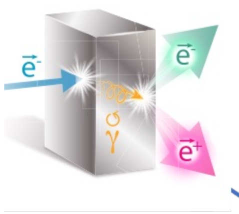
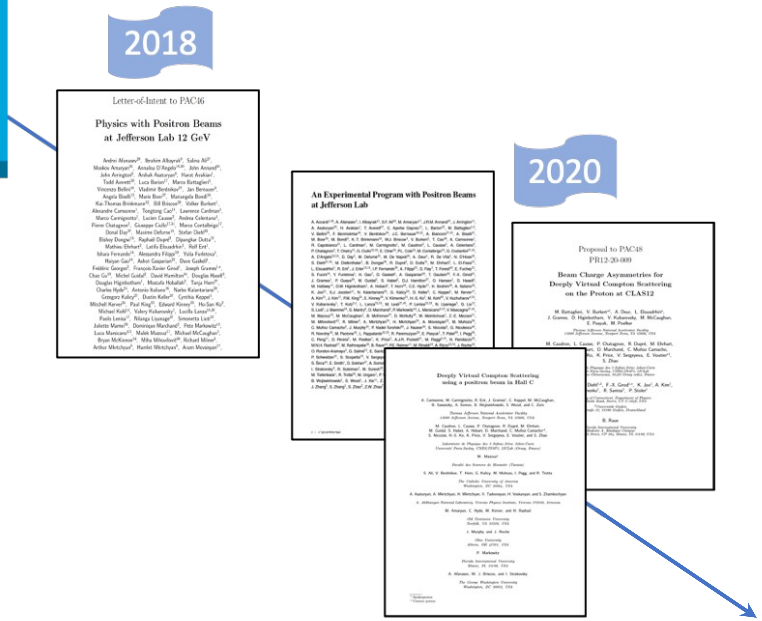
Opportunities with Positron Beams at Jefferson Lab

e^+@JLab



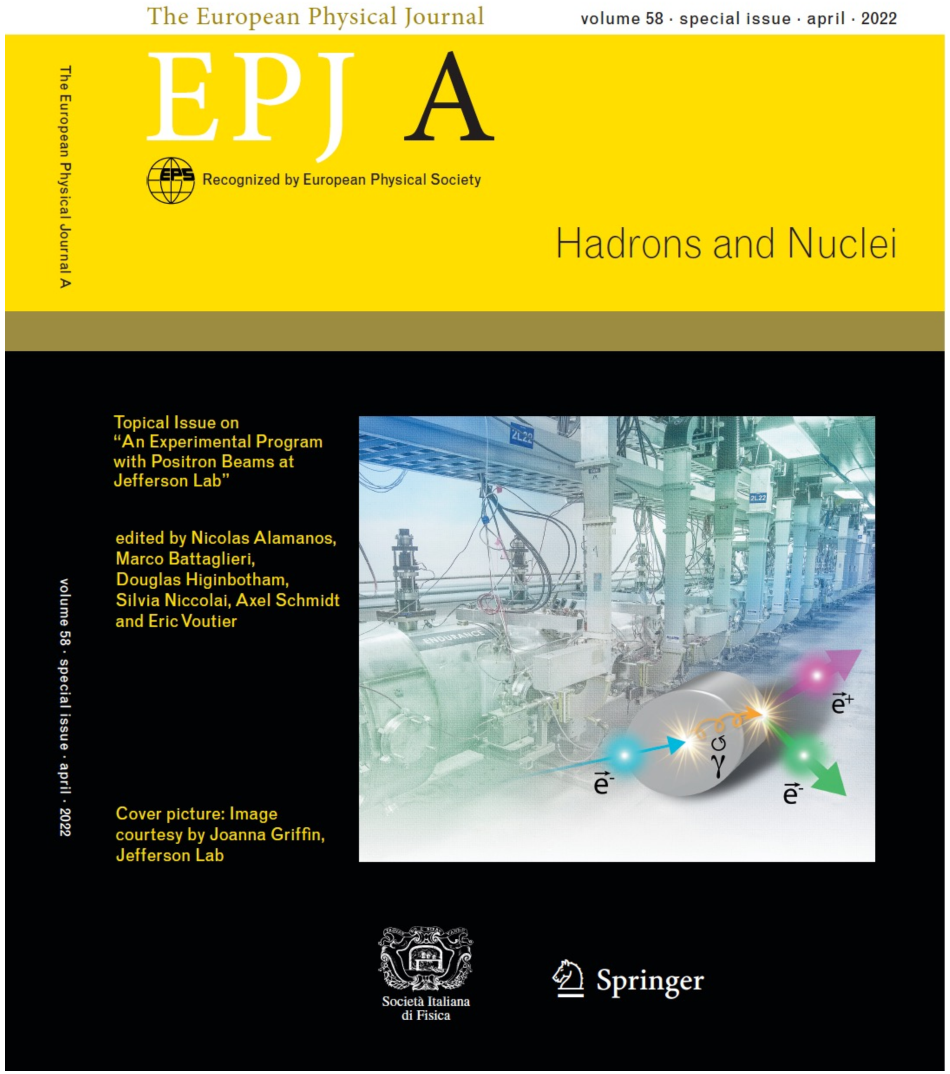
Eric Voutier and the **Jefferson Lab Positron Working Group**

Université Paris-Saclay, CNRS/IN2P3/IJCLab, Orsay, France



(i) Positron White Paper
(ii) Two photon exchange
(iii) Nuclear structure
(iv) Beyond the standard model
(v) Positron injector concept

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement Nº 824093.



- The **JLab Positron Working Group** (PWG) developed the perspectives of an experimental program with **positron beams at CEBAF** in a specific EPJ A Topical.

- This document constitutes the final **JLab Positron White Paper**, gathering 19 single contributions and a summary article, all peer-reviewed.

JLab PWG = ~**250** Physicists
from **75** Institutions and **16** countries

(Jefferson Lab Positron Working Group) A. Accardi *et al.* EPJ A 57 (2021) 261

Subscribe** to the JLab Positron Working Group mailing list **pwg@jlab.org

Positron Partial Program Summary

Experiment: Label (EPJ A)	Short Name	Measurement Configuration: Hall	Detector	Target	Beam Parameters: Polarity	p (GeV/c)	P (%)	I (μA)	Time (d)
Two Photon Exchange Physics									
57:144	$H(e,e'p)$	B	CLAS12	H_2	$+/-_s$	2.2/3.3/4.4/6.6	0	0.060	53
57:188	$H(\vec{e},e'\vec{p})$	A	ECAL/SBS	H_2	$+/-_p$	2.2/4.4	60	0.200	121
57:199	r_p r_d	B	PRad-II	H_2 D_2	$+$	0.7/1.4/2.1 1.1/2.2	0	0.070 0.010	40 39
57:213	$\vec{H}(e,e'p)$	A	BB/SBS	$N\vec{H}_3$	$+/-_s$	2.2/4.4/6.6	0	0.100	20
57:290	$H(e,e'p)$	A	HRS/BB/SBS	H_2	$+/-_s$	2.2/4.4	0	1.000	14
57:319	SupRos	A	HRS	H_2	$+/-_p$	0.6−11.0	0	2.000	35
58:36	$A(e,e')A$	A	HRS	He	$+/-_p$	2.2	0	1.000	38
Nuclear Structure Physics									
57:186	p-DVCS	B	CLAS12	H_2	$+/-_s$	2.2/10.6	60	0.045	100
57:226	n-DVCS	B	CLAS12	D_2	$+/-_s$	11.0	60	0.060	80
57:240	p-DDVCS	A	SoLID$^\mu$	H_2	$+/-_s$	11.0	(30)	3.000	100
57:273	He-DVCS	B	CLAS12/ALERT	^{4}He	$+/-_s$	11.0	60		
57:300	p-DVCS	C	SHMS/NPS	H_2	$+$	6.6/8.8/11.0	0	5.000	77
57:311	DIS	A/C	HRS/HMS/SHMS		$+/-_s$	11.0			
57:316	VCS	C	HMS/SHMS	H_2	$+/-_s$		60		
Beyond the Standard Model Physics									
57:173	C_{3q}	A	SoLID	D_2	$+/-_s$	6.6/11.0	(30)	3.000	104
57:253	LDM	B	PADME ECAL/HCAL	C $PbW0_4$	$+$	11.0	0	0.100	180 120
57:315	CLFV	A	SoLID$^\mu$	H_2	$+$	11.0			
								Total (d)	**1121**

SoLID$^\mu$ $\equiv$ SoLID complemented with a muon detector
$+$ Secondary positron beam
$-_s$ Secondary electron beam
$-_p$ Primary electron beam
(30) Do not require polarization but would take advantage if available at the required beam intensity

- **TPE Physics** in elastic scattering globally asks for low beam energies.
- **Nucleon Structure Physics** and **Beyond the Standard Model Physics** ask for high beam energies.
- There exists strong opportunities for **polarized target experiments**, which have not been yet explored.

Subscribe *to the JLab Positron Working Group mailing list* ***pwg@jlab.org***

➤ **6 Proposals** and **5 Letters-of-Intent** have been submitted to the 2023 JLab Program Advisory Committee

2023 Submissions @ JLab PAC51

Experiment			Measurement Configuration			Beam Parameters				
Short Name	Label	Contact	Hall	Detector	Target	Polarity	p (GeV/c)	P (%)	I (μA)	Time (d)
Two Photon Exchange Physics										
Coulomb Distorsion	PR12+23-003	D. Gaskell	C	HMS	LD_2,Au	+	4.4/11.	0	1.0	10
TPE@CLAS12	PR12+23-008	A. Schmidt	B	CLAS12	LH_2	$+/-_s$	2.2/4.4/6.6	0	0.075/0.075	55
Super-Rosenbuth	PR12+23-012	M. Nycz	C	HMS	LH_2	+/−	0.65−11.	0	1.0/20.	56
Polarization Transfert	LOI12+23-008	A. Puckett	A	SBS+BigCal	LH_2	+	2.2/4.4	60	0.200	120
Dispersive Effects	LOI12+23-015	P. Gueye	A,C	HRS or HMS	C,Al,Cu,Ca,Fe,Pb	+	0.6-4.4	0		
Nuclear Structure Physics										
DVCS BCAs	PR12+23-002	E. Voutier	B	CLAS12	LH_2	$+/-_s$	2.2/11.	60/60	0.050/0.050	100
DVCS XSection	PR12+23-006	C. Muñoz Camacho	C	SHMS+NPS	LH_2	+	6.6/8.8/11.	0	1.0	135
Polarizabilities	LOI12+23-001	N. Sparveris	C	SHMS+HMS	LH_2	+/−	2.2	0	5.0/50.	77
Axial Form Factor	LOI12+23-002	D. Dutta	A,C	mTPC+SBS	^{2}H	+	2.0-6.0	60	0.200	60
Beyond the Standard Model Physics										
Dark Photon Search	PR12+23-005	B. Wojtsekhowski	B	PRad	LH_2	+	2.2/4.4/11.	0	0.050	60
Dark Bhabha	LOI12+23-005	D. Mack	C	Pair Spec.	e^-	+	0.50-11.			

