Status update

$\tau_{\mathrm{had-vis}}$ reconstruction in traditional way

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Intro.

- The algorithm follows the CEPC CDR

- Starting from a charged hadron track with E > 1.5 GeV
  - Form a jet with visible objects in $\Delta R < 0.12$
  - ISO: $\frac{E_{0.12<\Delta R<0.31}}{E_{\Delta R<0.12}}$

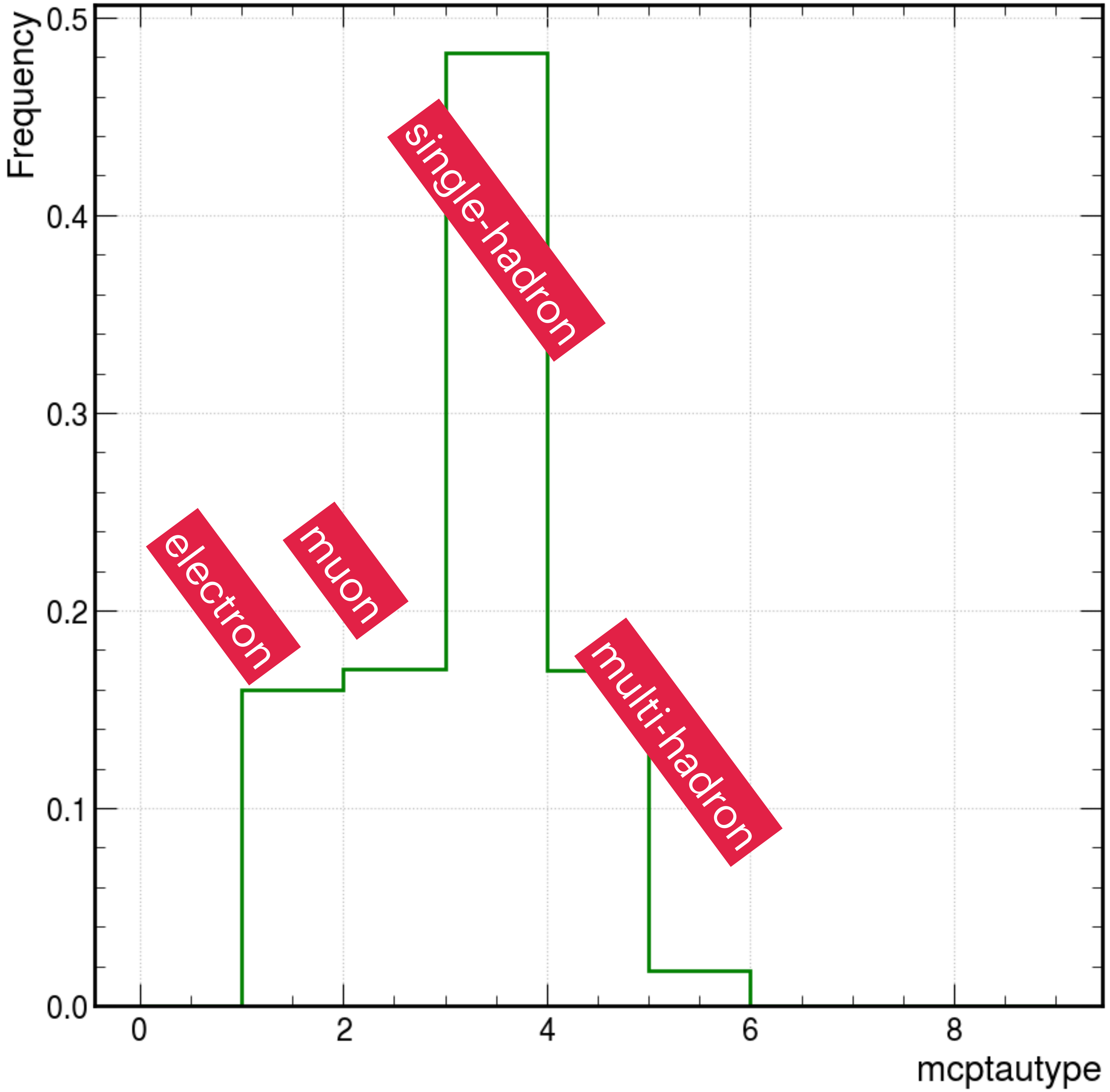
- Iterate over all tracks [hadron] with E > 1. GeV
  - If the later one shares components with a former
  - replace it with the later if the later has a smaller tau-iso

- $\tau\tau HX$ events from Kali; $qqH\tau\tau$ is being generated

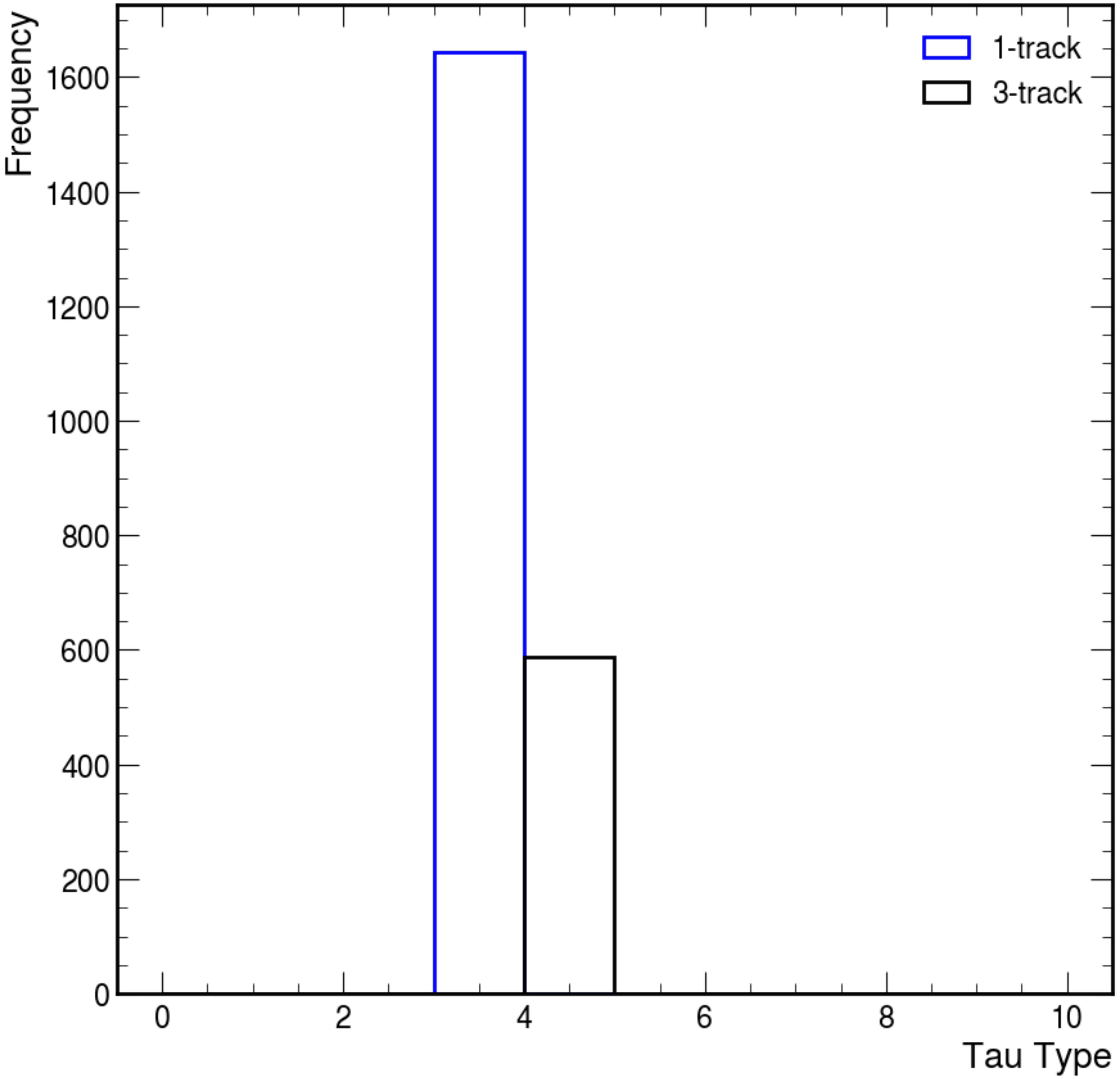
- Truth tau-leptons are categorised as:
  - Cat1(2), (Ne=1(0) | Nmu=0(1)) & Nh=0
  - Cat3, (Ne=0 & Nmu=0) & Nh=1
  - Cat4, (Ne=0 & Nmu=0) & Nh>1
  - Cat5, Other
- Match the seeding track with mcp using hits
- If the seeding track's mcp has tau-mother-particle, tag the tau-seed to the corresponding category.

