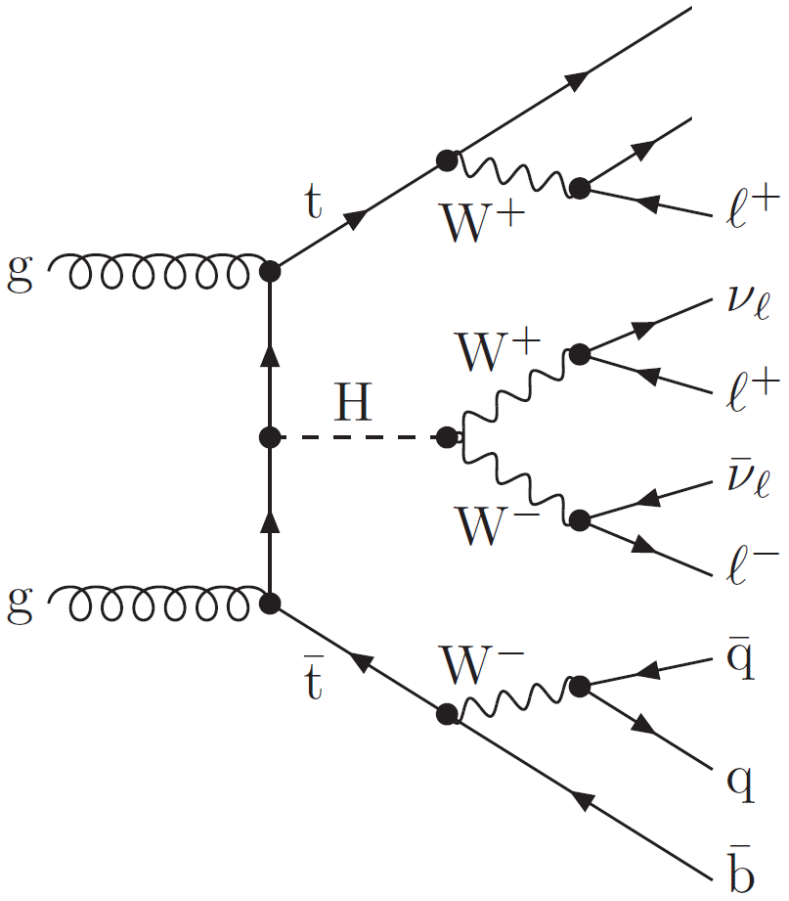
More lepton MVA studies



Giovanni Petrucciani
(CERN)

