Az X17 részecskére vonatkozó legutóbbi kísérleti eredmények

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XVII. (17.) Magyar Magfizikus Találkozó

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Observation of Anomalous Internal Pair Creation in ^{8}Be: A Possible Indication of a Light, Neutral Boson

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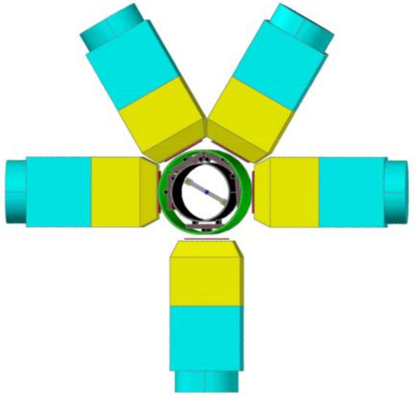
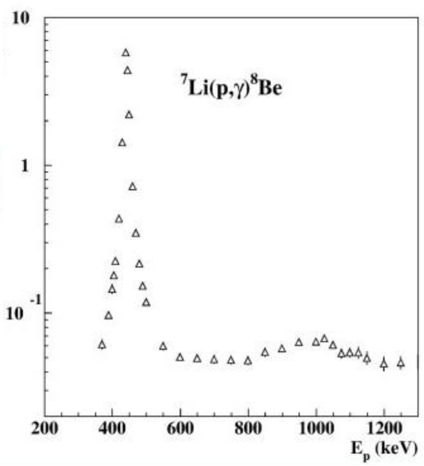
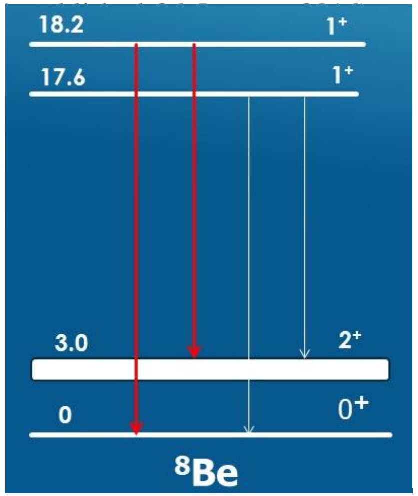
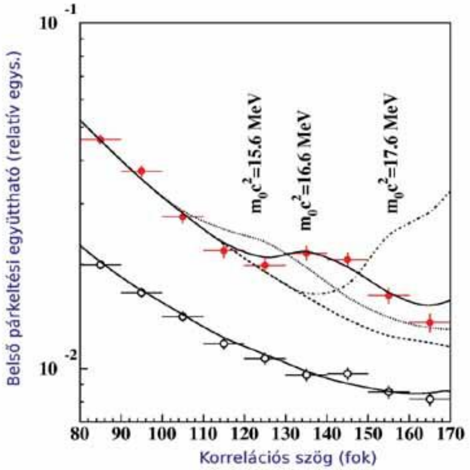
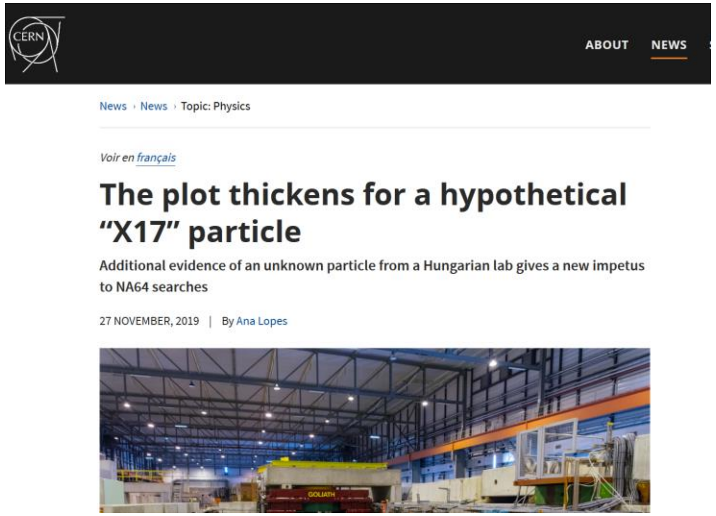






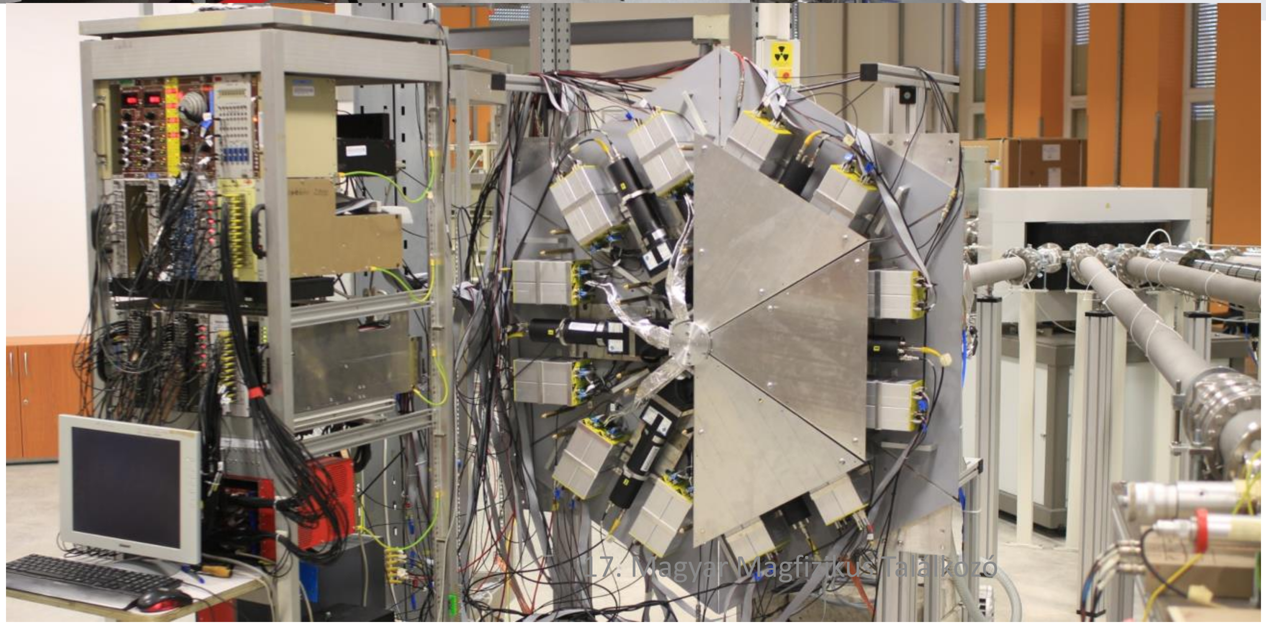




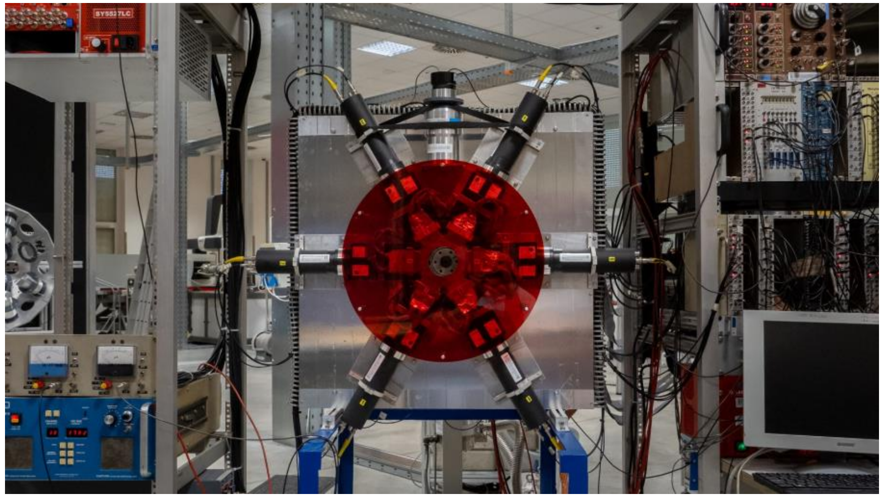
The ATOMKI anomaly → signals for a new 17 MeV boson → gauge boson of a new fundamental force of nature

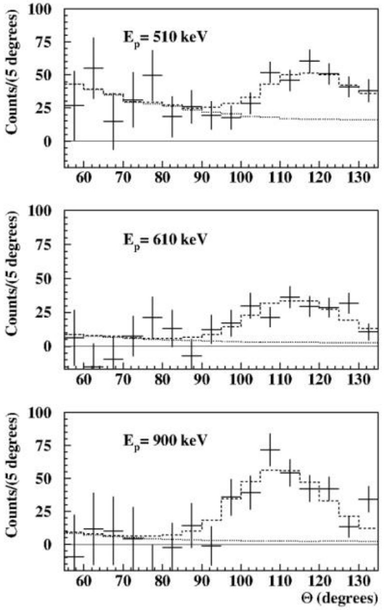
Article in Nature, CNN news, boom in the media

The newly built tandetron lab. in ATOMKI and the newest version of the e^+e^- spectrometer

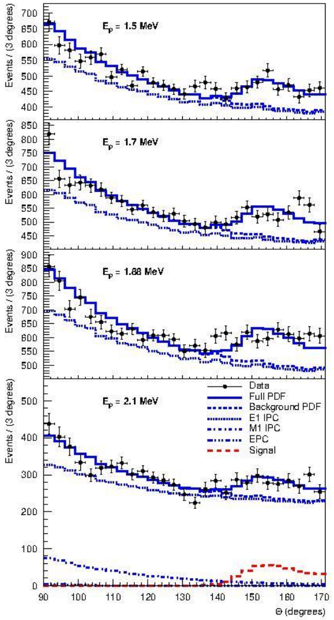


Our recent experimental results

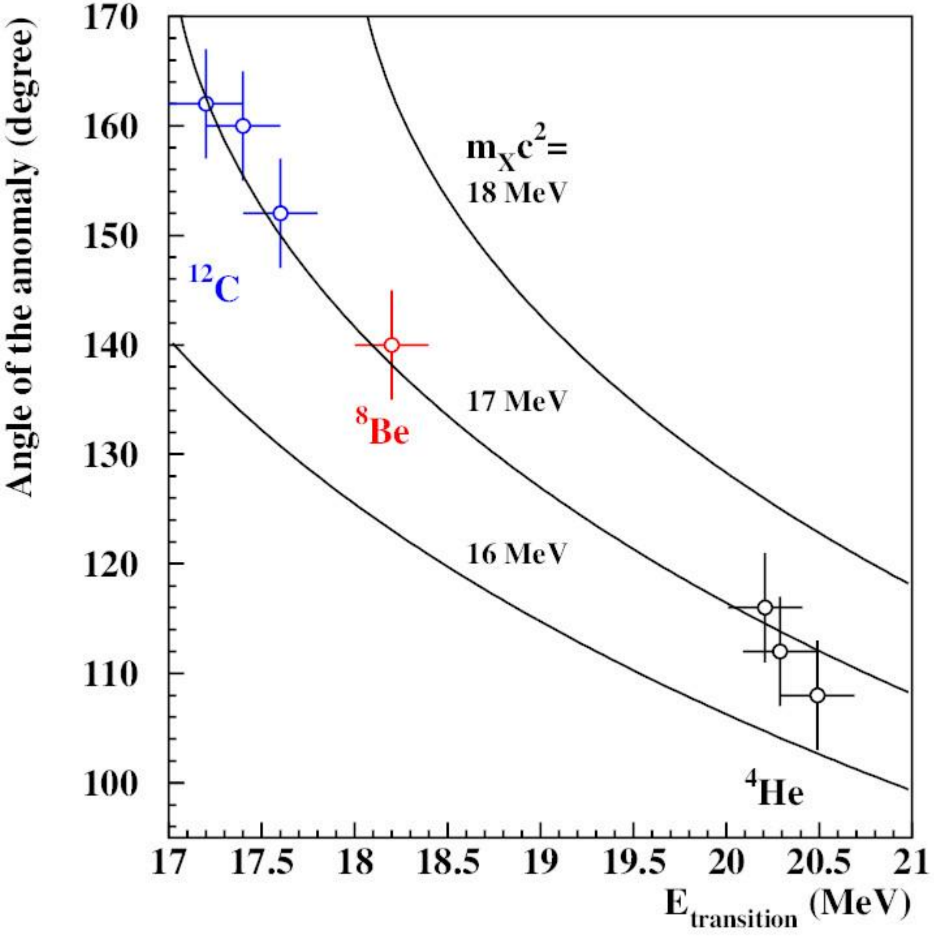




^{4}He PRC 2021



^{12}C PRC 2022



Nucl. Phys. News.

Frontiers of Fundamental Physics (FFP16), Conf. Proc. 2024

Kinematical evidence for the X17 particle

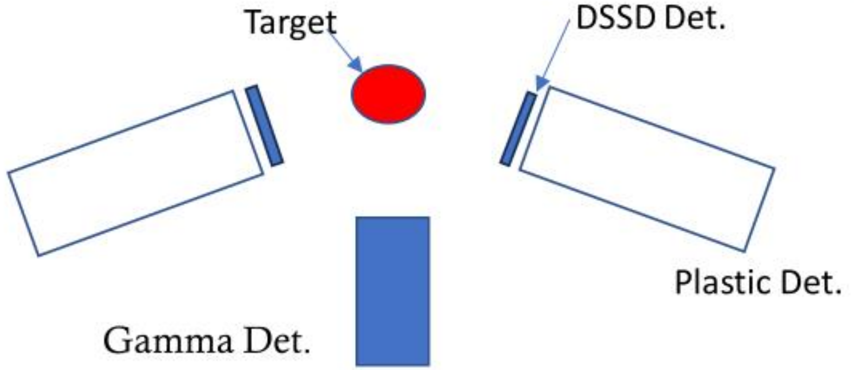
Az X17 részecske kutatása különböző laborokban

1. HUS, Hanoi, Vietnam
2. JINR, Dubna, Russia
3. BES III, Beijing, China
4. MEG II, PSI, Willigen, Switzerland
5. PADME, Rome, Italy
6. New JEDI projekt , GANIL, France
7. INFN, Legnaro, Italy
8. DAFNE, Montral, Canada
9. CTU, Prague, Czechia
10. nTOF, CERN, Switzerland
11. NA64, CERN, Switzerland
12. NA62, CERN, Switzerland
13. BES-III, Beijing, China
14. FASER, CERN, Switzerland
15. SUPER-X, ANU, Canberra, Australia
16. DARKLIGHT, GLAB, USA
17. PRad, GLAB, USA
18. REDTOP, USA, Purdue, USA
19. Belle-II, SuperKEKB, Japan
20. NA48, CERN, Switzerland
21. MAGIX, Dark MESA, Mainz, Germany
22. VEPP-3, Vladivostok, Russia

Experiment Setup

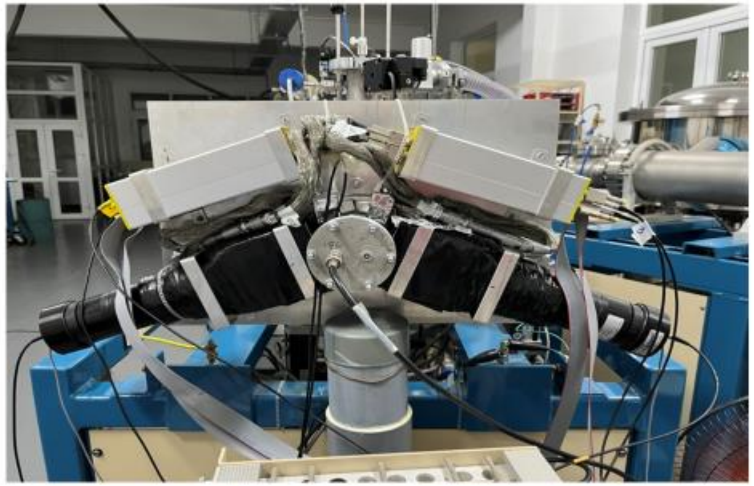
We used p-beam with different energies to bombard the Li-target to populate 18.15 and 17.6 MeV ^{8}Be excited states with resonant proton capture.

^{7}Li(p,e e)^{8}Be



Why did we arrange the Det-system like this?

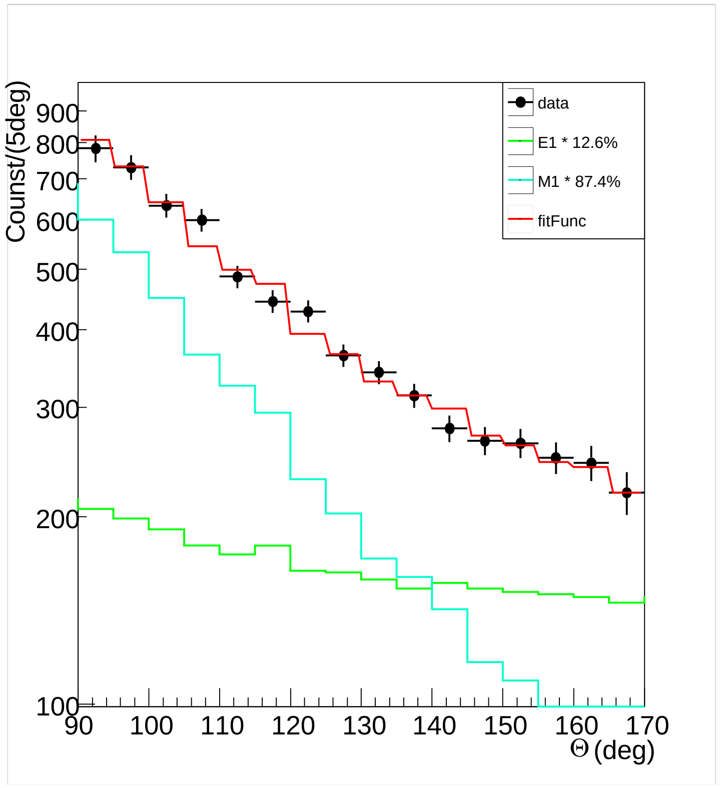
Detector setup to measure the energies and the angle between the $e^{+}e^{-}$ particles.

