

# Guide to MWPC Simulation in Garfield++

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# 1 What the Simulations Do

Allow the user to simulate the potential, field, and signal outputs of MWPCs (Multi-Wire Proportional Chambers) using the Garfield++ software. Access the GitLab repository [here](#). See [User Guide](#) for prerequisites and steps to install Garfield++. These simulations can be used to test a variety of MWPC configurations and compare their performances based on output signal amplitudes and shapes.

## 1.1 Additional Resources for Garfield++

- [Garfield++ Home](#)
- [Examples](#)
- [GitLab](#)

# 2 MWPC Configurations

All MWPCs have the following properties:

- 10 cm x 10 cm active area.
- Anode wire layer made out of 100 conducting wires with 20  $\mu\text{m}$  thickness and 1 mm interval. Signals are drawn from these anode wires.
- Cathode layer made of either:
  - 25  $\mu\text{m}$  thick conducting foil, or
  - 100 conducting wires with 25  $\mu\text{m}$  thickness and 1 mm interval.
- Anode layer set to 0 V (grounded) and cathode layer set to 3000–4000 V.
- Adjacent layers are separated by 5 mm (i.e. 3 mm thick window with 2 mm thick spacer) to prevent sparking.

The 4 configurations we wish to test differ in the number of cathode layers and their geometry (foils vs wires). This is shown in Figure 1. The 4 simulation files are named as:

- `config10ldFoil5LayerMWPC.C`
- `config2DWCWire6LayerMWPC.C`
- `config3NewWire5LayerMWPC.C`
- `config4Foil6LayerMWPC.C`

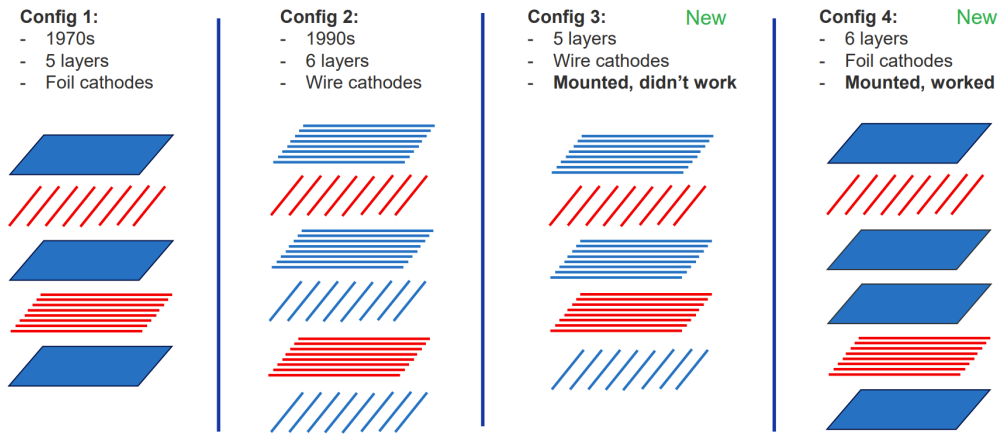


Figure 1: Config 1 has 3 cathode foils (traditional MWPC), Config 2 has 4 cathode wire planes (DWC - Delay Wire Chamber), Config 3 has 3 cathode wire planes, and Config 4 has 4 cathode foils.

### 3 Code

This section outlines the code in files `generate.C` and `config10ldFoil5LayerMWPC.C` with reference to each block and their functions. All codes are written in C/C++.

#### 3.1 Create a Gas File

In `generate.C`, create



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- 3.3 Define the MWPC Geometry**
  - 3.3.1 Cathode Layers**
  - 3.3.2 Anode Layers**
- 3.4 Compute Potential and Fields with neBEM**
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