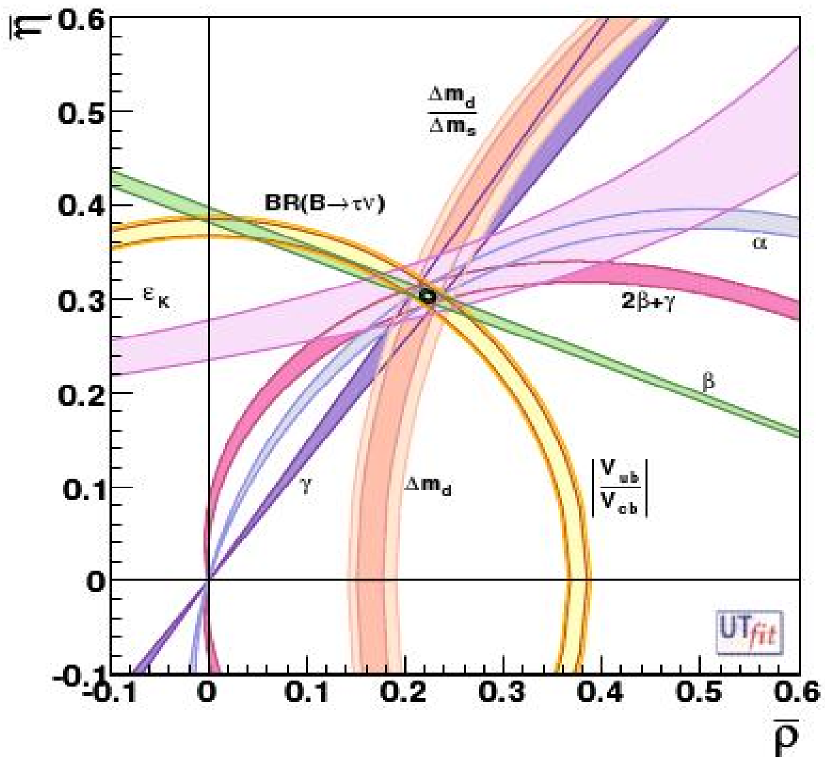
XIII SuperB General Meeting, Isola d'Elba, 31/05/2010

IFR Optimization



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Outline

- **IFR configurations results of the last General Meeting;**
  - **Do we need an extra layer?;**
  - **Preliminary results of BDT using a configuration with 8 and 9 layers;**
  - **Preliminary results of BDT adding noise and real detector efficiency;**
- **K_L first studies;**
  - **E_{DEP} : K_L energy lost in EMC;**
  - **FirstLayer and LastLayer distributions;**
  - **K_L Cluster size (iron cm);**
  - **A very loose K_L selector to compare configurations with 8 and 9 active layers;**
- **Summary.**

Results of the last Meeting

|=|=|========|============|============|=======|=====|
|2|2| 16 | 24 | 24 | 14 | 10 |

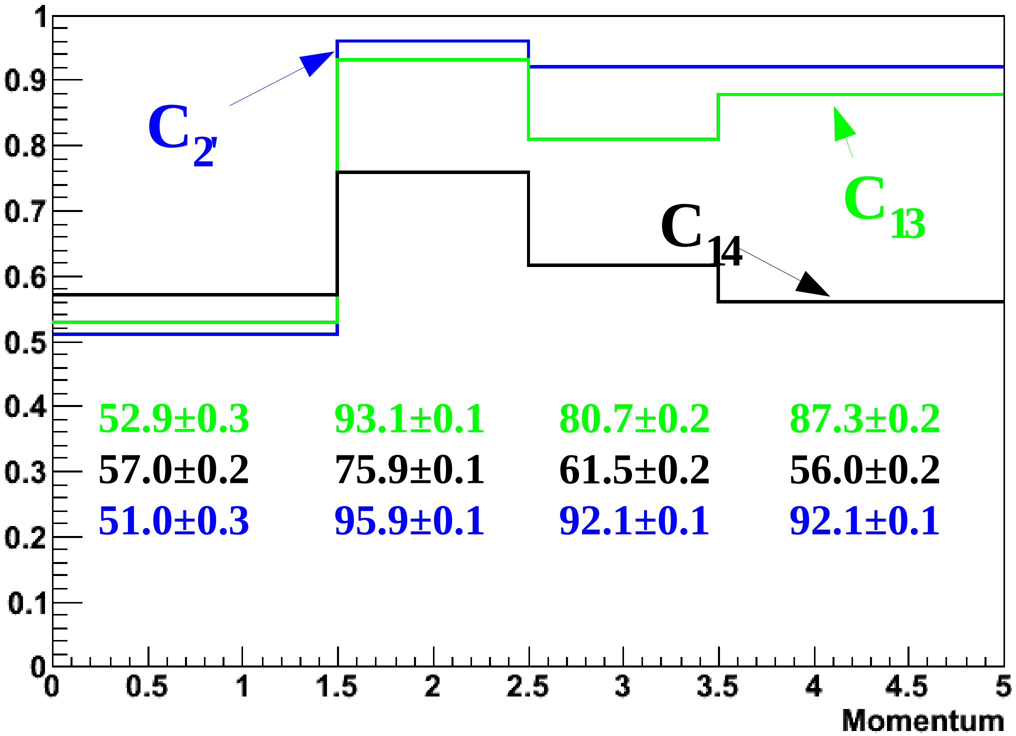
$C_2' \sim 920mm$

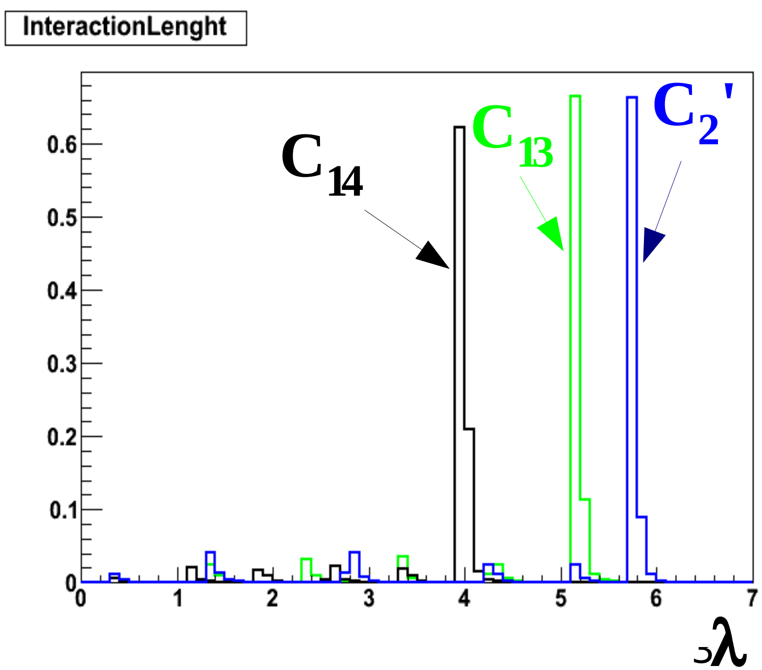
|=|=|========|========|========|========|=======|
|2|2| 16 | 16 | 16 | 16 | 14 |

$C_{13} \sim 820mm$

|=|=|======|======|======|======|=====|
|2|2| 12 | 12 | 12 | 12 | 10 |

$C_{14} \sim 620mm$





Do we need another active layer?

