Detector R&D and construction activities at the Wigner RCP

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REGARD
RMKI ELTE Collaboration on Gaseous Detector Research and Development

RECFA Visit to Hungary
Budapest 23rd Sept. 2022

MŰEGYETEM 1782

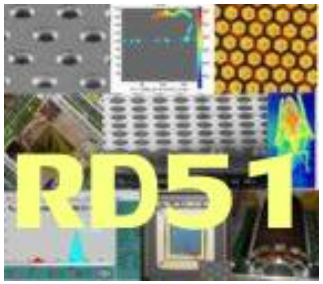
UNIVERSITAS BUDAPESTINENSIS DE ROLANDO EÖTVÖS NOMINATA

All colors of Physics

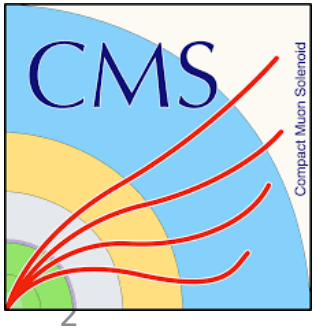
NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE HUNGARY
PROJECT FINANCED FROM THE NRDI FUND

Wigner RCP Detector Physics group: HEP instrumentation

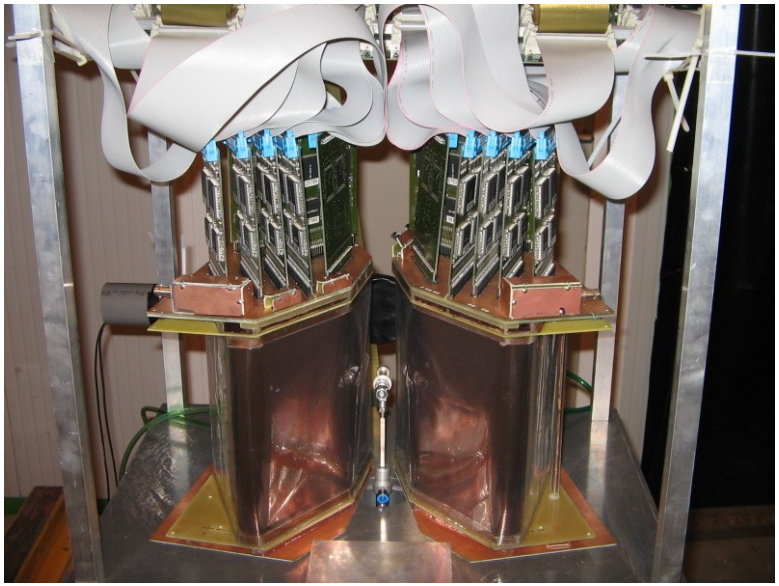
- CERN RD51: high performance gaseous detector R&D founding member
- CERN NA61: detector construction
- CERN ALICE: rebuilding the TPC
- ESS BrightnESS: neutron detector development
- Follow up by CMS group: CMS tracker