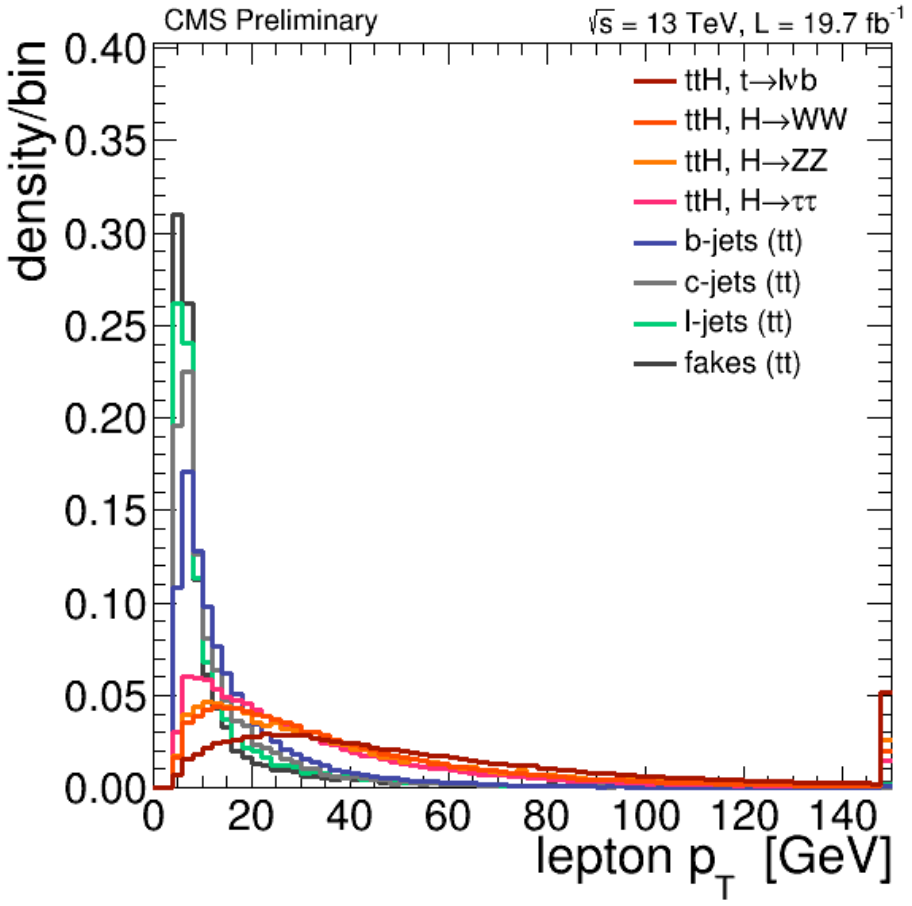
Intro & Outline

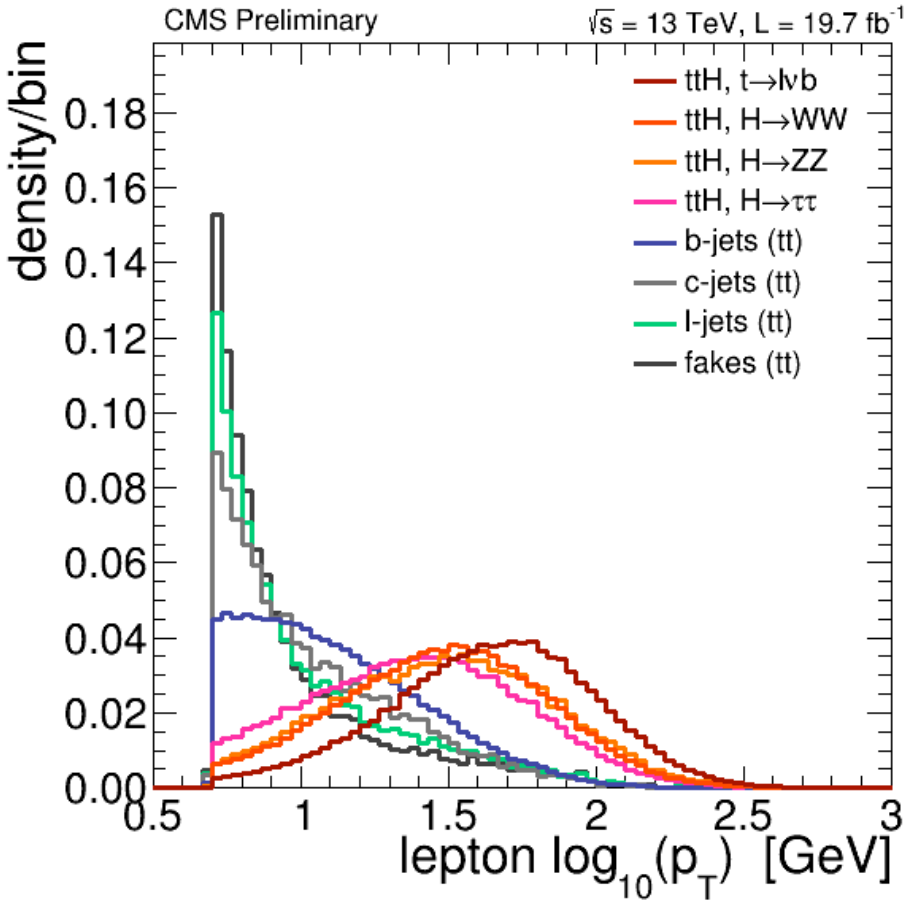
- Checklist of some LepMVA studies:
  - Test new PtRatio & PtRel definitions
  - Study interplay of the Pt usage in category definition, lepMVA, and signal extraction MVA
- We don't yet have the final lepMVA nor the final signal extraction, but don't expect those to change the outcome of the checks

Lep MVA input tests

- Compare two trainings of the LepMVA using:
  - Lepton pT, without any reweighting
  - miniRelIso, split in charged and neutral parts
  - sip3D, dxy, dz, jet b-tag discriminator
  - PtRatio & PtRel with old (v1) or new (v2) def
- Training samples: powheg ttH(nobb) vs powheg TT inclusive.

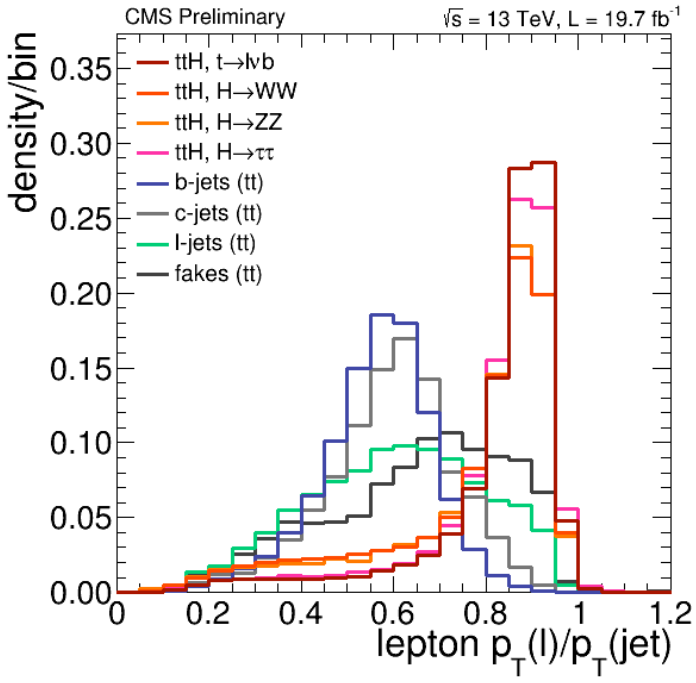
Input p_T distributions (muons)