Intro.

Truth



Reco.

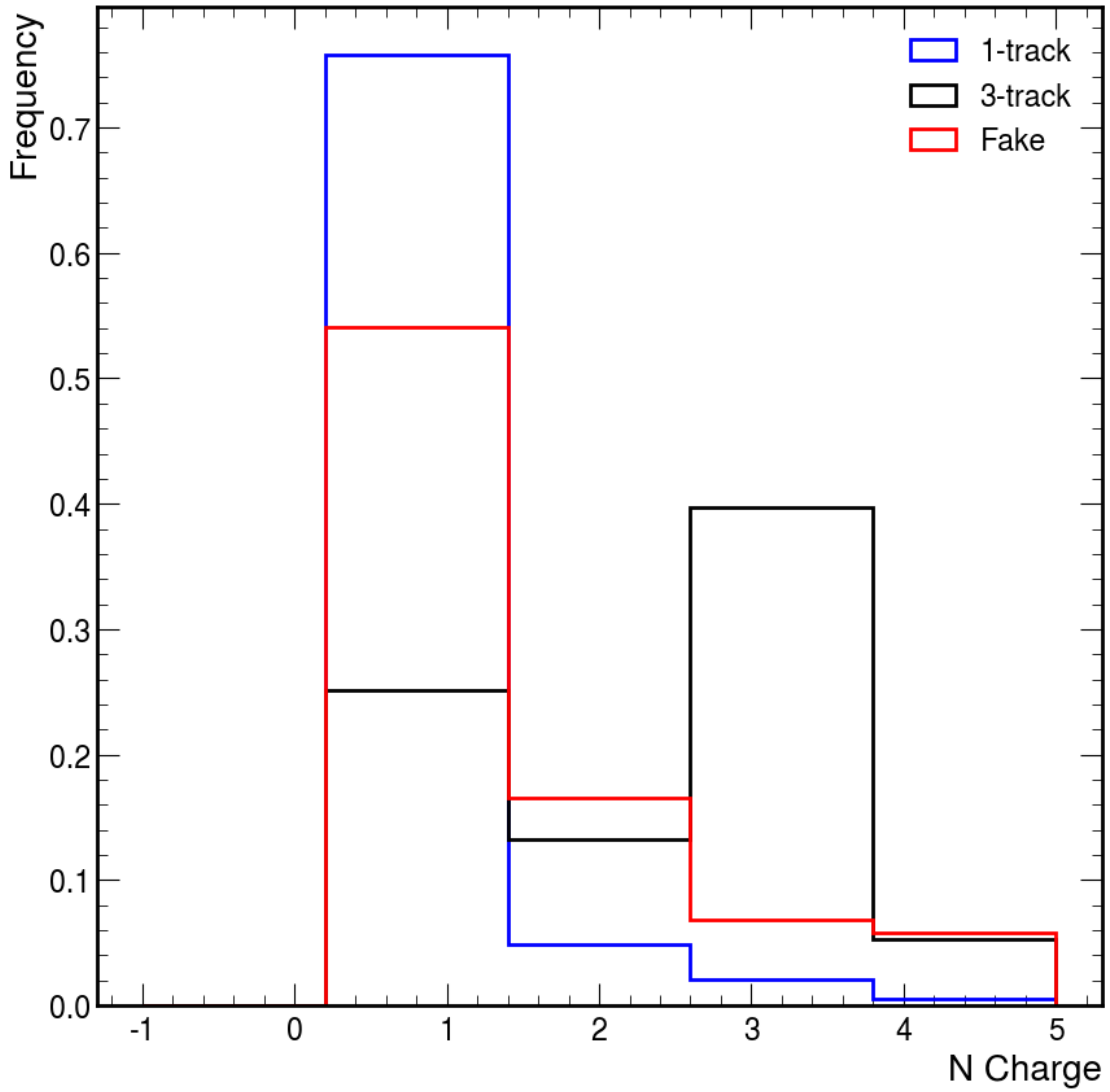


er

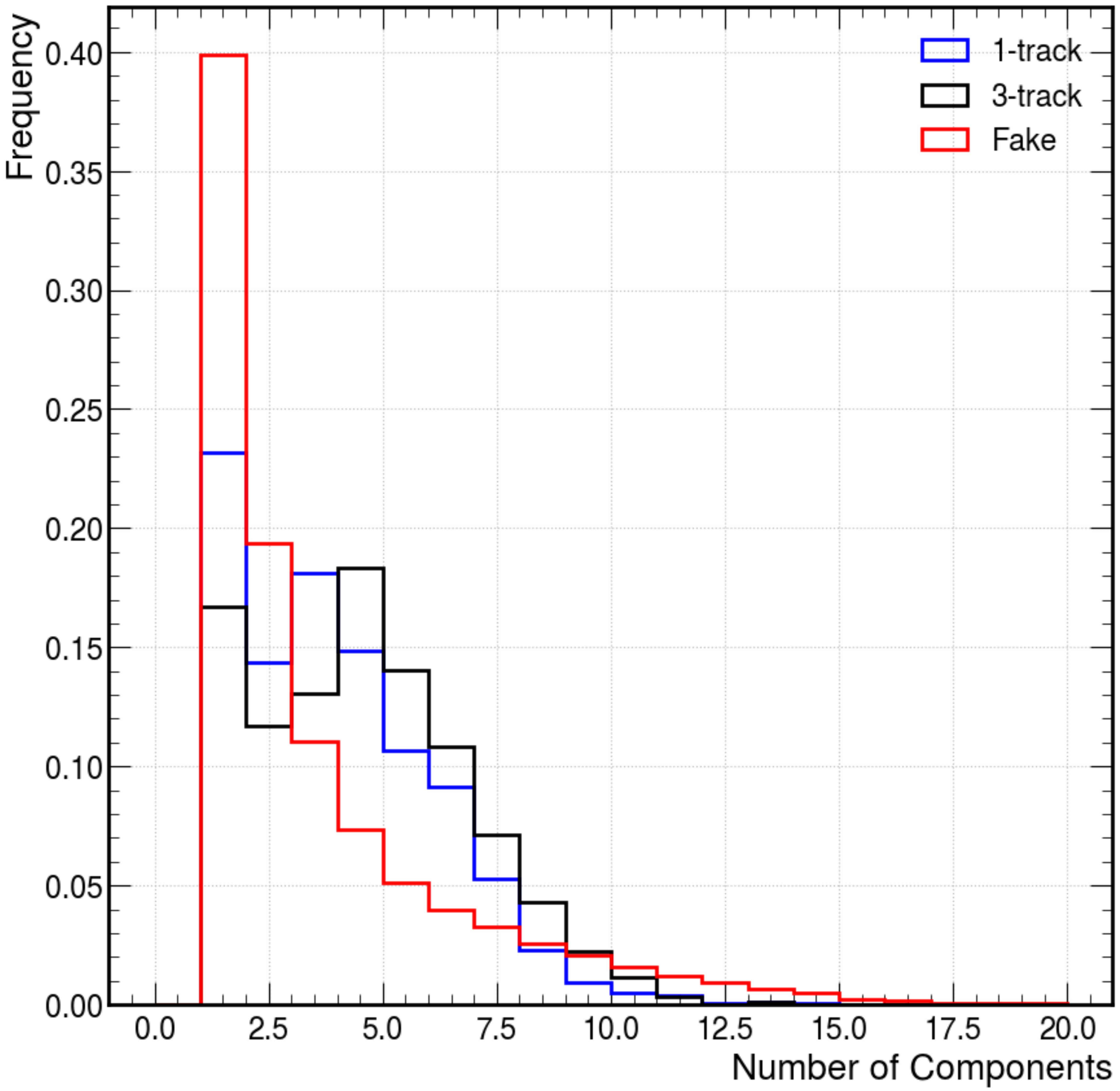
d

Sanity plot

Reco.

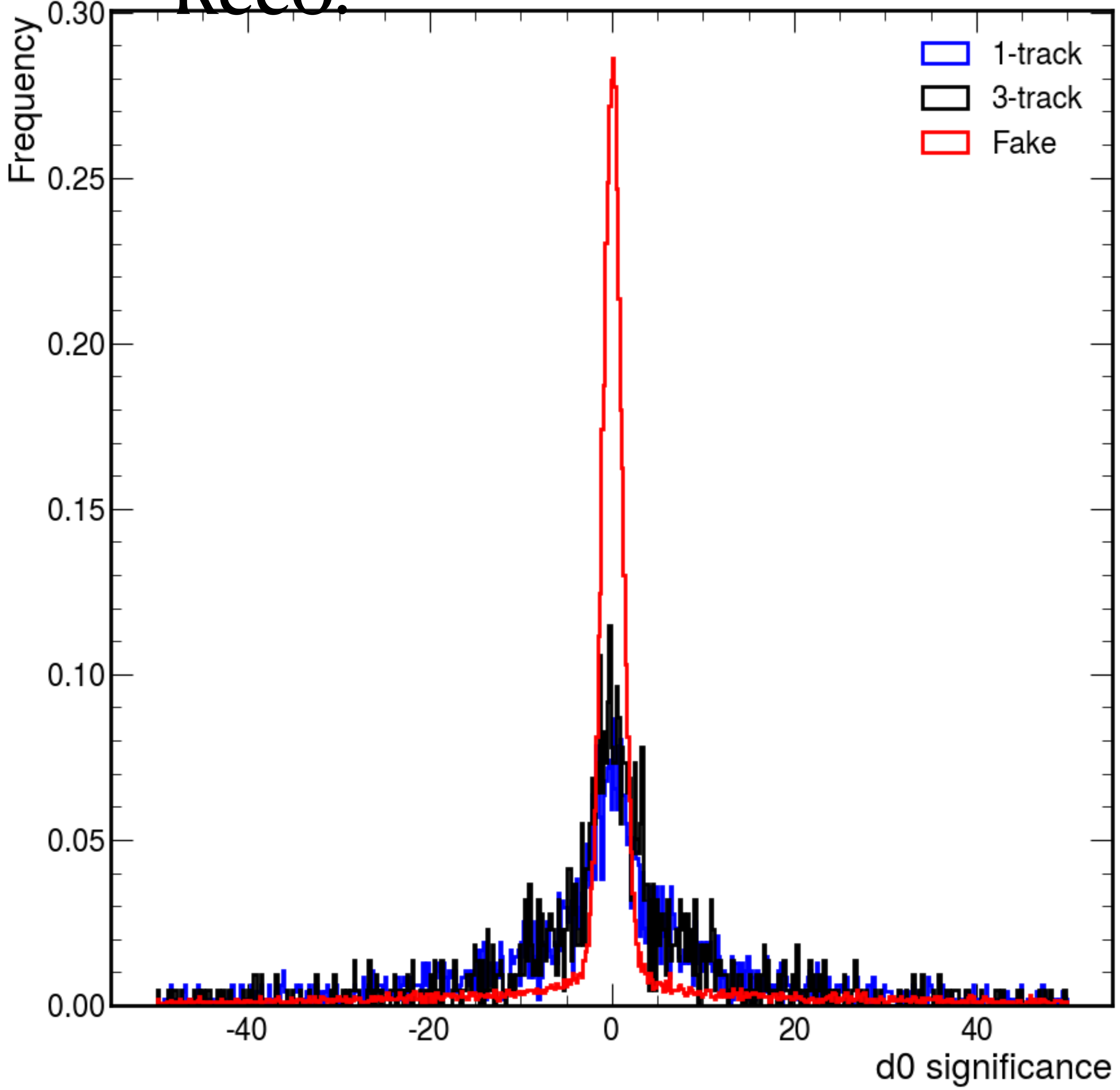


Reco.

