



**LICK APF ENCLOSURE  
2.4M TELESCOPE VIGNETTING  
REPORT**

**CI No. DN-500606-01**

**September 2005**

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Issue	Date	Description	Checked	Approved

ECO #	
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## 1 Scope

This report has been compiled to inform the customer of the presence and severity of vignetting of the telescope by the front shutter when it is in the parked position. This report applies specifically to the Lick APF enclosure featuring a 2.4m telescope.

## 2 Problem

To avoid interference between the rear shutter and the fiberglass skirt of the dome the end of travel position of the rear shutter was moved to  $65.33^\circ$  from zenith. The resulting gap is shown in figure 2.1.

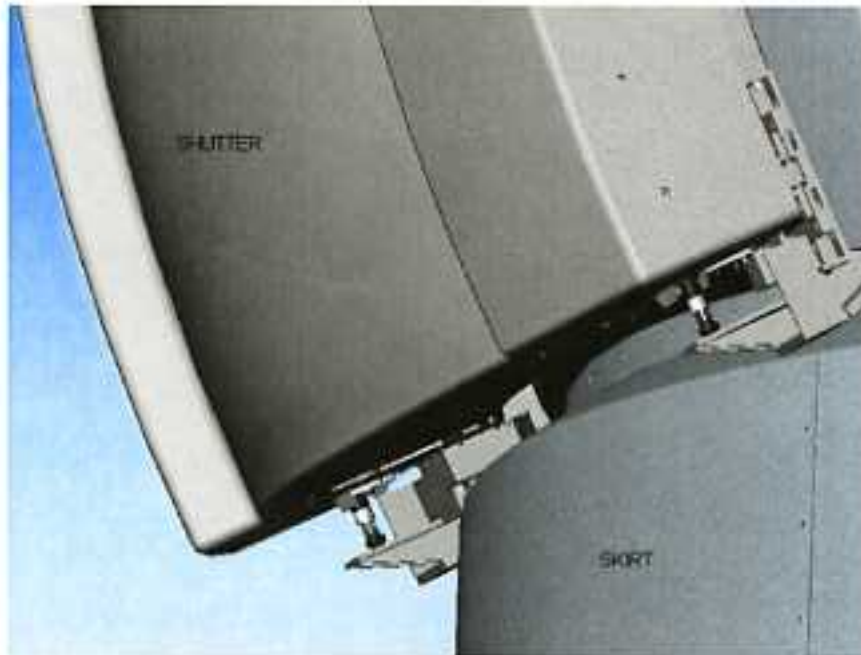


Figure 2.1 Gap Between Shutter And Skirt.

In turn this pushed the parked position of the front shutter around to  $65^\circ$  from zenith. As a result when the front shutter is in the parked position it obscures part of the telescopes view (vignetting). Figure 2.2 shows the shutter positions and highlights where vignetting occurs.

