Check ctag distribution anomaly
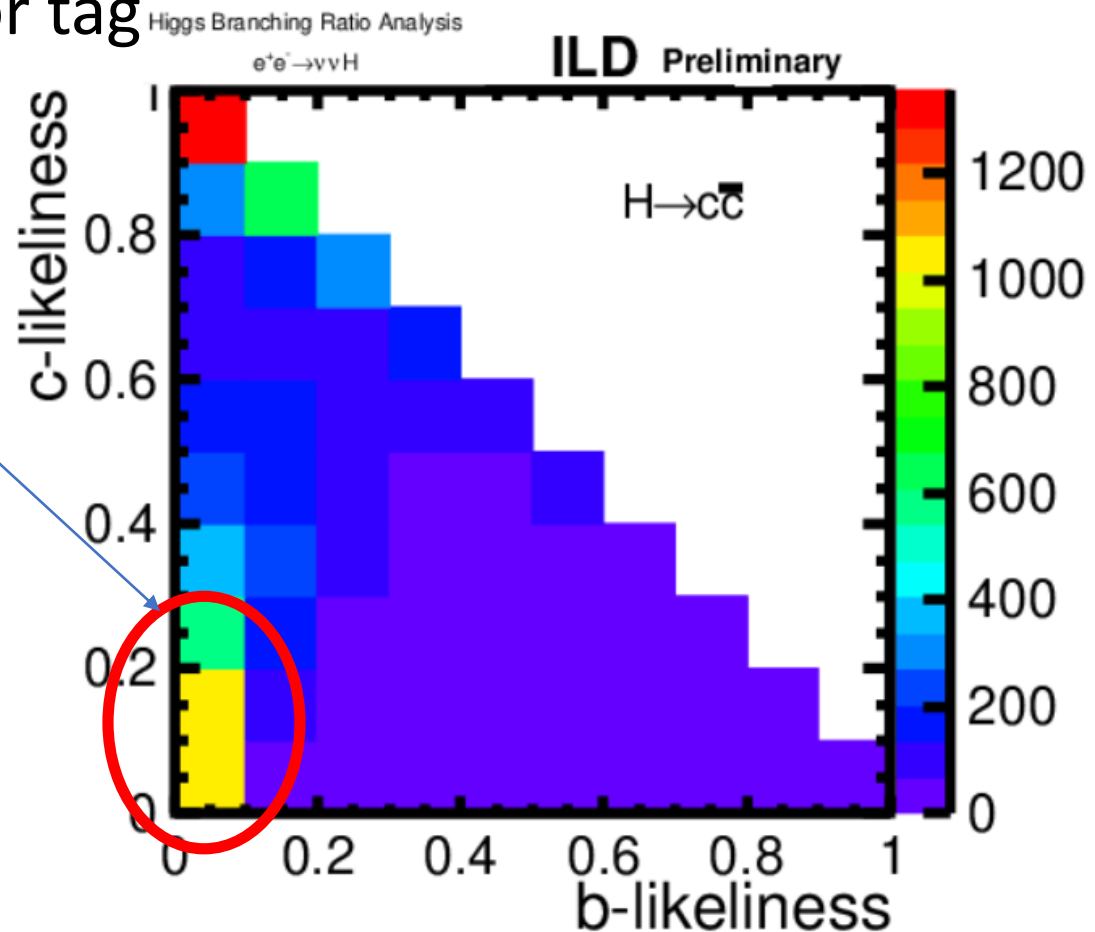
Masakazu Kurata

1/15/2020

Check cause of this point

- Analysis of Higgs branching ratio measurement precision

- Estimation of precision of σBR(H→bb), σBR(H→cc), σBR(H→gg)

- Using template of flavor tag

- Peak at this point

- No such peak@DBD

- Check it

Higgs Branching Ratio Analysis

$e^+e^- \rightarrow \nu\nu H$

ILD Preliminary

$H \rightarrow c\bar{c}$

Check points

1. LCFIPlus ctag output
   - IDR: b:c:uds=1:1:3 training
   - b:c:uds=1:1:1 training goes to same output as DBD?

2. ROC curve check with Higgs decays
   - H→cc v.s. H→gg
   - H→cc v.s. H→other
   - Compare among IDR1:1:3, IDR1:1:1, and DBD weight files

