are public unless otherwise decided
- decides on all ECFA activities
  - appoints the Chairman and Secretary,
  - approves the final reports of the working groups,
  - decides on admission of new countries and observers,
  - makes recommendations to outside organizations.

Restricted ECFA

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Restricted ECFA consists of:

- ECFA chairman (Prof. T. Nakada)
- **One** representative of each member state (20) + CERN
- Ex-Officio Members:
  - CERN Director-General Prof. R. Heuer
  - CERN D. for Research and Computing Prof. S. Bertolucci
  - DESY Prof. J. Mnich
  - INFN Prof. M. Calvetti
- Observers:
  - from Israel and Russian Federation

Restricted ECFA

- Restricted ECFA
  - assists and advises the Chairman and the Secretary in the current running of ECFA, and
  - acts as the **communication channel** to each participating country, its physics community and national institutes and authorities.

- normally holds five meetings per year
  - two meetings @ Plenary ECFA
  - three **„country visits”**

Restricted ECFA

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R-ECFA Country visits

- One day open session with reports on:
  - Scientific activities (most)
  - Research planning, structure and funding
  - Human resources, education and outreach

    + PhD students' point of view

      after discussion: RECFA feedback to the Community
- Half a day closed meeting
  - Reports from CERN, DESY, Frascati
  - Reports from working groups
  - Planning HEP activities in Europe (eg. FP7)

Other activities

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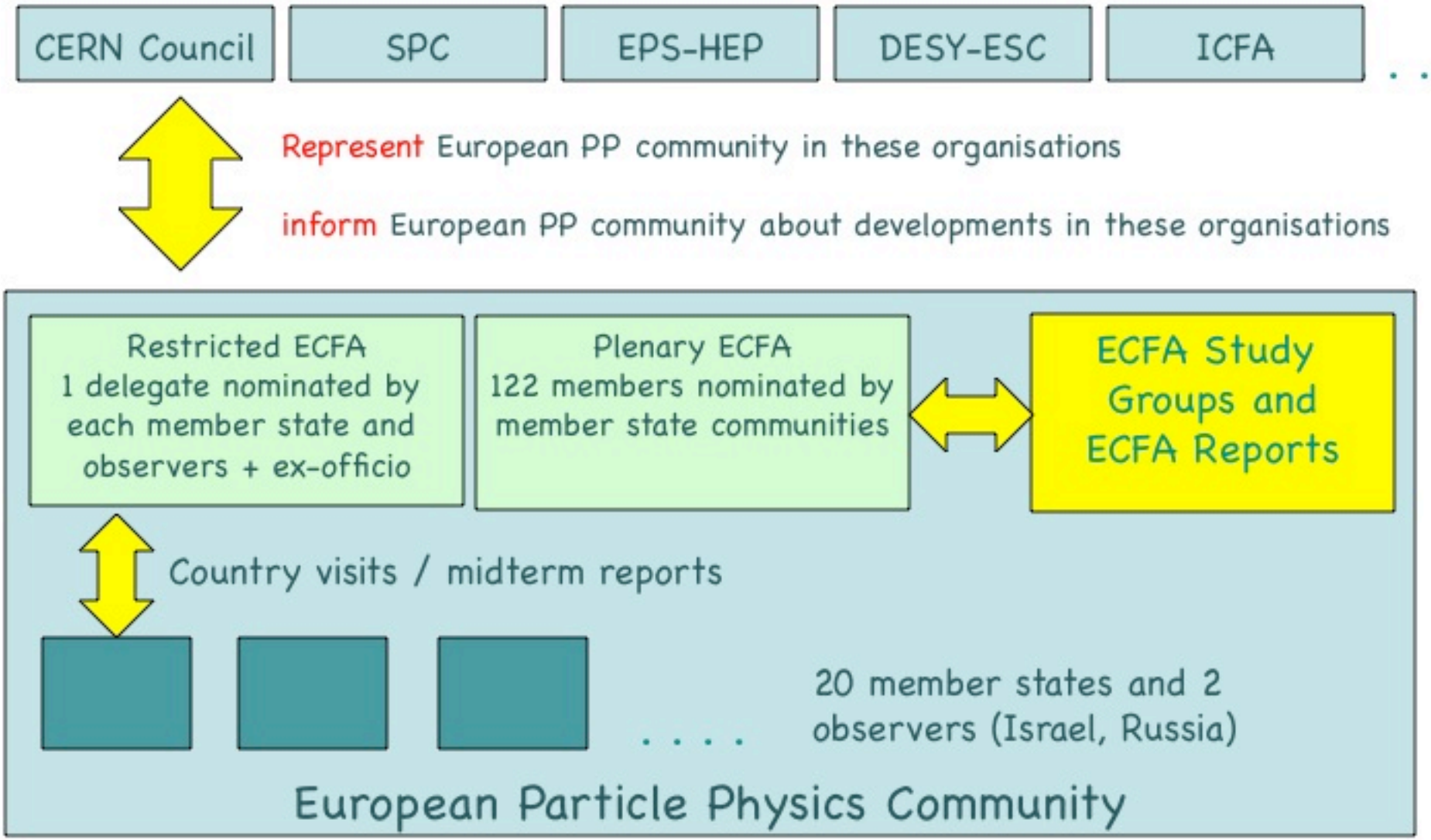
- ECFA Workshops on: (selected)
  - Developments in Particle Acceleration Techniques
  - LHC
  - European B-meson Factory
  - LHeC
- ECFA working groups/studies:
  - Physics and Detectors for a Linear e+e- Collider
  - Neutrino oscilations
  - Future of accelerator-based PP in Europe


CERN Council
SPC
EPS-HEP
DESY-ESC
ICFA
Represent European PP community in these organisations
inform European PP community about developments in these organisations
Restricted ECFA
1 delegate nominated by each member state and observers + ex-officio
Plenary ECFA
122 members nominated by member state communities
ECFA Study Groups and ECFA Reports
Country visits / midterm reports
20 member states and 2 observers (Israel, Russia)
European Particle Physics Community

2009

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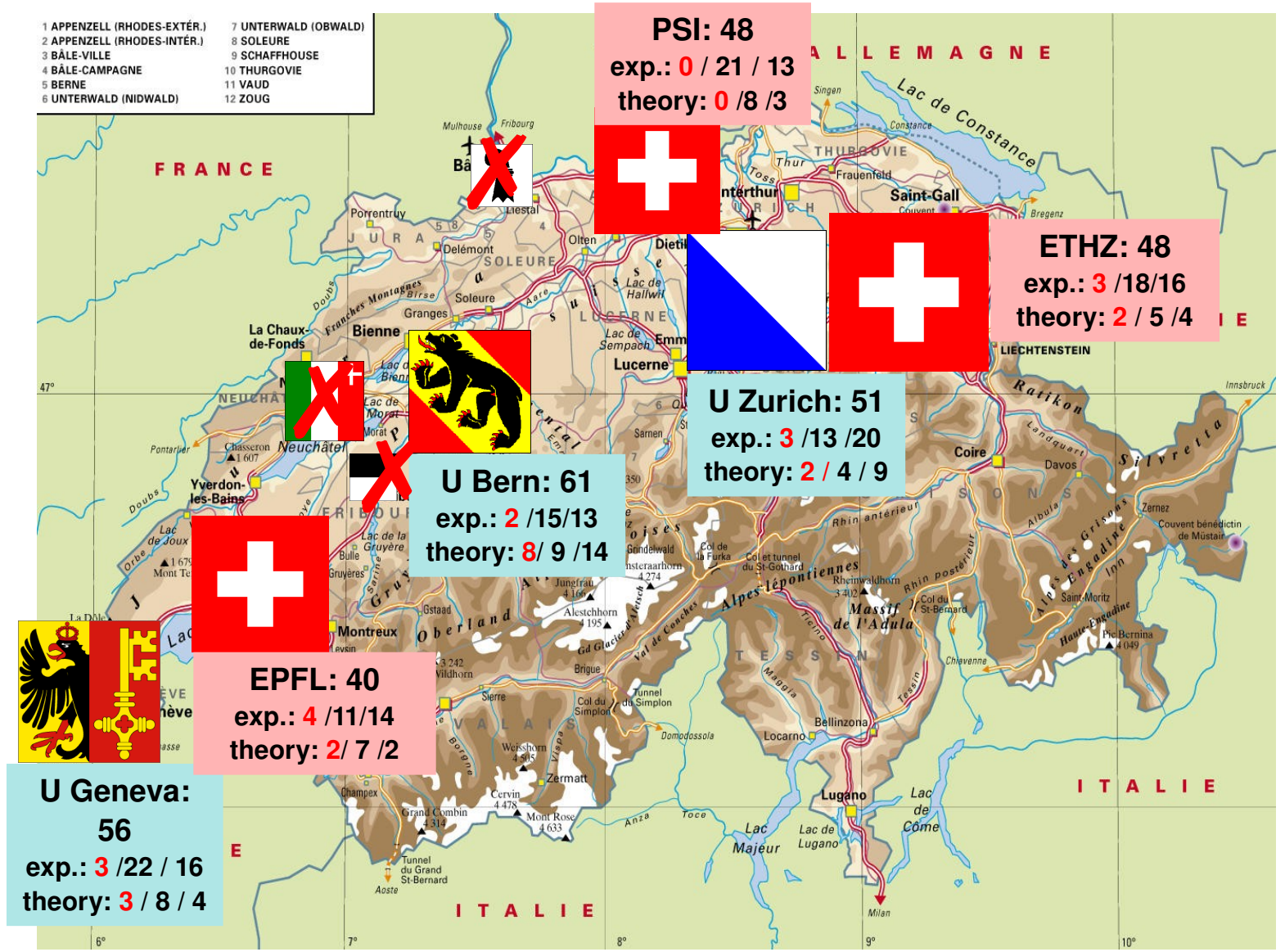
- R-ECFA meetings
  - Switzerland (March)
  - Norway (May)
  - Russia (observer state !) (October)
- P-ECFA meetings
  - EPS-HEP 2009 in Cracow (July)
  - CERN (November)

Swiss part. phys. landscape in 2009

Scientific personnel:

Full professors / staff / PhD students

+ administrative & technical staff (hard to quantify)

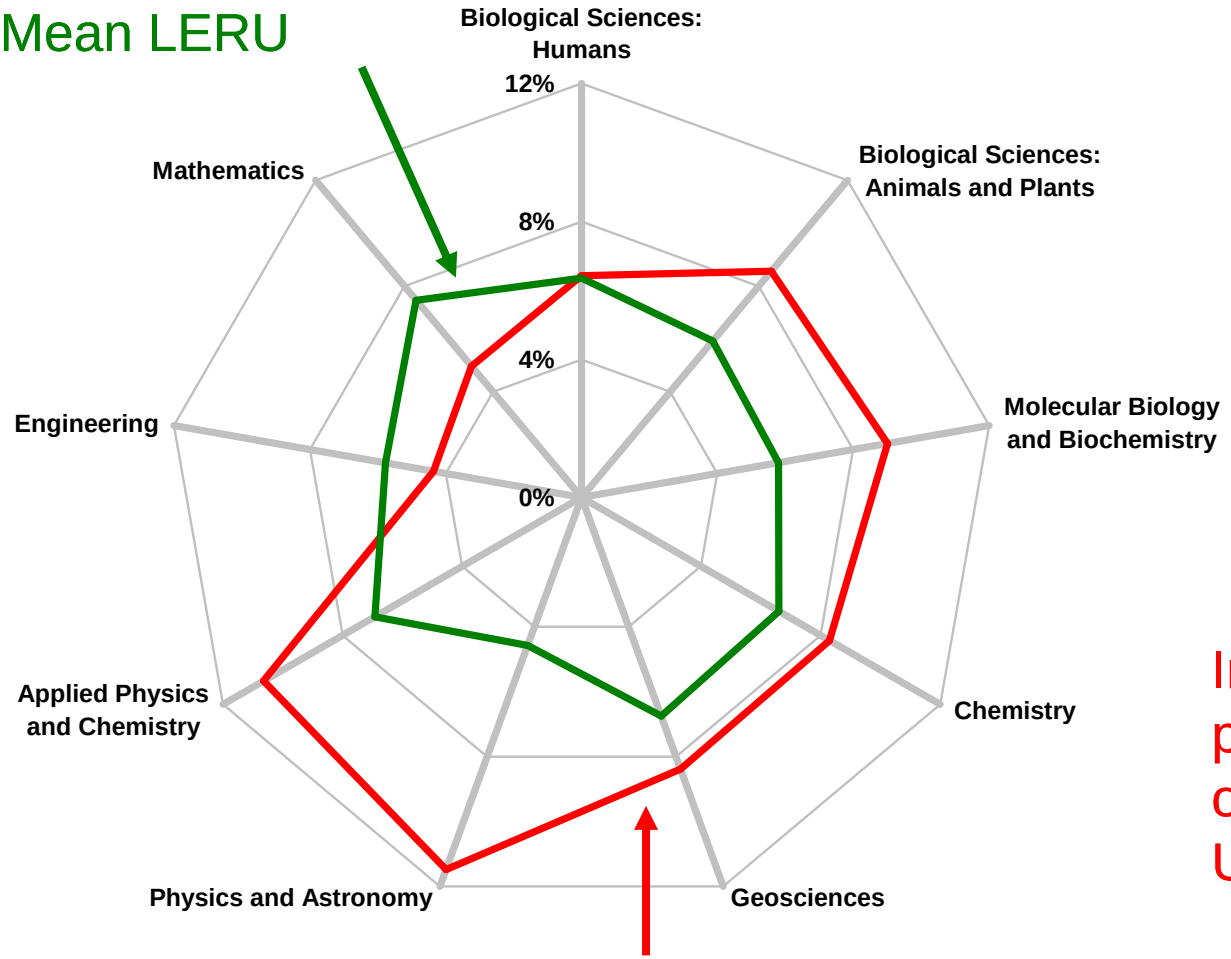


Particle physics concentrated to less universities, without reducing sum – so far

LEAGUE OF EUROPEAN RESEARCH UNIVERSITIES

Amsterdam • Cambridge • Edinburgh • Freiburg • Genève • Heidelberg • Helsinki • Karolinska • Leiden • Leuven
UCL (London) • Lund • Milano • LMU München • Oxford • PMC Paris • Paris-Sud • ULP Strasbourg • Utrecht • Zürich

Mean LERU



e.g. UniGE

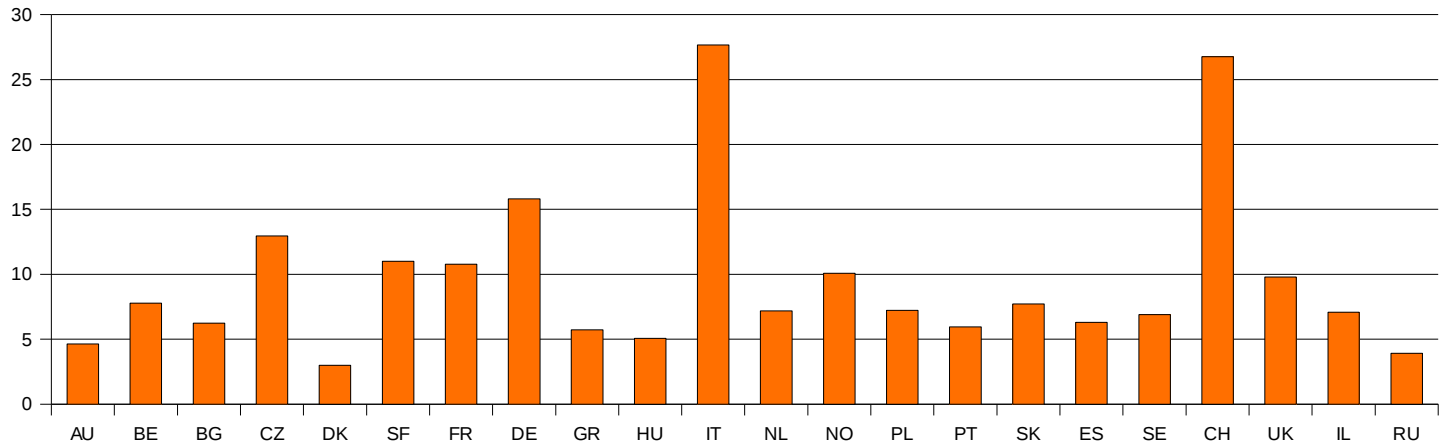
Source : LERU and CWTS (Uni Leiden/NL)

Impact of scientific production compared to other research Universities, per domain.

Swiss particle physics and Europe
(as of 1. January 2006) - experimentalists only

26 particle physicists / Million

All FTE per population



Swiss community is rather strong

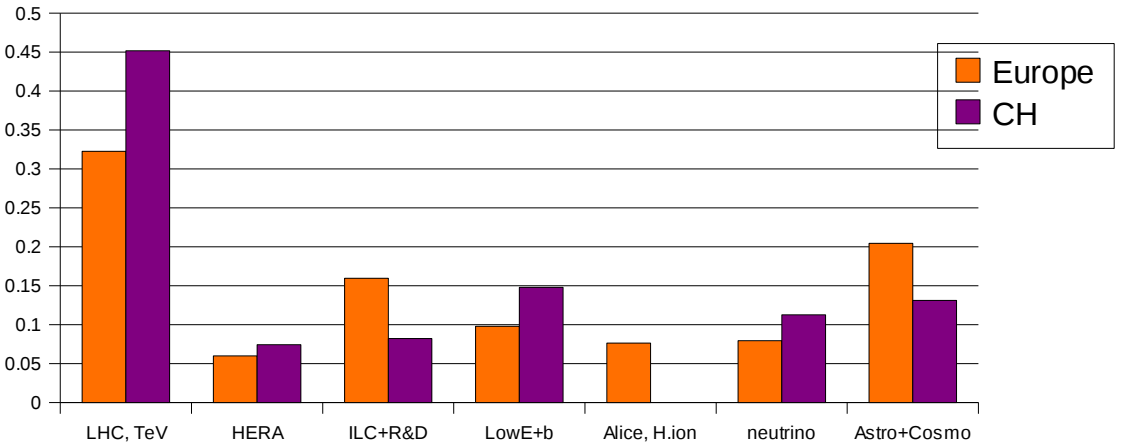
Makes use of the excellent opportunity being the host of CERN

Swiss FTE physics researchers (incl. PhD students)

H	**111**
N	**23**
A	**26**
Low Energy	**40**

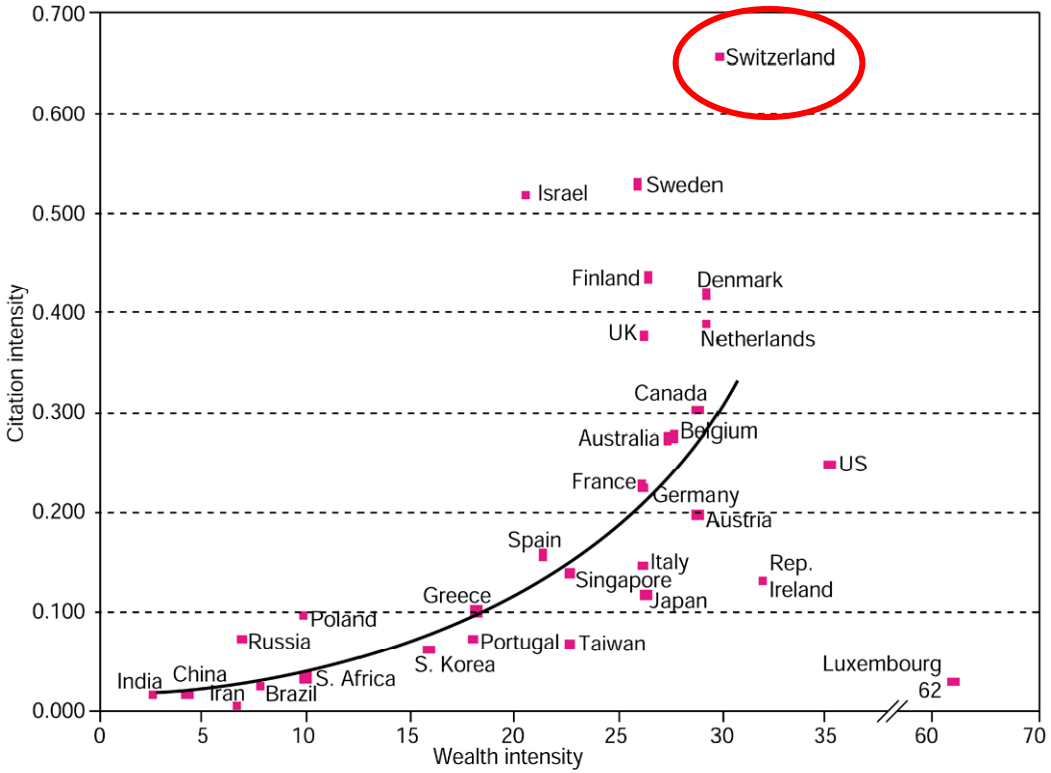
Total #:
2002: 227
2006: 200
2009: 209

Fraction of FTE in research fields

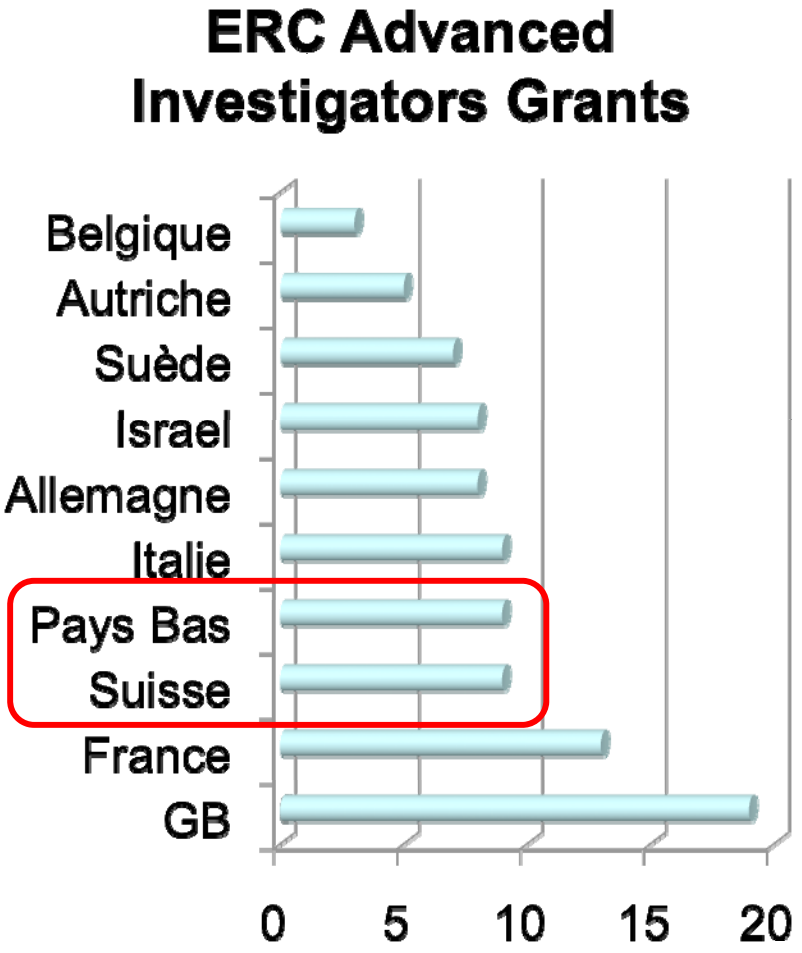


Pillars: ------ **H** ------- **LowE** **N** **A**

Science in Switzerland : investment et impact



Source : Nature, juillet 2004



Source : Physik Journal novembre 2008

Organization of Funding

Federal Department of Home Affairs

State Secretary for Education and Research

Federal money

Cantonal money

Coordination

Swiss National Science Foundation

~50% of Swiss HEP funding

Board of the Federal Institutes of Technology

Cantonal Department of Education

EPFL

ETHZ

PSI

University

HEP Lab

HEP Lab

HEP Lab

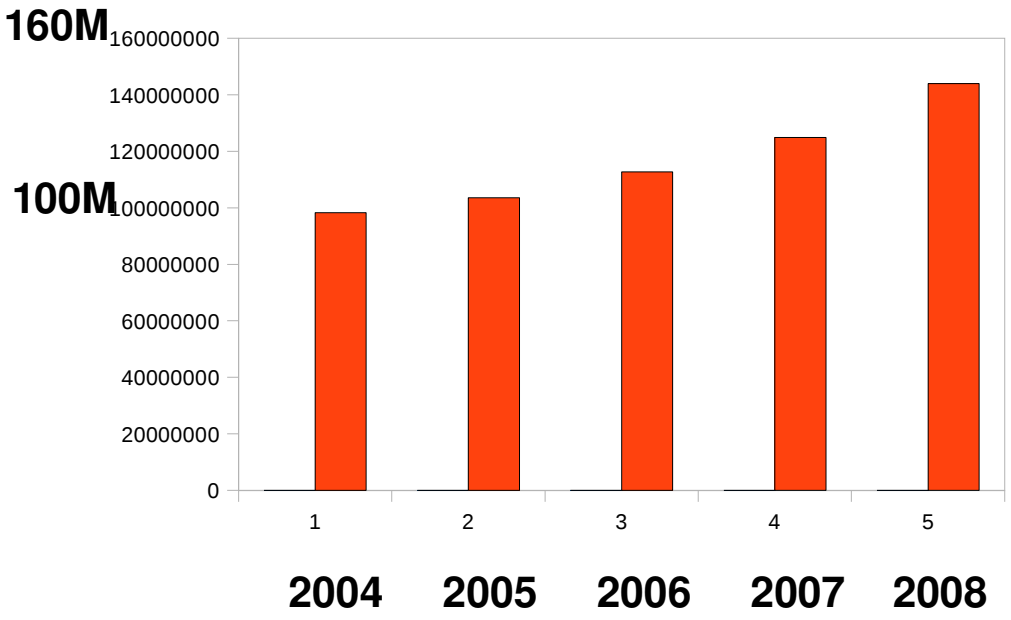
HEP Lab

Funding in Physics

(Swiss National Science Foundation only)

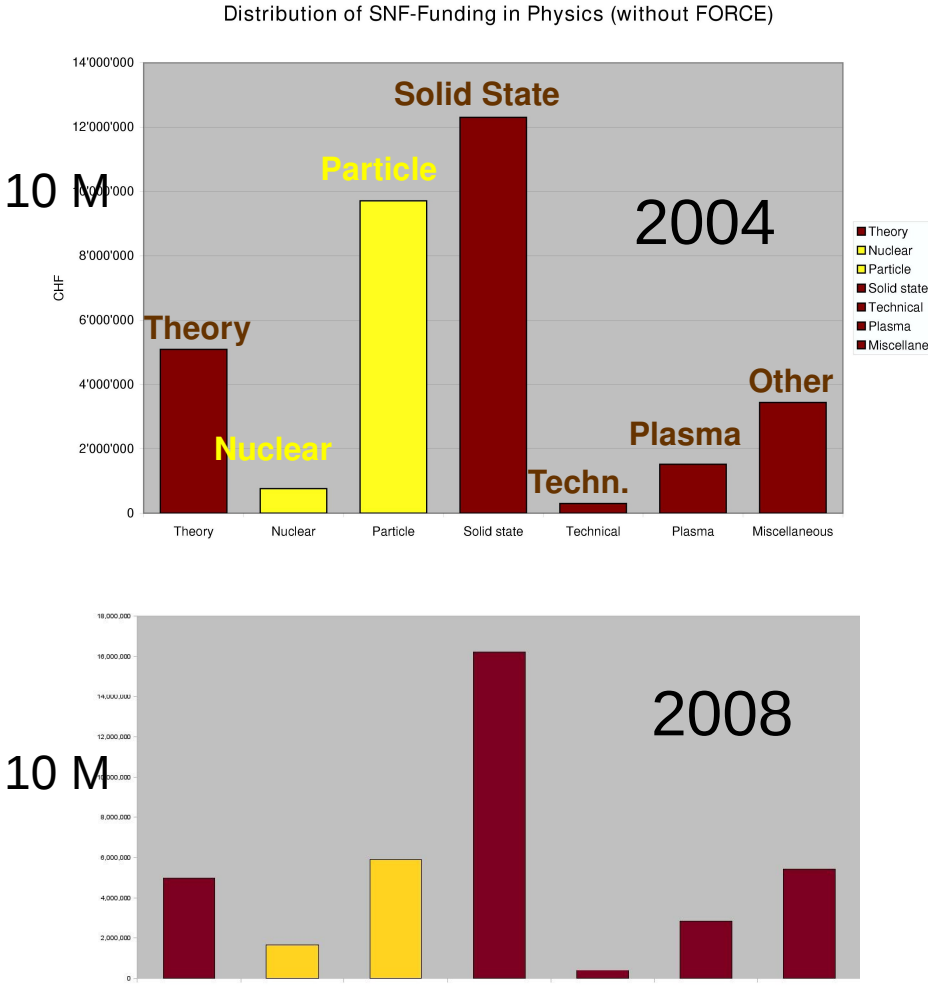
Budget Division II

(= Mathematics, Natural and Engineering Sciences)



Particle physics could not profit from increase in funding

Distribution within Physics



What is CHIPP ?

- Advisory council for particle physics in Switzerland
- Founded in 2003, with strong support by R-ECFA at its last visit

Thank you very much!

Structure:

- plenary (all active p.p. researchers), meets once per year
- board (all professors), meets twice per year
- executive board (presently 4 members, daily operation), monthly meetings

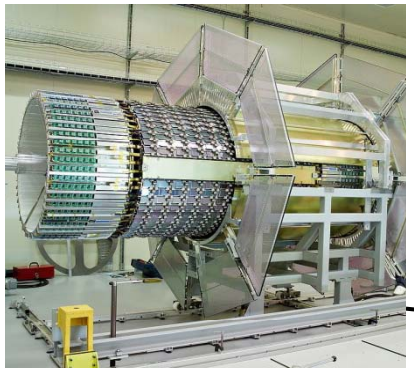
Purpose:

- coordinate the involvement of Swiss institutes in particle, astroparticle and nuclear physics research.
- coordinate high level graduate student teaching.
- recommend priorities within available resources.
- give advise on vacant professorships to promote synergies and well balanced programmes in Switzerland.

