Low Energy Polarized Positron at ALTO

LEPP @ ALTO

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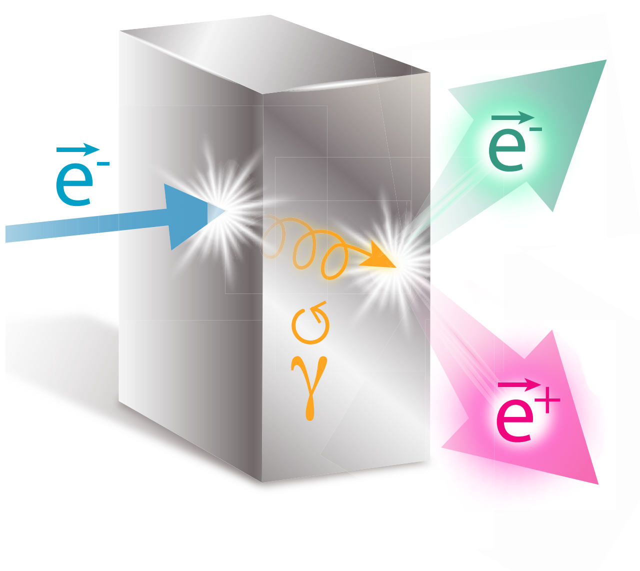

(i) PEPPo technique
(ii) Polarized positron production
(iii) Polarized electron source
(iv) Positron production target
(v) Positron deceleration

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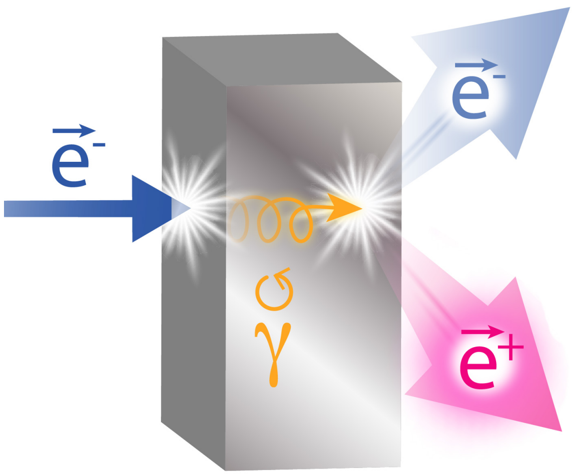
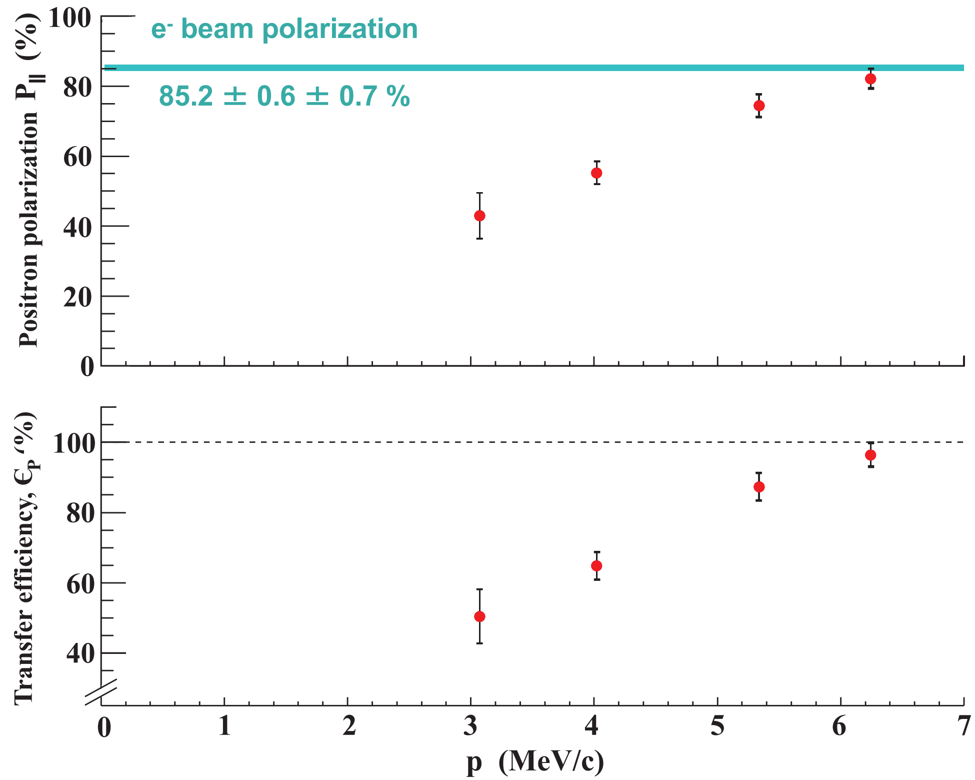
Electron Polarization Transfer