3. σBr precision
   - Compare among IDR1:1:3, IDR1:1:1, and DBD weight files

- check the order of 1→3→2

1. LCFIPlus output

- nnh→nncc

IDR-IDR 1:1:3

IDR-IDR 1:1:1

IDR-IDR DBDweight
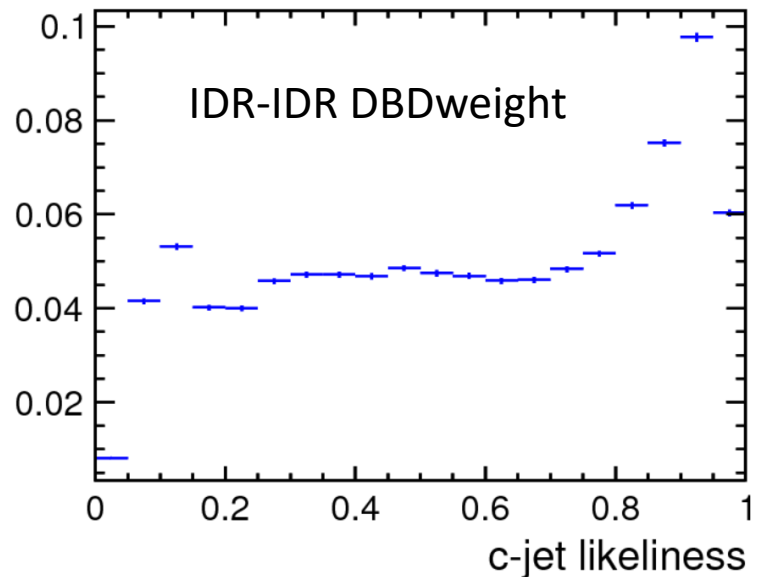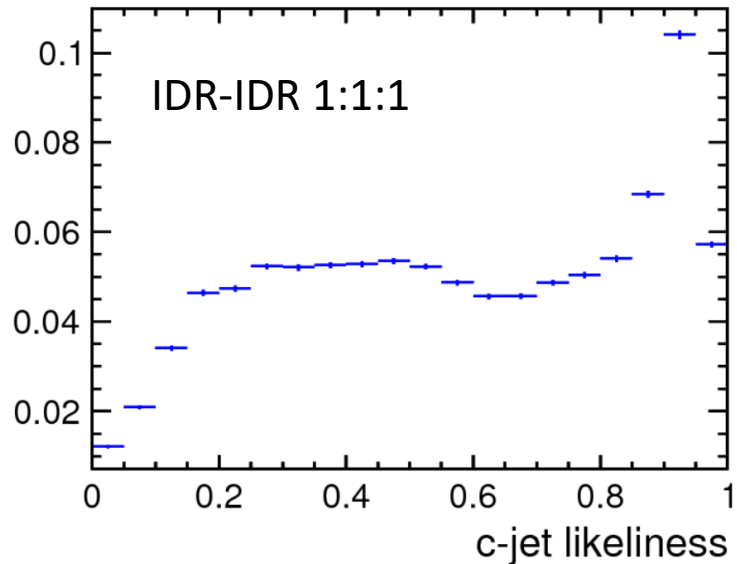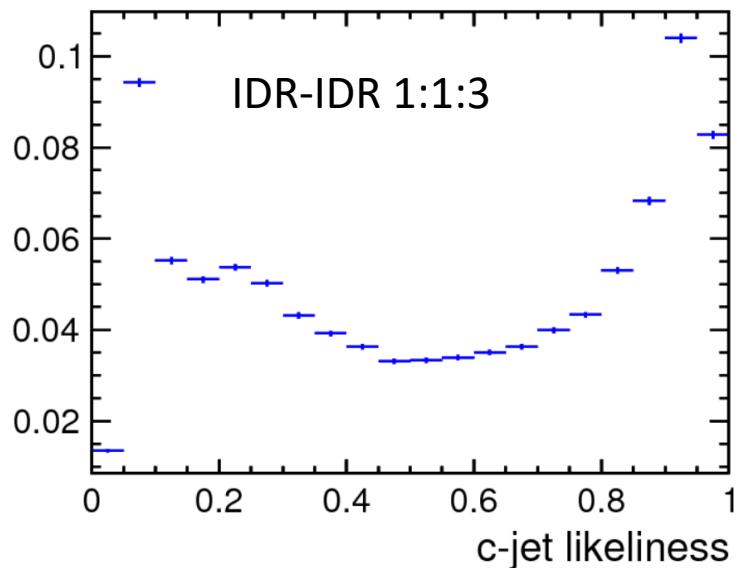
3. σBR for each weight file

- IDR-IDR, IDR-L, P(-0.8,+0.3), 1600fb^{-1}

Weight/Process	H→bb	H→cc	H→gg
IDR 1:1:3 (%)	0.43 ± 0.01	3.88 ± 0.02	1.70 ± 0.02
IDR 1:1:1 (%)	0.42 ± 0.01	3.94 ± 0.02	1.70 ± 0.02
DBD (%)	0.43 ± 0.01	3.95 ± 0.02	1.66 ± 0.02

- Almost same performance
  - Same tendency of IDR1:1:1 and DBD
  - A bit worse in H→cc, slightly better in H→gg

  - H→bb difference small

2. ROC curve with Higgs decays

H→cc vs. H→gg

H→cc vs. H→other
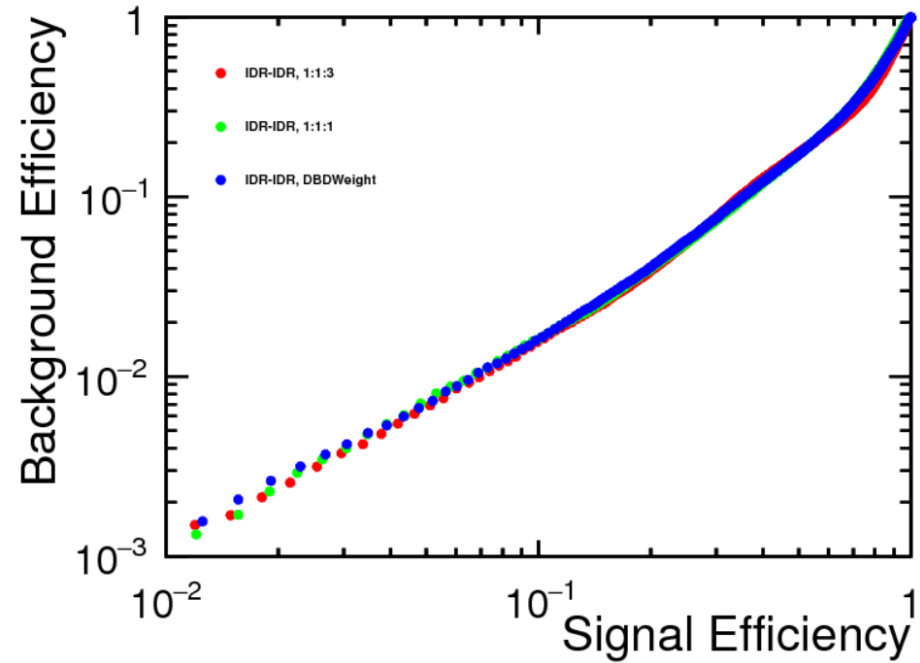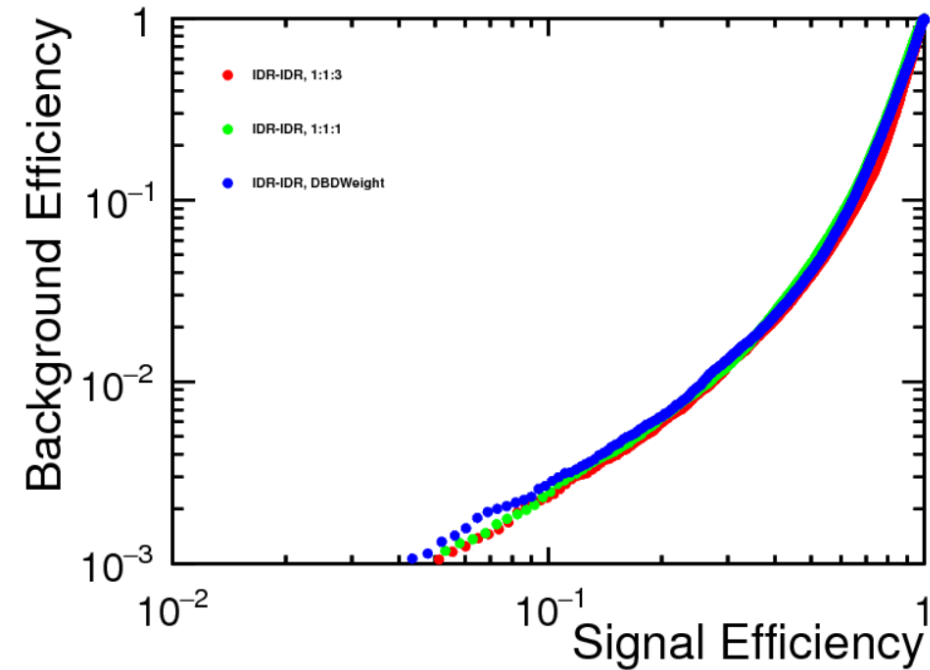
- No big difference among 3

