Affinity tool. Comparison between JLab12 and JLab22

Science at the Luminosity Frontier: Jefferson Lab at 22 GeV

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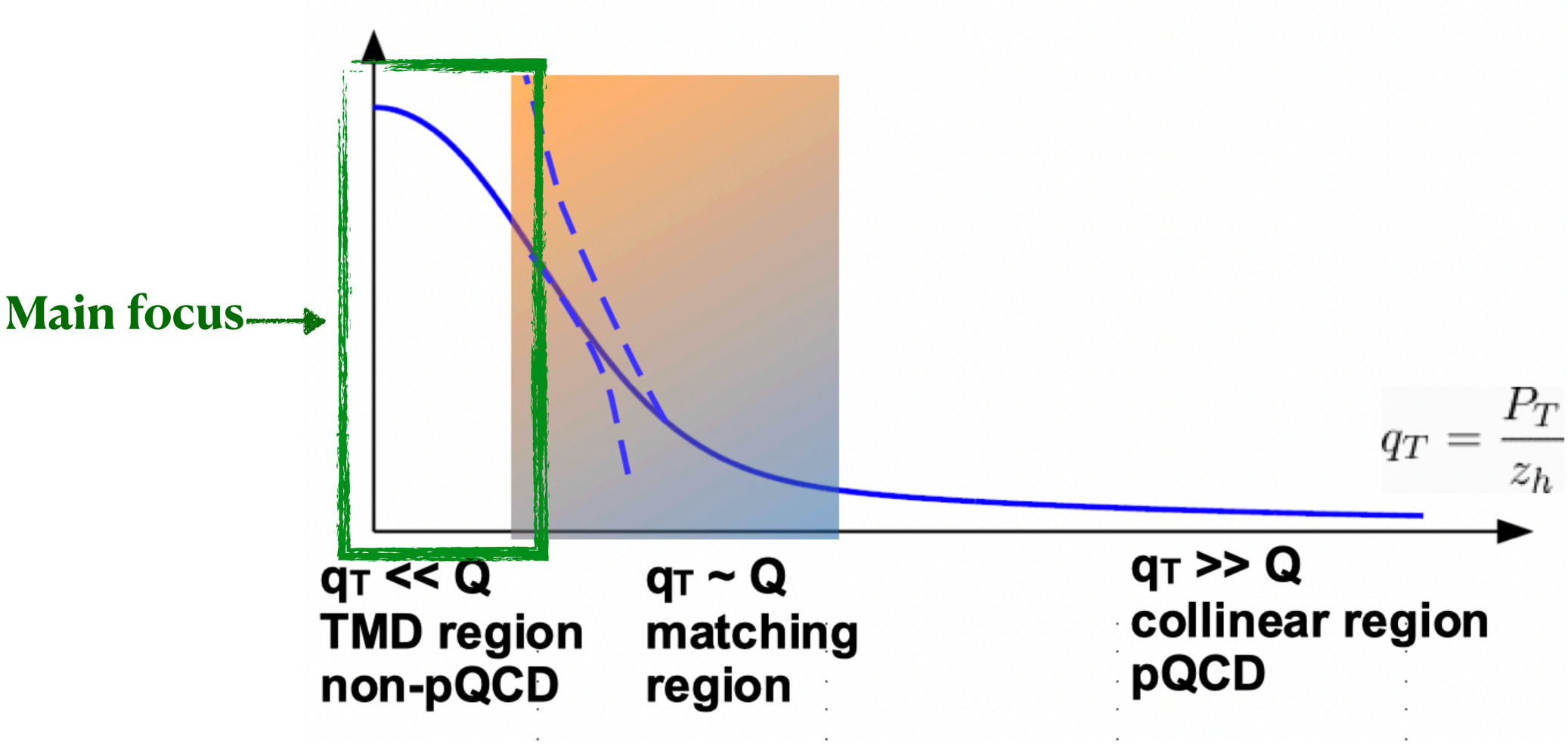
Distribution of SIDIS cross section according to q_T values



Affinity

$$\mathscr{A}(x_{\mathrm{Bj}}, z_h, Q^2, P_{hT} \,|\, \text{region}) = \int \mathrm{d}\{R_i\}\Theta(\{R_i\} \,|\, \text{region}) \int \mathrm{d}^4k_i \mathrm{d}^4k_f \mathrm{d}^4\delta k_T$$

$$\times \mathscr{P}(\{R_i\} \,|\, x_{Bj}, Q^2, z_h, P_{hT}; k_i, k_f, \delta k_T)\pi(k_i, k_f, \delta k_T)$$

Region indicators

$$R_0 \equiv \max\left(\left|\frac{k_i^2}{Q^2}\right|, \left|\frac{k_f^2}{Q^2}\right|, \left|\frac{\delta k_T^2}{Q^2}\right|\right)$$

