

| Source   | $R_{\text{t}\bar{\text{t}}\text{b}\bar{\text{b}}/\text{t}\bar{\text{t}}\text{j}}^{\text{VPS}} [\%]$ |             | $\sigma_{\text{t}\bar{\text{t}}\text{j}}^{\text{VPS}} [\%]$ |             |
|--|---|-------------|---|-------------|
|  | Dilepton  | Lepton+jets | Dilepton  | Lepton+jets |
|  | Lepton uncertainties  |             |   |             |
| Trigger  | <0.1  | 0.2         | 1.0   | 0.5         |
| Lepton identification  | 0.6   | 0.2         | 1.1   | 1.3         |
| Lepton energy scale  | —   | <0.1        | —   | 0.1         |
|  | Jet uncertainties   |             |   |             |
| Jet energy resolution (JER)  | 0.4   | 0.3         | 0.3   | 0.7         |
| Jet energy scale (JES)   | 1.5   | 1.2         | 2.9   | 3.6         |
|  | b tagging uncertainties   |             |   |             |
| c-flavor btag (lin.)   | 2.2   | 2.0         | 1.0   | 0.3         |
| c-flavor btag (quad.)  | 0.7   | 1.2         | 0.3   | 0.2         |
| Heavy-flavor btag  | 4.0   | 0.1         | 0.5   | 0.9         |
| Heavy-flavor btag (lin.)   | 0.9   | 0.4         | 1.5   | 0.5         |
| Heavy-flavor btag (quad.)  | 2.0   | 0.3         | 1.5   | 0.8         |
| Light-flavor btag  | 4.9   | 0.9         | 5.5   | 4.9         |
| Light-flavor btag (lin.)   | 0.1   | 0.2         | 0.3   | 1.1         |
| Light-flavor btag (quad.)  | 0.7   | 0.7         | 0.1   | 1.4         |
|  | Theoretical uncertainties   |             |   |             |
| Initial-state radiation (ISR)  | 1.0   | 2.2         | 2.5   | 1.2         |
| Final-state radiation (FSR)  | 0.8   | 0.7         | 2.5   | 5.9         |
| ME-PS matching   | 0.5   | <0.1        | 1.8   | 1.9         |
| Underlying event tune (UE)   | 1.5   | 1.5         | 0.4   | 1.4         |
| $\mu_{\text{F}}/\mu_{\text{R}}$ scales (ME)                                  | 0.1   | 0.4         | 0.1   | 1.4         |
| top- $p_{\text{T}}$  | 0.2   | 0.4         | 1.6   | 0.3         |
| Ratio $R_{\text{t}\bar{\text{t}}\text{b}\bar{\text{t}}\text{j}}^{\text{MC}}$ | 1.4   | 0.2         | 1.3   | 0.7         |
|  | Other uncertainties   |             |   |             |
| Pileup   | 0.7   | 0.2         | 1.3   | 0.1         |
| Backgrounds  | 0.3   | 2.0         | 0.7   | 1.2         |
| Simulated sample size  | 1.5   | 2.8         | 0.1   | 2.2         |
| Luminosity   | 0.2   | 0.5         | 2.6   | 3.1         |
| Total  | 8.0   | 5.5         | 8.8   | 10.0        |