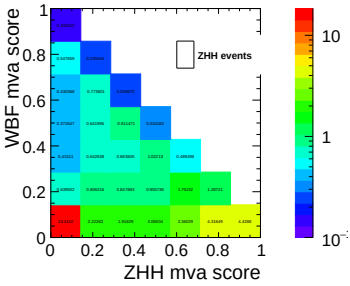
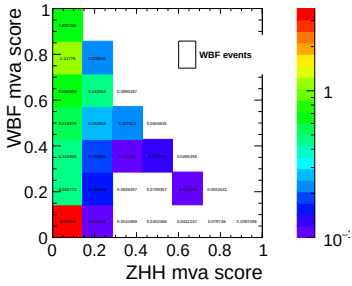
ZHH analysis.

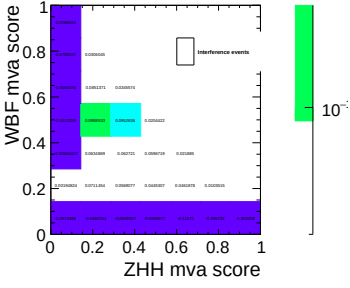
template fits

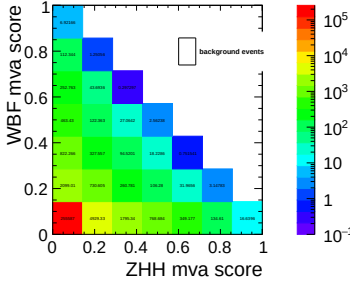
Julie Munch Torndal

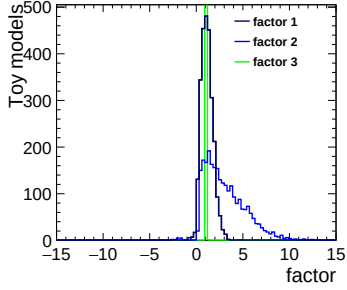
Di-Higgs working group meeting
November 4, 2026



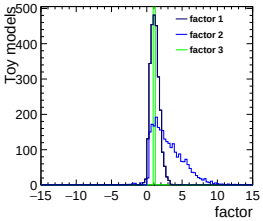








$$f_{ZHH} = 1.16199 \pm 0.619034$$
$$f_{WBF} = 3.0801 \pm 2.20545$$
$$f_{bkg} = 0.999914 \pm 0.00194859$$

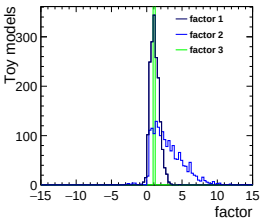


incl. interference

1.16199 ± 0.619034

3.0801 ± 2.20545

0.999914 ± 0.00194859

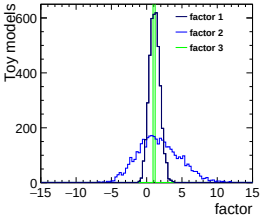


incl. interference

1.1442 ± 0.638325

3.0204 ± 2.23216

$1 \pm 0(fixed)$

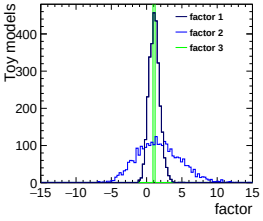


ignore interference

1.12663 ± 0.752

1.75226 ± 3.03444

0.999953 ± 0.00196983



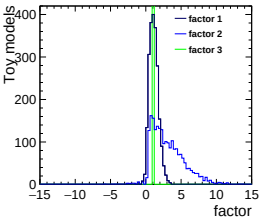
ignore interference

1.10115 ± 0.762743

1.73246 ± 3.06019

$1 \pm 0(fixed)$

Added cut on missing pt: $\not{p_T} > 10$ GeV -> worse precision, will try to optimise hyper param with scan

