160212 Nufact SPC agenda

- LOC statusn (J.D.)
- WG5 approval and convener candidates (A.B.)
- Scientific program(A.B.)
  - Block time talble
  - Talks
- Questions from the past and for this time
- Round table discussions
- AOB?

Proposal for WG5

The nufact15 'legacy paper' recommends that

-- that Nufact continues its role as craddle of ideas for accelerator based neutrino sources

-- discusses the creation of a 5th working group to attract new theoretical ideas

e.g. Enrique Fernandez suggested a «theory» working group

more discussions with Enrique and others have led to the suggestion of a working group on

'Neutrinos Beyond PMNS'

In the tradition of the NUFACT meetings this would involve experimenters as well as theorists

WG5, 'Neutrinos Beyond PMNS'

TOPICS and QUESTIONS *could* cover the following :

-- general discussion, motivation and, possibly, rationalization of models beyond PMNS

-- experimental searches for right handed neutrinos

- -- nuclear decays and galactic emissions (no emphasis)
- -- short baseline oscillations
- -- observation of neutral decays in beam dump experiments and neutrino beams
- -- observation in e-e- colliders (W-W- final state)
- -- observation in Z and Higgs factories
- -- observation at hadron colloiders LHC, HL-LHC and SppC and FCC-hh
- -- unification of interpretation framework

-- other beyond PMNS, NSI, etc.

Possible conveners: Silvia Pascoli, Pilar Hernandez, Andrea de Gouvea enthusiastic.
Other possibilities include: Osamu Yasuda, Sanjib Agarwalla;
NB these are ~senior phenomenologists. Should we involve experimenters?
Suggestions?
(e.g. M. Shaewitz or J. Conrad, someone from LHC, A. Golutvin/ N. Serra etc.)

WG5 conveners candidates

- Americas: Andrea de Gouvea, Pilar Coloma, J. Conrad
- Europe: Pilar Hernandez, Silvia Pascoli, Nicola Serra, Enrique Fernandez-Martinez, Golutvin
- Asia: T. Asaka(Niigata), S. Agarwalla, T.Maruyama (KEK)

WG5 some comments from theorists

- Enrique Fernandez-Martinez, from UAM, was one of the original proponents of WG5 (at the time was WG0, I think), so it would be good to find out about his availability to co-convene the group. Enrique had very clear ideas on how the group would work and how it can be used to help attract more theorists/phenomenologists to NuFact.
- Productive joint sessions with the other working groups. These joint sessions will foster interaction and dialogue between theorists/phenomenologists and experimentalists, an interaction that is often missing, but is essential as we assess the physics capabilities of large neutrino projects and will even look beyond those projects.

WG1 questions for nufact2015

- What are the new developments and predictions from flavour models on neutrino oscillation parameters? What precision do we need to achieve to probe them? Which parameters (or combinations of them) are more powerful to test them?

- Do the current bounds on new physics in the neutrino sector (NSI, non-unitarity, steriles…) allow for effects large enough to interfere with CPV searches? Which experimental setups can improve these bounds?

- Are atmospheric neutrino measurements competitive with next generation long baseline facilities in the determination of the mass hierarchy? And the octant of θ_{23}? How much complementarity is there between them?

- What is the target for the systematic error budget of next generation facilities? What do we need to reach this level? How much improvement in constraining flux uncertainties can we expect from dedicated hadron production experiments?

- What is the best strategy to fully probe the LSND anomaly? And the reactor/gallium anomaly?

- Explore the synergy between neutrino oscillations and other experiments (absolute mass searches, cosmological constraints, CLFV) to constrain new physics.

- What can we say about the new Majorana mass scale implied by neutrino masses? What are the current bounds and how much will they improve over the next decade?

WG1 questions for Nufact2016

New Questions For Next NuFact

Question: *What are the new developments and predictions from flavor models on neutrino oscillation parameters? What precision do we need to achieve to probe them? Which parameters (or combinations of them) are more powerful to test them?*

Question: *Are atmospheric neutrino and medium-baseline reactor measurements competitive with next generation long-baseline facilities in the determination of the mass hierarchy? And the octant of θ_{23}? How much complementarity is there between them?*

Question: *What is the best statistical metric to report sensitivity of experiments to mass hierarchy and CP violation?*

Question: *How important is it to account for correlations between systematic uncertainties in different experiments when producing global fits? How do we increase involvement of experiments in production of joint results?*

