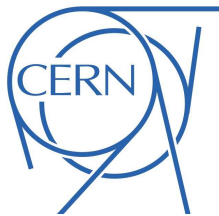
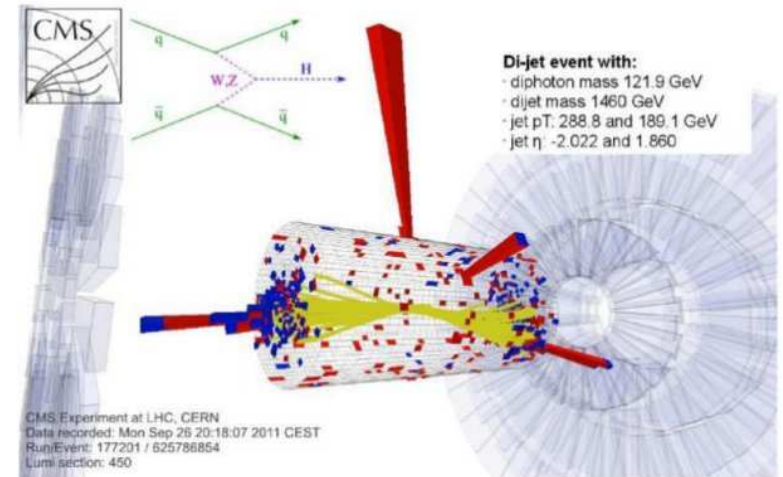
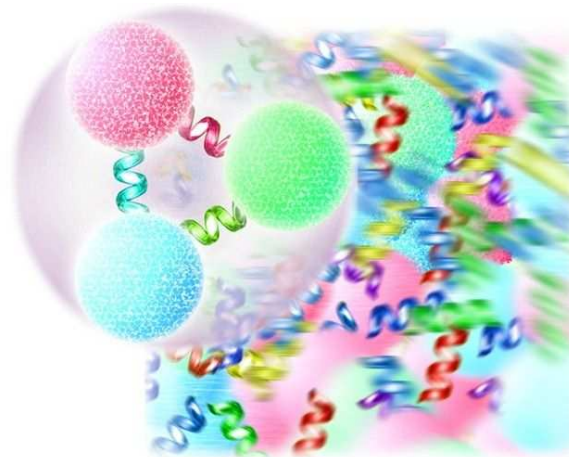
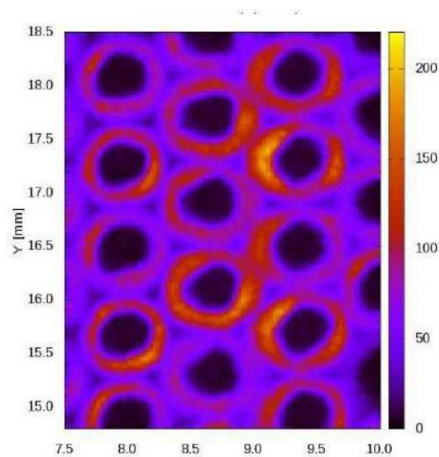


# Experimental high energy physics in Wigner



Budapest, January 20, 2017

# Experimental high energy physics in Wigner

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- The beginnings

- after Dubna, CERN membership of Hungary (1992)
- main activities: **detectors**, **electroweak** (LEP OPAL/L3) and **strong interaction** (SPS NA49, GSI FOPI, RHIC PHENIX)

- The present

- Detector research and development
- Big: CMS (with Debrecen and Eötvös U), ALICE [various topics]
- Small: ASACUSA, TOTEM, NA61 [selected topics]
- Computing: Tier0, WLCG

- The future

- LHC detector upgrades (CMS and ALICE)
- Plasma wake-field acceleration (AWAKE), [Rb plasma]
- Accelerator physics (FCC) [beamline]

Detector construction, operation, data analysis, phenomenology

# Dept of high energy physics – personnel

Detector R&D

Dezső Varga 

Hadron physics

Ferenc Siklér

SM and New Physics

Viktor Veszprémi

Emeritus



Contributor



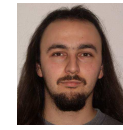
Advisor



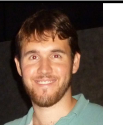
Senior



Fellow



PhD student



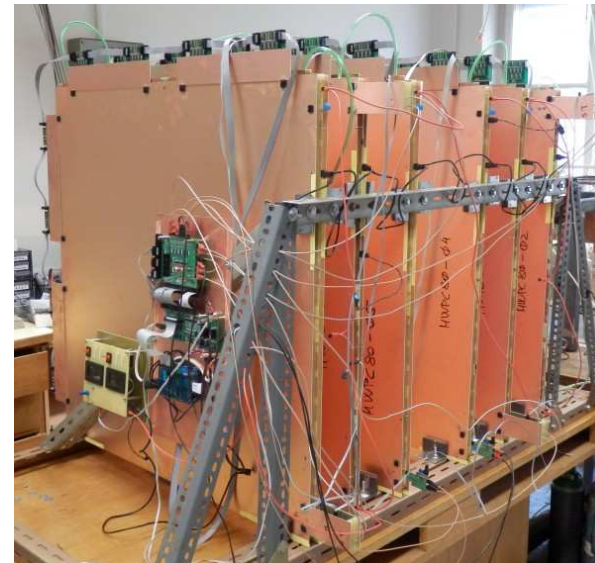
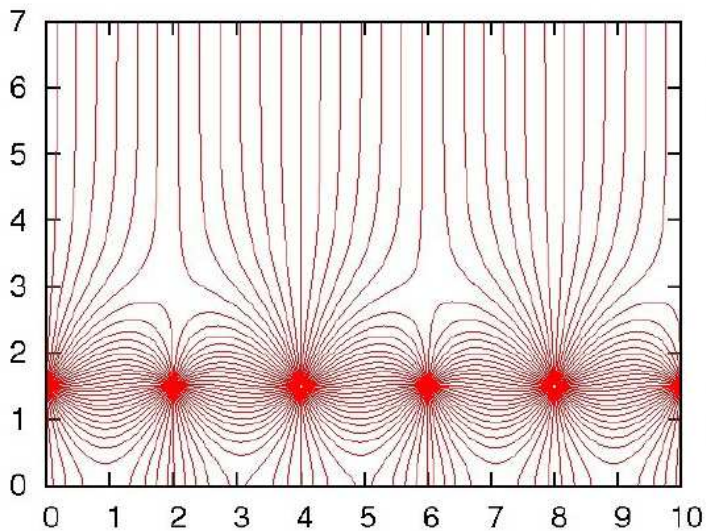
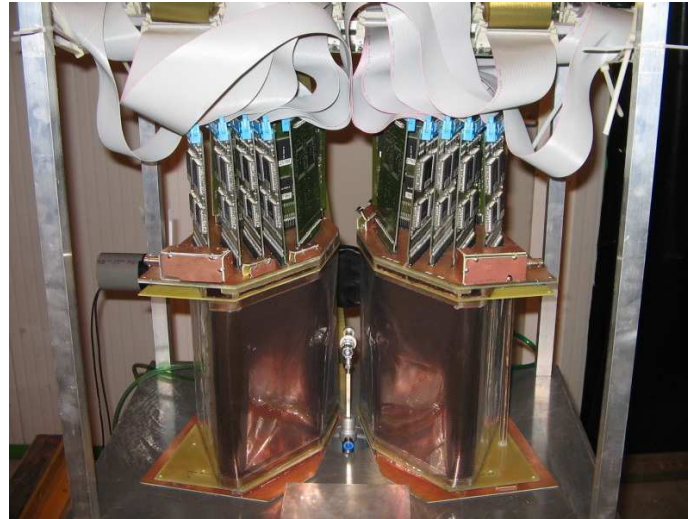
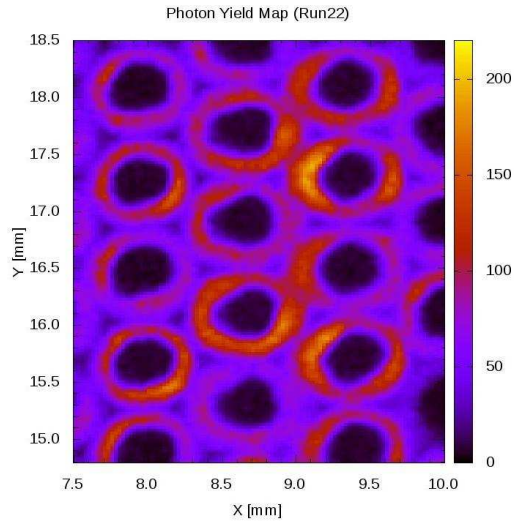
undergrad