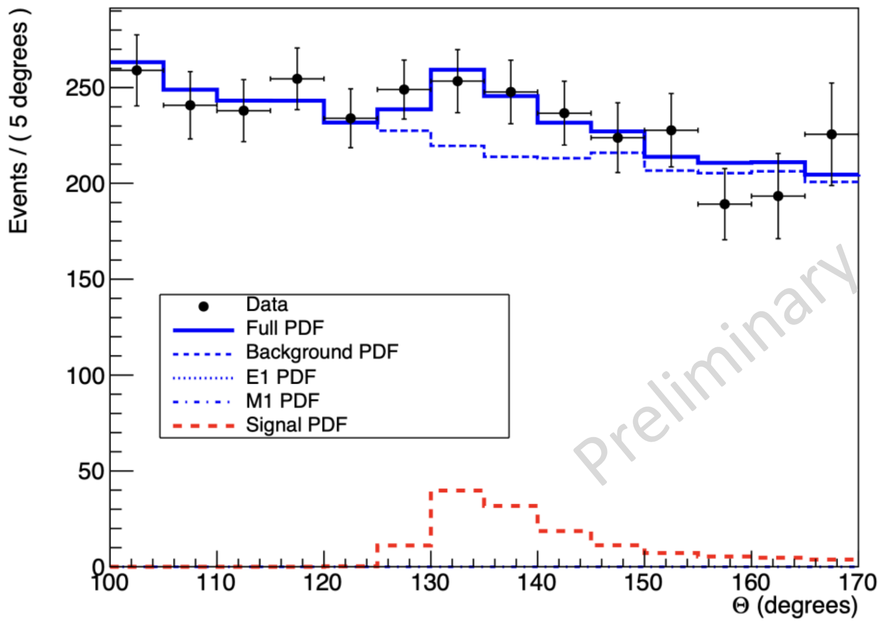


Picture in lab of the detector system and the DAQ connected to Pelletron

Tran The Anh et al., Universe 2024, 10(4) 168.

Aceptance corrected angular correlations





E_p=441 keV
No anomaly

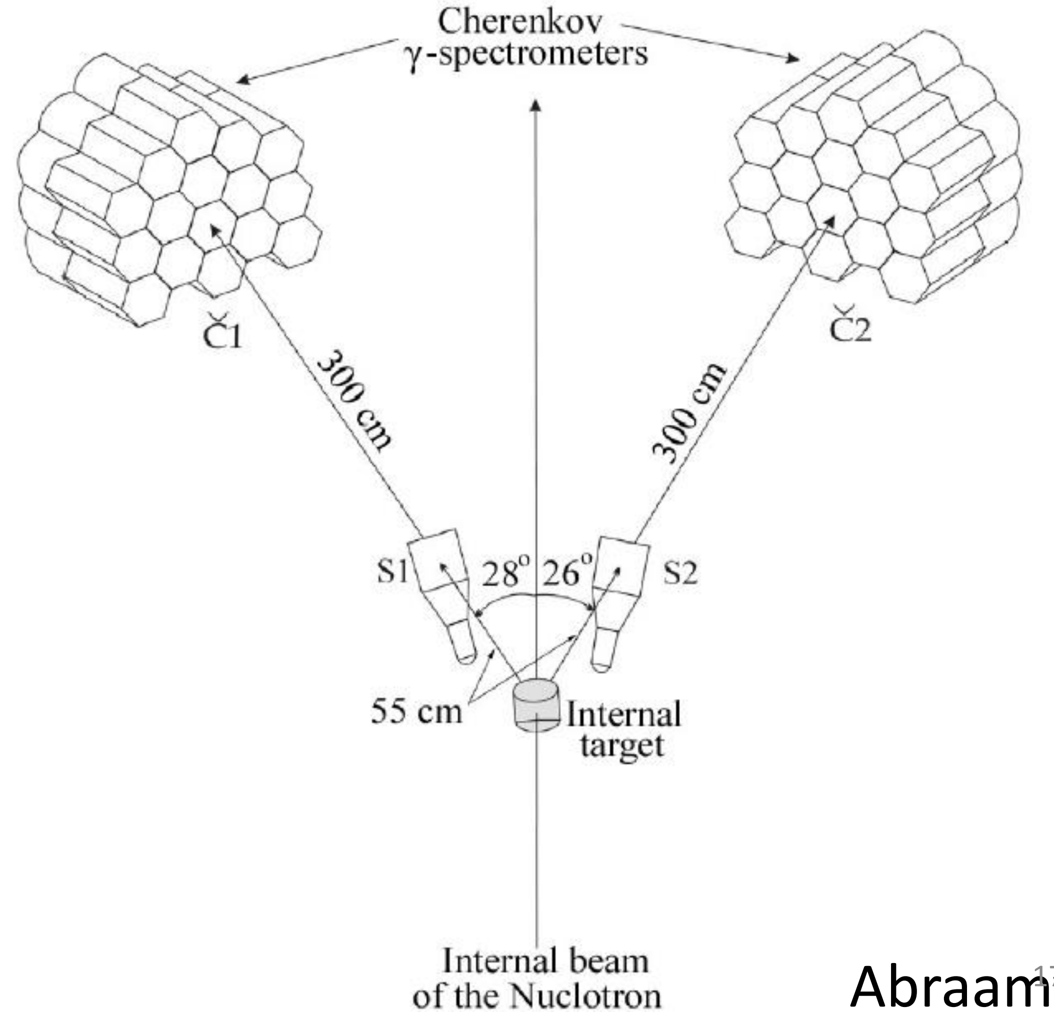
E_p=1.04 MeV. Background: M1+E1
The anomaly appears at angle around 140° (*)

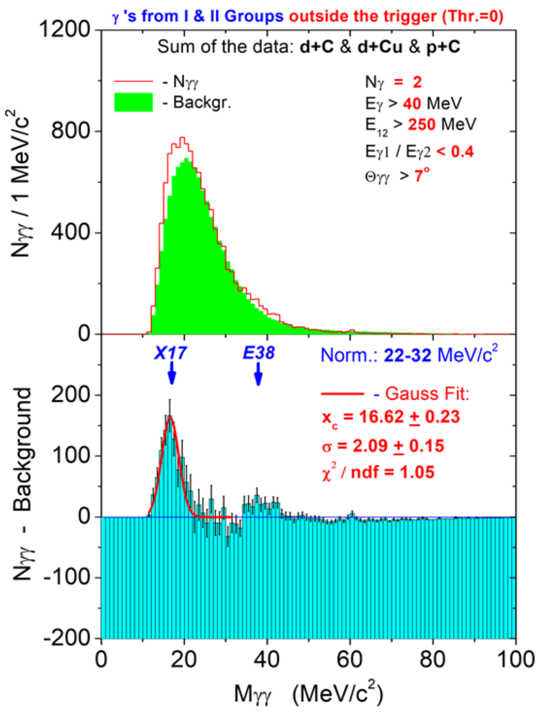
m_{boson}=16.7 ± 0.47 (MeV)
Significance: 4-5σ

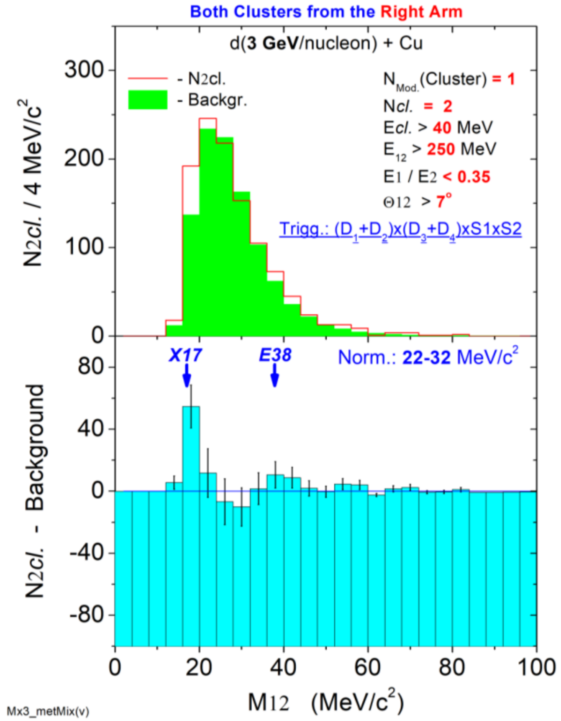
Joint Institute for Nuclear Research

SCIENCE BRINGS NATIONS TOGETHER

Confirmation of the X17 particle in the Dubna experiment





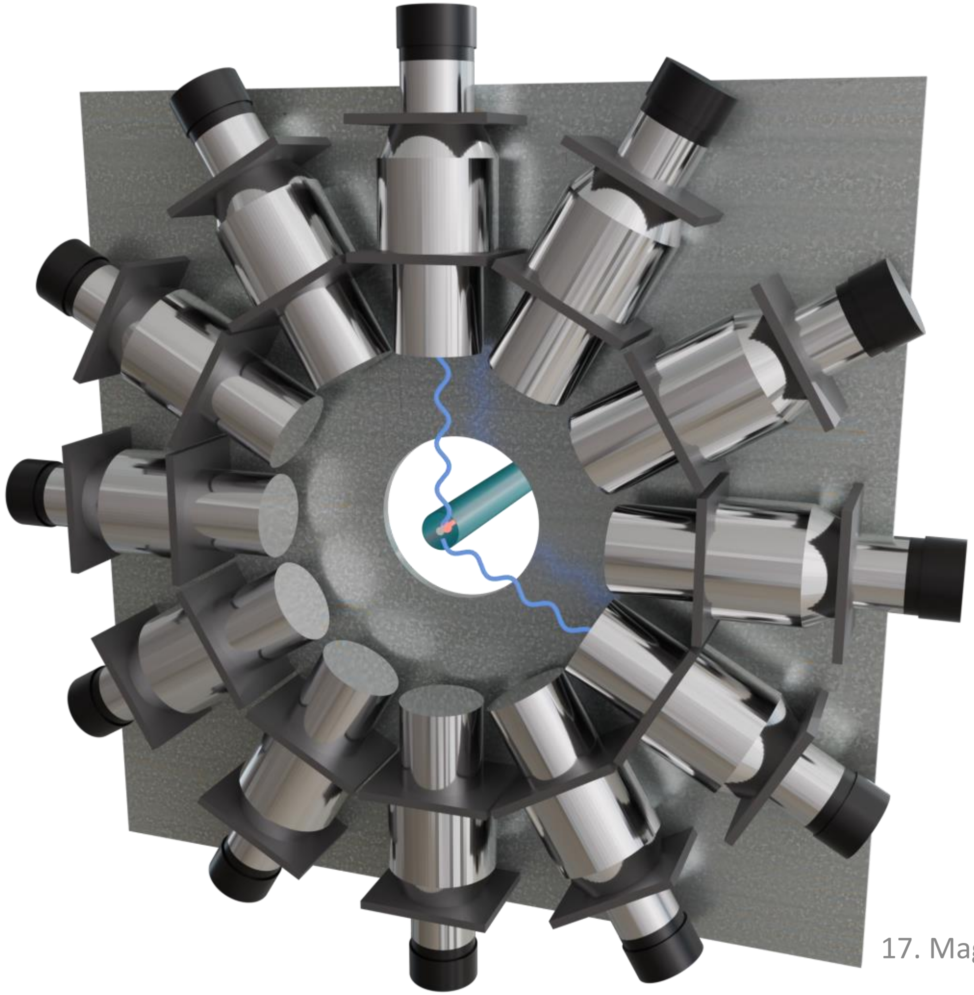


Confirms our results on the $\gamma\gamma^-$ -decay of X17

Confirms our results on the e^+e^- -decay of X17

Abraamyan et al., Phys. Part. and Nuclei, 2024, **55**, 4.

New experiments in HUN-REN ATOMKI
Study the γγ-decay of the X17 particle



The Dubna results for 2γ decay …
X17 is a QED meson ???
Cheuk-Yin Wong, MDPI, Universe, 2024, 10, 173

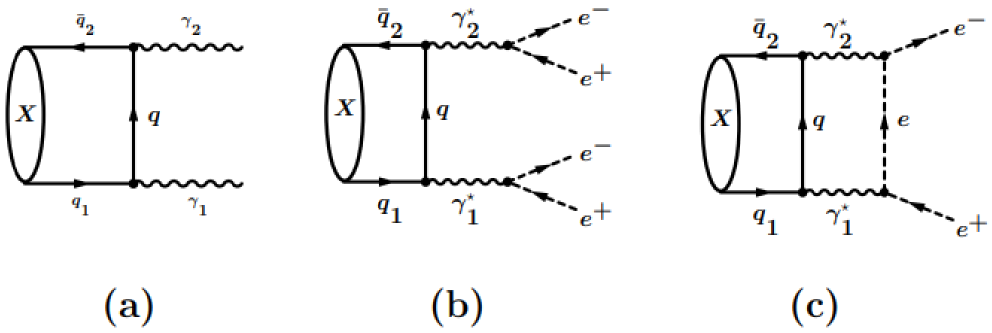


Figure 2. (**a**) A QED meson X can decay into two real photons $X \to \gamma_1 + \gamma_2$. (**b**) It can decay into two virtual photons, each of which subsequently decays into a (e^+e^-) pair, $X \to \gamma_1^* + \gamma_2^* \to (e^+e^-) + (e^+e^-)$, and (**c**) it can decay into a single (e^+e^-) pair, $X \to \gamma_1^* + \gamma_2^* \to e^+e^-$.

Az X17 első részecskefizikai megerősítése

JHEP
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PUBLISHED: *July 16, 2024*

Study of $\eta' \to \pi^+\pi^- l^+ l^-$ decays at BESIII

BESIII
The BESIII collaboration

Beijing, China

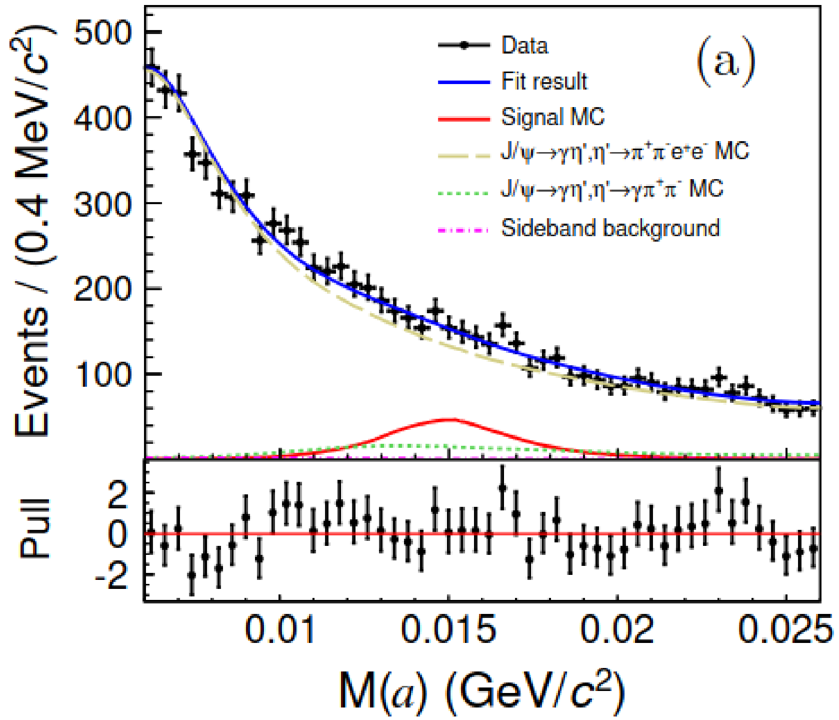
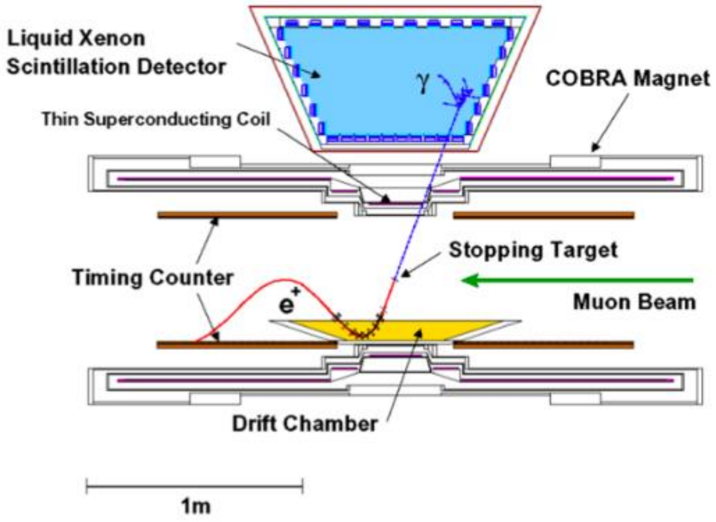


