Opportunities for a TeV Fixed Target Program (J.Conrad, G. Zeller, and M.Shaevitz)

- Fixed target program
  - Opportunity for a broad range of experiments
  - Able to address specific questions
  - Possibility for small groups and small experiments

- Previous 800 GeV program covered many topics - Why more?
  - New questions to be addressed
    - new physics topics
    - new ways at looking at previous topics
  - Higher intensity would provide better measurements
  - New detector technologies and capabilities
  - Opportunity for a wide range of experiments using booster, MI, and Tevatron extracted beams
    - Experiments may even use multiple beams

Future Tevatron Neutrino Program

- Previous experiments used Sign-selected quad beam or horn beam.
  - Improved intensity
    - Higher rep rate (optimize beam energy and rep rate)
    - Higher protons/spill from improved accelerator complex
      - Much progress on targeting higher intensity
    - New Technology? (Liquid Lithium Lens?)
  - Improved detectors
    - x10 or larger detectors (500 ton $\Rightarrow$ 5 kton)
    - New technologies
      - Low density, fine grained detectors
      - Liquid argon
    - Inexpensive, reliable technologies

Neutrino Physics Possibilities

- Electroweak Measurements
  - Neutrino - electron scattering
    - $\nu_\mu e^- \rightarrow \nu_\mu e^-$ vs $\nu_\mu e^- \rightarrow \mu^- \nu_e$
      - Very clean measurement (CC process gives flux)
        - Leptonic so different systematics from NuTeV
      - Need to develop a very large, fine grained detector with improved resolution
        $\rightarrow$ Super-Charm II experiment?
        - Charm II did 4% measurement (~2000 events for ν and $\bar{\nu}$)
        - Need to do <1% measurement $\Rightarrow$ ~50,000 events
  - Neutrino - Nucleon scattering
    - $\nu_\mu N \rightarrow \nu_\mu X$ vs $\nu_\mu N \rightarrow \mu^- X$
      - Follow up to NuTeV
      - Improved detector (in situ testbeam crucial)
        - Better separation of NC and CC,
        - Better identification of ν_e events
        - NuTeV measurement should be followed up with neutrinos

Neutrino Physics Possibilities

- Seach for unstable neutral particles, i.e. neutral heavy leptons, neutralinos
  - Technique developed on NuTeV with Decay Channel
  - Significant improvements possible
    $\Rightarrow$ Completely eliminate background
  - Signal in NuTeV should be followed up

- Strange sea and other parton distribution measurements
  - Neutrino dimuon (charm) production uniquely probes the strange sea
  - Statistics is currently the main limitation
  - Interesting A-dependence questions (nuclear community)

Neutrino Physics Possibilities

- Neutrino oscillations in the MiniBooNE region
  - If one sees an appearance signal $\nu_\mu \rightarrow \nu_e$ in MiniBooNE, then want to look for ν_μ disappearance ($\nu_\mu \rightarrow \nu_x$) and $\nu_\mu \rightarrow \nu_\tau$
  - To do this with high energy beam need near detector at Fermilab (use it for the other physics) and far detector at 50 (?) km.
  - Detector(s)
    - For disappearance need large detector
      - Need to minimize systematics for near/far comparison
    - For ν_τ appearance need large (1 to 5 kton) detector with ν_τ identification capability

Comments

- Two key areas that need improvement
  - Beam
    - improved intensity
    - sign selection very important for most physics
    - better beam designs, new type of beams?? (tagged neutrino beam...)
    - Need to do comparison of Tevatron, MI and Booster beam capabilities - rates, systematics, physics
  - Detector
    - Much work going on here in the community
    - Technology improvements in detectors and electronics
      - Large channel count can now be realized
      - Liquid argon may now be an available technology
      - Opera (DONUT) have brought emulsions to a realistic position

- In general: We need capability to follow up on interesting anomalies