New Detectors for the Kaon and Hypernuclear Experiments at GSI and MAMI

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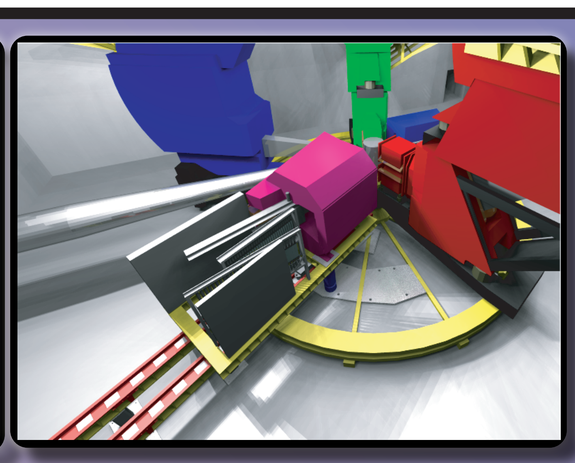
MOTIVATION

The kaon spectrometer in Mainz will be used in electroproduction of hypenuclei experiments. From former experiments the detection system for positive particles is completly implemented, but for negative particles is not. Due to the kinematics of the electroproduction experiments the development of a focal plane detector for the negative particles became necesary.

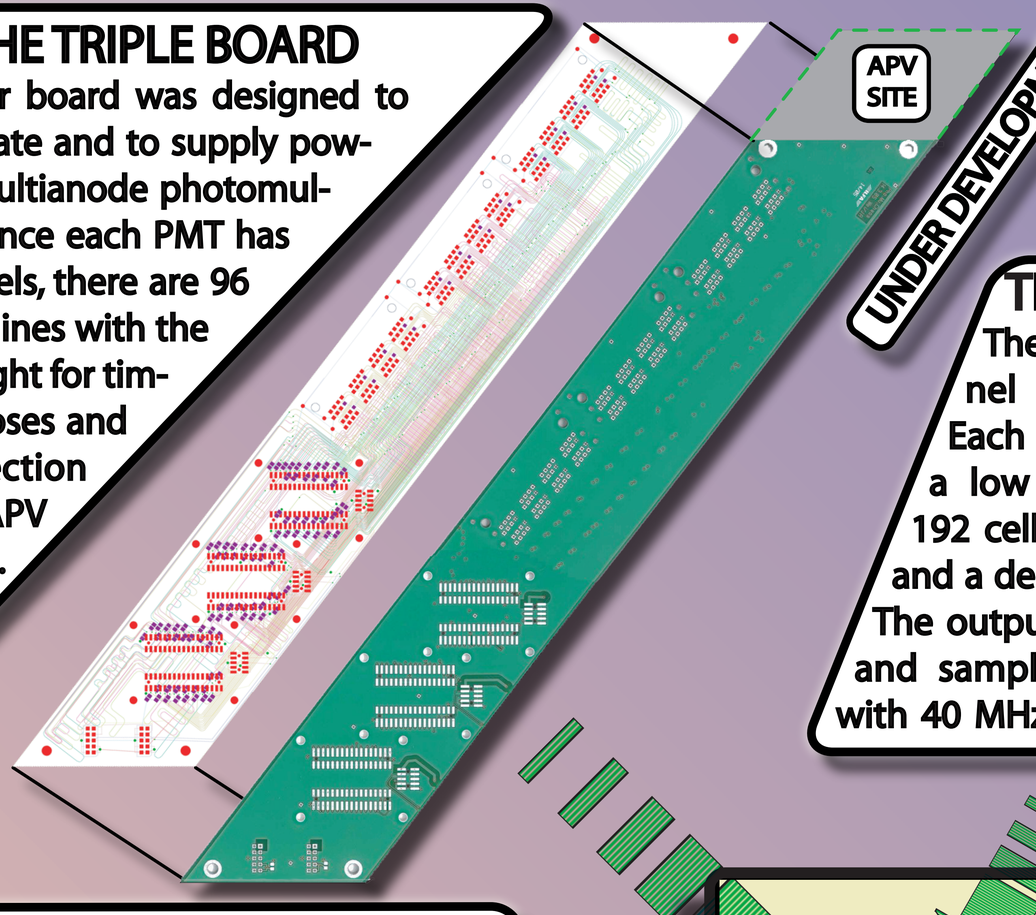


A NEW FOCAL PLANE DETECTOR

The new focal plane detector should have a high count rate capability, good position resolution and good timing. The solution chosen is a fiber array with multianode photomultiplier read-out. But the need for good timing, compactness, and modularity in order to read-out 4000 channels presents a challenge in mechanical and electronic development.