(PEPPo Collaboration) D. Abbott et al. , Phys. Rev. Lett. 116 (2016) 214801

- **PEPPo** demonstrated **efficient polarization transfer** from **8.2 MeV/c electrons to positrons**, expanding polarized positron capabilities from GeV to **MeV accelerators**.



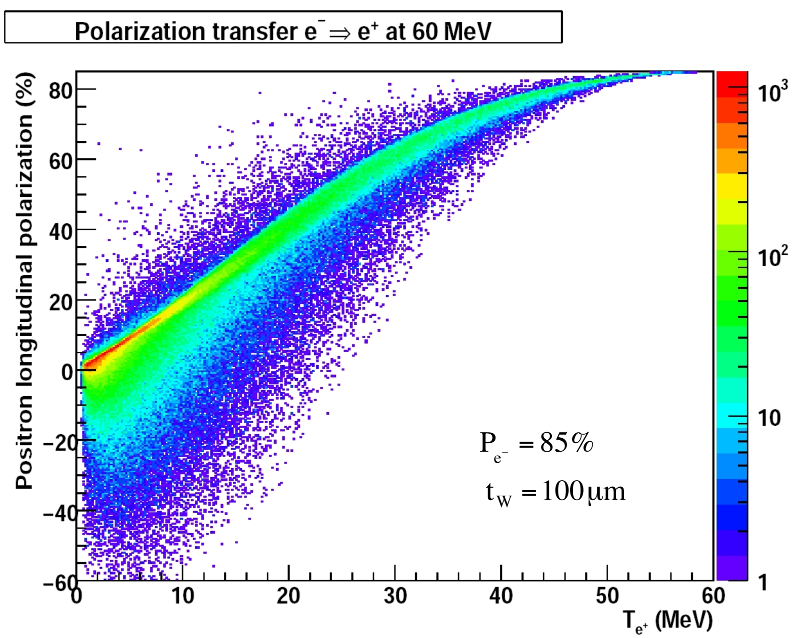


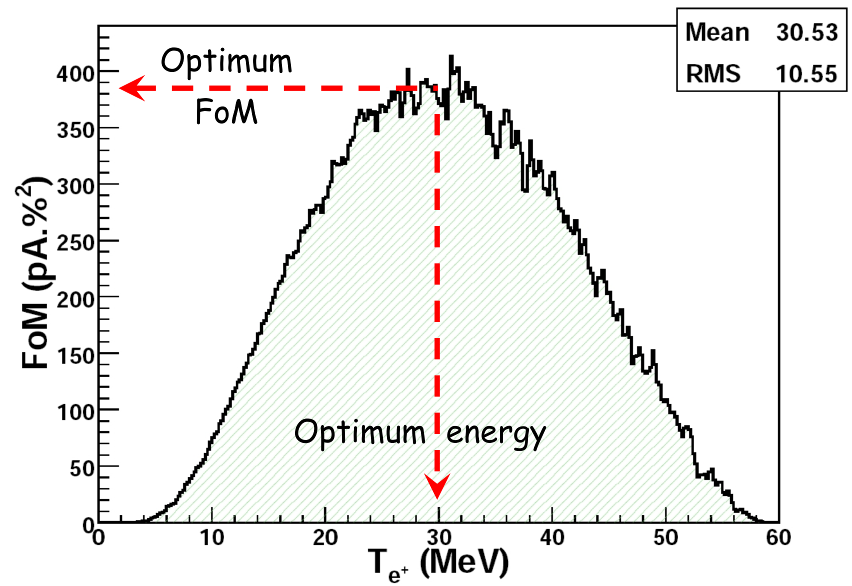
Whenever producing e^+ from e^-, polarization is coming for free if initial electrons are polarized.