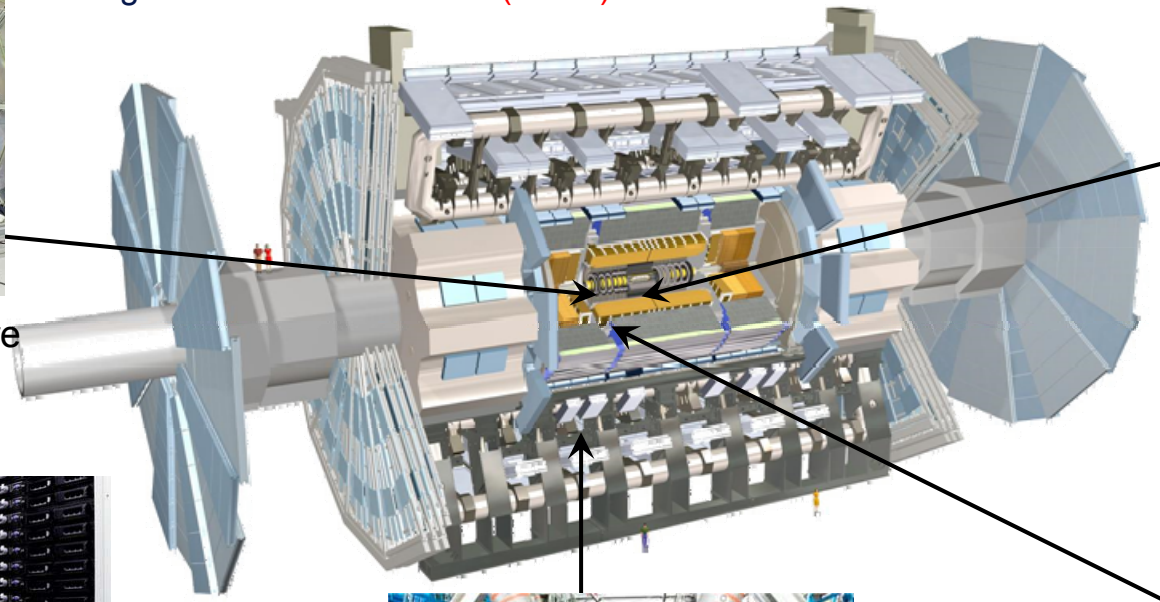
ATLAS

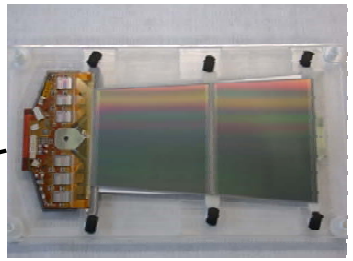
Weight: 7'500 t
Diameter: 22 m
Length: 46 m

Magnetic field:
2 T (solenoid)
0.2-2.5 T (toroid)



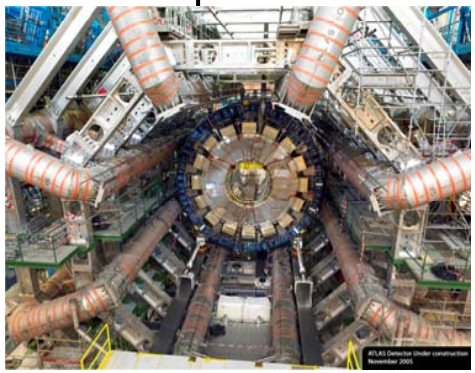
Si tracker support structure
Geneva



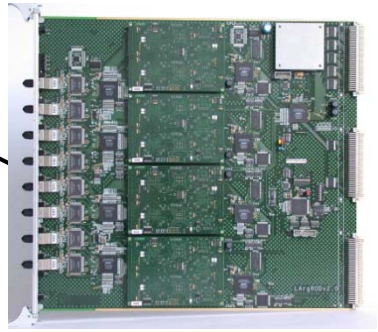


Silicon tracker
Geneva

TDAQ - Trigger and Dataflow
Bern and Geneva



Superconductor & casings for barrel toroid coil
Bern and Geneva



Readout electronics + trigger for liquid Ar calorimeter
Geneva

Online and Offline Software

Bern and Geneva

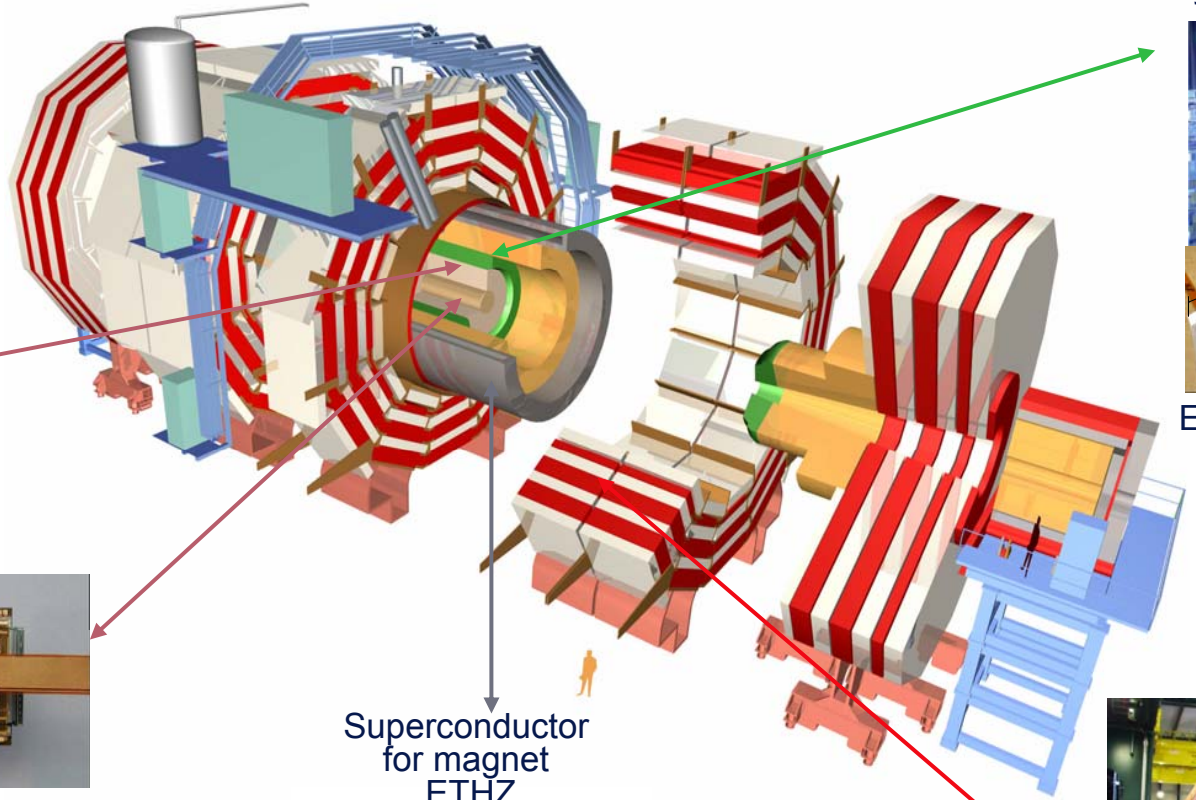
Physics and Computing

Bern and Geneva

CMS

Weight: 12’500 t
Diameter: 15 m
Length: 21.6 m

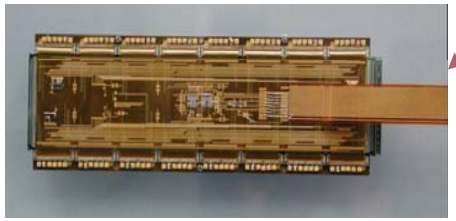
Magnetic field: 4 T



Crystal calorimeter ETHZ

Electronics ETHZ, PSI

Silicon strips ETHZ



Pixel detector
PSI, ETHZ, UniZh

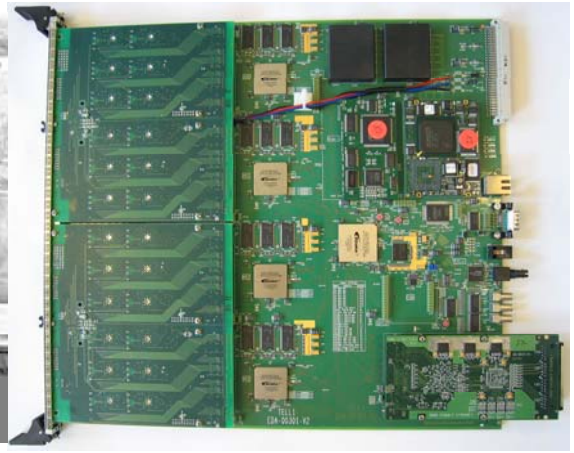
Superconductor
for magnet
ETHZ

Magnet design
and
procurement
ETHZ

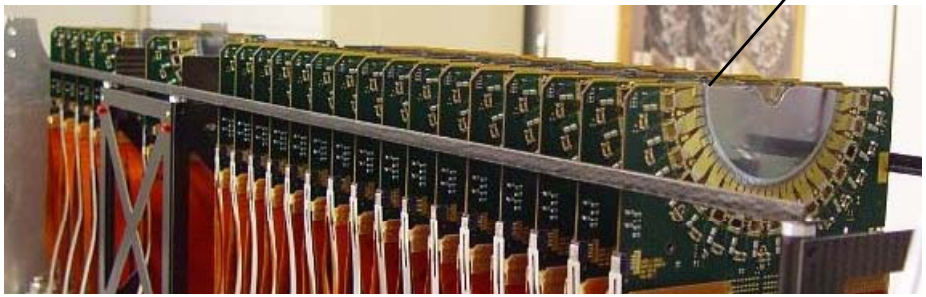
Software & Physics

ETHZ, PSI, UniZh

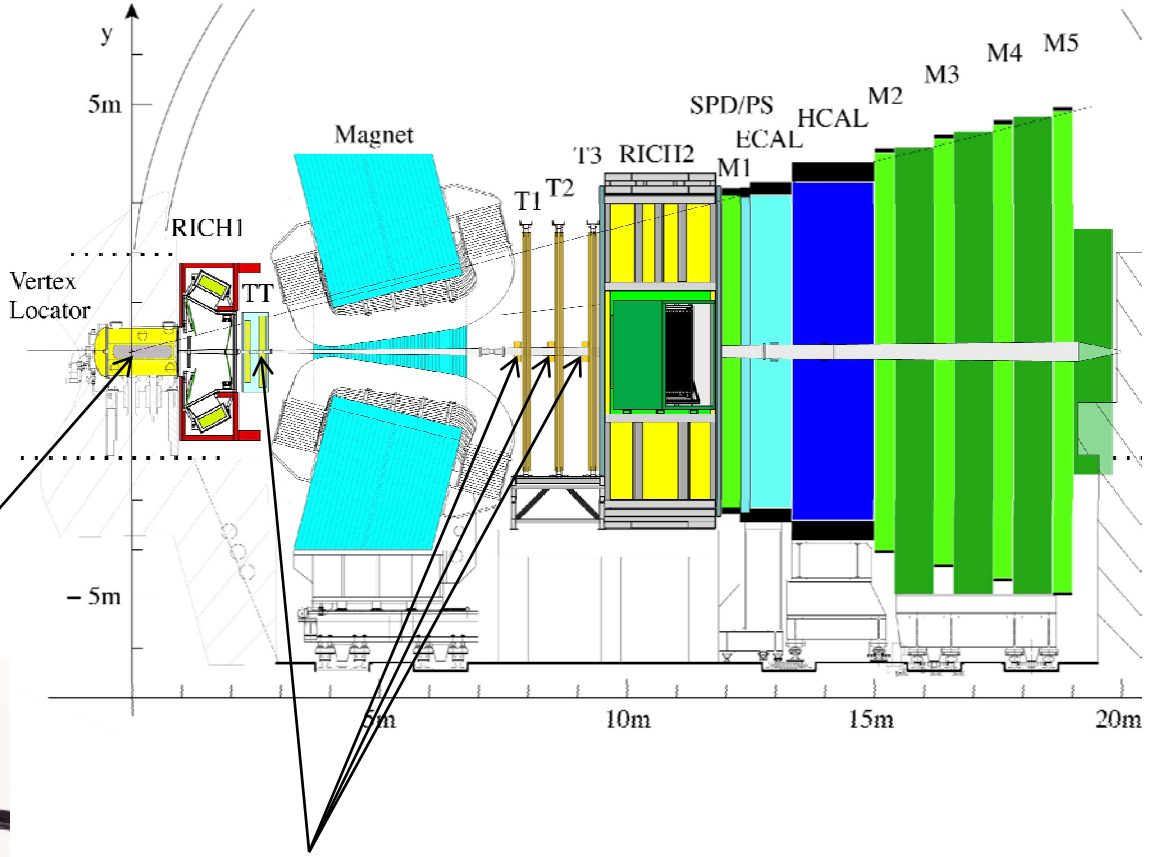
LHCb



- Common readout board (EPFL):
  - adopted by most sub-detectors
  - ~300 boards in LHCb



- Vertex detector (EPFL):
  - analogue transmission line (drivers, repeaters, …)
  - power supplies, grounding



- Silicon tracker (design, development, construction):
  - Trigger tracker (Uni Zurich)
  - Inner track (EPFL)

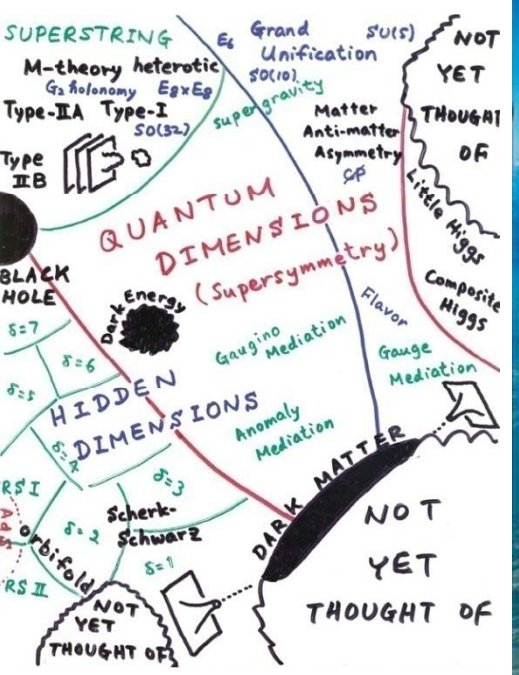
Summary

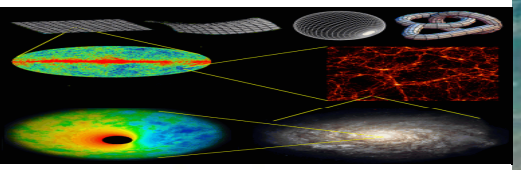
- Old collider frontiers:
  - Swiss groups maintained physics analysis activities at the major frontiers: HERA, Tevatron and B factory
  - Good for PhD students, and good for preparation in view of LHC
  - Will now phase out with LHC startup

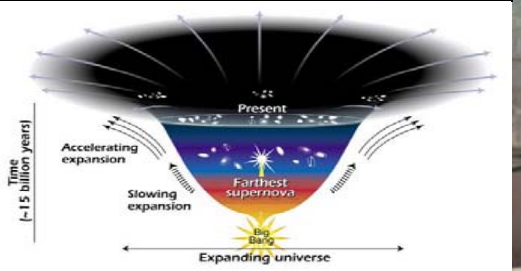
- New LHC frontier (ATLAS, CMS, LHCb):
  - large involvement of Swiss groups, including leadership at all levels
  - large construction effort over many years, successfully completed
  - strong involvement in commissioning
  - ready to start physics program and search for new

Conclusions:

- Switzerland is an excellent place to do science
- Switzerland is an excellent place to study physics
- Bologna system implemented early
- Unusually large fraction of doctoral students
- Action to federate teaching at PhD level
- Action towards young people, school teachers and general public
- Action to attract even more foreign (master) students

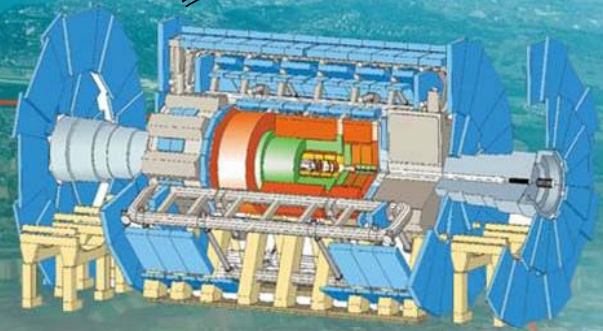






THE NORWEGIAN

HIGH ENERGY



PARTICLE PHYSICS

PROJECT 2006-11

http://koherens.uio.no/hep/hepp/

Previous Particle Physics Projects in Norway

- ***Period 1998 - 2005***

Analysis 01-05 Budget (k NOK)	
Running costs	5 430
Salaries	5 525
Theory	1 000
Total	11 955

- **Elementary Particle Physics Analysis (PL: Lars Bugge)**
  - ATLAS @ LHC (including Grid from 2002)
  - BaBar @ SLAC
  - Delphi @ LEP →
  - HERA-B @ HERA (until 2003)
  - WA102 @ SPS (until 2001)
  - Theory: (from 2000)

Year	Master degrees	PhD's
1998-1999	3	2
1999-2000	6	—
2000-2001	5	1
2001-2002	5	2
2002-2003	3	2
2003-2004	2	—
2004-2005	11	6
Total	35	13

- **ATLAS instrumentation (PL: Bjarne Stugu)**

ATLAS98-05 Budget (k NOK)	
Travel and operation	8 800
Project manpower	6 200
Ph.D grants	3 740
Sensors	8 800
ASICs, cooling, etc	4 400
Common Fund	9 800
Total	41 740

Total number of finished students (Atlas+Analysis): 1998 – 2005	
Master students	43
PhD students	17

On-going programmes 2006-2011

Main goals: best possible science, more people to/involved at CERN, pursue technology developments. **Organised in 3 main projects:**

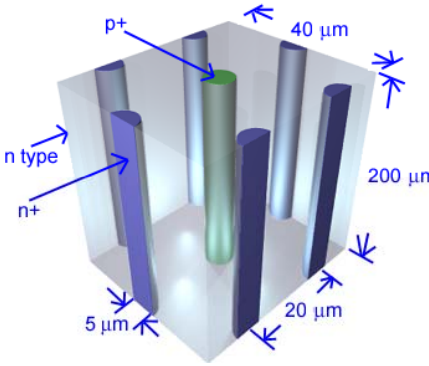
(1) ATLAS and (2) ALICE:

•Physics analysis, detector operation, pattern recognition software – mostly the experimental particle physics and heavy ions groups at UiB and UiO – in ATLAS and ALICE. Include also staff for Bergen and Gjøvik University Colleges.

•Theory programs for the theoretical physicist but limited funding

•Links to Norwegian part of Nordic GRID facility for data-analysis

•Talks by Ould-Saada, Roehrich, Bomark, Bravina



(3) Instrumentation and technology:

•Silicon technologies for trackers and calo readout, a Technology Student program , Industry Liaison and Technology Transfer Officer, CLIC involvement. Talks by Rohne, Nordahl

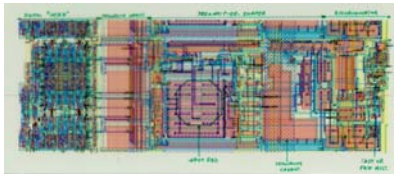
In addition (outside CERN related funding) :

•Astroparticle physics – for example Planck and Gravitational lensing (no talk)

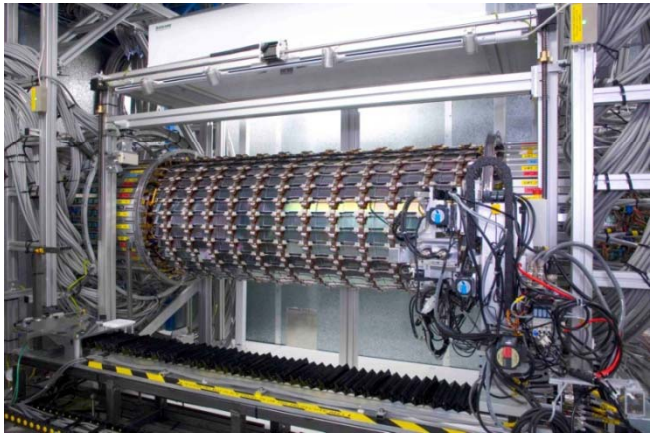
•Norwegian low energy nuclear physics community activities at ISOLDE (radioactive beam) – funding not secured (talk by Siem)

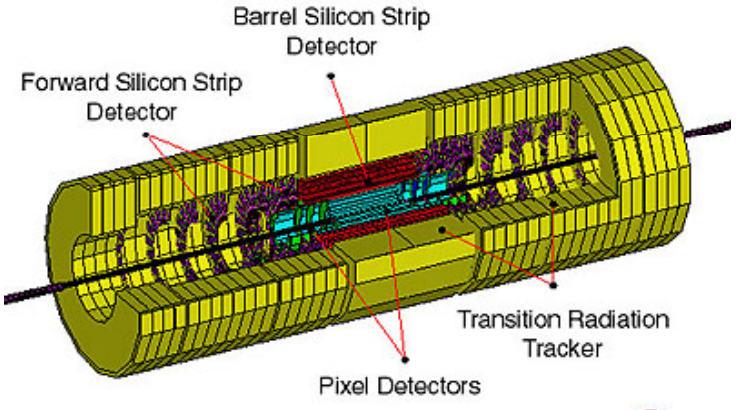
•A very significant GRID development program (talk by Read)

•Specifically funded project for Babar (talk by Eigen)

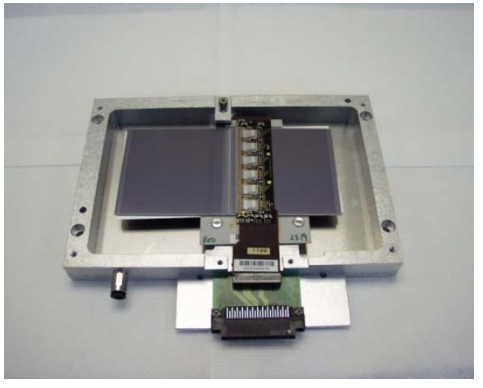


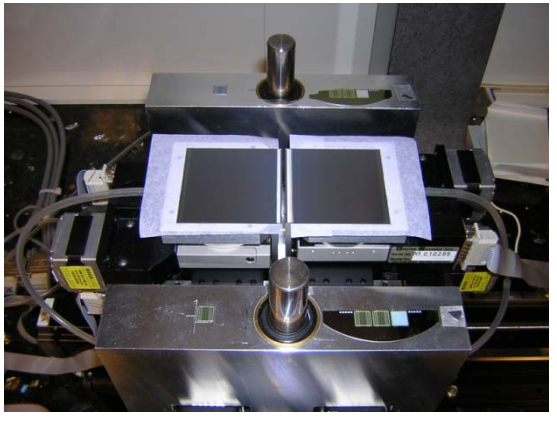
One of the Norwegian contributions to the ATLAS "Semi Conductor Tracker" (SCT): Oslo, Bergen and Uppsala built 320 silicon modules ~ 15% of Atlas needs.

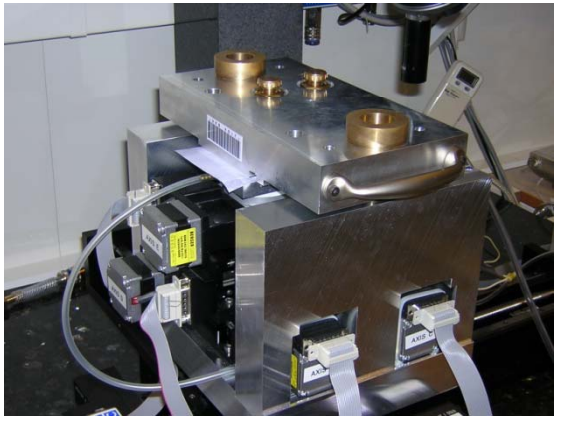




Inner Tracker







ATLAS Cryogenics

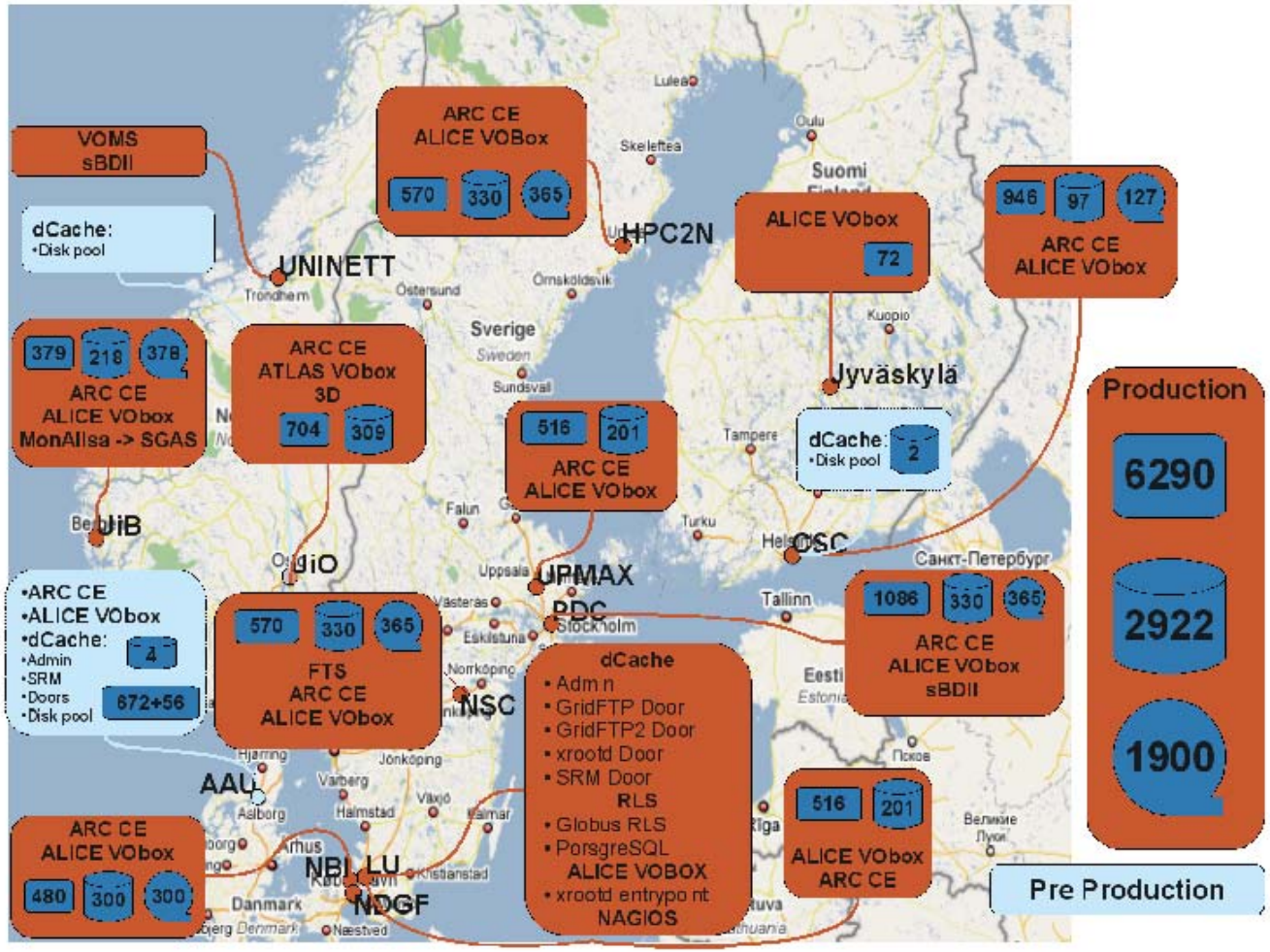
- Construction of cryogenics tanks for ATLAS (NTNU, UiO, Industry)
  - are successfully completed
- The liquid nitrogen and liquid argon vessels have all been installed and routinely used in the successful tests of the barrel superconducting toroïd magnet system which was tested at full current at the end of 2006.

Distributed! WLCG sites with ARC

Tier-1:
- NDGF

Tier-2s:
- Finnish
- Norwegian
- Slovenian
- Swedish

Tier-3s:
- Danish
- Norwegian
- Swedish
- Swiss



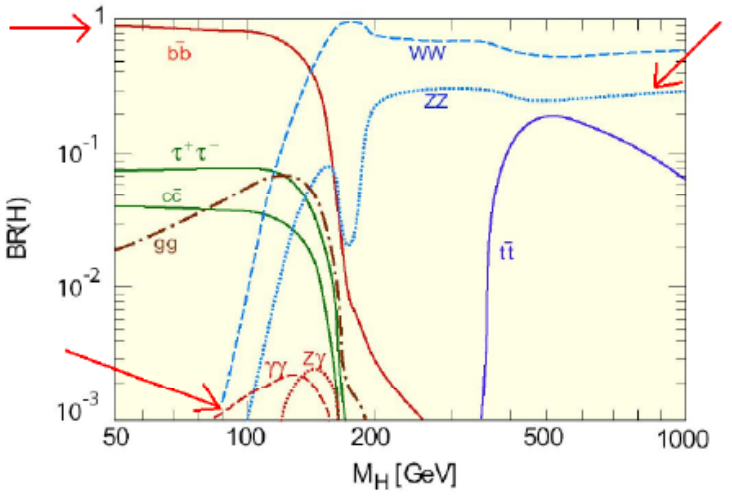
SEEN AS ONE SITE FROM CERN!

F. Ould-Saada

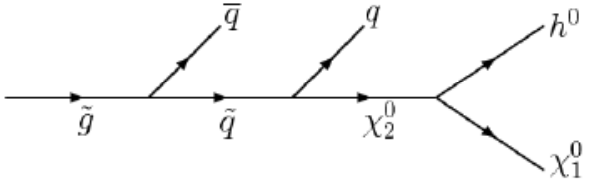
Physics strategy / Outline

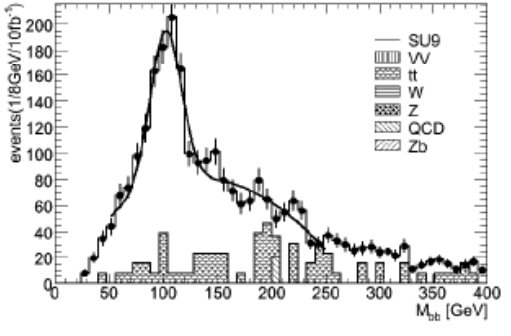
- Search for the SMs only missing component
  - Higgs (SM, SUSY)
- Search for new symmetries
  - Supersymmetry
  - Z', W'
- Search for extra space dimensions
  - Graviton
  - Black Holes
- Studies of SM properties and processes

  B-meson decay
  W,Z, top
- To tackle these analyses, we find some common denominator
- We divide our analysis by final state
- Different studies can use common strategies
  - Advocates model independent searches



- Our channels are
  - $h \to \gamma\gamma$
  - Associated Higgs production $W^*, Z^* \to W, Z + H$
  - $h \to b\bar{b}$
  - $h \to ZZ^* \to e^+e^-e^+e^-$ (invariant mass improvement)





Note: All Atlas MC studies for 14 TeV, new studies are taking place with 10 TeV and lower integrated luminosity

FINANCIAL SITUATION

	2006	2007	2008	2009	2010	2011	Total (kNOK)
Used / planned	**2853**	**7019**	**7231**	**7 542**	**6 643**	**5 454**	**42 025**
Received/ Ajusted	**6 076**	**7 478**	**5 715**	**5 595**	**8704**	**8 197**	**41 765**

- Due to various delays (late start of LHC, ...)
  - all post-docs were hired late
  - both personnel and running costs affected (fewer people to travel).
  - budget related to travel and presence at CERN affected (no shifts before 2009).
- **Budget re-ajusted but**
  - **More or less according to plans**

Next funding period 2012-2018: Preparations have started

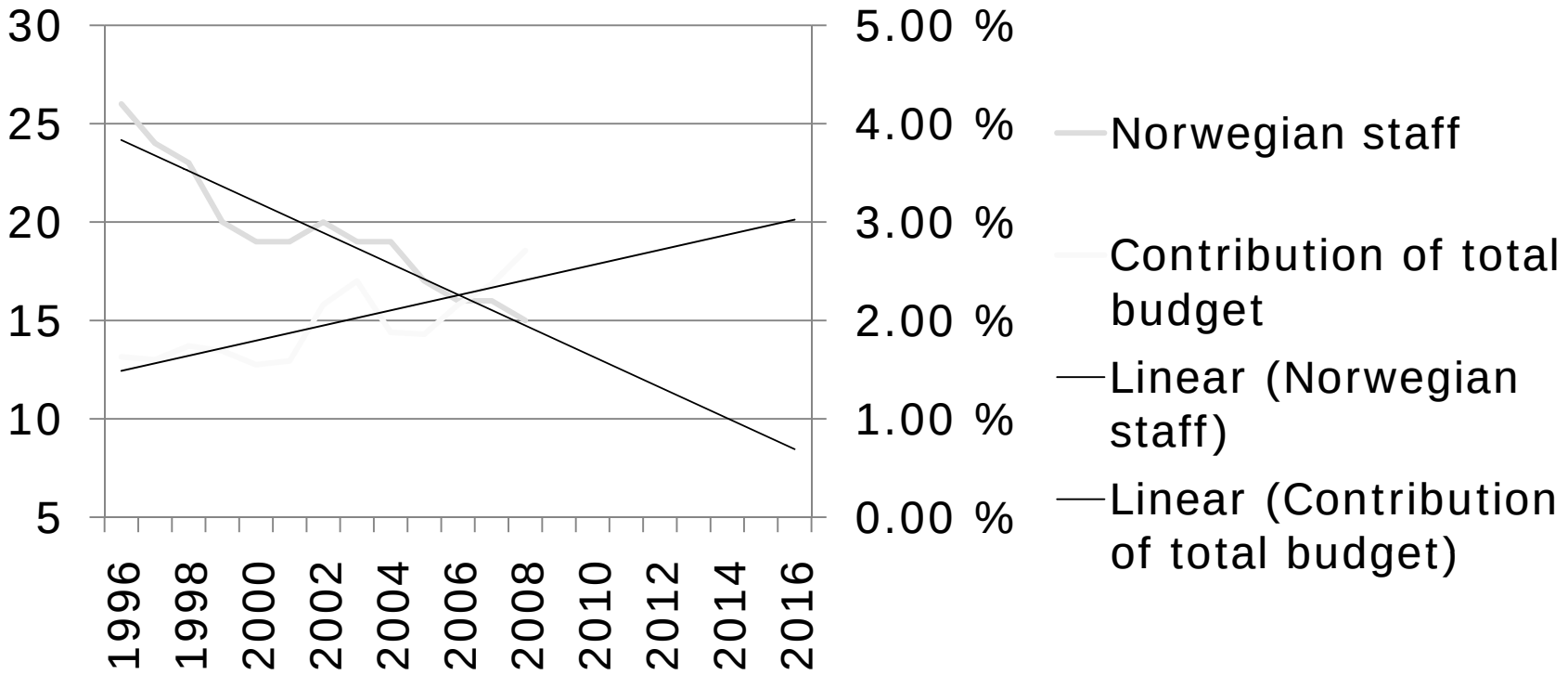
- The Strategy for European Particle Physics and Norwegian Programme
- Astroparticle Physics
- FAIR plans
- ILC, CLIC, SuperB
- Total funding level for next period not decided – but prioritisation will probably be necessary
- High quality results very important for future funding
- Yearly evaluation of CERN projects – international panel

  (Ellis, Jacak, Luth)
- Evaluation of Physics Research in Norway recently launched

Like in 2005 …We are still really worried that we can't keep even our bright students ...