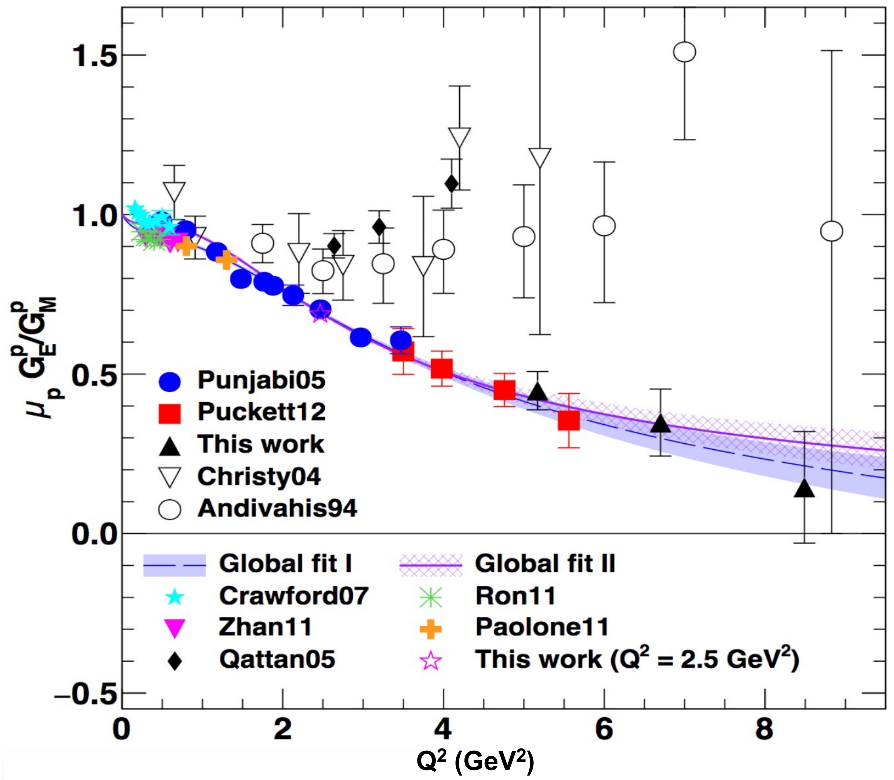
***More proposals** and **new ideas** to come…*

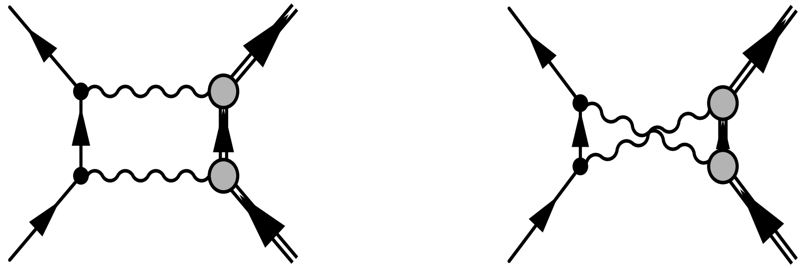
Subscribe** to the JLab Positron Working Group mailing list **pwg@jlab.org

P.A.M. Guichon, M. Vanderhaeghen, PRL 91 (2003) 142303   P.G. Blunden, W. Melnitchouk, J.A. Tjon, PRL 91 (2003) 142304

➢ Measurements of polarization transfer observables in electron elastic scattering off protons question the validity of the 1γ exchange approximation (OPE) of the electromagnetic interaction.

A.J.R. Puckett et al. PRC 96 (2017) 055203





Hard two-photon exchange (TPE) may be the cause of the form factor discrepancy at high Q^2.

- If TPE, the electromagnetic structure of the nucleon would be parameterized by 3 generalized form factors i.e. 8 unknow quantities.
- TPE can only be calculated within model-dependent approaches.

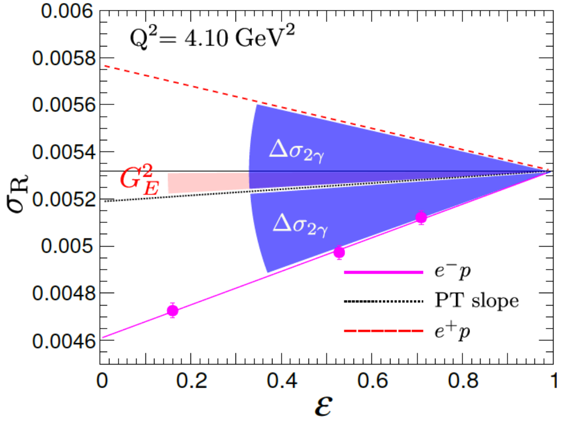
*e^+ @ JLab have the unique opportunity to bring a **definitive answer** about TPE.*

Experimental Observables

$$R_{2\gamma} = \frac{\sigma_{e^+}}{\sigma_{e^-}} \approx 1 + \delta_{2\gamma}$$

- The ratio of the positron and electron induced elastic cross sections measures TPE effects.

$$\sigma_R = G_M^2 + \frac{\varepsilon}{\tau} G_E^2 \pm 2\left\{ G_M \Re e\left[f_0\left(\delta\tilde{G}_M, \delta\tilde{F}_3\right)\right] + \frac{\varepsilon}{\tau} G_E \Re e\left[f_1\left(\delta\tilde{G}_E, \delta\tilde{F}_3\right)\right]\right\}$$



- The direct comparison of positron and electron Super-Rosenbluth separations doubles the sensitivity to a TPE signal, and test radiative correction hypotheses.

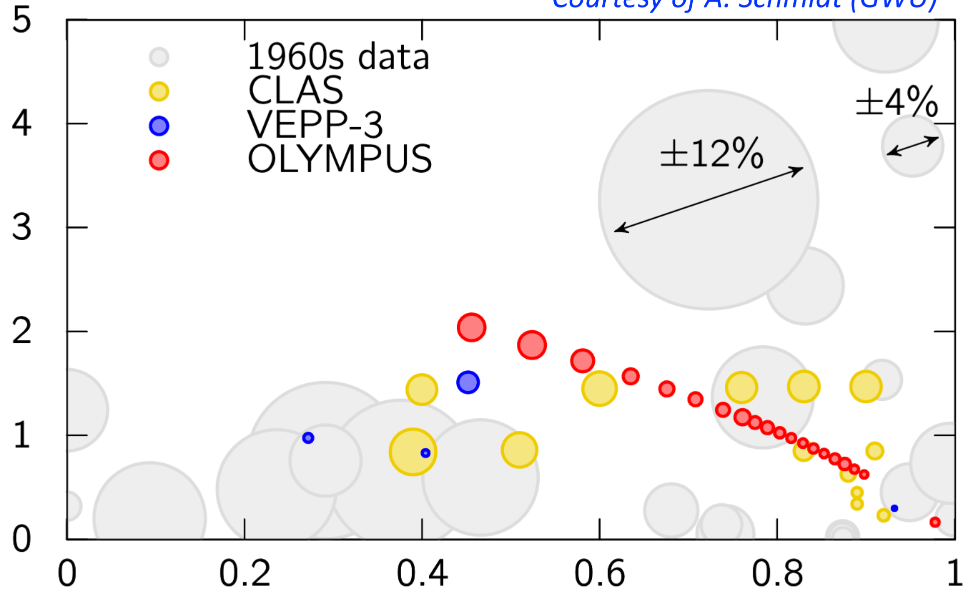
- The measurement of the polarization transfer of positrons to protons in the elastic scattering process is mandatory to establish its expected insensitivity to TPE.

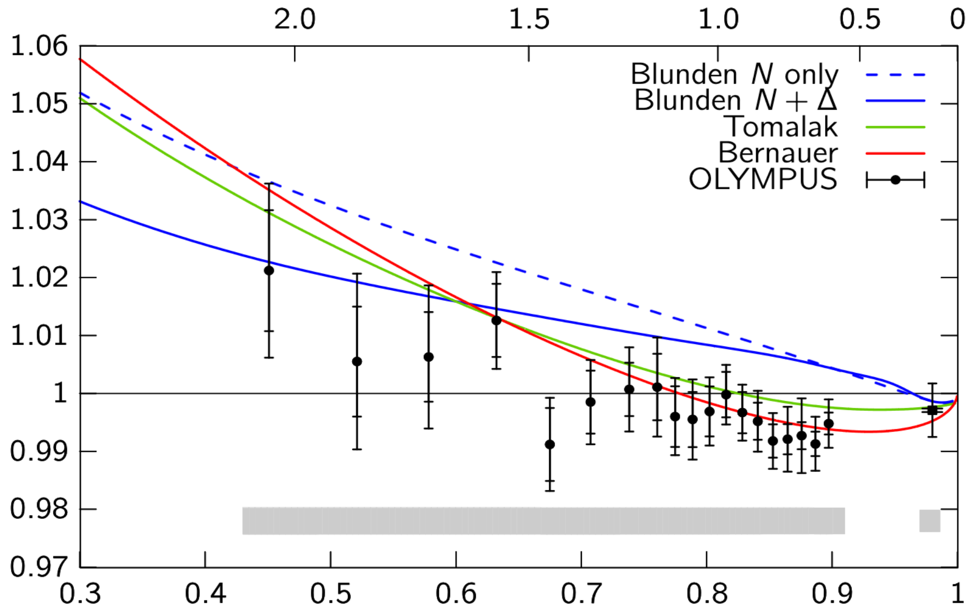
$$\frac{P_t}{P_l} \approx -\sqrt{\frac{2\epsilon}{(1+\epsilon)\tau}}\,\frac{G_E}{G_M}\left(1 \pm \left\{\frac{\Re e\left[\delta\tilde{G}_M\right]}{G_M} + \frac{\Re e\left[f_1\left(\delta\tilde{G}_E, \delta\tilde{F}_3\right)\right]}{G_E} - 2\frac{\Re e\left[f_2\left(\delta\tilde{G}_M, \delta\tilde{F}_3\right)\right]}{G_M}\right\}\right)$$

Current Knowledge

- Three experiments (CLAS,VEPP-3,OLYMPUS) recently attempted to measure TPE effects, but lacked the kinematical reach to draw meaningfull conclusions.
- OLYMPUS seems to observe a small effect, barely consistent with TPE expectations.

Courtesy of A. Schmidt (GWU)





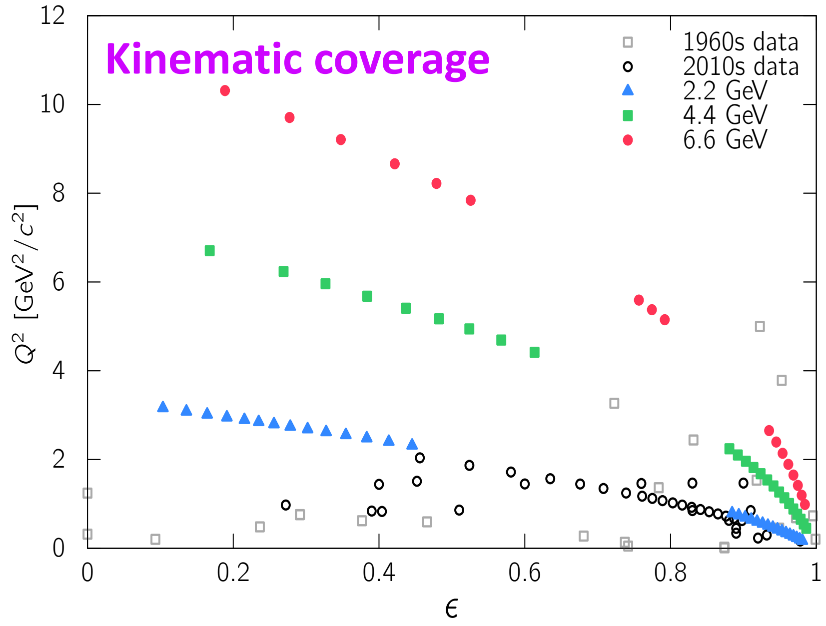
(CLAS Collaboration) D. Adikaram et al. PRL 114 (2015) 062003 I.A. Rachek et al. PRL 114 (2015) 062005 (OLYMPUS Collaboration) B. Henderson et al. PRL 118 (2017) 092501