Figure 9. (a) Fit to the invariant mass distribution of M(a) when the mass of a is 15 MeV$/c^2$. The dots with error bars represent data, and the blue solid line is the total fit result. The red dashed histogram represents the arbitrary normalized MC signal shape, which is scaled by a factor of 10. The golden dashed histogram is the $J/\psi \to \gamma\eta', \eta' \to \pi^+\pi^- e^+ e^-$ MC shape. The green dashed histogram is the $J/\psi \to \gamma\eta', \eta' \to \gamma\pi^+\pi^-$ MC shape, and the pink dotted histogram is the background obtained from

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



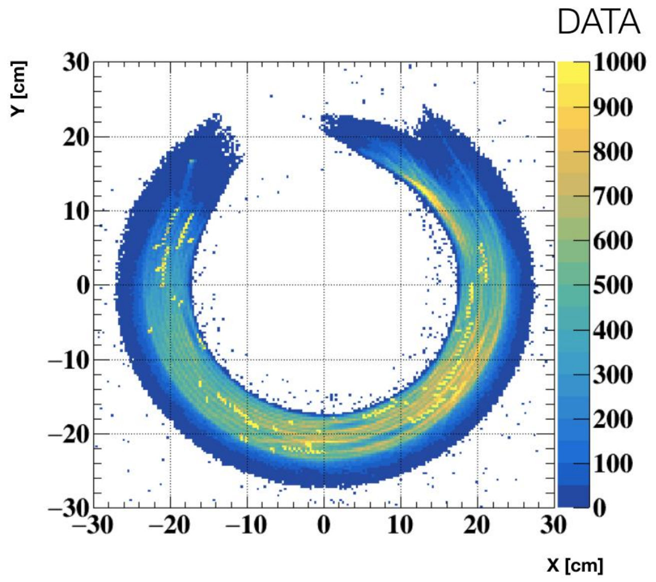
Collected data sample

- **Pivotal** run **2022**: Proton beam tuning, Mechanical/integration test of the new parts, LiF and LiPON target test, Different trigger settings, Optimised Data Taking and Reconstruction Algorithms

- **Physics** run **2023**: 4 weeks producing mainly the 17.6 MeV gamma-line
  - Proton energy at 1080 keV
  - Beam composition: H+ (~75%) and H2+(~25%)
  - Thick LiPON (~7 um)
  - Both 440 keV and 1030 keV excited simultaneously

- Statistics:
  - ~75 M Events
  - ~**300 K** Events Reconstructed pairs

- On full range of the Esum and Angular Opening angle observables:
  - ~60% EPC (14.6 + 17.6 MeV)
    - Dominant at low angle, negligible in the signal region
  - ~40% IPC (14.6 + 17.6 MeV)
    - Dominant in the signal region



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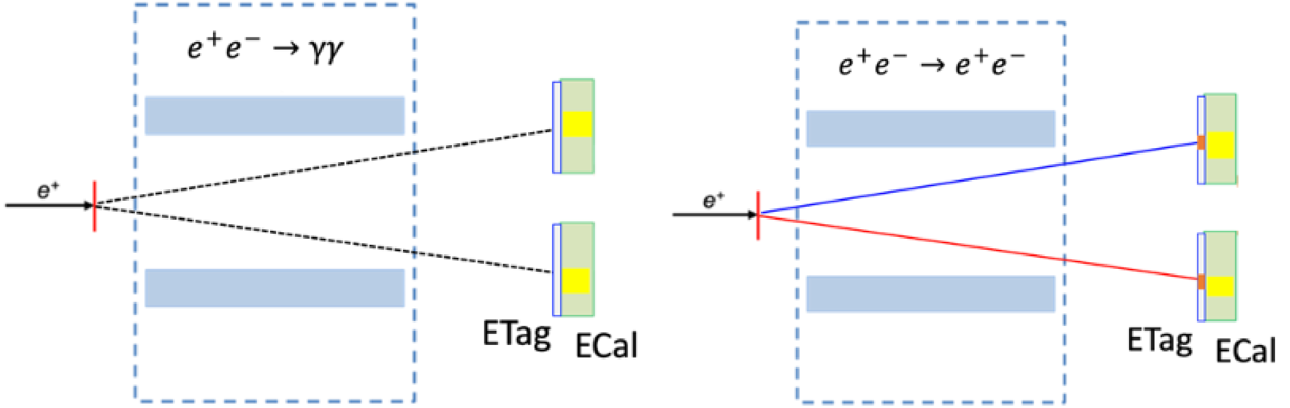
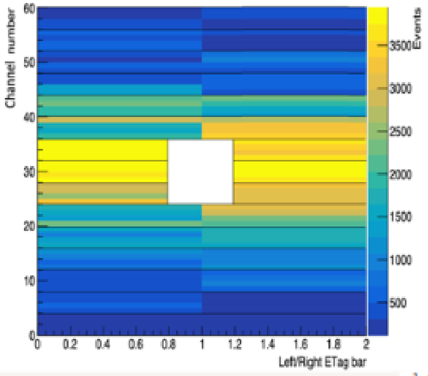
A X17 data collection fully exploiting the 1030 keV is foreseen during the first part of 2025.

PADME Run III modified setup

- Using PADME veto is impossible to reconstruct $e^+ e^-$ mass having no vertex info
- Idea: identify $e^+e^- \to e^+e^-$ using the BGO calorimeter only, as for $\gamma\gamma$ events in Run II

- Switch the PADME dipole **magnet off**
- Both positron and electron will reach the ECal
  - Can measure precisely (3%) electron-positron pair momentum and angles
  - Can reconstruct invariant mass of the pairs precisely (small pile-up)
- **Identify clusters** in ECal from photons or electrons
  - New detector, plastic scintillators, similar to PADME vetos (Electron tagger, ETag) with vertical segmentation and covering the fiducial region of ECal





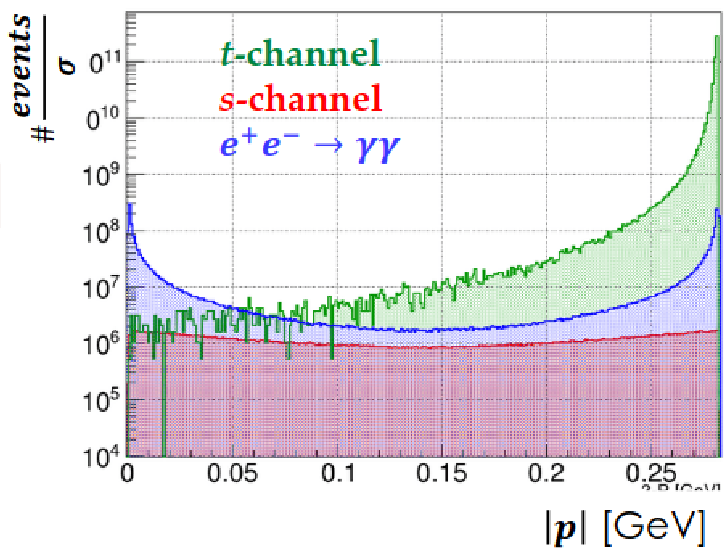
- Thanks to the enhanced production cross section can reduce N_{POT}/bunch by factor 10.
- Much lower pile-up and better energy resolution

The mass scan X17 search strategy

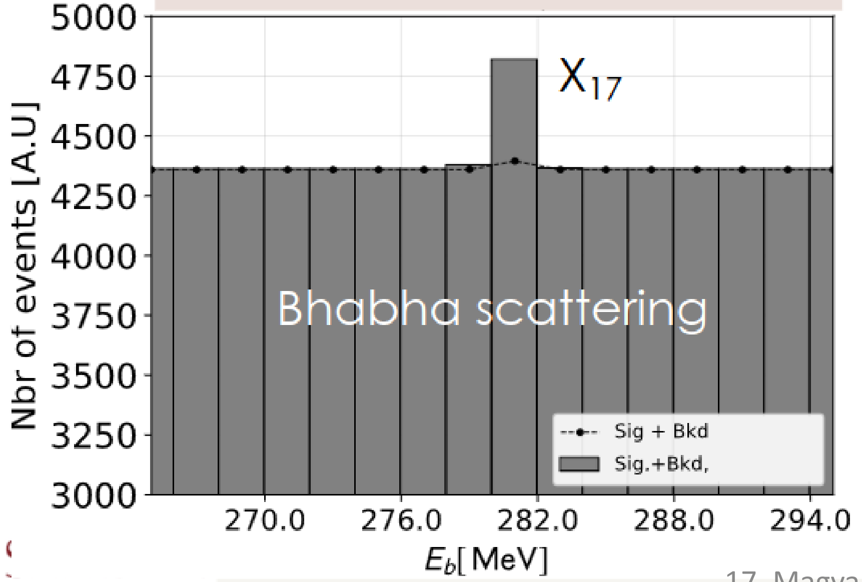
PADME, can use resonant X17 production process

- Extremely effective in producing X17 but in a very small mass range
- Scan E_{beam}=260–300 MeV in <1 MeV steps

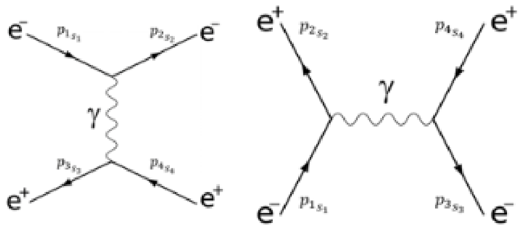
- Completely data driven no theory or MC input
- Signal should emerge on top of **Bhabha** BG in one or more points of the scan.
- Background estimated from surrounding bins



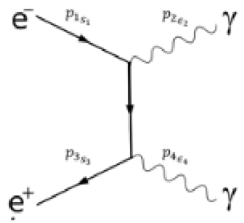
Cartoon view of the technique



Bhabha scattering



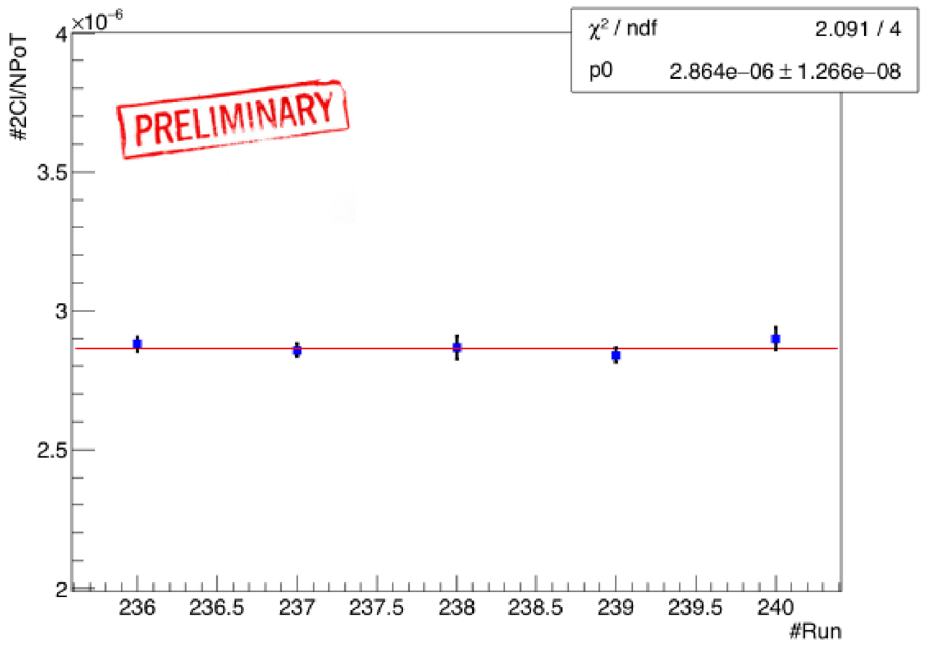
t channel s channel



$e^+e^- \to \gamma\gamma$

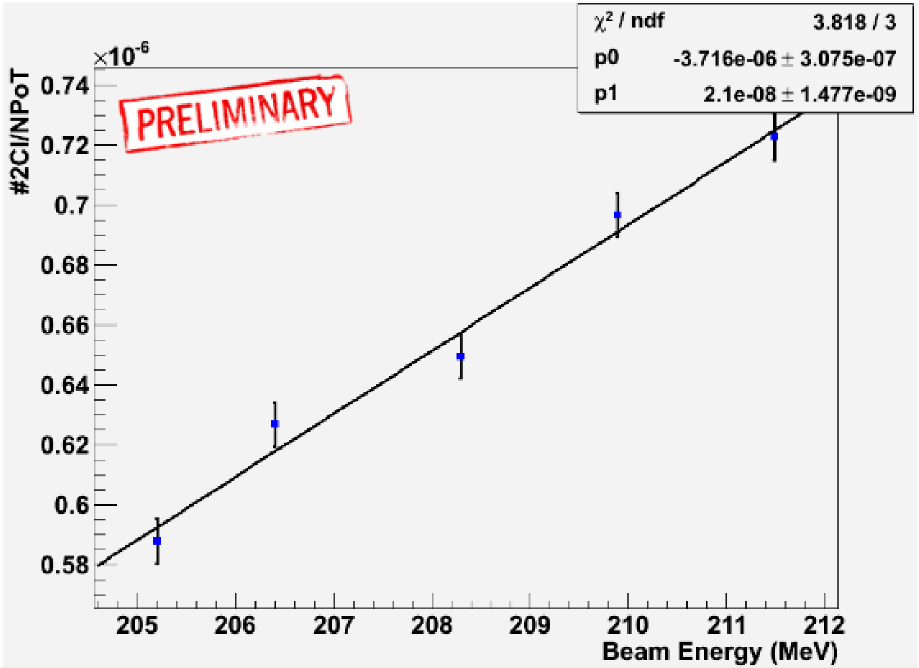
First look out of resonance data sets

Over resonance 402 MeV



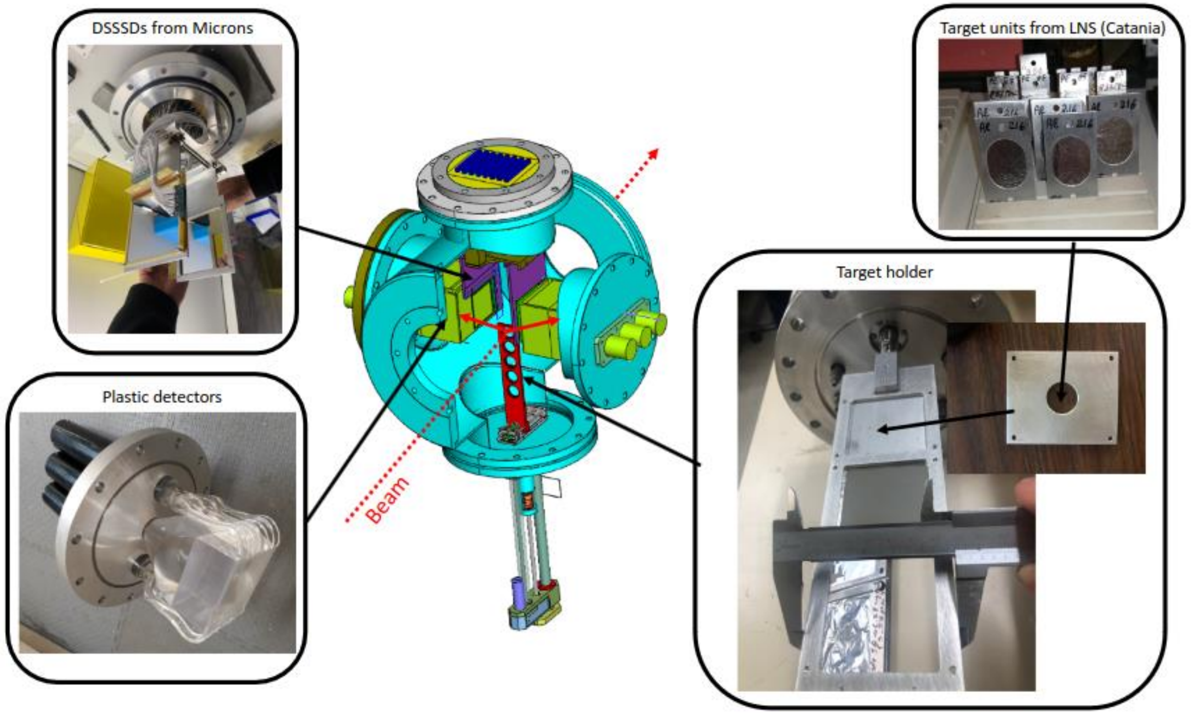
- **RMS ~0.7%** over the 5 runs
  - compatible with pure statistic
- Constant **fit has a good χ^2**
  - No significant systematic errors
- Vertical scale arbitrary:
  - No acceptance correction applied

Below resonance



- **RMS <1%** over the 5 energies
  - computed on residuals wrt the fit
- Good χ^2 of the linear fit
  - Trend due to acceptance
  - Trend is reproduced by MC
- Vertical scale arbitrary:

The New JEDI (Judicious Experiments for Dark sectors Investigations) project (PI:Beyhan Bastin GANIL, France)



The two set of Double-Sided Silicon Strips Detectors (DSSSDs) of the New JEDI setup provides energy losses and angles of the detected electrons and positrons. In addition, the sets of plastic detectors with SiPM readout is used to measure the residual energy of electrons and positrons.

