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LIGO- T1300585-v2

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1/10/14

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Setup and Alignment of Pcal Periscope Pre-Alignment  
Support Cradles

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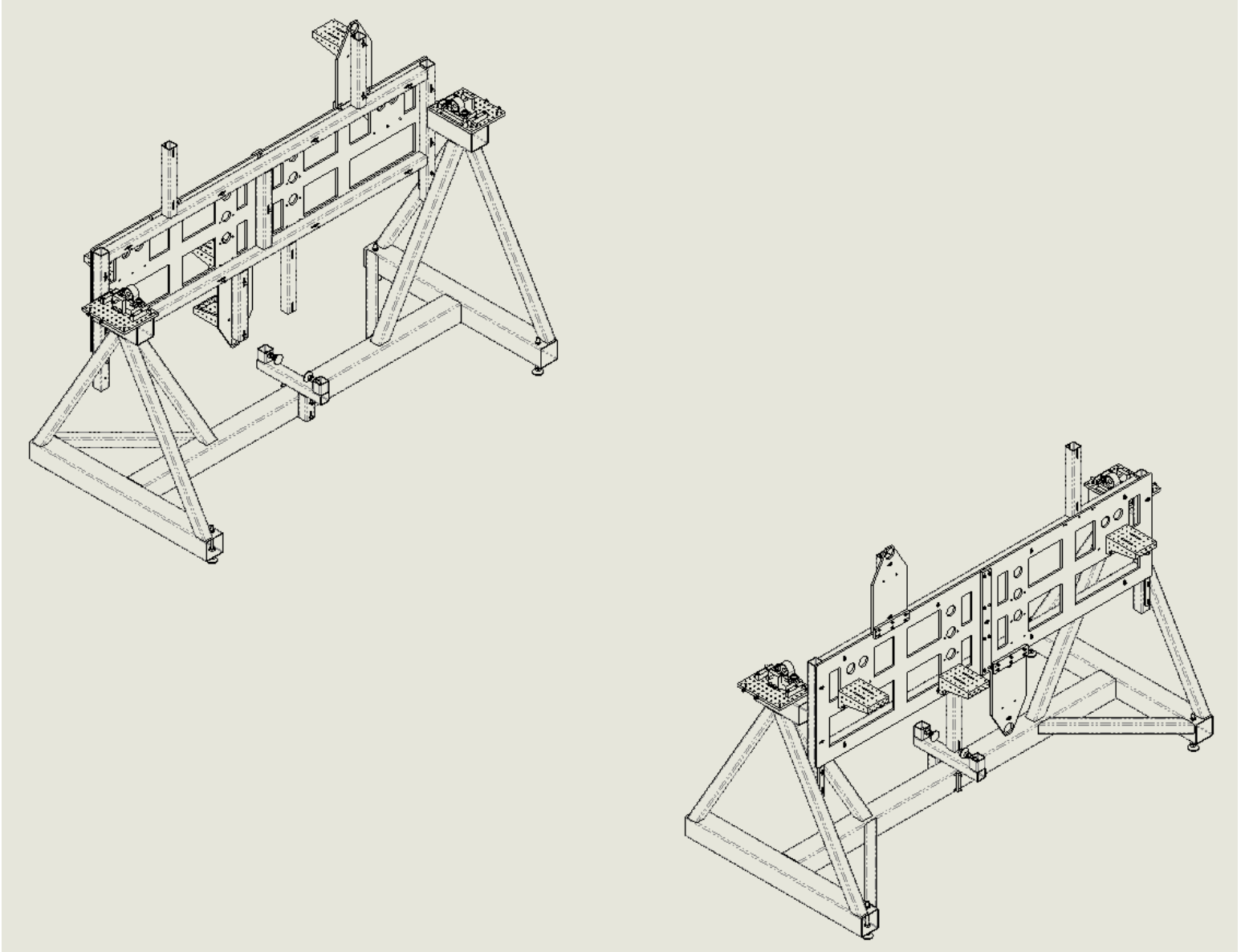