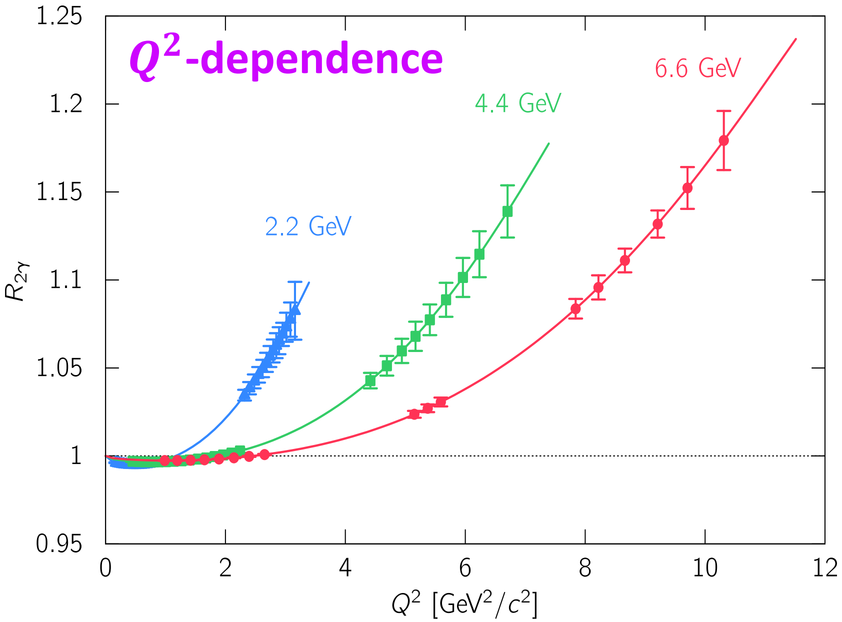
PR12+23-008

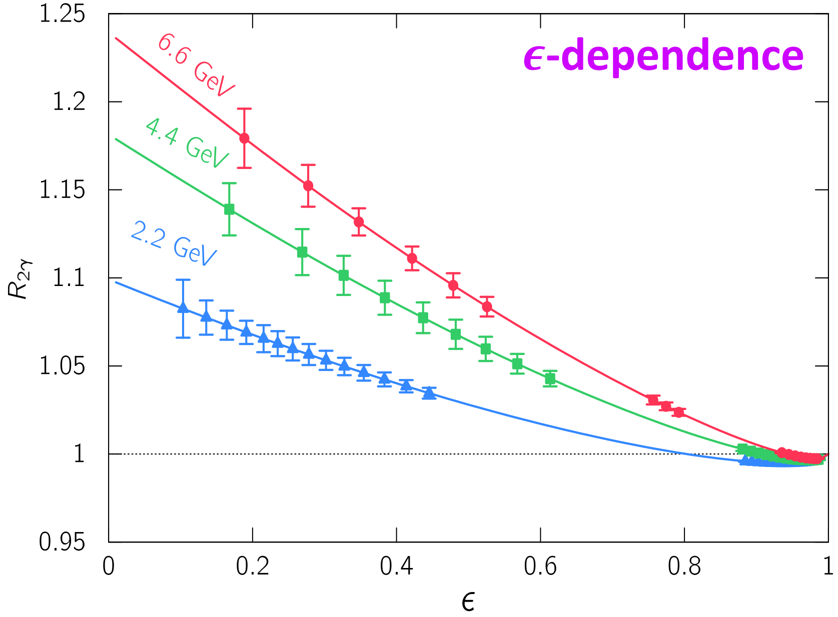
A. Schmidt, J.C. Bernauer, V. Burkert, E. Cline, I. Korover, T. Kutz, S.N. Santiesteban et al.

J.C. Bernauer et al. EPJ A 57 (2021) 144

- Over a run of **55 days**, alternating e⁻ and e⁺ at 2.2-4.4-6.6 GeV and an intensity of 50 nA, the TPE@CLAS12 experiment proposes to **map-out TPE effects**.
- The CLAS12 **trigger** will be **modified** to allow lepton detection in the Central Detector while protons will be detected in the Forward Detector.







And Beyond...

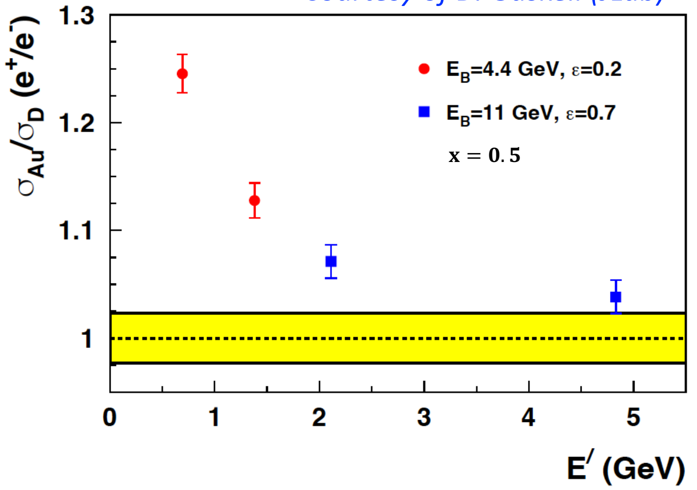
- The perspective of **positron beams** at JLab **nourishes further reflexions** about the importance of **multi-photon effects** in other reaction mechanisms.

T. Kutz, A. Schmidt EPJ A 58 (2022) 36
A. Afanasev at the Positron Working Group Workshop, Charlottesville (2023)
D. Gaskell et al. JLab Proposal PR12+23-003
P. Gueye et al. JLab Letter-of-Intent LOI12+23-015

❖ *TPE and multi-photon effects in $e^{\pm}N$ interactions*

- TPE in elastic scattering off nuclei
- Dispersive effects in A(e,e') inclusive scattering
- ...

Courtesy of D. Gaskell (JLab)



❖ *TPE effects in Deep Inelastic Scattering (DIS)*

- Magnitude of TPE effects in DIS experiments ?
- Magnitude of TPE and photon radiation by the hadrons in SIDIS ?
- Description of Coulomb corrections in the DIS regime
- ...

*This **list** is not exhaustive but only **indicative** of the **current reflexions**.*

E. Voutier

Virtual Compton Scattering

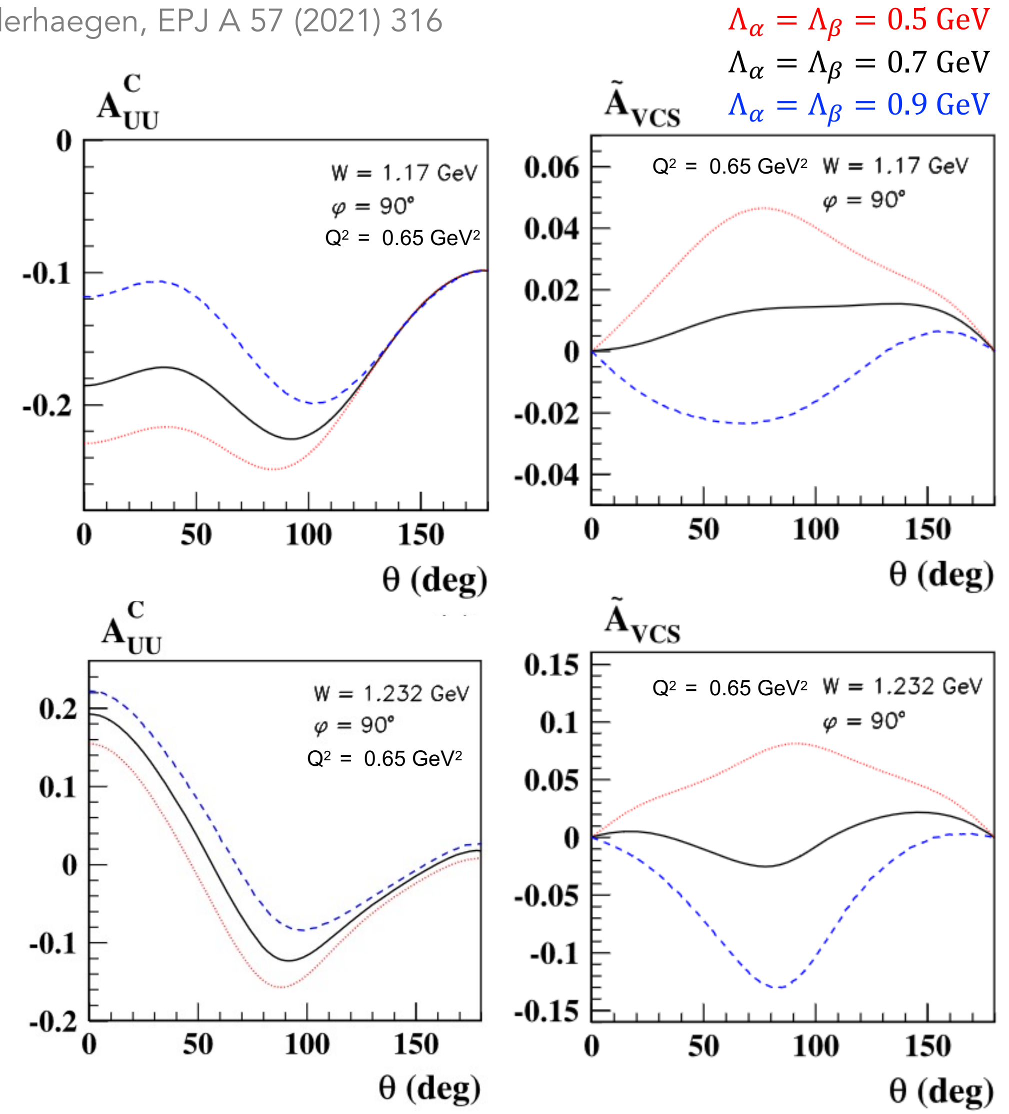
B. Pasquini, M. Vanderhaegen, EPJ A 57 (2021) 316

- The **comparison** of unpolarized/polarized electrons and positrons provides an independent path to access Generalized Polarizabilities (GPs).

$$d\sigma_P^e = d\sigma_{BH} + d\sigma_{VCS} + P d\tilde{\sigma}_{VCS} + e\,[d\sigma_{INT} + P d\tilde{\sigma}_{INT}]$$

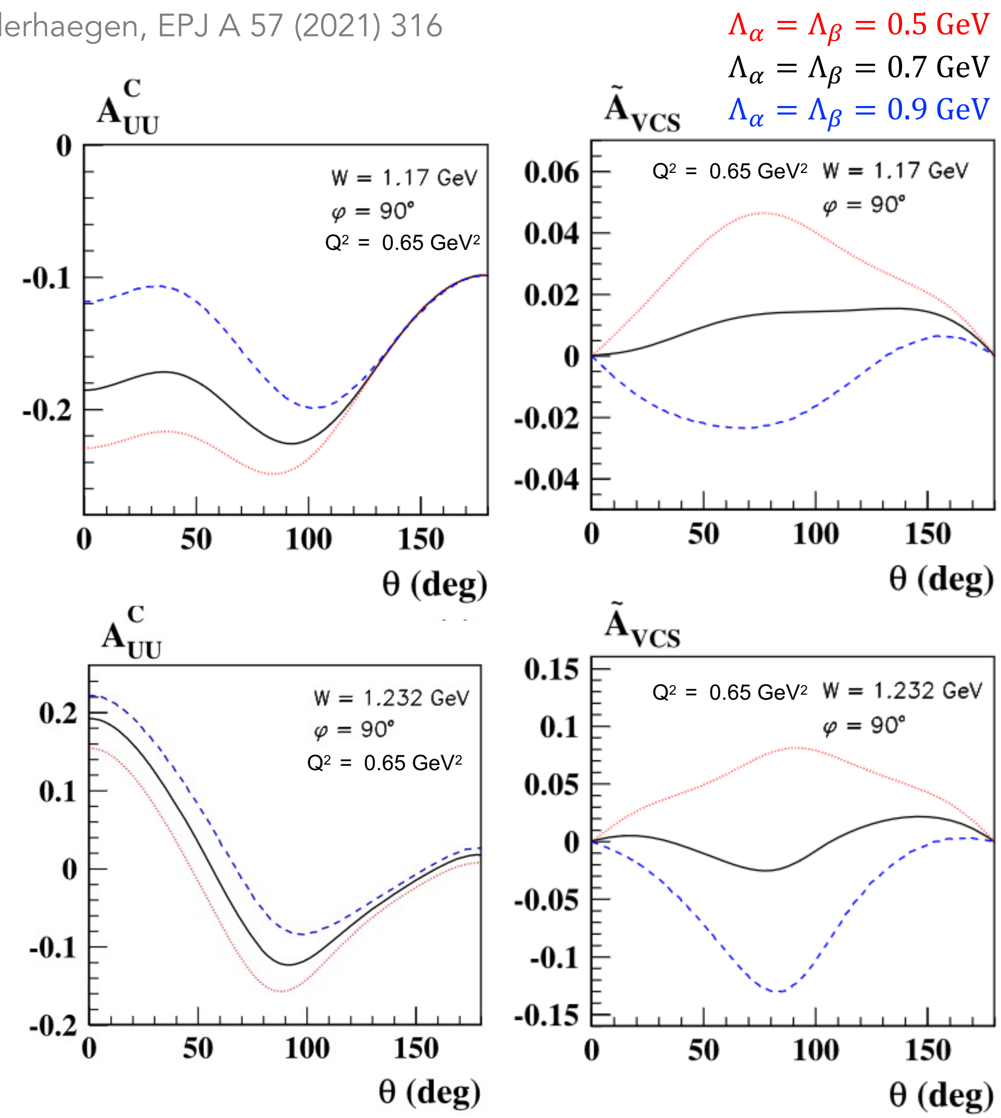
$$A_{UU}^C = \frac{d\sigma_{INT}}{d\sigma_{BH} + d\sigma_{VCS}} \qquad \tilde{A}_{VCS} = \frac{2\, d\tilde{\sigma}_{VCS}}{d\sigma_{BH} + d\sigma_{VCS}}$$

- These new observables show **sizeable sensitivity** to GPs.
- $\tilde{A}_{VCS}$ is particularly sensitive to the **electric dipole** GP.