2006 Status

Personnel situation

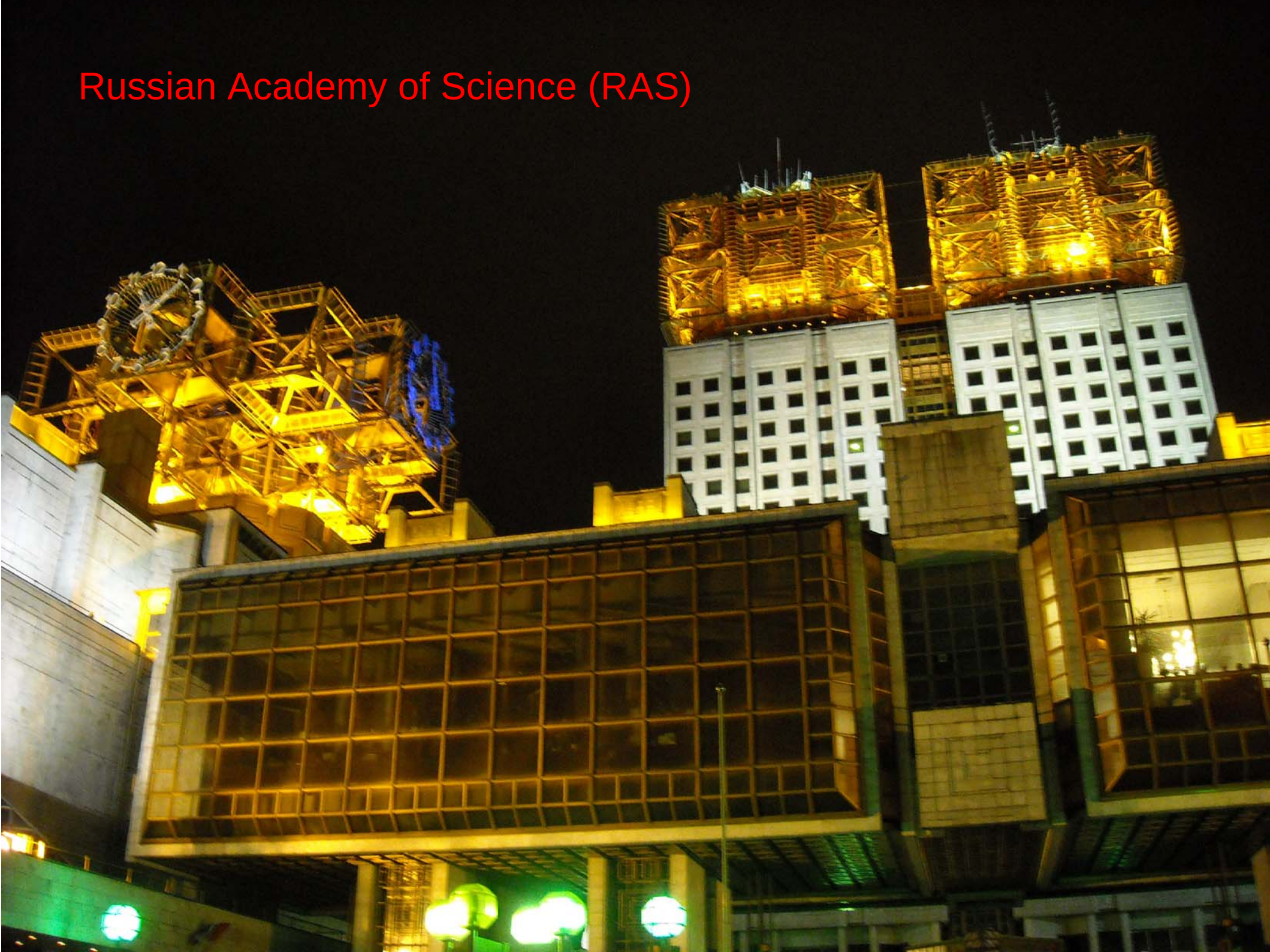


- Norwegian-CERN WG: Recruitment, industrial return and Tehnology Transfer

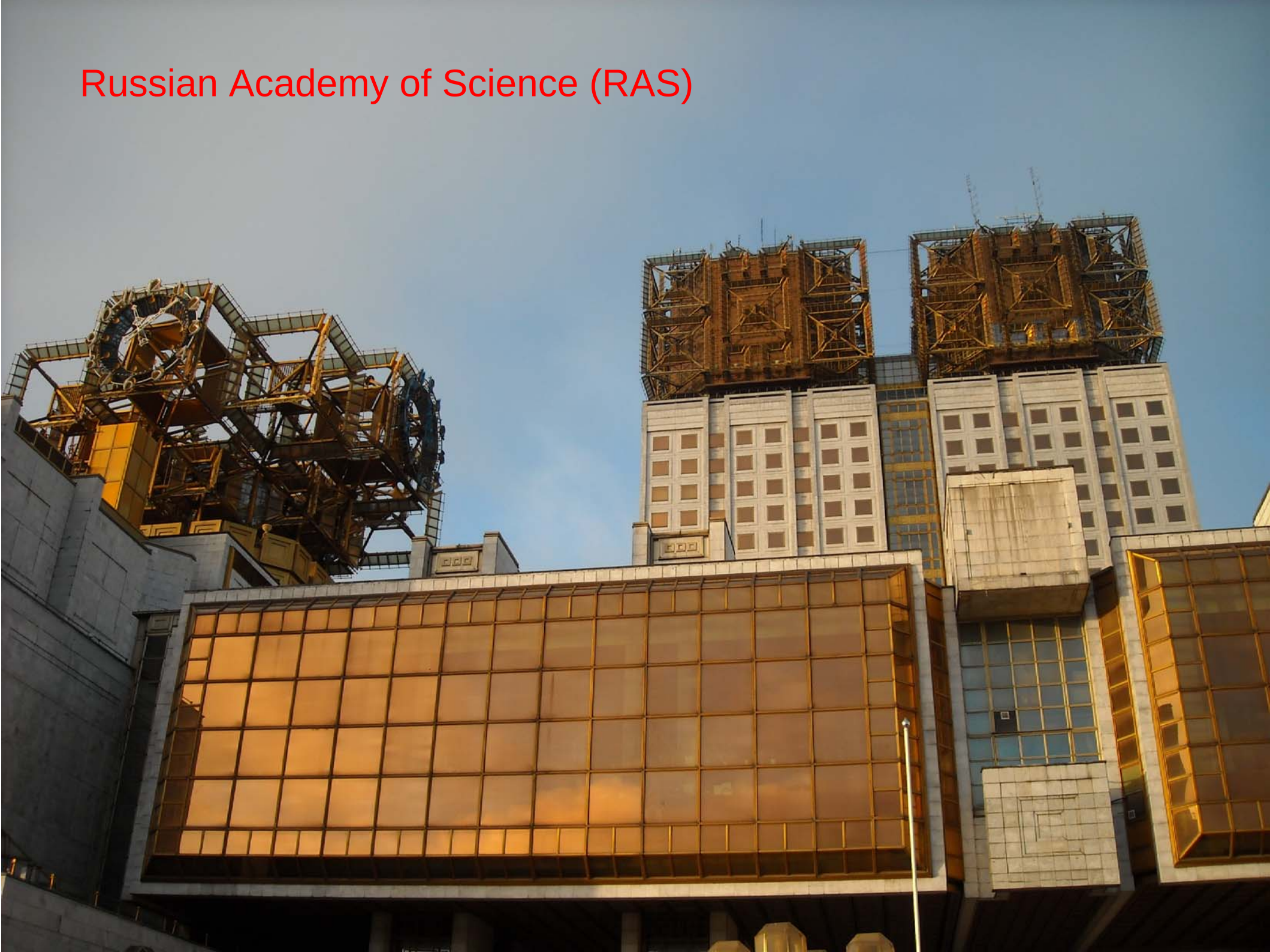
Conclusions and Outlook

- HEPP members are ready to tackle the LHC era
- Impressive contributions from students and others to the whole ATLAS "chain"
- Experimentalists hand in hand with theoreticians
  - Common colloquia and workshops around LHC http://koherens.uio.no/hep/hep-coll/
  - "Sharing" of students
- Good synergy HEPP-Grid
  - Towards efficient distributed physics analysis
- Huge activity in outreach
- Good news: more PhD students and more Post-docs
  - Several master students started PhD → **Let's hope it is not a statistical fluctuation ...**
- Worrisome:
  - Leaving senior physicists often not replaced ...
  - Experimental particle physics (ATLAS): Currently 2 active professors in Oslo and 3 in Bergen
  - Administrative help urgently needed ...
  - **We are still very motivated but are having hard time!**

Russian Academy of Science (RAS)

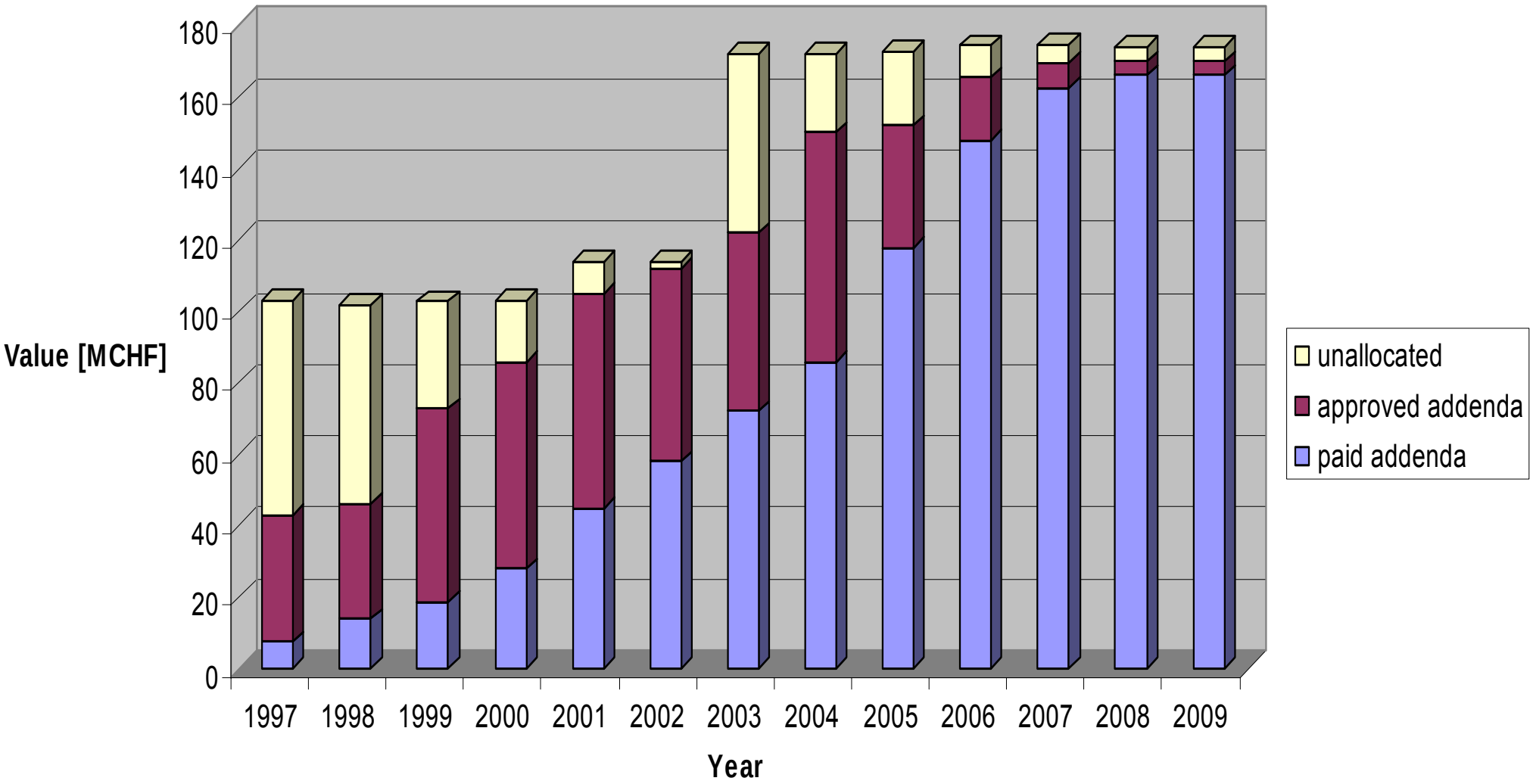


Russian Academy of Science (RAS)

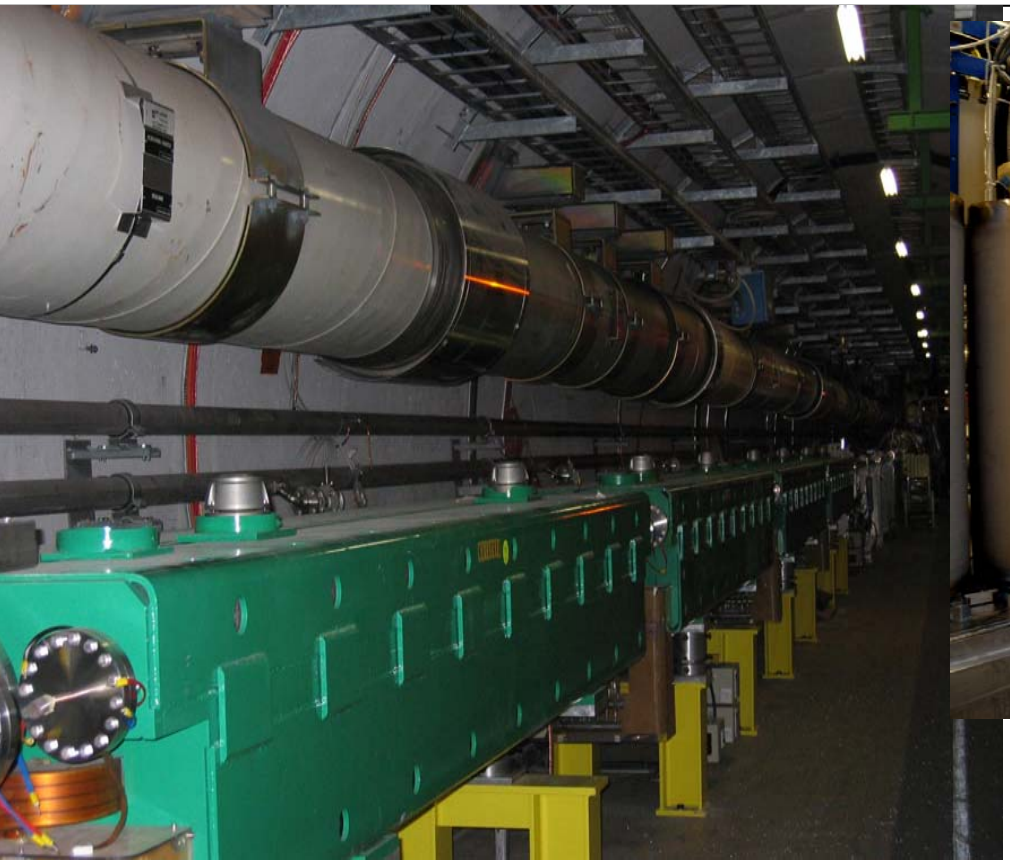


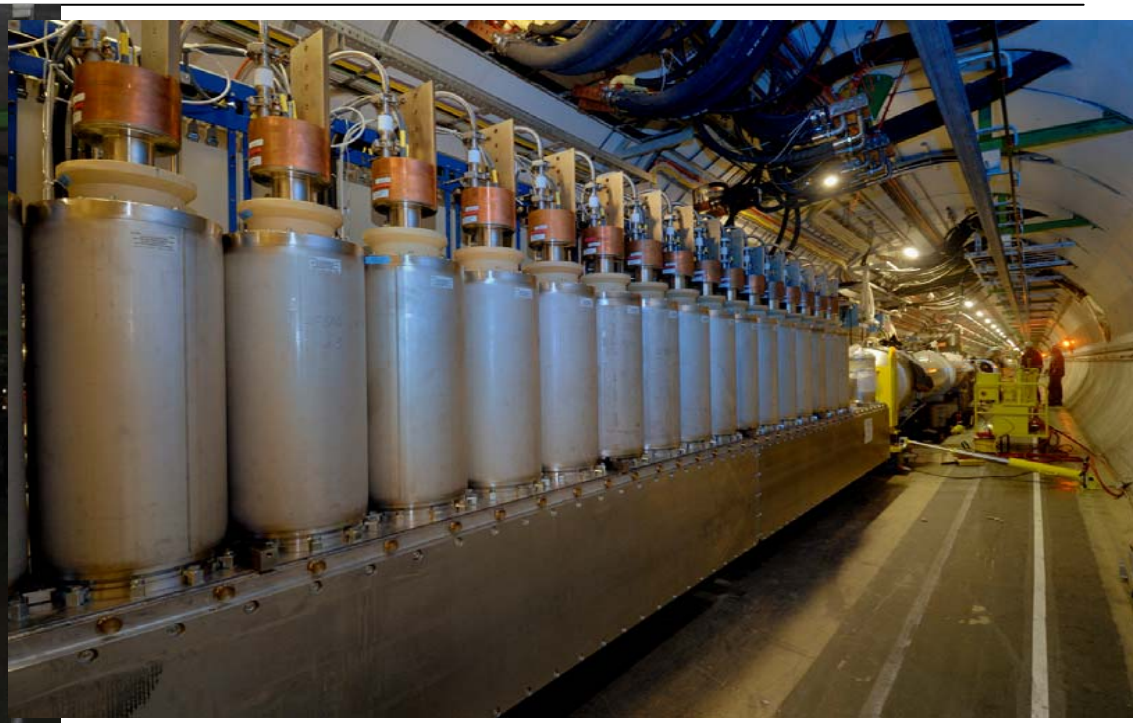
Russian contribution to the LHC Machine

(effective European value, in MCHF)



IHEP – CERN Cooperation





Septum-magnets

(Injection and Ejection systems)

(45 magnets in total)

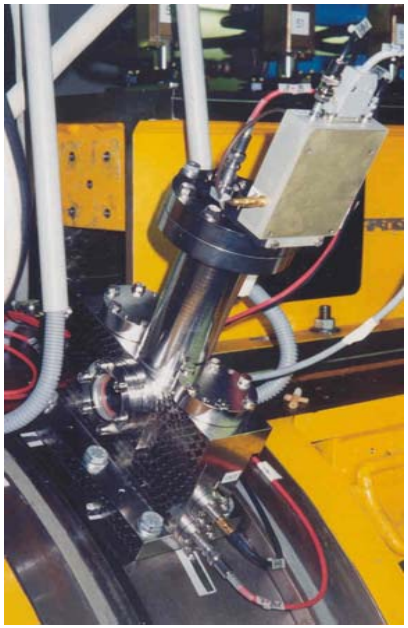
44 DFB structures produced at IHEP, Protvino

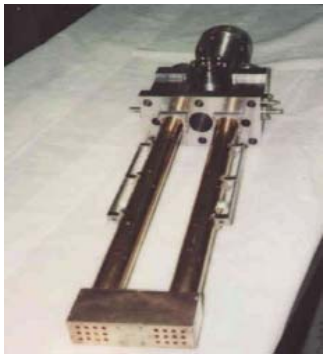
plus: High T_c current leads at BINP, Novosibirsk

D1: Inter-Tank Bunch Shape Monitors

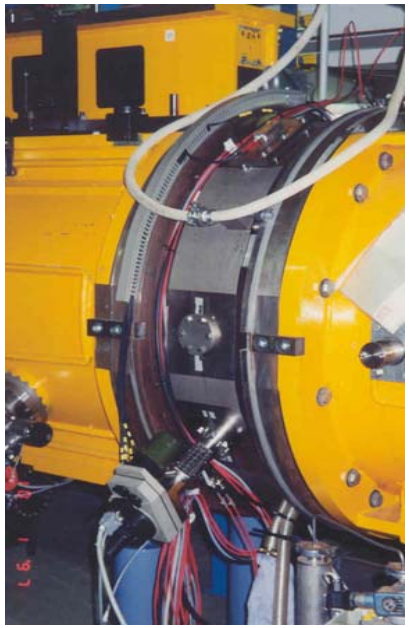
Two Bunch Shape Monitors for inter-tank sections Tank1-Tank2 and Tank2-Tank3 of CERN Linac-2 have been developed, fabricated and commissioned.

Total value of **360** kCHF. Completed in 1999.

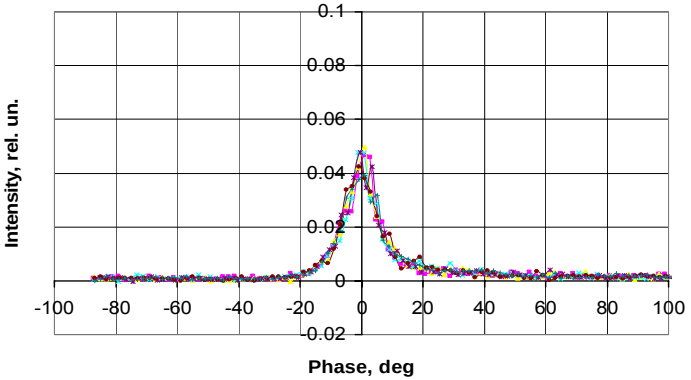




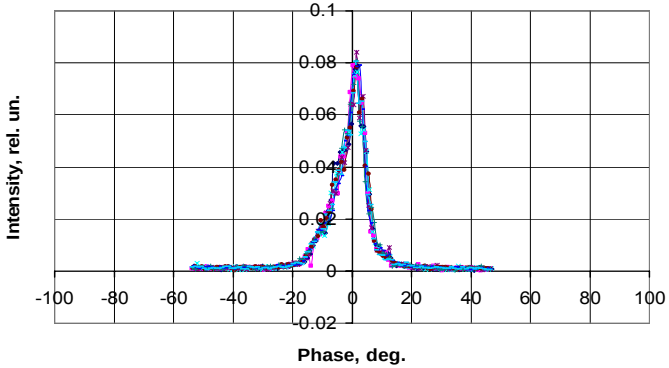
Combined RF deflector and Electron Collector Unit in inter-tank section



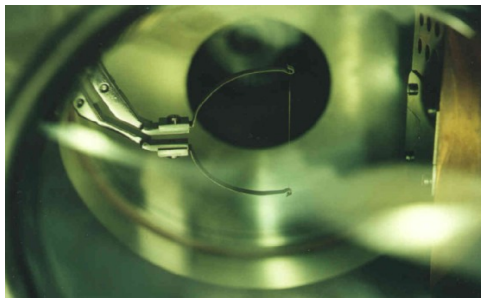
Target Actuator in inter-tank section



Multiple Bunch Shape measurements at the exit of Tank 1 (10 MeV)



Multiple Bunch Shape measurements at the exit of Tank 2 (30 MeV)



BSM Target in beam line

The LHC Transverse Feedback System:
Electrostatic Deflectors

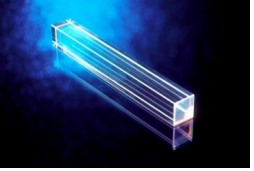
20 vacuum tanks and electrode structures for deflectors were manufactured in the Russian industry and at JINR in 2004-2005.

20 deflectors (10 pairs) were assembled by the joint JINR-CERN team in March–November 2006.

The obtained pressure limits were from $2.0 \cdot 10^{-10}$ Torr to $1.7 \cdot 10^{-9}$ Torr (all data are better than the expected limit of $2 \cdot 10^{-9}$ Torr).

8 pairs of deflectors were installed in the LHC tunnel in August–September 2006.

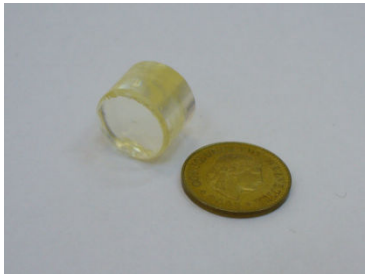
16 supports for power amplifiers were installed in December 2006.



