Elementary targets/elementary amplitudes workshop

RICHARD HILL

UKentucky and Fermilab

NUSTEC board meeting

16 November, 2017

"Elementary amplitudes for the neutrino scattering program"

- INT, Seattle

- ~2.5 days during the week of June 25-29, 2018 (TBC)

- w/ M. Betancourt (FNAL), S. Pastore (LANL)

- part of a larger INT program "fundamental physics with electroweak probes of light nuclei" (June 12 - July 13)

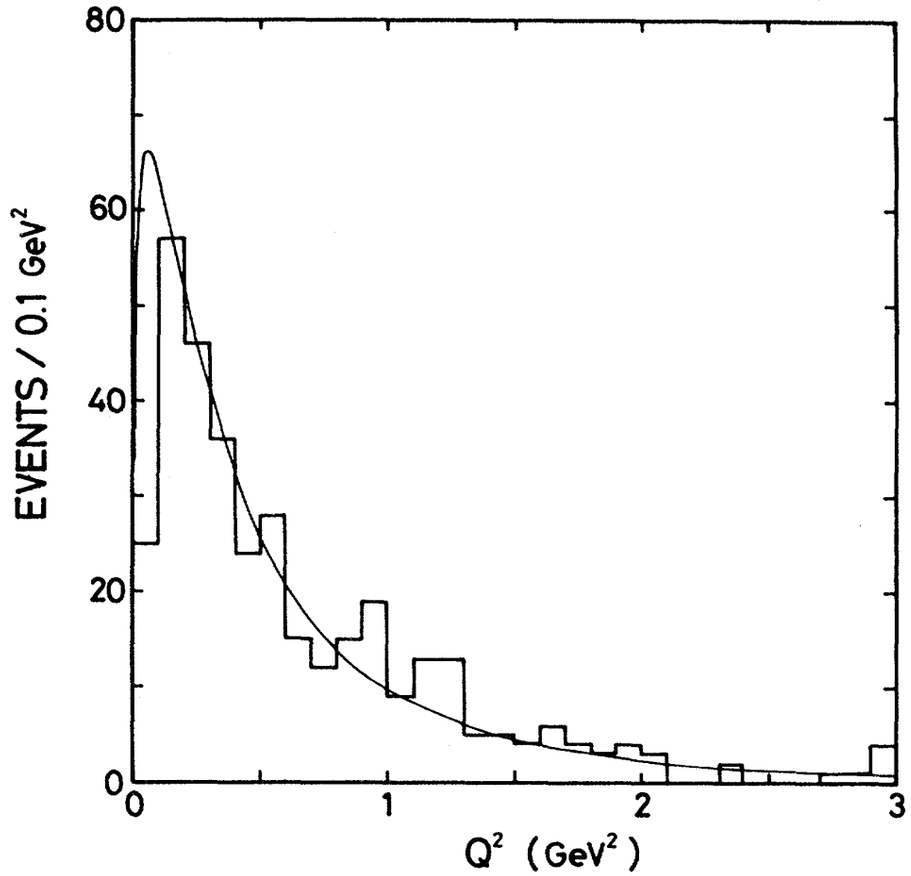
organized by S. Bacca (Mainz/TRIUMF), RJH, D. Phillips (Ohio), S. Pastore (LANL)

Elementary amplitudes workshop: **motivation**

- neutrino nucleus cross sections rely on nucleon-level inputs

- critical inputs rely on 70's era bubble chamber data: pioneering but not designed to underpin today's neutrino program

- e.g. neutrino-neutron CCQE: about 3K events in world data



Fermilab 15-foot deuterium bubble chamber, PRD 28, 436 (1983)

ANL 12-foot deuterium bubble chamber, PRD 26, 537 (1982)

BNL 7-foot deuterium bubble chamber, PRD23, 2499 (1981)

Elementary amplitudes workshop: **topics**

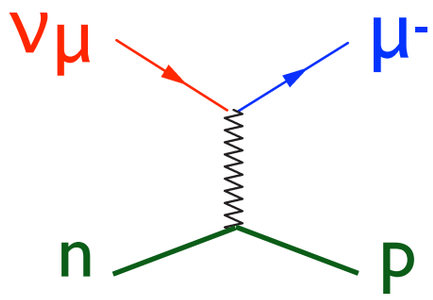
1) the quantitative impact of better constraints on the elementary amplitudes

