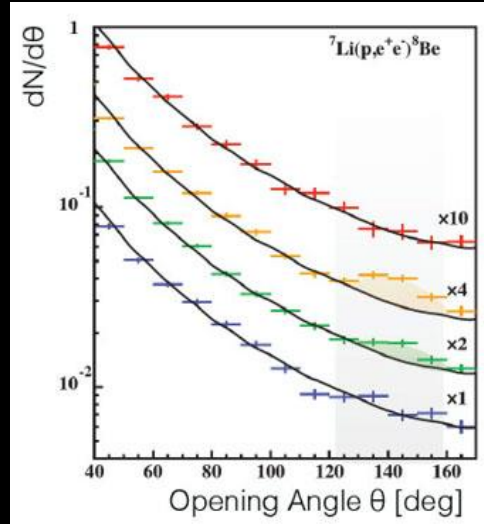
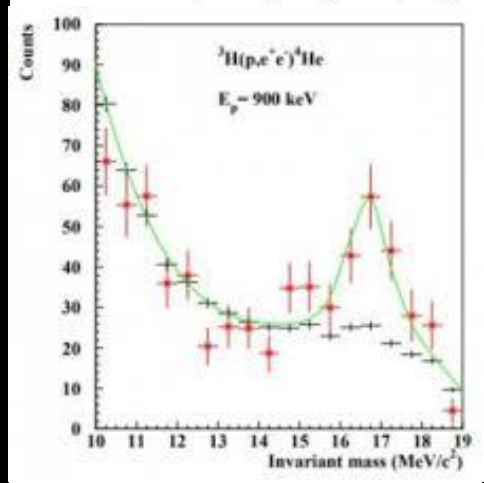
Update on the Montreal X17 Search Experiment

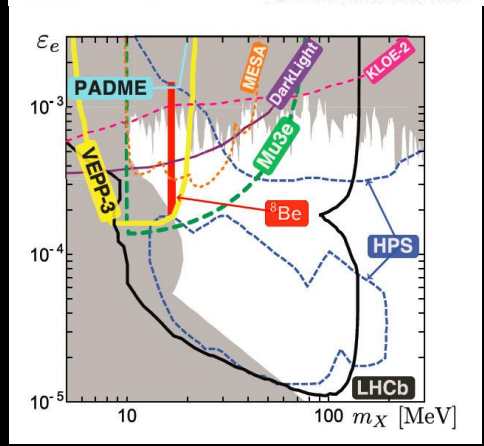
V. Zacek, Université de Montréal

- The ATOMKI Anomalies in ^{8}Be*, ^{4}He*, ^{12}C*
- The X17 boson & theor. interpretations
- Ongoing & planned verifications
- The X17 - project at U. of Montreal

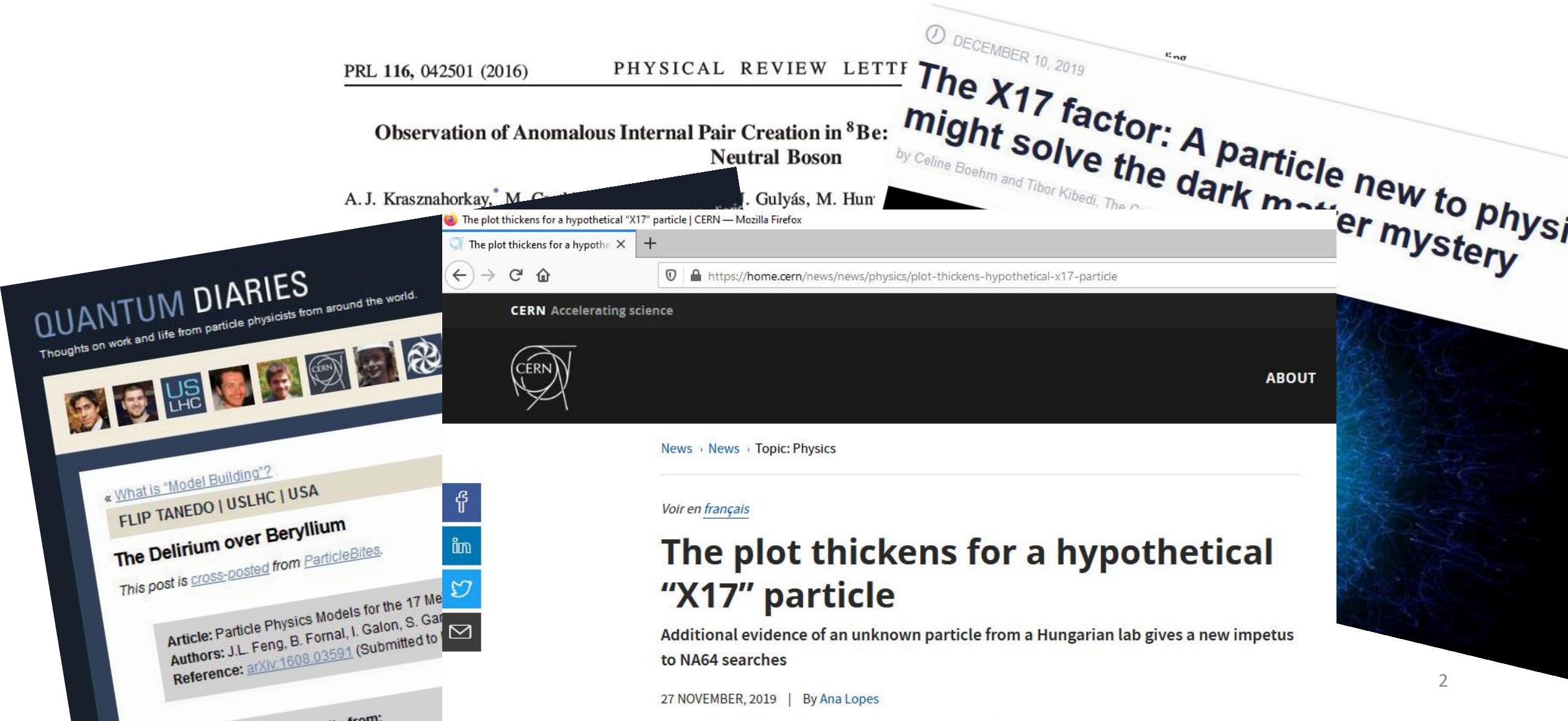
GUINEAPIG 2023 Workshop on Light Dark Matter
Université de Montréal, July 11 – 13, 2023



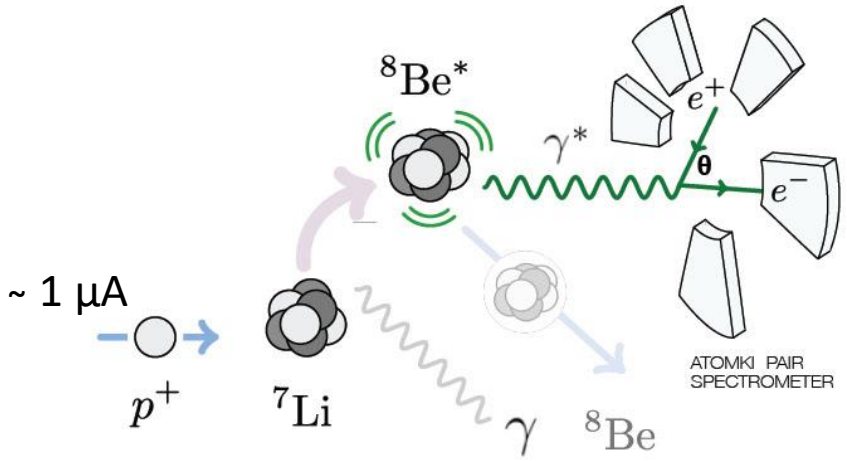


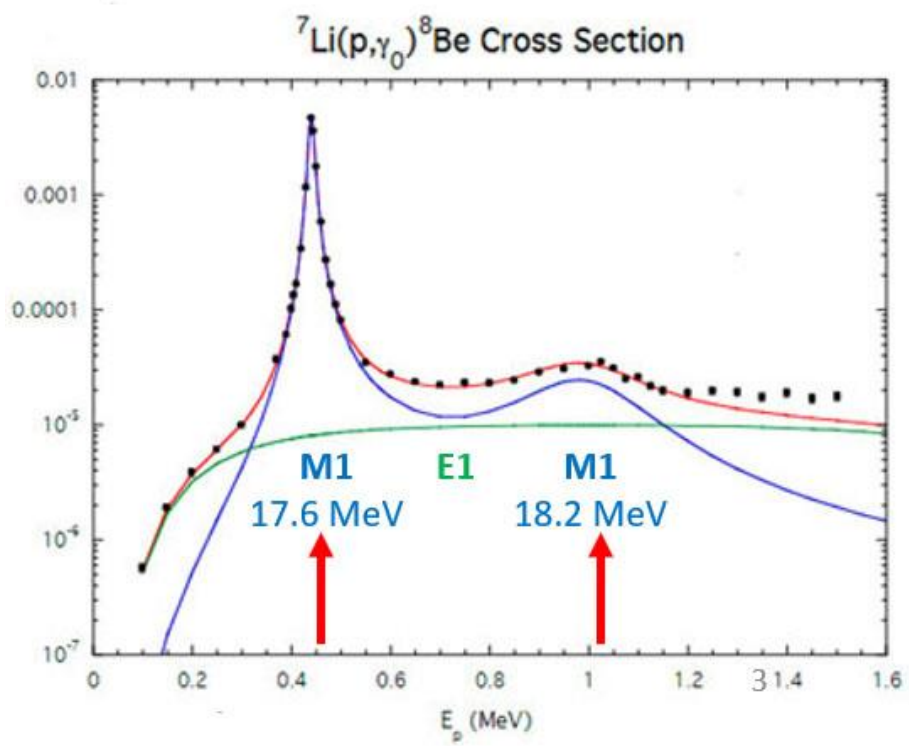


A 7σ Evidence for a New 17 MeV Boson?

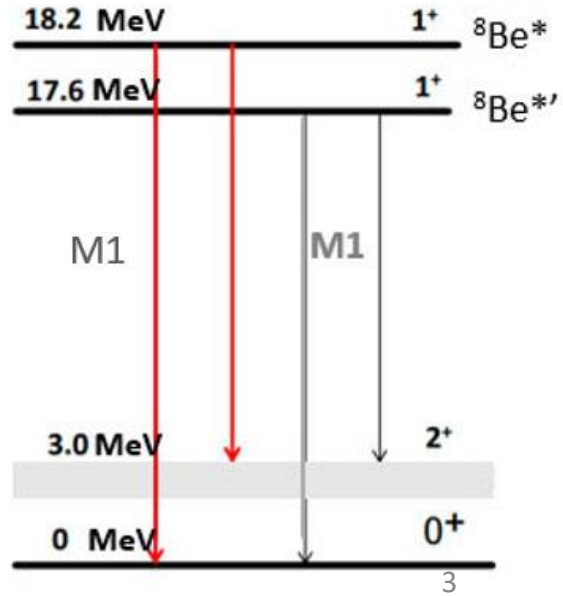


The ATOMKI Experiment!





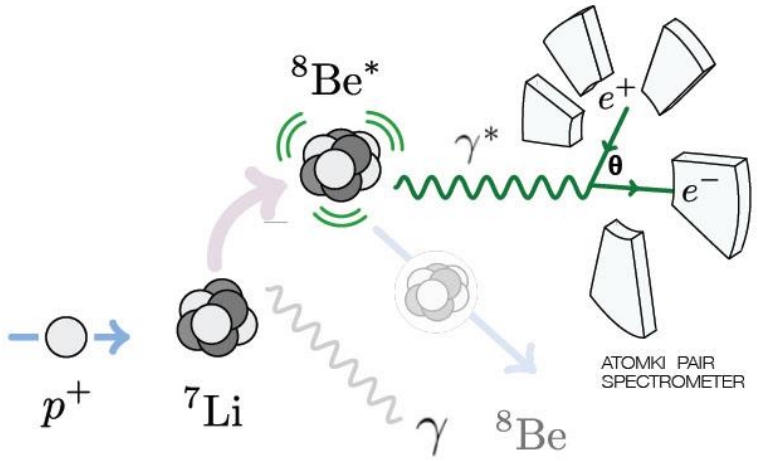
- Photo-production in ^{8}Be* via p +^{7}Li - reaction with high statistics
- Fraction of γ's converted into e^+e^- by Internal Pair Conversion (IPC)
- Measure angular distribution of e^+e^- pairs
- Photons produced on resonance (M1) & by direct rad. capture (**E1**)

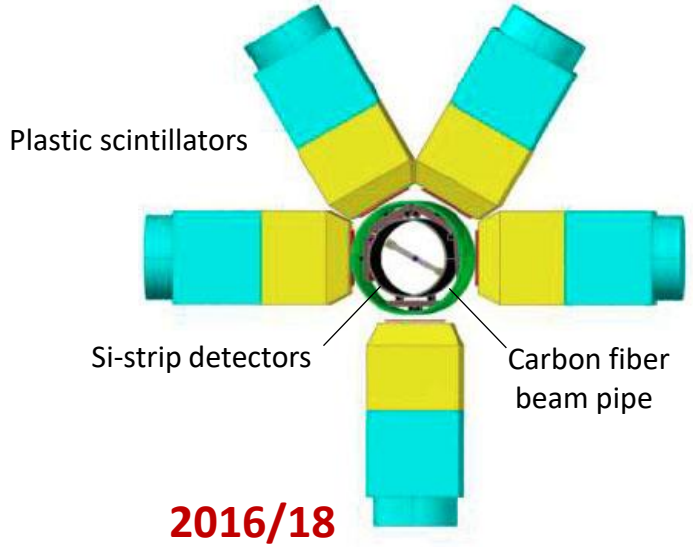


(Graphics J. Feng et al; arxiv:1707.09749)

A. J. Krasznahorkay et al.; *Phys. Rev. Lett.* **116** no. 4, (2016) 042501, arXiv:1504.01527 [nucl-ex].

The ATOMKI Experiment!





2016/18

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ATOMKI @ Institute for Nuclear Research, Debrecen, Hungary
2MV Tandetron

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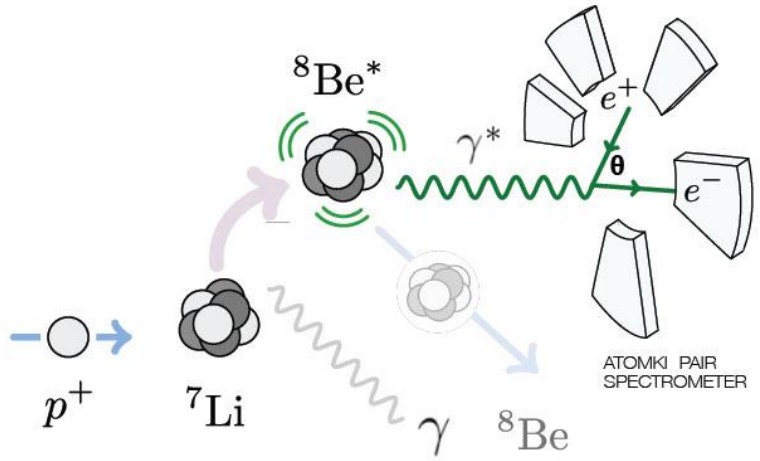

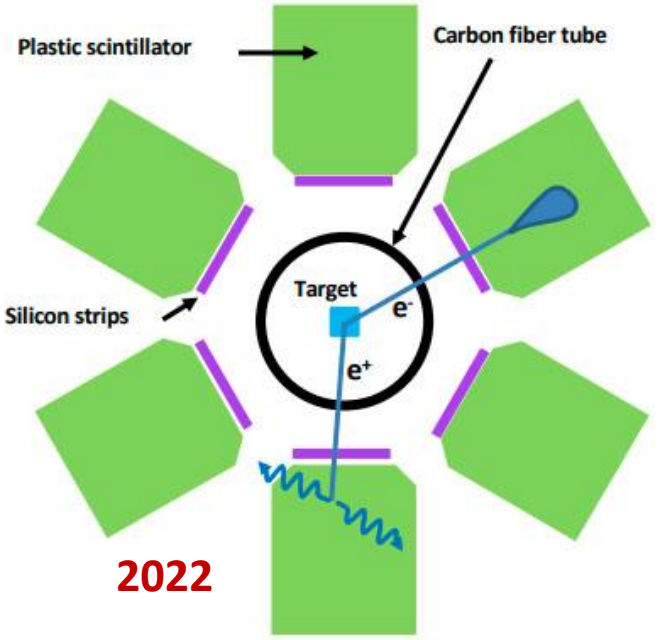

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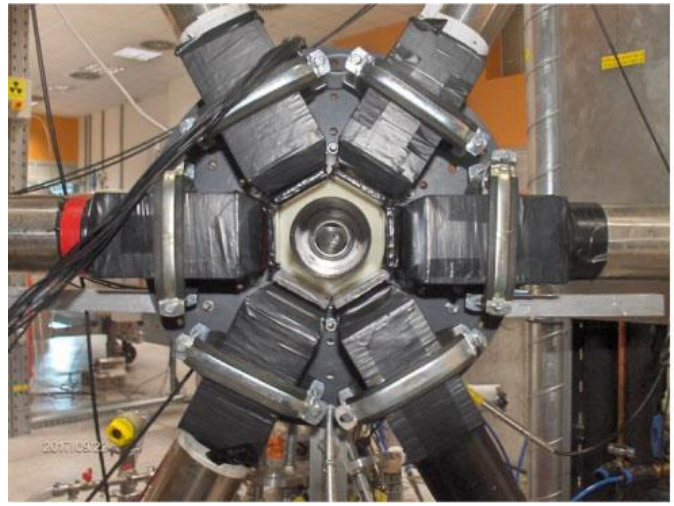

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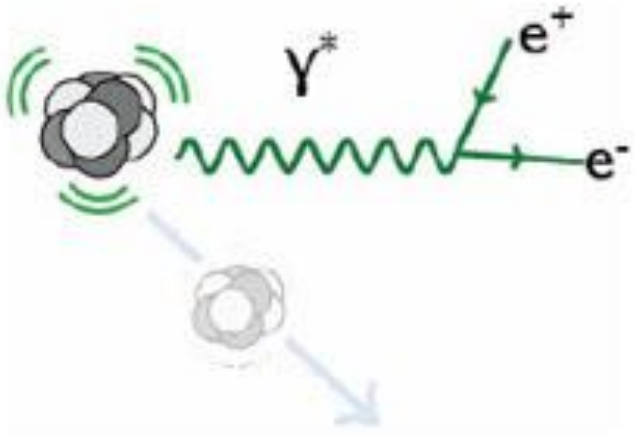
A. J. Krasznahorkay et al.; *Phys. Rev. Lett.* **116** no. 4, (2016) 042501, arXiv:1504.01527 [nucl-ex].