Virtual Compton Scattering

B. Pasquini, M. Vanderhaegen, EPJ A 57 (2021) 316



- The **comparison** of unpolarized/polarized electrons and positrons provides an independent path to access Generalized Polarizabilities (GPs).

$$d\sigma^e_P = d\sigma_{BH} + d\sigma_{VCS} + P d\tilde{\sigma}_{VCS} + e\left[d\sigma_{INT} + P d\tilde{\sigma}_{INT}\right]$$

$$A^C_{UU} = \frac{d\sigma_{INT}}{d\sigma_{BH} + d\sigma_{VCS}} \qquad \tilde{A}_{VCS} = \frac{2\, d\tilde{\sigma}_{VCS}}{d\sigma_{BH} + d\sigma_{VCS}}$$

- These new observables show **sizeable sensitivity** to GPs.

- $\tilde{A}_{VCS}$ is particularly sensitive to the **electric dipole** GP.

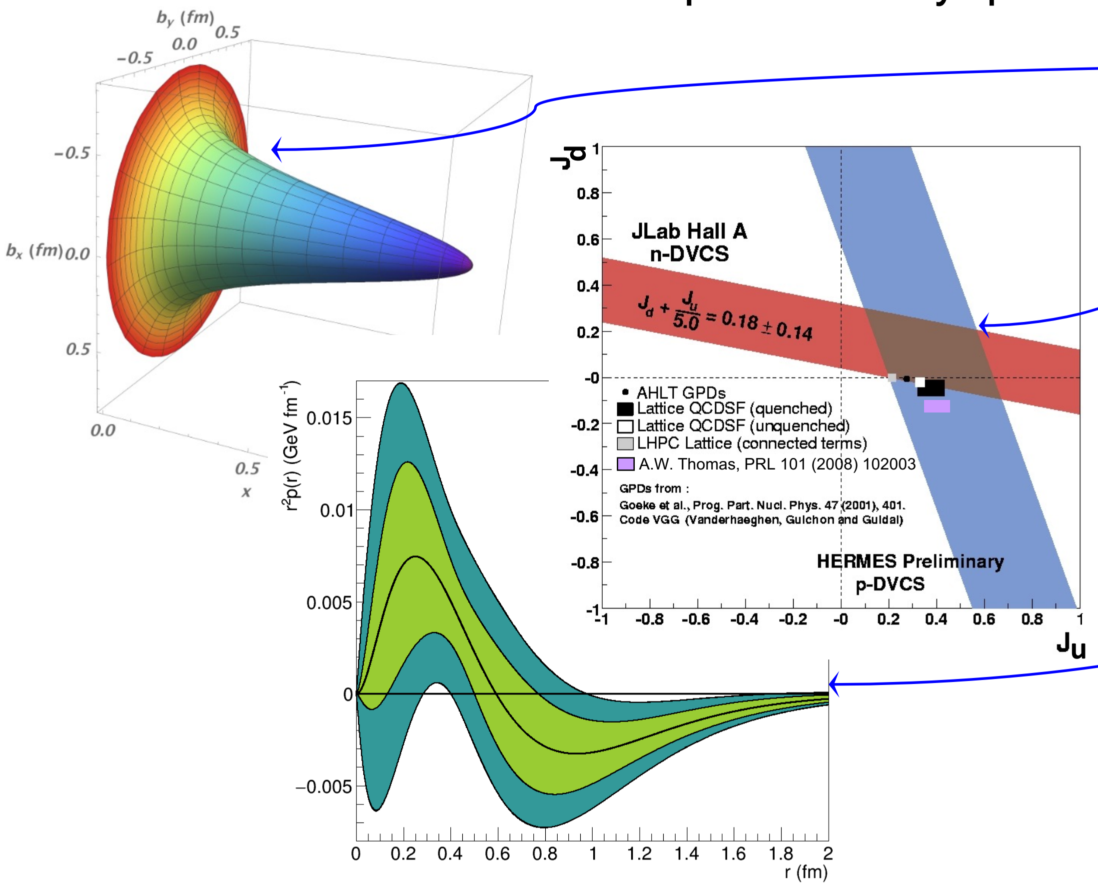
An experimental scenario is under study.

LOI12+23-001 N. Sparveris et al.

Nuclear sctructure

X. Ji, PRL 78 (1997) 610 M. Polyakov, PLB 555 (2003) 57 M.V. Polyakov, P. Schweitzer, IJMP A 33 (2018) 1830025

- Generalized Parton Distributions (**GPDs**) encode the **correlations between partons** and contain information about the **internal dynamics of hadrons** which express in properties like the **angular momentum** or the **distribution of the forces** experienced by quarks and gluons inside hadrons.



$$\rho_H^q(x,\boldsymbol{b}_\perp) = \int \frac{d^2\boldsymbol{\Delta}_\perp}{(2\pi)^2}\, e^{i\boldsymbol{b}_\perp\cdot\boldsymbol{\Delta}_\perp}\left[H^q(x,0,-\Delta_\perp^2) + H^q(-x,0,-\Delta_\perp^2)\right]$$

$$\lim_{t\to 0}\int_{-1}^{1} x\,[H^q(x,\xi,t) + E^q(x,\xi,t)]\,dx = J^q$$

$$\int_{-1}^{1} x \sum_q H^q(x,\xi,t)\ dx = M_2(t) + \frac{4}{5}\xi^2 d_1(t)$$

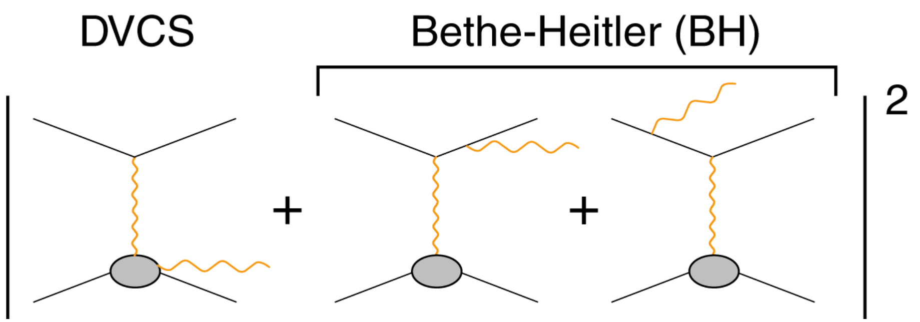
- **Unpolarized e^+ combined with unpolarized e^-** access the **real part** of the Compton Form Factors.
- **Polarized e^+ combined with polarized e^-** access the **imaginary part** of the Compton Form Factors (CFFs) and **higher twist effects**.

M. Mazouz et. al. PRL 9 (2007) 242501 A. Airapetian et al. JHEP 06 (2008) 066 R. Dupré, M. Guidal, M. Vanderhaeghen, PRD 95 (2017) 011501
V. Burkert, L. Elouadrhiri, F.-X. Girod, Nat. 557 (2018) 396

Deeply Virtual Compton Scattering

M. Diehl at the CLAS12 European Workshop, Genova, February 25-28, 2009

$\sigma(eN \longrightarrow eN\gamma) =$



CFF = Compton Form Factors

∝ to the **real part** of a **CFF linear combination**

∝ to the **imaginary part** of a **CFF linear combination**

$$\boxed{d^5\sigma^e_{P0} = d^5\sigma_{BH} + d^5\sigma_{DVCS} + P\, d^5\tilde{\sigma}_{DVCS} - e\left[d^5\sigma_{INT} + P\, d^5\tilde{\sigma}_{INT}\right]}$$

∝ to the **real part** of a **CFF bilinear combination**

∝ to the **imaginary part** of a **CFF bilinear combination**

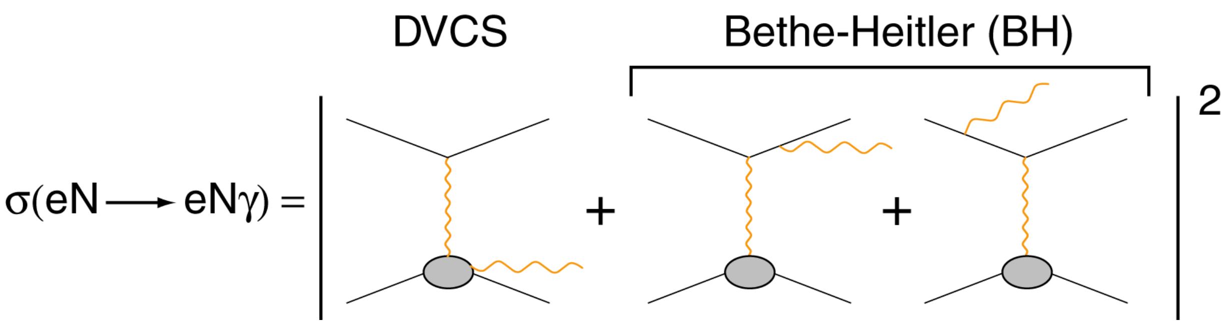
$$\boxed{d^5\sigma^e_{PS} = d^5\sigma^e_{P0} + S\left[P\, d^5\Delta\sigma_{BH} + (Pd^5\Delta\sigma_{DVCS} + d^5\Delta\tilde{\sigma}_{DVCS}) - e(Pd^5\Delta\sigma_{INT} + d^5\Delta\tilde{\sigma}_{INT})\right]}$$

Polarized electrons and positrons allow to separate the unknown amplitudes of the cross section for electro-production of photons.

