Vertexing performance with LCFIPlus

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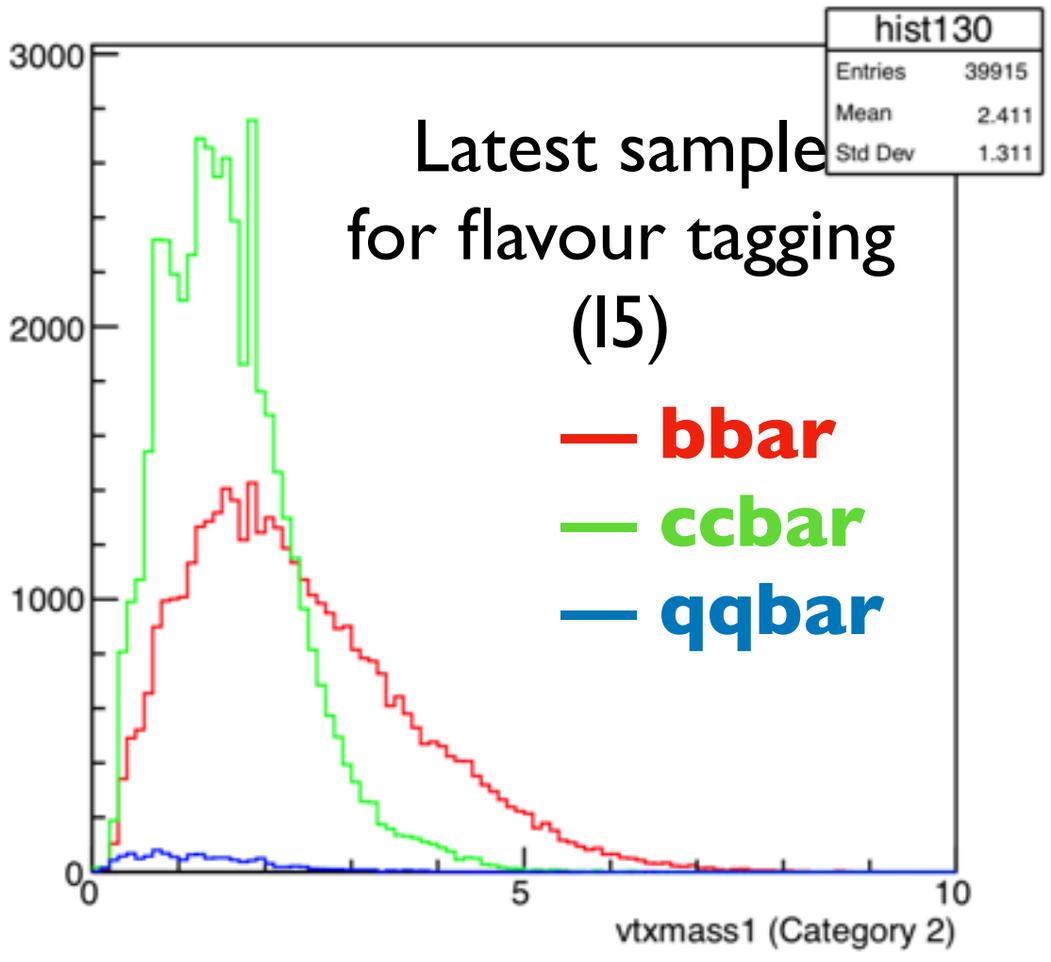
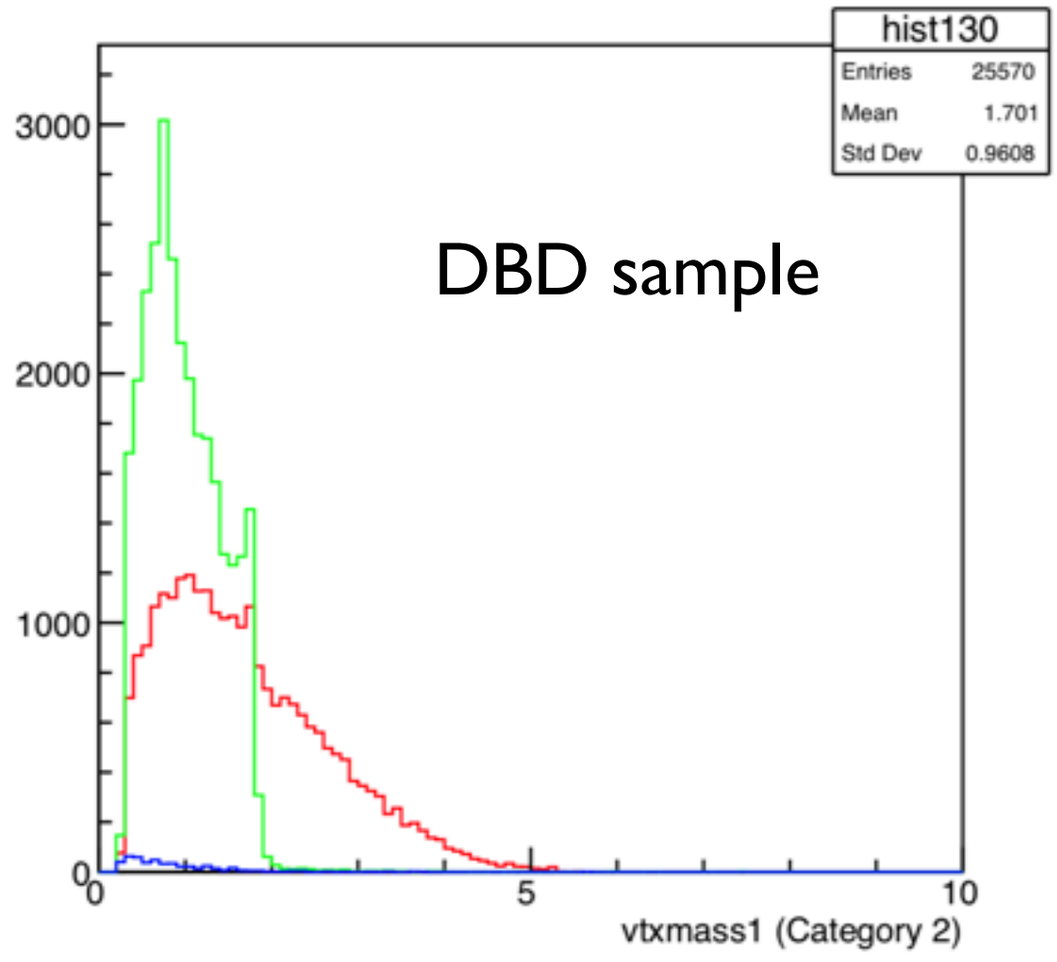
Previous concern

