Summary and discussion of the SK upgrade session
SK-Gd

- Approved by the SK collaboration in June 2015
- 0.2% Gd\(_2\)(SO\(_4\))\(_3\) loading for neutron tagging:
  - Supernova relic ν: suppress invisible μ decay
  - Proton decay: suppress atm. ν background
  - Long baseline: limited impact on CP? θ\(_{23}\) improvement
- EGADS 200ton Test (2009-)
  - Neutron tag, light attenuation, material compatibility
- Schedule to be decided:
  - T0: sealing SK tank (3.5+2 months)
  - T1: 0.02% Gd\(_2\)(SO\(_4\))\(_3\) loading (50% neutron capture)
  - T2: 0.2% Gd loading (90% neutron capture)
- Discussions
  - Impact on T2K: enough atm.ν samples for the estimation of syst. errors?
  - atm.ν: improvement in atmospheric ν CP violation
  - Spallation background from Gd\(_2\)(SO\(_4\))\(_3\) ?
Enlarging fiducial volume

- Potential to increase fiducial volume by x1.5-2.0
- Reduce OD (2.6m to 1m) as considered for HK and LBNE?
  - Dismantling/rebuilding the support structure
    - 60 people/day, 1-2 years, $10-20M (mainly labour)
    - Completely new LBNE-WC type string structure instead?
- Adding PMT in ID and dead space?
  - Finer granularity, veto backgrounds from outside
  - Additional benefits:
    - multi-ring reconstruction (mass hierarchy, p-decay)
    - low energy reconstruction (solar/supernova ν, 6MeV γ in p→Kν)
- Discussions
  - Large effort but significant gain on CP sensitivity
    - Additional concern expressed on the dead period for supernova watch
  - Backgrounds for solar neutrino from the rock wall?
    - Fiducial volume cut?
Water based scintillator (WbLS)

• Can observe both Cherenkov and scintillation
  • LAB+water technology developed for SNO+
  • 4% WbLS \rightarrow 4 \text{ times more light}

• Expanded physics potential with scintillation
  • nucleon decays:
    • K tag in p\rightarrow K\nu, Both proton and neutron rejection in atm.\nu
  • solar/supernova \nu:
    • invisible \mu rejection (for both \nu and \bar{\nu}-bar events)
  • Long baseline and atmospheric \nu
  • Double beta decays

• WbLS interest group (THEIA)
  • Prototyping under way: BNL1-t, ANNIE, WATCHMAN, SNO+
    • Purification studies, material compatibility (potting not compatible)

• Discussions
  • Cherenkov/scintillation separation? Timing shape analysis