THE TRIPLE BOARD

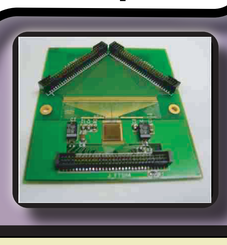
A 12-layer board was designed to accomodate and to supply power to 3 multianode photomultipliers. Since each PMT has 32 channels, there are 96 read-out lines with the same lenght for timing purposes and a connection to the APV board.



UNDER DEVELOPMENT

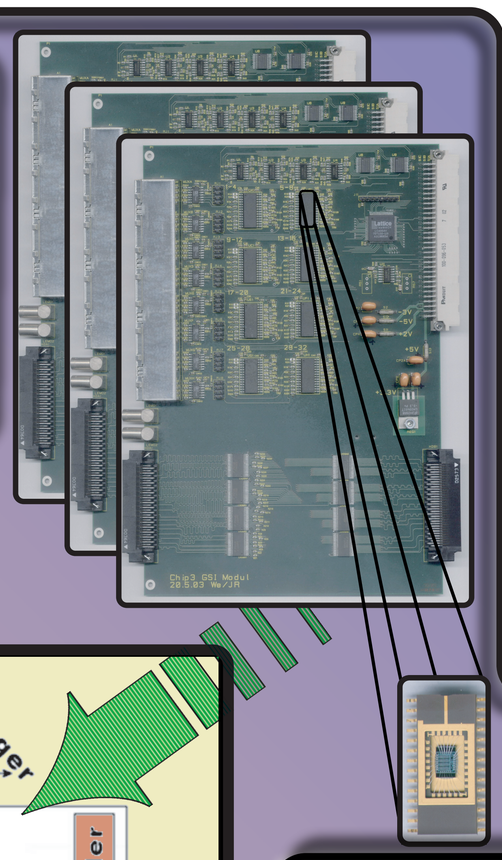
THE APV25 CHIP

The APV is a 128 channel analogue pipeline. Each channel comprises a low noise amplifier, a 192 cell analogue pipeline and a deconvolution circuit. The outputs are multiplexed and sampled with 40 MHz.



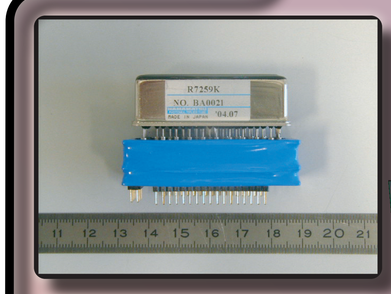
THE DISCRIMINATOR BOARDS

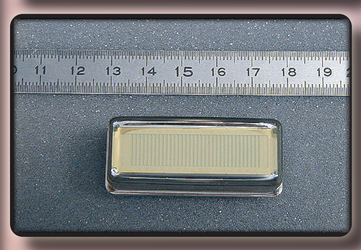
The signal from the triple board is sent to a discriminator board developed in Mainz based on the GSI Chip3 which works with the double threshold principle. The module was developed to fit in a VME 6U crate. It has 8 GSI3 in order to handle 32 channels (4 ch/chip), 32 analogue inputs (Ethernet RJ45), two digital outputs compatible with COMPASS logic levels, and two analogue outputs. The VME crate is controlled by a module developed in Mainz. It has 1 parallel port for communication between PC and FPGA.