E. Voutier

Deeply Virtual Compton Scattering

M. Diehl at the CLAS12 European Workshop, Genova, February 25-28, 2009



CFF = Compton Form Factors

∝ to the **real part** of a **CFF linear combination**

∝ to the **imaginary part** of a **CFF linear combination**

$$d^5\sigma^e_{P0} = d^5\sigma_{BH} + d^5\sigma_{DVCS} + P\, d^5\tilde{\sigma}_{DVCS} - e\,[d^5\sigma_{INT} + P\, d^5\tilde{\sigma}_{INT}]$$

∝ to the **real part** of a **CFF bilinear combination**

∝ to the **imaginary part** of a **CFF bilinear combination**

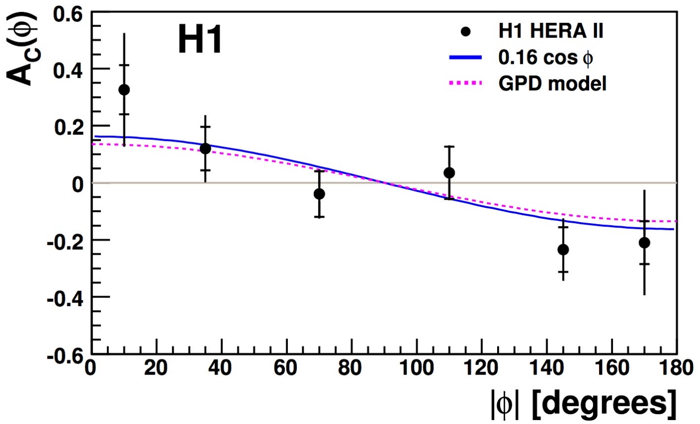
$$d^5\sigma^e_{PS} = d^5\sigma^e_{P0} + S\,[P\, d^5\Delta\sigma_{BH} + (P d^5\Delta\sigma_{DVCS} + d^5\Delta\tilde{\sigma}_{DVCS}) - e(P d^5\Delta\sigma_{INT} + d^5\Delta\tilde{\sigma}_{INT})\,]$$

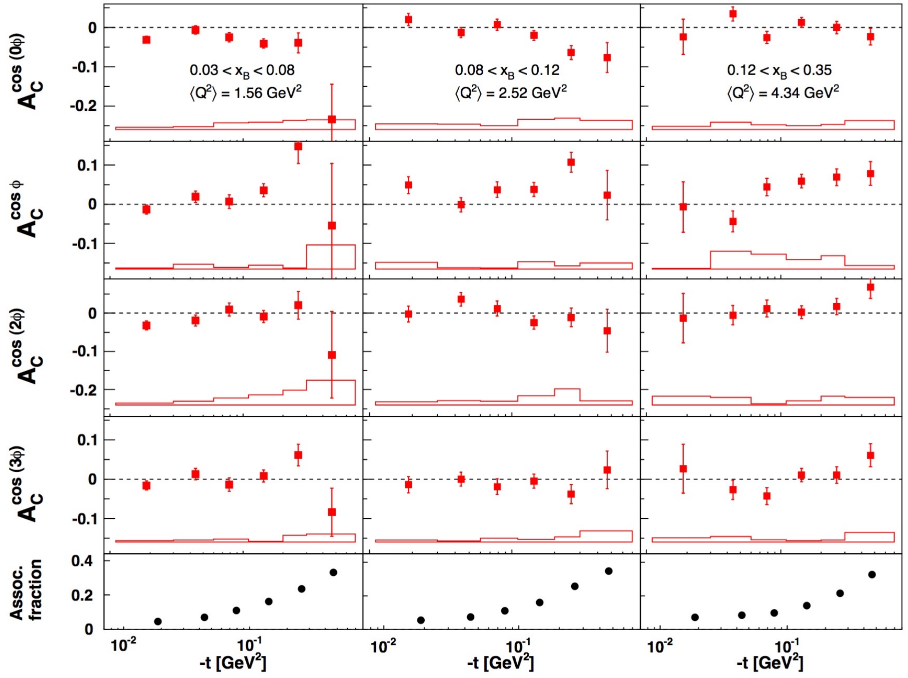
Polarized electrons and positrons allow to separate the unknown amplitudes of the cross section for electro-production of photons.

E. Voutier

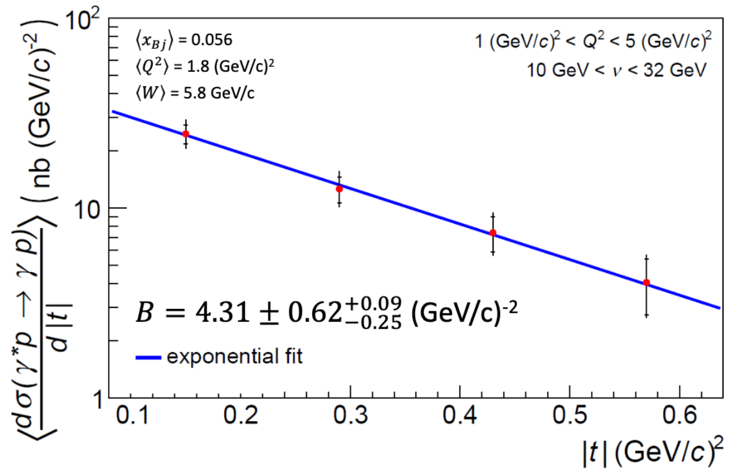
Current Knowledge

- Pioneering comparisons of DVCS with electron and positron beams at HERA and HERMES demonstrated the existence of a BCA-signal.
- Because of the $\overleftrightarrow{\mu}^{\pm}$ beam nature, the COMPASS experiment cannot combine beam charge and polarization independently.





$$\Sigma\sigma^{\pm}_{\mp P} = 2(d\sigma_{BH} + d\sigma_{VCS} - P d\tilde{\sigma}_{INT})$$



(H1 Collaboration) F.D. Aaron et al. PLB 681 (2009) 391 (HERMES Collaboration) A. Airapetian et al. JHEP 06 (2008) 066 – 11(2009) 083 – 07 (2012) 032
(COMPASS Collaboration) R. Akhunzyanov et al. PLB 793 (2019) 188

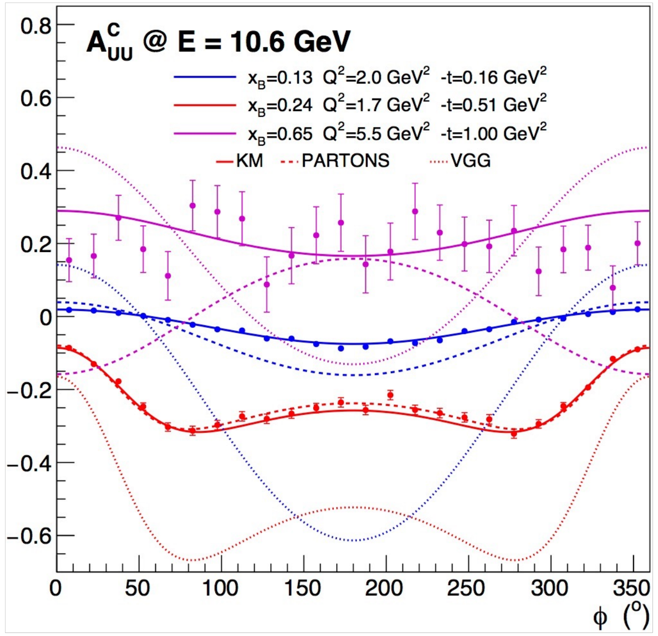
PR12+23-002
E. Voutier, V. Burkert, S. Niccolai, R. Paremuzyan et al.

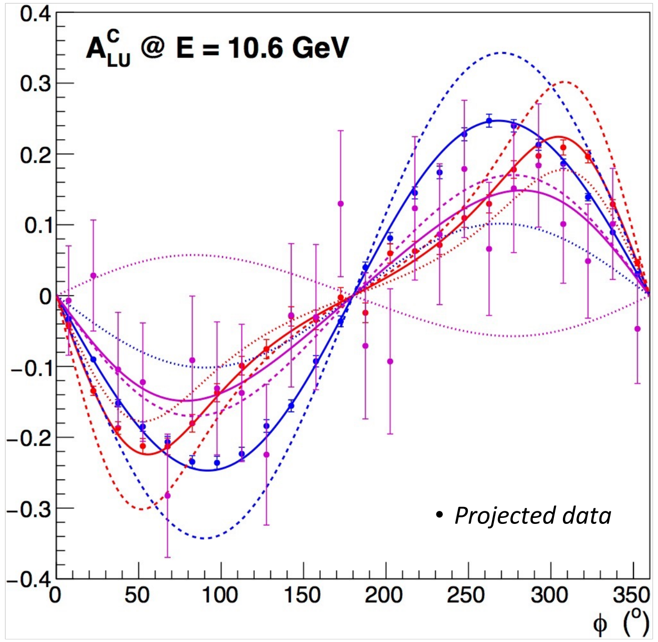
V. Burkert et al. EPJ A 57 (2021) 186

- Measurements of beam charge asymmetries with CLAS12 will provide a full set of new GPD observables:

  - the unpolarized beam charge asymmetry A^C_{UU}, sensitive to the CFF real part;
  - the polarized beam charge asymmetry A^C_{LU}, sensitive to the CFF imaginary part;
  - the charge averaged beam spin asymmetry A^0_{LU}, signature of higher twist effects.

$$A^C_{UU} = \frac{d^5\sigma_{INT}}{d^5\sigma_{BH} + d^5\sigma_{DVCS}}$$





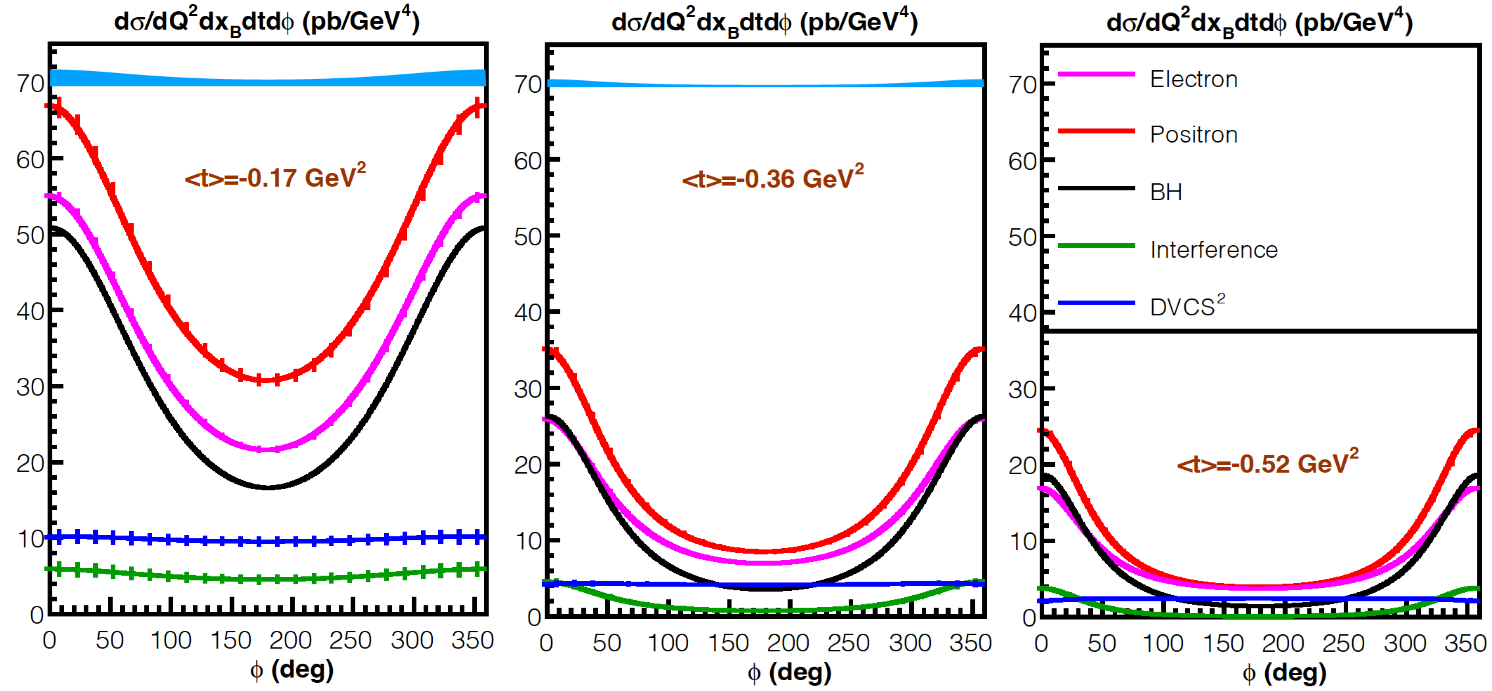
$$A^C_{LU} = \frac{d^5\tilde{\sigma}_{INT}}{d^5\sigma_{BH} + d^5\sigma_{DVCS}}$$