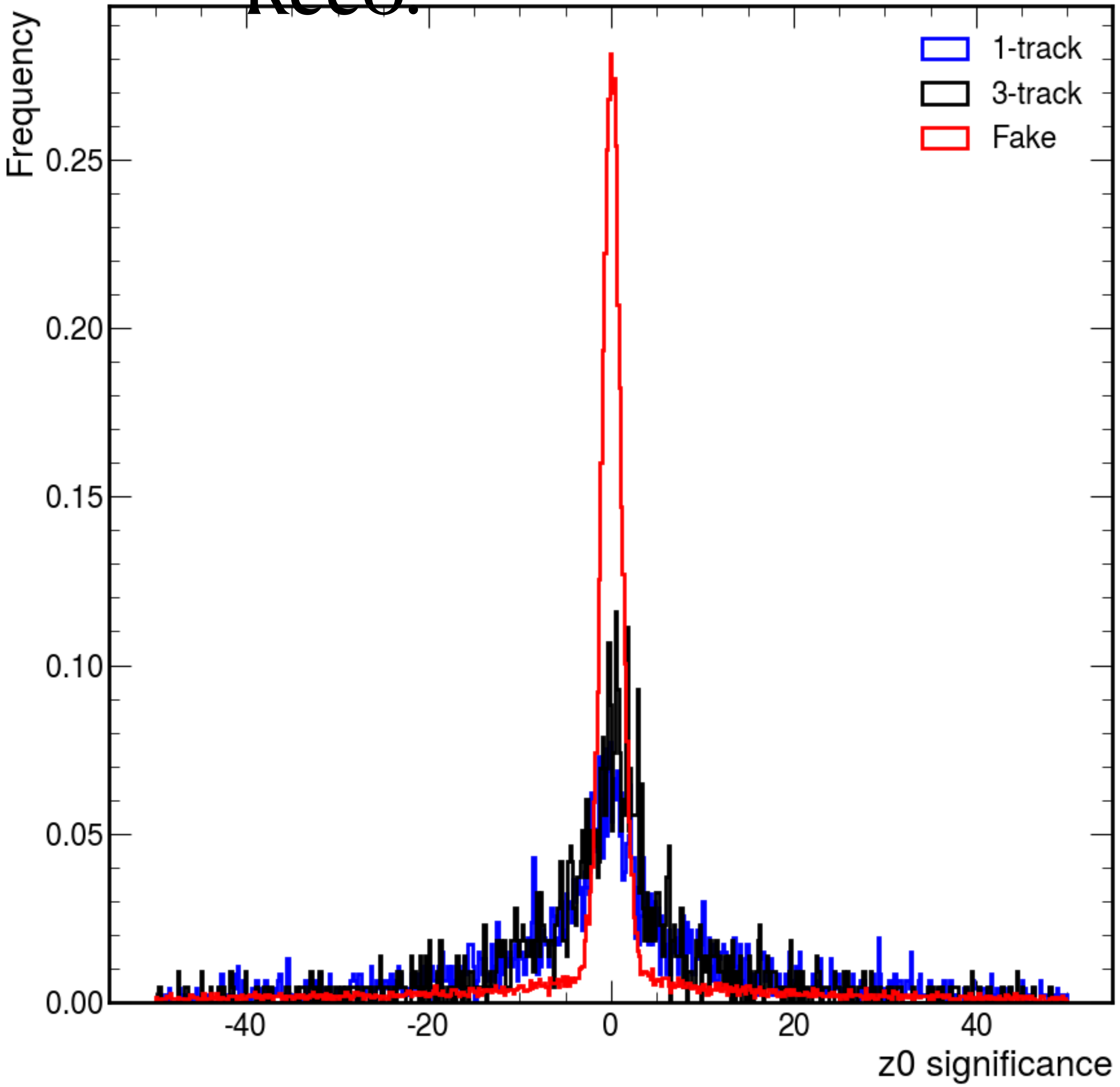


Sanity plot

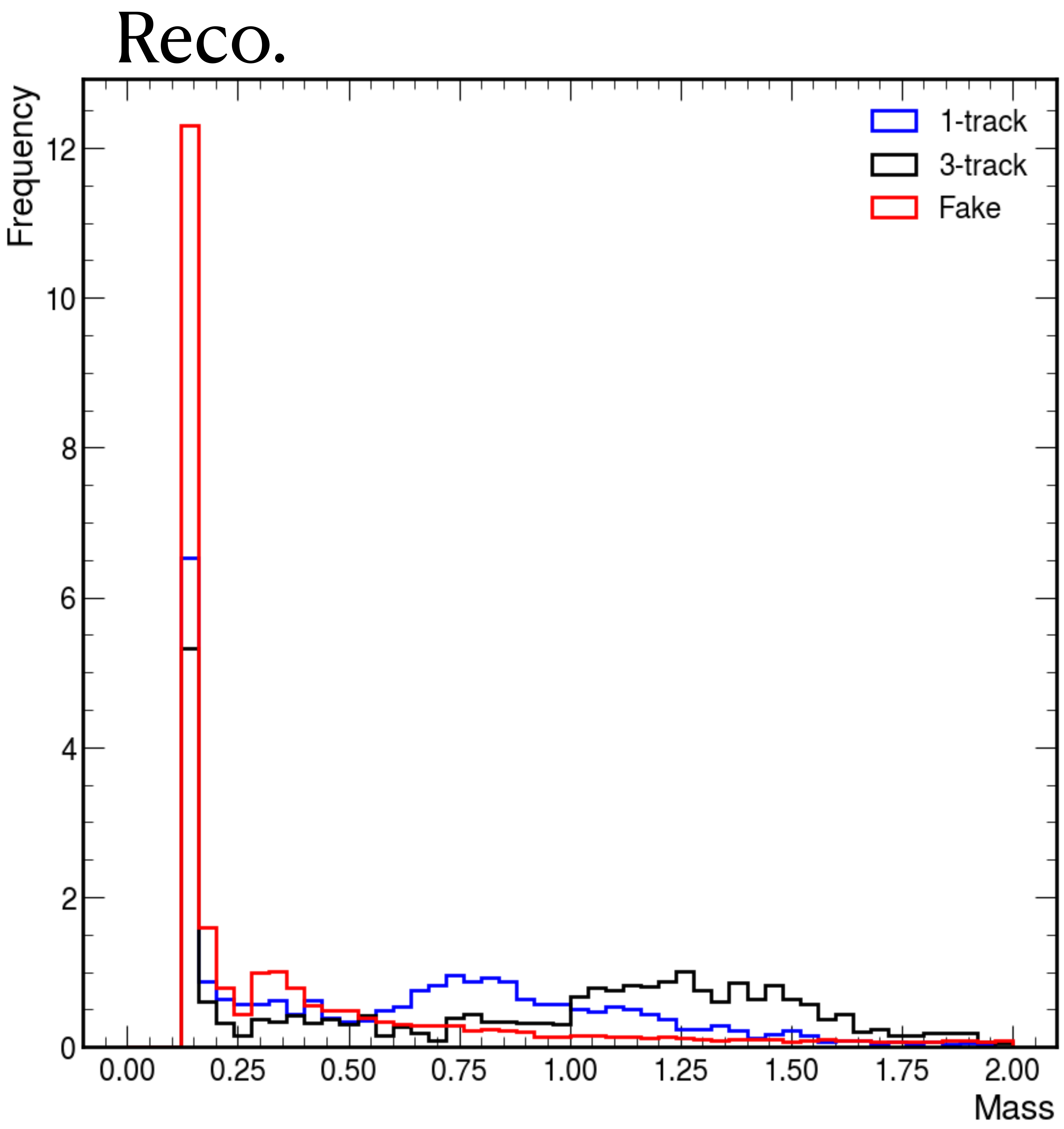
Reco.



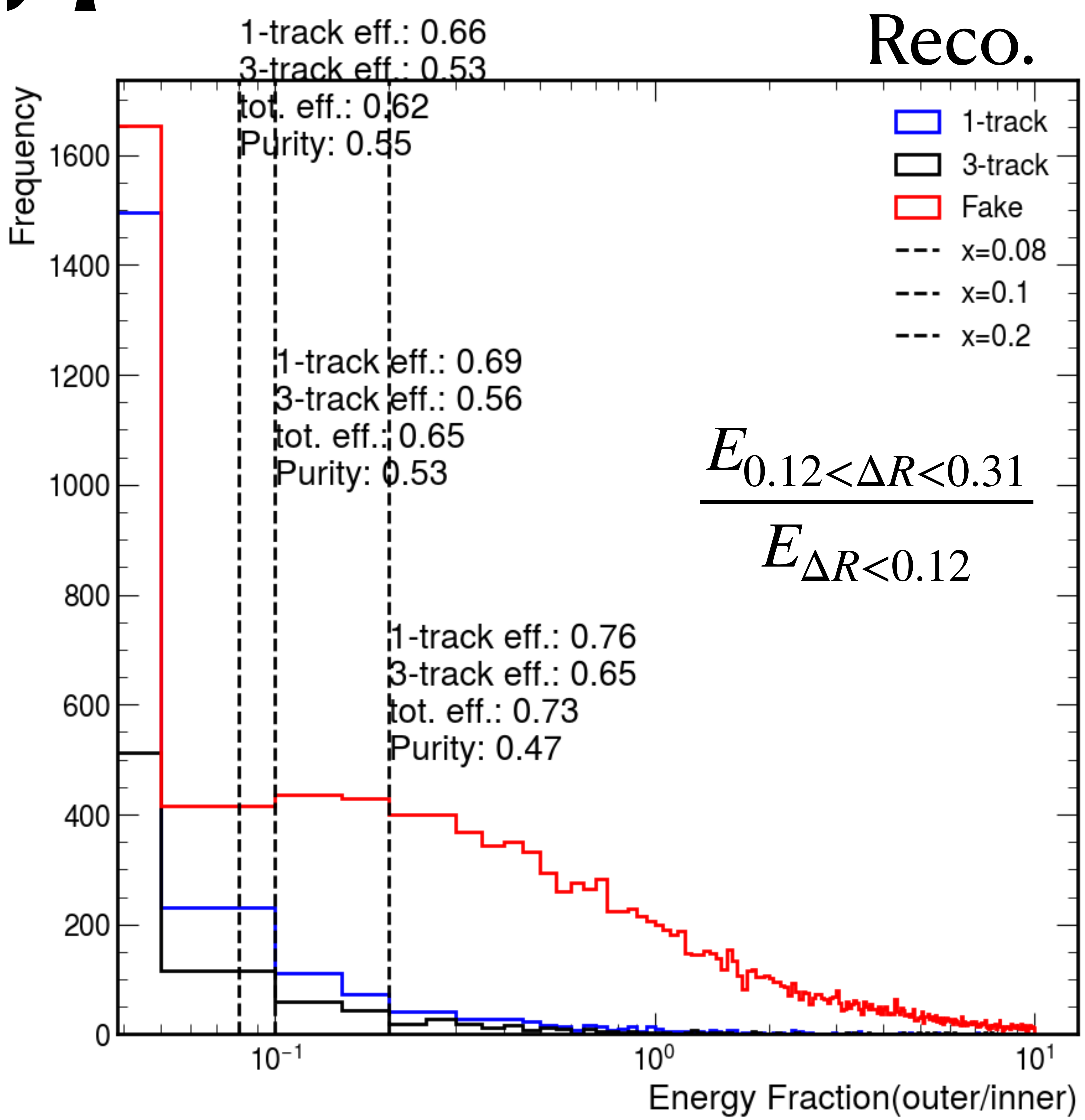
Reco.



