$B^0 \to \pi^0\pi^0$ analysis progresses

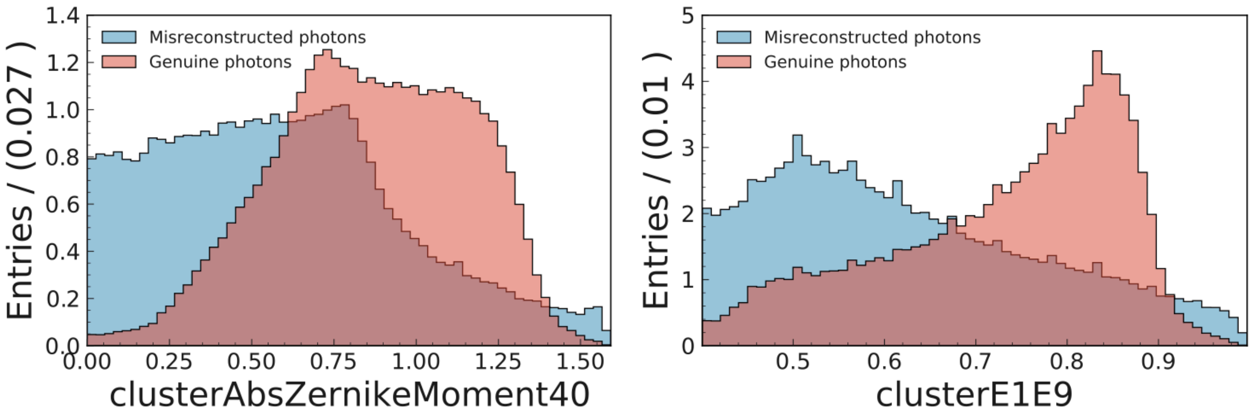
Sebastiano

Photon MVA

Photon MVA

Distinguish between real photons and “false” photons: beam backgrounds, other particles, energy releases from other particles (split-offs)….

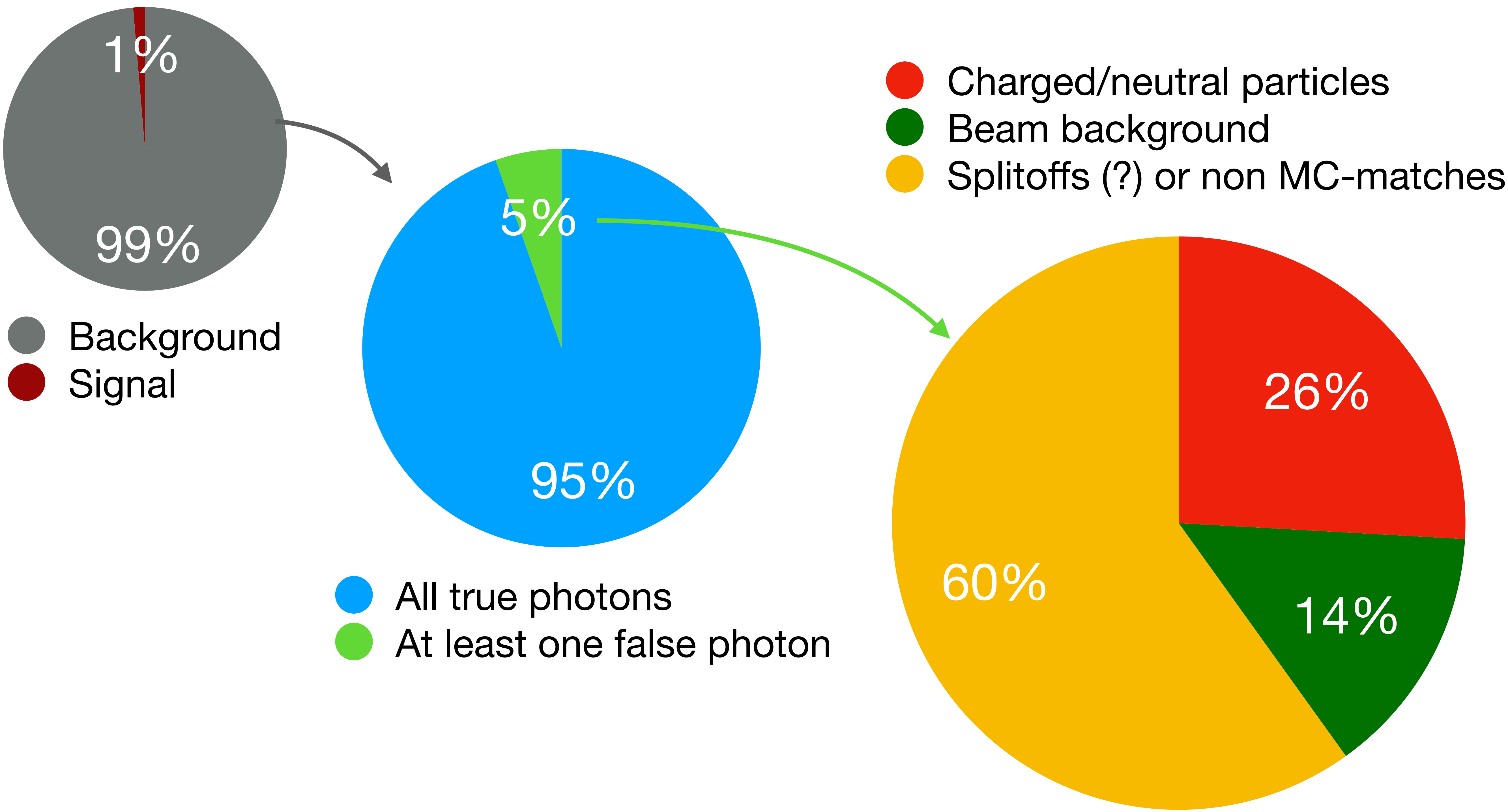
Combine highly-discriminant cluster- and photon-variables in a MVA.



