The Daya Bay Reactor Anti-Neutrino Experiment

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RPI
Outline

- Neutrino Oscillations (recap)
- The Daya Bay Baseline
- Hall Layout
- Timeline
- Requirements
$U_{\text{MNSP}} = \begin{pmatrix}
1 & 0 & 0 & C_{13} & 0 & \hat{S}_{13} & C_{12} & S_{12} & 0 & e^{i\phi_1} \\
0 & C_{23} & S_{23} & 0 & 1 & 0 & -S_{12} & C_{12} & 0 & e^{i\phi_2} \\
0 & -S_{23} & C_{23} & -\hat{S}_{13} & 0 & C_{13} & 0 & 0 & 1 & 1
\end{pmatrix}$

$C_{jk} = \cos \theta_{jk}, \quad S_{jk} = \sin \theta_{jk}, \quad \hat{S}_{13} = e^{i\delta CP} \sin \theta_{13}$
Neutrino Oscillations

Our current knowledge of neutrino oscillations is summarized by a recent global fit of the world data to $2\sigma \at 95\% C.L.$ by Fogli et al.

\[
\Delta m^2_{21} = 7.92(1.00 \pm 0.09) \times 10^{-5} \text{ eV}^2
\]
\[
\sin^2 \theta_{12} = 0.314(1.00^{+0.18}_{-0.15})
\]
\[
|\Delta m^2_{32}| = 2.4(1.00^{+0.21}_{-0.26}) \times 10^{-3} \text{ eV}^2
\]
\[
\sin^2 \theta_{23} = 0.44(1.00^{+0.41}_{-0.22})
\]
\[
\sin^2 \theta_{13} = (0.9^{+2.3}_{-0.9}) \times 10^{-2}
\]
Detector Geometry
Hall layout
Muon System

Cave

RPCs

Water

Anti-neutrino detector

8" PMT

1 m
### Summary of Determined Requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>Sensitivity in $\sin^2 2\theta_{13}$ (90% C.L.)</td>
<td>$\leq 0.01$</td>
</tr>
<tr>
<td>Standard error of $\sin^2 2\theta_{13}$</td>
<td>0.0061</td>
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<tr>
<td>Baseline of the far detector</td>
<td>$\leq 2$ km</td>
</tr>
<tr>
<td>Number of events at the Daya Bay near hall</td>
<td>650,000</td>
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<tr>
<td>Number of events at the Ling Ao near site</td>
<td>600,000</td>
</tr>
<tr>
<td>Number of events at the far site</td>
<td>170,000</td>
</tr>
<tr>
<td>Background/signal</td>
<td>$\leq 0.09$</td>
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