Garfield++

Status Update

RD51 Collaboration Meeting WG4
13 April 2011

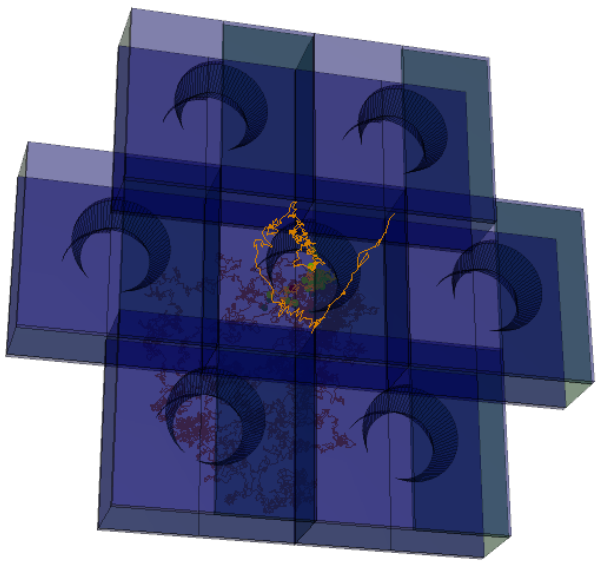
Garfield++

Overview

- Concept:
  - (partial) reimplementation of Garfield functionality in C++, with focus on modern detector technologies
  - provide collection of classes to be used as building blocks for a detector simulation program
  - facilitate combination with other packages (e. g. Root, G4)
- Installation instructions and basic examples are available on a webpage (`http://cern.ch/garfieldpp`).

Microscopic Tracking
Magnetic Fields

- stepping algorithm extended to allow for B fields
- example application: transparency of a gating GEM



electron spiralling into GEM hole

- $B = 4$ T, collinear with E
- T2K gas

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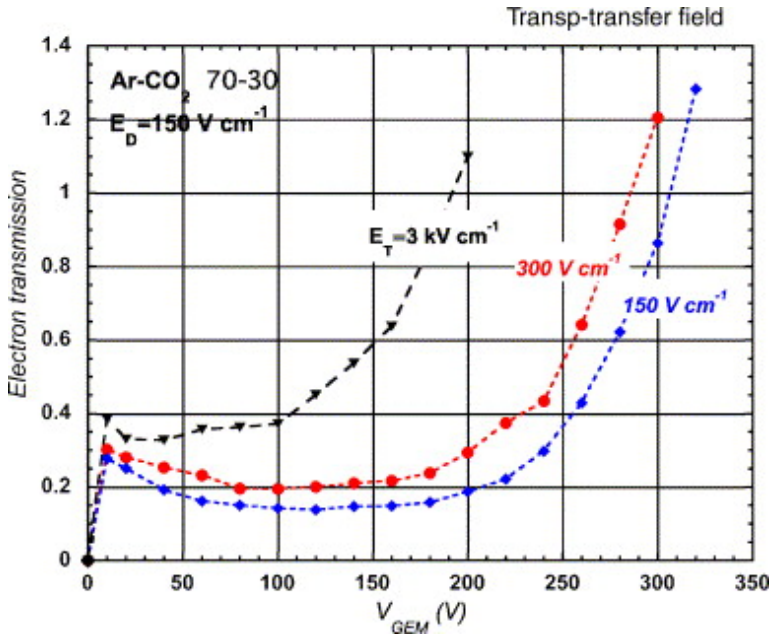
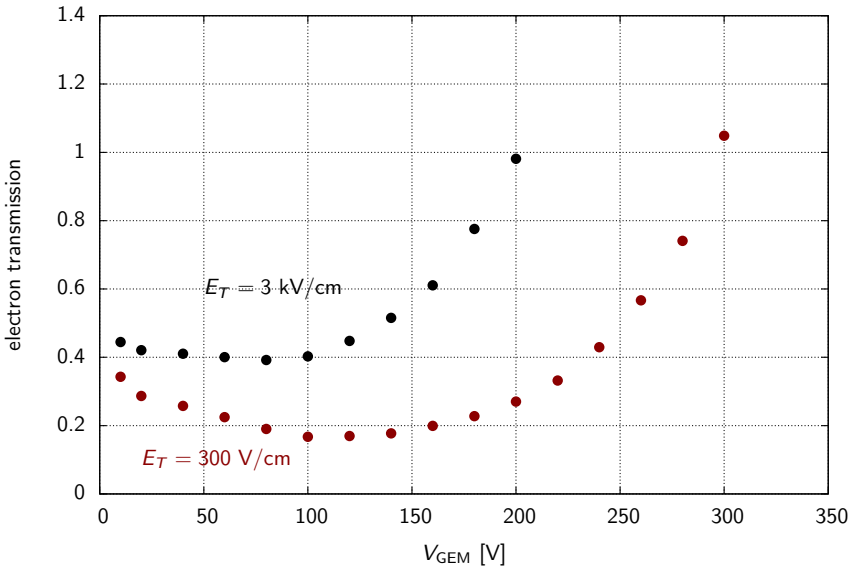


