

Status of new Minerva detector simulation

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- ◆ 20/06/06

Proposed scheme

- ♦ Described at <http://minerva-wiki.fnal.gov/mediawiki/index.php?title=Digits>
- ♦ Start with MCHits produced by GEANT4
 - ♦ MCHit: energy, entry, exit, time, link to MCParticle
- ♦ MCPulseCreatorAlg MCHits->MCPulses
 - ♦ MCPulse: pe, arrivalTime
- ♦ MCDigitCreatorAlg MCPulses->MCDigits
 - ♦ MCDigit: vector<MCPulse>

How does light actually get to the PMT?

- ▶ dE->excited scintillator->"blue" photons are emitted isotropically
- ▶ blue photons bounce around the strip, some get absorbed in the green fiber core and re-emitted as "green" photons
- ▶ some "green" photons are captured in the fiber core due to total internal reflection and travel along the fiber
- ▶ some "green" photons survive attenuation in the fiber and reach the PMT

Need to represent photons

- ◆ Need to represent photons, so add MCPPhoton to the proposed scheme
- ◆ MCPPhotons: pos, direction, wavelength, link to MCHit
- ◆ Modify MCPulse – list of MCPPhotons

MCPulseCreator Implementation Steps

- ♦ Associate MCHits with Minerva strips
- ♦ Run pluggable modules (“AlgTools” in Gaudi lingo)
 - ♦ IBluePhotonMakerTool
 - ♦ IBluePhotonTransportTool
 - ♦ IGreenPhotonMakerTool
 - ♦ IGreenPhotonTransportTool

BluePhotonMaker (done)

- ◆ Convert energy deposition to blue photons
 - ◆ Birks law
 - ◆ Isotropic
 - ◆ Uniform along the path between MCHit entry and “exit”
 - ◆ Scintillator fluor decay time
 - ◆ (prescale for “future losses” right from the start)

BluePhotonTransport

- ◆ Blue photons travel in the scintillator reflecting off the surfaces until entering the green fiber core or getting absorbed
- ◆ “Full” simulation is unreasonable (time consuming) – pdf's of photon reaching the fiber can be parameterized as $p(\text{location, direction, time,..})$
- ◆ Will start with Minos parameterizations

GreenPhotonMaker

- ▶ Blue photons get absorbed in the fiber core
 - ▶ Absorbtion length
- ▶ re-emittted isotropically as green photons

GreenPhotonTransport

- ◆ Simulate reflections off the cladding, attenuation on the way to the PMT
- ◆ “Collect” all the photons arrived at the PMT (from all MCHits in this strip) and form the MCPulse

Status

- ◆ Done
 - ◆ ID classes (StripID, PlaneID, ModuleID etc)
 - ◆ Beginning of the event model MCPPhoton, MCPulse, MCDigit
 - ◆ MCPulseCreator “frame”
 - ◆ BluePhotonMaker
- ◆ Working on
 - ◆ BluePhotonTransport, GreenPhotonMaker, GreenPhotonTransport
- ◆ Plots next week