Question: *What do we need to do to reach the required systematic error budget level? How much improvement in constraining flux and cross section uncertainties can we expect from dedicated hadron production, cross-section measurements, and near detector efforts? How can we improve knowledge of nue cross sections and improve energy reconstruction?*

Question: *Do the current bounds on new physics in the neutrino sector (NSI, non-unitarity, steriles...) allow for effects large enough to interfere with CPV searches? And with other parameters like mass hierarchy ? Which experimental setups can improve these bounds?*

Question: *Is the current landscape of proposed experiments able to conclusively probe the LSND anomaly? And the reactor/gallium anomaly?*

Question: *What can we say about the Majorana mass scale implied by neutrino masses? How much will the current bounds improve over the next decade? If normal hierarchy is confirmed, what new strategies are available to probe the Majorana/Dirac nature of the neutrino.*

Question: *How can we explore synergies between neutrino oscillations and other experiments (absolute mass searches, cosmological constraints, CLFV) to constrain new physics?*

Question: *What could an R&D program leading to a neutrino factory look like in the present landscape of LBL experiments? What physics could we probe with it and how complementary would it be to the ongoing LBL efforts?*

WG2 questions in nufact 2015

However, open questions still persist:

- Disagreement between MiniBooNE, NOMAD data in reporting overall CCQE cross section
- Difficulty modeling MiniBooNE outgoing pion distributions from resonance production
- What are the implications of these issues on oscillation experiments?

Question: Where is there agreement/disagreement between new experimental results at different beam energies?

Questions: Are modern models able to describe the new results? What puzzles remain? Where is there agreement/disagreement between new experimental results at different beam energies?

Questions: How have near detectors been used so far? What are the tactics used by future near detectors (or dedicated service experiments) to address deficiencies? What are the most significant neutrino interaction systematic uncertainties which need confronting for osc experiments?

Dear Alain and NuFact16 Chairs,
please find below the summary of the WG2 NuFact15 questions.

Cheers

The WG2 conveners

Questions:

Are the modern models able to describe the recent ad new experimental results?
What is the state of the art in the CCQE, 1 pion production and cohent pion production?
What puzzles remain?

Where is the agreement/disagreement between new experimental results at different beam energies?

What are the prospects for new measurements?

How have near detectors been used so far? What are the tactics used by future near detectors (or dedicated service experiments) to address deficiencies?

What are the most significant neutrino interaction systematic uncertainties which need confronting for oscillation experiments?

WG3 questions for nufact 2015

Target/capture

- What is the path to a multi-MW target/capture system?
  - What are the options to mitigate energy deposition and shielding problems for multi-MW solenoid capture systems?
    - Depends on the power on target and proton energy
    - Use carbon target instead of liquid Hg
    - Preliminary He-gas cooled W-bead shielding has been proposed
  - Are there outstanding target handling issues for multi- MW designs? How do material properties evolve with time (radiation, strain, stress and temperature)?
    - Topics of ongoing studies (RaDIATE collaboration). Solid targets are much easier to handle than liquid. Magents are bigger issue than the target itself.
  - Is our modeling of pion production sufficiently complete to address proposed accelerator projects?
    - Uncertainties at 20% level were reported previously, no update at this NuFact.
  - While there is progress, we can't completely eliminate any of the questions above.
- New question: what are the limits of the carbon target.

Acceleration

- What is the optimum muon acceleration scheme for the Neutrino Factory with respect to feasibility, performance and cost (FFAG, RLAs with FFAG arcs, linac)?
  - Cost-saving concept: dual-use linac for the NuMAX scheme
  - Single FFAG type arc replacing multiple arcs in RLA
  - Studies are ongoing, item persists.

Muon experiments

- What are the optimum beam designs for next generation muon experiments based on current and future proton beams?
- New questions:
  - What are the possible applications of (cooled) muon beams?
  - Can we design the capture/front end system, which would be beneficial for many experiments?

nuSTORM

- What is the best solution/design for the nuSTORM facility (performance, cost)?
  - Ongoing analysis of FFAG vs FODO solutions
  - FFAG ring: DFD triplet vs doublet in the straights, optimization
  - Item persists
- New questions:
  - How to generate short proton pulse for nuSTORM at CERN?
  - What is the location of the far detector at CERN?