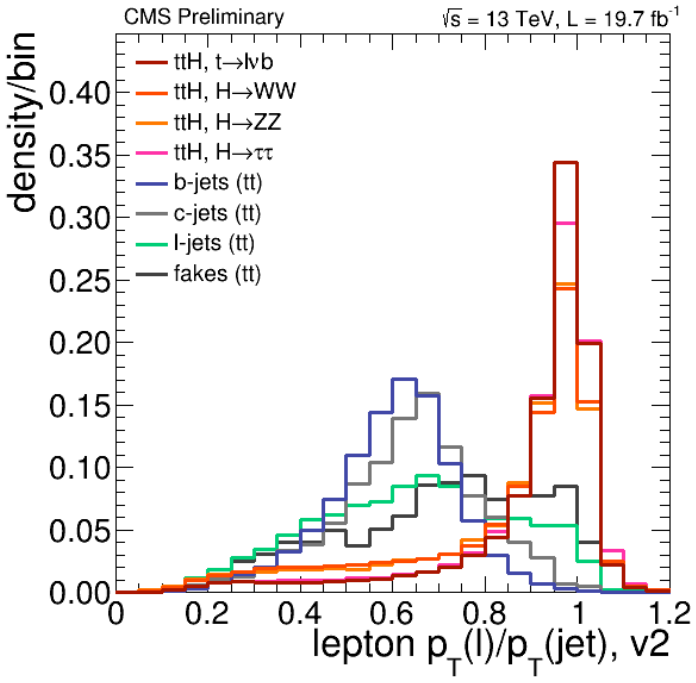


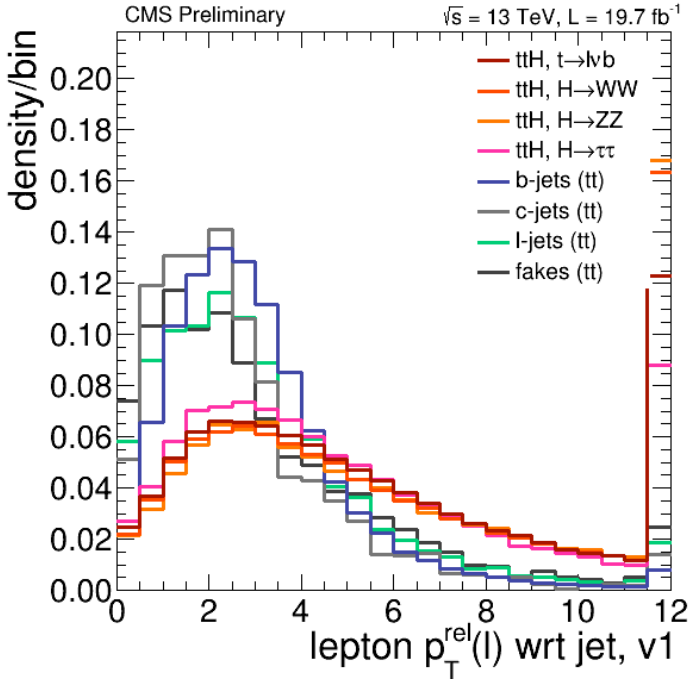


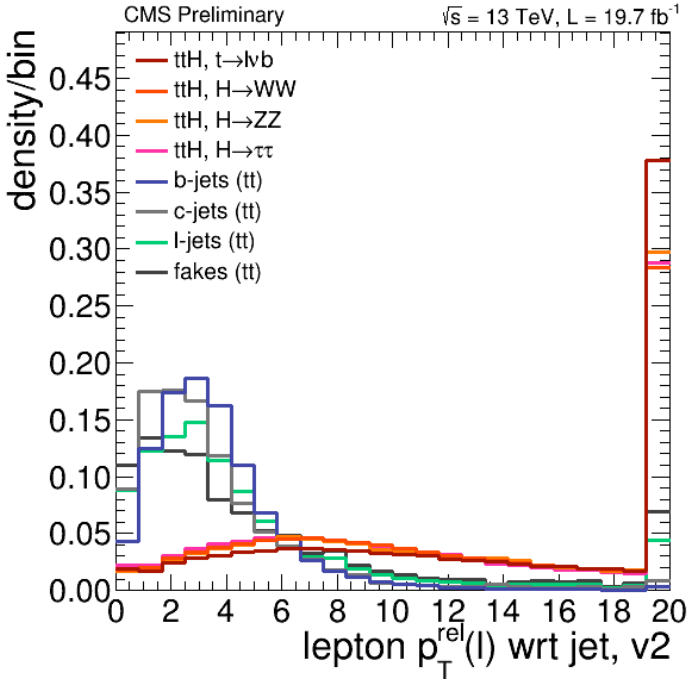
Input PtRatio, PtRel

μ, p_T > 20 GeV



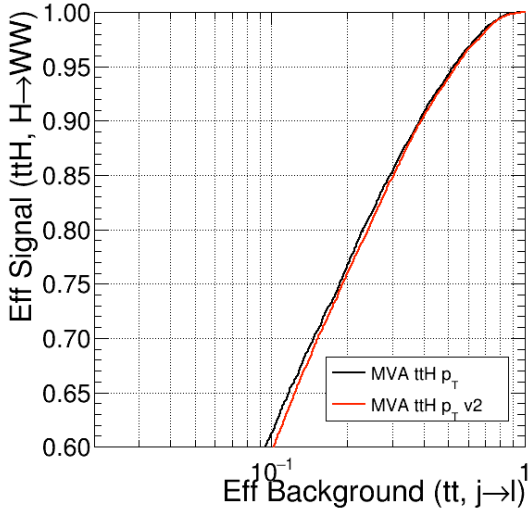


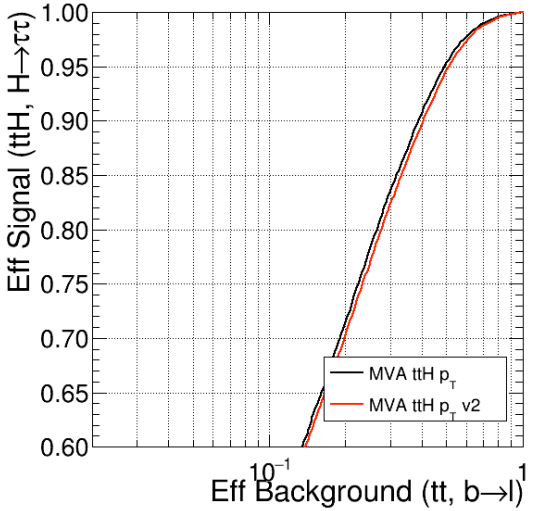




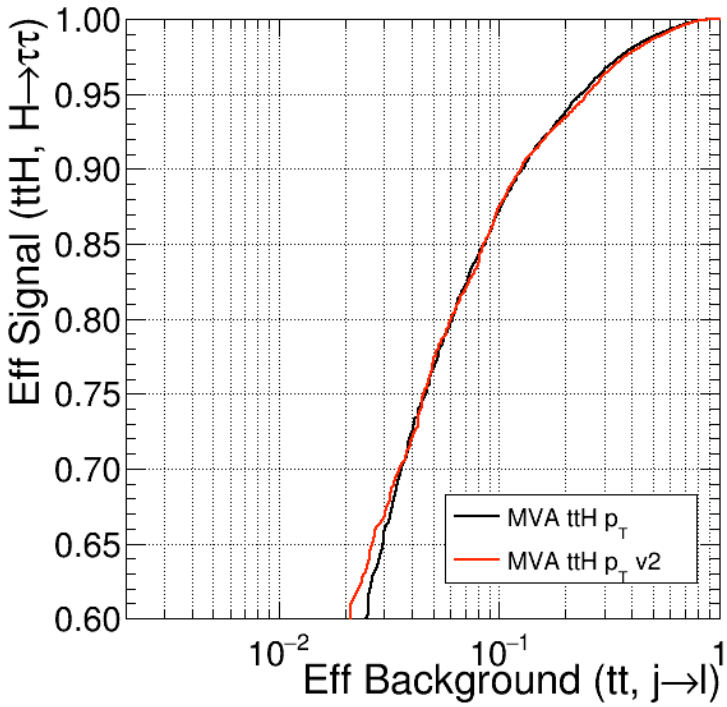
ROCs v1 vs v2

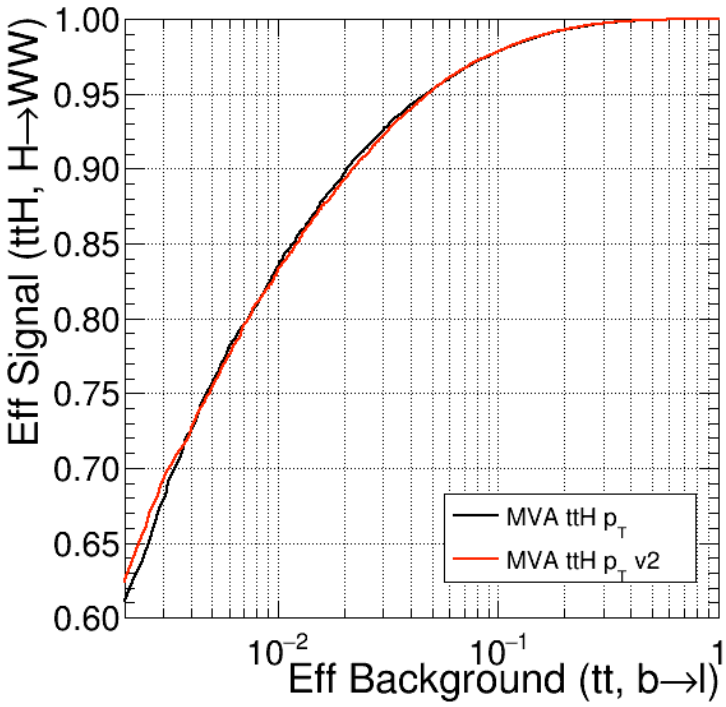
