PALAO optical beam heights

Version 1.0

Anna Moore

2007-08-02
Abstract

This document summarizes the measured beam height of a HeNe laser back-propagated through the PALAO system.

Version History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>2007-08-02</td>
<td>AMo</td>
<td></td>
</tr>
</tbody>
</table>

Contributing Authors

Rick Burrus
Jeff Hickey
Chris Shelton
Table of Contents

1 Introduction .................................................................................................................................. 4
  1.1 Overview ................................................................................................................................ 4
  1.2 Scope ...................................................................................................................................... 4
  1.3 Reference documents ........................................................................................................... 4
  1.4 Reference links ...................................................................................................................... 4
  1.5 Acronyms ................................................................................................................................ 4

2 Summary .................................................................................................................................... 4
  2.1 Set-up ..................................................................................................................................... 4
  2.2 Photos ..................................................................................................................................... 5
  2.3 Results ..................................................................................................................................... 7
  2.4 Conclusions ............................................................................................................................ 7
1 Introduction

Please abide by Word formatting rules when editing this document, in particular, use only
the provided styles (there are 35).
Dimensions given without units are in SI (millimeter) format.

1.1 Overview

A HeNe laser was used to measure the beam height at every optic in the PALAO system
excluding the difficult-to-access wavefront sensor path. All measurements were taken on
June 26th 2006 inside the AO lab of the Hale 200” dome at Palomar with the PALAO
optical bench orientated at an equivalent zenith position.

1.2 Scope

1.3 Reference documents

[1] PALAO design specifications (Dekany et al., 1998, SPIE, 3353, 56)

1.4 Reference links

PALAO (JPL): http://ao.jpl.nasa.gov/Palao/Palaolndex.html
PALAO (COO): http://www.astro.caltech.edu/palomar/AO/

1.5 Acronyms

PALAO Palomar Adaptive Optics system

2 Summary

2.1 Set-up

The set-up procedure was as follows:
1. The PALAO bench was placed on the AO spit and PHARO was removed (giving
   access to the focus location);
2. The PALAO bench, supported on the AO spit, was rotated to the equivalent of zenith
   position;
3. The white light source in the STIMULUS unit was used to acquire AO lock;
4. The location of the white light spot in the X/Y plane of the STIMULUS unit was noted;
5. The fold mirror reflecting the white light source was retracted to allow access to the optical axis of the PALAO system (shown in Figure 1);
6. The HeNe laser was placed in the STIMULUS unit and fixed onto a mount;
7. A fold mirror was used to direct the beam down the hole in the PALAO bench such that the laser spot was coincident with the previously marked location of the white light source (shown in Figure 2);
8. The laser and mirror orientation were adjusted until the laser beam was at the centre of the deformable mirror and roughly in the correct location in the field of the acquisition camera;
9. The science focus location was measured;
10. Consecutively the heights of the beam were measured at each optic in the PALAO system excluding any element after the reflection from SSM1. An example is shown in Figure 3. Each height was measured using a calliper as accurately as possible.

2.2 Photos

Figure 1: Setting up of the HeNe laser in the PALAO STIMULUS unit
Figure 2: The fold mirror was mounted firmly and the laser was adjusted such that the laser beam was aimed along the optical axis of the PALAO system.

Figure 3: The laser beam on one of the PALAO optical elements represents the optical axis of the system.
2.3 Results

The beam heights are summarized in Table 1. Some of the optics were inaccessible directly therefore measurement of the beam height was made as close as possible. In these cases the approximate distance to the optic is noted.

<table>
<thead>
<tr>
<th>Optical Element</th>
<th>Beam height</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM1</td>
<td>169.9mm</td>
<td>On mirror</td>
</tr>
<tr>
<td></td>
<td>(6.69&quot;)</td>
<td></td>
</tr>
<tr>
<td>OAP1</td>
<td>162.3mm</td>
<td>~4” from mirror</td>
</tr>
<tr>
<td></td>
<td>(6.39&quot;)</td>
<td></td>
</tr>
<tr>
<td>FSM</td>
<td>153.9mm</td>
<td>~2” from mirror</td>
</tr>
<tr>
<td></td>
<td>(6.06&quot;)</td>
<td></td>
</tr>
<tr>
<td>DM</td>
<td>163.1mm</td>
<td>~5” from mirror</td>
</tr>
<tr>
<td></td>
<td>(6.42&quot;)</td>
<td></td>
</tr>
<tr>
<td>FM2</td>
<td>173.7mm</td>
<td>On mirror</td>
</tr>
<tr>
<td></td>
<td>(6.84&quot;)</td>
<td></td>
</tr>
<tr>
<td>OAP2</td>
<td>174.0mm</td>
<td>~5.5” from mirror</td>
</tr>
<tr>
<td></td>
<td>(6.85&quot;)</td>
<td></td>
</tr>
<tr>
<td>SSM1</td>
<td>171.7mm</td>
<td>~2” before SSM1</td>
</tr>
<tr>
<td></td>
<td>(6.76&quot;)</td>
<td></td>
</tr>
<tr>
<td>FM3</td>
<td>166.9mm</td>
<td>~2.5” before</td>
</tr>
<tr>
<td></td>
<td>(6.57&quot;)</td>
<td></td>
</tr>
<tr>
<td>Science focus</td>
<td>171.2mm</td>
<td>On focus</td>
</tr>
<tr>
<td></td>
<td>(6.74&quot;)</td>
<td></td>
</tr>
<tr>
<td>At edge of optical bench</td>
<td>183.1mm</td>
<td>Used to measure slope of exiting beam from FM3; on beam</td>
</tr>
<tr>
<td></td>
<td>(7.21&quot;)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Beam heights of the PALAO optics and science focus

2.4 Conclusions

The height of the current PALAO science focus is not the expected 165.16mm (6.5025”), but slightly higher at 171.2mm (6.74”). In addition, there is beam deviation throughout the system of a maximum value of~20mm.