

Systematic Uncertainties

- BFs : Systematic uncertainties from ST side can be canceled.
- $R(D_s)$: Systematic uncertainties from $Br(D_s^* \rightarrow \gamma D_s)$ and charged Kaon on the signal side can be canceled

| Systematics uncertainties(%) | $D_s^+ \rightarrow K_S^0 K^+$ | $D_s^+ \rightarrow K_L^0 K$ | $R(D_s)$ |
|---|-------------------------------|-----------------------------|----------|
| K^+/K^- tracking | 0.6 | 0.6 | - |
| K^+/K^- PID | 1.0 | 1.0 | - |
| K_S^0 selection | - | - | - |
| photon selection | - | - | - |
| $E_{extra}^{max} \gamma$ requirement | - | - | - |
| $N_{extra} \pi^0$ requirement | - | - | - |
| $N_{extra} track$ requirement | - | - | - |
| ST mD_s fit | - | - | - |
| DT fit | 0.9 | - | - |
| MM2 fit | - | 1.6 | - |
| MC statistics | 0.4 | 0.3 | - |
| $\mathcal{B}(D^* \rightarrow \gamma D_s)$ | 0.8 | 0.8 | - |
| tag bias | - | - | - |
| total | - | - | - |

$$\mathcal{B}_{sig} = \frac{\sum_i N_{DT}^i}{\sum_i N_{ST}^i \cdot \epsilon_{DT}^i / \epsilon_{ST}^i}$$

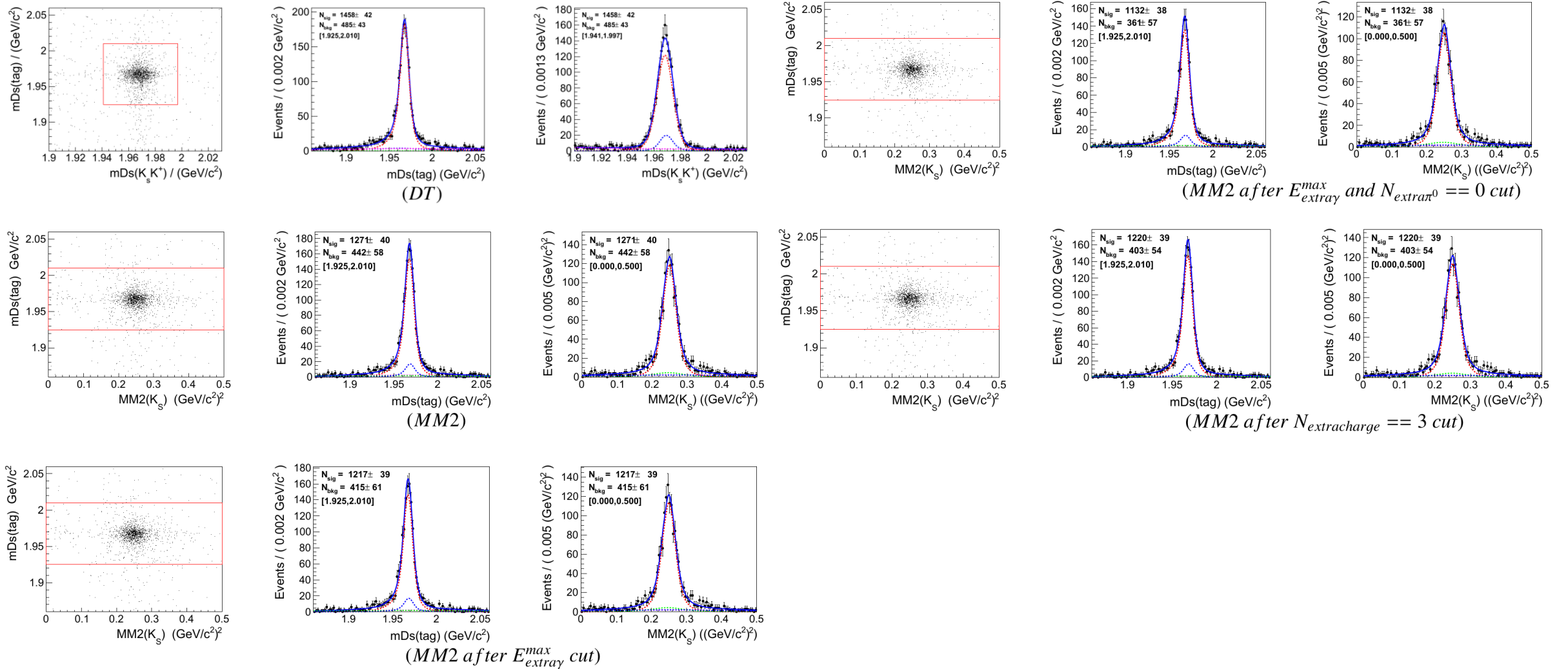
$$R(D_s^+) = \frac{\mathcal{B}_{D_s^+ \rightarrow K_S^0 K^+} - \mathcal{B}_{D_s^+ \rightarrow K_L^0 K}}{\mathcal{B}_{D_s^+ \rightarrow K_S^0 K^+} + \mathcal{B}_{D_s^+ \rightarrow K_L^0 K}}$$

