

## COSY Vacuum-Break Detection to Protect the ANKE Silicon Tracking Telescopes

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At COSY several severe vacuum breaks have happened over the last years of operation. In 2003 such an accident destroyed a complete setup of two Silicon Tracking Telescopes at ANKE. Meanwhile an extended new setup is in preparation. To protect the ANKE Silicon Tracking Telescopes against future COSY vacuum breaks, it is planned to install Fast Shutters around the ANKE section [1]. These shutters shall close the section in less than 10ms in both directions: COSY against ANKE but also ANKE against COSY. This seems feasible within a re-design of the existing prototype. Measurements with this prototype shutter show the fast response time of the shutter (< 10ms) but the vacuum sensors are not fast enough [2].

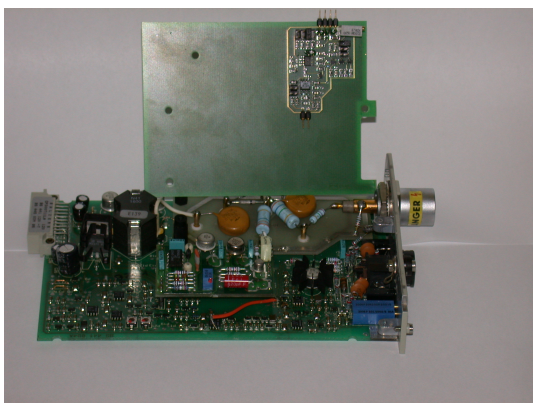


Fig. 1: Balzers TPG300 electronics (front) together with the add-on electronics (behind).

For the vacuum sensors the proposal now is to use the COSY standard Balzers vacuum gauges IKR070 together with an add-on electronics for the total pressure controls TPG300 (Fig. 1). It provides a parasitic linear voltage output in a pressure range from  $10^{-7}$  to  $10^{-5}$  mbar. It is designed to detect a pressure increase at a pressure of  $10^{-6}$  mbar within 2ms.

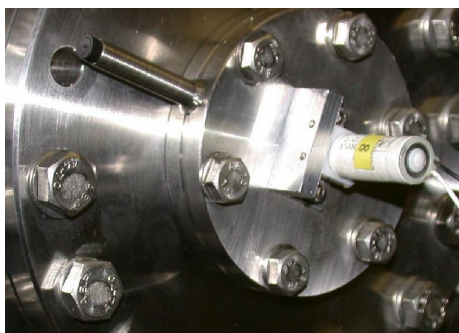


Fig. 2: Fast valve mounted on a DN40-CF flange.

To check the development a 'vacuum break' has been stimulated by a fast valve [3]. Triggered by an electrical signal, it opens a diameter of 0.8mm within 1.3ms and closes it again after a minimum time of 3.2ms, providing a controlled fast pressure increase from  $10^{-7}$  to  $10^{-5}$  mbar. Fig. 2 shows a picture of this valve mounted on a DN40-CF flange.

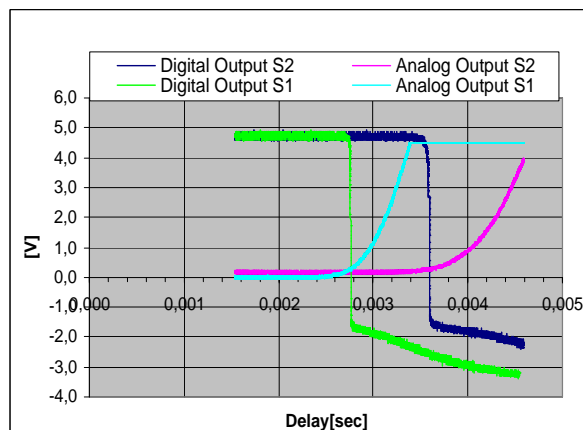


Fig. 3: Electrical signals on the oscilloscope.

Results of the measurements are illustrated in Fig. 3. Zero is defined by the time when the voltage is applied to the fast valve. The light blue curve 'Analog Output S1' shows the analogue output of the add-on electronics in case where the IKR070 gauge is mounted as close as 0.2m. The green curve 'Digital Output S1' reflects the time-mark crossing a pressure level of  $10^{-6}$  mbar. So the time delay to detect the 'vacuum break' is  $T_{0=2.8ms}$ . The magenta curve 'Analog Output S1' and the dark blue curve 'Digital Output S2' are the corresponding signals if the IKR070 is mounted at a distance of 0.7m. Here the time delay is  $T(0.5m)=3.6ms$ . Taking into account the response time of the fast valve of about 1.3ms, the pressure increase is detected after 1.5ms. From the second measurements one deduces a speed of about 0.6m/ms for the air-front.

This add-on electronics is prepared to upgrade the existing total pressure controls TPG300 at COSY. Once equipped, a vacuum break along the COSY ring can be detected at a selectable pressure level from  $10^{-7}$  to  $10^{-5}$  mbar with a time delay of less than 2 ms. This signal can be used to close the fast shutters within 10ms and to shut down the high voltage of the Silicon Tracking Telescopes at ANKE in a comparable time.

### References:

- [1] 'Schnellschliessendes UHV-Ventil für COSY', ZAT-Wissenschaftlicher Ergebnisbericht 2003
- [2] 'Schnellschliessendes UHV-Ventil für COSY', ZAT-Wissenschaftlicher Ergebnisbericht 2004
- [3] LFAA1203218H, 2-way injector valve, THE LEE CO. <http://www.theleeco.com/>

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