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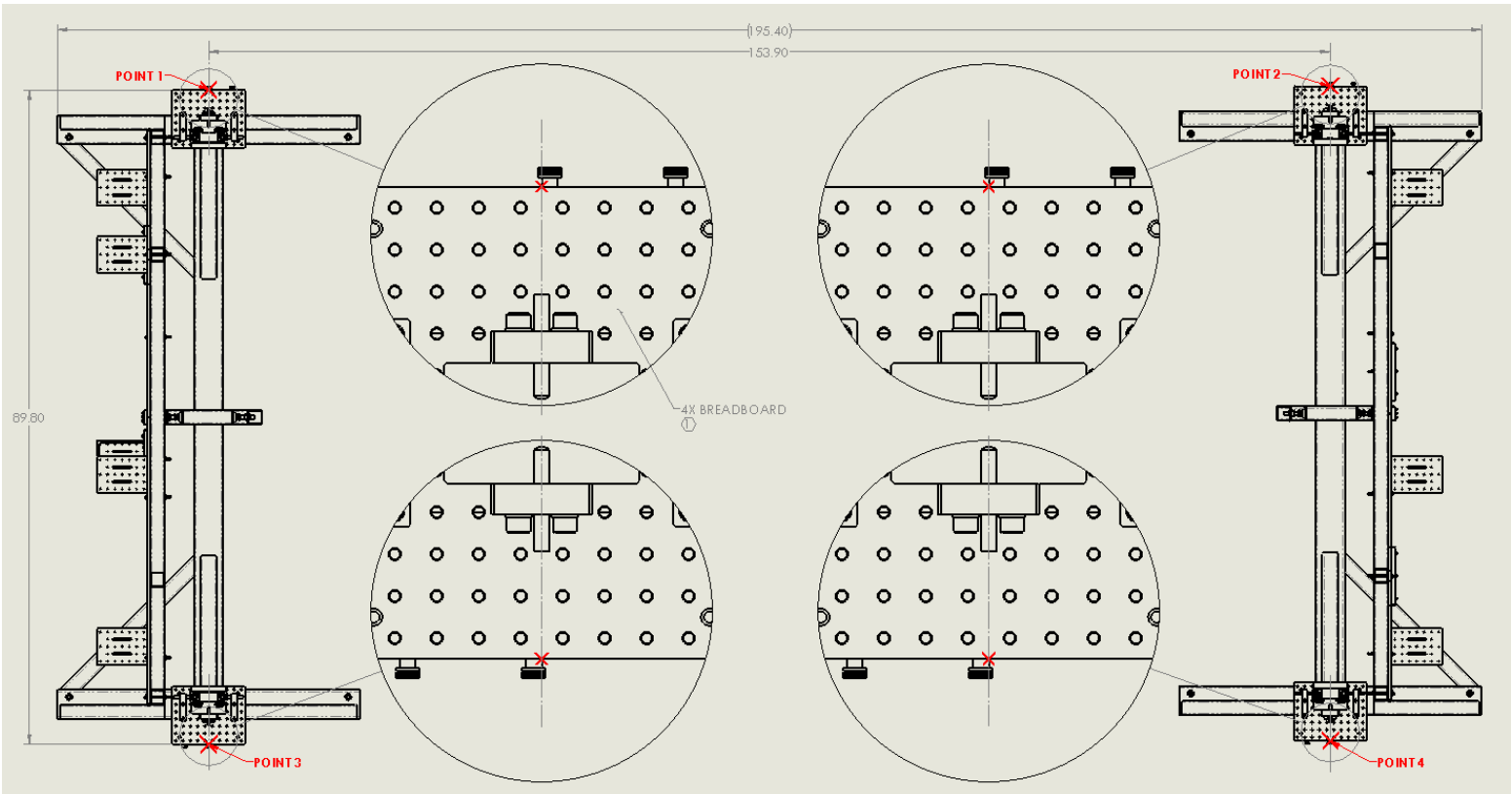
## 1 Introduction

This document outlines procedures for setting up and aligning the Pcal Periscope Pre-Alignment Support Assemblies (Cradles), per Layout [D1201412](#), in the H2 PSL anteroom.