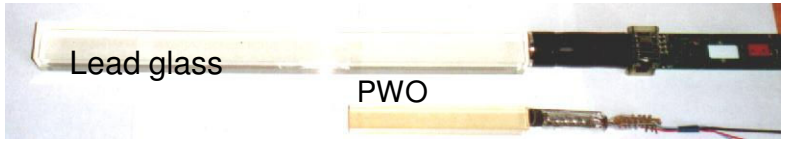
Calorimeters

PWO crystals

1991 – First PWO crystal



1992 – First PWO sell



IHEP

KI

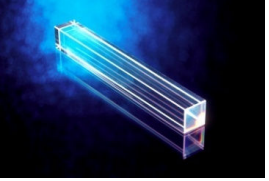
INR

1994 - 60 PWO cells in H8 beam at CERN with PMT readout

1994 – CMS accepted PWO

2000 – 2008 Crystal production in BTCP

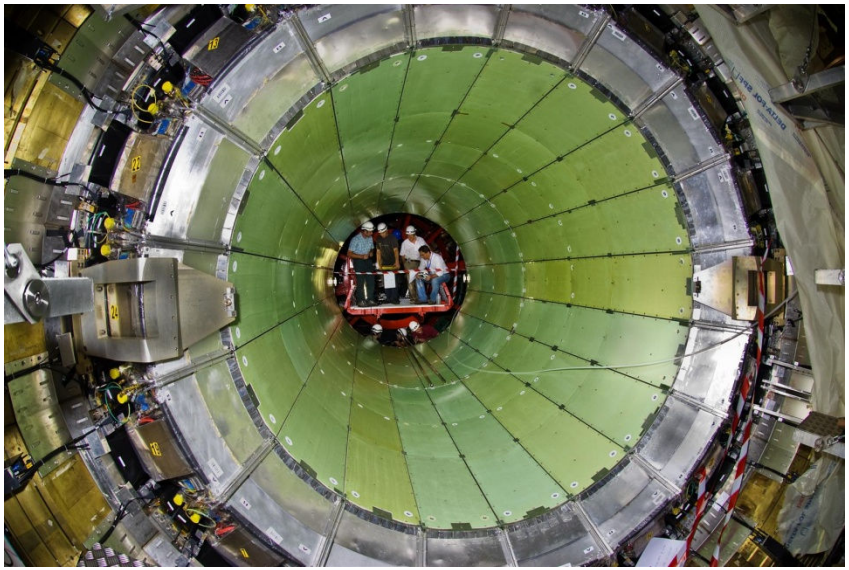
About 80,000 crystals produced for CMS



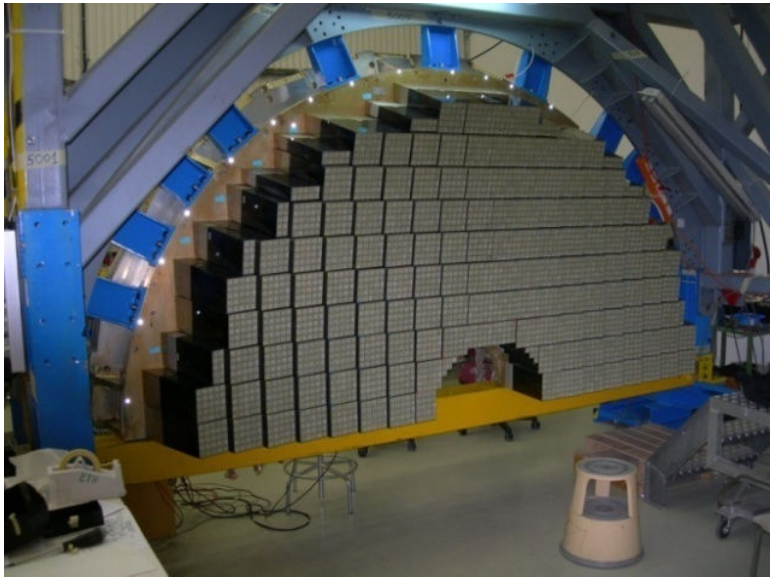
Calorimeters

PWO crystals

CMS 2007 – All 36 EB supermodules mounted

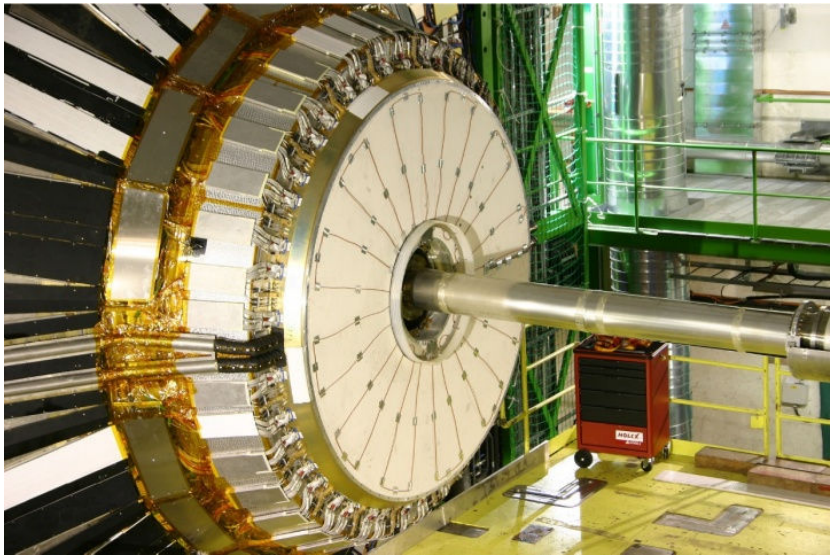


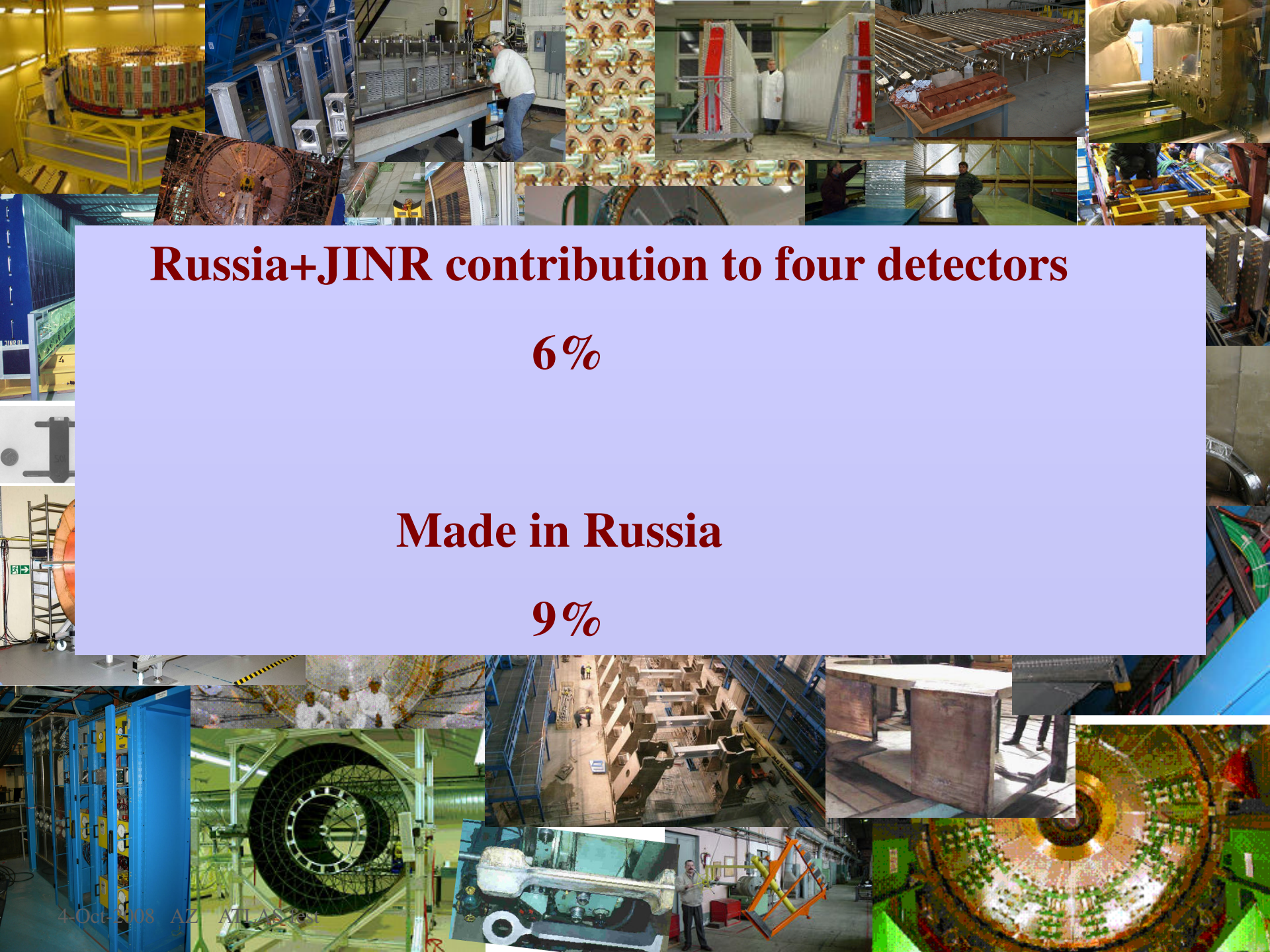
CMS 2007 – Dee 1 assembly



CMS 2009 – ES Dee connection

CMS 2009 - Endcap ready





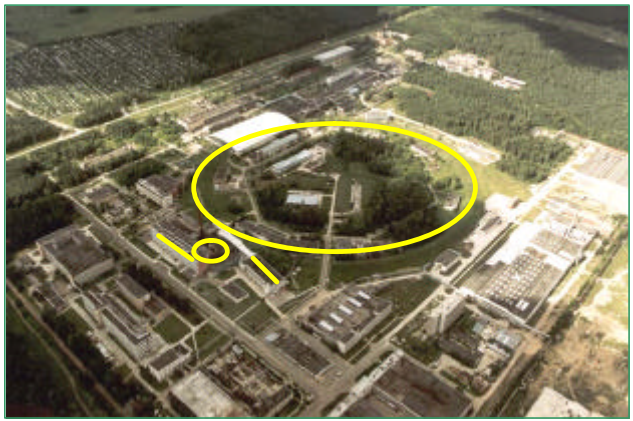
Russia+JINR contribution to four detectors

6%

Made in Russia

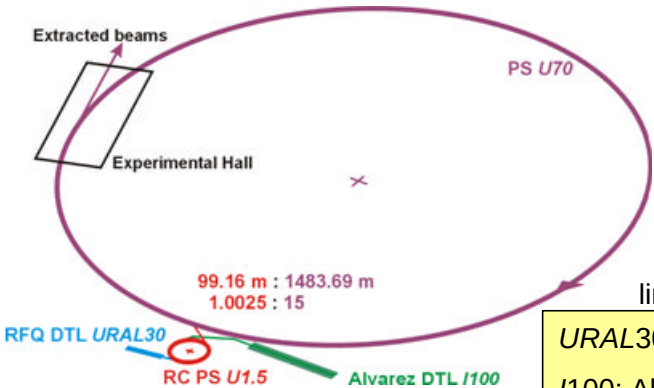
9%

Layout of accelerator complex *U*70



October 14, 2007
40 years to *U*70

4 machines (since 10.2007):
- 2 *p*-linacs
- 2 *p*-synchrotrons



synchrotrons

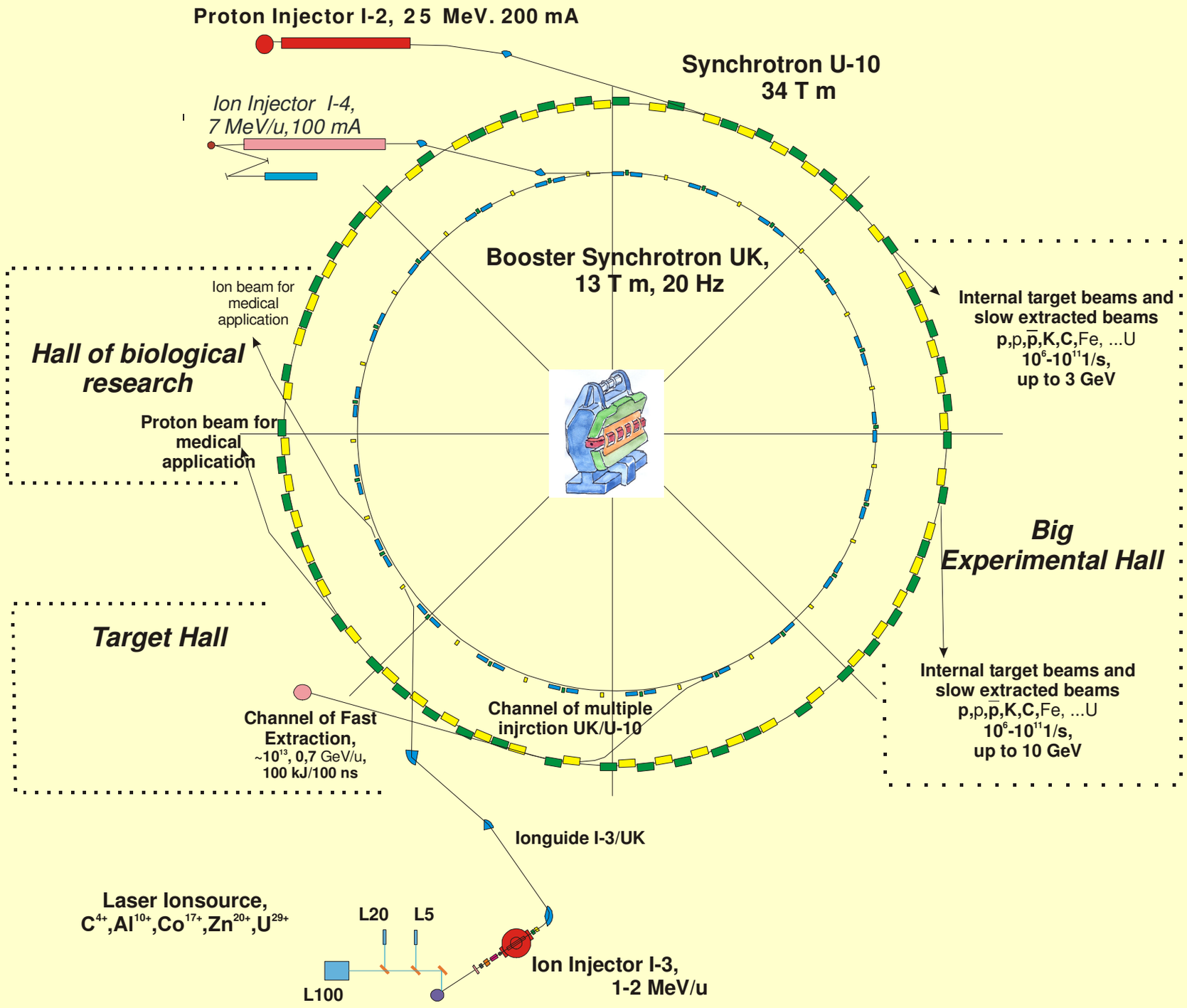
	*U*1.5	*U*70
E, GeV	0.03 – 1.32	1.32 – 50/60
L, m	99.16	1483.69
N	3–5 ?10^{11} p p b	1?10^{13} p p p
B?, T?m	0.8 – 6.9	6.9 – 233.4
h	1	30
f_{RF}, MHz	0.75 – 2.79	5.52 – 6.06
Cycle	16 2/3 Hz, PPM	9.8 sec

linacs

*URAL*30: 0.1-30 MeV, RFQ (2 MeV) + RFQ DTL

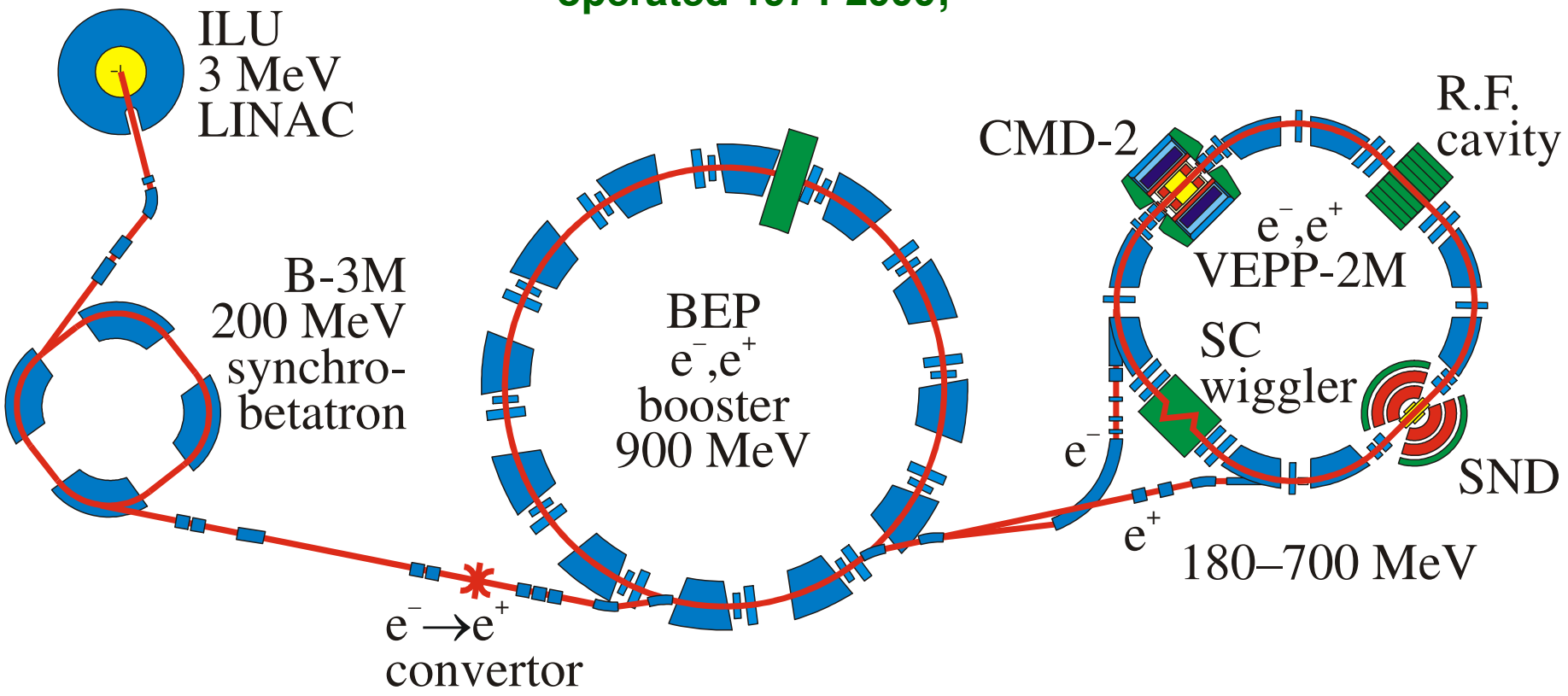
*I*100: Alvarez DTL, 0.7—100 (72.7) MeV *p*; 16.7 MeV/u *d*, *C* (@ 4?)

ITEP Accelerator Facility



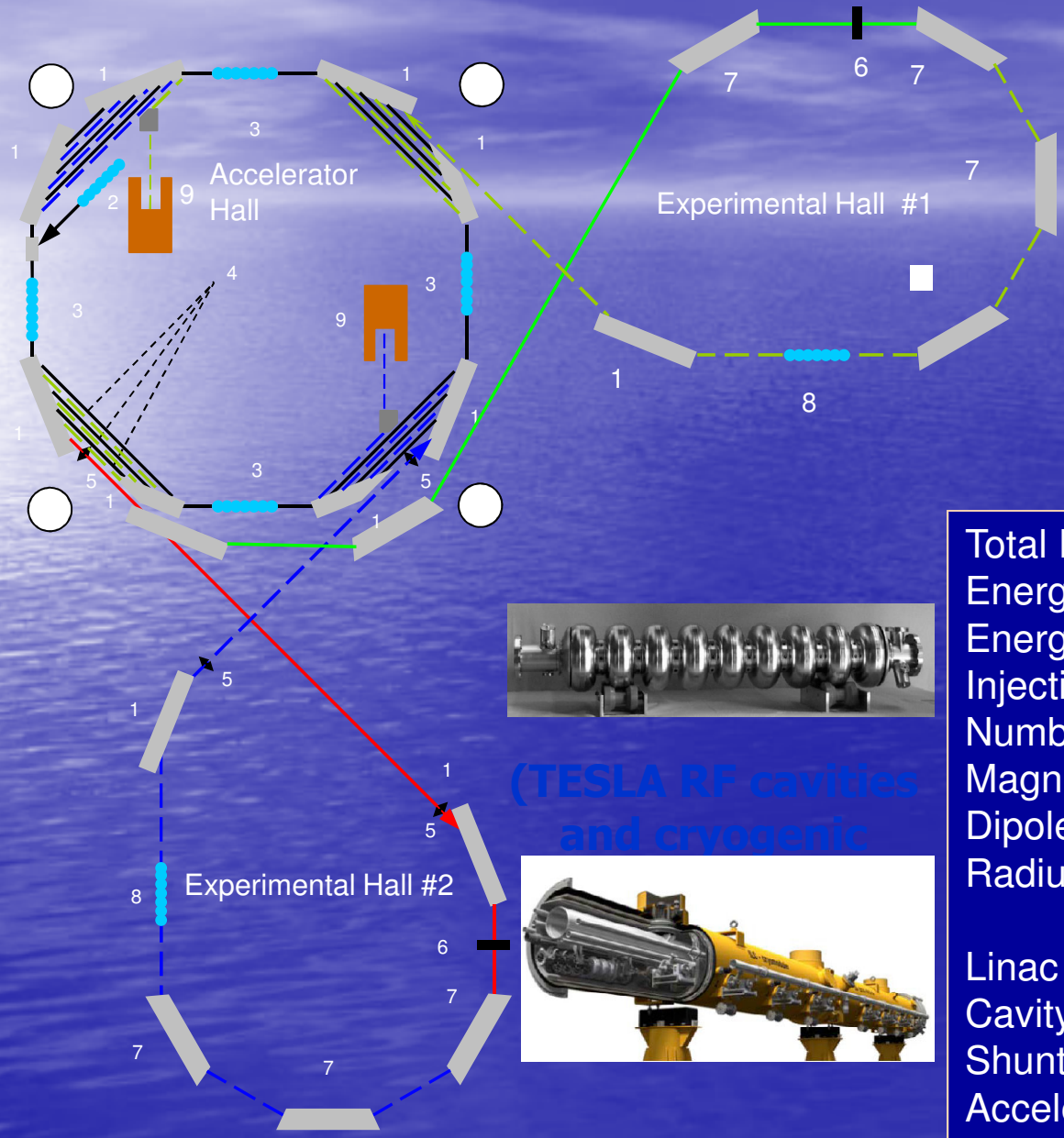
VEPP-2M Collider Complex

operated 1974-2000;



- $L_{max}=4x10^{30}cm^{-2}sec^{-1}$ at $E_0=510$ MeV; Total integrated luminosity 80 pb^{-1}.
- **Main results:**
  - Development of the resonant depolarization technique for precise measurements of particles masses (from 1975)
  - Detailed study of ρ, ω, *and* ϕ- mesons (precise measurements of parameters, rare decays and etc)
- **Data analysis is not completed yet**

One of possibilities for upgrade of the LPI accelerator complex in Troitsk –



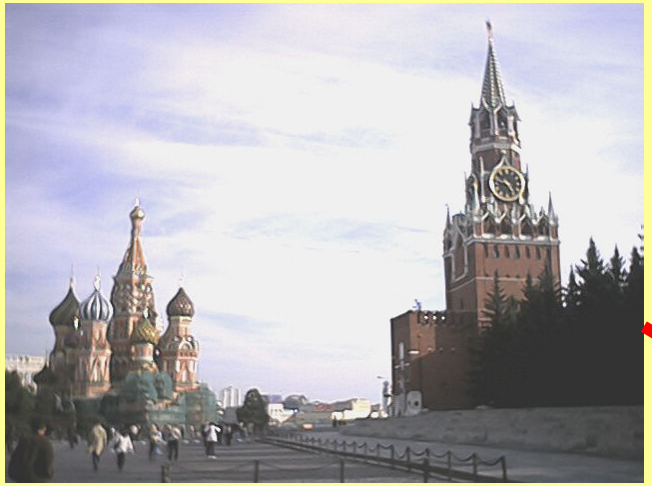
A compact 2-GeV CW recirculator with modern super-conducting RF resonators and the energy recovering.

With the gradient ~25 MeV/m, it fits into existing infrastructure.

(TESLA RF cavities and cryogenic

Total Energy	2.05 GeV
Energy Gain per Turn	600 MeV
Energy Gain in a Linac	150 MeV
Injection Energy	100 MeV
Number of Turns	3
Magnetic Field in Dipoles	1.36 T
Dipole Pole Sizes	0.4 x 3.6 m
Radius of Trajectory	0.6 m min
	4.7 m max
Linac Frequency	1.3 GHz
Cavity Quality Factor	5×10^9
Shunt Impedance	1 kΩ
Accelerating Gradient	25 MeV/m

MOSCOW



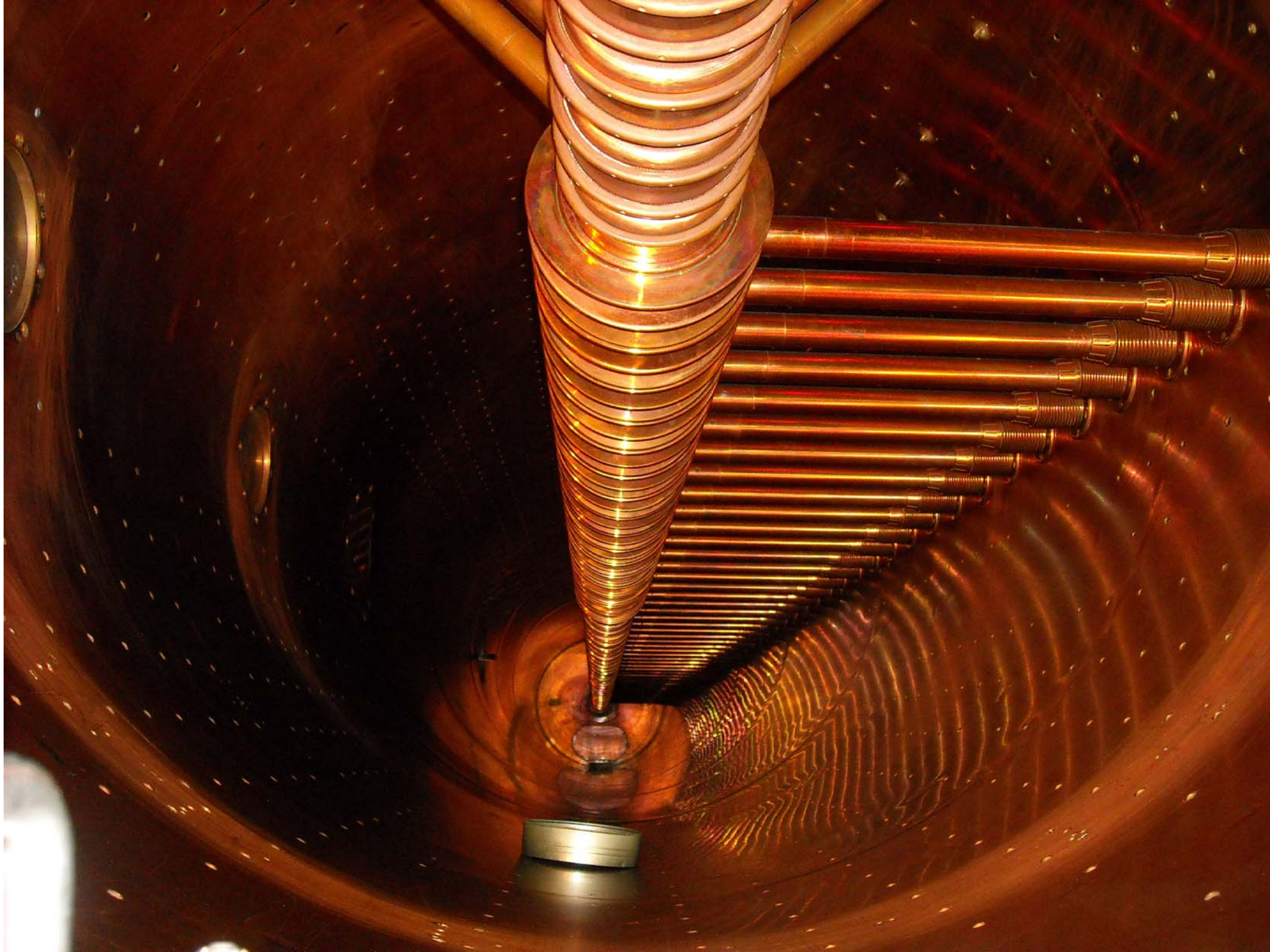
20 km

TROITSK

INR Accelerator (MMF)

1 km

RUSSIAN ACADEMY OF SCIENCES
INSTITUTE
FOR NUCLEAR RESEARCH




1M2B

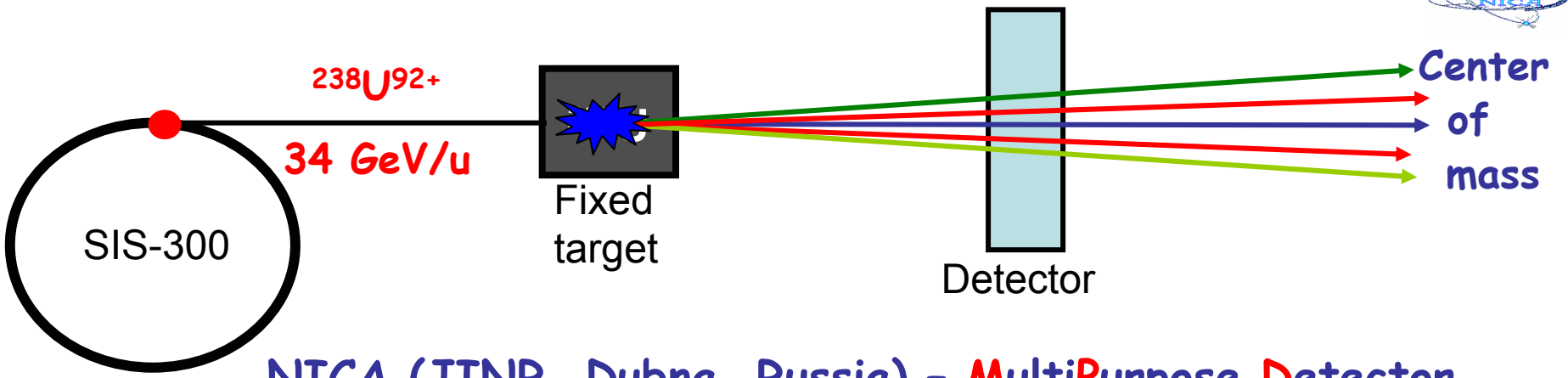
NICA Project

Nuclotron-based Ion Collider fAcility

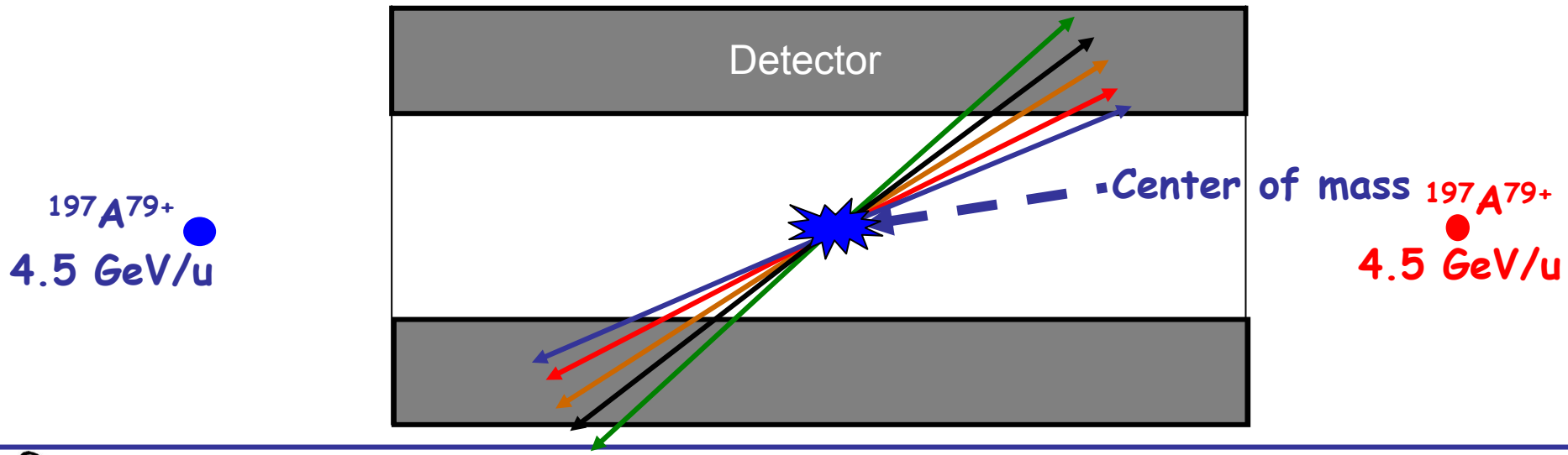
I.Meshkov, G.Trubnikov
for NICA Collaboration

1. Two projects- FAIR/CBM & NICA/MPD

FAIR (Darmstadt, Germany) – Compressed Baryonic Matter



NICA (JINR, Dubna, Russia) – MultiPurpose Detector



The NICA Project goals formulated in NICA CDR are the following:

1a) Heavy ion colliding beams $^{197}Au^{79+}$ x $^{197}Au^{79+}$ at

$\sqrt{s_{NN}}$ = **4 ÷ 11 GeV** (1 ÷ 4.5 GeV/u ion kinetic energy)

at

$L_{average}$ = **$1 \cdot 10^{27}$ $cm^{-2} \cdot s^{-1}$** (at $\sqrt{s_{NN}}$ = 9 GeV)