μ, p_T 5-10 GeV





μ, p_T > 20 GeV



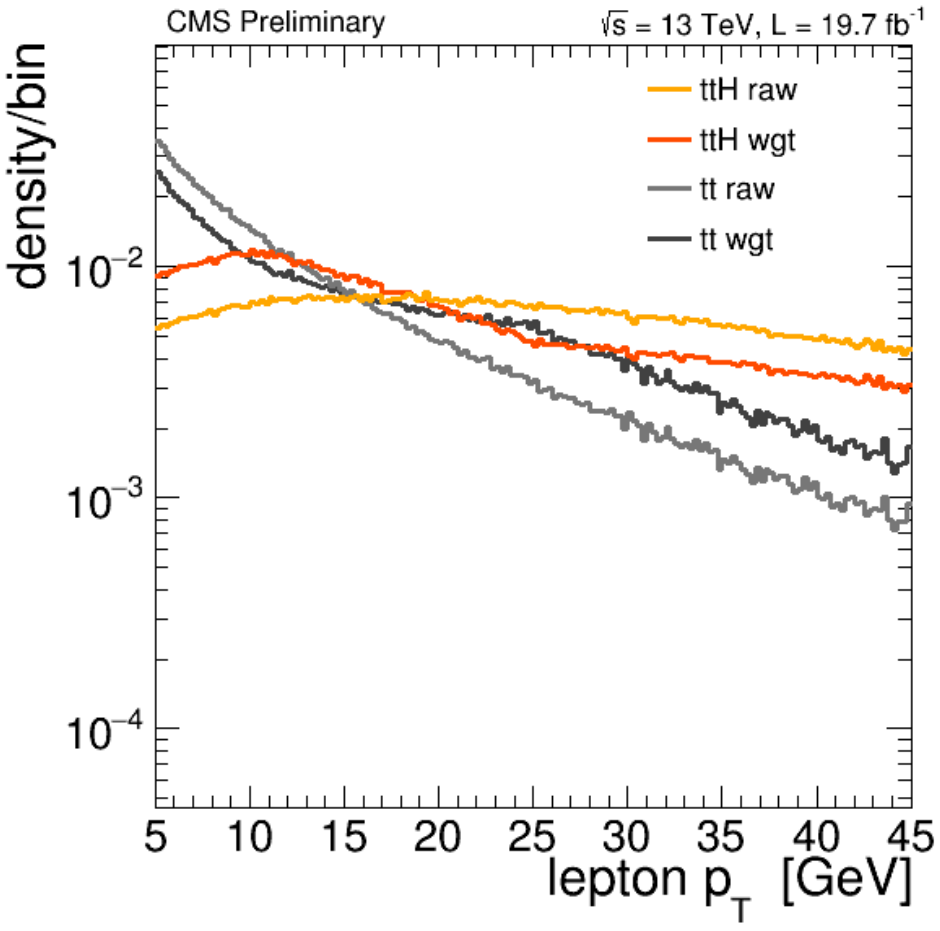


P_T usage in LepMVA

- Brief recap from past presentation (31/08):
  - Including p_T in lepMVA improves discrimination
  - efficiency strongly but smoothly p_T-dependent, can be modulated with p_T-dependent cut
- Things we wanted to check:
  - how reweighting p_T changes p_T dependency
  - if the gain from using p_T in lepMVA remains after we use $p_T(\ell_2)$ in the final MVA

p_T re-weighting test

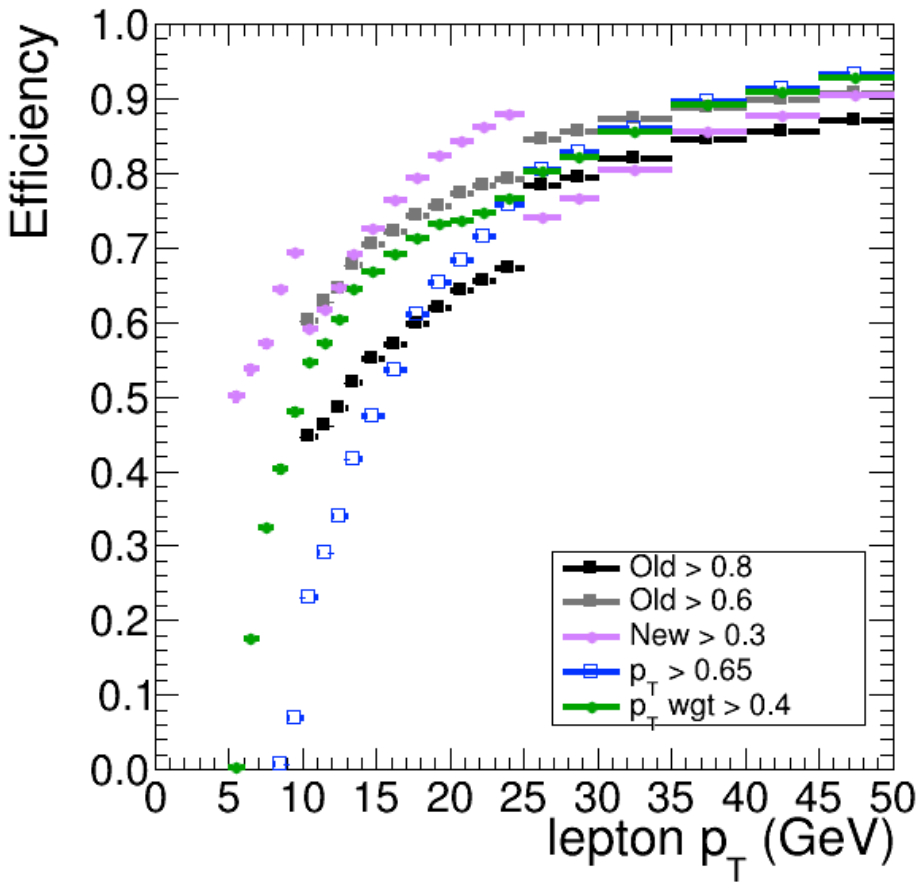
- Apply approximate weight to make p_T spectrum of true leptons (ttH) and fakes (tt) more similar in the 10-30 GeV range
- Compare weighted vs unweighted training