We plan to develop a long-term research program in the MeV terra incognita energy range at the new SPIRAL2 facility, that will deliver unique high-intensity beams of light, heavy-ions and neutrons in Europe.

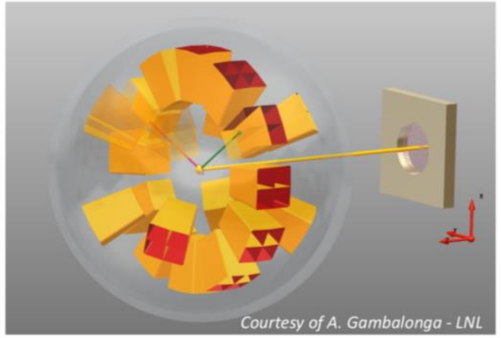
In practice, three experiments using the New JEDI setup concerning the existence of the X17 Dark Boson are envisaged…

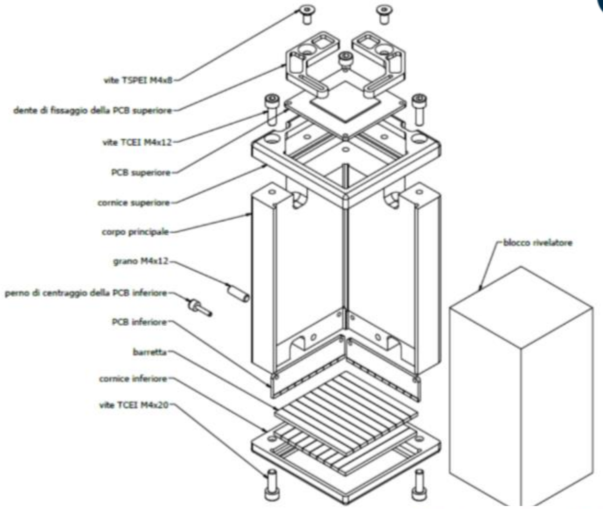
A new setup: proposal

- Improve angular resolution by reducing material budget.
- Improve angular coverage and measure out-of-plane correlation
- Improve confidence on target composition.

- Allow future coupling with a magnetic field.

- Focus on ^{8}Be and, possibly, ^{12}C cases.



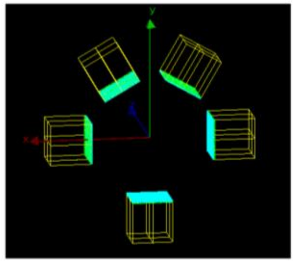


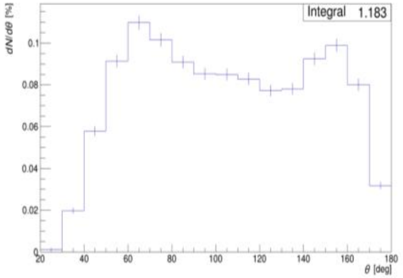
DSSD + Plastic sci. with SiPM readout.

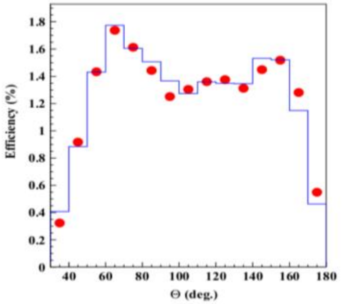
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Legnaro

Pair detection efficiency: two angular configurations

A – Angles: 0° - 60° - 120° - 180° - 270° (Atomki configuration)

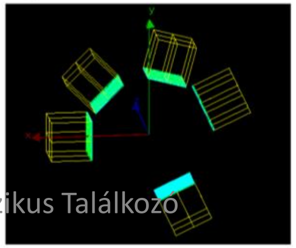


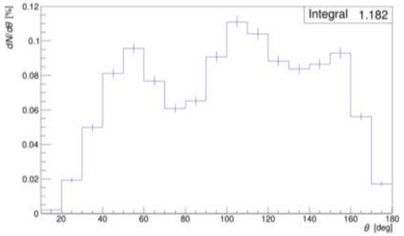




Good compatibility in shape with respect to the Atomki configuration. [J. Gulyás et al, NIM A 808, 21 (2016)]

B – Angles: 0° - 45° - 105° - 155° - 245°

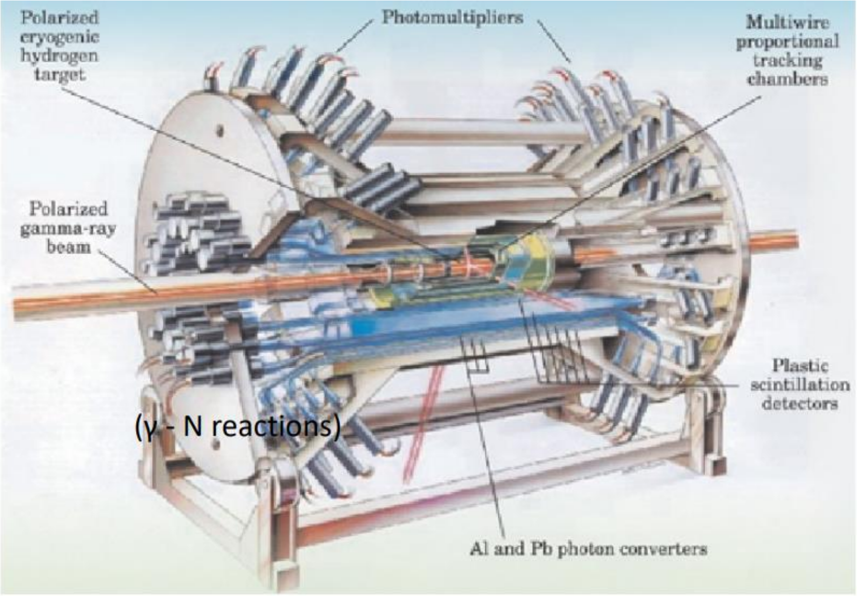




Estimated Pairs detection efficiency
$\varepsilon_{pairs} = 1.18\ \%$

The Montreal X-17 Project

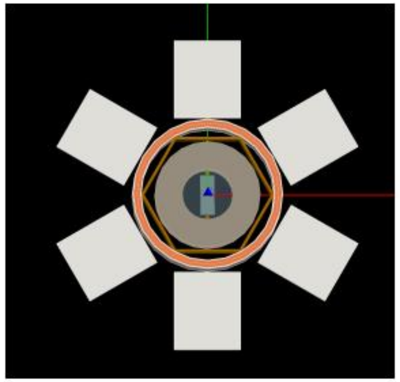
- Use parts of the DAPHNE experiment (Saclay/Mainz*)
- Tracking MWPC chamber & 16 scintillators (NE102A)
- Scints & MWPC from U. Mainz → now @ Montreal
- Phototubes and some ADC/TDC's borrowed from TRIUMF

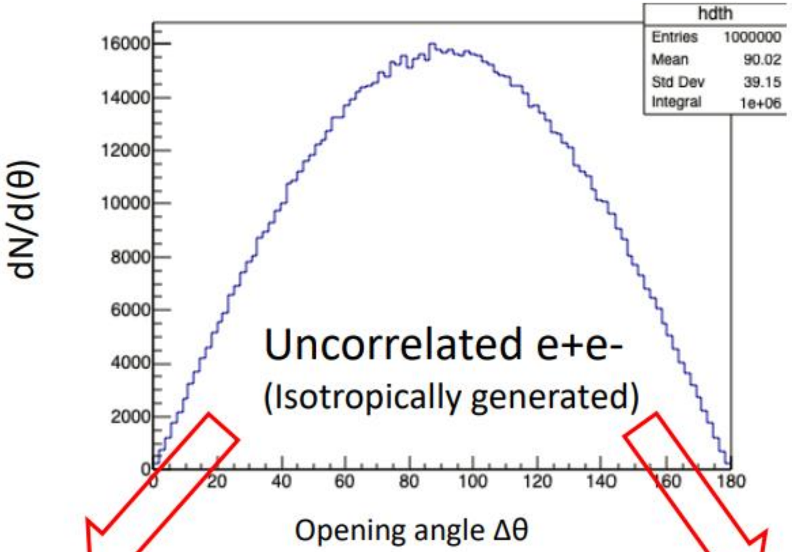


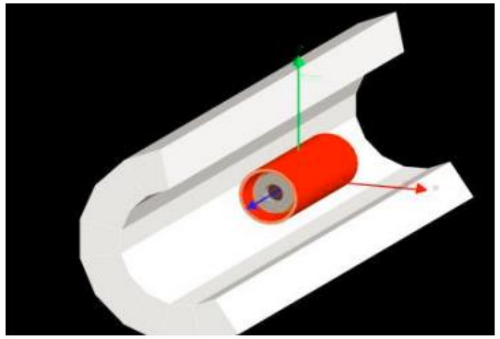
Large solid angle coverage → 0.95 x 4π

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

Geant4 Simulation: Acceptances

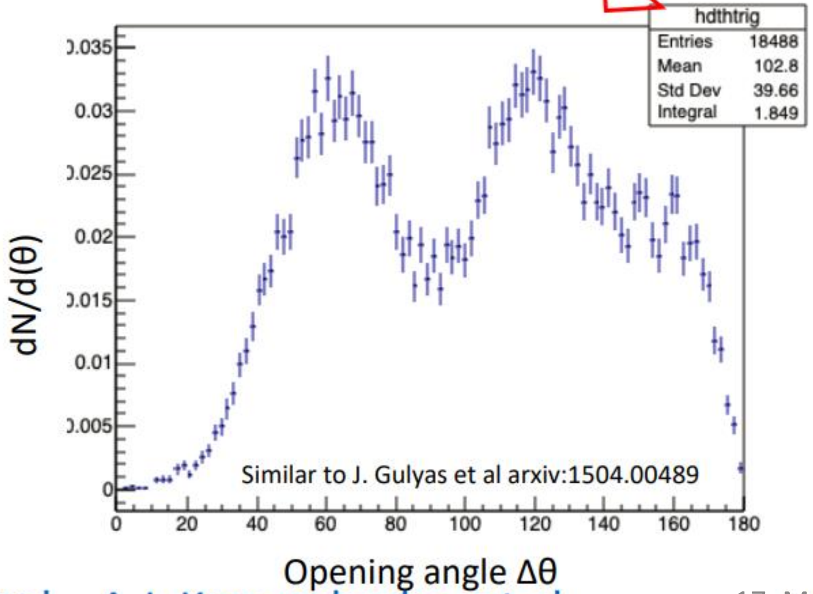


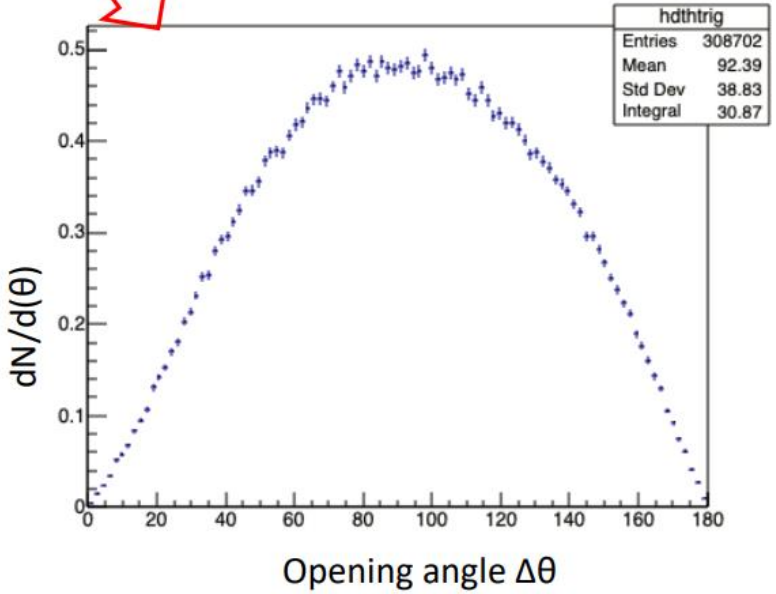




ATOMKI geometry

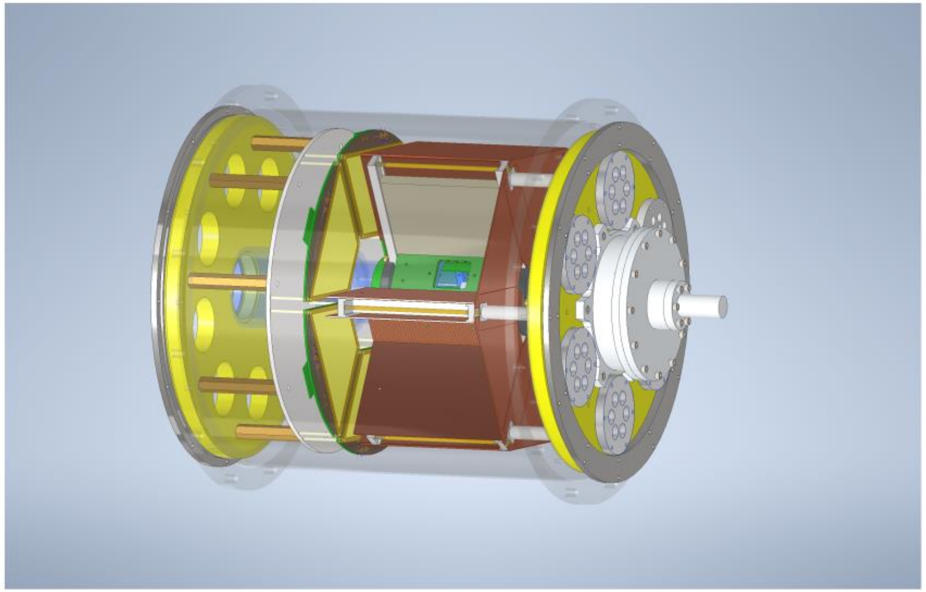
Montreal geometry

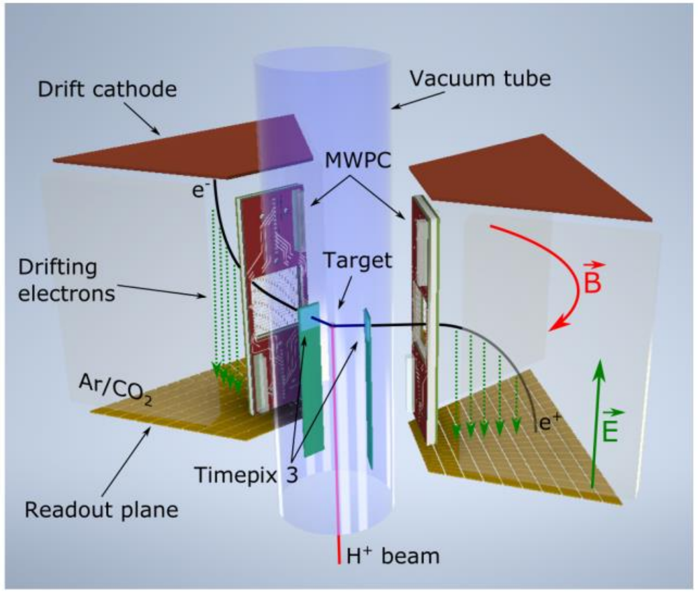




Gulyás J, et al. , A.J. Krasznahorkay et al.

A detector to measure e^-e^+ angular corelations

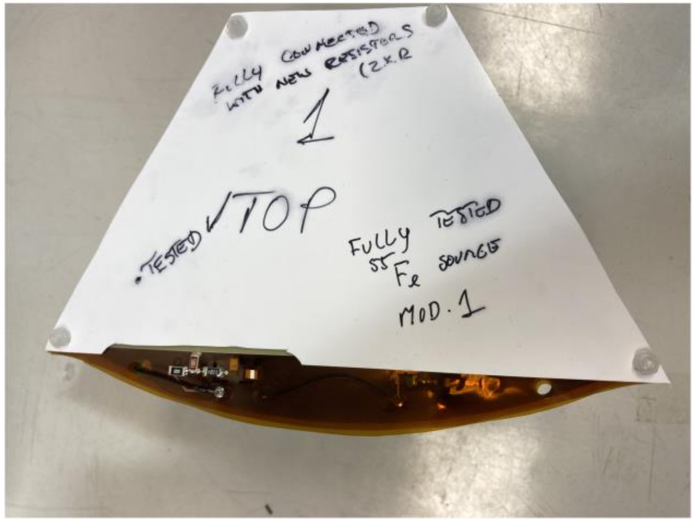


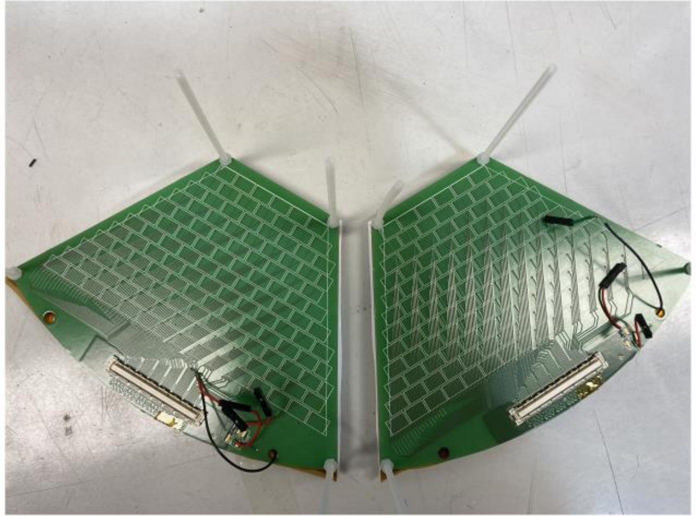


Completion of setup built in ATOMKI

- Three layers of detectors:
  - Timepix3 (angle measurement),
  - Multiwire Proportional Counter (angle and scattering measurement),
  - Time projection Chamber (energy measurement and particle Id)
- Azimuthal angle divided in sextants,
- Toroidal B-field with permanent magnets,
- State of the art TPC readout.

