EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

MATHEMATISCH-
NATURWISSENSCHAFTLICHE
FAKULTÄT

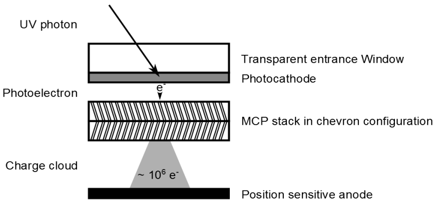
# Development of Advanced UV MCP Detectors

J. Barnstedt, S. Diebold, S. Hermanutz, C. Kalkuhl, N. Kappelmann, M. Pfeifer, T. Schanz, K. Werner
Institut für Astronomie und Astrophysik

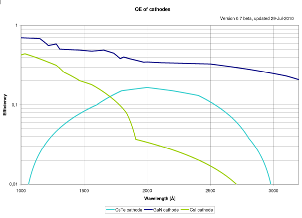
## Introduction

We develop microchannel plate (MCP) UV detectors for the wavelength range of 172-310nm (UV band). Initially our efforts were driven by the use of MCPs in a possible German contribution to the WSO-UV: The high resolution double echelle spectrograph, which was engineered in Germany during the last 20 years. Although Russia is now designing own spectrographs for this mission we are continuing to develop a MCP-detector head with improved efficiency and life-time characteristics. Spectrographs in the UV require solar blind, highly-efficient detector heads with high dynamics. The detector system should show low degradation during its lifetime to achieve long operational times, low power consumption and low heat dissipation to match the constraints of possible spacecrafts.

## MCP Detector Principle

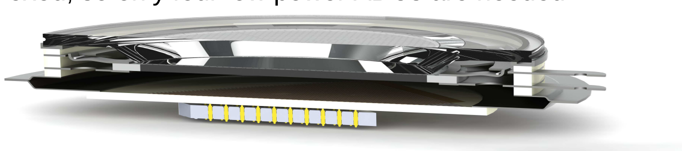



Working principle



GaN performance

Since most types of photocathodes degrade rapidly under atmospheric conditions a sealed tube MCP detectors is necessary. Therefore a thin photocathode is coated on the inside of a MgF2- window. This window is sealed under vacuum conditions on top of a leak tight tube, which houses the MCPs and the anode. To obtain a high QE over a broad spectrum we use cesium-activated gallium nitride photo cathodes which are developed in cooperation with Clausthal Technical University. The lifetime of MCP detectors is limited by the extracted total charge, so a low gain is eligible. We are therefore developing a cross-strip (XS) anode with 64 x 64 stripes on 33mm x 44mm. The goal for the resolution is 15µm in main dispersion direction of the spectrograph. The read-out of a XS anode makes great demands on the front-end electronics, since 128 channels are needed. For combining a fast read-out with a power dissipation below 10W we study the feasibility to use the Beetle chip, which was developed for the LHCb. It provides 128 input channels, each equipped with a preamplifier and a shaper. For the output 32 channels are multiplexed, so only four low power ADCs are needed.

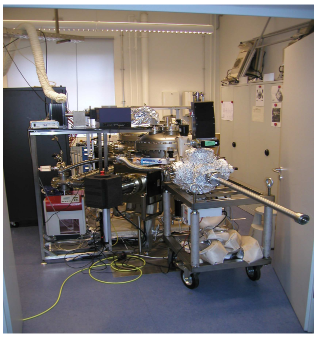


CAD drawing of detector

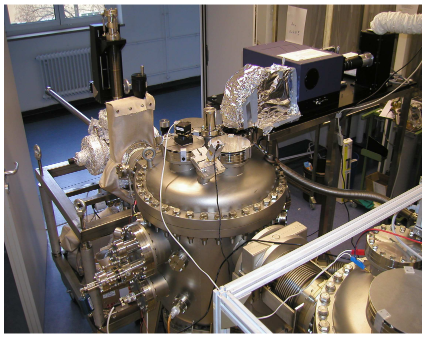
## Lab and Setup

The production setup consists of two UHV-vessels connected by a transport mechanism. In the first vessel the gallium nitride is activated and qualified. Then the coated window is transferred to the second vessel where the assembling takes place. The detector body with integrated anode and MCPs will be sealed with the window by molten indium.

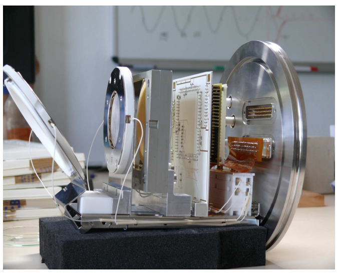
Schematic view of vacuum vessels

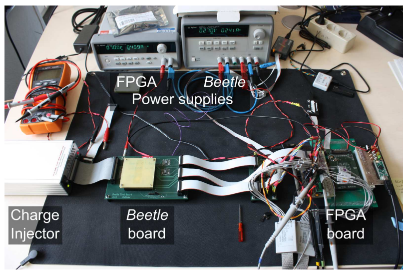


Sample transport box



Cathode testing device






Test bench to simulate readout of the detector

## Status and Outlook

In the past year we fixed our detector design and finished the setup to activate, test and assemble our detectors. In the upcoming year we will produce the first complete detector prototypes.

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University of Tübingen · Faculty of Science
Kepler Center for Astro and Particle Physics
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