



EM shower call meeting

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Problem description

Two types of hadronic interactions are possible for electromagnetic particles:

- $\blacksquare \ e^- + Z \rightarrow e^- + {\rm hadronic}$
- ${\color{black}\bullet} \ \gamma + Z \rightarrow {\color{black}\mathsf{hadronic}}$

In both cases, we have a combination of electromagnetic and hadronic processes!

PROPOSAL can provide limited information about hadronic interactions, including:

- \blacksquare mean free path λ
- relative energy transfer *v* into hadronic component
- information about nucleon Z that we interacted with ("target")

However, PROPOSAL can not provide the explicit secondary particles to put on the CORSIKA stack.

 \Rightarrow We need some kind of event generator here!



Idea using pseudo particles

- If PROPOSAL encounters a hadronic interaction, put a pseudo particle with all relevant information on the (particle) stack
- Pseudo particle will later be read from the stack by a different module and further processed

Advantages:

- No dependency between modules
- Interchangebility / flexibility

Disadvantages / tasks:

- Conceptional: No virtual particles on the stack
- Can not ensure that interaction and event generation are compatible
- We need to ensure that only the correct modules handles the pseudo particle



Direct call of event generator

- Pass hadronic module to PROPOSAL module
- If PROPOSAL module encounters a hadronic interaction, call appropriate event generator

```
corsika::proposal::doInteraction() {
    \\ ...
    if (type == PROPOSAL::InteractionType::Photonuclear) {
        hadronicInteraction_.doEventGeneration(v, target, projectile, ...);
    }
    \\ ...
}
```

Advantages:

- No virtual particles on stack
- We can perform basic checks about compatibility of modules
- Interchangebility possible (?)

Disadvantages / tasks:

- Can still not entirely ensure that interaction and event generation are compatible
- Unclear owner structure of modules



Create new module for hadronic interactions

- Write extra module that is only responsible for hadronic interactions of EM particles
- Module will depend on PROPOSAL and appropriate hadronic model

Advantages:

- No virtual particles on stack
- We have full control on compatibility of models

Disadvantages / tasks:

- We need to take hadronic crosssections out of PROPOSAL
- Possibly unintuitive to divide EM model into different modules
- Limited flexibility
- Higher maintainability effort