Future measurements and facilities

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The next step

We must achieve consensus about the next step in neutrino physics. This consensus will be based on (assuming a science driven agenda):

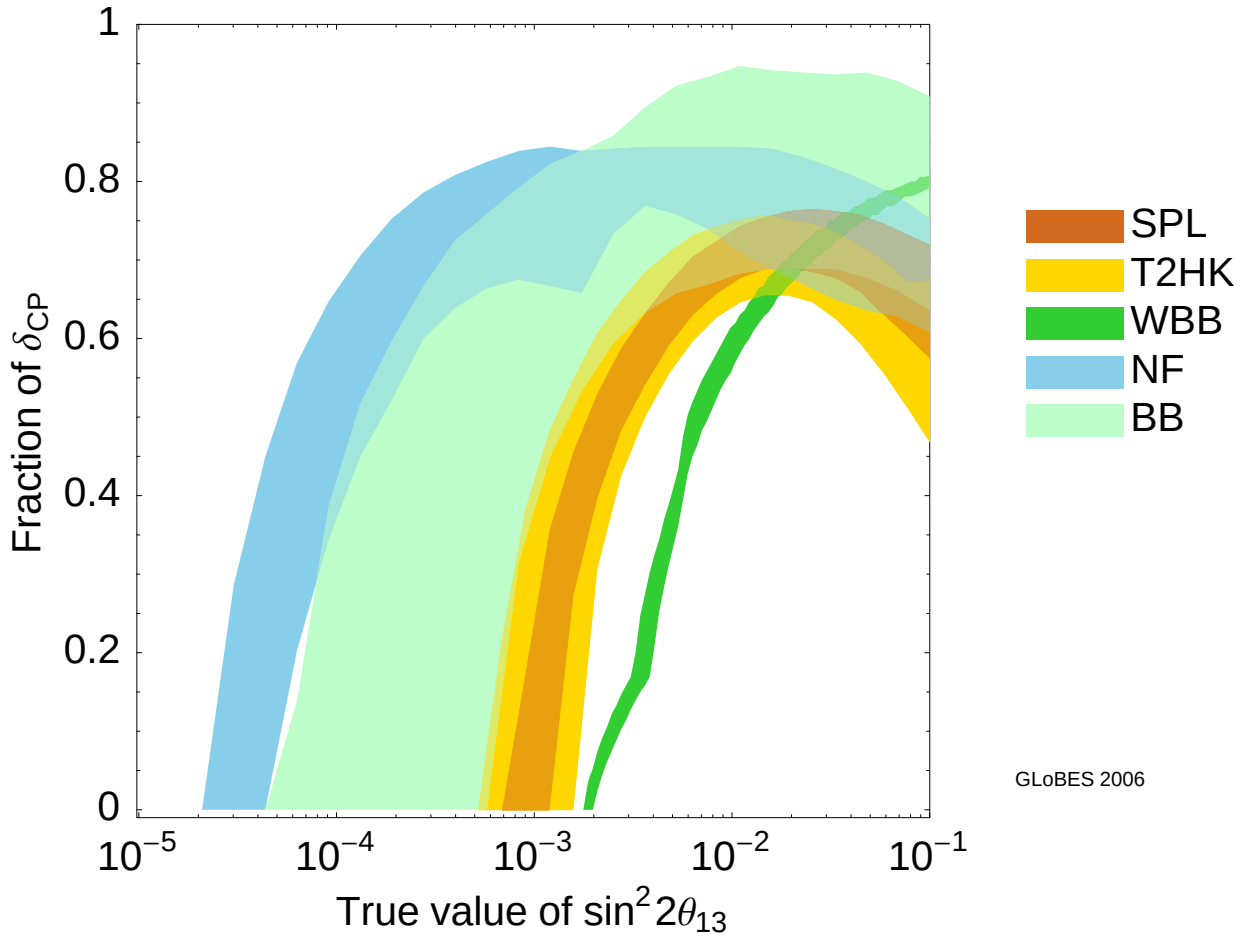
- results on θ_{13} – nothing to be done about that
- performance estimates – nearly done, albeit with large uncertainties
- cost estimates – in progress
- associated risks – ?

Based on that we can understand

- time scales
- funding opportunities

Performance estimates

CP violation sensitivity at $3\,\sigma$ from the ISS



Different perspectives

It seems that everyone draws slightly different conclusion from the previous plot, or more generally any performance, cost or risk estimate.

This is mostly due to the implicit assumptions one makes in drawing these conclusions.

Since I don’t know what your assumptions are, I will show you the ones I make and I would like to use that as starting point for the discussion.

Key measurements

In the context of long baseline neutrino experiments, I want to know

- $\sin^2 2\theta_{13}$
- δ_{CP}
- mass hierarchy
- $\theta_{23} = \pi/4$, $\theta_{23} < \pi/4$ or $\theta_{23} > \pi/4$?

It is very difficult to rank those measurements in their relative importance, with exception of $\sin^2 2\theta_{13}$ since its size has practical implications beyond theory.

Given the current state of the theory of neutrinos, I can not say with confidence that any one quantity is more fundamental than any other.

Choice of experiment

Any accelerator-based experiment able to address the key measurements will cost more than several 10^8 €, hence I strongly feel that there will be at most one of these at any given time.

Therefore, any measurements not performed by this one experiment will not be performed for a very long time, probably exceeding my professional lifetimes.

Therefore, any experiment should strive to address all of the key measurements with satisfactory parameter reach.

NB The satisfactory parameter reach may change with time, *e.g.* an early positive DoubleCHOOZ result.

Editorial comment

Humans consider anything they do not know, as inherently more risky or difficult than than things they know.

This is also to be seen in neutrino physics, *e.g*

- solar neutrinos – the fact that the early experiments where all chemistry experiments certainly has delayed the acceptance of the results by the high energy community for a long time.

This often leads to:
I don’t believe your numbers
(since I don’t understand them)