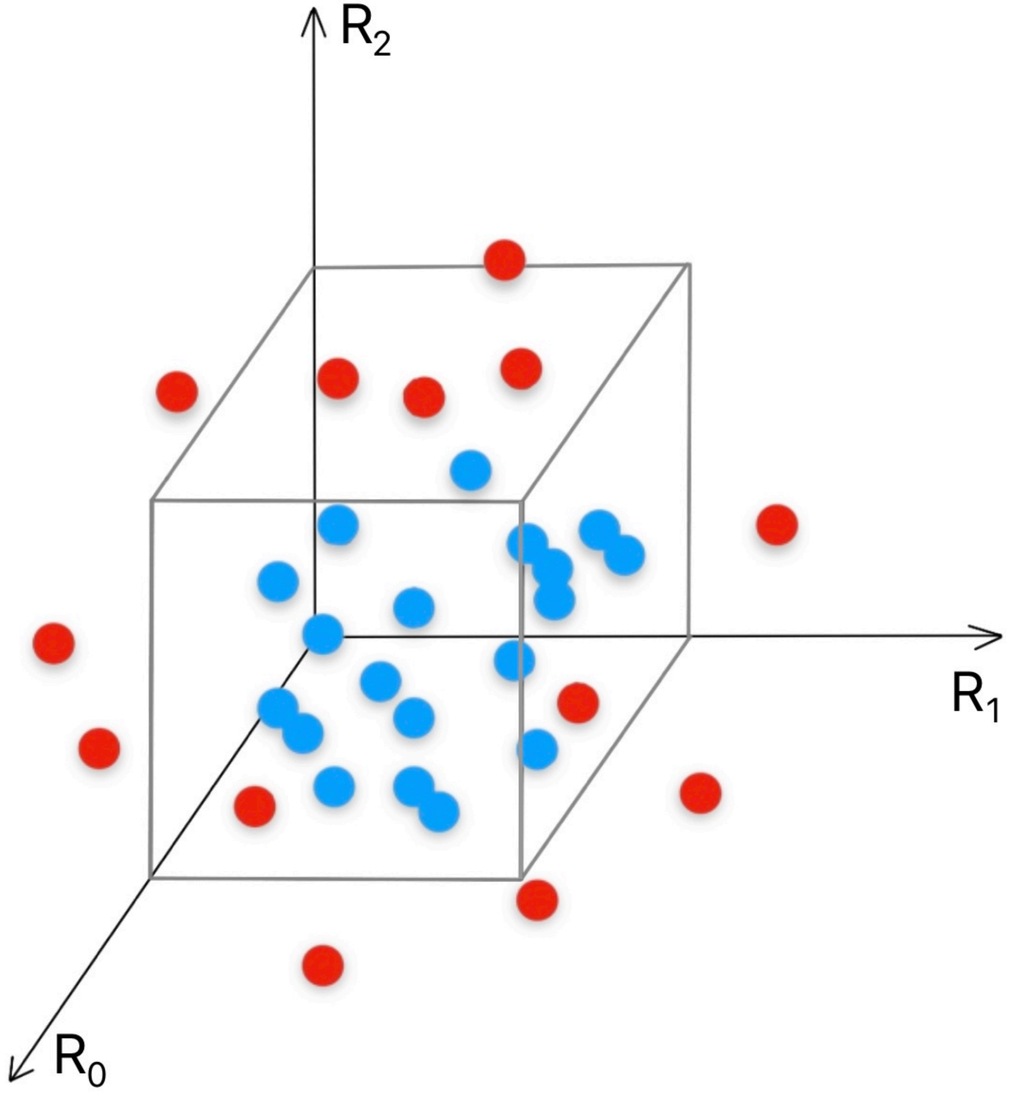
$$R_1 \equiv \frac{P_h \cdot k_f}{P_h \cdot k_i}$$

