

# Behavior of Fitter varying the fit components

# All HF Fit Together (default)

$$\sigma_{t\bar{t}} = 7.9^{+1.1}_{-1.0}$$

- $F_{\text{EWK}} = 0.98 \pm 0.16$
- $F_{\text{MT}} = 1.02 \pm 0.12$
- $F_{\text{MT2}} = 1.00 \pm 0.3$
- $F_{\text{QCD}} = 1.06 \pm 0.33$
- $F_{\text{QCD2}} = 1.00 \pm 0.66$
- $F_{\text{HF}} = 1.19 \pm 0.11$

$$\rho_{t\bar{t}-\text{HF}} = 0.11$$

# (W<sub>bb</sub>+W<sub>cc</sub>) + W<sub>c</sub>

$$\sigma_{t\bar{t}} = 7.7^{+1.1}_{-1.0}$$

- $F_{\text{EWK}}=1.02\pm 0.16$
- $F_{\text{MT}}=1.02\pm 0.12$
- $F_{\text{MT2}}=1.00\pm 0.3$
- $F_{\text{QCD}}=1.06\pm 0.33$
- $F_{\text{QCD2}}=1.00\pm 0.66$
- $F_{\text{bb+cc}}=1.20\pm 0.18$
- $F_{\text{c}}=1.04\pm 0.24$

HF Correlation Submatrix

|            | <b>Fhf</b>       | <b>Fc</b>       |
|------------|------------------|-----------------|
| <b>Fhf</b> | 1                |                 |
| <b>Fc</b>  | <b>-0.513439</b> | <b>1</b>        |
| <b>Stt</b> | <b>-0.012756</b> | <b>0.127017</b> |

- Sum(bb+cc+c) constrained by fit to 9% in 1 and 2 jet bins
  - Consistent with  $F_{\text{HF}}$  result
  - Known to 11% ( events) in signal region

# Wbb+ Wcc + Wc all separate

$$\sigma_{t\bar{t}} = 7.8^{+1.1}_{-1.0}$$

- $F_{EWK}=1.03\pm 0.16$
- $F_{MT}=1.03\pm 0.12$
- $F_{MT2}=1.00\pm 0.3$
- $F_{QCD}=1.08\pm 0.33$
- $F_{QCD2}=1.00\pm 0.66$
- $F_{bb}=1.17\pm 0.23$
- $F_{cc}=1.09\pm 0.31$
- $F_c=1.08\pm 0.25$
  
- Sum(bb+cc+c) constrained by fit to 10% in 1 and 2 jet bins
  - Consistent with  $F_{HF}$  result
  - Known to 12% (1.5 events) in signal region

HF Correlation Submatrix

|            |       |       |      |   |
|------------|-------|-------|------|---|
| <b>Wbb</b> | 1     |       |      |   |
| <b>Wcc</b> | -0.20 | 1     |      |   |
| <b>Wc</b>  | -0.41 | -0.13 | 1    |   |
| <b>Top</b> | 0.02  | -0.03 | 0.13 | 1 |

# Sum of (Wbb+Wcc) + Wc

|     | 1 Jet  | Sigma | Frac. Unce |
|-----|--------|-------|------------|
| HF  | 145.7  | 21.86 |            |
| c   | 127.2  | 29.25 |            |
| Sum | 272.90 | 26.10 | 0.10       |

$$= \sqrt{\sigma_{bb}^2 + \sigma_{cc}^2 + \sigma_c^2 + 2\rho_{bb-cc}\sigma_{bb}\sigma_{cc} + 2\rho_{bb-c}\sigma_{bb}\sigma_c + 2\rho_{cc-c}\sigma_{cc}\sigma_c}$$

|     | 2 jets | Sigma | Frac. Unce |
|-----|--------|-------|------------|
| HF  | 73.3   | 11.00 |            |
| c   | 27.7   | 6.38  |            |
| Sum | 101.04 | 9.49  | 0.09       |

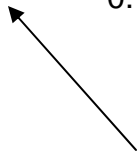
|     | 1+2    | Sigma | Frac. Unce |
|-----|--------|-------|------------|
| HF  | 219.0  | 32.85 |            |
| c   | 154.9  | 35.63 |            |
| Sum | 373.94 | 33.98 | 0.09       |

|     | 3/more jet | Sigma | Frac. Unce |
|-----|------------|-------|------------|
| HF  | 10.5       | 1.57  |            |
| c   | 2.5        | 0.57  |            |
| Sum | 12.93      | 1.37  | 0.11       |

# Sum of $W_{bb}+W_{cc}+W_c$

|   | 1 Jet       | Sigma  | Frac. Uncer |
|---|-------------|--------|-------------|
| • |             |        |             |
| • | bb          | 115.12 | 25.33       |
| • | cc          | 36.59  | 10.25       |
| • | c           | 107.04 | 24.62       |
| • |             |        |             |
| • | Sum         | 258.75 | 25.92       |
| • |             |        |             |
| • |             |        |             |
| • | 2 Jets      |        |             |
| • | bb          | 54.53  | 12.00       |
| • | cc          | 21.60  | 6.05        |
| • | c           | 23.34  | 5.37        |
| • |             |        |             |
| • | Sum         | 99.46  | 10.91       |
| • |             |        |             |
| • |             |        |             |
| • | 1+2 jets    |        |             |
| • | bb          | 169.64 | 37.32       |
| • | cc          | 58.19  | 16.29       |
| • | c           | 130.37 | 29.99       |
| • |             |        |             |
| • | Sum         | 358.20 | 35.63       |
| • |             |        |             |
| • |             |        |             |
| • | 3/more Jets |        |             |
| • | bb          | 6.89   | 1.52        |
| • | cc          | 3.43   | 0.96        |
| • | c           | 2.07   | 0.48        |
| • |             |        |             |
| • | Sum         | 12.39  | 1.47        |

$$= \sqrt{\sigma_{bb}^2 + \sigma_{cc}^2 + \sigma_c^2 + 2\rho_{bb-cc}\sigma_{bb}\sigma_{cc} + 2\rho_{bb-c}\sigma_{bb}\sigma_c + 2\rho_{cc-c}\sigma_{cc}\sigma_c}$$



# Conclusions

- W+HF uncertainty for events in 3+ jets region
  - 1.2 for HF all lumped together
  - 1.4 for Wc broken out
  - 1.5 for Wbb,Wcc, Wc broken out
    - Negligible contribution to total uncertainty for using 1.5 instead of 1.2
- Size of contribution in 3+jets
  - 12.6 all HF together
  - 12.4 Wc broken out
  - 12.9 all three separately
- Wbb fit separately gives a fraction (wrt MII) of  $F_{bb}=1.17\pm0.23$
- **Top cross section, total backgrounds, stable under fitting procedure**