

Progress Report

ZHH Meeting | 2026/05/20

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DER FORSCHUNG | DER LEHRE | DER BILDUNG



Current Results in Lepton Channel

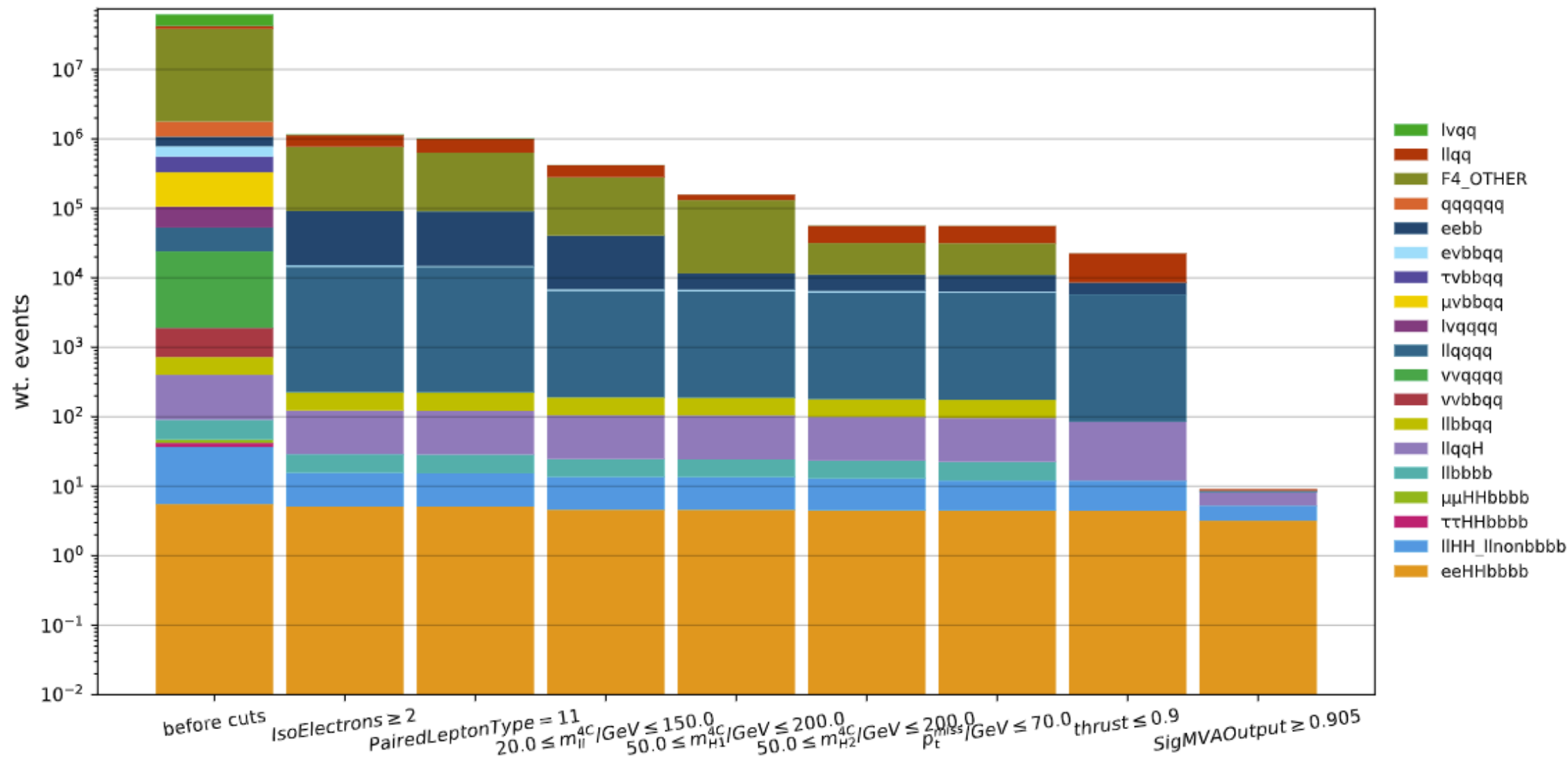
➤ Here: Assuming one total signal composed of