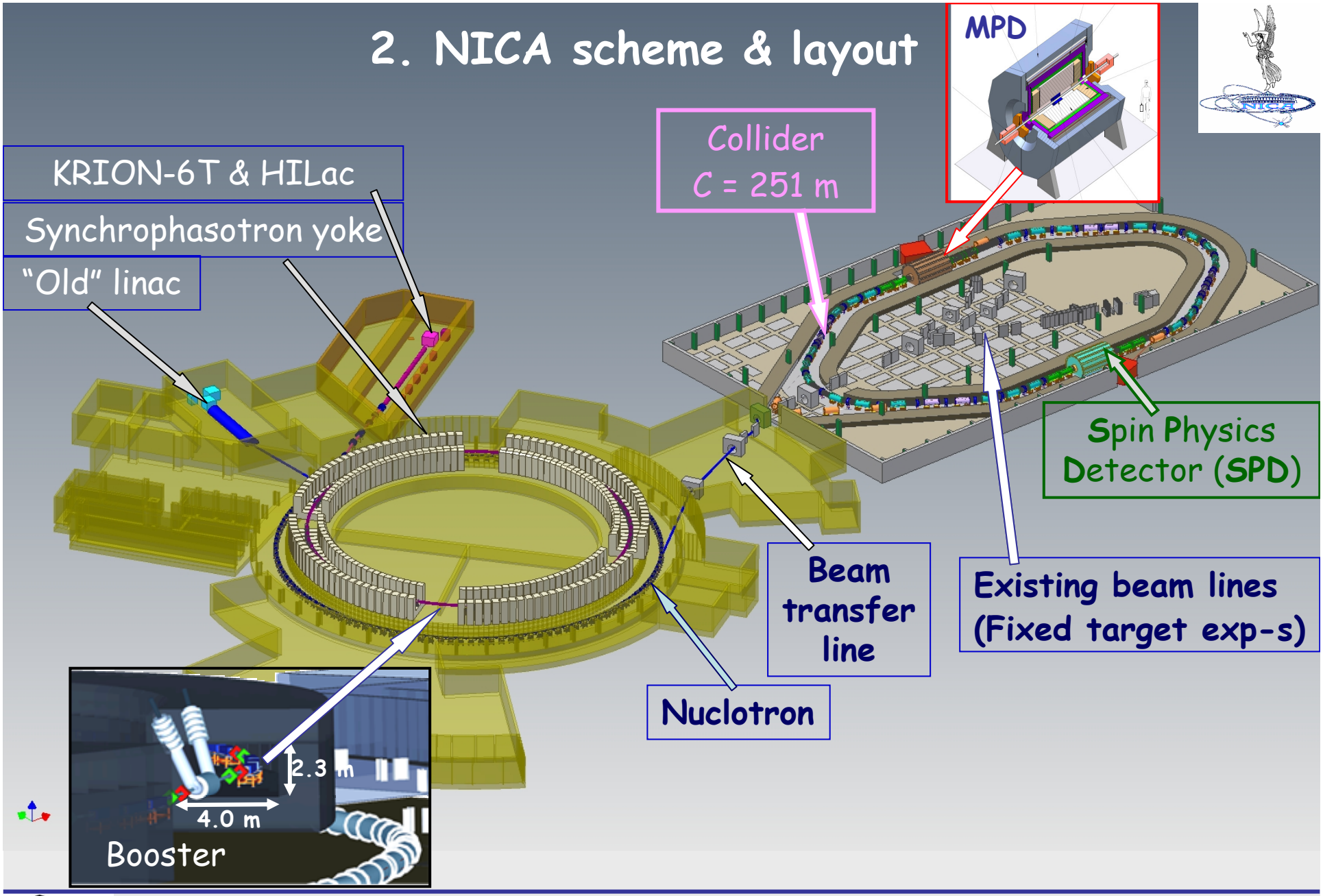
1b) Light-Heavy ion colliding beams of the same energy range and luminosity

2) Polarized beams of protons and deuterons:

p↑p↑ $\sqrt{s_{NN}}$ = **12 ÷ 25 GeV** (5 ÷ 12.6 GeV kinetic energy)

d↑d↑ $\sqrt{s_{NN}}$ = **4 ÷ 13.8 GeV** (2 ÷ 5.9 GeV/u ion kinetic energy)

2. NICA scheme & layout



GSI/JINR/BNL
2005 - 2009
Round Table Discussions I, II, III, IV
JINR, Dubna, 2005, 2006, 2008
http://theor.jinr.ru/meetings/2008/roundtable/

- ✓ Booster RF system
- ✓ Booster electron cooling
- ✓ Collider RF system
- ✓ Collider SC magnets (expertise)
- ✓ HV electron cooler for collider
- ✓ Electronics (?)

ollaboration

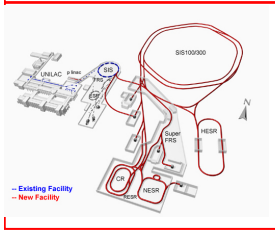
IHEP (Protvino)
Injector Linac

FZ Jűlich (IKP)
HV Electron cooler
Stoch. cooling

Fermilab
HV Electron cooler
Beam dynamics Stoch. cooling

BNL (RHIC)
Electron & Stoch. Cooling

All-Russian Institute for Electrotechnique
HV Electron cooler



GSI/FAIR
SC dipoles for Booster/SIS-100
SC dipoles for Collider

ITEP: Beam dynamics in the collider

Corporation "Powder Metallurgy" (Minsk, Belorussia):
Technology of TiN coating of vacuum chamber walls for reduction of secondary emission

EPS-HEP 2009

ECFA
European Committee for Future Accelerators

- Plenary ECFA meeting
  - Approval of new ECFA Chair

- Joint EPS-ECFA Session

  Presentations and discussion on:
  - Astroparticle physics and relations with the LHC
  - The high-energy frontier
  - The future of accelerator based neutrino physics
  - Super-B factories

P-ECFA, Nov. 2009

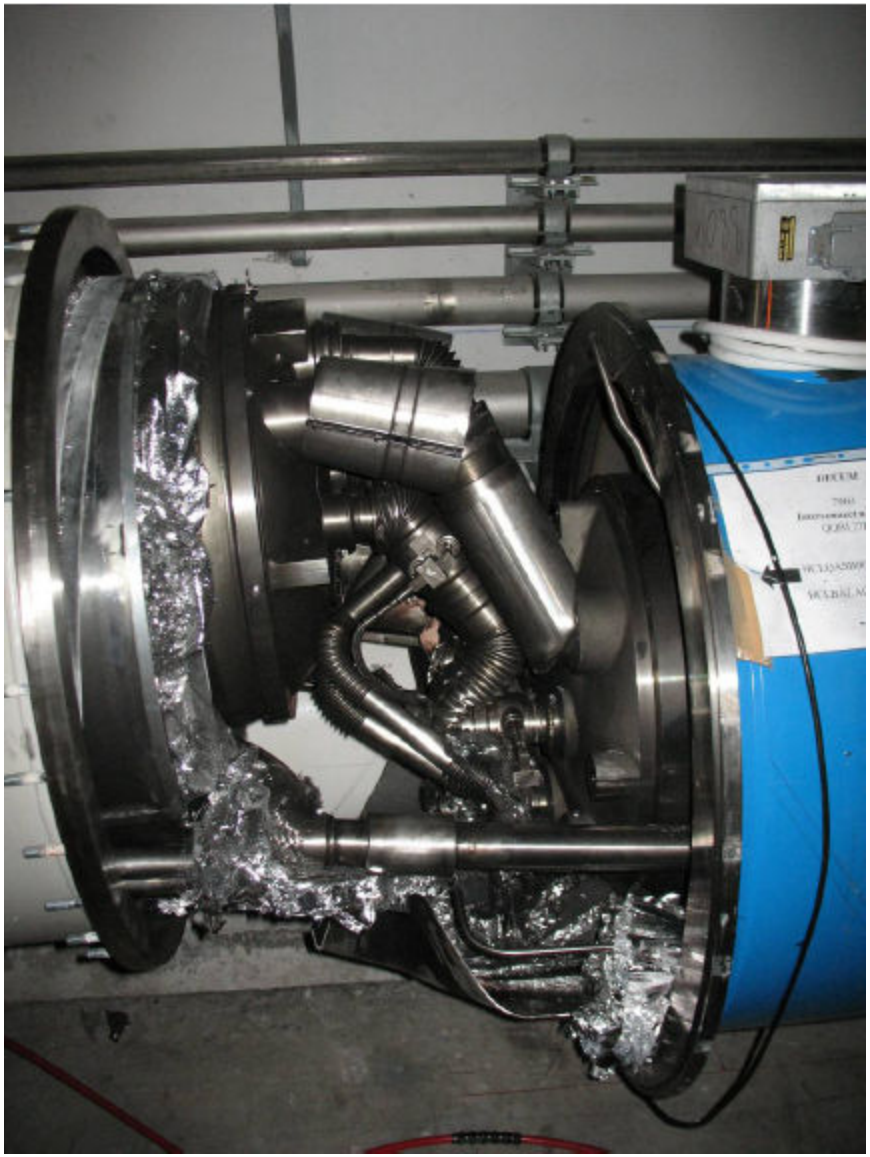
ECFA
European Committee for Future Accelerators

- Reports from CERN, DESY, Frascati
- Midterm reports: Italy, Poland and Israel
- European Strategy (FP7) and Outreach
- ECFA survey results
- Review of projects:
  - LHeC
  - Super-B factories (INFN, KEK)
  - Linear Colliders (ILC, CLIC, detectors)
  - Neutrino experiments/neutrino factories

LHC is back!

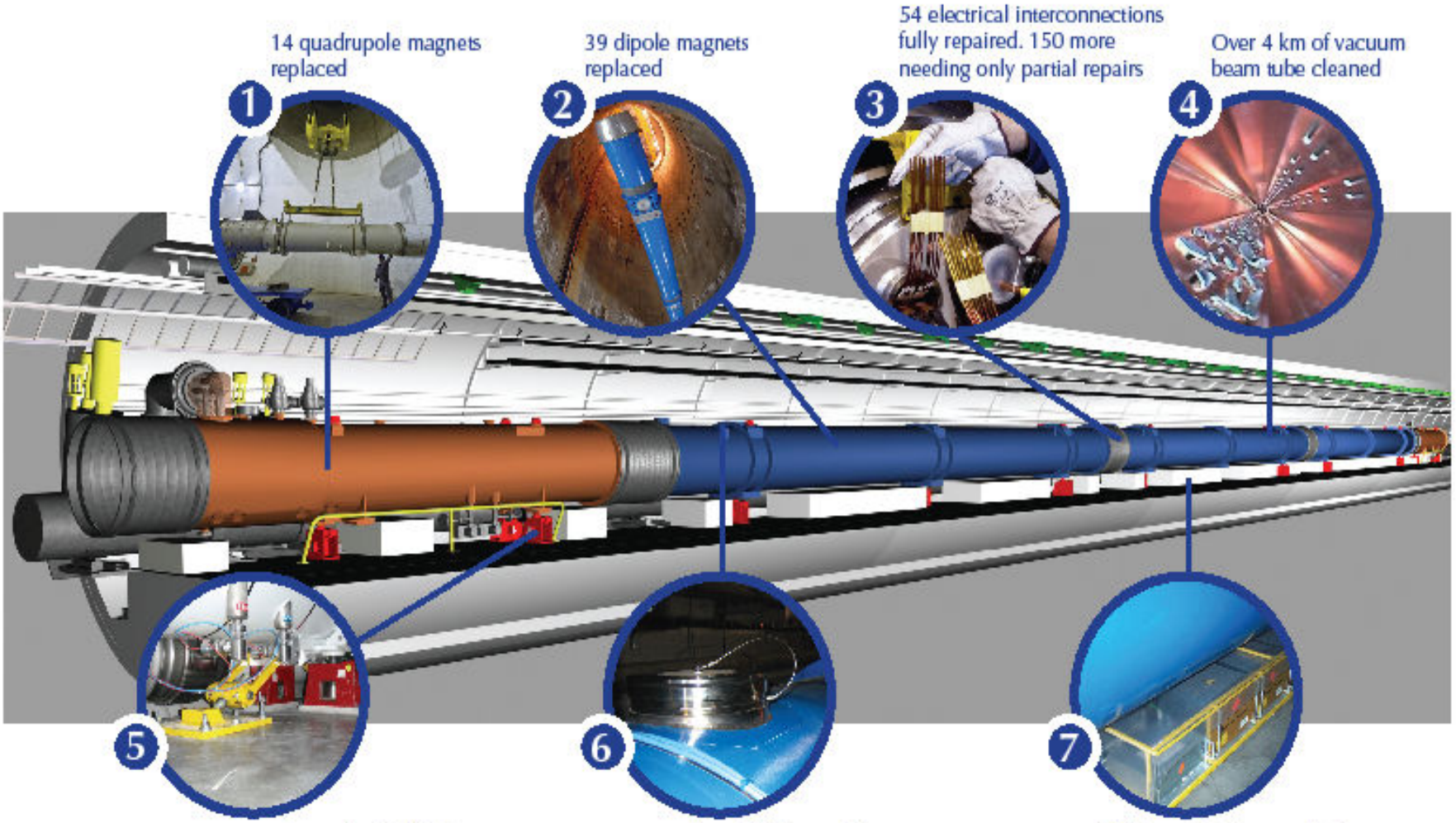
From the dark days after September 19, 2008 to the bright days of late November 2009

From This!



Phase 1 +2

The LHC repairs in detail

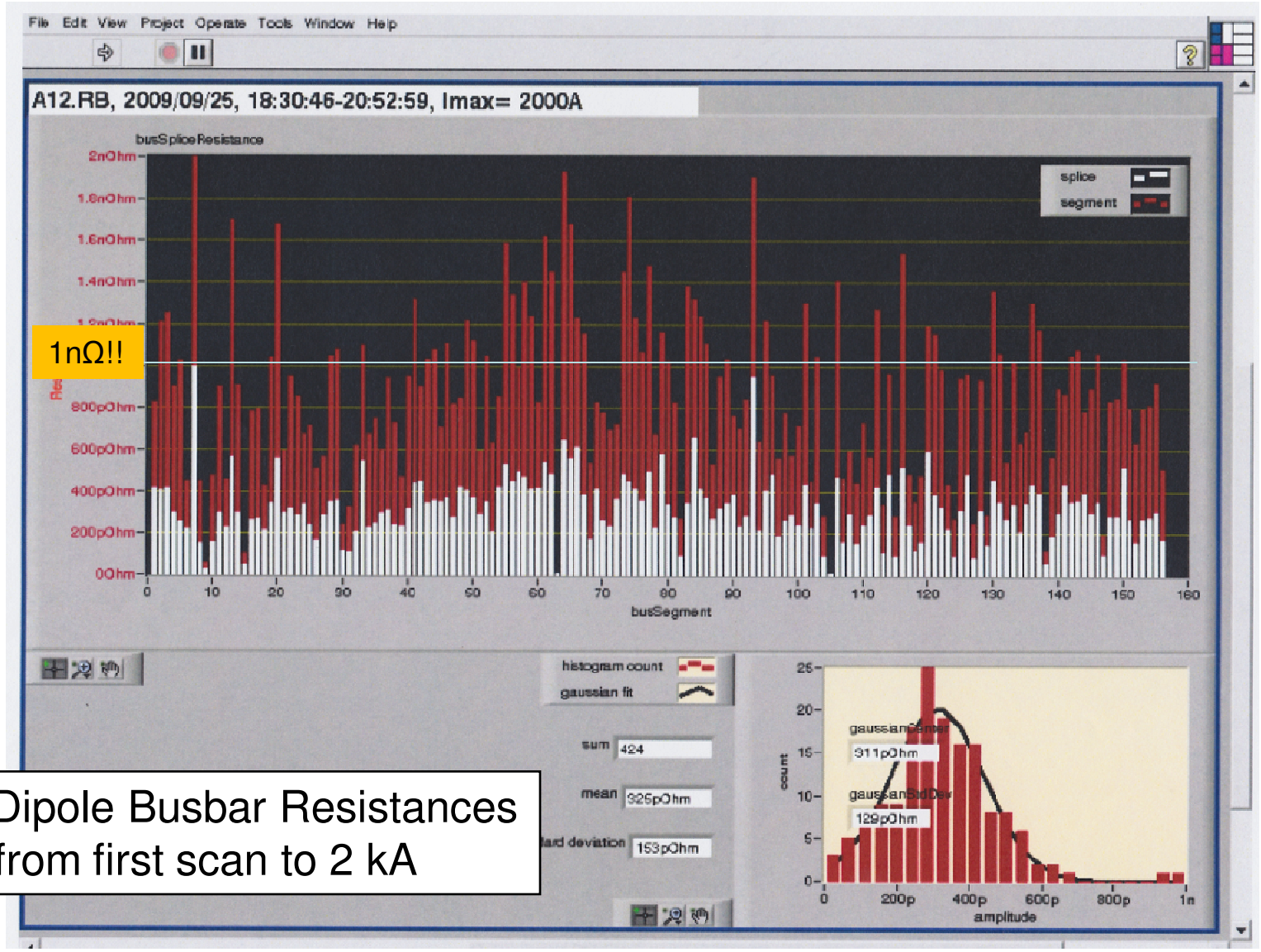


CERN

+ cryogenics!

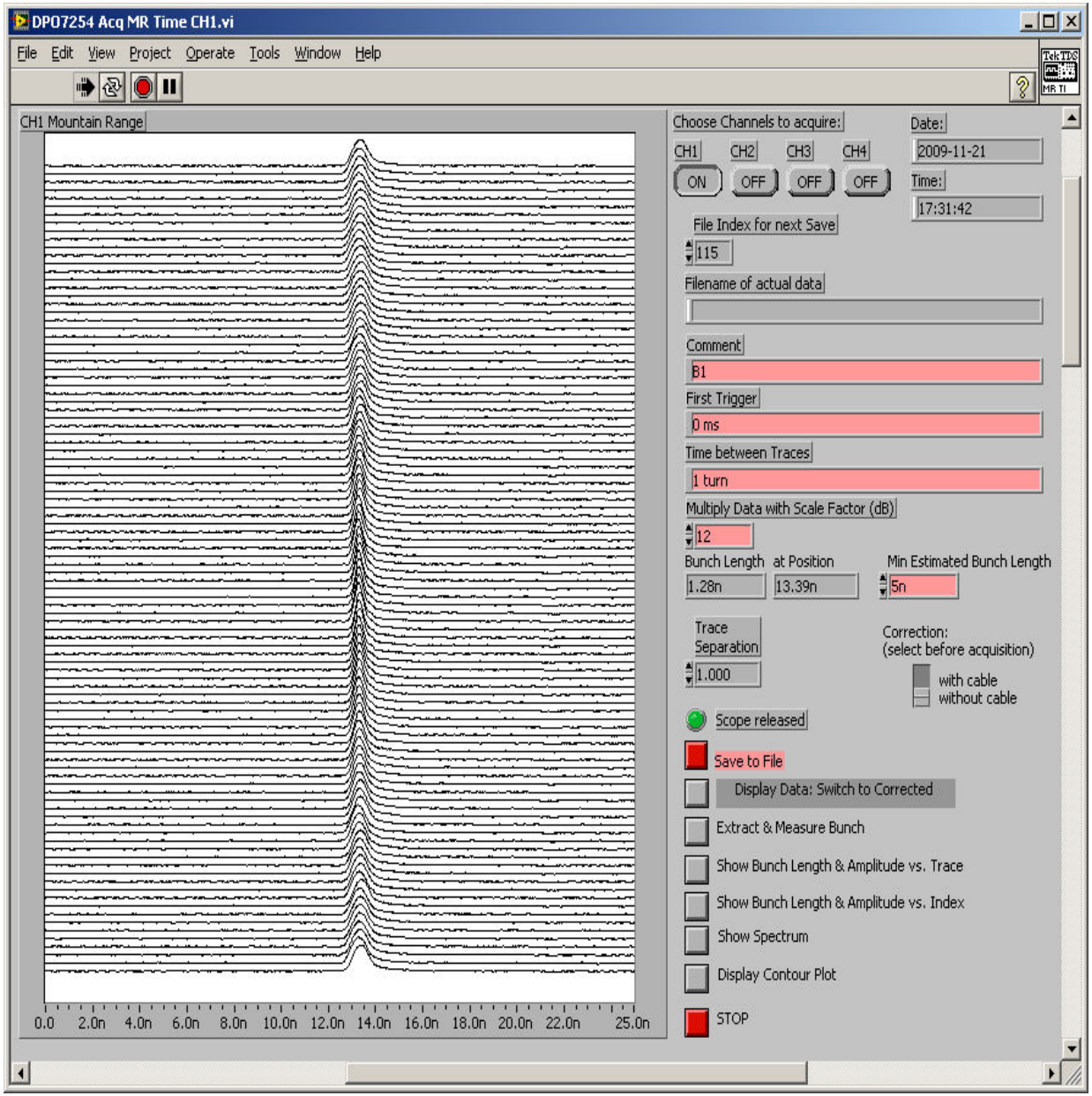
Splice Mapping of Dipoles

QPS team



First Dipole Busbar Resistances from first scan to 2 kA

To This



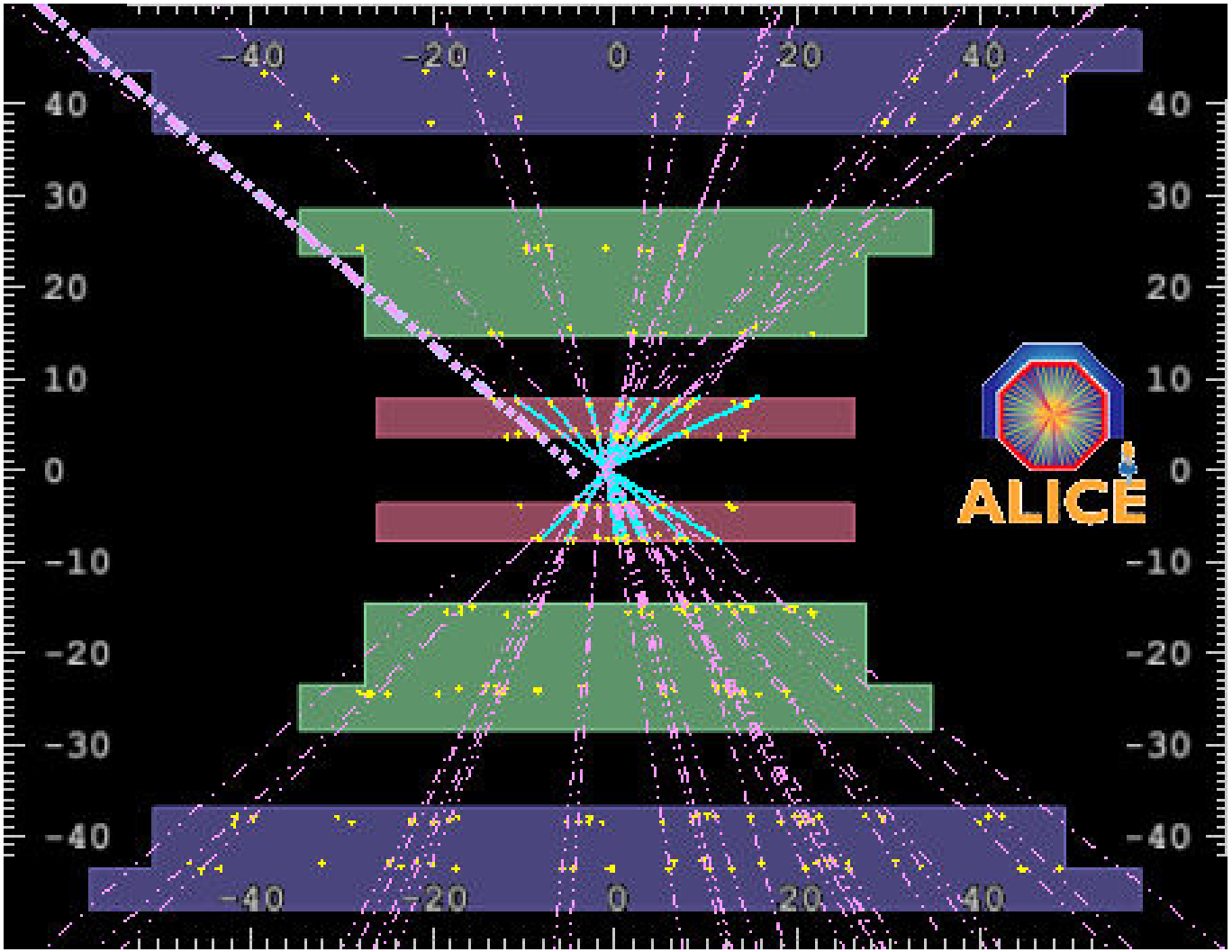
Beam is circulating and stable

- magnets
- power supplies
- vacuum
- RF
- cryogenics
- all infrastructure
- optics
- injection

