Simulation studies of trapezoidal GEM for CMS muon high eta upgrade

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Outline

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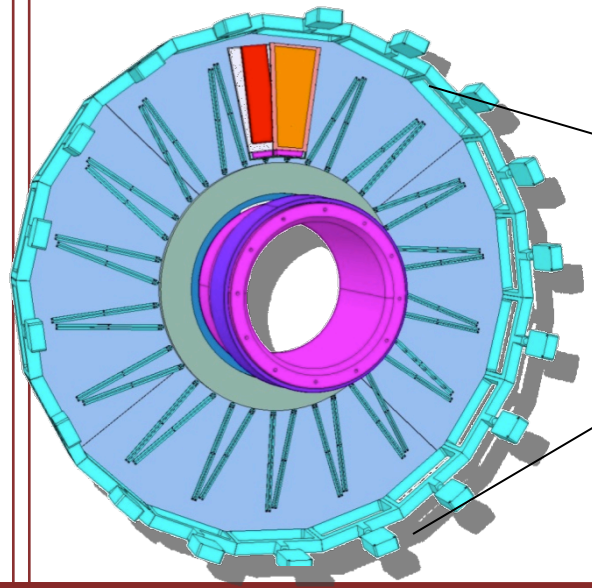
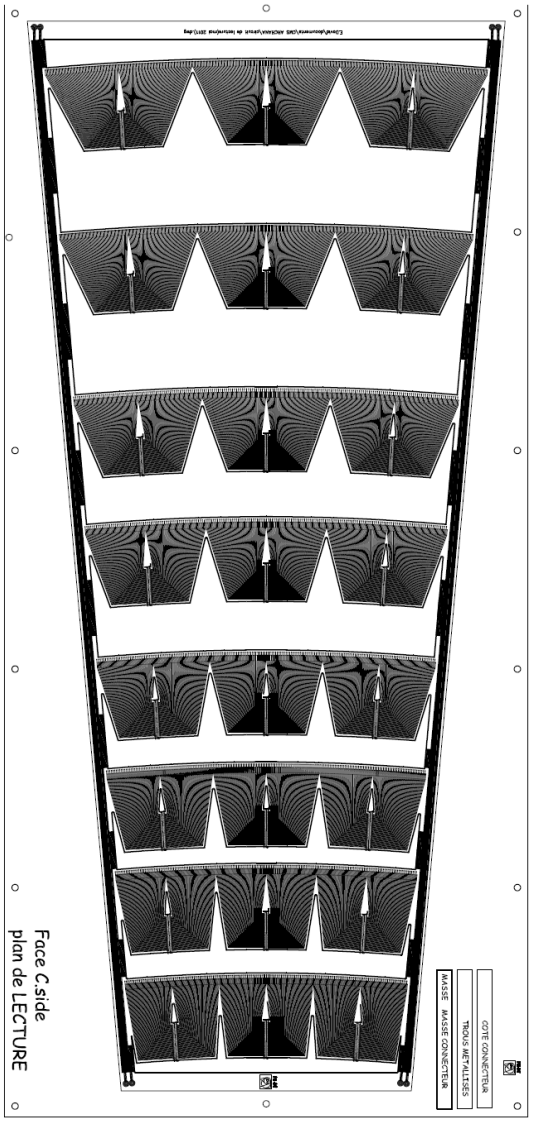
- Proposed GEM layout for high eta upgrade
- Simulation results
- Future work