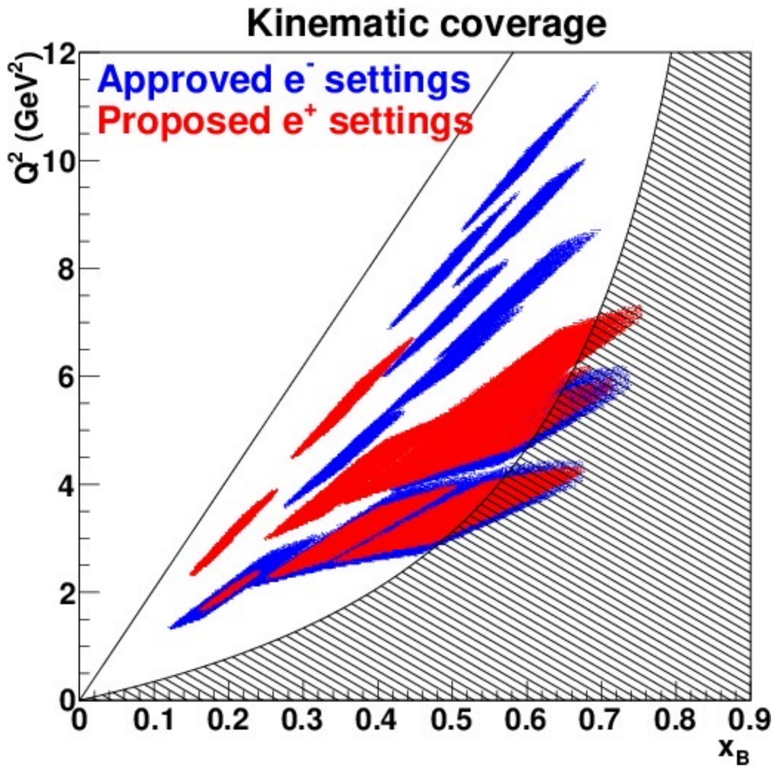
PR12+23-006
C. Muñoz Camacho, M. Mazouz et al.

A. Afanasev et al. EPJ A 57 (2021) 300

- Combining the HMS and the NPS spectrometers, precise cross section measurements with unpolarized positron beam are proposed at selected kinematics where electron beam data will soon be accumulated.

$x_B = 0.36 \quad Q^2 = 4.0\ GeV^2$

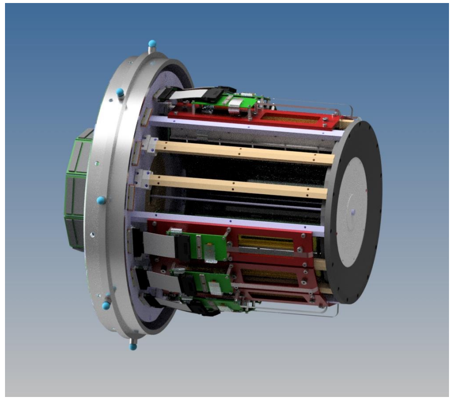




And Beyond…

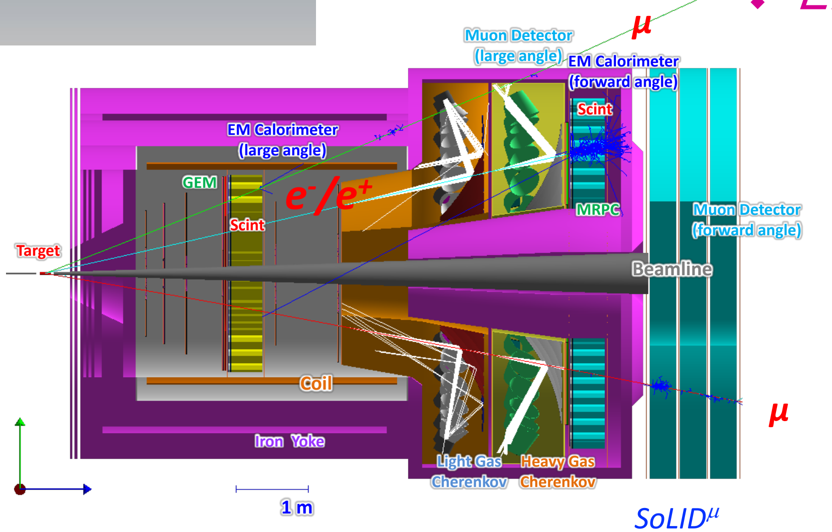
S. Niccolai, P. Chatagnon, M. Hoballah, D. Marchand, C. Muñoz Camacho, E. Voutier, EPJ A 57 (2021) 226
S. Fucini, M. Hattawy, M. Rinaldi, S. Scopetta, EPJ A 57 (2021) 273
S. Zhao et al. EPJ A 57 (2021) 240

ALERT



❖ *Generalized parton distributions*

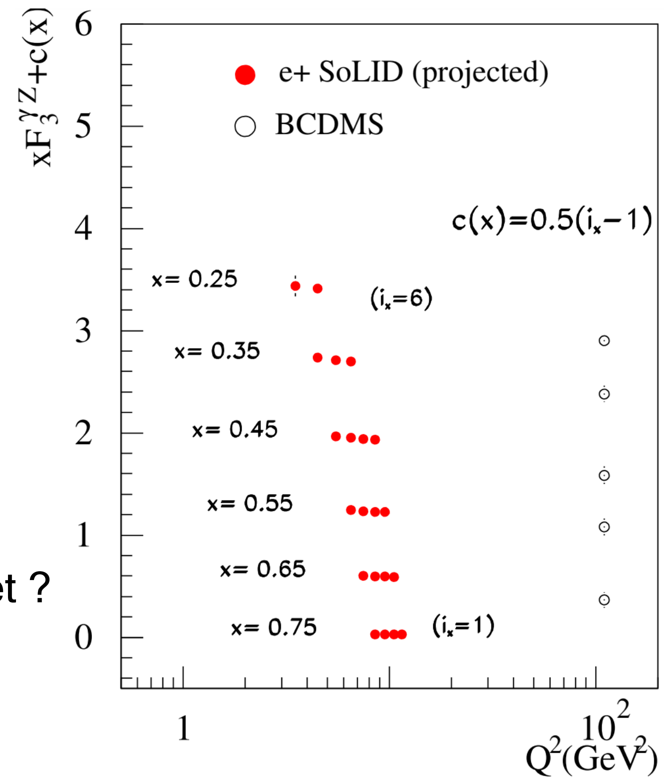
- DVCS off the neutron
- Coherent DVCS off the nucleus
- Incoherent DVCS off the nucleus
- Double DVCS off the proton
- DVCS off polarized targets ?
- ...



SoLID$^{\mu}$

❖ *Electroweak physics*

- Axial form factor of the proton
- DIS on a longitudinally polarized target ?
- Strangeness content of the nucleon ?
- Electroweak structure function $F_3^{\gamma Z}$
- ...



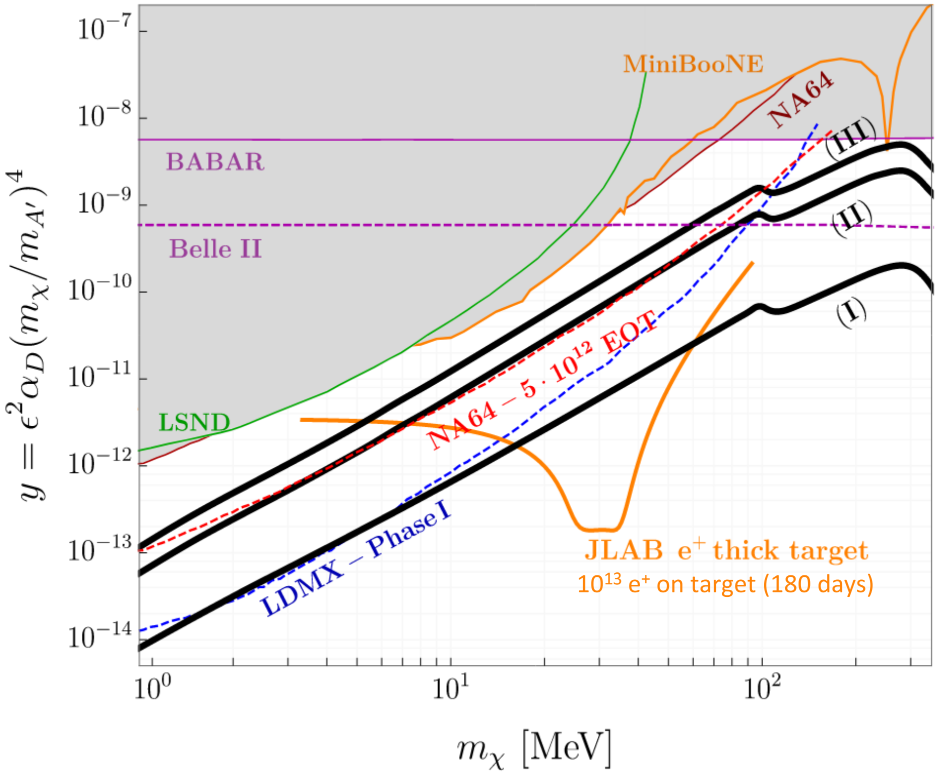
E. Aschenauer, T. Burton, T. Martin, H. Spiesberger, M. Stratman, PRD 88 (2013) 114025
W. Melnitchouk, J.F. Owens EPJ A 57 (2021) 311
X. Zheng et al. Jefferson Lab Proposal PR12-21-006 (2021)
D. Dutta et al. JLab Letter-of-Intent LOI12+23-002

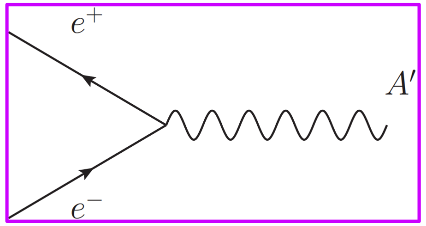
This list is not exhaustive but only indicative of the current reflexions.

Direct Dark Matter Production

M. Battaglieri et al. EPJ A 57 (2021) 253

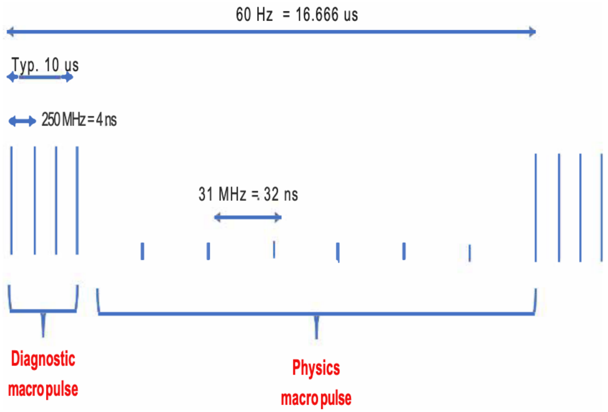
- A direct search of dark matter in the e^+e^-**annihilation** has been evaluted using a beam energy of **11 GeV** and a **180 days** data taking period.
- The measurement of an **energy deposit smaller** than the **e⁺ beam energy** signs the **production** of the *A'*.



