

Comparison of PFA vs MC for tagging $t\bar{t}$ Events

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LAPP, Annecy

$t\bar{t}$ Analysis meeting

Outline

- 1 Framework of the study
- 2 Input variables Gen/Sim Comparison
- 3 Generator level $t\bar{t}/W^+ W^-$ separation
- 4 Full simulation $t\bar{t}/W^+ W^-$ separation
- 5 conclusion

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Framework of the study

Software and physics channel

- Generation: WIZHARD
 - Simulation: MOKKA 0706
 - Reconstruction: Marlin 0110
 - Analysis: root v5.28 and TMVA
-
- Detector: CLIC_ILD_CDR
 - Energy: 3 TeV (500 GeV not available yet)
 - ISR and BS
-
- Event type: $t\bar{t}$
 - background: $W^+ W^-$ (all decays for the moment)
 - Statistics: 9000 events for both channel + same for testing
 - No $\gamma\gamma$ background yet

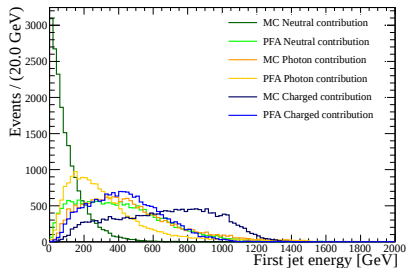
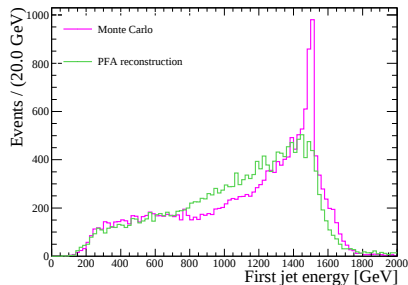
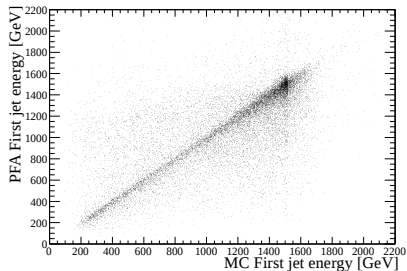
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 - First jet mass
 - Second jet energy
 - Second jet mass
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Input Variables

First jet energy

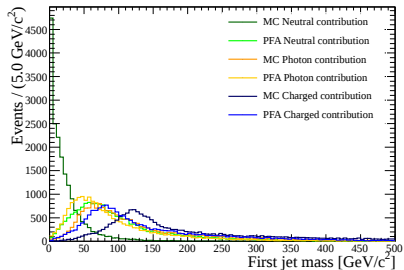
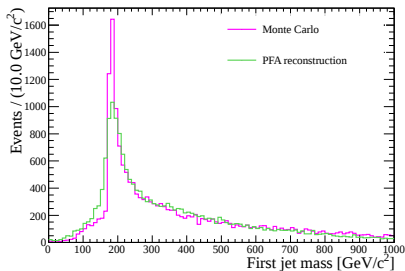
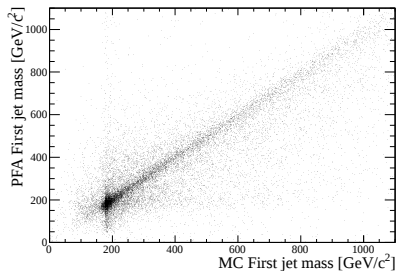


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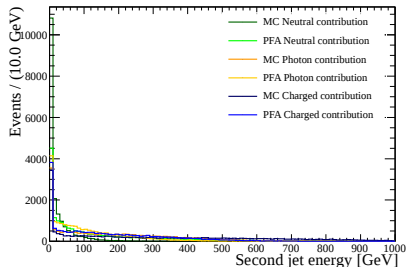
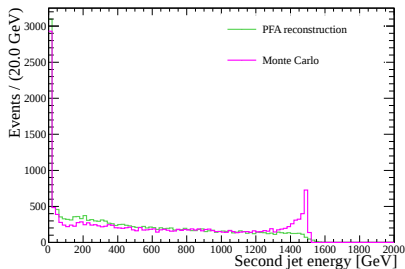
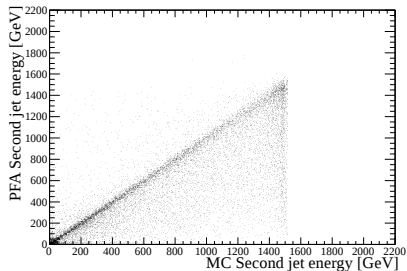


