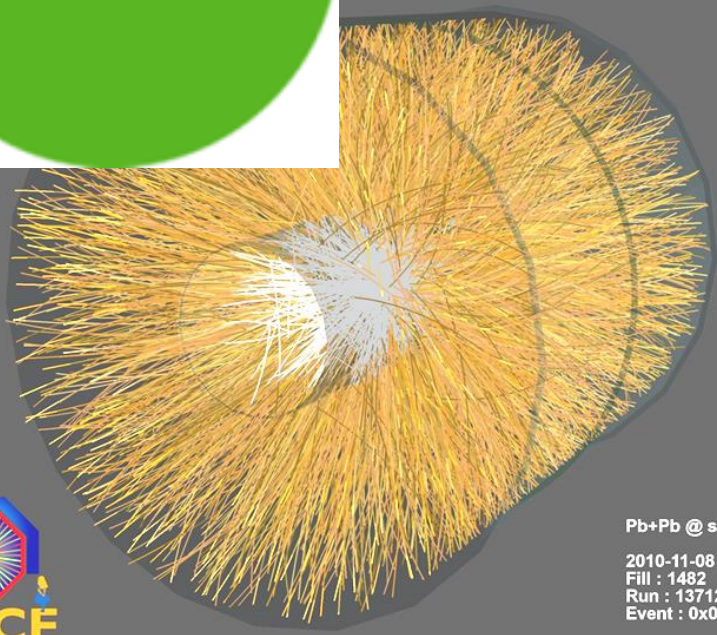


**ELKH**  
 Eötvös Loránd  
 Research Network



**MATE**



Pb+Pb @  $\sqrt{s}$  = 2.76 ATeV  
 2010-11-08 11:30:46  
 Fill : 1482  
 Run : 137124  
 Event : 0x00000000D3BBE693

KULTURÁLIS ÉS INNOVÁCIÓS  
 MINISZTERIUM



# **Introductory overview of High Energy Physics in Hungary (2013-2022)**

**Péter Lévai**

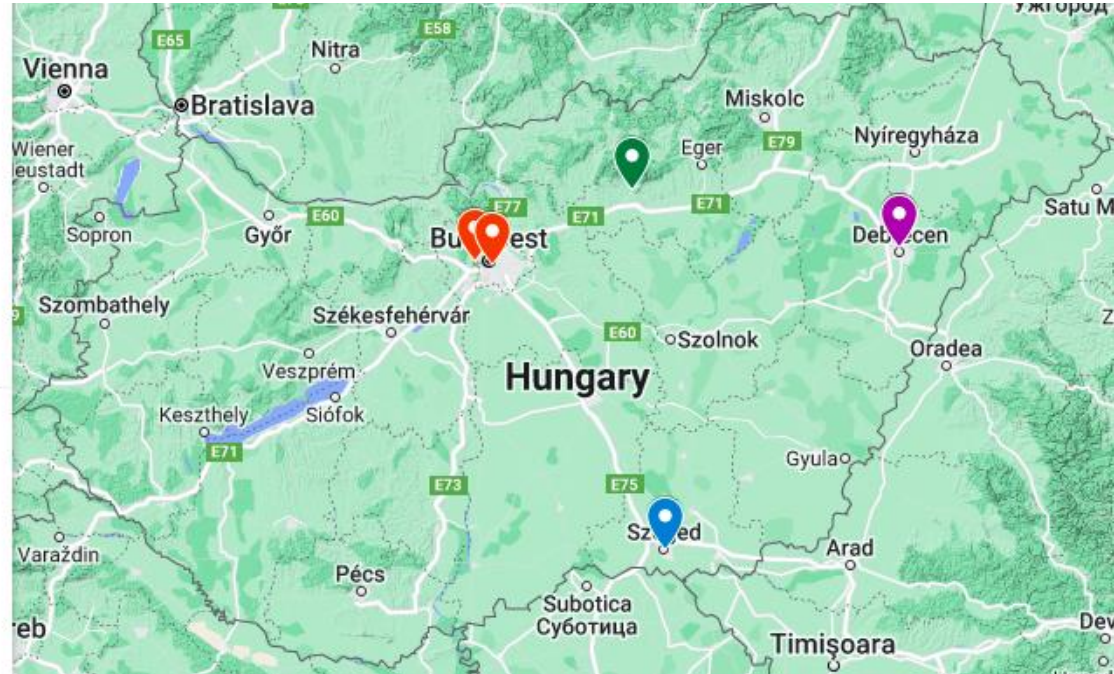
**WIGNER Research Centre for Physics  
Budapest, Hungary**