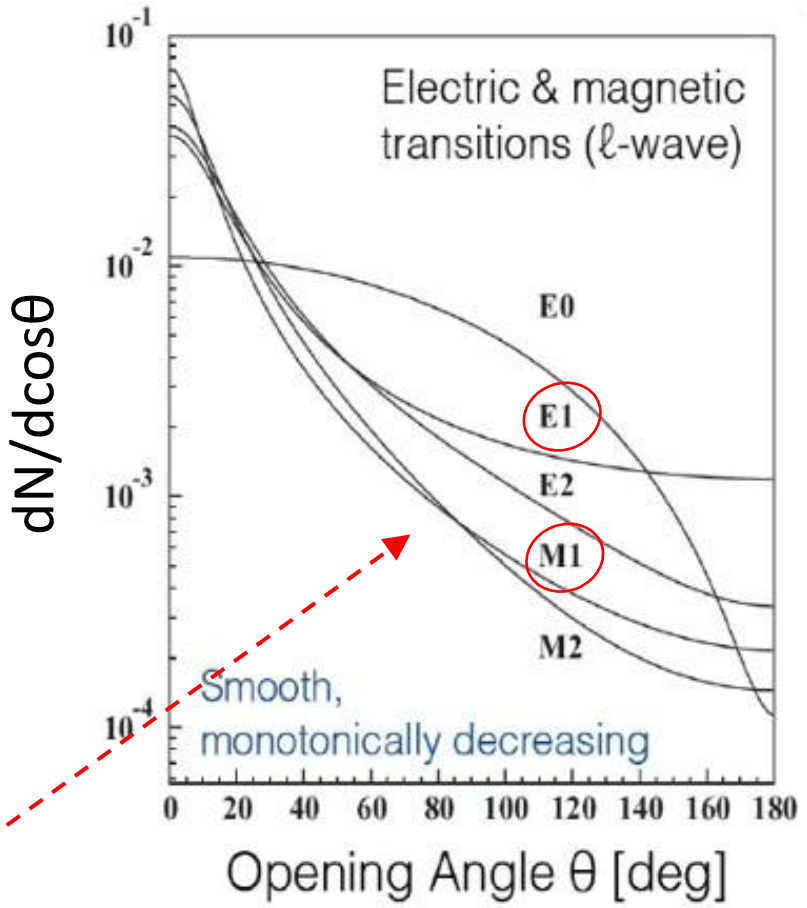
$^{8}Be^{*}$ - Decay and Internal Pair Creation (IPC)



- IPC - Branching ratio:

$$\frac{\Gamma[Be^{*} \rightarrow e^{+}e^{-}]}{\Gamma[(Be^{*} \rightarrow \gamma]} \approx \frac{\alpha}{\pi} \approx 4 \times 10^{-3}$$

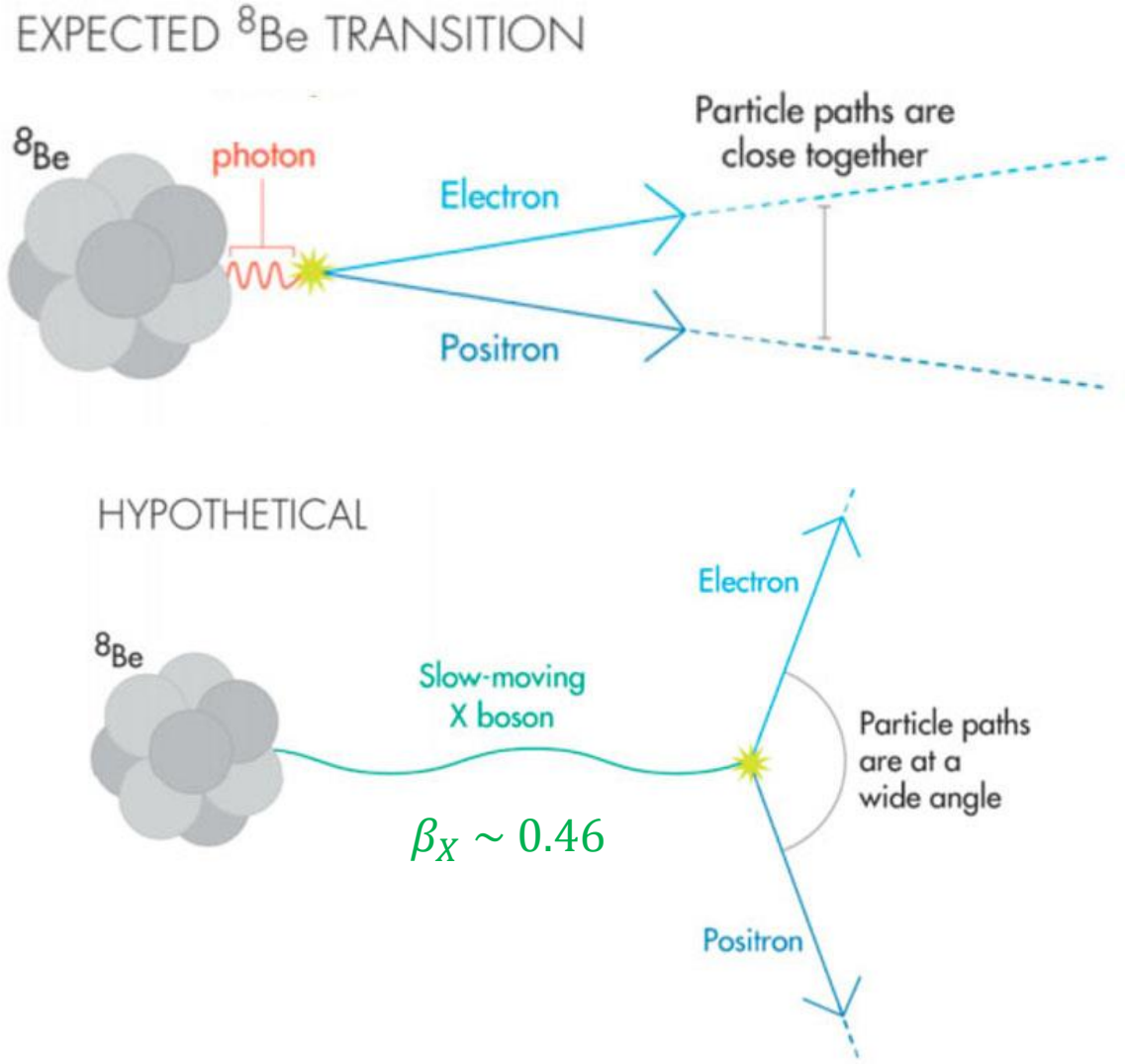
- dN/dθ decreases steadily with increasing θ



Gulyas et al.; http://arxiv.org/abs/1504.00489v1

M.E. Rose, PR 76.678 (1949)

^{8}Be* - A Particle Physics Lab ?

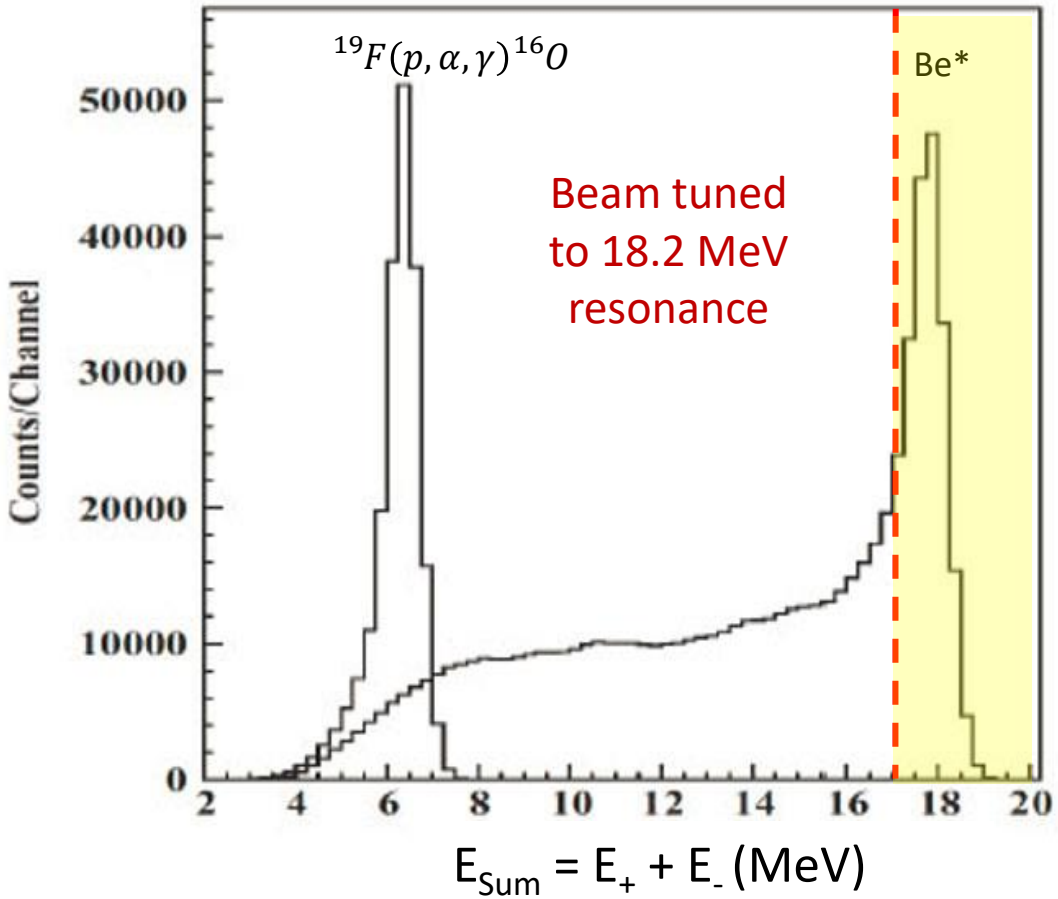


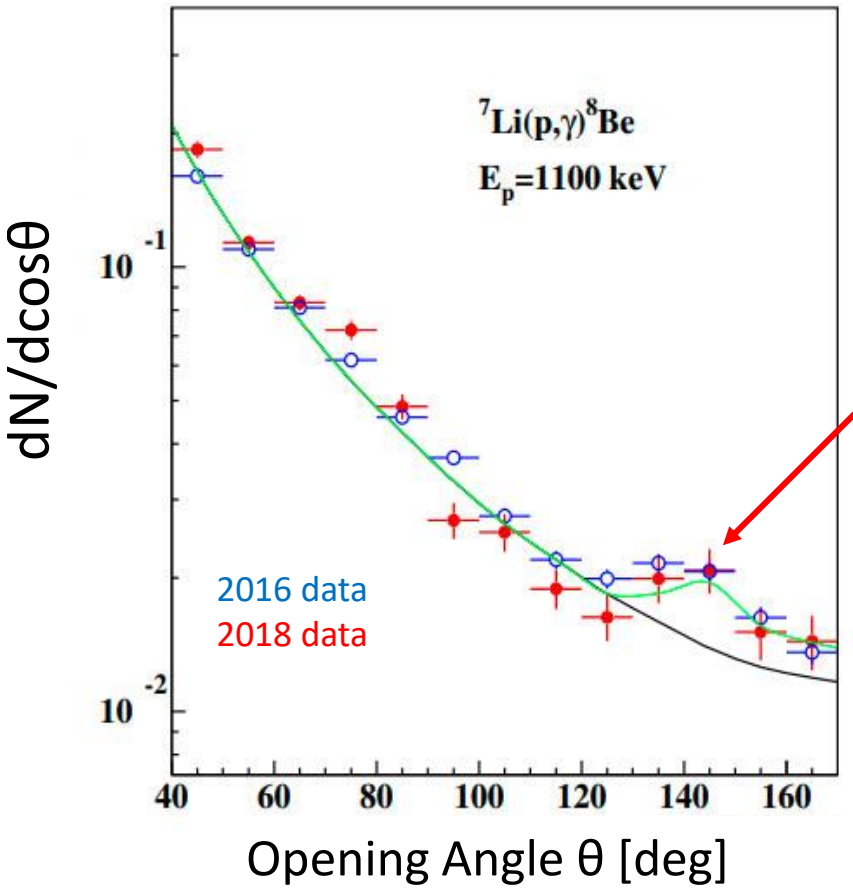
Promising environment to search for new physics at MeV-scale !

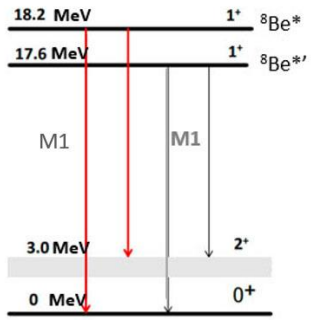
….complementary to accelerator and astroparticle searches

A. J. Krasznahorkay et al.; *Phys. Rev. Lett.* **116** no. 4, (2016) 042501
A. J. Krasznahorkay et al.; Acta Physica Polonica B, Vol.50 (2019)

The ATOMKI ^{8}Be* - Experiment 2016/18







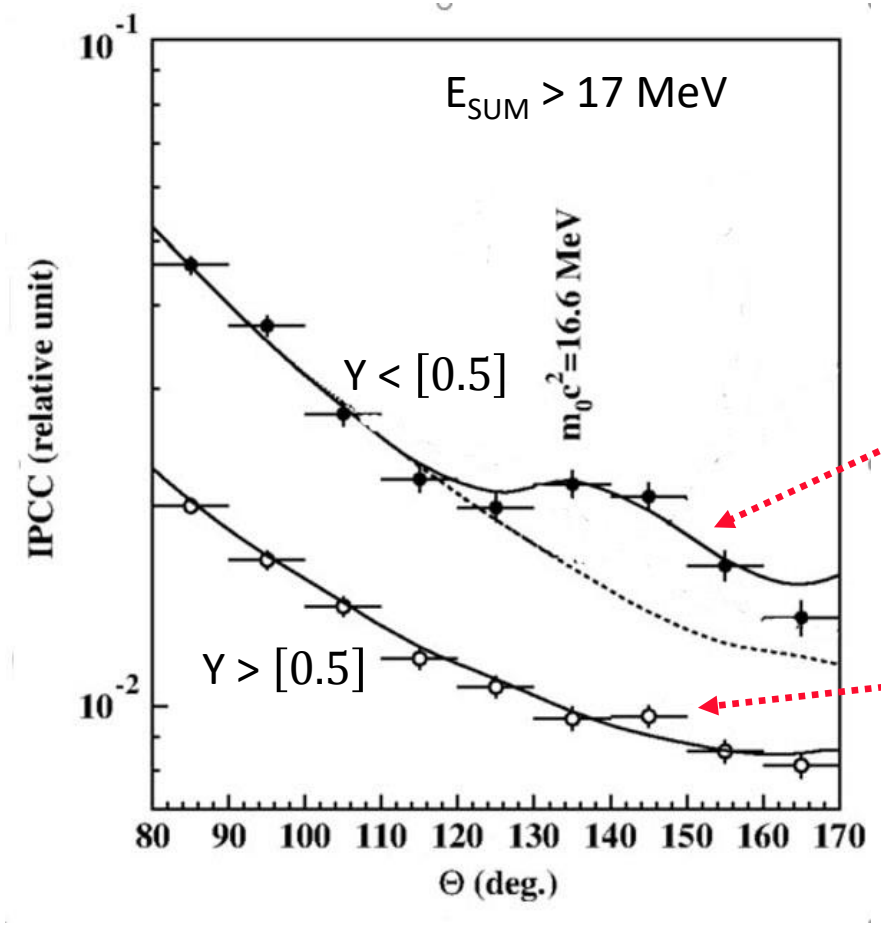
The Anomaly!

$$\frac{\Gamma(^{8}Be \rightarrow {}^{8}Be\,X)}{\Gamma(^{8}Be \rightarrow {}^{8}Be\,\gamma)} = 5.6 \times 10^{-6}$$

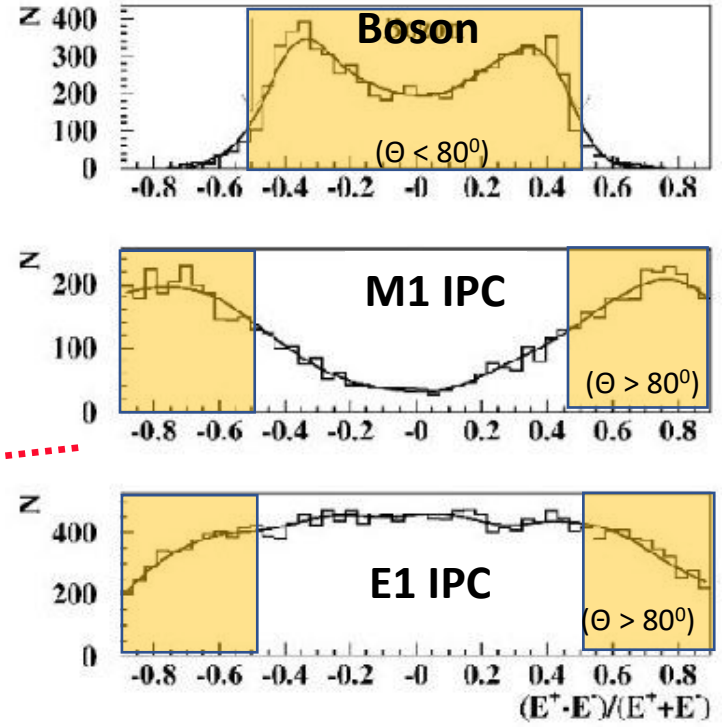
Scale of coupling ε ~ 10^{-3} times electric → BSM !

The ATOMKI ^{8}Be* - Experiment 2016/18

An important variable: the energy asymmetry

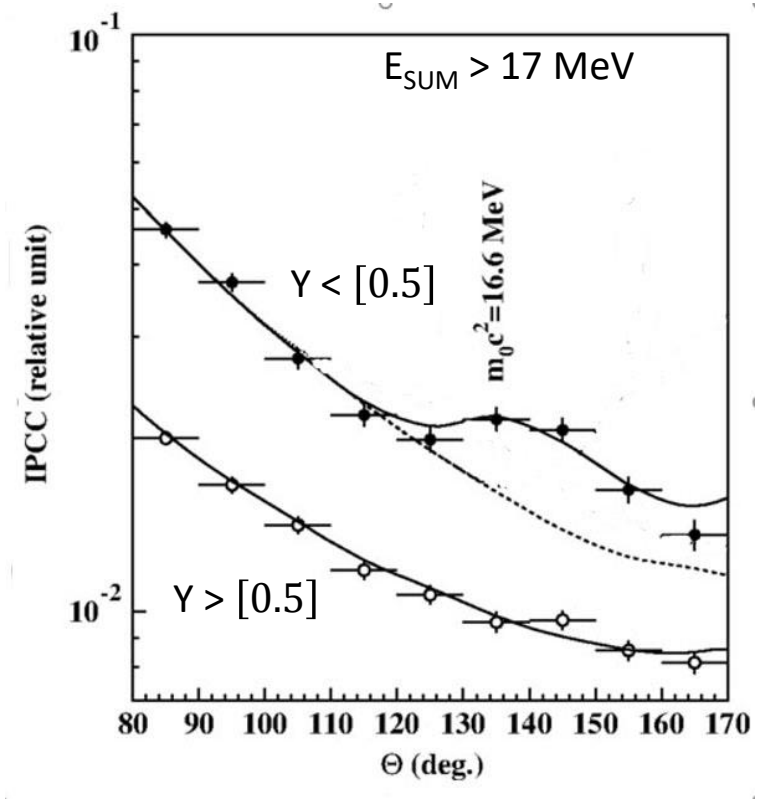


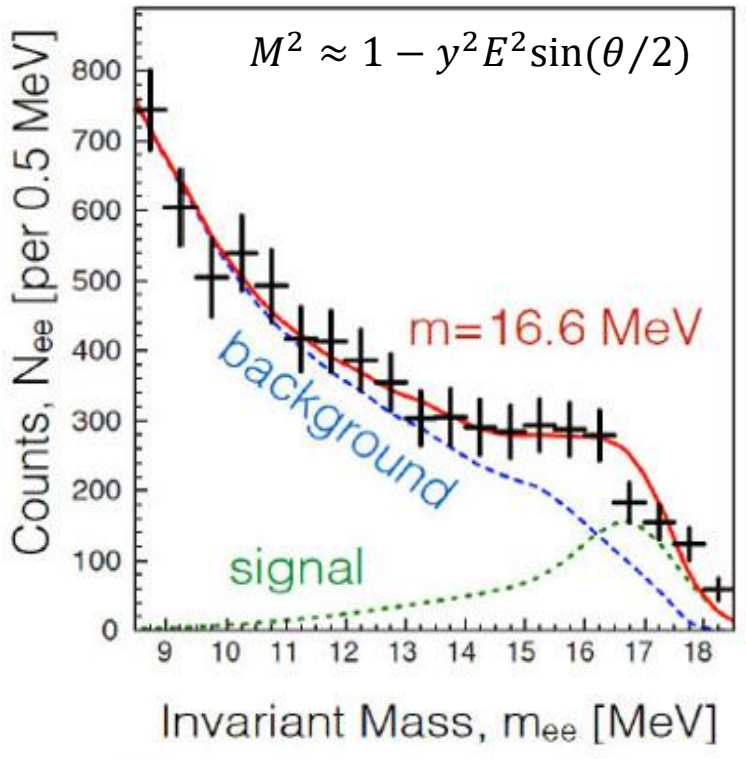
$$y = \frac{E^+ - E^-}{E^+ + E^-}$$



Asymmetry consistent with the decay of a new particle

The ATOMKI ^{8}Be* - Experiment 2016/18



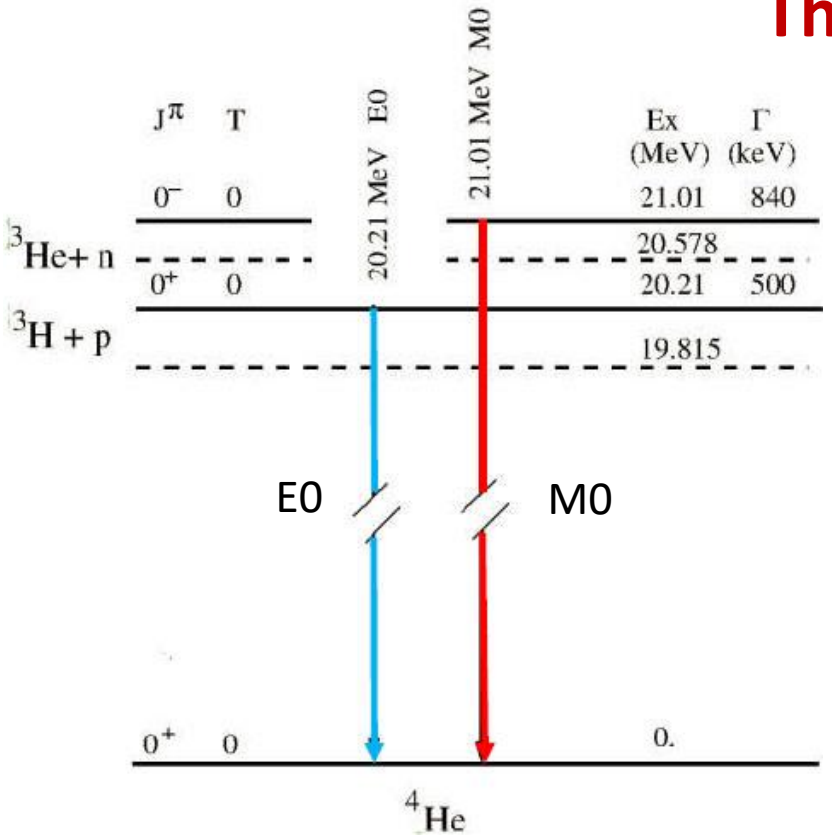


Opening angle, asymmetry and invariant mass consistent with decay of a new particle

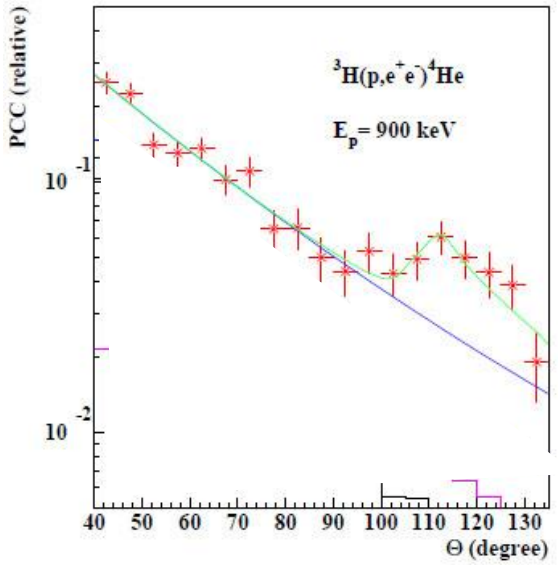
M_X = 16.7 ± 0.35 (stat) ± 0.5 (sys) MeV

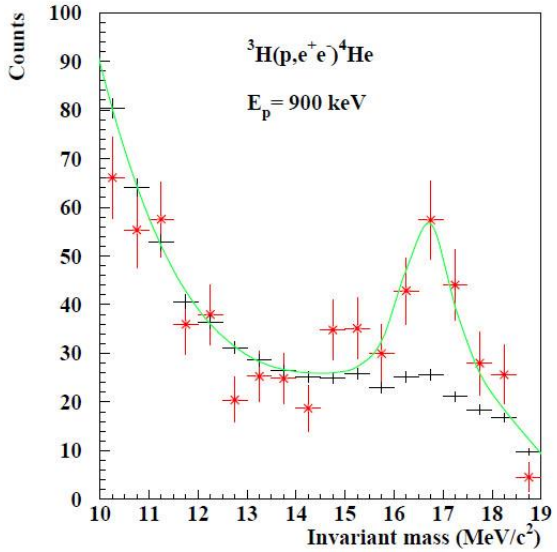
A. J. Krasznahorkay et al.; *Phys. Rev. Lett.* **116** no. 4, (2016) 042501

The ATOMKI ^{4}He* - Experiment 2019



Capture via: $p + {}^3H \rightarrow {}^4He^*$
into overlapping 0^+ & 0^- states





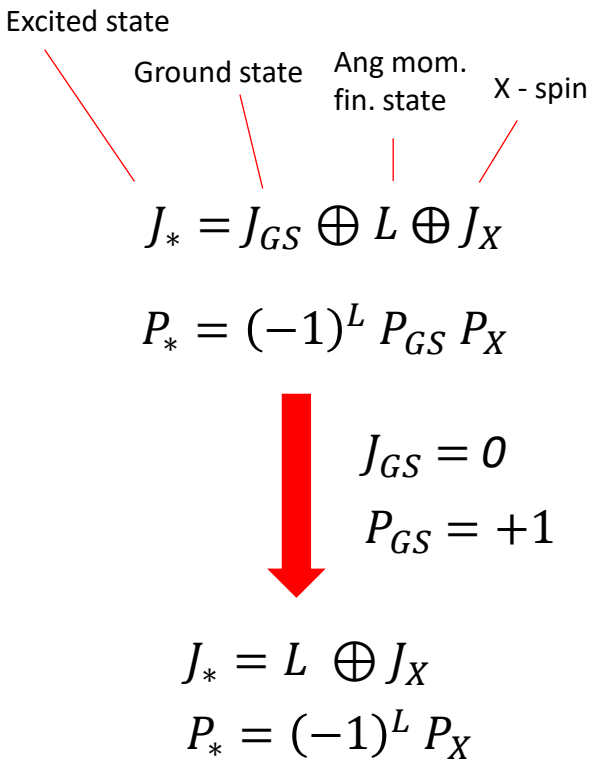
Recently confirmed at 3 different beam energies arXiv:2104.10075

Opening angle and invariant mass consistent with decay of new particle as in Be*

M_X = 16.98 ± 0.16 (stat) ± 0.2 (sys) MeV

A. J. Krasznahorkay et al., arXiv:1910.10459v1

….what Particle could it be?