Sanity plot



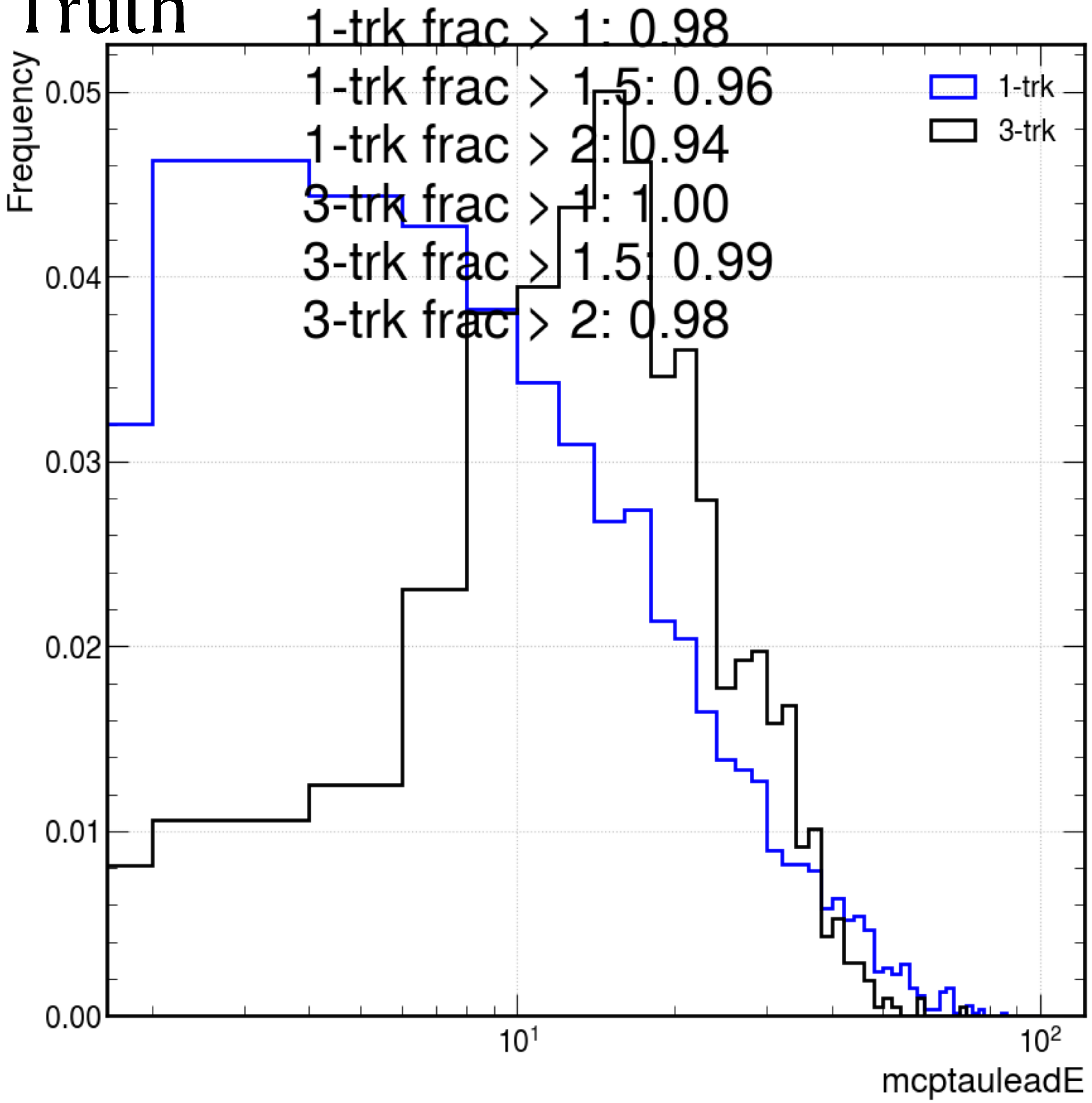
Reco.
Frequency
1-track
3-track
Fake
Mass
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
0 2 4 6 8 10 12



