Discussion: extraction of NP contribution with pTW/Z

LHC EW precision sub-group meeting (pT W/Z benchmarking)

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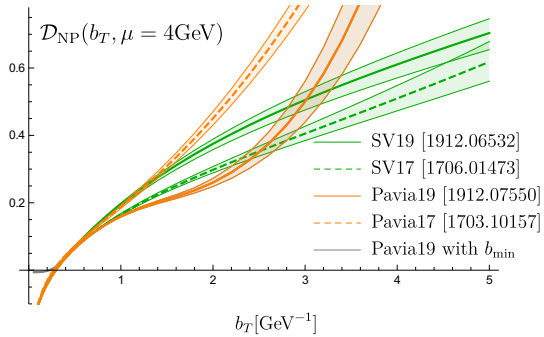
$$\frac{d\sigma}{d^2q_T} = \sigma_0 \sum_q z_q \int \frac{d^2b}{(2\pi)^2} e^{i(bq_T)} \underbrace{R[b;Q,Q^2 \to \text{ref}]}_{\text{evolution factor.}} \underbrace{f_{1q}(x_1,b;\text{ref})}_{\text{TMDPDF}} \underbrace{f_{1\bar{q}}(x_2,b;\text{ref})}_{\text{TMDPDF}} \quad (1)$$

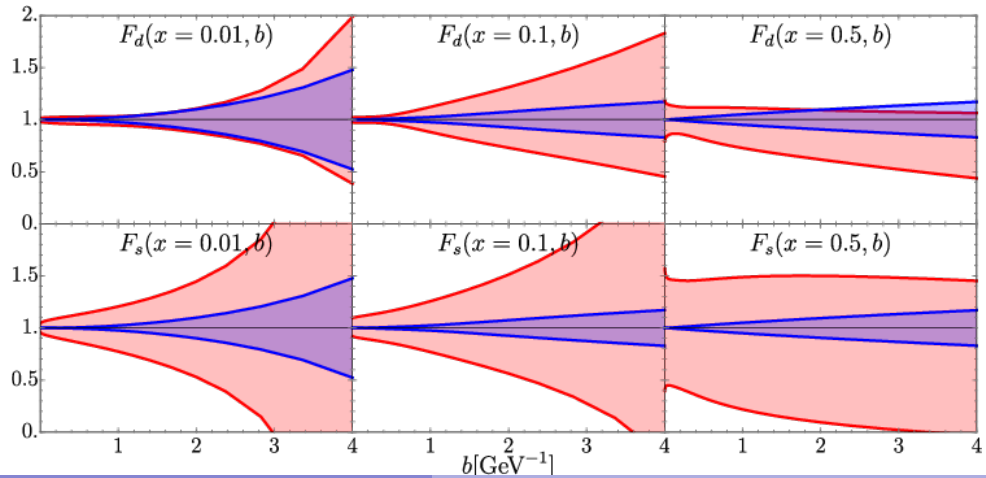
Evolution factor

- Single equations → Different realizations/ref.scales (CS-like, ζ-prescription, etc.)
- Dependent on non-perturbative function $\mathcal{D} = -K/2$= CS-kernel
- Non-perturbative CS-kernel ⇒ structure of vacuum [AV;2003.02288]



TMDPDFs

- Match to PDFs at small-b (perturbative)
- Non-perturbative at large-b



I will try to answer the following question:
which regions of vector-boson production p_T spectrum
are **most sensitive for NP-input**?

Correlation coefficient $= \rho[\sigma, O] = \dfrac{\langle \sigma O \rangle - \langle \sigma \rangle \langle O \rangle}{\Delta\sigma \Delta O}$

measures correlation between NP-parameter and cross-section

Sensitivity coefficient $= S[\sigma, O] = \rho[\sigma, O] \dfrac{\Delta O}{\Delta O_{\text{exp.}}}$

reweigh the correlation by expected experimental uncertainty and shows feasible regions

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Nonperturbative input → SV19 model [I.Scimemi,AV;1912.06532]

- CS-kernel = 1 parameter

$$\mathcal{D}(b,\mu) = \mathcal{D}_{\rm resum}(b,\mu) + c_0 b b^* \tag{2}$$

- TMDPDF = 5 parameters (no-flavor dependence)

$$f_1(x,b) = C \otimes f_1(x) \exp\left(-\frac{\lambda_1 \bar{x} + \lambda_2 x + x\bar{x}\lambda_5}{\sqrt{1+\lambda_3 x^{\lambda_4} b^2}} b^2 \right) \tag{3}$$

- Distribution of 300 replicas fitted to DY+SIDIS data (ATLAS,LHCb,CMS,COMPASS,HERMES,...)