1. $[ee/\mu\mu]HHbbbb$: $[ee/\mu\mu] HH (HH \rightarrow bbbb)$ and
2. $llHH_{llnonbbbb}$: $[ee/\mu\mu] HH (HH \not\rightarrow bbbb)$

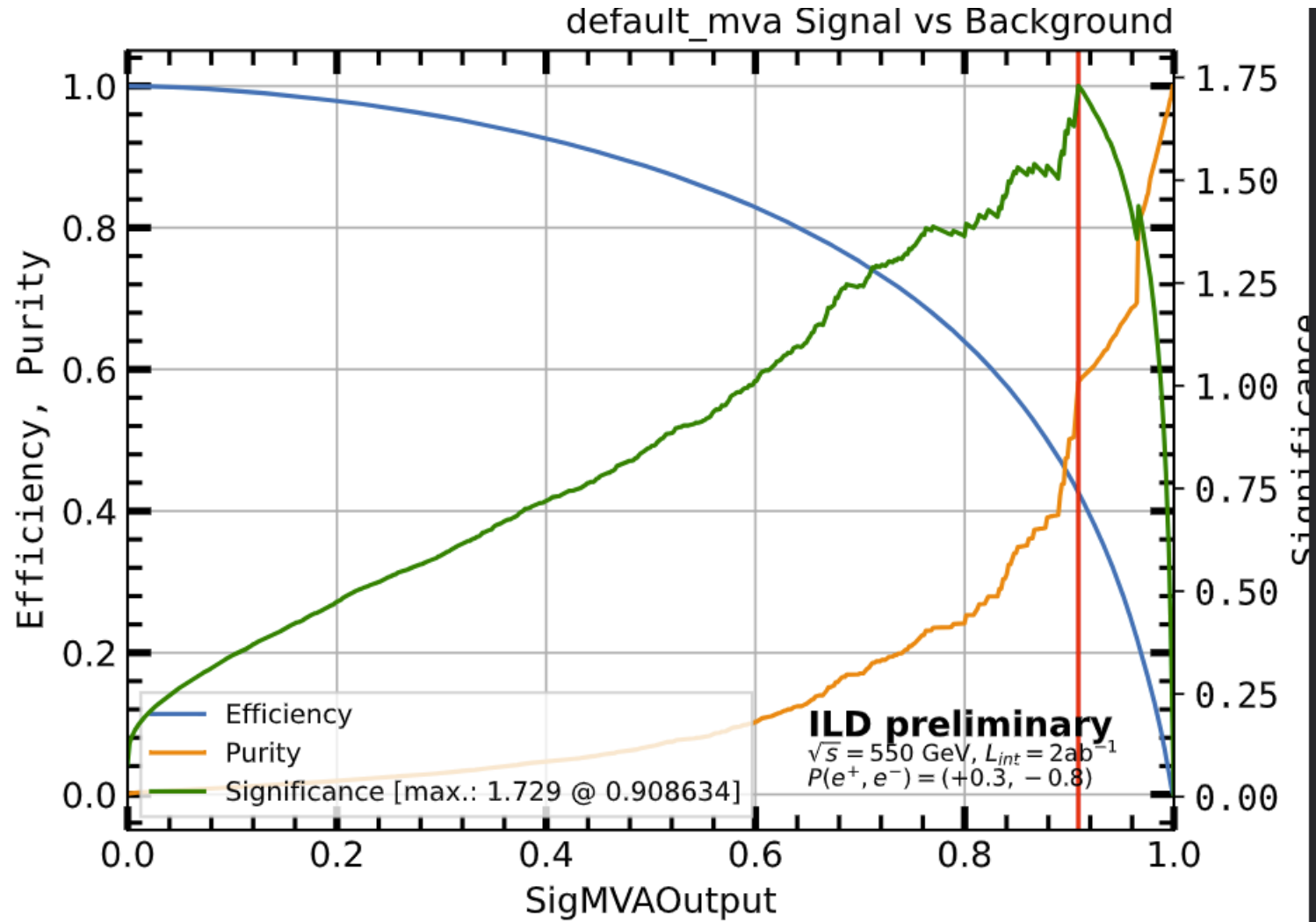
➤ MVA training with 7 classes

- $[ee/\mu\mu]HHbbbb$
- $llHH_{llnonbbbb}$
- $llqqH$ (i.e. ZZH)
- $Llqqqq$
- $[ee/\mu\mu]bb$
- $lvbbqq$
- $llll$