Transition	Vector $(J_X^\pi = 1^-)$	Axial vector $(J_X^\pi = 1^+)$	Scalar $(J_X^\pi = 0^+)$	Pseudo scalar $(J_X^\pi = 0^-)$
^{8}Be: 1^+ 0^+ M1-IS	L=1	L=0,2		L=1
^{8}Be: 1^+ 0^+ M1-IV	L=1	L=0,2		L=1
^{4}He: 0^- 0^+ M0		L=1		L=0
^{4}He: 0^+ 0^+ E0	L=1		L=0	
^{12}C 1^- 0^+ E1	L=0,2	L=1	L=1	

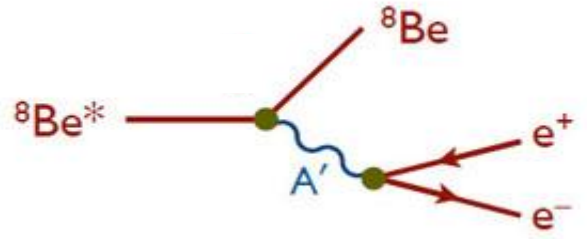
- But for AV theory predicts for Be/He widths differing by factor 10^2, maybe uncertainty in nuclear matrix el. ?

J. L. Feng, et al, *Phys.* arXiv:2006.01151 [hep-ph].

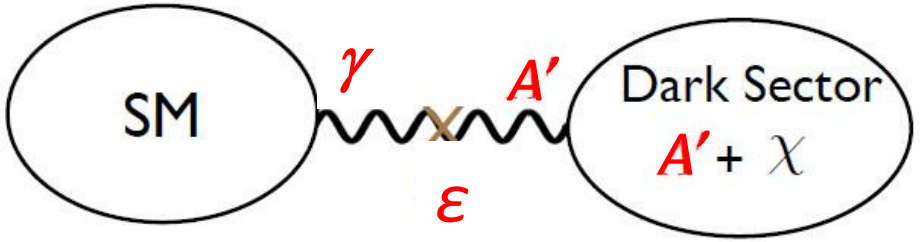
- Also PS (0^-) difficult to reconcile w. Be & He
- ^{12}C also interesting….see later & if seen then PS excluded

X17 with $J^\pi = 1^{+/-}$ could fit the bill!

Maybe a Dark Photon A' ($J^{\pi} = 1^{-}$) ?



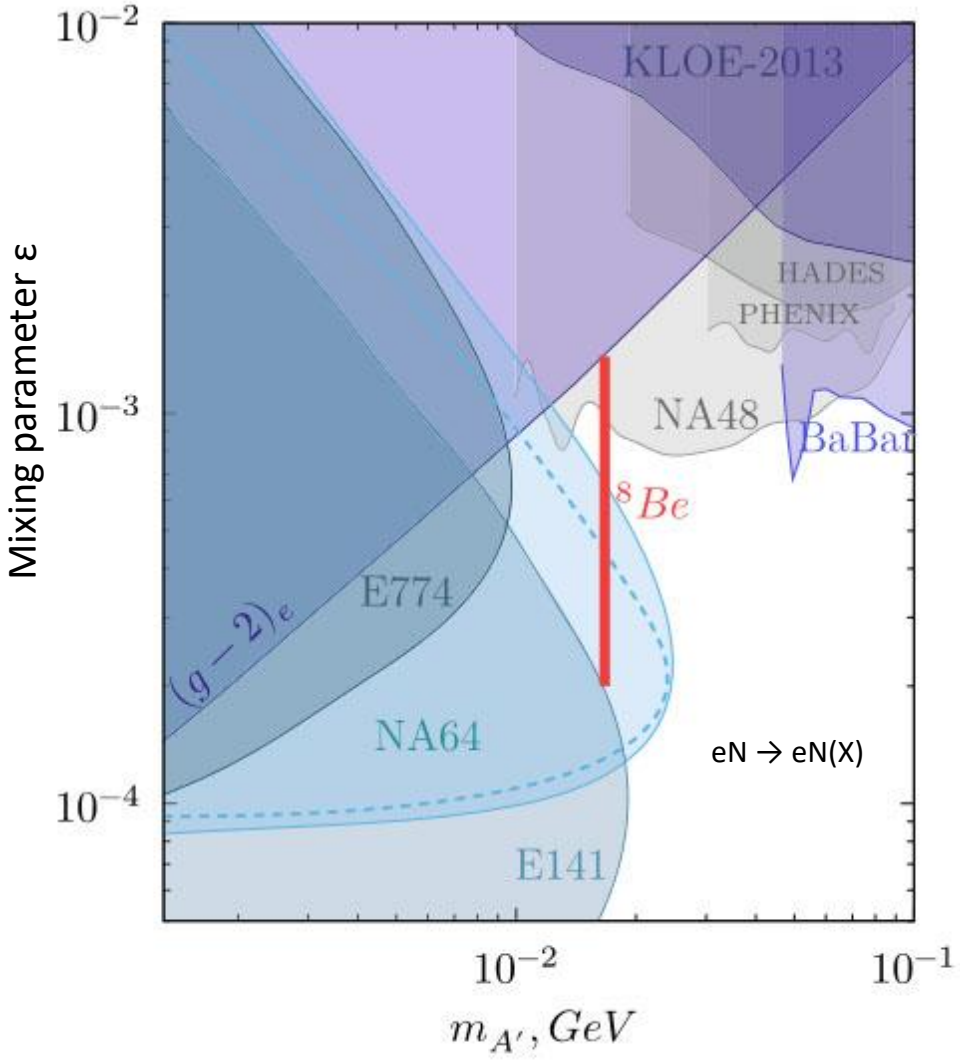
- Interaction with ord. matter mediated by "dark " A'
- Gauge boson A' mixes kinetically with γ and $\varepsilon \sim 10^{-3}$
- A' coupling to SM – particles prop. to ε and SM charges: $\varepsilon e Q_f$
- Vector mediator decays to low mass WIMPs



But…..

But ….it cannot be the Standard Dark Photon

J. L. Feng, et al, *Phys.* arXiv:2006.01151 [hep-ph].



Na64 Eur. Phys. J. C (2020) 80:1159

The anomaly in Be & He could be explained by a "proto-phobic" vector gauge boson with:

Hadronic couplings:

$\varepsilon_u \approx \pm 3.7 \times 10^{-3}$

$\varepsilon_d \approx \mp 7.4 \times 10^{-3}$

$\boldsymbol{\varepsilon_d \approx -2 \times \varepsilon_u}$

Range ≈ 12 fm → Looks like a force!

Proto-phobic: $\left|\frac{\varepsilon_p}{\varepsilon_n}\right| < 8\%$

Similar coupling as for Z° at low energy (7%)

J. L. Feng, *Phys. Rev.* **D95** no. 3, (2017) 035017, arXiv:1608.03591 [hep-ph].

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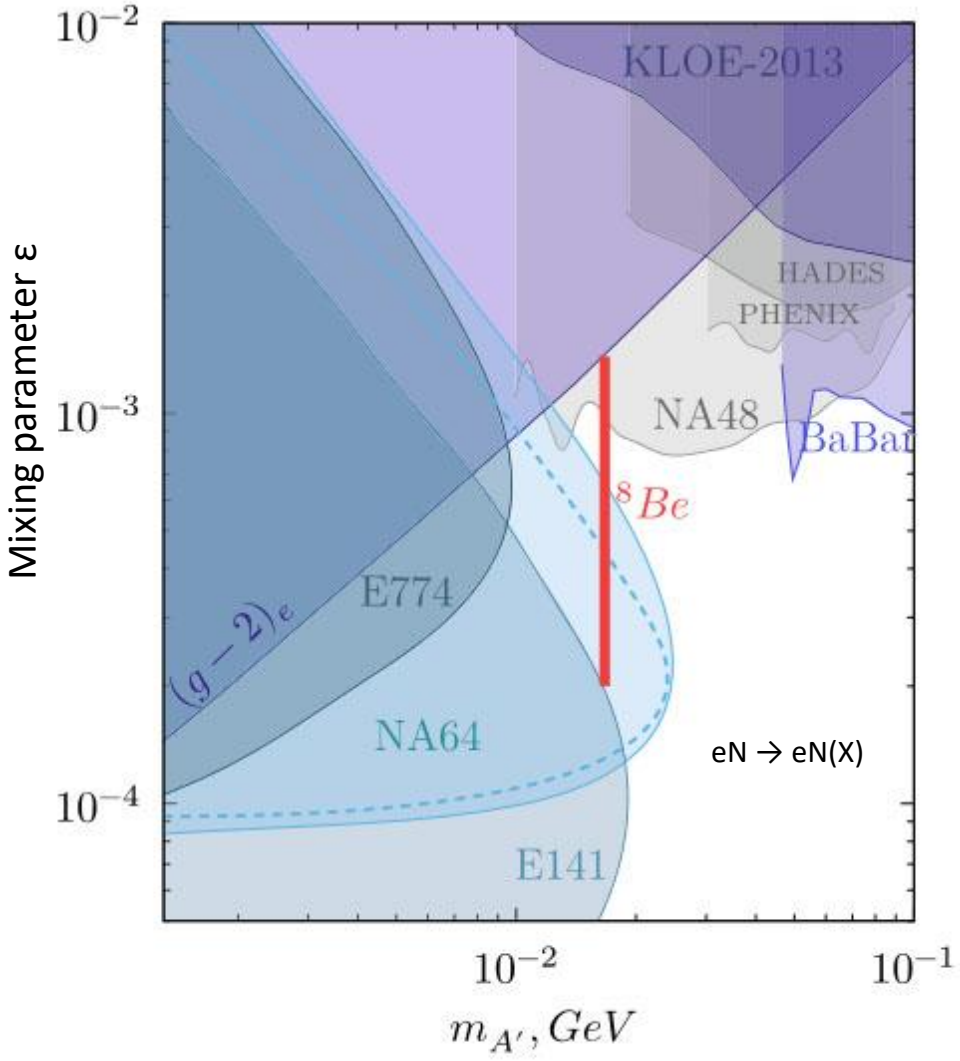
J. L. Feng, et al, *Phys.* arXiv:2006.01151 [hep-ph].



Na64 Eur. Phys. J. C (2020) 80:1159

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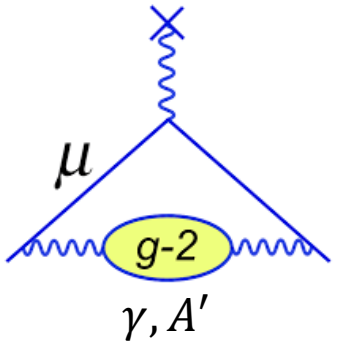
Leptonic couplings:

$$\sqrt{\varepsilon_e \varepsilon_\nu} \leq 7 \times 10^{-5}$$

$$2 \times 10^{-4} \leq |\varepsilon_e| \leq 10^{-3}$$ — (ν – e scatt.)

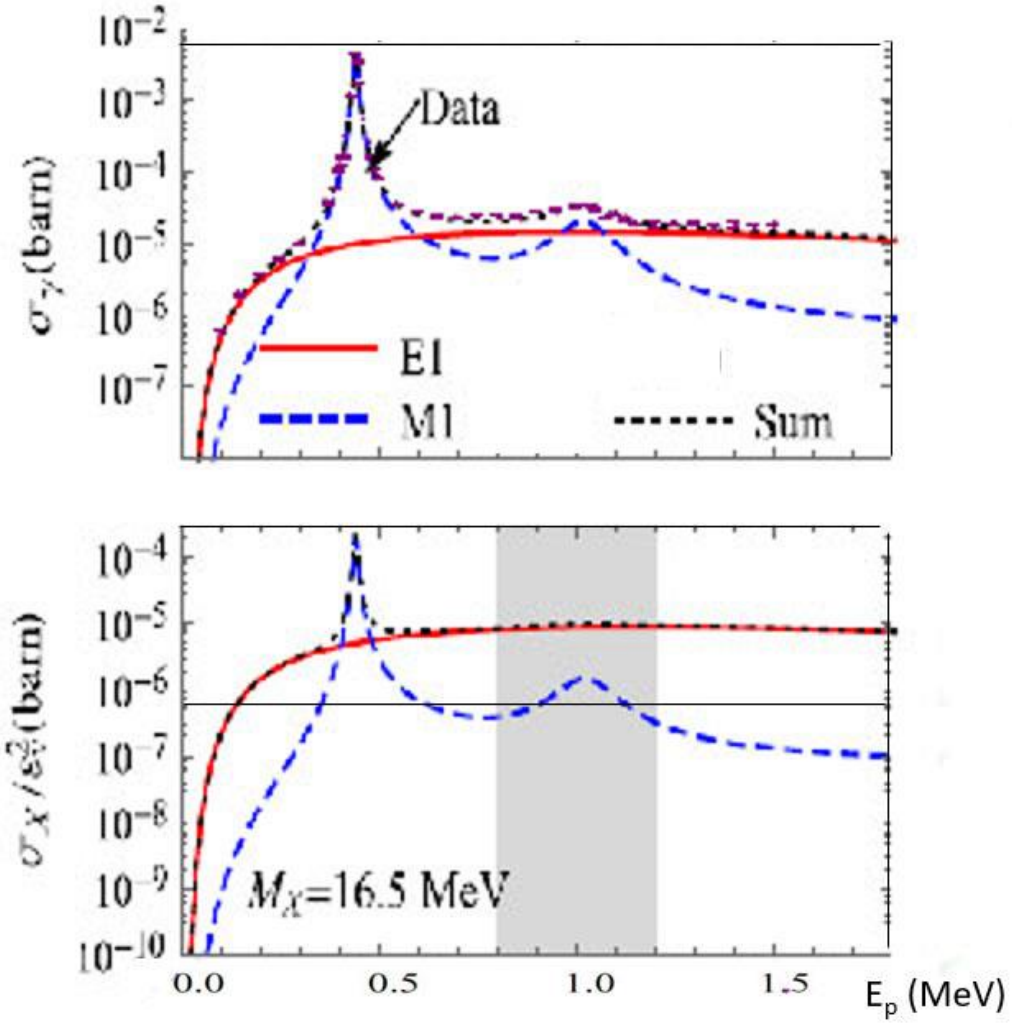
Range ≈ 12 fm

These lepton couplings could also resolve the (g_μ – 2) anomaly!



J. L. Feng, *Phys. Rev.* **D95** no. 3, (2017) 035017, arXiv:1608.03591 [hep-ph].

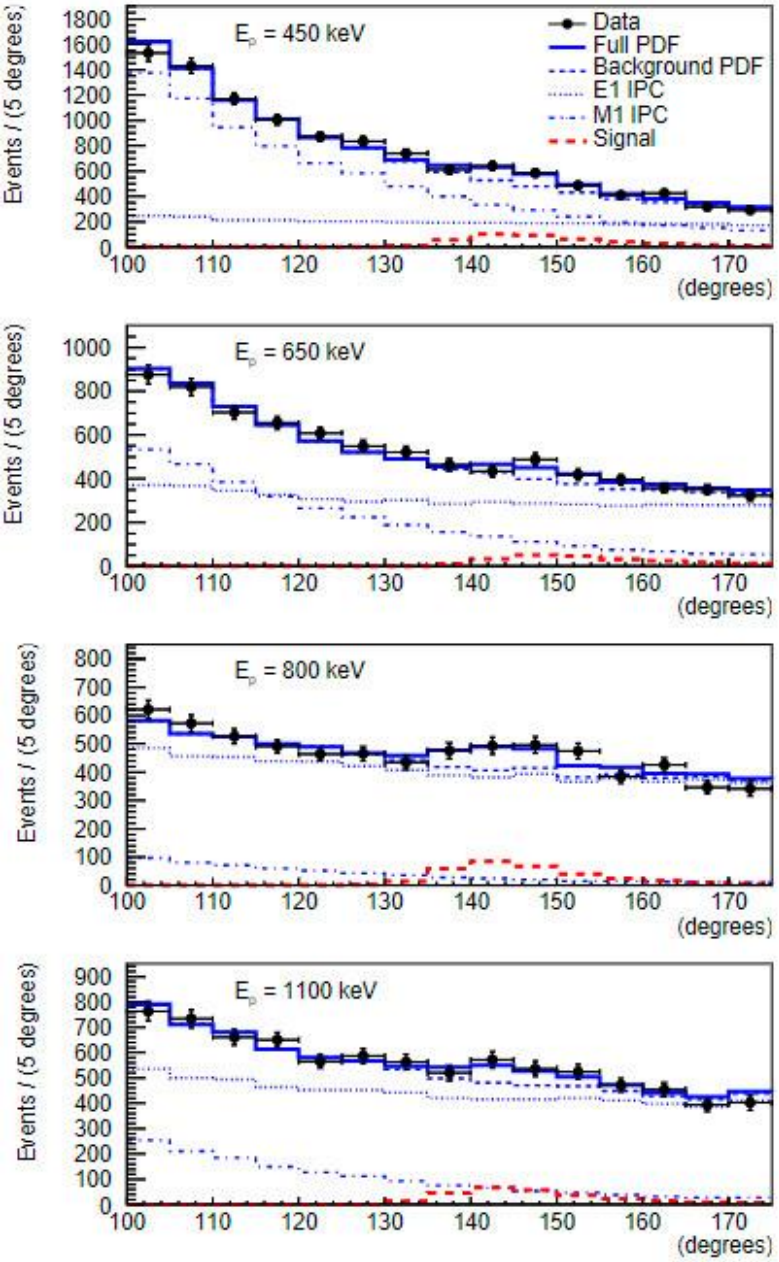
…..Recent Theoretical Insight (2021 +)



- If X17 protophobic, then its production in Be should be dominated by direct capture E1 transitions for all beam energies above the 17.6 MeV resonance!
  (X. Zhang, G.A. Miller - Physics Letters B 813 136061 (2021))

