RD-51 COLLABORATION MEETING

Signals in Resistive MPGDs: an introduction

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October 5th, 2020

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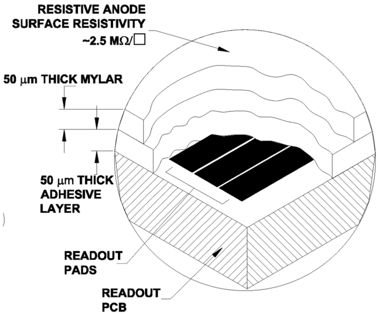
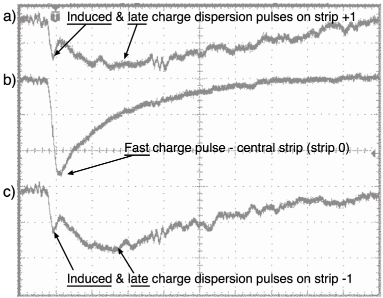
INTRODUCTION

SIGNALS AND CHARGE DIFFUSION IN DETECTORS WITH RESISTIVE ELEMENTS

Resistive elements are applied to different families of detectors to improve performance and robustness.





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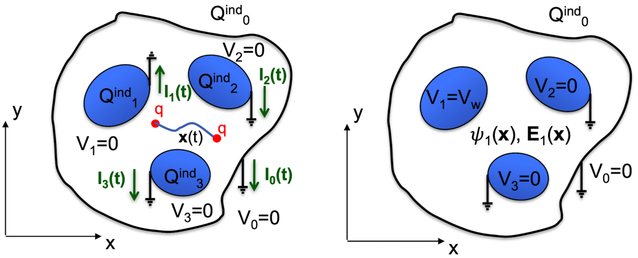
RAMO-SHOCKLEY THEOREM AND ITS EXTENSIONS

RAMO-SHOCKLEY THEOREM (NO RESISTIVE ELEMENTS)

The induced current on a grounded perfectly conducting electrode can be calculated using the weighting field:

$$I_n^{\text{ind}}(t) = -\frac{dQ_n^{\text{ind}}(\vec{x}(t))}{dt} = -\frac{q}{V_w}\vec{E}_n(\vec{x}(t)) \cdot \dot{\vec{x}}(t)$$



W. Shockley, J. Appl. Phys. **9** (1938) no.10, 635-636.

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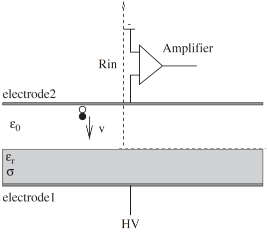
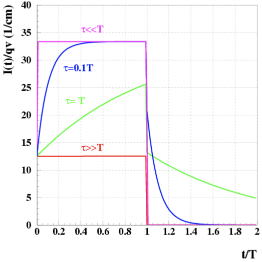
RAMO-SHOCKLEY THEOREM AND ITS EXTENSIONS

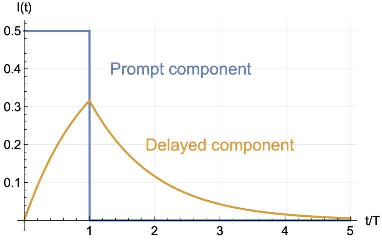
AN EXAMPLE WITH FINITE CONDUCTIVITY

For a parallel plate detector containing a conductive layer, altering the conductivity ($\sigma \propto \tau^{-1}$) modifies the shape of the induced signal.

$$I(t) = I_{\text{prompt}}(t) + I_{\text{delayed}}(t)$$







W. Riegler, Nucl. Instrum. Meth. A **535** (2004), 287-293.

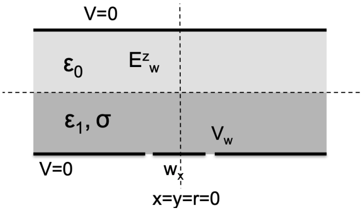
W. Riegler, Nucl. Instrum. Meth. A **940** (2019), 453-461 [arXiv:1812.07570 [physics.ins-det]].

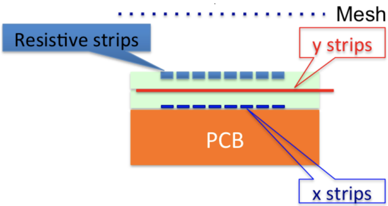
COMSOL Multiphysics:

Calculating $\vec{E}_n(\vec{x}, t)$ for electrodes in the detector geometry.

Garfield++:

Using $\vec{E}_n(\vec{x}, t)$ the signal will be able to be modeled for avalanches happening in the resistive MPGDs.





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SUMMARY AND OUTLOOKS

We are intrested in a better understanding the effects on signal formations and spread, on detector element protection and discharge mitigation in MPGDs with resistive elements.

Modeling:

Main focus for modelling and simulation is the signal formation in presence of resistive electrodes.

Experiments:

Validation studies of the developed modelling tools will be done on real cases coming from structures investigated during the project as well from research activities of the community.

Thank you for attention!