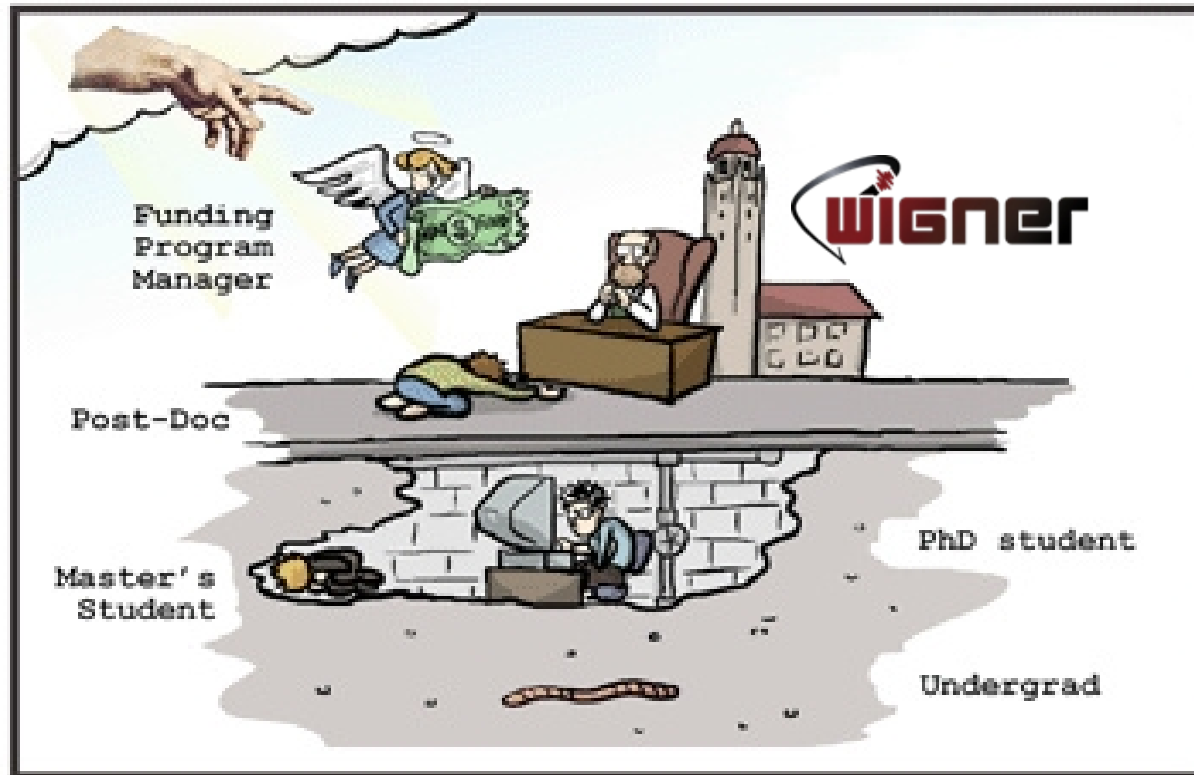


The Group

ALICE
A JOURNEY OF DISCOVERY

Hungarian ALICE Group @ Wigner RCP of the HAS



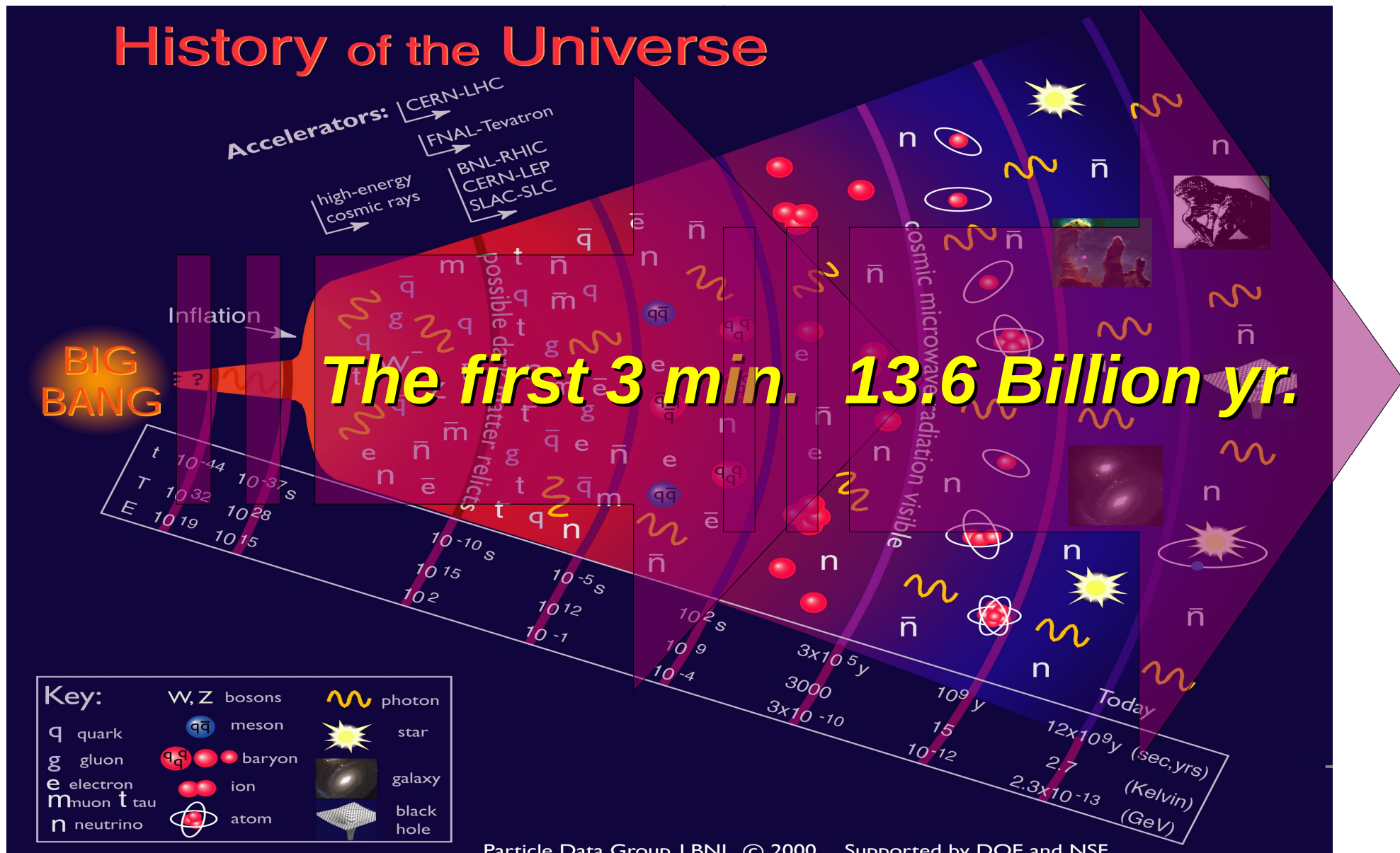
G.G. Barnaföldi,
RECFA 2013, Wigner Datacenter, Budapest, 5th October 2013

OUTLINE

- The ALICE Experiment at the LHC
 - HIC: Research of the early Universe
 - ALICE: Properties of the Primordial Matter
- The Hungarian ALICE Group
 - Resources
 - Directions
- Contributions by the Hungarian ALICE Group
 - Hungarian Contribution at the early stage
 - Recent works for the ALICE Collaboration
- The Future of the Hungarian ALICE Group
 - Participation in UGs and recent developments,

