

Application of BNN for prompt/ non prompt separation in ALICE @5TeV in Pb-Pb

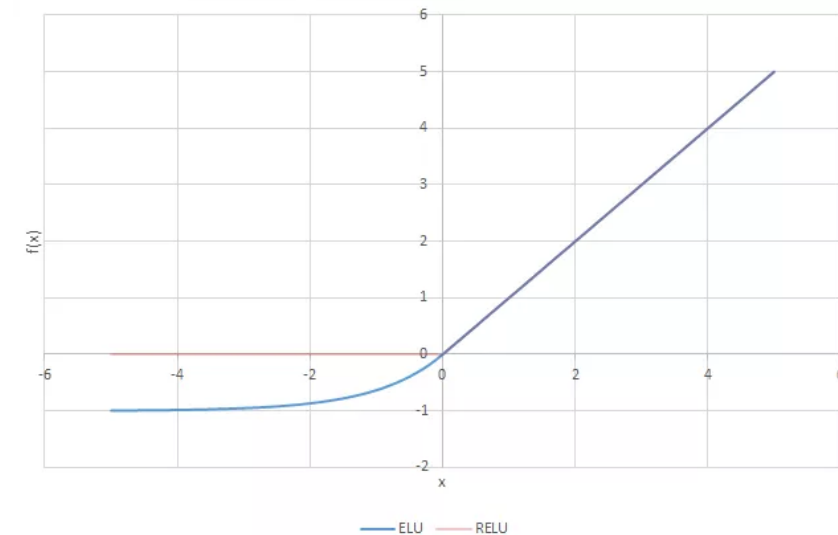
JB

Data set

- 2 M events
- 35 tracks on average in ALICE acceptance
- **Number of Candidates 2.5 M (RAW)**
- 70% prompt events generate by HIJING
- 30% B decays by EvtGen
- Only $e^+ e^-$ final state (by particle ID)
- Dst produced by Himanshu (see slides for cut descriptions)

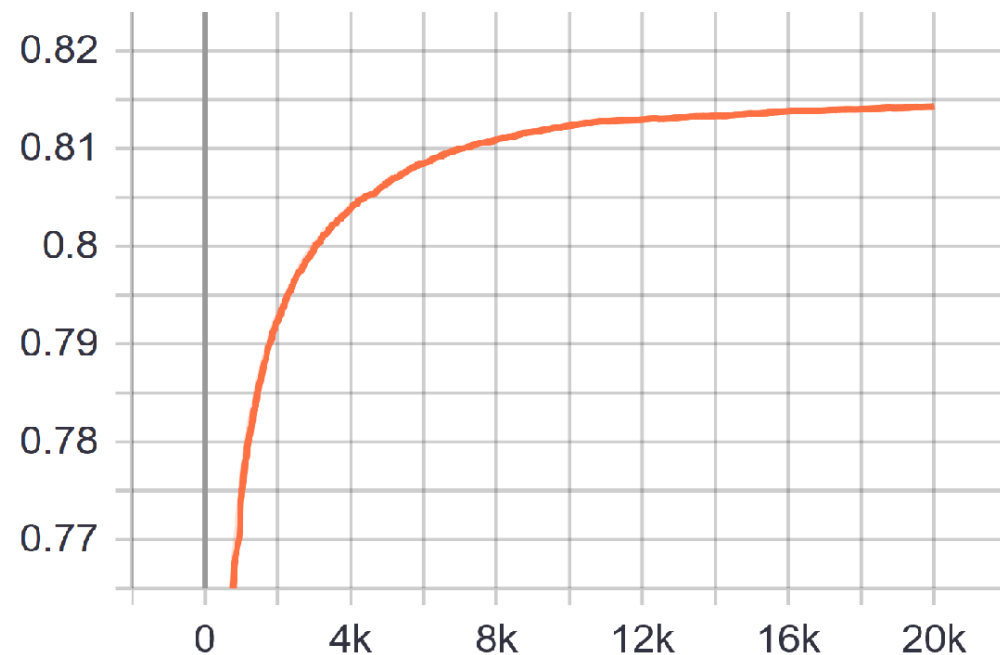
The Network

- TensorFlow 1.15
- NumPy for data storage
- 50/50 Signal background mixing
- 85 element input vector
- 4 hidden layers
 - 100 neurons
 - 165 neurons (3x)
 - Activation function “Elu[**Exponential Linear Unit**]”
 - 70/30 prompt /non prompt mixing for test validation



