IL & CA, IR Halls
AGENDA

Thursday, January 8, 8:30-10:30

8:30 - 8:50    Outstanding Detector Issues
               J. Jaros, SLAC

8:50 - 9:10    Benchmarking the Detector
               M. Battaglia, LBNL

9:10 - 9:30    European Detector Performance Studies
               T. Behnke, DESY

9:30 - 9:50    Physics Requirements for Detectors in the Forward Region
               G. Wilson, Kansas

9:50 - 10:05   Implications for Detector Installation/Running at US Sites
               C. Corvin, SLAC

10:05 - 10:30  Discussion
               All

C. Corvin : clay@slac.stanford.edu

ALCPG - 01.07.04
Topics

* IR Hall Detector Type(s)
* Critical Dimensions & Layout
* Geology Type & Alignment
* Surface View & Deep View
* IR Hall vs. LC Campus Location
* Cost Drivers & Estimates
Acknowledgments

## IR Baseline

### Large Detector (Self Shielded), or Silicon Detector, or Precise Detector

<table>
<thead>
<tr>
<th>Vaults</th>
<th>Sept-May</th>
<th>June-Aug</th>
<th>Deg.C</th>
</tr>
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<tbody>
<tr>
<td>dT over 24 hours</td>
<td>0.1</td>
<td>2</td>
<td>Deg.C</td>
</tr>
<tr>
<td>dT over period</td>
<td>2</td>
<td>5</td>
<td>Deg.C</td>
</tr>
<tr>
<td>HEIR</td>
<td>62.00</td>
<td>15.00</td>
<td>m</td>
</tr>
<tr>
<td>HEIR Detector Footprint</td>
<td>20.00</td>
<td>13.00</td>
<td>m</td>
</tr>
<tr>
<td>LEIR</td>
<td>62.00</td>
<td>15.00</td>
<td>m</td>
</tr>
<tr>
<td>LEIR Detector Footprint</td>
<td>20.00</td>
<td>13.00</td>
<td>m</td>
</tr>
<tr>
<td>DUMPS</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>Beamline y with respect to IR pit floor</td>
<td></td>
<td>7.00 m</td>
<td></td>
</tr>
<tr>
<td>Hook height above IR pit floor</td>
<td></td>
<td>14.00 m</td>
<td></td>
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</table>

Most Constrained
Most Critical CF Structural Dimension is in Z

Maximum Roof Span?

Tunnel-to-Detector Support Bridge?

Detector End Shielding?
Tunnel -to- IP Approach Layout Concept (iso view)

*2nd Most Critical CF Structural Dimension is in X

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Next Most Critical CF Structural Dimension is in X

Beam Tunnel -to- IR Hall Spacing & Structural Stability?

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Preliminary IP Concept Designs for the USLCSG Report

Deep @ -400 Feet
Vertical Shaft Access
Below Water Table
57 M ($US) Each in IL

Surface @ -30 Feet
Side-Hill Ramp Access
Above Water Table
17 M ($US) Each in CA

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IL Deep Cavern IP @ -eL 400 Feet
View in Z

CA Surface IP View in X @ -eL 30 Feet

IL Surface Support Building for Deep Cavern

CA Surface IP View in Z

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IL Deep IR Halls
IL Rock Units are Layered & Deep

400 Ft Vertical Access Shaft

Water Bearing Rock Units

2 Tunnel Alignment

- GLACIAL TILL
  - EL. (+)840.0
  - EL. (+)787.0
- SILURIAN GROUP
  - EL. (+)740.0
  - EL. (+)710.0
- MAQUOKETA GROUP
  - EL. (+)640.0
  - EL. (+)635.0
- GALENA/PLATTEVILLE GROUP
  - EL. (+)540.0
  - EL. (+)440.5
- ST. PETER SANDSTONE
  - EL. (+)340.0
  - EL. (+)240.0
  - EL. (+)144.0
  - EL. (+)140.0
  - EL. (+)40.0
IL Deep Cavern IP $ @ -eL 400 Feet

<table>
<thead>
<tr>
<th>R18</th>
<th>IR-1 Cold</th>
<th>IR-2 Cold</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>dX by dZ</td>
<td>203' x 98'</td>
<td>203' x 98'</td>
<td>62 m x 30 m Overall IP Hall</td>
</tr>
<tr>
<td>Sq Ft</td>
<td>20000</td>
<td>20000</td>
<td>Large, Silicon or Precise Detector IP</td>
</tr>
<tr>
<td>Civil</td>
<td>$41,000,000</td>
<td>$41,000,000</td>
<td>Deep Cavern in IL @ -eL 400 Ft</td>
</tr>
<tr>
<td>Civil Shaft</td>
<td>$7,000,000</td>
<td>$7,000,000</td>
<td>Deep Shaft Required in IL @ -eL 400 Ft</td>
</tr>
<tr>
<td>Mech</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
<td>Requires Closed Utility Bldg in IL Climate</td>
</tr>
<tr>
<td>Elect</td>
<td>$2,000,000</td>
<td>$2,000,000</td>
<td>Requires Closed Utility Bldg in IL Climate</td>
</tr>
<tr>
<td>Surf. Bldg</td>
<td>$3,000,000</td>
<td>$3,000,000</td>
<td>Required in IL Climate</td>
</tr>
<tr>
<td>Sum</td>
<td>$58,000,000</td>
<td>$58,000,000</td>
<td></td>
</tr>
<tr>
<td>$/SqFt</td>
<td>$2,800</td>
<td>$2,800</td>
<td>w/Deep Cavern Excavation in IL</td>
</tr>
</tbody>
</table>