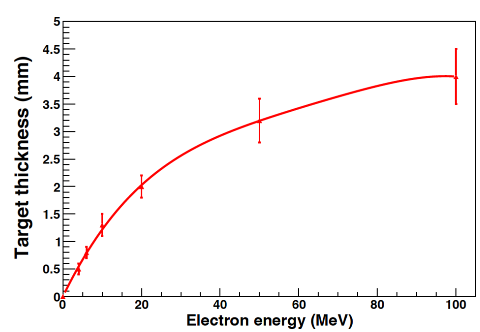
Figure-of-Merit

R. Dollan, K. Laihem, A. Schälicke, NIM A 559 (2006) 185   J. Dumas, J. Grames, E. Voutier, JPos09, AIP 1160 (2009) 120
J. Dumas, Doctorate Thesis (2011)

- The **polarization distribution** of generated positrons is typical of bremsstrahlung induced pair creation with a production rate **dominated by low-energy particles**.





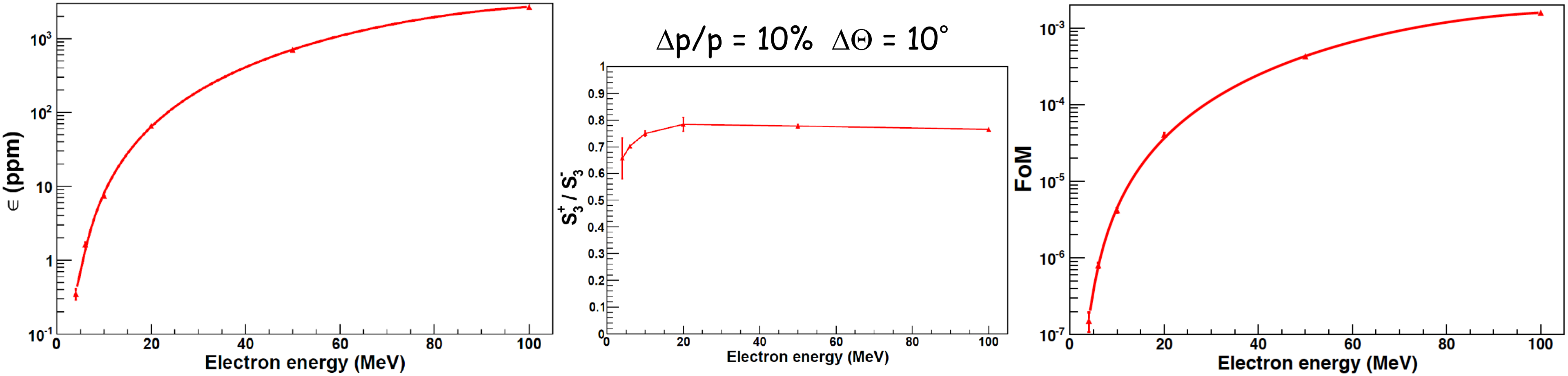


The **positron energy** at optimum FoM is about **half** of the **electron beam energy**.

Expected Performances

J. Dumas, Doctorate Thesis (2011)

➢ The **optimized FoM** at each electron beam energy defined the « **operational conditions** »; simplistic cuts mimic a **capture system** and/or an **accelerator acceptance**, and define the quantitative **source performances**.



In the **100 MeV** energy range, one can reasonably expect to optimaly achieve **75%** electron **polarization transfer** and **10^{-4}-10^{-3} e^+/e^-**.