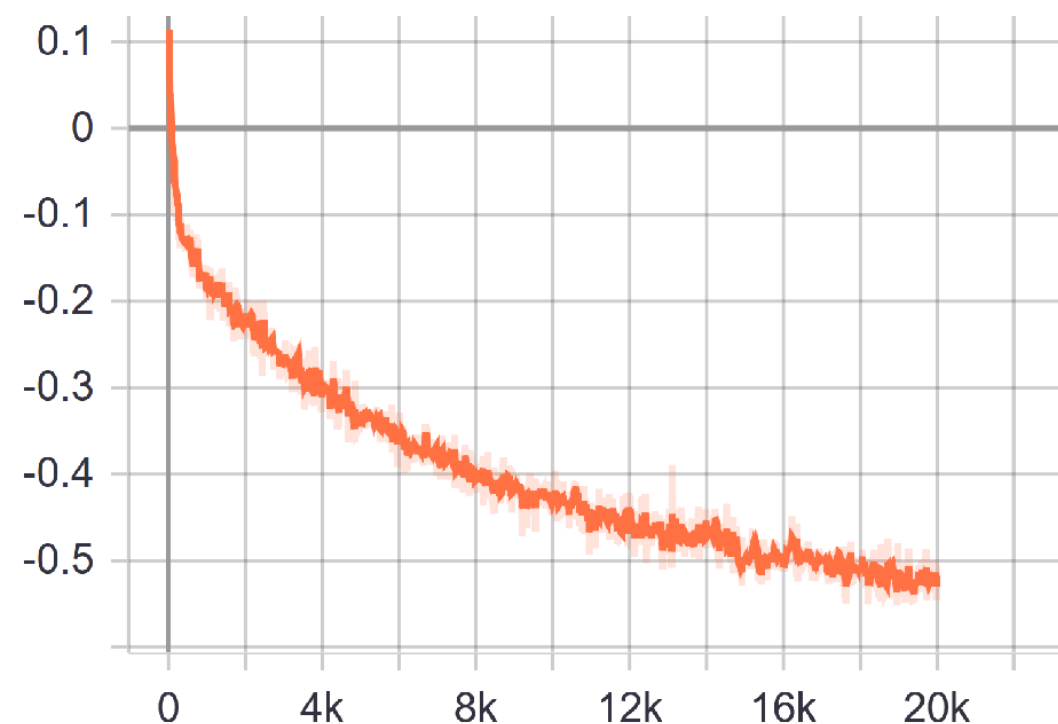
Training on GPU

- 20 000 training iterations

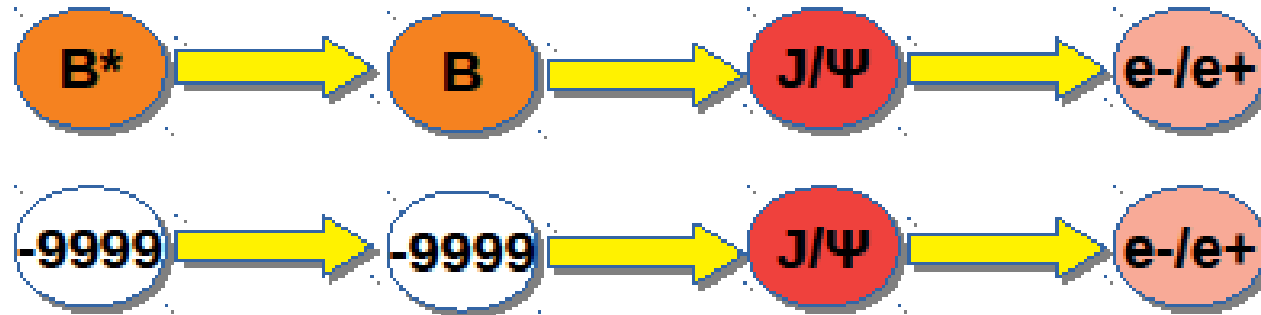


- More training iterations
- Unstable system (look loss function)