So,

- Low ctag peak disappears when training with b:c:uds = 1:1:1
  - Go to similar shape as DBD

- No big difference among each TMVA weight file

- Almost same results of σBR precision
  - DBD and 1:1:1 training have same tendency
  - A bit worse in H→cc, slightly better in H→gg

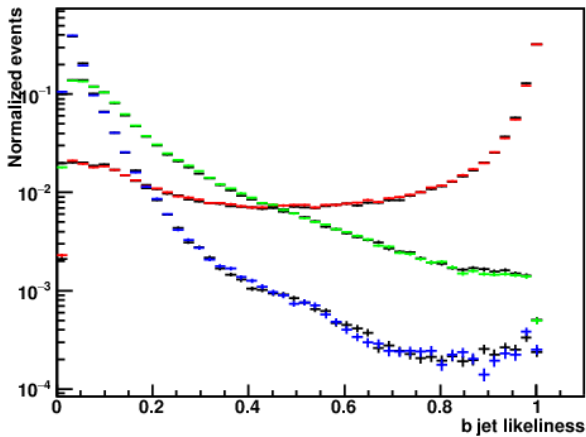- Looks no problem
  - OK?

Redo for final results

- TMVA weight file: train with b:c:uds = 1:1:1
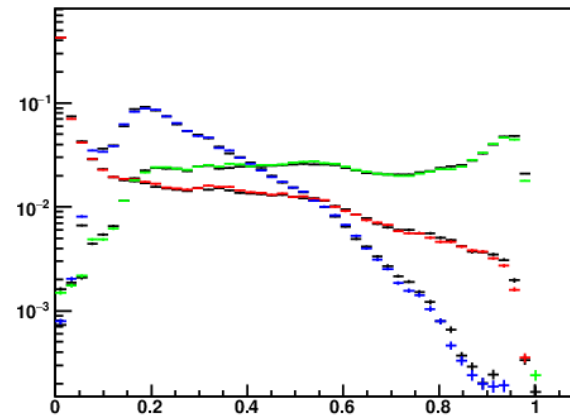- Recreate templates
- Redo template fitting
- Recreate IDR plots

LCFIPlus check

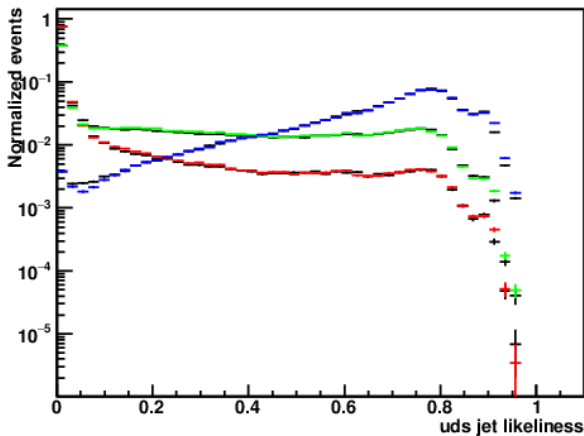- LCFIPlus output between large and small
  - 1:1:1 training