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Second jet energy

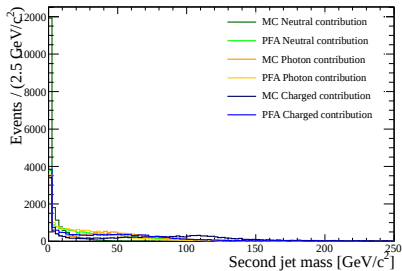
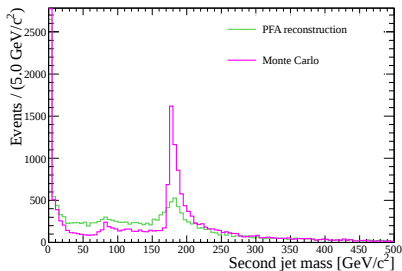
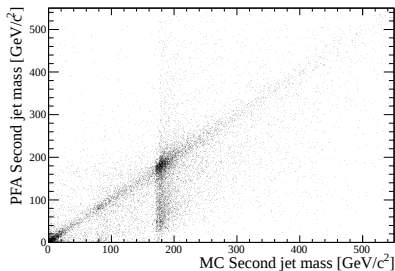


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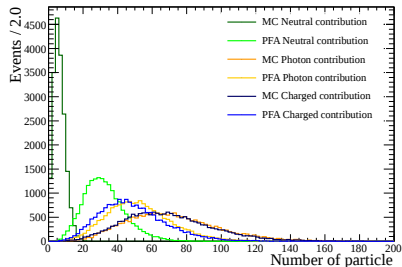
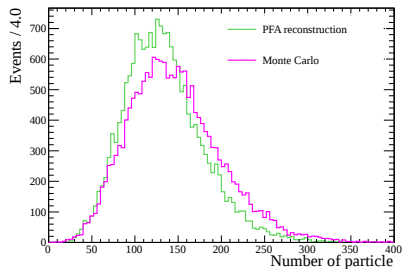
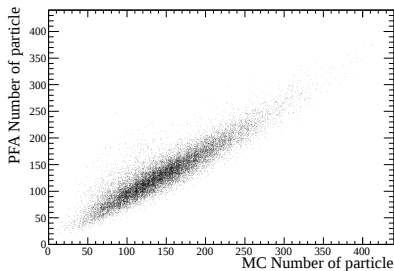


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Input Variables

Number of particle

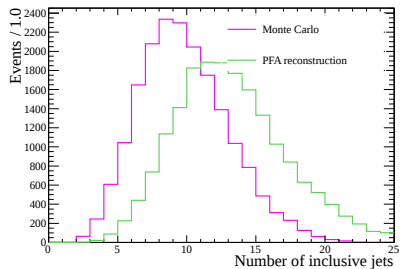
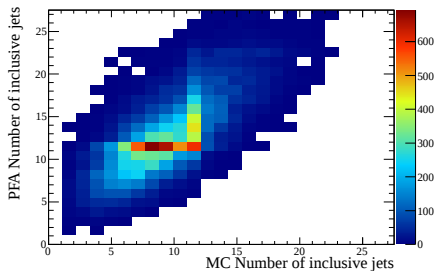


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Input Variables

Number of inclusive jets



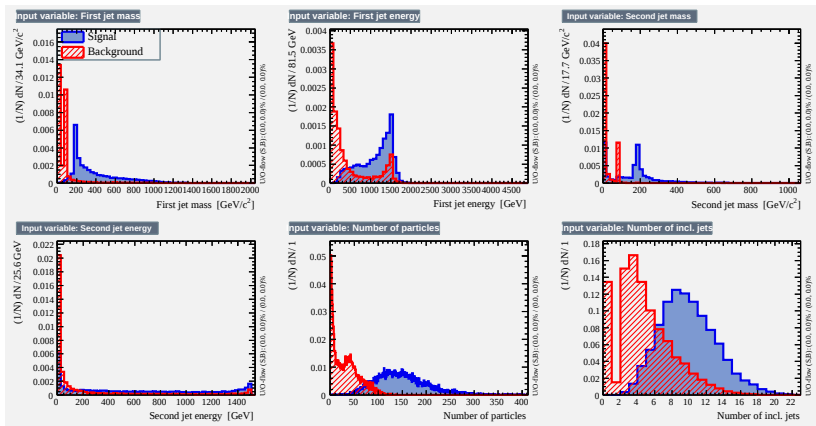
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Generator level $t\bar{t}/W^+ W^-$ separation