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|=|=|========|============|============|=======|=====|
|2|2|   16    |     24     |     24     |  14   |  10 |
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C_{8L} ~ 920mm

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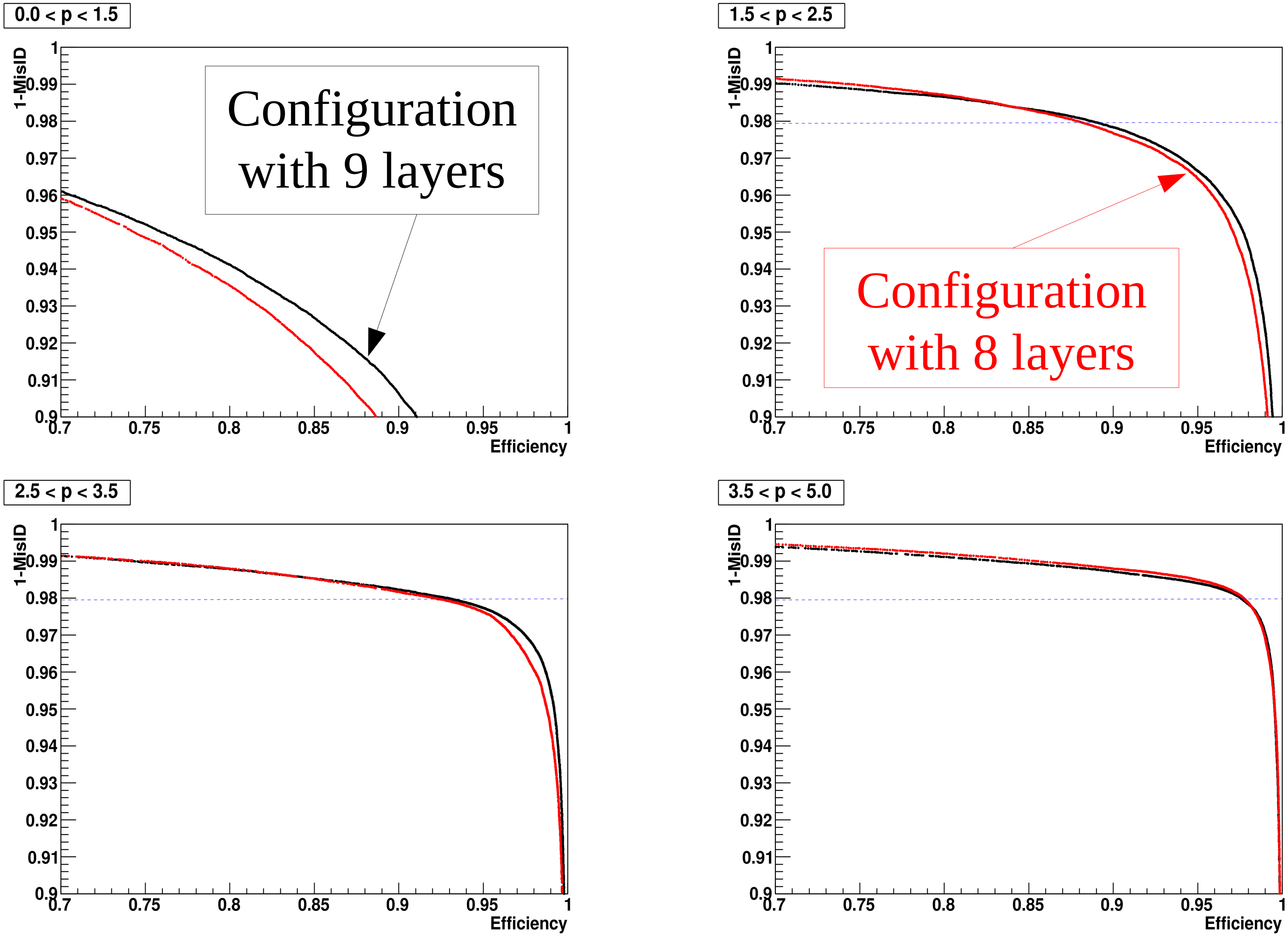
|=|=|======|======|========|============|=======|=====|
|2|2|  12  |  12  |   16   |     24     |  14   |  10 |
```

C_{9L} ~ 920mm

- Extra layer to check if is possible to increase the muon efficiency requiring a fixed value of pion mis-ID;