LCFIPlus check

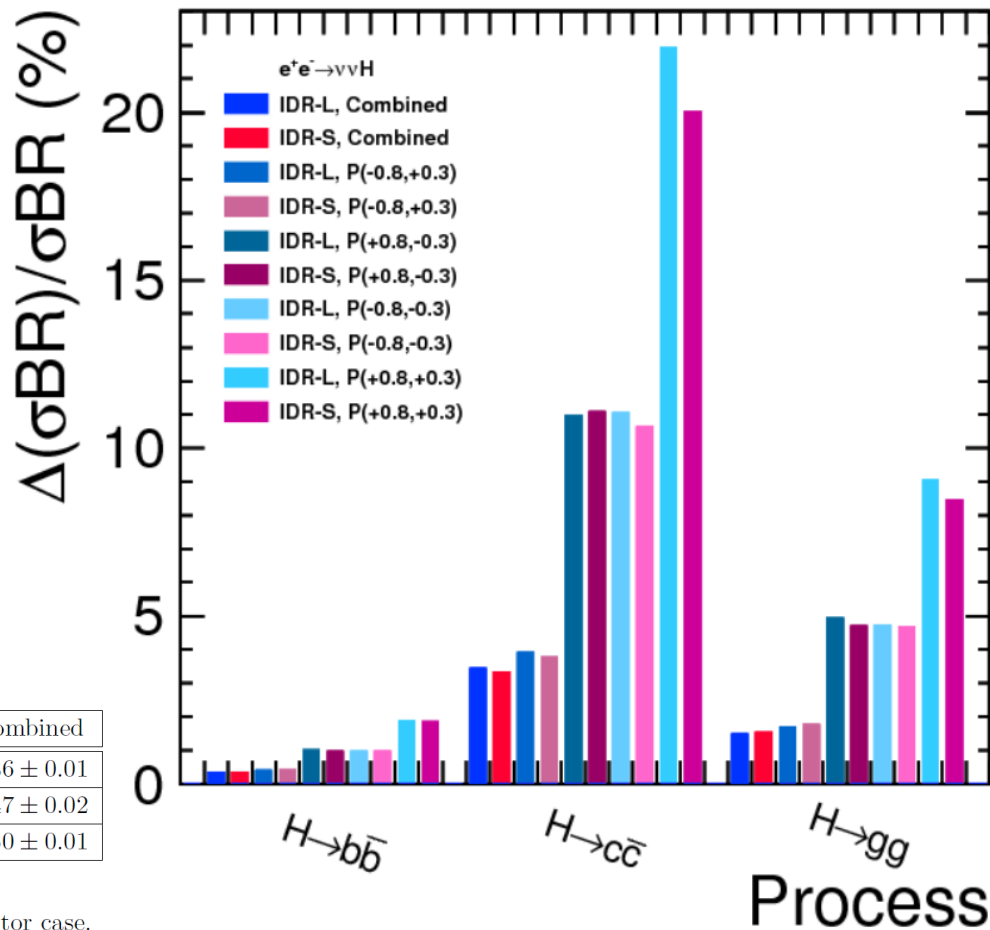- LCFIPlus output between large and small
  - 1:1:3 training
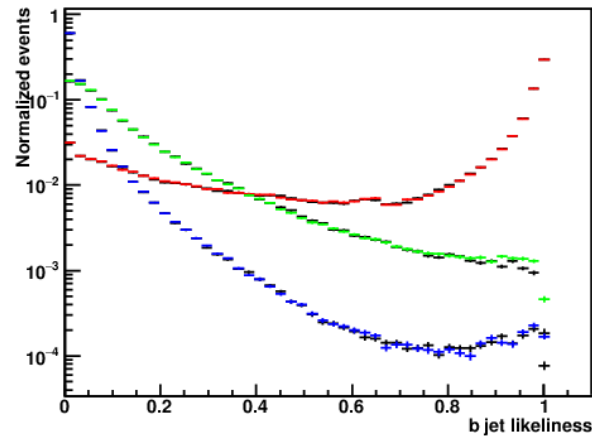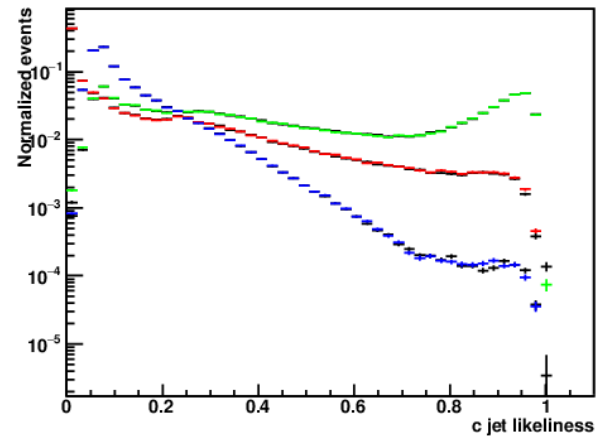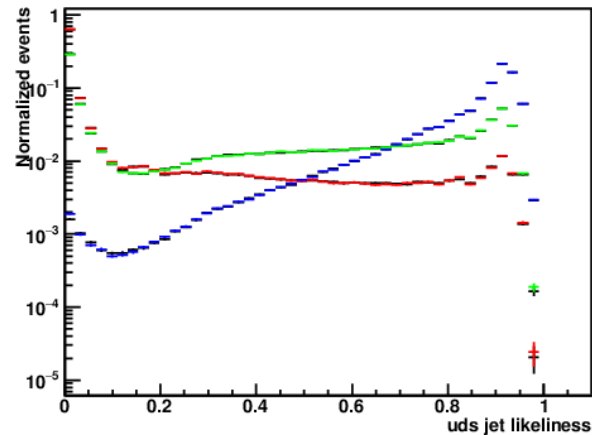
LCFIPlus v.s. perfect flavortag
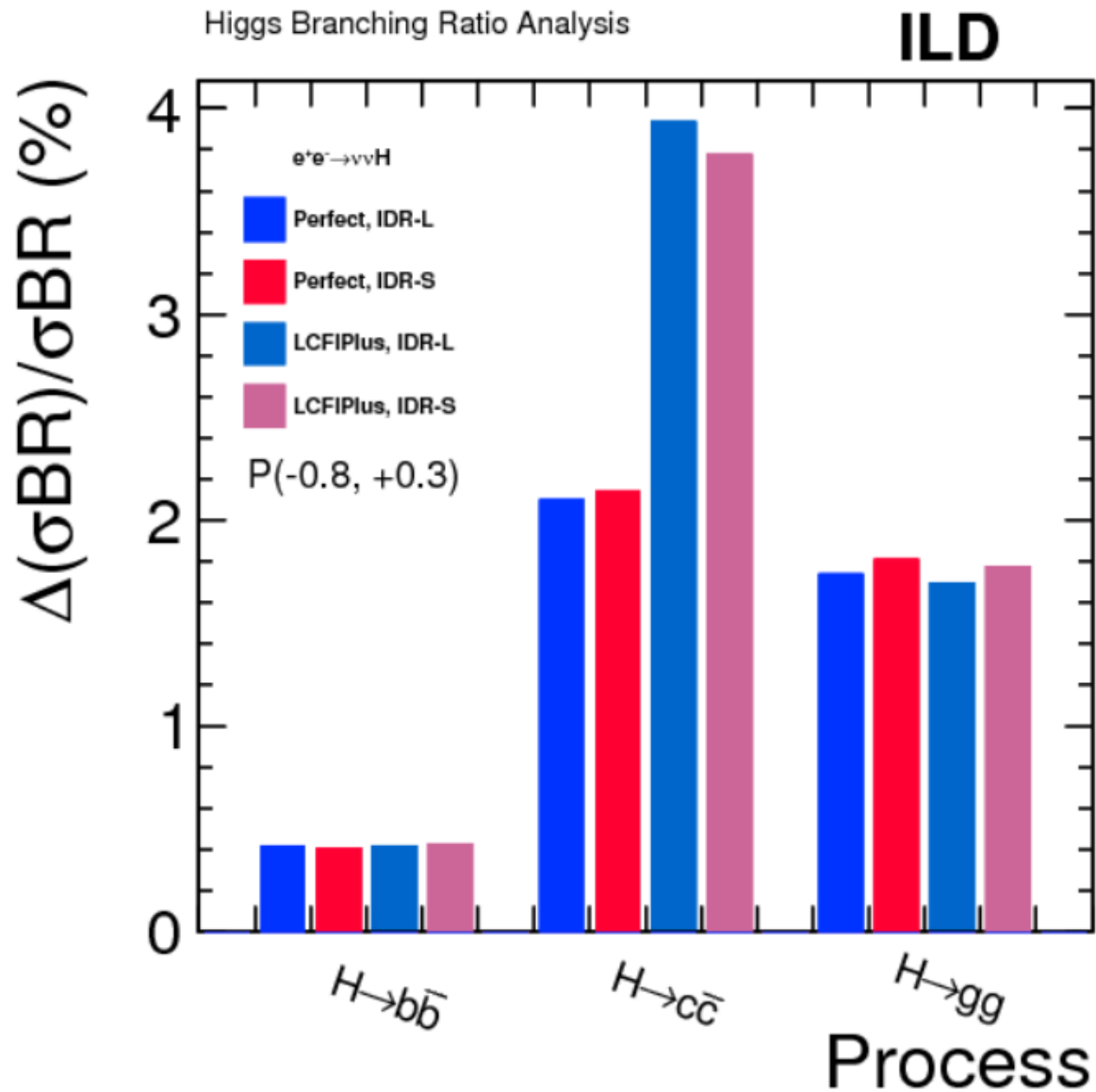
σBR for all the polarization status