Photon selection, E_{maxg} , N_{Pi0} and extra track cuts uncertainties

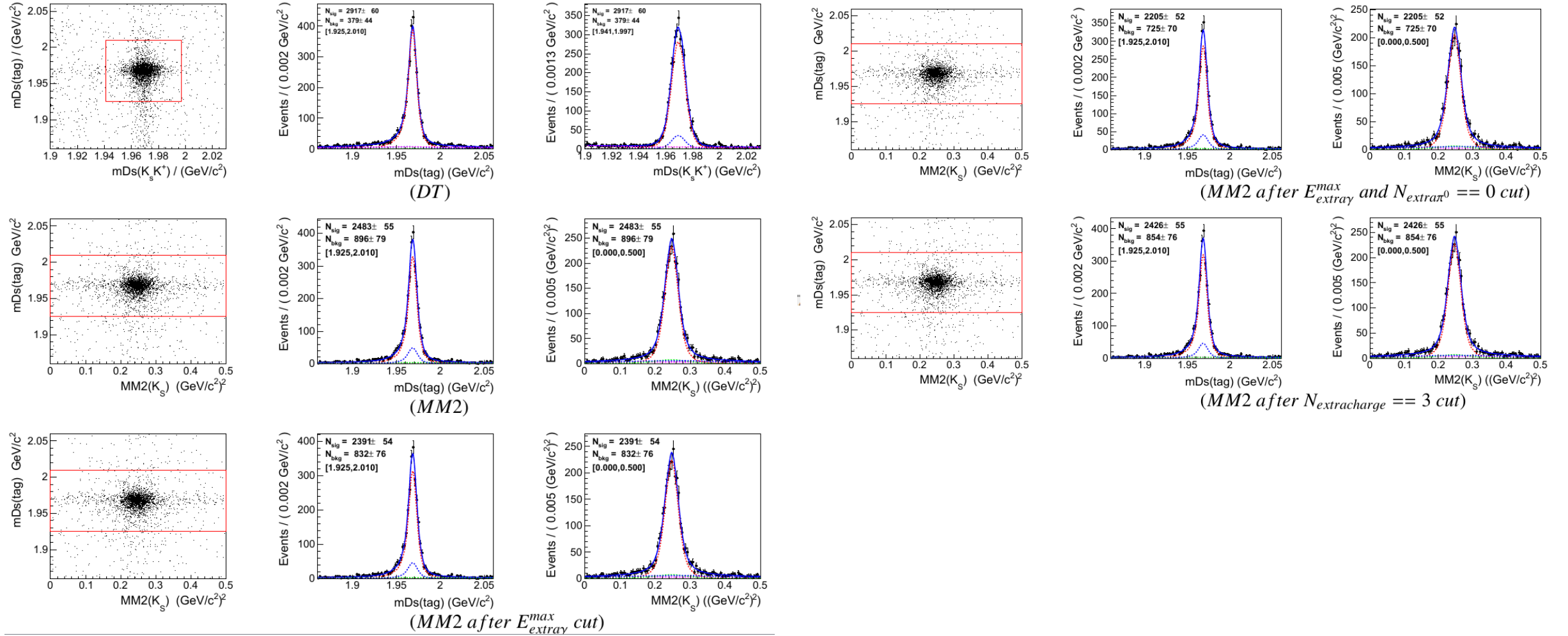
Using Ds -> Kkpi and KsK Sample to study

- Photon selection: fit DT and MM2, using the different of $N_{\text{MM2}}/N_{\text{DT}}$ between data and MC as the uncertainty
- E_{maxg} cut : fit MM2 before and after cut, using the different of cut eff between data and MC as the uncertainty
- N_{Pi0} cut: fit MM2 before and after cut, using the different of cut eff between data and MC as the uncertainty
- N_{extrk} cut : fit MM2 before and after cut, using the different of cut eff between data and MC as the uncertainty