- Simulated 5M of single muons and pions for both the configurations;
- Momentum range from 0 to 5 GeV/c with flat distribution fired in all the sextants of the barrel;
- Configurations compared using a BDT as multivariate classification algorithm: same 9 variables used for the previews comparison (C_{13}, C_{14}, C_2');
- BDT analysis performed in 4 momentum bins;
- Check how the result changes adding 1.5% of noise and real detector efficiency (95%)

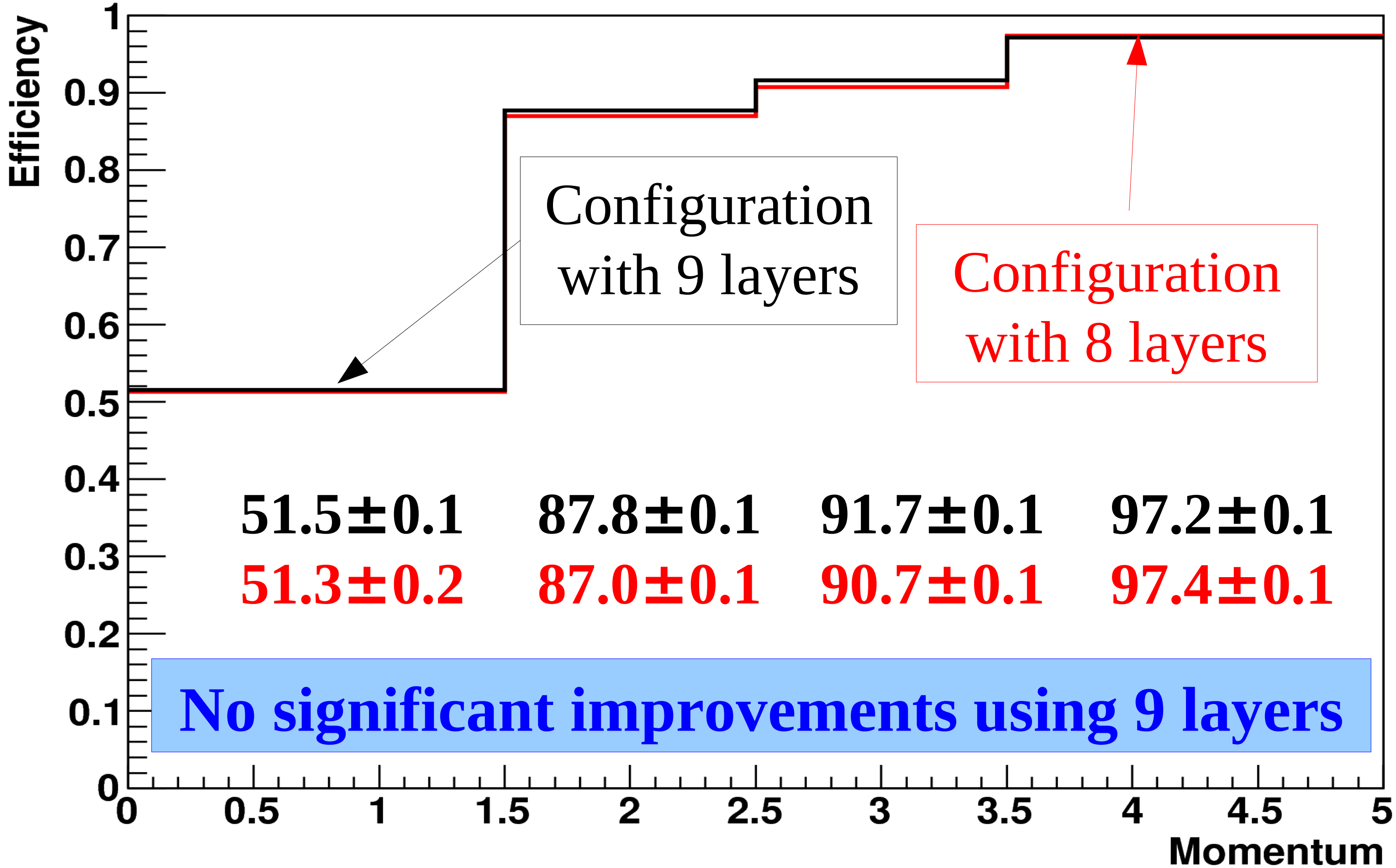
BDT optimization

- BDT optimization performed in 4 momentum bins;