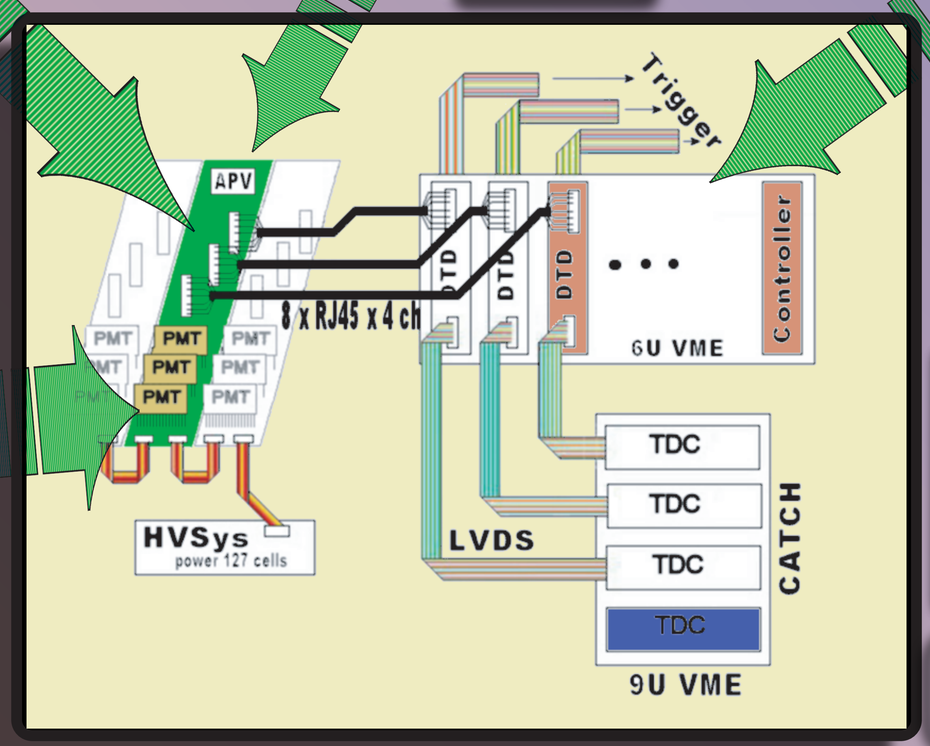


THE PHOTOMULTIPLIER AND THE VOLTAGE MULTIPLIER

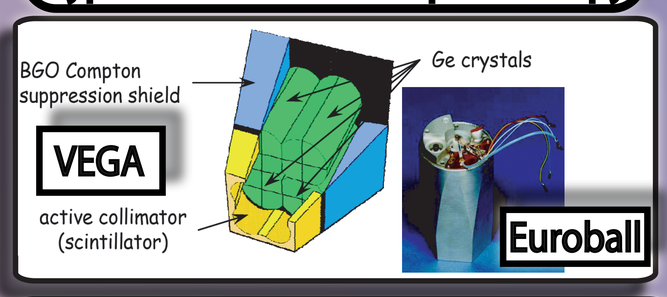
The photomultiplier chosen is the Hamamatsu H7260K. It is a multianode PMT with 32 channels in a linear array. Instead of the voltage divider provided by Hamamatsu, a Cockroft-Walton voltage multiplier was developed in Dubna. It allows to provide only a low voltage (140 V) to the base.