$$R_2 \equiv \frac{|k^2|}{Q^2}$$

$\left(k_X = k_i + q - k_f\right)$

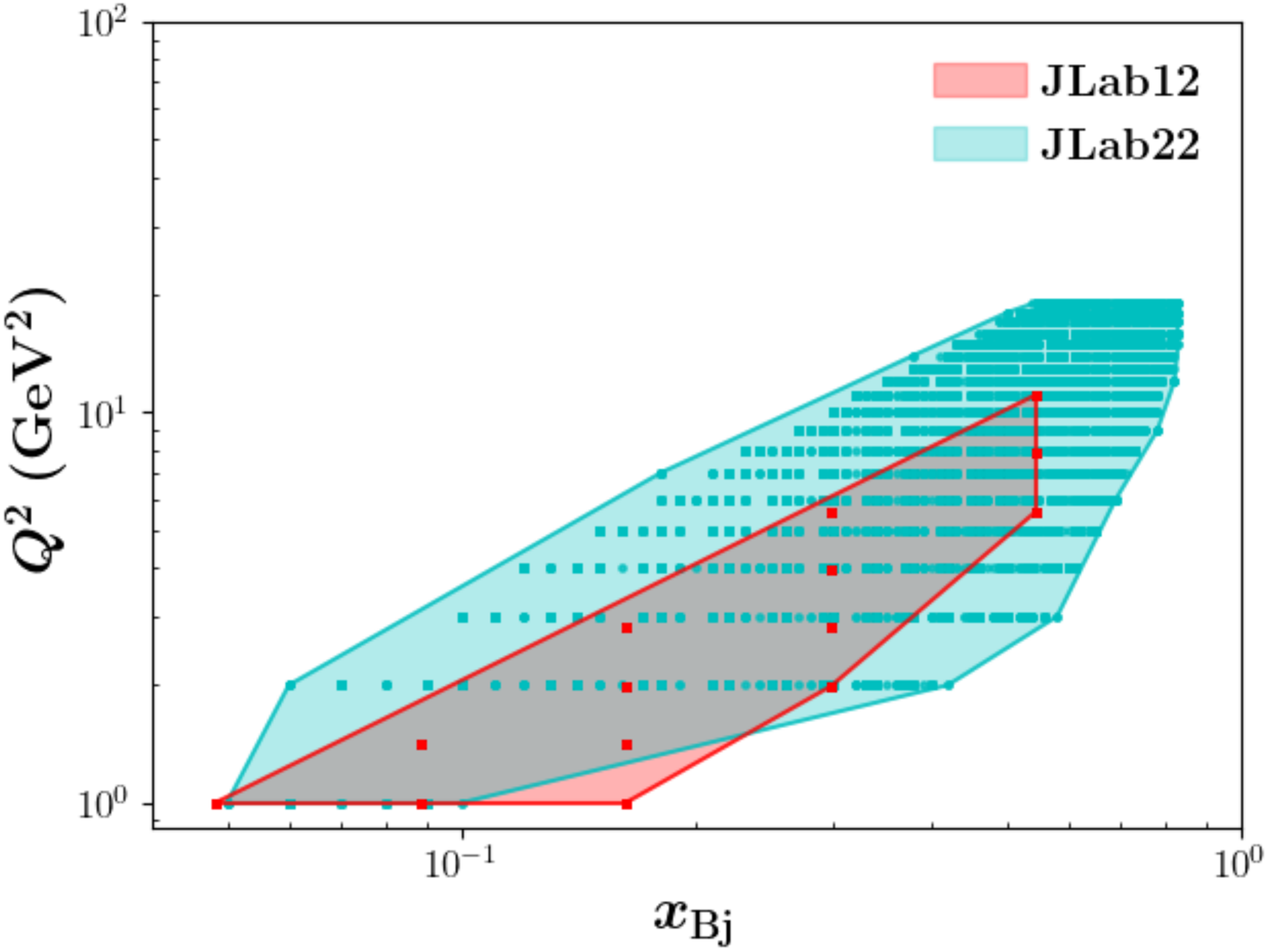
$$R_3 \equiv \frac{|k_X^2|}{Q^2}$$

$$R_4 \equiv \max\left(\left|\frac{k_i^2}{k^2}\right|, \left|\frac{k_f^2}{k^2}\right|, \left|\frac{\delta k_T^2}{k^2}\right|, \left|\frac{k_{iT}^2}{k^2}\right|\right)$$