F. Sauli, L. Ropelewski, P. Everaerts,
NIM A **560** (2006), 269–227



$B = 0$

preliminary

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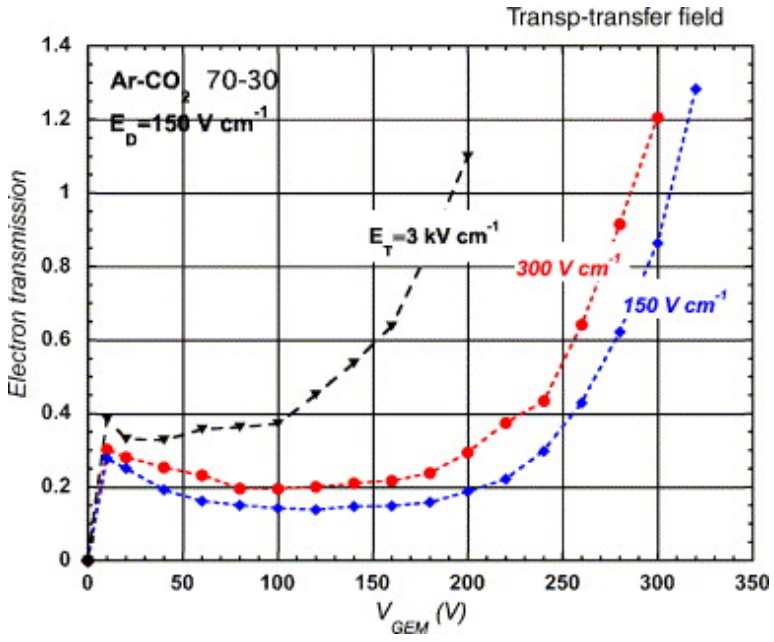

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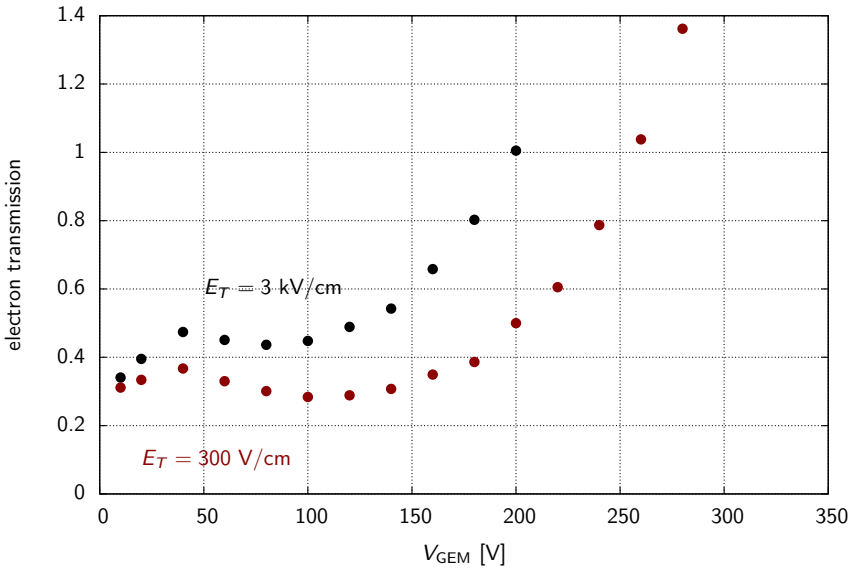


