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# Attempts to event filtering from hits in detector

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# Outline

- 50K MC sample of hit coordinates;
- No tracking or clustering applied….
- Can one filter ‘interesting’ event before reconstuction?
- As ‘interesting’ events one may consider events with single muon, events with dimuons (possibly coming from a common vertex), events with prompt tracks of any kind, events with high multiplicity, events with pT imbalance, etc.
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- ~30% events contain muons;
- ~3% of events contain mu+mu- pairs.
- Average track multiplicity ~15-20 per event.
- Information used: layer number, x-, y-coordinates  of the hits;
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- PyKeras based NN is applied
- 400 coordinate hits are used by default for NN input (x and y coordinates of hits in the first 10 layers)
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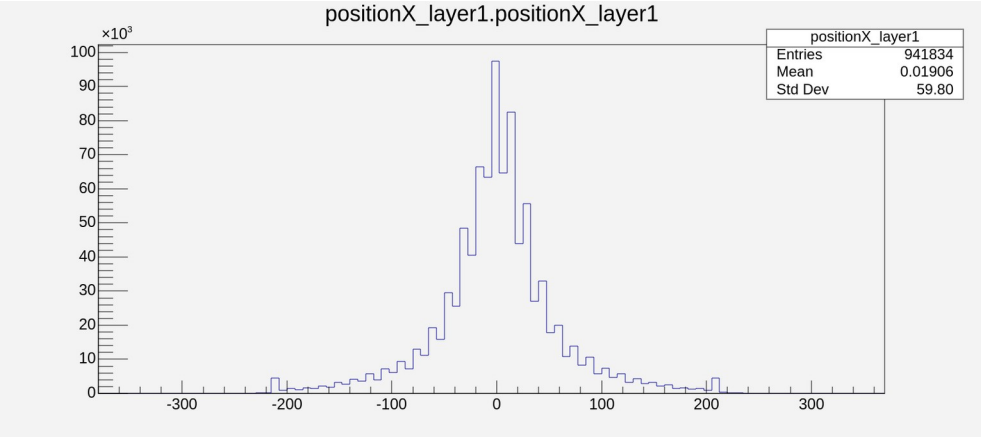
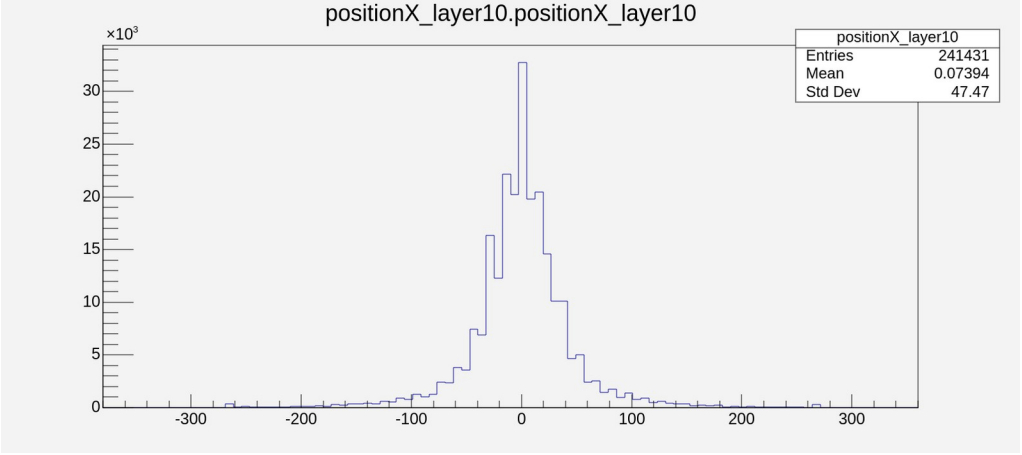
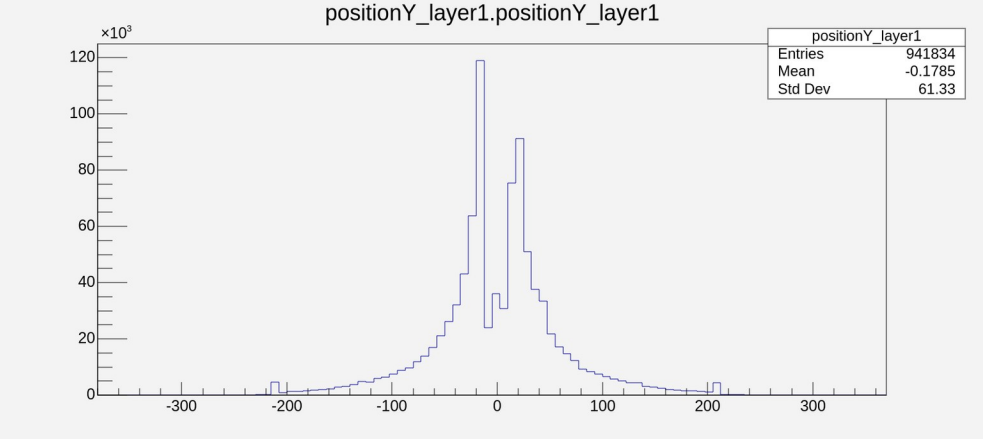
- RMSProp training algorithm
- 1000 (tanh), 800 (tanh), 400(tanh), 80(tanh) fully connected NN structure