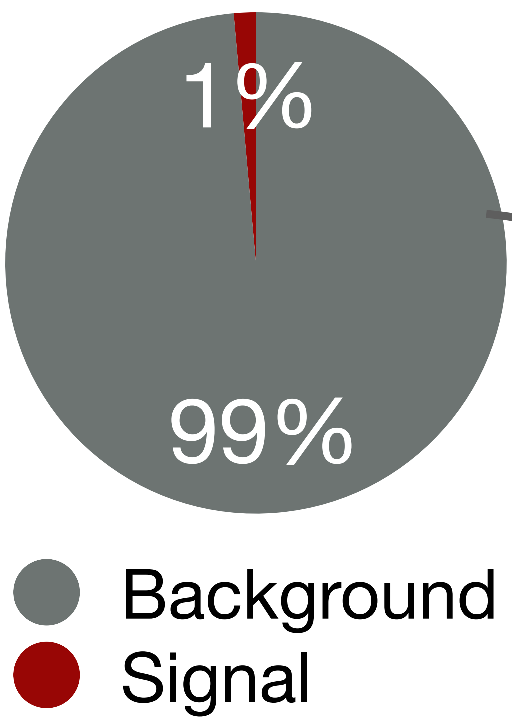
False photons have usually low energies, while $B^0 \to \pi^0\pi^0$ photons high-energy.

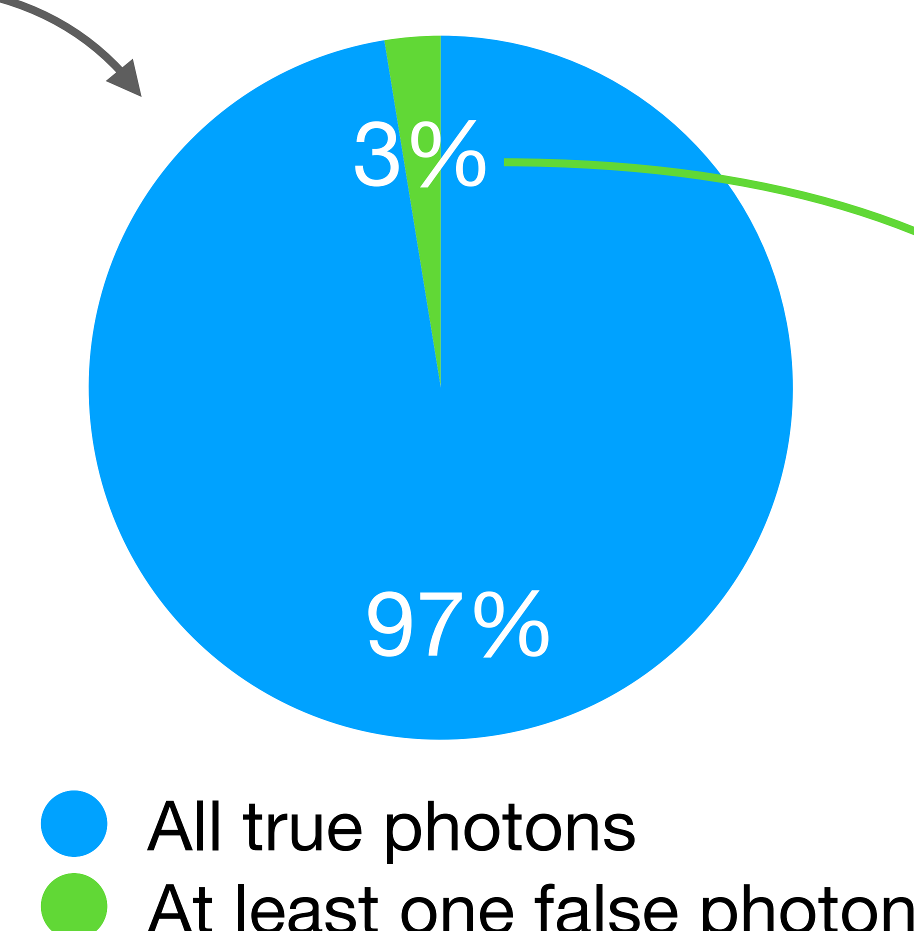
After the default selection on photons and π^0’s, the residual bkg is mainly composed by true combinatorial π^0’s (95%).

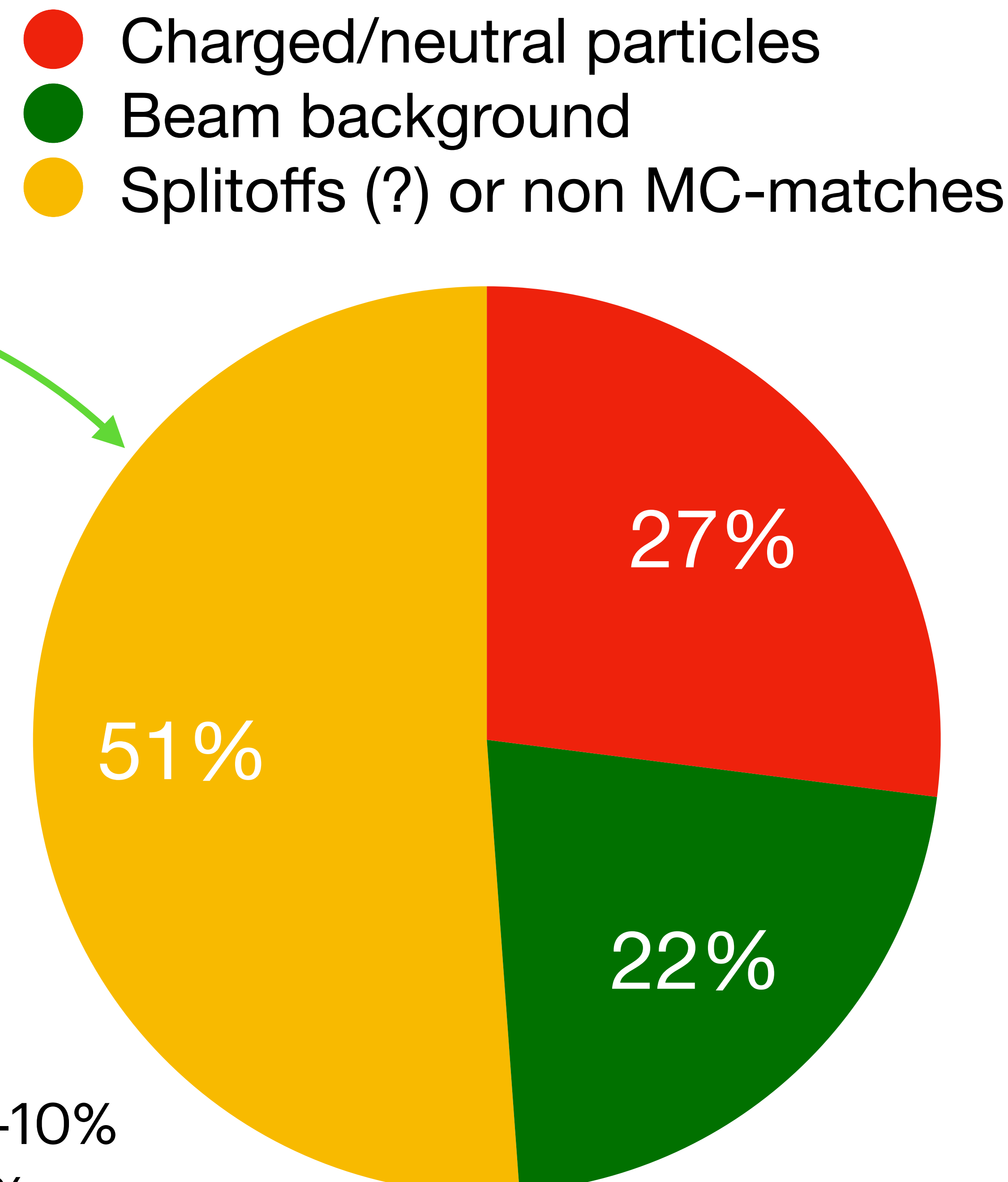
B0-sample composition - after all selections and CS>0.7 (but photonMVA)