Electron Channel



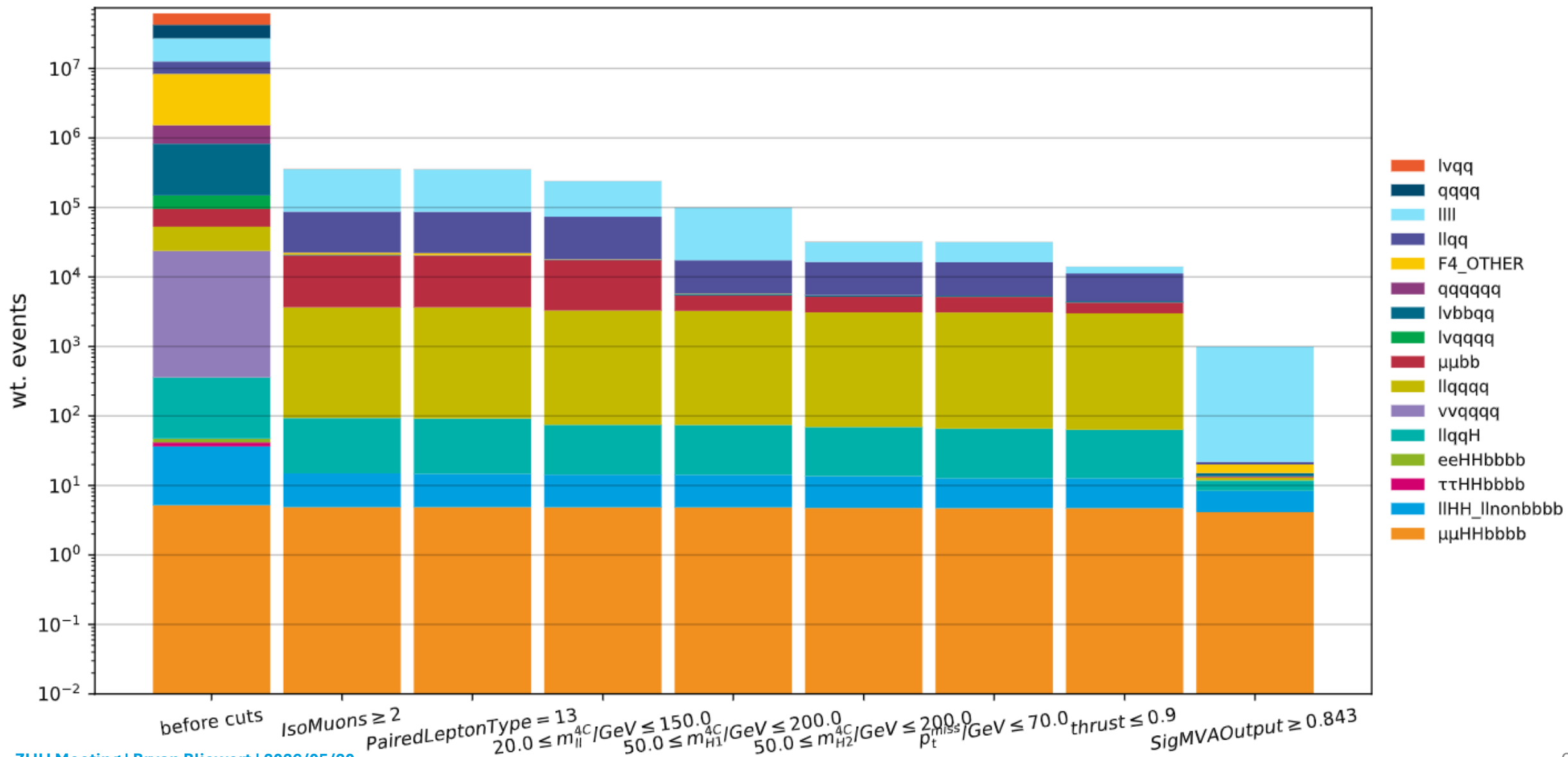
Electron Channel



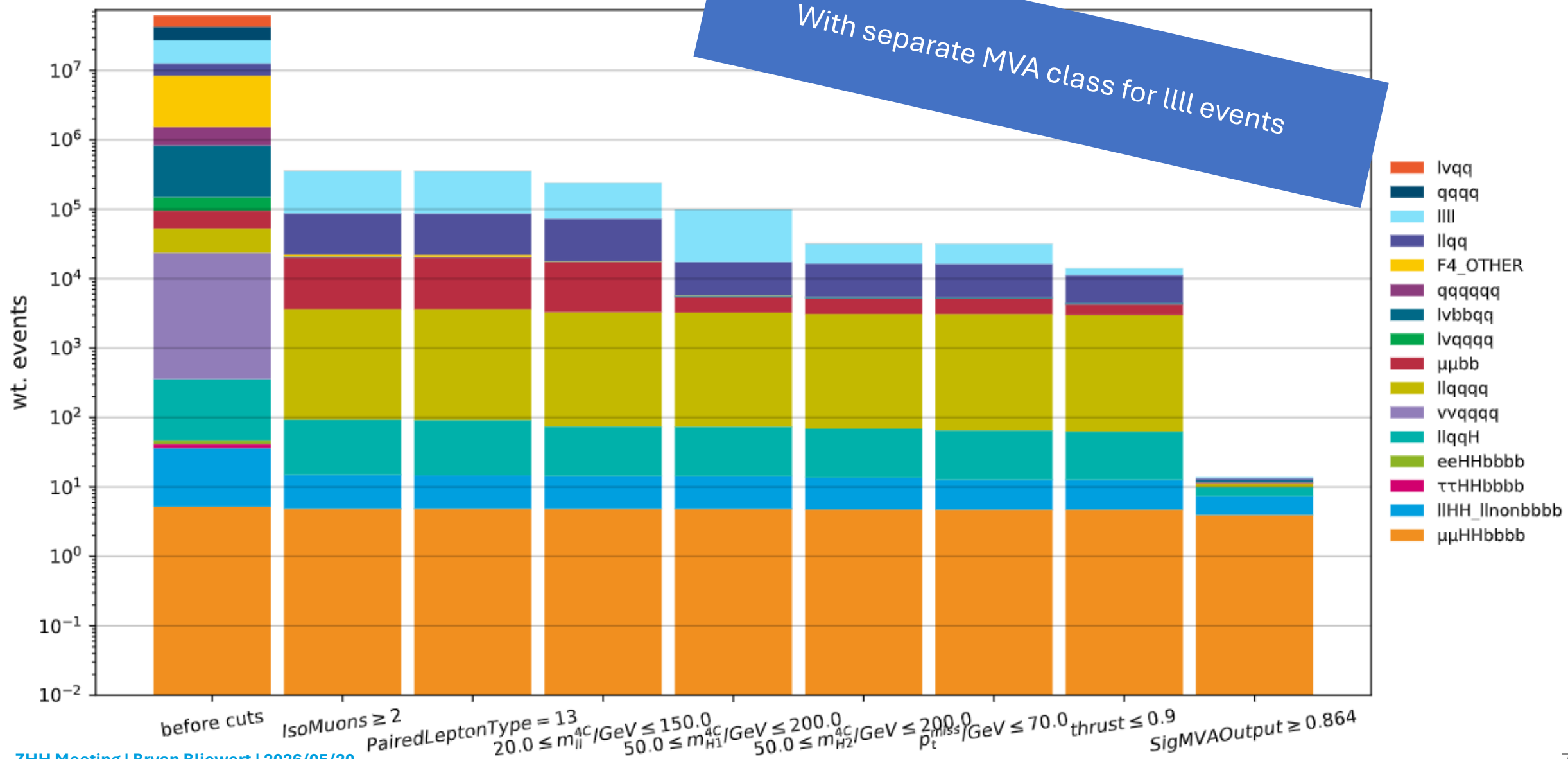
Electron Channel

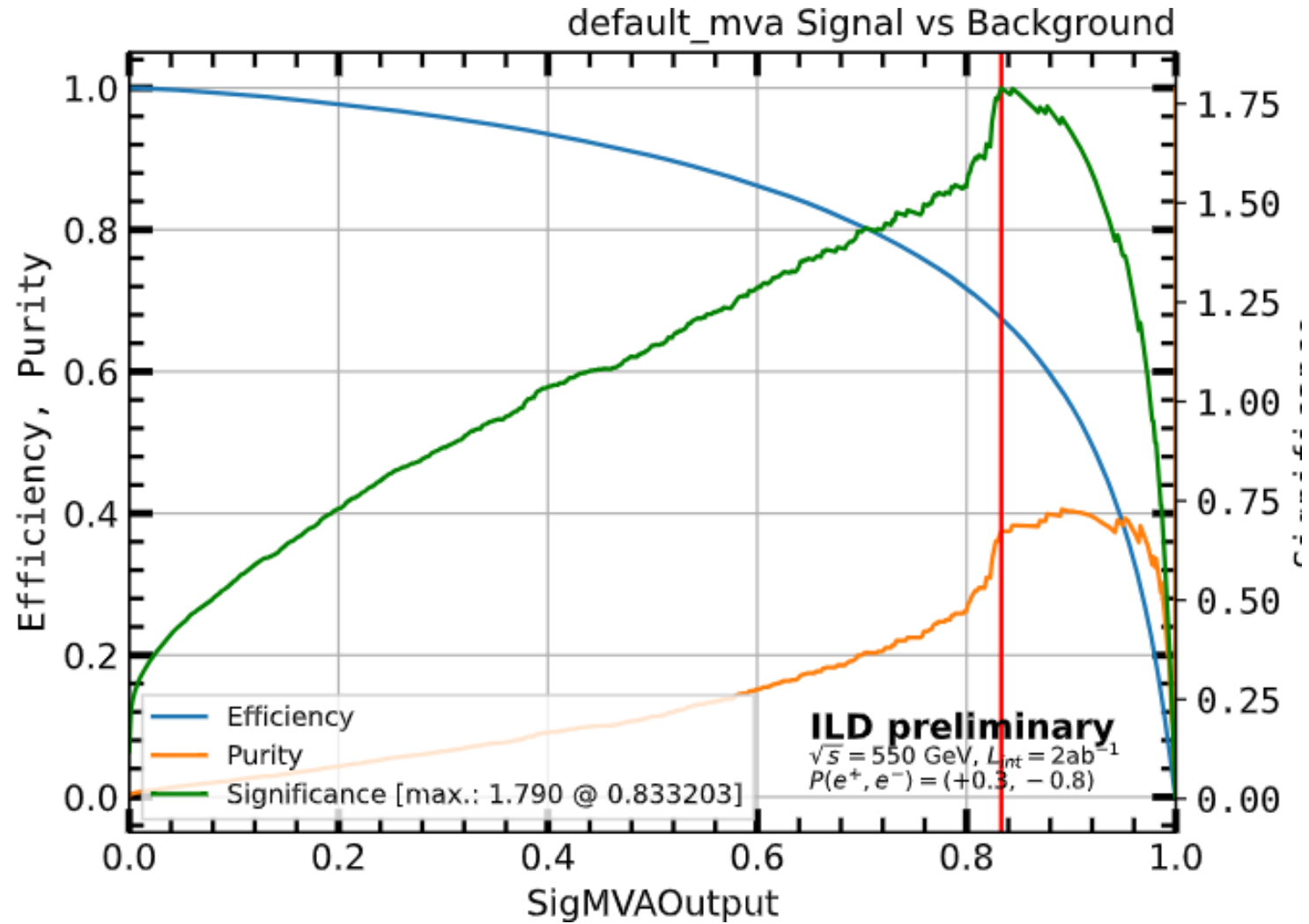
	expected	$IsoElectrons \geq 2$	$PairedLeptonType = 11$	$20.0 \leq m_{ll}^{AC}/GeV \leq 150.0$	$50.0 \leq m_{H_1}^{AC}/GeV \leq 200.0$	$50.0 \leq m_{H_2}^{AC}/GeV \leq 200.0$	$p_t^{miss}/GeV \leq 70.0$	$thrust \leq 0.9$	$SigMVAOutput \geq 0.905$