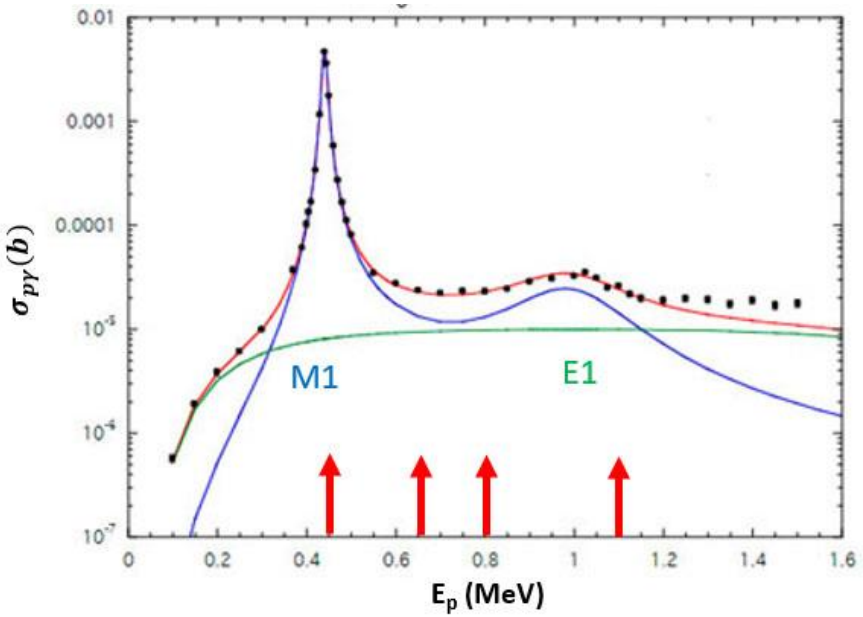
- BTW: Also in ^{4}He expect E1 direct capture contribution
  (M. Viviani et al. - Phys. Rev. C105,014001 (2022)

ATOMKI ^{8}Be* Off - Resonance Results (2022)



N.J. Sas et al. arXiv: 2205.07744

- Protons @ 450, 650, 800, 1100 keV
- Peaks around 140^0 correlate w. E1 contribution, rather not w. M1



Ep (keV)	m_0c^2(X17) (MeV)	E1/M1	X17/E1
450	16.6(3)	0.04	0.14(16)
650	16.94(14)	0.14	0.05(3)
800	16.81(9)	1.05	0.053(14)
1100	17.11(12)	0.44	0.041(13)

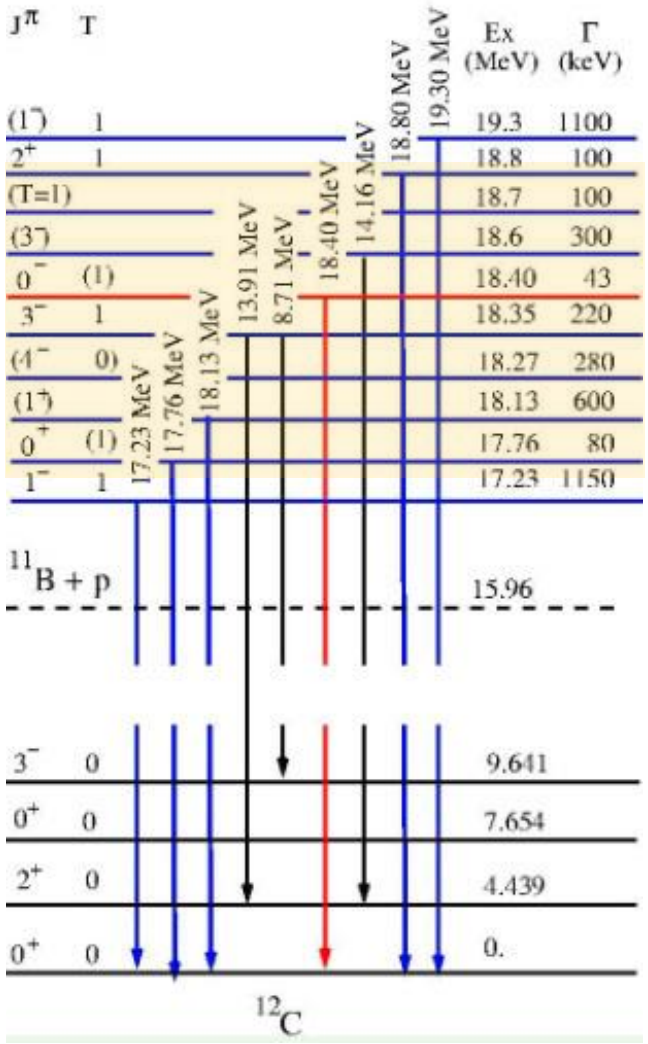
X17: protophobic V/AV boson?

…at variance with 2016/18 data, but maybe explained by a better understanding of target & bckg effects?

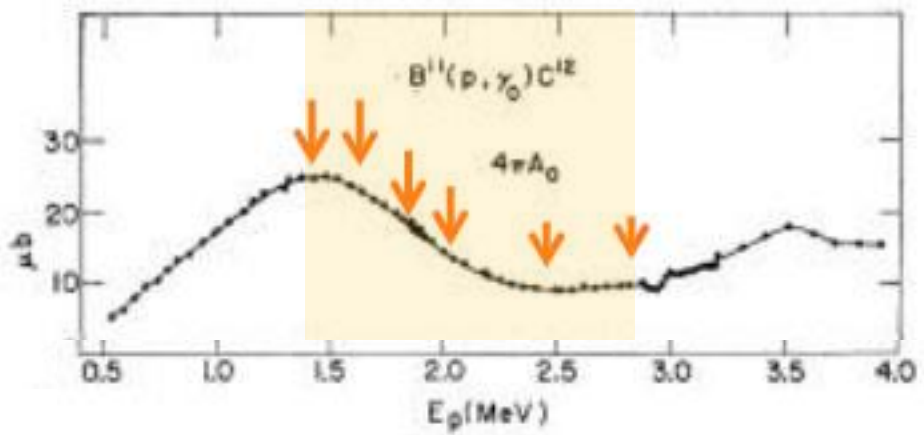
A. J. Krasznahorkay, TRIUMF Workshop '22 https://meetings.triumf.ca/event/262/timetable/#20220525and

ATOMKI $^{11}B(p,e^+e^-)^{12}C^*$ (2022)

Suggested by J. Feng et al., Phys. Rev. D102, 036016 (2020)

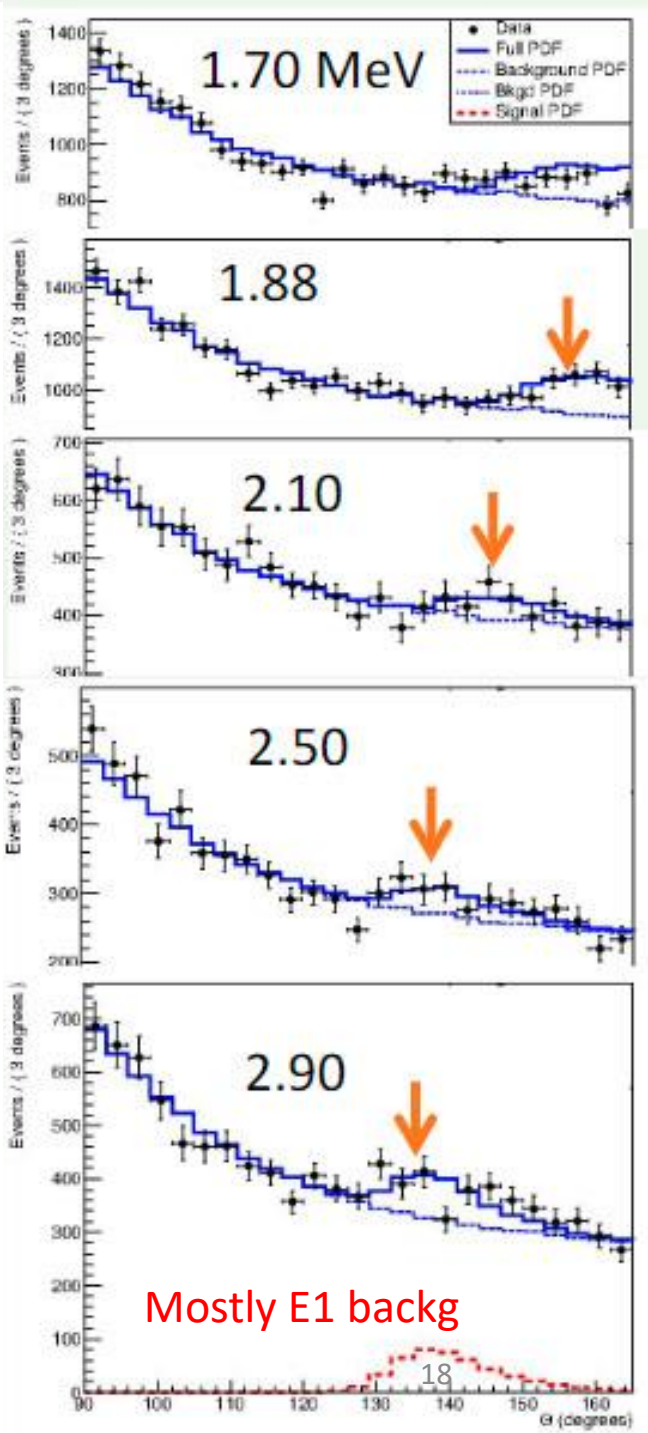


E1 IPC following radiative capture?



X17 branching ratio relative to E1 contribution appears constant

Average mass 16.88 (0.15 MeV)
…PS (0^-) ruled out



A.J. Krasznahorkay, TRIUMF Workshop '22 https://meetings.triumf.ca/event/262/timetable/#20220525
A. J.Krasznahorkay et al; Arxiv 2205.7744

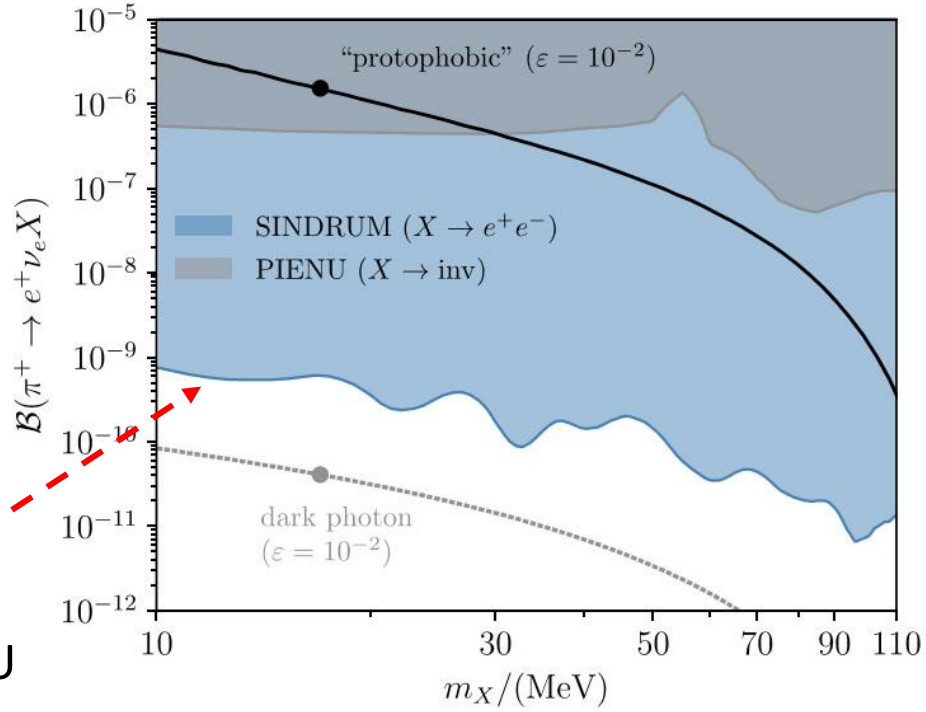
Most Recent Theoretical Insight (2023)

- AV (1^+) can explain Be/He
- Tension with ^{12}C, but matrix el. unknown
- Compatible with $(g-2)_\mu$ and KTEV anomaly $(\pi^+ \to e^+e^-)$

D. Barducci, C. Toni (arXiv:2212.06453v June 2023)*:

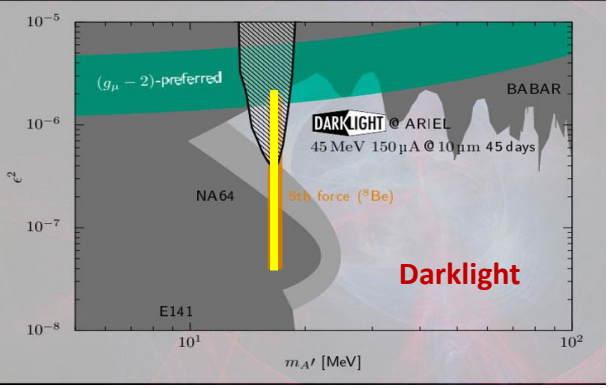
- Protophobic V (1^-) excluded by limits on $\pi^+ \to e^+\nu_e X$
- V (1^-) coupling in Be/He in 4σ tension w. ^{12}C
- AV (1^+) remains, but strongly constrained by SINDRUM, PIENU
- Large uncertainties in AV nuclear matrix elements

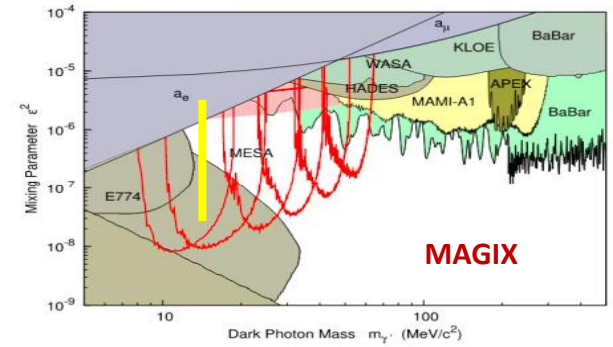
M. Hoster, M. Pospelov (arXiv:2306.15077 June 2023):

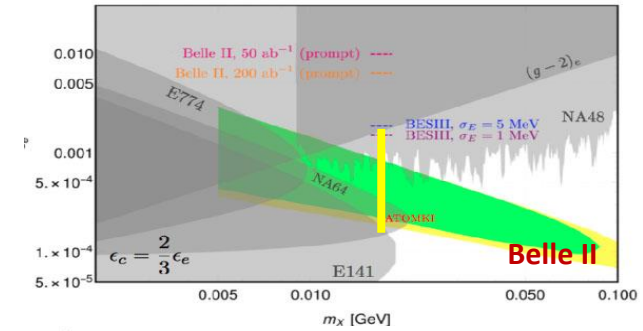


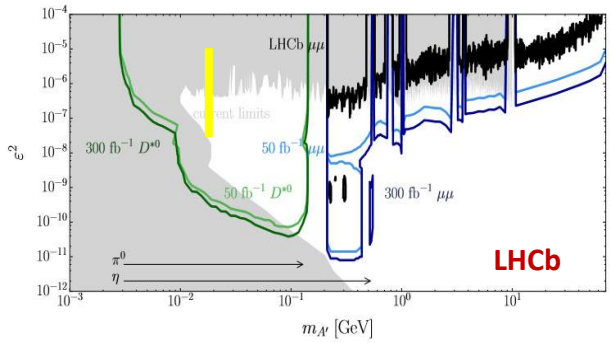
Independent exp. verification needed!

*Pure AV also proposed in by J. Kozaczuk, D.E. Morrissey,S. R. Stroberg arXiv:1612.01525v2 2016



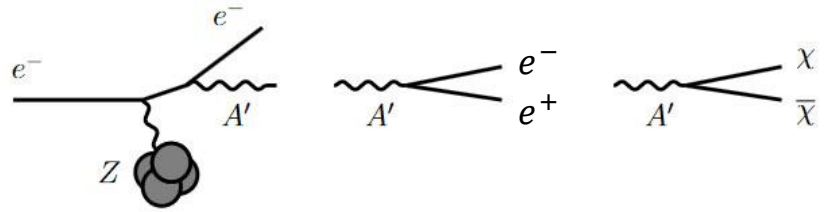






Where Else Can We look?

Dark photon searches @ accelerators and beam dumps



Darklight @ Ariel, TRIUMF 30 MeV 2023; 45 -50 MeV 2024

JlabX17@Jefferson L., 2 – 3 GeV e^- ; > 2023

MAGIX@ MESA, Mainz - operates > 2024/25

LDMX@JLAB/SPS? - operates > 2024, statistics!

NA64 @CERN/SPS – needs detector upgrade, statistics!

PADME@Frascati - to reach sensitivity needs modif.

…also

Belle II: $D^{+*} \rightarrow D^+ + A'$; $A' \rightarrow e^+e^-$; statistics! >2025

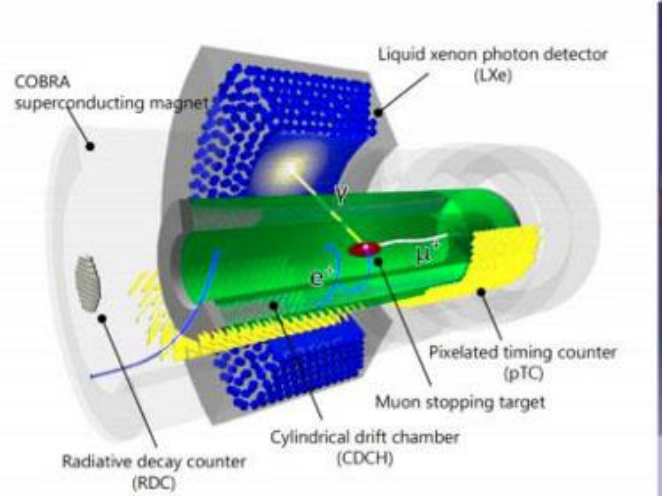
LHCb: ; $D^{0*} \rightarrow D^0 + A'$; $A' \rightarrow e^+e^-$ after upgrade 2025

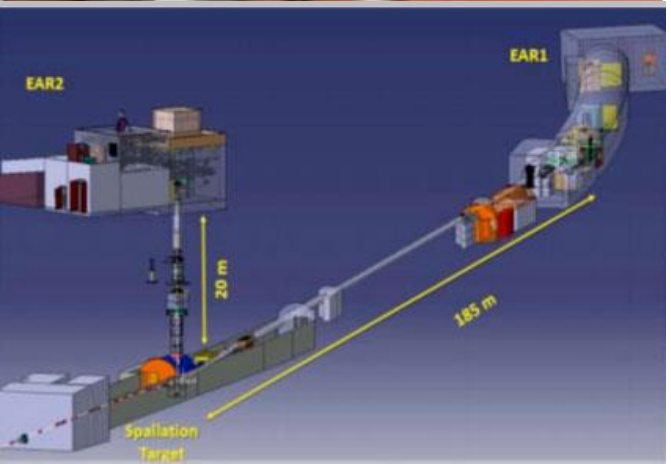
MAGIX: $\gamma d \rightarrow pn + A'$ → e^+e^- > 2024/25

Window of opportunity for fast moving new intitatives !

Other Ongoing Efforts

Nuclear physics verifications





MEGII @PSI
$^{7}Li(p, X17)\ ^{8}Be$
MeV Cockroft Walton
Tracking DCH, LXe
Taking data

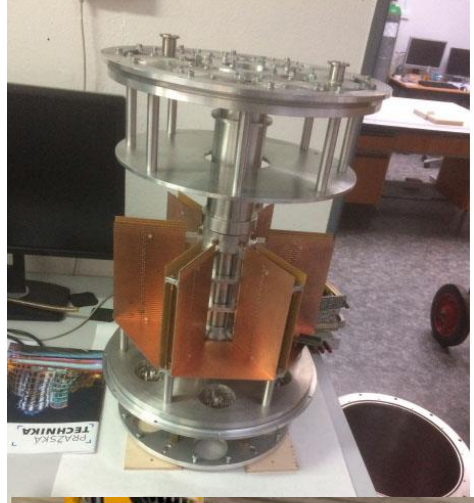
NUCLEX @ LNGS
$^{3}H(p, X17)\ ^{4}He$
I_p = 100 μA
Dedicated detector
LoI 2022

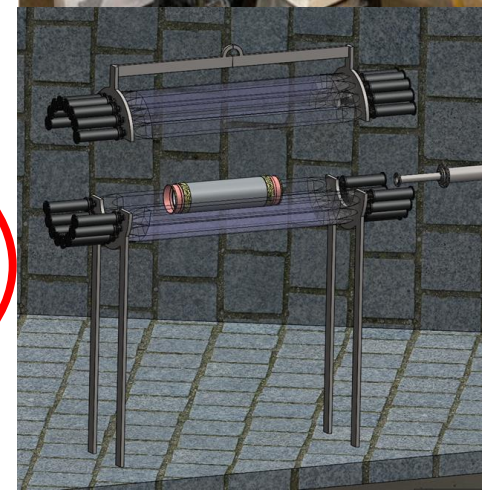
N_Tof @ CERN
$^{3}He(n, X17)\ ^{4}He$
Pulsed n- beam
Dedicated detector
LoI 2022

COPE @ IEAP – CTU Prague
$^{7}Li(p, X17)\ ^{8}Be$
2.5 MeV Van de Graaff
Mag. spectrometer ATOMKI → IEAP
Vertexing with Timepix 3

NewJedi @ IJCLab, GANIL, Ithemba
$^{7}Li(p, X17)\ ^{8}Be$; $^{3}H(p, X17)\ ^{4}He$
Vertexing w. DSSSDs;
E- plastic scints.
Ongoing

Project X17 @ U. Montreal
$^{7}Li(p, X17)\ ^{8}Be$;
$^{7}Li(\ ^{3}He, X17)^{10}B$
DAPHNE vertex chamber;
E- plastic scints 0.95 4π
Ongoing

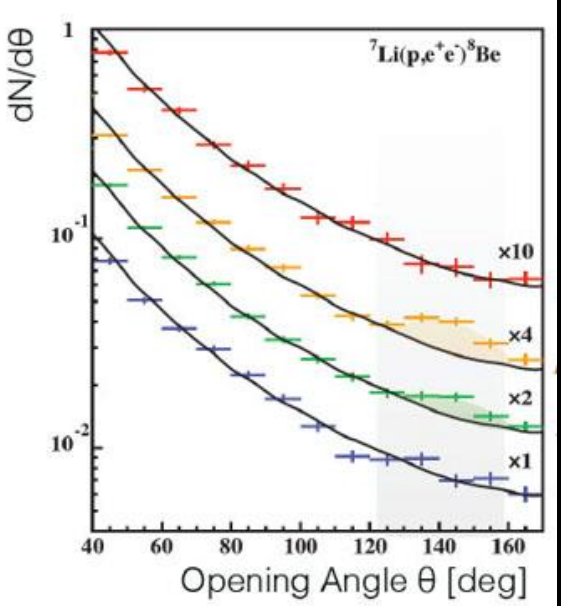


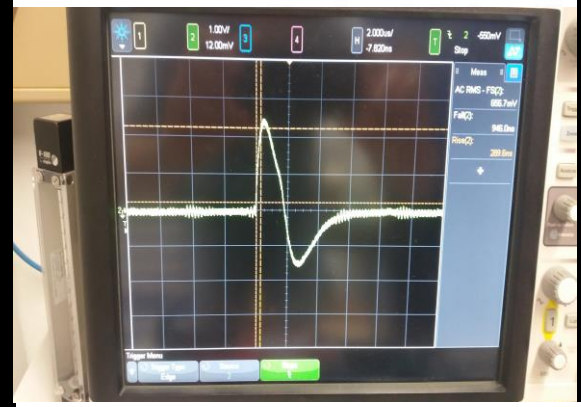


The Montreal X-17 Project

G. Azuelos[1], B. Broerman[2], D. Bryman[3], W.C. Chen[1], L. Desmarais[1], L. Doria[4], M. Francois[1], A. Gupta[1], L.-A. Hamel[1], M. Laurin[1], K. Leach[5], H. de Luz[6], J.P. Martin[1], F. Nadeau[1], H. Nozart[1], A. Robinson[1], N. Starinski[1], R. Sykora[6], D. Tiwari[7], P.A. Tremblay, U. Wichoski[8], V. Zacek[1],

[1]U. Montreal, [2]Queens U. [3]UBC, [4]U. Mainz, [5]C.S. Mines, [6]CTU Prague, [7]U. Regina, [8]Laurentian U.