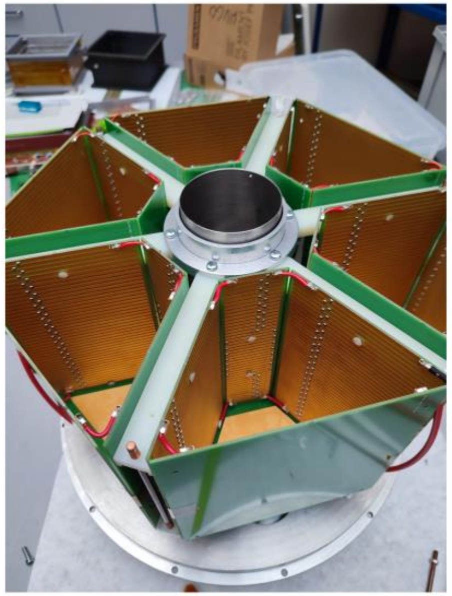
Status of the assembly of the full detector

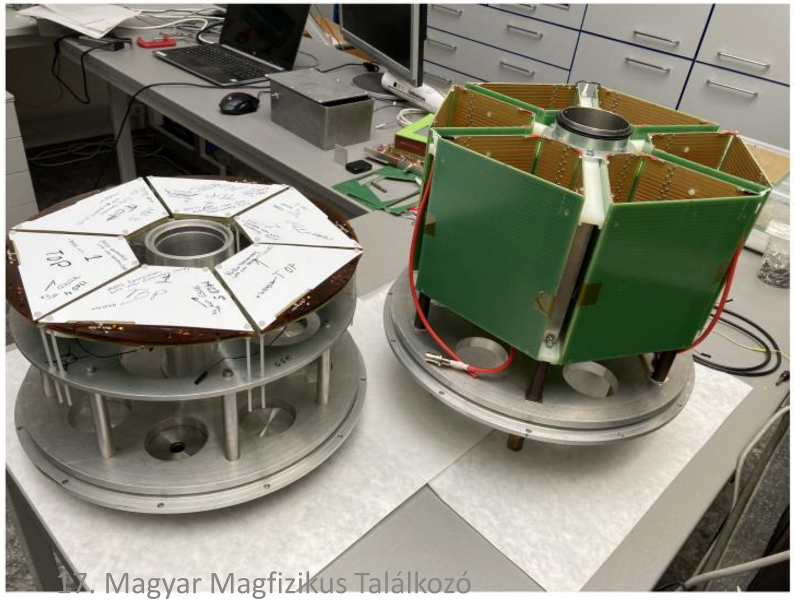


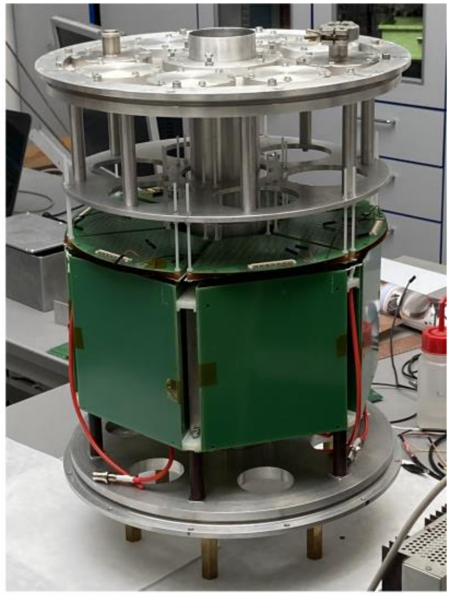


Triple GEM stack.

Readout with SAMPA chip, developed by USP for ALICE







Searching for X17 anomaly at nTOF experiment

- G. Gervino (UNITO)
- P. Mastinu (INFN LNL)
- C. Gustavino (INFN ROMA)
- A. Mengoni (ENEA)
- C. Massimi (UNIBOLOGNA)
- N. Colonna (INFN BARI)
- S. Fiore (ENEA ROMA)
- A. Mazzone (CNR BARI)

} n_TOF and LUNA

- L. E. Marcucci (UNIPISA)
- M. Viviani (INFN PISA)
- A. Kievsky (INFN PISA)
- L. Girlanda (UNISALENTO)

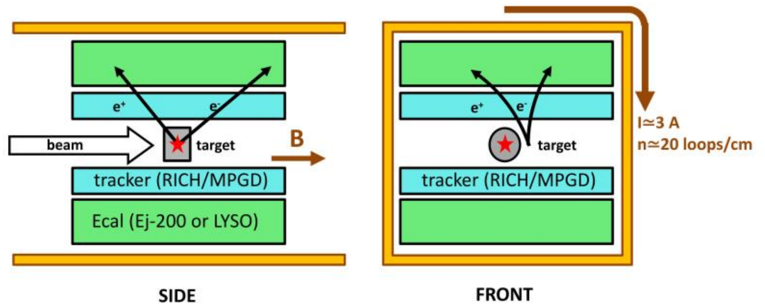
} Theoretical group

- E. Cisbani (ISS)
- F. Renga (INFN ROMA)

} Detector R&D

Working group (in evolution)

DETETCOR Conceptual design



High intensity neutron beam $0<E_n[MeV]<3$
High density target $\rho=10^{21}$ atoms/cm^3
Tracking (vertex and Pairs aperture angle energy)
4-momenta

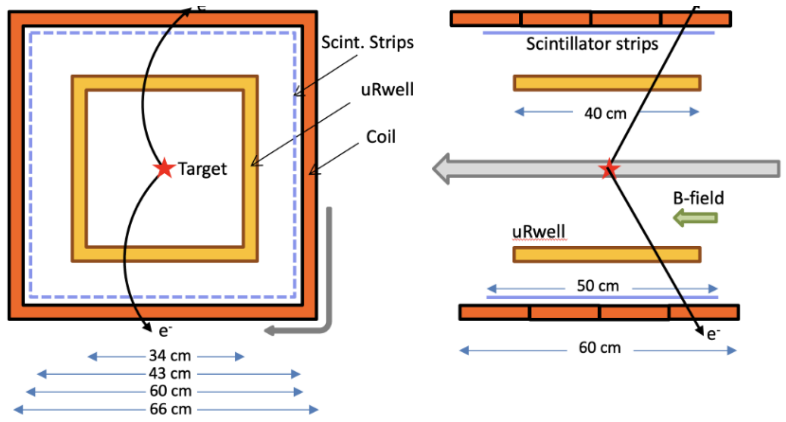


Figure 10. Setup for the study of the $^3He(n,e^+e^-)^4He$. It consists of 4 large µRwells, surrounded by an array of scintillating bars. The detectors are inside a coil with a squared section, providing a magnetic field up to 500 Gauss. See text.

C.Gustavino, Shedding light on X17 boson, Centro Ricerche E. Fermi, 6-8 september 2021, Rome, Italy

Workshop at 1 GeV Scale: From mesons to axions, Cracow

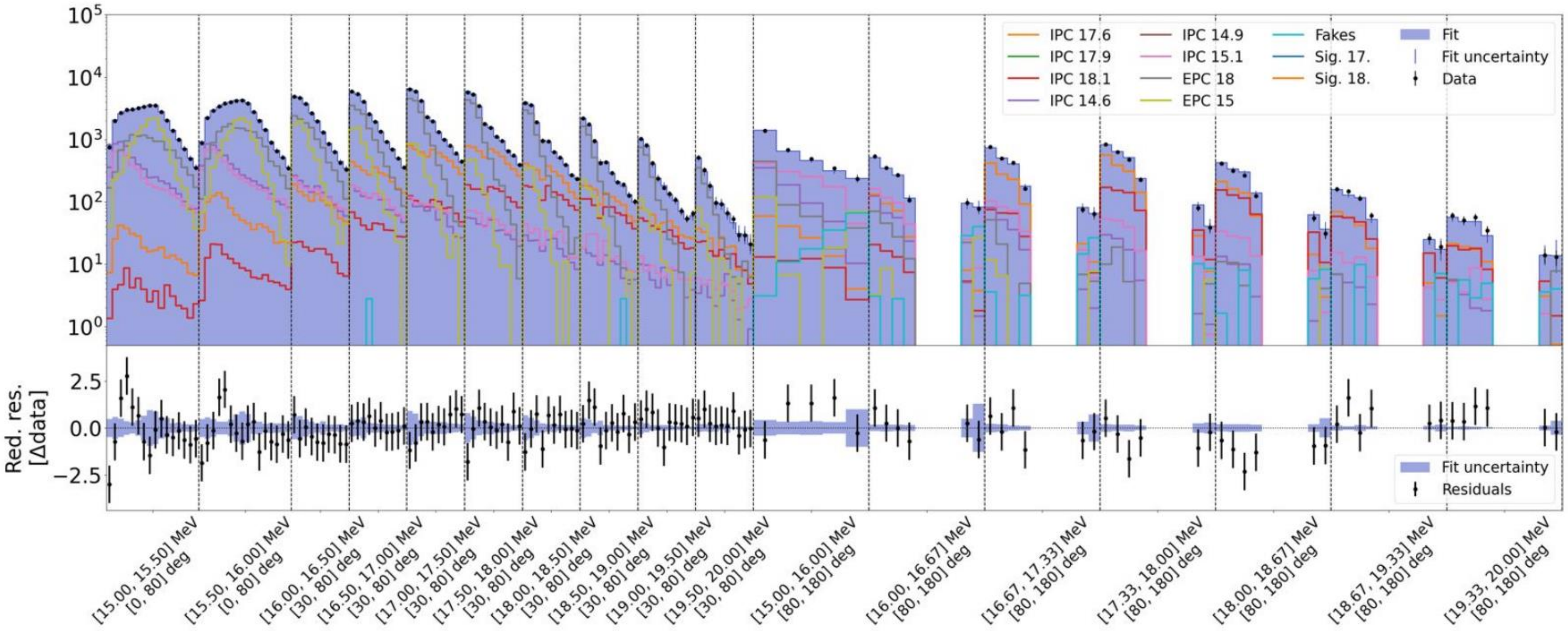
- Probing light dark particles with η and η' decays Sergi Gonzalez-Solis
- An update of the X17 particle Attila Krasznahorkay
- New light particle searches with PADME Kalina Dimitrova
- Search for Hidden Sector New Particles in the 3-60 MeV Mass Range: Focusing on the Hypothetical X17 Particle William Briscoe
- Storage ring as an ALP antenna - an experimental proof of principle Aleksandra Wrońska
- Search for Dark Photons by the HPS experiment at Jefferson Lab Alessandra Filippi
- Searching for WIMP and axion dark matter with DEAP-3600 Marcin Kuźniak
- Searches for cold dark matter particles in the DarkSide experiment Grzegorz Zuzel
- The GLUEX JLab Eta Factory (JEF) Experiment at JLAB Hall D William Briscoe
- Recent results from the GlueX collaboration Yannick Wunderlich
- Light mesons and axions at BESIII Andrzej Kupsc
- Anomalous interactions for mesons with J=1,2 and glueballs Francesco Giacosa
- The REDTOP experiment: a η/η' factory to explore dark matter and physics beyond the Standard Model Marcin Zieliński
- Exclusive analysis of the pp $\to$ ppKK reaction with HADES detector Valentin Kladov
- Exclusive production of eta meson in proton-proton collisions at FAIR energies Piotr Lebiedowicz
- Search for X17 in the η->e+e-π+π- decay at pp@4.5 GeV with HADES Krzysztof Prościński
- Exclusive production of η and ω in pp@4.5 GeV with HADES Szymon Trelinski
- Inclusive production of η and ω in pp@4.5 GeV with HADES Mr Adam Strach

Thank you very much for your kind attention.

X17 analysis: A bit more on the sidebands

- Best US+DS fit with all MC statistics
    - Side bands reproduced
    - Sample of **17.6 MeV** [79.2%] **and 18.1 MeV** [20.8%]

DATA



The NA64 experiment at CERN

- The main aim of the NA64 experiment is to search for unknown particles from a hypothetical “dark sector”. These particles could be dark photons, which would carry a new force between visible matter and dark matter, in addition to gravity, or they could make up dark matter themselves.
- For these searches, NA64 directs an electron beam of 100–150 GeV energy from the Super Proton Synchrotron (SPS) onto a fixed target. Researchers then look for unknown dark- sector particles produced by collisions between the SPS beam’s electrons and the target’s atomic nuclei. The search can either be done by looking for ordinary particles, such as electrons, into which the new particles would decay, or for the “missing” collision energy the dark-sector particles would carry away.
- NA64 also searches for axions and axion-like particles that could explain the puzzling symmetry properties of the strong force or serve as a mediator of a new force. The experiment looks for the production of such particles in interactions between high-energy photons generated by the SPS beam’s electrons in the target and virtual photons from the target’s atomic nuclei.

A NEW EXPERIMENT SEARCHING FOR DARK MATTER AT CERN ...

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

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

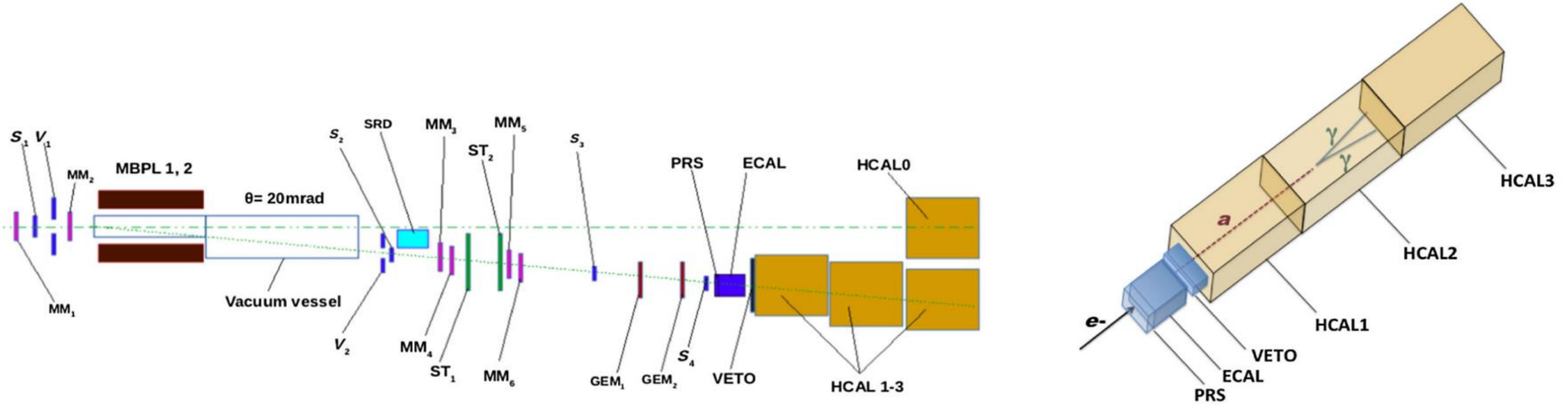


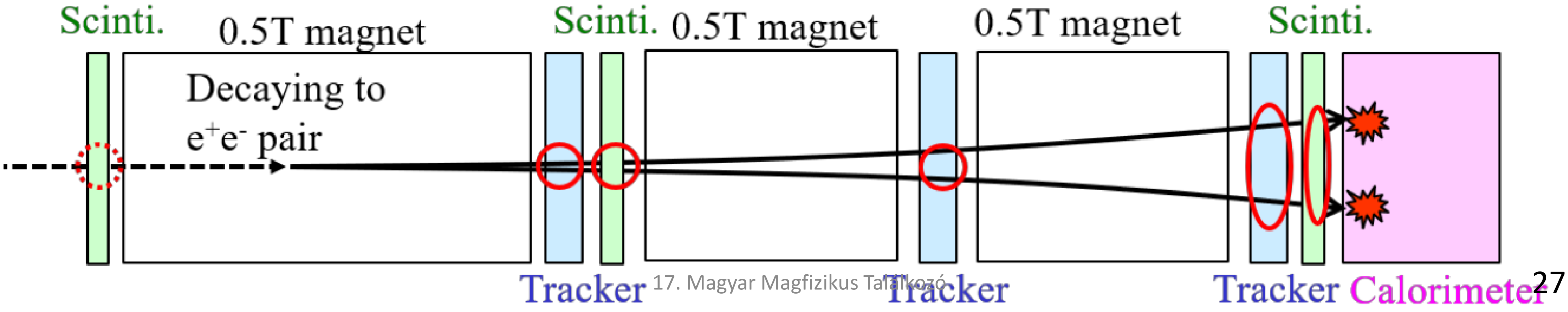
FIG. 1. The left panel illustrates schematic view of the setup to search for the $a \to \gamma\gamma$ decays of the as produced in the reaction chain $e^-Z \to e^-Z\gamma; \gamma Z \to aZ$ induced by 100 GeV e^-s in the active ECAL dump. The right panel shows an example of the $a \to \gamma\gamma$ decay in the HCAL2 module.

