

# Big Bite MWDC Rate Estimates Using GEANT3 Modeling

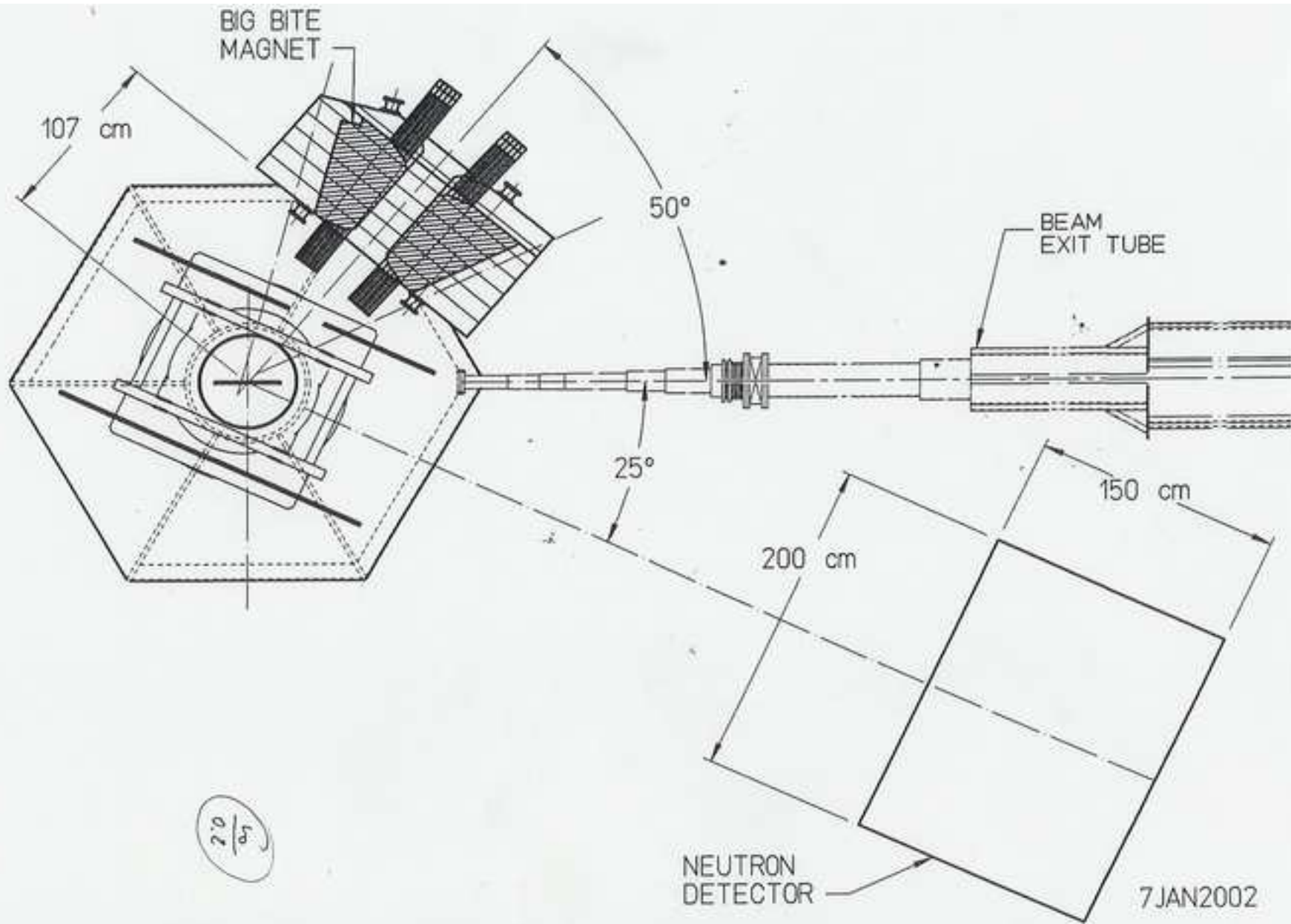
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## MWDC background rates in the Hall

- In open-target geometry:  
mostly determined by few-MeV electrons coming from target; source terms may be used for estimates
- In shielded configurations, or with magnetic fields:  
secondary cascades contribute; there's a need to use model calculations, verified by measurements