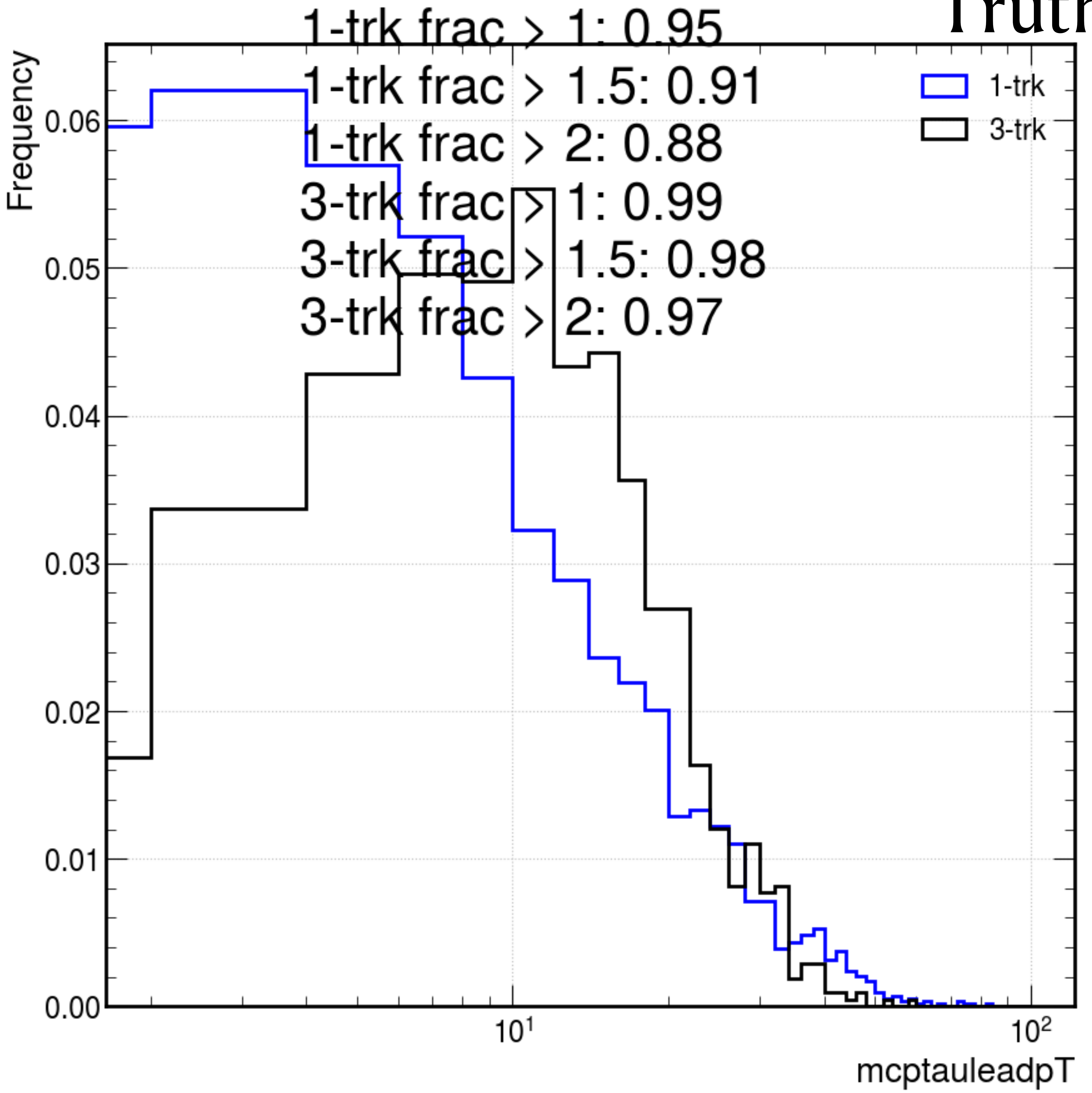
Reco.
1-track eff.: 0.66
3-track eff.: 0.53
tot. eff.: 0.62
Purity: 0.55
1-track eff.: 0.69
3-track eff.: 0.56
tot. eff.: 0.65
Purity: 0.53
1-track eff.: 0.76
3-track eff.: 0.65
tot. eff.: 0.73
Purity: 0.47
1-track
3-track
Fake
x=0.08
x=0.1
x=0.2
$\frac{E_{0.12<\Delta R<0.31}}{E_{\Delta R<0.12}}$
Frequency
Energy Fraction(outer/inner)
0 200 400 600 800 1000 1200 1400 1600
10^{-1} 10^{0} 10^{1}

