

Efficiency tables for $\ell\ell + b(b)$ selection ()

Table: $\mu\mu + b$ event selection

| Cut / Sample | tt | ZZ | Z+b | Z+c | Z+l | $\sum MC$ | Data | ratio | Dev. |
|-----------------------|----------------|--------------|------------------|--------------------|--------------------|--------------------|--------------------|-------|---------|
| All | 32683 \pm 32 | 2353 \pm 5 | 239886 \pm 781 | 1138701 \pm 1886 | 2977473 \pm 3758 | 4391096 \pm 4277 | 5128403 \pm 2265 | 1.17 | 152.36 |
| HLT range | 32683 \pm 32 | 2353 \pm 5 | 239886 \pm 781 | 1138701 \pm 1886 | 2977473 \pm 3758 | 4391096 \pm 4277 | 2143158 \pm 1464 | 0.49 | -497.30 |
| $\ell\ell$ | 4111 \pm 12 | 884 \pm 3 | 95780 \pm 494 | 453711 \pm 1190 | 1200388 \pm 2383 | 1754875 \pm 2709 | 1856471 \pm 1363 | 1.06 | 33.50 |
| $\ell\ell$ tight | 4111 \pm 12 | 884 \pm 3 | 95780 \pm 494 | 453711 \pm 1190 | 1200388 \pm 2383 | 1754875 \pm 2709 | 1856471 \pm 1363 | 1.06 | 33.50 |
| ℓ -HLT match | 4111 \pm 12 | 884 \pm 3 | 95780 \pm 494 | 453711 \pm 1190 | 1200388 \pm 2383 | 1754875 \pm 2709 | 1856471 \pm 1363 | 1.06 | 33.50 |
| Z($\ell\ell$) | 1123 \pm 6 | 818 \pm 3 | 89603 \pm 477 | 417710 \pm 1141 | 1112815 \pm 2295 | 1622068 \pm 2607 | 1709041 \pm 1307 | 1.05 | 29.82 |
| Z+j | 1078 \pm 6 | 575 \pm 2 | 22534 \pm 238 | 85596 \pm 517 | 188413 \pm 946 | 298196 \pm 1104 | 301020 \pm 549 | 1.01 | 2.29 |
| Z+j(vtx) | 1078 \pm 6 | 575 \pm 2 | 22534 \pm 238 | 85596 \pm 517 | 188413 \pm 946 | 298196 \pm 1104 | 301020 \pm 549 | 1.01 | 2.29 |
| Z+>=1b(HE) | 770 \pm 5 | 82 \pm 1 | 6530 \pm 126 | 3643 \pm 104 | 1826 \pm 89 | 12850 \pm 186 | 13791 \pm 117 | 1.07 | 4.28 |
| Z+>=1b(HE)+ S_{MET} | 332 \pm 3 | 52 \pm 1 | 4879 \pm 109 | 2545 \pm 86 | 1191 \pm 71 | 8998 \pm 156 | 10018 \pm 100 | 1.11 | 5.51 |
| Z+>=1b(HP) | 588 \pm 4 | 49 \pm 1 | 4339 \pm 101 | 1082 \pm 56 | 106 \pm 23 | 6163 \pm 118 | 6426 \pm 80 | 1.04 | 1.85 |
| Z+>=1b(HP)+ S_{MET} | 250 \pm 3 | 31 \pm 1 | 3204 \pm 87 | 761 \pm 47 | 50 \pm 15 | 4296 \pm 100 | 4513 \pm 67 | 1.05 | 1.81 |

Table: $ee + b$ event selection

| Cut / Sample | tt | ZZ | Z+b | Z+c | Z+l | $\sum MC$ | Data | ratio | Dev. |
|-----------------------|----------------|--------------|------------------|--------------------|--------------------|--------------------|--------------------|-------|---------|
| All | 32683 \pm 32 | 2353 \pm 5 | 239886 \pm 781 | 1138701 \pm 1886 | 2977473 \pm 3758 | 4391096 \pm 4277 | 5128403 \pm 2265 | 1.17 | 152.36 |
| HLT range | 32683 \pm 32 | 2353 \pm 5 | 239886 \pm 781 | 1138701 \pm 1886 | 2977473 \pm 3758 | 4391096 \pm 4277 | 2985245 \pm 1728 | 0.68 | -304.79 |
| $\ell\ell$ | 3552 \pm 12 | 708 \pm 3 | 73674 \pm 460 | 349562 \pm 1114 | 912529 \pm 2219 | 1340025 \pm 2525 | 1297117 \pm 1139 | 0.97 | -15.49 |
| $\ell\ell$ tight | 3524 \pm 12 | 697 \pm 3 | 72385 \pm 457 | 342244 \pm 1105 | 890247 \pm 2198 | 1309098 \pm 2503 | 1266973 \pm 1126 | 0.97 | -15.35 |
| ℓ -HLT match | 3524 \pm 12 | 697 \pm 3 | 72385 \pm 457 | 342244 \pm 1105 | 890247 \pm 2198 | 1309098 \pm 2503 | 1266973 \pm 1126 | 0.97 | -15.35 |
| Z($\ell\ell$) | 936 \pm 6 | 644 \pm 3 | 67963 \pm 443 | 315629 \pm 1062 | 828704 \pm 2121 | 1213875 \pm 2413 | 1168253 \pm 1081 | 0.96 | -17.26 |
| Z+j | 897 \pm 6 | 456 \pm 2 | 17464 \pm 223 | 65954 \pm 484 | 146475 \pm 891 | 231247 \pm 1039 | 214544 \pm 463 | 0.93 | -14.69 |
| Z+j(vtx) | 897 \pm 6 | 456 \pm 2 | 17464 \pm 223 | 65954 \pm 484 | 146475 \pm 891 | 231247 \pm 1039 | 214544 \pm 463 | 0.93 | -14.69 |
| Z+>=1b(HE) | 634 \pm 5 | 65 \pm 1 | 5182 \pm 119 | 3077 \pm 102 | 1398 \pm 84 | 10356 \pm 178 | 9894 \pm 99 | 0.96 | -2.27 |
| Z+>=1b(HE)+ S_{MET} | 282 \pm 3 | 54 \pm 1 | 4597 \pm 112 | 2832 \pm 97 | 1271 \pm 79 | 9037 \pm 168 | 8510 \pm 92 | 0.94 | -2.74 |
| Z+>=1b(HP) | 480 \pm 4 | 39 \pm 1 | 3405 \pm 95 | 892 \pm 55 | 109 \pm 25 | 4925 \pm 112 | 4668 \pm 68 | 0.95 | -1.96 |
| Z+>=1b(HP)+ S_{MET} | 216 \pm 3 | 33 \pm 1 | 3006 \pm 89 | 825 \pm 53 | 109 \pm 25 | 4190 \pm 107 | 3914 \pm 63 | 0.93 | -2.23 |