The ALICE Experiment at the LHC

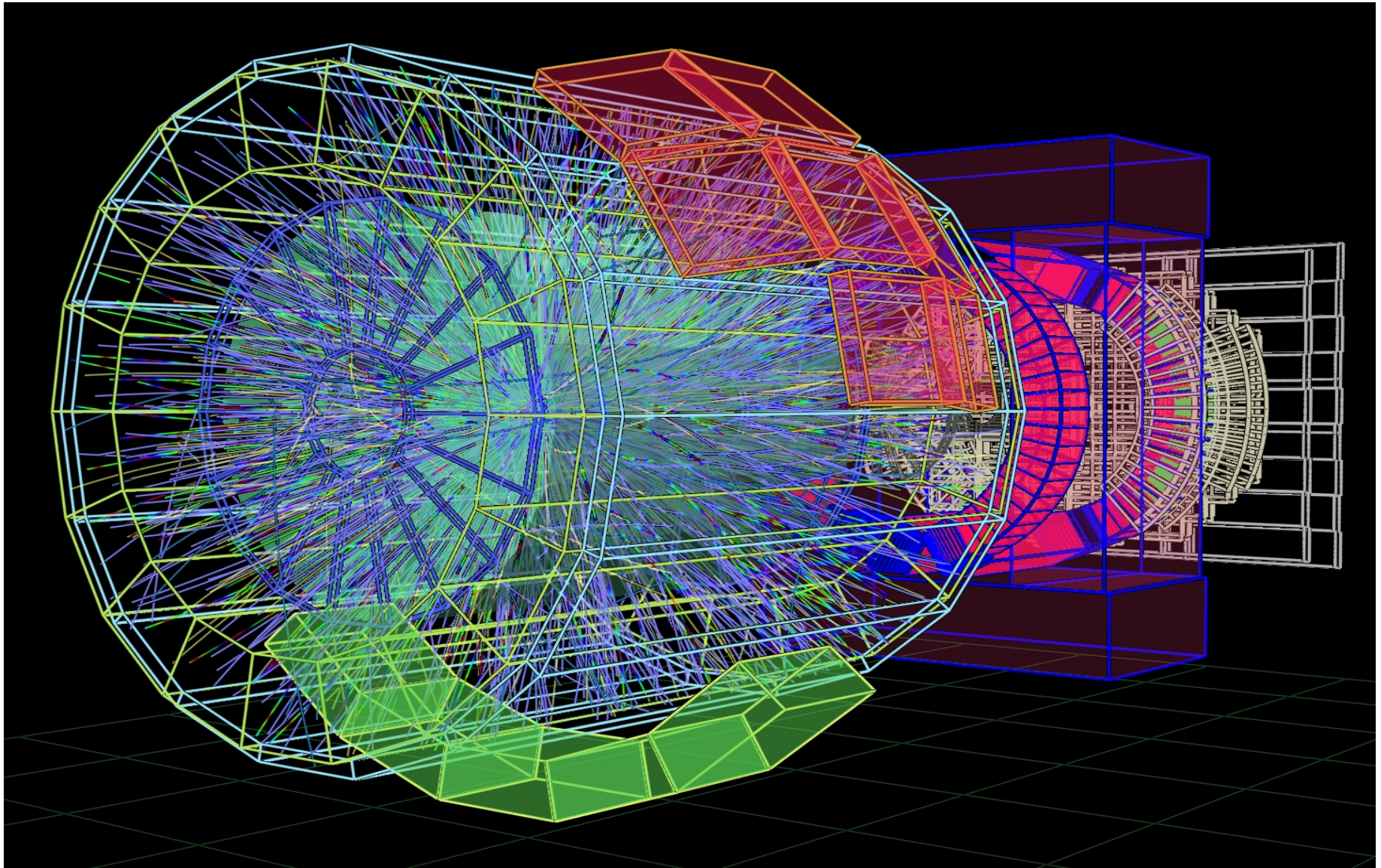
HIC: Research of the early Universe



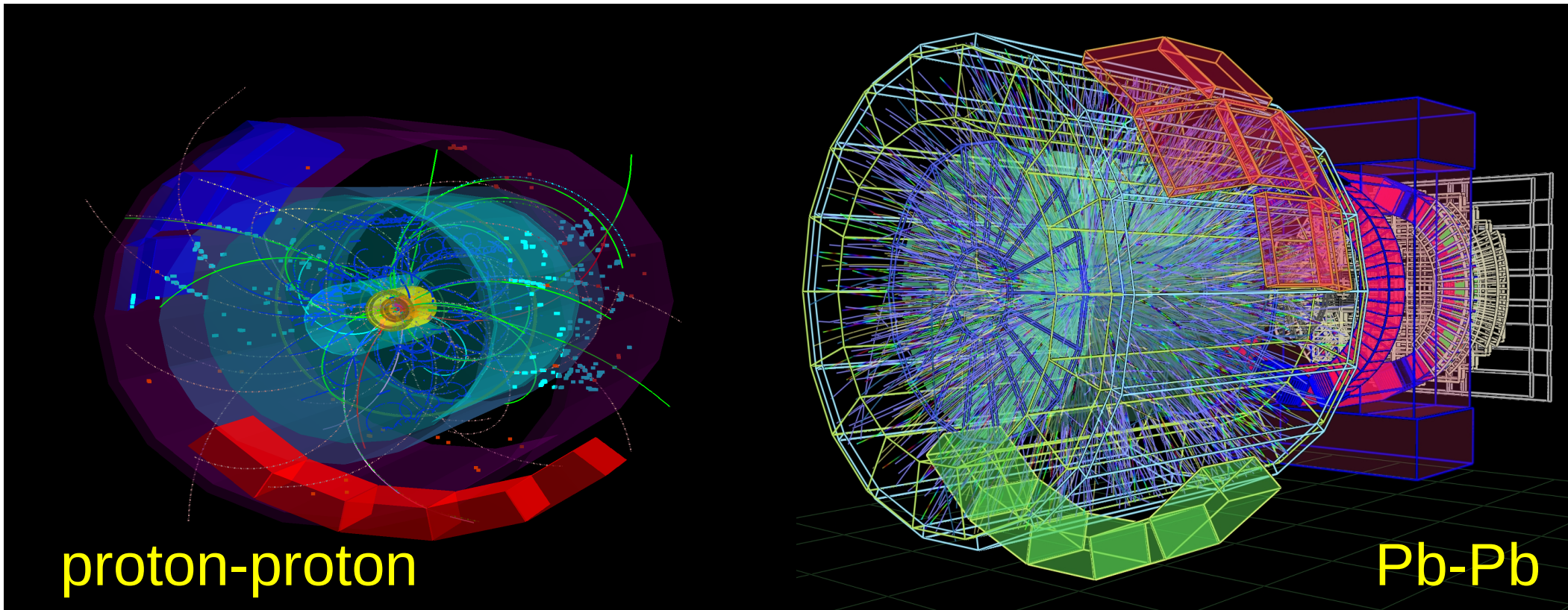
The Big Bang Experiment at P2: ALICE



ALICE: Properties of the Primordial Matter

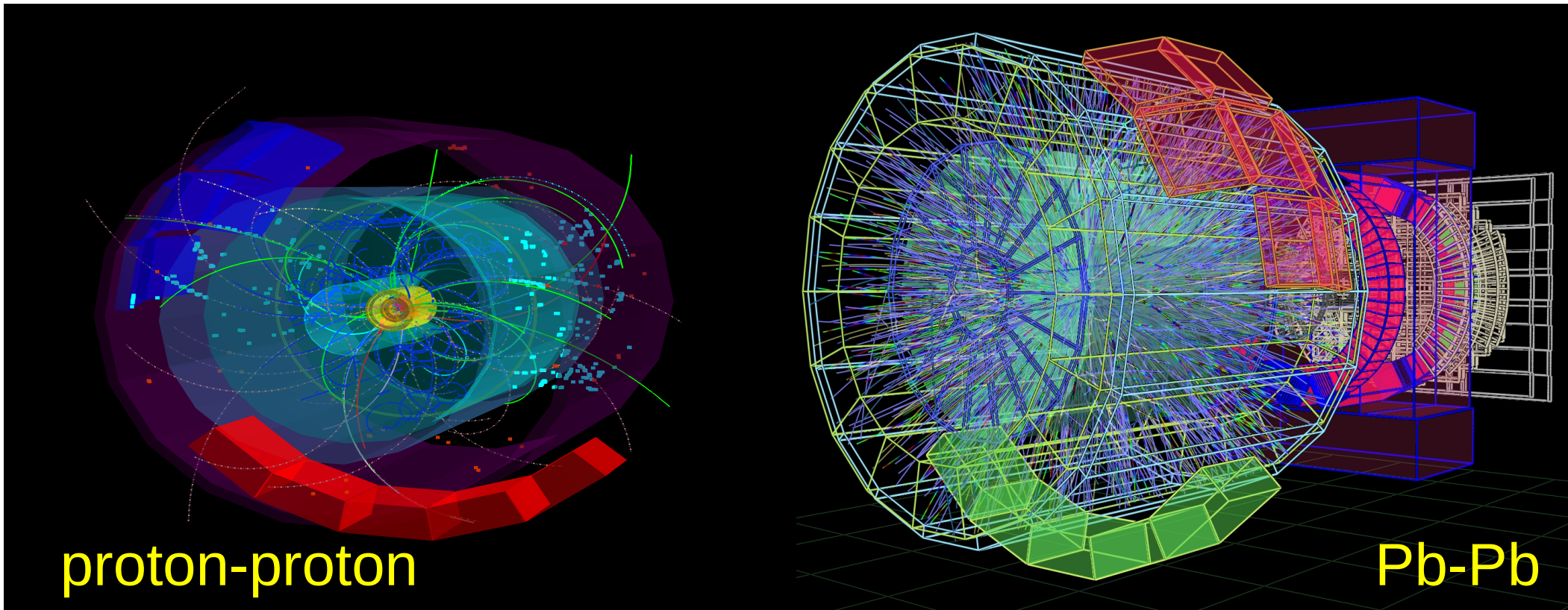


ALICE: Search for the perfect fluid...



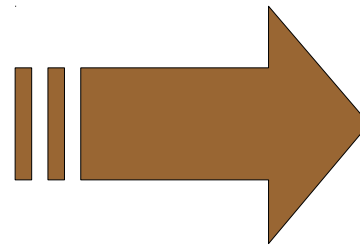
- Quar-Gluon Plasma (QGP):
- proton-proton vs. Pb-Pb
 - hot, color (quark+gluon)
 - superfluid
 - This is a „perfect fluid“...

ALICE: Search for the perfect fluid...

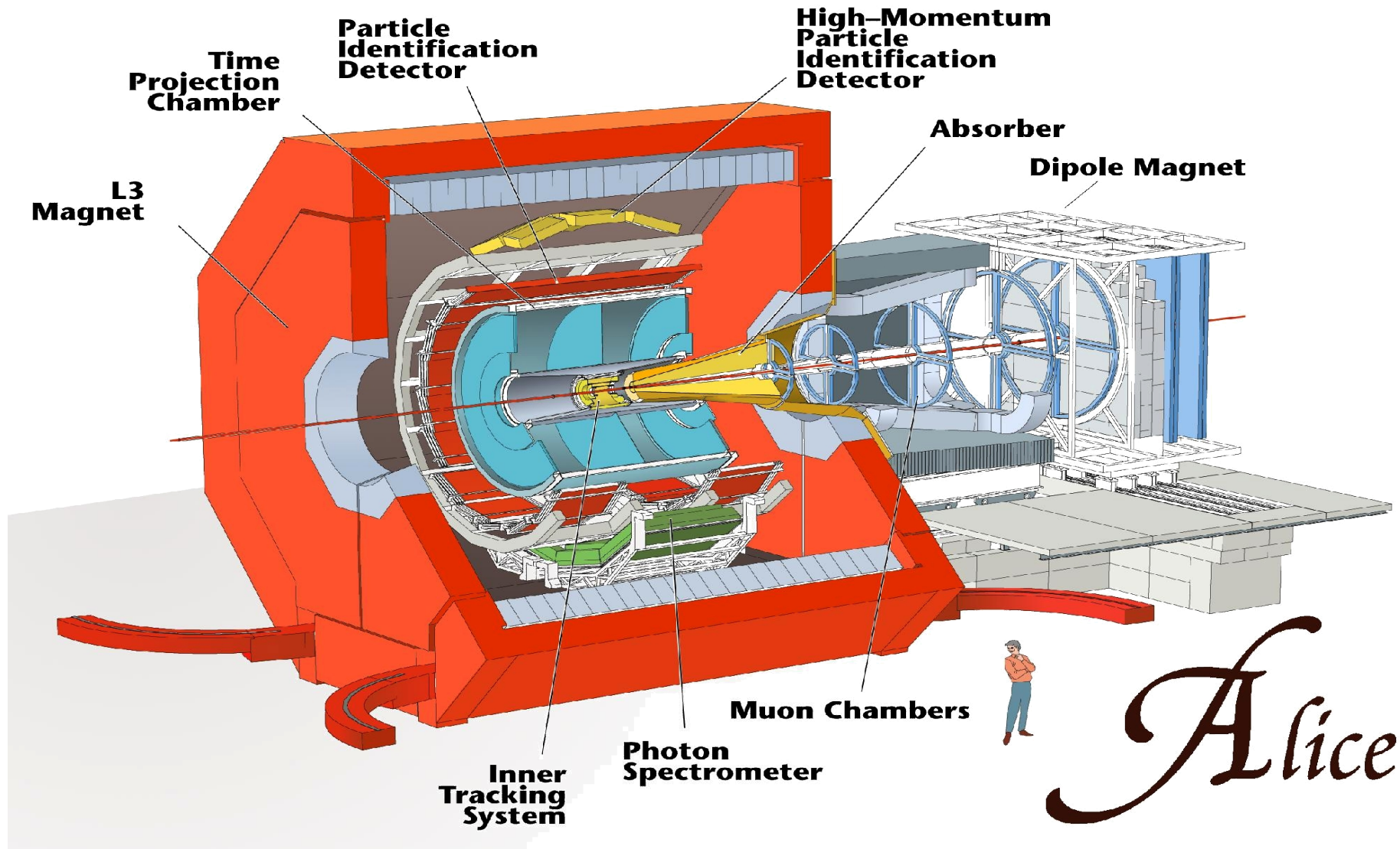


Quar-Gluon Plasma (QGP):

- proton-proton vs. Pb-Pb
- hot, color (quark+gluon)
- superfluid
- This is a „perfect fluid“...