Sanity plot

Truth

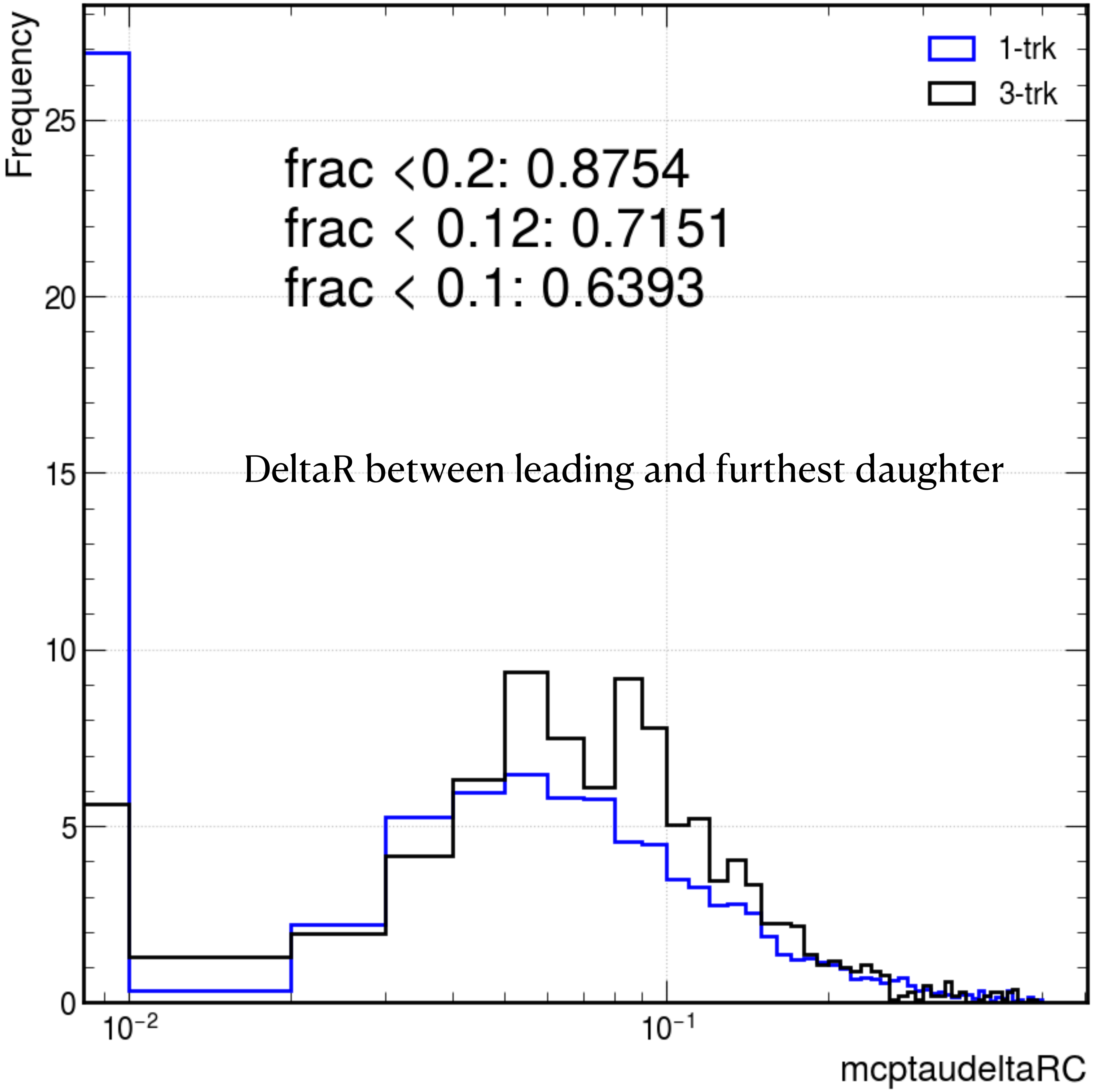


Truth

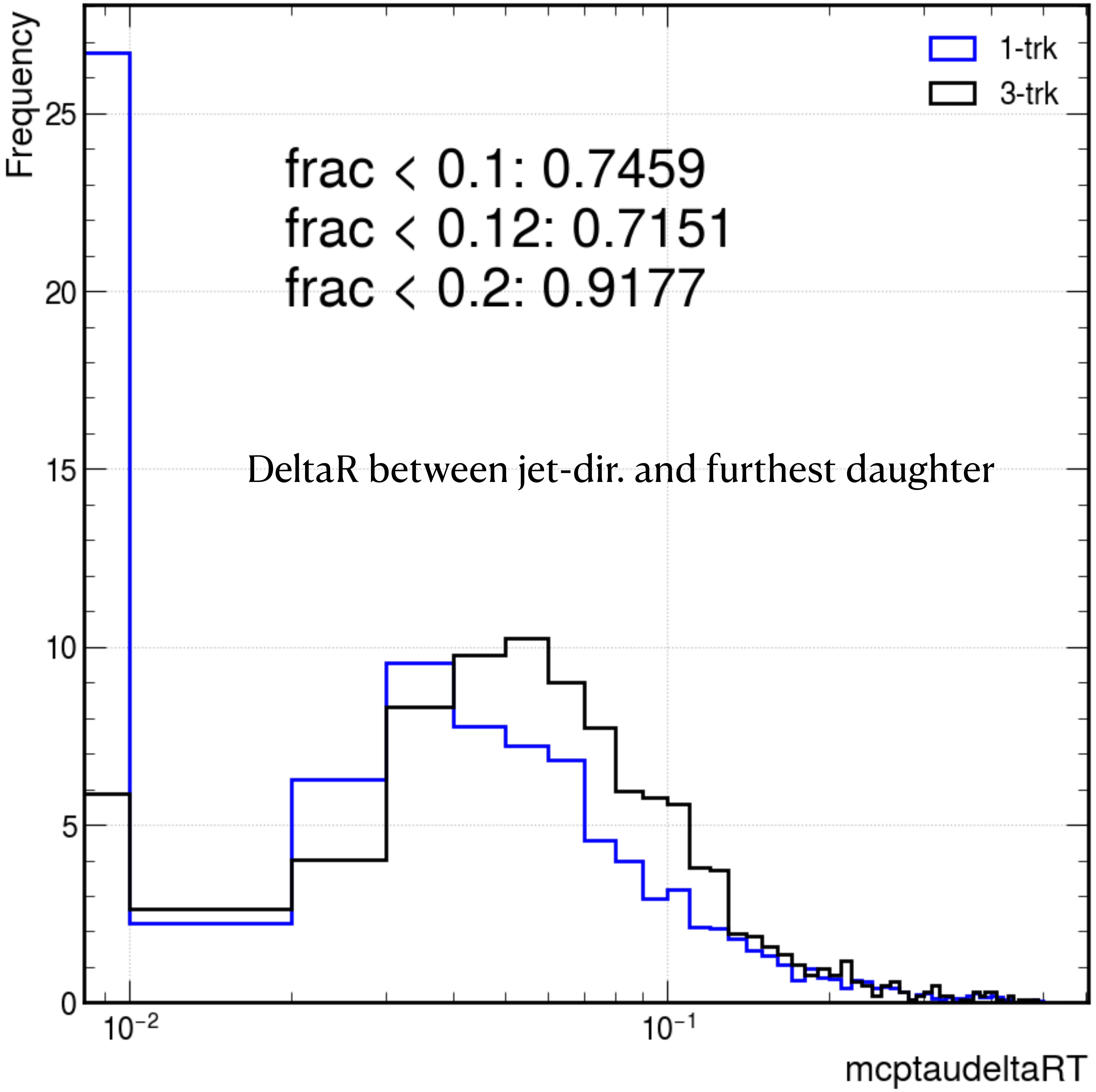


Sanity plot

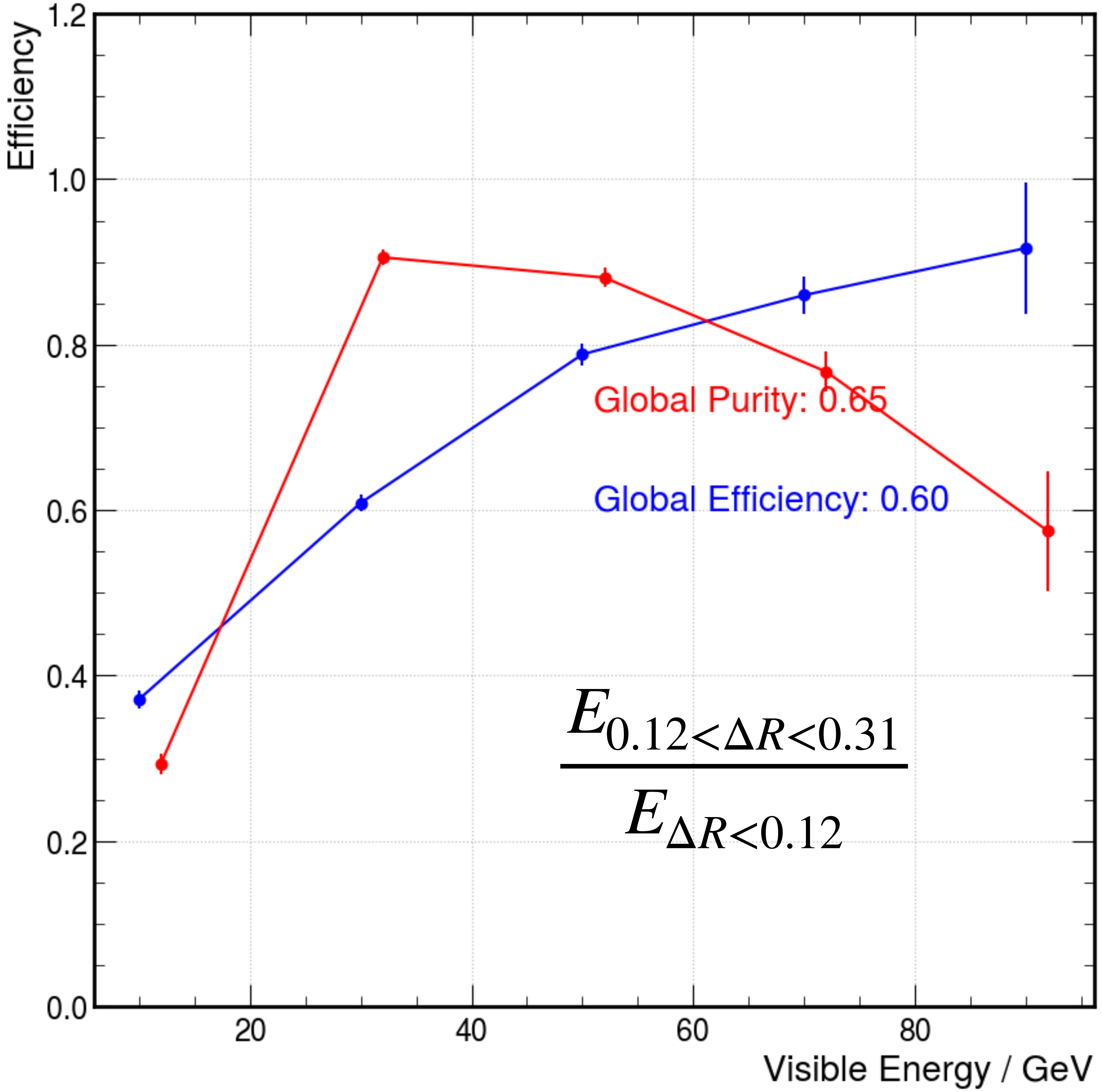
Truth



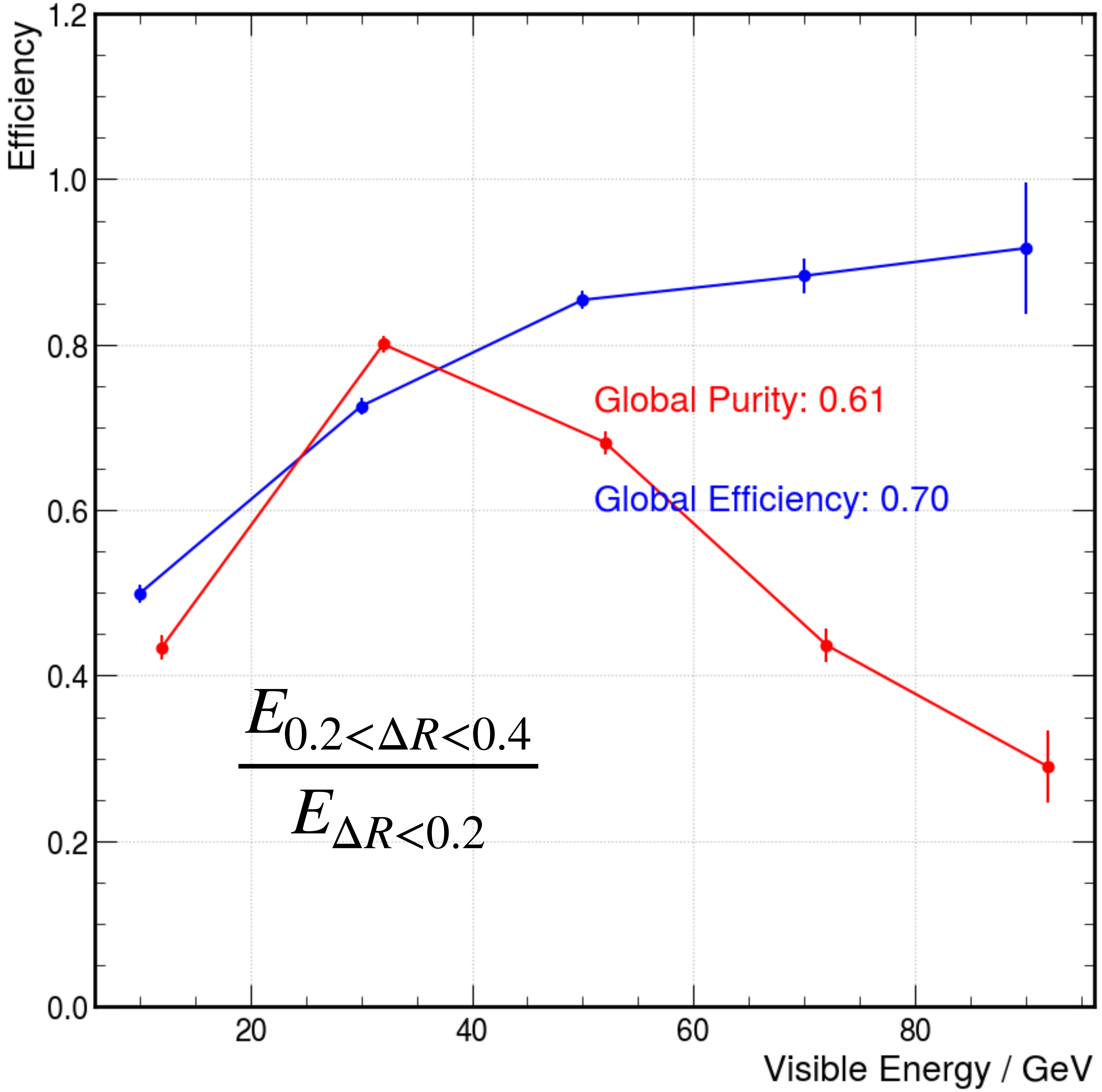
Truth



Sanity plot



Efficiency
1.2
1.0
0.8
0.6
0.4
0.2
0.0
20
40
60
80
Visible Energy / GeV
Global Purity: 0.65
Global Efficiency: 0.60
$\frac{E_{0.12<\Delta R<0.31}}{E_{\Delta R<0.12}}$



Efficiency
1.2
1.0
0.8
0.6
0.4
0.2
0.0
20
40
60
80
Visible Energy / GeV
Global Purity: 0.61
Global Efficiency: 0.70
$\frac{E_{0.2<\Delta R<0.4}}{E_{\Delta R<0.2}}$

Summary&Todo

- Expect a better performance in $qqH\tau\tau$ events
- Better performance with BDT is foreseeable

Backup

decay mode	fit result	coefficient
$\mathcal{B}(\tau^- \to \mu^- \bar{\nu}_\mu \nu_\tau)$	0.1739 ± 0.0004	1.0000
$\mathcal{B}(\tau^- \to e^- \bar{\nu}_e \nu_\tau)$	0.1782 ± 0.0004	1.0000