- We were checking distributions of input variables for flavour tagging.
- All plots looked ok except for vertex mass distribution, though this did not seem to affect much flavour tagging performance as far as these samples.





What's "Category 2"?
We classify jets into 4 categories in LCFIPlus according to the number of vertices and pseudo-vertices (single track vertex).
Category 2 : #vtx==1

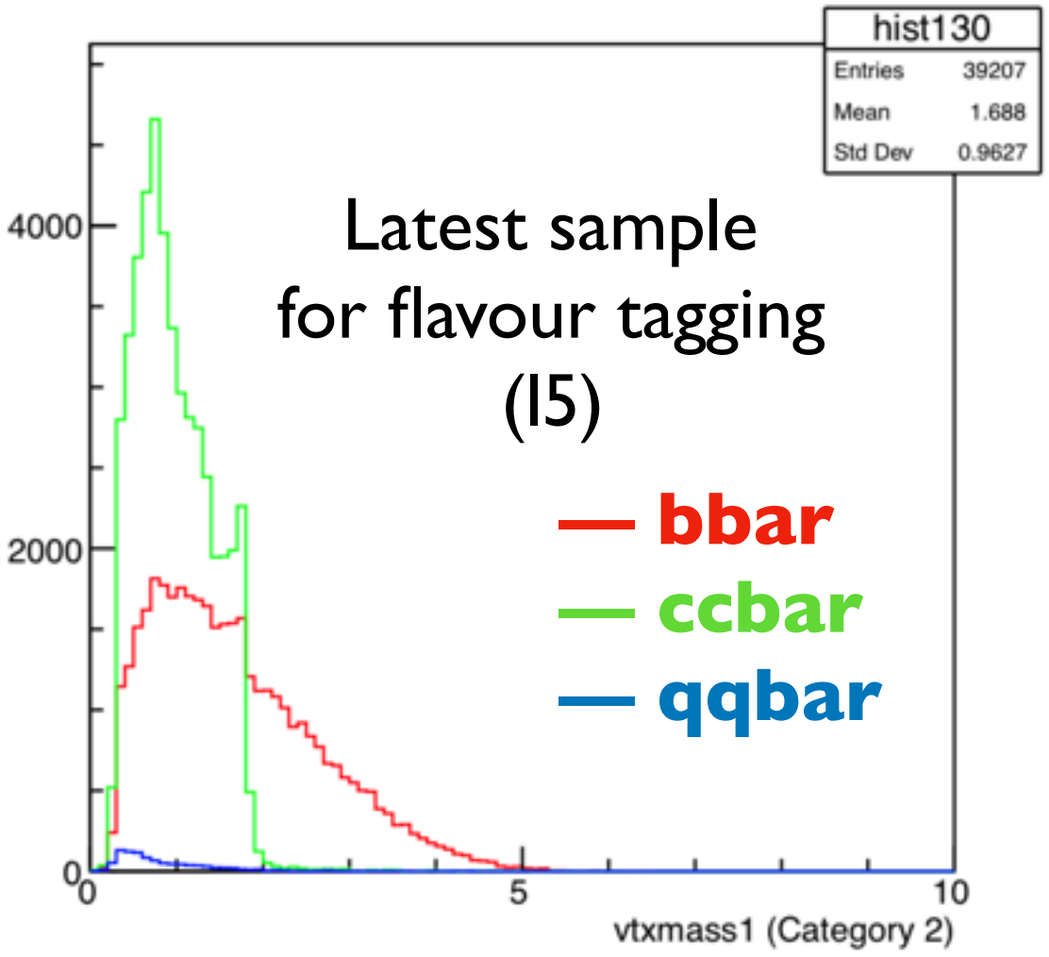
Masakazu has found the cause

- **Caused by a track energy correction that uses PID**
