

LCFIPlus status

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Flavour tagging (statistical dependency issue)

❖ **vtxmasspc in flavour tagging**

- ▶ I found this variable seems to be the main cause. (I checked by removing each input variable.)
- ▶ Powerful to indentify b-jet ($M_b \sim 5\text{GeV}$, $M_c \sim 2\text{GeV}$)
- ▶ Used in earlier experiments e.g. SLD (“Pt-corrected mass”).
- ▶ Taking neutrinos into account to correct secondary vertex mass.
- ▶ Estimate minimum contributions from neutrinos by comparing the direction of the secondary vertex from the primary vertex and the momentum sum of the tracks from the secondary vertex.

$$M_{pc} = \sqrt{M_{vis}^2 + p_t^2} + |p_t|$$

if the primary- and secondary-vertex position errors are not precise, p_t is set to be 0. —> vertex position error estimation could affect on this variable.

❖ **Checking helix trajectory, coordinate, etc**

- ▶ No problem found

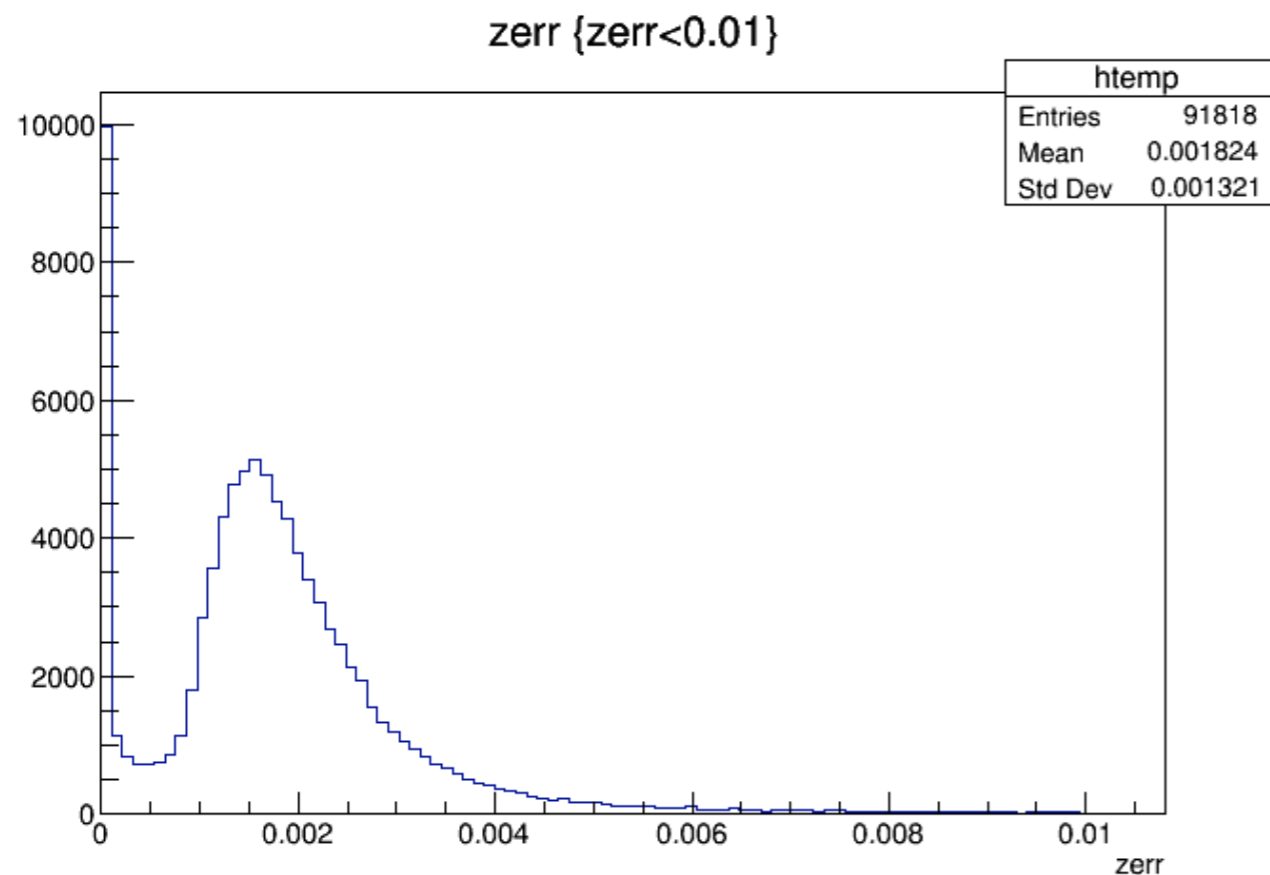
❖ **Checking minimization process.**

- ▶ There are two different minimization :
 - ▶ 1) finding a position on a helix trajectory which gives the minimum distance to a target point. This is one-dimensional minimization.
 - ▶ 2) finding a position that gives minimum chi2 defined as a sum of variances to helices. To compute variance for each helix, we use 1). This is 3 dimensional minimization.
- ▶ A method : PrintLevel(2) in minimization of 1) dumps more detailed info. though they are not so clear to me. But at least I found that some cases the minimization fails because of “nan” as error estimation.)

