EUROν Program Assessment

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***for E. Blackmore, S. Chattopadhyay, S. Holmes (and H. Murayama)**

Findings (1)

- WP1
  - 73 EUROν documents have been prepared
    - and posted on the web
  - many meetings were held
  - responses to the IAP report from last meeting delivered as requested
    - annual report also delivered to us in a timely way
  - IAP request to modify presentation schedule was honored
    - all WP leaders responded well to our request
      - which is appreciated!
  - progress against milestones has been very good in the past year
    - a few were late, but in the end all were completed
  - resource issues remain
    - particularly with regard to costing, safety, and design engineering
  - expected EU review has been postponed

Findings (2)

- WP2
  - baseline comprises 5 GeV, 4 MW, 50 Hz proton driver based on SPL
    - aimed at the MEMPHYS water Cherenkov detector located in the Fréjus tunnel at 130 km distance
    - uses four target/horn assemblies mounted together in a 4 m diameter decay tunnel, 25 m long
      - preferred target is 10 bar helium-cooled "pebble-bed" titanium target
        - 30 mm in overall diameter, 78 cm long
        - located inside a 300-350 kA horn based on the MiniBoone design
      - target design should be able to handle 1-1.3 MW beam and be insensitive to dynamic stresses and off-center beam
      - expected to produce more flux than the previous baseline solid graphite target
      - pencil shaped solid beryllium target has also been studied and shows promise

Findings (3)

- WP2 (cont'd)
  - horns are located adjacent to each other
    - operated at 12.5 Hz by beam sharing
    - cooled by internal water spray
  - idea of an integrated current carrying target/horn abandoned in favor of independent target
    - results in reduced temperatures and stresses, increased reliability, and advantage of remotely-handled target exchange
- flux and sensitivity studies used to optimize design
  - baseline design gives good suppression of wrong-sign pions
  - sensitivity to θ_{13} slightly improved over the previous baseline
- preliminary layout of the target hall/decay tunnel developed
  - possible method of remotely exchanging target/horn assemblies in a nearby hot cell also shown

Findings (4)

- WP3
  - first three high-level milestones completed
  - baseline design settled and written up as part of IDS-NF IDR
    - design efforts of EUROν played key role in this process
  - issue with power deposition in target area has been identified
    - will require modifications of present baseline layout
    - downstream areas also have substantial losses to address
  - WBS prepared but costing not yet commenced
  - major achievements include
    - comparison of FLUKA and MARS production simulations with HARP data
    - fringe field effects evaluated for acceleration system
    - injection/extraction scheme for FFAG developed
      - along with initial ring magnet designs
    - data exchange developed in preparation for end-to-end tracking
    - multi-particle tracking of linac completed
    - most lattice designs completed

Findings (5)

- WP4
  - two scenarios under development
    - $^{6}He/^{18}Ne$ (baseline)
    - $^{8}Li/^{8}B$
  - lots of progress on many fronts
    - production, acceleration, decay ring
  - present scheme indicates sufficient production of ^{18}Ne to meet performance goals
    - based on $^{19}F(p,2n)^{18}Ne$ direct production utilizing Linac 4 proton source
      - needs experimental verification (proposal submitted to CERN)
        - requires two years of scientific associate effort
  - new direct production scheme under study for ^{8}Li and ^{8}B
    - gas jet target in production ring deemed infeasible (vacuum problems)
    - experimental measurements of $^{7}Li(d,p)^{8}Li$; under analysis
    - proposal for $^{6}Li(^{3}He,n)^{8}B$ measurement submitted
      - expect to carry out in Spring 2011

Findings (6)

- WP4 (cont'd.)
  - new acceleration scheme
    - based on +1 charge state from ECR
    - requires new RFQ design
  - production ring simulations carried out
  - new decay ring design
    - lower γ_t to mitigate collective effects; would like to go somewhat lower
    - reconfigured arcs to increase straight section fraction
    - collective effects deemed ok for ^{18}Ne; factor of ~2 to go for the others
    - "cocktail" approach being considered, as is double-bore magnet
    - clarified duty factor requirements (with help from WP6)
  - ECR and collector development making progress
  - exceptional job in documenting/publishing results and presenting seminars
  - comprehensive parameter list established
    - a good example for the other WPs