Main goals:

- Verification of ATOMKI results
- Increase acceptance → 0.95 x 4π
- Improve statistics & angular resolution
- Eventually extend to other nuclei: ^{10}B , ^{12} C, ^{4}He…

The Montreal X-17 Project

UdeM 6 MV Tandem
Van de Graaff Facility

- E - resolution of 2 Kev for E_p = 0.4 - 1 MeV
- Dedicated Beam Line for X17 – project
- 2 μA proton beam on target (possibly up to 20 μA)

Motivation #1: Other nuclei!

$^{7}Li(p,\gamma)\,^{8}Be$

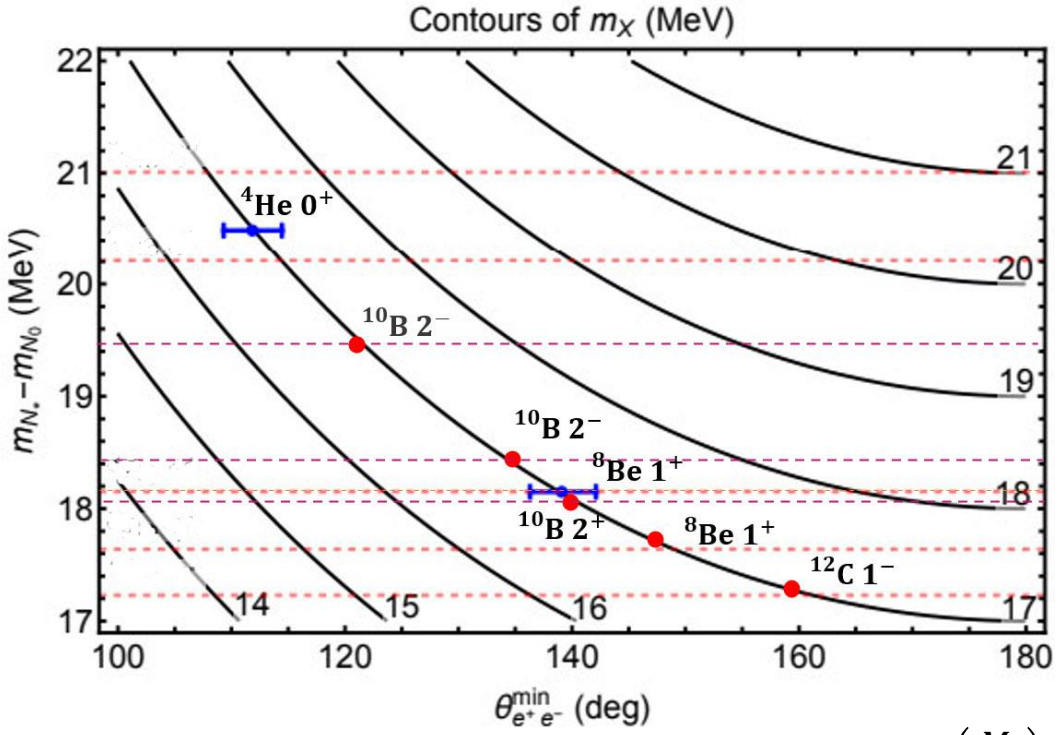
$^{11}B(p,\gamma)^{12}C$

$^{3}H(p,\gamma)\,^{4}He$

$^{7}Li(\,^{3}He,\gamma)^{10}B$

N_*	$J^{P_*}_*$	T_*	Γ_{N_*} (keV)
^{8}Be(18.15)	1^+	0	M1 IV 138
^{8}Be(17.64)	1^+	1	M1 IS 10.7
^{12}C(17.23)	1^-	1	E1 IV 1150
^{4}He(21.01)	0^-	0	M0 840
^{4}He(20.21)	0^+	0	E0 500
^{10}B(19.3)	2^- (-3^+)	1	E1 280
^{10}B(18.1)	$2+$ (-1^+)	1	M1 < 600
^{10}B(18.4)	2^- (-3^+)	1	E1 280
^{10}B(17.0)	1^- (-2^+)	1	E1 280

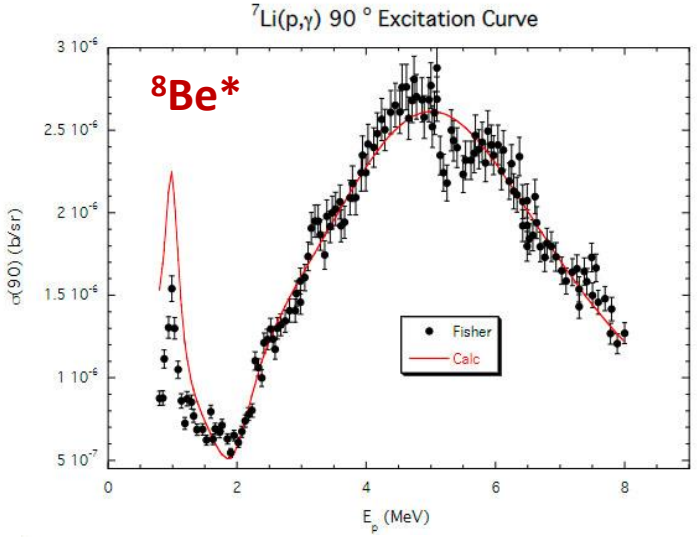
- ^{3}He beam available at Montreal

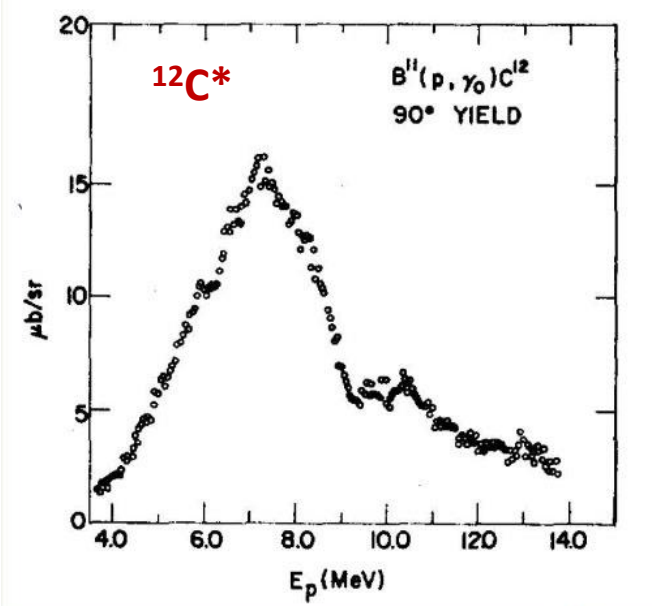


$$\theta = 2\,sin^{-1}\left(\frac{M_x}{E_x}\right)$$

Motivation #2: Explore Giant E1 Resonance in Be*!

A.C. Hayes et al - https://arxiv.org/abs/2106.06834 (June 2021) X. Zhang, G.A. Miller - Physics Letters B 813 136061 (2021))



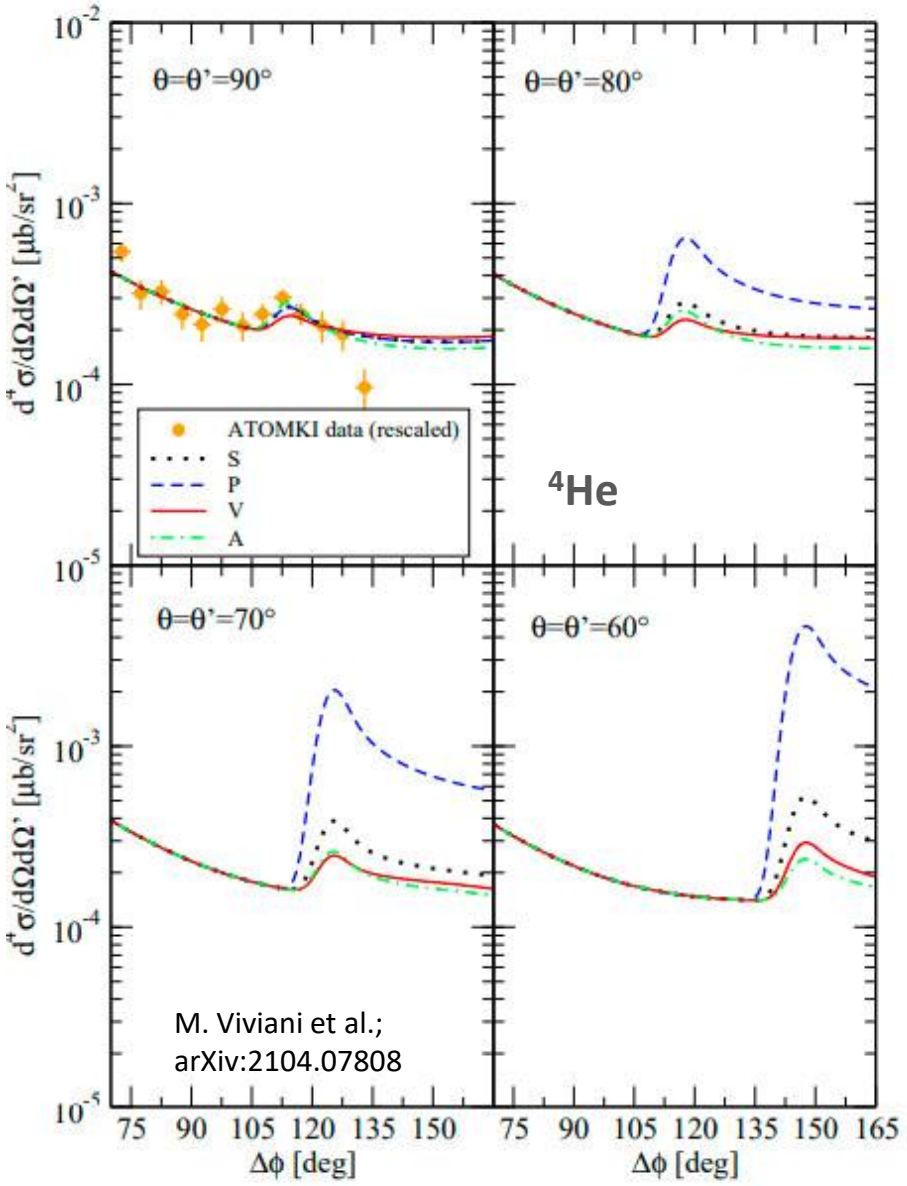


- GDR's are collective oscillations of protons against neutrons (discovered in photonuclear reactions, C. Baldwin, '47)
- GDR excited by proton S-wave capture into ^{8}Be* &^{12}C* → decay by E1 gamma emission
- Higher energies → smaller θ_{+-}

Proton beams with required energies available @ Montreal VdG

Motivation #3: Increase Angular Acceptance!

M. Viviani et al., arXiv:2104.07808v1



If X17 produced in direct E1-capture (^{8}Be, ^{4}He,^{10}B, ^{12}C..)

↓

Polar angular distribution of the e^+e^- pair depends on the X17 quantum numbers

↓

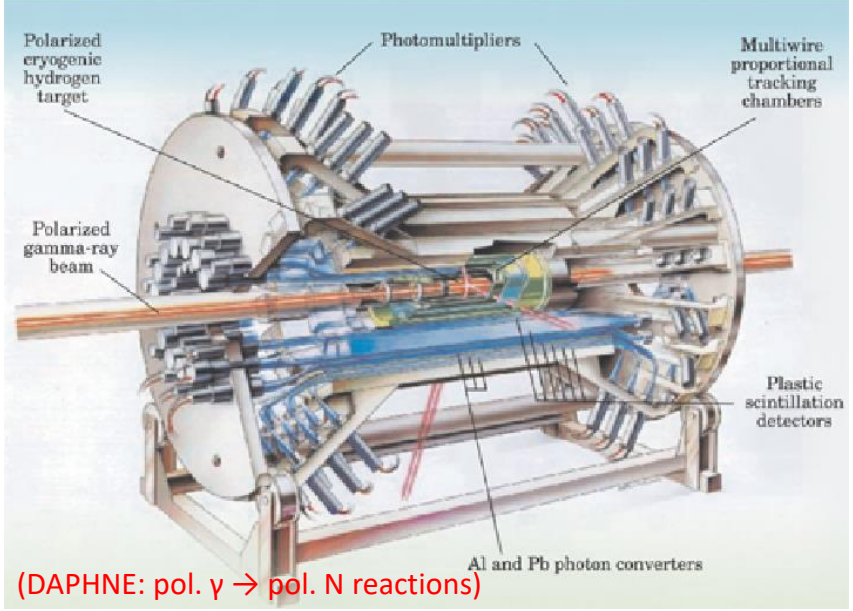
Large angular acceptance allows discrimination btw. different options

↓

Aim at close to 4π solid angle coverage

The Montreal X-17 Project

- Uses parts of the DAPHNE experiment (Saclay/Mainz)
- Tracking MWPC chamber & 16 scintillators (NE102A)
- Scints & MWPC generously provided by U. Mainz (Ge)*
- Phototubes, bases and ADC/TDC's borrowed from TRIUMF*

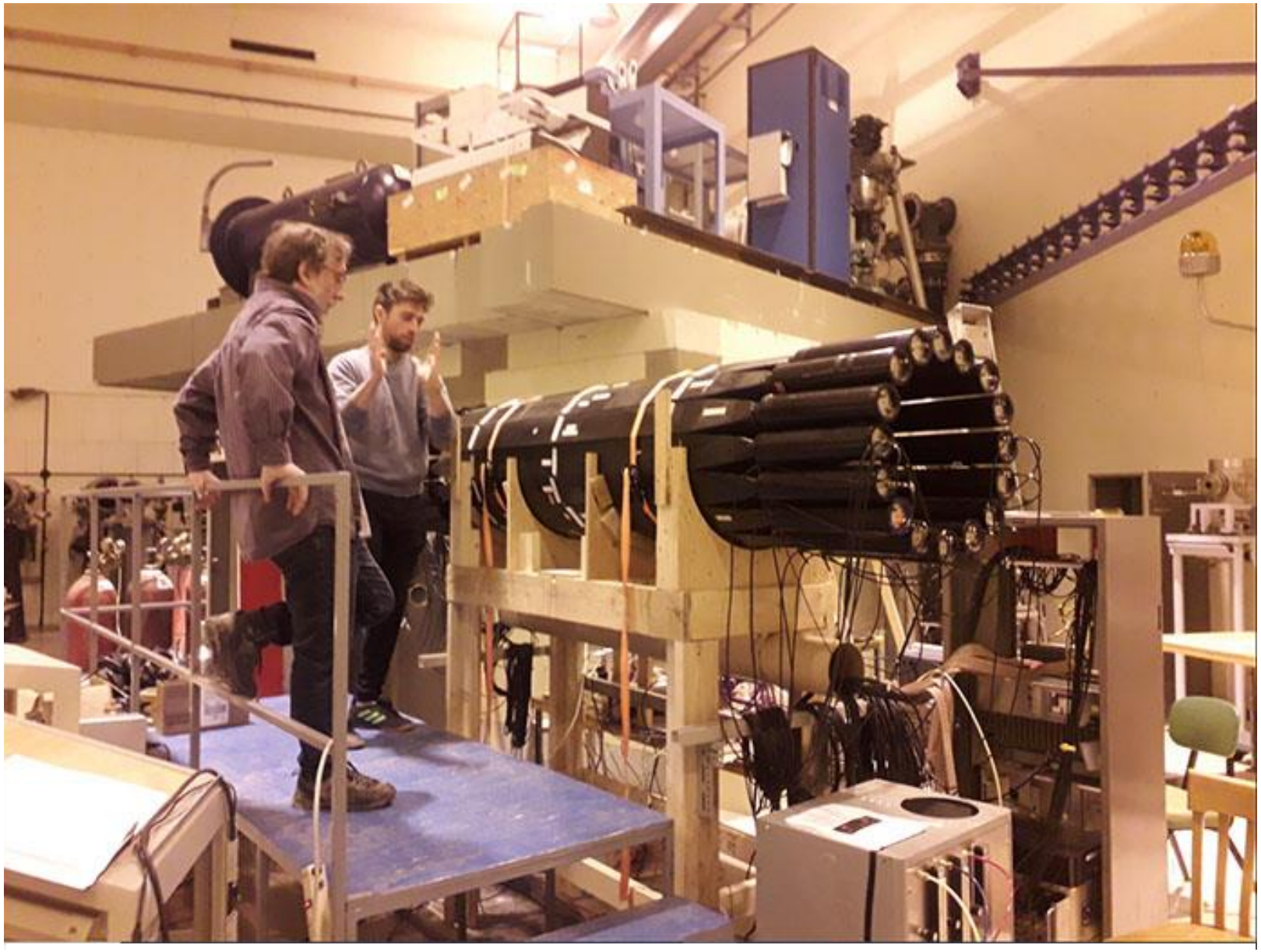


(DAPHNE: pol. γ → pol. N reactions)

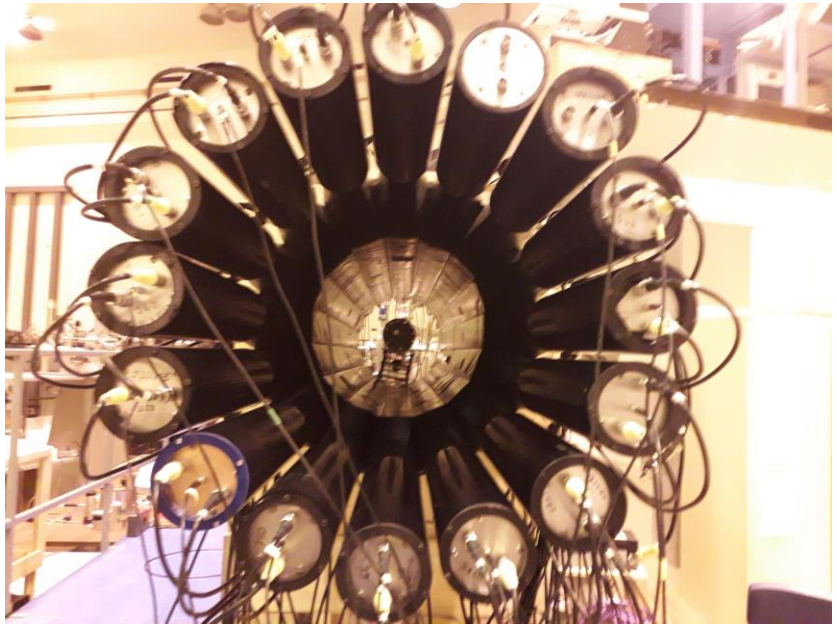
*Many thanks to
L. Doria & U. Mainz
D. Bryman & TRIUMF

Large solid angle coverage: 0.95 x 4π
Angular res.: $\Delta\theta \sim 2^0$ (FWHM)