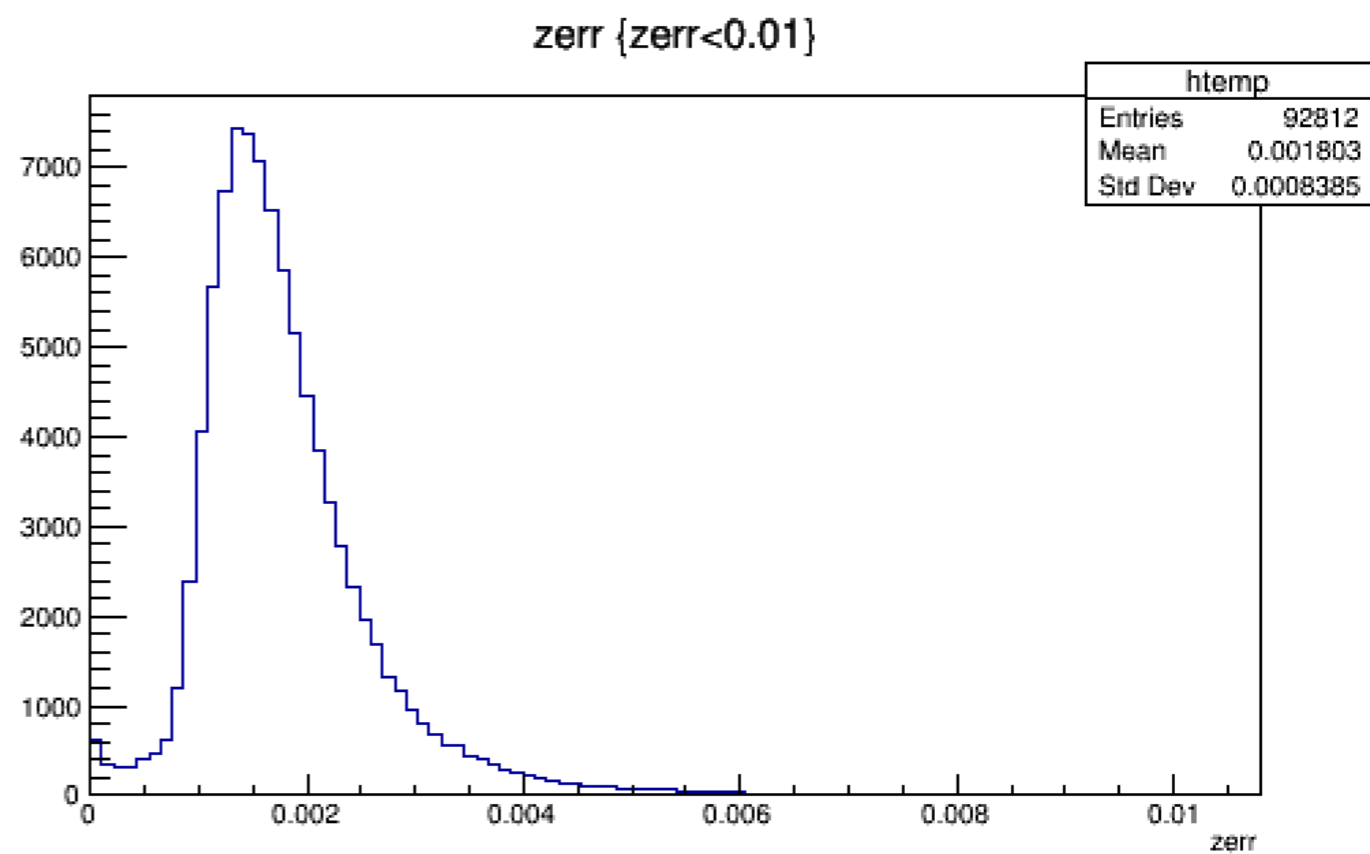
❖ **Findings**

- ▶ Too-small error appears only when turning the beam constraint on.
- ▶ ROOT::Minuit2::MnStrategy(1) → ROOT::Minuit2::MnStrategy(0) in minimization (2) seems to be more stable.
- ▶ Tolerance = 10^{-3} → 10^{+3} in minimization (1) solve the “nan” problem above.
- ▶ I tried these test parameters and see what happened.