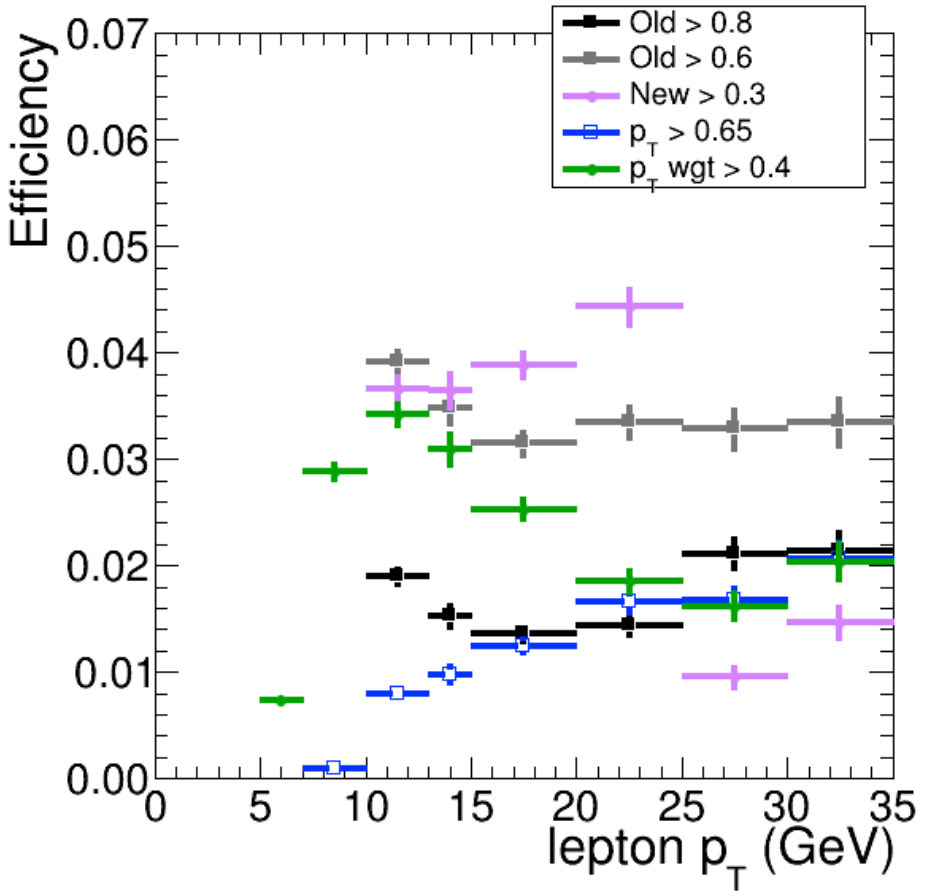


Efficiency and fake rate

Compare: **old**, **new**, **new w/ p_T**, **new w/ p_T wgt**

(new = using miniIso & ptRel; old = using relIso)

