Lime-AmBe analysis with ML

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Data used:

- AmBe runs [Run3]
 - [23821-24318]
 - only source_type == 2 data
- Background runs [Run3]
 - [22726-23762]
 - Golden runs

- AmBe Simulations
 - New simulations for 10cm Cu shielding

Data Selection:

- Geometrical cut:
 - Rectangular cut: sc_xmin>400 & sc_xmax<1900 & sc_ymin>400 & sc_ymax<1900
- Noise:
 - sc_tgausssigma*0.152 >0.5
 - sc_rms >6
- Cut for High energy tracks:
 - Exclude events with sc_length*0.152 > 20 & dEdA >1
- Cut on energy:
 - Energy < 200 keV

Energy Calibration using LY from Stefano's method.

Geometrical Cuts



Cuts and number of events survived:

	Circular Cut	Circular+ NR cuts	Rectangular cut	Rectangular + NR cut
Bkg Run 3	55290	148	18536	141
Ambe Run	45428	596	13687	550
MC - ER	1551	1	300	5
MC- NR- Geant	791	100	828	268
MC-NR-Srim	1090	140	1164	317

NR cut: dEdA>0.9 & dEdA<1.7 & Energy <60 keV

Comparing Shape Variables for NR events:



Comparing Shape Variables for NR events:



0.8

0.6

slimness

1.0

1.2

0.0

0.2

0.4









Supervised Approach

- Used AmBe simulations + BKG data [run3] for training.
 - Reason: expected NR events in BKG is ~1000/year
 - Bkg data selection: dEdA <0.7 and slimness < 0.8
- Variables: Energy, dEdA, dEdX, SDCD, CylThick, ChargeUnif, LAPA, MaxDen, eta, slimness, size, tgausssigma



Prediction:



0 :ER 1: NR

Predicted events:



Semi-Supervised Approach:

- AmBe simulations as the labeled data
- 50% of AmBe Lime data as unlabeled



Results:



Prediction score while labelling the un-labelled data.
Prediction on the LIME data.

Predicted Events:



Predicted NR events from GBC and RFC models with probability greater than 99% and 98% respectively.