**Figure 1** Complete Pre-Alignment Setup

## 2 Marking Cradle Positions and Positioning the Cradles



**Figure 2** Pre-Alignment Setup, plan view, showing the two Periscope Support Assemblies (Cradles). Before positioning, four points are to be marked on the floor in a true rectangle of dimensions **153.90" x 89.80"**.

1. Required: 3 persons and 2 (20' minimum) tape measures or steel rules.
2. Mark **point 1**
  - a. Pick a point approximately **4'** from the enclosure anteroom entrance (East) wall, and near the South wall as space permits. This will be the first of the four points, and all others will be referenced to this point.
3. Mark **point 2**
  - a. **Point 2** is **153.90"** from **point 1** toward the enclosure anteroom West wall, directed parallel to the South wall.
4. Mark **point 3** (reference: The hypotenuse of the **153.90" x 89.80"** rectangle is **178.18"**.)
  - a. To accurately locate **point 3** (refer to **Figure 2** for its general location), two persons hold tape measures, one at **point 1**, and another at **point 2**.
  - b. A third person, by crossing the two tape measures at the vicinity of **point 3**, locates and marks its precise position **89.80"** from **point 1** and **178.18"** from **point 2**.
5. Mark **point 4** using the same technique as used for **point 3**, again (or still) holding one tape measure at **point 1**, and another at **point 2**. The third person now crosses the two tape measures at the vicinity of **point 4** and marks its precise position **178.18"** from **point 1** and **89.80"** from **point 2**.

6. Double check that all distances, including diagonals, between points match with the desired **153.90" x 89.80"** rectangle. All measurements should check within 1/32" of expected dimensions.
7. Using plumb bobs hung over the Breadboard shoulder screws (see **Figure 2**) at either end of a Cradle, position each Cradle to its two designated points.

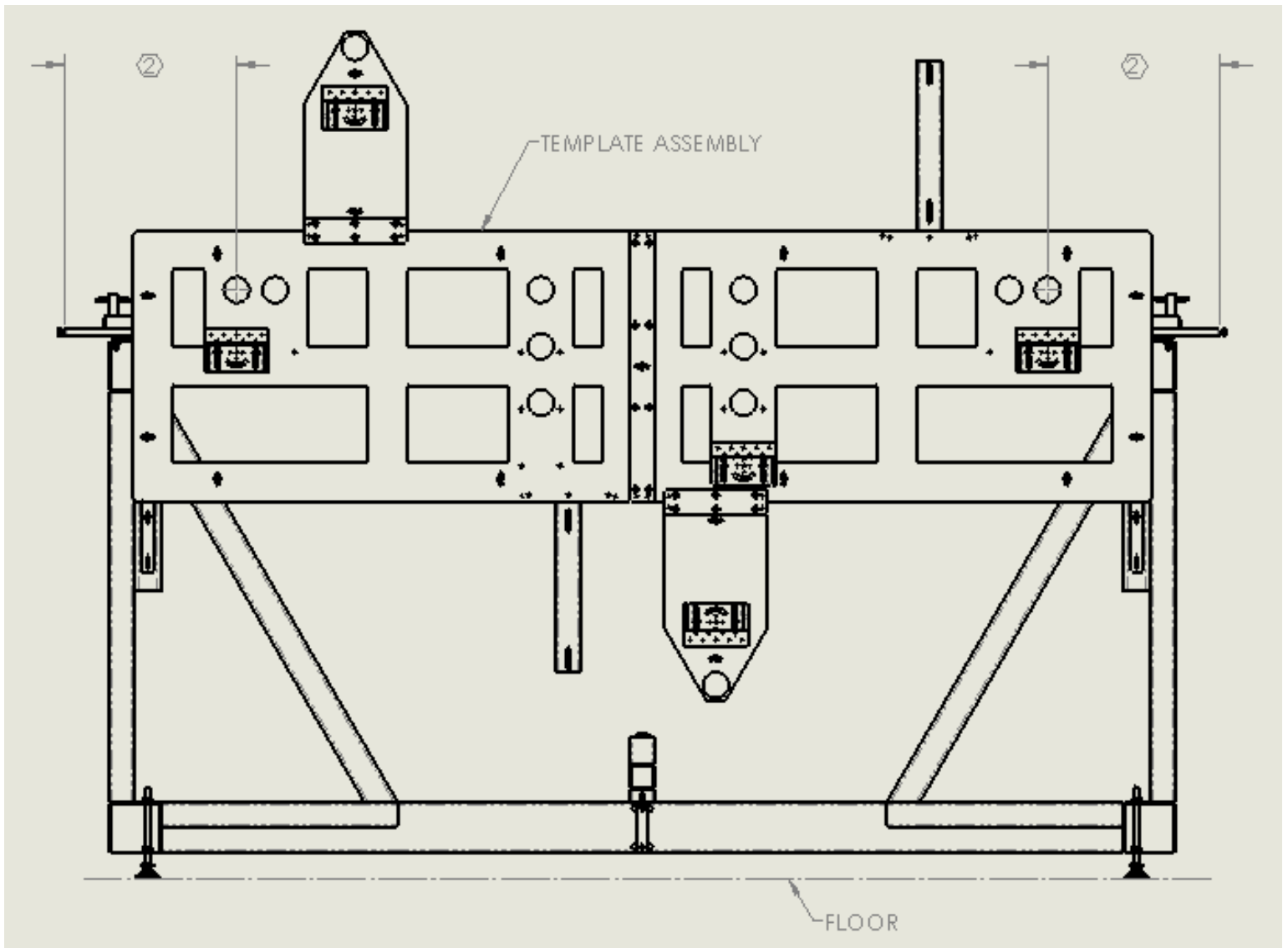
### 3 Leveling and Alignment of the Four Breadboards and Plumbing of the Template Assemblies (Templates)