Status of Scintillator System

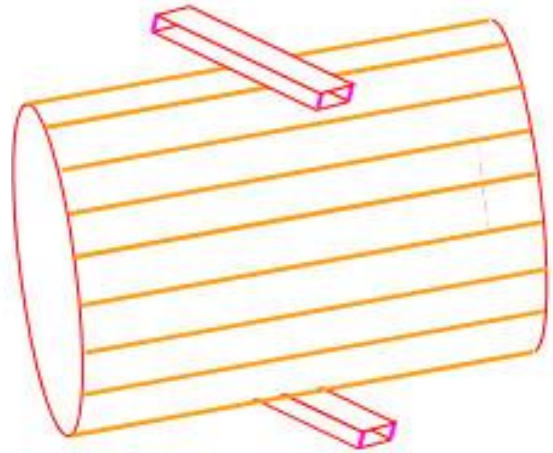


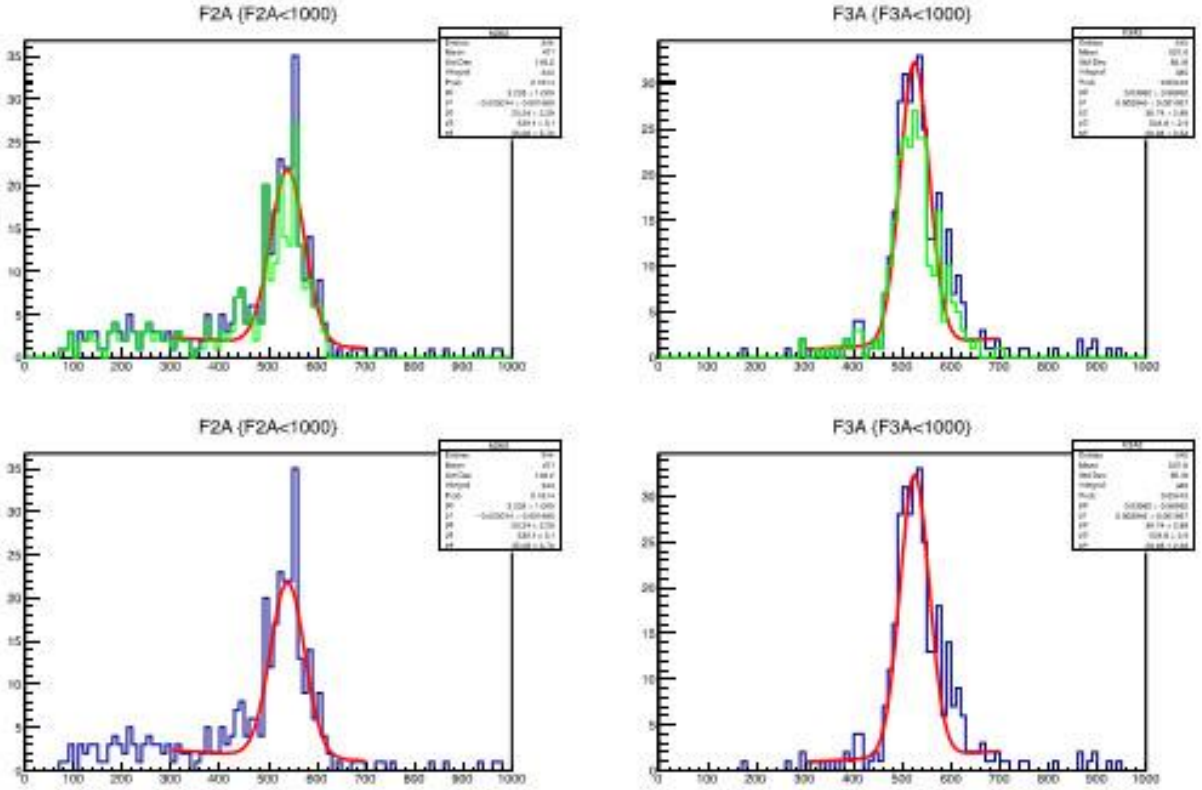
- All scintillator bars instrumented
- PMT gains approx. adjusted
- Gains later fine-tuned offline

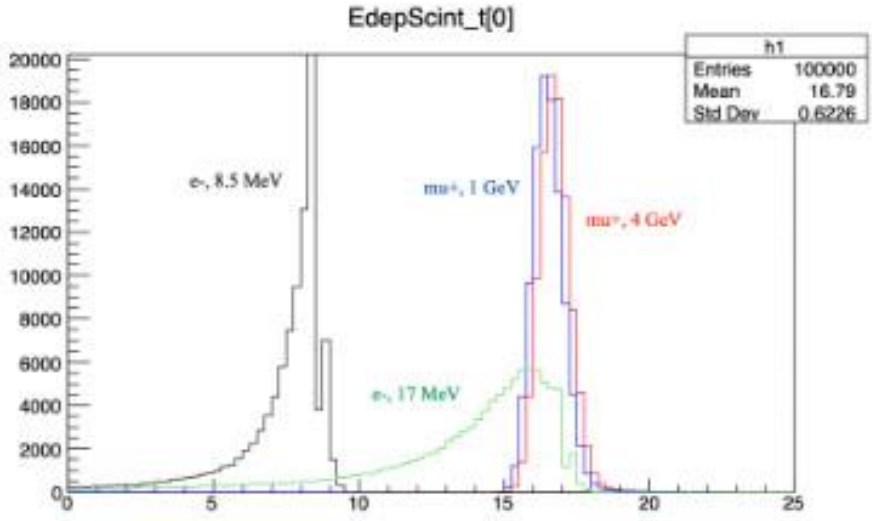


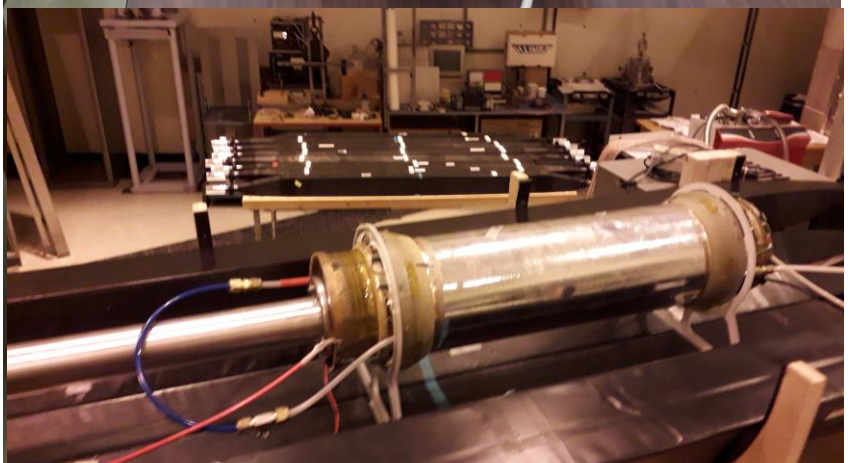
Cosmics Run w. Scintillators

- 4- fold coincidence with Cosmics
- Attenuation length 5 m < L_{att} < 10 m
- DAPHNE: L_{att} = 6 m (O. Jahn Dissert., Mainz 2005)
- Gains adjusted





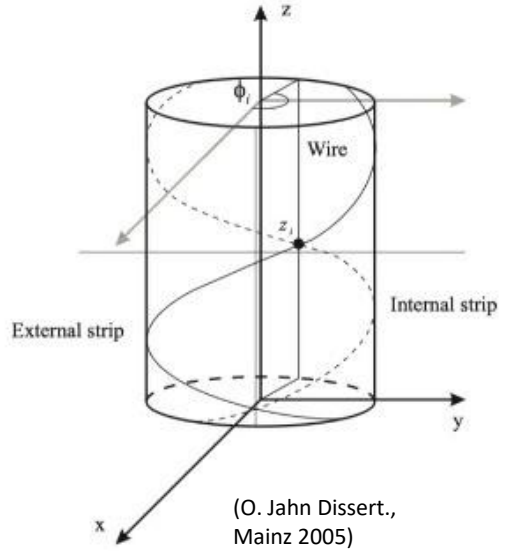




The DAPHNE Tracking Chamber

- ID 12 cm / OD 14 cm - Length 36 cm
- Cathode-anode distance: 4 mm;
- 192 Anode wires: 20 µm diam; spacing: 2mm
- 60/68 cathode strips at 45^0 w.r. to wires; width 4mm

Gas mixture: magic gas »*



(O. Jahn Dissert., Mainz 2005)

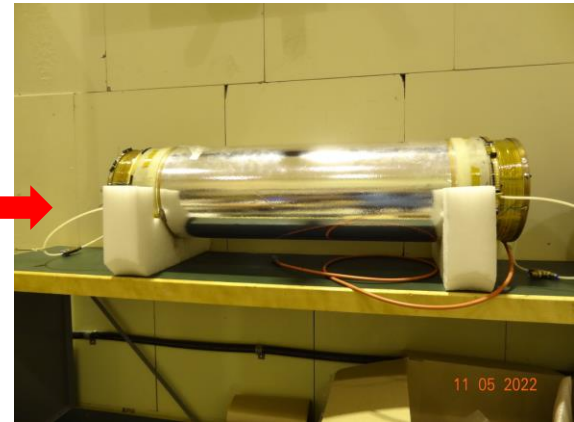
Figure 2.11. MWPC: Reconstruction of the

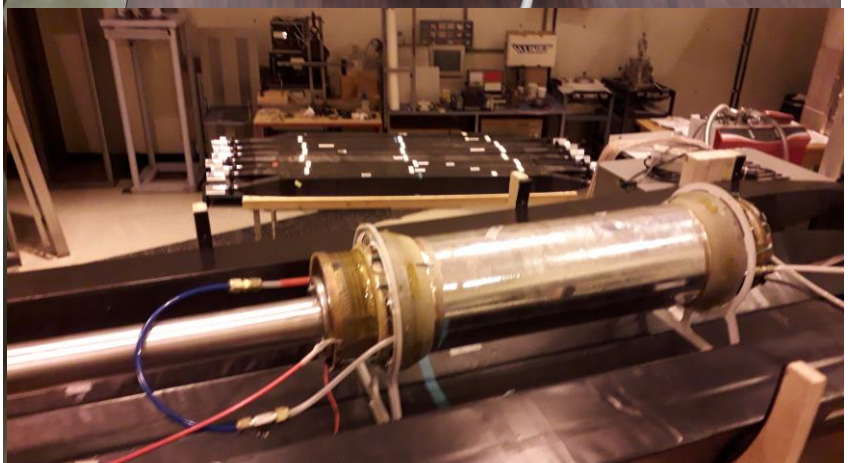
* 74.5% Ar, 25% Ethane, 0.5% Freon

- Angular res.: $\Delta\theta \sim 2^0$ (FWHM)
- Low density material to avoid EPC!

2^{nd} larger chamber (can be added later…)

- ID 24.8 cm / OD 26 cm – Length 76cm
- 384 Anode wires/ 124/132 strips





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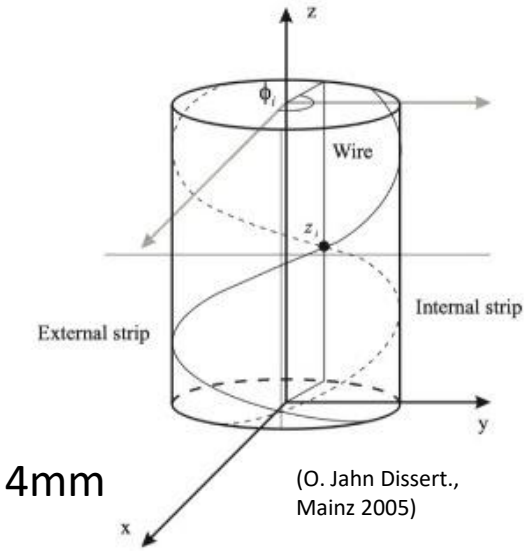
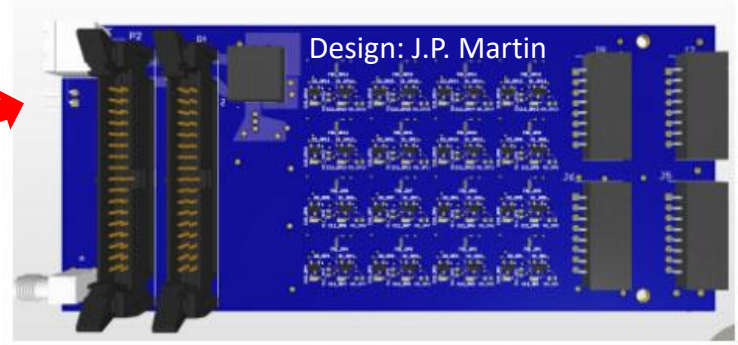


(O. Jahn Dissert., Mainz 2005)

* 74.5% Ar, 25% Ethane, 0.5% Freon

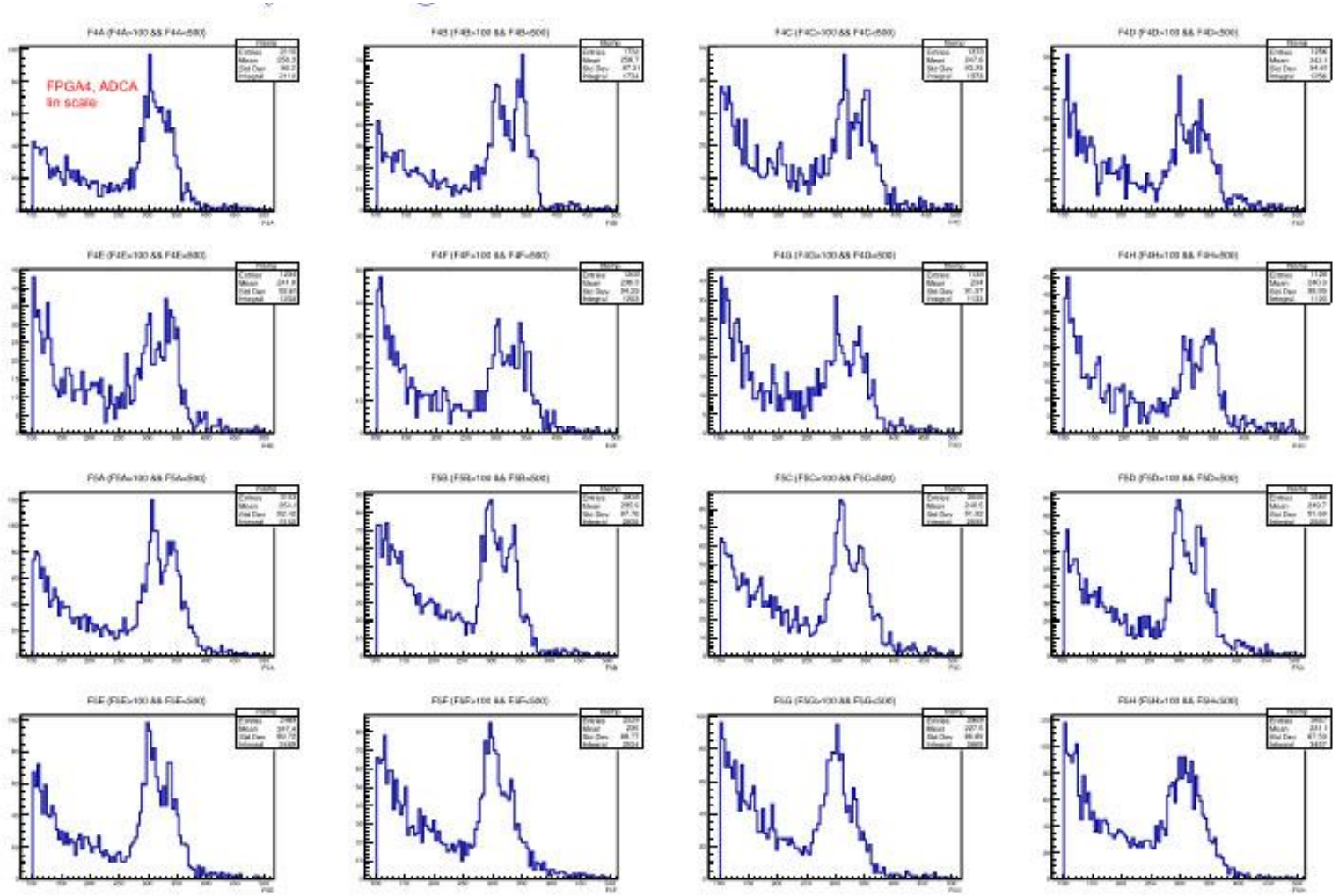
- Angular res.: $\Delta\theta \sim 2^0$ (FWHM)
- Low density material to avoid EPC!

  - 32 ch./ preamp card
  - For wires & strips
  - 1V/picoCb
  - Read by VF48 DSP

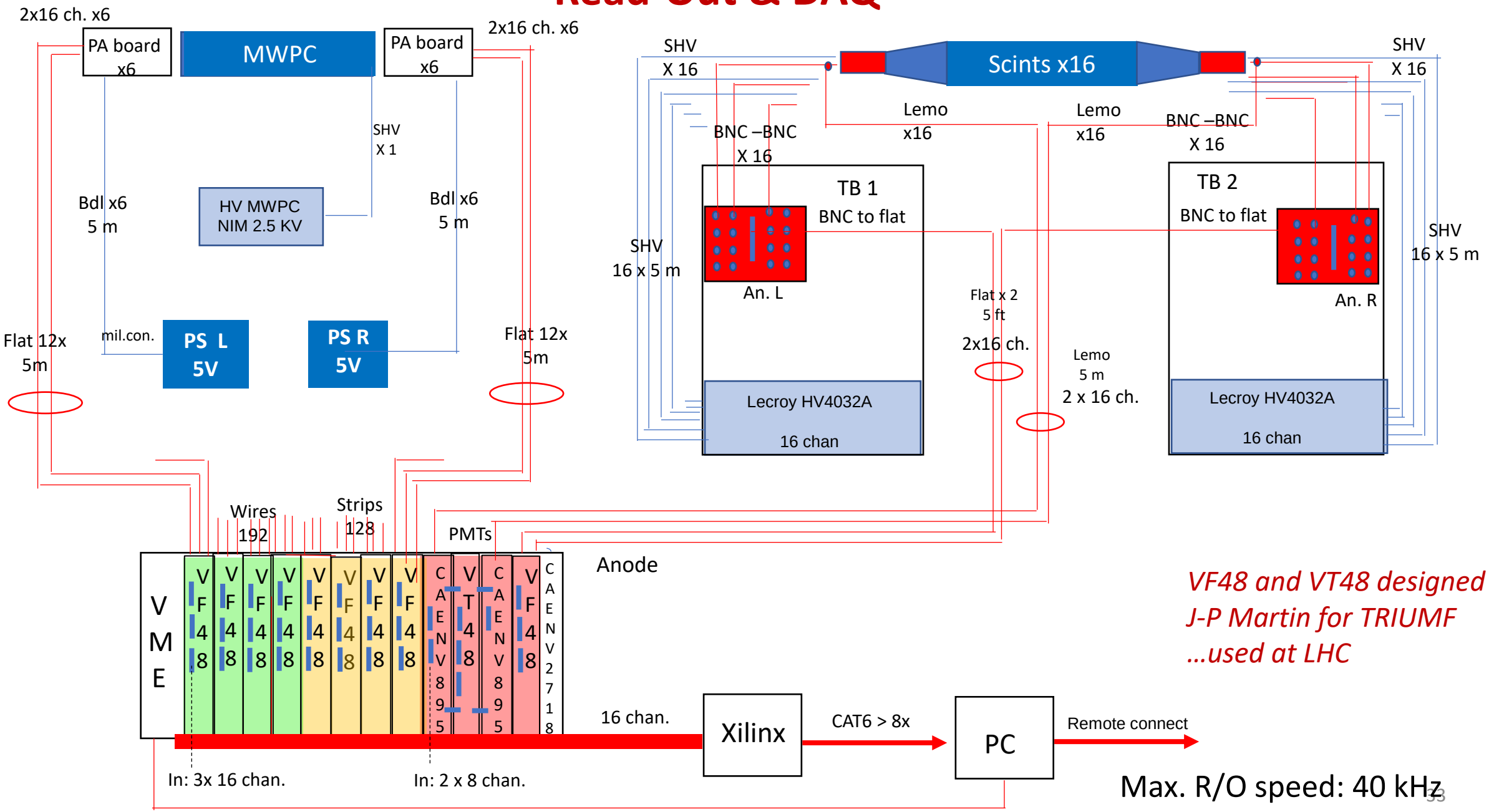


Cosmics Ray Signals in MWPC

- Wire signals only
- Trigger from cosmics through 2 scintillators

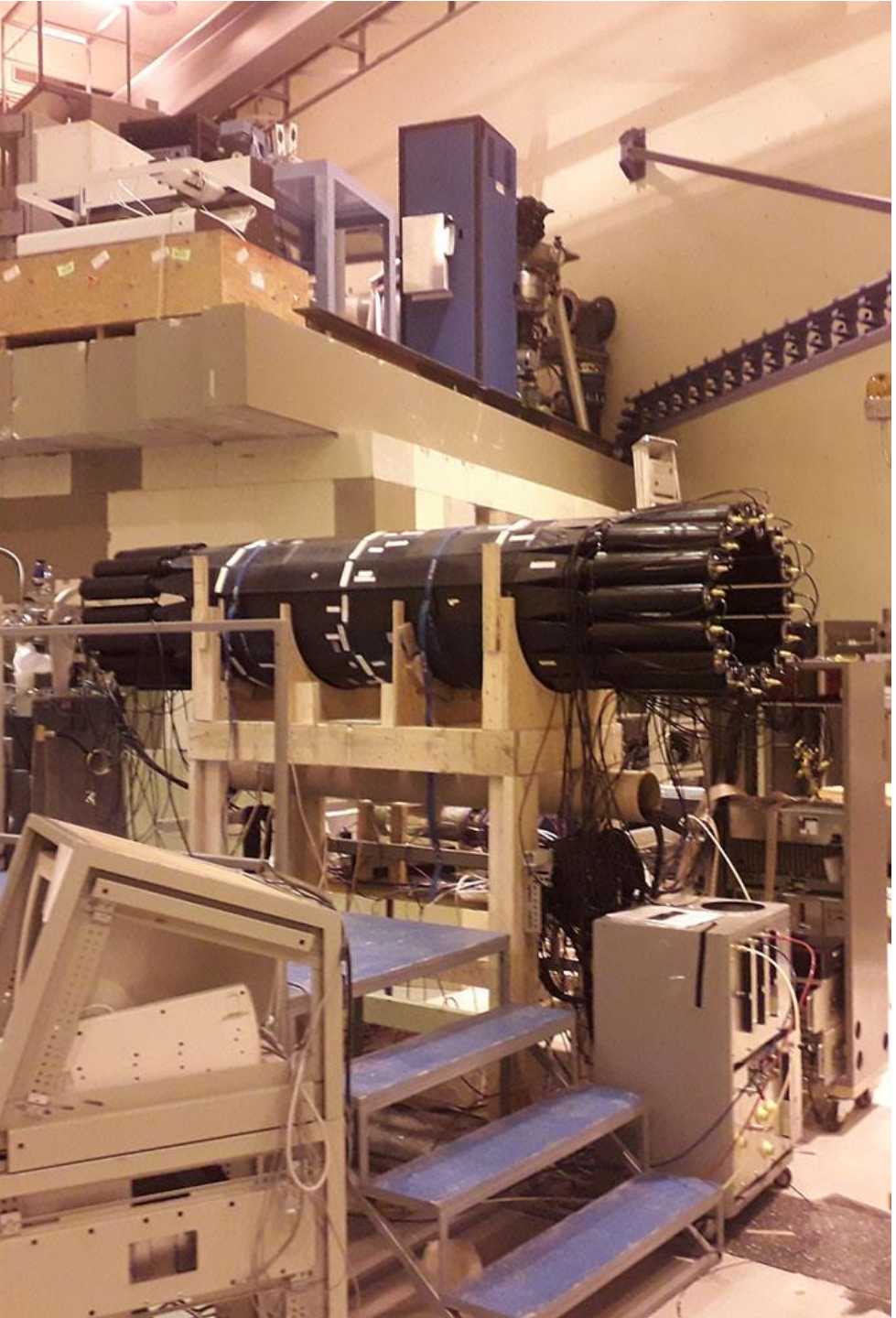


Read-Out & DAQ



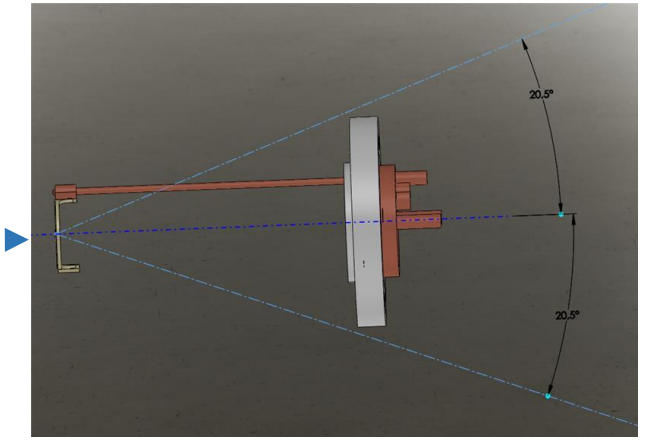
VF48 and VT48 designed by J-P Martin for TRIUMF …used at LHC