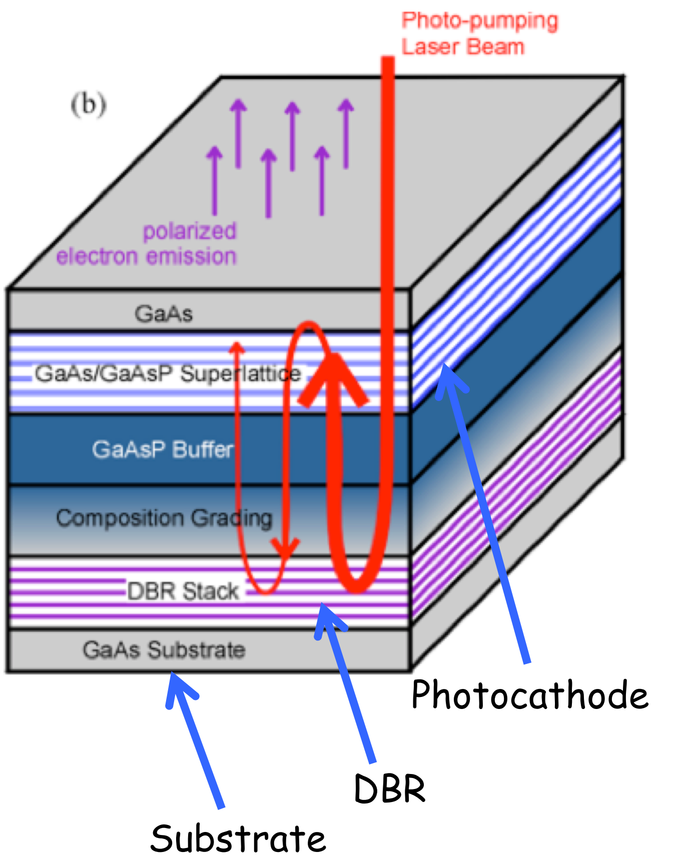
Photocathode R&D

W. Liu et al. SPIN Conference 2016

- Current developments based on the **Distributed Bragg Reflector** (DBR) technique demonstrated the **highest QE & FoM** of any reported strained GaAs/GaAsP superlattice photocathode.

Cathode	Lab	P(%)	QE (%)	FOM (P^2QE)
GaAs-GaAsP	SLAC/SVT	86	1.2	0.89
AlInGaAs-AlGaAs	St. Petersburg	92	0.85	0.72
GaAs-GaAsP	Nagoya	92	1.6	1.35
GaAs-GaAsP/DBR	JLab/SVT	84	6.4	4.52