2) the scientific impact of a new hydrogen or deuterium target experiment

3) the optimal design and technical feasibility of a new hydrogen or deuterium target experiment;

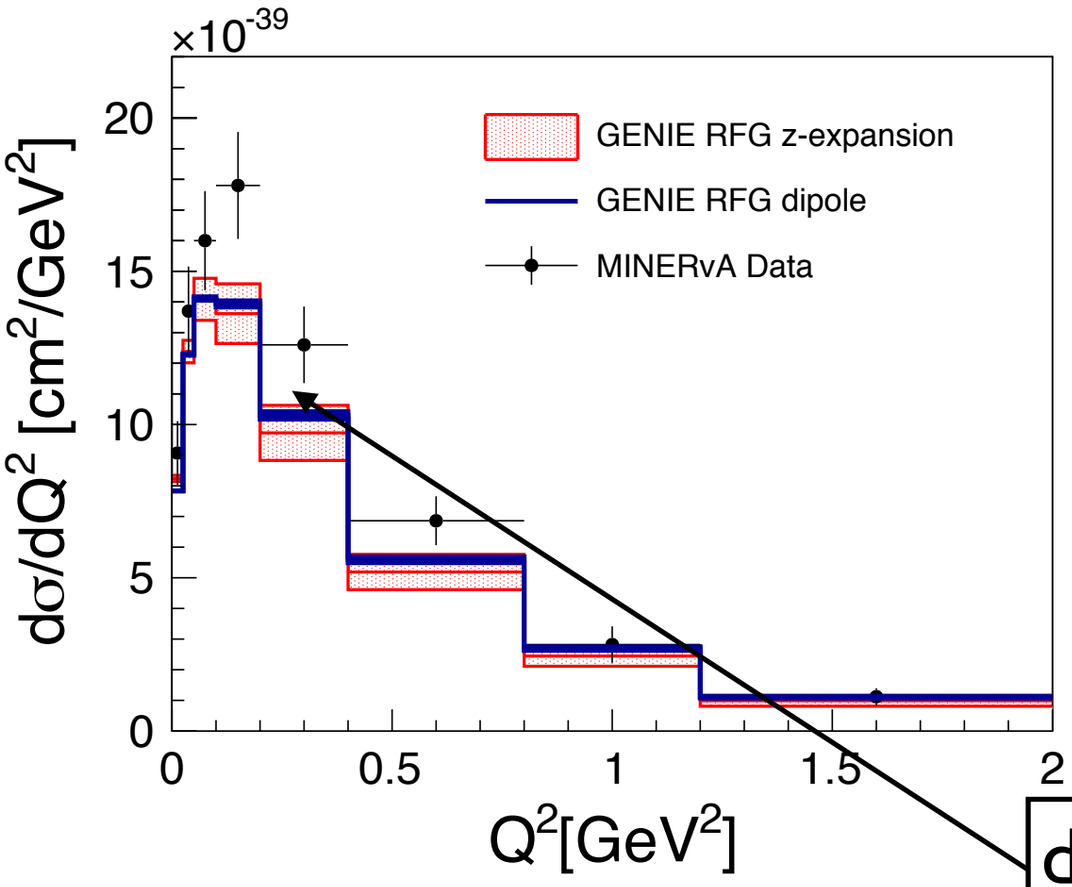
4) constraints on the elementary amplitudes from other methods

- impact of nucleon-level uncertainties



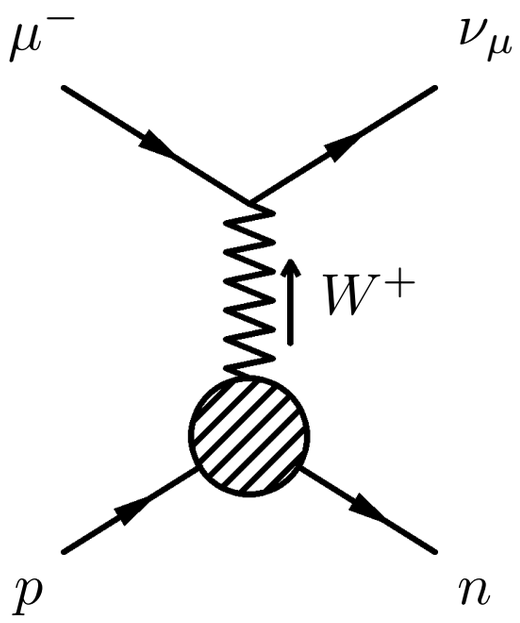
$$\sigma(\nu n \to \mu p) = |\cdots F_A(q^2) \cdots|^2$$