- As mentioned, difference is small from 1:1:3
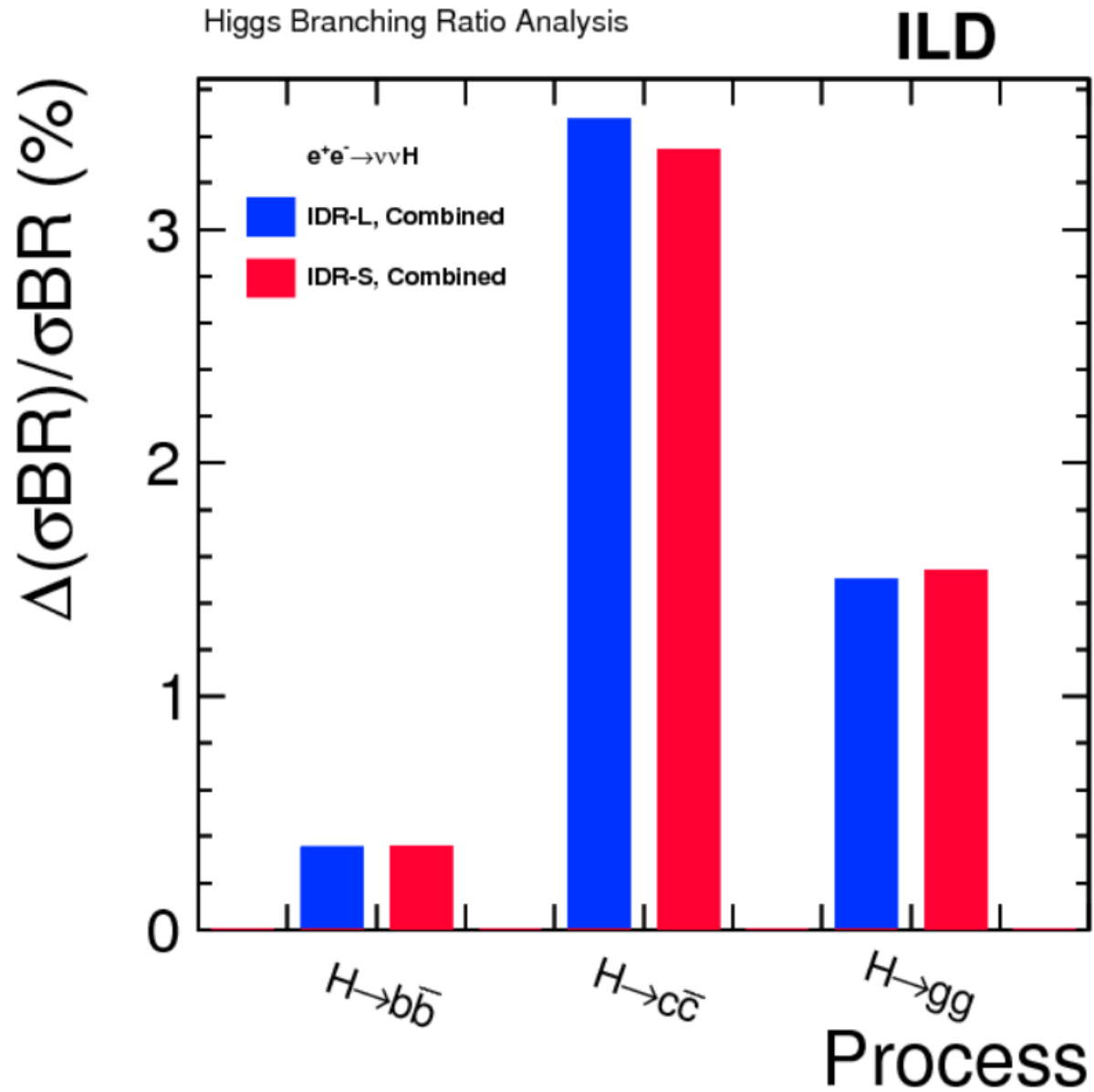

Higgs Branching Ratio Analysis — ILD

$e^+e^- \to \nu\nu H$

- IDR-L, Combined
- IDR-S, Combined
- IDR-L, P(-0.8,+0.3)
- IDR-S, P(-0.8,+0.3)
- IDR-L, P(+0.8,-0.3)
- IDR-S, P(+0.8,-0.3)
- IDR-L, P(-0.8,-0.3)
- IDR-S, P(-0.8,-0.3)
- IDR-L, P(+0.8,+0.3)
- IDR-S, P(+0.8,+0.3)

Process	P(-0.8,+0.3)	P(+0.8,-0.3)	P(-0.8,-0.3)	P(+0.8,+0.3)	Combined
$H \to b\bar{b}$ (%)	0.42 ± 0.01	1.03 ± 0.01	0.99 ± 0.01	1.89 ± 0.01	0.36 ± 0.01
$H \to c\bar{c}$ (%)	3.94 ± 0.02	10.99 ± 0.07	11.06 ± 0.08	21.93 ± 0.14	3.47 ± 0.02
$H \to gg$ (%)	1.70 ± 0.01	4.95 ± 0.03	4.74 ± 0.03	9.05 ± 0.06	1.50 ± 0.01