Los function



Dominating Processes :

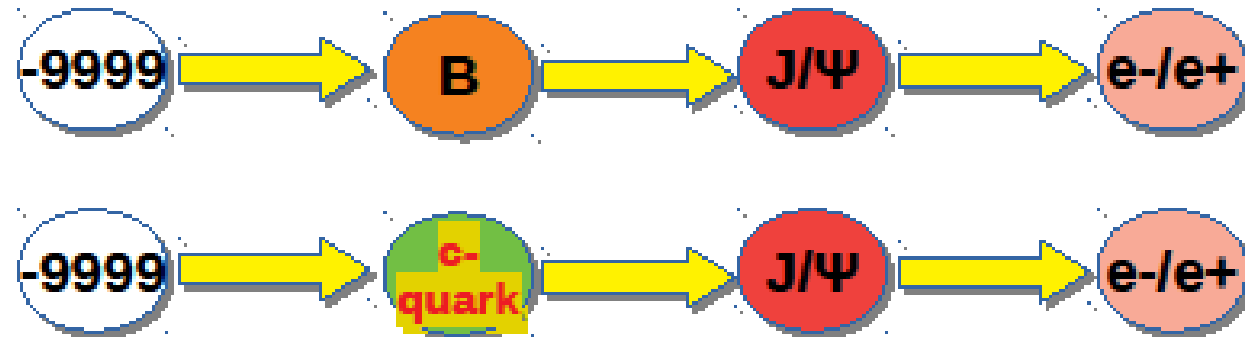


Number of Processes

→ # 5,040,030

→ # 8,245,574

Rare Processes :



→ # 15,304

→ # 846

Model nr 1

- Signal = Ele_fGrandGrandMother > -9999 && abs(Ele_fGrandGrandMother) != 5
- bg_sel = 'Ele_fGrandGrandMother == -9999'

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☐ All numbers come from Invariant mass integral from 2.9 to 3.2 GeV

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===== BEFORE the NN=====

- **All reconstructed J/psi 474321**
- **Number of non prompt J/psi 136619**
- **Number of Prompt J/psi 337452**

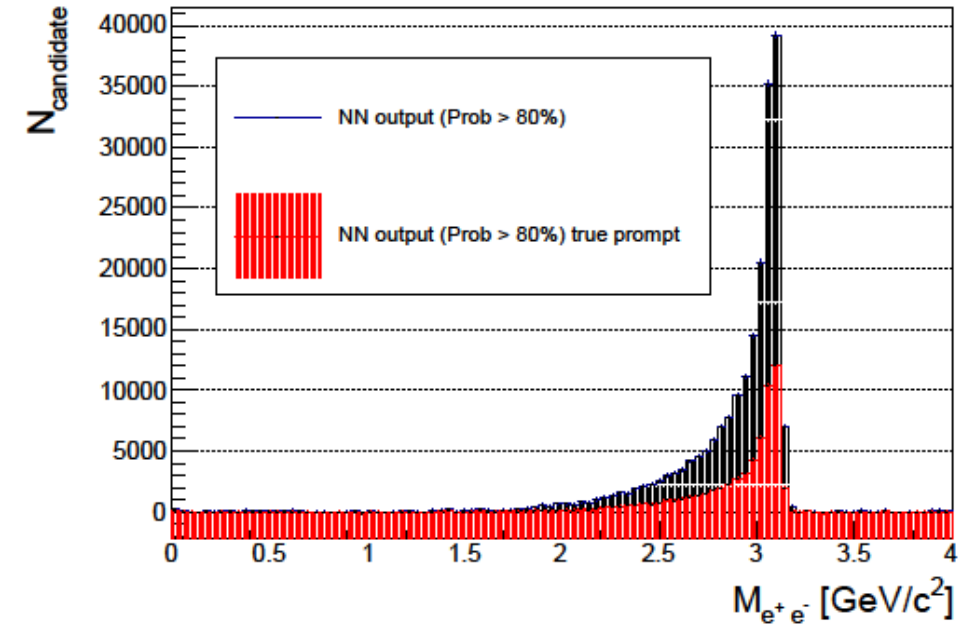
=====After NN (Prob > 80%)=====

- Number of non prompt J/psi 102547 (true)
- Number of Prompt J/psi 42909 (true)
- Total number of J/psi after NN 145456 marked as Non prompt
- Contamination is 29%