Data

I did not know that there exists pseudo data....

- $\sqrt{s} = 13$TeV
- y-bins like in ATLAS 8 TeV Z-boson
- Q-bins 9 bins from 30GeV → 540 GeV
- $q_T/Q < 0.25$

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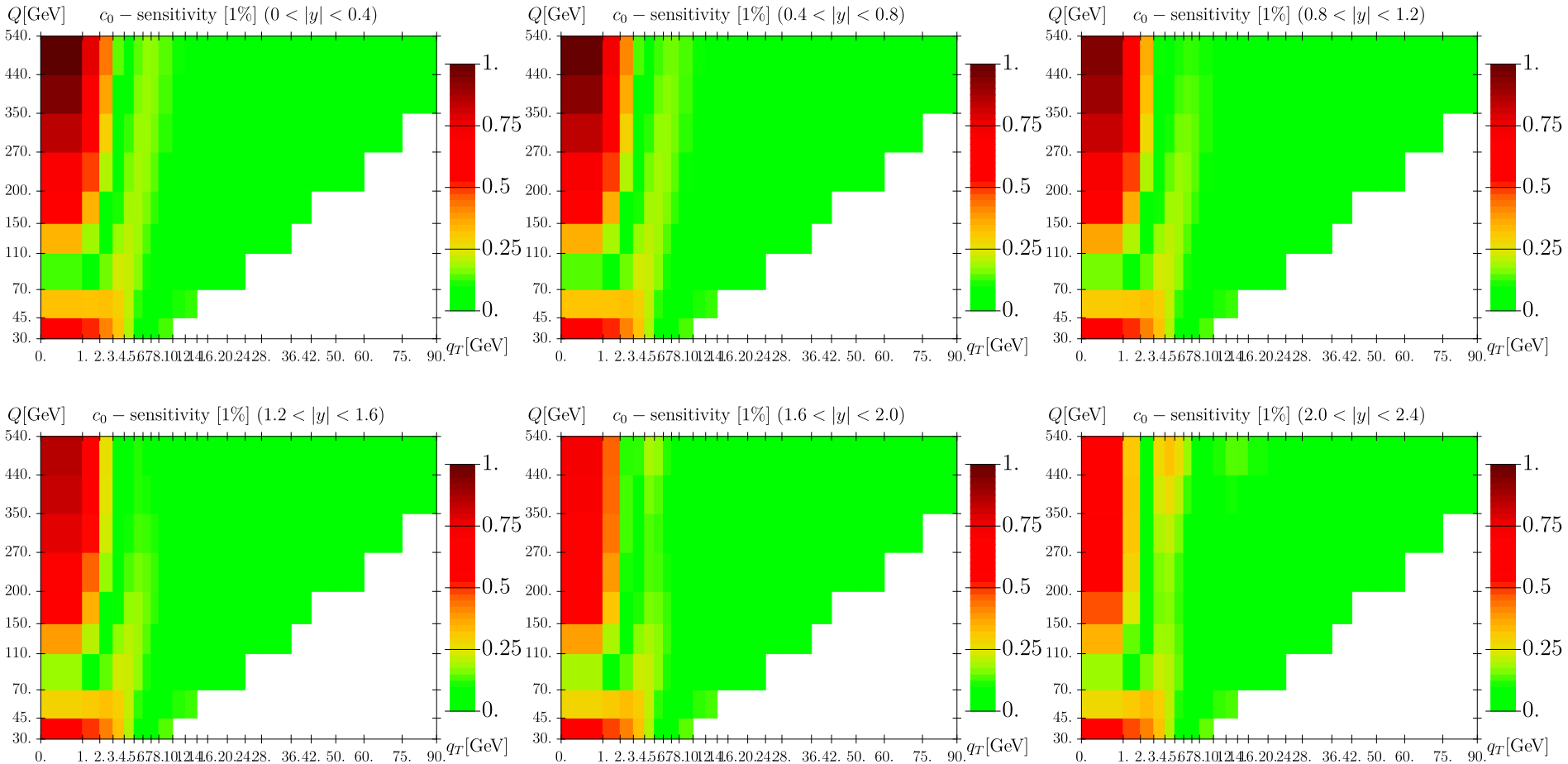
Experimental uncertainty = 1 %