The structure of the ALICE detector















The Hungarian ALICE Group

The most valuable: Human Resource

Senior Staff

 <p>Barnaföldi Gergely Gábor csoportvezető E-mail: barnafoldi.gergely (kukac) wigner.mta.hu Profil: fizikai háttér, szimulációk, GRID és információtechnológia</p>	 <p>Lévai Péter csoportvezető helyettes E-mail: levai.peter (kukac) wigner.mta.hu Profil: fizikai háttér, szimulációk, GRID és információtechnológia</p>	 <p>Bencze György E-mail: gorygy.bencze (kukac) cern.ch Profil: detektor fejlesztés, VHMPID technikai koordináció</p>
 <p>Boldizsár László E-mail: boldizsar.laszlo (kukac) wigner.mta.hu Profil: adatfeldolgozás: HMPID, VHMPID</p>	 <p>Dénes Ervin tudományos főmunkatárs E-mail: ervin.denes (kukac) cern.ch Profil: detektorépítő csoport vezetése, ALICE Detector Data Link fejlesztése</p>	 <p>Fodor Zoltán E-mail: fodor.zoltan (kukac) wigner.mta.hu Profil: -</p>
 <p>Futó Endre E-mail: endre.futo (kukac) cern.ch Profil: -</p>	 <p>Kiss Tivadar E-mail: kiss.tivadar (kukac) wigner.mta.hu Profil: -</p>	 <p>Molnár Levente E-mail: molnar.levente (kukac) wigner.mta.hu Profil: adatfeldolgozás: HMPID, VHMPID, jet-fizika</p>
 <p>Pála Gabriella E-mail: palla.gabriella (kukac) wigner.mta.hu</p>	 <p>Varga Dezső E-mail: dezszo.varga (kukac) cern.ch</p>	

Students

 <p>Bencédi Gyula E-mail: bencedi.gyula (kukac) wigner.mta.hu Profil: detektor fejlesztés, HPTD</p>	 <p>Berényi Dániel E-mail: berenyi.daniel (kukac) wigner.mta.hu Profil: detektor szimulációk</p>	 <p>Hamar Gergő tudományos segédmunkatárs E-mail: hamar.gergo (kukac) wigner.mta.hu Profil: detektor fejlesztés, HPTD</p>
 <p>Kiss Gábor E-mail: kiss.gabor (kukac) wigner.mta.hu Profil: DAQ fejlesztés és szimuláció</p>	 <p>Kovács Levente E-mail: gerycobt (kukac) freemail.hu Profil: elektronika és detektorfejlesztés, HPTD</p>	 <p>Oláh László E-mail: olah.laszlo (kukac) wigner.mta.hu Profil: detektor fejlesztés, szimulációk</p>
 <p>Pochybova Sona E-mail: sona.pochybova (kukac) cern.ch Profil: 2 jet - 3 jet folyamatok vizsgálata, HMPID és VHMPID szimulációk</p>		
 <p>Blutman Kristóf E-mail: kristof.laszlo.blutman (kukac) cern.ch Profil: elektronika, ALICE DAQ</p>	 <p>Harangozó Szilveszter E-mail: harangozo.szilveszter (kukac) wigner.mta.hu Profil: ALICE GRID, nukleáris effektusok</p>	 <p>Horváth Péter E-mail: bhorpeth (kukac) freemail.hu Profil: detektor fejlesztés, szimuláció</p>
 <p>Kalmár Gergely E-mail: kalmar.gergely (kukac) wigner.mta.hu Profil: ALICE GRID, hadronizációs folyamatok, web-design</p>	 <p>Melegh Hunor Gergely E-mail: melegh.hunor (kukac) wigner.mta.hu Profil: adatgyűjtő rendszerek, elektronikai fejlesztések</p>	

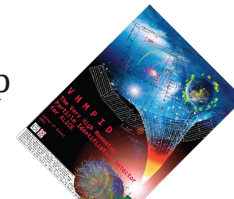
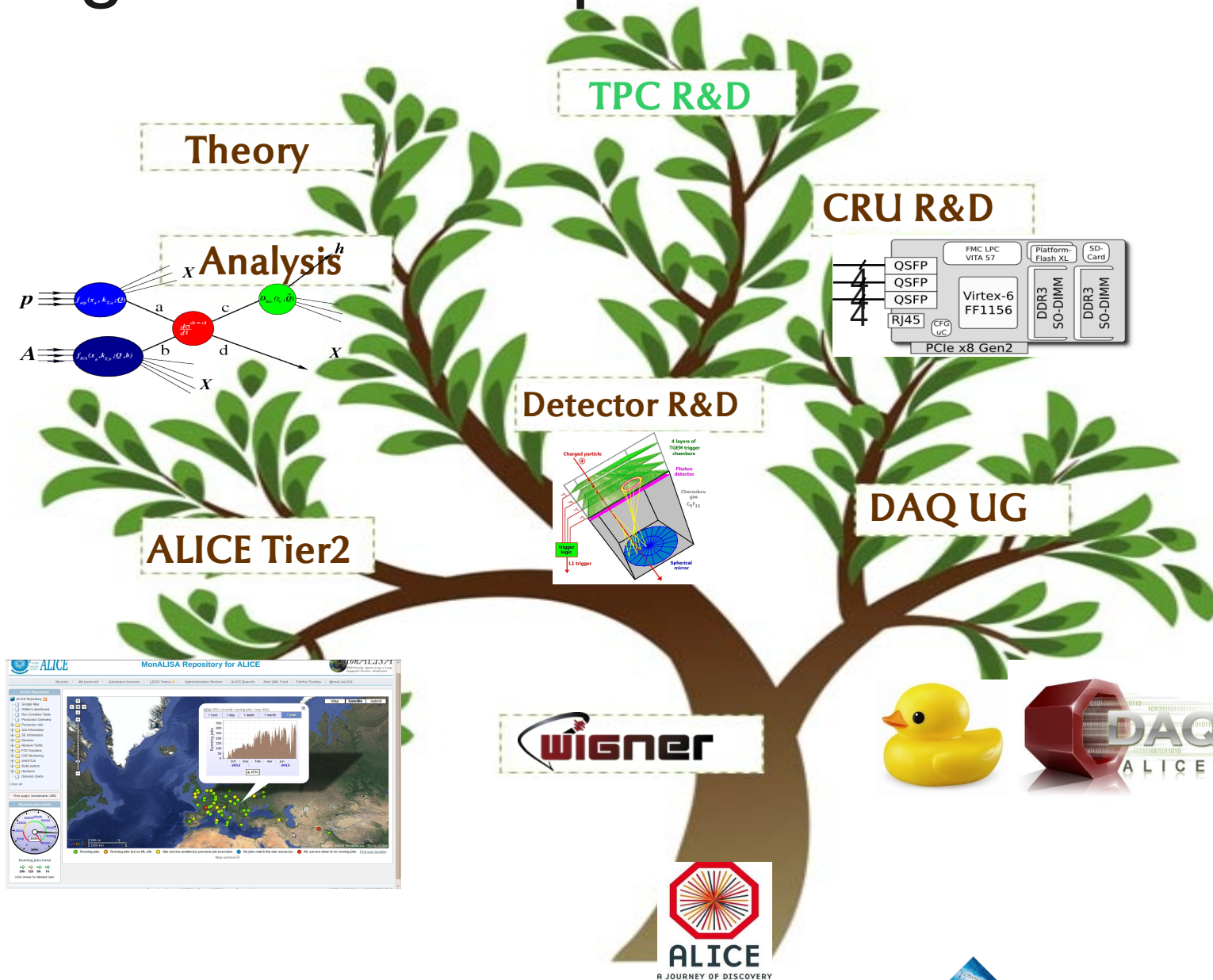
5 permanent + engeneers

11 students MSc, PhD

Resources: Wigner ALICE group in numbers

- cc. 10 FTE
 - 5 staff in addition technicians + engineers
 - 11 students (Eötvös University, Technical University)
- Supports:
 - VHMPID: OTKA NK77816 (2009-13),
 - DAQ R&D: OTKA NK106119 (2012-16)
- Fully equipped Wigner mechanical workshop (5 eng.+techn.)
- DAQ & Gaseous Detector R&D labs,
- Access to clean rooms at Wigner RCP

Hungarian Participation in the ALICE



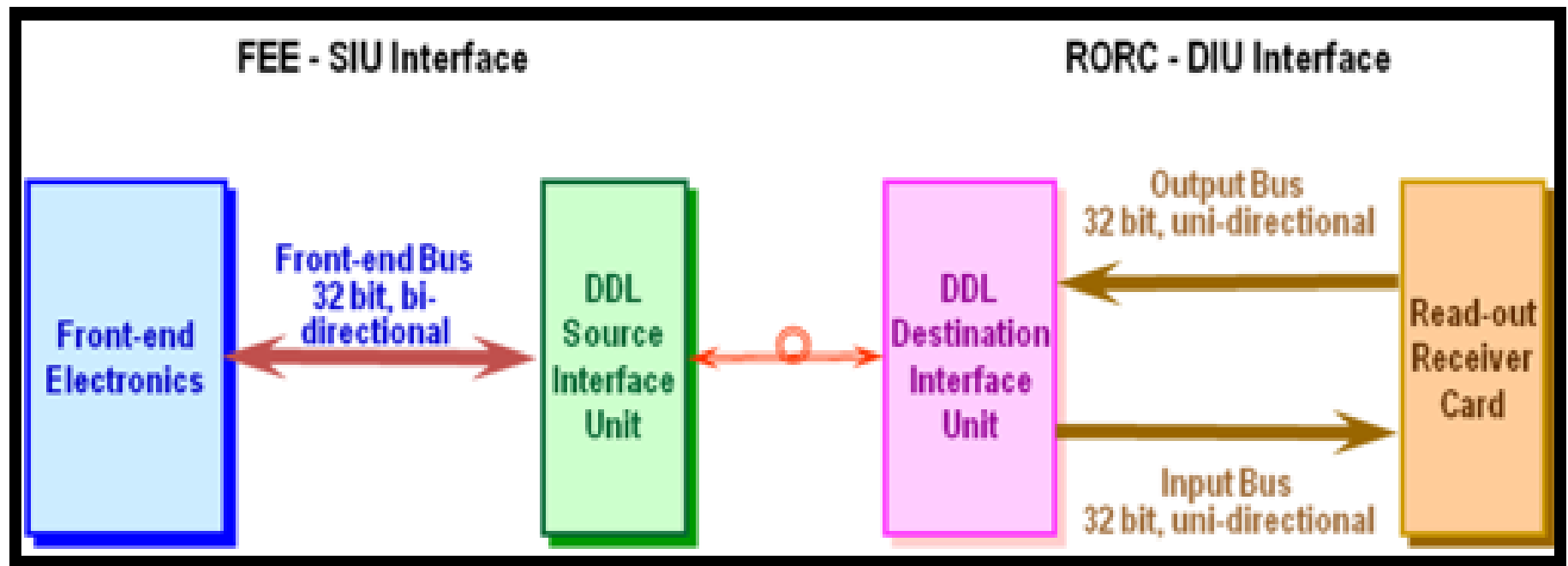
Contributions by the Hungarian ALICE Group