Findings (7)

- WP5
  - MIND has most mature analyses
    - comprehensive analysis and full migration matrices have been produced
      - and given to the theory group
    - some NF performance studies have already been made (found in IDS-NF IDR)
      - demonstrate improved low energy reconstruction
        - would allow a NF to operate at lower energy if needed
      - future work identified.
  - water Cherenkov has made impressive progress in the last year
    - new simulation able to reproduce Super-K results developed despite
      - lack of access to the proprietary Super-K software
      - very limited manpower (1 post-doc and fraction of a professor)
        - post-doc now at Strasbourg but will continue working on this task
    - full performance simulation capability expected by September 2011
      - including full migration matrices (a challenge)

Findings (8)

- WP5 (cont'd.)
  - near detector concept defined
    - vertex detector, scintillating fiber tracker and muon catcher
  - simulations of Inverse Muon Decay demonstrating a 1% flux prediction have been established (threshold of 11 GeV)
  - not yet done: neutrino-electron elastic scattering (to measure flux below 11 GeV), tau/charm reconstruction, and cross-section error calculations
    - alternative design with a straw tube tracker being pursued in US (outside of EUROν).
  - lack of dedicated engineering effort hindering cost and safety work
    - some help from Fermilab engineers hopefully available
      - no funds presently identified within EUROν to carry out this task

Findings (9)

- WP6
  - interaction with other WPs much improved
    - improved communication with WP4 on Beta Beam scenarios very valuable
      - compilation of scenarios provided by WP6 now used as guidance for WP4
    - active communication with WP2 via A. Longin has led to more robust performance evaluations
    - good communication with WP3 via IDS

Comments (1)

- WP1
  - deliverable for costing needs to be precisely defined
    - appears likely that less will be accomplished than originally hoped
      - "expectation management" needed with Brussels *and* EUROν
      - comparative costing goal represents a unique opportunity that should not be squandered
  - appears to be some confusion between costing and engineering design
    - design must come from individual WPs
    - costing group will only help with costing of defined items
  - decide where "safety" items reside in WBS
    - distributed item-by-item, all in one place, or some of each
  - overall cohesion and coordination of program has improved
    - progress is very visible
  - WPs could use guidance/encouragement to create parameter lists
    - "sharing" a parameter list between WP3 and IDS-NF should be workable
      - one list, with links on both web sites

Comments (2)

- WP2
  - we commend their progress since last meeting
    - converging on very reasonable designs for the target and horn
    - maintaining or improving physics reach of the Superbeam approach
  - other aspects of the design need to be considered to permit reliable costing of this facility:
    - layout (at least conceptual) of the beam line design for proton beam sharing between the 4 targets (or 3 if there is a problem with one)
      - work out enough to show that there is a reasonable solution
        - need for collimators, baffles, and beam instrumentation to provide beam position and target protection to be assessed
    - arrangement and thickness of shielding around target area and decay tunnel need to be determined
      - also, design and instrumentation of beam dump and cooling needed to handle the 4 MW of beam power in the decay tunnel and dump
      - activation issues will be important but shielding requirements must be known first

Comments (3)

- WP2 (cont'd.)
  - further work on the target hall layout will be needed for costing
    - services (crane requirements, cooling water and helium services, remote handling hot cells, nuclear ventilation, location of power supplies, etc.) must be assessed
      - these requirements presently being met at NUMI and T2K, so those layouts should be reviewed for possible solutions
  - we assume that CERN remains responsible for providing cost for the 4 MW SPL and deciding on its location on the CERN site

Comments (4)

- WP3
  - better articulation of rationale for baseline choices appears to be needed for both target and cooling channel
    - upcoming review makes this high priority
  - preparations for costing in place, but additional resources needed
    - CERN was expected to handle this, but a "plan B" may be required
  - prudent to carry out initial error studies to make sure there is no unexpected sensitivity
    - acceleration system; decay ring
  - parameter list should be made public on web
    - shared between WP3 and rest of IDS-NF
  - both design decisions and costing require performance specifications
    - magnetic field quality, fringe field extent, gradients,…
      - did not see much evidence for these
  - decay ring RF eliminated from design
    - has reasoning been documented?
  - IDS-NF and EUROν notes should be cross-linked