“Momentum” grant of the Academy

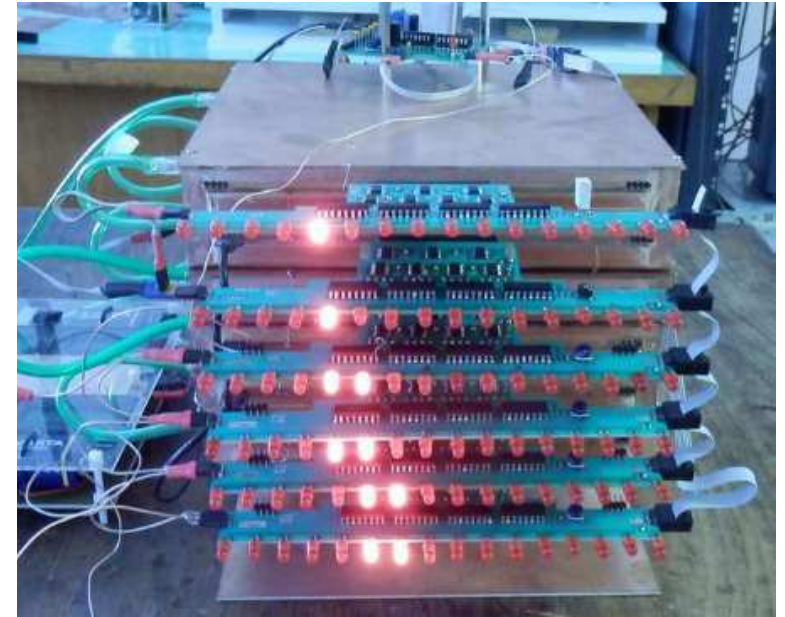
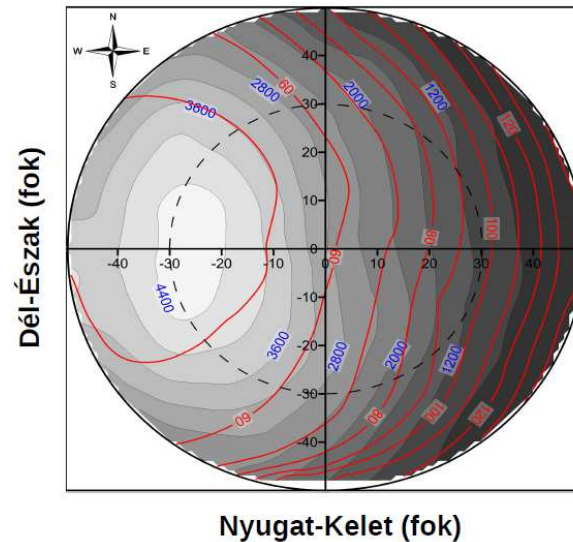
Several students (in collaboration with Eötvös U and U of Technology)

# Detector research and development (D Varga)



Innovation; gas-electron multipliers, MWPC; readout

# Detector research and development



L Oláh, G Hamar et al

Detection of cosmic muons, various applications  
(underground cavities, materials, volcanos [Japan])

Several international connections:

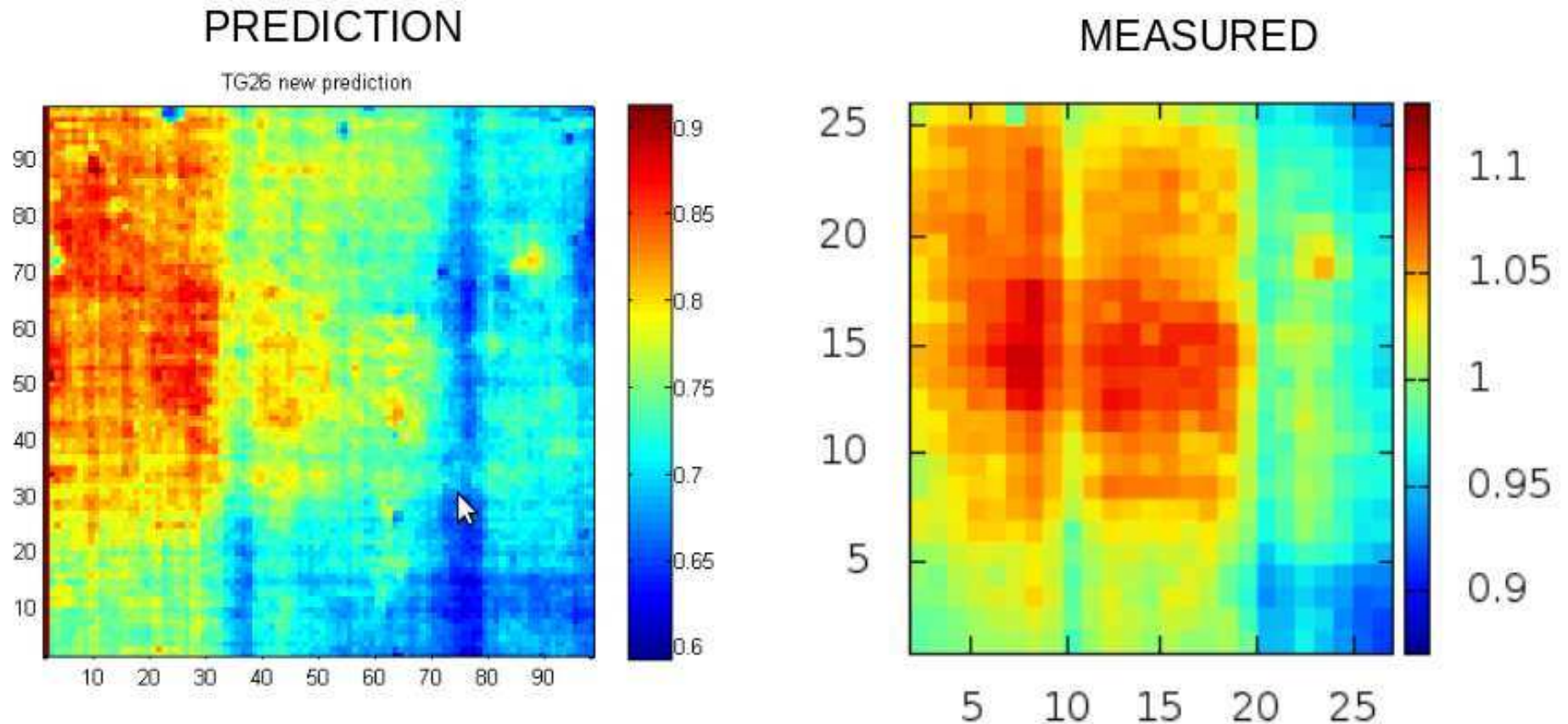
RD51, AIDA-2020, ALICE, NA61, BrightnESS  
Joint laboratory with Chinese Academy of Sciences

