

Technical Note

EM namespace & Q^2 Threshold

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Abstract

This technical note illustrates how a new namespace could be introduced to account for the differences in the Q^2 threshold and the calculation of kinematic quantities for electromagnetic scattering events.

1 Existing Issues

1 Given that the Q^2 threshold is different for leptons (0.02) and neutrinos (10^{-4}), at this point the
2 analyzers have to change the hard-coded Q^2 limit in GENIE and build from scratch whenever
3 they want to simulate electromagnetic scattering events, which is a time-consuming process. At
4 the same point, the existing utilities do not take the mass of the incoming lepton into account,
5 something that results in an erroneous calculation of the necessary kinematic quantities.

2 Proposed Solution

6 Our proposed solution to the issues mentioned in section 1 is the introduction of a namespace that
7 takes the relevant Q^2 limit and masses into account.

8 The added / modified files are listed below:

- 9 • src/Framework/Utils/KineUtils.cxx
- 10 • src/Framework/Utils/KineUtils.h
- 11 • src/Framework/Conventions/Controls.h
- 12 • src/Framework/Interaction/KPhaseSpace.cxx
- 13 • src/Physics/Multinucleon/XSection/EmpiricalMECPXSec2015.cxx
- 14 • src/Physics/Resonance/EventGen/RESKinematicsGenerator.cxx
- 15 • src/Physics/DeepInelastic/EventGen/DISKinematicsGenerator.cxx
- 16 • src/Physics/Multinucleon/EventGen/MECGenerator.cxx
- 17 • src/Physics/QuasiElastic/EventGen/QELEventGenerator.cxx
- 18 • src/Physics/QuasiElastic/EventGen/QELKinematicsGenerator.cxx
- 19 • src/Physics/XSectionIntegration/GSLXSecFunc.cxx

2.1 Validation

21 The first thing that was done was to verify that the introduction of our changes doesn't affect the
22 neutrino side of our generator, as can be seen in figures 1 and 2.

23 At the same time, we want to verify that the introduction of our changes has exactly the same
24 effect on the electron side as if we had modified the relevant Q^2 in Controls.h, which is the case as
25 can be seen in figures 3 and 4.

3 Github

27 The relevant code modifications can be located in the following Github repository

28
29

<https://github.com/afropapp13/Generator.git>

30 and the corresponding branch is

31 devel_namespace

32 and the relevant pull request has been submitted (figure 5).

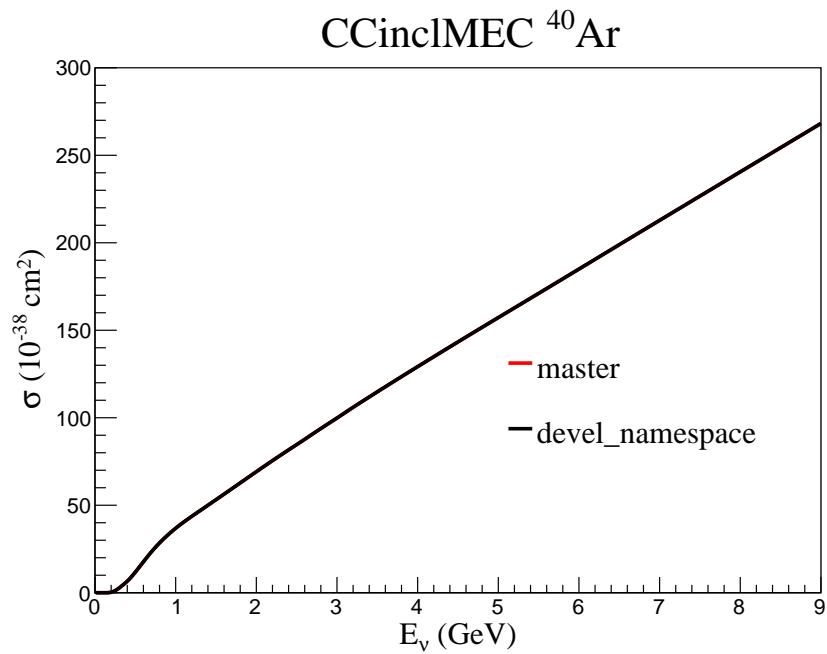


Figure 1: Spline for CCinclMEC events @ $E = 1$ GeV on ^{40}Ar for tune G18_10a_02_11a.