**RECFA Meeting, Budapest,  
23 September 2022**



# Location of HEP-involved Research Institutes and Universities and HR

- 📍 Wigner Fizikai Kutatóközpont
- 📍 Eötvös Loránd Tudományegyetem Természett...
- 📍 Debreceni Egyetem. Természettudományi Kar. ...
- 📍 Atomki
- 📍 MAGYAR AGRÁR- ÉS ÉLETTUDOMÁNYI EGYET...
- 📍 University of Szeged



## Human resources (2021/22):

|                    | Authors/Users  |
|--------------------|----------------|
| <b>Wigner RCP:</b> | <b>19 / 42</b> |
| <b>ELTE Univ.:</b> | <b>12 / 22</b> |
| <b>DE Univ:</b>    | <b>2 / 7</b>   |
| <b>ATOMKI:</b>     | <b>13 / 15</b> |
| <b>MATE:</b>       | <b>3 / 4</b>   |
| <b>SZTE:</b>       | <b>2 / 1</b>   |

**Total:** **51 / 91**

+ Theory (10)

+ Computing (5)

▶▶▶▶ **100-110 FTE**

**Relatively flat number  
during last 10 years**

## Human resources (2021/22):

|                    | Staff Res. + Postdoc / Staff. Eng / PhD student / Other |           |           |           |
|--------------------|---|-----------|-----------|-----------|
| <b>Wigner RCP:</b> | <b>15</b>   | <b>5</b>  | <b>4</b>  | <b>18</b> |
| <b>ELTE Univ:</b>  | <b>7</b>  | <b>0</b>  | <b>5</b>  | <b>10</b> |
| <b>ATOMKI:</b>     | <b>6</b>  | <b>4</b>  | <b>3</b>  | <b>2</b>  |
| <b>Others:</b>     | <b>5</b>  | <b>1</b>  | <b>1</b>  | <b>5</b>  |
| <b>Sum:</b>        | <b>33</b>   | <b>10</b> | <b>13</b> | <b>35</b> |

## Hungarian funding agencies and funding capacities in HEP (2013-22):

**NIH (-2014) ▶▶▶ NRDIO: National Research Development Innovation Office**  
**Minister of ITM ▶▶▶ Minister of KIM**  
**(Ministry of Innov.&Techn.) ▶▶▶ (Ministry of Cult.&Innov.)**

**-- CERN Membership fee**

**[2013: 6,2 MCHF → 1,7 Mrd HUF ▶▶▶ 2022: 8,6 MCHF → 3,1 Mrd HUF] (2023: 3,5 Mrd HUF)**

**-- M&O A (ALICE, CMS) 120 kCHF/y CMS + 60 kCHF/y ALICE → 70 M HUF/y**

**-- HiLU-LHC (CMS) (ALICE ?)**

**1 M CHF (CMS) during 10 years (2020-2029): 100 kCHF/y → 40 M HUF/y**

**-- Research supports and Special grants (OTKA, NEMZ-KI, ...) ≈ 150 kCHF/y → 60 M HUF/y**

**MTA (-2019) ▶▶▶ ELKH: Eötvös Loránd Research Network**

**Minister of ITM ▶▶▶ Minister of KIM**

**-- Support – HR: Wigner FK (≈1 MCHF/y) and ATOMKI (≈ 0,25 MCHF/y) → 500 M HUF/y**

**-- Support – Infrastructure: Wigner FK (≈1 MCHF in 2021/22)**

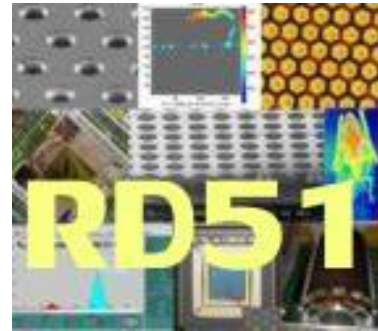
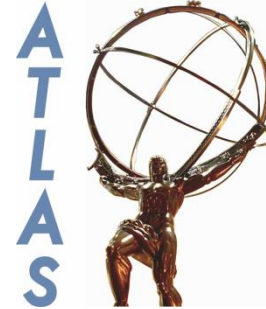
**Universities (2021: State Univ. ▶▶▶ Private Univ.)**