## MWDC rates in Big Bite

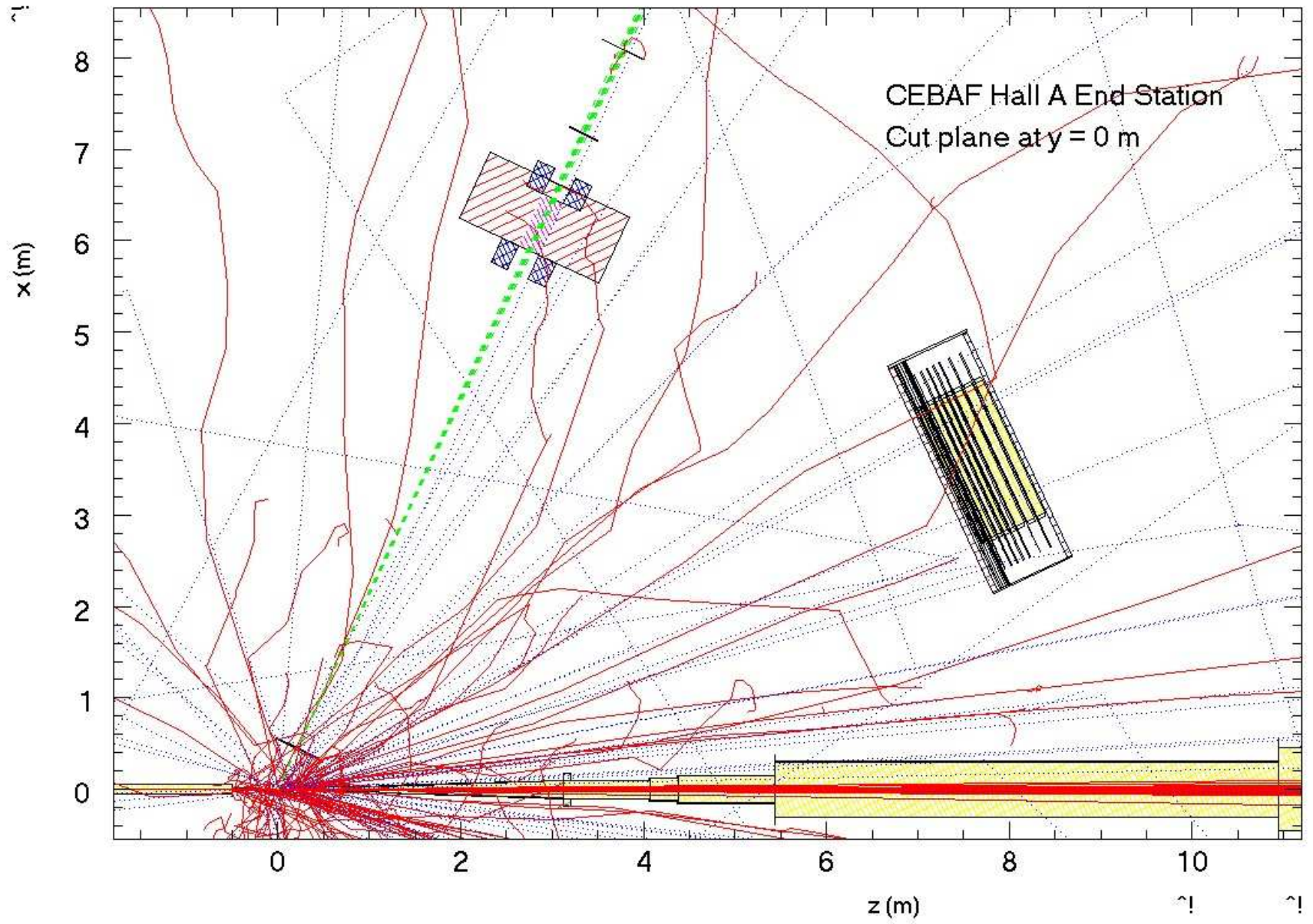
- Experimental study in a test setup
- Comparison with GEANT3 model results
- Predictions for GEN setup