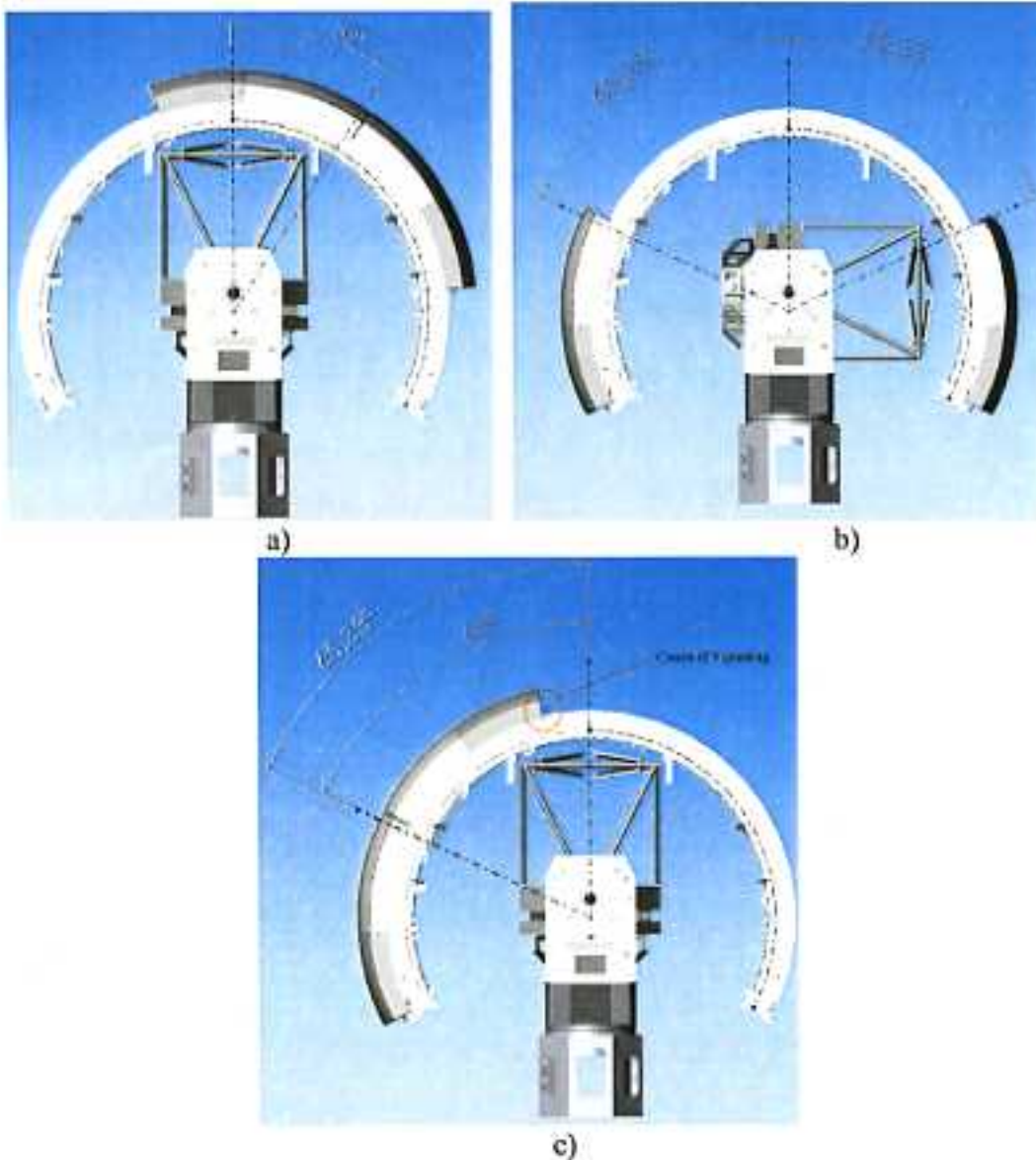


Figure 2.2 Shutter Positions. a) Home, b) End Of Travel, c) Parked.

As a result the view of the telescope is obscured by the front shutter when the shutter is in both the parked and end of travel positions (see figure 2.2). Hence the telescope cannot move continuously from horizon to zenith without having part of its view obscured at one time or another.

### 3 Severity

The CAD model of the dome was used to calculate how much of the telescope is obscured by the shutter when it is in the parked position.

The front transverse seal flap is the component furthest into the field of view of the telescope. It is an insertion rubber flap and it is assumed that the rubber is stiff enough to retain its shape when in the parked position. See figure 3.1.