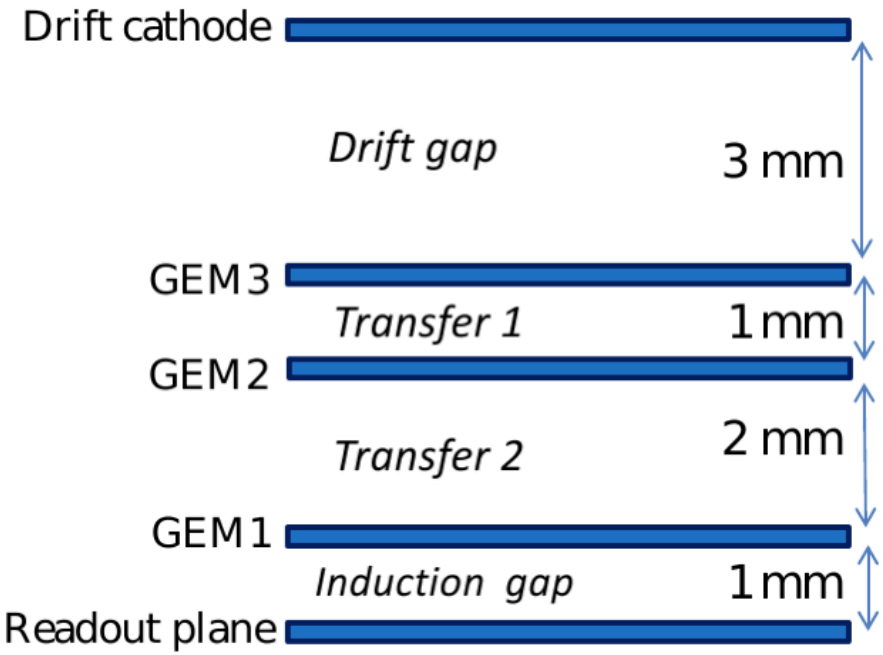
Proposed Layout

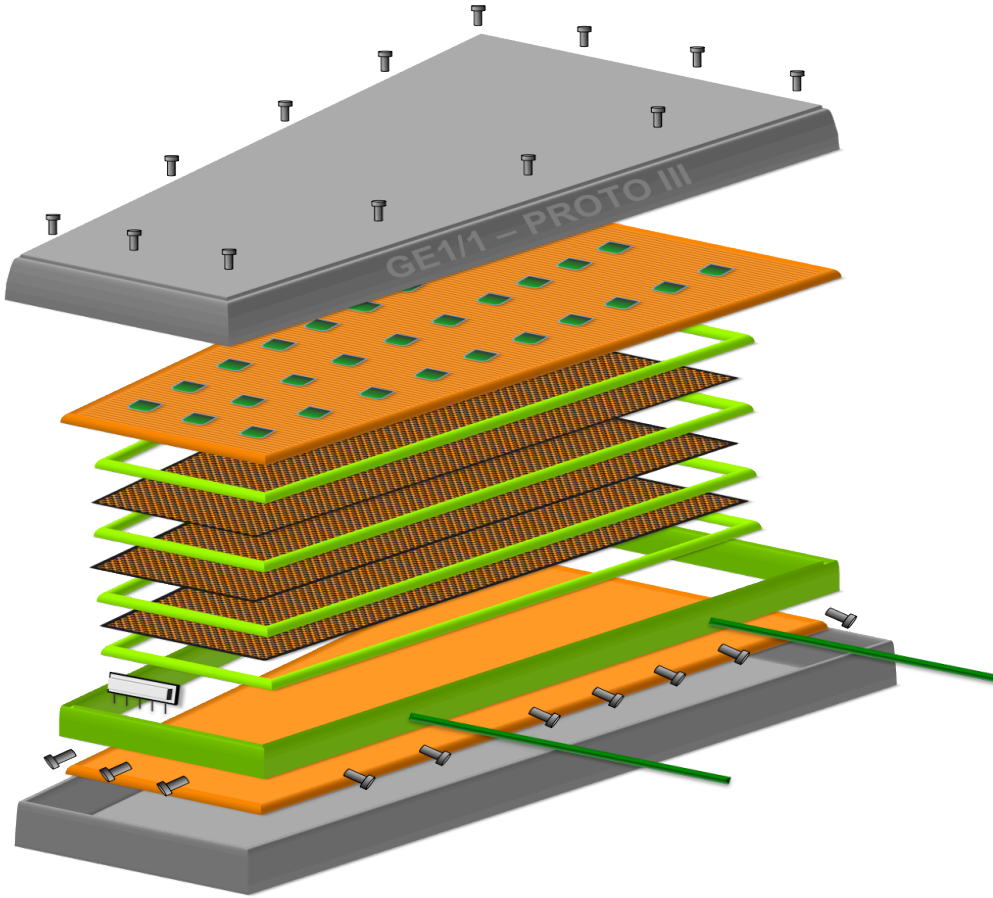
- Super Chambers (SC) equipped with triple GEMs
- each SC is a double readout layer
- Pitch from 0.6 to 1.2 mm