Error distribution on primary vertex z-position



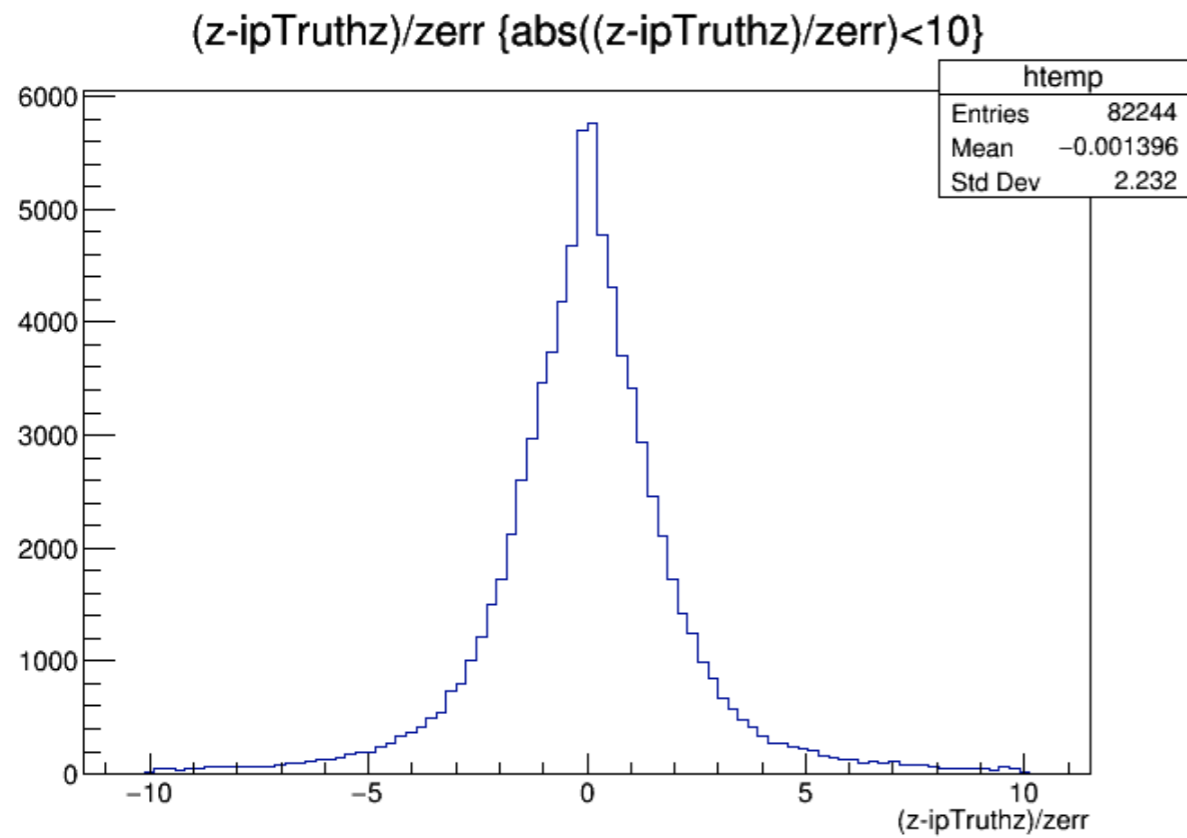