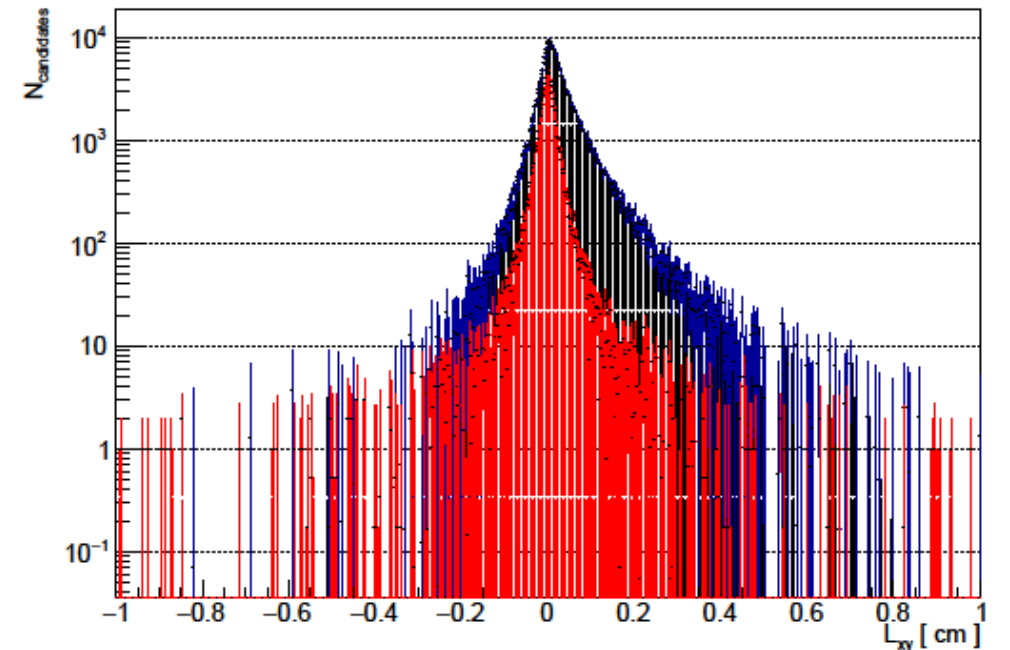
==== Reduction rate of NN=====

- For Prompt the sample is reduced 7.9 times
- For non prompt the sample is reduced 1.3 times

All plots after combinatorial background subtraction!



Binning set to 1000 for higher precision



Model nr 2

- `s_sel = 'Ele_fGrandGrandMother > -9999 && abs(Ele_fGrandGrandMother) != 5 && Ele_fMother == 443'`

- `bg_sel = 'Ele_fGrandGrandMother == -9999 && Ele_fGrandMother == -9999'`

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☐ All numbers come from Invariant mass integral from 2.9 to 3.2 GeV
=====