Proposed Layout: Super Chambers



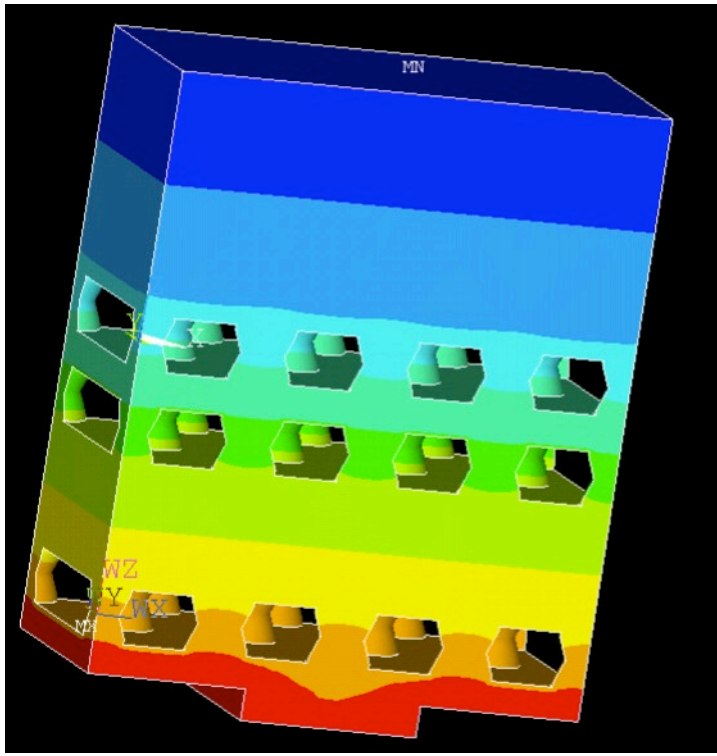


Large size Triple-GEM chamber (Super Chamber)

GEM Simulation

Full chain: ANSYS+GARFIELD

- Gain vs HV (Ar/CO2 + CF4)
- Gain vs pitch
- Gain vs hole size uncertainty
- Gain vs gas gap uncertainty



GEM Simulation

The simulation was done taken into account different values For Penning transfer coefficient:

$$G = e^{\alpha_{penning} . d}$$

$$\alpha_{penning} = \alpha(1 + r_p \frac{f_{exc}}{f_{ion}})$$

Excited level energy

Ionization potential energy

Results will be shown for different values of r_p

Gain vs HV: Ar/CO_2 70/30

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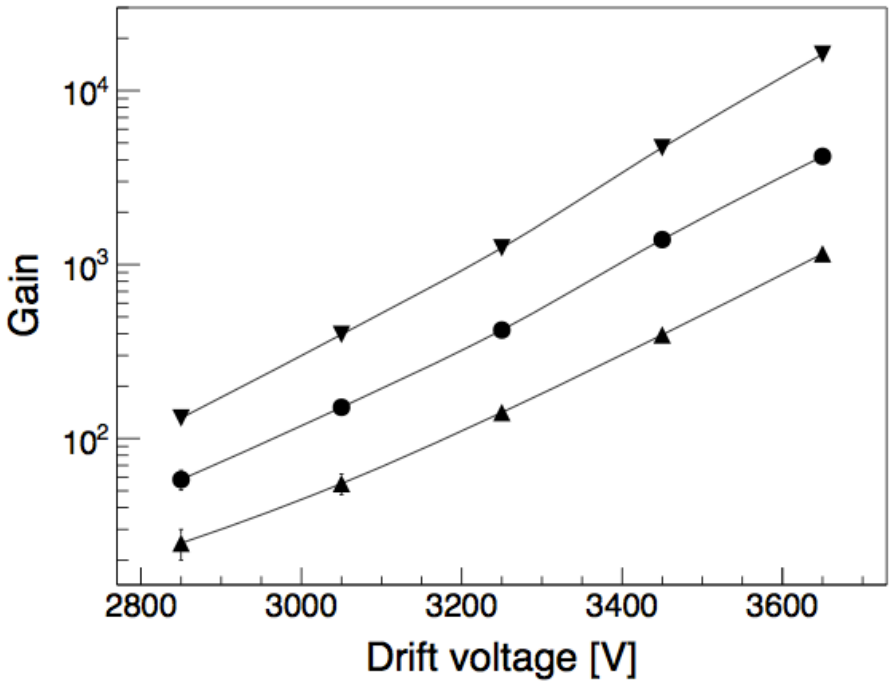
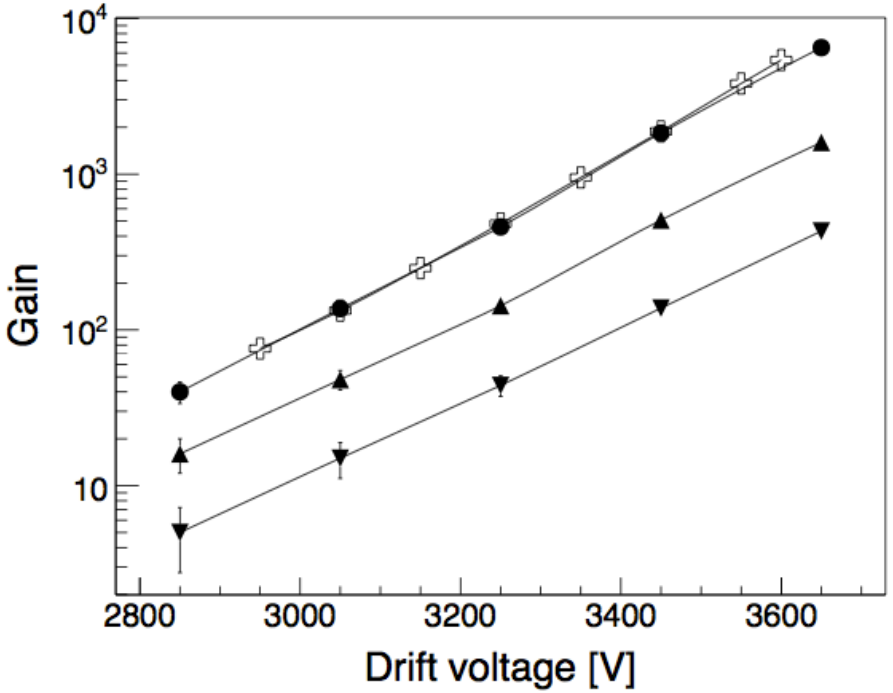
Total Gain