- No noise simulated.



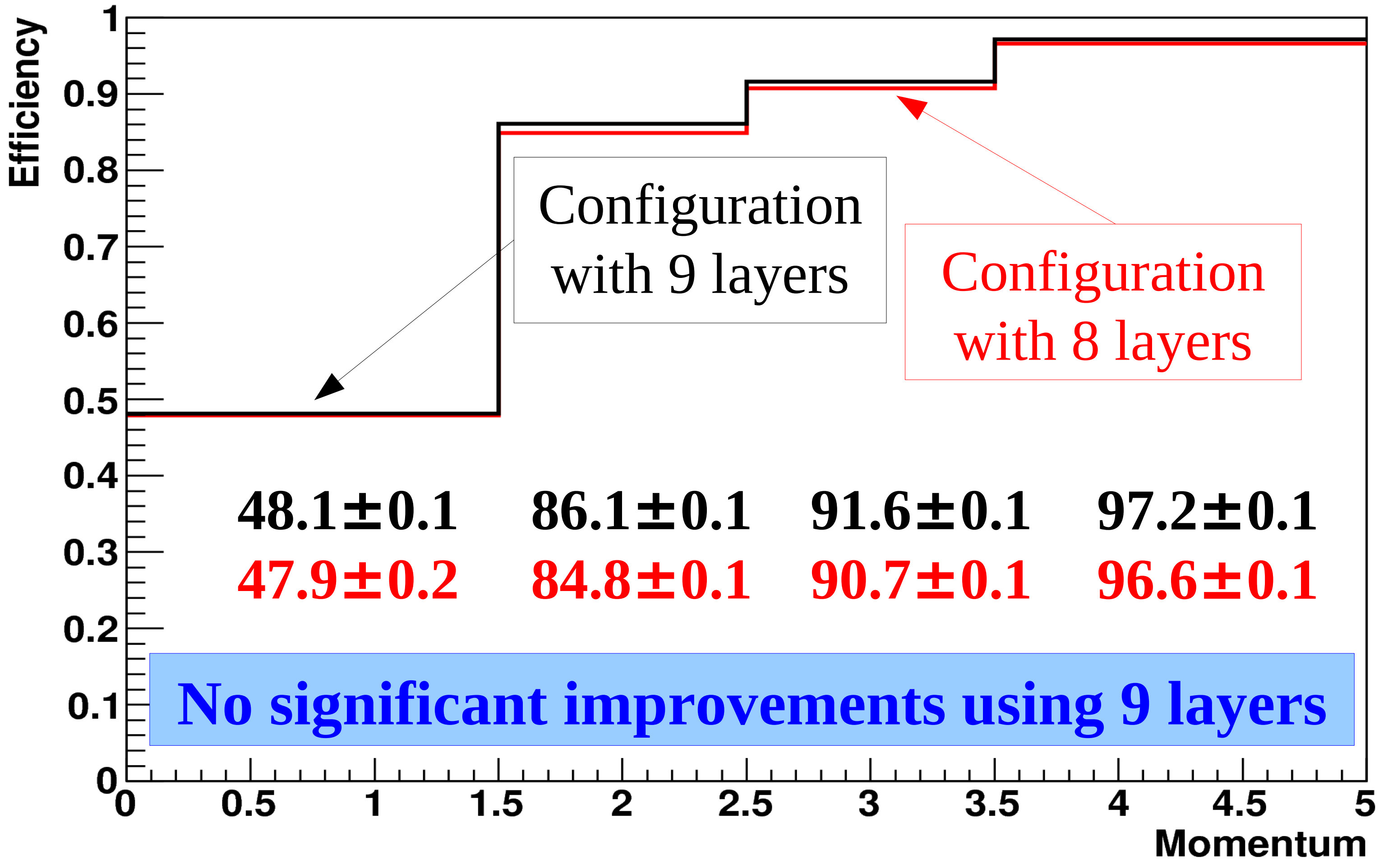
BDT results

- Muon efficinecy extracted for each momentum bin requiring a pion mis-ID of 2%



Noise and real detector efficiency

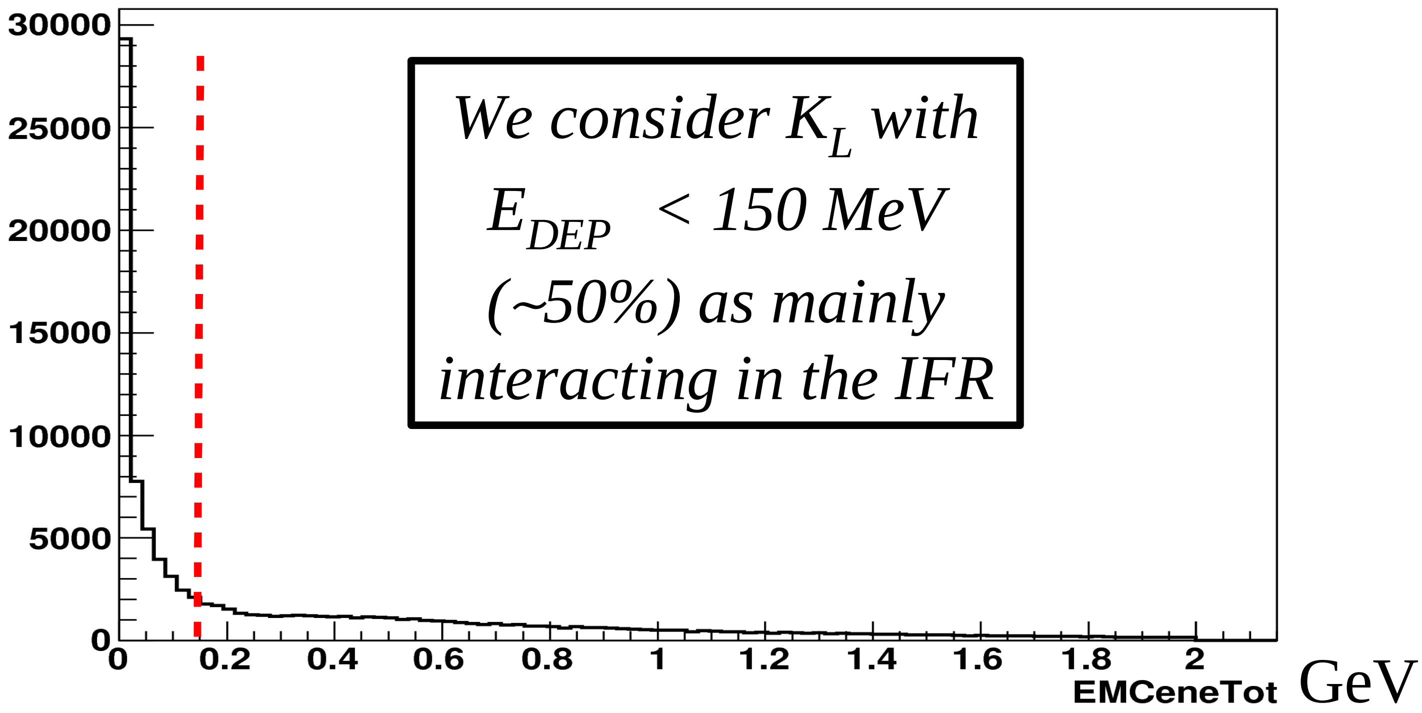
- Add 1.5% of uniform noise
- Active Layers efficiencies of 95%



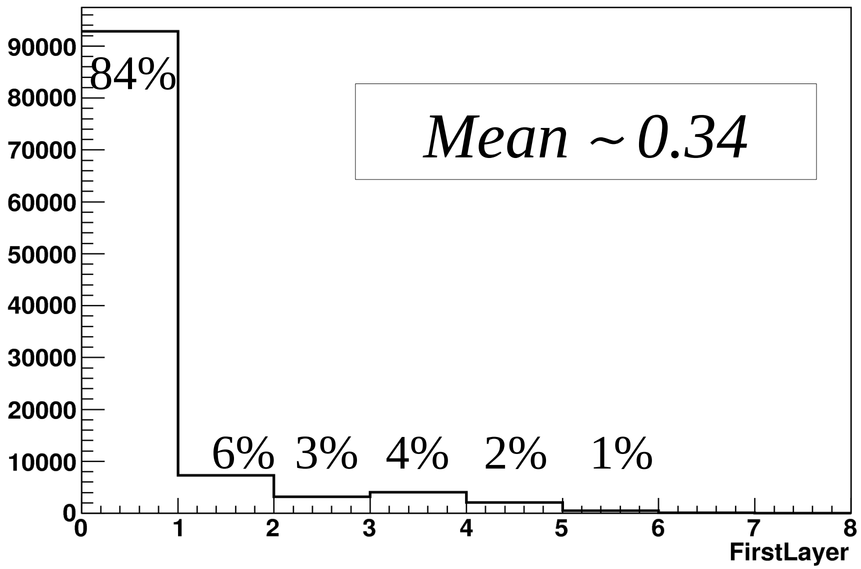
K_L studies

First overview of the K_L interactions

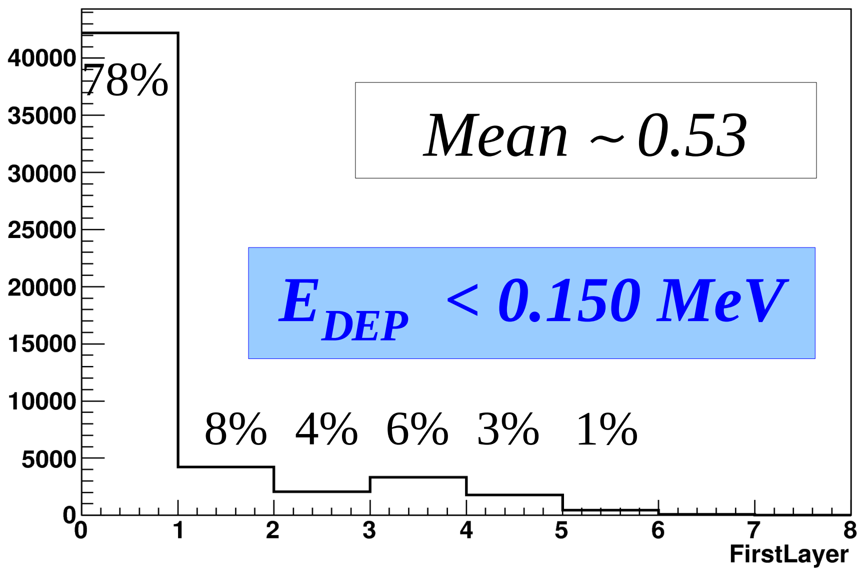
- Simulated 110k of single K_L using C_2' configuration and 10k using C_2' with 9 active layers;
- Momentum: range from 0.6 MeV to 4.5 GeV/c with flat distribution;