**-- Support – HR: ≈ 0,5 MCHF/y → 300 M HUF/y**

**Summary 2022: Membership fees 9 MCHF/y + Res. Grants 0.25 MCHF/y + Res. HR 1.75 MCHF/y**

**(2013: Membership fees 6,2 MCHF/y + Grants&HR 1.3 MCHF) → Memb. Fee + 20 %**

# Hungarian flagship projects at CERN (2013-2022):



## Special collaborations:

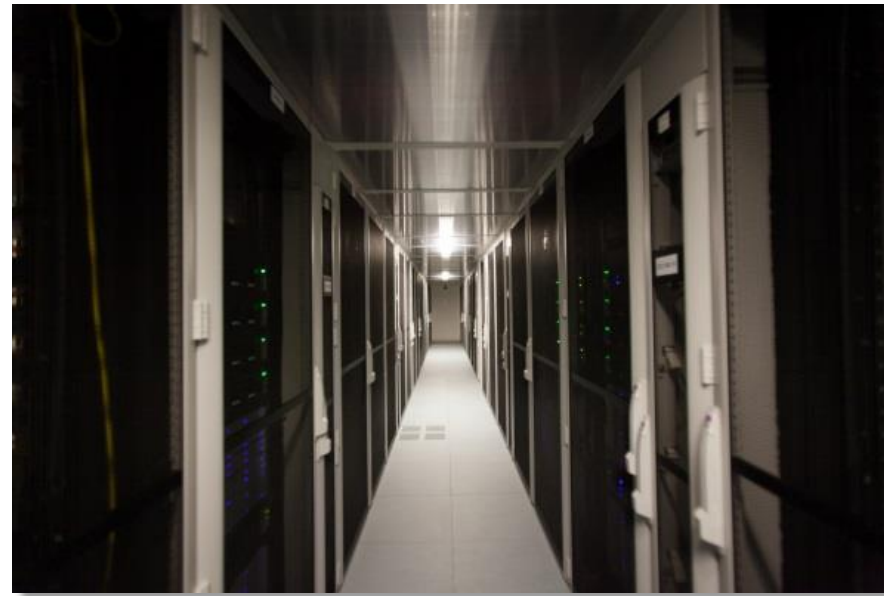
- HEPTECH (Tech Transfer)
- SPOTTING (Big Data)
- Hadron therapy R&D
- **QTI (Quantum Technology)**