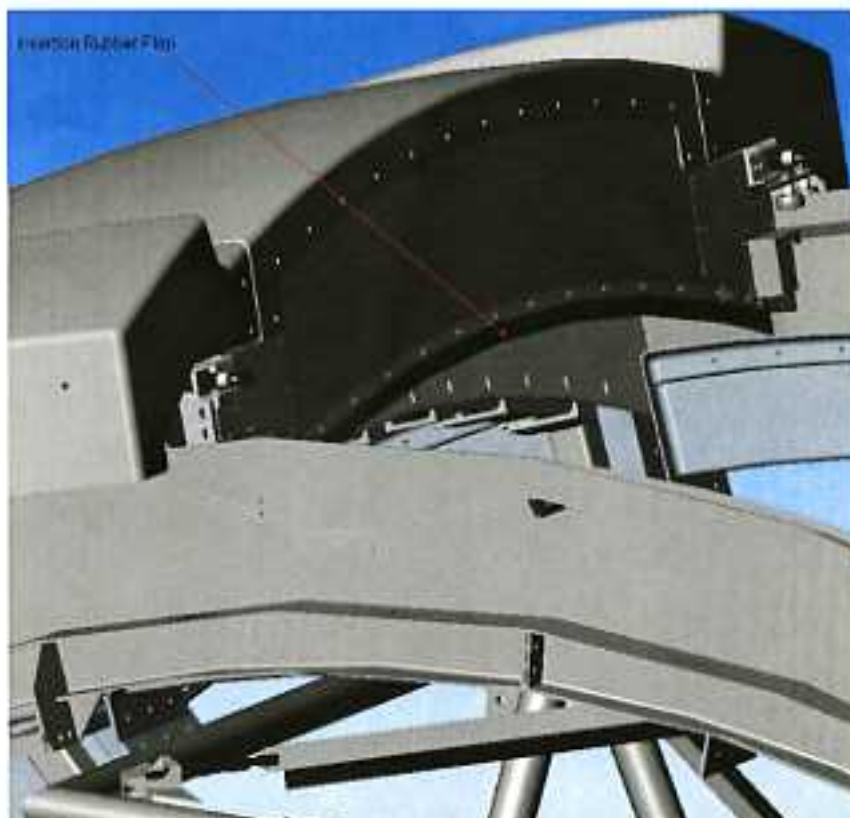


Figure 3.1 Insertion Rubber Seal Flap

Figure 3.2 shows the percentage of the image obscured for different angles from horizon of the telescope. This percentage was calculated by taking the projected area of the front shutter (when in the parked position) onto the telescope mirror as a percentage of the mirror area. A mirror diameter of 2388.175mm was used.

7 different angles from  $90^\circ$  to  $87^\circ$  in steps of  $0.5^\circ$  were used to create the graph (Table 3.1). The obscured area was measured at these angles and a curve of best fit was calculated using quadratic regression.

Table 3.1 Vignetting Data

Mirror Area (mm <sup>2</sup> )
4479424.044

Obscured Area (mm <sup>2</sup> )	Vignetting (%)	Angle From Horizon (deg)
197658.6165	4.412589979	90
153140.4365	3.418752834	89.5
112357.5047	2.508302488	89
75826.8536	1.692781323	88.5
44275.43674	0.988418071	88
18863.0739	0.421104895	87.5
2076.734032	0.046361631	87

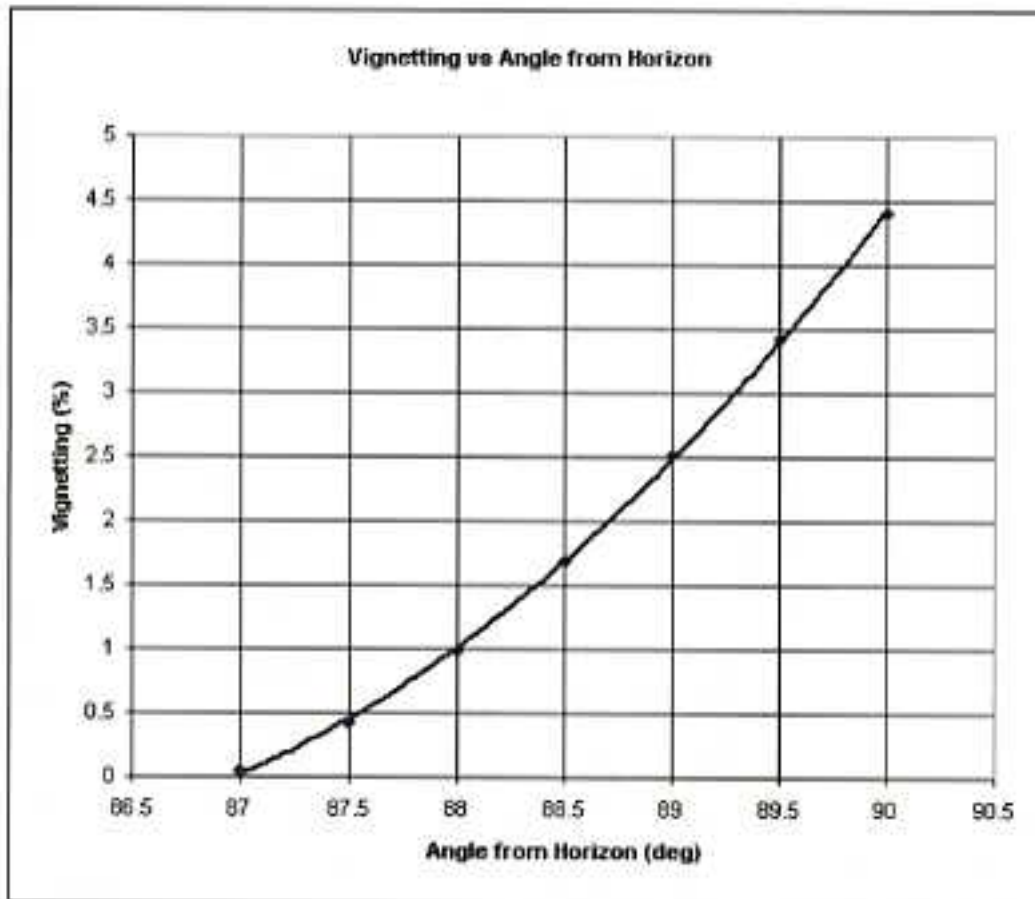


Figure 3.2 Vignetting vs Angle From Horizon.