Laboratories, clean room; students; outreach

# Detector research and development

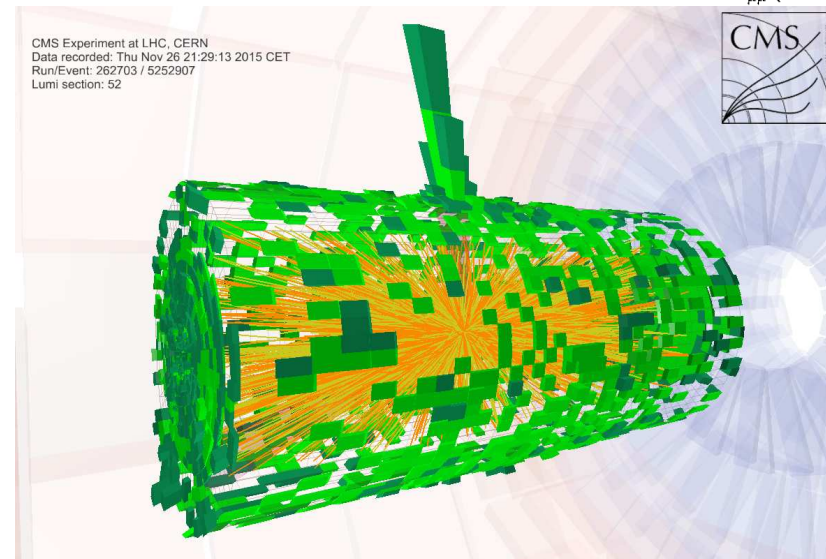
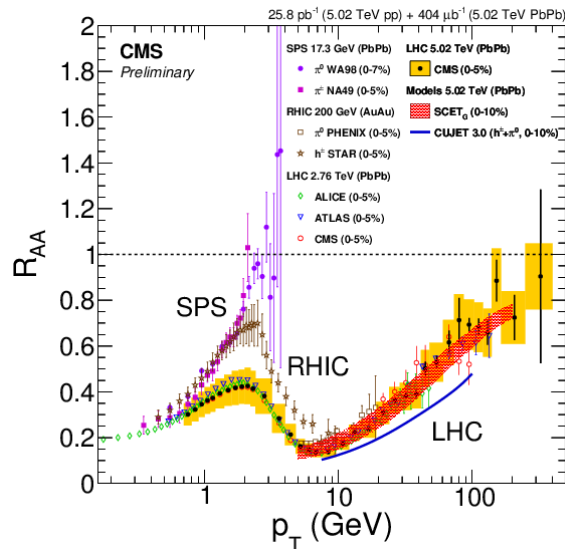
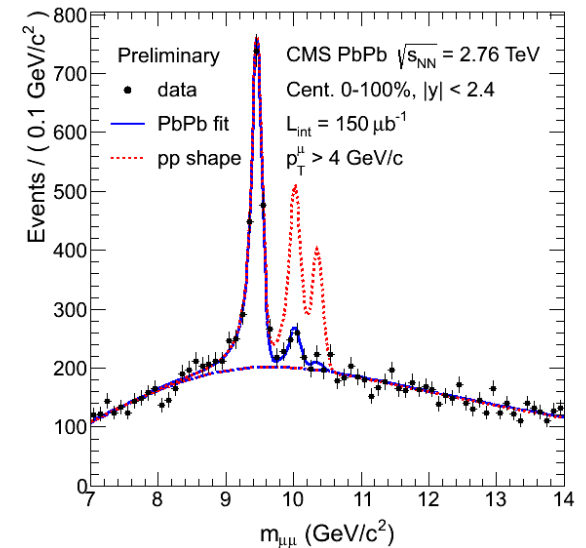
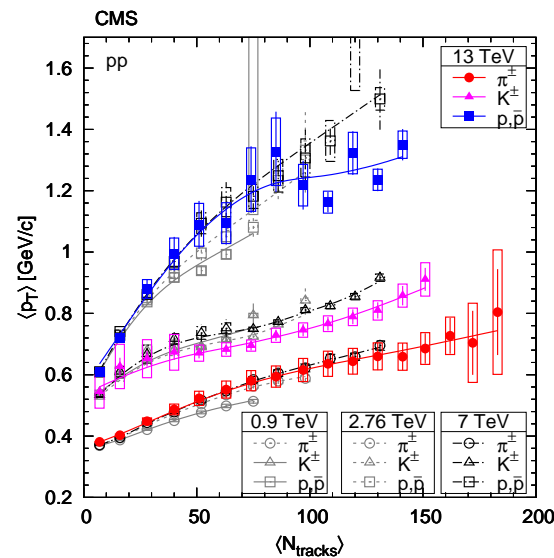
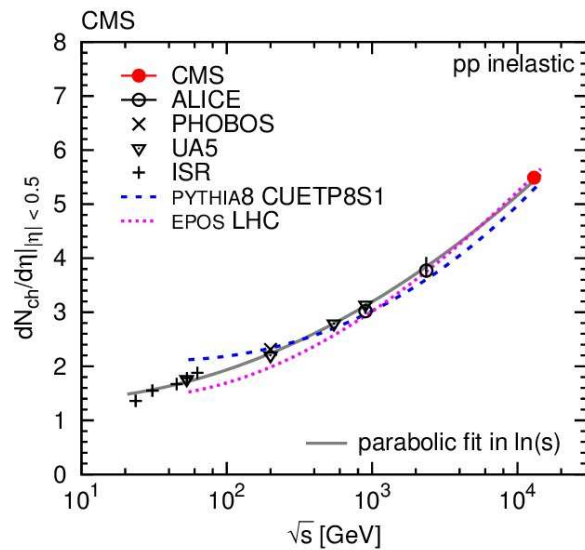
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GEM hole size distribution:



Qualifying GEM layers, used to read out of the upgraded ALICE TPC  
In collaboration with the U of Helsinki, TU Munich, and CERN