  - newly implemented after DBD,
  - used for vertex mass recovery,
  - no need for a nominal flavour tagging procedure,
  - affected somehow the vertex mass distribution.

- **First-aid solution (This test)**
  - Just comment out a corresponding line.
  - https://github.com/lcfiplus/LCFIPlus/blob/master/src/LCIOStorer.cc#L454

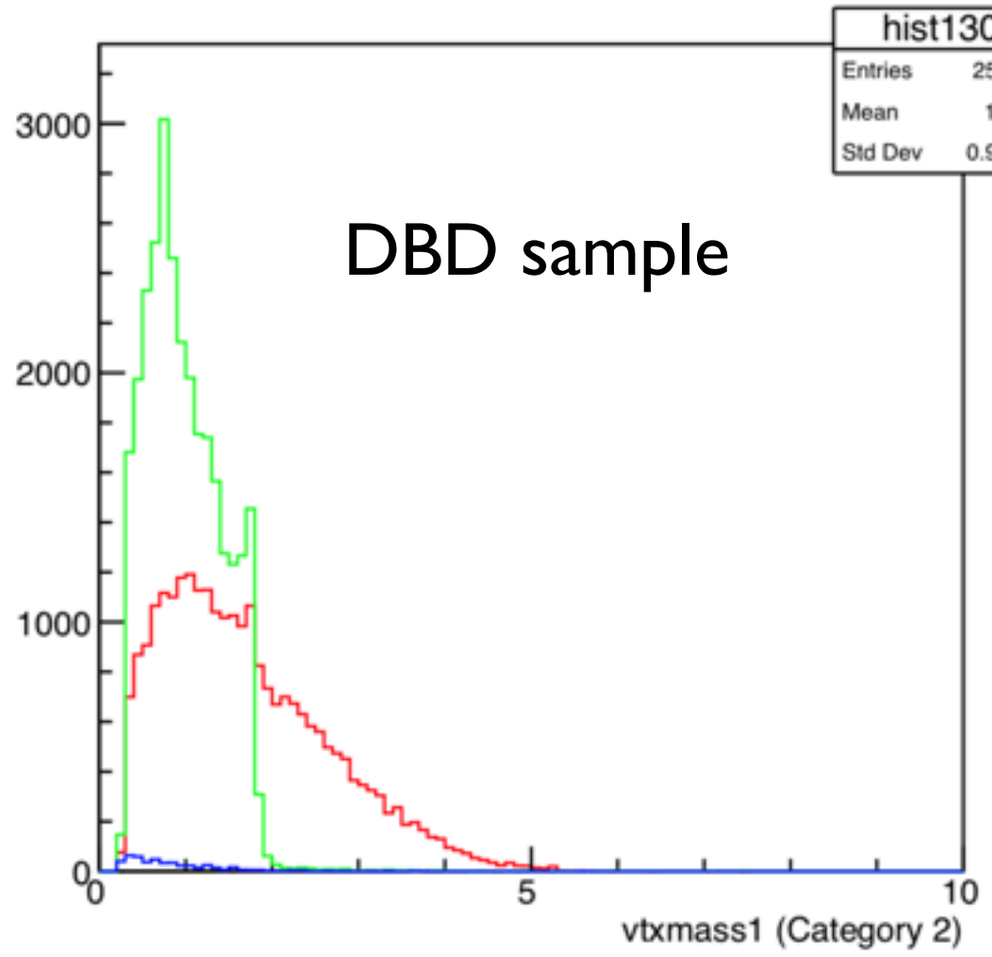
- **Proper solution**
  - Call the function at another place, or make it configurable (on/off).
  - Masakazu is working on it.