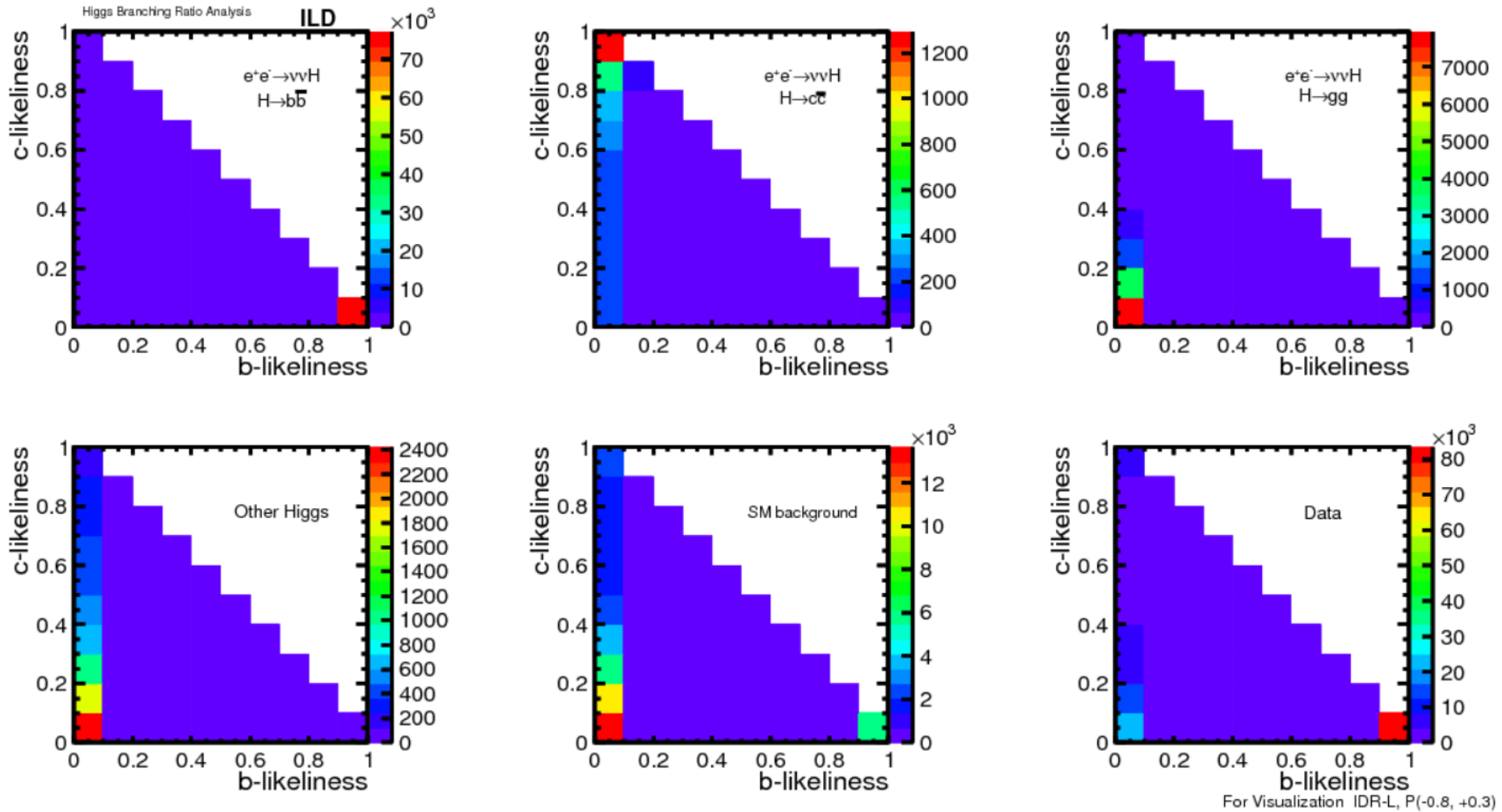Table 12: Results of measurement precision of σBR. These are the large detector case.

Process	P(-0.8,+0.3)	P(+0.8,-0.3)	P(-0.8,-0.3)	P(+0.8,+0.3)	Combined
$H \to b\bar{b}$ (%)	0.43 ± 0.01	1.00 ± 0.01	0.98 ± 0.01	1.87 ± 0.01	0.36 ± 0.01
$H \to c\bar{c}$ (%)	3.78 ± 0.02	11.10 ± 0.08	10.65 ± 0.08	20.06 ± 0.14	3.34 ± 0.02
$H \to gg$ (%)	1.78 ± 0.01	4.72 ± 0.03	4.71 ± 0.03	8.47 ± 0.06	1.54 ± 0.01