$B = 4$ T

preliminary

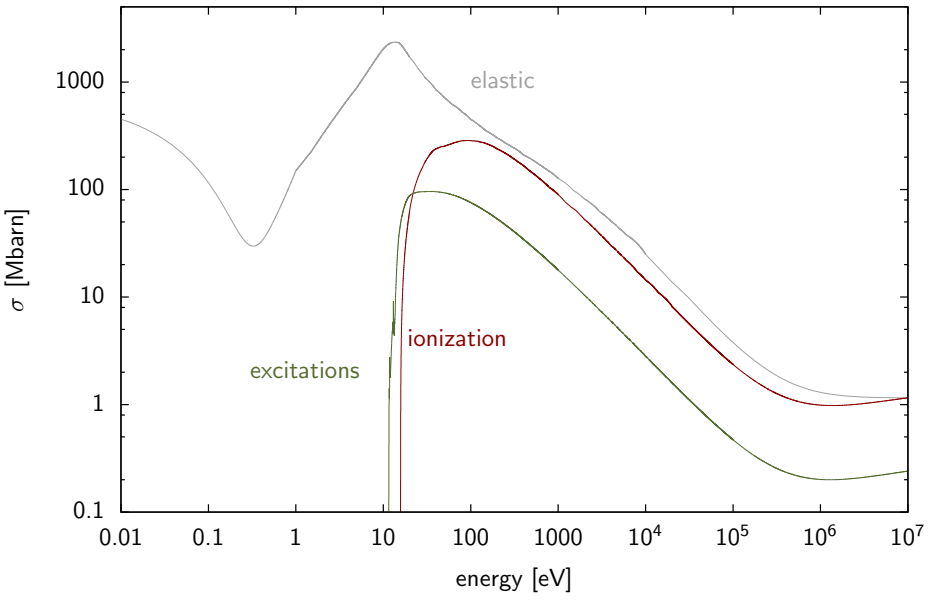
Microscopic Tracking

High Energy Cross-Sections in Magboltz

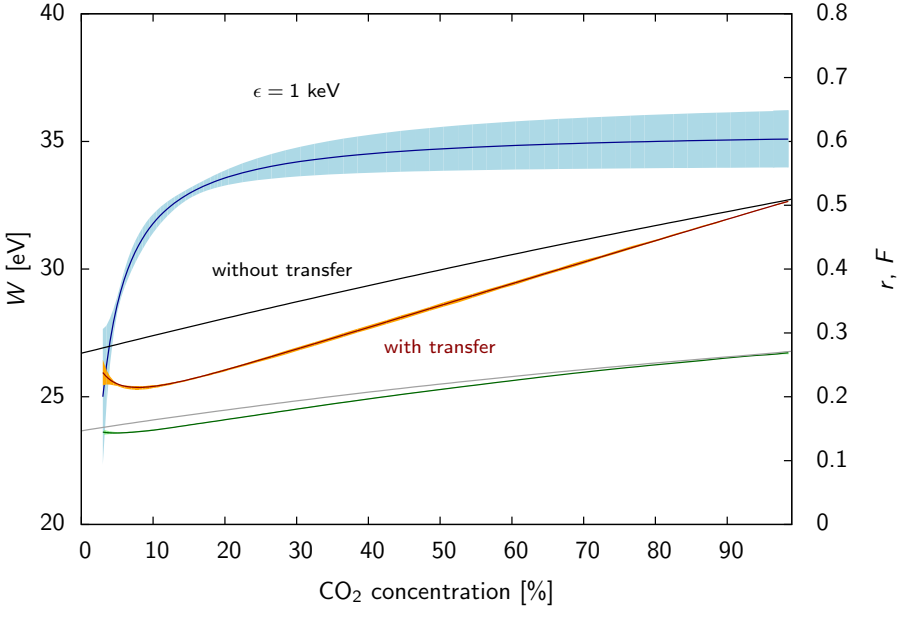
- For many popular gases, Magboltz includes cross-sections up to $\gtrsim$ MeV energies (can easily be extended beyond).
- Applications:
  - "first-principle" calculation of δ electron transport properties (W, F, range) $\rightarrow$ "Imip" program by S. Biagi
  - simulation of primary scintillation
  - $\mathrm{d}E/\mathrm{d}x$, cluster size distribution, multiple scattering, ...
- Modelling of differential ionization cross-section to be improved. For now: added option to use Green-Sawada parameterization (instead of Opal-Beaty "splitting function")

Microscopic Tracking

- cross-sections for electron scattering in Ar as implemented in Magboltz 8



- W value and Fano factor in Ar/CO_2



"Classic" Applications

- Activity pursued by team from Carleton University to interface Garfield(++) with Geant4 framework.
- Use Atlas MDT as showcase example.
- Status
  - ✓ analytic field calculations (wires, planes, tube)
  - ✓ interface to Magboltz, calculation and interpolation of transport parameter tables
  - implementation of RKF drift line integration: basically done, being validated

Outlook

Plans

- Implementation of avalanche simulation including photon transport is under way (challenge: modelling of radiation trapping).
- Program would greatly benefit from interface to neBEM field solver (problem: need geometry package with surface discretization).
- Feedback is highly appreciated. Contributors are very welcome.