Efficiency tables for $\ell\ell+b(b)$ selection ()

Table: Combined $\ell\ell + b$ event selection

| Cut / Sample | tt | ZZ | Z+b | Z+c | Z+l | $\sum MC$ | Data | ratio | Dev. |
|-----------------------|----------------|--------------|-------------------|--------------------|--------------------|--------------------|---------------------|-------|---------|
| All | 65366 \pm 45 | 4706 \pm 6 | 479772 \pm 1104 | 2277403 \pm 2667 | 5954946 \pm 5315 | 8782193 \pm 6048 | 10256806 \pm 3203 | 1.17 | 215.47 |
| HLT range | 65366 \pm 45 | 4706 \pm 6 | 479772 \pm 1104 | 2277403 \pm 2667 | 5954946 \pm 5315 | 8782193 \pm 6048 | 5128403 \pm 2265 | 0.58 | -565.76 |
| $\ell\ell$ | 7663 \pm 17 | 1592 \pm 4 | 169454 \pm 675 | 803273 \pm 1630 | 2112917 \pm 3256 | 3094900 \pm 3703 | 3153588 \pm 1776 | 1.02 | 14.29 |
| $\ell\ell$ tight | 7635 \pm 17 | 1581 \pm 4 | 168165 \pm 673 | 795956 \pm 1624 | 2090635 \pm 3242 | 3063972 \pm 3688 | 3123444 \pm 1767 | 1.02 | 14.54 |
| ℓ -HLT match | 7635 \pm 17 | 1581 \pm 4 | 168165 \pm 673 | 795956 \pm 1624 | 2090635 \pm 3242 | 3063972 \pm 3688 | 3123444 \pm 1767 | 1.02 | 14.54 |
| Z($\ell\ell$) | 2058 \pm 9 | 1462 \pm 4 | 157566 \pm 651 | 733339 \pm 1559 | 1941518 \pm 3125 | 2835943 \pm 3552 | 2877294 \pm 1696 | 1.01 | 10.50 |
| Z+j | 1976 \pm 8 | 1031 \pm 3 | 39998 \pm 326 | 151550 \pm 708 | 334887 \pm 1300 | 529443 \pm 1516 | 515564 \pm 718 | 0.97 | -8.28 |
| Z+j(vtx) | 1976 \pm 8 | 1031 \pm 3 | 39998 \pm 326 | 151550 \pm 708 | 334887 \pm 1300 | 529443 \pm 1516 | 515564 \pm 718 | 0.97 | -8.28 |
| Z+>=1b(HE) | 1404 \pm 7 | 147 \pm 1 | 11712 \pm 173 | 6720 \pm 145 | 3223 \pm 122 | 23206 \pm 257 | 23685 \pm 154 | 1.02 | 1.60 |
| Z+>=1b(HE)+ S_{MET} | 614 \pm 5 | 106 \pm 1 | 9476 \pm 156 | 5377 \pm 130 | 2462 \pm 107 | 18035 \pm 230 | 18528 \pm 136 | 1.03 | 1.85 |
| Z+>=1b(HP) | 1068 \pm 6 | 88 \pm 1 | 7744 \pm 139 | 1973 \pm 78 | 216 \pm 33 | 11089 \pm 163 | 11094 \pm 105 | 1.00 | 0.03 |
| Z+>=1b(HP)+ S_{MET} | 466 \pm 4 | 64 \pm 1 | 6210 \pm 124 | 1586 \pm 70 | 160 \pm 29 | 8486 \pm 146 | 8427 \pm 92 | 0.99 | -0.34 |