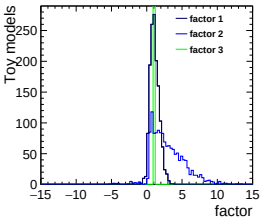


incl. interference

1.14157 ± 0.636844

3.12789 ± 2.31408

0.999908 ± 0.00222844

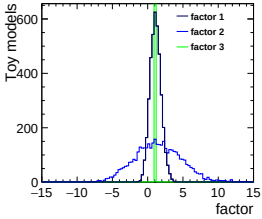


incl. interference

1.12688 ± 0.644884

3.05234 ± 2.33385

$1 \pm 0(fixed)$

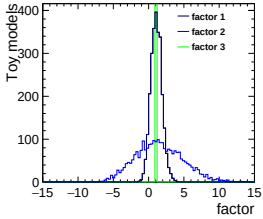


ignore interference

1.11651 ± 0.777873

1.50219 ± 3.3328

0.999927 ± 0.00224444



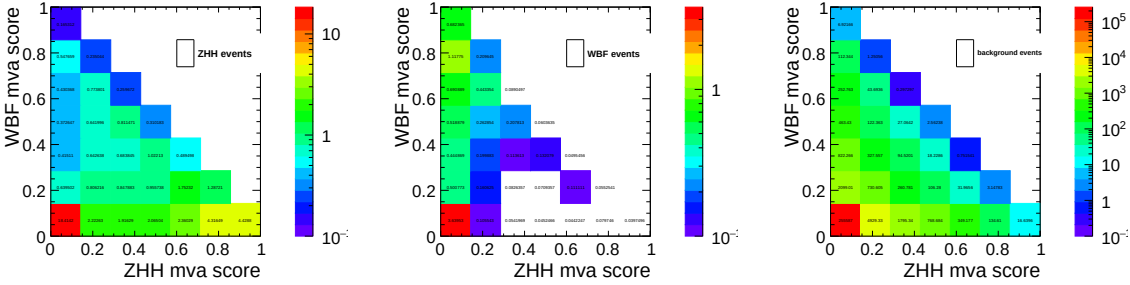
ignore interference

1.10488 ± 0.78219

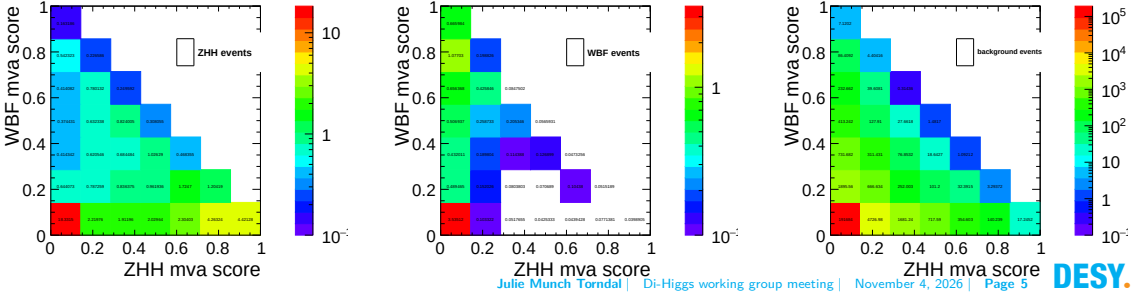
1.52743 ± 3.36972

$1 \pm 0(fixed)$

No cut on p_T:



$p_T > 10$ GeV:



DESY.

No cut on $\not{p}_T$:

	expected	$Isolatedleptons = 0$	$\Sigma_{bTags} \geq 1.8$	$60.0 \leq m^{4C}_{H1}/GeV \leq 180.0$	$40.0 \leq m^{4C}_{H2}/GeV \leq 250.0$	$thrust \leq 0.93$	$E_{vis}/GeV \leq 510$	$M_{vis}/GeV \geq 200$
evbbqq	$2.27 \cdot 10^5$	$7.94 \cdot 10^3$	$5.60 \cdot 10^3$	$5.42 \cdot 10^3$	$5.29 \cdot 10^3$	$5.27 \cdot 10^3$	$5.14 \cdot 10^3$	$5.12 \cdot 10^3$
μvbbqq	$2.25 \cdot 10^5$	$9.94 \cdot 10^3$	$7.06 \cdot 10^3$	$6.86 \cdot 10^3$	$6.74 \cdot 10^3$	$6.72 \cdot 10^3$	$6.60 \cdot 10^3$	$6.55 \cdot 10^3$
τvbbqq	$2.26 \cdot 10^5$	$2.02 \cdot 10^5$	$1.31 \cdot 10^5$	$1.26 \cdot 10^5$	$1.22 \cdot 10^5$	$1.22 \cdot 10^5$	$1.21 \cdot 10^5$	$1.21 \cdot 10^5$
vvbbbb	132	131	130	128	126	126	126	109
bbqqqq	$6.52 \cdot 10^5$	$6.42 \cdot 10^5$	$3.73 \cdot 10^5$	$1.99 \cdot 10^5$	$1.66 \cdot 10^5$	$1.66 \cdot 10^5$	$6.74 \cdot 10^4$	$6.74 \cdot 10^4$
vvbb	$3.35 \cdot 10^5$	$3.32 \cdot 10^5$	$2.60 \cdot 10^5$	$1.10 \cdot 10^5$	$3.45 \cdot 10^4$	$3.12 \cdot 10^4$	$3.12 \cdot 10^4$	$4.40 \cdot 10^3$
ττbb	$2.79 \cdot 10^4$	$2.26 \cdot 10^4$	$1.71 \cdot 10^4$	$1.55 \cdot 10^4$	$1.32 \cdot 10^4$	$6.62 \cdot 10^3$	$6.47 \cdot 10^3$	$5.83 \cdot 10^3$
bbbb	$2.44 \cdot 10^4$	$2.37 \cdot 10^4$	$2.33 \cdot 10^4$	$2.18 \cdot 10^4$	$2.00 \cdot 10^4$	$1.45 \cdot 10^4$	$8.63 \cdot 10^3$	$8.49 \cdot 10^3$
bbqq	$2.94 \cdot 10^5$	$2.87 \cdot 10^5$	$1.81 \cdot 10^5$	$1.71 \cdot 10^5$	$1.52 \cdot 10^5$	$8.42 \cdot 10^4$	$4.46 \cdot 10^4$	$4.37 \cdot 10^4$
ttH	$2.64 \cdot 10^3$	$1.45 \cdot 10^3$	$1.10 \cdot 10^3$	297	260	260	217	217
ttZ	$6.75 \cdot 10^3$	$3.81 \cdot 10^3$	$2.20 \cdot 10^3$	988	916	916	813	805
vvqqH	837	750	422	416	407	406	405	381
Total background	$6.36 \cdot 10^7$	$4.30 \cdot 10^7$	$1.14 \cdot 10^6$	$7.14 \cdot 10^5$	$5.54 \cdot 10^5$	$4.50 \cdot 10^5$	$3.01 \cdot 10^5$	$2.69 \cdot 10^5$
vvHH	72.5	52.2	30.8	30.2	29.7	29.6	29.6	27.9
(v23v23bbbb)	20.6	20.3	20.1	20.0	19.9	19.9	19.9	19.8
(v1v1bbbb)	16.5	16.4	16.2	16.1	16.0	16.0	15.9	15.9
Total signal	110	88.9	67.1	66.3	65.6	65.4	65.4	63.7