# Flagship projects in Hungary - 1:

**WIGNER Datacenter: hosting CERN TIER-0 [2013/01/01 – 2020/03/31]**

**Peak: 80 000 CPU-core, 90 PB HD, 1300 km 2 x 100 Gbit/s**



**High reliability data transfer, data handling, data mining**

**Mission: Knowledge center, know-how transfer**

**Big Data Day, GPU - Multicore Workshop, (2011-)**

**HEPTECH AIME ICT (2015, 2018-2022) AI/ML/QT R&D**

**Wigner Cloud (1000+ core), MTA Cloud (1000+ core)**

**+ GPUminisuper comp. + 2 PB HD → → WSCLab (ALICE AF, GPU, FPGA, QT)**

**→ → Talk of BiróG**

# Flagship projects in Hungary - 2:

## 2020 European Strategy for Particle Physics (Update)

- **Detector R&D Roadmap (VargaD, VeszprémiV, BarnaföldiG, ...)**

**HU Implementation: Vesztergombi HEP Laboratory (VLAB – TOP50)**

**Gaseous-detector R&D Laboratory**

**Silicon-detector R&D Laboratory**

**Janossy Underground R&D Laboratory**

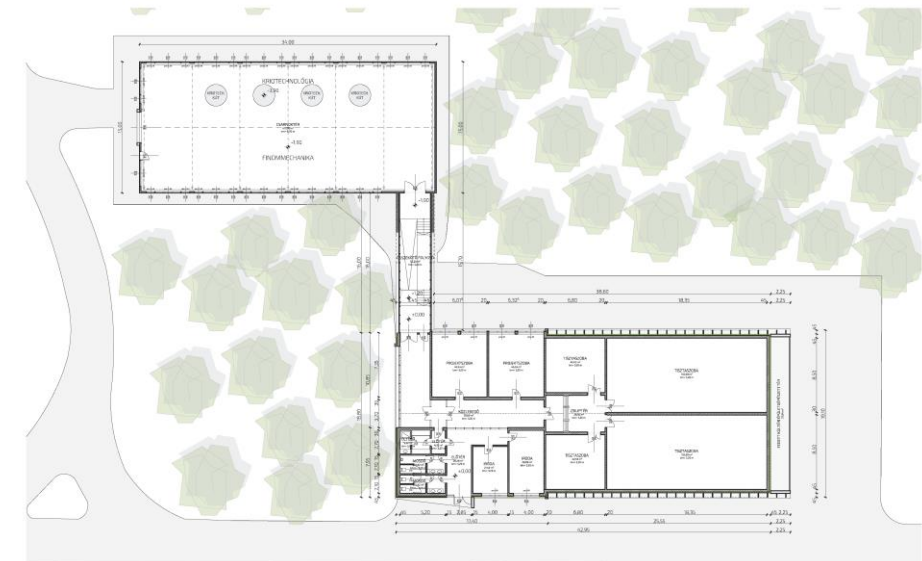
- **Accelerator R&D Roadmap (BarnaD)**

**Accelerator Construction & Test Laboratory**

**Modernization Plan at Wigner RCP: Build. 2 Reconstr. & Technology Hall [Crio R&D]**



WIGNER FIZIKAI KUTATÓKÖZPONT 7/1 A JÓVŐ TECHNOLÓGIÁI KOMPLEXUM LÁTVÁNYTÉRY





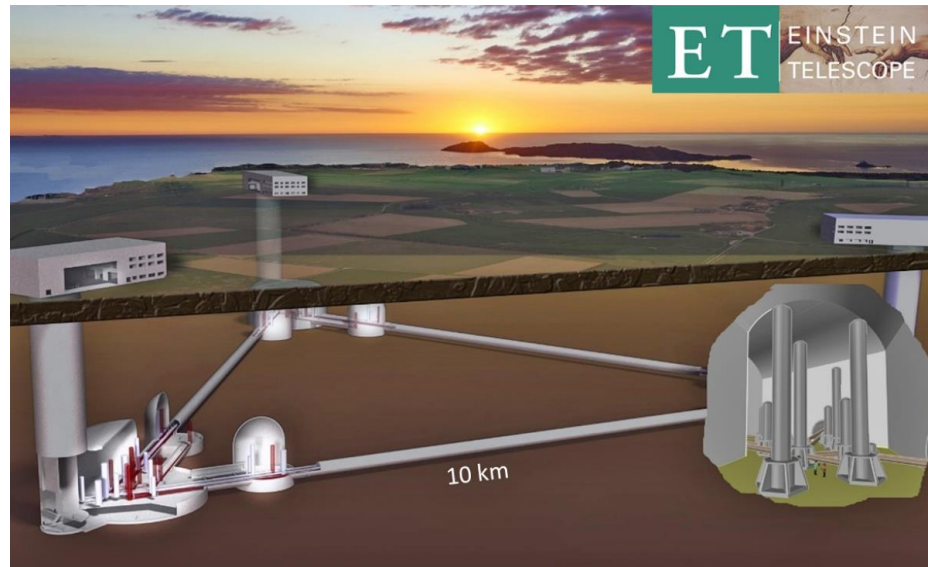
# Flagship projects in Hungary - 3: the nature of gravitation

CERN-ET  
Agreement - 2021

Gravitation waves – LIGO/VIRGO Collab (2005-) – ET (2021 -)



EGO VIRGO: Cascina (Pisa, Italy)



ET project: ESFRI List, INFRADEV ET-PP

**LIGO/VIRGO Collaboration (2007):**  
integrated common data analysis  
**GW-150914: 50 Million CPU-hour**  
**ELTE-ATOMKI-Szeged and WIGNER RCP partic.**