Sample composition - after all selections and CS>0.7 (and photonMVA>0.2)

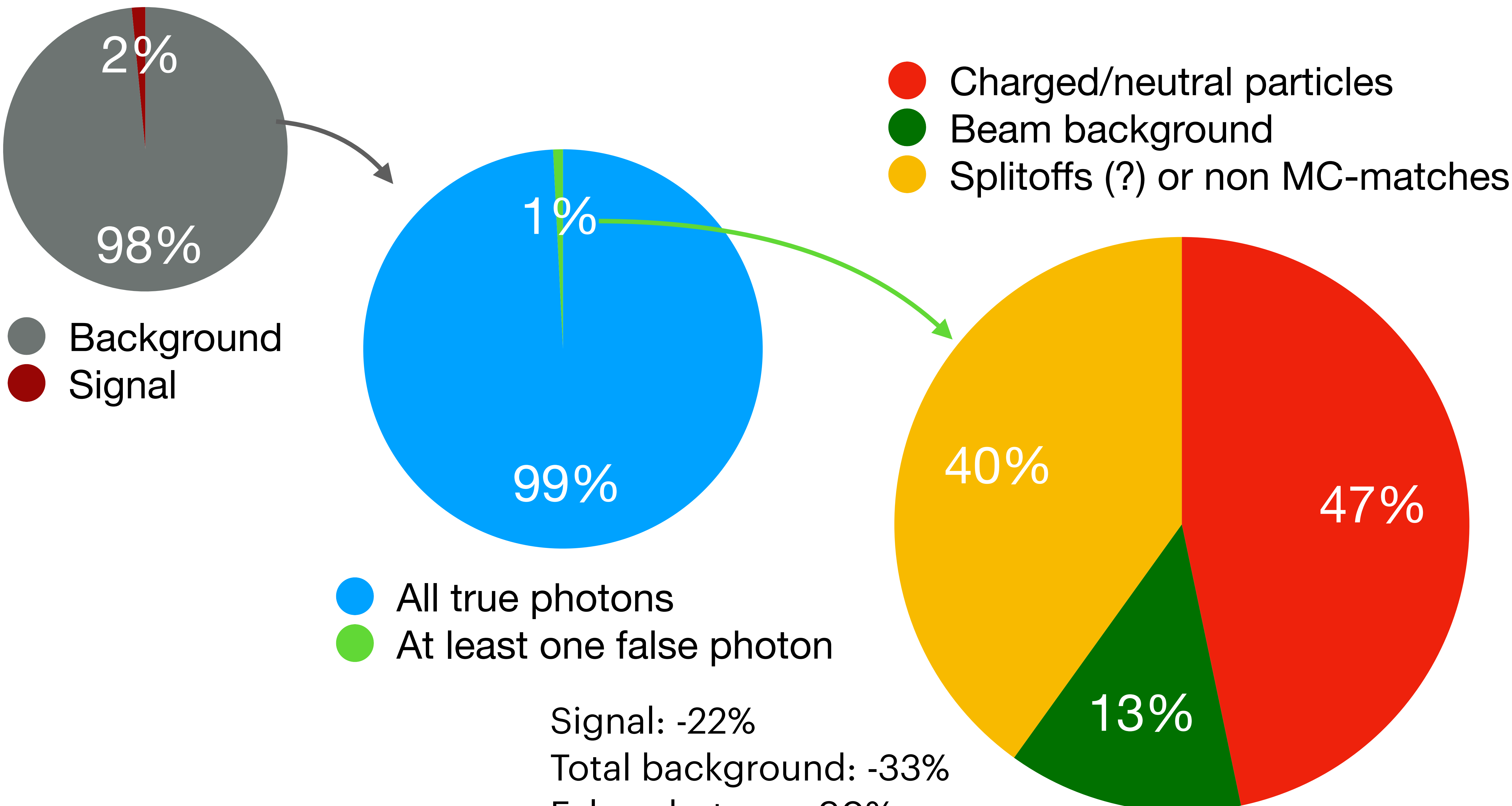






Signal: -4.4%
Total background: -10%
False photons: -58%

Sample composition - after all selections and CS>0.7 (and photonMVA>0.5)



Signal: -22%
Total background: -33%
False photons: -90%

Photon MVA: plan

We can apply a photonMVA, but new variables give small improvement wrt previous analysis (mainly LAT variable).

Other highly-discriminant variable is pulseShapeDiscriminatorMVA (but I recall it was suggested not to use it on data due to wrong calibrations).

Improvement using new variables is not very promising.

My idea is to obtain a new photonMVA (not large improvement wrt previous analysis) and stick to it. No division in barrel-endcaps (Francesco can check).