default



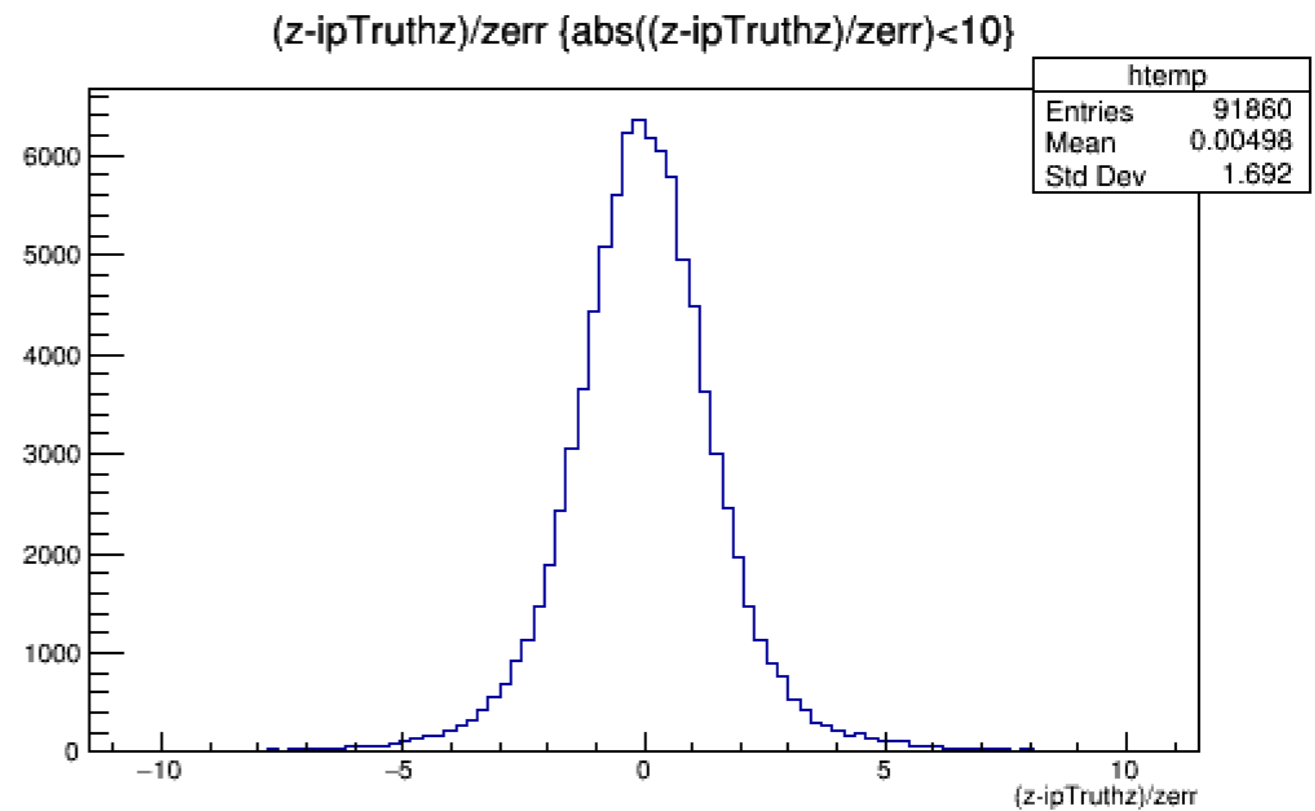
this test

[mm]