- Fired orthogonally to the top-sextant of the barrel ($\vartheta=\pi/2, \phi=\pi/2$);
- Distinguish K_L interacting in the EMC from K_L interacting in the IFR volume;
- Use the energy deposited in the EMC to distinguish these K_L categories;

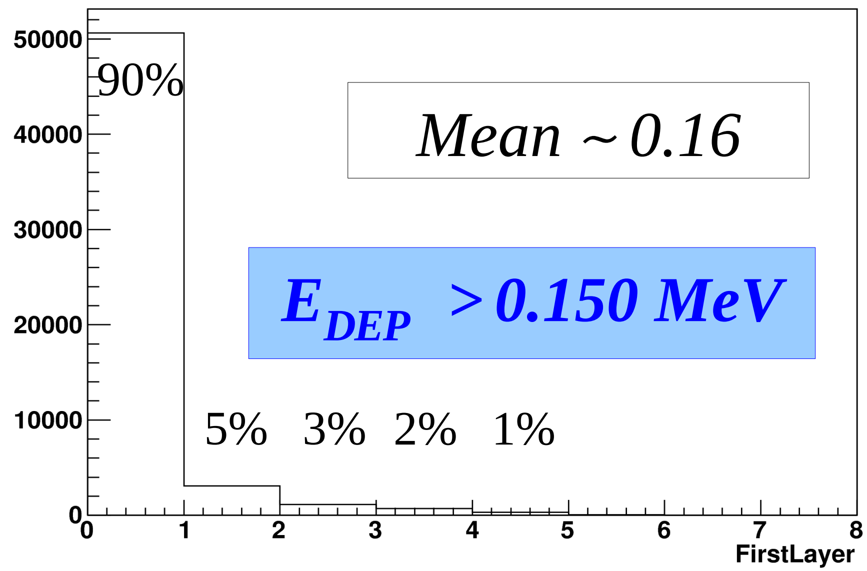


First Layer

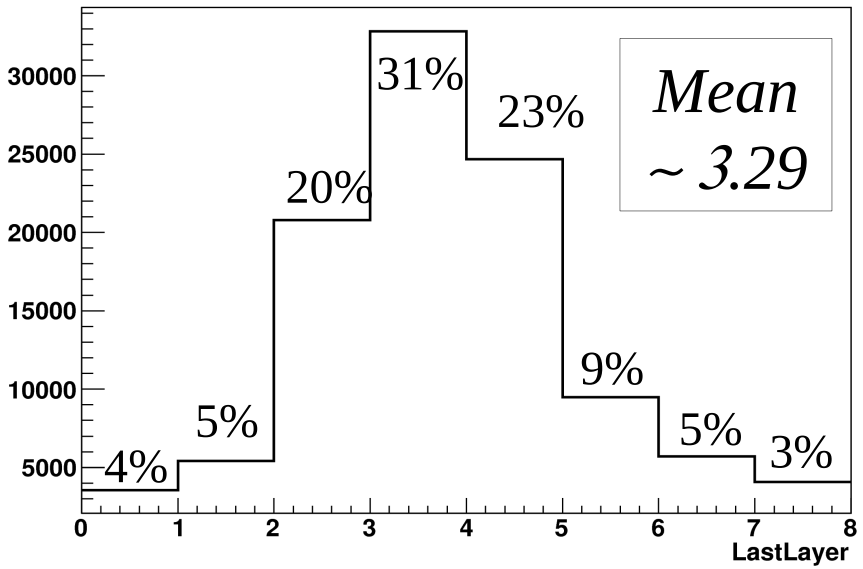


- Distribution of the K_Ls first hit layer which leave a signal in the IFR
- In average the number of first hit layer increases if we require weak interactions in the EMC

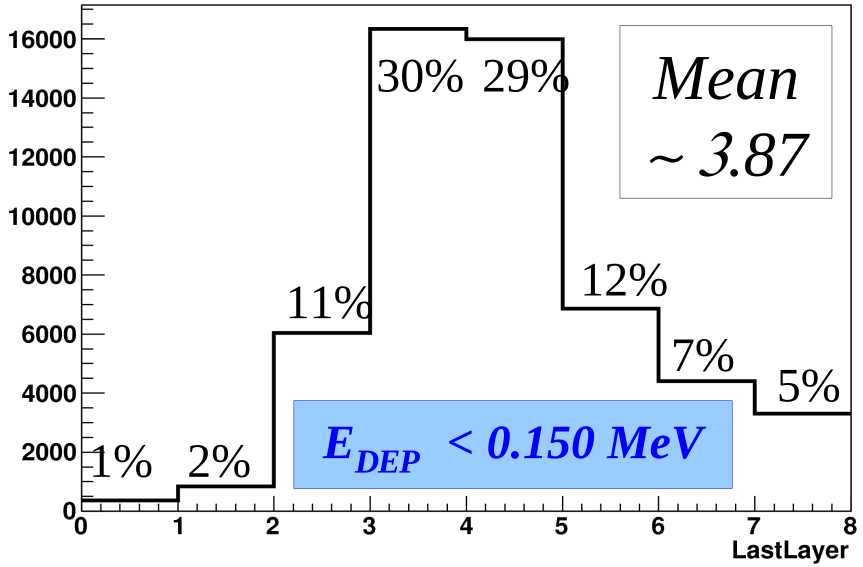


