

The 10 bar Hydrogen Time Projection Chamber of the MuCap Experiment

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The MuCap Experiment measured the muon capture rate, $\mu^- + p \rightarrow n + \text{neutrino}$. This measurement determines the induced pseudo-scalar form factor g_p . The experiment is located at the Paul Scherrer Institut (PSI) in Switzerland. Physics data taking has finished, data analysis is ongoing.

The Time Projection Chamber is located inside a pressure vessel and is operated with 10 bar hydrogen. The TPC has a sensitive volume of (300 x 150 x 120) mm³ and acts as an active muon stop detector.

The sensitive volume is enclosed by the drift cathode and a MWPC. All cathodes and the anodes are made of wires, whereas anode and cathode wires of the MWPC are mounted perpendicular. The wires are soldered on glass frames whereas the soldering pads are made of titanium, nickel and gold. All materials were chosen to be low-outgassing and the complete setup was baked out under high vacuum up to temperatures of 110° C.

An elaborate gas handling system was constructed for evacuating and filling the pressure vessel with ultra-pure protium. Samples with defined admixtures of impurity gases could be generated in order to study and calibrate their effects on the muon capture rate.

The voltages applied to the wire planes are typically -29.5 kV (drift cathode), -5.5 kV (MWPC cathodes), while the anode wires are on ground potential (half gap 3.5 mm). This configuration generates a vertical drift field of 2.0 kV/cm which leads to a maximum drift time of 24 microsec in the TPC.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

<http://people.web.psi.ch/hildebrandt/vci2010/tpc-mucap/vci2010-hildebrandt-tpc-mucap.pdf>

Primary author: Dr HILDEBRANDT, Malte (PSI)

Co-authors: Dr PETITJEAN, Claude (PSI); Dr EGGER, Johny (PSI)

Presenter: Dr HILDEBRANDT, Malte (PSI)

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