**Contribution from Wigner RCP:**

- Theoretical studies
- Data analysis
- **IT: VIRGO Cluster in the Wigner Cloud**
- **MATRA Gravitation and Seismology Laboratory, Gyöngyösoroszi**  
(Test period started: 25 Febr. 2016)



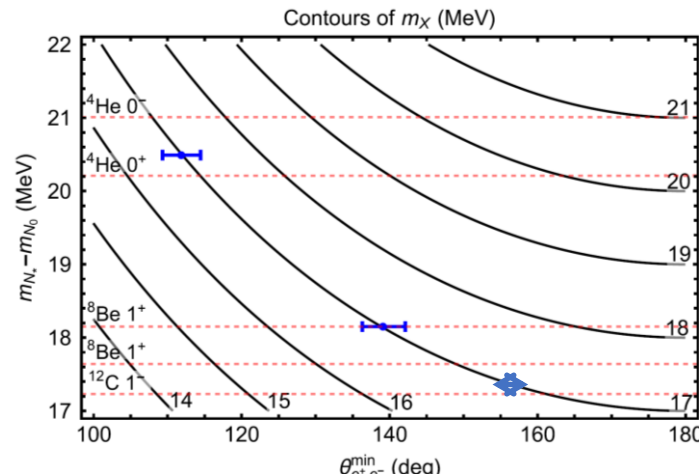
