



# Phase 1 Tasks International Scoping Study: Machine Working Group

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ISS Machine Council Meeting
August 22, 2005



#### 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)

#### o 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
     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 captureenergy range of interest
  - choice of target material



# Bunching/ $\Phi$ Rotation/Cooling (1)



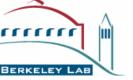
- · Compare performance of existing schemes (KEK, CERN, U.S.-FS 2b)
  - use common proton driver and target configuration(s)
  - consider possibility of both signs simultaneously
  - conclusions will require cost comparisons, which will come later
- · Evaluate implications of reduced  $V_{RF}$  for each scheme
  - take  $V_{\text{max}} = 0.75 \ V_{\text{des}}$  and  $0.5 \ V_{\text{des}}$  ore-optimize system based on new  $V_{\text{max}}$ , changing lattice, absorber, no. of cavities, etc.
- $\cdot$  Optimize  $\Phi$  Rotation/Bunching with lower gradients and/or fewer frequencies
  - evaluate performance
  - costs will come later



# $\bigcirc$ Bunching/ $\Phi$ Rotation/Cooling (2)



- Evaluate trade-offs between cooling efficacy and downstream acceptance
  - consider several values of downstream acceptance (longitudinal and transverse)
    - small, medium, and large (or extra-large?)
    - o see how much can cooling channel be simplified
  - develop agreed-upon figure-of-merit (e.g.,  $\mu/P_{prot}$ )
  - consider need/merits of longitudinal cooling
  - costs will come later
- · Evaluate performance issues and limitations
  - absorbers (LH<sub>2</sub>, LiH, Be or plastic)
    - oconsider 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
    o 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"