and This

ALICE

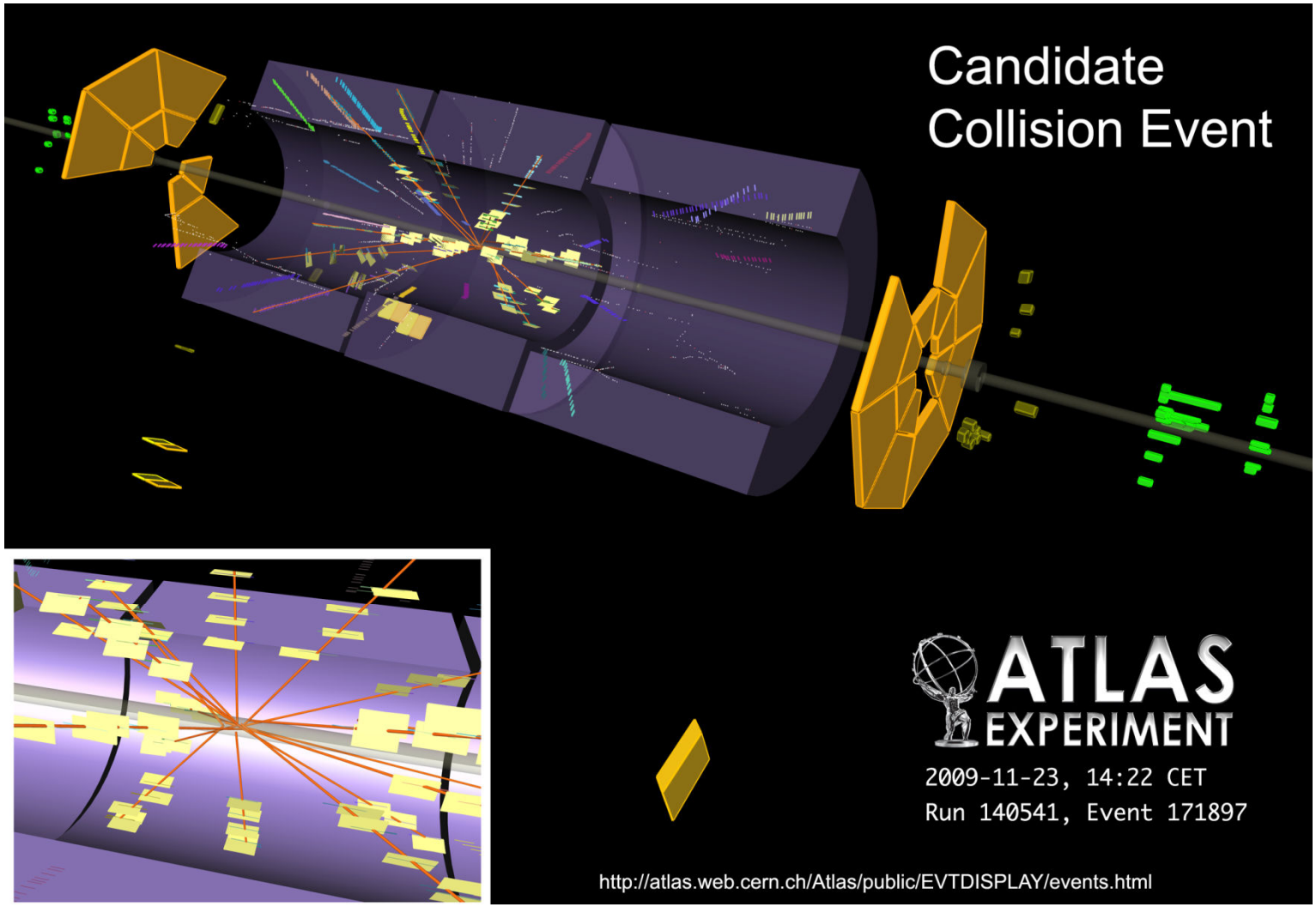
Monday 23, Nov



and This

ATLAS

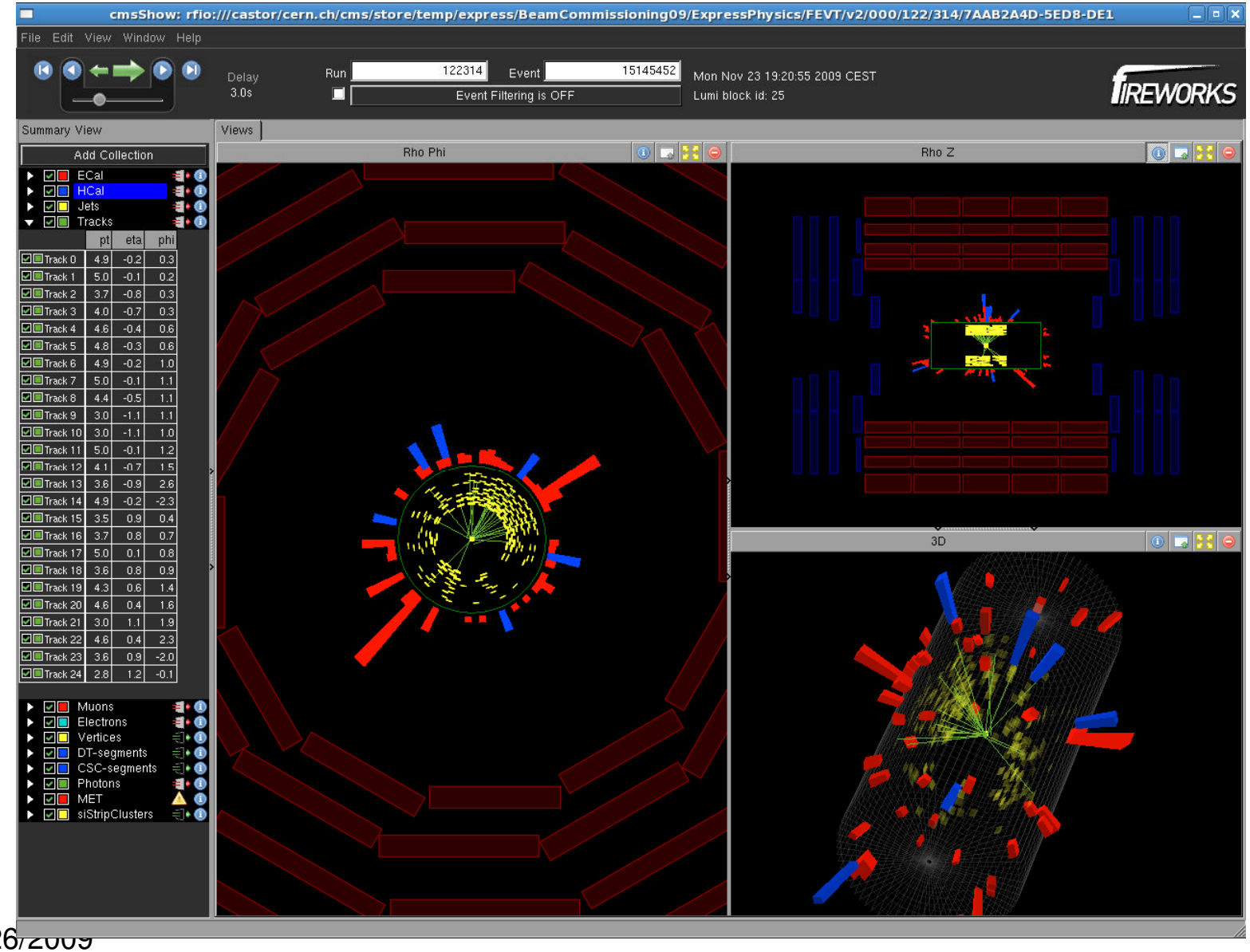
Monday 23, Nov



and This

CMS

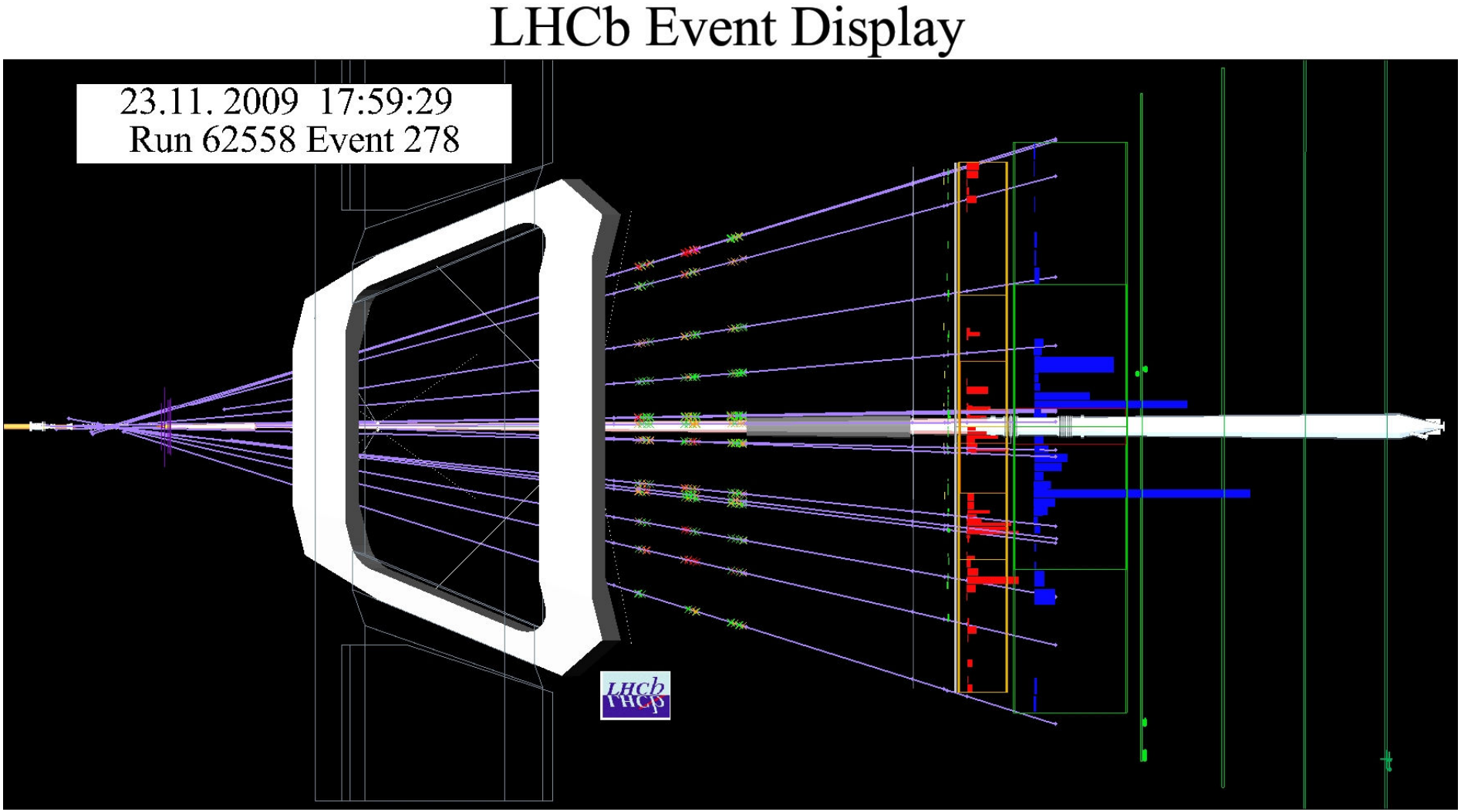
Monday 23, Nov



and This

Monday 23, Nov

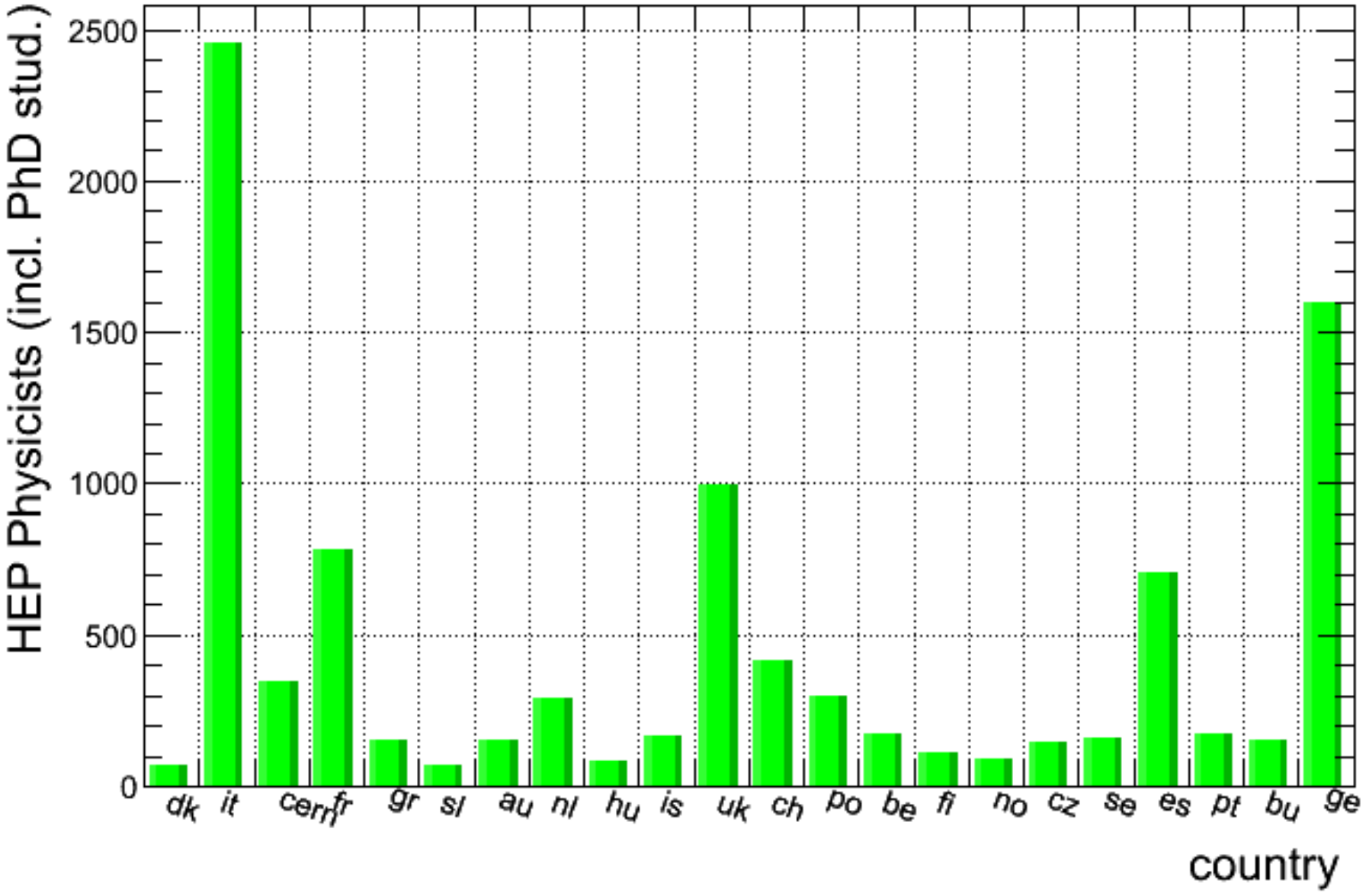
LHCb

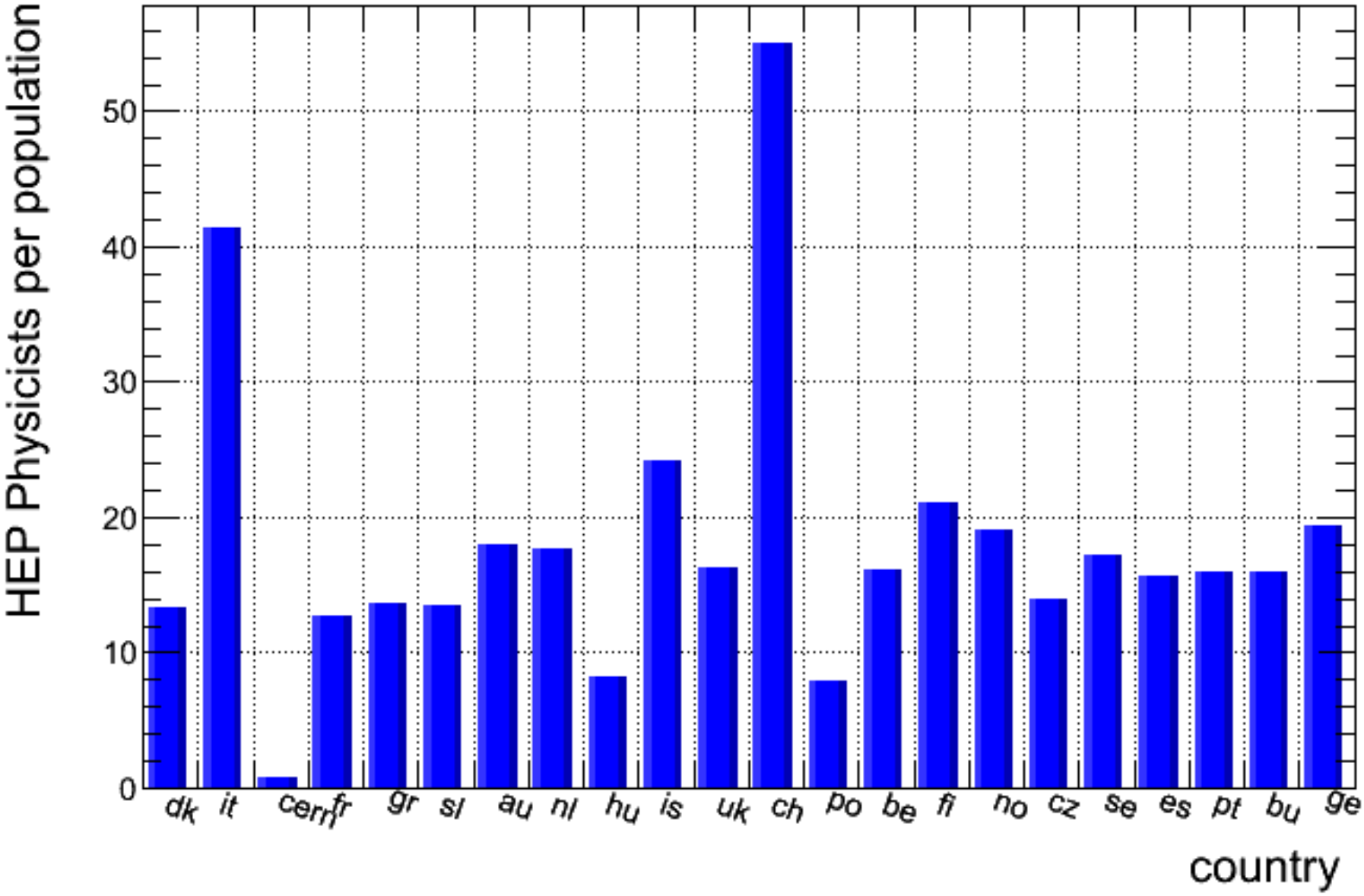


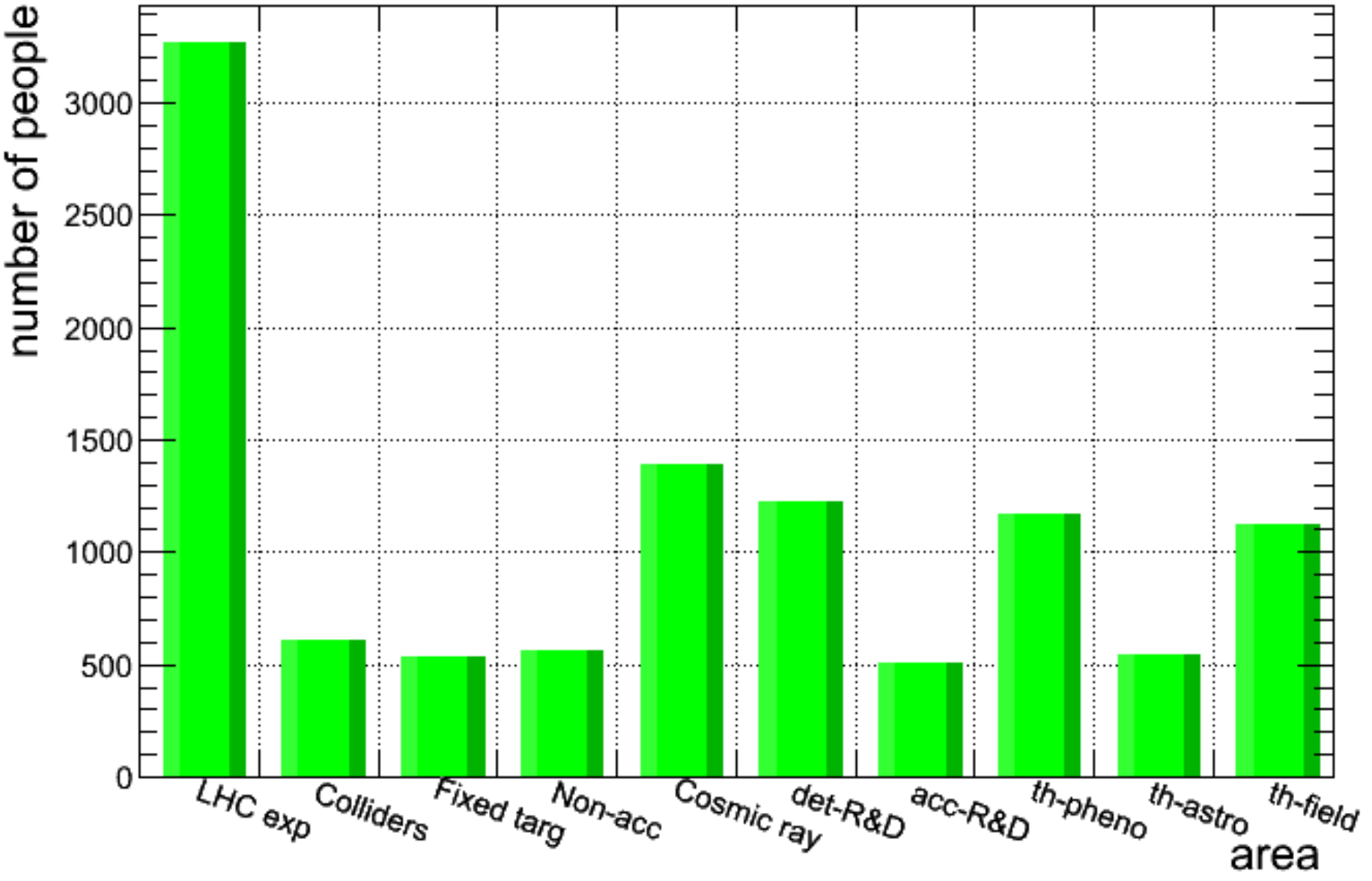
2009 ECFA Survey preliminary results

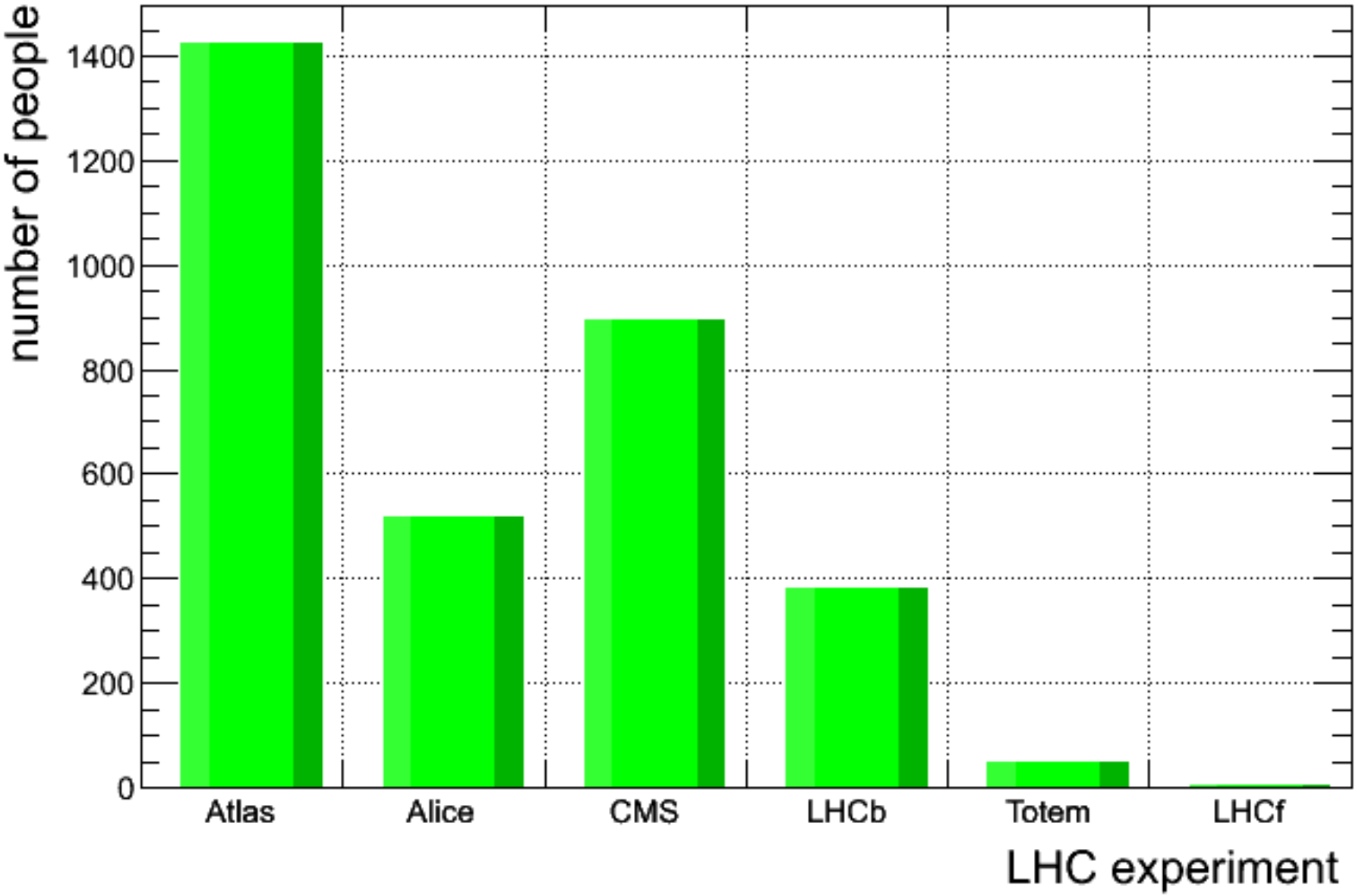
Peter H Hansen

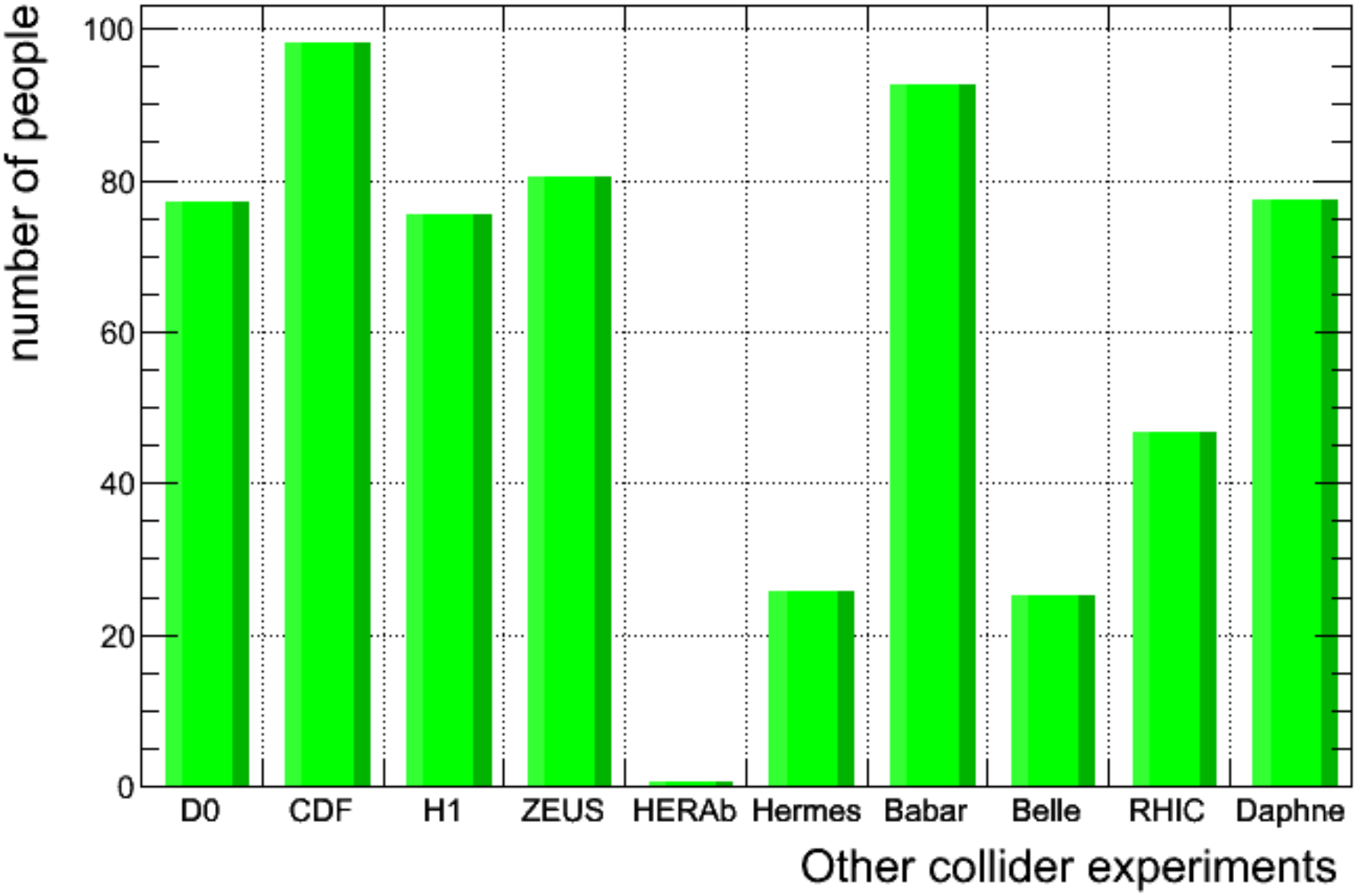
Plenary ECFA meeting 26/11/2009

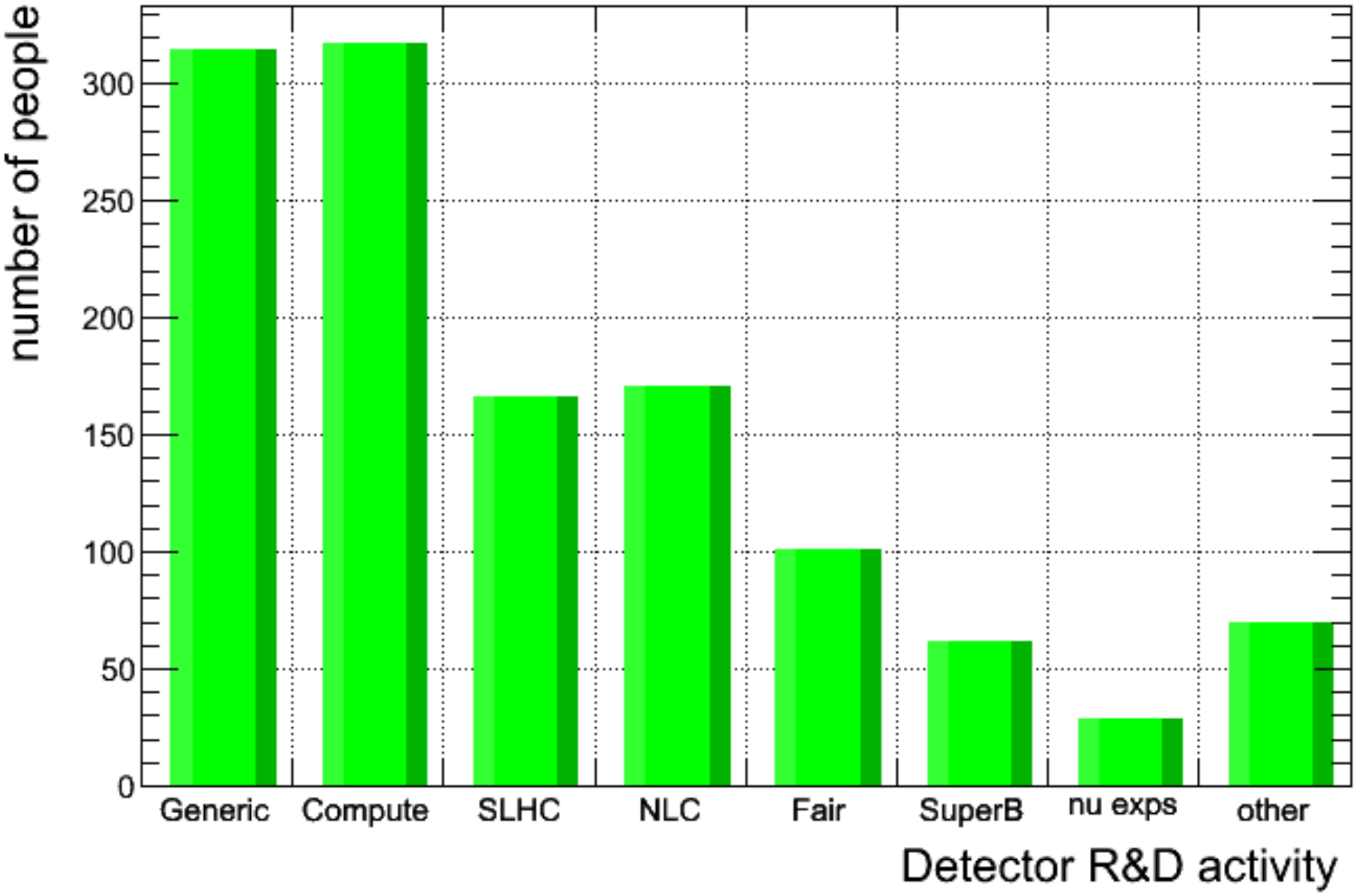

HEP Physicists (incl. PhD stud.)
2500
2000
1500
1000
500
0
dk
it
cern
fr
gr
sl
au
nl
hu
is
uk
ch
po
be
fi
no
cz
se
es
pt
bu
ge
country

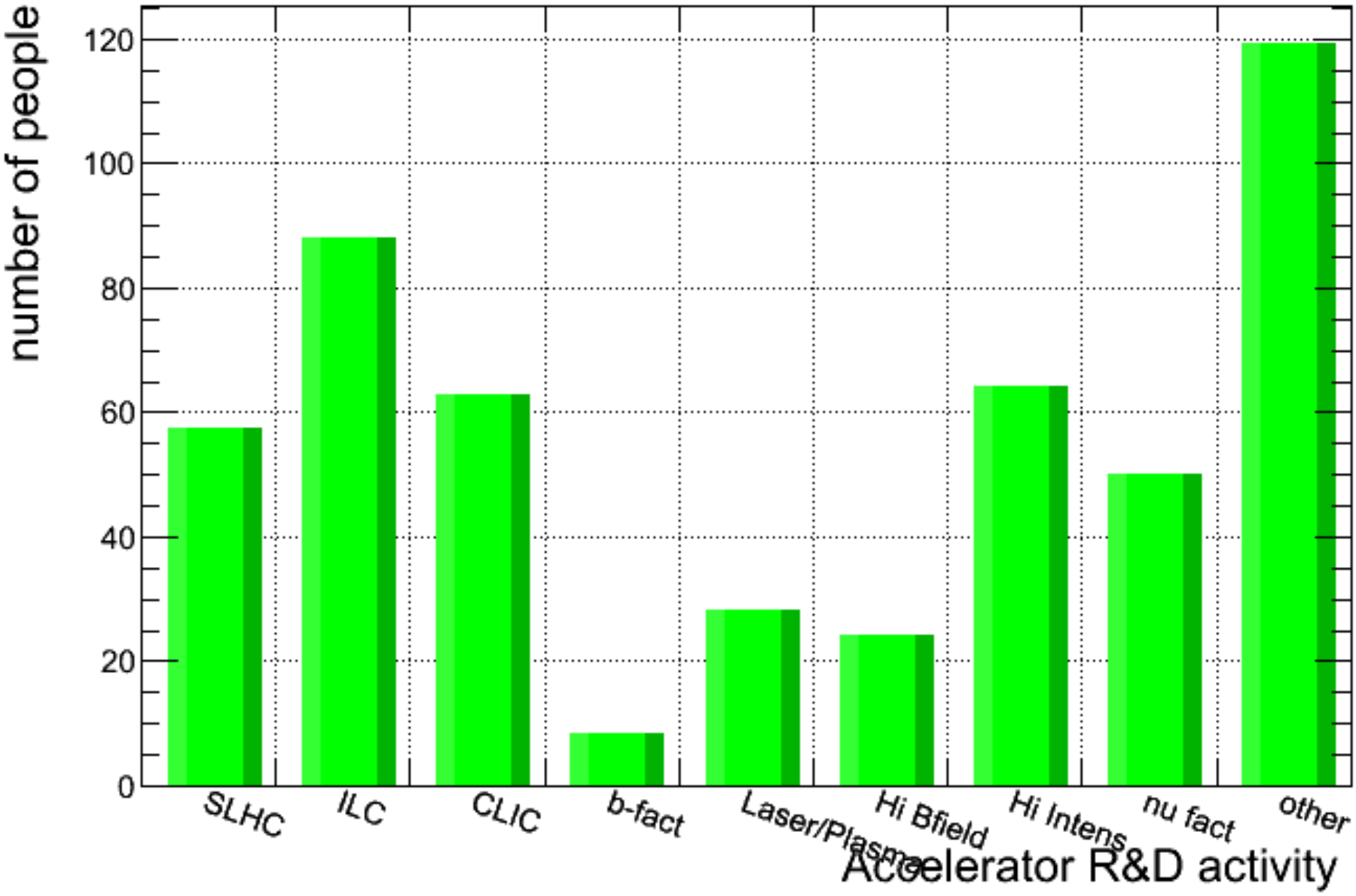

HEP Physicists per population
0
10
20
30
40
50
dk
it
cern
fr
gr
sl
au
nl
hu
is
uk
ch
po
be
fi
no
cz
se
es
pt
bu
ge
country