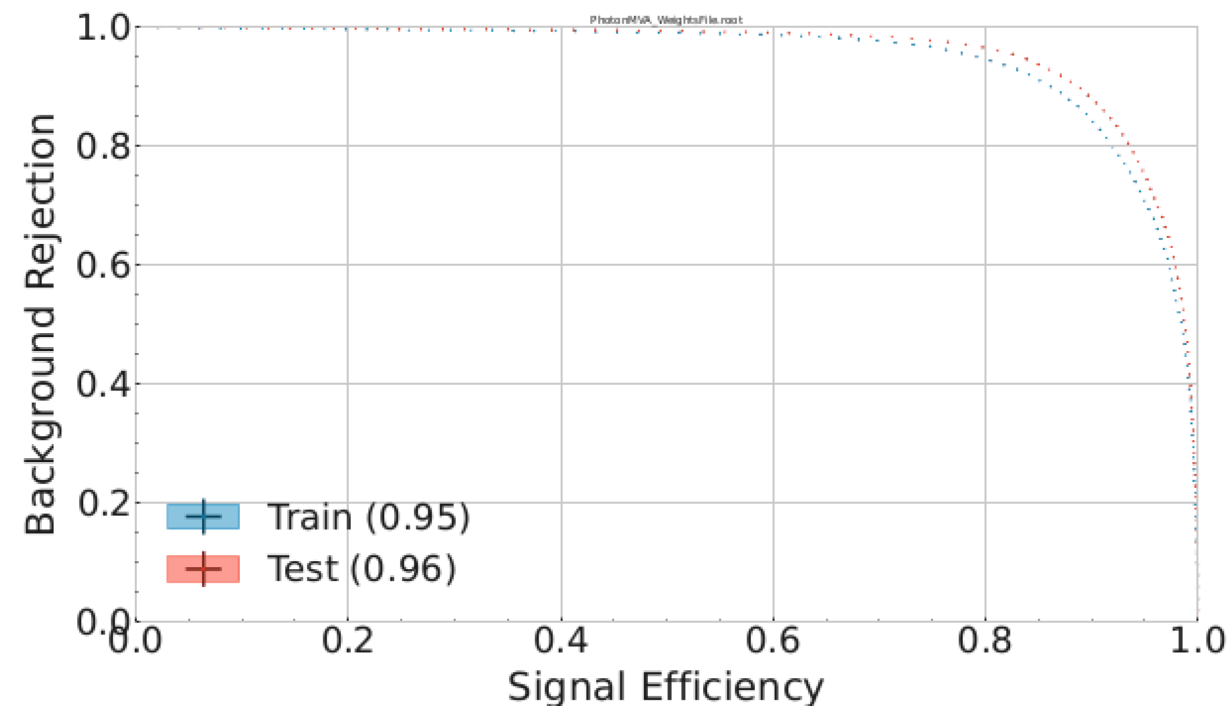
Optimised selection? Before/after γ/π^0/CS selections?

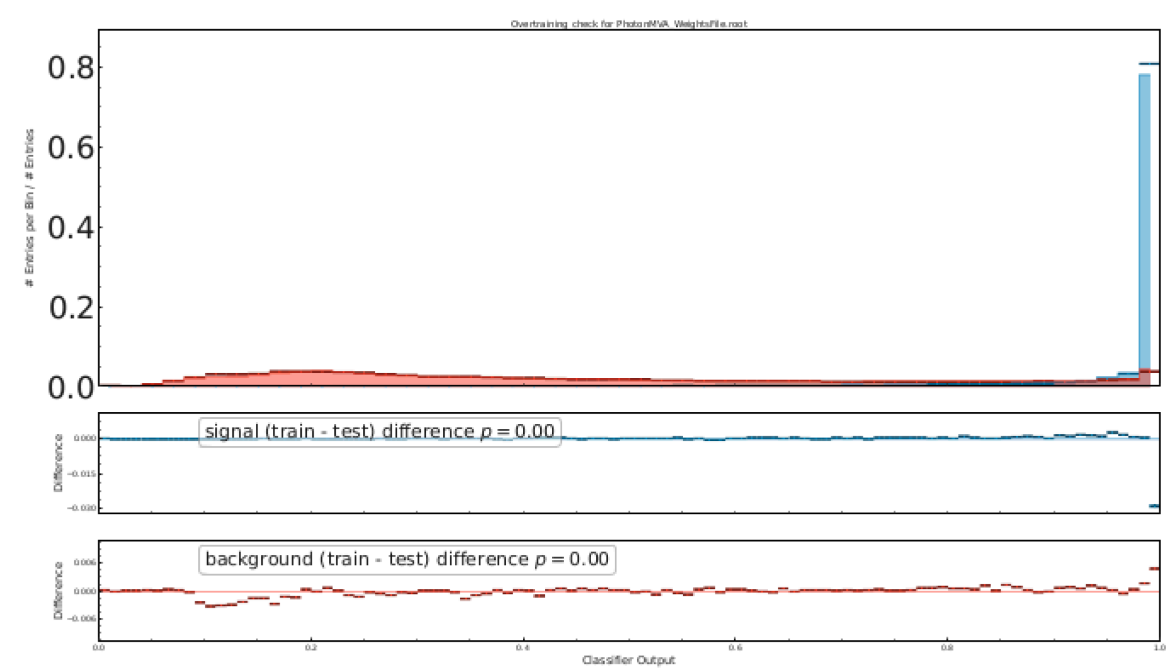
To do: validation of the photonMVA (Francesco?).

Photon MVA

Apply all π^0 selections. No CS.

My FBDT
pt (15)
clusterZernike40 (1)
clusterZernike51 (0)
clusterE1E9 (1)
clusterE9E21 (3)
clusterErrorPhi (11)
clusterHighestE (100)
clusterSecondMoment (40)
clusterZernikeMVA (13)
minC2TDist (12)
clusterE (1)
clusterErrorE (2)
clusterErrorTiming (1)
clusterLAT (30)
clusterNHits (10)
clusterTheta (3)





