VII. Understanding the Infrared

1) Regioni Soft e collinear

2) Separare l'ampiezza

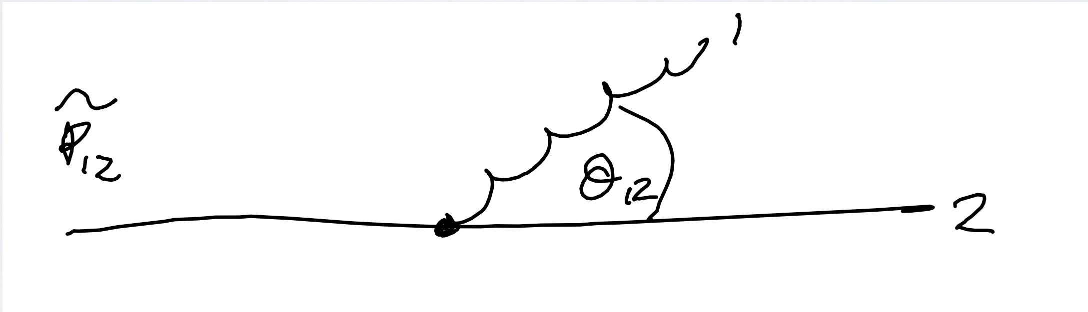
3) Secondo tentativo

1.1)

Infrared limits

$$s_{ij} = E_i E_j \left(1 - \cos(\theta_{ij})\right)$$

(see notes)



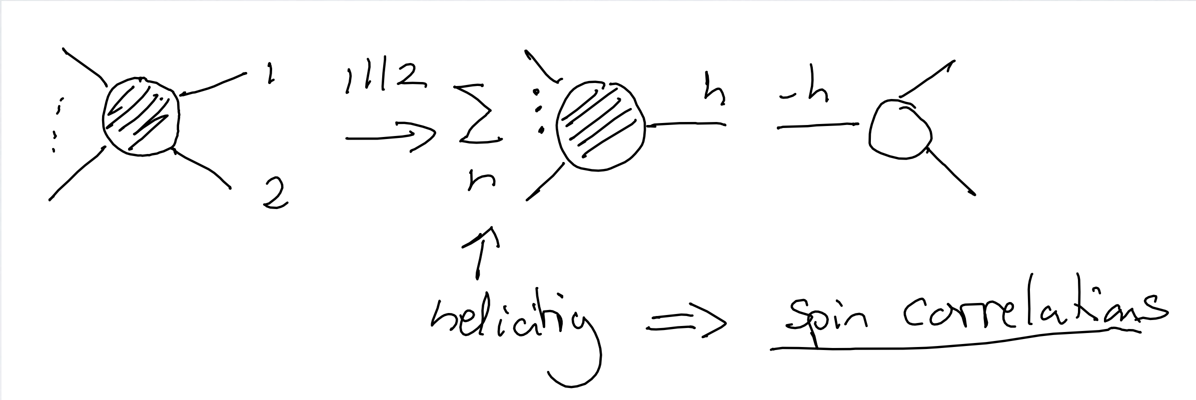
$\theta_{ij} \to 0$ collinear

$E_i \to 0$ soft

1.1)

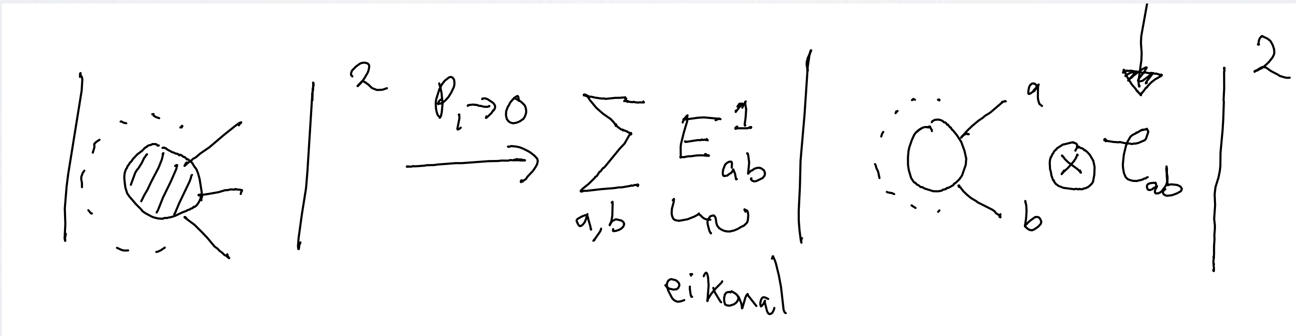
Factorisation

collinear



colour space factor

soft



2)