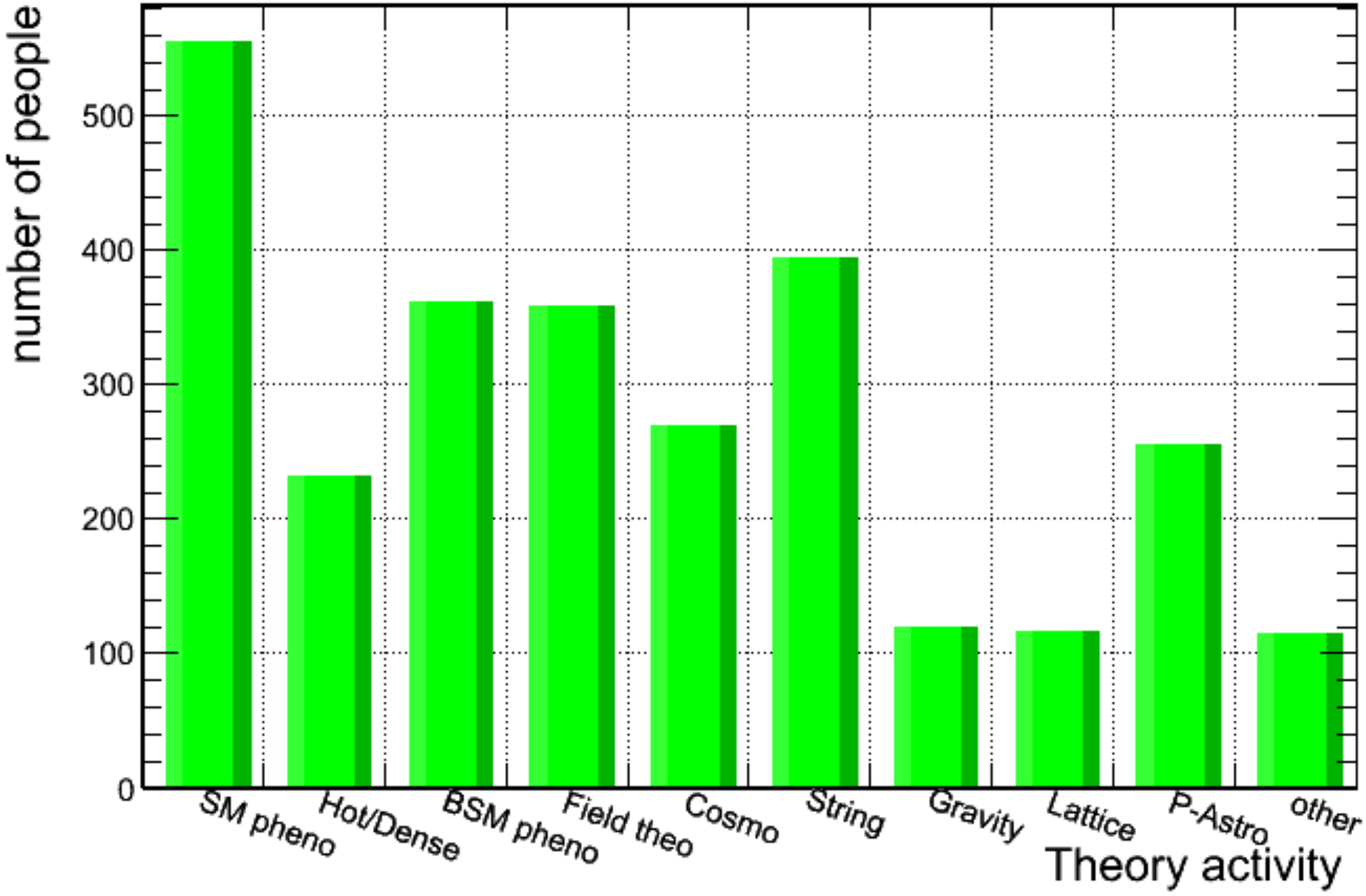

number of people
3000
2500
2000
1500
1000
500
0
LHC exp
Colliders
Fixed targ
Non-acc
Cosmic ray
det-R&D
acc-R&D
th-pheno
th-astro
th-field
area


number of people
1400
1200
1000
800
600
400
200
0
Atlas
Alice
CMS
LHCb
Totem
LHCf
LHC experiment


number of people
100
80
60
40
20
0
D0
CDF
H1
ZEUS
HERAb
Hermes
Babar
Belle
RHIC
Daphne
Other collider experiments

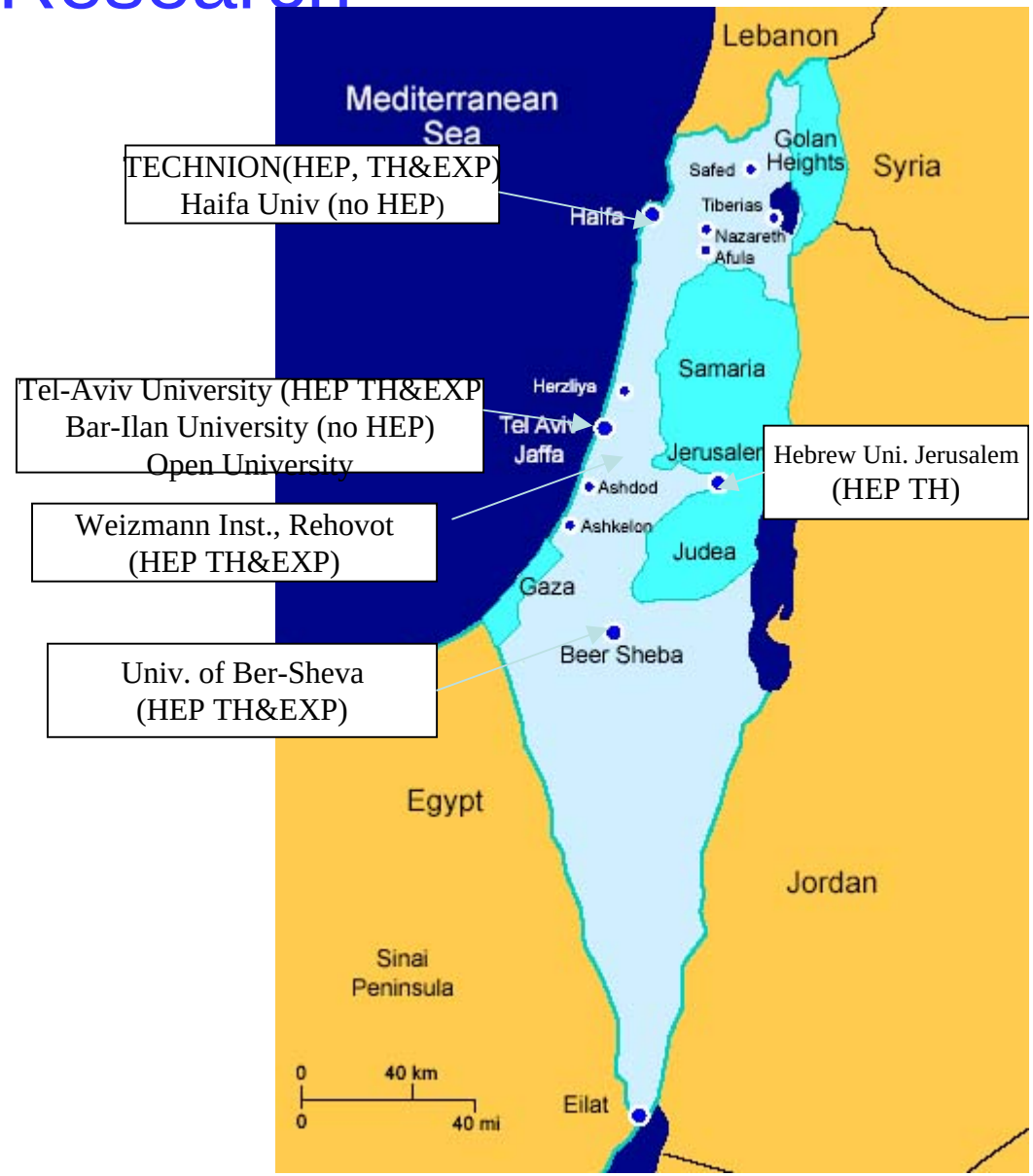

number of people
300
250
200
150
100
50
0
Generic
Compute
SLHC
NLC
Fair
SuperB
nu exps
other
Detector R&D activity


number of people
120
100
80
60
40
20
0
SLHC
ILC
CLIC
b-fact
Laser/Plasma
Hi Bfield
Hi Intens
nu fact
other
Accelerator R&D activity


number of people
0
100
200
300
400
500
SM pheno
Hot/Dense
BSM pheno
Field theo
Cosmo
String
Gravity
Lattice
P-Astro
other
Theory activity

General Comments on Israeli Education and Research

- Israeli Population 7.4 Millions habitants.
- GDP (PPP)/capita=28K$
- Unemployment ~8.2% (not very high taking into account 1M immigration wave, and in particular the present economic crisis, normally ~6%)
- 8 Universities (7 with large Research Programs) & 60 Academies/Colleges.
- % of GDP for Civilian R&D: 4.8%
- Average monthly wage:1.9K$.
- TECHNION created in 1924 & HU Jerusalem in 1925, Weizmann in 1935 (in 1948: 1,600 students, in 2007: 260,000)



Higher Education in Israel

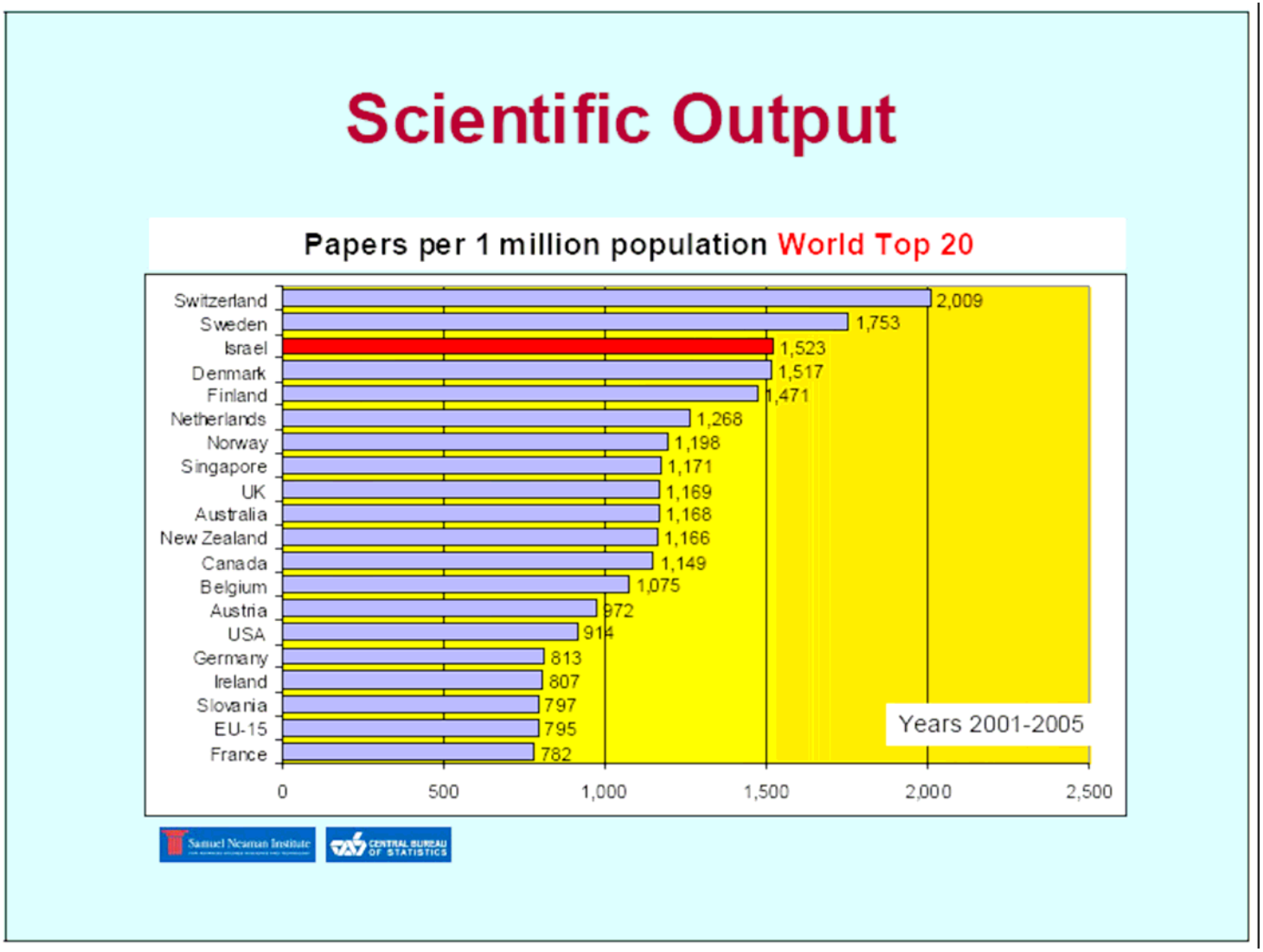
Higher Education in Israel

A Quick Glance: Facts & Figures

	1990	2007
INSTITUTIONS	**21**	**62**
• Universities	7	7
• Open University	1	1
• Art Academies	2	2
• Comprehensive Colleges	0	9
• Engineering Colleges	2	7
• Teacher Training Colleges	7	27
• Non-Budgeted Comprehensive Colleges	2	9
STUDENTS	***89,000***	***256,438***

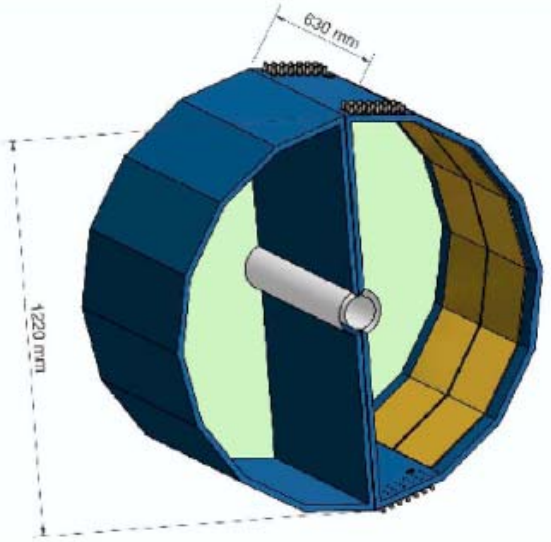
- Growth of number of academic institutions in Israel in the last 17 years.

Good Scientific Education leads also to a high level of publications



Experimental Activities in Israel

- Completion of analysis of ZEUS data (Tel-Aviv, Weizmann groups).
- Analysis of COMPASS data (Tel-Aviv).
- Construction of the Pad Detector and Hadron Blind Detector (triple Gems) for the PHENIX Experiment (RHIC) and subsequent analysis of PHENIX data.

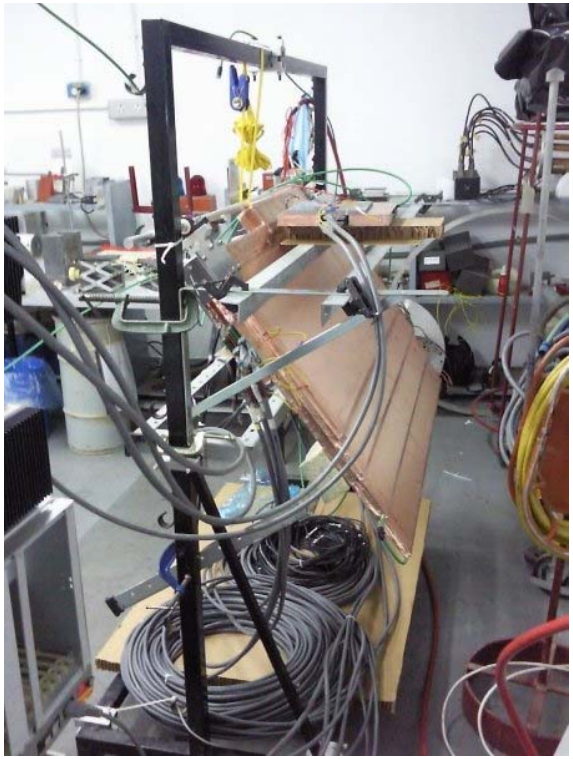


Experimental Activities in Israel

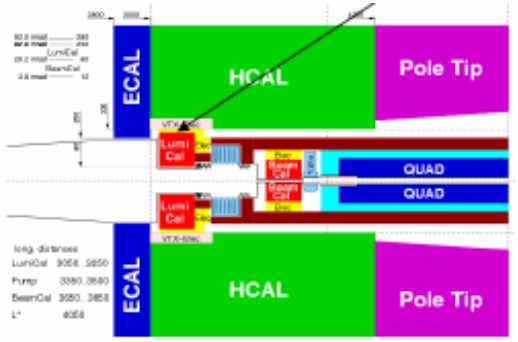
- Main activity is in ATLAS. 3 Experimental Groups (Tel-Aviv, Technion & Weizmann) joint forces to work in ONE Experiment & ONE Subsystem.
  - Construction of 66% of the End-Cap MUON Trigger Chambers (TGCs).
  - Construction of the DCS and its Alignment System.
  - Construction of its DAQ and monitoring system.
  - Responsible of one of the 4 MUON reconstruction algorithms (MUGIRL)
  - Analysis of SUSY Higgs.
  - Analysis of SUSY signatures (including long lived particles).
  - Analysis of possible Z' signal.
  - Statistical combination of data.

Detector Developments for Future Accelerators

- Tracking and trigger MUON detectors for the SLHC, based in the TGC technology, for high background rates (Technion, Tel-Aviv, Weizmann).



- Forward calorimeters for ILC based on W-Si (Tel-Aviv)

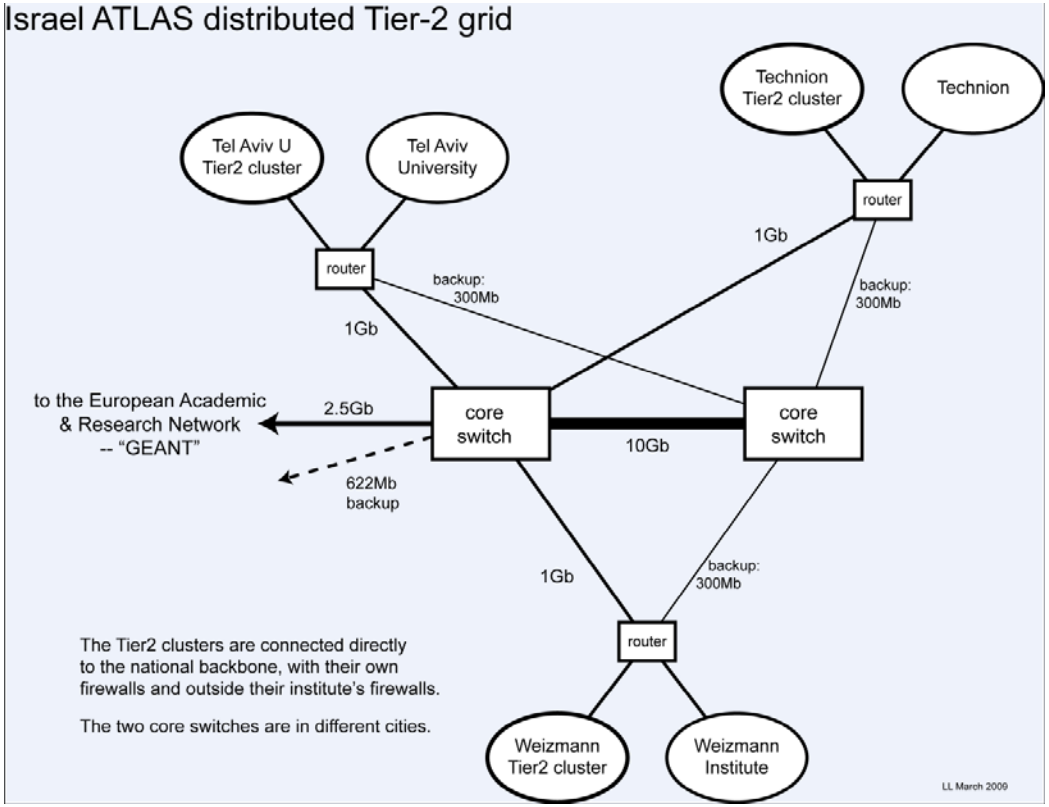


GRID-ATLAS Activity (following RECFA visit in May 2005)

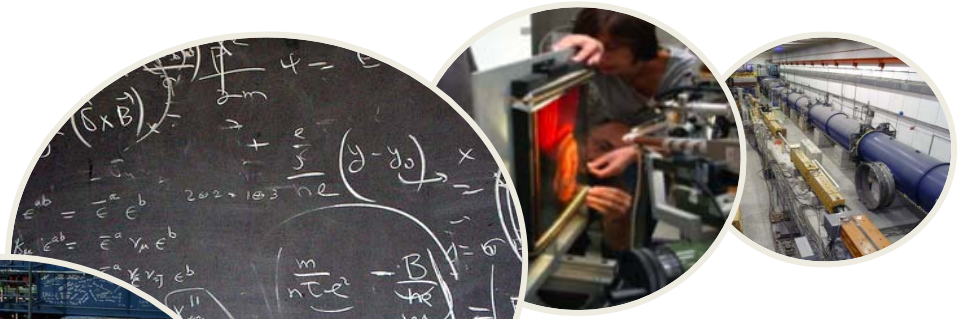
- The Israel-ATLAS Tier2 is based on a distributed architecture, interconnected between the 3 Institutions.
- Presently:
  - Processing cores
    544 latest generation
    368 previous generation

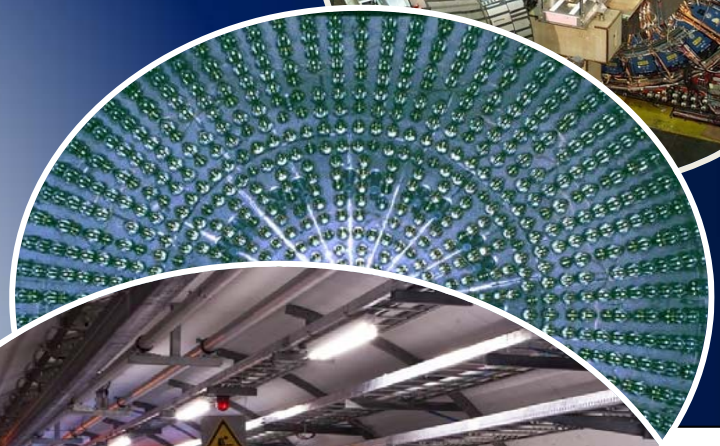
    912

    Total CPU power for HEP experiments:
    ~9000 HEPspec's
  - Storage
    500TB net (excl RAID redundancy)
    Bruto would be 625TB
- A total budget of 620KCHF/year for the Distributed Tier2 has been approved.



Plenary ECFA Meeting
CERN November 26th, 2009





INFN
Istituto Nazionale di Fisica Nucleare

Italy Midterm Report

Valerio Vercesi
INFN - Pavia

Latest available OECD / ISTAT data

Population

- **59.3 millions, 51.5% women**

GDP/capita

- **30K US$, 9% below the EU OECD average**

Secondary Education

- **2.8 millions enrolled**

Tertiary Education now a two-tier (3+2)

- **Triennal + Magistralis (and tail of previous scheme)**
- **2.0 millions enrolled, 57% women, 3% foreign**
- **300K graduates / year, 65K in the upper tier**
  - **2000 Magistralis in “scientific” fields , 37% women**
  - **10000 in Engineering Sciences, 23% women**

Long-sighted government(s)

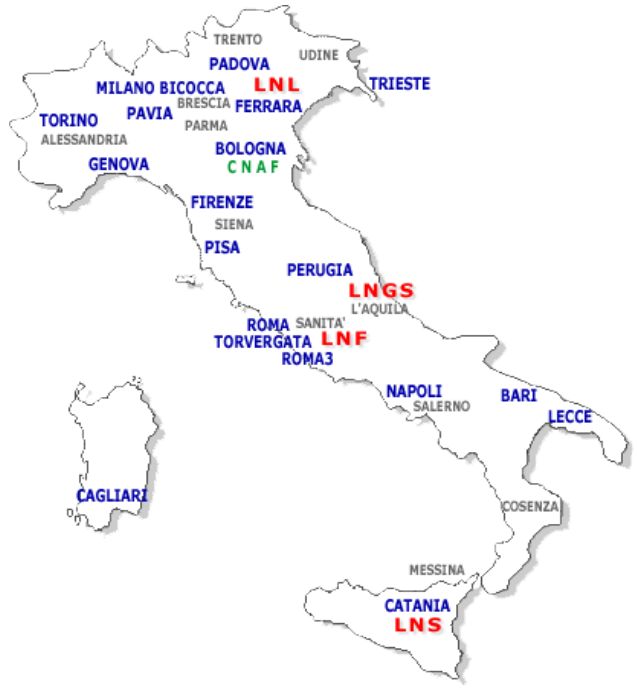
- **R&D investment: 1.14 % of GDP**
- **3.55 researchers / thousand employed**

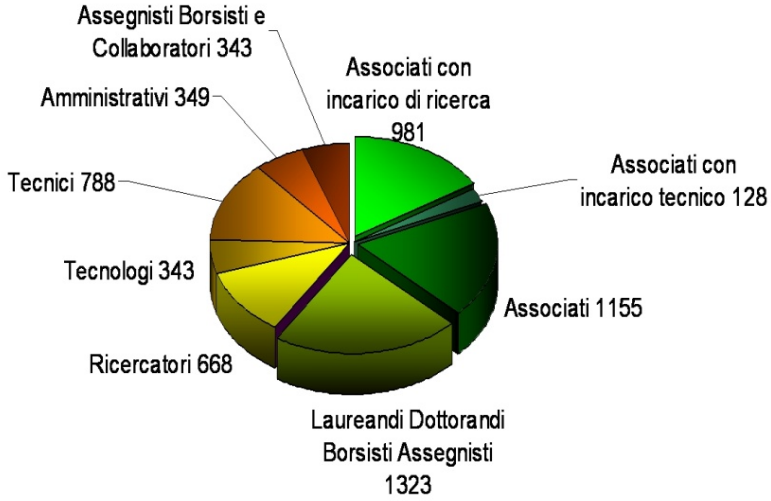
On the national ground, INFN works in strict collaboration with Italian Universities and in cooperation with other Research Institutes like CNR and INAF and Agencies like ASI

INFN activities are based on two complementary research structures

- **20 Scientific Units, each located in a Physics Department, ensuring the proper link with the University**
- **4 National Laboratories (Frascati, Gran Sasso, Legnaro and Catania) hosting large infrastructures available for national and foreign researchers**

INFN personnel (head count) includes about 2000 employees, 2000 associates from Universities and a pool of 1500 young people (Degree, Ph.D., PostDocs, Fellows)

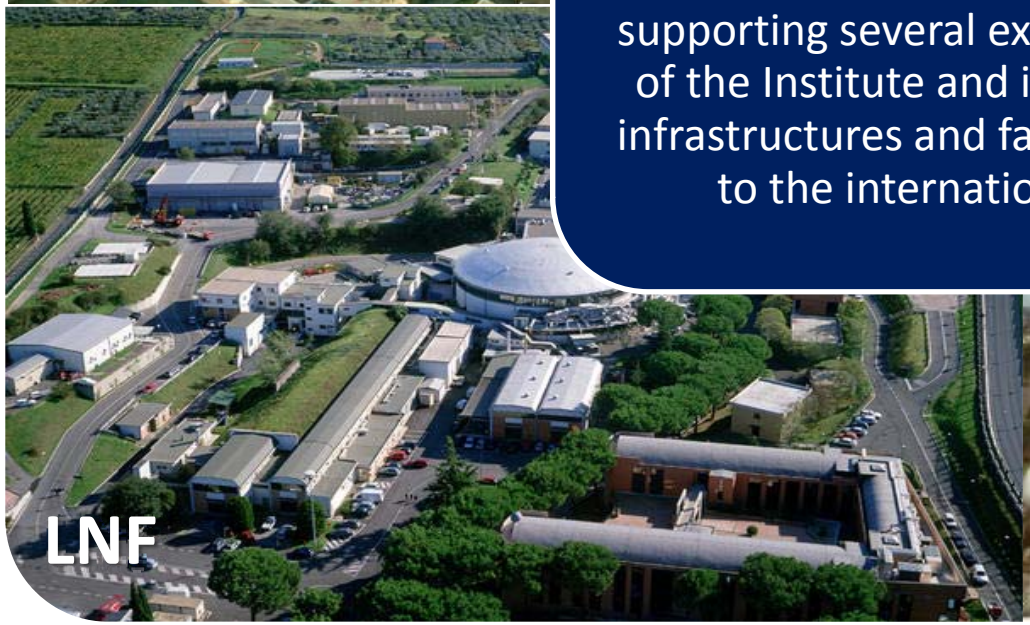




4 National Laboratories

LNL, LNGS, LNF, LNS

A backbone for all INFN scientific initiatives, supporting several experimental activities of the Institute and in particular hosting infrastructures and facilities available also to the international community



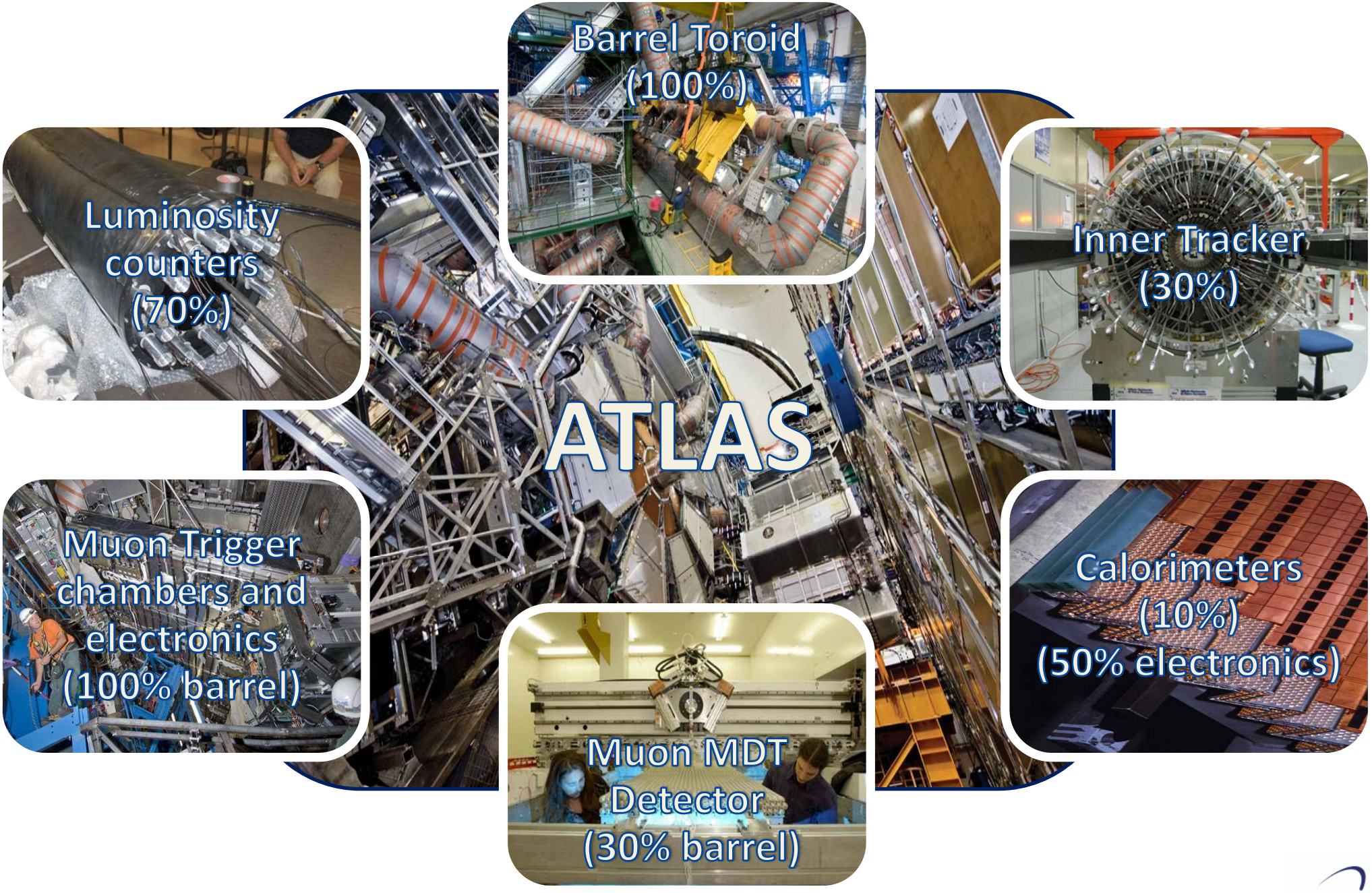
- Large Hadron Collider (ATLAS, CMS, ALICE, LHCb, TOTEM, LHCf)
- Fermilab (CDF)
- HERA (ZEUS)
- B-factories (BaBar)
- DAΦNE (KLOE)
- Fixed target (NA48/n, COMPASS)