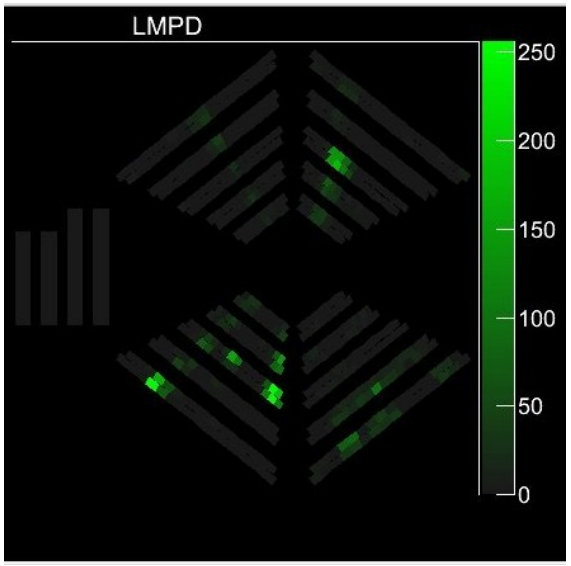


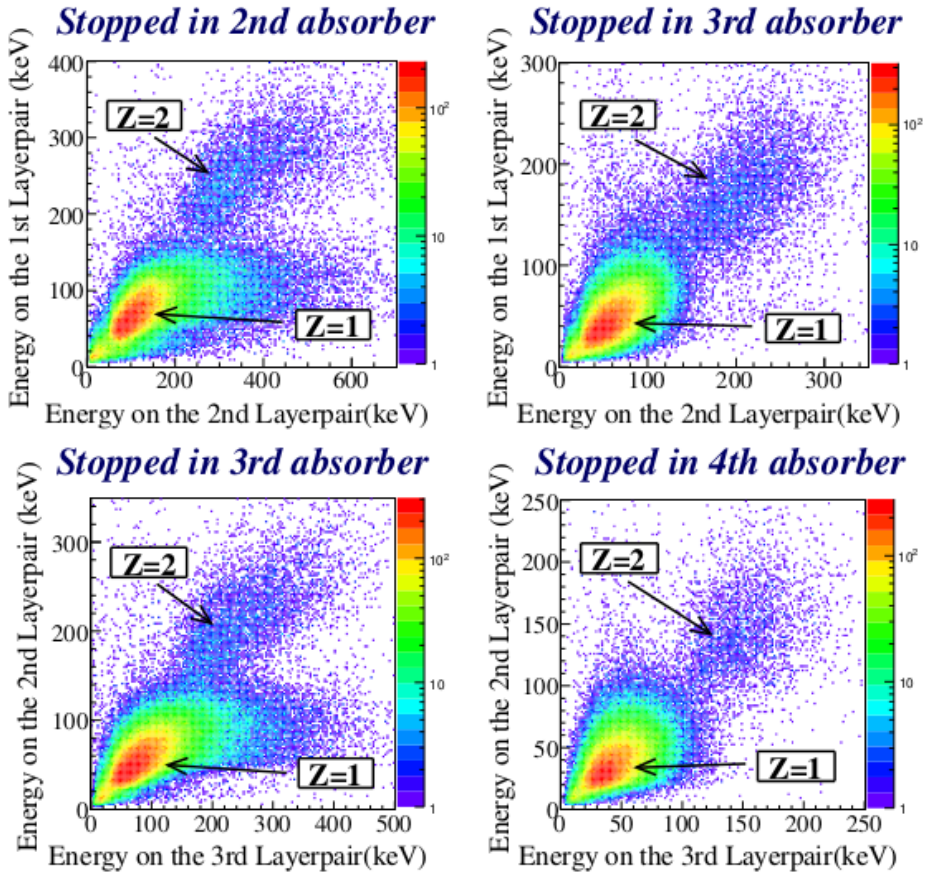
EUROPEAN SPALLATION SOURCE



NA61 highlight (2014): LMPD





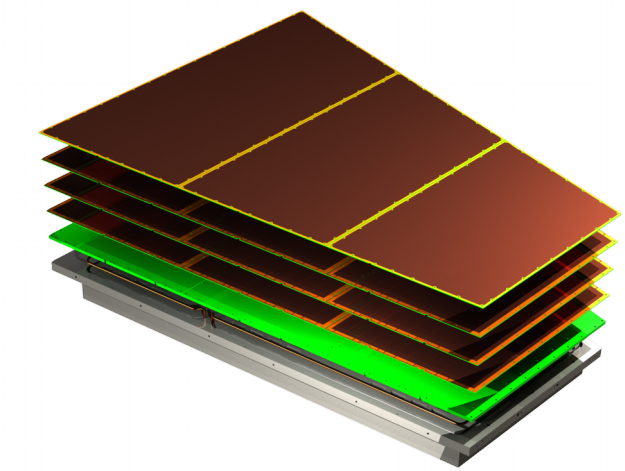


- Identified low momentum particles
  NIM A763 372 (2014)
  See many others in A. Laszlo talk!

