Preliminary Layout for LCLS

Direction Stake-out
Scope of the Job – Part 1

• Mark the direction of the accelerator in the research yard and to the radiation fence.

• Chosen solution:
  – Use existing feature such as FFTB housing or roof of klystron gallery to get the direction.
  – For each chosen feature, set-up a TC2002 near tower 20 and stake every 50 feet in both directions.
  – Run a GPS/RTK survey of all stakes.
  – Best fit a line to assess each staking process.
Step 1: Find a direction to buck-in

Step 2: Set-up the instrument

Step 3: Move prism to line of sight and stake

Step 4: Survey all stakes using GPS/RTK
Note: Linac roof center line marked with blue paint in the research yard and blue flagging tied to orange stakes elsewhere
Residuals to Orange Best Fitted Line

![Graph showing residuals to Orange Best Fitted Line with data points and fitted line.](image)

Preliminary LCLS extension
Alignment Engineering Group
02 / 25 / 2004
Residuals to Purple Best Fitted Line

![Graph showing residuals to a purple best fitted line](image)
Scope of the Job – Part 2

• Determine the offset of the two painted lines to the accelerator tube line.
• Chosen solution:
  – Select some brass plates in the klystron galley and install a PK nail in the road for each plate.
  – Set-up a TC2002 on each chosen brass plate, backsight on one of the neighboring plate and survey the PK nail in the road.
  – Run a GPS/RTK survey of all the PK nails on the road.
  – Correct for the nominal offset of the klystron brass plates with respect to the accelerator tube and fit a line to these values.
End of Part 2

– Transform the 2 painted lines into this new line system and evaluate the offset of each stake.

• External Check:
  – Perform a local survey of M20 with respect to both lines and transform both results into the accelerator line to compare with the published SLC values.
  – Select SLC survey monuments directly observable by GPS/RTK and perform similar transformation and comparison.

• Remaining Field Work as of 2/25
  – Stake out the actual accelerator tube line using a new GPS/RTK survey based on above calculated offsets.
PK nails versus
Klystron Gallery Brass Plates

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dx (m)</th>
<th>Dz (m)</th>
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<tbody>
<tr>
<td>1</td>
<td>9.999</td>
<td>-1.516</td>
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<tr>
<td>2</td>
<td>10.017</td>
<td>-3.263</td>
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<tr>
<td>3</td>
<td>9.996</td>
<td>-3.254</td>
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<td>21</td>
<td>10.012</td>
<td>-1.786</td>
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<tr>
<td>28</td>
<td>10.002</td>
<td>-3.253</td>
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<td>29</td>
<td>10.004</td>
<td>-3.253</td>
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<tr>
<td>30</td>
<td>9.999</td>
<td>-1.943</td>
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</tbody>
</table>
Typical Section of Klystron Gallery and Accelerator Housing

Looking East

SLAC Drawing # SK - GE 5153 - A

The nominal X offset of all klystron gallery brass plates to the accelerator tube is:

6'10" + 1'9" – 1'7" = 7'

<table>
<thead>
<tr>
<th>PK nail at Sector #</th>
<th>X Offset to Acc. (m)</th>
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<tbody>
<tr>
<td>1</td>
<td>12.133</td>
</tr>
<tr>
<td>2</td>
<td>12.151</td>
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<tr>
<td>3</td>
<td>12.130</td>
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<td>29</td>
<td>12.138</td>
</tr>
<tr>
<td>30</td>
<td>12.133</td>
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</table>
Tower 20 / M20 survey mark

SLC published values on March 26, 1986
\[ X = -0.48673 \text{ m} \quad Z = 533.44932 \text{ m} \]

Transformed fitted offset on February 17, 2004
\[ d = -0.483 \text{ m} \]
Miscellaneous

- 2/13/04: Extend the orange line to Alpine road and locate on this line elevation 245’ above sea level.
- 2/24/03: Determine distance from end of LINAC to end of pavement in the research yard.
Location of Elevation 245’ above sea level using GPS/RTK set in NAD83 coordinates

Given

\[ H = 245' = 74.676 \, \text{m} \]

Knowing from model GEOID99 at latitude 37° 25’ and longitude -122° 12’ 15”

\[ N = -32.508 \, \text{m} \]

Found

\[ h = 42.168 \, \text{m} \]
Last Orange Stake at Alpine Road

Start of the Orange Line Extension
Distance from Edge of Pavement to these Walls

216.51 m

213.76 m

125.91 m
Edge of Pavement

Stake

PK nail O32

<table>
<thead>
<tr>
<th>Point Name</th>
<th>Horizontal Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey Wall</td>
<td>151.141</td>
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<tr>
<td>White Wall</td>
<td>148.389</td>
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<tr>
<td>End FFTB</td>
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<td>PK O36</td>
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<td>PK O35</td>
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<td>PK O32</td>
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<tr>
<td>Pavement</td>
<td>65.368</td>
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