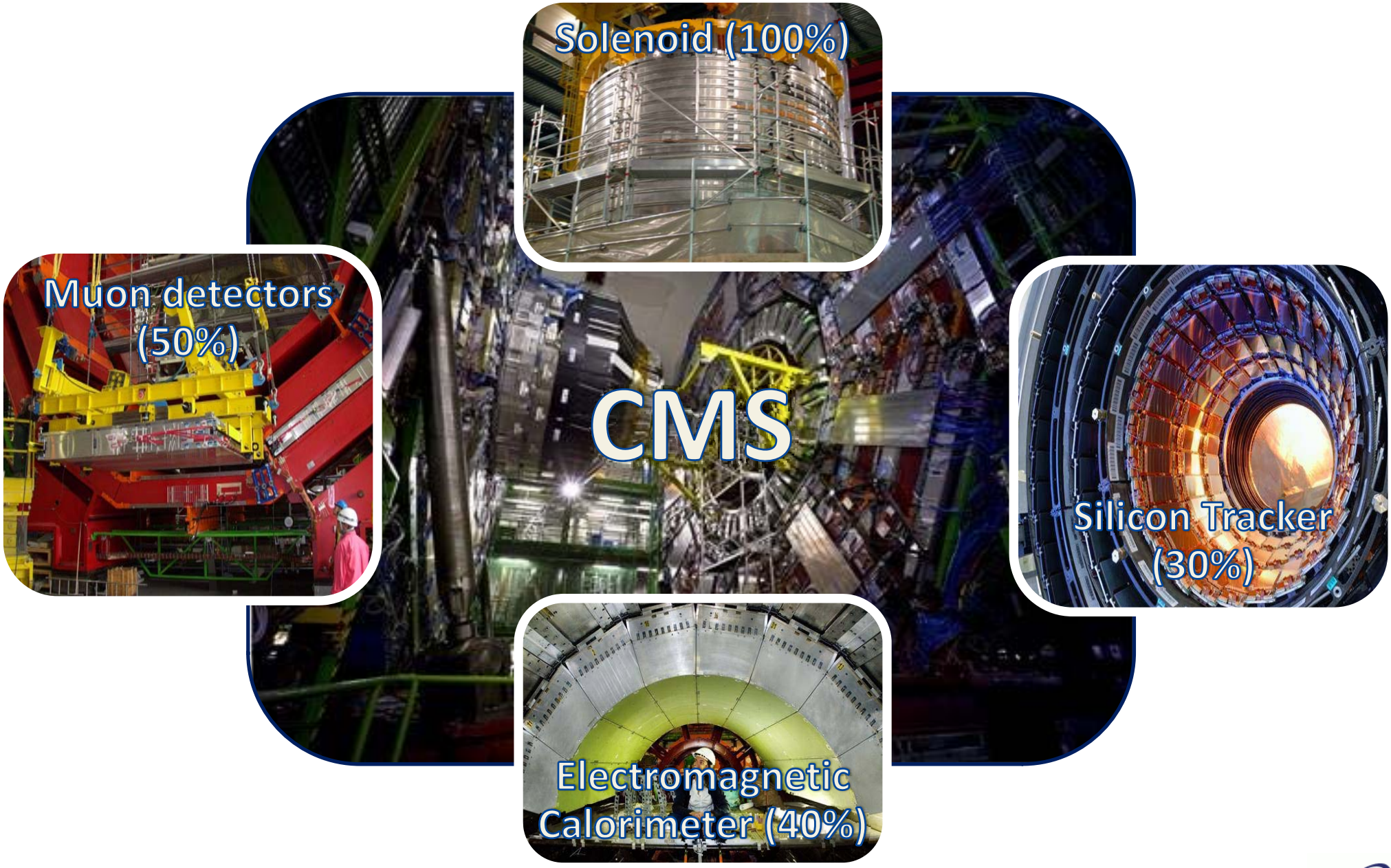
- Detector R&D
- Upgrades for LHC
- ILC / CLIC
- Super-B
- Neutrino
- Fixed target (NA62, MEG)
- Accelerators Development

- Dark Matter (DAMA, WARP, XENON)
- Neutrino properties (CUORE, GERDA)
- Neutrino oscillations (BOREXINO, ICARUS, OPERA)
- Cosmic rays (AUGER, ARGO)
- Gamma rays (MAGIC)
- Neutrinos (ANTARES, NEMO, KM3NeT)
- Space based (AMS, PAMELA, AGILE, FERMI)
- Gravitational Waves (VIRGO, Nautilus)

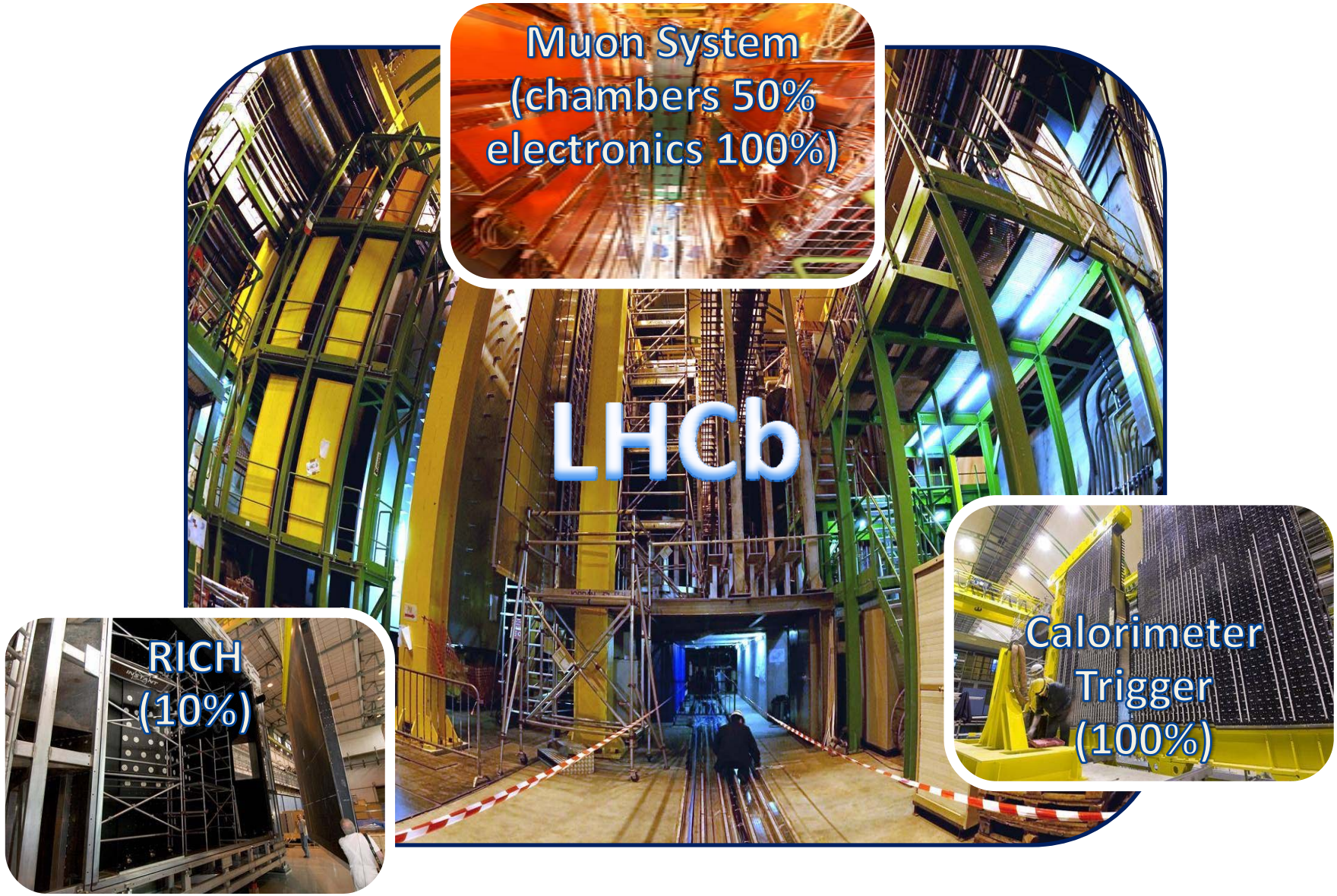
Theoretical Physics: SM, BSM, Nuclear Matter, Fields, Strings, Astroparticle, Cosmology, ...

Computing, GRIDs, HPC


Barrel Toroid
(100%)
Luminosity
counters
(70%)
Inner Tracker
(30%)
ATLAS
Muon Trigger
chambers and
electronics
(100% barrel)
Calorimeters
(10%)
(50% electronics)
Muon MDT
Detector
(30% barrel)


Solenoid (100%)
Muon detectors (50%)
CMS
Silicon Tracker (30%)
Electromagnetic Calorimeter (40%)


RICH(70%)
Zero Degree Calorimetry (100%)
ALICE
TOF (100%)
Inner Tracking System (60%)
Muon Spectrometer (25%)


Muon System
(chambers 50%
electronics 100%)
LHCb
RICH
(10%)
Calorimeter
Trigger
(100%)

ECFA Midterm Report
for Poland

presented by

Jan Kalinowski
University of Warsaw

Plenary ECFA Meeting, CERN, 26 November 2009

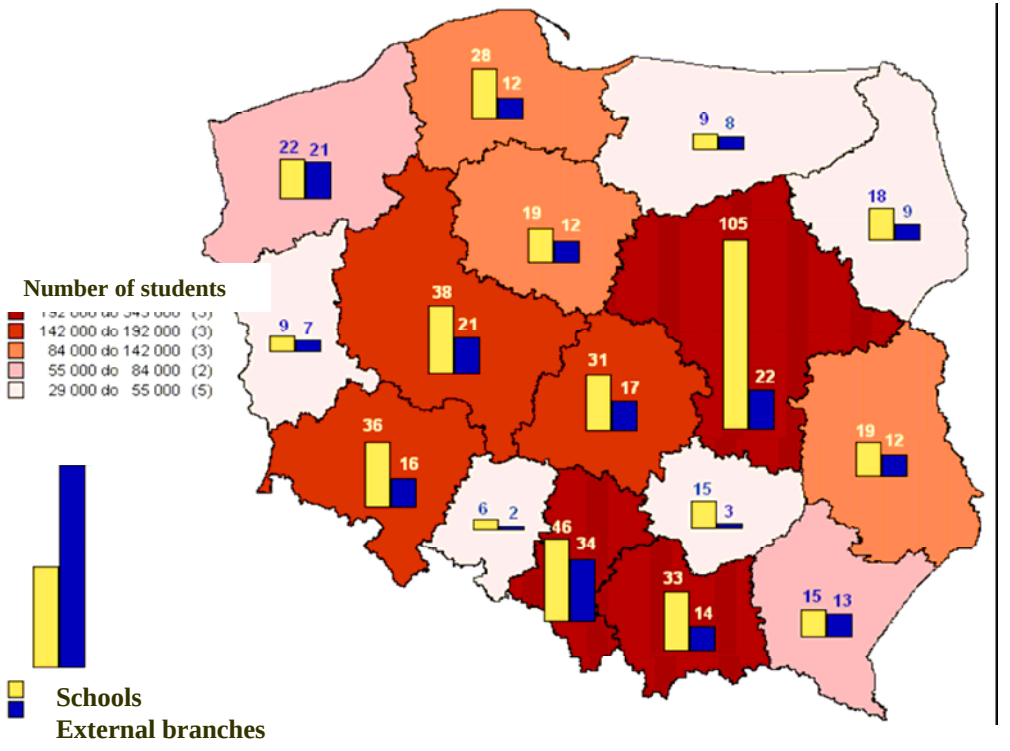
Basic facts about Poland

- Rzeczpospolita Polska – Republic of Poland
- Capital Warszawa - Warsaw
- Population 38.1 milion
- Area 312,679 km²
- GDP: 609 B$, per capita 16 k$ Source: OECD 2007
- Higher education exp. of GDP: 1.6% (=1.2%+0.4%)
- R&D expenditure of GDP: 0.57%
- 4.4 researchers for 1000 FTE
- Tertiary education: 18% of population 25-64 years of age
  28% of population 25-34 years of age

- CERN member state since July 1991, observer since 1963
  contribution to CERN budget 2.86%
  number of users: 195, fellows 21, staff 40 (Jan. ’09)

Education - schools

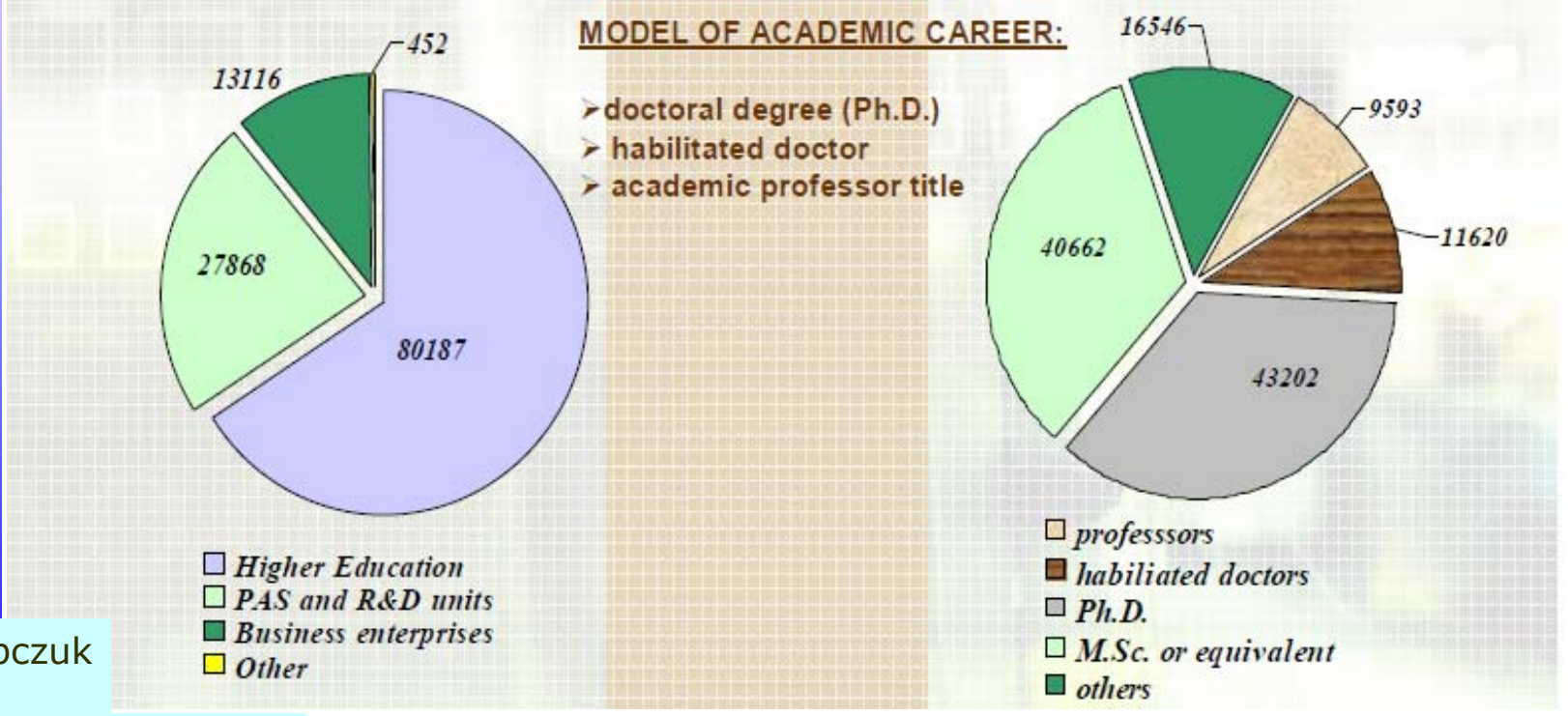
- 456 higher education institutions
  131 public and 325 non-public
- 1927762 students
  65.8% in public, 34.3% in non-public



Source: Science and Technology in Poland in 2007, Central Statistical Office, 2009

Teaching and research

- Higher Education Institutions (Universities, Academies): **131 public;**
- Polish Academy of Sciences: **75 research units**
  59 institutes, **16** independent research departments;
- Branch R&D Units supervised by sector ministries: **180 units**
  128 institutes, **6** central laboratories, **45** R&D centres;
- Industrial R&D centres, units, laboratories: **aproximately 670 units**



Source: Science and Technology in Poland in 2007, Central Statistical Office, 2009

Research funding in Poland

Public funding:

- Ministry of Science and Higher Education
- The National Centre for Research and Development – funding agency for applied science (since July 2007)

Private:

- Industry
- Foundations (The Foundation for Polish Science)

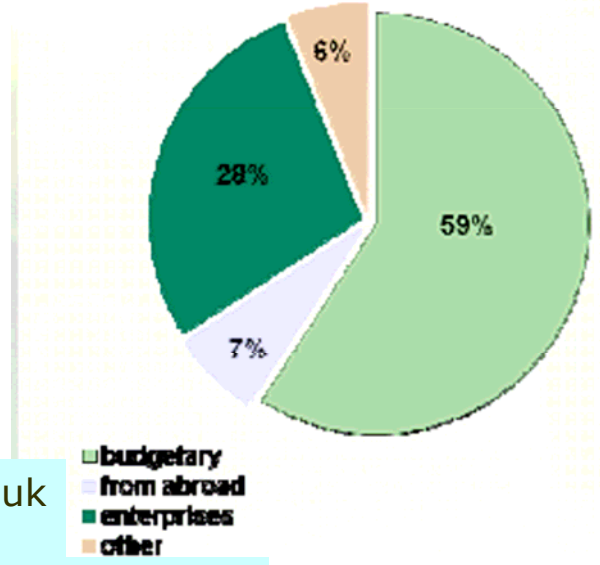
EU Funding:

- Structural Funds: MSHE, The Foundation for Polish Science,...
- Framework Programmes

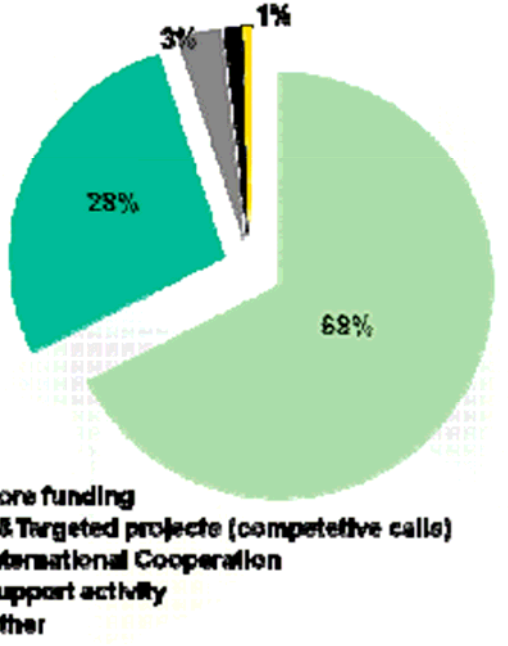
~1.4 B$

Expenditures by sources of funds

~2.4B$



Budgetary: app. 3,9 bn PLN



HEP in Poland – research centers

Warsaw:
- University of Warsaw (UW)
- Warsaw University of Technology (PW)
- Institute of Nuclear Studies (IPJ)
- N. Copernicus Astronomical Centre (CAMK)
- Space Research Center (CBK)

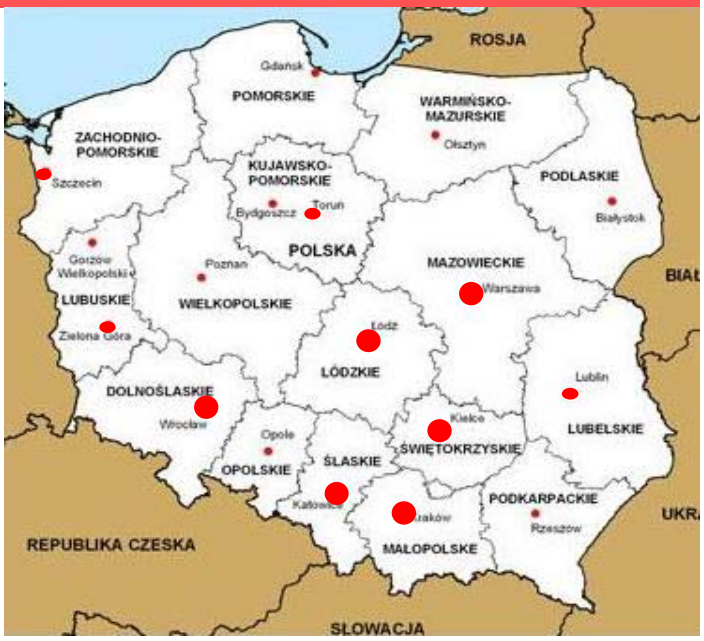
Cracow
- Institute of Nuclear Physics (IFJ)
- AGH U. Science and Technology (AGH)
- Jagellonian University (UJ)

Katowice
- University of Silesia (UŚ)

Wrocław
- University of Wrocław (UWr)
- Wrocław University of Technology (P

Łódź
- University of Łódź (UŁ)
- Institute of Nuclear Studies (IPJ)

Kielce
- Jan Kochanowski University (UJK)



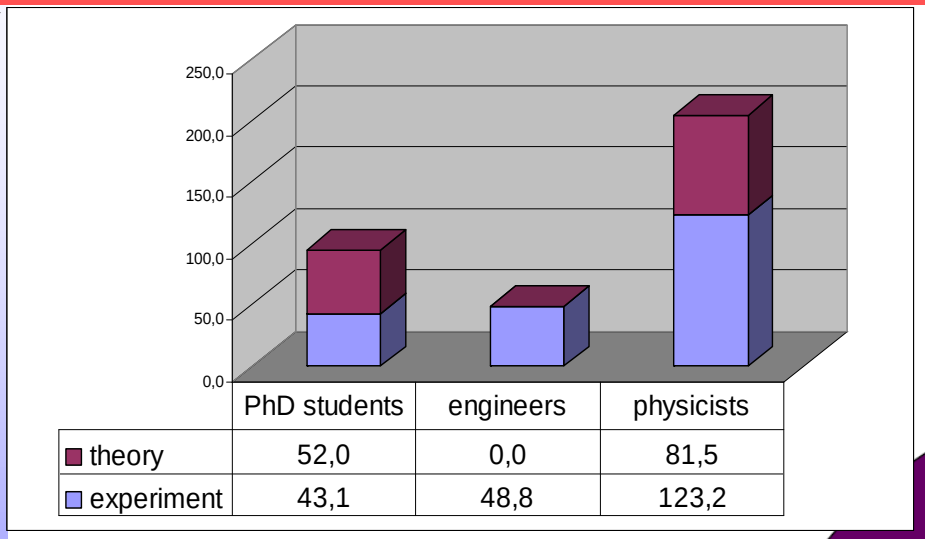
Toruń
- N. Copernicus University (UMK)
- N. Copernicus Astronomical Centre

Lublin
- M. Curie-Skłodowska U. (UMCS)

Szczecin
- University of Szczecin (USz)

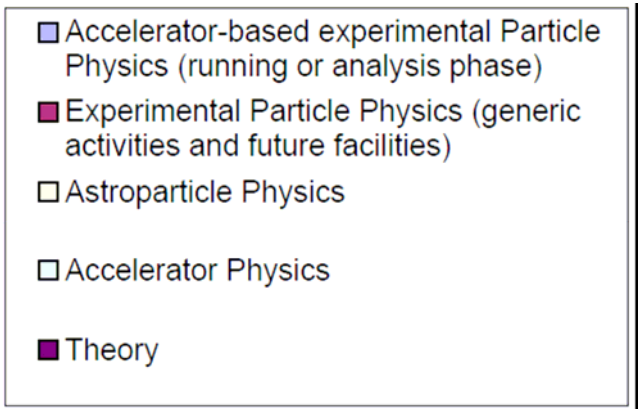
Zielona Góra
- University of Zielona Góra (UZG)

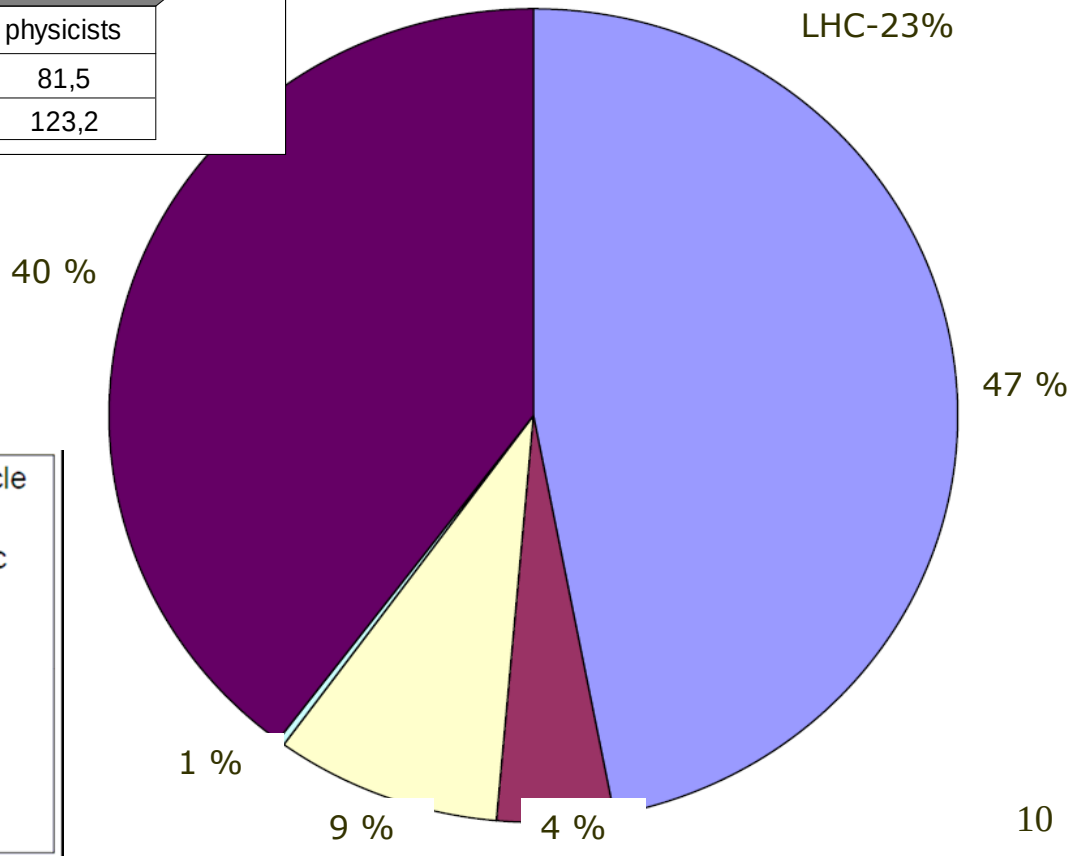
HEP – human resources



	PhD students	engineers	physicists
theory	52,0	0,0	81,5
experiment	43,1	48,8	123,2

Source: ECFA Poll 2009



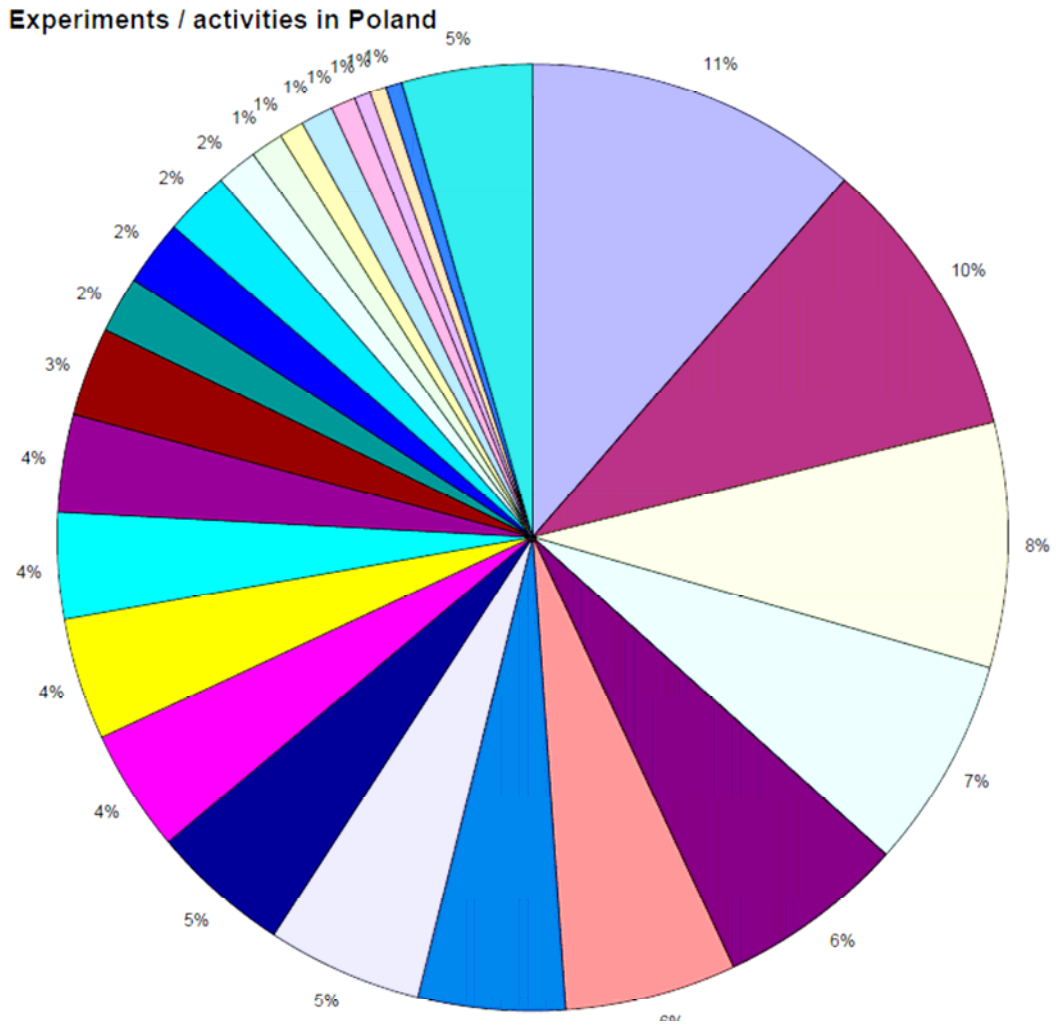


HEP – experimental projects

LHC experiments: ALICE, ATLAS, CMS, LHCb
SPS experiments: COMPASS, NA49, NA61
HERA experiments: ZEUS, H1
Experiments at BNL: STAR, PHOBOS, BRAHMS
Belle at KEK
Neutrino experiments: SK, T2K, ICARUS, BOREXINO
GERDA, MINOS
Dark matter: SK, WArP, ArDM, OSQAR, LAGUNA
Gamma ray bursts: Pi of the Sky
Cosmic rays: AUGER, JEM-EUSO
Gamma ray astronomy: H.E.S.S., MAGIC

Summary

Source: ECFA Survey 2009



Process of consolidation in progress

Polish share in European activity