$\mathcal{B}(\tau^- \to \pi^- \nu_\tau)$	0.1082 ± 0.0005	1.0000
$\mathcal{B}(\tau^- \to K^- \nu_\tau)$	0.00696 ± 0.00010	1.0000
$\mathcal{B}(\tau^- \to \pi^- \pi^0 \nu_\tau)$	0.2549 ± 0.0009	1.0000
$\mathcal{B}(\tau^- \to K^- \pi^0 \nu_\tau)$	0.00433 ± 0.00015	1.0000
$\mathcal{B}(\tau^- \to \pi^- 2\pi^0 \nu_\tau \text{ (ex.}K^0))$	0.0926 ± 0.0010	1.0022
$\mathcal{B}(\tau^- \to K^- 2\pi^0 \nu_\tau \text{ (ex.}K^0))$	$(0.65 \pm 0.22) \cdot 10^{-3}$	1.0000
$\mathcal{B}(\tau^- \to \pi^- 3\pi^0 \nu_\tau \text{ (ex.}K^0))$	0.0104 ± 0.0007	1.0000
$\mathcal{B}(\tau^- \to K^- 3\pi^0 \nu_\tau \text{ (ex.}K^0, \eta))$	$(0.48 \pm 0.21) \cdot 10^{-3}$	1.0000
$\mathcal{B}(\tau^- \to h^- 4\pi^0 \nu_\tau \text{ (ex.}K^0, \eta))$	0.0011 ± 0.0004	1.0000
$\mathcal{B}(\tau^- \to \pi^- \bar{K}^0 \nu_\tau)$	0.00838 ± 0.00014	1.0000
$\mathcal{B}(\tau^- \to K^- K^0 \nu_\tau)$	0.001486 ± 0.000034	1.0000
