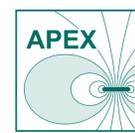


A buffer-gas trap for the NEPOMUC positron beam: optimization studies with electrons

Adam Deller^{*1,2}, C. W. Rogge^{1,3}, S. Desopo², E. V. Stenson¹, M. R. Stoneking^{1,4}, T. Sunn Pedersen^{1,5}, J. R. Danielson², C. M. Surko², and C. Hugenschmidt³.

¹Max-Planck-Institut für Plasmaphysik, ²University of California San Diego, ³Technische Universität München, ⁴Lawrence University, ⁵University of Greifswald

& the APEX collaboration



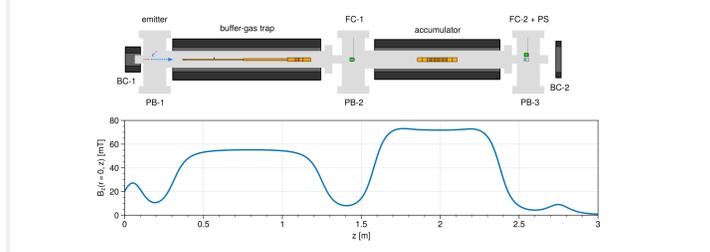
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INTRODUCTION

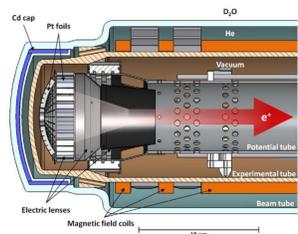
Buffer-gas traps (BGT) use inelastic interactions with nitrogen molecules to efficiently capture positrons from a continuous source [1]. A BGT has been assembled at IPP Garching [2] and optimized using an electron beam with a similar intensity and energy spread to the remoderated NEPOMUC positron beam [3, 4]. Bunches of electrons were ejected from the BGT at rates of between 0.1 to 10 Hz in 100 ns-long pulses. The bunches were recaptured and accumulated in a separate Penning trap to produce a non-neutral plasma of $N > 10^8$ electrons. The BGT and accumulator are vital components of APEX (A Positron Electron eXperiment), which aims to produce a low-energy electron-positron pair plasma [5].

