Phase 1 Tasks
International Scoping Study: Machine Working Group

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Proton Driver

• Examine candidate machine types for 4 MW operation
  — FFAG (scaling and/or non-scaling)
  — Linac (SPL and/or Fermilab approach)
  — Synchrotron (J-PARC and/or AGS approach)

  • consider
    - beam current limitations (injection, acceleration, activation)
    - bunch length limitations and schemes to handle (1–3 ns)
    - repetition rate limitations (power, vacuum chamber,...)
    - tolerances (field errors, alignment, RF stability,...)
    - practical limitations on beam energy, if any (e.g., RF power)

• Compare and contrast Superbeam and Neutrino Factory requirements
Target/Capture/Decay

• Production rates as $f(E)$ for C, Ni, Hg
  — do reality check with HARP data if possible

• Target limitations for 4 MW operation
  — use guidance from FEA and experiments
    o consider bunch intensity, spacing, repetition rate

• Implications of 1 vs. 3 ns bunches on delivered beam

• Superbeam vs. Neutrino Factory comparisons
  — required emittance and focusing
  — horn vs. solenoid capture
    o energy range of interest
  — choice of target material
Bunching/Φ Rotation/Cooling (1)

- Compare performance of existing schemes (KEK, CERN, U.S.-FS 2b)
  - use common proton driver and target configuration(s)
  - consider possibility of both signs simultaneously
  - conclusions will require cost comparisons, which will come later

- Evaluate implications of reduced $V_{RF}$ for each scheme
  - take $V_{\text{max}} = 0.75 \ V_{\text{des}}$ and $0.5 \ V_{\text{des}}$
    - re-optimize system based on new $V_{\text{max}}$, changing lattice, absorber, no. of cavities, etc.

- Optimize Φ Rotation/Bunching with lower gradients and/or fewer frequencies
  - evaluate performance
  - costs will come later
Bunching/Φ Rotation/Cooling (2)

・Evaluate trade-offs between cooling efficacy and downstream acceptance
  — consider several values of downstream acceptance (longitudinal and transverse)
    o small, medium, and large (or extra-large?)
    o see how much can cooling channel be simplified
  — develop agreed-upon figure-of-merit (e.g., $\mu/P_{\text{prot}}$)
  — consider need/merits of longitudinal cooling
  — costs will come later

・Evaluate performance issues and limitations
  — absorbers ($\text{LH}_2, \text{LiH, Be}$ or plastic)
    o consider implications of both sign muons
  — RF windows
  — interactions with Target group recommended for this topic
Acceleration

• Compare different schemes on an even footing
  — RLA, scaling FFAG, non-scaling FFAG, linac
    ◦ consider implications of keeping both sign muons

• Prepare scenarios with different values of acceptance
  — transverse and longitudinal
    ◦ small, medium, large (or extra-large?)
  — these will be used later to assess cost vs. acceptance

• Consider matching between acceleration subsystems
  — are there simplifications in using fewer types of machines?
Storage Ring

• Design implications of final energy (20 vs. 50 GeV)

• Optics requirements vs. beam emittance
  — arcs, injection and decay straight sections

• Implications of keeping both sign muons
  — can there be both injection and decay optics in this case?

• Implications of two simultaneous baselines

• Radiation issues at $10^{21}$ useful neutrinos per year
  — liner vs. open-midplane magnets

• Cost implications of design will be dealt with later
Organization

• Strawman organizer names (updated)
  — Driver: Garoby, Kirk, Mori, Prior
  — Target: Lettry, McDonald
  — Phase rotation/Bunching/Cooling: Fernow, Yoshimura
  — Acceleration: Berg, Mori, Prior
  — Storage Ring: Johnstone, Keil, Rees

  — names in green not yet confirmed
Summary

• We need to get web pages set up and encourage the task groups to start meeting regularly
  — I have asked Juan Gallardo and Scott Berg to help with this

• We need to firm up plans for topics and speakers for CERN meeting (see my later presentation)
  — we need a web registration page ASAP with an indication of who will attend our Working Group

• Must remind all task coordinators that we need ingredients for ongoing accelerator R&D program
  — this should be prioritized and filtered such that it appears “finite”