$\mathcal{B}(\tau^- \to \pi^- \bar{K}^0 \pi^0 \nu_\tau)$	0.00382 ± 0.00013	1.0000
$\mathcal{B}(\tau^- \to K^- K^0 \pi^0 \nu_\tau)$	0.00150 ± 0.00007	1.0000
$\mathcal{B}(\tau^- \to \pi^- \bar{K}^0 2\pi^0 \nu_\tau \text{ (ex.}K^0))$	$(0.26 \pm 0.23) \cdot 10^{-3}$	1.0000
$\mathcal{B}(\tau^- \to \pi^- K^0_S K^0_S \nu_\tau)$	$(235 \pm 6) \cdot 10^{-6}$	2.0000
$\mathcal{B}(\tau^- \to \pi^- K^0_S K^0_L \nu_\tau)$	0.00108 ± 0.00024	1.0000
$\mathcal{B}(\tau^- \to \pi^- K^0_S K^0_S \pi^0 \nu_\tau)$	$(18.2 \pm 2.1) \cdot 10^{-6}$	2.0000
$\mathcal{B}(\tau^- \to \pi^- K^0_S K^0_L \pi^0 \nu_\tau)$	$(0.32 \pm 0.12) \cdot 10^{-3}$	1.0000
$\mathcal{B}(\tau^- \to \bar{K}^0 h^- h^- h^+ \nu_\tau)$	$(0.25 \pm 0.20) \cdot 10^{-3}$	1.0000
$\mathcal{B}(\tau^- \to \pi^- \pi^+ \pi^- \nu_\tau \text{ (ex.}K^0, \omega))$	0.0899 ± 0.0005	1.0022
$\mathcal{B}(\tau^- \to \pi^- \pi^+ \pi^- \pi^0 \nu_\tau \text{ (ex.}K^0, \omega))$	0.0274 ± 0.0007	1.0000