Comments (5)

- WP3 (cont'd.)
  - design work shows a good maturity in most aspects
    - most known critical issues have been addressed
      - but some results did raise new concerns
    - the proton driver emittance requirement was questioned and its practicality should be checked
  - issue of whether to take advantage of lower MIND detector threshold by reducing muon beam energy was raised
    - probably not a big deal technically
      - but, suggest *not* making baseline change at this time
        - might wish to reconsider for IDS-NF RDR in a few years
      - generally unwise to "live too close to the edge"

Comments (6)

- WP4
  - no real start yet on costing or safety requirements
    - will require (engineering) resources
  - need to complete experiments on ^{18}Ne, ^{8}B, and ^{8}Li production
    - contact ANL about liquid-Li curtain target
  - continue ECR development
  - need to settle soon on a final scenario as basis of cost estimate
    - choice of isotopes and production mechanisms/rates
    - decay ring RF solution
  - still "tension" between baseline scenario performance and what is deemed competitive by WP6
    - our only advice is that the baseline design, performance evaluation, and costing must be for a single consistent scenario
      - what is not competitive today may become more interesting when costs are evaluated

Comments (7)

- WP4 (cont'd.)
  - parameter list updates needed for all ion scenarios
    - also impedance specifications to cope with collective effects
      - making progress on this
        - may need vacuum chamber conceptual design to obtain credible impedance specification
  - main technical risks
    - production of required isotope intensities
    - achieving sufficiently low impedance in decay ring

Comments (8)

- WP5
  - extremely ambitious tasks proposed with extremely limited funding
    - 3 postdocs for two years plus academic time
  - to keep up with the milestones, tasks being prioritized
    - results in unequal progress on the three detector systems
  - lack of dedicated engineering effort is a real deficiency
    - especially for costing and safety
  - revisit timing criteria between accelerator and detector

Comments (9)

- WP6
  - good progress in analysing how to treat systematics
    - in close coordination with WP5.
  - implementation of migration matrices to parametrize detector performance has now been established as standard method and is included in GLoBES
  - dissemination & outreach very effective
    - all WP6 reports made public via submission to arXiV and/or publication in refereed journals
      - including annual report

Recommendations (1)

- WP1
  - access to the CERN costing tool must be established as soon as possible
  - consider identifying a contact person to handle interactions between EUROν and the various upcoming review committees (ECFA, CERN Strategy Group, and the like)
- WP3
  - availability of parameter list for all systems under investigation is essential for performance and cost comparison
    - work package manager, in collaboration with IDS-NF counterpart, must ensure that one consistent baseline parameter list is available for all participants
  - work on uncontrolled particle losses in the front end, and radiation-induced heat load in the target solenoids, should be completed with high priority
    - problem is severe for baseline target configuration
      - investigation of a low-Z target may be worth considering
    - can rule-of-thumb criteria be replaced by firm specifications?

Recommendations (2)

- **WP4**
  - complete isotope production experiments
  - establish self-consistent scenario as a basis for estimate
  - secure required (engineering) support for costing and safety analysis

- **WP5**
  - continue MIND simulations with updated geometry, toroidal field, inclusion of taus, etc.
  - near detector must be raised to level of maturity comparable to MIND
    - e.g., creation of migration matrices
  - unified solution to the treatment of systematic errors is a priority and must be taken up urgently (a very difficult subject)
    - do in collaboration with WP6

Recommendations (3)

- WP6
  - systematics of cross sections identified as important issue at low energies
    - can influence comparison of facilities
    - steps should be taken to clarify this issue

Technical Risk

- **We would like to hear presentation on risk register and mitigation strategies at next meeting**

Final Comments

- We once again greatly enjoyed the meeting and hearing about the many activities now under way
  - thanks to WP leaders, speakers for excellent presentations
    - and my IAP colleagues for their help in evaluating what we heard

- We congratulate the EUROν participants for the excellent progress made since our last meeting