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First Results of the Interferometer Measurements in SPEAR3

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File: First Results Interferometer Meas.doc

1 Introduction

Previous HLS measurements have shown that the floor in SPEAR3 is moving by up to 100 micrometers per day. To get more information on the movement in the SPEAR 3 ring a laser interferometer was set up to measure the floor versus ceiling and the wall to wall movements.

2 Interferometer

We used an HP laser interferometer with the 5519A laser head, a 10702A linear interferometer and an Agilent 10767A retroreflector. The HP laser interferometer is based on the Michelson laser interferometer principle.

3 Monitoring Setup

The most suitable set up for a laser interferometer measurement was found to be inside the tunnel (Corbett, Gassner) where the atmospheric conditions are much more stable than outside. The first setup was to monitor the floor to ceiling movements. The interferometer was set up on the floor on the same concrete slab as the beam line components, the retroreflector part of the interferometer was glued to the ceiling with epoxy which was cured over night before the measurements were started; see Figures 1, 2 and 3. The second measurement was set up to measure the movement of the walls with respect to each other, see Figures 1and 4. The interferometer was mounted on one wall with the retroreflector mounted on the opposite wall fastened to a white bracket which holds the two blocks of the inner ring wall together, see Figures 5 and 6.

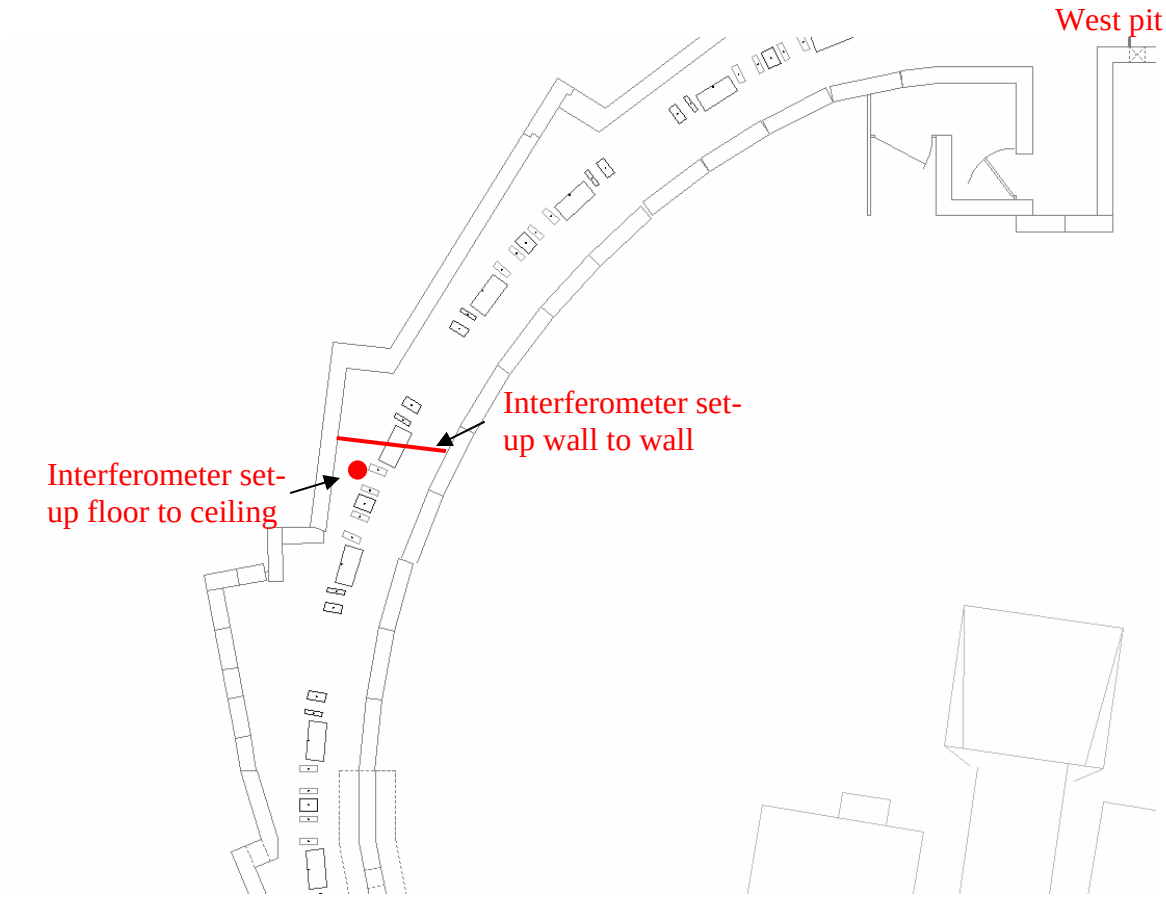

Figure 1: Set-up of the HLS sensors

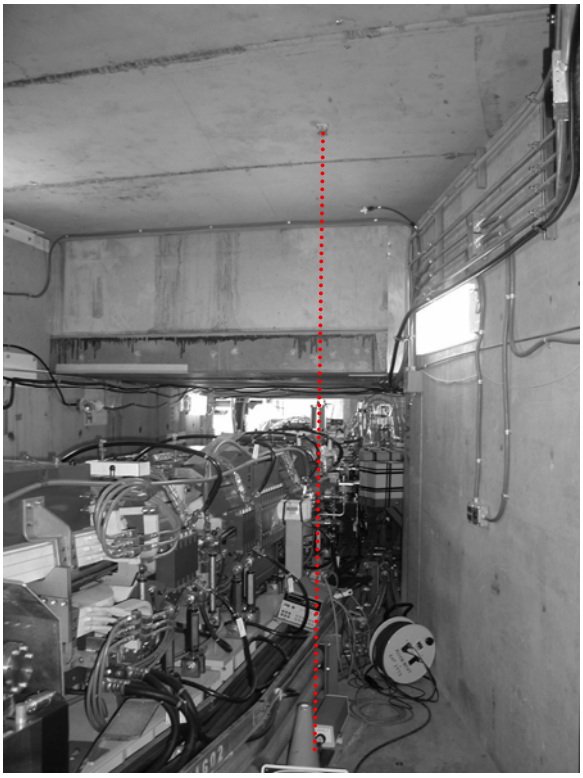

Figure 3: Laser beam path floor to ceiling

Figure 2 Floor setup

Figure 4 Laser beam path wall to wall

Figure 5: Mount of the laser head and the interferometer on the wall

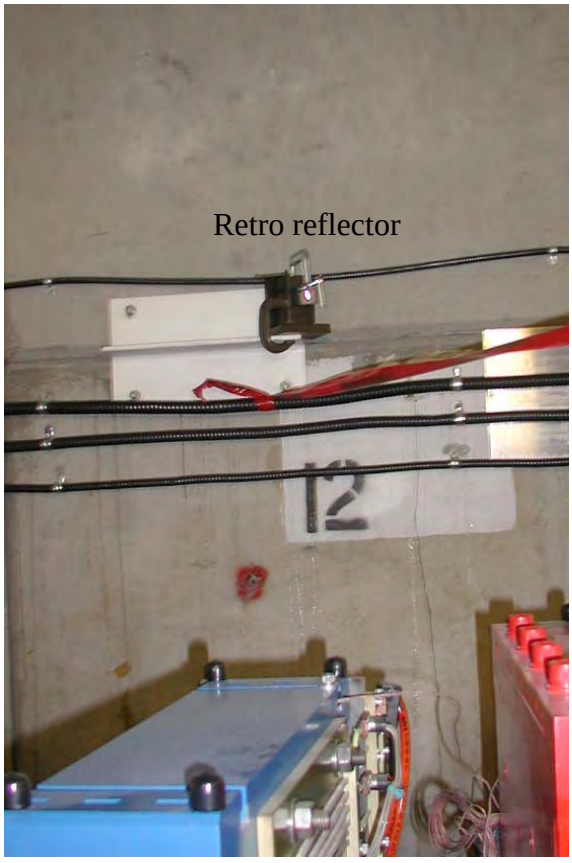

Figure 6: Mount of the retroreflector on a bracket on the opposite side of the wall

4 Results

The results are illustrated in Figure 7. We measured the floor to ceiling distance for approximately 28 h. the ceiling is lowering with respect to the floor during one day by about 400 μm. For the wall to wall movements we had four consecutive days. Here we see an expansion of the distance between the two walls of also 400 μm. The pattern of the movement repeats each day. The results have not been corrected for atmospheric changes therefore the results have an accuracy of ±30 μm. The flat spot in the movements around noon could result from the shadow cast onto the building at about the same time, see Figure 8.

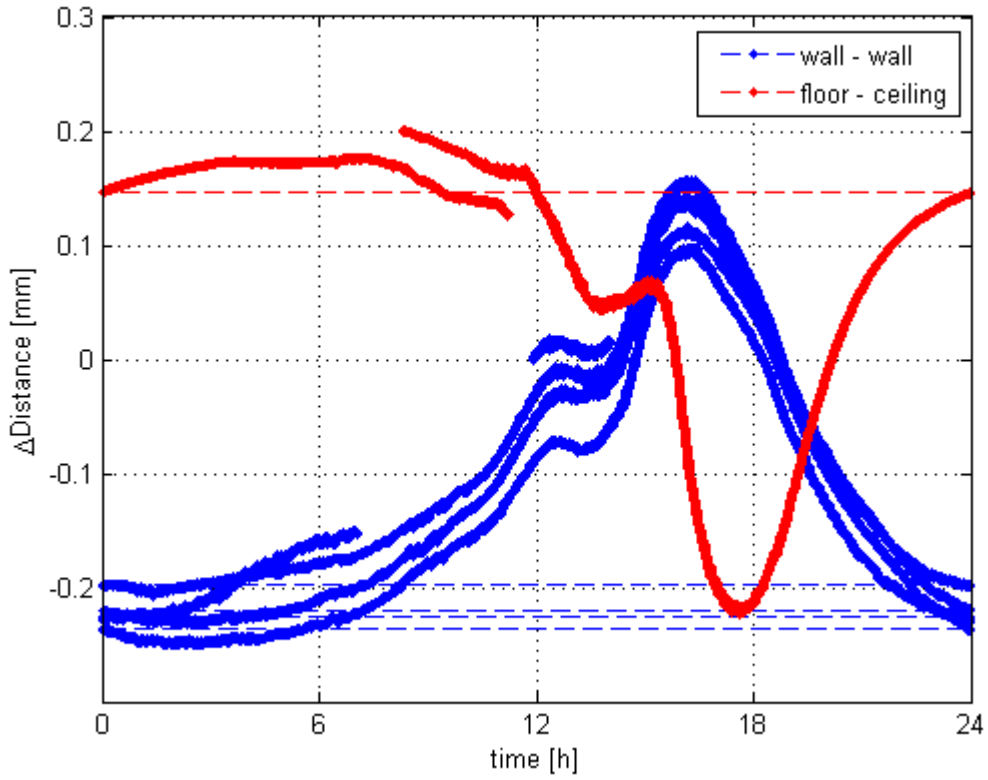

Figure 7: Interferometer results.

Figure 8: SPEAR ring at the position of the interferometer measurements