STRONG-2020

Annual Meeting 2024

F. Maas for the P3E team (WP31/JRA13)

WP31/JRA13 objectives

Pushing further
the **intensity frontier** of polarized electron sources,
the **intensity frontier** of low energy polarized positron sources,
and the **precision frontier** of electron polarimetry

P3E-1 : High Intensity Polarized Electron Source

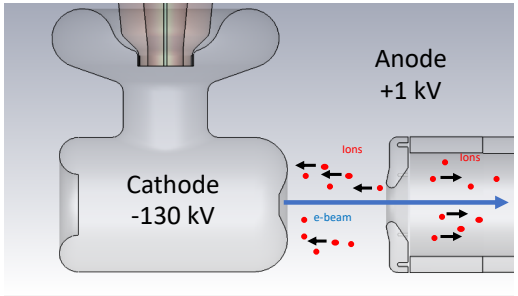
P3E-2 : High Intensity Polarized Positron Source

P3E-3 : High Precision Electron Polarimetry

N. Berger (JGU Mainz) & E. Voutier (Université Paris-Saclay) spokespersons

High intensity polarized electron source

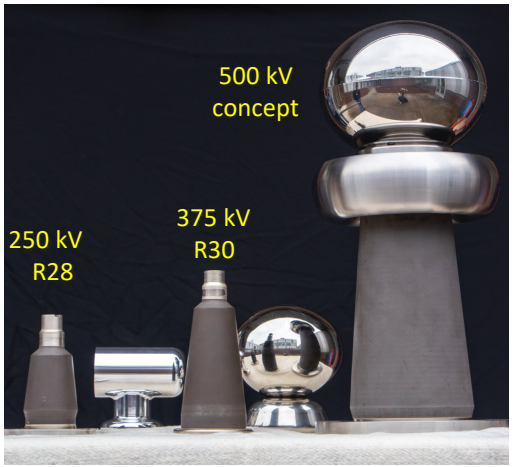
- The R&D achieved in the context of the **STRONG 2020** program serves the today development of the high intensity (**$I \geq 1$ mA**), high polarization (**$P \geq 90\%$**), and long life-time (**$Q \geq 1$ kC**) electron source of the polarized positron source project **Ce⁺BAF** at the Jefferson Lab.



The main limitation of photocathode lifetime is the **back-bombardment of ions** produced by the interaction of electrons with the **residual gas**.

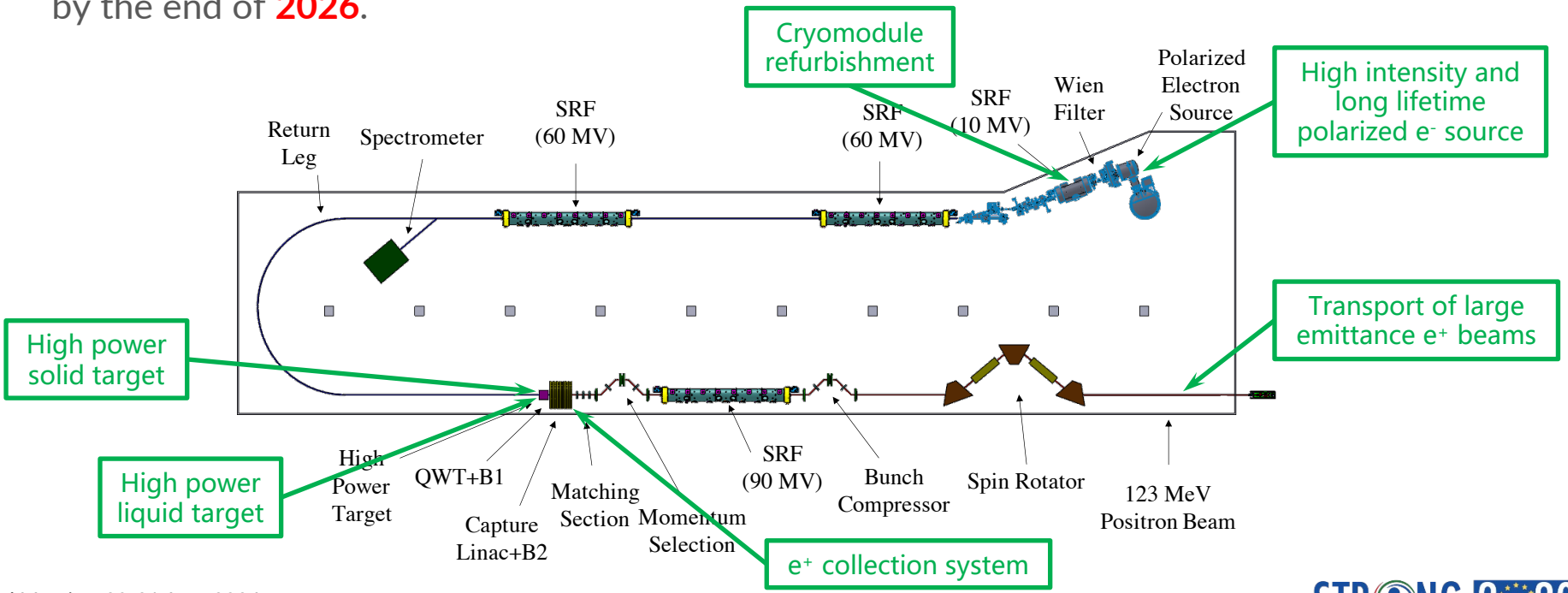
- Improvement of the **vacuum**.
- Increase of the gun **HV**.
- Enlargement of the **laser spot size**.
- Enlargement of the **photocathode**.

