

Floor and Wall deformation in LCLS I (2008-2012)¹

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Abstract

For LCLS II planning purposes the deformation of the floor and the walls in the LCLS I was investigated.

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1. Available information

The Alignment Engineering Group maintains a network of floor and wall monuments throughout the LCLS tunnels. Floor and wall monuments are spaced at intervals of about 10m. The monuments are anchored to the floor and walls with 2” long anchors and are therefore locally representative of the floor and wall movements. Six measurement campaigns have been conducted throughout the years with different extent:

Table 1: Areas covered by measurement campaigns.

Date	Areas mapped					
	LTU	UH	FEE	NEH	XRT	FEH
January 2008 – April 2008	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
July 2008	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
February 2009	<input checked="" type="checkbox"/>					
January 2010	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
November 2010	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
March 2011 (heights only)	<input checked="" type="checkbox"/>					
September 2012	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The partial networks in 2010 and 2012 can only provide localized information about relative deformation within the area measured.

2. Height Deformation Results

The height deformation results are generated by comparing the vertical positions of floor monuments. This information is obtained with leveling runs (Leica DNA03 digital level $\pm 3\text{mm/km}$) during the various measurement campaigns, see Table 1. The initial 3 mm height deformation between March 08 and July 08 in the E-Dump and FEE are timely correlated with the backfill of material above that area. Since July 2008, all height deformations are smaller than 0.5 mm.

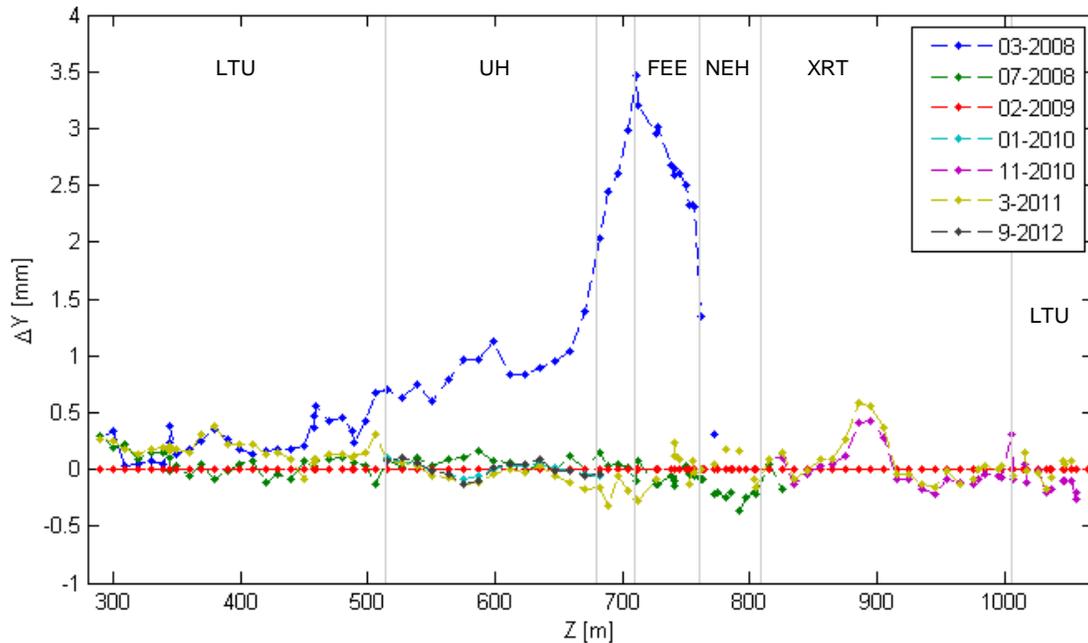


Figure 1: Height deformation in respect to the February 2009 campaign.

3. Wall Deformation Results

The main reason for repeating network measurement was that we noticed local deformation of our wall monuments from south to north wall. Below are plots of the development in the undulator hall and the XRT over the past two years (Figure 2 and **Error! Reference source not found.**). For the analysis the floor monuments are used as reference points, the plots therefore only show localized motion of the walls. In both cases the tunnel diameter is reducing by less than 1mm/year. The above ground construction in the BTH showed movement in the opposite direction, the walls separated by less than 1mm in the first year.