FKS sectors

(see notes)

$$S_{ij} = \frac{1}{D} \frac{1}{s_{ij}}$$

where $D = \sum_{i,j} 1/s_{ij}$

use FKS factors to separate divergences into different sectors

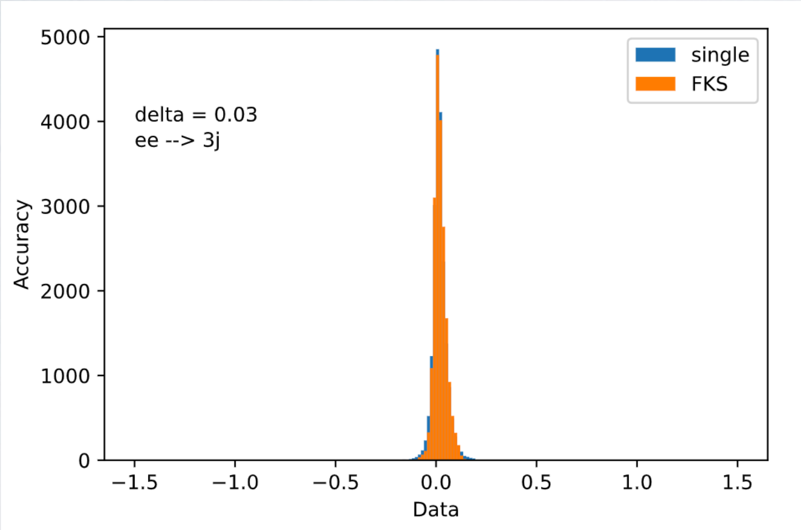
$$\langle |A|^2 \rangle = \sum_{i,j} S_{ij} \langle |A|^2 \rangle$$

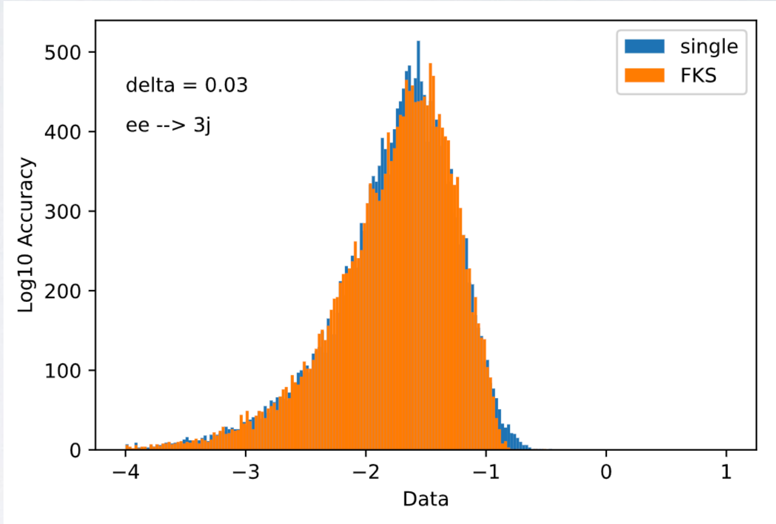
train more networks - each with simpler features

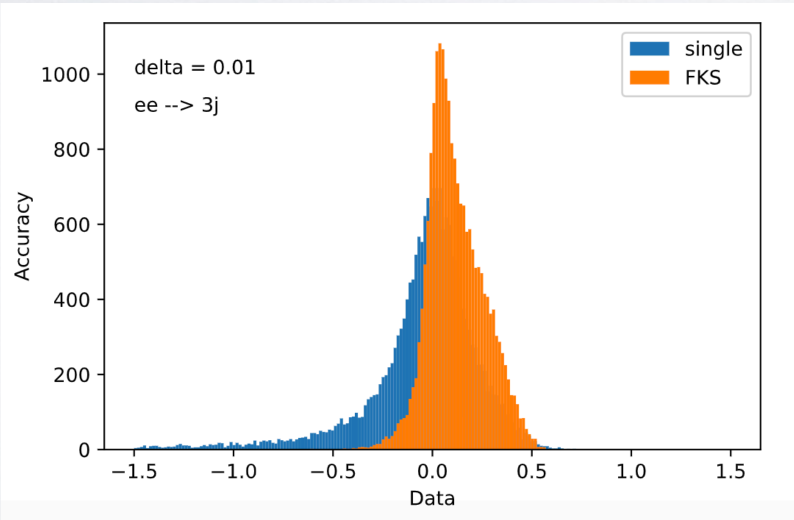
3)