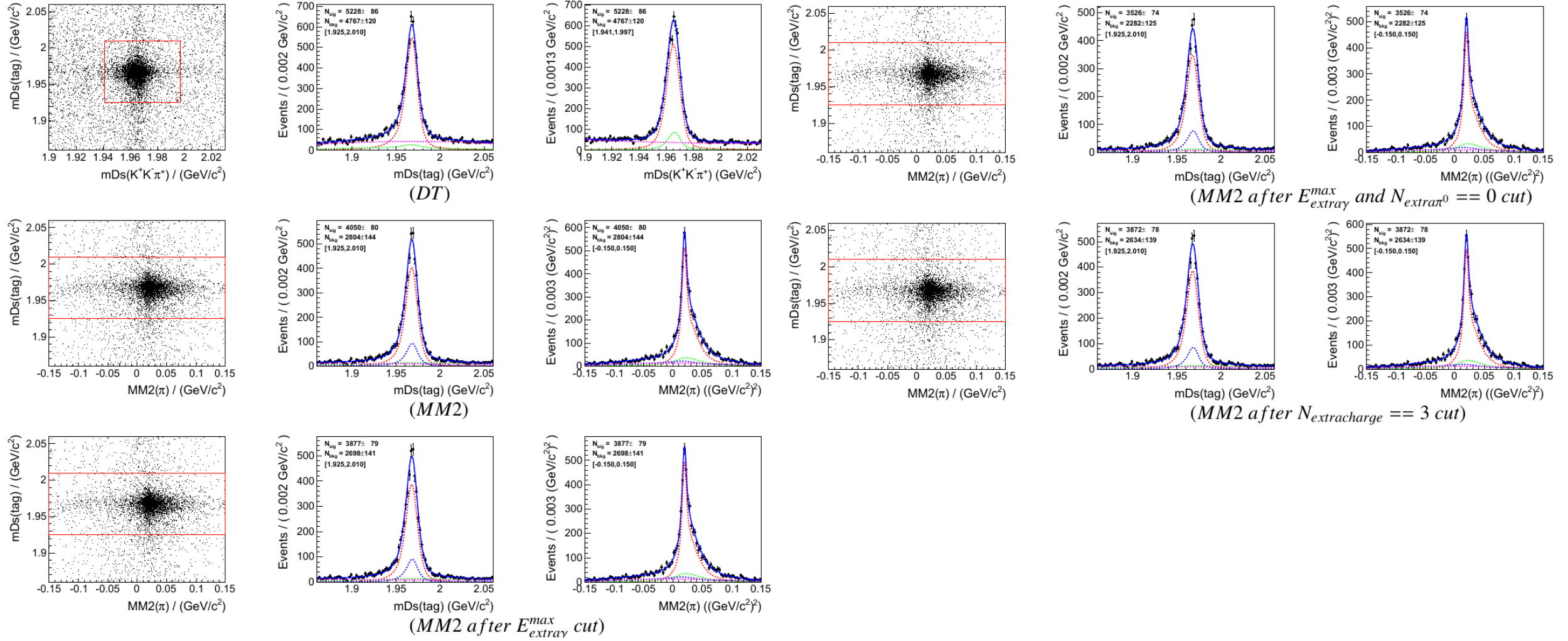
Fit of Ds->KsK for data



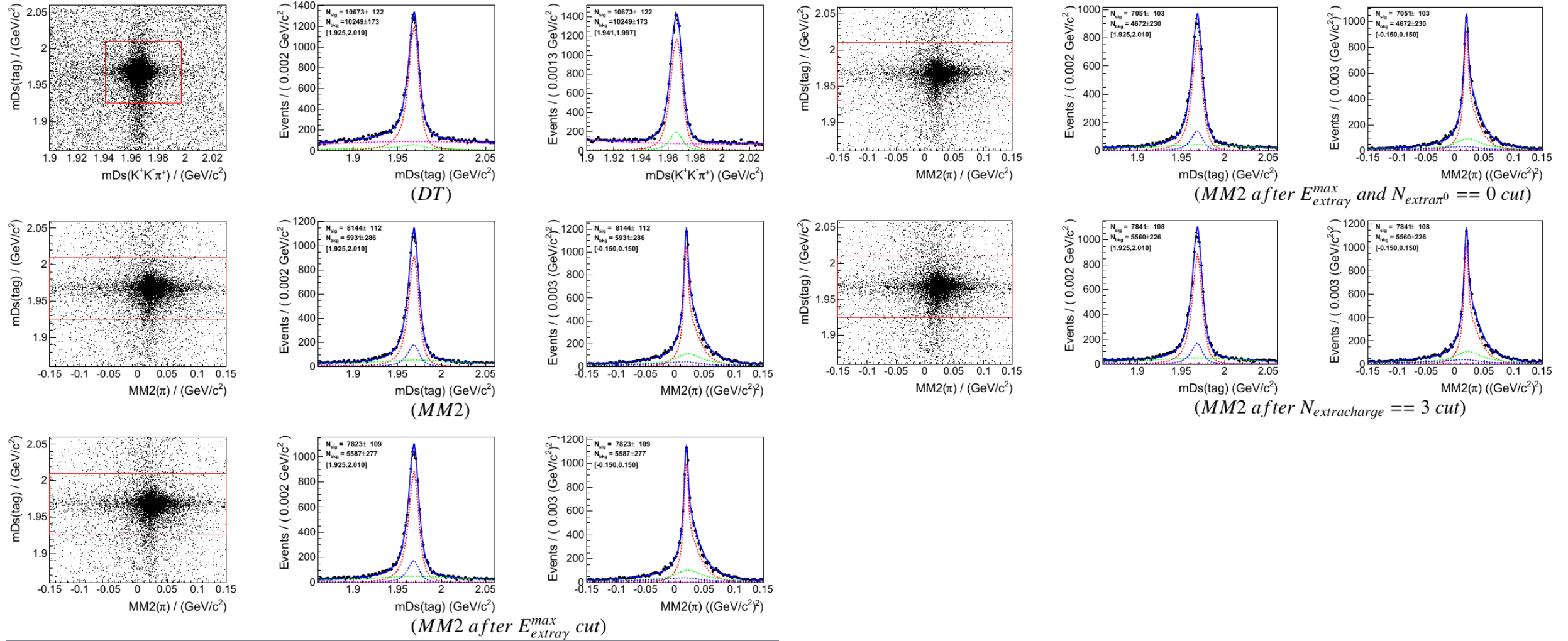
Fit of Ds->KsK for MC



Fit of Ds->Kkpi for data



Fit of Ds->Kkpi for MC



| <i>Ksk sample</i> | ϵ_{data} | ϵ_{MC} | $\epsilon_{data}/\epsilon_{MC} - 1$ |
|--------------------------------------|-------------------|------------------|-------------------------------------|
| Photon selection | 87.17 \pm 0.84 | 85.12 \pm 0.75 | 2.41 \pm 1.26 |
| $E_{extra\ \gamma}cut$ | 95.75 \pm 0.68 | 96.29 \pm 0.41 | -0.56 \pm 0.82 |
| $N_{extra\ \pi^0}requirement$ | 93.02 \pm 0.71 | 92.22 \pm 0.59 | 0.86 \pm 0.97 |
| $N_{extra\ chargedtrack}requirement$ | 95.99 \pm 0.68 | 97.70 \pm 0.51 | -1.76 \pm 0.70 |

| <i>Kkpi sample</i> | ϵ_{data} | ϵ_{MC} | $\epsilon_{data}/\epsilon_{MC} - 1$ |
|--------------------------------------|-------------------|------------------|-------------------------------------|
| Photon selection | 77.47 \pm 0.58 | 76.30 \pm 0.43 | 1.52 \pm 0.88 |
