Tasks for neutrino factory study

suggestions only [1]

1 Technical

1.1 Target and capture

- Target and Capture experiment (BNL/Princeton/CERN)

1.2 rf

- 70 MHz test stand (BNL)
- 175 MHz test stand (CERN/Cornell ?)
- 805 MHz test stand continued for collider (FNAL)

2 Studies

2.1 driver

- FNAL (W. Chou)
- BNL (Tom Roser)

2.2 rf general

- Be foil design for 805 MHz (LBNL)
- sc sled Cornell/SLAC
- Nb3Sn cavities in fields (eg for phase rotation) (Cornell)

[1] http://pubweb.bnl.gov/people/palmer/nu/tasks.ps

2.3 phase rotation

- parameter exploration (FNAL-Van G)
- bunching (FNAL-David)
- single stage phase rotation (FNAL)
- induction linac for second rotation (LBNL)
- bunched beam second rotation (BNL-Bob, FNAL-David, CERN?)

2.4 cooling

- Tolerances (FNAL-Paul)
- Cool to 1.5 mm (BNL-Bob)
- elliminate bucking coil (LBNL)
- grad vs dp/p, frequency, and energy (LBNL)
- design Be foil 175 MHz cavities (CERN-Laas ?)

2.5 acceleration

- 1.5 π mm rms (16 π mm acceptance) (CERN-Eberhard)
- 3 π mm rms (30 π mm acceptance) (FNAL-Carol)
- 175 MHz sc cavities for acceleration (Cornell ?)
- gradients with lep cavities if pulsed/reworked (CERN)

2.6 storage ring

- racetrack at 1.5 π mm rms (16 π mm acceptance) (CERN-Eberhard)
- racetrack at 3 π mm rms (30 π mm acceptance) (FNAL-Carol)
- triangles and bow ties (?)
- Geotechnical (BNL-Harold, FNAL-Geer)

3 DETAILS

3.1 Target and capture

3.1.1 Target and Capture experiment (BNL/Princeton/CERN)

3.2 rf

3.2.1 70 MHz test stand (BNL)

3.2.2 175 MHz test stand (CERN/Cornell ?)

3.2.3 805 MHz test stand continued for collider (FNAL)

4 Studies

4.1 driver

4.1.1 FNAL (W. Chou)

4.1.2 BNL (Tom Roser)

4.2 rf general

4.2.1 Be foil design for 805 MHz (LBNL)

4.2.2 sc sled Cornell/SLAC

4.2.3 Nb3Sn cavities in fields (eg for phase rotation) (Cornell)

4.3 phase rotation

4.3.1 parameter exploration

- Explore relationship between efficiency, gradient, and minimum frequency.
  - pick two initial energies: a maximum and a minimum. Apply rf whose frequency and phase varies so as to maximally decelerate the former and accelerate the latter. The gradients should be entered as a function

of the frequency, and adjustd accordingly. Add higher frequency rf to remove the resulting S shape of energy vs ct. This can be automated and the lowest rf frequency plotted as a function of a) the energy span, and b) the gradient assumptions.

  – Pick a few examples from the above and approximate them with a few fixed frequencies See how much you lose as a function of the number of frequencies allowed

- Study loss in a typical phase rotation channel for different periodic solenoid focussing coils placed in the nose cones of the structures. It is probably best to use an outside solenoid for the early part of the channel, where the energy span is very large, but it should be possible to use periodic structures later.

4.3.2 amplitude-energy correlation

It is my understanding that as long as the phase rotation drift and buncher have a lattice with the same amplitude-zvelocity properties as the cooling lattice, then the correllation is automatically generated. Remember: the drift sorts particles by their z velocity, not their energy. After the drift, their longitudinal positon is a function of that z velocity which is the required correlated combination of energy and amplitude. The bunching, done in the same lattice (or one with the same properties) is also a bunching by z ve-

locity, not energy, so the correlation is preserved. And so into the cooling. Note that a simple solenoid will NOT do for the drift or bunching, since the z velocity is a function not only of amplitude, but also of angular momentum. A solenoid of one sign gives a higher z velocity for one ang momentum sign than the other. Both drift and bunching must done with alternating fields of some kind. I would suggest that for out studies we actually use the same super fofo lattice as in the first cooling stage. Then all should be well. Whether we will need to do something clever to match into the start of the accelerator is another question.

bunching (FNAL-David)

4.3.3 single stage phase rotation (FNAL)

4.3.4 induction linac for second rotation (LBNL)

4.3.5 bunched beam second rotation (BNL-Bob, FNAL-David, CERN?)

4.4 cooling

4.4.1 Tolerances (FNAL-Paul)

4.4.2 Cool to 1.5 mm (BNL-Bob)

4.4.3 elliminate bucking coil (LBNL)

4.4.4 grad vs dp/p, frequency, and energy (LBNL)

4.4.5 design Be foil 175 MHz cavities (CERN-Laas ?)

4.5 acceleration

4.5.1 1.5 π mm rms (16 π mm acceptance) (CERN-Eberhard)

4.5.2 3 π mm rms (30 π mm acceptance) (FNAL-Carol)

4.5.3 175 MHz sc cavities for acceleration (Cornell ?)

4.5.4 gradients with lep cavities if pulsed/reworked (CERN)

4.6 storage ring

4.6.1 racetrack at 1.5 π mm rms (16 π mm acceptance) (CERN-Eberhard)

4.6.2 racetrack at 3 π mm rms (30 π mm acceptance) (FNAL-Carol)

4.6.3 triangles and bow ties (FNAL-Carol)

4.6.4 Geotechnical (BNL-Harold, FNAL-Geer)