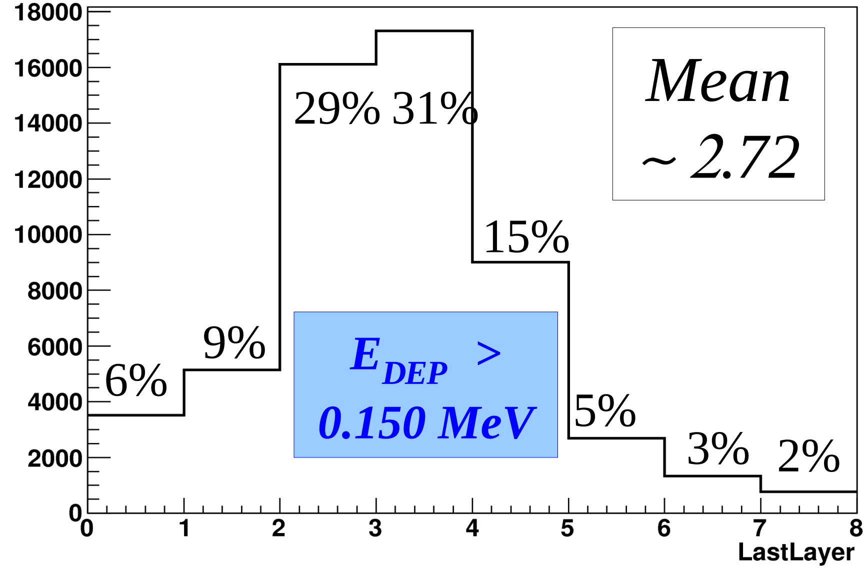


Last Layer



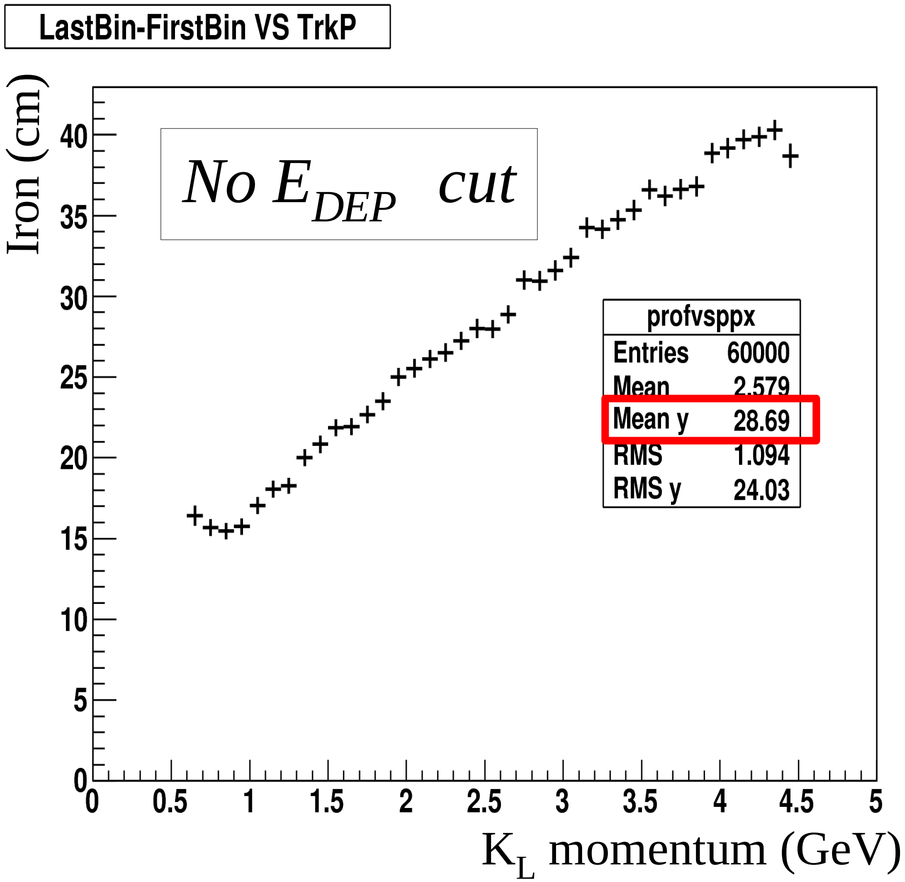
- Distribution of the K_Ls last hit layer which leave a signal in the IFR
- In average the number of last hit layer increase if we require weak interactions in the EMC

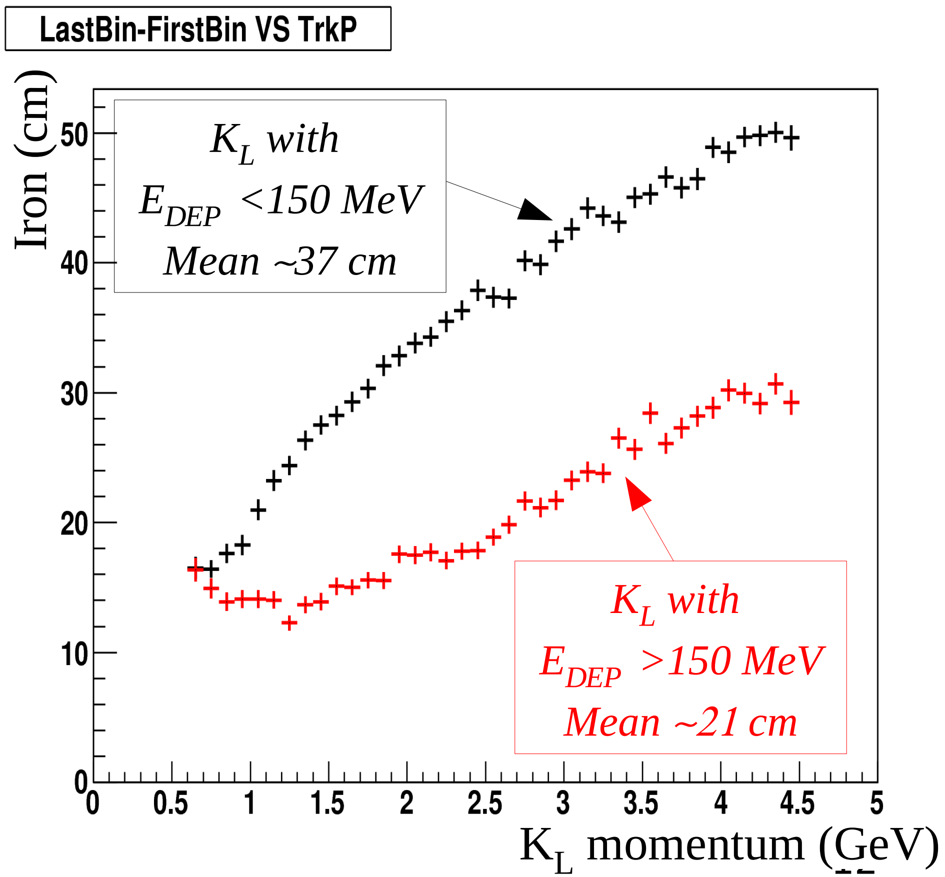




K_L cluster size

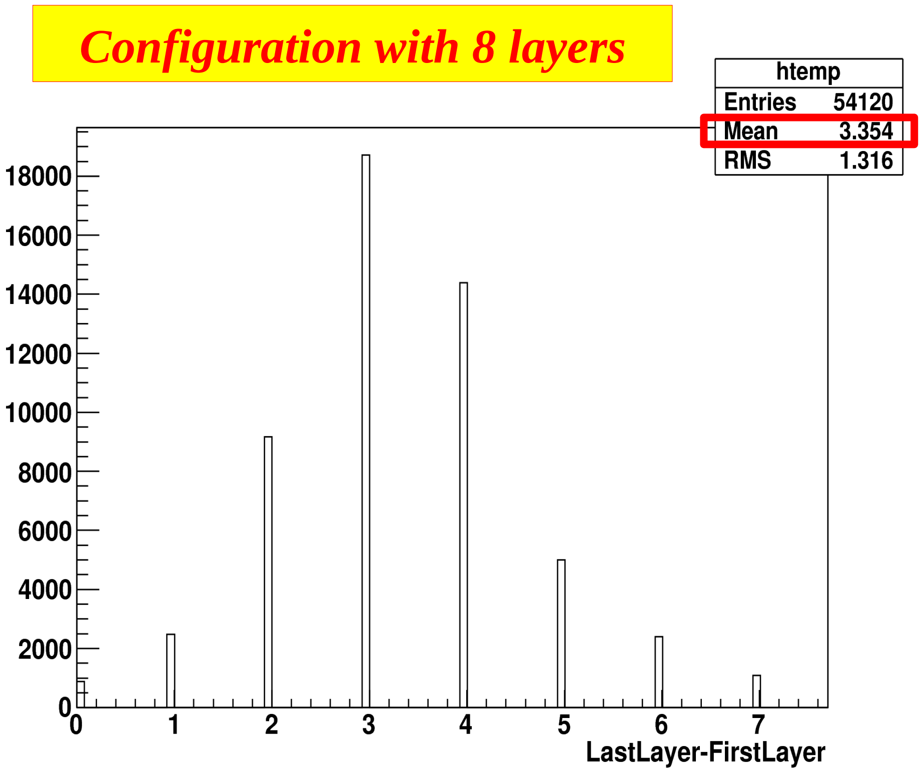
- Analyzing the distribution of LastLayer-FitstLayer as function of the momentum is possible to infer the K_L cluster size (iron cm)
- Different K_L cluster size depending by E_{DEP}