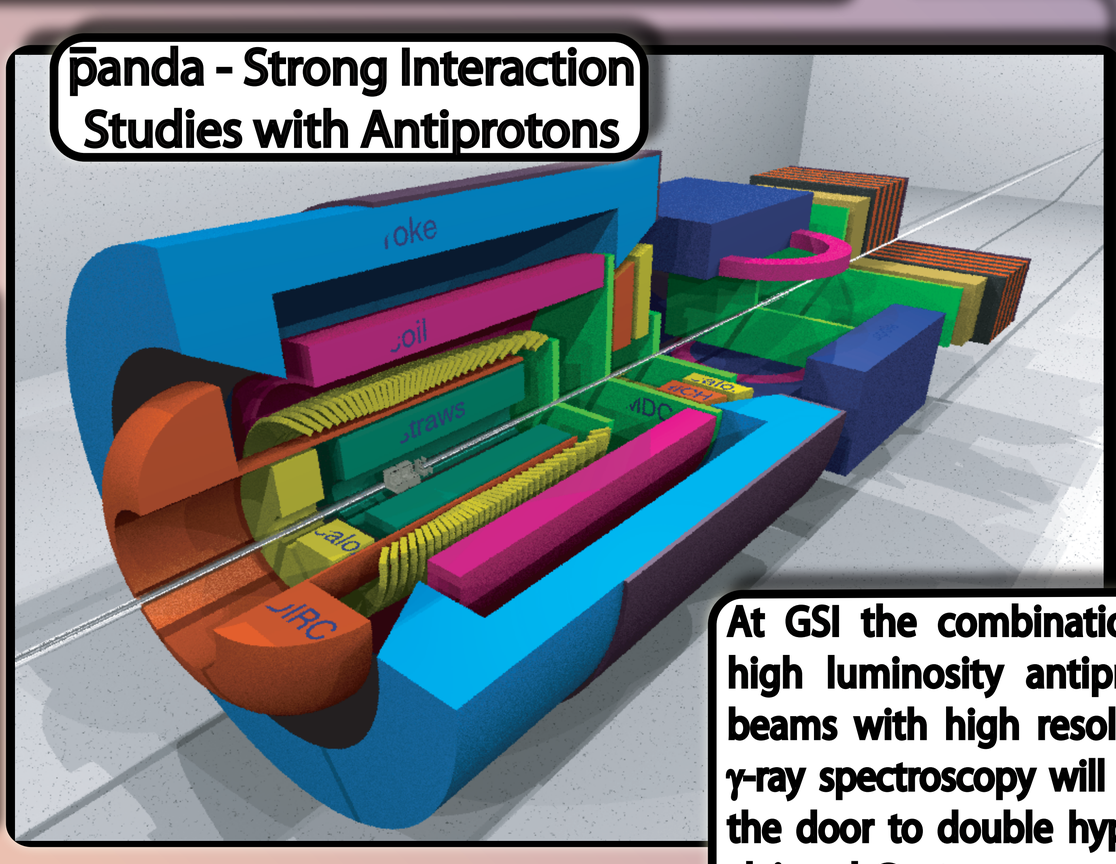
HyperGamma: High Luminosity Hypernuclear Gamma-Spectroscopy



TECHNOLOGICAL CHALLENGE

We are developing read-out schemes and tracking algorithms which enable high resolution γ-spectroscopy in an environment of high particle fluxes. Furthermore, we are developing new techniques and procedures to make germanium detectors nearly insensitive to high magnetic fields. Tests have been performed at DAΦNE, and at GSI.

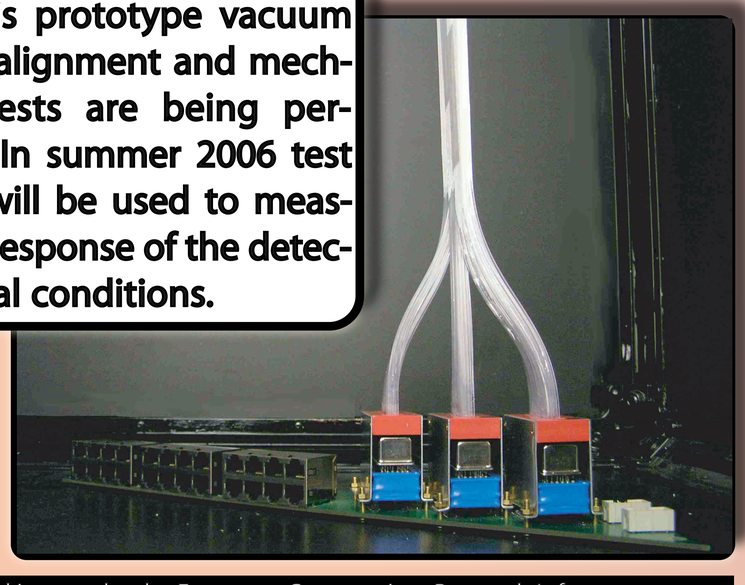
p̄anda - Strong Interaction Studies with Antiprotons



At GSI the combination of high luminosity antiproton beams with high resolution γ-ray spectroscopy will open the door to double hypernuclei and Ω atoms.

FIBRE PROTOTYPE DETECTORS

With this prototype vacuum sealing, alignment and mechanical tests are being performed. In summer 2006 test beams will be used to measure the response of the detector in real conditions.



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