===== BEFORE the NN=====

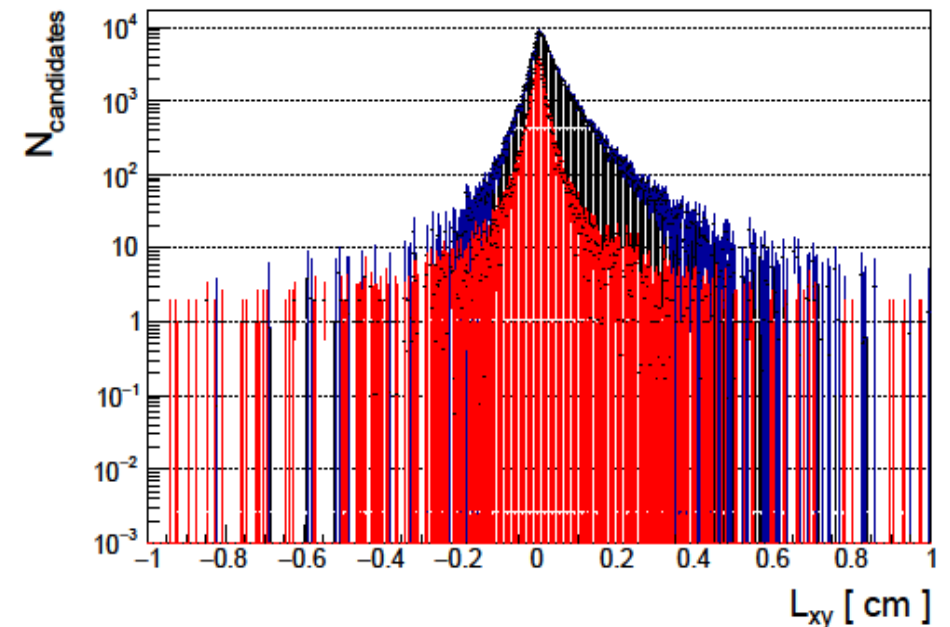
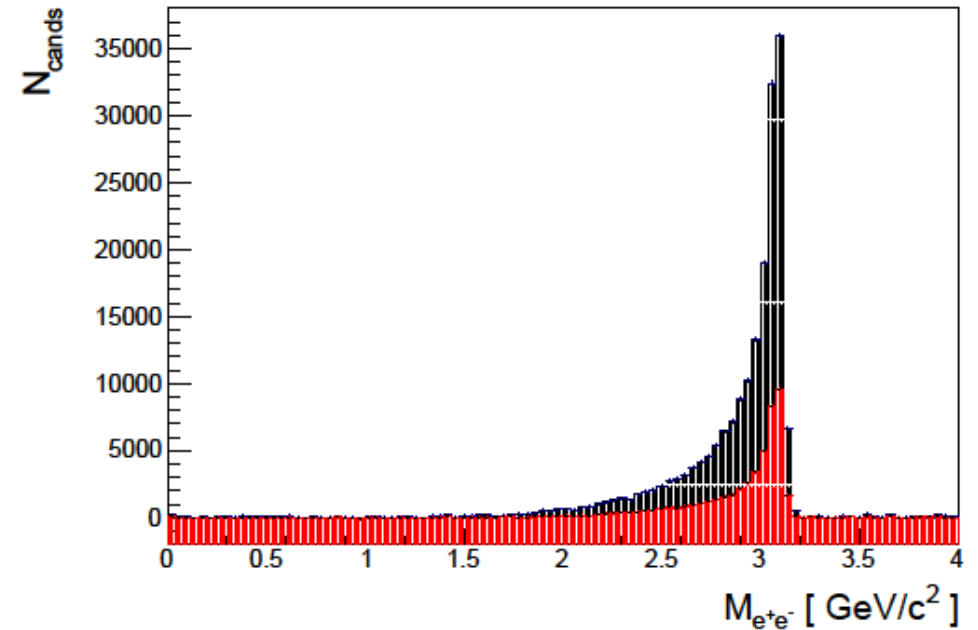
- **All reconstructed J/psi 474321**
- **Number of non prompt J/psi 136619**
- **Number of Prompt J/psi 337452**

=====After NN (Prob > 80%)=====

- Number of non prompt J/psi 99793 (true)
- Number of Prompt J/psi 34350 (true)
- Total number of J/psi after NN 134119 marked as Non prompt
- Contamination is 25.6 %

==== Reduction rate of NN=====

- For Prompt the sample is reduced 9.8 times
- For non prompt the sample is reduced 1.37 times



Comparison

Model	Contamination	Prompt reduction rate	Non prompt reduction rate	True prompt	True non prompt	All after NN
1.	29%	7.9	1.3	42909	102547	145456
2.	25.6%	9.8	1.37	34350	99793	134119

To do list

- Apply PID cuts
- Run on data