*A Suite of Profile Monitors at Fermilab

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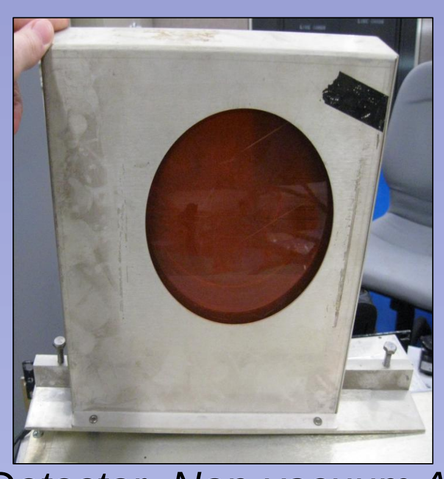
Fiber Profile Monitor/FPM

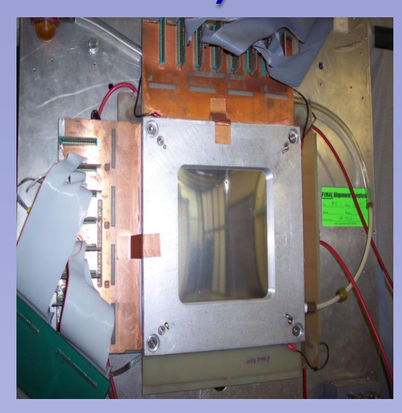
Prototype Detector (Circa 2007) [1]

Segmented Wire Ionization Chamber-SWIC



Active Detector -Non-vacuum Application (Circa ~1970)

Proportional Wire Chamber (*Fenker* chamber)/PWC



Active Detector (Circa ~1980) [1]

SWICs

Box

Characteristics:
Chamber isolated from beam line vacuum
Ar/$C0_2$ (80/20%)
Bias Supply
Medium Intensity Beam
>10^5protons

Bayonet

Specifications:
1 High Voltage Plane between x-y signal planes @ 1 mm AuW
.003” Ti Foil Window
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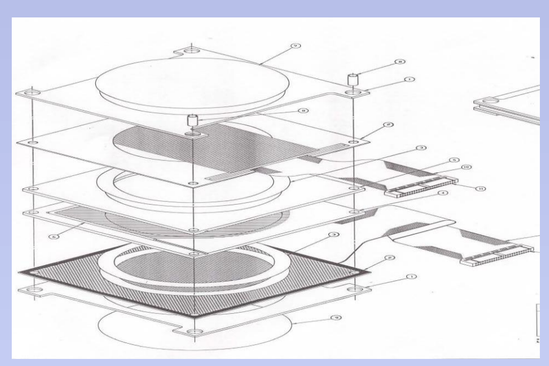


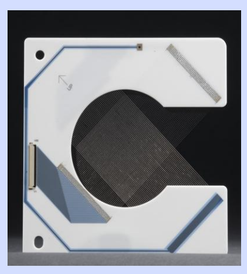
Exploded View of SWIC [1]

Theory of Operation:
Functions in a medium level vacuum environment on the principle of ionization of a gas by charged particles in the beam. As the beam passes through the chamber, it frees electrons from active gas molecules. Electrons then move toward the high voltage bias plane, create an avalanche and provide more signal gain between the signal planes attracting the positive ions to the sense wires. As the positive charged gas ions strike the sense wires they deposit their charge, which is then integrated and quantized by the scanner. [2]

SEMs
Secondary Emission Montiors

Booster Type Multiwire

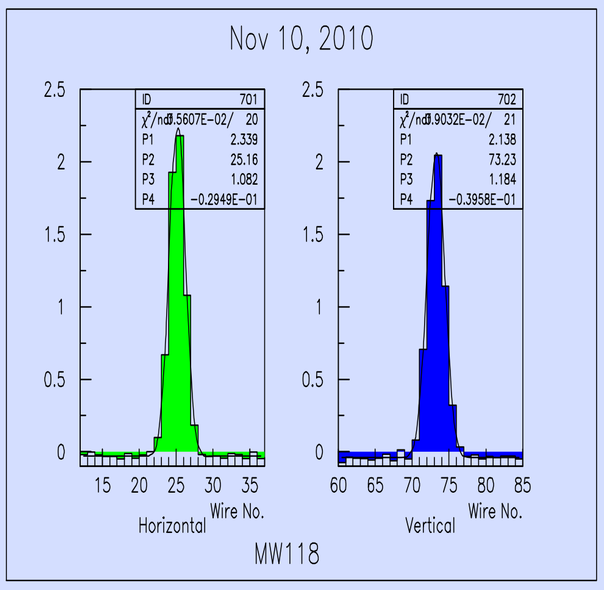
Characteristics:
Bias Supply for test purposes
Higher Intensity
Lower residual beam losses



NuMI wire plane

Gloor II Multiwire

Specifications:
25μm Φ Ti wire
33μm Φ Carbon Filament
5μ x 125μ Ti foil
Spacing .5mm, 1mm, or 2mm
Single or Dual Plane



Typical Profile shown from the Carbon Fiber SEM [3]

Theory of Operation:
Functions in a higher vacuum environment on the secondary emission principle of electrons that induces a current into the wires and is measured by the same data acquisition scanner as mentioned above. [2]

Summary:
Many types of detectors are available at Fermilab for various types of Beam Line Applications, this poster only covers a few of those developed, built, installed and currently maintained.

References:
[1] G. Tassotto , H. Nguyen, G. Sellberg, D. Schoo, “A Fiber Profile Monitor for Low Beam Intensities” DIPAC2007-TUB01
[2] D. Schoo, “Fermi Profile Monitor Systems Detector Designs and Applications SWIC Scanner Function” Draft, Nov 2010
[3] D. A. Jensen, “Studies of the Carbon Filament Position Monitor at NuMI 118” Draft February, 2011

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