- DAQ – DAQ UG/service group
 - Strongly involved in the ALICE DAQ UG, CRU
 - Ervin D, Kiss T, Rubin Gy, [Melegh HG](#), [Monostori B](#), [Blutman K](#)
- P/A – Physics/Analysis group
 - High p_T , jets, PID, Correlation
 - BGG, Lévai P, Lowe A , [Oláh L](#), [Pochybová S](#), [Bencédi Gy](#), [Boldizsár L](#)
- DDG – Detector Development group
 - Gaseous detector R&D, VHMPID (HPTD, pressurized vessel),
 - Varga D, Bencze Gy, Hamar G, Endrőczi G, [Kovács L](#), [Kiss G](#)
- GRID – ALICE Tier-2 Site
 - T2 Budapest: 200 cores, 73 TB HDD
 - BGG, Kalmár G, [Harangozó Sz](#)

ALICE DAQ: Highway for Information

ALICE DAQ/DDDL (Data Acquisition & Link

Connection between FEE and Data Collector Computers: Detector Data Link (DDL) & Read-Out Receiver Card (RORC)



ALICE DAQ: Highway for Information

ALICE DAQ/DDDL

500 DDLs

450 D-RORCs

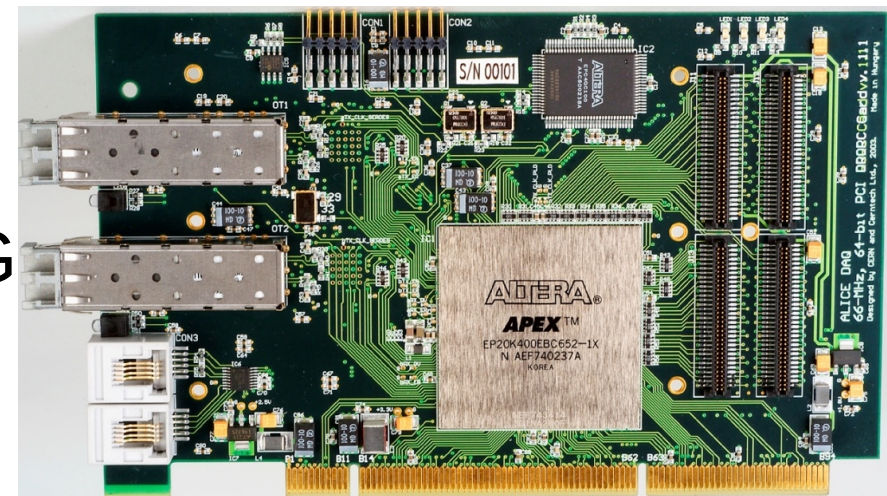
2 PB/yr

High radiation background (kRad)

Mainly in the TPC

Used by other CERN experiments

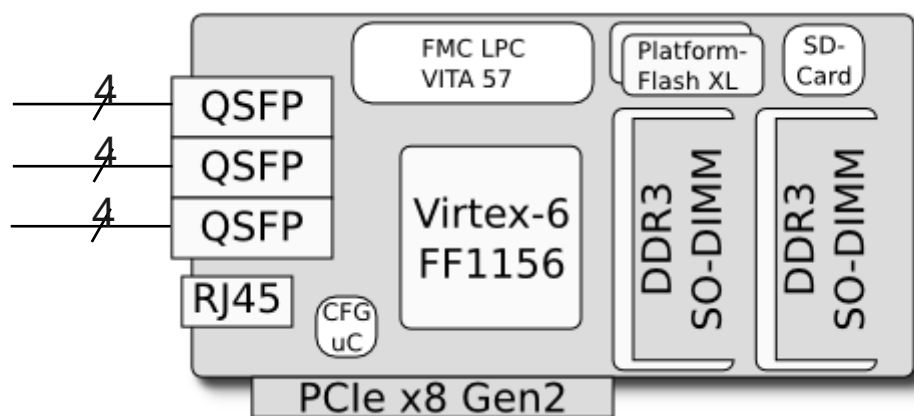
Success reloaded.. ALICE DAQ UG



ALICE DDL/DAQ: data on the Highway

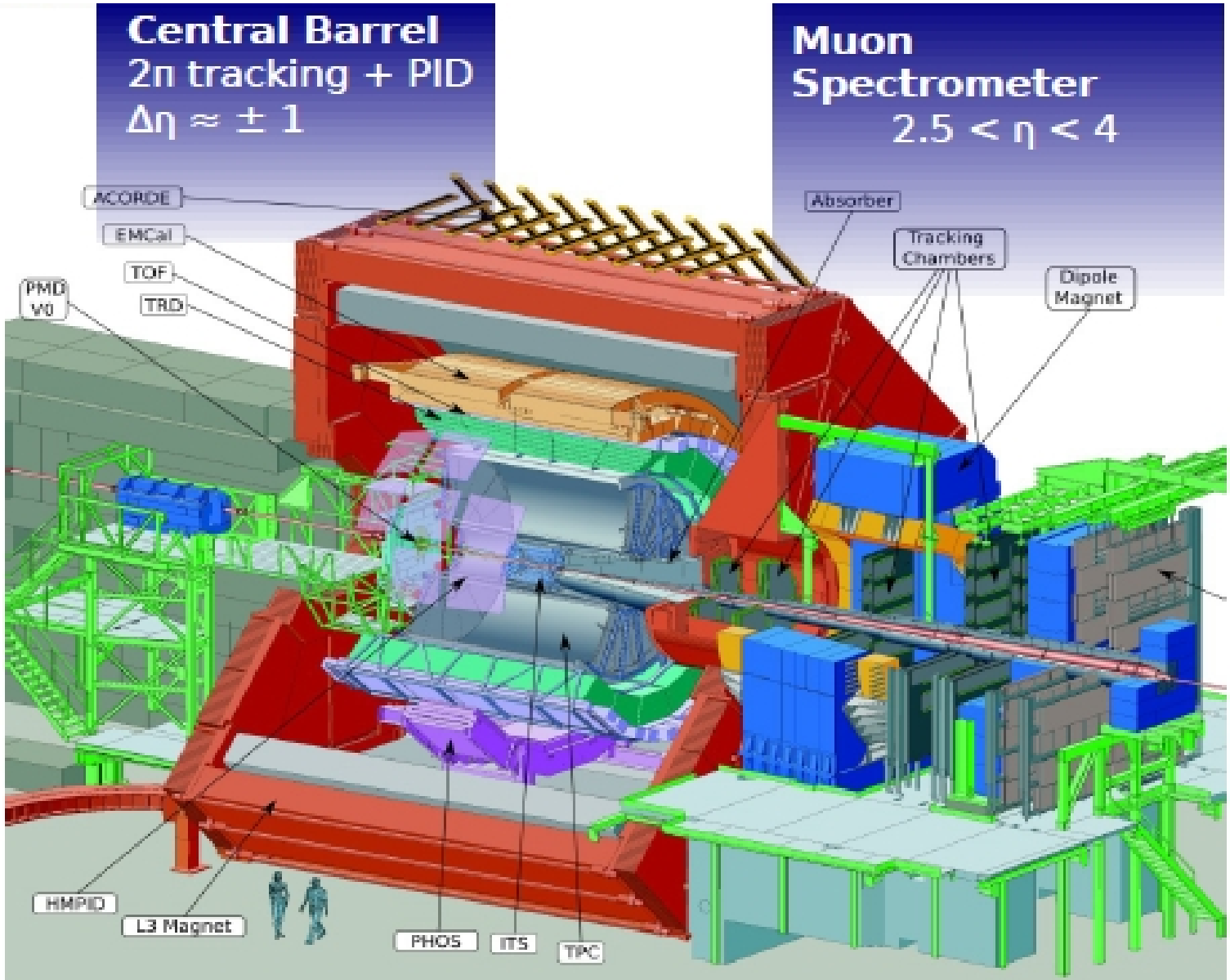
CommonDAQ & trigger DAQ/HLT DDL2, RORC2

- Prototype READY
- Built in during LS1 (2014-16) (LS1) and LS2
- 12 pcs. DDL2 (6 Gb/s) link including DAQ LDC (36 Gb/s) data flow
- PCIe V2 8 bus (500 MB/s/lane) → I/O 32 Gb/s
- FPGA based data acquisition at trigger/DAQ level (e.g cluster finding)