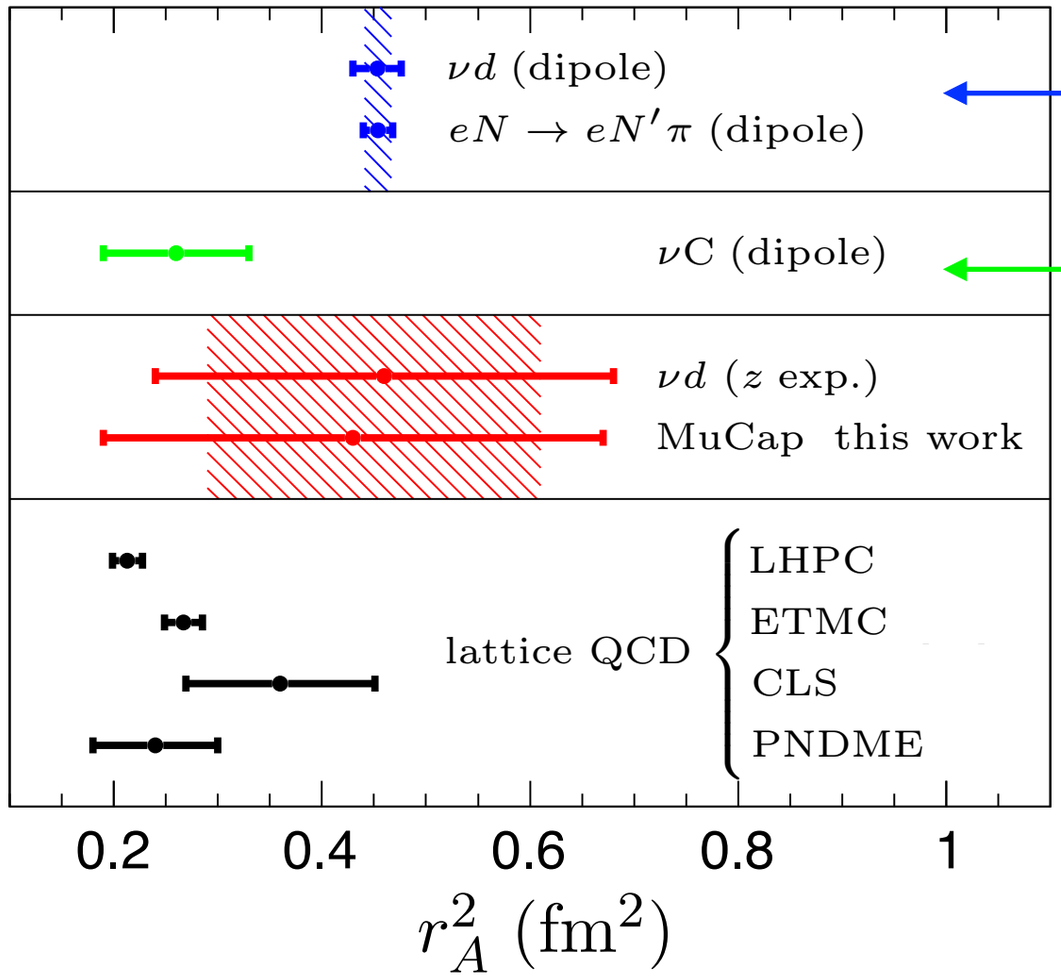
poorly known axial form factor



discrepancy: nucleon effects or nuclear effects ?

- complementary processes





form factor assumption

nuclear model assumption

from RJH, Kammel, Marciano, Sirlin 1708.08462

lattice average: see also Yao, Alvarez-Ruso, Vicente-Vacas 1708.08776 [r_A^2=0.26(4) fm^2]