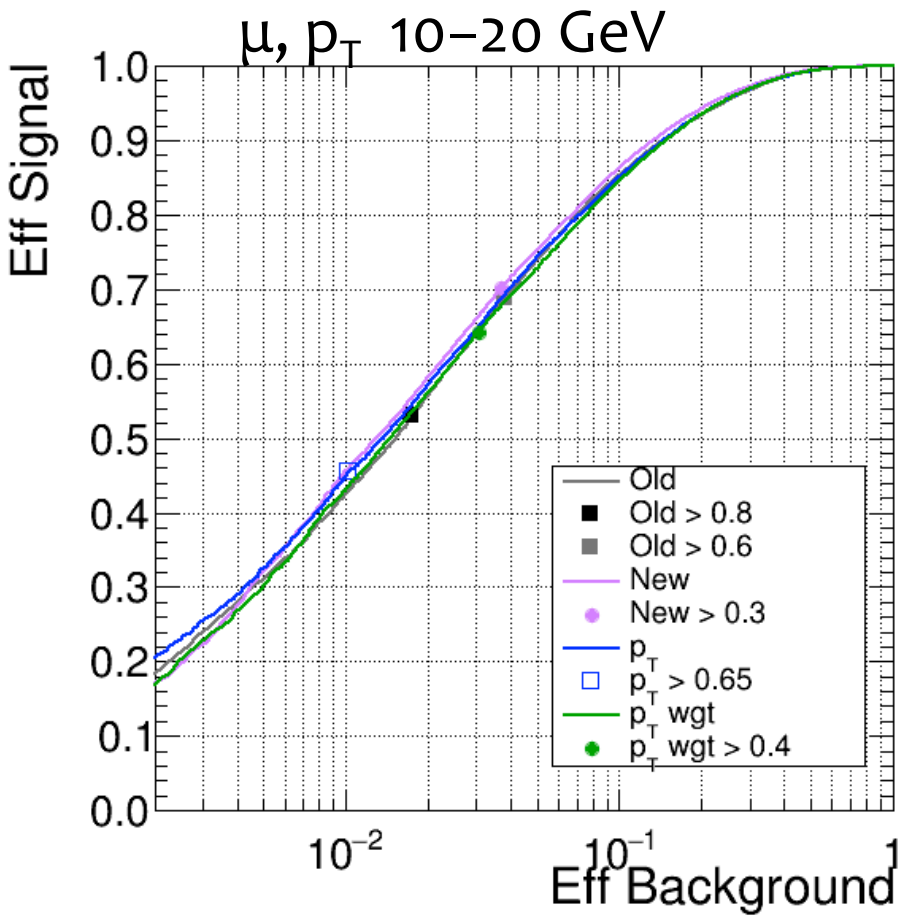


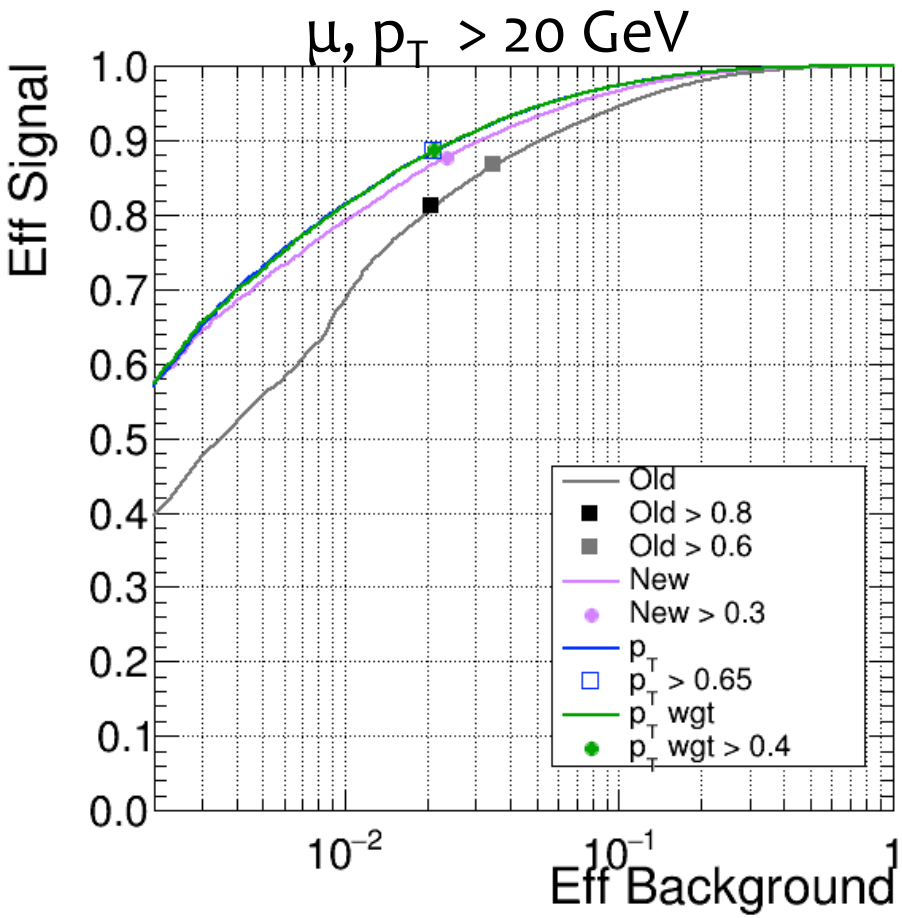


ROCs in p_T bins

Compare: **old**, **new**, **new w/ p_T**, **new w/ p_T wgt**

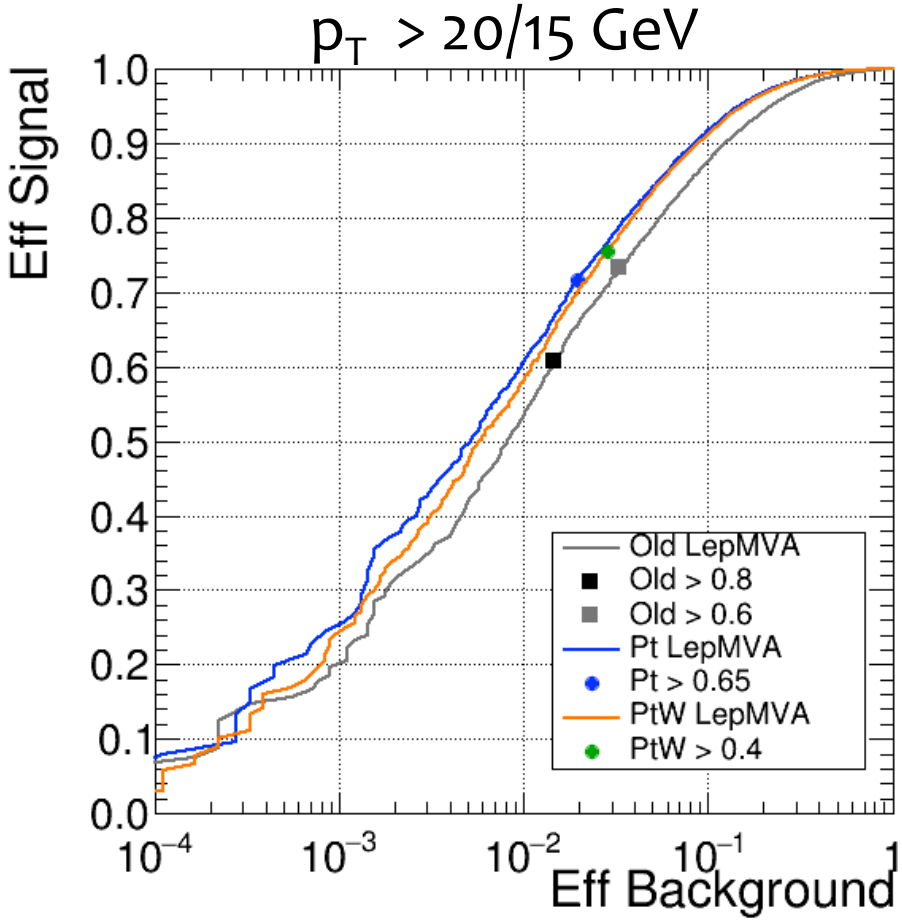
(new = using miniIso & ptRel; old = using relIso)