Effective Gain



r_p = 1, 0.7 and 0.4 from top to bottom

Crosses: experimental values

Gain vs HV: $Ar/CO_2/CF_4$ 45/15/40

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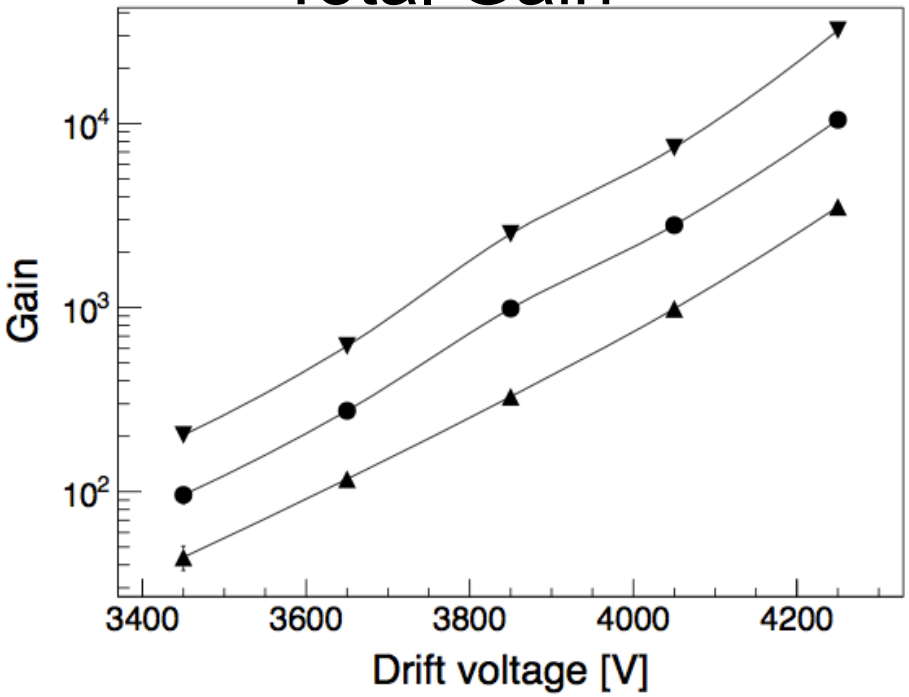
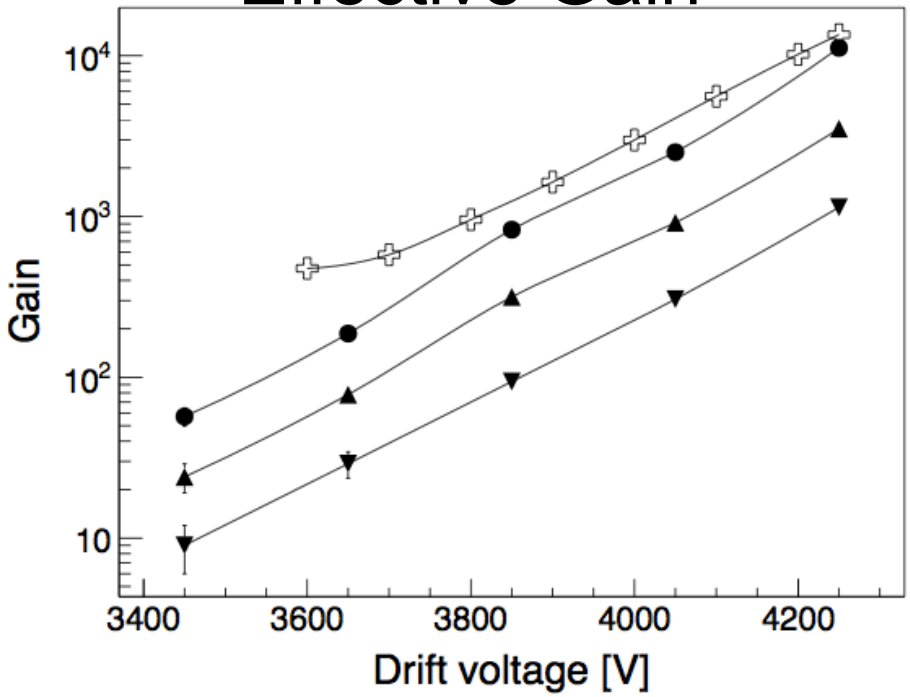
Total Gain