ALICE highlight: TPC Upgrade participation

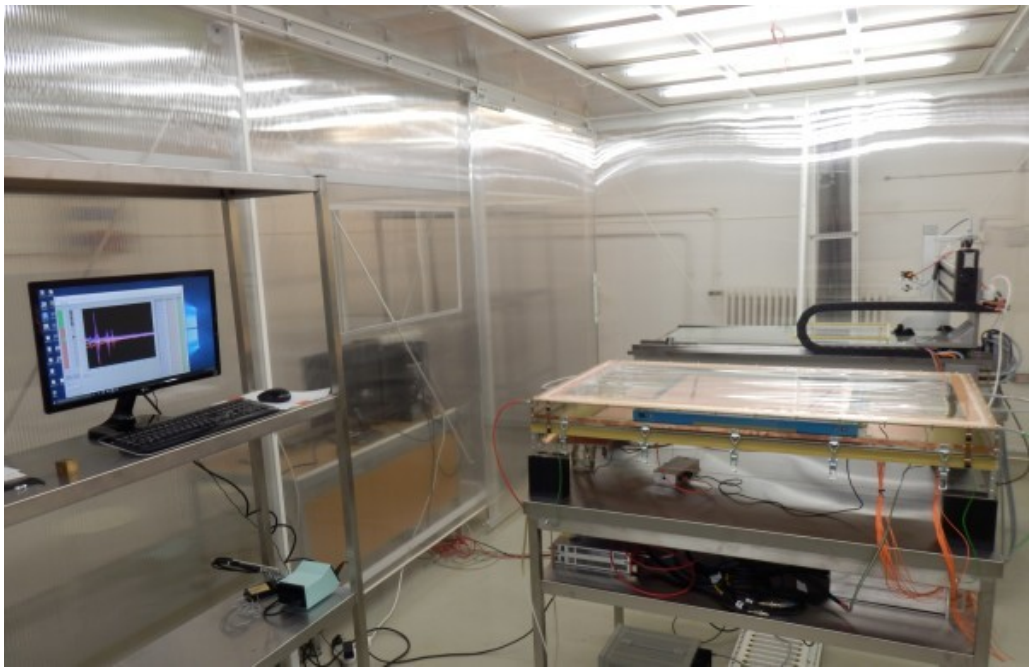
- World's largest TPC tracking system, 80 m^3 – see ALICE talk!

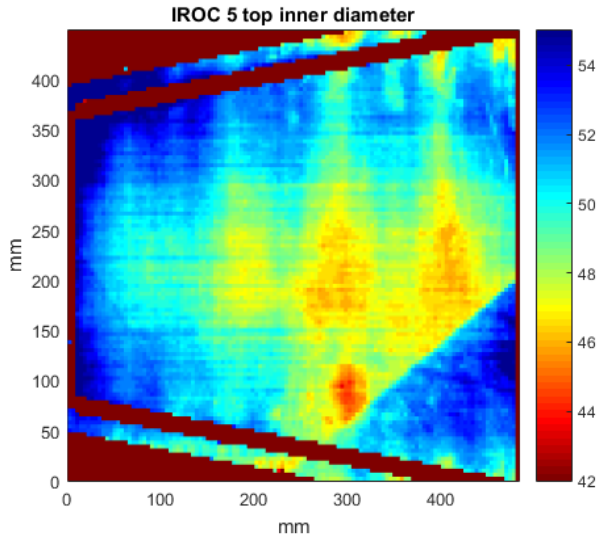
- Key construction step: individual foil testing



Micropattern Gaseous Detector laboratory upgrade needs

- “Large” clean room ($12m^2$) installed in 2016
- Quality control of **ALICE TPC Upgrade** GEM foils: over 300 foils scanned
- GEM-related R&D
- As of now (2020) transferred to CMS tracker upgrade activities