5 times better performance than the state-of-the-art CEBAF photogun



High intensity polarized positron source

- The R&D activity around the **Ce⁺BAF** project entered a new phase aiming at the **testing of critical components** and an **elaborated design of the positron source** towards a **pre-CDR** by the end of **2026**.



Scientific production

- The **Ce⁺BAF positron beam experimental program** at Jefferson Lab continues to develop with new proposals and letters-of-intent at the July **PAC52** meeting.

Presentations at Conferences

- IPAC 2024, Nashville (TN, USA)

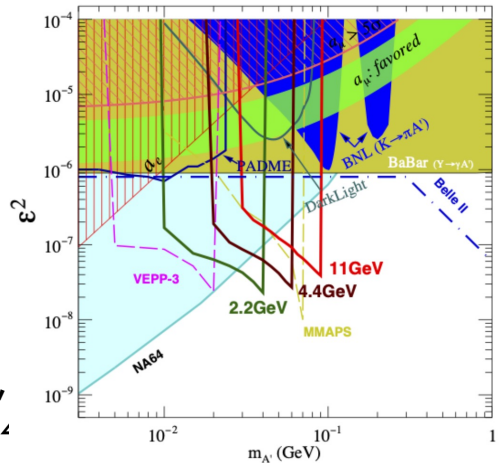
Publications

- S. Habet et al. arXiv:2401.04484
- T. Lengler et al. JACoW IPAC (2024) TUPC81

Workshop

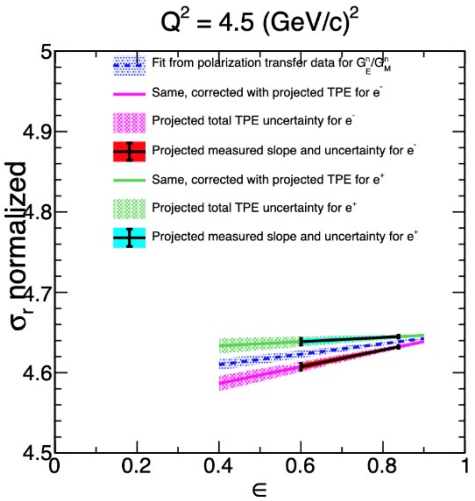
- Jefferson Lab Positron Working Group Workshop, Charlottesville (Virginia, USA), March 18-20, 202