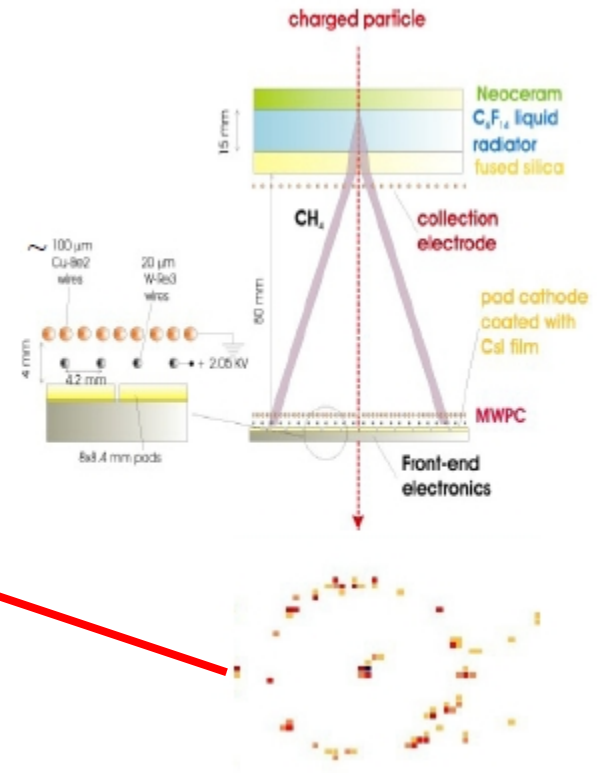
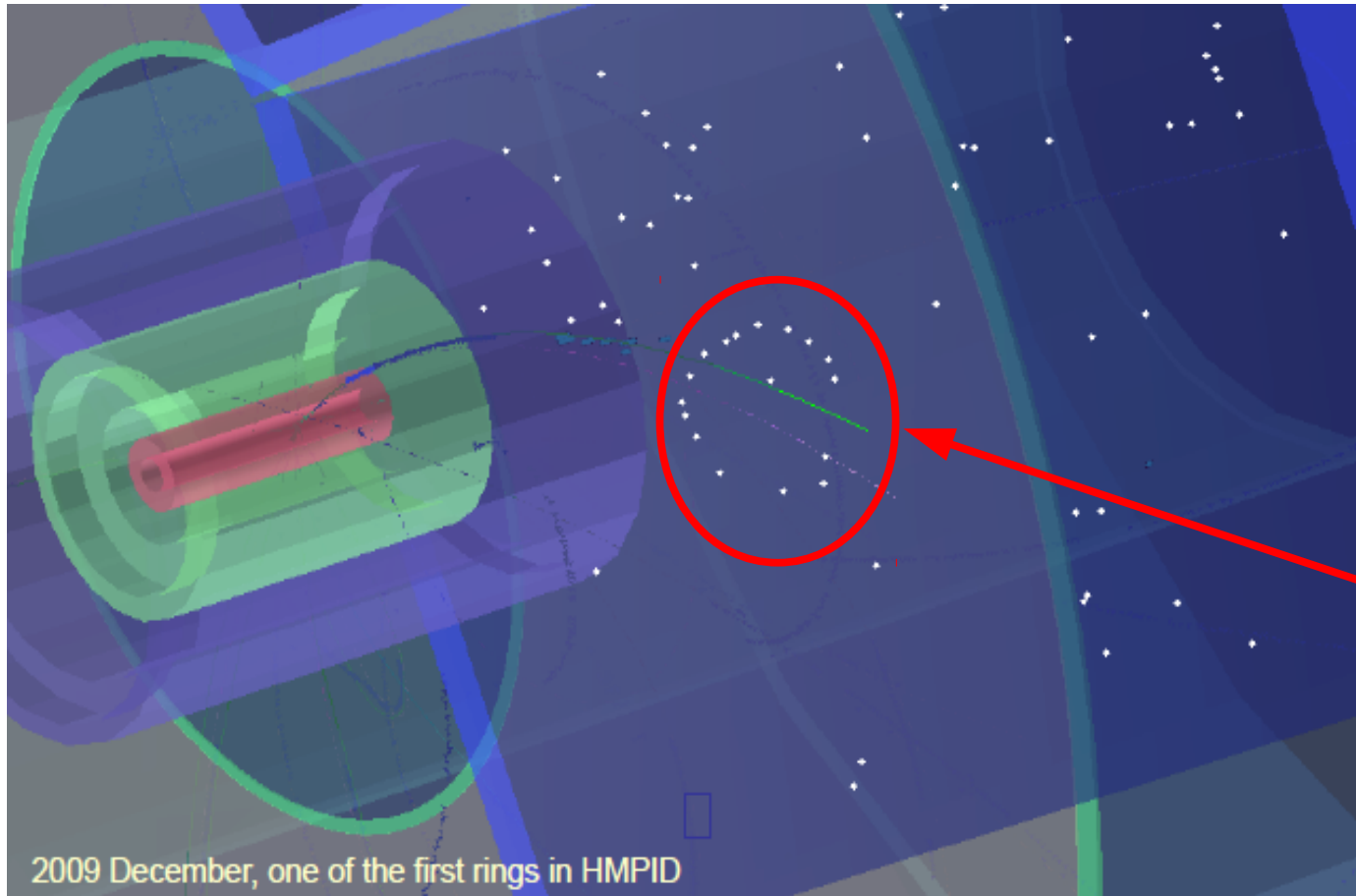
- Now: In 1 PC 5 links (2Gb/s) I/O (10 Gb/s)
- Prototype Parameters (under devel.)
 - 12 link (6 Gb/s)
 - 6 link DAQ LDC commom (36 Gb/s).
 - PCIe2x8 (500 MB/s/lines) I/O (32 Gb/s)
- At the building in time
 - 12 links (10 Gb/s/PC)
 - PCIe3 16 lines I/O (128 Gb/s)

Participation in CERN ALICE collaboration: HMPID + VHMPID



- Central barrel PID**
- ITS:**
 PID: dE/dx
 low p_t tracking
- TPC:**
 · PID: dE/dx
 · Global tracking
- TOF:**
 · PID: ToF
 · PID + TPC matching
- TRD:**
 · PID: transition rad.
 · e / π separation
- HMPID:**
 · PID: Cherenkov
 · $\pi/K/p$

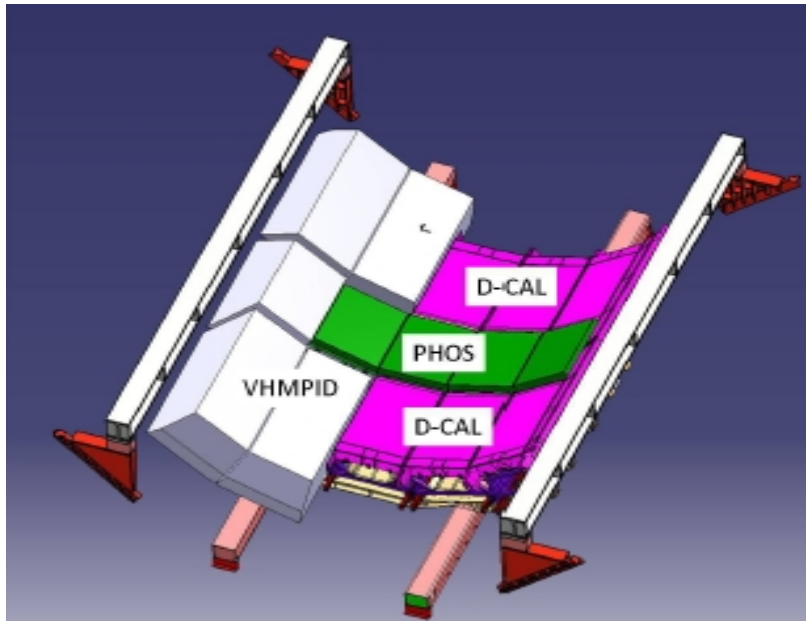
High Momentum Particle Identification Detector: CERN ALICE HMPID



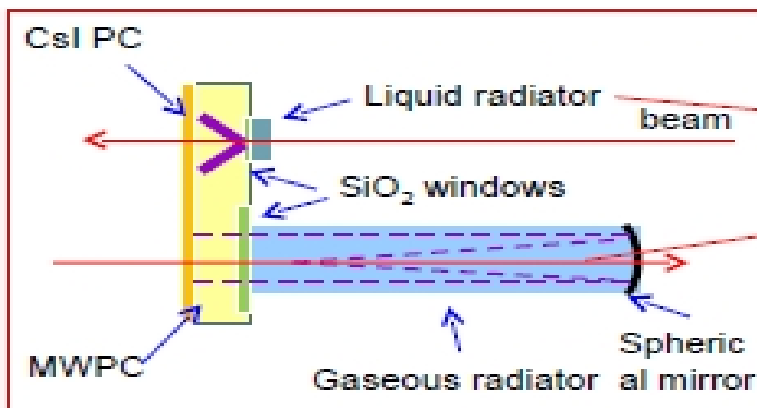
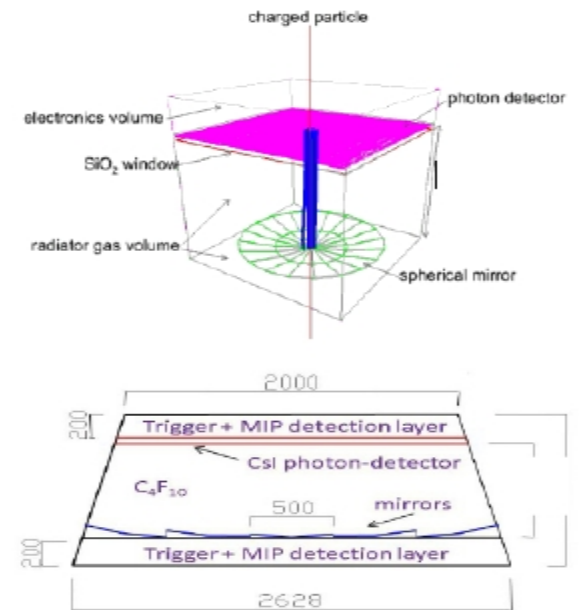
RICH: Ring Imaging Cherenkov Detector: the only way for
event-by-event particle identification

CERN ALICE upgrade: VHMPID

A proposed ALICE upgrade: beyond high momentum particle identification: 1-5 GeV/c helyett 5-25 GeV/c

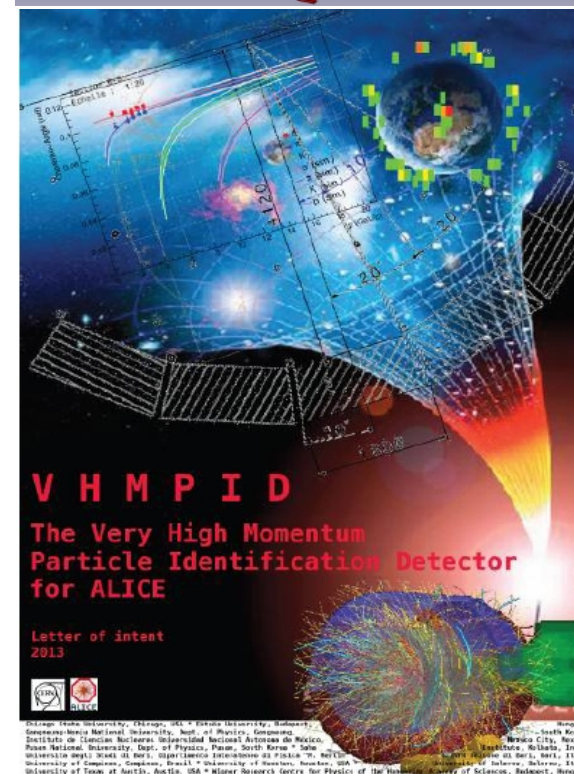
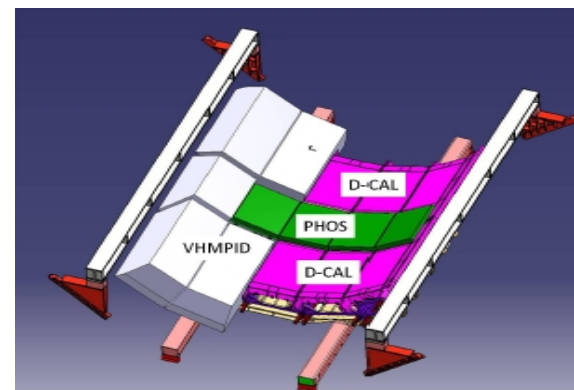