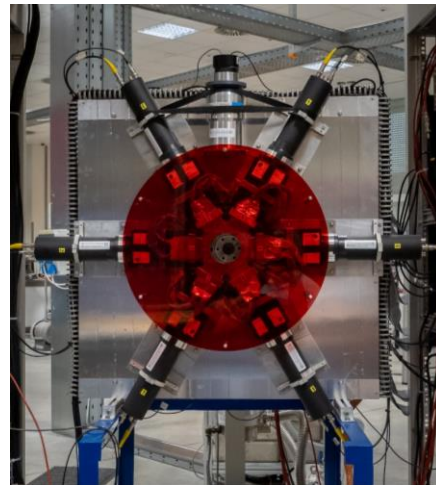
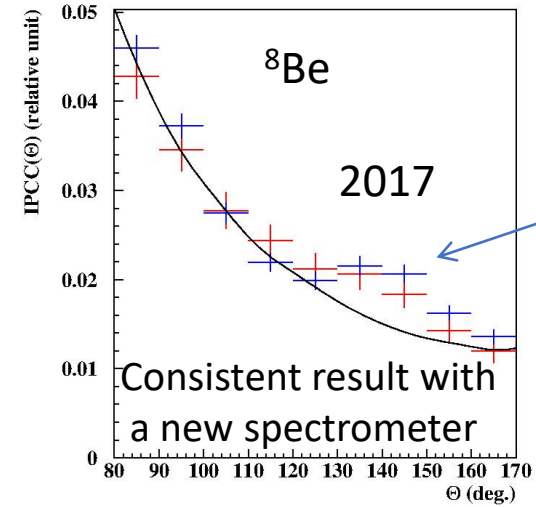
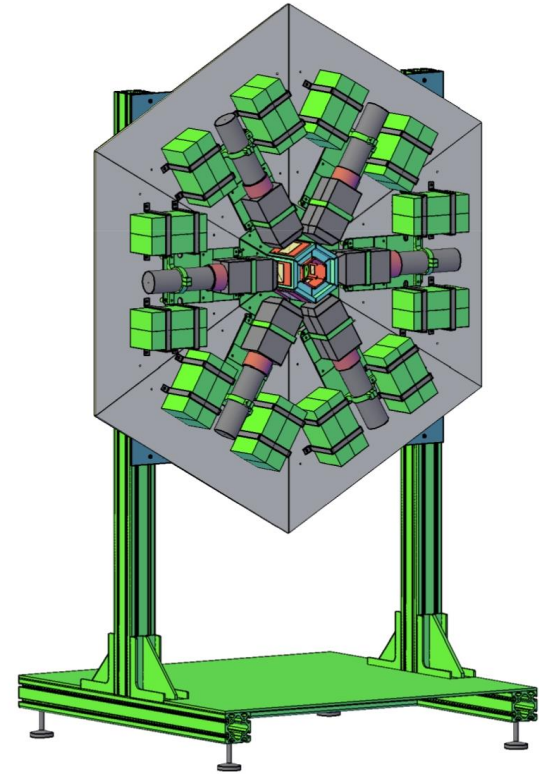
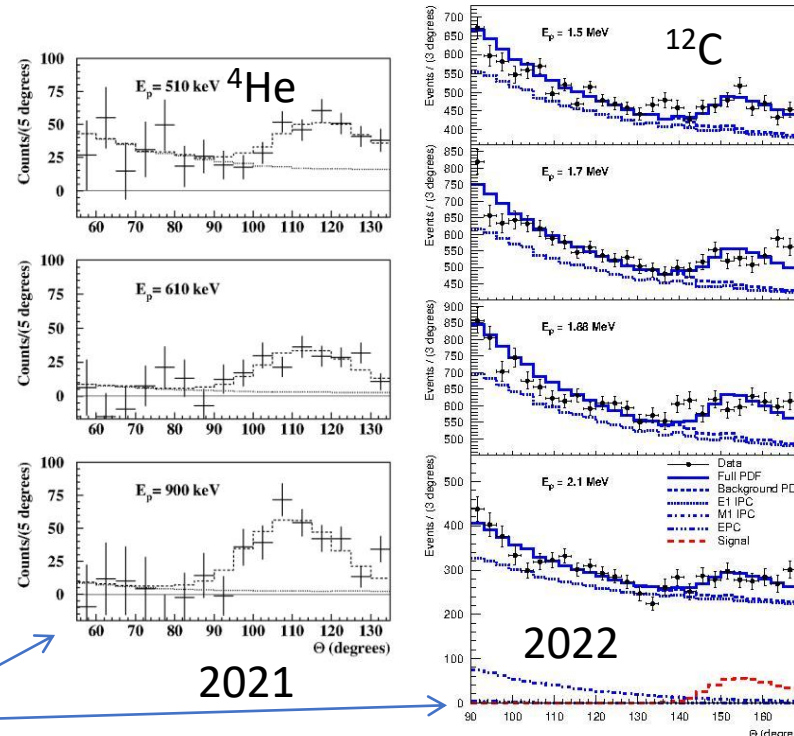
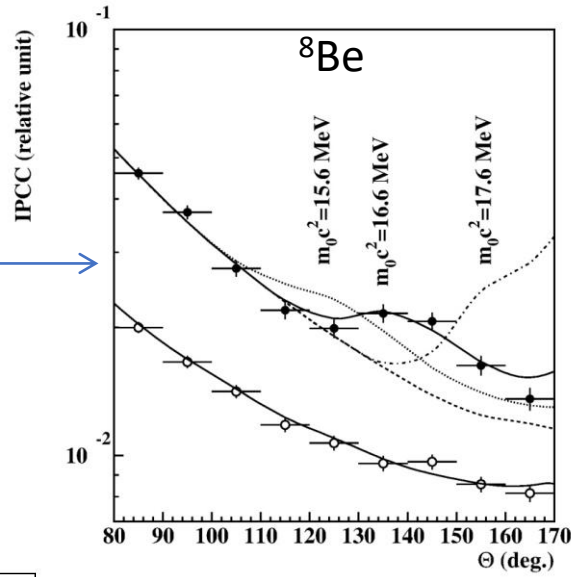
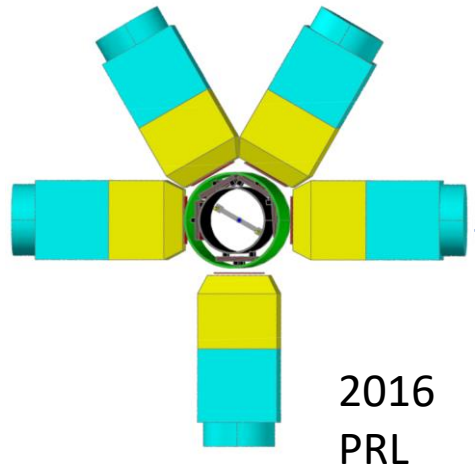