eebb	$2.94 \cdot 10^5$	$7.65 \cdot 10^4$	$7.60 \cdot 10^4$	$3.37 \cdot 10^4$	$4.84 \cdot 10^3$	$4.65 \cdot 10^3$	$4.64 \cdot 10^3$	$2.76 \cdot 10^3$	0.0279
other 4f sl	$2.51 \cdot 10^7$	$3.93 \cdot 10^5$	$3.86 \cdot 10^5$	$1.41 \cdot 10^5$	$2.65 \cdot 10^4$	$2.49 \cdot 10^4$	$2.47 \cdot 10^4$	$1.42 \cdot 10^4$	0.497
bbqqqq	$6.52 \cdot 10^5$	40.7	40.0	2.62	2.62	1.66	1.66	1.66	0.0
other 6q	$4.77 \cdot 10^4$	10.0	9.81	0.0	0.0	0.0	0.0	0.0	0.0
evbbqq	$2.27 \cdot 10^5$	683	362	303	298	289	190	188	0.028
l^+l^+qqqq	$2.91 \cdot 10^4$	$1.42 \cdot 10^4$	$1.42 \cdot 10^4$	$6.40 \cdot 10^3$	$6.32 \cdot 10^3$	$6.04 \cdot 10^3$	$6.04 \cdot 10^3$	$5.75 \cdot 10^3$	0.0357
(l^+l^+bbbb)	43.3	13.2	13.2	10.9	10.7	10.4	10.4	10.2	0.376
other 2l4q	$5.28 \cdot 10^5$	92.3	62.5	29.0	27.0	26.3	19.1	17.7	0.0
bbbb	$2.44 \cdot 10^4$	10.7	10.4	0.921	0.921	0.921	0.921	0.241	0.0
$l^+l^+l^+l^+$	$1.45 \cdot 10^7$	$6.60 \cdot 10^5$	$5.23 \cdot 10^5$	$2.40 \cdot 10^5$	$1.20 \cdot 10^5$	$2.05 \cdot 10^4$	$2.05 \cdot 10^4$	$4.10 \cdot 10^3$	0.0581
other 4fl / 4fh	$2.21 \cdot 10^7$	$1.98 \cdot 10^4$	$1.95 \cdot 10^4$	184	134	78.5	77.8	3.13	0.0
l^+l^+qqH	311	94.2	93.3	80.8	80.4	76.3	73.6	72.8	2.91
Total background	$6.36 \cdot 10^7$	$1.16 \cdot 10^6$	$1.02 \cdot 10^6$	$4.22 \cdot 10^5$	$1.58 \cdot 10^5$	$5.66 \cdot 10^4$	$5.62 \cdot 10^4$	$2.71 \cdot 10^4$	3.94
(eebbbb)	5.55	5.1	5.1	4.61	4.59	4.5	4.47	4.46	3.2
other signal	41.6	10.6	10.3	9.08	9.03	8.48	7.63	7.61	2.06
Total signal	47.1	15.7	15.4	13.7	13.6	13.0	12.1	12.1	5.26