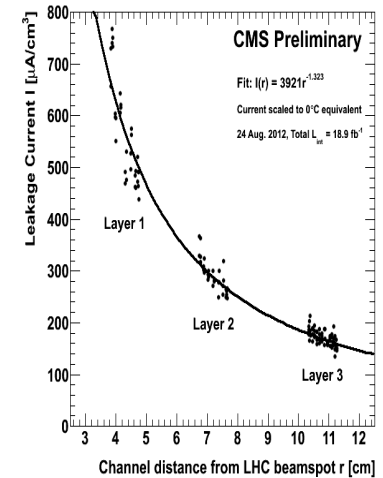
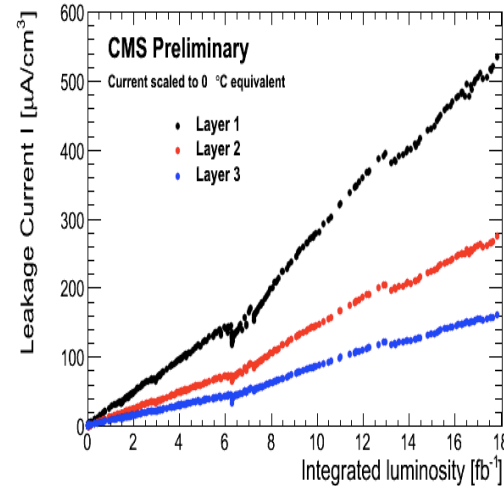
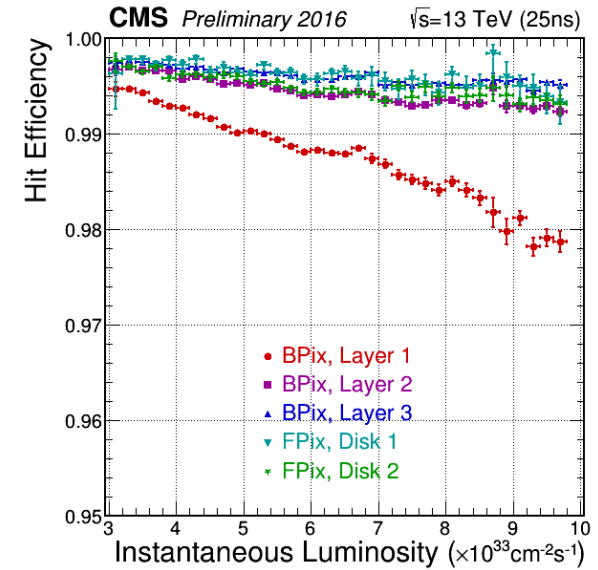
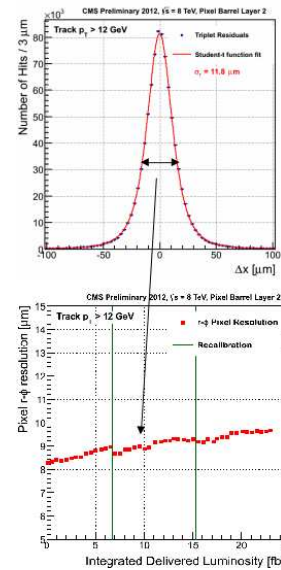
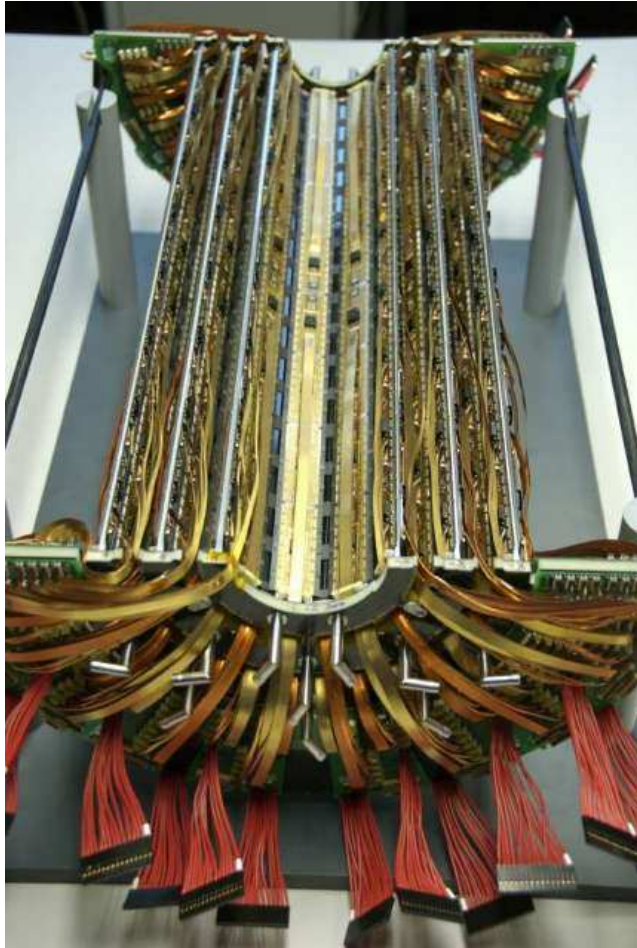
# CMS – hadron physics (F Siklér)



K Krajczár, AJ Zsigmond

Strong interaction (QCD and heavy-ion physics); first measurements  
Charged particle tracking, PID, spectra and correlations, resonances

# CMS – pixel detector (V Veszprémi)

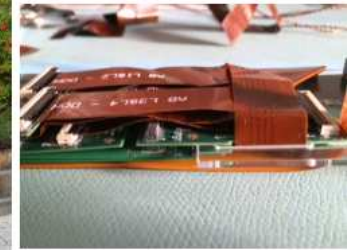
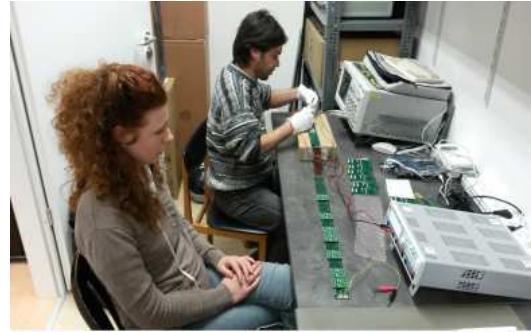


Various calibrations of the pixel detector, chips

Ageing: monitoring spatial resolution vs luminosity and readout threshold



# CMS – upgrades (V Veszprémi, T Kiss)



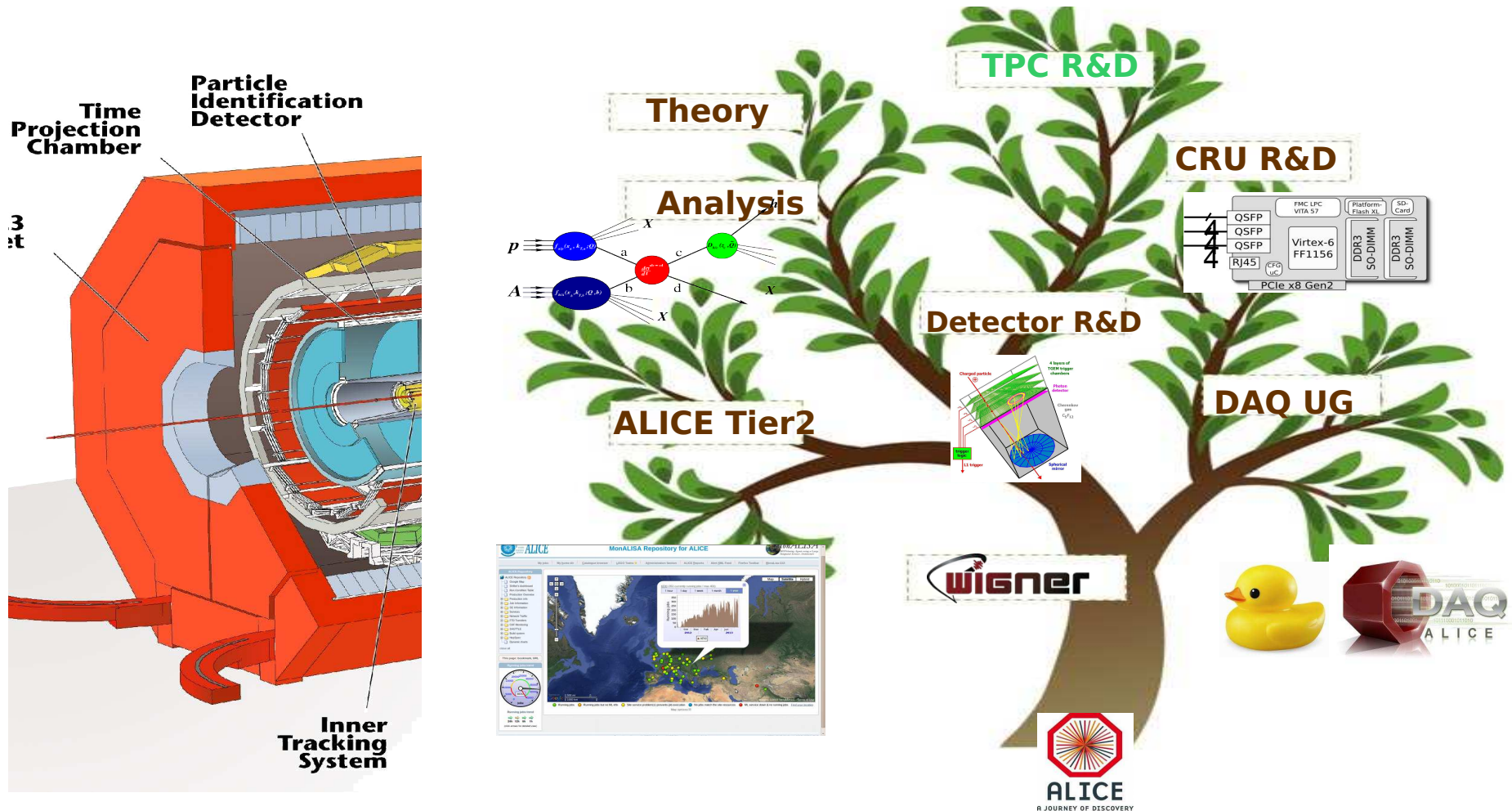
New pixel detector to be installed this spring