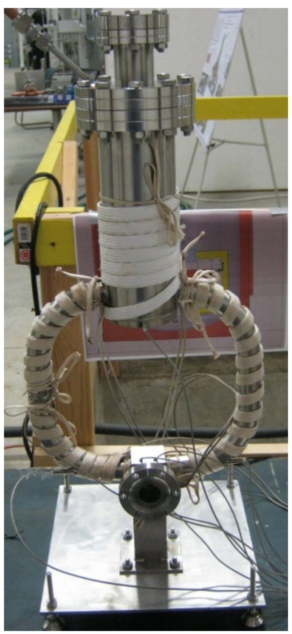
@ 776 nm

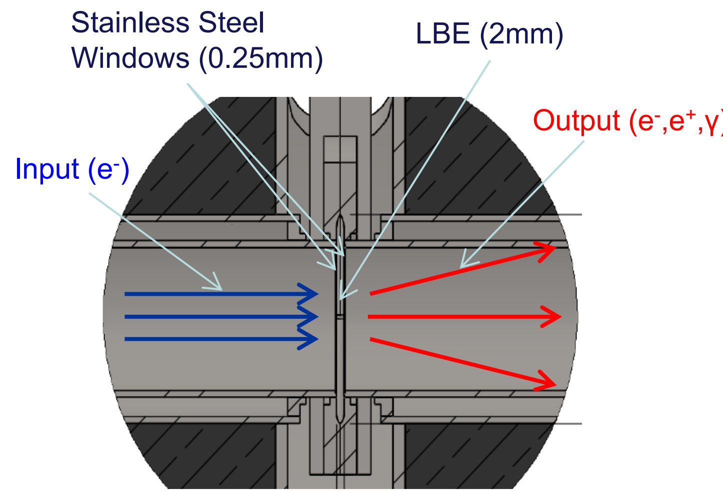


Courtesy of Joe Grames

High Power Target

- ✓ **Liquid Metal Target** – lead-bismuth eutectic (LBE)
  - High Z = 82, 83
  - Low melting point: 124° C High boiling point: 1670° C
- ✓ Multiple LBE targets tested on various accelerators
  - Natural Circulation
  - Mechanical & Electromagnetic Pumping
- ✓ Approaching **10 kW** power level CW





NIOWAVE
www.niowaveinc.com

Courtesy of James McCarter

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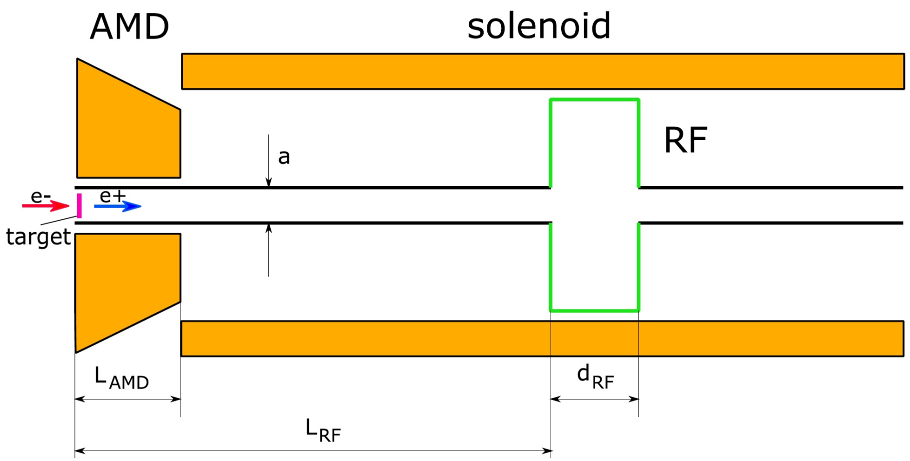
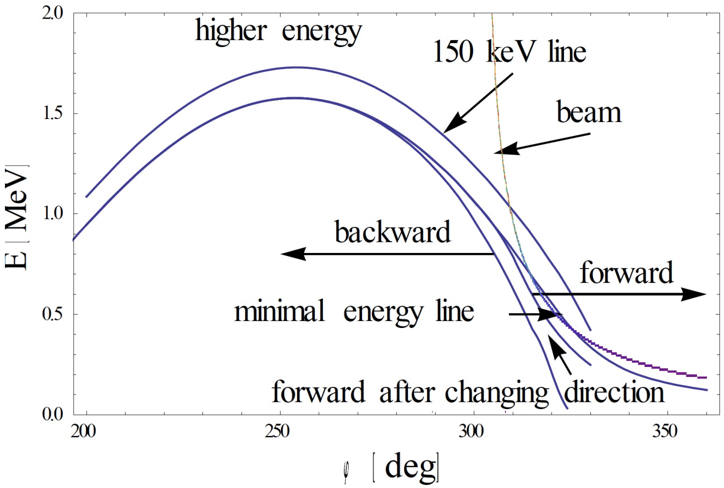
Concept

J. Long, S. Chemerisov, W. Gai, C.D. Jonah, W. Liu, H. Wang, JACoW (2007) THPMN091 V. Angelov, E. Voutier, *in progress*





- **Deceleration** of positrons, i.e. a moderator free slow positron source, is capable to provide **much higher positron flux** that the moderator technique.

- There exists a **direct relationship** between the **size of the cavity**, the **initial phase** of the RF field, the **distance to the production target**, and the **initial energy** of the particles that can be decelerated.