"Search for a hypothetical 16.7 MeV gauge boson and dark photons in the NA64 Experiment at CERN". *Physical Review Letters*. **120** (23): 231802, (2019).

Search for Axionlike and Scalar Particles with the NA64 Experiment, D. Banerjee *et al.* (NA64 Collaboration)
Phys. Rev. Lett. **125**, 081801 – Published 17 August 2020

Forward Search Experiment

- FASER* (Forward Search Experiment), CERN's newest experiment, is now in place in the LHC tunnel, only two years after its approval by CERN's Research Board in March 2019. FASER is designed to study the interactions of high-energy neutrinos and search for new, as-yet-undiscovered light and weakly interacting particles. Such particles are dominantly produced along the beam collision axis and may be long-lived particles, travelling hundreds of metres before decaying. The existence of such new particles is predicted by many models beyond the Standard Model that attempt to solve some of the biggest puzzles in physics, such as the nature of dark matter and the origin of neutrino masses.
- FASER is located along the beam collision axis, 480 m from the ATLAS interaction point, in an unused service tunnel that formerly connected the SPS to the LEP collider – an optimal position for detecting the particles into which light and weakly interacting



Search for *K*+ decays into the *π*+*e*+*e*−*e*+*e*− final state
NA62 collaboration, *Phys.Lett.B* 846 (2023) 138193

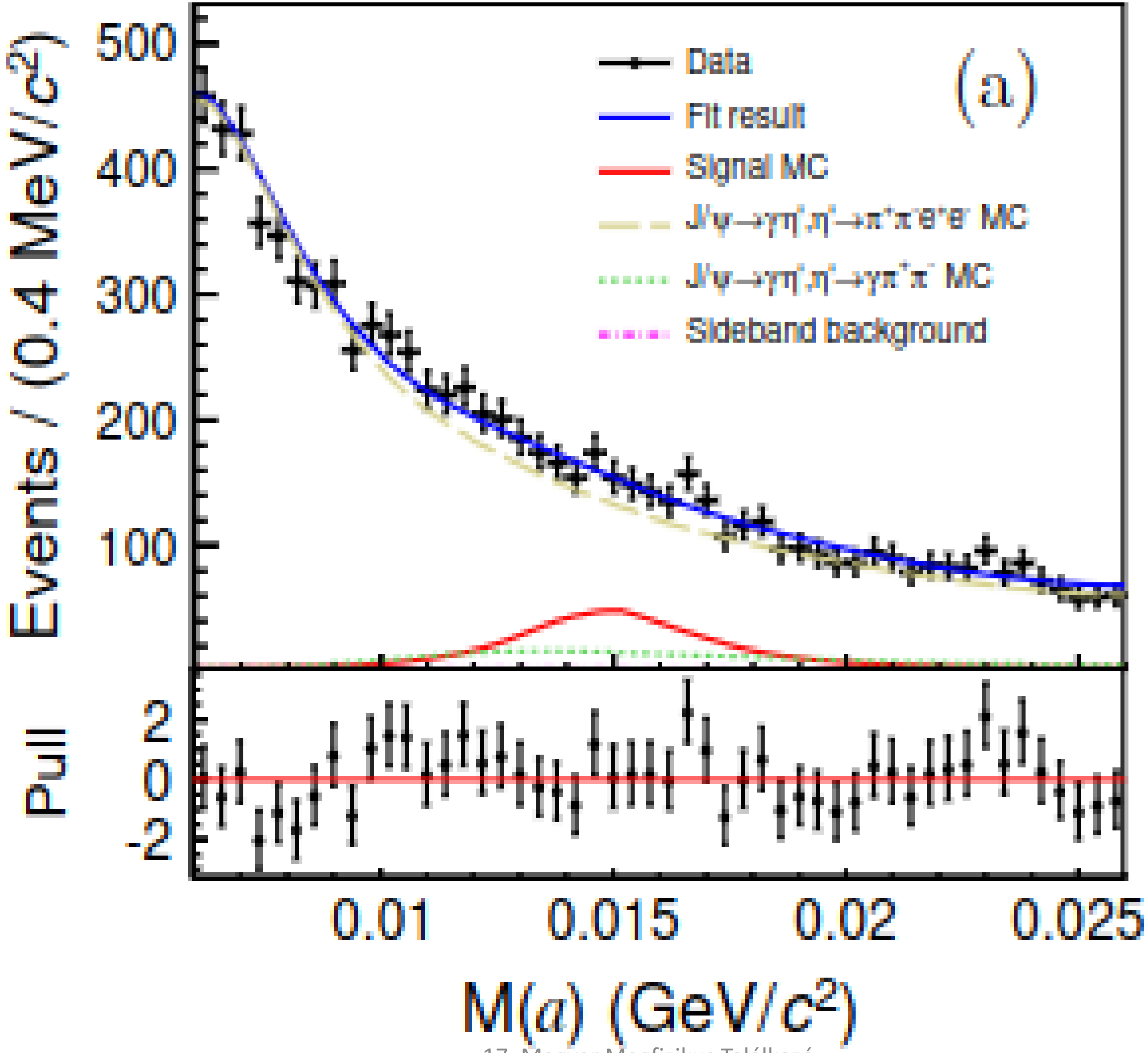
- Assuming an axion mass of 17 MeV/, lower bounds of >2E-8 is predicted, allowing a test of the QCD axion explanation for the 17 MeV anomaly. →
- Upper limits at 90% CL are obtained at the level of 1E-9 for the branching ratios of two prompt decay chains.
- → QCD axion is ruled out

Published for SISSA by Springer

Received: February 6, 2024
Revised: June 20, 2024
Accepted: June 21, 2024
Published: July 16, 2024

Study of $\eta' \to \pi^+\pi^-l^+l^-$ decays at BESIII

The BESIII collaboration



Events / (0.4 MeV/c^2)
Data
Fit result
Signal MC
$J/\psi\to\gamma\eta',\eta'\to\pi^+\pi^-e^+e^-$ MC
$J/\psi\to\gamma\eta',\eta'\to\gamma\pi^+\pi^-$ MC
Sideband background
(a)
Pull
M(a) (GeV/c^2)

A plan for a super η factory at Huizhou accelerator complex

arXiv:2407.00874

SEARCHING FOR THE X17 USING MAGNETIC SEPARATION

Australian National University

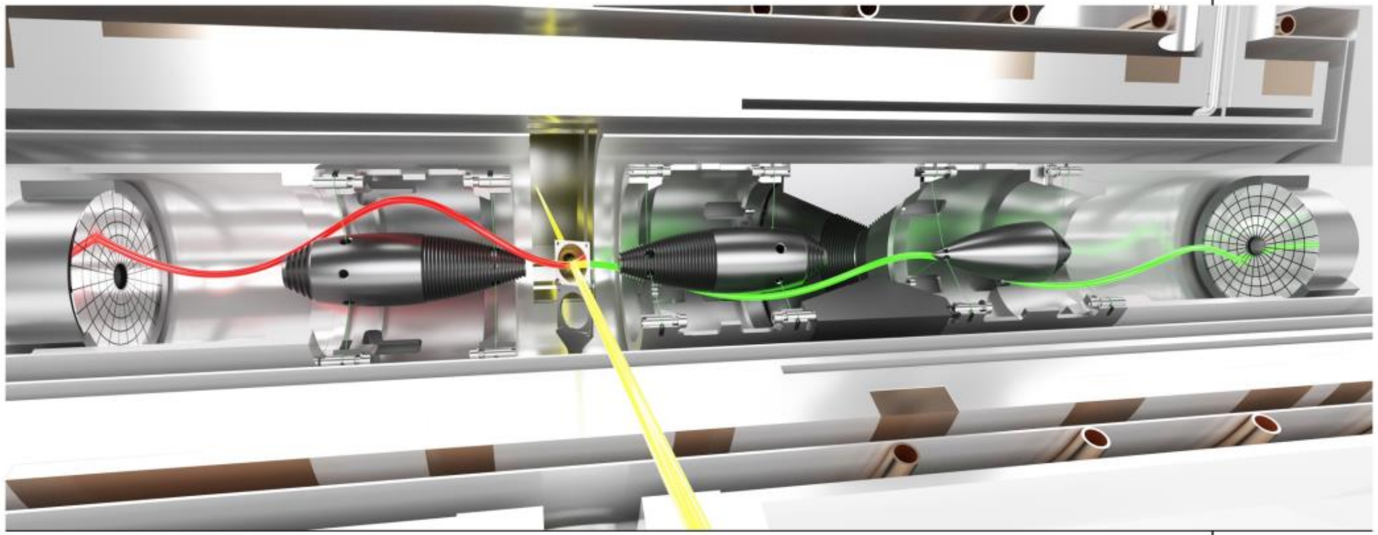
Tibor Kibédi

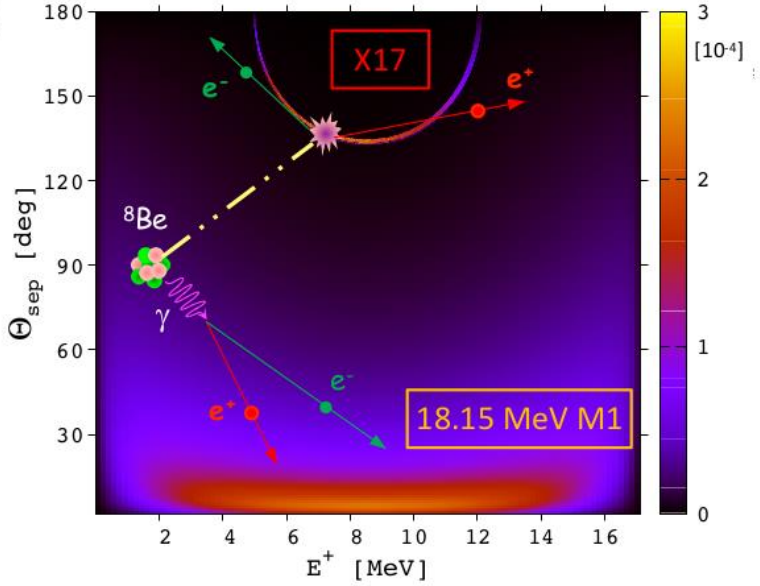
Department of Nuclear Physics and Accelerator Applications

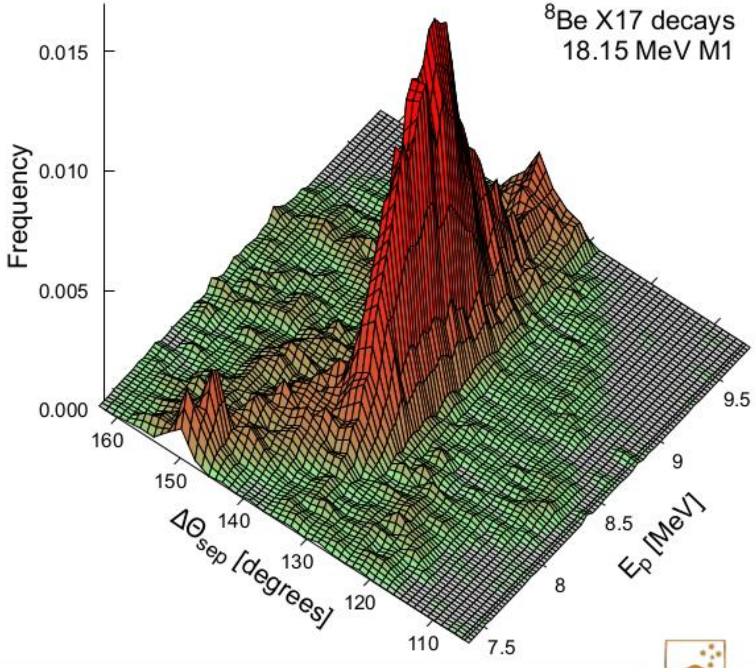
Research School of Physics, Australian National university

ISMD 25-Aug-2023

Searching for X17 in ^{7}Li(p,$\gamma\pi$)^{8}Be* - Super-X (ANU)



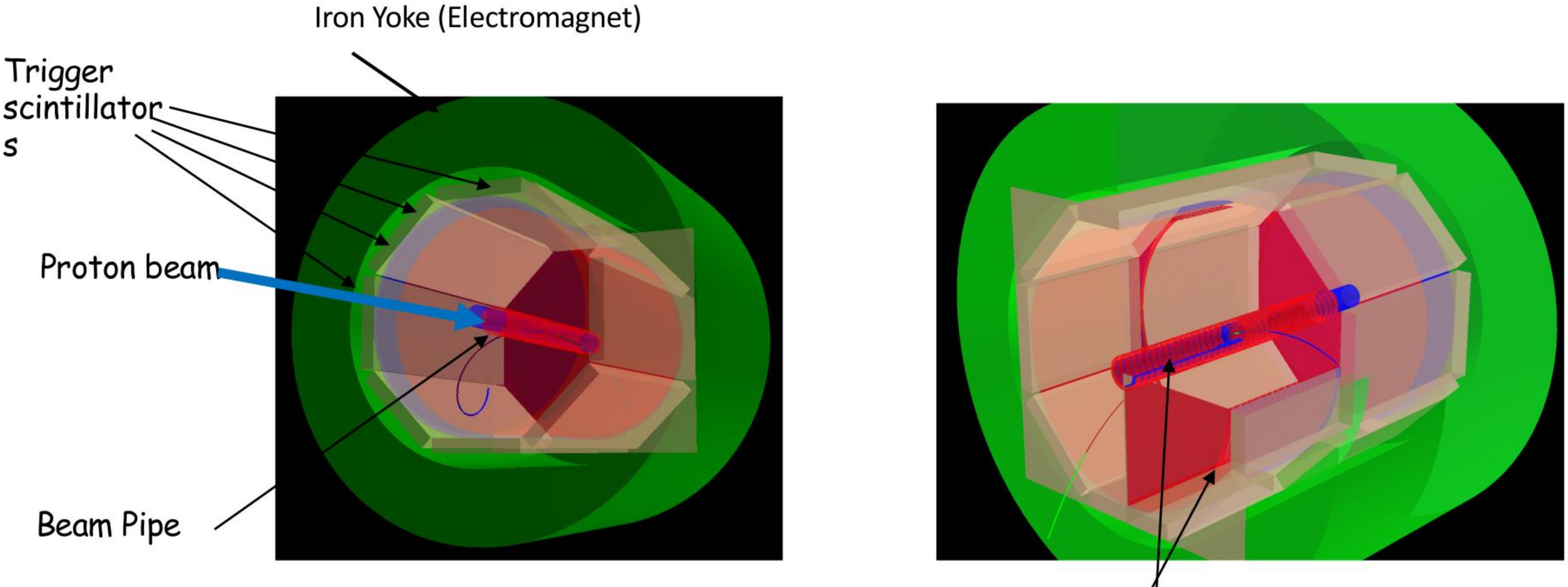




- ❑ Twin lens system to accept e+e- $110^{o} < \Theta_{sep} < 180^{o}$
- ❑ Three double sided DSSD to reconstruct trajectories; $\Delta\Theta_{sep}$ ~6^{o}
- ❑ NaI energy detectors; Si(Li) or hpGe bremsstrahlung?
- ❑ 14 UD & energy degrader foil to run at 1.03 MeV resonance energy

Time Projection Chamber to be installed on 5 MV Pelletron

Univ. Melbourne, details available at Sevior et al. arXiv:2302.13281)

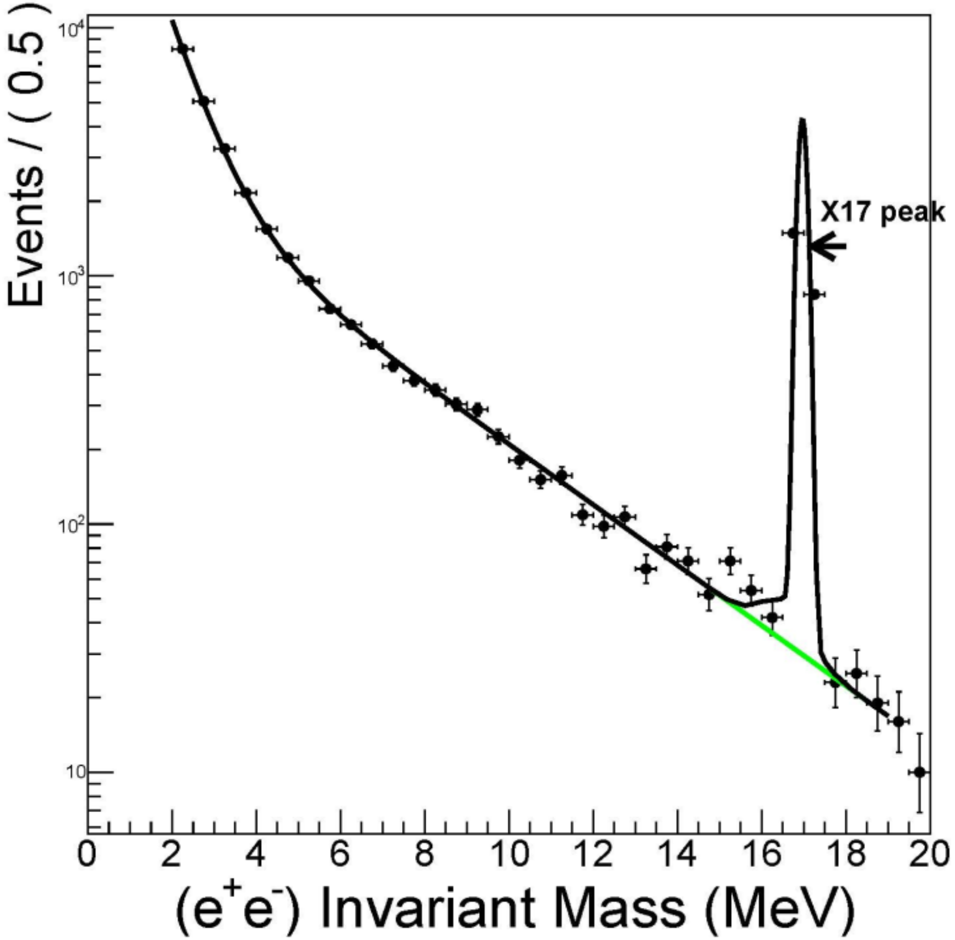


- ❑ 34 cm diam solenoid, up to 0.4 Tesla
- ❑ 35 cm long active volume He (90%) / CO_2 (10%)