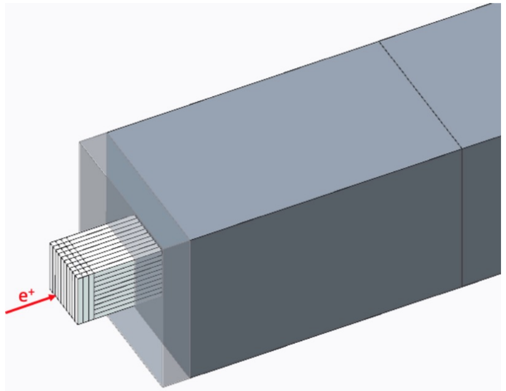


$$E_{miss} = E_{beam} - E_{CAL}$$

$$m_{A'} = \sqrt{2 m_e E_{miss}}$$

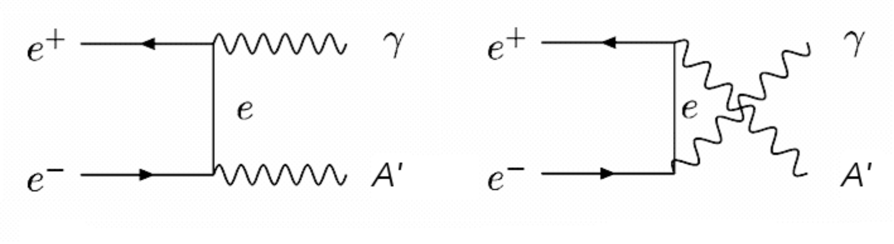


A non-trivial time structure of the beam is required to avoid e⁺ beam pile-up in the detector.



*An **active thick target** completed with an **hadronic calorimeter** constitute the experimental set-up.*

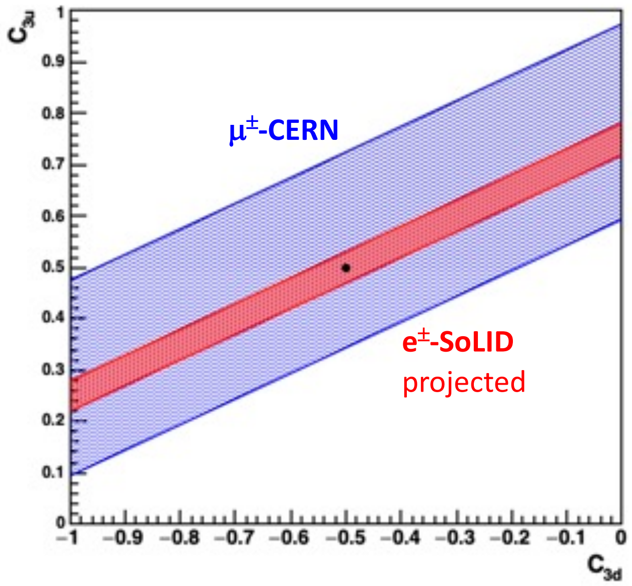
And Beyond...



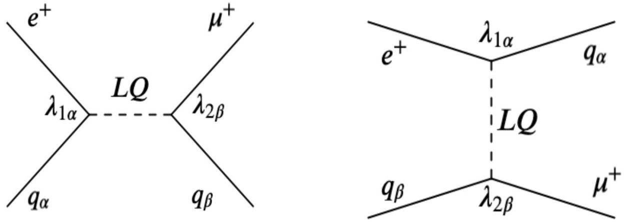
❖ *Testing standard model predictions*

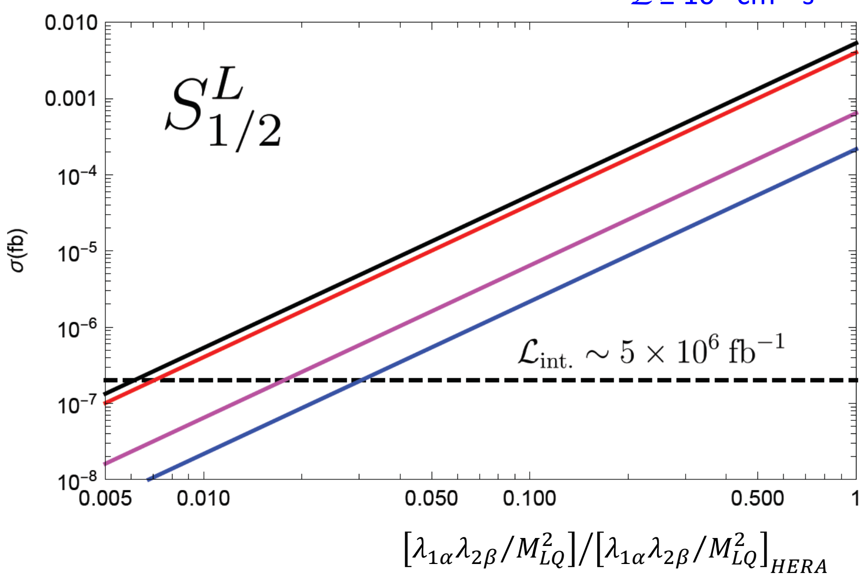
- Dark matter search
- Axial-axial neutral current coupling
- Charged lepton flavor violation ?
- ...

$$\mathcal{L} = \frac{G_F}{\sqrt{2}} \sum_q \left[C_{1q}\, \bar\ell\gamma^\mu\gamma_5\ell\bar q\gamma_\mu q + C_{2q}\, \bar\ell\gamma^\mu\ell\bar q\gamma_\mu\gamma_5 q + C_{3q}\, \bar\ell\gamma^\mu\gamma_5\ell\bar q\gamma_\mu\gamma_5 q \right]$$



$$\boxed{e^\pm + N \longrightarrow \mu^\pm + X}$$





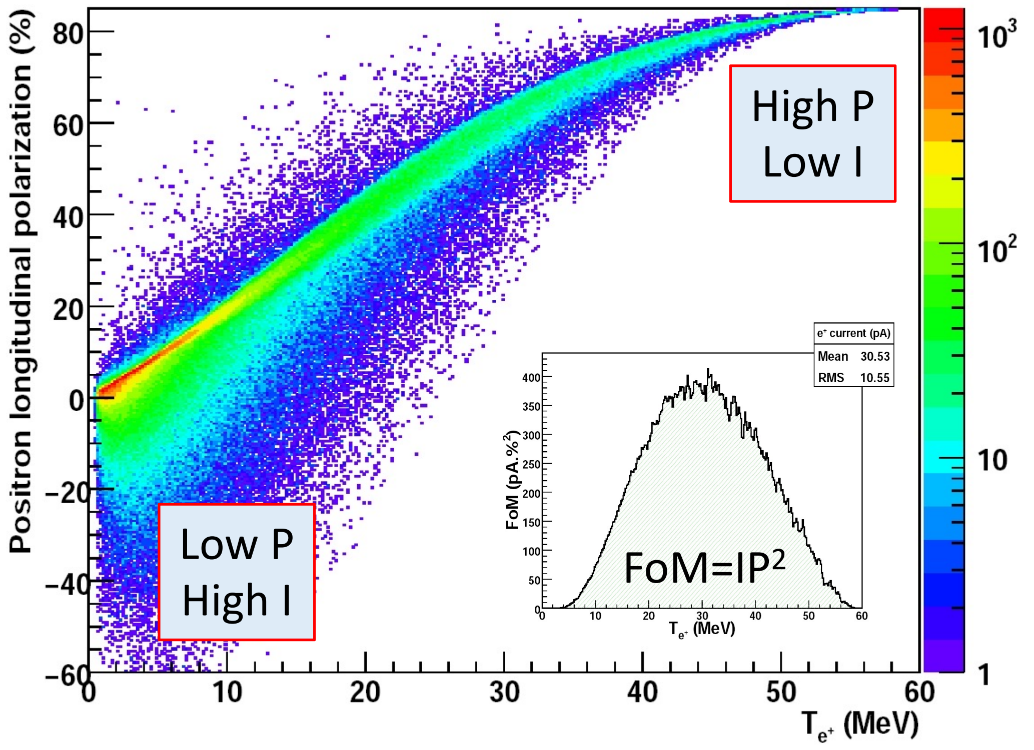
X. Zheng, J. Erler, Q. Liu, H. Spiesberger, EPJ A 57 (2021) 173 Y. Furletova, S. Mantry, EPJ A 57 (2021) 315
B. Wojtsekhowski et al. Jefferson Lab Proposal PR12+23-005 D. Mack Jefferson Letter-of-Intent PR12+23-005

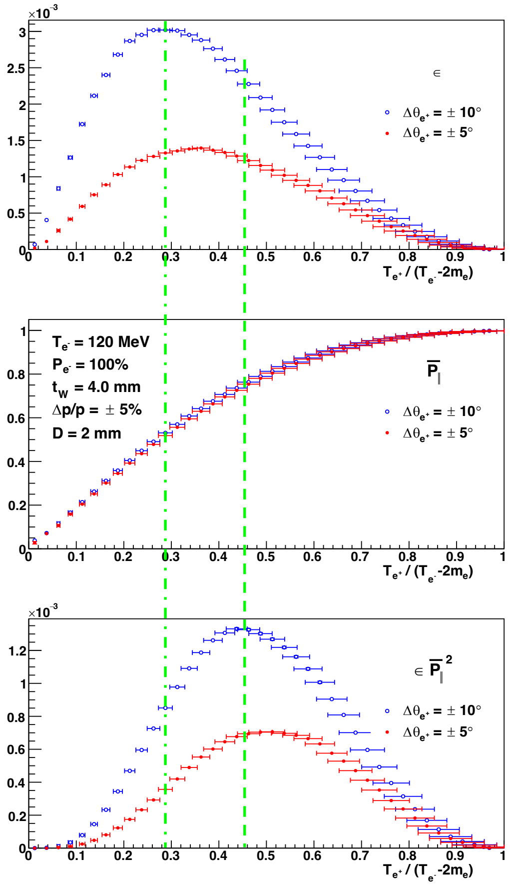
*This **list** is not exhaustive but only **indicative** of the **current reflexions**.*

Positron Production

(PEPPo Collaboration) D. Abbott *et al.* PRL 116 (2016) 214801

- The JLab positron source built on the PEPPo (Polarized Electrons for Polarized Positrons) experiment which demonstrated the efficient polarization transfer from electrons to positrons produced by polarized bremsstrahlung radiations.





- Selection of e^+ momentum allows to operate the source from low to highly polarized modes.

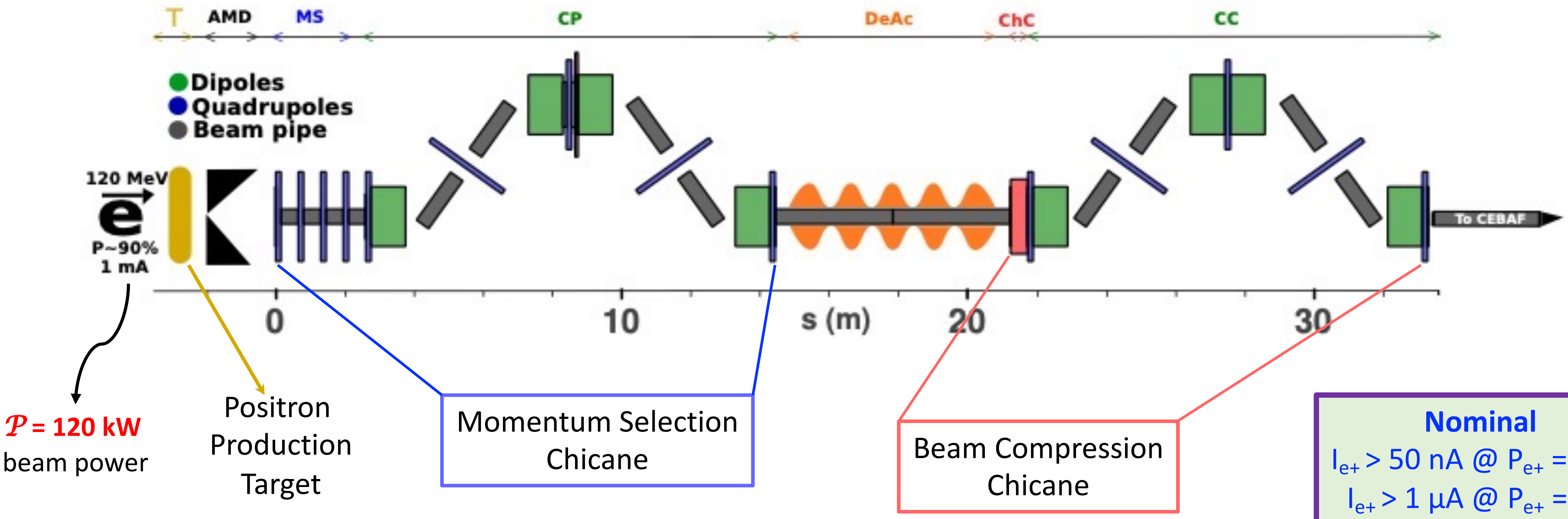
(Jefferson Lab Positron Working Group) A. Accardi *et al.* EPJ A 57 (2021) 261