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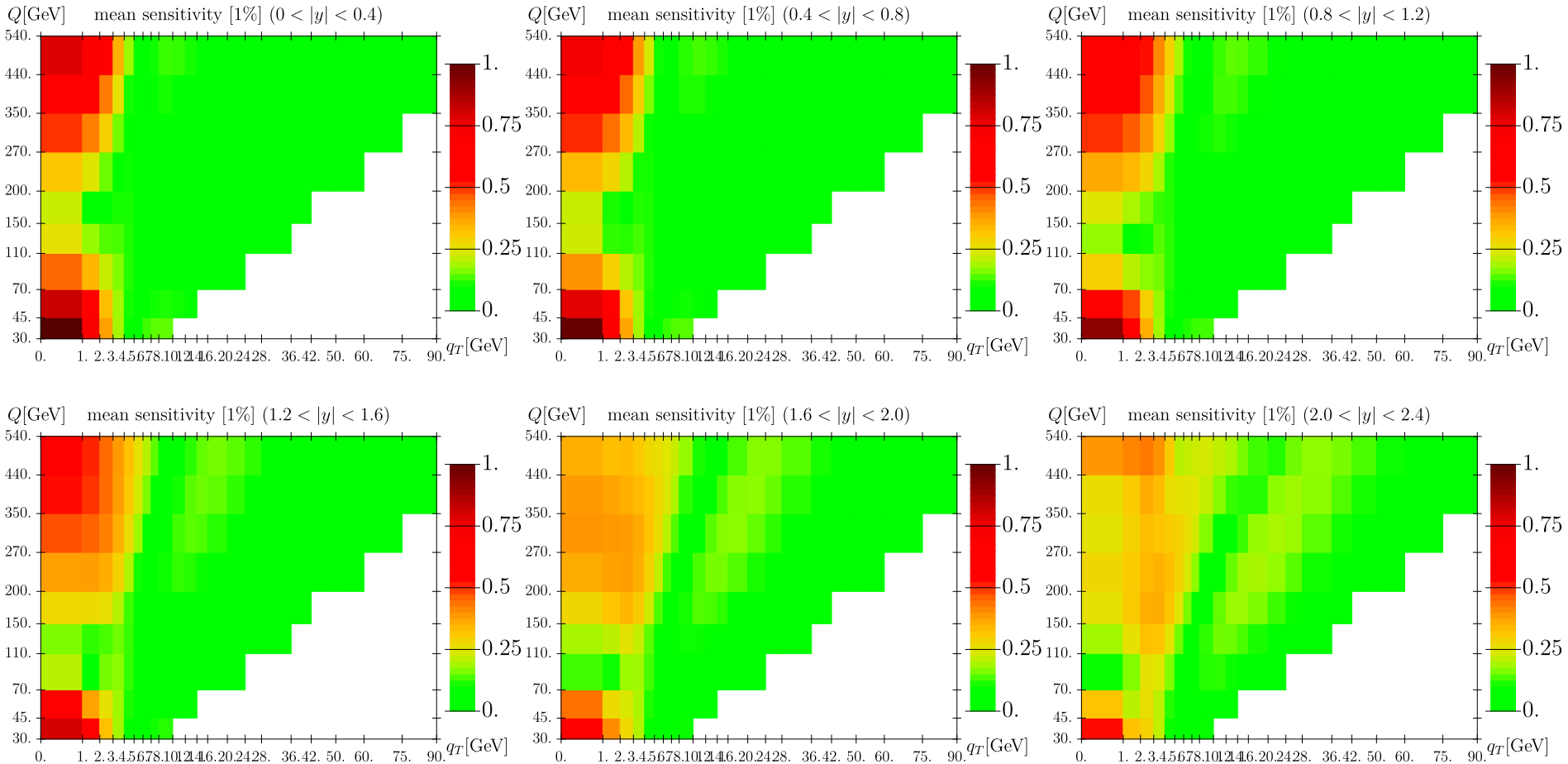
Experimental uncertainty = 1 %



