Low Gain Data and NID simulations

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Simulation of NID and Low gain data

- Low Gain Simulations
 - GEM V: 400 V
 - Diffusion Parameters:

 σ_0^T : 350 μm σ^T : 120 $\mu m / \sqrt{cm}$ σ_0^L : 260 μm σ^L : 101 $\mu m / \sqrt{cm}$

- Energy
 - ER: 2,6,10,20,30,40,50
 - NR: 6,10,20,30,40,50,60,100
 - NR-QF: 2.5,5.4,14,23.4,33,42.8,49,92

NID Simulations

- GEM V: 440 V
- Diffusion Parameters:
 - σ_0^T : **173** μm σ^T : **38.2** $\mu m / \sqrt{cm}$ σ_0^L : 260 μm σ^L : 101 $\mu m / \sqrt{cm}$
- Energy
 - ER: 2,6,10,20,30,40,50
 - NR: 6,10,20,30,40,50,60,100
 - NR-QF: 2.5,5.4,14,23.4,33,42.8,49,92

Event Selection ED-440V

- Geometrical: sc_xmin & sc_ymin >350, sc_xmax & sc_ymax<1950
- Noise: rms >6 & tgausssigma x 0.152>0.5
- Alpha like tracks: length>20 mm & dEdA >1 & Energy >200 keV



- Geometrical: sc_xmin & sc_ymin >350, sc_xmax & sc_ymax<1950
- Noise: rms >6 & tgausssigma x 0.152>0.5
- Alpha like tracks: Energy >200 keV

ED-400V

- NID
- Geometrical: sc_xmin & sc_ymin >350, sc_xmax & sc_ymax<1950
- Noise: rms >6 & tgausssigma x 0.152 > 0.15







Energy Calibration





 Energy calibration using 6 keV ER from all the data. 6 keV ER looks saturated even at the farthest distance from the GEM in ED-440V data.





Energy -MC-6keV-ER 50 mm 100 mm 300 150 mm 200 mm 250 mm 💴 300 mm 250 350 mm 25 🔲 400 mm 450 mm 200 20 15015 10010 50 10 0.0 2.5 5.0 7.5 2 8 Energy [keV]

saturating.

ED-400V

NID



Simulations with 400V on GEMs and also NID, shows that 6 keV ER is not



Energy Linearity ED-440V



- and NR.
- negative ions.

ED-400V

NID

Simulations with NID and 400 V on GEMs shows good linearity for both ER

• NID is simulated without saturation, to account for the drift velocity of the

Energy Resolution ED-440V



- and NR.
- Energy resolution of Fe calibration data is also compatible with the MC simulation for both ED-440V and ED-400V data.

ED-400V

NID

Simulations with 400V on GEMs shows good energy resolution for both ER

	ER-NID						
	NR-N	iiu					
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	-						

ED-440V



 In ED-440V, NR band is populated with NR energies upto 1 MeV. In ED-440V and NID, NR band comes from NR recoils only upto 60 keV.

ED-400V

NID

Length without removing the MIP band **ED-440V ED-400V** NID



- Since selection is only on Energy, the longer tracks (MIP like tracks) of lime data could be these events with length greater than 250 pixels.
- Tracks with length larger than 250 pixels have low slimness and low energy density (orange distribution in







Length after removing the MIP band



- Red curve shows the selection of MIP band. All the events below red curve are discarded, thus giving a better match between Data and MC.
- Selection for MIP is only applied to ED-440V LIME background data.
- In ED-400V LIME background data, we don't see any MIP band.





Shape Variables Comparison ED-440V ED-400V



NID

Energy density shows better discrimination as we go from ED-440V to ED-400V and NID.

This is because with ED-400V and NID, NRs saturate less thus giving better discrimination.

Also in ED-440V, NRs are simulated upto 1 MeV, but in ED-400 and NID they are only upto 60 KeV.







Diffusion Calculation ED-440V ED-400V



• 6 keV ER simulated data

• Fit: $\sqrt{\sigma_0^2 + z[cm]\sigma_T^2}$, z is distance from the GEM in cm. 12

NID

Diffusion Calculation ED-440V ED-400V



Fe Calibration data

NID

Diffusion Calculation

	$\sigma_0^{ED}[\mu m]$	$\sigma_T^{ED}[\mu m/\sqrt{cm}]$	$\sigma_{0}^{400}[\mu m]$	$\sigma_T^{400}[\mu m/\sqrt{cm}]$	$\sigma_0^{NID}[\mu m]$	$\sigma_T^{NID}[\mu m/\sqrt{cm}]$
Simulation Paramters	350	120	350	120	~173	~38.2
6 keV ER MC	528.7	116.2	485.5	88.6	222	38.2
Fe Calib Data	536.8	113.2	462.7	86.4		

Why there's tail in Energy Density plot?



Tilt in the Z-direction creates the tail in the distribution of dEdA as can be seen in simulated ER and

This spread is not so much in the LIME data, and as a result NR and ER band starts to separate at lower energies compared to