- Insertion into ALICE
- Working prototype
- CERN beam in 2011-12 and NOW



Very High Momentum PID Detector

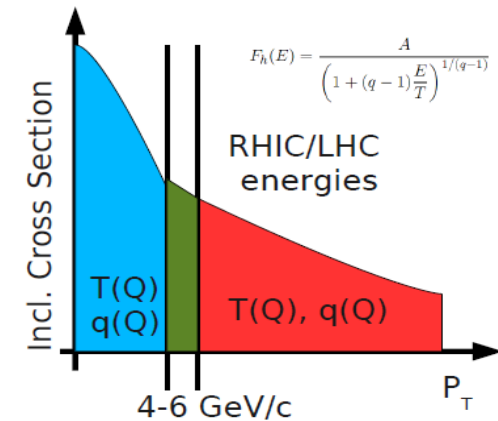
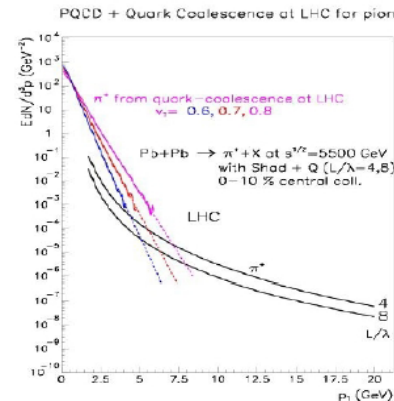
- Unique high-pT PID Capability at the LHC
- Proposed RICH Detector
- 20 institutes 5 countries
- Special technical design
- Lol has been submitted
arXiv:1309.5880
- Result: “Not supported”
 - Excellent new Physics
 - Resources needed for TPC



Physics/Analysis & Theory

- Theoretical background

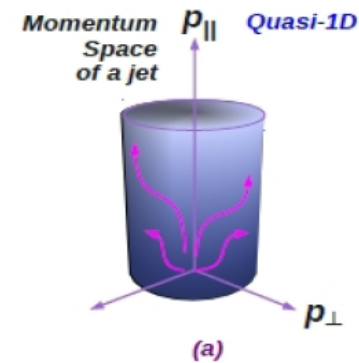
High- p_T @ pQCD



P. Lévai, GGB, G. Fai: JPG35, 104111 (2008)

New theoretical developments

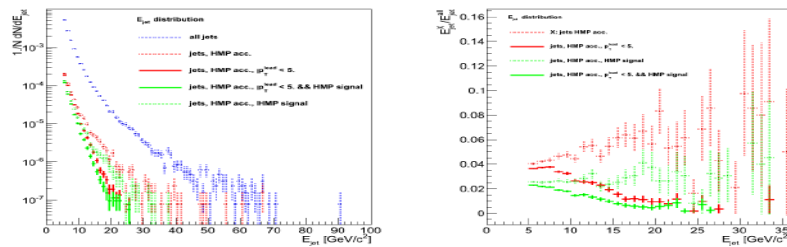
- Microcanonical Jet-Fragmentation in pp at LHC energies:
Phys. Lett. B701 (2011) 111
- Generalized Tsallis distribution in e^+e^- collisions
Phys. Lett. B718 (2012) 125



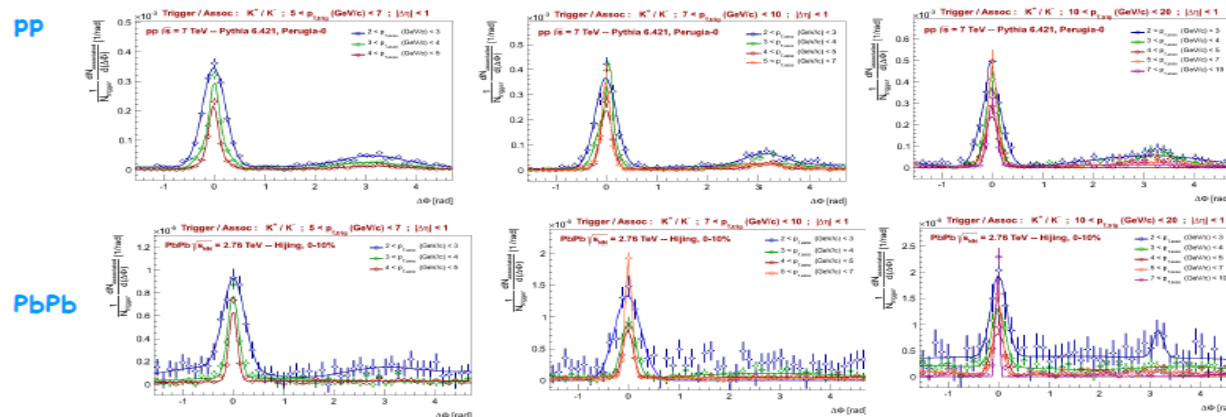
Physics/Analysis & Theory

- The analysis

Jets: q/g separation, PID based FFs by HMPID



PID-triggered hadron correlation



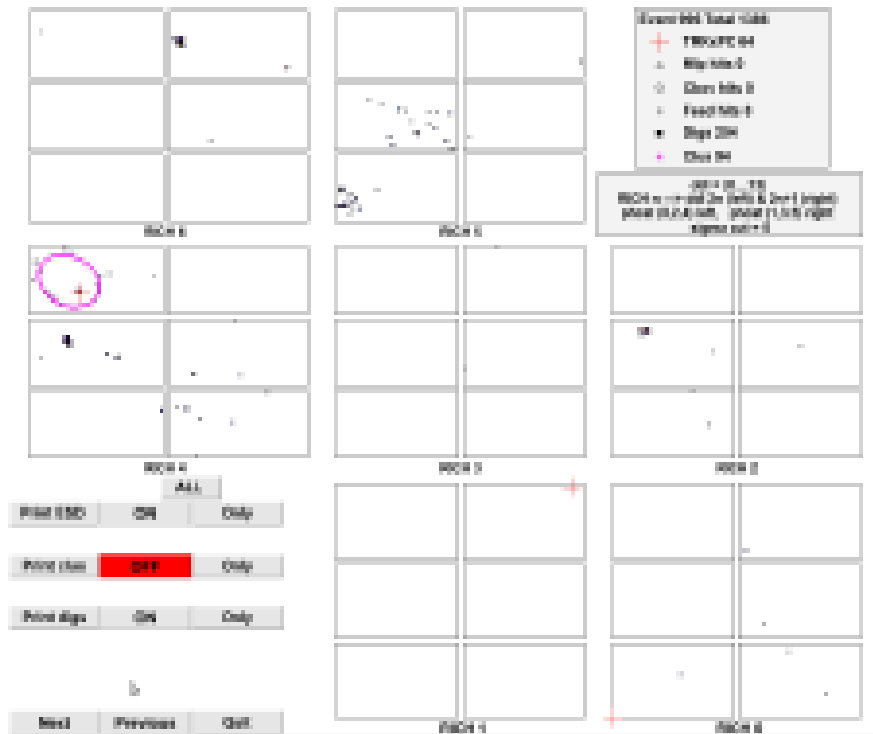
- Aging test of the HMPID detector

10/04/13

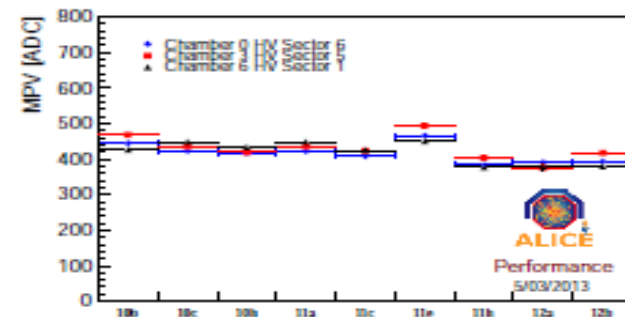
G.G. Barnaföldi: The Wigner ALICE Group

Physics/Analysis & Theory

- Aging test of the HMPID detector



Period	Ph. Ch. Info.	Events [$\times 10^3$]
LHC10b pass3	Yes	3.76
LHC10c pass3	Yes	2,900
LHC10d pass2	No	2.2
LHC10h pass2	Yes	3,600
LHC11a pass4	Yes	2,150
LHC11b pass1	Yes	13
LHC11c pass1	Yes	386
LHC11e pass1	Yes	186
LHC11h pass2	Yes	10,000
LHC12a pass1	No	50
LHC12b pass1	No	177
LHC12c pass1	No	360
LHC12d pass1	No	2.5



Detector Development: TPC upgrade

In the TDR's language

In our language

???



1. Physics objectives and design considerations

H. Appelshäuser, J. Harris

2. Mechanical structure, field cage and gas system

C. Garabatos

???



3. Gas Choice

C. Garabatos

4. Readout chambers

B. Ketzer, Fabbietti, C. Garabatos

5. Front-end electronics and readout

A. Oskarsson, D. Röhrich, C. Lippmann

6. Monitoring, calibration and online reconstruction

J. Wiechula, J. Thaeder

???



7. Simulation and detector performance

P. Christiansen, M. Ivanov

???



8. Tests with prototypes

P. Gasik, M. Ball, T. Gunji

???



9. Alternative R&D options

T. Gunji, N. Smirnov

10. Detector Control System

C. Lippmann

11. Installation, services and commissioning

R. Renfordt

12. Organization

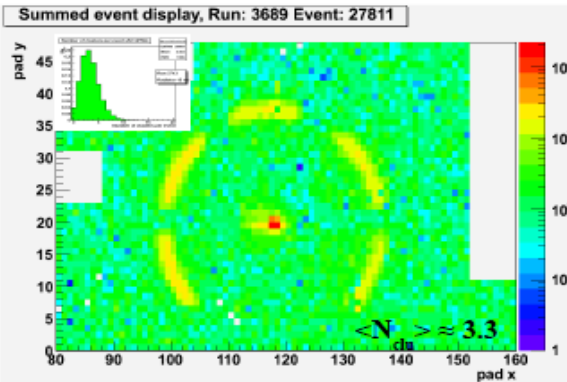
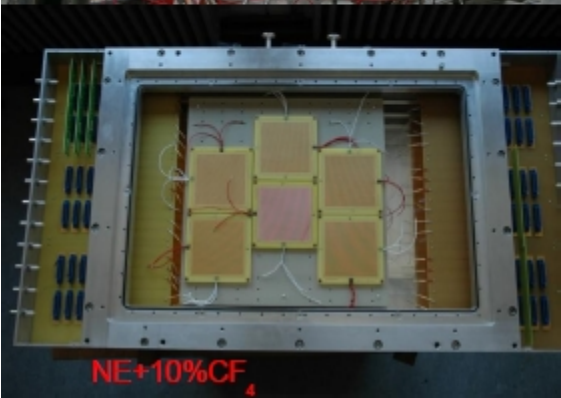
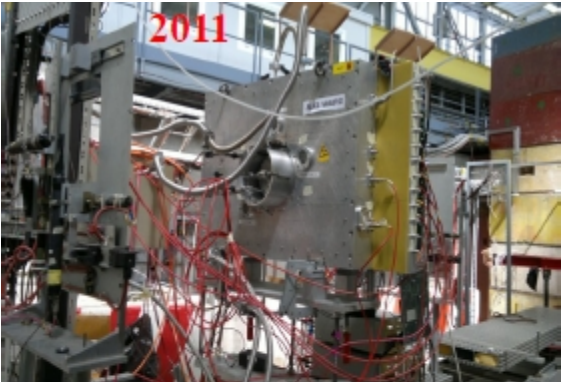
H. Appelshäuser, J. Harris