Designed and produced readout and controller cards with the DAQ group

Managing the development of data processing software; Simulation

Physics interest: SUSY searches

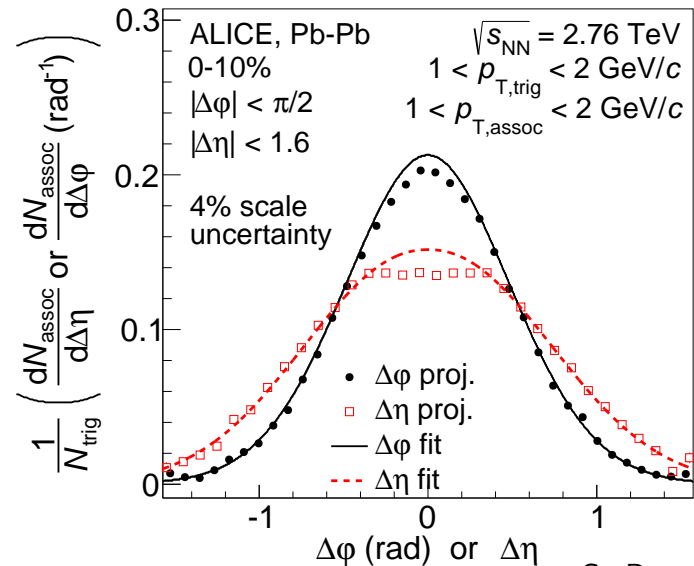
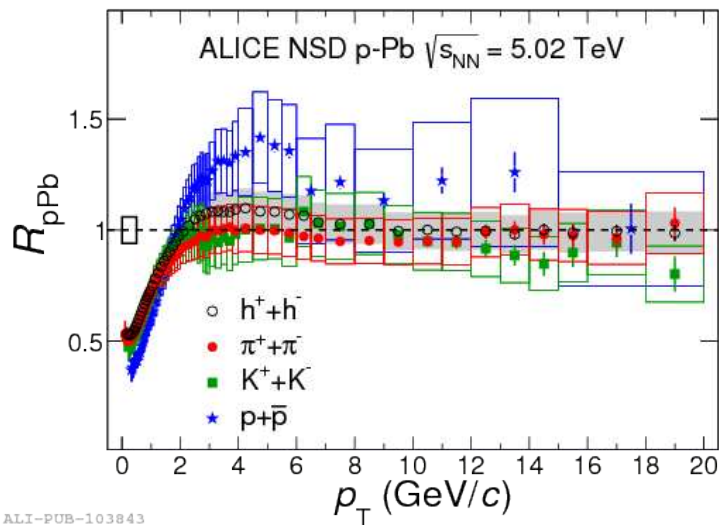
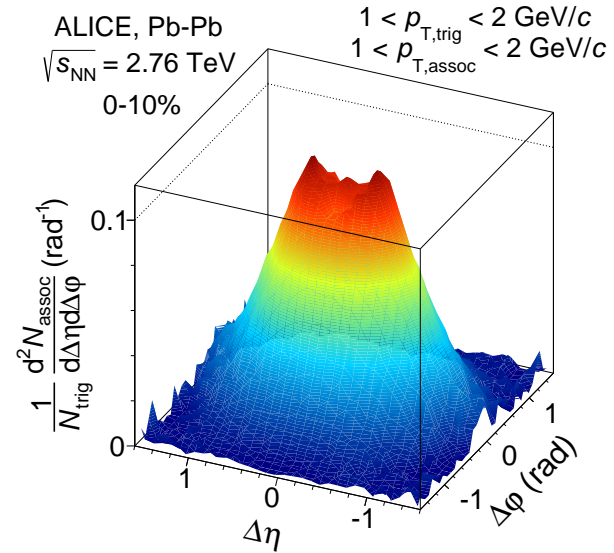
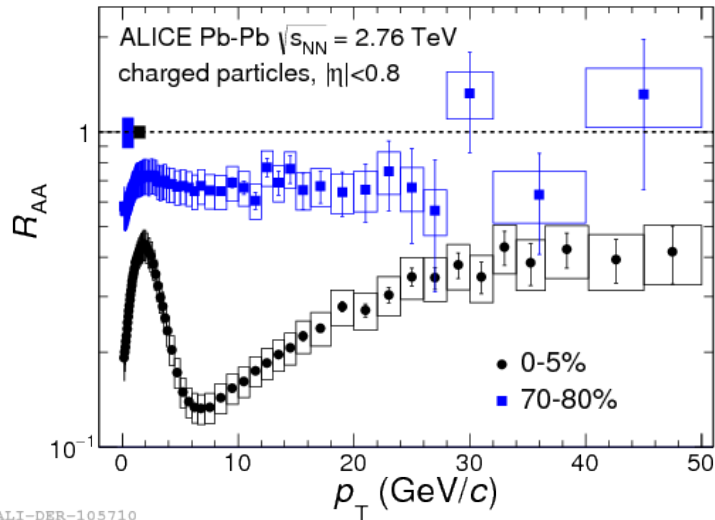
# ALICE (GG Barnaföldi)



- Upgrades

- strongly involved in the det readout and DAQ: CRU development
- TPC readout: gaseous detector R&D, GEM