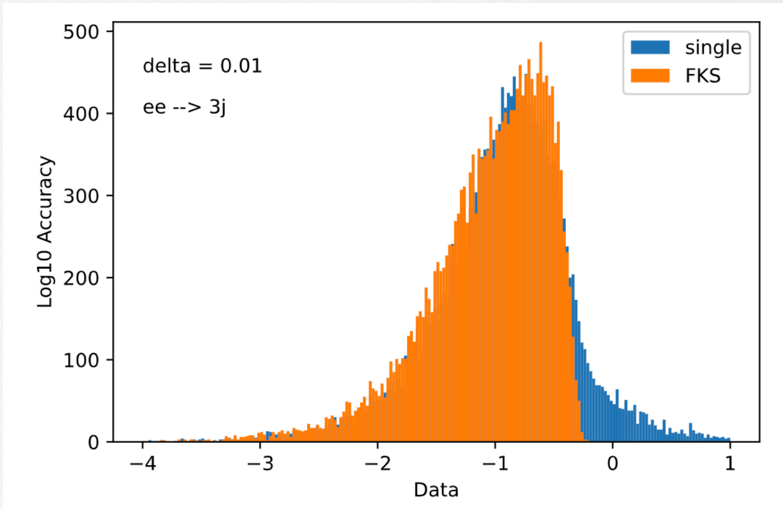
Second attempt

`from NNamps/NNNJet_FKS.ipynb`



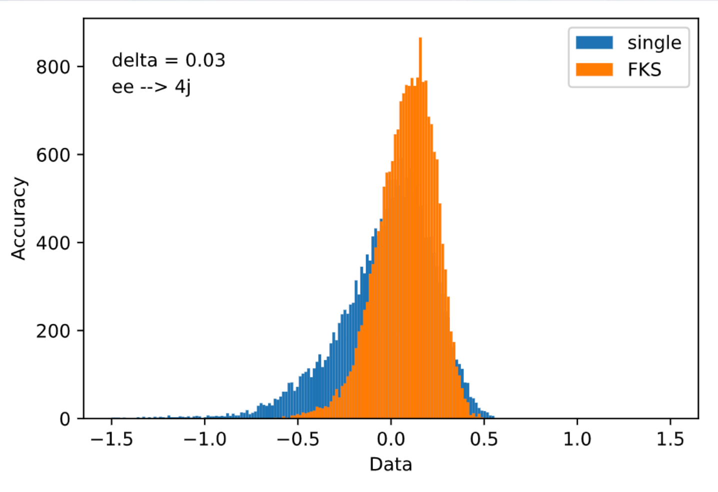


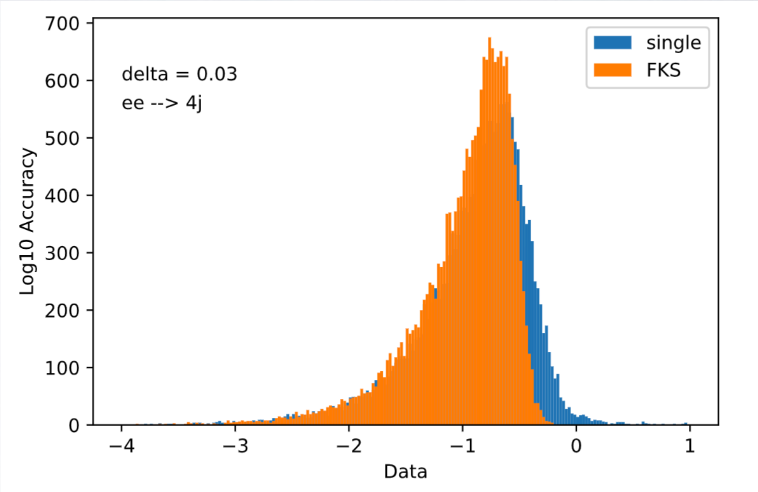


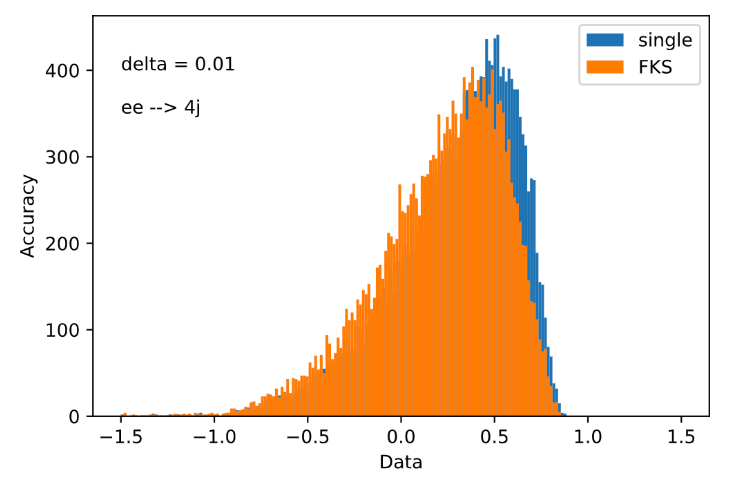


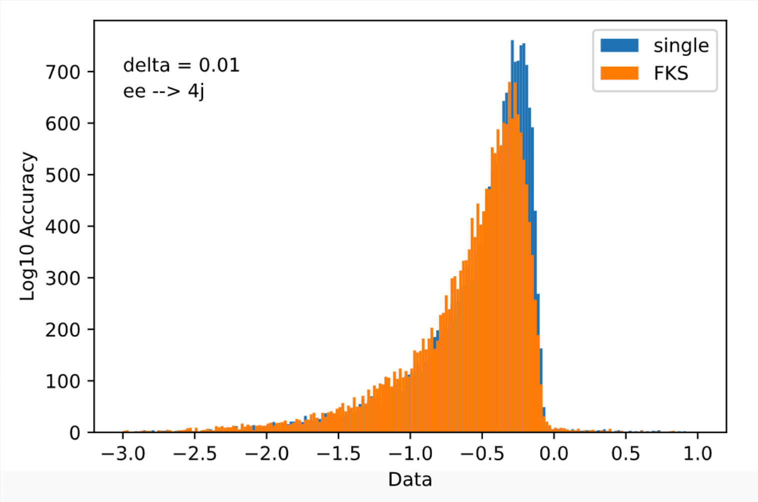
3) Second attempt

`from NNamps/NNNJet_FKS.ipynb`







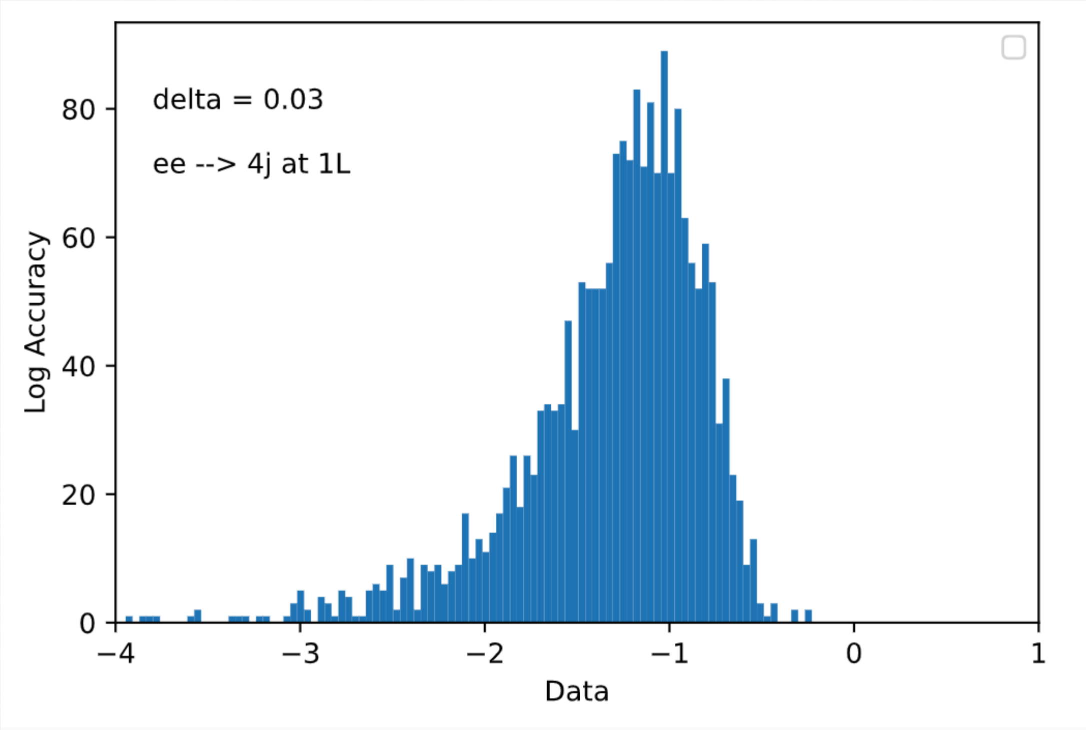


3)

Second attempt

`from NNamps/NNNJet_eejets_1L.ipynb`

for $e^+e^- \rightarrow 4j$ at 1-loop, the generation of the training data is already the bottleneck. Speed up is roughly $N_{inference}/N_{training}$



3)

Improvements?

There are many things that would be nice to try from here

- ensuring input variables are the independent invariants
- making sure the training and early stopping parameters are sufficient, did we train enough?
- check other preprocessing of the initial data, e.g.

$$\hat{y}_i = \log(1 + y_i/\sigma_y)$$

- can we improve the loss function?
- other ideas?