- PID & correlation studies
- How to share the work
- We have the infrastructure

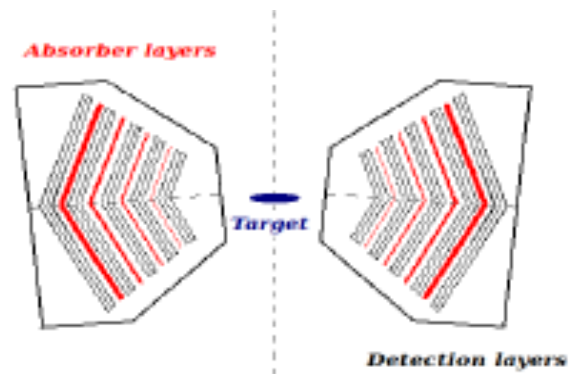
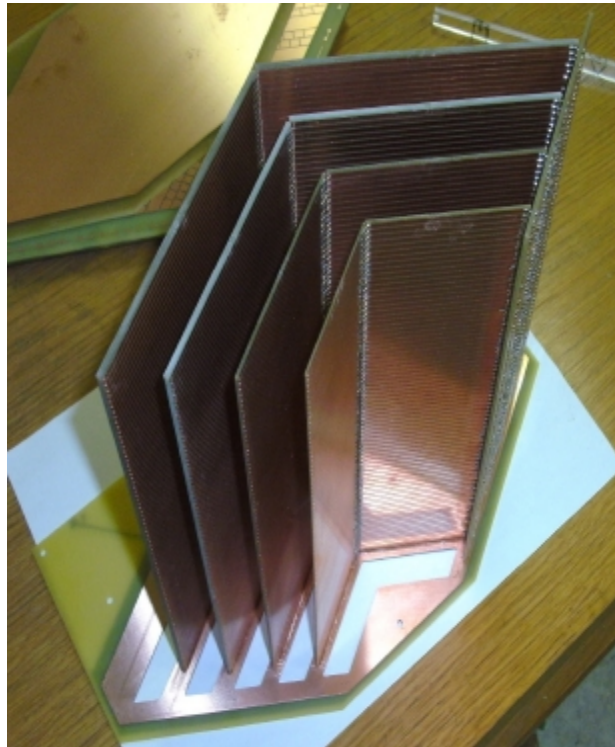
- Would be nice to join
- We are ready to take
- Yessss
- Must do...

ALICE TPC fits into ReGaRD's portfolio

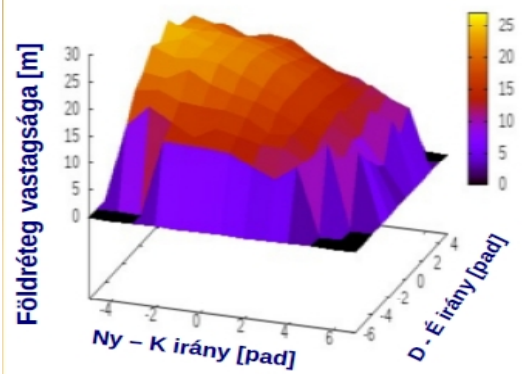
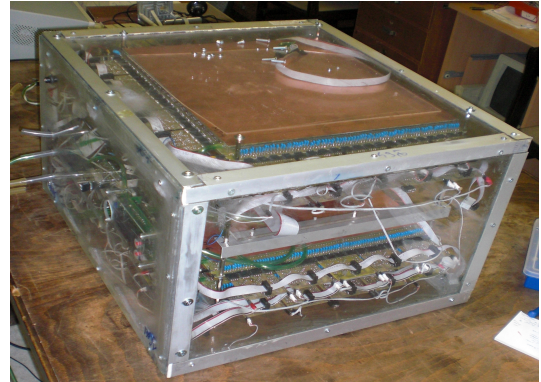
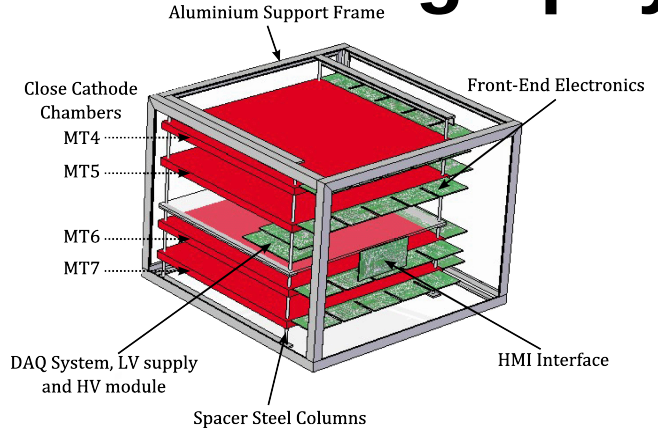
VHMPID



NA61 SHINE



Muontomography



GRID – ALICE Tier-2

The Wigner WLCG Tier-2 site is

- HR: 1-2 technicians
- cc 500 cores shared between ALICE & CMS
- Storage Element 73 TB
- Local CAF for R&D

GRID – ALICE Tier-2

The screenshot displays the MonALISA Repository for ALICE interface. At the top, the ALICE logo is on the left, the title "MonALISA Repository for ALICE" is in the center, and the MonALISA logo with the tagline "MONitoring Agents using a Large Integrated Services Architecture" is on the right. A navigation bar below the title contains links for "My jobs", "My home dir", "Catalogue browser", "LEGO Trains", "Administration Section", "ALICE Reports", "Alert XML Feed", "Firefox Toolbar", and "MonaLisa GUI".

The main content area is divided into several sections:

- ALICE Repository:** A sidebar menu with categories like "Production info", "Job Information", "SE Information", "Services", "Network Traffic", "FTD Transfers", "CAF Monitoring", "SHUTTLE", "Build system", "HepSpec", and "Dynamic charts".
- Running jobs trend:** A circular gauge showing the current number of jobs (3006) and a range from 0 to 40500.
- Map:** A satellite map of Europe with various sites marked by colored dots. A callout window for KFKI shows a line graph of "Running jobs" from November 2012 to September 2013, with a peak of 192 jobs. The graph has tabs for "1 hour", "1 day", "1 week", "1 month", and "1 year".
- Legend:** A row of colored dots with corresponding text: green for "Running jobs", orange for "Running jobs but no ML info", yellow for "Site service problem(s) prevents job execution", blue for "No jobs match the site resources", and red for "ML service down & no running jobs".

The Future of the Hungarian ALICE Group

Direction to the Future: Projects

- Participation in ALICE Upgrade Projects

ALICE UG Projects

- PID analysis with ALICE HMPID detector
- ALICE Tier-2 upgrade (Storage +50%)
- ALICE DAQ & CRU development
- TPC R&D and partial production?

Funds:

- NIH
- OTKA (2013-2016)
- Joint project D. Varga (momentum)

Direction to the Future: HR, PR

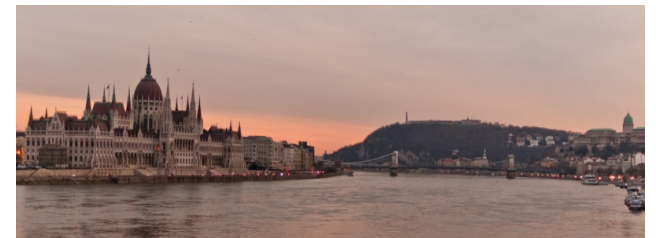
Search for the future HR for High Energy Physics

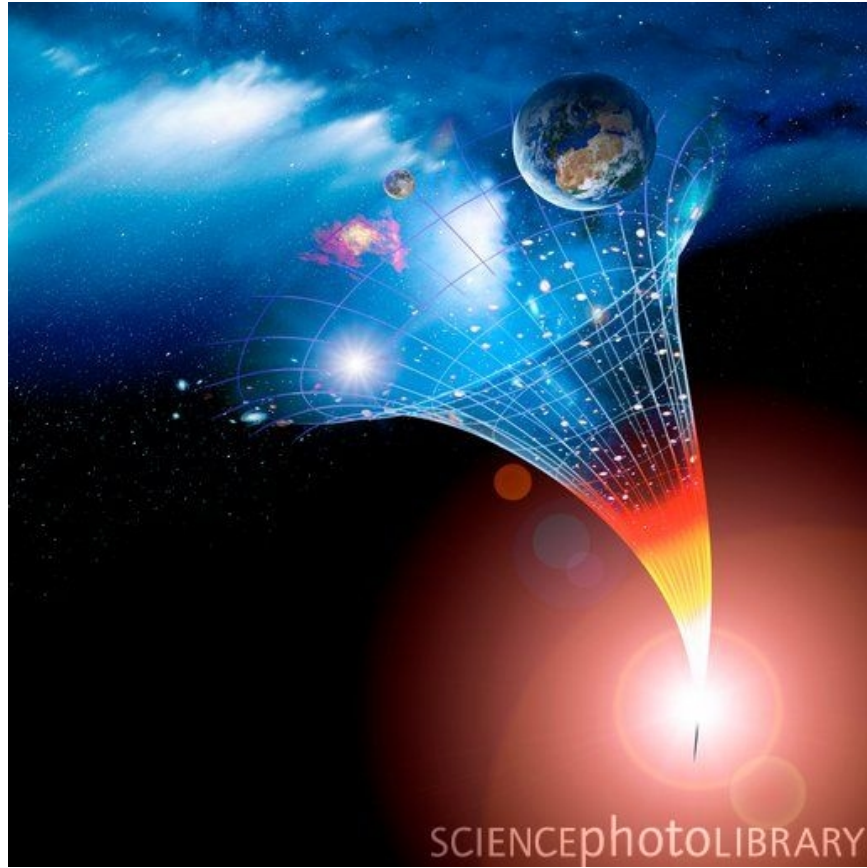
Teaching and PR activities

- BSc and MSc level teaching & supervising at
 - Eötvös Loránd University (Introductory talks)
 - Connection to Technical University of Budapest
 - Connection to University of Miskolc
 - Public lectures (AtomCsill)

Organization of Schools and Workshops

- ISOTDAQ2014, 28.02.-05.01.2014
<http://isotdaq2014.wigner.mta.hu>
- Summer School at Eötvös University
- ALICE Week 2015?