Table 13: Results of measurement precision of σBR. These are the small detector case.
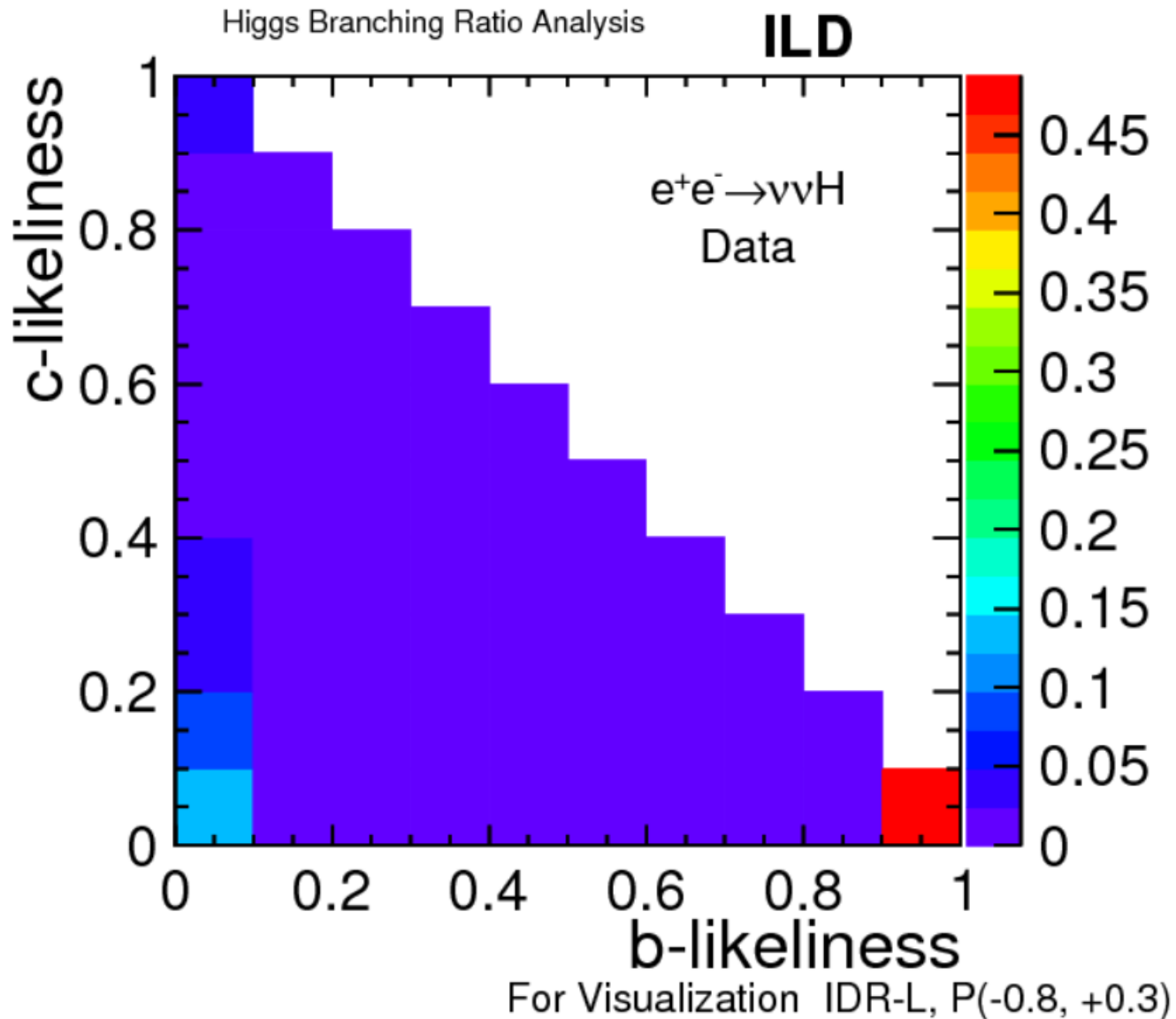
Combined only

Higgs Branching Ratio Analysis

2D projection of 3D templates

- No anomaly peak in H→cc

"Normalized" 2D projection

Higgs Branching Ratio Analysis ILD

$e^+e^- \rightarrow \nu\nu H$
Data

For Visualization IDR-L, P(-0.8, +0.3)
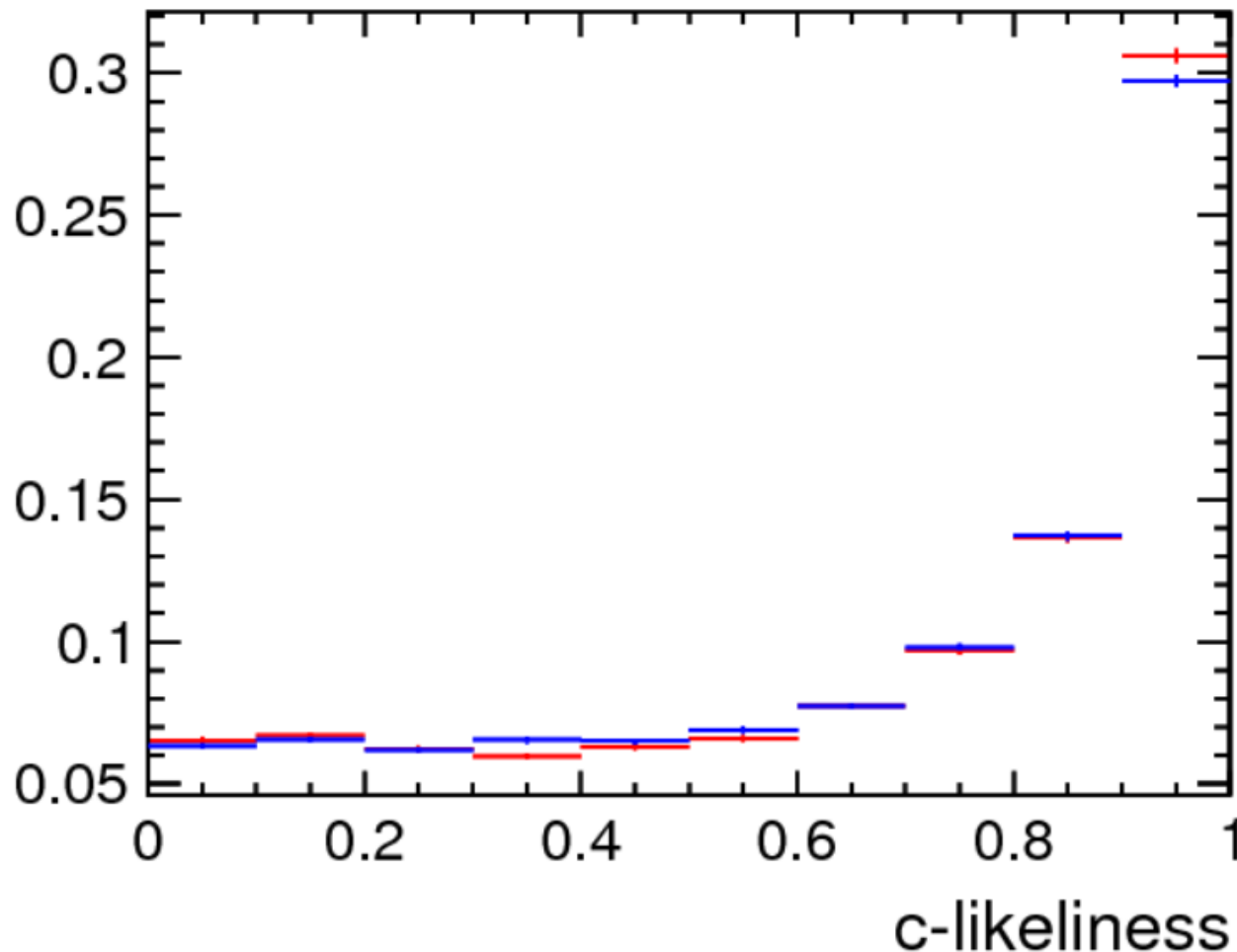
c-likeliness between small & large