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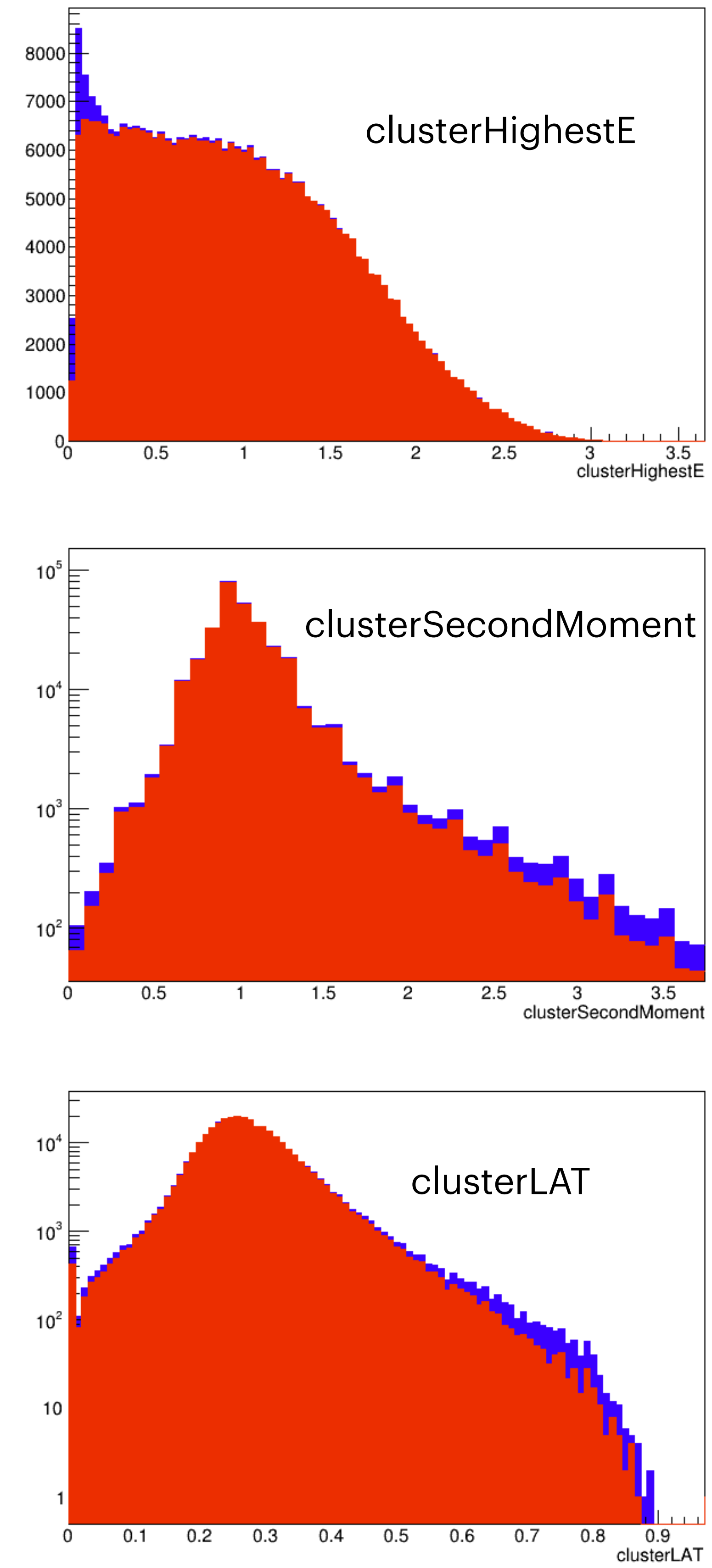
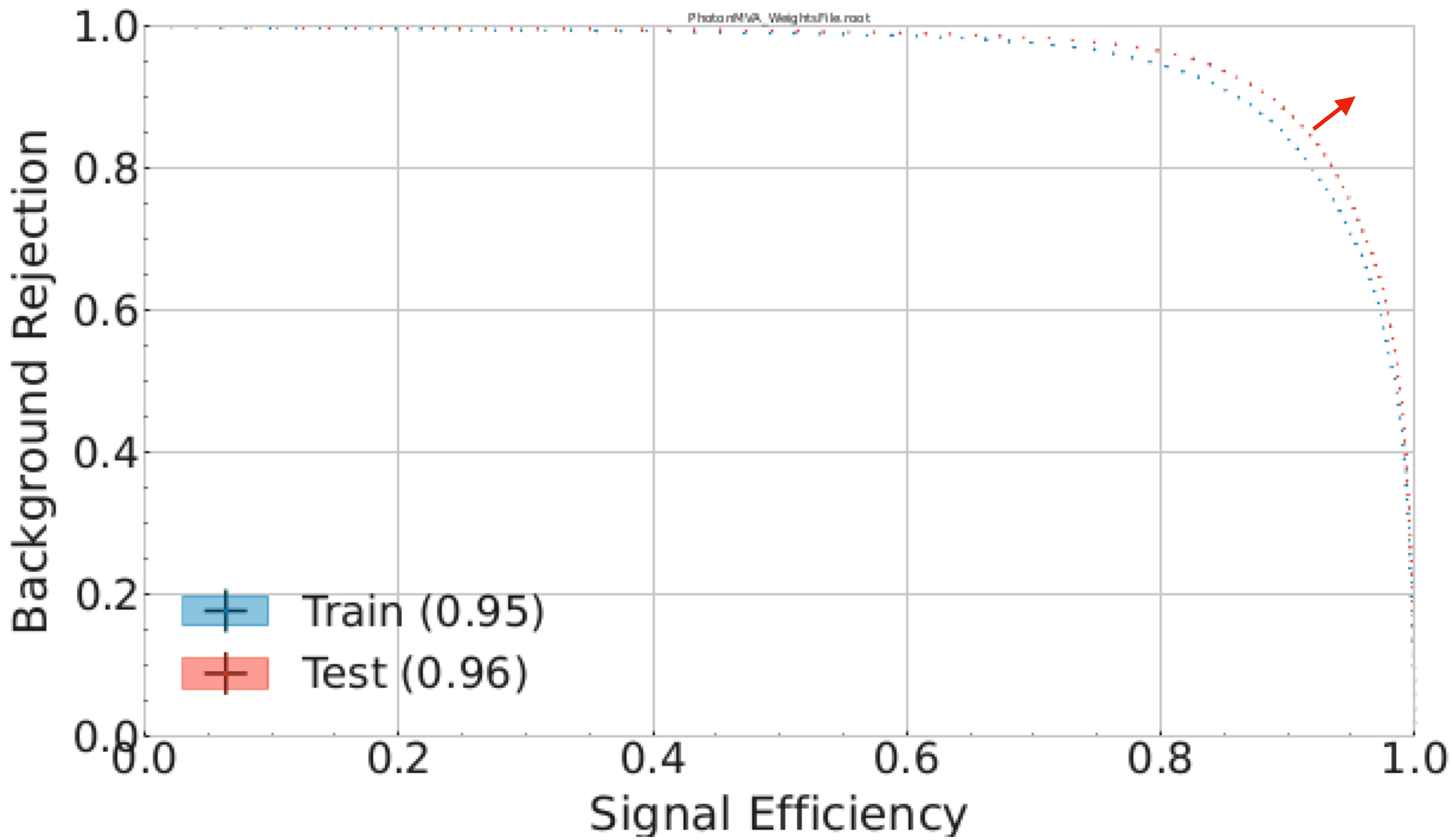


Photon MVA

New from Savino: *beamBackgroundSuppression*, *hadronicSplitOffSuppression*, and *clusterPulseShapeDiscriminatorMVA* can be included in the photonMVA (2/3% increase in AUC).



