WG2: Neutrino Scattering Physics

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NuFACT 2018

WG2: Neutrino Scattering Physics

Accelerator-based neutrino oscillation experiments



Detected rate of ν_{α} events



WG2: Neutrino Scattering Physics

Cross section in the factorized scheme



- Free nucleon scattering: elementary interaction cross section
- Initial nuclear state: modeling nucleons in the nuclear medium before the weak interaction
- Extra nuclear effects: multiple-nucleon interactions or correlations
- Final state interactions: in-medium outgoing particle propagation

Complexity of the nuclear response

Tom Van Cuyck



 \rightarrow after FSI they contribute to different topologies: CC0 π , CC1 π , etc.

Uncertainty of neutrino energy reconstruction

- ightarrow we need not only **inclusive** but also **exclusive** predictions
- \rightarrow energy is reconstructed using leptonic or hadronic information



Still many problems to solve...

Contributions to the CC0 π topology:

- CCQE axial mass: $M_A \sim 1.03 \text{ GeV}$
- 2p2h magnitude in MC generators
- π^0 production with its **absorption**

we have established an important 2p2h contribution to the MiniBooNE result \rightarrow



Deep and shallow inelastic scattering region (quark-hadron duality)

Implementation of theoretical models in Monte Carlo event generators

→ exciting workshop at ECT* in Trento, Italy in July: https://indico.ectstar.eu/event/19/overview

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For a review of neutrino scattering physics see the NuSTEC White Paper!

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Goals for the meeting

- \rightarrow Fundamental nuclear physics and neutrino scattering
- \rightarrow Cross section results
- \rightarrow Engagement with oscillation physics
- $\rightarrow\,$ New projects and exciting developments

- \rightarrow 8 theoretical talks
- \rightarrow **12 experimental** talks
- \rightarrow 3 Monte Carlo generator talks
- \rightarrow 2 joint sessions with WG1



Fundamental nuclear physics and neutrino scattering

Parallel session 1.

- W. Van Orden: Nuclear Theory, Data, and Event Generators
- A. Lovato: Ab Initio Methods
- R. González Jiménez: Theory of neutrino pion production
- A. Kronfeld: Lattice QCD and neutrino cross sections

Parallel session 4.

- J. Morfin: Problems in DIS and SIS
- A. Ankowski: Electron vs Muon Neutrinos
- N. Rocco: Theory of electron scattering and neutrinos

Cross sections results

Parallel session 2.

- M. Judah: NOvA Cross Sections Results
- C. Wret: T2K Cross Sections Results
- M. Tzanov: LArIAT Cross Section Results

Parallel session 3. (WG1 + WG2)

- X. Lu: MINERvA Cross Section Results
- L. Jiang: MicroBooNE Cross Section Results
- J. Zennamo: FNAL SBN Status
- J. Chaves: CAPTAIN Results

Engagement with oscillations

Parallel session 3.

· Cross sections results external to oscillation experiments

Parallel session 4.

• A. Bodek: Binding energy in event generators

Parallel session 6. (WG1 + WG2)

- J. Wolcott: NOvA Cross Section Model / Oscillation Needs
- C. Wret: T2K Cross Section Model / Oscillation Needs
- L. Jiang: GENIE Physics Tuning

New projects and exciting developments

Parallel session 5.

- L. Weinstein: Electron scattering data and neutrinos
- S.-P. Hallsjö: WAGASCI Status
- S. Hedges: Low energy neutrino interactions

Parallel session 7.

• E. Saul Sala: Nucleon axial form-factor from a Bayesian neural network analysis of scattering data

Parallel session 7.

• L. Pickering: NUISANCE for neutrino cross section fits

WG2 schedule

Monday	Tuesday	Thursday	Friday	
14:00 - 16:00	14:00 - 16:00	14:00 - 16:00	14:00 - 16:00	
Session 1.	Session 3. + WG1	Session 4.	Session 6. + WG1	
4 talks	4 talks	4 talks	3 talks + discussion	
16:30 - 18:00		16:30 - 18:00	16:30 - 18:00	
Session 2.		Session 5.	Session 7.	
3 talks		3 talks	2 talks + discussion	