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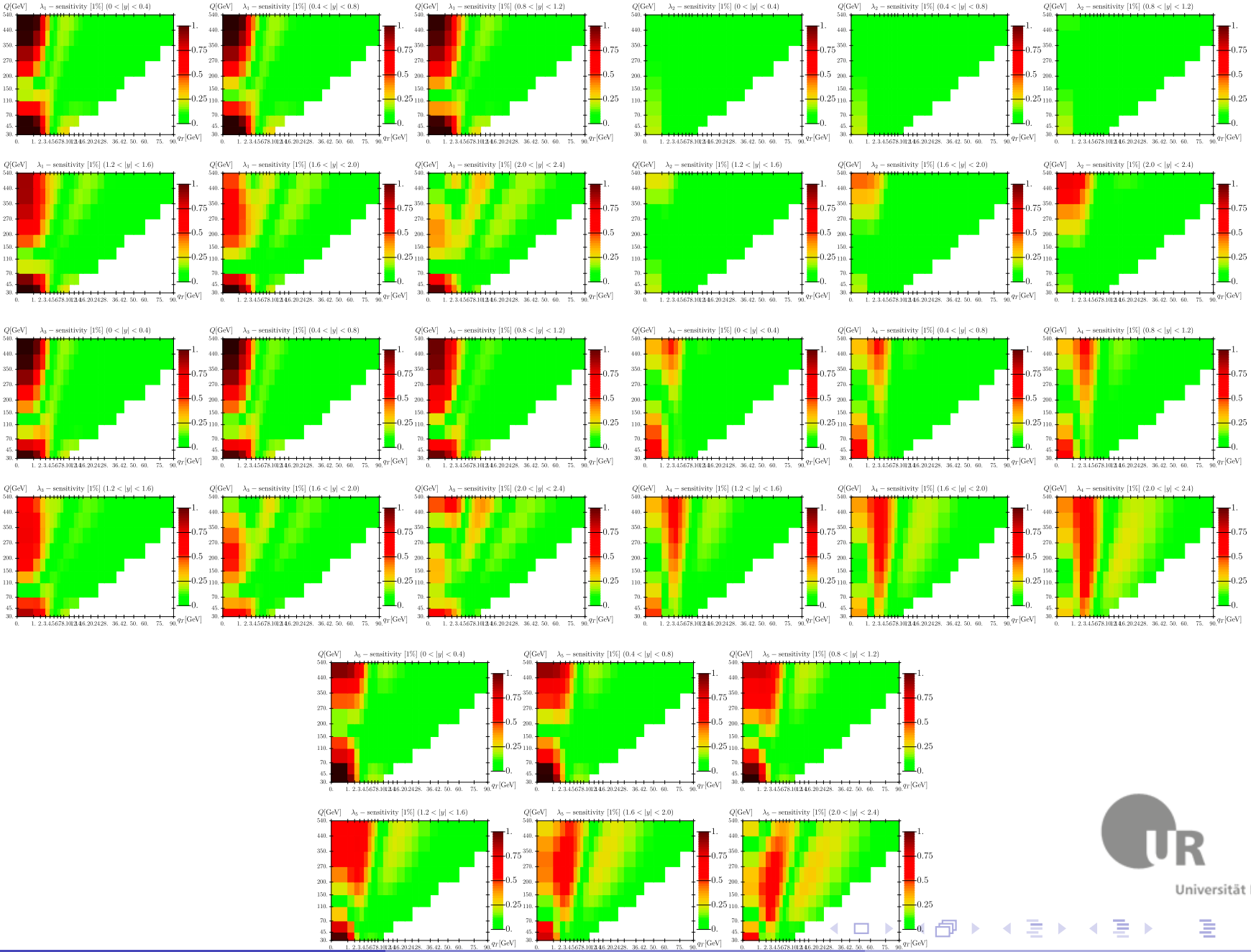