Photon MVA: inputs validation

Ideally we need a sample of true photons and a sample of false photons.

Difficult to obtain sample of false photons!

Ryogo uses B->Drho decays (true+false photons), while Francis uses D*->D(KspiO)pi decays with hard cuts (mainly true photons).

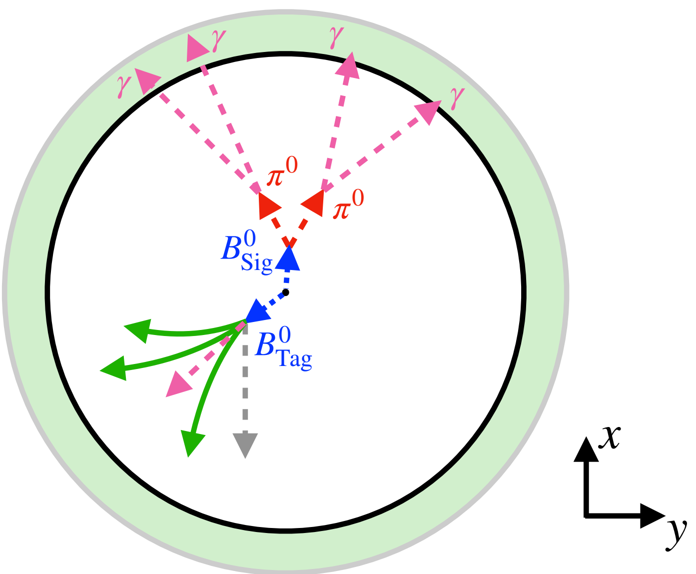
This study: use D*->D(KpipiO)pi decays (mainly true photons).

Still working on this.

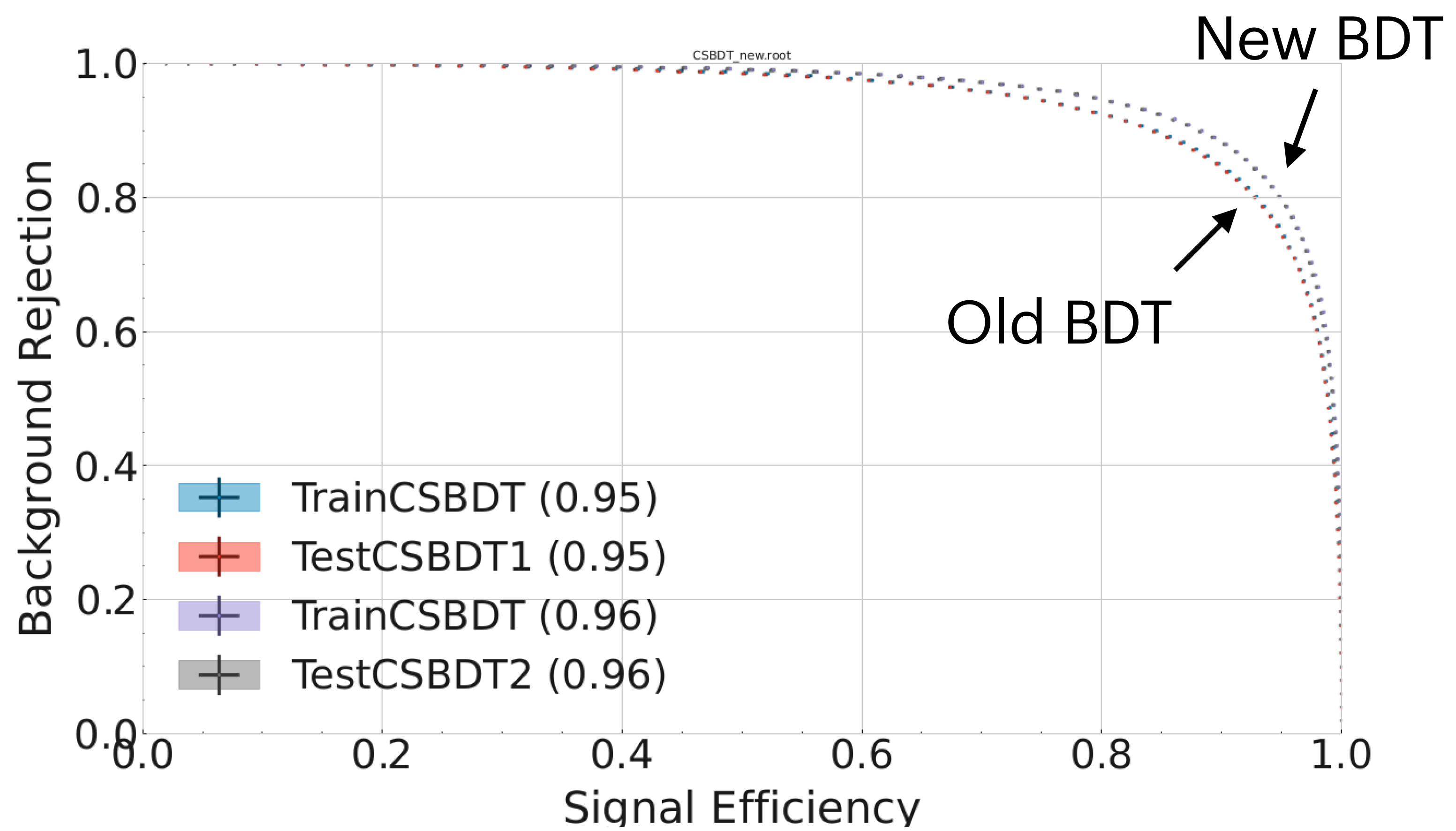
Continuum suppression MVA

CSMVA inputs

Old inputs:
- 13 Kakuno-Super-Fox-Wolfram moments
- cosTBTO
- 7 CleoCones
- cosTheta*
- R2