**Figure 3** Pre-Alignment Setup, elevation view, showing the two Periscope Support Assemblies (Cradles).

1. Using a bubble level, an optical level, and a surveying target, set each of the four Breadboards level within 0.6 mrad (i.e. within 0.005" over surface), and coplanar within 0.01". Keep the Template of each Cradle plumb across its height within 0.02". To do all of the above, make adjustments to the Cradle leveling feet, and shim the Breadboards at their three attachment points, as needed.
2. Check with plumb bobs to see whether each cradle is still well positioned to its floor marks. Adjust positions if necessary, then re-check the Breadboards' co-planarity. Make final adjustments if necessary.
3. The final elevation of the four-Breadboard plane should be within +/- 0.2" of 42.7". The bottoms of the Cradle weldments should be within +/- 0.2" of 2.0" above the floor.

## 4 Template Horizontal Centering



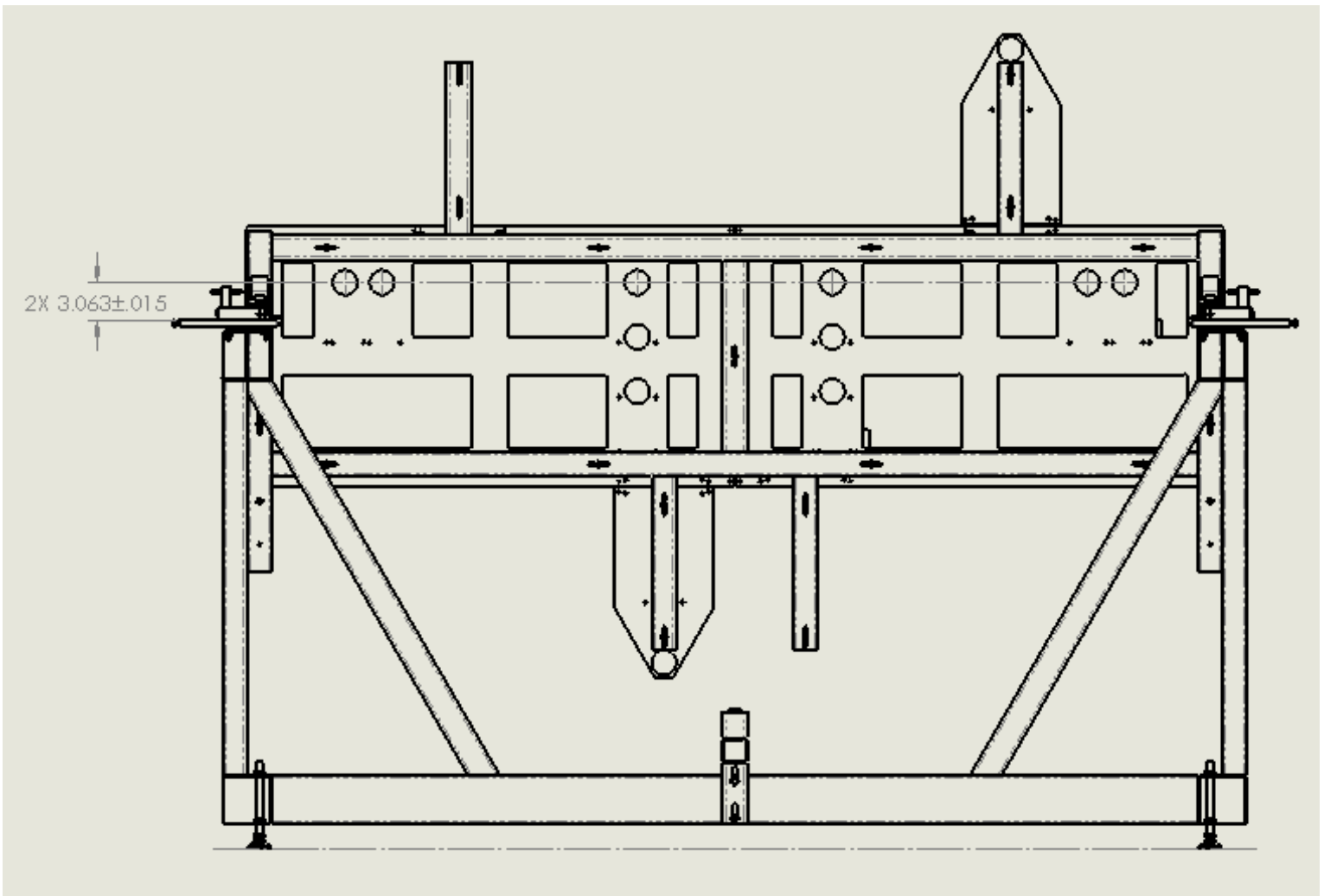
**Figure 2** Center each Template horizontally within its Cradle to be equidistant from the noted 2" diameter holes to the Breadboards. For each Template, these two dimensions should match within 0.02".

1. The Template should be supported from below by slotted brackets at its two ends, attached to the Cradle such as shown in **Figure 4**.
2. To adjust the Template's position, loosen all of its mounting screws and nuts. The Template can then be moved vertically and horizontally. Exercise caution not to affect the Cradle's position on the floor, i.e. be careful not to push or pull on the cradle horizontally in any direction.
3. Before horizontally centering the Template, roughly level and position its elevation slightly below (to allow for shimming) the specified final elevation relative to the Breadboards (see

section 5 and Figure 5 for specified final elevation).

- Use plumb bobs and D1300072 Target Disks (not shown) at the outer 2" diameter holes (Figure 4) for the centering process, measuring from the noted ends of the Breadboards to the plumb bob strings.

## 5 Template Vertical Positioning and Alignment



**Figure 5** Survey and shim the Templates vertically so that the upper rows of 2" diameter holes are level, and  $3.063 \pm .015$ " above the four-Breadboard plane.

- Insert D1300072 Target Disks (not shown) at the outer 2" diameter holes of each Cradle's Template.
- Using an optical level and surveying target, shim the elevations of the two Templates to be matched and level (per the precision of the optical level), and within  $3.063 \pm .015$ " above the four-Breadboard plane.