DISCUSSIONS for a POSSIBLE P0D UPGRADE

• In Sept Collab meeting, we will have a ND280 session to discuss possible upgrades to the P0D. The results will be presented in the T2K session on Saturday.

• Upgrade Guidelines (not known)?
  • timeline; when would this start; in 3 or 5 years?
  • how long shutdown is required; 1 year or summer months?
  • how much costs; few $100K or $0.5-1M or more?

• Physics Guidelines (assuming future JPARC design luminosity?)
  • beam, background and NCπ0 measurement improvements for current oscillation measurement program?
  • New measurements?
    • engineering measurements (like Minerva?, to help LBNE?)
    • anti-neutrino running, LSND/miniBoone effect, etc.
IDEAs for POSSIBLE UPGRADES

1) Water Target System Upgrades

2) Put spare POD’s into test beam for calibration

3) Improve POD timing electronics

4) add 2nd MPPC readout on LI side of each fiber

5) reconfigure the POD for measuring cross sections on different targets.

The next slides will present each of the above and solicit comments from people in this meeting.
WATER TARGET UPGRADES

1) Flow meter replacements
2) Ideas to improve precision of water volume measurements (~1% now)
3) Ideas to reduce future leaks, adding more monitoring?
4) Check or fix bulging problems in between layers
5) Other ideas?

COMMENTS;
1) Low costs and moderate effort
2) Can be done in summer shutdown
P0D test beam running

1) Put space P0D modules in test beam for calibration
   • Measure different energy, angles, and particles
2) Improve energy measurement precision & PID
   • By how much???
3) We have 4 spares and not much electronics (?)
   • What can be achieved with 4 spares?
   • Do we need to add lead/brass/water bag?

COMMENTS;
1) Low costs and moderate effort
2) Does not impact ND280 running
TIMING UPGRADES

1) Current P0D time precision is very poor ~10 ns, barely enough to know which direction the track is going in the P0D.
2) 1 ns precision should improve background rejections
3) RMM change needed or something else??

COMMENTS:
1) Moderate costs and effort in electronics
2) New electronics needed ??
3) Can be done in summer shutdown ??
2nd MPPC readout on fibers

1) Add position measurement along fiber direction, improved tracking.
2) 11K new fibers, new MPPC’s, and new electronics channels
3) Requires major work and retesting on each P0Dule (can be done at JPARC?)
4) Needs redesign and rebuild of light injection system
5) Probably needs to have Super P0Dules dismantled.

COMMENTS;
1) Large costs and effort, guess at least few $100K
2) Needs 1 year shutdown
Reconfigure P0D to measure different targets

1) Move the both ECAL SPODs upstream and both water target SP0Ds downstream. Remove the water target bags and insert different target material plates (ex. lead, carbon, iron, etc.) for measuring cross section in 0.5-2 Gev region. Using P0D+TPC with target in/out subtraction runs to measure rates on different targets.

2) KevinM comments; In nuclei of different density, it's certainly interesting to know how the CC 1pi or CC pi0 (or even CC pi-!) rates vary with nuclear density due to nuclear effects. Actually, though, the material you'd really like is deuterium to get good lever arm in nuclear density… But carbon to lead gives you some lever arm.

COMMENTS;
1) Moderately large costs and effort, guess ~$100-200K
2) Requires new engineering of 26 target plate/sheet inserts
3) MAYBE we do not have to dismantle SP0D, to insert target plates?
4) Maybe done in 3-4 summer months??
SOME COMMENTS:
Although the timing is bad (earthquake recovery is starting), upgrades take 2-3 years to get funded so now is the time to start planning and asking. In 2-3 years we should be running at design luminosity, which should provide new physics opportunities in ND280 especially if $\theta_{13}$ is large. This could be further exploited with an improved detector.