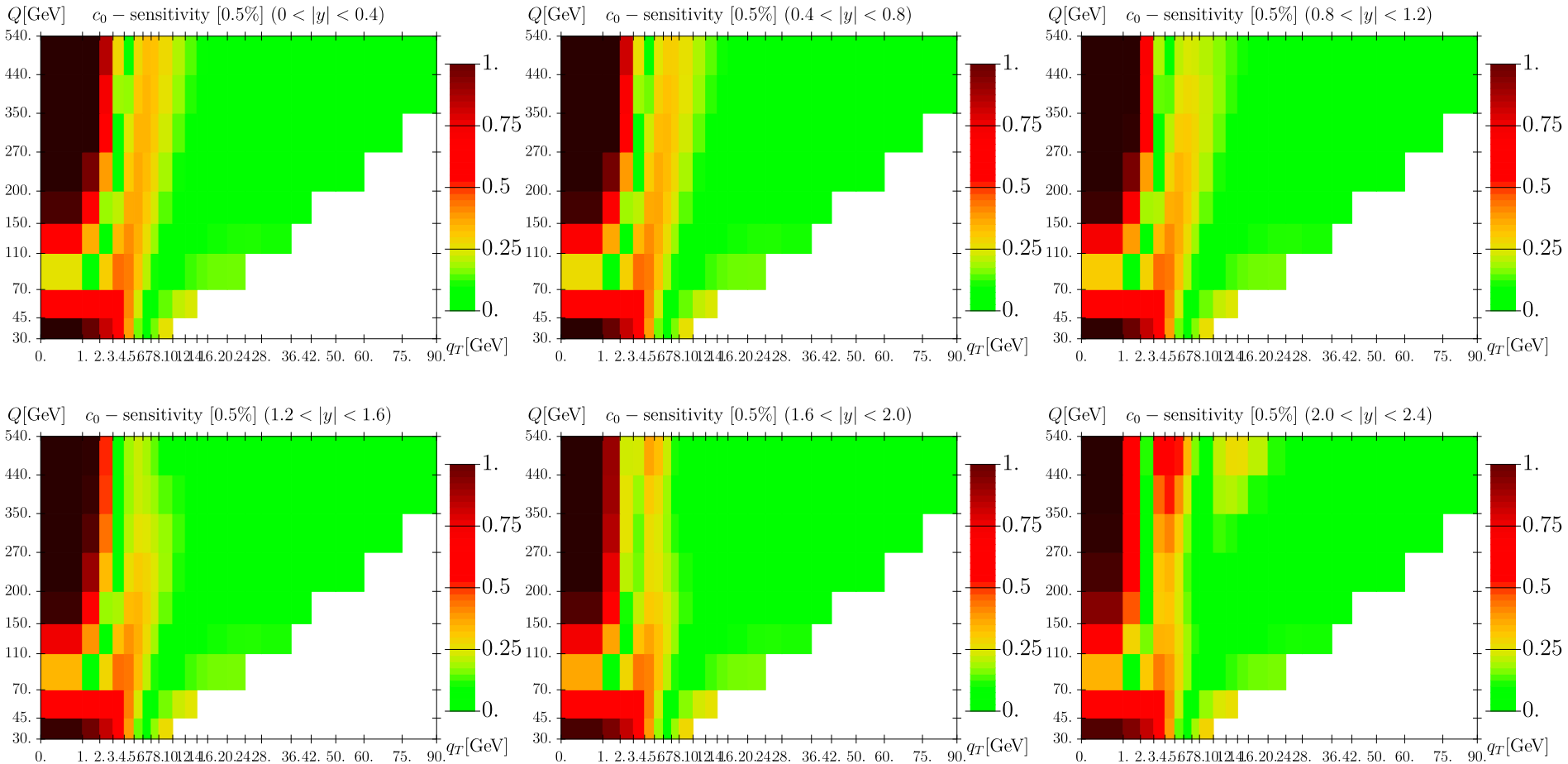
Experimental uncertainty = 1 %