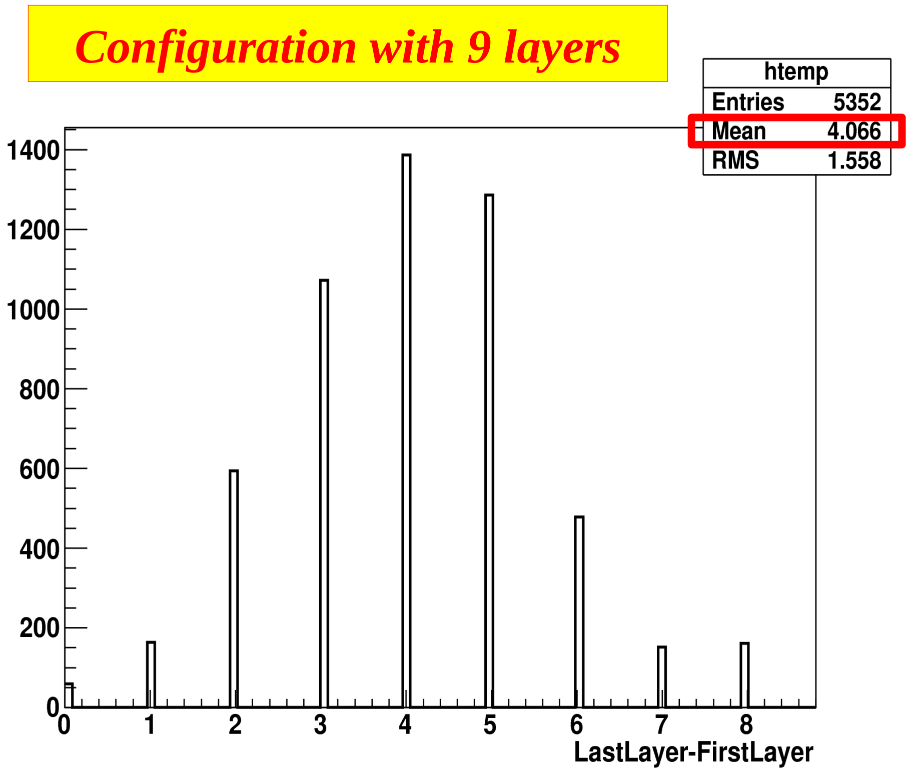




C_{8L} vs C_{9L}

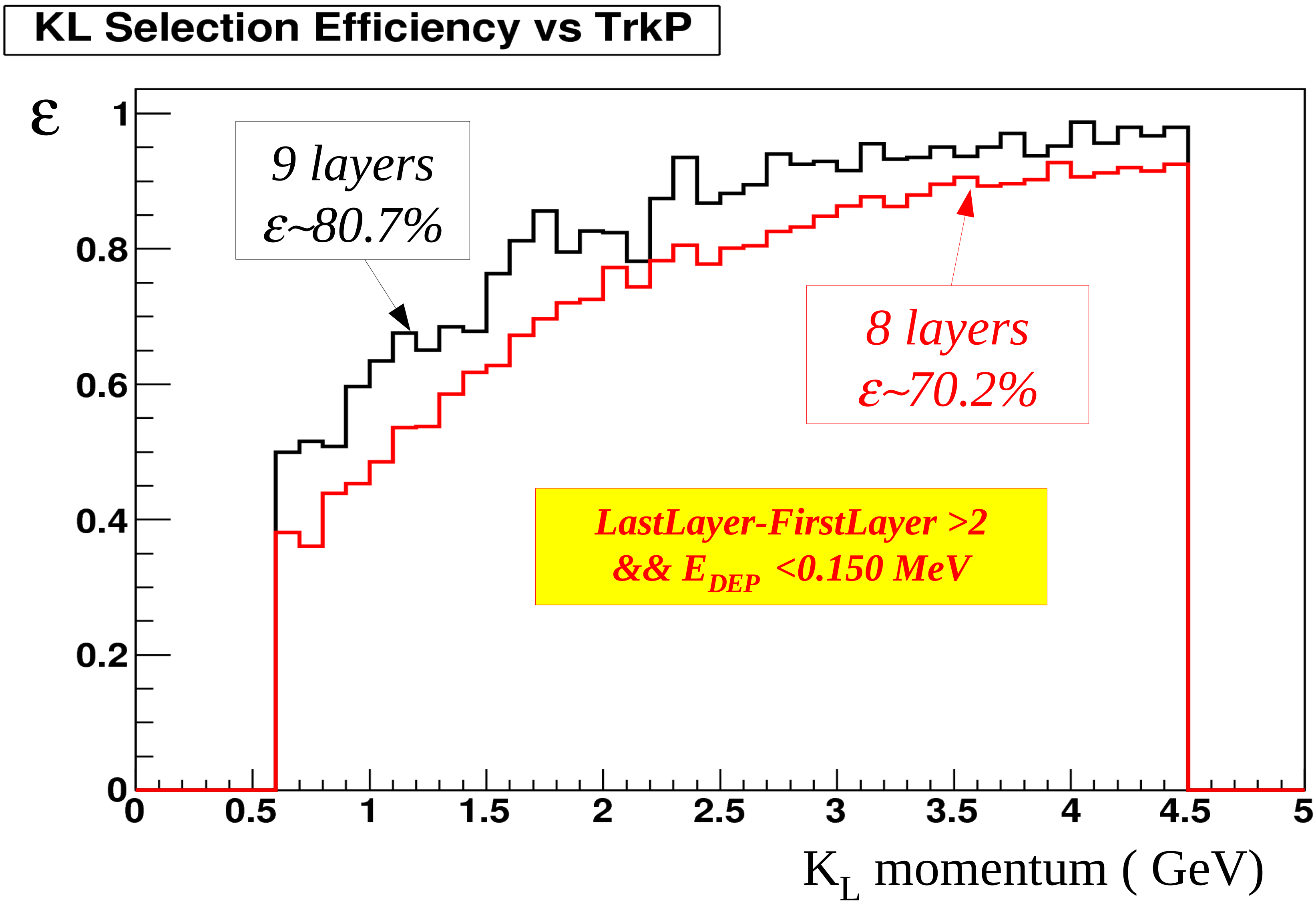
- Performed a K_L selector in order to compare the configurations with 8 and 9 active layers;
- We require K_L with E_{DEP} <0.150 MeV and at least 3 layers hits
- Study the K_L selection efficiency as function of the momentum





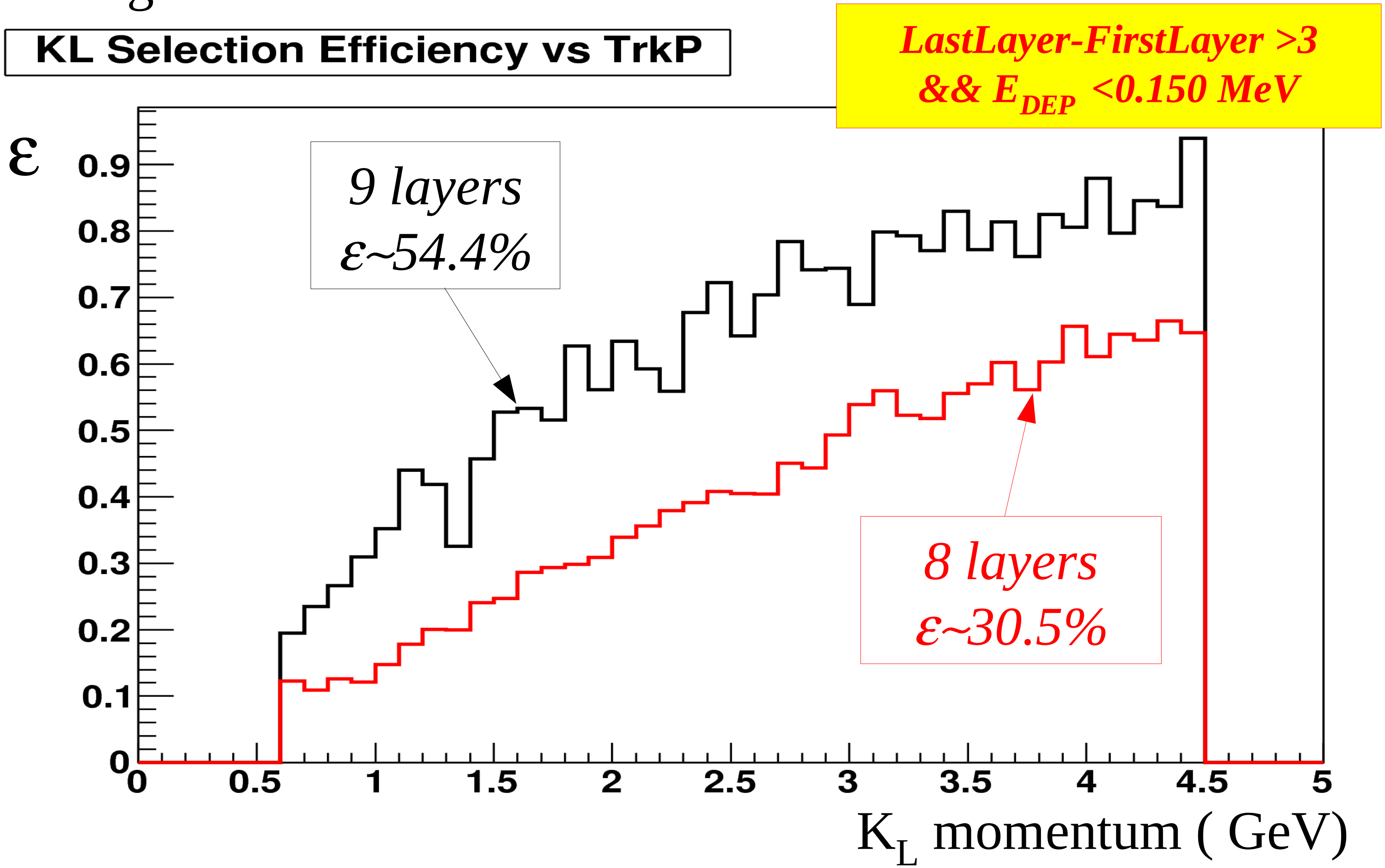
K_L efficiency vs momentum

- Configuration with 9 active layers gives better performance



K_L efficiency vs momentum

- Requiring at least 4 layers hits (hypothesis of larger background)
- Increased the performance difference between the two configurations



Summary

- From the study seems that an extra layer doesn't increase significantly the muon ID and pion rejection (in average about 1% for each momentum bin considered);

- Started to study K_L ID;
- We distinguish K_L interacting in the EMC from K_L interacting in the IFR volume
- Performed a Very Loose K_L selector to compare configuration with 8 and 9 active layers;
- Configuration with 9 layer gives better K_L efficiency;
- Need to simulate background samples ;
- Energetic gamma;
- Pions;
- ?