# ALICE – hadron physics

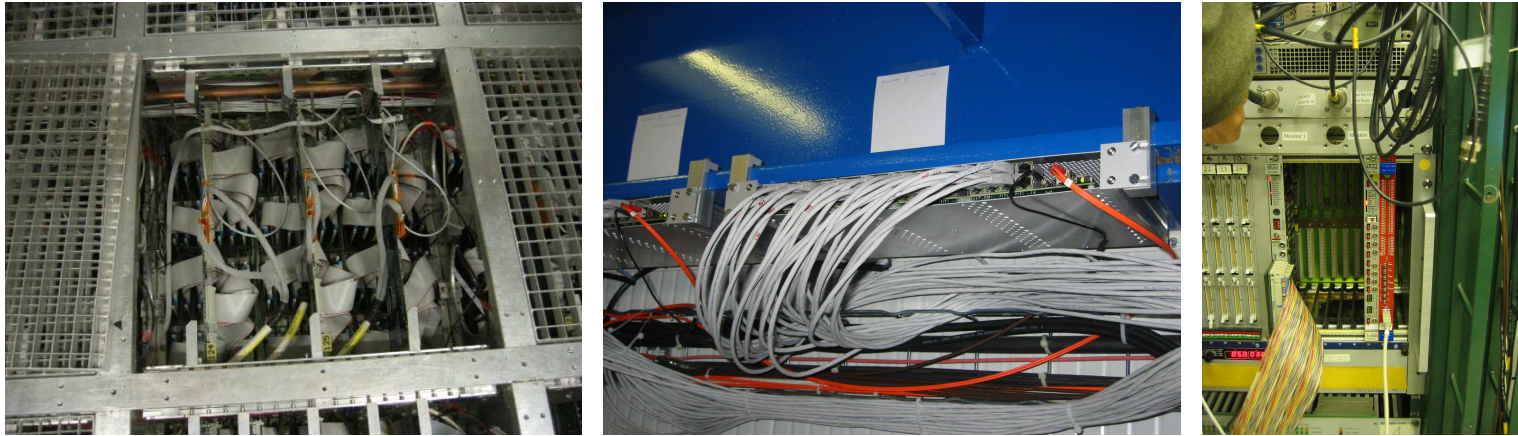


Gy Bencédi, M Kőfaragó

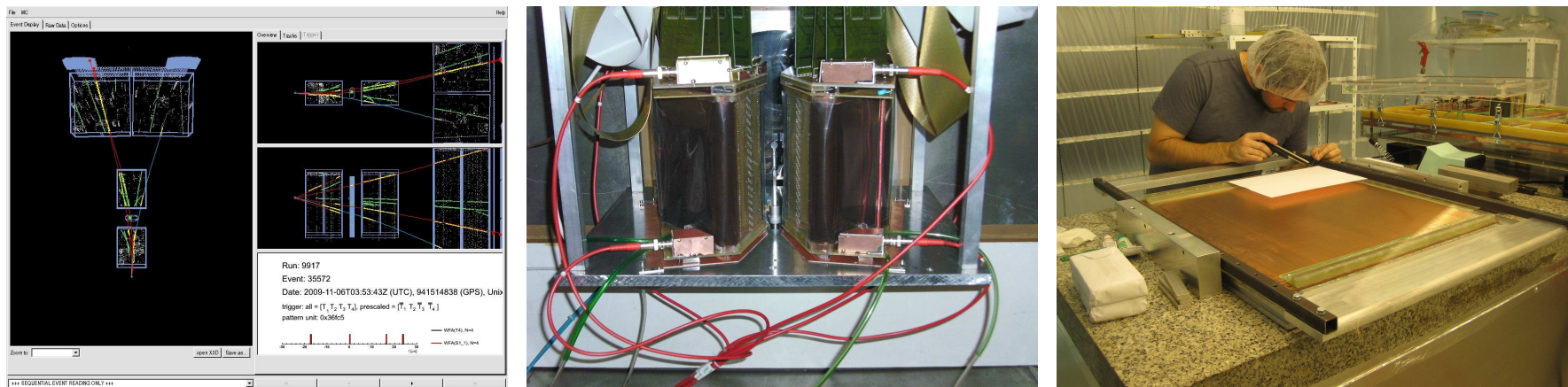
Physics analysis: High  $p_T$ , jets, PID, heavy quarks, correlations

# NA61/Shine (A László)

Development, building and maintenance of DAQ



Offline software development, gaseous detector development

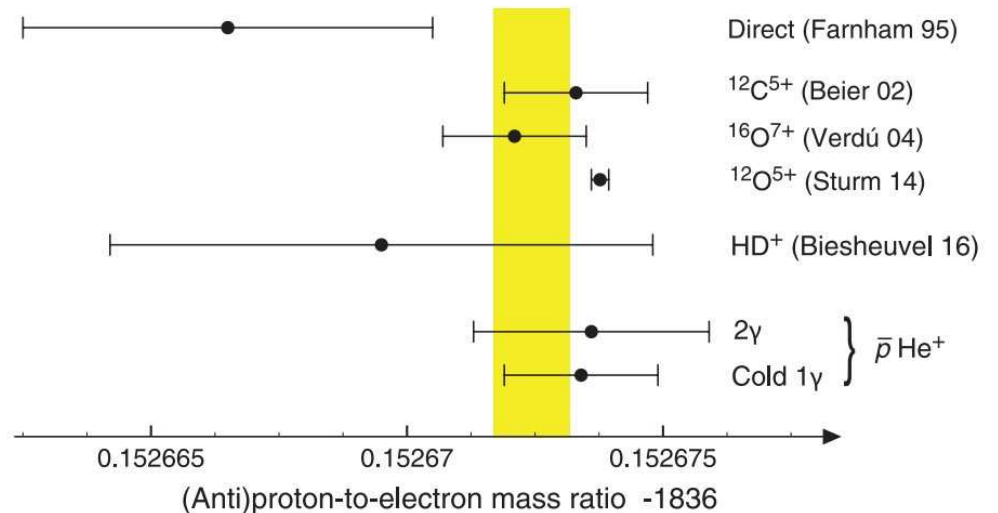
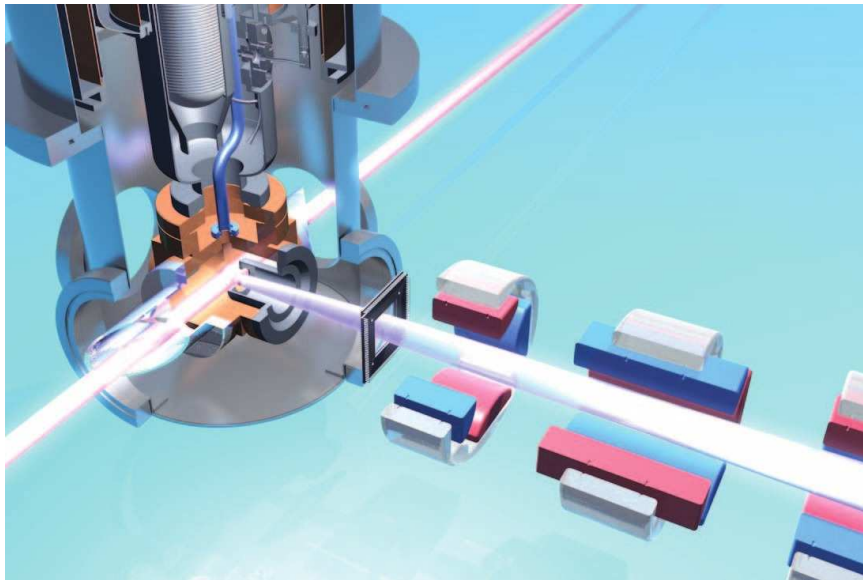


Physics: single particle spectra ( $R_{AA}$ ,  $R_{pA}$  analysis)