$\not{p}_T > 10$ GeV:

	expected	$Isolatedleptons = 0$	$\Sigma_{bTags} \geq 1.8$	$60.0 \leq m^{4C}_{H1}/GeV \leq 180.0$	$40.0 \leq m^{4C}_{H2}/GeV \leq 250.0$	$p_t^{miss}/GeV \geq 10.0$	$thrust \leq 0.93$	$E_{vis}/GeV \leq 510$	$M_{vis}/GeV \geq 200$
evbbqq	$2.27 \cdot 10^5$	$7.94 \cdot 10^3$	$5.60 \cdot 10^3$	$5.42 \cdot 10^3$	$5.29 \cdot 10^3$	$5.22 \cdot 10^3$	$5.20 \cdot 10^3$	$5.09 \cdot 10^3$	$5.07 \cdot 10^3$
μvbbqq	$2.25 \cdot 10^5$	$9.94 \cdot 10^3$	$7.06 \cdot 10^3$	$6.86 \cdot 10^3$	$6.74 \cdot 10^3$	$6.66 \cdot 10^3$	$6.65 \cdot 10^3$	$6.54 \cdot 10^3$	$6.48 \cdot 10^3$
τvbbqq	$2.26 \cdot 10^5$	$2.02 \cdot 10^5$	$1.31 \cdot 10^5$	$1.26 \cdot 10^5$	$1.22 \cdot 10^5$	$1.20 \cdot 10^5$	$1.20 \cdot 10^5$	$1.19 \cdot 10^5$	$1.19 \cdot 10^5$
vvbbbb	132	131	130	128	126	123	123	123	107
bbqqqq	$6.52 \cdot 10^5$	$6.42 \cdot 10^5$	$3.73 \cdot 10^5$	$1.99 \cdot 10^5$	$1.66 \cdot 10^5$	$6.92 \cdot 10^4$	$6.92 \cdot 10^4$	$3.79 \cdot 10^4$	$3.79 \cdot 10^4$
vvbb	$3.35 \cdot 10^5$	$3.32 \cdot 10^5$	$2.60 \cdot 10^5$	$1.10 \cdot 10^5$	$3.45 \cdot 10^4$	$3.35 \cdot 10^4$	$3.04 \cdot 10^4$	$3.04 \cdot 10^4$	$4.34 \cdot 10^3$
ττbb	$2.79 \cdot 10^4$	$2.26 \cdot 10^4$	$1.71 \cdot 10^4$	$1.55 \cdot 10^4$	$1.32 \cdot 10^4$	$1.12 \cdot 10^4$	$5.88 \cdot 10^3$	$5.79 \cdot 10^3$	$5.27 \cdot 10^3$
bbbb	$2.44 \cdot 10^4$	$2.37 \cdot 10^4$	$2.33 \cdot 10^4$	$2.18 \cdot 10^4$	$2.00 \cdot 10^4$	$8.40 \cdot 10^3$	$6.24 \cdot 10^3$	$4.68 \cdot 10^3$	$4.63 \cdot 10^3$
bbqq	$2.94 \cdot 10^5$	$2.87 \cdot 10^5$	$1.81 \cdot 10^5$	$1.71 \cdot 10^5$	$1.52 \cdot 10^5$	$4.66 \cdot 10^4$	$2.69 \cdot 10^4$	$1.77 \cdot 10^4$	$1.74 \cdot 10^4$
ttH	$2.64 \cdot 10^3$	$1.45 \cdot 10^3$	$1.10 \cdot 10^3$	297	260	226	225	205	205
ttZ	$6.75 \cdot 10^3$	$3.81 \cdot 10^3$	$2.20 \cdot 10^3$	988	916	814	814	776	767
vvqqH	837	750	422	416	407	402	401	401	377
Total background	$6.36 \cdot 10^7$	$4.30 \cdot 10^7$	$1.14 \cdot 10^6$	$7.14 \cdot 10^5$	$5.54 \cdot 10^5$	$3.14 \cdot 10^5$	$2.77 \cdot 10^5$	$2.33 \cdot 10^5$	$2.04 \cdot 10^5$
vvHH	72.5	52.2	30.8	30.2	29.7	29.3	29.2	29.2	27.5
(v23v23bbbb)	20.6	20.3	20.1	20.0	19.9	19.7	19.7	19.7	19.7
(v1v1bbbb)	16.5	16.4	16.2	16.1	16.0	15.6	15.6	15.6	15.6
Total signal	110	88.9	67.1	66.3	65.6	64.6	64.5	64.5	62.8