17 Electronics Workshop

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During the reporting period the electronic workshop contributed to many projects of our institute and supported all research groups in maintaining and repairing existing equipment. Below we list some activities.

- **Remote controlled test setup for the CTA experiment (Sec. 5)**
  The Cherenkov Telescope Array (CTA) project is a planned network of optical gamma-ray telescopes. Mechanical instabilities in the support structure of the telescopes require a continuous alignment of the facets. This is done with two precise actuators installed on every segment. The electronic workshop developed and built the control electronics for a prototype system. To test the actuators under realistic long-term conditions with constant exposure to the environment we installed in spring 2009 a remote controlled test setup with a dummy mirror facet on the roof of the institute's building. Whereas the actuators are permanently moving we record the actual positions and weather conditions simultaneous. Meanwhile the system has gone through a number of moving cycles which correspond to a running time of 30 years, demonstrating that the requirements have been met.

- **CTA photomultiplier frontend-amplifier and frontend clock generator (Sec. 5)**
  A prototype camera will use photomultiplier tubes as photon detectors. The electronics workshop is involved in the development of associated amplifiers (Fig. 17.1). Requirements are low power consumption while having enough amplification for driving the following analogue-digital converters (ADC). To cover the large dynamic range of possible photon signals (up to 4000 photoelectrons), two parallel stages with different gains and shaping times are used for each PMT.

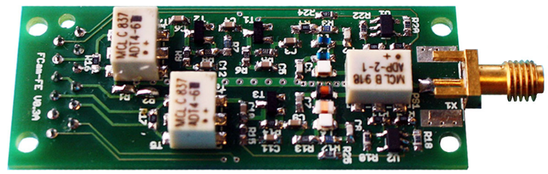

Figure 17.1: CTA frontend-amplifier.

  In addition, we are constructing a prototype for a stable clock, able to provide low-jitter clock signals to the ADCs at different frequencies. These clocks will be tied via a timing GPS receiver to the GPS time standard and will therefore provide an absolute time reference at the nanosecond level.

- **CTA trigger processor board (Sec. 5)**
  For studying different trigger algorithms, an FPGA based trigger processor is being designed. It is planned to be interfaced to ADC boards designed by the Max-Planck Institute for Nuclear Physics (Heidelberg).

- **Special ultra-clean PMT bases (Sec. 4)**
  For the Xenon experiment additional special ultra-clean PMT bases made out of a Teflon substrate were built.

- **PPMS-heater and kHz-amplifier (Sec. 12)**
  For a PPMS (Physical Property Measurement System) device a heater interface was built (Fig. 17.2). The output voltage signal of the lock-in amplifier is converted to a power signal which is used to drive a heater in the cryostat. In return, the thermocouple signal is amplified and connected to the input of the lock-in amplifier. Another frontend amplifier for the

PPMS (shown in Fig. 17.3) consists of two stages with integrated active low-pass filter for noise rejection.

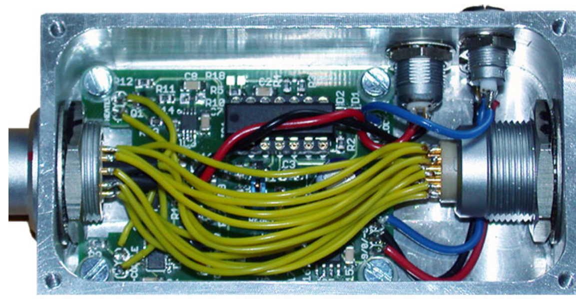

Figure 17.2: PPMS heater.

- **Prototype infrared detector (Sec. 12)**
  In the beginning of 2010 we finished the assembly of an infrared detector for the single photon counter test setup (Fig. 17.4). A final unit consisting of the IR detector, the preamplifier, a 400 Hz filter and a rectifier was realized on a compact printed circuit board and installed in a shielding enclosure. The device allows the intensity measurement of the infrared radiation clocked with 400 Hz.

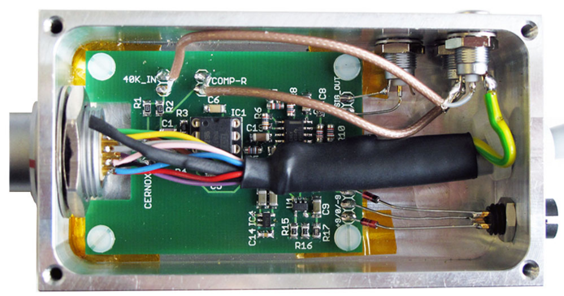

Figure 17.3: kHz amplifier.

- **Solid State Physics (Sec. 11)**
  We renewed a motor control unit for the NMR laboratory because the faulty drive controller chip was no longer available on the market. In a second device we implemented in addition an electronic drive brake circuit.

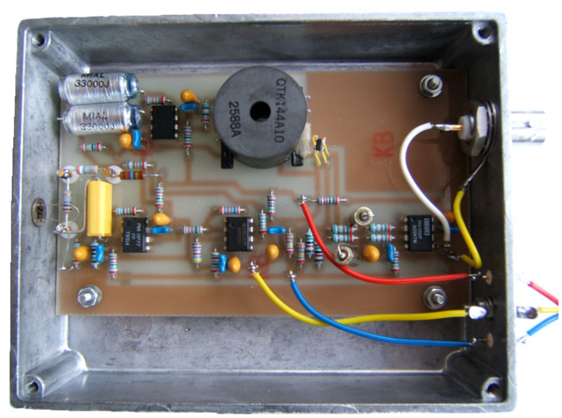

Figure 17.4: Final device with the electronics for the infrared detector.

- **Demonstration and laboratory experiments**
  For a laboratory experiment used to measure the gravitational constant we integrated a converter which steers the drive with the needed control electronics to connect the system to a computer. For a demonstration experiment based on high-temperature superconductors (magnetic levitation train, Maglev), an automatic acceleration system has been developed. Controlled by a photo-sensor, once per lap pressurized air is released to accelerate the train and thus compensate losses caused by air friction.