Max. R/O speed: 40 kHz



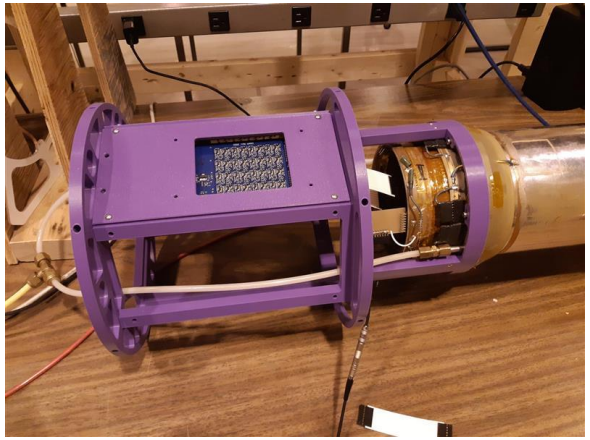
Status Set-UP

p - beam



Beam & Target:

- 10 µA on target demonstrated
- 500 nm LiF on 10µm Cu backing
- Cooling w. heat pipe (T < 70°)



MWPC:

- Wires r/o with preamps & DAQ
- Testing strip r/o ongoing
- 3 x 32 channels ready
- 352 channels total → 10 VF48

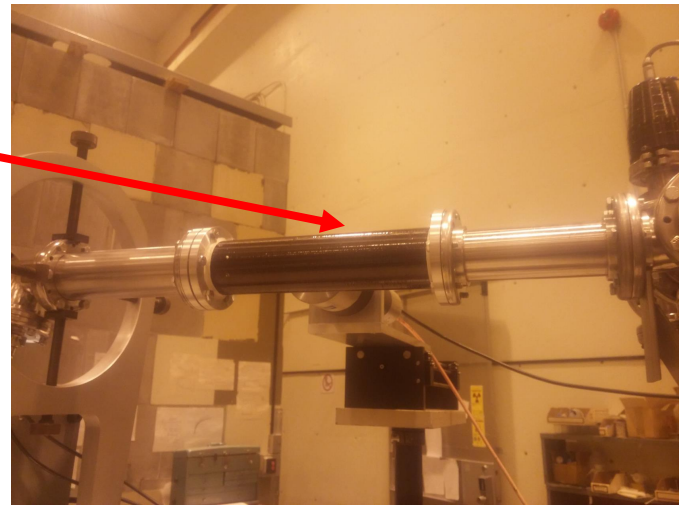
Scintillators:

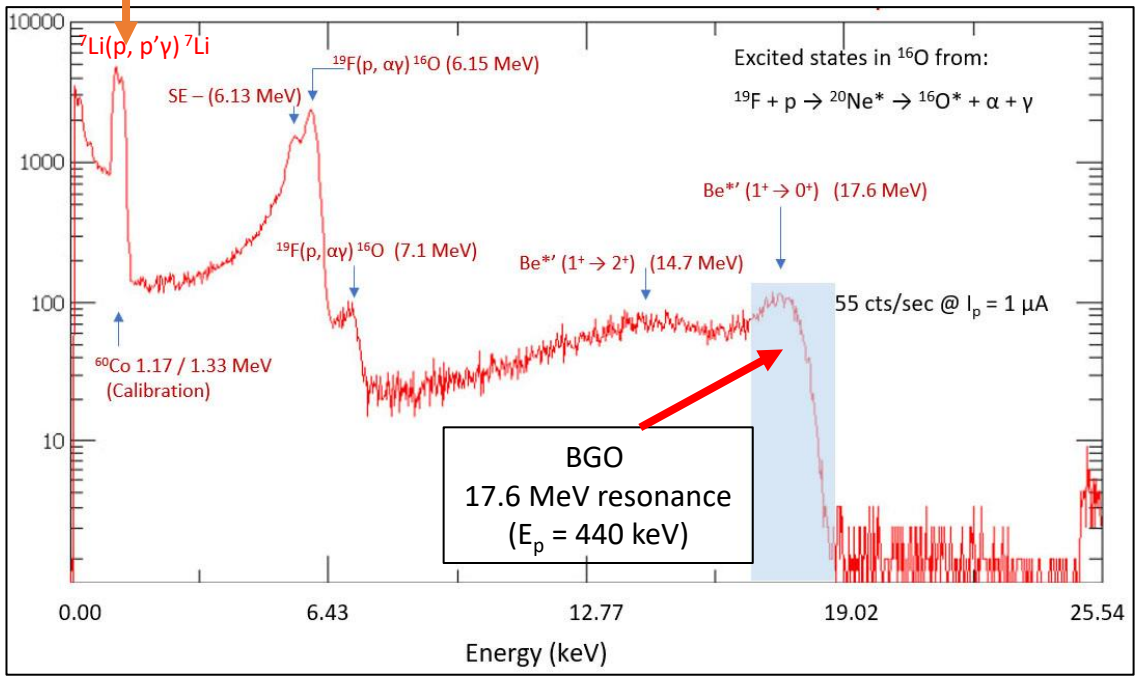
- All 16 scints. installed & calibr.
- Gains adjusted; histos taken w. cosmics & DAQ (VF48)
- diff. trigger conditions ok

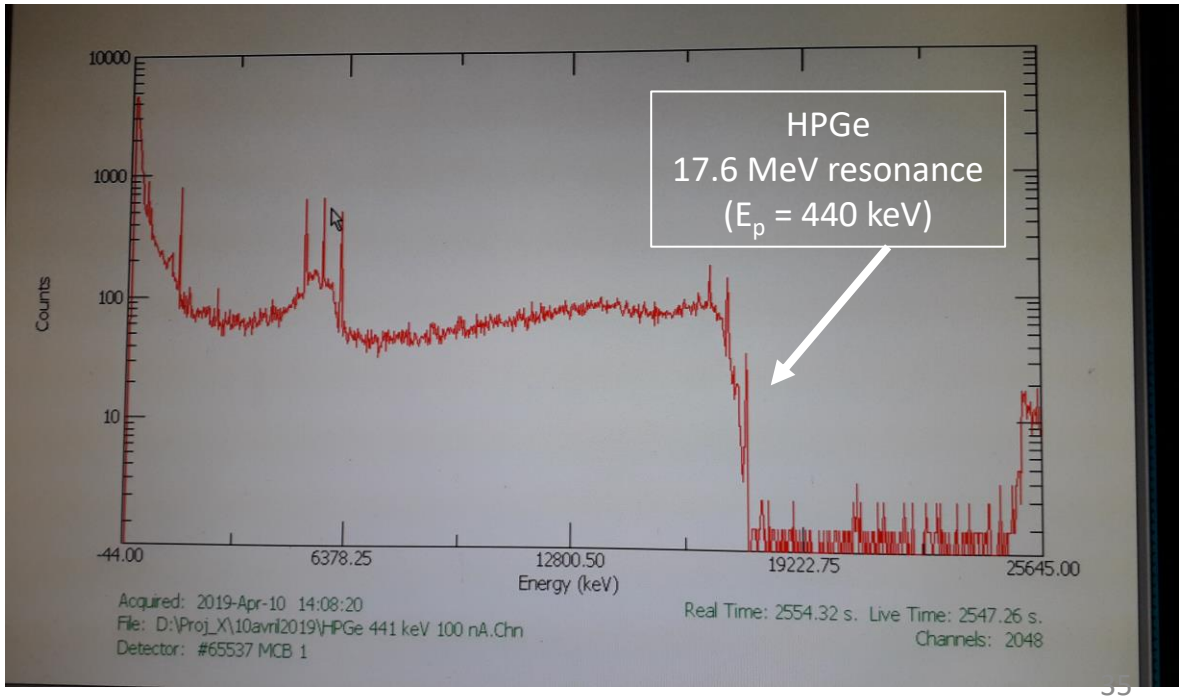
Test – Beam Measurements

Exploring Be* physics

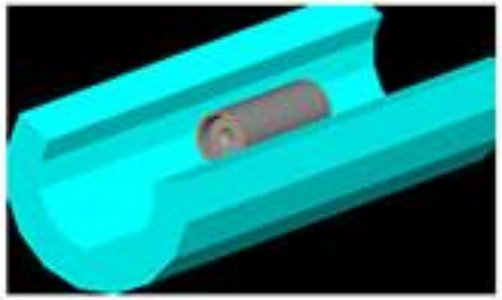
- 0.8 mm thick C-beam pipe
- Target: 0.2 µm LiF (52 µg/cm^2)
- Beam current: I_p = 2 µA
- γ – spectra with BGO , HPGe
- 478 keV line serves as reference

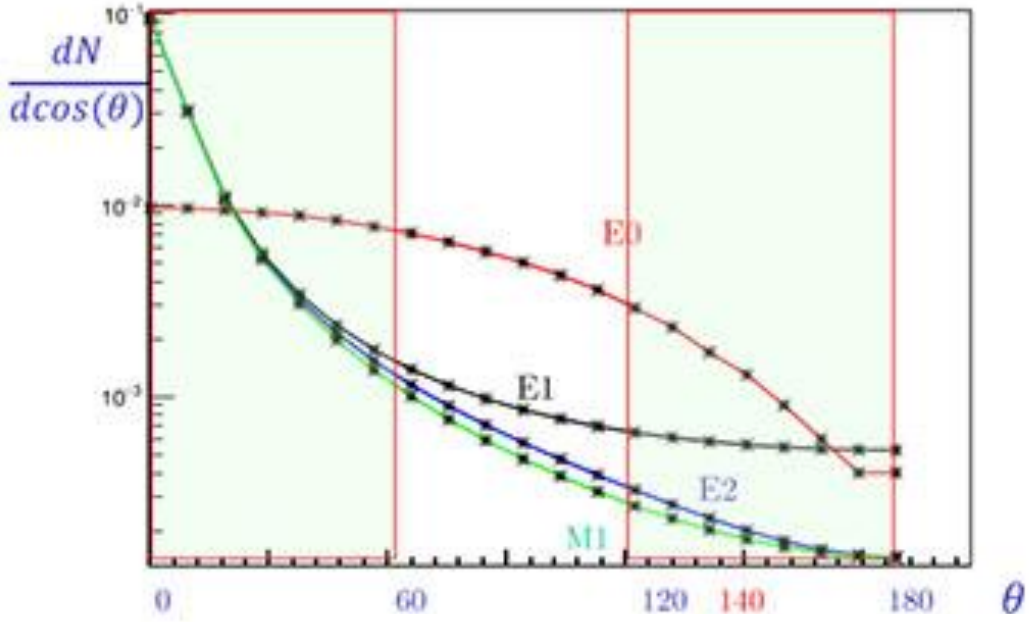


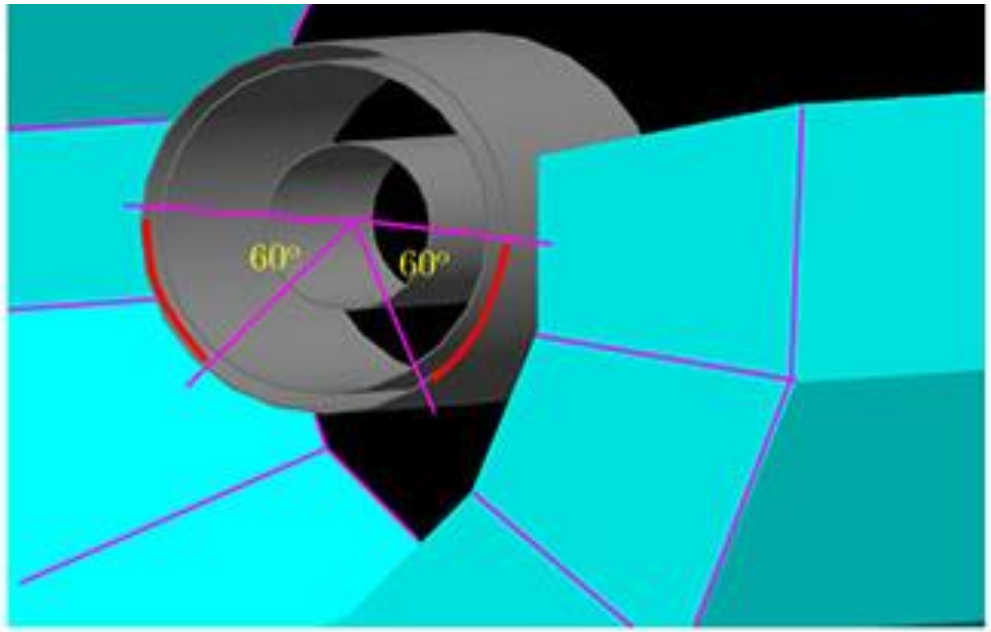




Next: 1st Physics Test Run



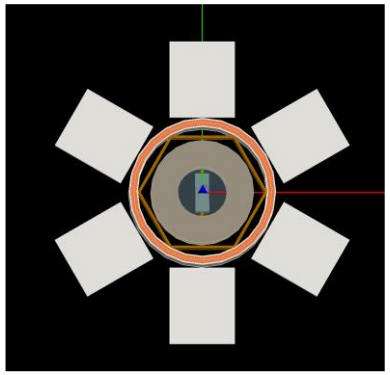


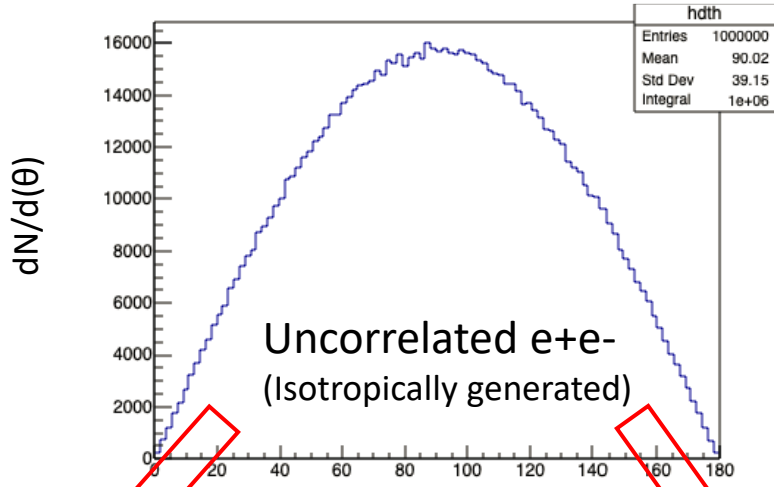


- Initial run at 18.15 MeV ^{8}Be* resonance
- With 2 sectors covering 60°
- Angular range 0° - 60° and 120° - 180°
- Test full R/O chain & DAQ
- Calib. with 6.15 MeV $e^{+}e^{-}$ IPC from $^{19}F(p,\alpha\gamma)^{16}O$

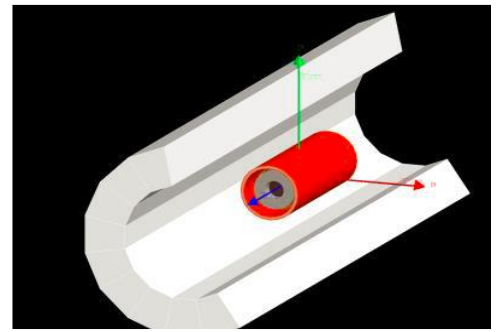
Geant 4 Simulations: Acceptances

G. Azuelos, J. Pothier-Leboef (U. Montreal)
K. Leach, I. Bisset (Colorado School of Mines)

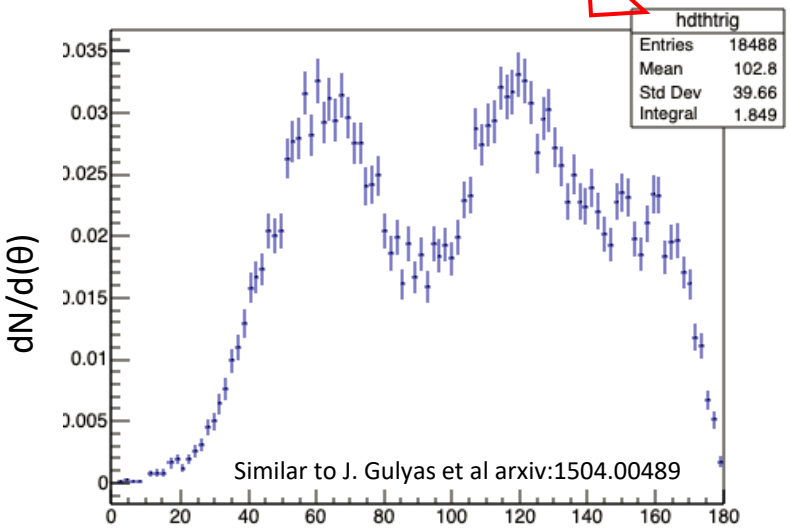




Uncorrelated e+e-
(Isotropically generated)

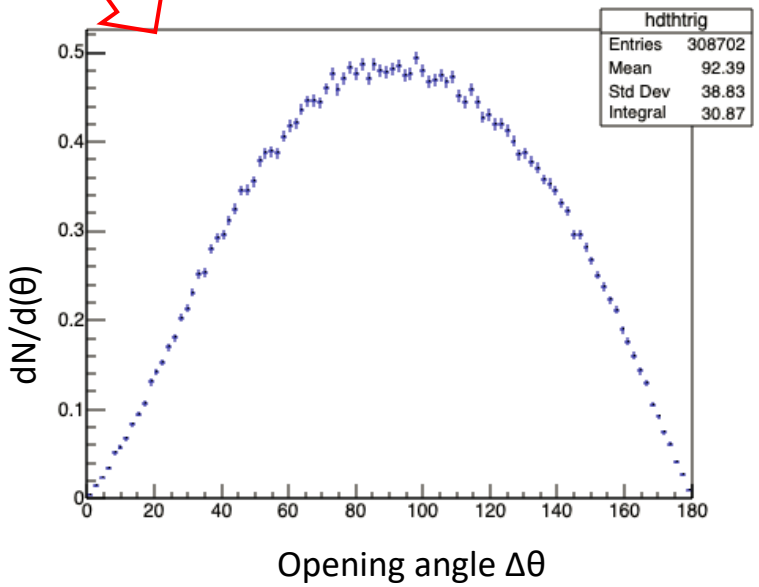


ATOMKI geometry



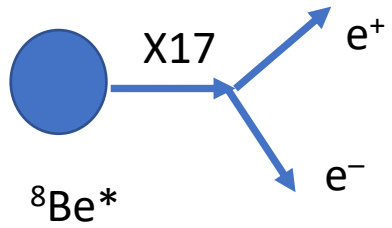
Similar to J. Gulyas et al arxiv:1504.00489