Now it looks ok!



Latest sample
for flavour tagging
(I5)

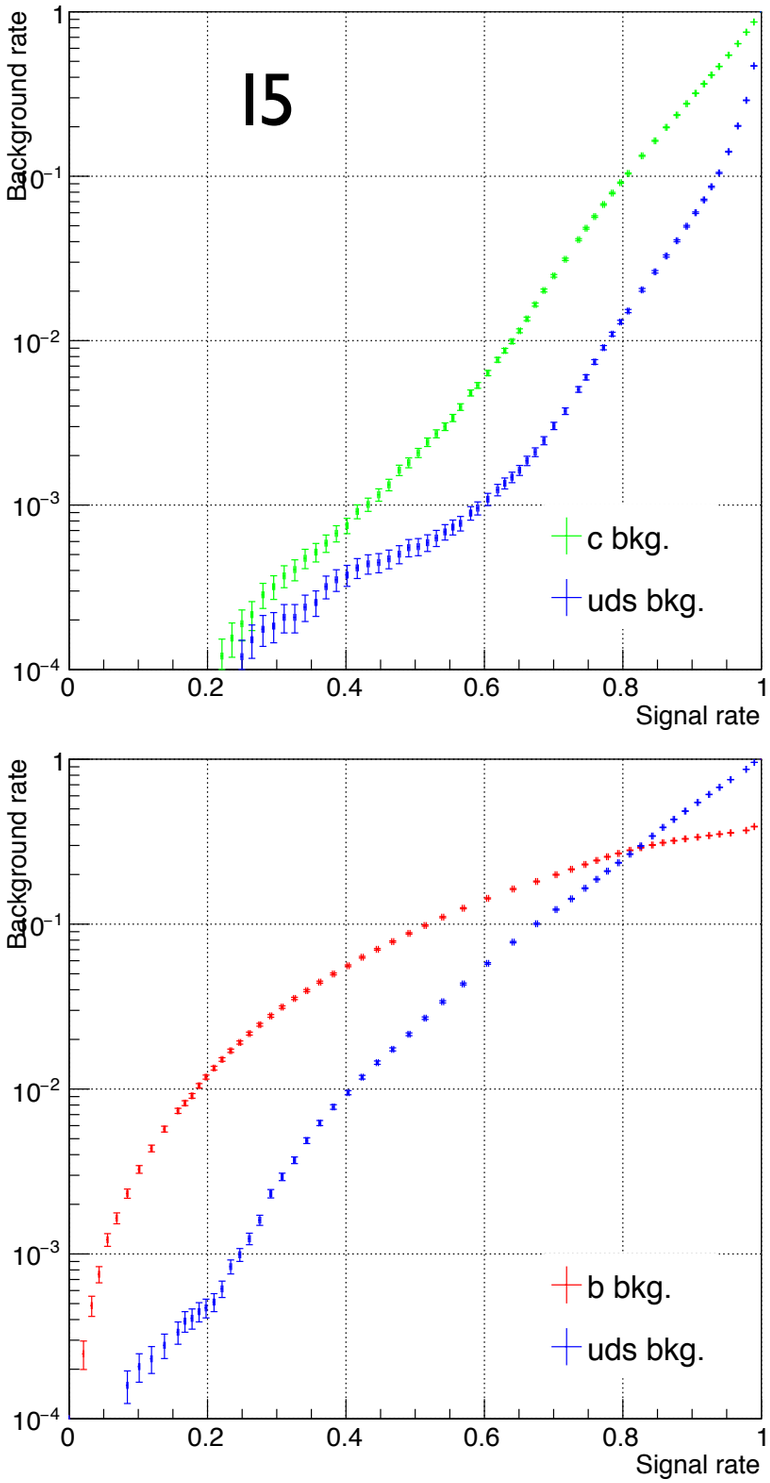
— bbar
— ccbar
— qqbar

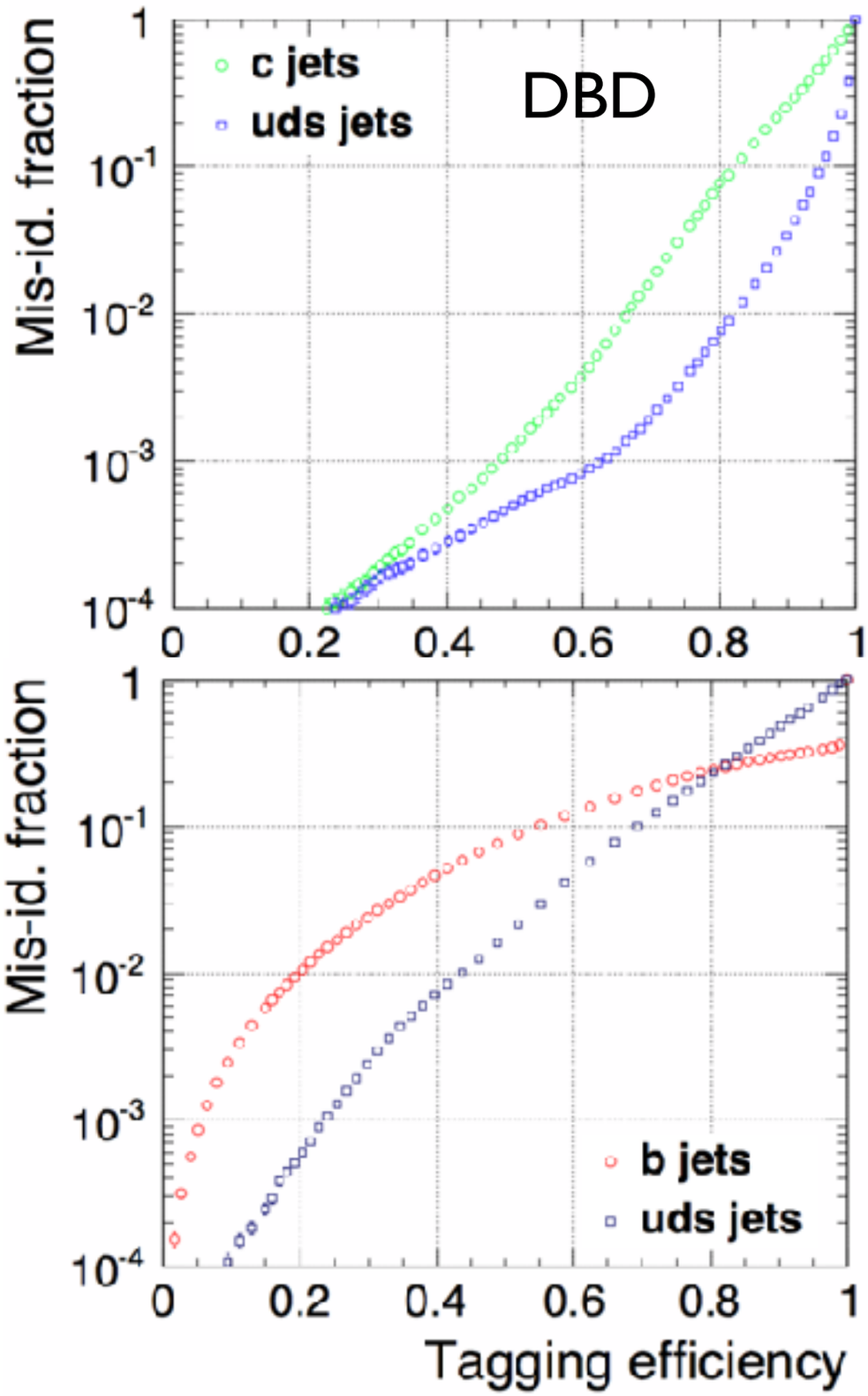


DBD sample

I will put the other plots in a separated file.

Flavour tagging





$\sqrt{s}$=91.2GeV,
bb, cc, qq,
w/o beam bkg

look not so bad.

Conclusion

- **A fix is necessary**
  - Track energy correction with PID affected vertex mass distribution, but did not affect much flavour tagging performance.
  - Masakazu is updating the code and will upload to the GitHub repository.
  - We will let you know as soon as it gets ready.

- **With the Masakazu's fix, vertexing is now ready to go!**
  - For flavour tagging, we may need some optimization.

One remark:

Currently there is a beam spot smearing in LCFIPlus.
To turn it off, the following line must be added in LCFIPlus processor configuration in HighLevelReco.xml.

```
<parameter name="PrimaryVertexFinder.BeamspotSmearing" type="bool" value="0" />
```