Input variable



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Generator level $t\bar{t}/W^+W^-$ separation

Variable importance

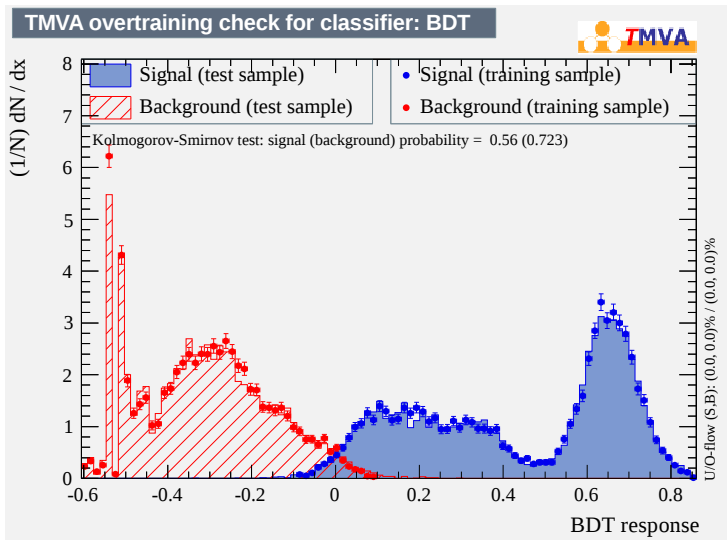
Variable name	Description	Importance
nPart	Number of particles	22.3%
jet1M	First jet mass	21.3%
nJets	Number of kt inclusive jets	16.7%
jet2M	Second jet mass	14.9%
jet1E	First jet energy	13.2%
jet2E	Second jet energy	11.6%

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BDT response

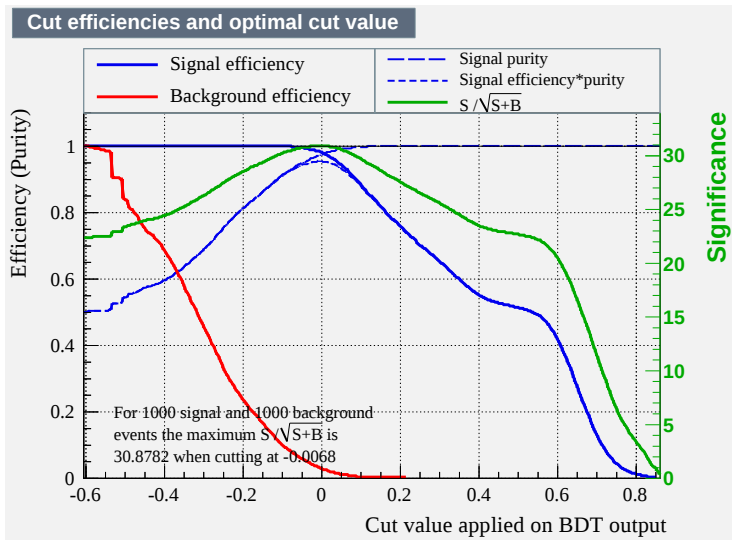


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BDT cut efficiencies



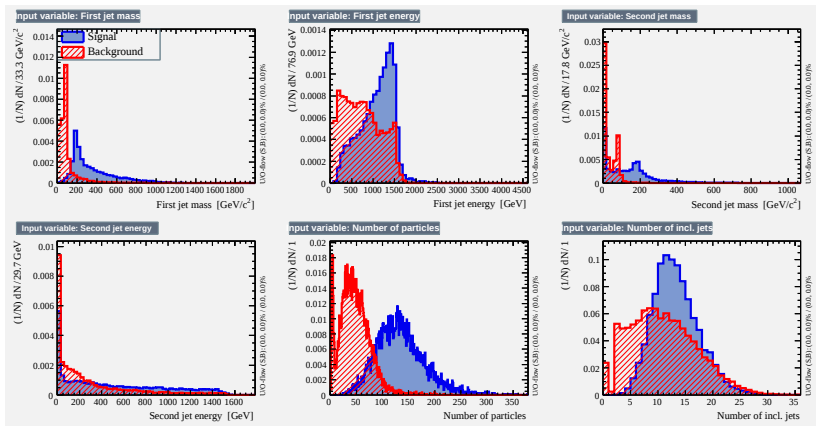
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Full simulation $t\bar{t}/W^+ W^-$ separation