Dark photon search



Proposal

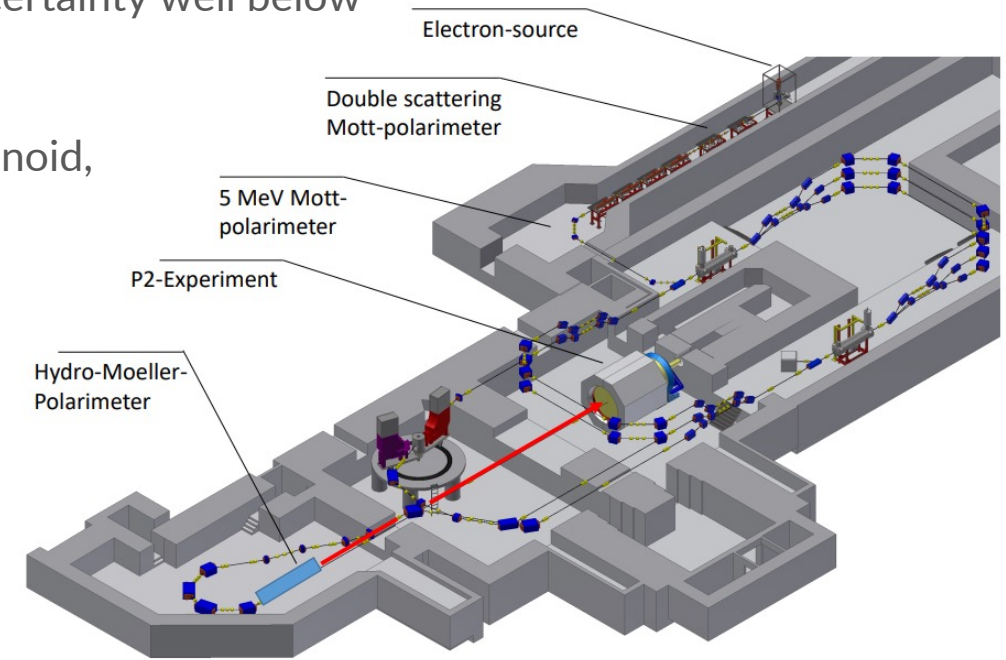
Two-photon effects in electron-neutron scattering



Letter-of-Intent

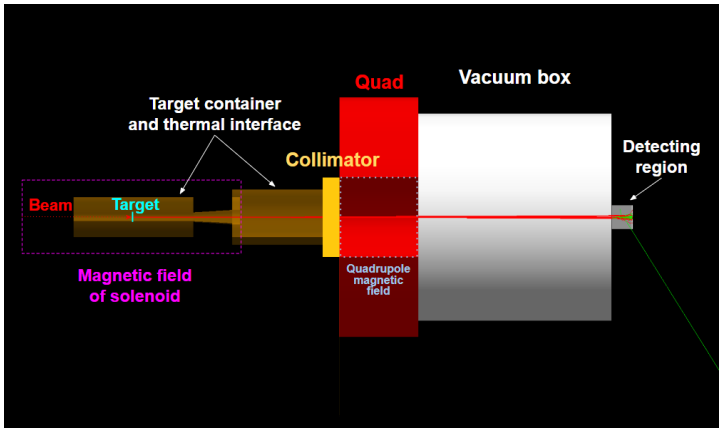
High precision electron polarimetry

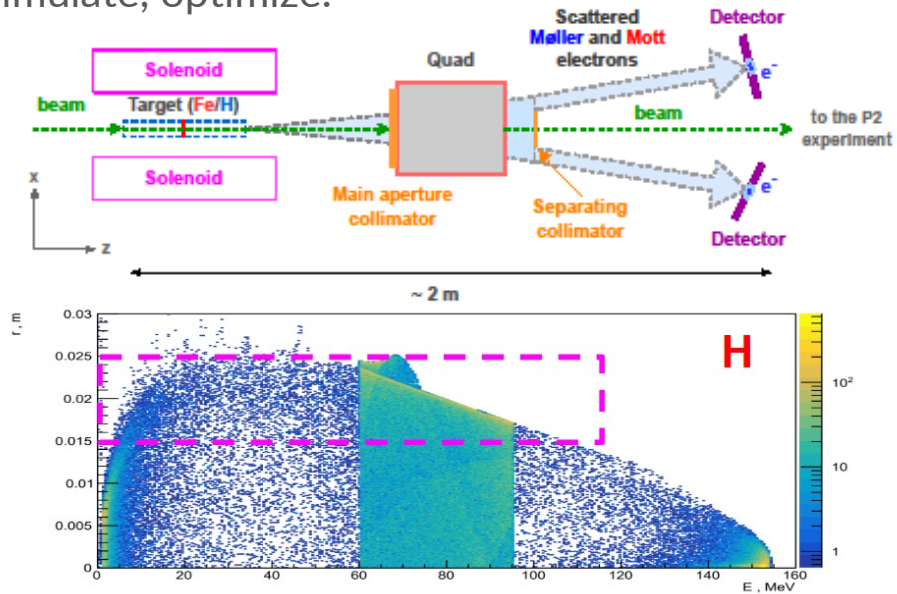
- **Goal:** Come up with a design for an online polarimeter at **MESA** in Mainz (e^- of **155 MeV** at **150 µA**) – uncertainty well below **1%**.
- **Idea:** use atomic hydrogen in a strong solenoid, fully polarizable
- **Work package:** design detection system for such a polarimeter.



Achievements

- **Create simulation framework: g**enerators for Møller and Mott scattering, magnetic fields and geometry in Geant4.
- **Develop and iterate design: c**reate geometry, simulate, optimize.