Expected performance of the TPC

- Design based on extensive simulations (Geant4, COMSOL, GARFIELD, ROOT, GenFit
- Full simulation and reconstruction of IPC+X17 with 50 μm Mylar vacuum wall
- 4 Day run on Pelletron. 2μA proton beam, 2×10^{19} /cm^2 ^{7}Li target
- Quantify sensitivity as a function of BR relative to $p + {}^7Li \rightarrow {}^8Be + \gamma$
- ATOMKI found X17 with BR ~6×10^{-6} $^7Li\,(p,\gamma)$ at 6 σ

IPC + X17 Log plot

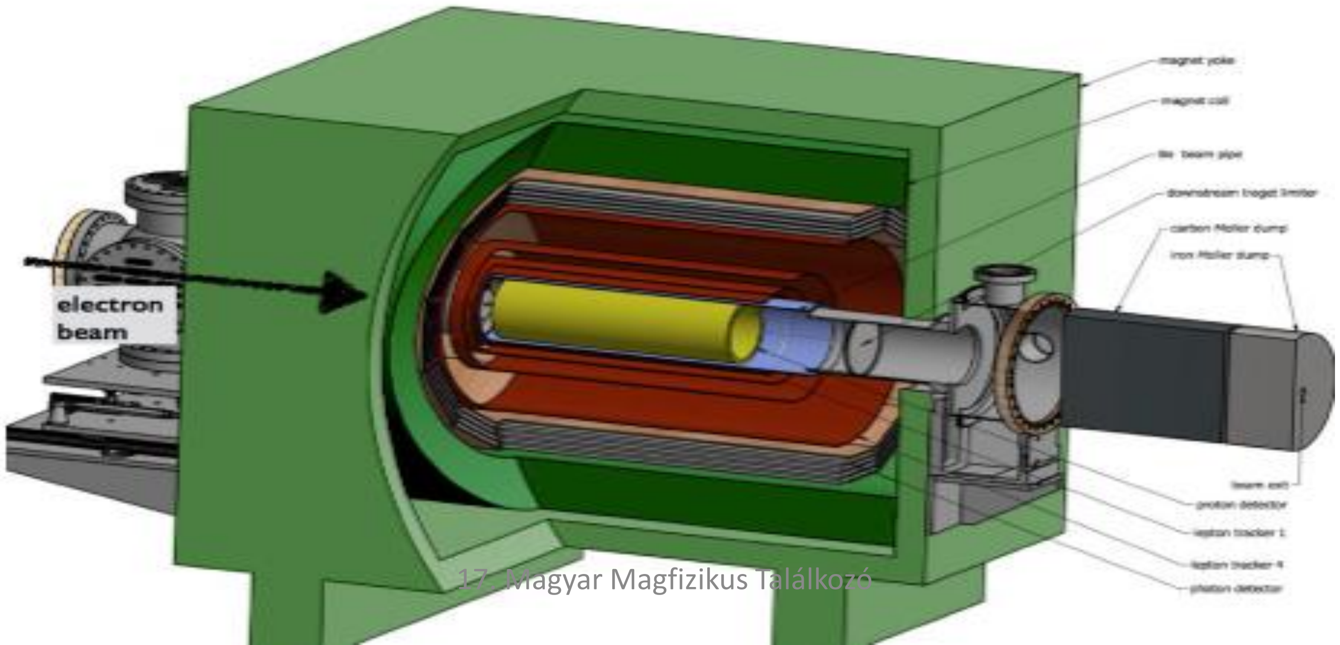


X17 BR= 6×10^{-6} $^7Li(p,\gamma)$
2300(48) events
50 σ significance

Slide courtesy of Martin Sevior

The DarkLight experiment at JLAB

- The DarkLight experiment proposes to search for dark photon through complete reconstruction of the final states of electron–proton collisions. In order to accomplish this, the experiment requires a moderate-density target and a very high intensity, low energy electron beam.



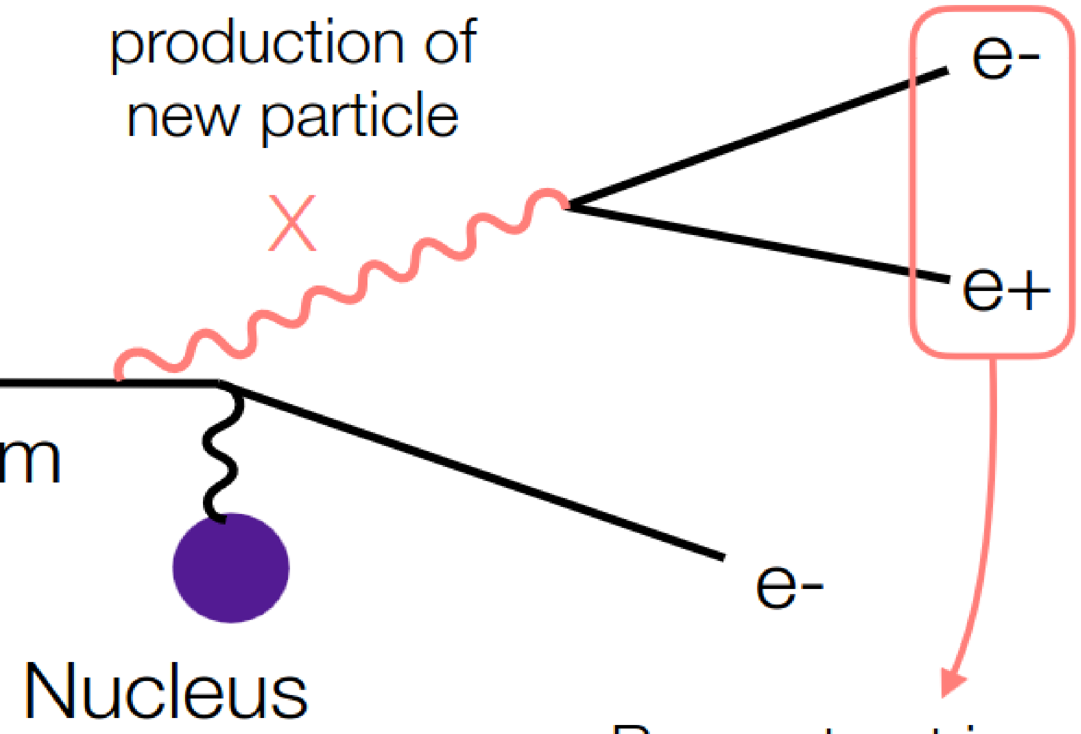
The DarkLight @ ARIEL experiment

Moderate energy,
high intensity e- beam
from ARIEL e-linac

Radiative
production of
new particle

Broad opening
angle: measure
e+ and e- in
spectrometers
on opposite
sides of
beamline

30 (50) MeV e- beam



High-N target optimised
for minimum multiple
scattering: baseline target
is 1 μm Tantalum foil

Reconstruct invariant
mass of e+e- pair and
search for resonant peak
over smooth SM
background

Collaboration

Arizona State University, Tempe, AZ, USA
University of British Columbia, Canada
Hampton University, Hampton, VA, USA
TJNAF, Newport News, VA, USA
Massachusetts Institute of Technology, Cambridge, MA, USA
St. Mary's University, Halifax, Nova Scotia, Canada
Stony Brook University, NY, USA
TRIUMF, Vancouver, British Columbia, Canada
University of Manitoba, Canada
University of Winnipeg, Manitoba, Canada

M. Hasinoff

R. Kanungo

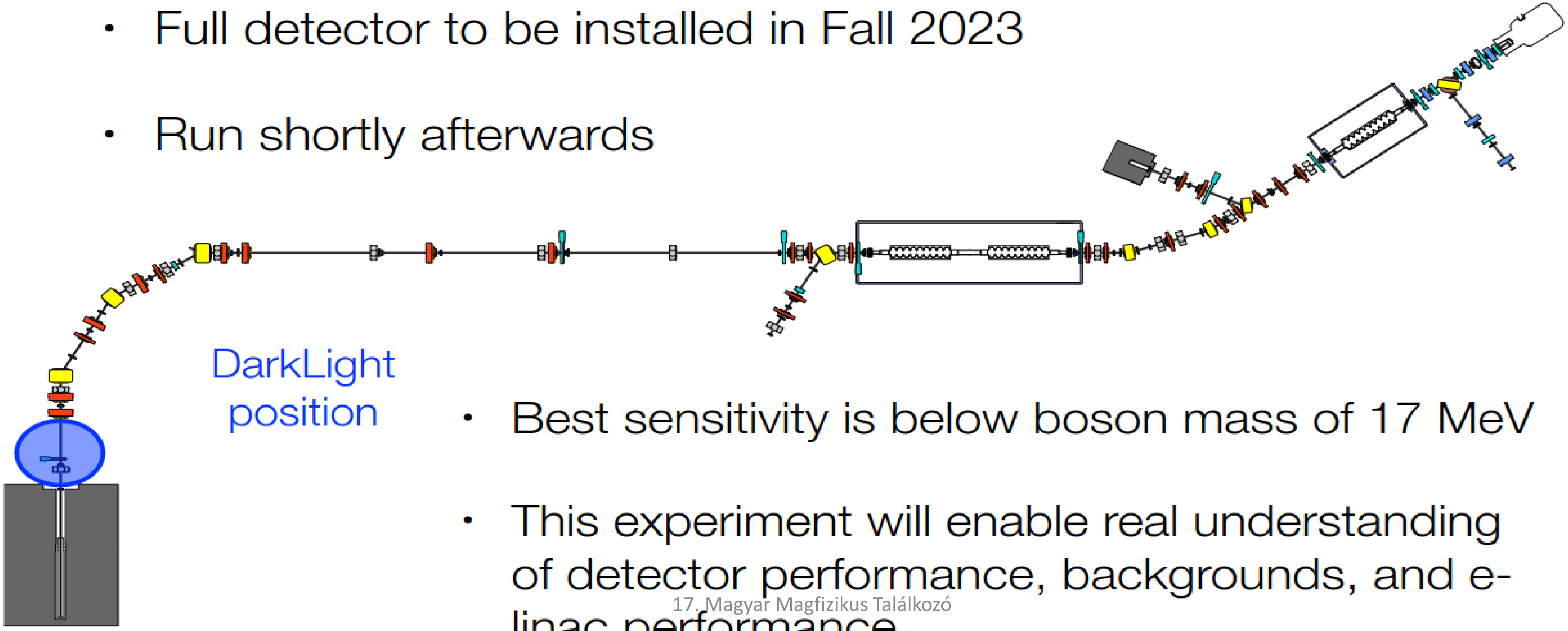
S. Yen, K. Pachal, T. Planche, B. Laxdal, O. Kester

W. Deconinck

J. Martin

30 MeV running with current ARIEL e-linac

- First experimental stage is a full run (18 fb^{-1}) at 30 MeV
  - Full detector to be installed in Fall 2023
  - Run shortly afterwards



- Best sensitivity is below boson mass of 17 MeV
- This experiment will enable real understanding of detector performance, backgrounds, and e-linac performance

Timeline and milestones

Spring 2021: beam time approved @ TRIUMF

Dec 2021: test chamber installed in beamline

Feb 2022 CFI passed selection round at universities

Feb 2022: Passed TRIUMF Gate 1

April 2022: NSERC awarded

May 2022: workshop at TRIUMF, first collaboration meeting

Today

Rest of 2022: install existing spectrometer, initial test experiments

2023: CFI decision; install and run full experiment @ 30 MEV

2024/2025: install second cryomodule; first run @ 50 MeV

2025+: install infrastructure for parallel running with ARIEL

Searching for new light gauge bosons at colliders

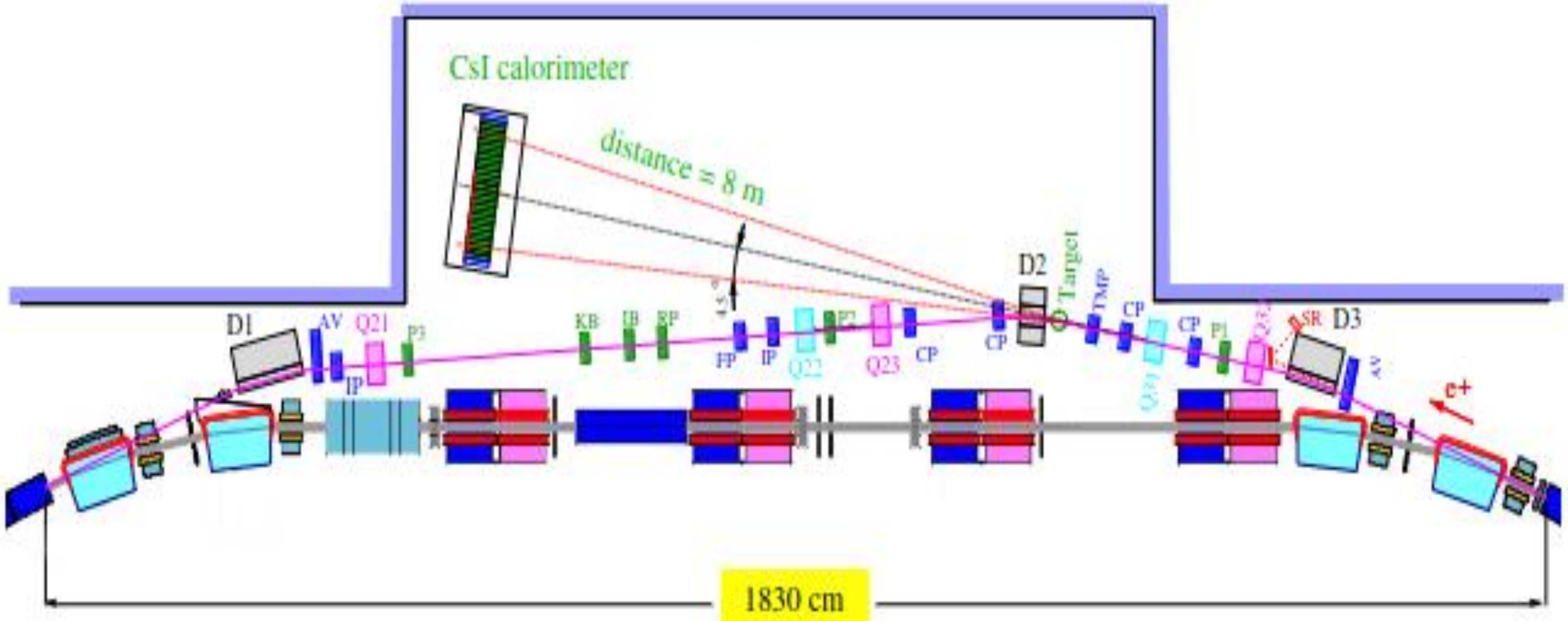
I. Alikhanov and E. A. Paschos

Phys. Rev. D 97, 115004 – Published 5 June 2018

The standard processes and that lead to the same signal are considered. The case with a light scalar boson is also discussed. The calculations are performed at 10 GeV in detail and can be useful for additional studies.