| $E_{extra\ \gamma}cut$ | 95.73 \pm 0.31 | 96.06 \pm 0.31 | -0.34 \pm 0.44 |
| $N_{extra\ \pi^0}requirement$ | 90.95 \pm 0.67 | 90.13 \pm 0.43 | 0.90 \pm 0.86 |
| $N_{extra\ chargedtrack}requirement$ | 95.60 \pm 0.43 | 96.28 \pm 0.35 | -0.70 \pm 0.57 |

| Combination | $\epsilon_{data}/\epsilon_{MC} - 1$ |
|--------------------------------------|-------------------------------------|
| Photon selection | 1.81 \pm 0.72 |
| $E_{extra\ \gamma}cut$ | -0.39 \pm 0.39 |
| $N_{extra\ \pi^0}requirement$ | 0.88 \pm 0.64 |
| $N_{extra\ chargedtrack}requirement$ | -1.12 \pm 0.44 |

Back - Up

For KLK (using MM2 methods):

1. Find only one Kaon left;
2. No extra charged track ($|z| < 20\text{cm}$);
3. $E_{extra\ \gamma}^{max} < 0.25\text{ GeV}/c^2$, the angle of γ and missing KL direction is larger than 20° .
4. No extra π^0 ($0.115 < M(2g) < 0.15\text{ GeV}/c^2$), the angle of daughter gamma and KL direction is larger than 20° .