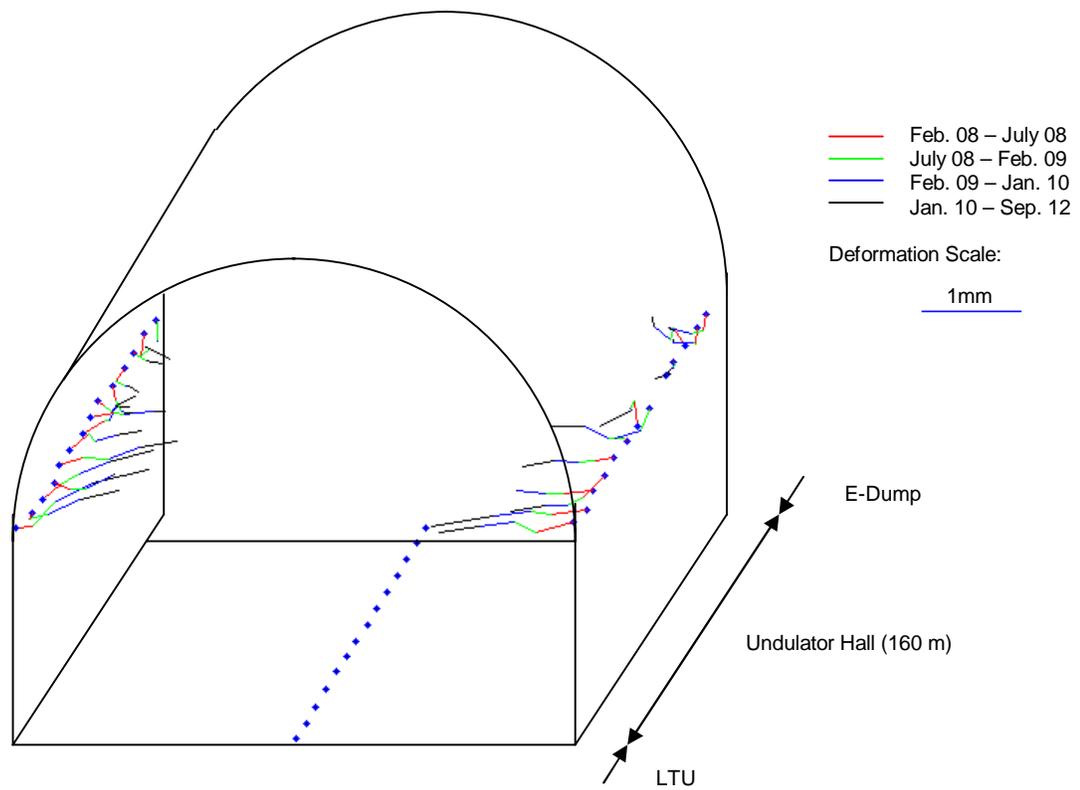


Figure 2: Relative wall deformations in the undulator hall.

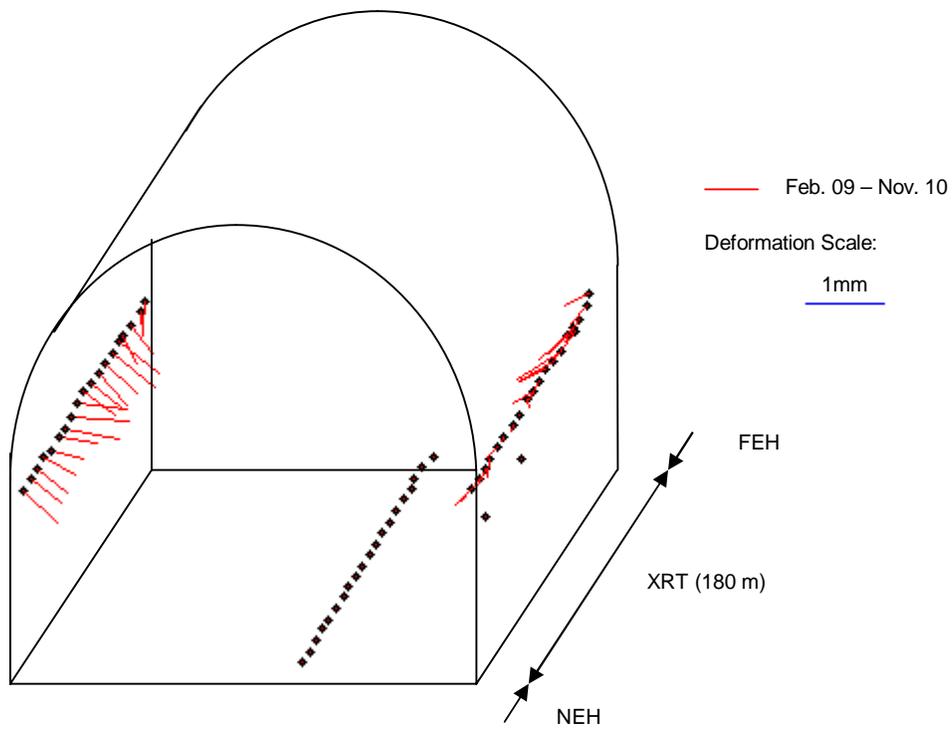


Figure 3: Relative wall deformations in the x-ray tunnel.