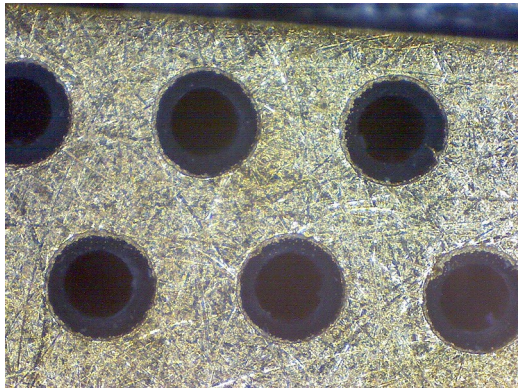


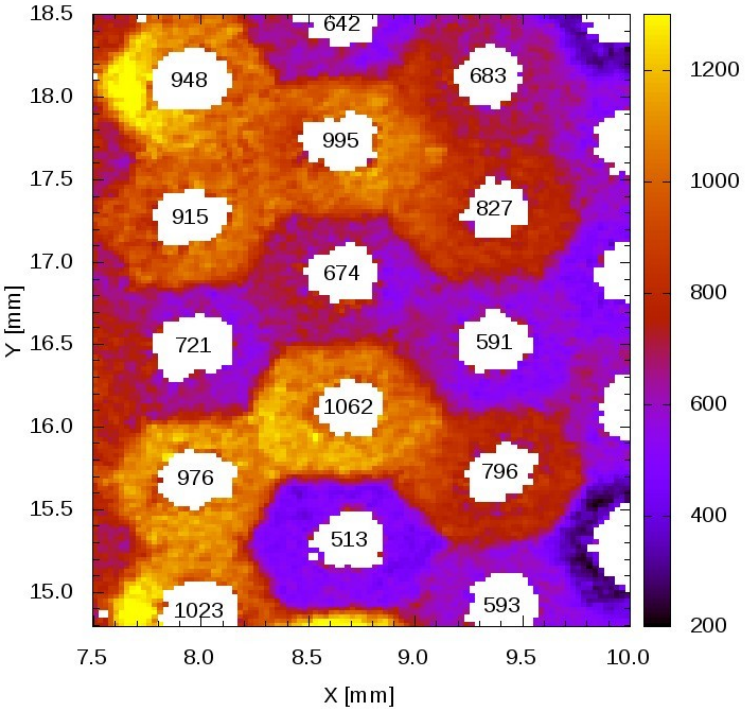


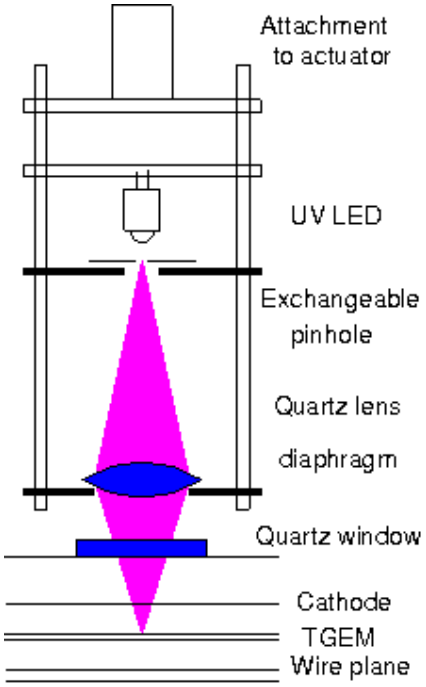
GEM foil holesize map

Detector physics highlight: Thick-GEM detectors single hole gain

- Within AIDA2020 (H2020 Research Innovation Action) subtask







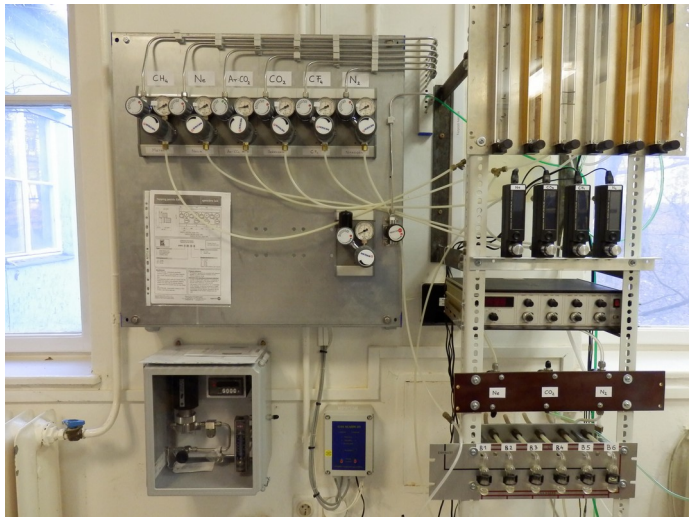
NIM A 694C, 16 (2012)