Additional inputs:
- thrustOm
- ΔZ (BTag)
- Δr (BTag)
- angle between track and π^0
- cone around π^0
- angle between π^0's
- cosHelicityAngle
- KSFWVariableset
- KSFWVariablesmm2

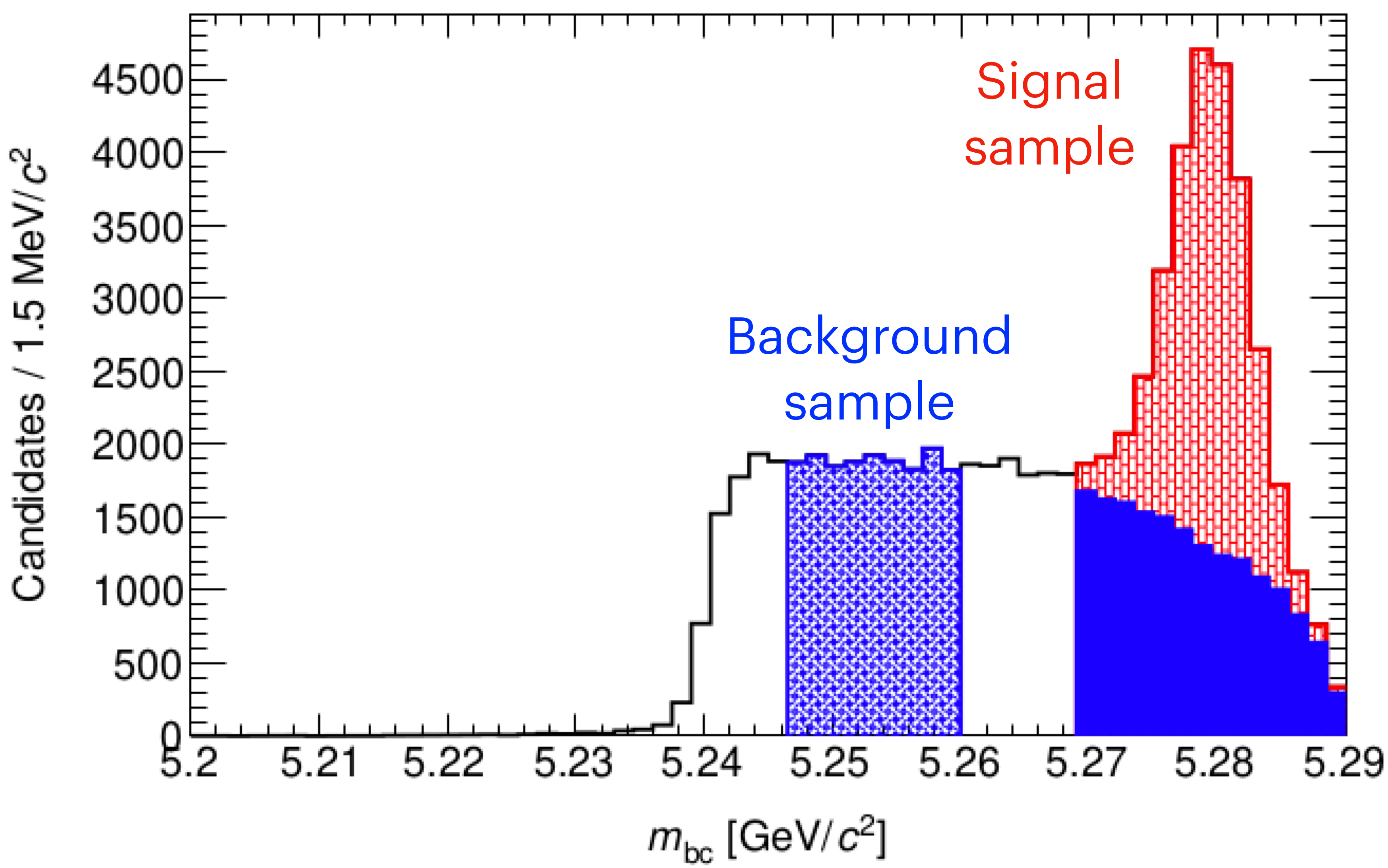


Some correlations with fit variables (<10%), but no sculpting.