IL Deep Cavern IP @ -eL 400 Feet View in Z
Illinois IR Hall Surface View (winter)
CA Surface IR Halls
California Topography (concept art view)

Beam Tunnel
Support Tunnel
Side Hill
Access Ramps

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CA Cretaceous Sandstone Rock Units Incline to Surface

Plan View of Rock Unit Surface Projection
California Lo-Res Greyscale 3D (digitized topo)
California IR Hall Access Ramp (art view)

Clear Area without an adjacent Beam Dump (pumps, heat exchangers & noise)
CA Surface IP $ @ -eL 30 Feet

<table>
<thead>
<tr>
<th>R18</th>
<th>IR-1 Warm</th>
<th>IR-2 Warm</th>
<th>Note: SLD, SLC, PEP-II CA Baselines</th>
</tr>
</thead>
<tbody>
<tr>
<td>dX by dZ</td>
<td>203' x 98'</td>
<td>203' x 98'</td>
<td>62 m x 30 m Overall IP Hall</td>
</tr>
<tr>
<td>Sq Ft</td>
<td>20000</td>
<td>20000</td>
<td>Large, Silicon or Precise Detector IP</td>
</tr>
<tr>
<td>Civil</td>
<td>$11,504,000</td>
<td>$11,504,000</td>
<td>Open Pit w/Ramps in CA $@ -eL 30 Ft</td>
</tr>
<tr>
<td>Civil Shaft</td>
<td>$0</td>
<td>$0</td>
<td>None Required in CA $@ -eL 30 Ft</td>
</tr>
<tr>
<td>Mech</td>
<td>$3,359,000</td>
<td>$3,359,000</td>
<td>w/Open Utility Shelter Pads in CA</td>
</tr>
<tr>
<td>Elect</td>
<td>$2,202,000</td>
<td>$2,202,000</td>
<td>w/Open Utility Shelter Pads in CA</td>
</tr>
<tr>
<td>Surf. Bldg</td>
<td>$0</td>
<td>$0</td>
<td>None Required in CA Climate</td>
</tr>
<tr>
<td>Sum</td>
<td>$17,065,000</td>
<td>$17,065,000</td>
<td></td>
</tr>
<tr>
<td>$/SqFt</td>
<td>$853</td>
<td>$853</td>
<td>w/Open Pit Surface Excavation in CA</td>
</tr>
</tbody>
</table>
California IR Hall Surface View - West

Summer (near view)  Winter (far view)
Central (X) or Remote (√) Campus?
The LC Campus and related

Cultural Noise

Should **NOT** be near the IR’s

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The LC Campus and related Cultural Noise should **NOT** be near the IR.

Campus ~ 16 km from IP

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IR Hall Costing Estimates
**IR Rev. 18 Preliminary Cost Estimates for the USLCSG Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Warm CF IR Halls</td>
<td>1 each</td>
<td>34,130,000</td>
</tr>
<tr>
<td>CF Interaction Region Hall #1</td>
<td>1 each</td>
<td>17,065,000</td>
</tr>
<tr>
<td>CF Interaction Hall Civil/Structural</td>
<td>1 lot</td>
<td>11,504,000</td>
</tr>
<tr>
<td>CF Interaction Hall - Mechanical</td>
<td>1 lot</td>
<td>3,359,000</td>
</tr>
<tr>
<td>CF Interaction Hall - Electrical</td>
<td>1 lot</td>
<td>2,202,000</td>
</tr>
<tr>
<td>CF Interaction Region Hall #2</td>
<td>1 each</td>
<td>17,065,000</td>
</tr>
<tr>
<td>CF Interaction Hall Civil/Structural</td>
<td>1 lot</td>
<td>11,504,000</td>
</tr>
<tr>
<td>CF Interaction Hall - Mechanical</td>
<td>1 lot</td>
<td>3,359,000</td>
</tr>
<tr>
<td>CF Interaction Hall - Electrical</td>
<td>1 lot</td>
<td>2,202,000</td>
</tr>
<tr>
<td>Cold Beam Div. IR Halls</td>
<td>2 each</td>
<td>141,205,800</td>
</tr>
<tr>
<td>Cold LC IR Hall</td>
<td>1 each</td>
<td>56,706,800</td>
</tr>
<tr>
<td>Cold LC Beam Dump</td>
<td>2 each</td>
<td>13,896,000</td>
</tr>
</tbody>
</table>

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IR Preliminary Cost Estimates - Rough Parametrics

IL- Deep Cavern IR Hall - Rough Comparable Civil Cost:
1) The unit volume cost of a deep cavern excavation using a road header is about twice as much as a tunnel boring machine per unit volume cost.
2) TBM excavation costs for a 16.5 ft diameter tunnel are ~$2,000 per lineal foot. This is ~$10/CF.
3) The IR Hall volume is ~2,000,000 CF, thus at $20/CF it equals $40M, add $1M for miscellaneous to get the estimated $41 M.

CA – Surface IR Hall - Rough Comparable Civil Cost:
1) The net excavation is ~75,000 CY at $13/CY is $975,000 or say $1 M.
2) Tiebacks (soil/rock nailing) of about 60,000 SF of wall at $33/SF is $1,980,000 or say $2 M.
3) IR Hall building of 20,000 SF of high bay (~98 ft height) at $400/SF comes to $8 M.
4) The pit, tieback and IR hall building total is about $11 M with $ 0.5 M added for ramps to get the estimated $11.5 M.

Note: Dry &/or Wet Rock Unit Cost Extensions not Included.
IL & CA IR Halls
End