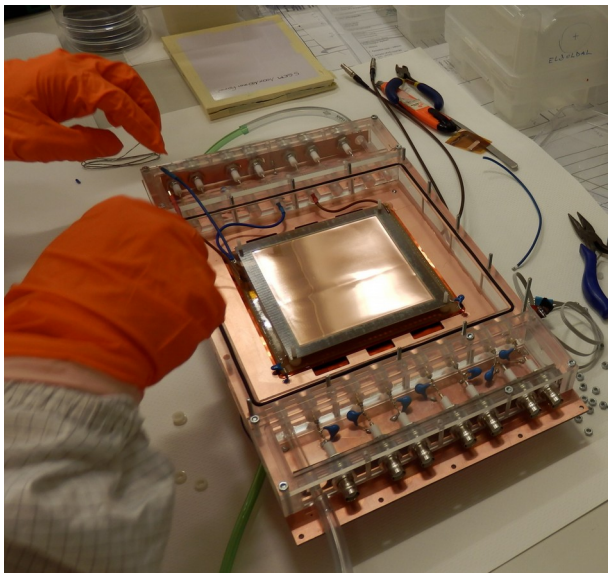
Evolution steps from local activities to national “Top Infrastructures”

- pre-2010: Strengthening national groups at different experiments, sharing similar needs, weak on infrastructure
- 2013: “Horizontal” proposal: dedicated group for gaseous **detector R&D** (“Momentum” grant of the HAS, DV)
- 2015-2019: Innovation Action **H2020 grants**, broad range of collaborations (national and international; CERN and others)
- 2017-2020: establishment of “Vesztergombi Laboratory for High Energy Physics (**VLAB**)”, rapid expansion of capabilities
- 2021: **Certificate of Recognition** by NRDI Office
- 2021-2022: funding (national and HorizonEurope) driven by **innovation and tech-transfer** secured up to 2025

Vesztergombi Laboratory for High Energy Physics

- Coordinated allocation, maintenance and improvement of the laboratory infrastructure
- Both internal and external “users”
- Lab spaces, gas systems, expertise
- Underground laboratory (10-20-30m)
- Electronics, readout, HV supplies, ...





Funding and manpower

- 2010-2019: **Innovation-driven** funds (H2020: AIDA2020, BrightnESS 300kEUR), direct funding from Wigner RCP, commercial funding (muon imaging), OTKA grants

- Recently long term funding established, focused on **technology transfer and applications** (Eötvös Research Network 180kEUR, NRDI Office 900kEUR, Horizon Europe 270kEUR) – funding is well secured up to 2025!

- **Joint infrastructure**: Fundamental science has access to the laboratories and equipments

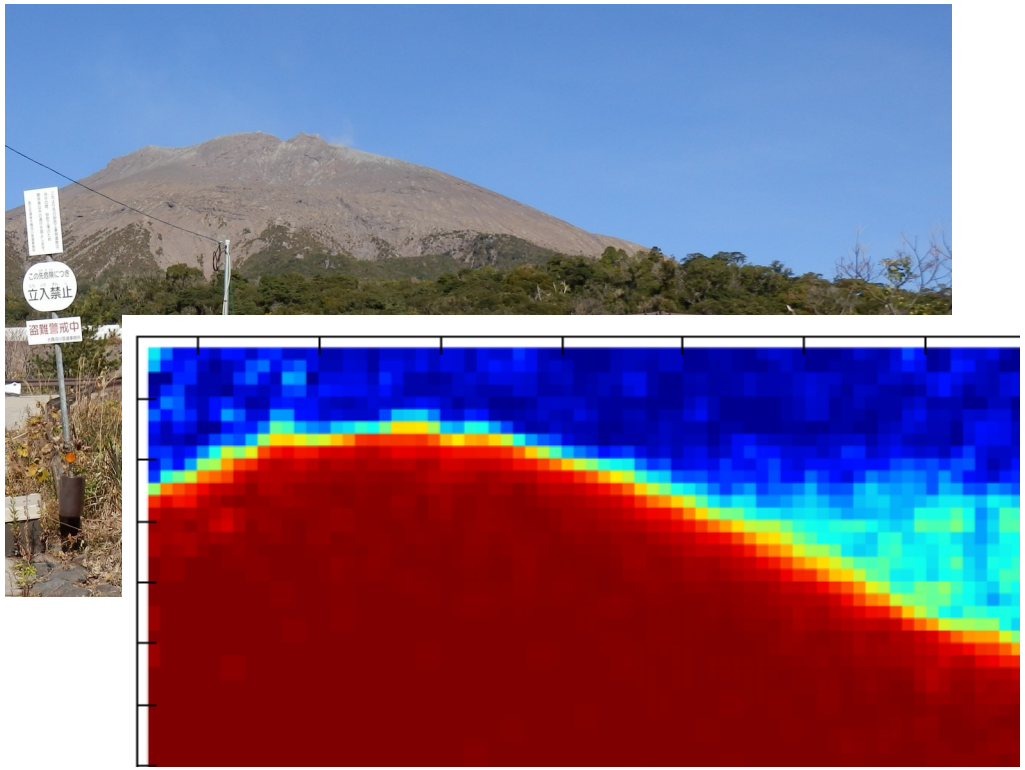
  (Note the difficulty to explain to funding agencies, how fundamental science is “useful” for society)