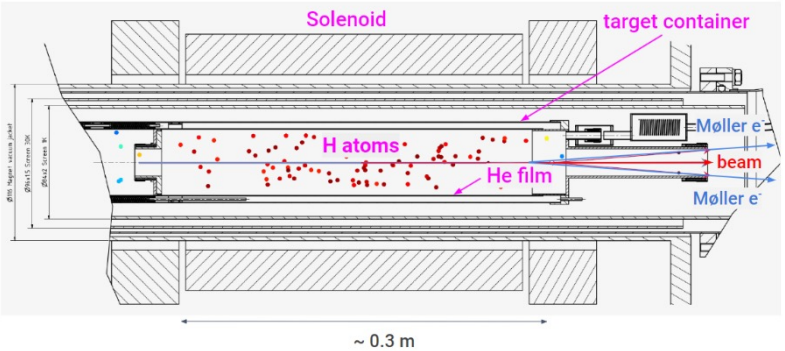




- **Conclusion:** found nicely working design, report in final stage of write-up.

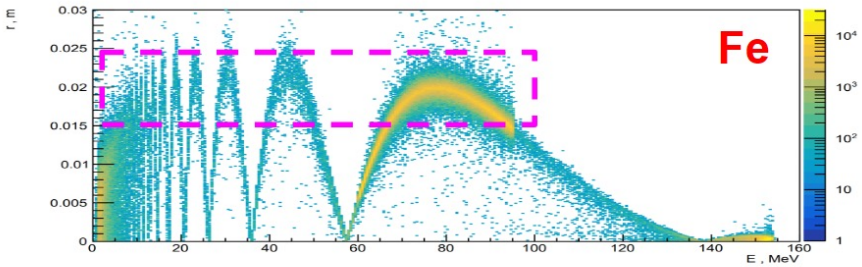
Unexpected

- **Supply Chain Issues** due to war in Ukraine: the hydrogen target will be much delayed.



- **MESA polarimetry will start with a conventional iron target.**

The polarimeter design was adapted to also work with the iron configuration.



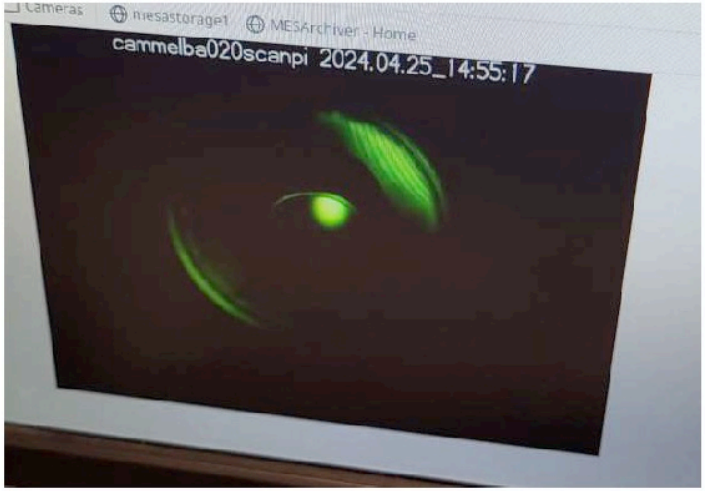
Outlook

Build and operate polarimeter at MESA: validate design and gain operational experience.

Push accuracy by another order of magnitude: hydrogen target, colliding beams, …

Presentation at conference:

Michail Kravchenko at DPG Spring Meeting 2024, Karlsruhe



First MESA beam !

P3E Commitments

P3E-1 - **MS75** : ion damage simulations.

P3E-1 - **MS76** : charge lifetime experiments.

P3E-2 - **MS77** : simulation package of the positron source.

P3E-2 - **MS78** : simulation package of the target stress.

P3E-3 - **MS79** : GEANT4 simulation package of the polarimeter detector.

P3E-1 – **D31.1** : Feasibility report for an intense polarized electron source. **Available**

P3E-2 – **D31.2** : Feasibility report for an intense polarized positron source. **Available**

P3E-3 – **D31.3** : Technical Design Report for the polarimeter. **Pre-final**

Summary

Despite the different difficulties suffered along the completion of the STRONG 2020 program, the **P3E Joint Research Activity successfully achieved its goals** which are leading to the construction of new experimental capabilities.

It is now construction, operation, and exploitation time.

The **STRONG 2020** support and funding benefited the development of **new technologies for hadronic physics** and helped the accomplishment of a challenging experimental program at **MESA** and **CEBAF**.