

CERN LIBRARIES, GENEVA



CM-P00044115

CERN/PSCC/89-12

PSCC/S117

9 March, 1989

Proposal to the PSCC

**HIGH RESOLUTION SPECTROSCOPY OF X-RAYS
FROM ANTIPROTONIC HYDROGEN AND HELIUM ISOTOPES
USING A CRYSTAL SPECTROMETER**

G.L. Borchert, D. Gotta*, O.W.B. Schult
Institut für Kernphysik, KFA Jülich
D-5170 Jülich

L.M. Simons
PSI, CH-5214 Villigen

K. Elsener**
Institute of Physics, University of Aarhus,
DK-8000 Aarhus C

K. Rashid
Pakistan Institute for Nuclear Science and Technology,
Islamabad

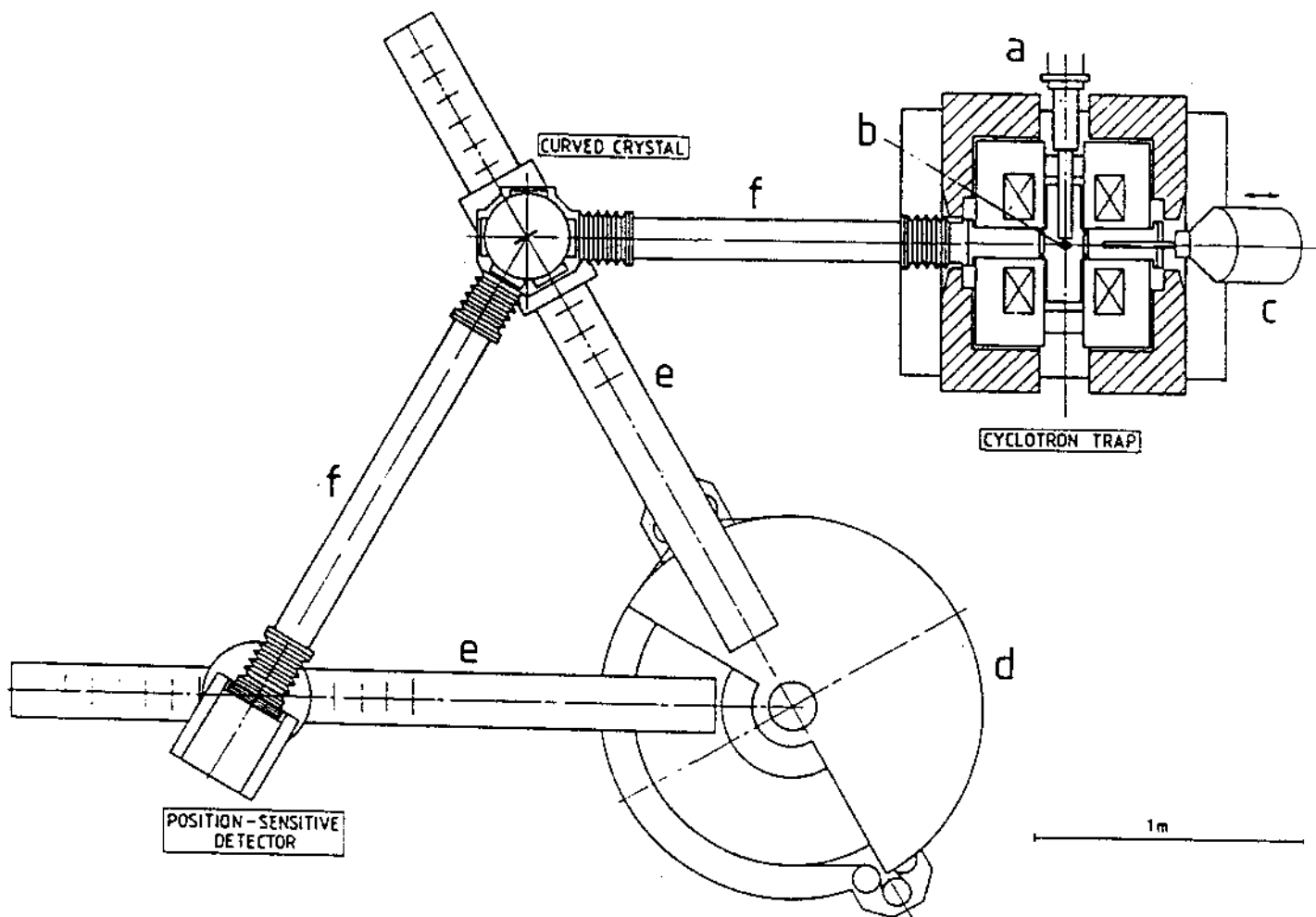
J.J. Reidy
Physics Department, University of Mississippi,
University, Miss. 38677, USA

* Spokesman

** Contactman

ABSTRACT

A precision measurement is proposed of the line shape and energy shift of antiprotonic L_{α} transitions for nuclei with $A \leq 4$. These measurements study the antiproton-proton and antiproton-nuclear spin-spin and spin-orbital interaction at threshold. The high intensity LEAR beam will be stopped in the cyclotron trap. This provides an intense X-ray source at low gas pressures. A focussing crystal spectrometer will be used to measure the X-ray energies with a resolution $\Delta E/E$ of 10^{-3} to 10^{-4} . This permits for the first time a direct measurement of the strong interaction shifts and widths of the 2p levels in different antiprotonic hydrogen isotopes. Furthermore the accuracy of the present detection methods will be increased by two orders of magnitude. This should allow the resolution of fine structure and hyperfine structure in favourable cases.



Experimental set-up for a Bragg angle $\theta_B = 30^\circ$:

- a - LEAR beam tube with appendix for the target chamber
- b - \bar{p} stop distribution (i.e. X-ray source)
- c - monitor detector
- d - support for the spectrometer arms (e)
- f - vacuum tight tube