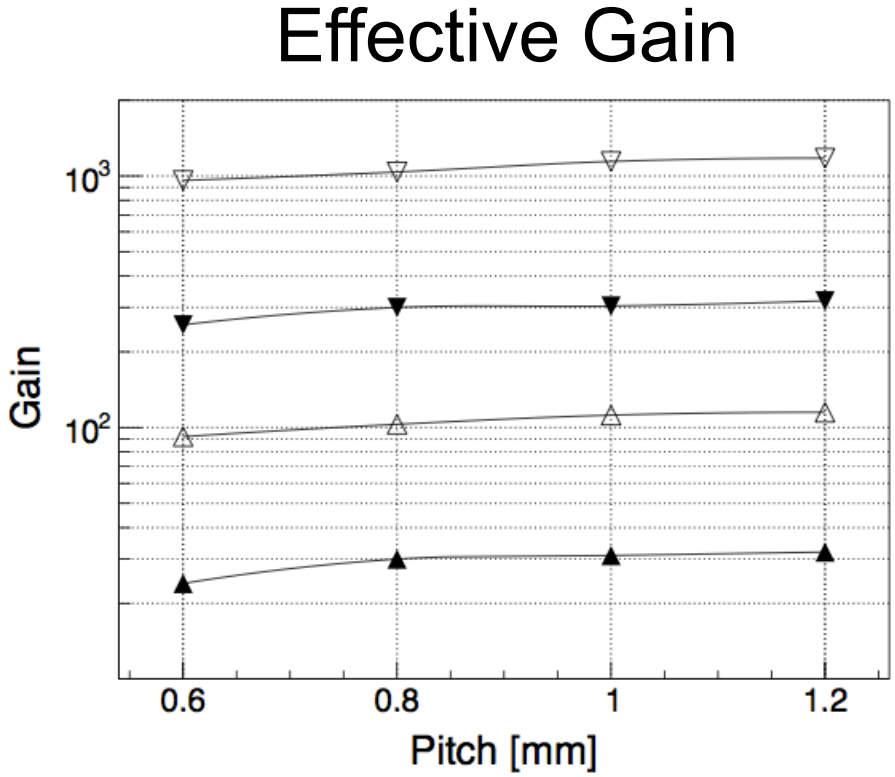
Effective Gain



r_p = 1, 0.7 and 0.4 from top to bottom

Crosses: experimental values

Gain vs pitch



HV= 3650, 3850, 4050 and 4250 from bottom to top

Less 15 % of gain variation can be observed

Gain vs Hole size uncertainty

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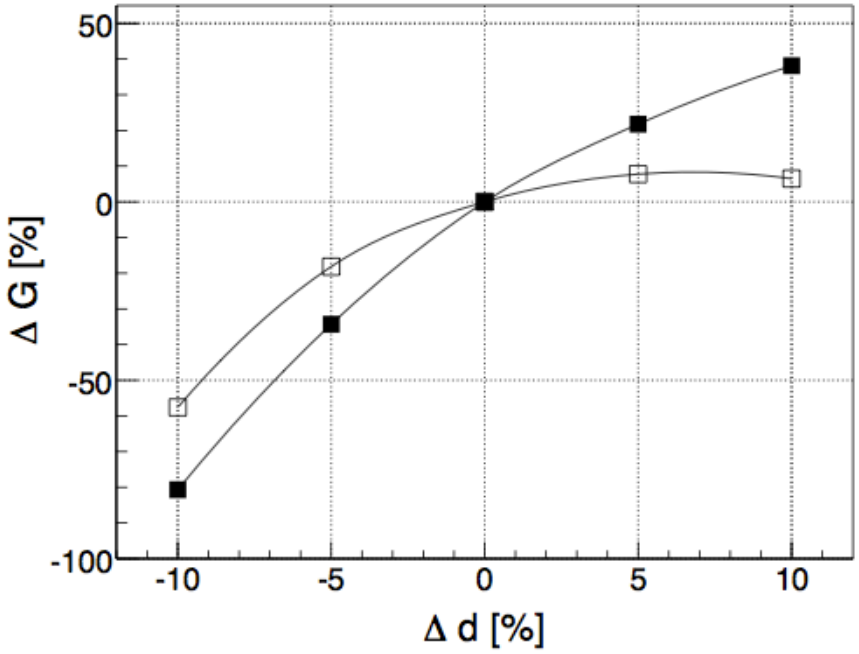
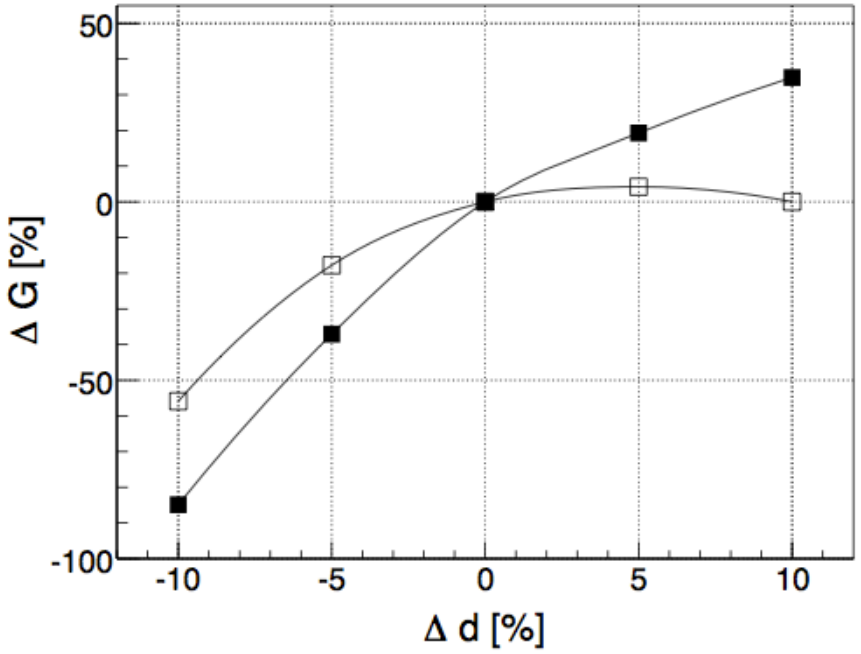
Hole inner radius



Hole outer radius



Open (full) circle: effective (total) gain

5% variation in hole diameter can lead to 20% variation

Effective gain is less affected

Summary and ongoing work

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- Extensive simulation work is undergoing
- Ongoing work:
  - Effect of gas gap variation on gain
  - Effect of temperature variation
  - Sensitivity studies (incident particle/electron energ
  - Alternative gas mixtures (Ne and He based)

What I did not show:

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- Gain versus gas gap variation
  (drift, transfer1, transfer 2 and induction)
- Gain versus temperature variation
- All results have been put in a paper/submitted to NIMA