Montreal geometry



Geant 4 Simulations: Reconstruction

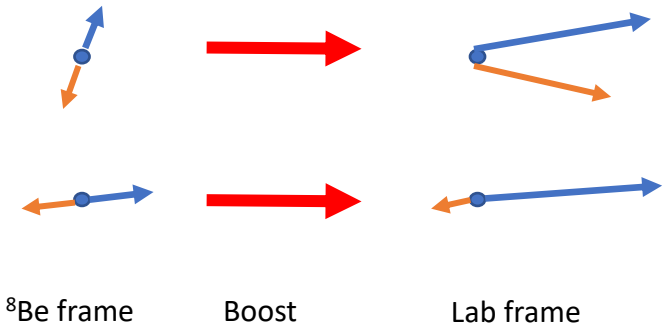
3 Basic Observables for e+e- Pairs

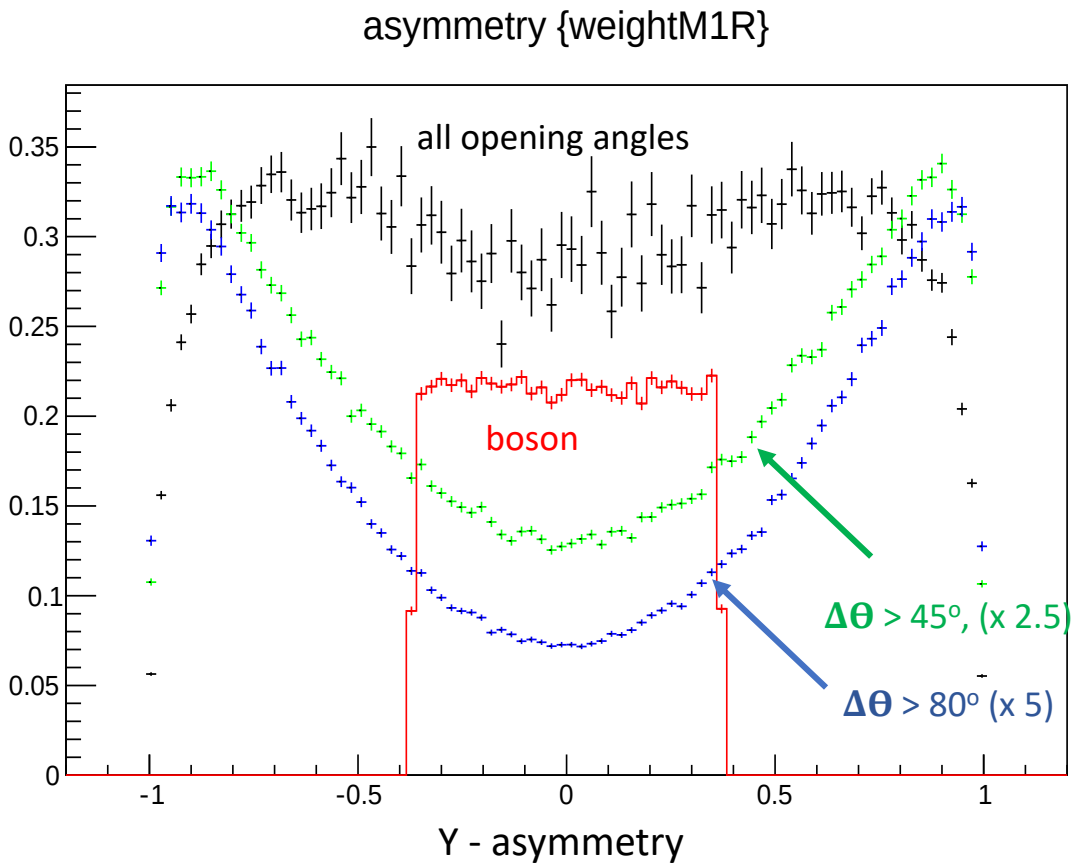


Opening angle : Heavy particle → small boost → large opening angle

Invariant mass m_{ee} : Preselection of large m_{ee} removes a lot of background and fake signals

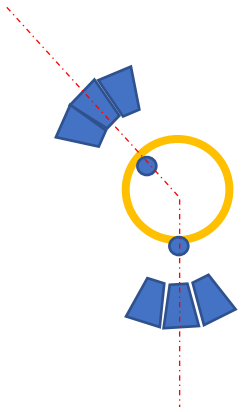
Asymmetry: $y = \frac{|E_1 - E_2|}{E_1 + E_2}$ for low m_{ee} large opening angles correlate with large asymmetry.

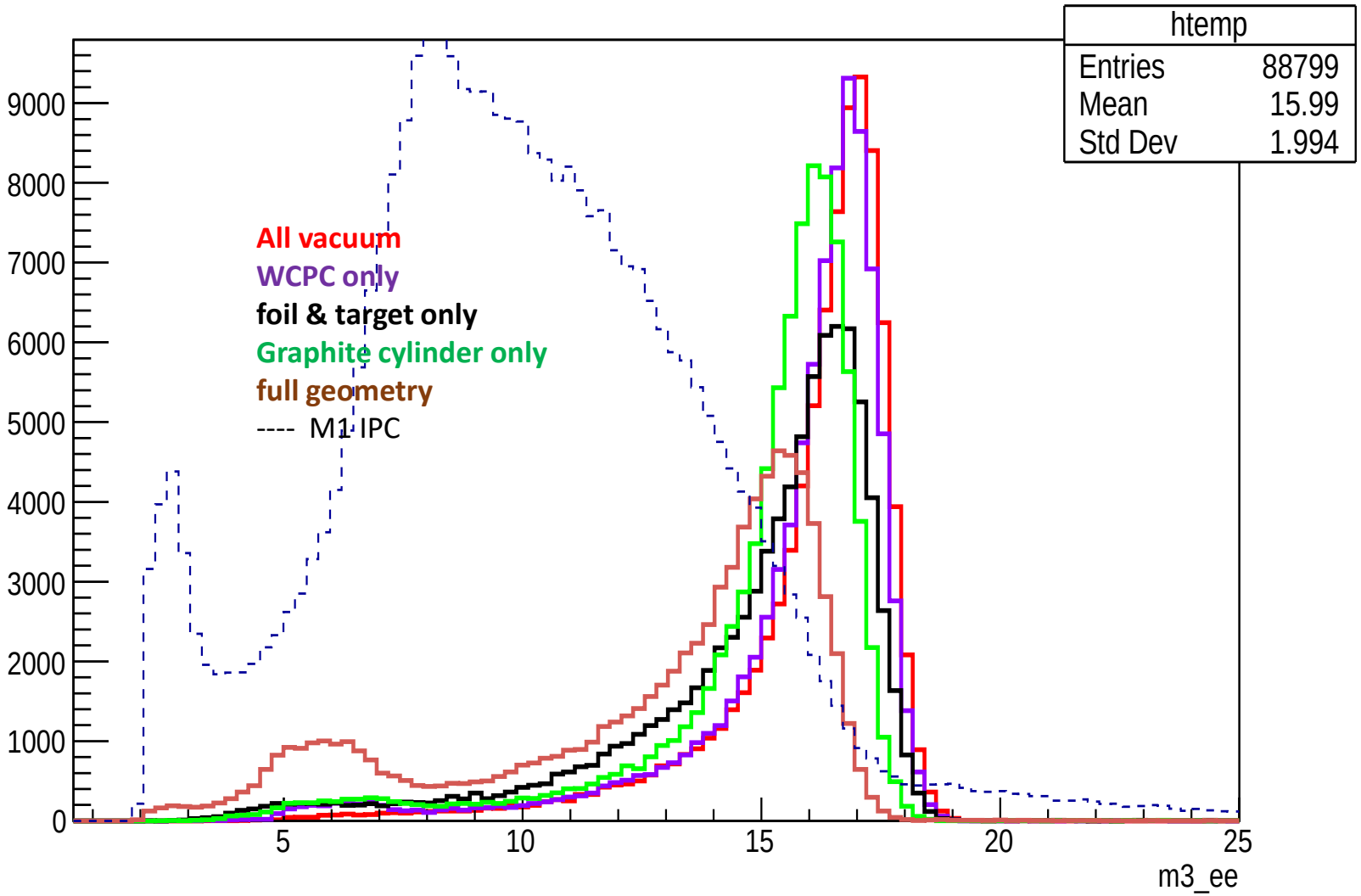




Geant 4 Simulations: Reco Invariant Mass

Groups of 3 scints centered on the 2 scints opposite to the 1st two MWPC hits





Geant 4 Simulations : ^{8}Be* (IPC & X17)

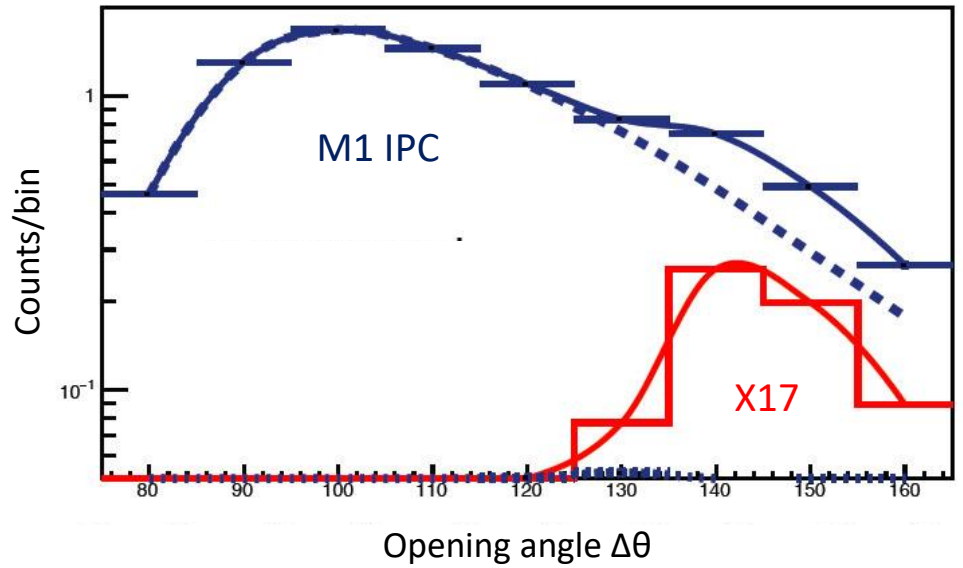
Full detector geometry:

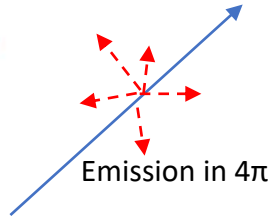
- M1- IPC: E_γ = 18.15 MeV
- $\Delta\theta \sim 2^0$ (FWHM); $\Delta E/E \sim 7.4\%/\sqrt{E}$
- |y| < 0.45; m(ee) > 12 MeV/c^2
- $B(X/IPC) = \frac{B(X/\gamma)}{B(IPC/\gamma)} = \frac{5.8\times10^{-6}}{3.9\times10^{-3}} = 1.5\times10^{-3}$
- Signal/Background in region of interest:

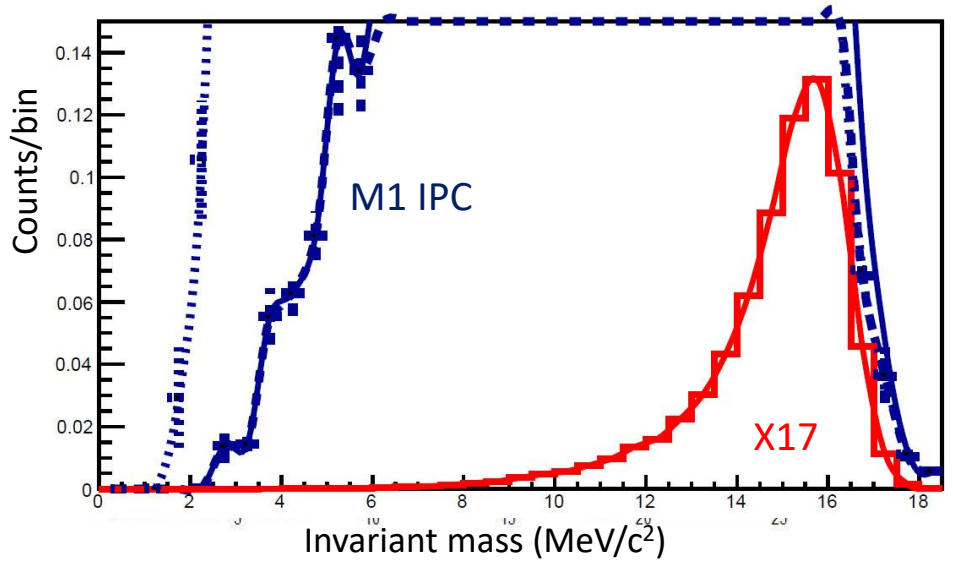
$$S/B \approx 0.6$$

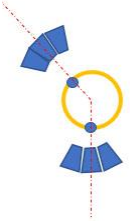
$(135^0 \leq \theta \leq 180^0)$

- ….later optimization w. neural net analysis









Geant 4 Simulations : ^{8}Be* (IPC & X17)

- Measured BGO rates @ I_p = 2μA extrapolated to 0.9 x 4π – coverage:

E_γ = 478 keV: $R_\gamma = 5.7 \times 10^5\ s^{-1}$

$$\frac{\sigma\ ^7Li(p,\gamma)\ ^8Be^*}{\sigma\ ^7Li(p,\gamma)\ ^7Li} = 7.5 \times 10^{-4}$$

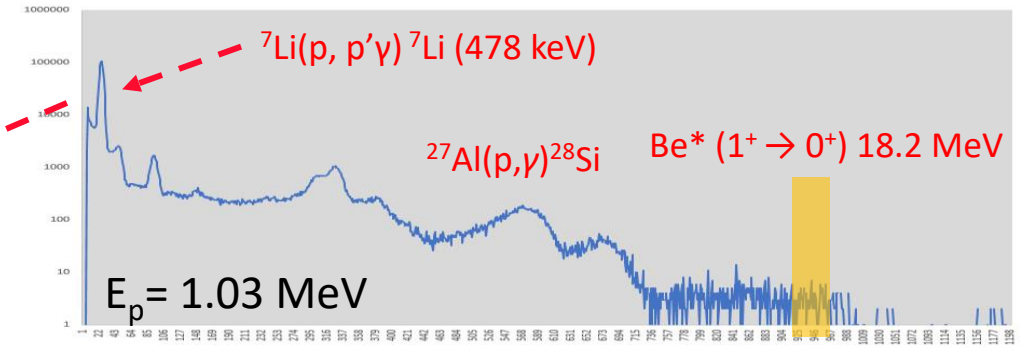
R_{IPC} (18.2 -> GS) = 1.7 s^{-1}

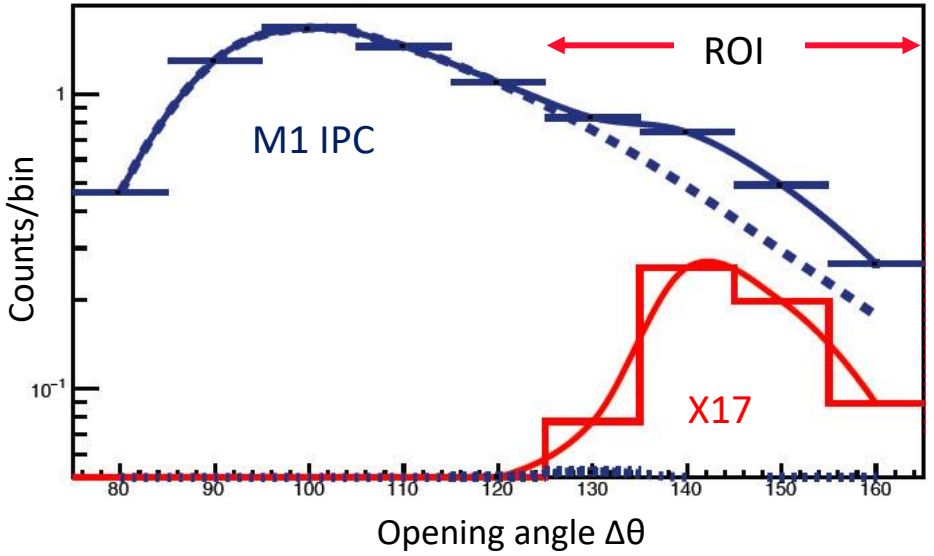
Geant4

R_{IPC} (in ROI) = 15 h^{-1}

R_{X17} (in ROI) = 9 h^{-1}

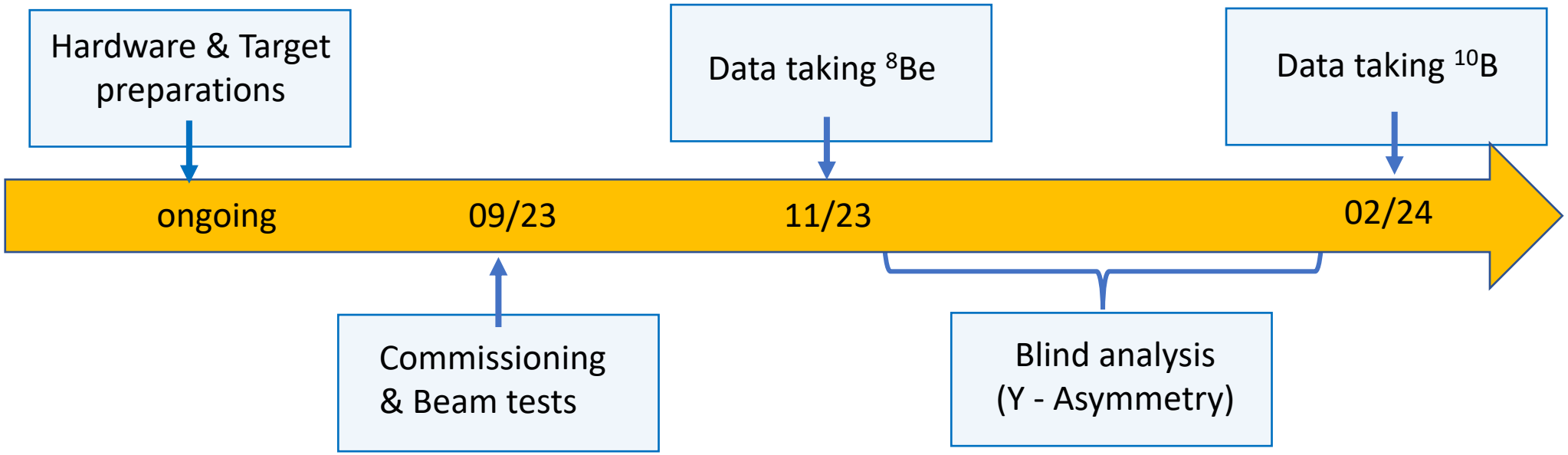
(Data taking 1 - 2 weeks @ I_p = 2μA)





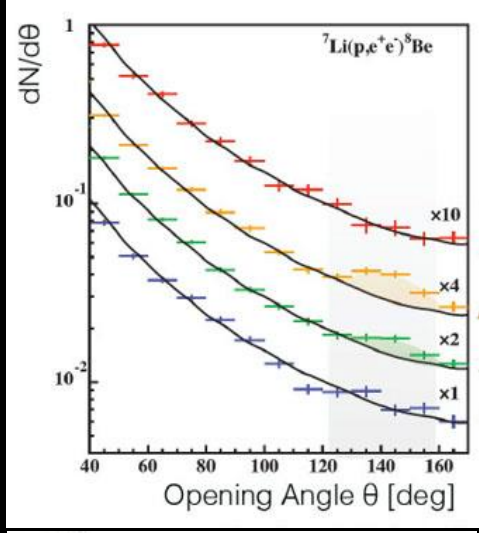
(Expected $R_{trigger}$ (E_γ > 1 MeV; $E_1 \wedge E_2$) = 200 Hz)

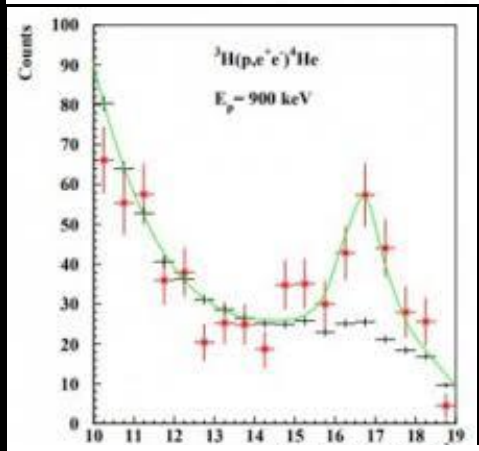
The Montreal X-17 Project - Timeline



Summary

- Intriguing results by the ATOMKI collaboration in Be*, He*, (C*?)
- UdeM – experiment for independent & timely verification
- Extend to other states & nuclei: ^{10}B(17.8), ^{12}C (17.2)….E1 GDR's (?)
- Large solid angle increases coverage of param. space (V, AV P, PS)
- Collaborators welcome!





Physics > Instrumentation and Detectors

[Submitted on 21 Nov 2022]

Status of the X17 search in Montreal

G. Azuelos, B. Broerman, D. Bryman, W.C. Chen, H.N. da Luz, L. Doria, A. Gupta, L-A. Hamel, M. Laurin, K. Leach, G. Lefebvre, J-P. Martin, A. Robinson, N. Starinski, R. Sykora, D. Tiwari, U. Wichoski, V. Zacek

At the Montreal Tandem accelerator, an experiment is being set up to measure internal pair creation from the decay of nuclear excited states using a multiwire proportional chamber and scintillator bars surrounding it from the DAPHNE experiment. The acceptance covers a solid angle of nearly 4π. Preamplifiers and the data acquisition hardware have been designed and tested. The water-cooled ^{7}LiF target, mounted on an Al foil is in a thin carbon fiber section of the beamline. The experiment will focus at first on a measurement of the internal pair creation from the 18.15 MeV state of ^{8}Be. Assuming the ATOMKI evaluation of the electron-pair production rate from X17, a Geant4 simulation predicts observation of a clear signal after about two weeks of data taking with a 2 μA proton beam. The IPC measurement could eventually be extended to the giant dipole resonance of ^{8}Be, as well as to other nuclei, in particular to ^{10}B.

Comments: 5 pages, 4 figures, Proceedings contribution, TRIUMF Ariel Workshop, May 25-27 2022
Subjects: **Instrumentation and Detectors (physics.ins-det)**; Nuclear Experiment (nucl-ex)
Cite as: arXiv:2211.11900 **[physics.ins-det]**
(or arXiv:2211.11900v1 **[physics.ins-det]** for this version)
https://doi.org/10.48550/arXiv.2211.11900
Related DOI: https://doi.org/10.1088/1742-6596/2391/1/012008

Submission history

From: Georges Azuelos [view email]
[v1] Mon, 21 Nov 2022 22:57:47 UTC (5,081 KB)