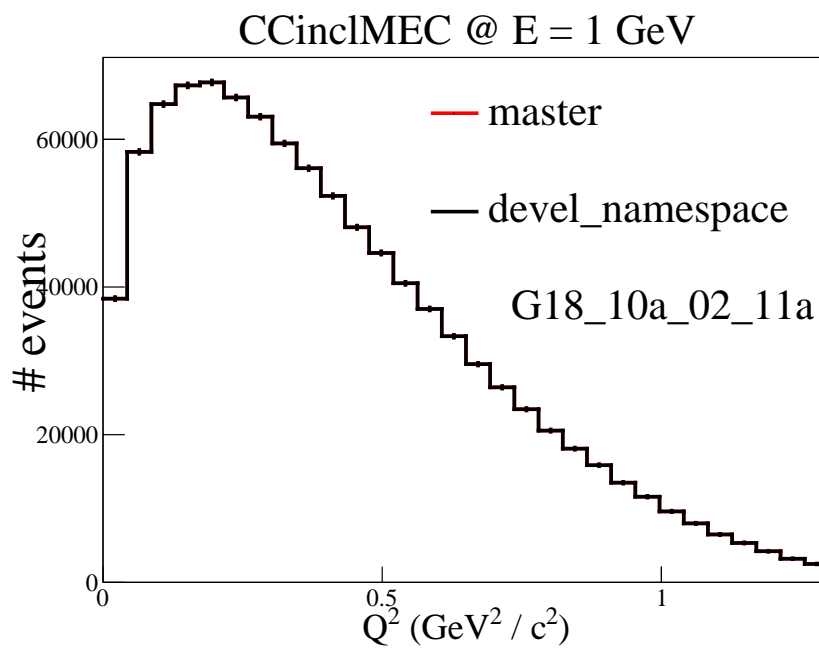


Figure 2: Q^2 distribution for CCinclMEC events @ $E = 1$ GeV on ^{40}Ar for tune G18_10a_02_11a.

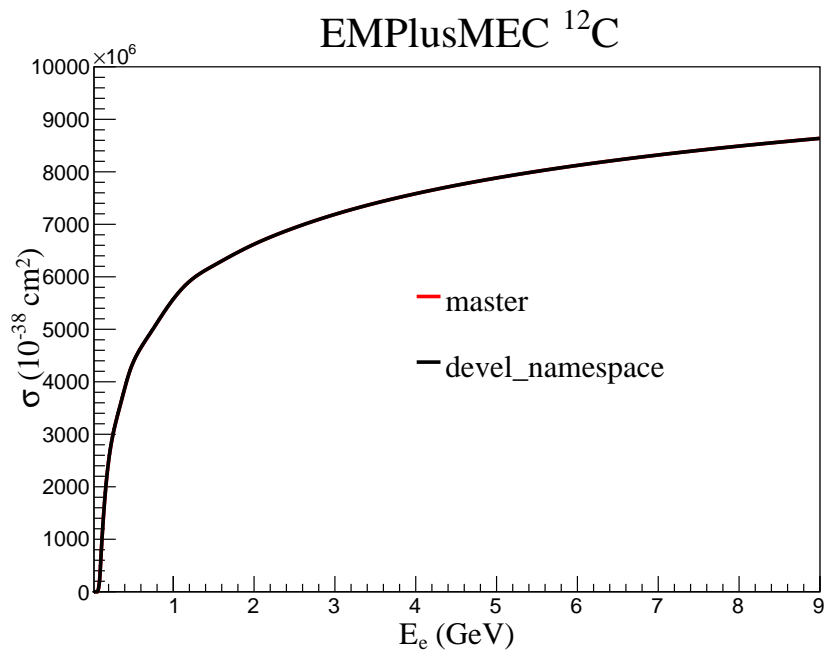
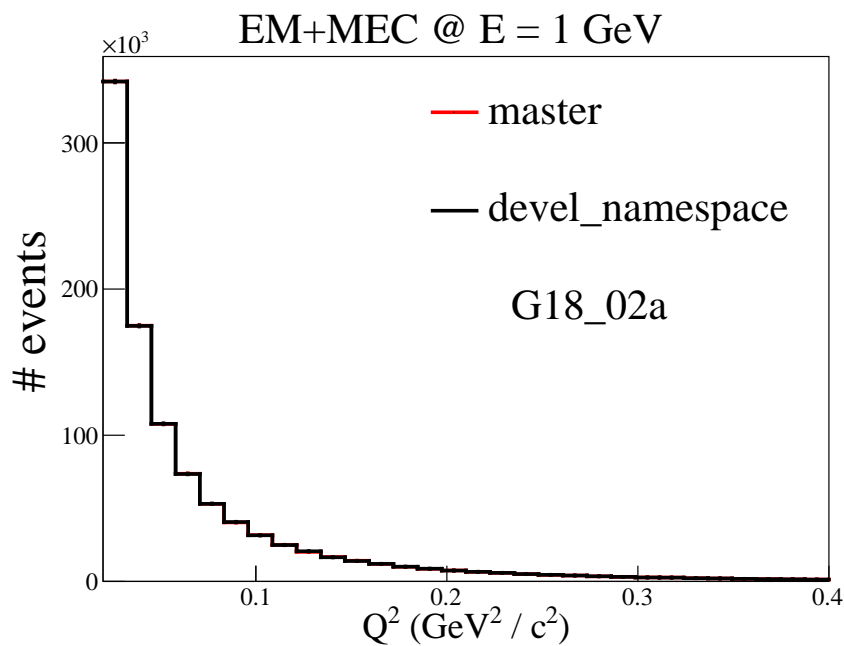
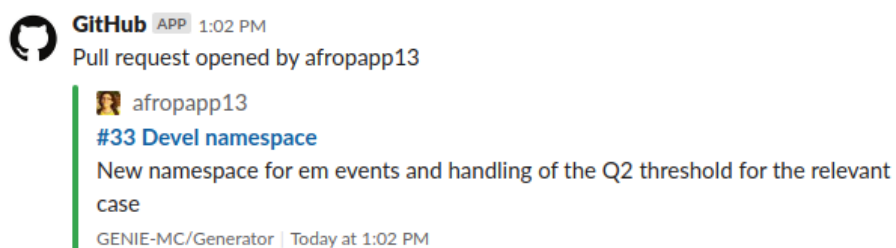
Figure 3: Spline for EM+MEC events @ $E = 1$ GeV on ^{12}C .Figure 4: Q^2 distribution for CCinclMEC events @ $E = 1$ GeV on ^{12}C .

Figure 5: Submitted pul request.