# ASACUSA (D Horváth, D Barna)

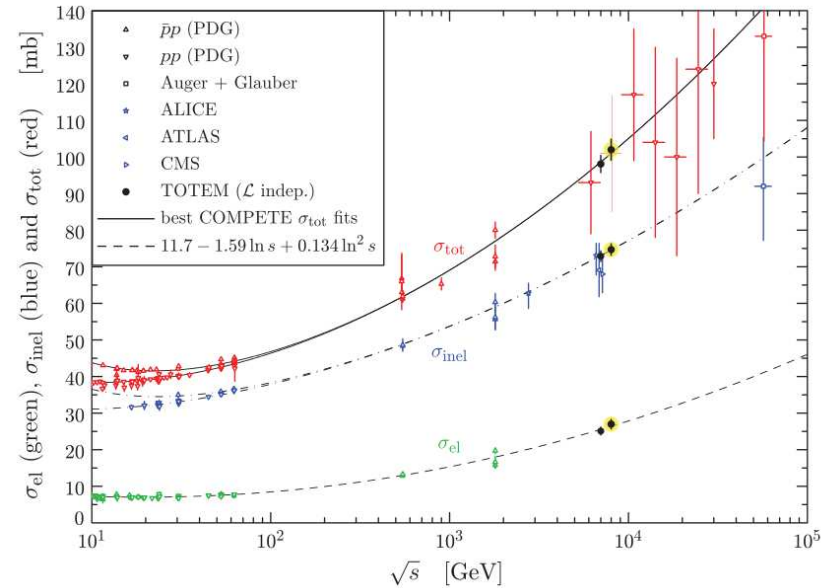
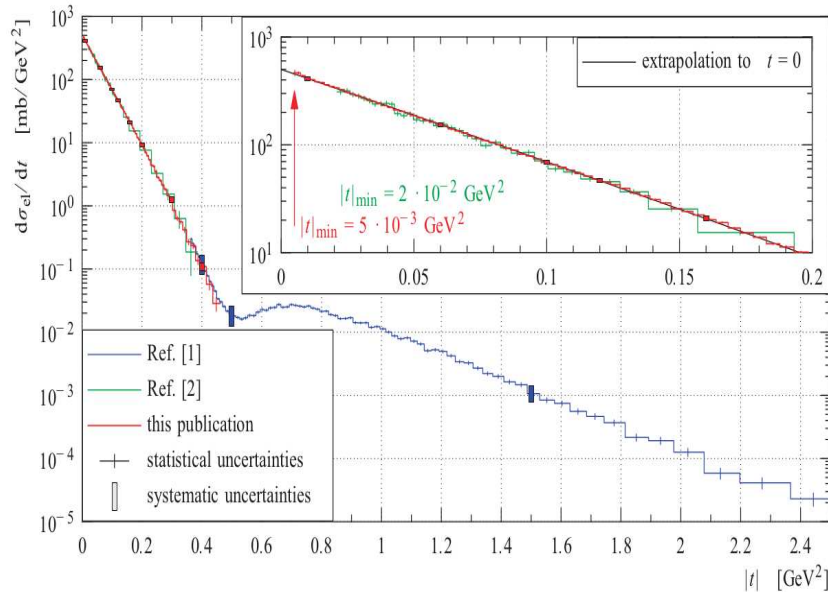
- Antimatter research

- Motivation: Testing CPT invariance via measuring  $\bar{p}$ -mass
- Method: laser spectroscopy on  $\bar{p}$ -He atoms
- CPT-limit reached:  $7 \times 10^{-10}$  (90% confidence level).



A recent spectacular result: antiproton-to-electron mass ratio  
3 out of 12 authors are Hungarians

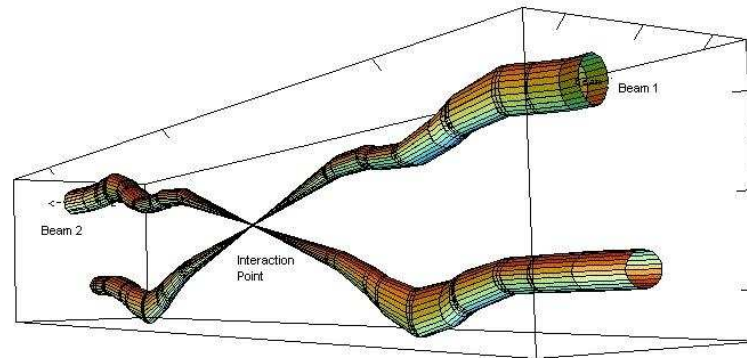
# TOTEM (T Csörgő)



Differential and total pp cross sections

Crucial Hungarian contribution: determining LHC magnet optics

F Nemes



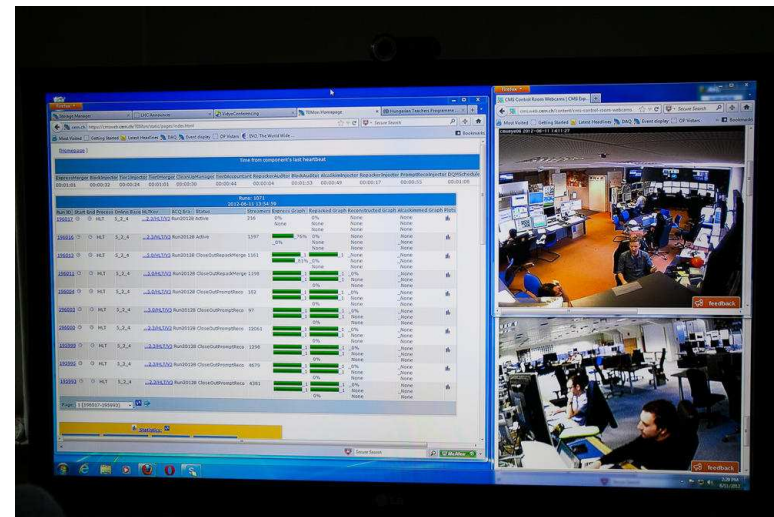
Data analysis and modelling; joint data taking with CMS

# Computing

- Tier0 – Wigner Data Center

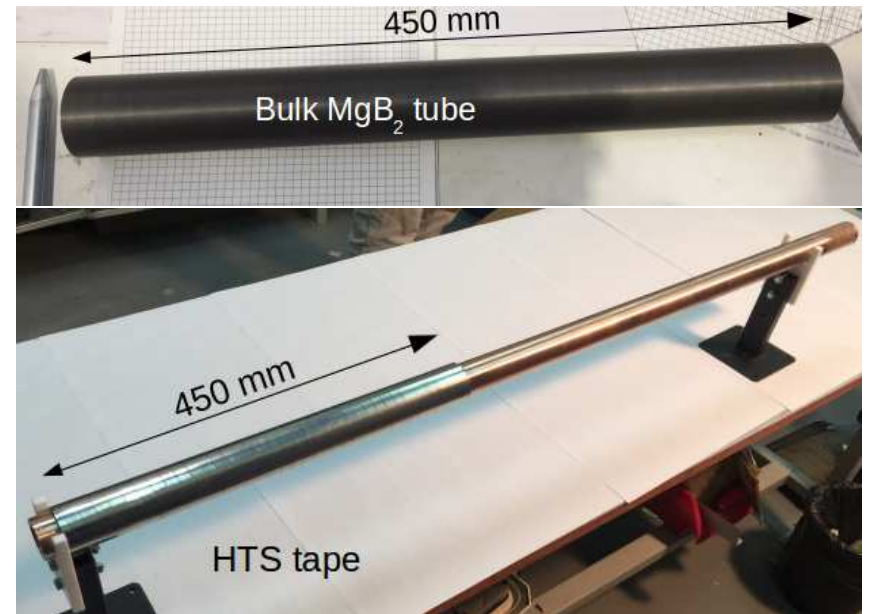
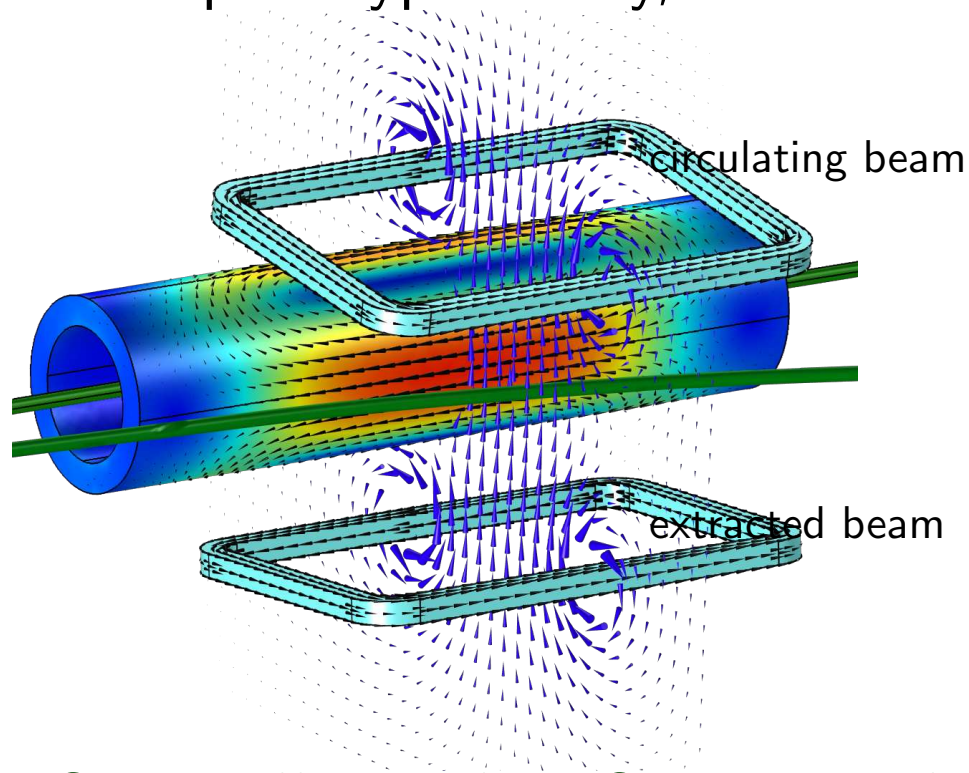