The curve of best fit is;

$$y = 0.239728859x^2 - 40.95958359x + 1748.993954$$

where y is the vignetting in percentage and x is the angle from horizon in deg.

The maximum vignetting is 4.4% and occurs when the telescope is at zenith or 90° from horizon.

From the equation the vignetting starts at 86.98°.

A sketch was also done in the CAD model to determine the angle when vignetting started. This gave 86.90°. See figure 3.3.

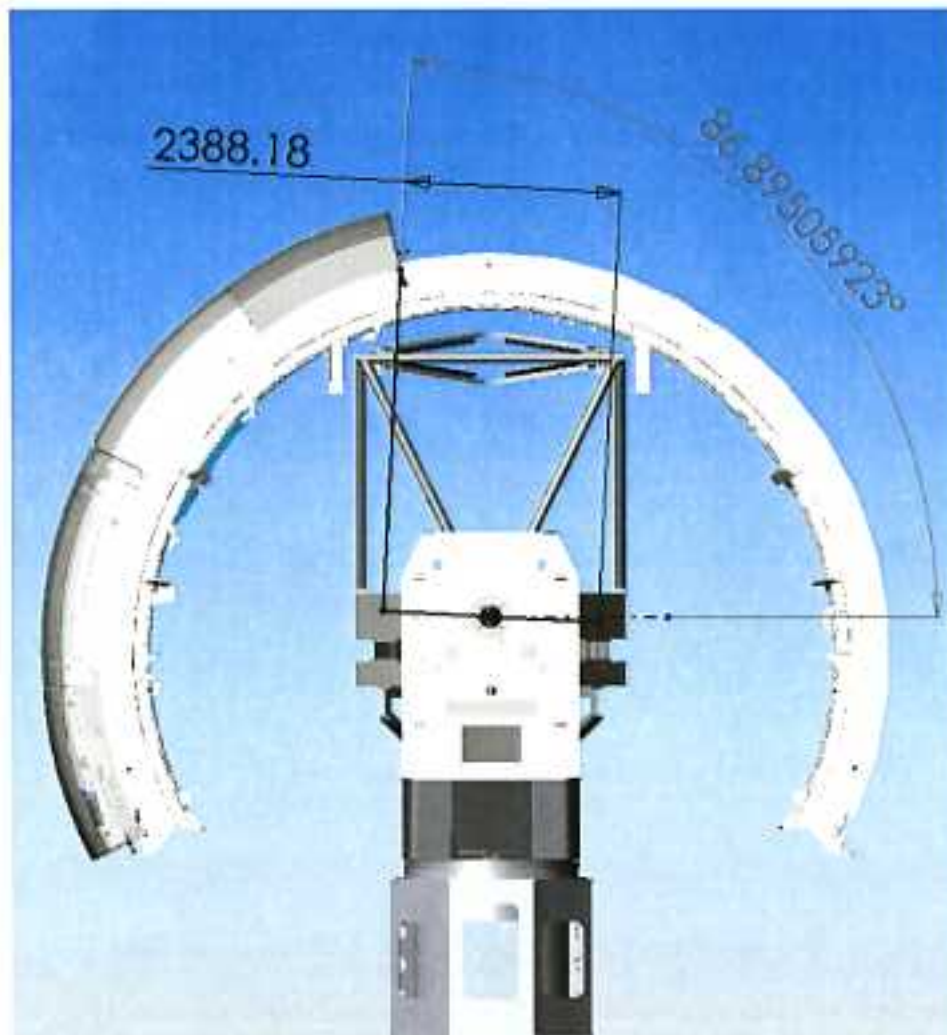


Figure 3.3 Angle Where Vignetting Begins Derived From CAD Model

The angle derived from the CAD model gives an accurate idea of when the vignetting begins and the equation can be used to get a relatively accurate idea of the vignetting at a given angle. Of course all data contained here is calculated from the CAD model and the actual data from the installation will vary.