Experimental uncertainty = 0.5 %



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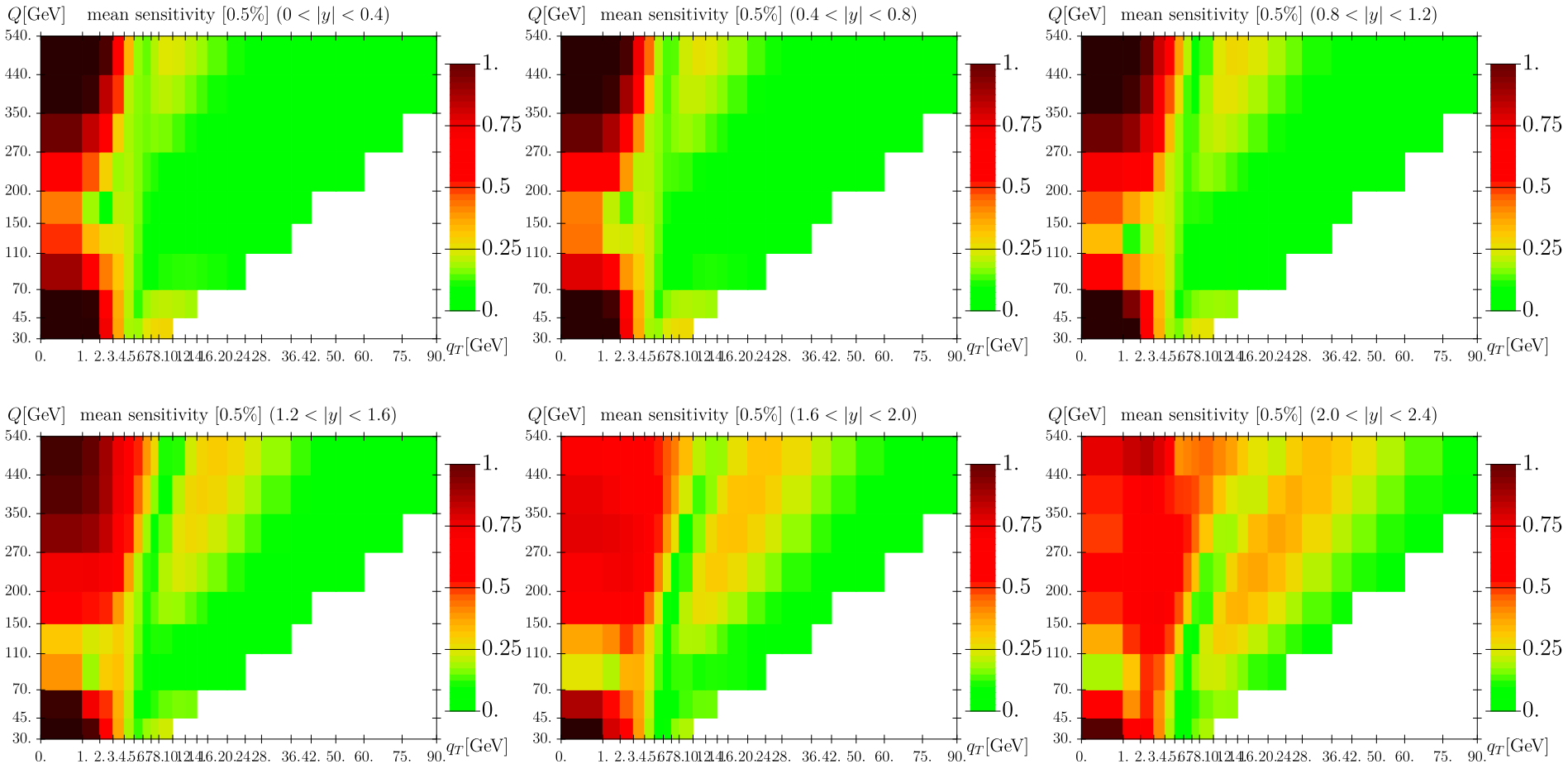

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Experimental uncertainty = 0.5 %