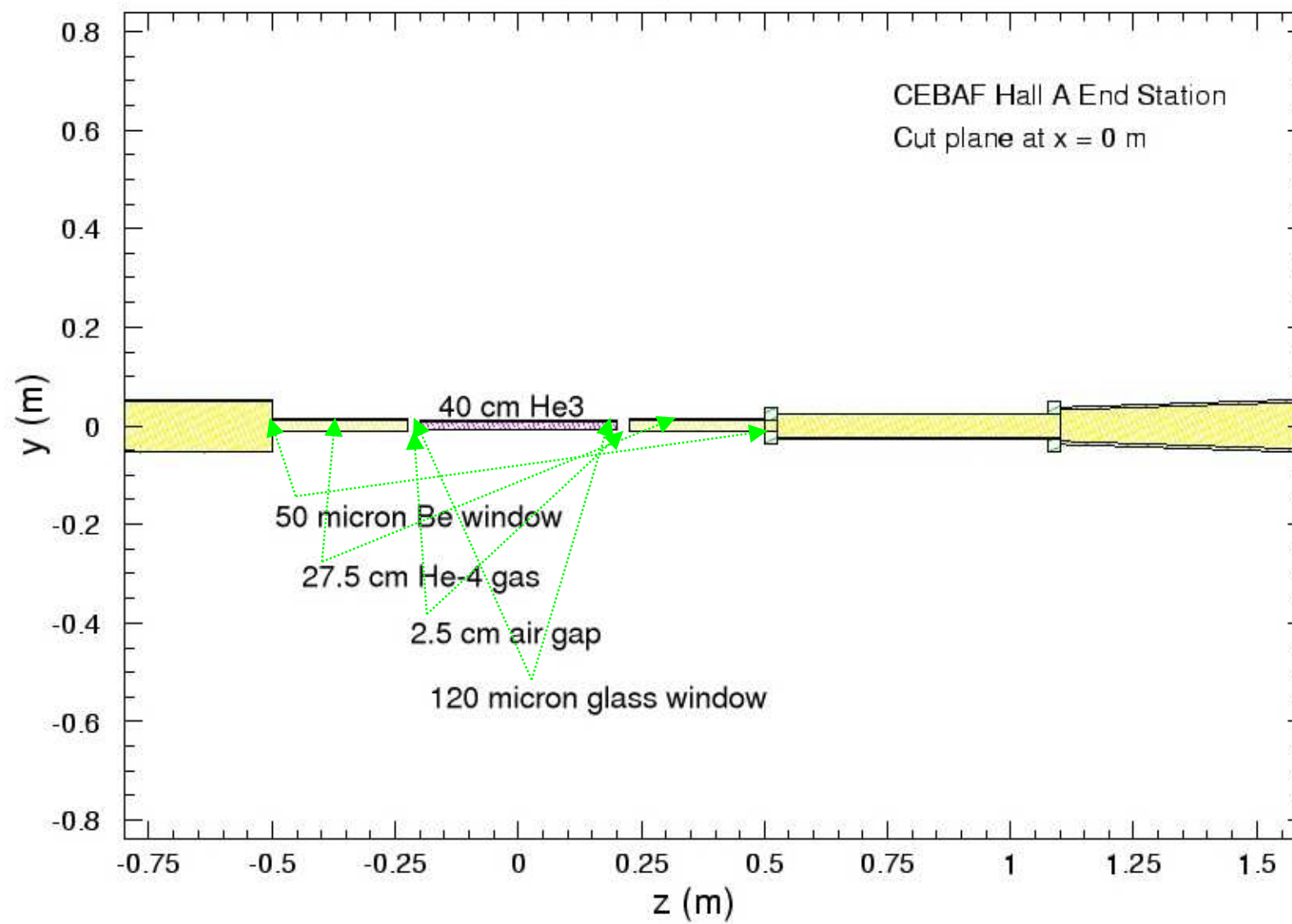




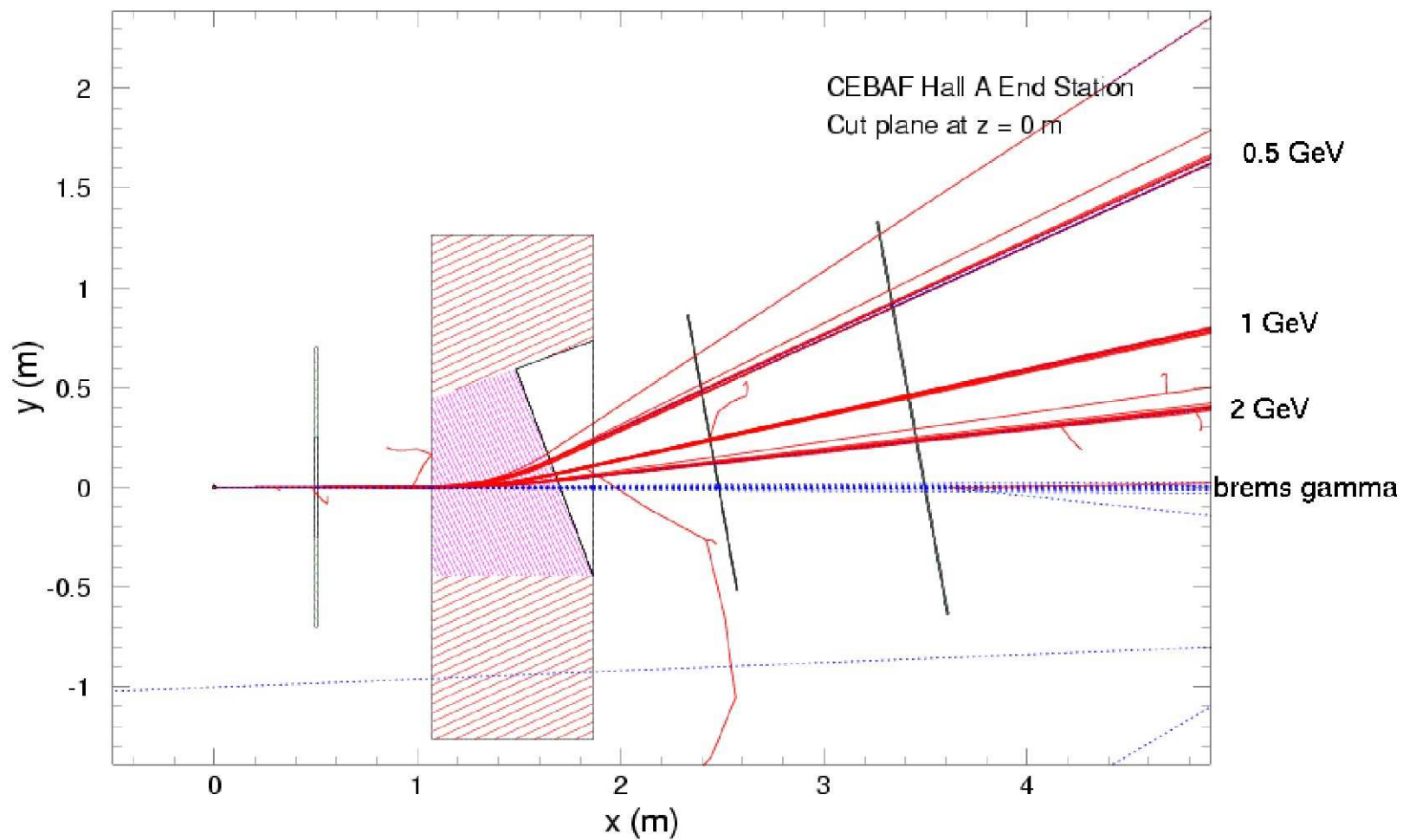
# GEN MWDC test setup GEANT3 model

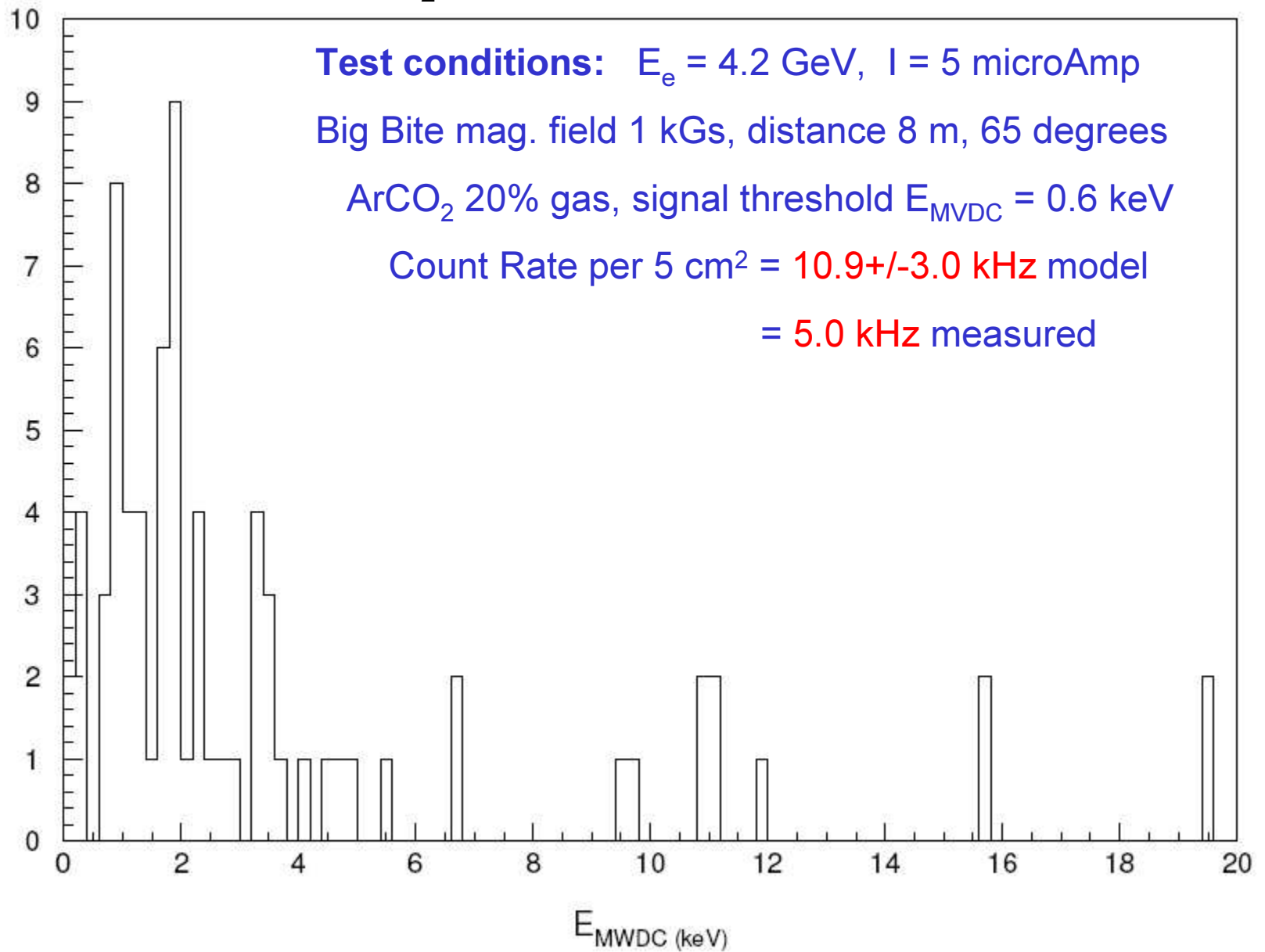


## GEN target region GEANT3 model



### BigBite