pull distribution of primary vertex z-position

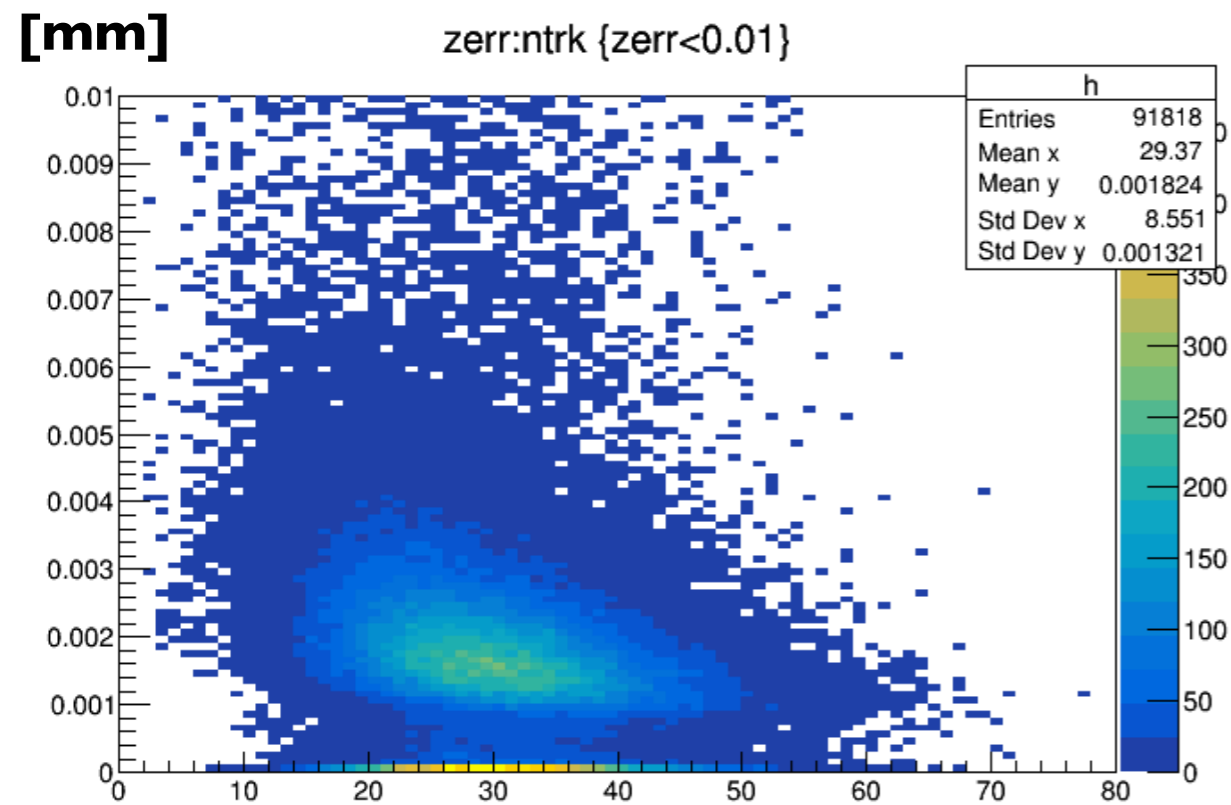


default

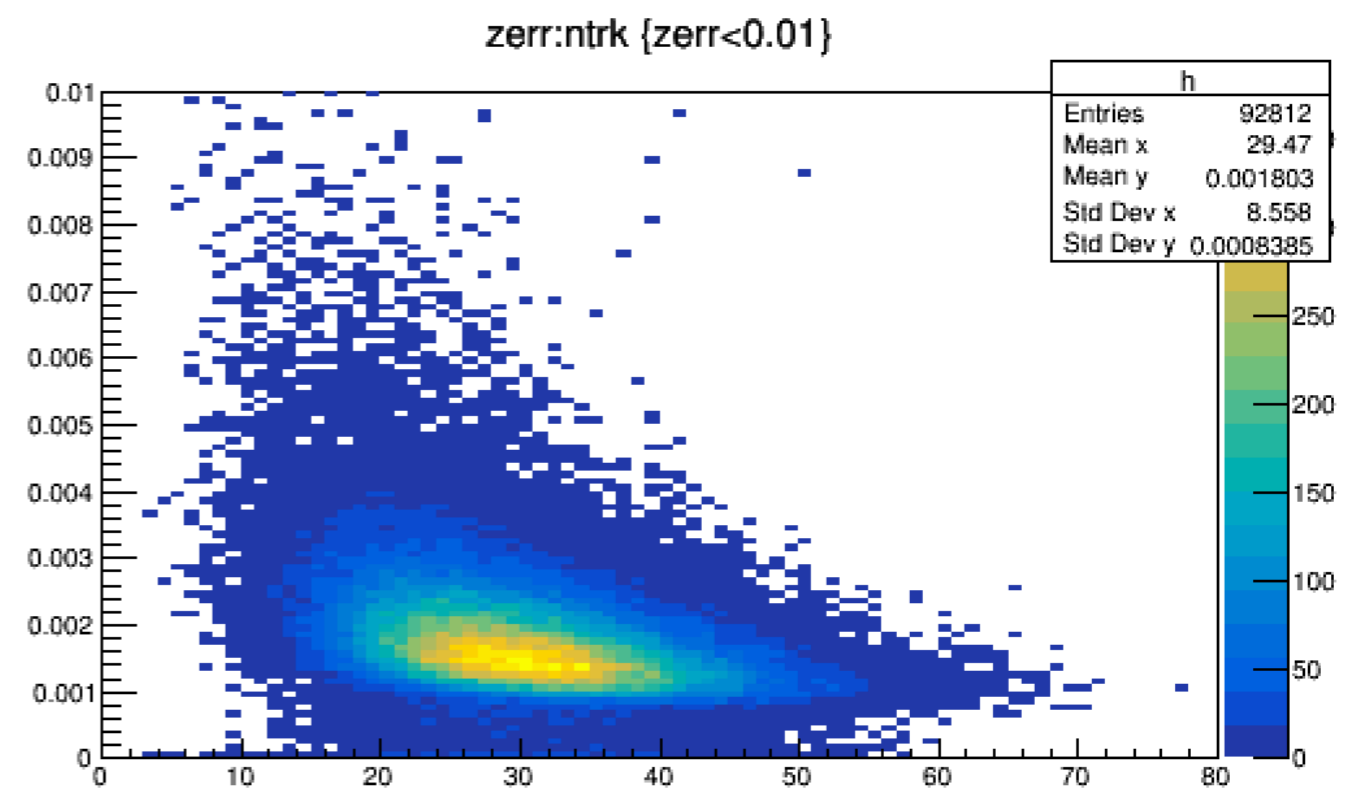


this test

Vtx z-pos error vs # of vtx tracks



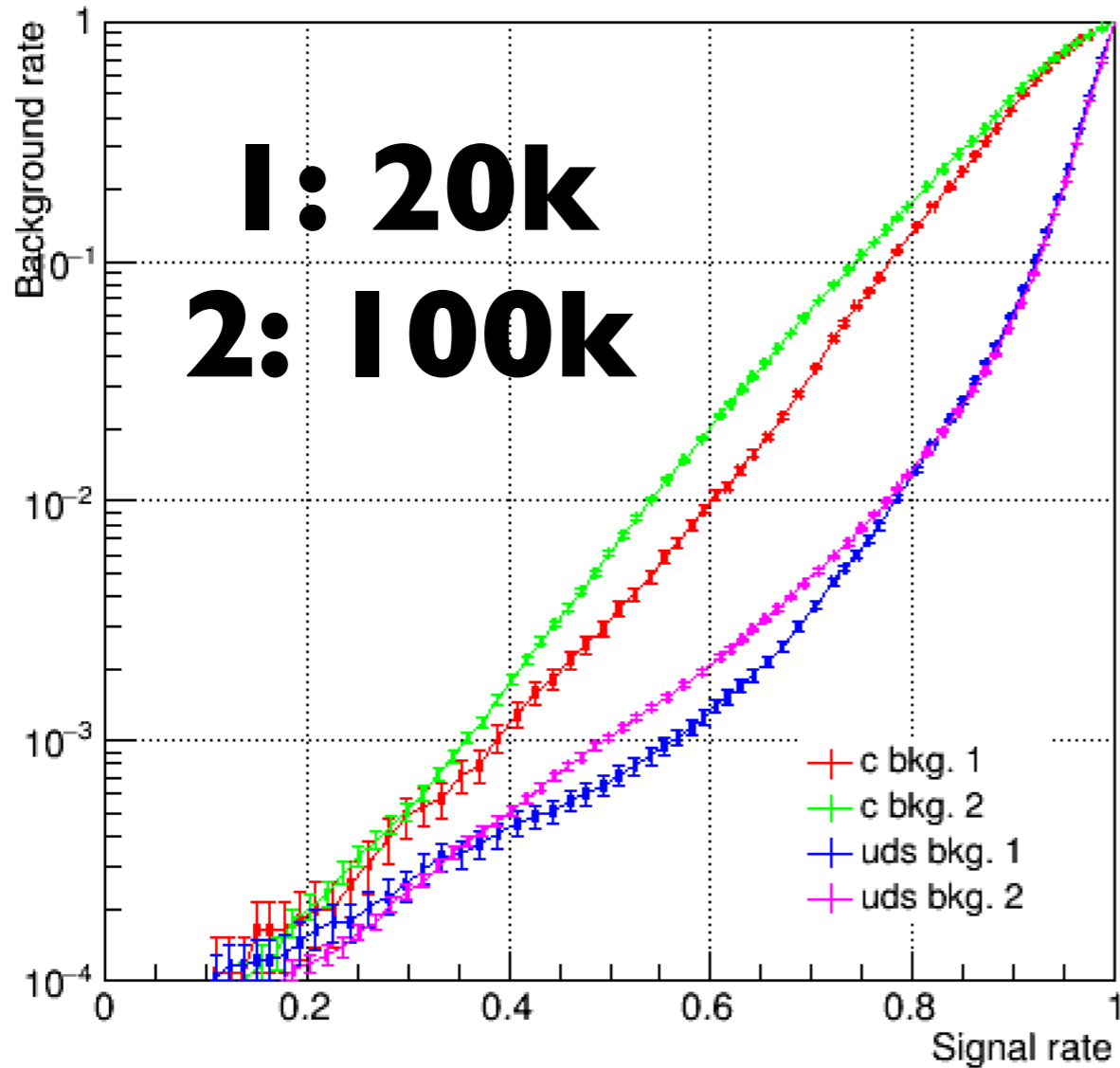