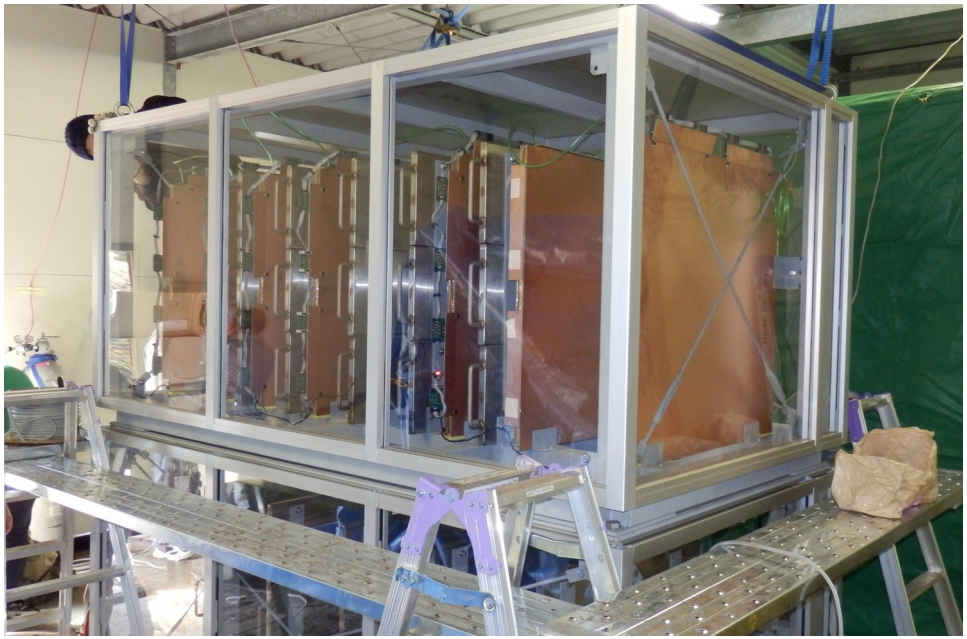
Funding and manpower

- Mostly **young personnel** (not necessarily optimal), well equilibrated including scientists (6), engineers (4), students (many) – note that HEP groups contribute to manpower based on the collaborative project
- **Extensive** (and needed!!) **collaboration** with other groups – national, CERN, external, commercial
- Healthy interaction between cutting edge science and innovation activities (patents, licensing, commercializaton...)

Application and tech-transfer highlight: Sakurajima Muography Observatory

- Currently running at Sakurajima (Kyushu), funded and managed by University of Tokyo. Joint patent (2016) licensed by NEC Corporaion
- **Now total 8 square meter**, the world's largest





Patent: H. Tanaka, K. Tarou, D. Varga, G. Hamar, L. Oláh: Muographic Observation Instrument, Japanese Ref. No.: 2016-087436, date 25/04/2016, PCT WO2017187308A1

Tracking system for underground muon imaging

From lab…

… to an operational mine

Development of Muographic Instruments: Outstanding Project financed by NRDI Fund

Conclusions and future plans

- Highly active detector development community, reasonable mid-term funding, well embedded in the Wigner RCP environment

- Broad range of collaborations: CERN experiments (ALICE, CMS, NA61, upgrades…), non-CERN HEP, applied sciences, industrial/commercial partners

- Priority I. Keep existing manpower and expertise
- Priority II. Expand collaborations (national and outside)

- Funding is fluctuating (as everywhere in HEP), usually not directly related to HEP, and not long term – however, clear national and institutional support