Searching for a dark photon: Project of the experiment at VEPP-3

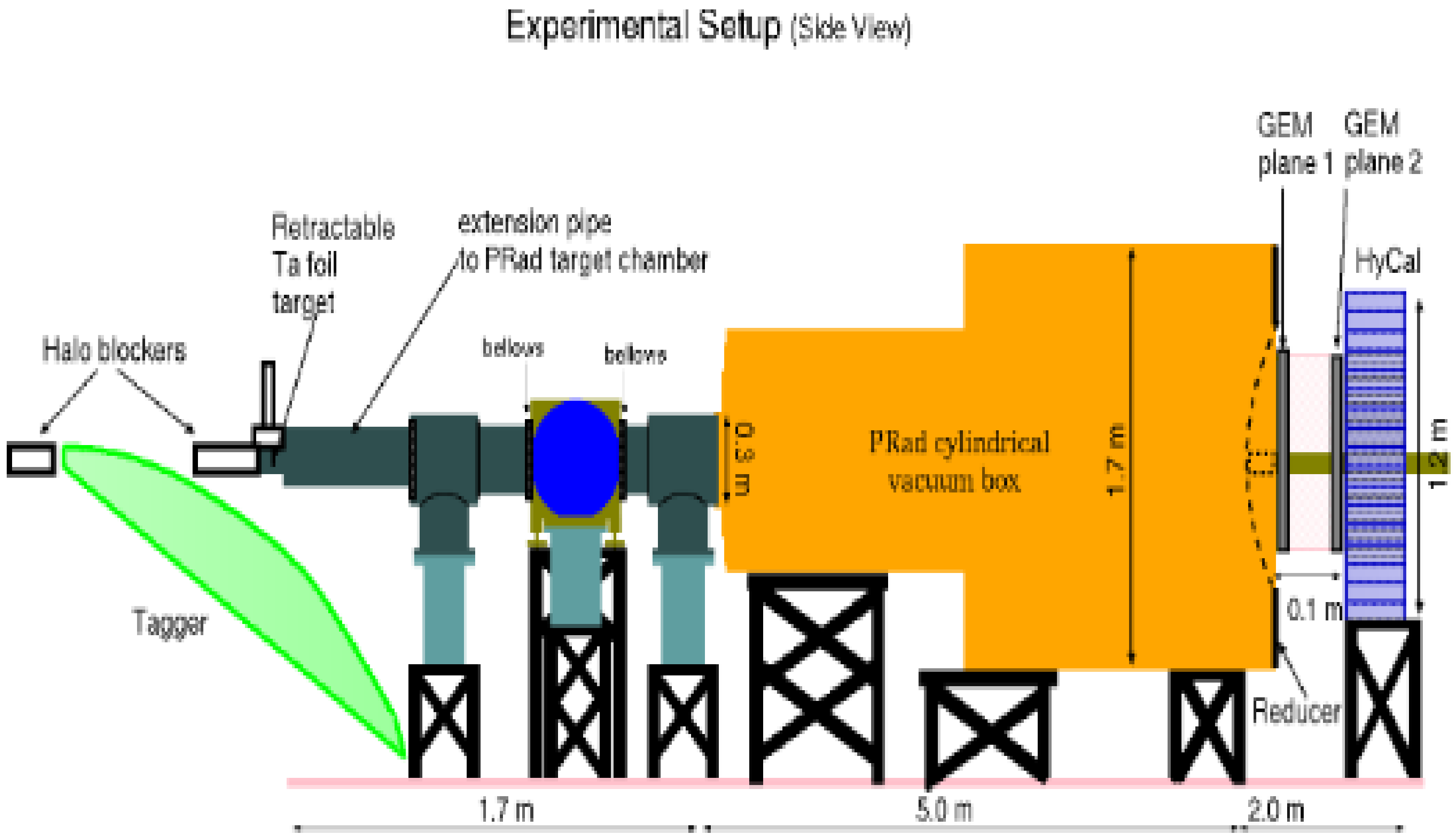
- **The VEPP-3 electron-positron storage ring**
- The VEPP-3 storage ring (perimeter: 74.4 m, injection energy: 350 MeV, maximal energy: 2000 MeV) was built in 1967-1971 and modernized in 1986-1987.



New accelerator in Russia at the Joint Institute for Nuclear Research, Dubna

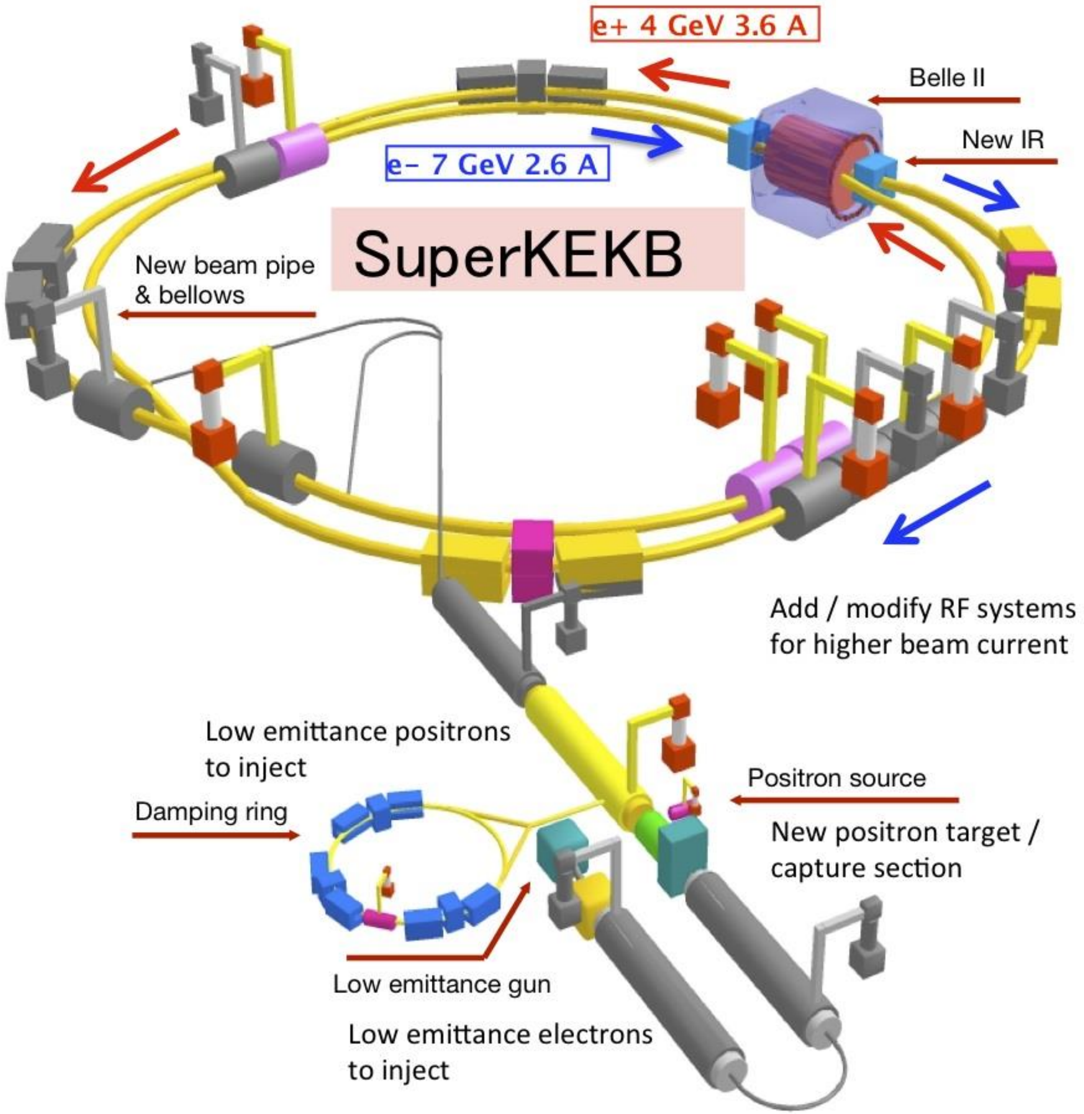
- FLAP (Fundamental & applied Linear Accelerator Physics collaboration) devoted to the study of the basics of electromagnetic interactions and new applications of controllable generation of electromagnetic radiation by relativistic electrons using functional materials.

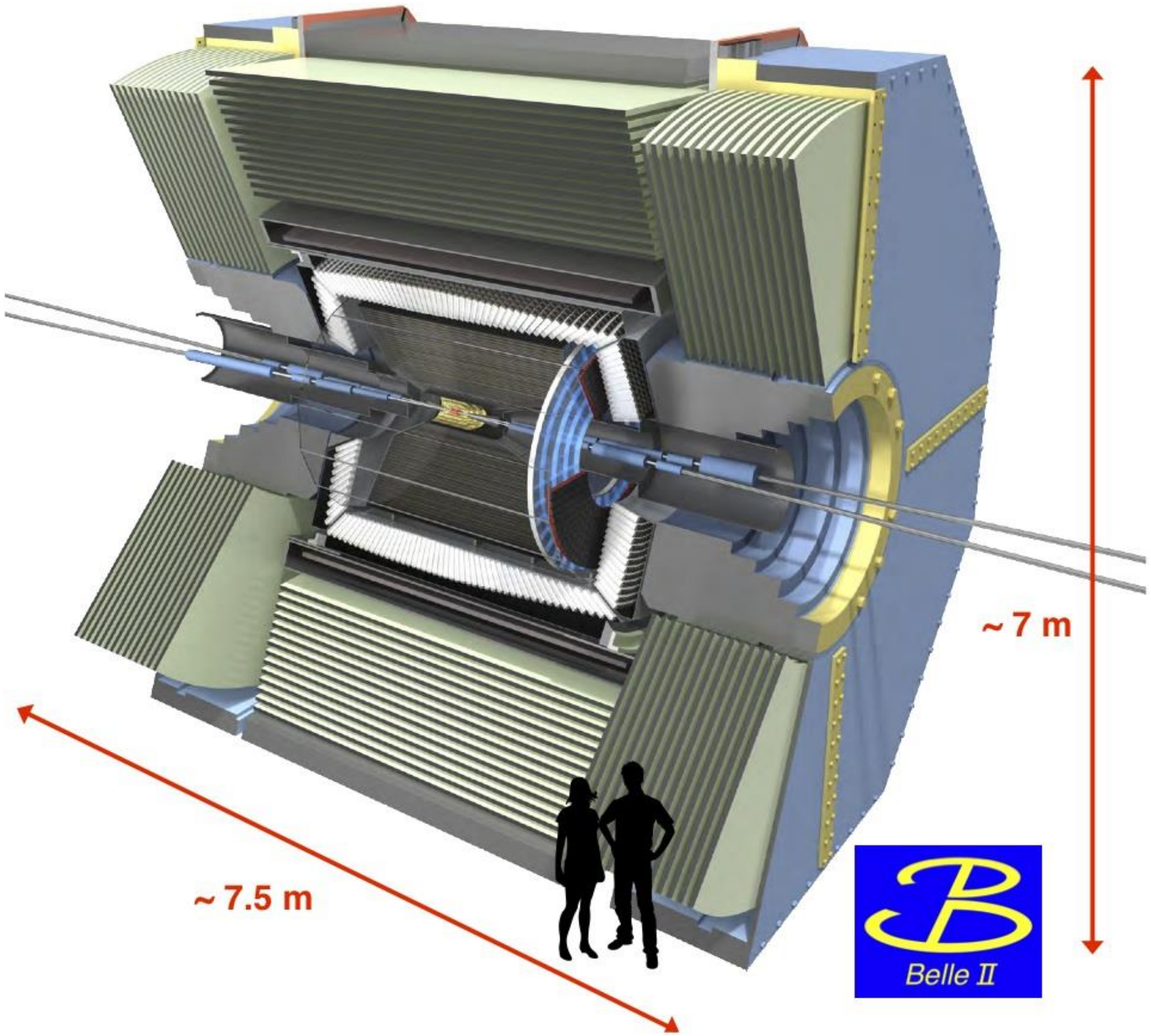
A new direct detection electron scattering experiment to search for the X17 particle.



Searching for the X(17) in particle decays

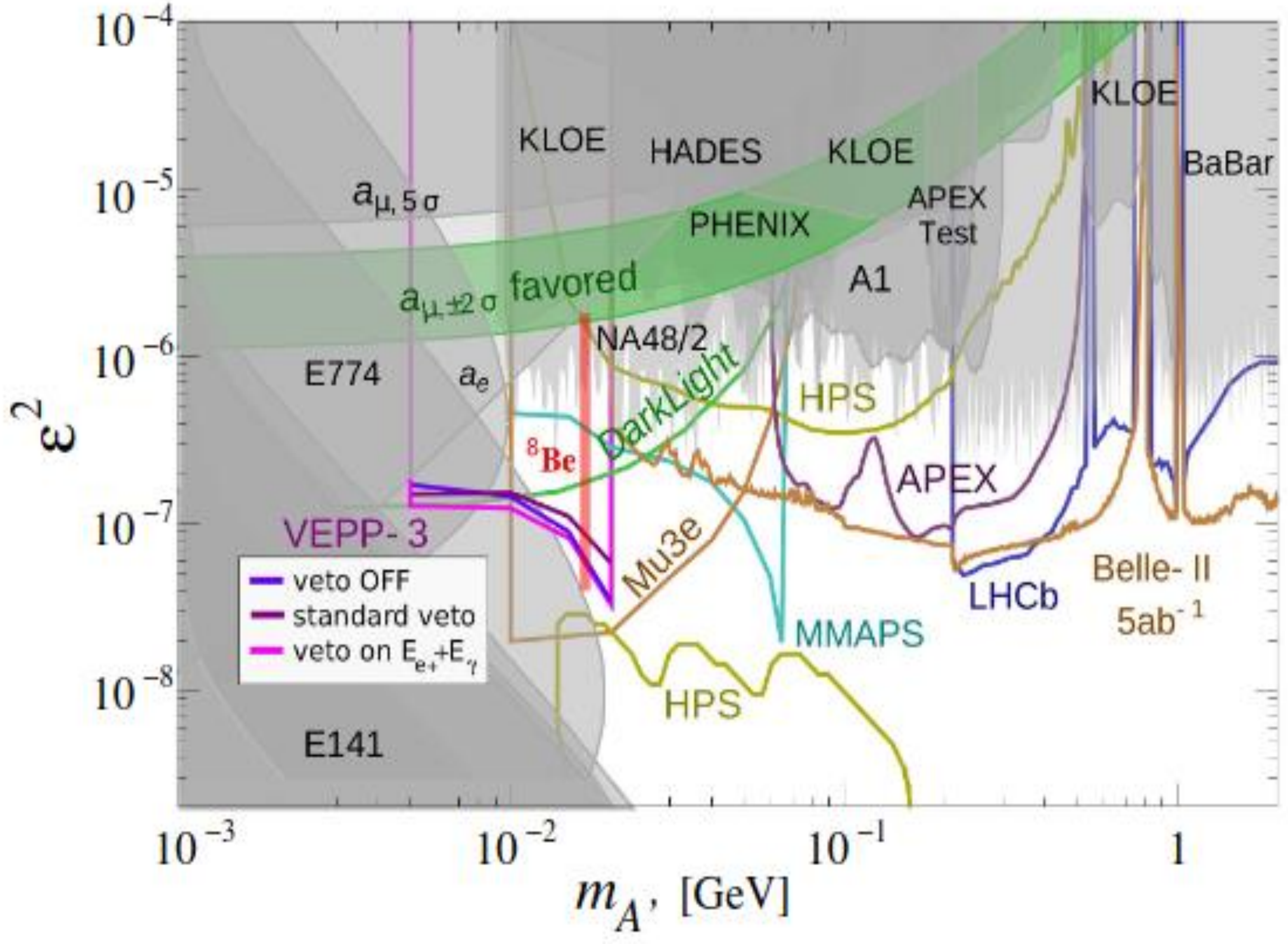
- Araki et al, (Phys. Rev. D 95, 055006 (2017)) discussed the feasibility of detecting the gauge boson of the U(1) symmetry, which possesses a mass in the range between MeV and GeV, at the **Belle-II experiment**. They have found that the Belle-II experiment with the design luminosity can examine a part of the parameter region that evades the current experimental constraints and, at the same time, is favored by the observation of the muon anomalous magnetic moment.
- Rare leptonic kaon and pion decays $K^+(\pi^+) \rightarrow \mu^+\nu_\mu e^+e^-$ can also be used to probe a dark photon of mass O(10)MeV. Cheng-Wei Chiang (Physics Letters B 767 (2017) 289) evaluated the reach of future experiments for the dark photon with vectorial couplings to the standard model fermions except for the neutrinos, and show that a great portion of the preferred 16.7-MeV dark photon parameter space can be decisively probed.


e+ 4 GeV 3.6 A
Belle II
New IR
e− 7 GeV 2.6 A
SuperKEKB
New beam pipe
& bellows
Add / modify RF systems
for higher beam current
Low emittance positrons
to inject
Positron source
Damping ring
New positron target /
capture section
Low emittance gun
Low emittance electrons
to inject


~ 7 m
~ 7.5 m
Belle II

REDTOP: Rare Eta Decays To Observe new Physics (experiments at Fermilab)

- REDTOP is a low-energy, fixed-target experiment in its proposal stage. It belongs to the High Intensity class of experiments, as it aims at detecting small variations from the Standard Model by studying a large sample of events produced with an intense beam. REDTOP scientists propose using a 1.8 GeV Continuous Wave (CW) proton beam impinging on a target made with 10 foils of a low-Z material (lithium or beryllium) to produce about 10^{13} η mesons in one year of running. The detector surrounding those targets will attempt to capture the decay products of the η mesons and, in particular, those that are either not expected or are suppressed up to the 10^{-11} level. Read a more detailed discussion of the physics processes of interest for REDTOP.



KLOE
HADES
KLOE
KLOE
BaBar
APEX
Test
PHENIX
A1
favored
NA48/2
DarkLight
E774
HPS
8Be
APEX
VEPP- 3
Mu3e
veto OFF
standard veto
veto on E_e+ + E_γ
LHCb
Belle- II
5ab-1
MMAPS
HPS
E141
ε2
m_A', [GeV]