default



this test

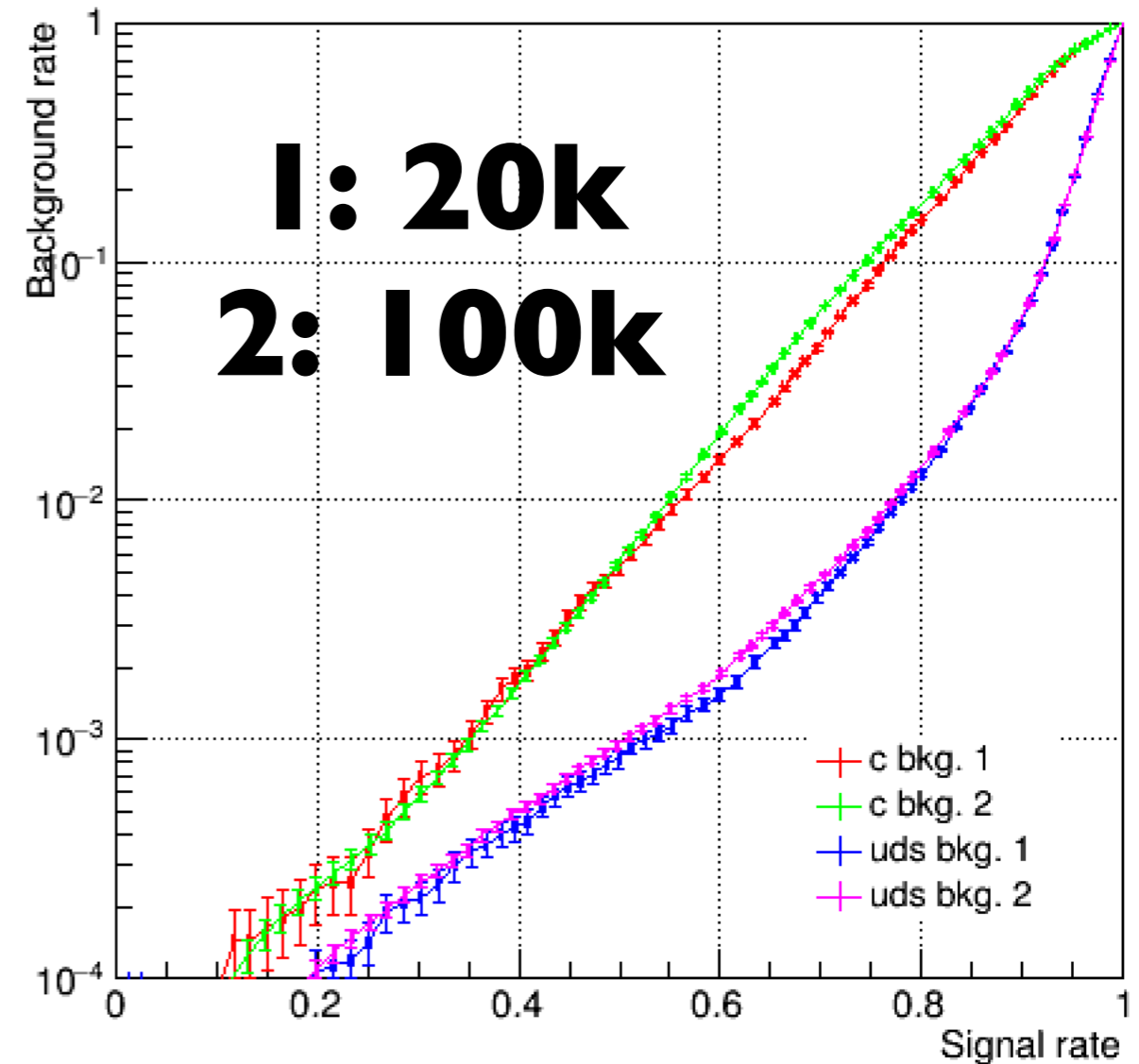
Flavour tagging

Using same BDT parameters.



default

(+some modification
to take primary vertex position into account.)



this test

Prospects

- ❖ **Taikan is investigating Minuit2 parameters more deeply.**
 - ▶ Need to be understood why the setting used in this study looks (not perfect but) a bit better behaviour in terms of “statistical dependency”.
 - ▶ Need to identify what is the optimal settings for the primary vertexing.
- ❖ **Even if the “statistical dependency” disappears, the performance seems not to be as good as the case without the beam spot smearing.**
 - ▶ Probably there is another reason.
- ❖ **Test w/ beam background**