# Synergy between HEP and low-energy NP: search for dark matter at ATOMKI

## A New Particle is Being Born in ATOMKI that Could Make a Connection to Dark Matter

Vol. 32, No. 3, 2022, *Nuclear Physics News*

ATTILA J. KRASZNAHORKAY, ATTILA KRASZNAHORKAY, MARGIT CSATLÓS, LÓRÁNT CSIGÉ AND LŐRINC TÍMÁR



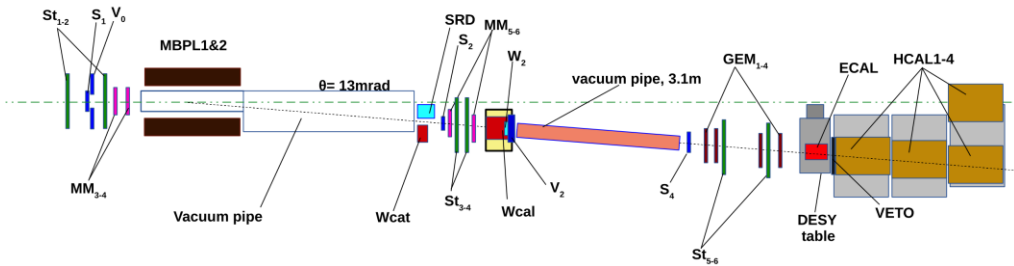
The newest version of the spectrometer

- Kinematical evidence for the X17 particle
- Vector character of X17 is supported

# Particle and nuclear physics experiments searching for the X17 particle

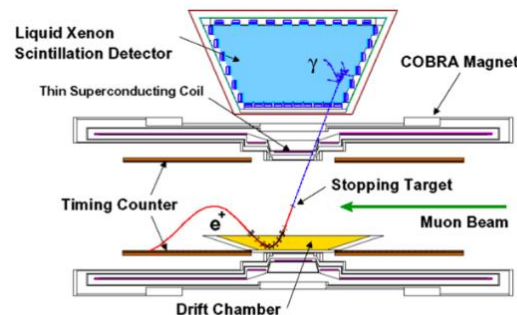
The  $^8\text{Be}$  excess and search for the  $X \rightarrow e^+e^-$  decay of a new light boson with NA64 (CERN)

S.V. Donskov, S.N. Gninenko, M.M. Kirsanov, D.V. Kirpichnikov

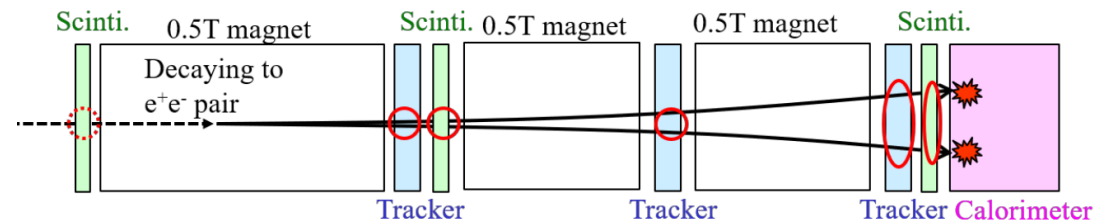


Phys. Rev. Lett. **125**, 081801 (2020)

Search for the X(17) particle in the  $^7\text{Li}(p, e^+e^-)^8\text{Be}$  reaction with the MEG II detector (PSI, Willigen, Switzerland)



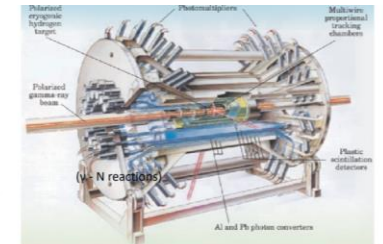
## Forward Search Experiment (FASER)



CERN's newest experiment, is now running in the LHC tunnel. FASER is designed to study the interactions of light and weakly interacting particles.

## The Montreal X-17 Project

- Use parts of the DAPHNE experiment (Saclay/Mainz\*)
- Tracking MWPC chamber & 16 scintillators (NE102A)
- Scints & MWPC from U. Mainz → now @ Montreal
- Phototubes and some ADC/TDC's borrowed from TRIUMF



Large solid angle coverage →  $0.95 \times 4\pi$

\*Many thanks to L. Doria & U. Mainz!

**We are looking forward  
for scientific collaboration  
with our partners at CERN !**

**Exploring new opportunities  
of European and international  
S&T collaboration**