Accelerator Capabilities

W. Barletta

Energy-frontier hadron colliders:
LHC evolution & possible VLHC designs

- How high a luminosity is possible for the LHC?
- What are strategies for increasing integrated luminosity without compromising experiments? Detector survival?
- How high an energy is possible in the LHC tunnel?
  - What technologies are needed for higher energy operation of LHC?
  - Where are the break-points for each technology?
  - What are luminosity limits for LHC energy upgrades?
- The energy frontier beyond LHC
  - What are the impediments to a 100 TeV cm collider?
  - CERN will launch a detailed study later this year
- What is the accelerator R&D roadmap?

Discussion with EF study on Tuesday morning

Frontier lepton & photon colliders

ENERGY Frontier

- Can ILC & CLIC designs be improved using new technologies?
  - What is the growth potential if a superconducting Higgs factory?
  - What would be parameters of a photon collider Higgs factory
- Could one design a multi-TeV μ+μ- collider?
  - Would a Higgs factory have a role?
- Are plasma-based accelerators relevant to HEP?
- What accelerator is the accelerator R&D roadmap?

Discussion with EF study on Tuesday morning

INTENSITY Frontier

- How will super flavor factories inform ILC design
- How will advances in Free Electron Lasers benefit HEP?

Working group discussion on Sunday

High intensity proton sources:
Neutrinos, muons, rare processes

- Parameter space:
  - Protons-on-target, secondary particle spectra, backgrounds, time format
  - What is needed for new investigations into muon, kaon physics?
- What is possible with existing sources?
  - What are options for upgrading existing sources to multi-MW?
  - What are possibilities for $E_{neutrino} > 100$ GeV
- What are technology options for new sources?
  - Super-beams v. neutrino factories
  - Decay-at-Rest sources & beta-beams
  - Cost v. technology choice
- What R&D is need to advance high power targetry to >>1 MW
- What is the R&D roadmap for linacs? High power cyclotrons?

Discussion in joint session with IF on Thursday morning

What are "big questions" regarding accelerator-based HEP capabilities

- *How would one build a ~100 TeV scale hadron collider?*
  - *CERN will begin a serious study this fall*
- *How would one build a lepton collider at >1 TeV?*
- *How would one generate 5 - 10 MW of proton beam power*
- *Can multi-MW targets survive? For how long?*
- *Can accelerators be made 10x cheaper per GeV? Per MW?*
- *Can plasma accelerators deliver luminosity relevant to HEP?*

Technology working group discussion on Thursday morning

Non-Accelerator (Underground) Capabilities

M. Gilchriese

Why Working Group on Underground Capabilities?

- Central scientific program enabled by underground(and ice) facilities
  - Direct dark matter detection
  - Neutrinoless double beta decay
  - Proton decay
  - Long baseline neutrinos from accelerators
  - Atmospheric neutrino experiments
  - Supernova and solar neutrinos
  - Growing overlap with aspects of reactor neutrino experiments
- Many U.S. scientists - about 1,000 now and expect to grow this decade
- Critical upcoming decisions by U.S. community
  - LBNE underground?
  - Very diverse program, likely to grow over next decade. U.S. roles?
  - Balance between domestic and foreign underground facilities?

Underground Capabilities - Working Groups

- NAF1 – on underground facilities to support very large detectors for neutrino physics, proton decay and other science requiring detectors of the multi-kiloton scale.
  - NAF1 conveners: K. Heeger (Wisconsin), K. Scholberg (Duke), H. Sobel (Irvine)
- NAF2 – on underground facilities for dark matter experiments, neutrinoless double beta decay experiments, underground accelerators for nuclear astrophysics or other physics, low background assay of materials and related topics.
  - NAF2 conveners: P. Cushman (Minnesota), J. Klein (Pennsylvania), M. Witherell (Santa Barbara)
- Underground facilities in support of instrumentation development in both working groups
  - Conveners, contact with Instrumentation: P. Cushman (Minnesota), M. Gilchriese (LBNL)
- Neutrinos and society
  - Convener is A. Bernstein (LLNL), potential connections with underground capabilities. Primarily detectors for non-proliferation monitoring.

Underground Capabilities Working Group

- Only meeting July 30 starting at 0830 in Biegen 105
- If you are interested in the future of U.S. “underground science”, please attend

Overview and non – US facilities	M. Gilchriese
Connection to dark matter experiments	M. Witherell
Connection to $0\nu\beta\beta$, nuclear expts.	J. Klein
Reactor experiments	K. Heeger
Synergy with non-proliferation detectors	A. Bernstein
Supernova, solar neutrinos	K. Scholberg
Long-baseline, atmospheric ν, proton decay	H. Sobel
Infrastructure, support and R&D	P. Cushman
U.S facilities and conclusions	M. Gilchriese

- Substantial time for discussion, review of conclusions and draft executive summary