Muon Channel



Muon Channel





Muon Channel

	expected	$IsoMuons \geq 2$	$PairedLeptonType = 13$	$20.0 \leq m_{ll}^{AC}/GeV \leq 150.0$	$50.0 \leq m_{H1}^{AC}/GeV \leq 200.0$	$50.0 \leq m_{H2}^{AC}/GeV \leq 200.0$	$p_t^{miss}/GeV \leq 70.0$	$thrust \leq 0.9$	$SigMVAOutput \geq 0.864$
$\mu\mu bb$	$4.25 \cdot 10^4$	$1.66 \cdot 10^4$	$1.66 \cdot 10^4$	$1.42 \cdot 10^4$	$2.17 \cdot 10^3$	$2.10 \cdot 10^3$	$2.09 \cdot 10^3$	$1.32 \cdot 10^3$	0.472
other 4f sl	$2.53 \cdot 10^7$	$6.77 \cdot 10^4$	$6.71 \cdot 10^4$	$5.67 \cdot 10^4$	$1.19 \cdot 10^4$	$1.12 \cdot 10^4$	$1.11 \cdot 10^4$	$6.81 \cdot 10^3$	0.892
bbqqqq	$6.52 \cdot 10^5$	5.27	4.32	1.32	1.31	1.1	1.1	1.1	0.0
other 6q	$4.77 \cdot 10^4$	0.469	0.469	0.0	0.0	0.0	0.0	0.0	0.0
$\mu\nu bbqq$	$2.25 \cdot 10^5$	553	313	275	268	252	185	182	0.811
$l^{\pm}l^{\pm}qqqq$	$2.91 \cdot 10^4$	$3.55 \cdot 10^3$	$3.55 \cdot 10^3$	$3.20 \cdot 10^3$	$3.16 \cdot 10^3$	$3.02 \cdot 10^3$	$3.01 \cdot 10^3$	$2.94 \cdot 10^3$	0.324
$(l^{\pm}l^{\pm}bbbb)$	43.3	11.7	11.7	10.4	10.3	9.95	9.91	9.72	0.91
other 2l4q	$5.30 \cdot 10^5$	51.4	30.2	23.5	23.1	21.6	14.6	14.2	0.0
bbbb	$2.44 \cdot 10^4$	1.16	0.935	0.695	0.695	0.468	0.468	0.014	0.0
$l^{\pm}l^{\pm}l^{\pm}l^{\pm}$	$1.45 \cdot 10^7$	$2.70 \cdot 10^5$	$2.67 \cdot 10^5$	$1.66 \cdot 10^5$	$8.20 \cdot 10^4$	$1.56 \cdot 10^4$	$1.55 \cdot 10^4$	$2.85 \cdot 10^3$	0.442
other 4fl / 4fh	$2.21 \cdot 10^7$	$1.56 \cdot 10^3$	$1.55 \cdot 10^3$	232	84.6	15.9	12.1	5.39	0.0
$l^{\pm}l^{\pm}qqH$	311	78.2	77.1	60.2	59.9	55.6	53.1	50.6	2.66
Total background	$6.36 \cdot 10^7$	$3.60 \cdot 10^5$	$3.56 \cdot 10^5$	$2.41 \cdot 10^5$	$9.97 \cdot 10^4$	$3.23 \cdot 10^4$	$3.20 \cdot 10^4$	$1.42 \cdot 10^4$	6.51
$(\mu\mu bbbb)$	5.2	4.87	4.87	4.85	4.83	4.74	4.71	4.69	3.95
other signal	41.9	10.1	9.83	9.45	9.4	8.86	7.96	7.94	3.37
Total signal	47.1	15.0	14.7	14.3	14.2	13.6	12.7	12.6	7.33