

Some Thoughts on the Consistent Treatment of Hybrid Processes

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The Problem

- Several “hybrid” processes in hadronics should, strictly speaking, be considered as EM as they must be assigned to gammas or leptons
 - mu-nuclear
 - electron- and positron-nuclear
 - mu capture
- Others belong in the decay category:
 - radioactive decay
- Some hadronic processes have EM (atomic) components
 - various hadron capture reactions (π^- , K^- , etc.)
- Any future neutrino interaction code would fall into yet a different category

The Problem

- Moving hadronic code into EM or other categories would require an expanded set of dependencies which tend to:
 - complicate the build procedure
 - be more error-prone
 - be difficult to maintain
 - some hadronic codes already have too many dependencies
- Many of these hybrid processes/models do not employ code re-use
 - even though pieces of well-established models could be used
 - in some cases multiple sets of identical constants need to be maintained

Possible Code Solution

- Develop a “sub-model” framework
 - design well-defined model components which may be assigned to models
 - could be similar to the way de-excitation models are used
 - would need to formalize and unify the interfaces
- Example: mu-nuclear with two sub-models
 - one sub-model handling the EM vertex of the interaction and the subsequent generation of a real photon
 - a second sub-model interacting the real photon with the nucleus

Possible Code Solution

- Advantage:
 - each sub-model could be independently swapped with an alternative
- Disadvantage:
 - another hierarchy layer would be added

Possible Dependency Solution

- First re-examine the dependencies to see what can be removed
- Factorize the libraries
 - in EM, make separate libraries containing only code which may be coupled to hadronic
 - vice versa for any hadronic code required by EM
 - examples:
 - split off the part of the EM low energy library which is used by electro-nuclear (would also help the existing de-excitation dependencies)
 - make a separate library with only electro- and muon-nuclear code which code be included in EM processes

Organization

- Consider a third category “EMHad” or “HadEM”
 - outside of both EM and hadronic frameworks
 - might help with the dependency problem