ESS

- Is there a possible solution for an ESS driven proton driver for the SB and/or NF?
  - For SB the answer is definitely 'yes'
  - For low-energy nuSTORM at ESS:
    - Should it be based on a storage ring or a straight channel (like MOMENT)?
  - For NF:
    - How to provide short bunch structure after accumulator at ESS (do we need a compressor, or accumulator can be used as compressor)?

WG3 questions for nufact 2016

Target/capture

- What is the path to a multi-MW target/capture system?
  - Progress on all subsystem studies, summary in K. McDonald's talk
  - Other studies:
    - W powder target (see O. Caretta talk)
    - RaDIATE collaboration
- What are the limits of the carbon target?
  - Recent indications are that operation of graphite at high temperature (radiation cooling, ~ 2000 K) would permit long life even at 4-MW beam power (deserves verification in beam tests.)

Acceleration

- What is the optimum muon acceleration scheme for the Neutrino Factory with respect to feasibility, performance and cost?

MICE

- MICE started collecting data in Step IV configuration
- New question: what would be the best way to present results obtained by next year

Muon experiments

- What are the optimum beam designs for next generation muon experiments based on current and future proton beams? =>
  - Discussion needs to continue with more interaction between WG3 and WG4 groups
- What are the possible applications of (cooled) muon beams? =>
  - New question: How would the performance of muon experiments be improved by using muon cooling? (Mu2e, PRISM)
- Can we design the capture/front end system, which would be beneficial for many experiments?
  - Related new question: in the next couple of years Fermilab will have a muon beam. What are the additional applications for this beam?

nuSTORM

- What is the best solution/design for the nuSTORM facility (performance, cost)?
- How to generate short proton pulse for nuSTORM at CERN? What is the location of the far detector at CERN?

New questions related to nuSTORM/nuPIL

- Should the workshop expand its emphasis and consider extensions to conventional neutrino beams moving beyond horn-focused beams? What is the physics performance of non-conventional neutrino beams?
- Can a muon-based neutrino beam be operated parasitically to a high-power pion-based neutrino beam (nuPIL)?

WG4 questions for nufact2015

Guide lines 2015

- With the next generation of precision measurements experiments starting (muon g-2, mu to e conversion) are there additional measurement which can be made to ensure their success or to improve their background estimates and expand their sensitivities?
- Are there connections between cLFV searches and precision measurements which can be exploited to improve our progress in both regimes?
- How could a neutrino factory (and the supporting accelerator complex) be exploited to push our sensitivities for cLFV searches and precision measurements? Is there a secondary physics program that could be supported by such a complex which could address questions in both HEP and Nuclear Physics?
- What is the global picture that ties together "direct" and "indirect" for BSM physics? What are the results from the LHC and B-Factories telling us and is there a way to connect this sector with the next generation of precision measurements?

WG4 questions for nufact2016

New Questions

- Neutrino/Muon Physics:

  "What overlaps exist in non-standard interactions? How would these manifest in both the near term muon/precision measurements sector & in the neutrino sector?"

- Beam/Machine Design:
  - "How can you improve experiments with out increasing the beam power? Cooled muon beams w/ phase rotations? New methods?"

- Program Planning:
  - "How do you support the physics needs for both DC and pulsed (high sculpted) beam structures in the planning (and cost) of new facilities?"

Round table discussion

- Nufact 2015
  - Developing an International Strategy toward a Neutrino Factory
  - Panelists
    - *Dr. Daniel CHERDACK(Colorado State University); Prof. Takashi KOBAYASHI (KEK); Prof. Kenneth LONG(Imperial College London); Dr. Mark PALMER(Fermilab); Prof. Jingyu TANG (Institute of High Energy Physics)*
- Nufact 2016
  - Roadmap toward understanding nature of neutrino???
    - Present SuperBeam → Next generation → (nustorm?)→Nufact?
  - Members
    - Kajita-san?, Art?,
    - Fermilab&J-PARC&CERN accelerator
    - Fermilab/Japan neutrino experiments (DUNE? HK?)
      - Japan: Nakaya, ichikawa,
    - Muon acceleration : Alain, …
    - Ken Long

Next meetng?

- Mar 2 (Wed) 23:00JST?

NuFact organization

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SPC meeting slide

- Scientific Program Committee
  - Define science coverage of WS
  - Define scientific goals of WS
  - Appoint WG conveners
  - Define Plenary program & Round table (questions)
    - Poster sessions?
  - SPC meeting during WS Thursday
    - Feedback to next
- Local Organizing Committee
  - Local logistics, Venue, Web,
- INSS: Their own organizing committee