E. Voutier
IJCLab Irène Joliot-Curie

Positron Collection

S. Habet *et al.* JACoW IPAC2022 (2022) 457

- The design of the JLab positron source evolved towards the today's concept :



Nominal
$I_{e+} > 50$ nA @ $P_{e+} = 60\%$
$I_{e+} > 1$ μA @ $P_{e+} = 0\%$

High duty cycle, ***intensity***, *and* ***polarization*** *distinguish JLab positron beam from any past or existing others.*

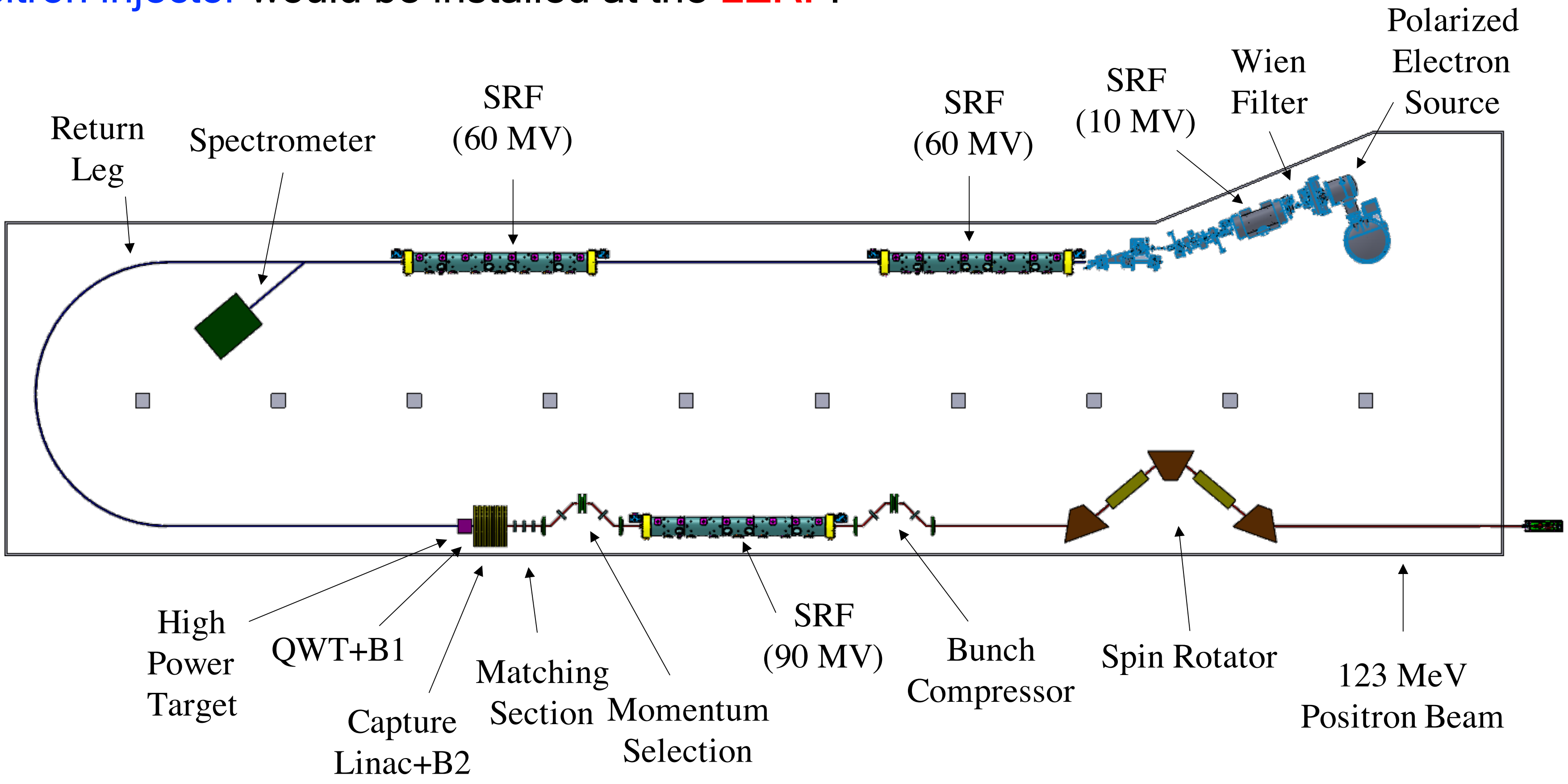
Work of Sami Habet (IJCLab/JLab)

E. Voutier
Irène Joliot-Curie

e+@LERF

(Ce+BAF Working Group) J. Grames *et al.* JACoW IPAC2023 (2023) MOPL152

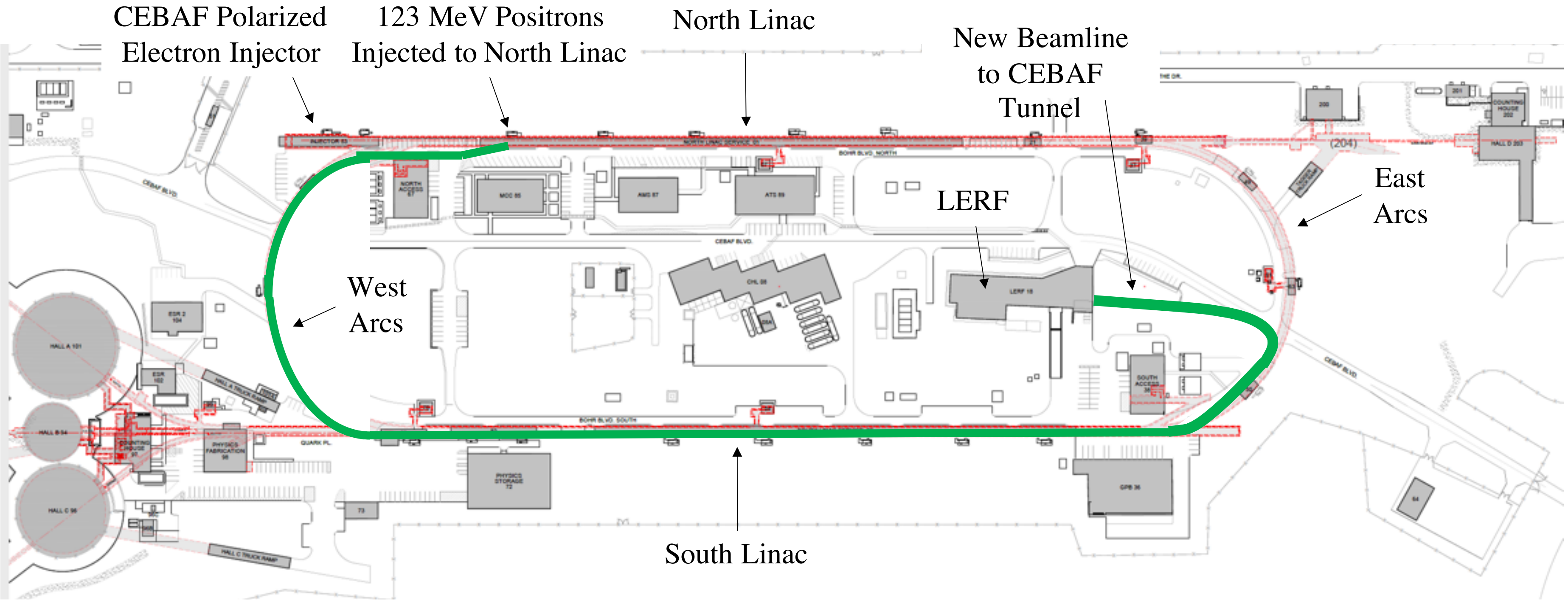
- Taking advantage of the existing infrastructure (electric and cryogenic power supplies, shielding…), the new positron injector would be installed at the LERF.



Ce^+BAF

(Ce+BAF Working Group) J. Grames *et al.* JACoW IPAC2023 (2023) MOPL152

- A new beam transport line attached to the ceiling of the existing tunnel will guide the 123 MeV e^+ beam till the injection point of the entrance of the North LinAc.



Work of Denis Turner and Yves Roblin (JLab)

Ce^{+}BAF Working Group

J. Benesch, A. Bogacz, L. Cardman, J. Conway, S. Covrig, J. Grames, J. Gubeli,
C. Gulliford, S. Habet, C. Hernandez-Garcia, D. Higinbotham, A. Hofler, R. Kazimi,
V. Kostroun, F. Lin, V. Lizarraga-Rubio, M. Poelker, Y. Roblin, A. Seryi, K. Smolenski,
M. Spata, R. Suleiman, A. Sy, D. Turner, A. Ushakov, C. Valerio, E. Voutier, S. Zhang, Y. Zhang

(Ce^{+}BAF Working Group) J. Grames *et al.* JACoW IPAC2023 (2023) MOPL152

S. Habet *et al.* JACoW IPAC2022 (2022) 457 R. Kazimi *et al.* JACoW IPAC2023 (2023) WEPA035 A. Sy *et al.* JACoW IPAC2023 (2023) MOPM081
A. Ushakov *et al.* JACoW IPAC2023 (2023) WEPM120

A pre-CDR document is due by the end of 2023 to serve positron source developments over the next years.

Summary

- A rich and high impact experimental program asking for intense CW polarized and unpolarized positron beams at JLab has been elaborated.

These beams would be a worldwide « première ».

- An R&D and construction plan is under progress, which goal is the production at the LERF of positron beams suitable for CEBAF acceleration within the 5 coming years.

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement Nº 824093.

Summary

- A rich and high impact experimental program asking for intense CW polarized and unpolarized positron beams at JLab has been elaborated.

These beams would be a worldwide « première ».

- An R&D and construction plan is under progress, which goal is the production at the LERF of positron beams suitable for CEBAF acceleration within the 5 coming years.

> ○ It is now time to submit the experimental program to the evaluation of the JLab PAC.
>
> Consider submitting proposals not only for high energy experiments at Ce$^+$BAF, but also for lower beam energies to be available at LERF an early stage of the project.

Subscribe** to the JLab Positron Working Group mailing list **pwg@jlab.org

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement Nº 824093.

Summary

E. Voutier
IJCLab Irène Joliot-Curie

- A rich and high impact experimental program asking for intense CW polarized and unpolarized positron beams at JLab has been elaborated.

These beams would be a worldwide « première ».

- An R&D and construction plan is under progress, which goal is the production at the LERF of positron beams suitable for CEBAF acceleration within the 5 coming years.

- It is now time to submit the **experimental program** to the **evaluation** of the **JLab PAC**.

Consider submitting proposals not only for **high energy** experiments at **Ce^+BAF**, but also for **lower beam energies** to be available at **LERF** an early stage of the project.

LERF

$I_{e-} > 1$ mA @ $P_{e-} > 90\%$
$I_{e+} > 50$ nA @ $P_{e+} = 60\%$
$I_{e+} > 1$ μA @ $P_{e+} = 0\%$
$T_{e^\pm} \lesssim 120$ MeV

Ce^+BAF

$I_{e+} > 50$ nA @ $P_{e+} = 60\%$
$I_{e+} > 1$ μA @ $P_{e+} = 0\%$
$T_{e^+} \lesssim 12$ GeV

__Subscribe__ to the JLab Positron Working Group mailing list __pwg@jlab.org__

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement Nº 824093.