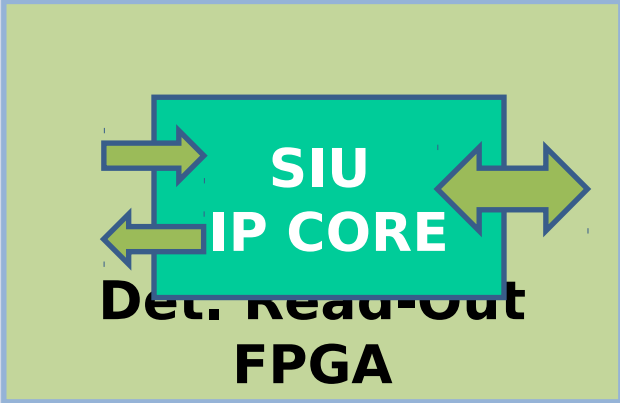
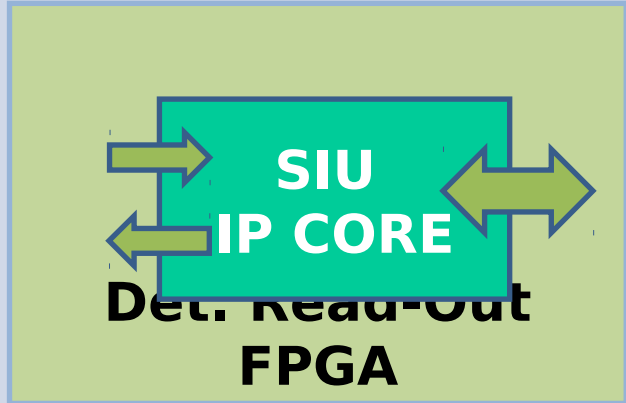





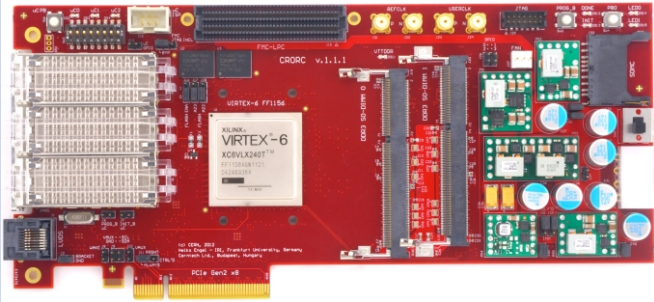
10/04/13

G.G. Barnaföldi: The Wigner ALICE Group

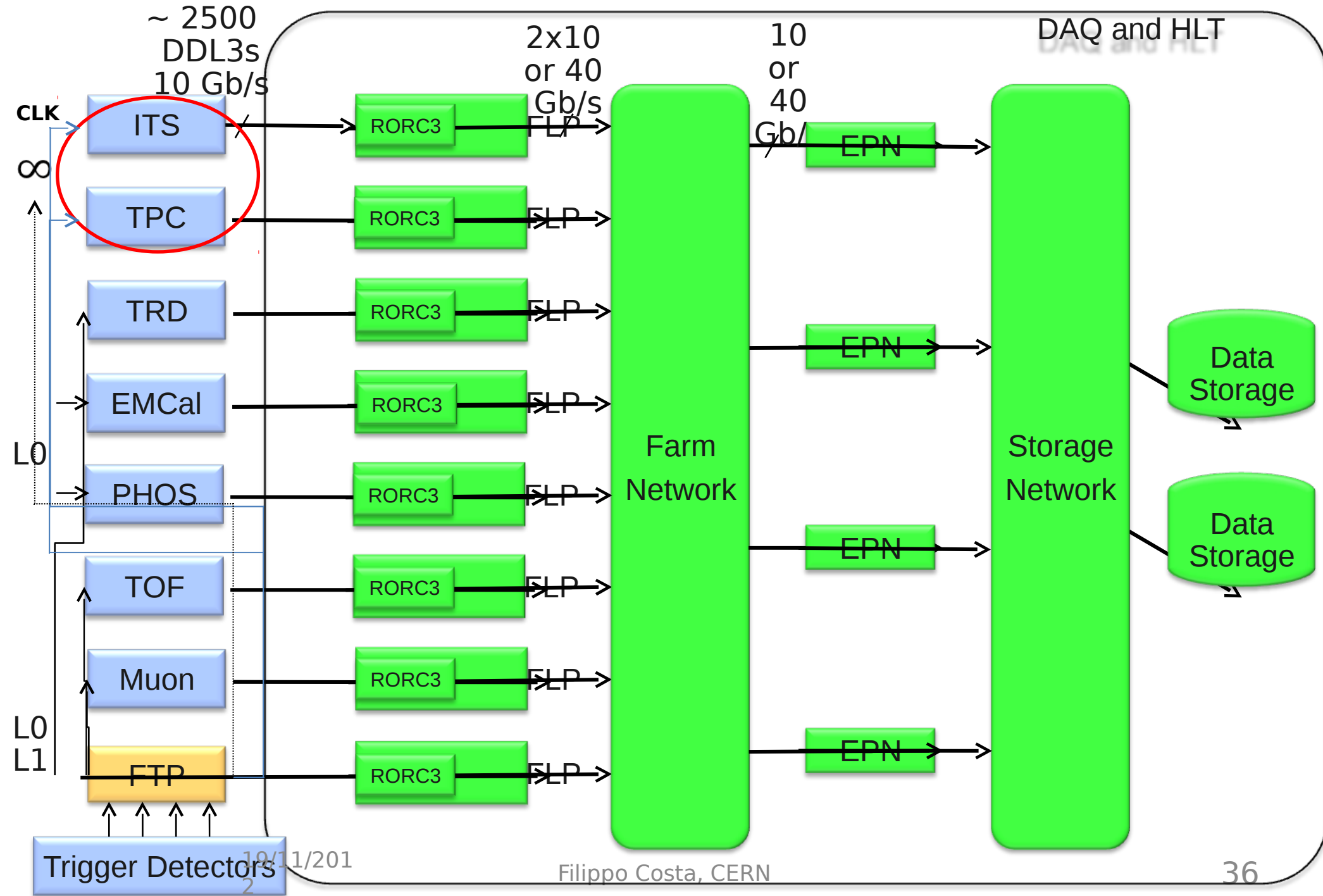
DDL SIU evolution

SIU1	SIU2	SIU3		
				
<p>1 ch @ 2 Gb/s ACTEL FPGA (CORE cost 560 CHF)</p>	<p>Up to 6 Gb/s XILINX / ALTERA /ACTEL FPGA (CORE cost 0 CHF)</p>	<p>10 Gb/s XILINX / ALTERA / ACTEL FPGA (CORE cost 0 CHF)</p>		
<p>Custom DDL protocol</p>	<p>Custom DDL protocol (same protocol but faster)</p>	<ul style="list-style-type: none"> • Custom DDL 10 Gb/s • Ethernet @ 10 Gb/s • PCIe over fibre 		
<p>RUN1</p>	<p>L S 1</p>	<p>RUN2</p>	<p>L S 2</p>	<p>RUN3</p>

RORC evolution

RORC1	RORC2 (aka C-RORC)	RORC3		
		<h1>TBD</h1>		
<p>2 ch @ 2 Gb/s PCIe gen.1 x4 (1 GB/s) ALTERA FPGA</p>	<p>12 ch @ up to 6 Gb/s PCIe gen.2 x8 (4 GB/s) XILINX FPGA</p>	<p>12 ch @ 10 Gb/s PCIe gen.3 ALTERA / XILINX</p>		
<p>Custom DDL protocol</p>	<p>Custom DDL protocol (same protocol but faster)</p>	<ul style="list-style-type: none"> • Custom DDL 10 Gb/s • Ethernet @ 10 Gb/s • PCIe over fibre 		
<h2>RUN1</h2>	<h2>LS1</h2>	<h2>RUN2</h2>	<h2>LS2</h2>	<h2>RUN3</h2>

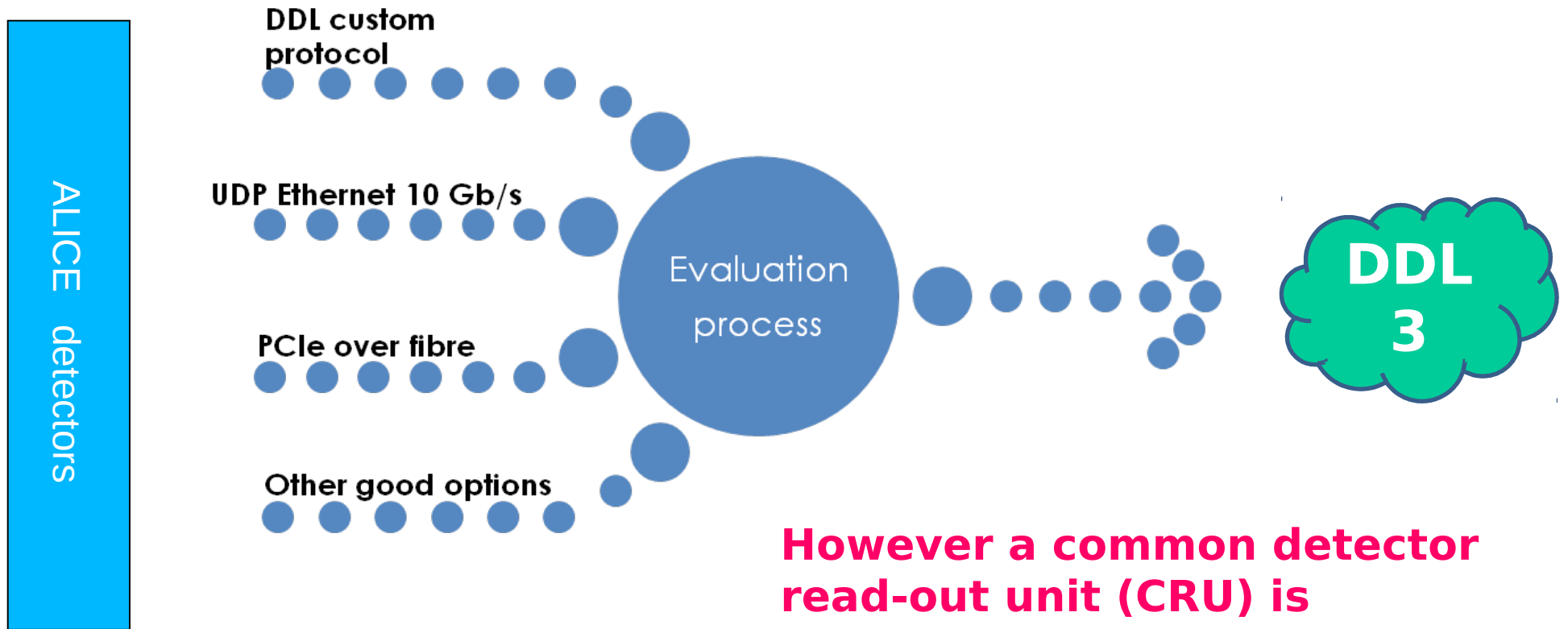
LS2 Online Upgrade



R&D „DDL3”

Data transmission protocols are under evaluation, for the time being **no final decision has been taken yet.**

Each protocol has different pros and cons, tests started already now, soon to come a reasonable decision.



However a common detector read-out unit (CRU) is needed!

Introduction: simplified DAQ Block Diagram

CRU will be in the heart of the system...