BGT SYSTEM

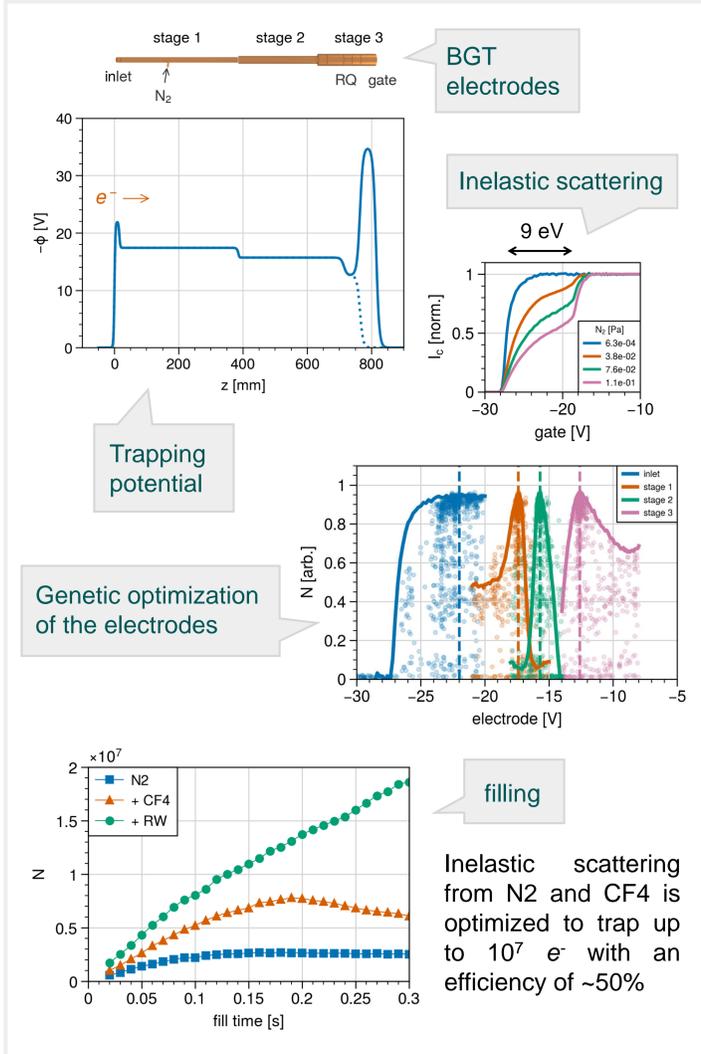


POSITRONS

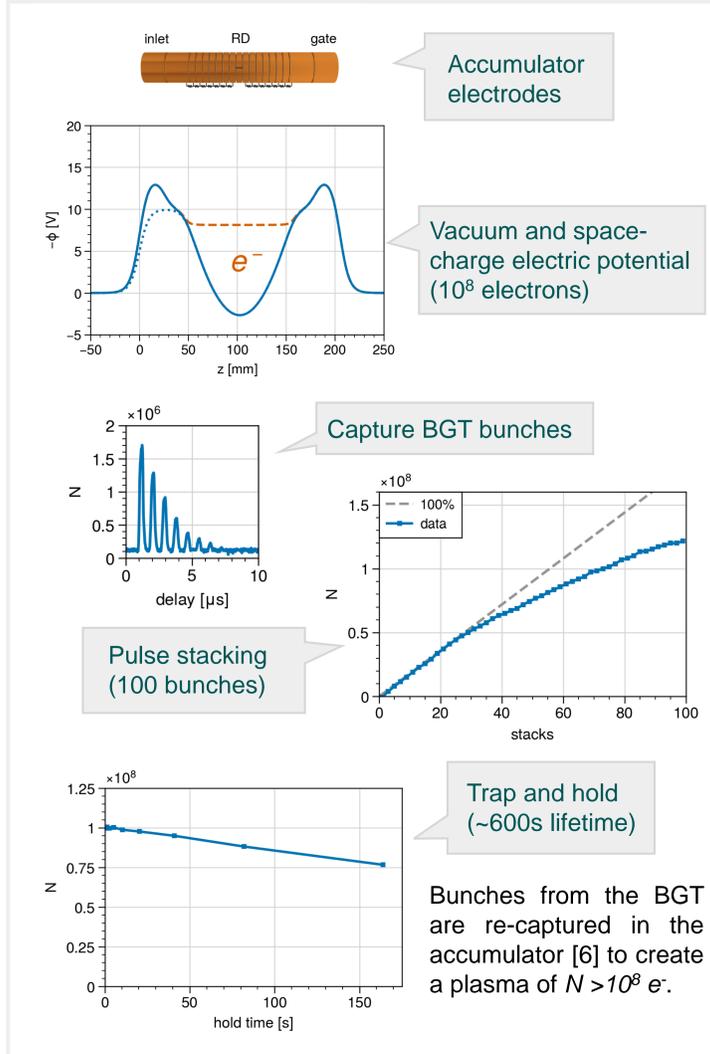
NEPOMUC: Thermal neutrons generated by FRM II impinge on a cadmium target to produce gamma rays and instigate pair production of electrons and positrons in platinum foils. The positrons are extracted and then remoderated to ~ 20 eV [3, 4].



BUFFER-GAS TRAP

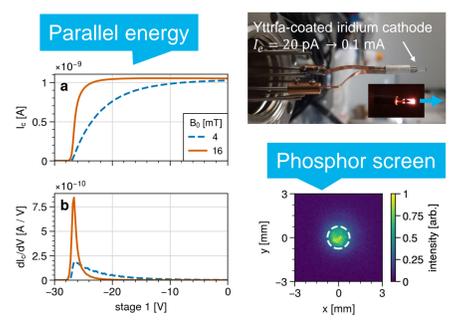


ACCUMULATOR



ELECTRONS

An electron beam with a comparable intensity and energy spread to the remoderated NEPOMUC beam was used to optimize the BGT [2].

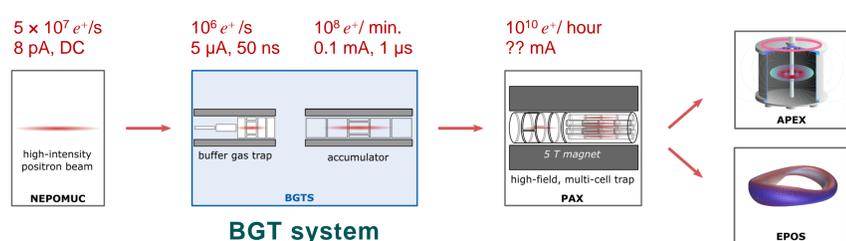


SUMMARY

A BGT system has been successfully optimized using electrons [2]. We plan to install the device on the NEPOMUC in 2024 and hope to accumulate plasmas containing $N = 10^8$ positrons every 30s. The device is a crucial component of the APEX project [5]. The low-energy trap-based beam will also expand the capabilities of NEPOMUC. Anticipated applications include (almost) background-free positron-annihilation-induced Auger-electron spectroscopy [8] and production of a very dense positronium gas [9].



BGT and accumulator
APEX pair plasma experiment



EXPECTED PERFORMANCE

	e^+ / s	$E_{ }$ [eV]	$\Delta E_{ }$ [eV]	ΔE_{\perp} [eV]	$N_{e^+} / 30 s$
Primary beam	5×10^8	1000	10	4	1.5×10^8
W remoderated	3×10^7	20	3	1.3	7.5×10^7
SiC remoderated [7]	3×10^8	20	1	0.5	9.0×10^8

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*Corresponding author:
adam.deller@ipp.mpg.de

This work has been carried out with support from the U. S. DOE (DE-SC0019271) and the UCSD Foundation; The work has also received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement No. 741322); and the Deutsche Forschungsgemeinschaft, (Hu 978/15-1 and Sa 2788/2-1). The views and opinions expressed herein do not necessarily reflect those of the European Commission. The NEPOMUC positron beam facility is operated by FRM II at the Heinz Maier-Leibnitz Zentrum (MLZ), Garching, Germany.