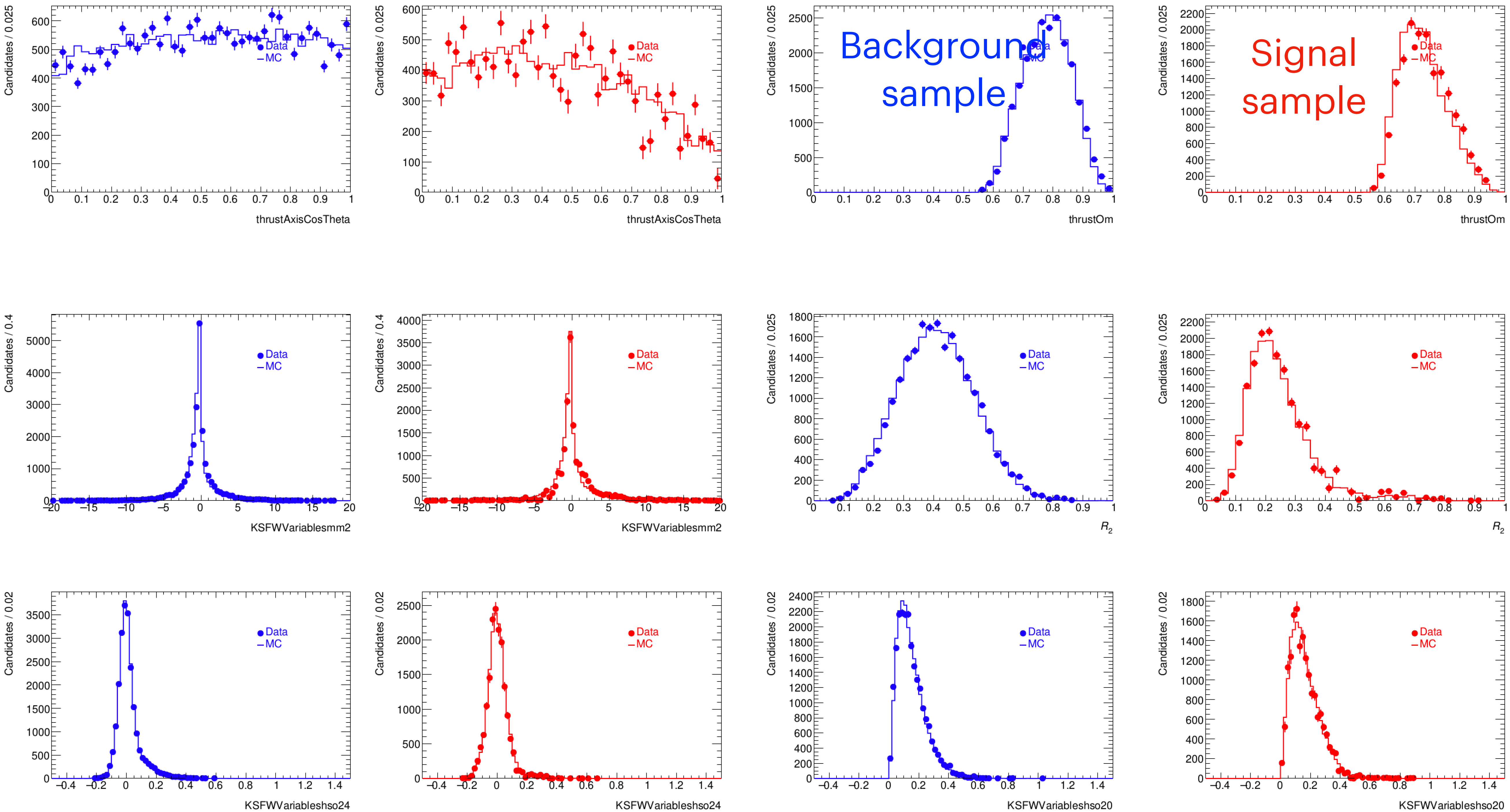
CSBDT: inputs validation

For previous conferences, we used a sample of $B \to D(K\pi)\pi$ decays to validate CSBDT.

This study: use $B \to D(K\pi\pi^0)\pi$ decays (where we apply our π^0 selections).



CSBDT: inputs validation



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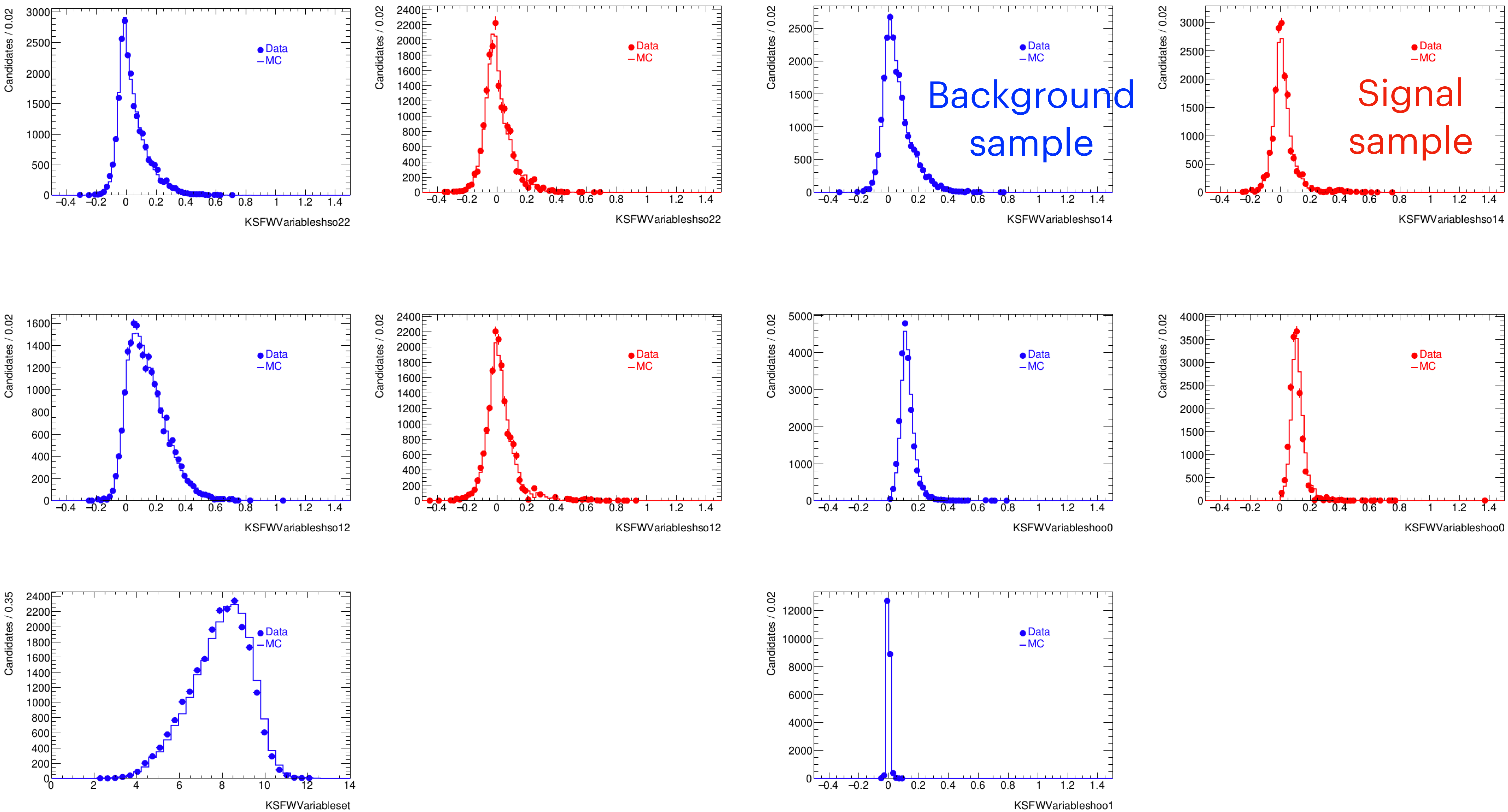

CSBDT: inputs validation