- (-,+) distribution
  - Excess in small detector @high c-likeliness
  - Better precision for small
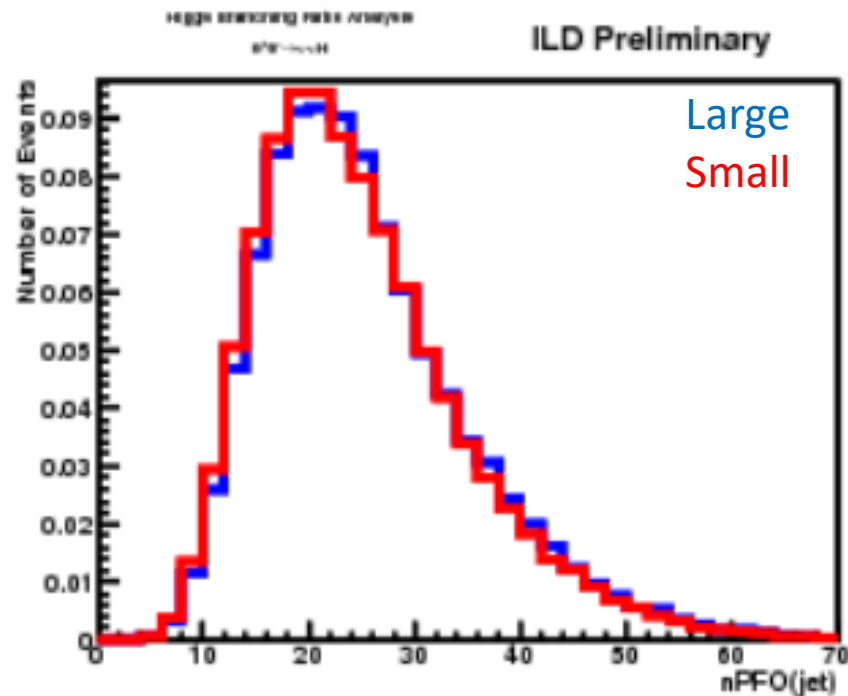
Large
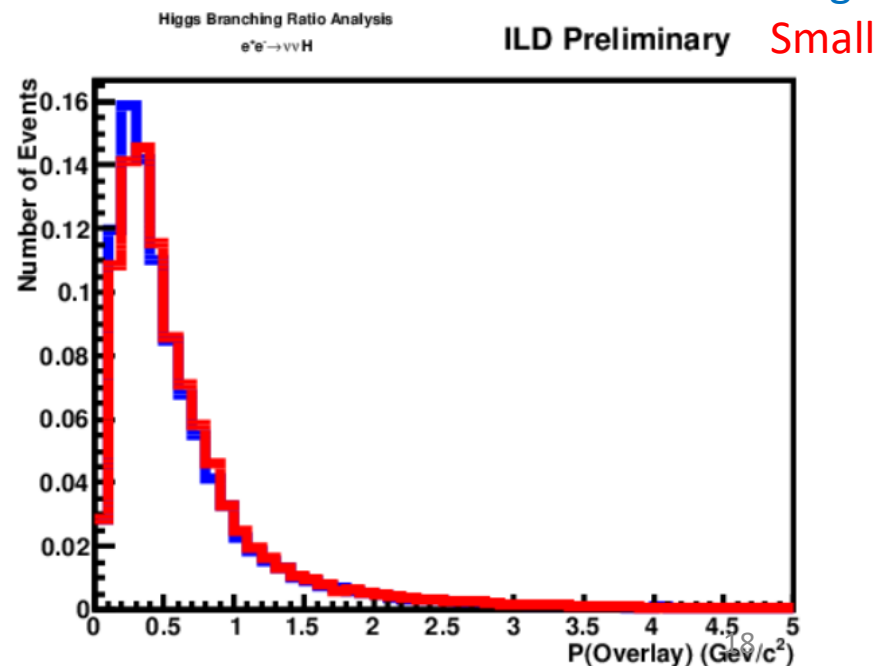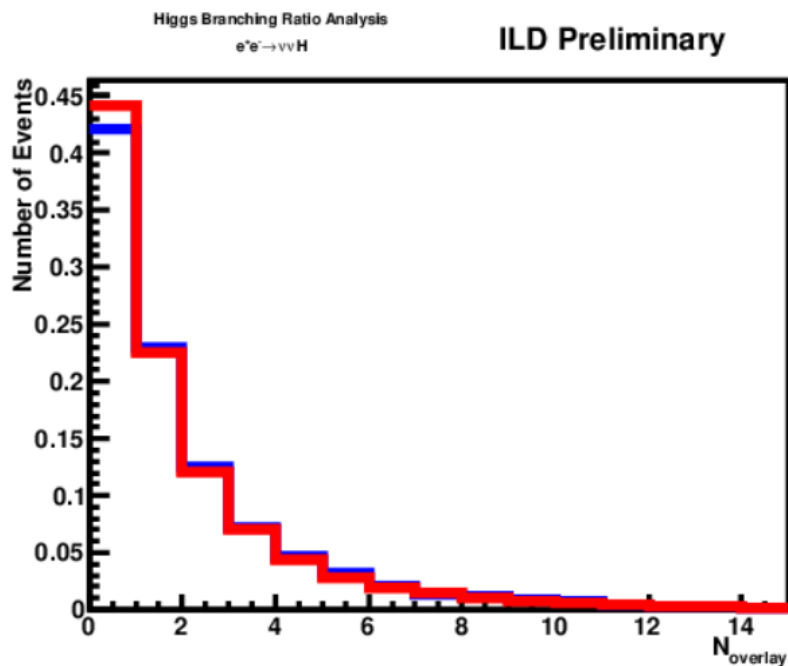Small

Some distributions at high c-likeliness events

- (-,+) case
- Choose events with c-likeliness>0.9
- nPFO: small difference – small is (slightly) smaller number
  - Coming from beam background??

Some distributions at high c-likeliness events

- (-,+) case

- Choose events with c-likeliness>0.9

- Overlaid particles:
  - Jets without overlaid particle: small detector has more
  - Momentum of overlaid particle: lower momentum can be detected in large detector

Large
Small

c-likeliness without beambackground

- Status
  - Remove overlaid particles using MCTruth
  - Pass through event selection

Large
Small