GEANT3 Model, electrons at 0.5, 1.0, and 2.0 GeV



**N<sub>2</sub> gas at 10.7 atm 40 cm target**



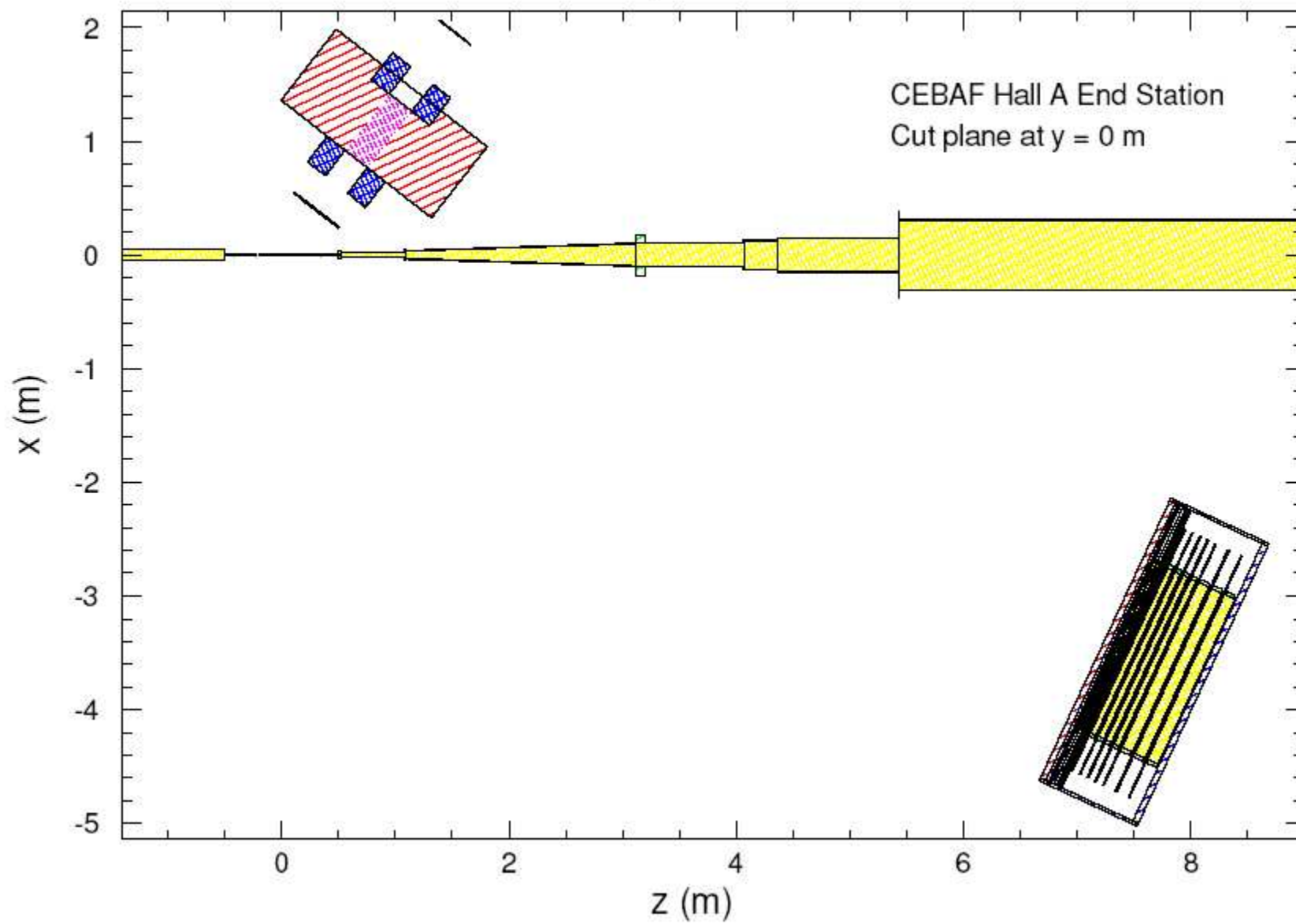
Simplifications in the model that may have contributed to the difference:

- Standard GEANT3 energy cutoff 10 keV; reliability of the low energy cross sections unknown.
- No interaction chamber included in the model; material around the target could stop low energy electrons.
- Possible uncertainty in the signal threshold calibration; how well do we know that the threshold used in the test was 0.6 keV; the threshold calibration procedure should be modeled in GEANT, too.