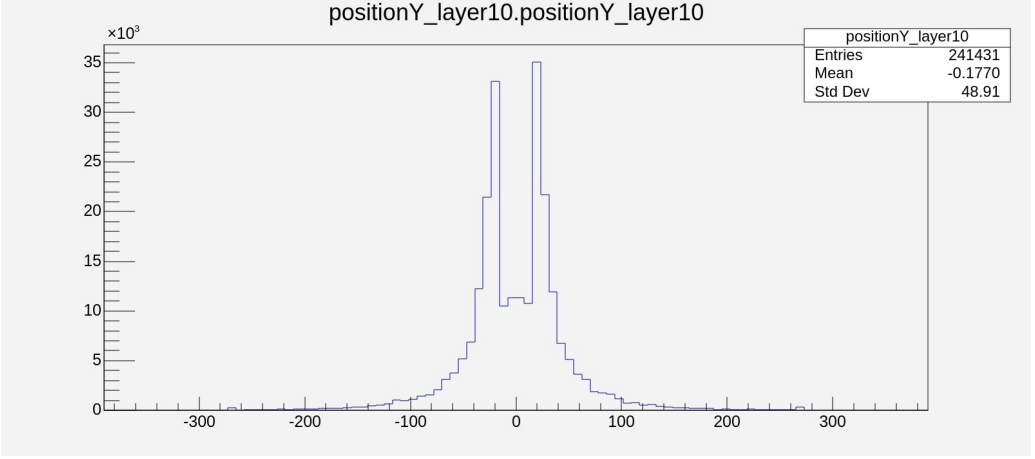
# Input information

Hit coordinates in all 20 layers are used as input for NN

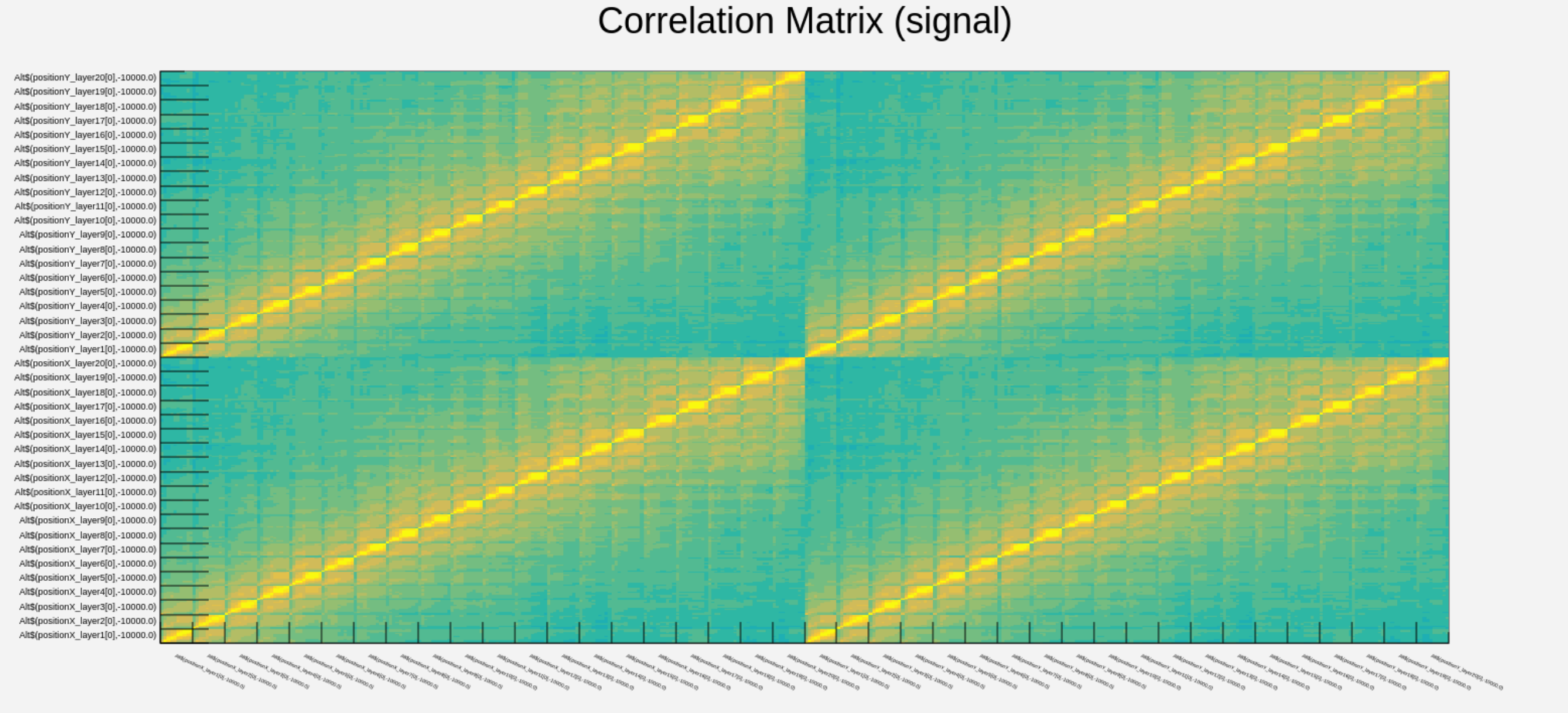


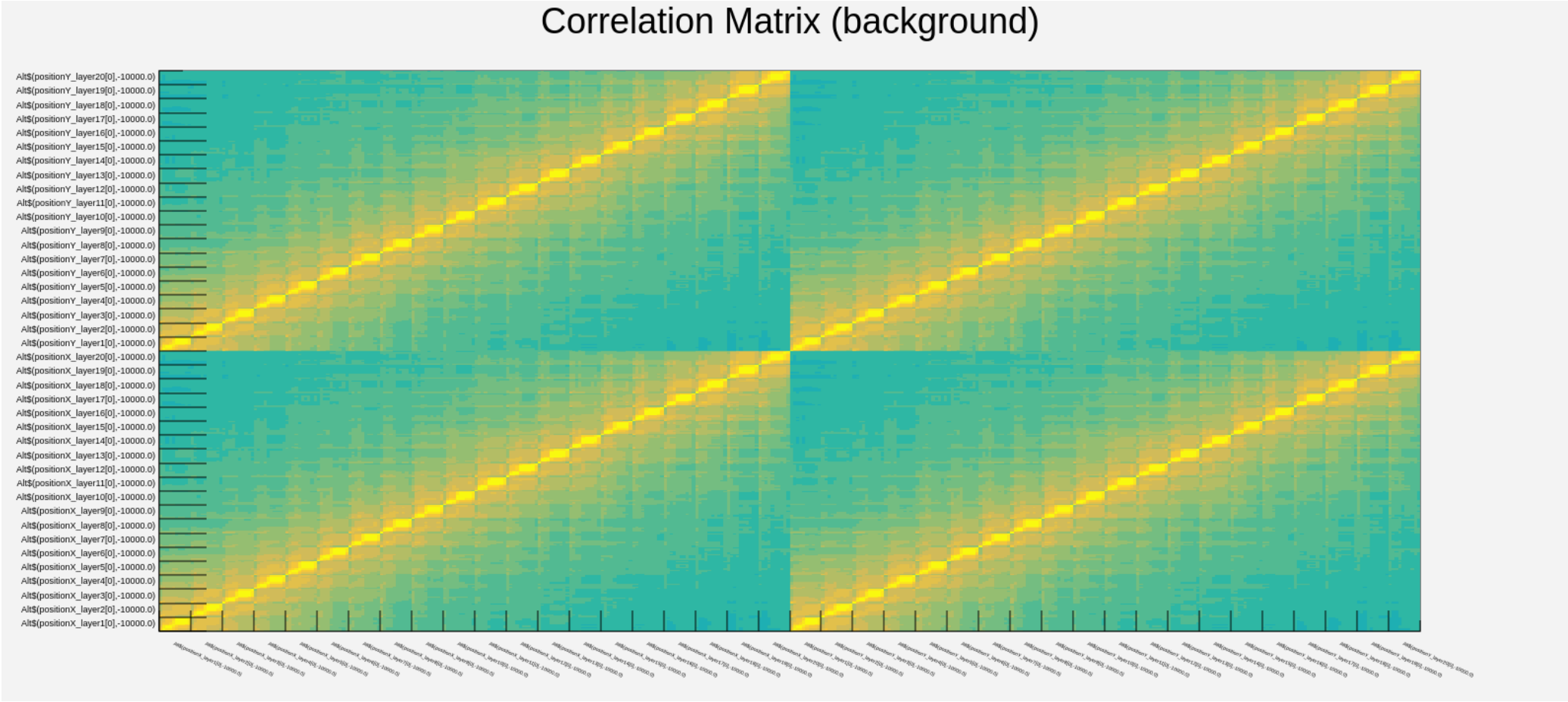



# Input information



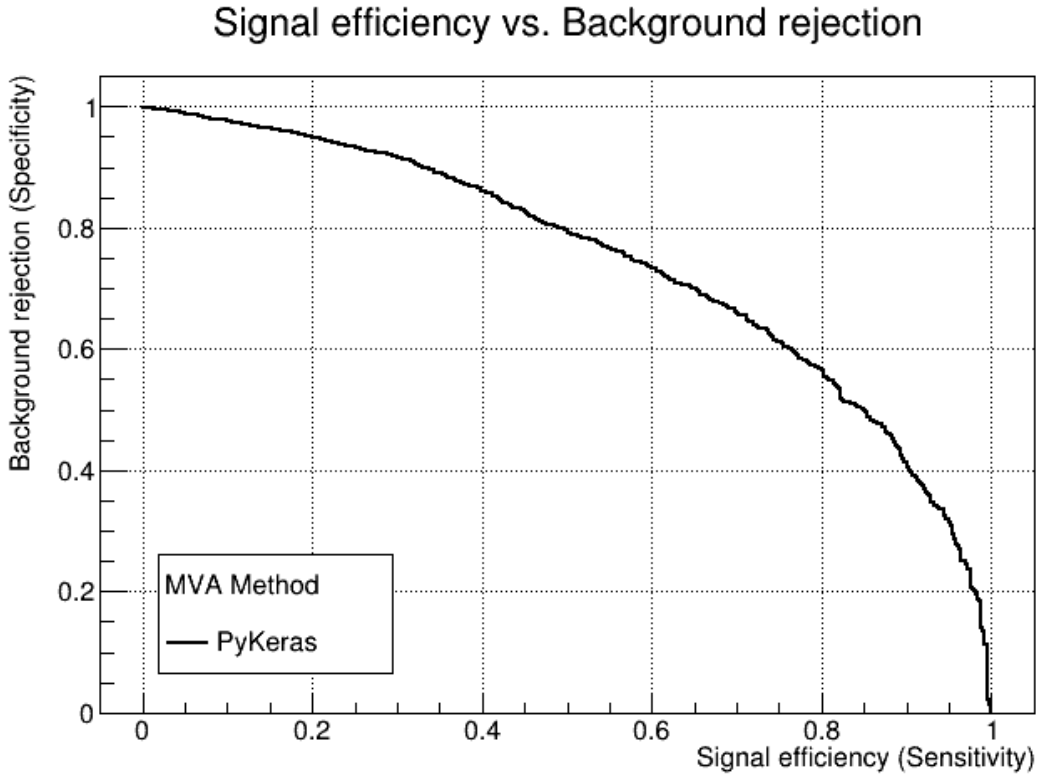

- Signal contains pair of muon + antimuon
- Expectedly high correlation of the hit coordinates in the neighboring layers
- Expectedly higher hits rate in outer part of tracker...

# Input information




- Expectedly high correlation of the hit coordinates in the neighboring layers

- Di-Muon events is signal




- AUC = 0.90 for both cases
- ~90% of di-muon events can be kept with cutting out 50% of background
- AUC = 0.75 which is not impressive…
- Single muon events are hardly distinguishable from the ‘no-muon’ background.

# Conclusions

- Distinguishing different types of tracks/events is (in principle) possible before clusterization or/and track reconstruction applied. Possible hardware implementations...
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- Realistic MC sample with higher multiplicity and fake hits dropped performance of classification as anticipated
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- Additional selections may be applied to signal (pT thresolds, good common vertex, etc), which will distinguish signal from BG (in progress)… fully reconstructed events needed.
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- Realistic approach will probably apply classification alongside the reconstruction algorithms (like HEP.TrkX or TrackNetV3) as an extension of these algorithms (in progress)...