Input variable



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Full simulation $t\bar{t}$ $W^+ W^-$ separation

Variable importance

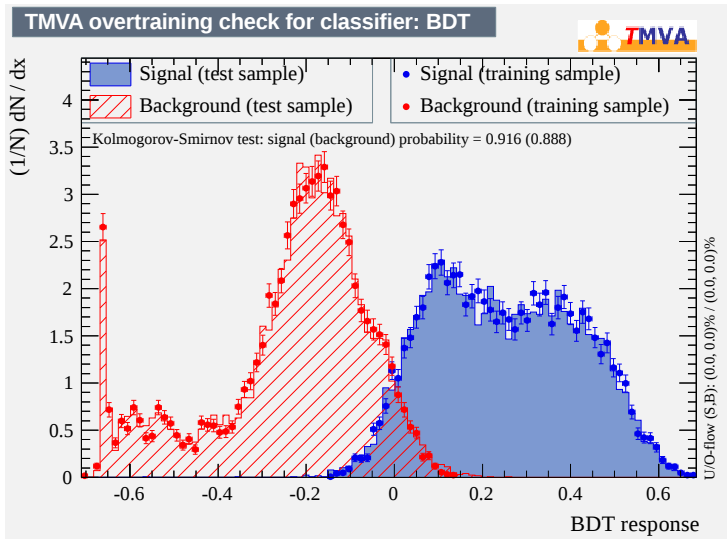
Variable name	Description	Importance
nPart	Number of particles	24.6%
jet2M	Second jet mass	21.1%
jet1M	First jet mass	20.3%
jet2E	Second jet energy	12.4%
jet1E	First jet energy	11.9%
nJets	Number of kt inclusive jets	9.7%

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Full simulation $t\bar{t}/W^+ W^-$ separation

BDT response

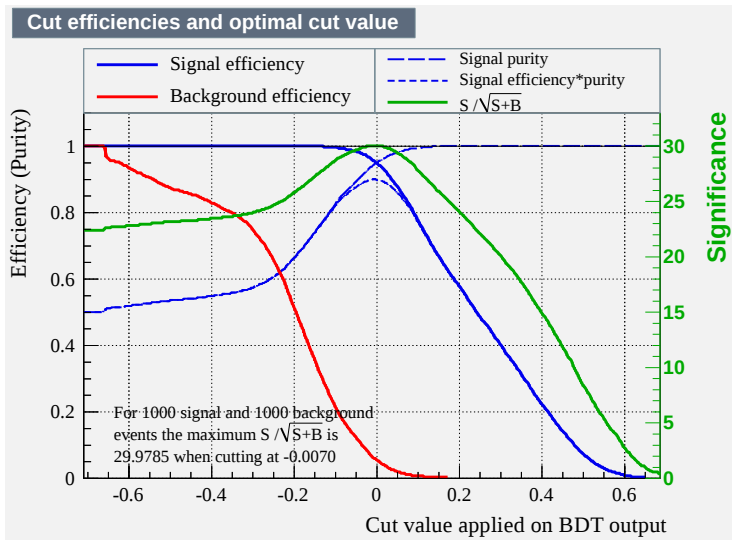


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BDT cut efficiencies



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Conclusion

Disclaimer

- No $\gamma\gamma$ background included yet
- Only one physics background channel included (but the main one)

Next steps

- Re-look at all available variables and check for the best choice
- Take benefit of the TMVA workshop to optimize the tools
- Add B-tagging information
- Include $\gamma\gamma$ and more physics backgrounds (ZZ, WWZ, ...)

@ 500GeV ?

- Some works has been done (cf. Frank's presentation at the kick-off meeting)
- Mainly redo it with the most recent tools