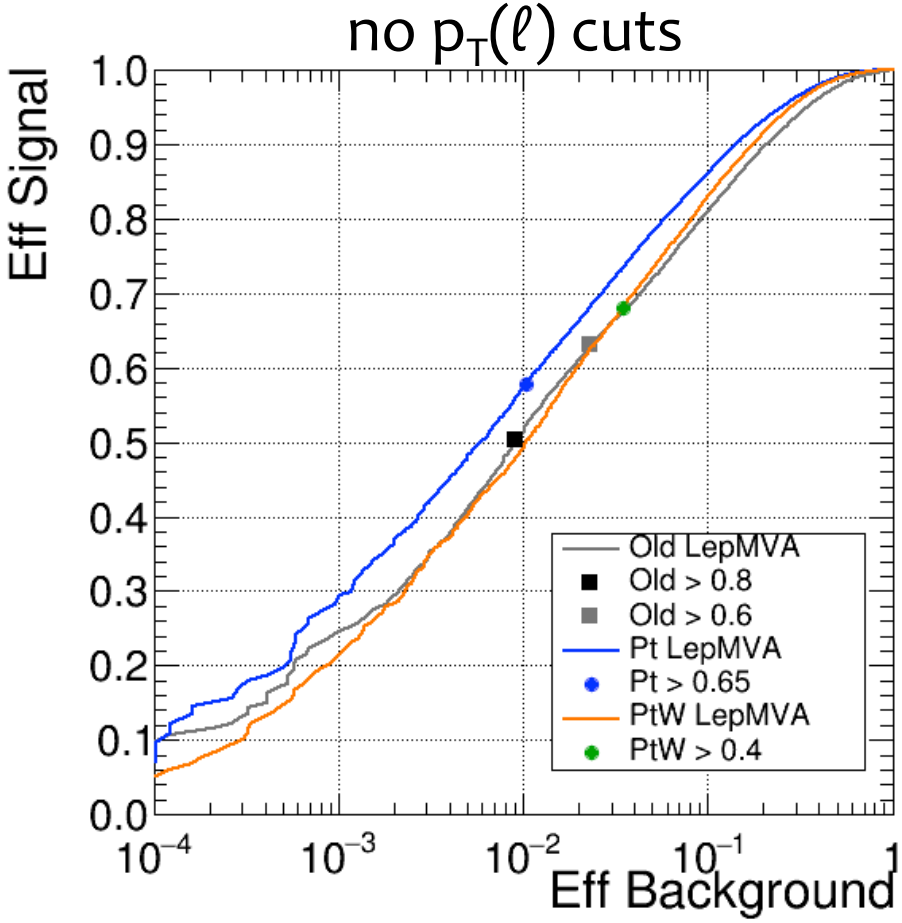




ROCs per event

Full selection, ttH signal vs tt fake background





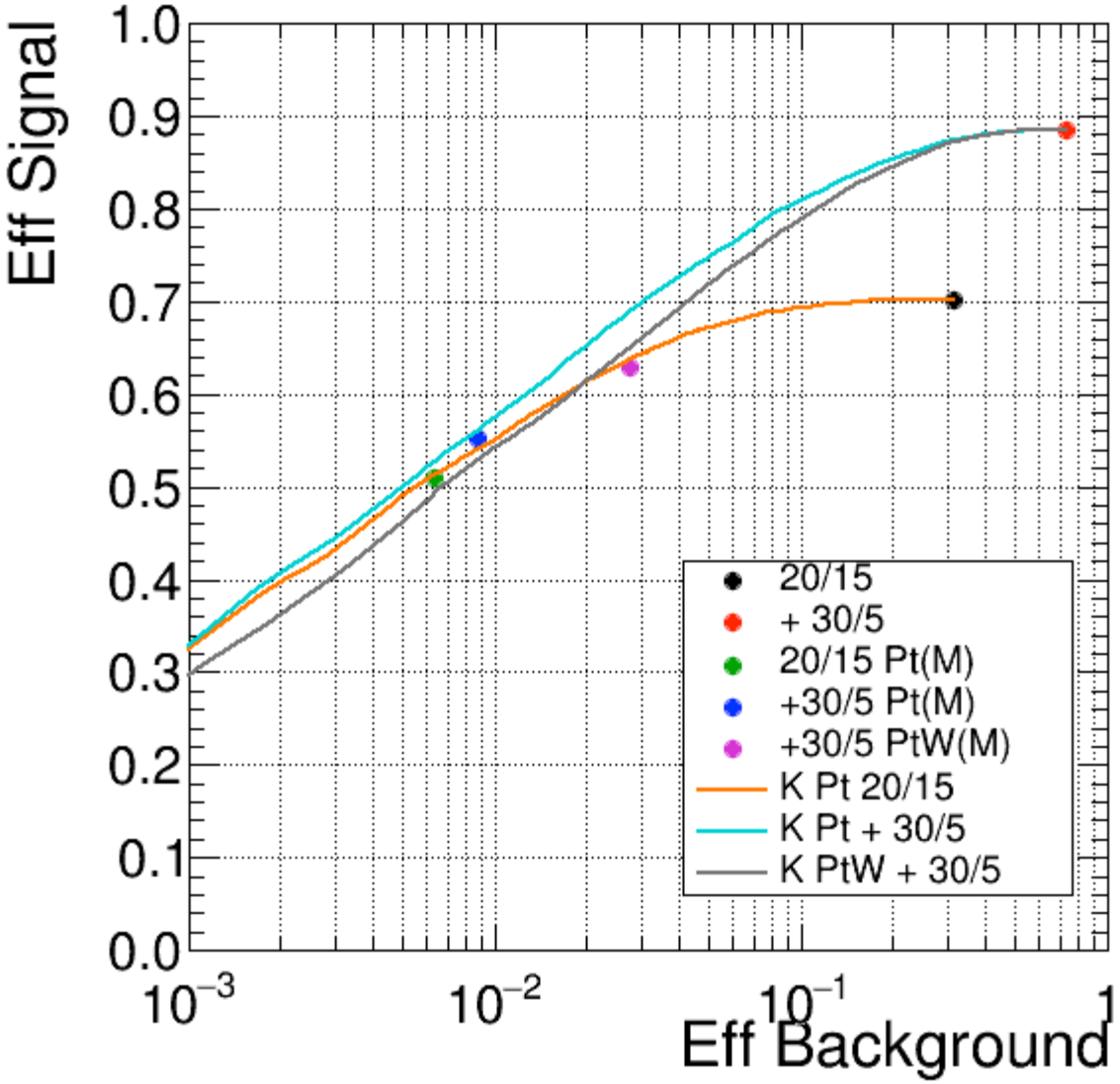
Combining lepMVA & final MVA

- Test interplay of p_T cuts, lepMVA, finalMVA:
  - Train finalMVA, using run 1 vars including $p_T(\ell 2)$
  - do ROCs for a 2D cut on (lepMVA, finalMVA)
- See effect of two possible changes:
  - Adding p_T 30/5 category on top of 20/15 one
  - Using weighted lepMVA training
- Note: to be redone including ttW, ttZ backgrounds, not just ttbar

Per event ROCs

Compare:

- p_T cuts before lepton MVA (**black**, **red**)
- p_T cuts including lepton MVA (**green**, **blue**, **pink**)
- 2D cut on lepton MVA + final MVA (**curves**)



Summary

- New PtRatio & PtRel variables work on in the lepton MVA → will use them
- Reweighting lepton p_T in the lepMVA training can increase efficiency, but overall performance is worse also after combining with the final MVA
- Low p_T category brings in some ~5% gain in efficiency for the same background.
- The two latter points will benefit from further study with the full analysis