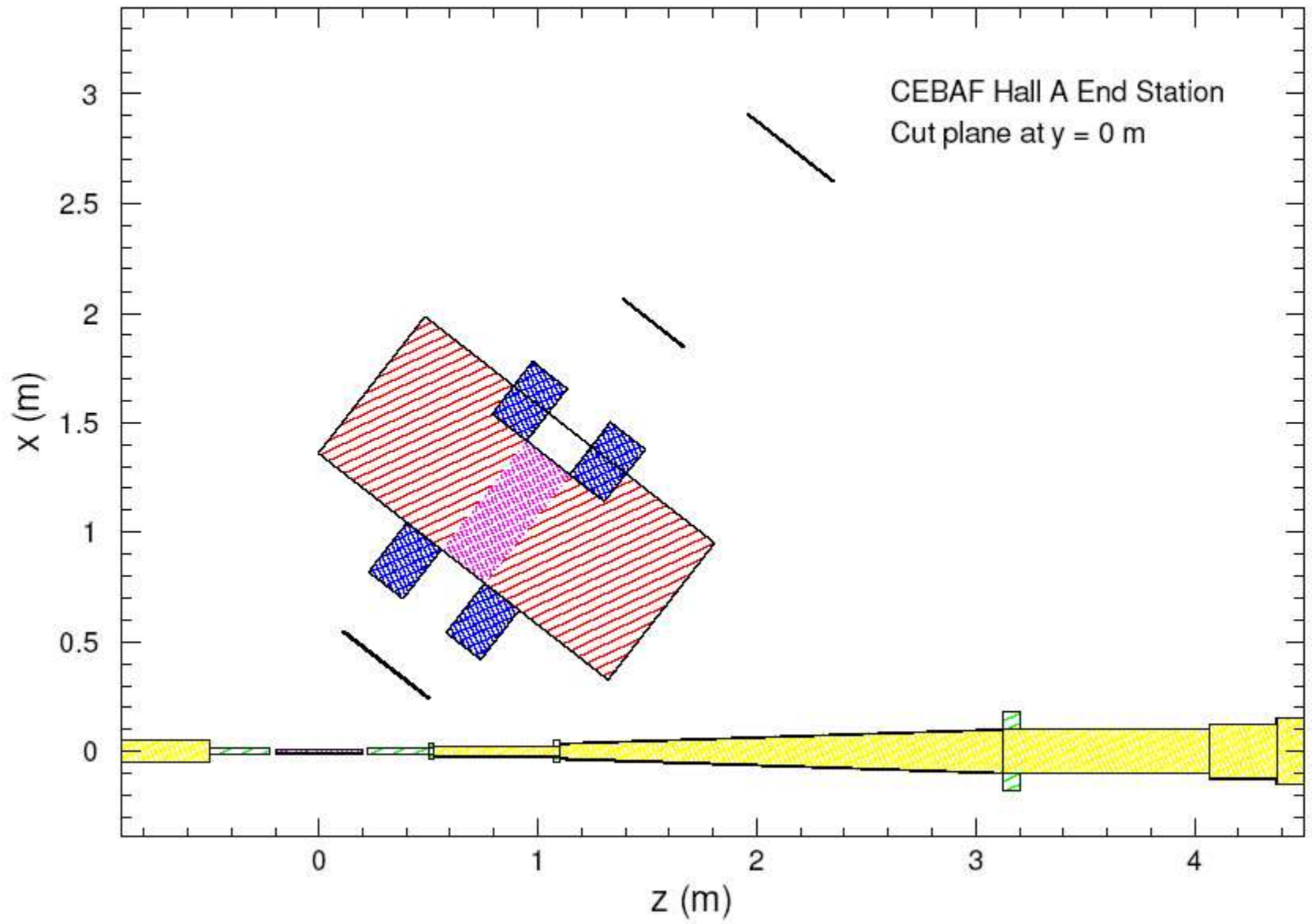
Still reasonable qualitative agreement

Predictions for GEN setup: change of distance, angle, beam energy, magnetic field.

## GEN Setup GEANT3 Model



# BigBite GEANT3 Model



## MWDC load estimates for the GEN conditions

- $E_e = 3.2$  GeV,  $I = 12$  microAmp, distance = 2.5 m, angle = 52 degrees, Big Bite magnetic field = 12 kGs, MWDC gas ArCO<sub>2</sub> 20% mixture,  $E_{\text{threshold}} = 0.6$  keV

Estimated count rates:

DC1: 31+/-6 MHz, DC2: 119+/-12 MHz

## Additional observations

- No difference (within ~30%) between setups with cell diameters 1.9 cm and 2.5 cm
- Modeling vacuum inside Big Bite results in doubling loads; looks like the air in the setup is a shielding against low energy electrons



## Conclusions

- Reasonable agreement between the GEANT3 model results and the test measurements
- Predictions for the MWDC count rates in GEN:  
DC1: 31+/-6 MHz, DC2:119+/-12 MHz
- Using GEANT3 for such calculations is at its limits; Geant4 should model low energy electromagnetic processes better
- More target region details needed in the model
- Shielding around the Big Bite arm might be useful; at least a wall shielding from the downstream beam line.