- Tier2 for CMS (Cs Hajdu) and ALICE (G Biró)  
Local CMS center, for giving shifts and educational purposes



# Accelerator research and development (D Barna)

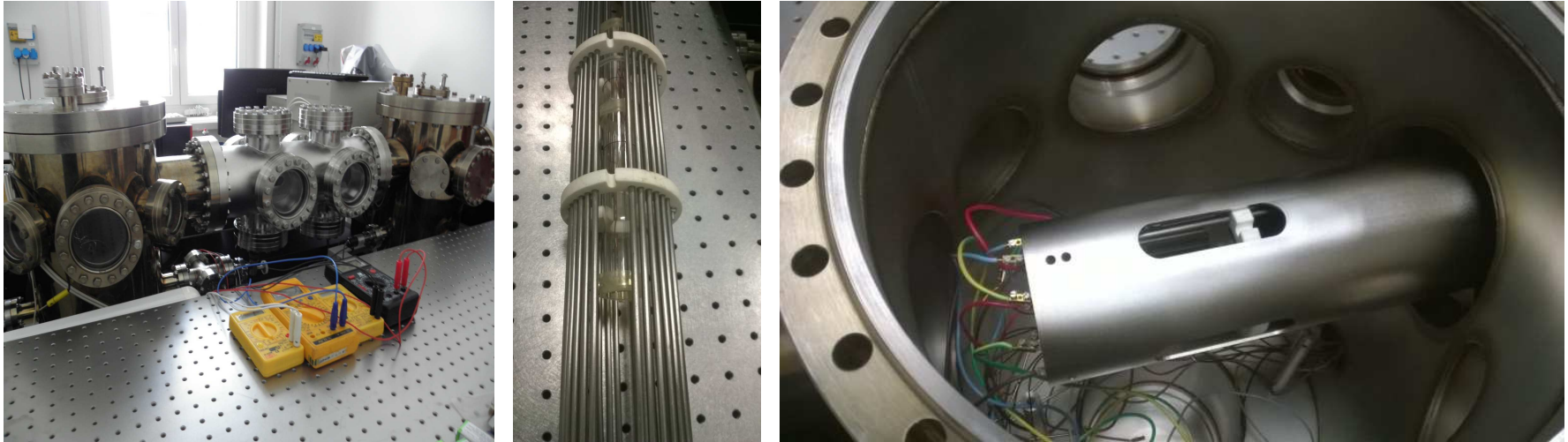
- Participation in FCC (MoU signed in 2015)
  - Leading “Superconducting Shield (SuShi) septum for FCC”
  - Goal: 3-4 T septum magnet for extraction with supercond shield
  - Two prototypes ready, first test this February (SM18)



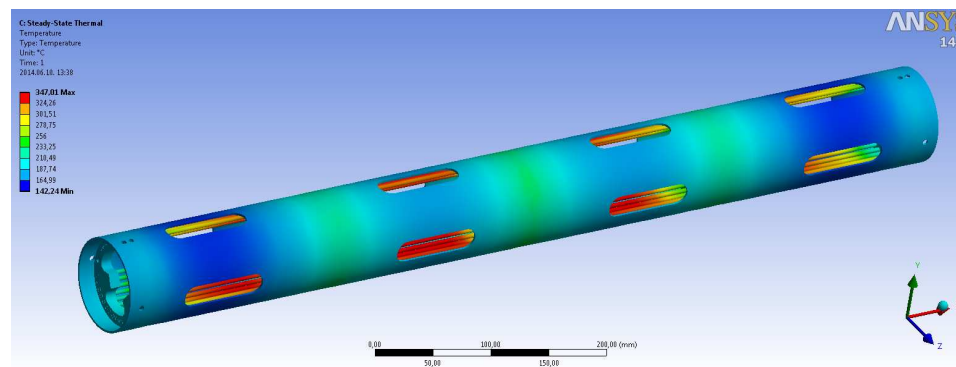
Study effects of HTS coating of beam screen on field quality  
Introducing accelerator technology at the university; cyclotron



# Plasma wake-field acceleration (D Gagik)

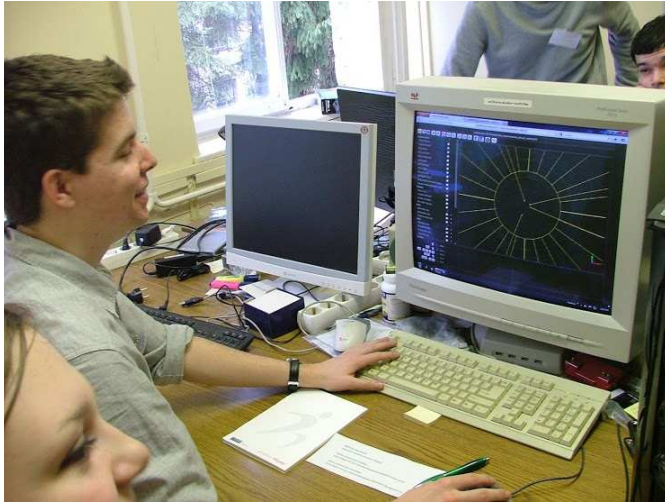


Rb-plasma creation by laser  
Experimental test facility at Wigner for AWAKE



# Outreach

## International Masterclasses at Wigner



## Teacher's programme at CERN

**Hungarian Teacher Programme**

15-21 August 2016  
CERN  
Europe/Zurich timezone

**Overview**  
Timetable  
Videoconference Rooms

**Support: Jeff Wiener**  
jeff.wiener@cern.ch  
+41 75 411 9010

The Hungarian Teacher Programme 2016 will take place from visits, exhibitions, and hands-on workshops will introduce its physics. We hope our participants will go back to Hungary as an our next generation of physicists, engineers, IT specialists and as CERN is looking forward to welcome the Hungarian teachers here!

**Hungarian Teacher Programme**  
<https://indico.cern.ch/e/HU>

**Teacher Programme Manager**  
Jeff Wiener: 0041 75 411 904

**In case of emergency:**  
CERN fire brigade: 0041 22 76

**Starts** 15 Aug 2016 10:00  
**Ends** 21 Aug 2016 16:05  
Europe/Zurich

**Location:** CERN  
Dzso Horvath  
Jeff Wiener  
Noemi Benli

## CERN-Wigner Open Days at Wigner



## Physics bus in Hungary



# Experimental high energy physics – Wigner



- Funding in Hungary

- National Research, Development and Innovation Office  
(membership fees, M&O A, limited amounts for basic research)
- Hungarian Academy of Sciences  
(salaries; also through “Momentum” and personal grants)