Pellet Target Development at the University of Uppsala

PANDA Collaboration

The antiproton-proton experiments, which form the major part of the physics programme of PANDA, require a high density hydrogen target. The approach of using frozen droplets of hydrogen, called pellets, is successfully in operation at the CELSIUS/WASA facility [1, 2]. In fact, the parameters achieved at that installation are already close to the requirements for the experiments at PANDA. In order to further improve this target and to evaluate whether such a target could be operated in PANDA, a second independent target (Pellet Test Station – PTS) has been build up at the The Svedberg Laboratory, Uppsala, Sweden.

This system is designed taking into account the experiences from the WASA system. However, a maximum of compatibility with this system is kept, such that an interchange of nozzles, capillaries, *etc* is feasible between the systems. The objective is to provide a set-up where tests and modifications are easily possible giving access for the measurement of all variables, like beam diameter, distribution, vacuum, *etc*. It may, however, be used in large parts for the installation at the future FAIR facility.

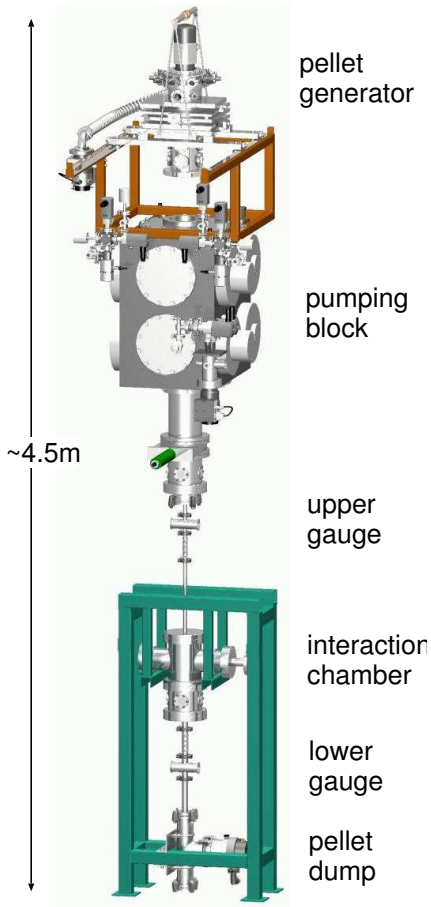

Figure 1: Pellet Test Station PTS designed for testing and further development of the target. On this drawing vacuum gauges, diagnostic tools, several pumps, and fittings are omitted.

Below the pumping block (see Fig. 1) an additional vacuum system has been designed and completed, which simulates the situation at PANDA. Furthermore, it also allows the monitoring of crucial variables like vacuum and beam shape, especially also at the so-called "interaction chamber", which is the point which simulates the beam intersection at PANDA.

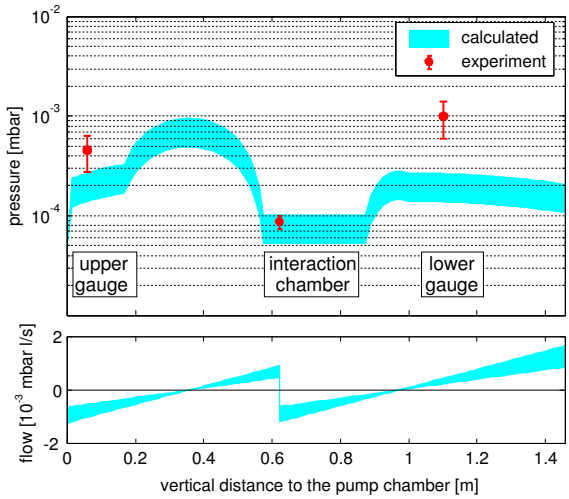

Figure 2: Comparison of experimental (red points) and calculated vacuum (light blue band) in the target pipe of the PTS. The errors indicate a 1σ uncertainty. The experimental points lie factors 2 to 4 above the calculated band but agree within 2σ. The lower part shows the calculated gas flow, which is below zero if the gas flows to the left the figure and positive if the flow is to the right, i.e. upwards and downwards respectively at the experiment.

Several test and measurements were performed using this system. The results of a vacuum measurement and its comparison to vacuum calculations using VAKLOOP [3] described in more detail in Ref. [4] are shown in Fig. 2. Applying the same calculations to the current PANDA design a vacuum of below than 2×10^{-5} mbar is expected inside the beam line around the interaction point. This is a value acceptable from the point of view of both the accelerator as well as the experiment.

Currently the system is equipped with a pellet tracking system and further tests on the divergence and pellet rate will follow.

References

[1] C. Ekström *et al.* [CELSIUS/WASA Collaboration], Phys. Scripta **T99** (2002) 169.

[2] J. Zabierowski *et al.* [CELSIUS/WASA Collaboration], Phys. Scripta **T99**, (2002) 159.

[3] V. Ziemann, SLAC-PUB-5962, (1992).

[4] Technical Progress Report for PANDA, [PANDA collaboration], (2005).