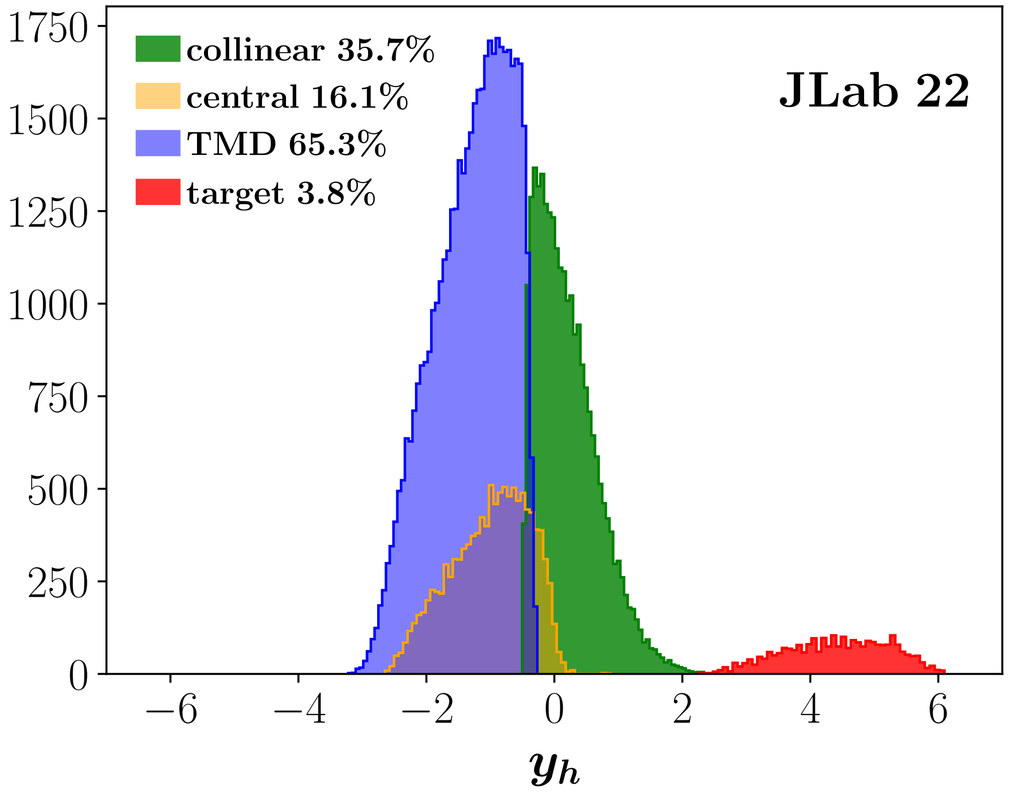
$$\textbf{Affinity} = \frac{\textbf{\# times in}}{\textbf{\#times in} + \textbf{\#times out}}$$

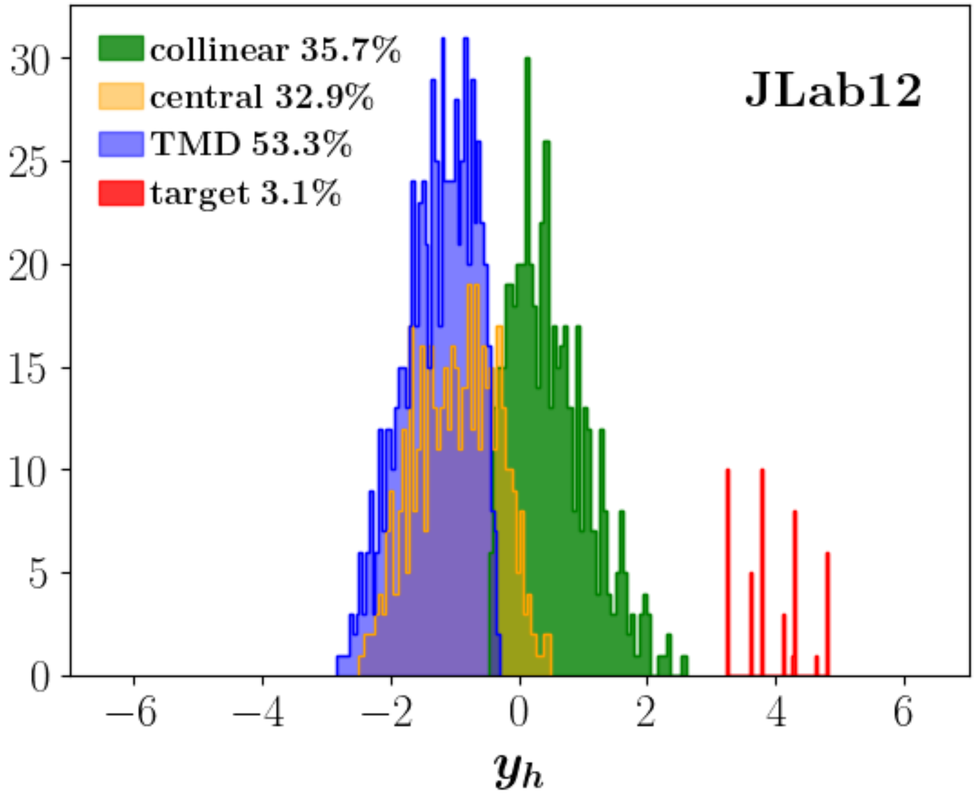
Affinity ranges from 0% to 100% and indicates affinity of a bin of a measurement to a particular kinematic region.



Kinematical reach of Q^2/x_{Bj} for data from JLab12 (red) and JLab22 (cyan). Bin centers are indicated by filled circles, with each bin representing measurements for different values of z_h and P_{hT}

Phase space of produced hadrons





$$y_h = \frac{1}{2}\log\left(\frac{P_h^+}{P_h^-}\right)$$

TMD region

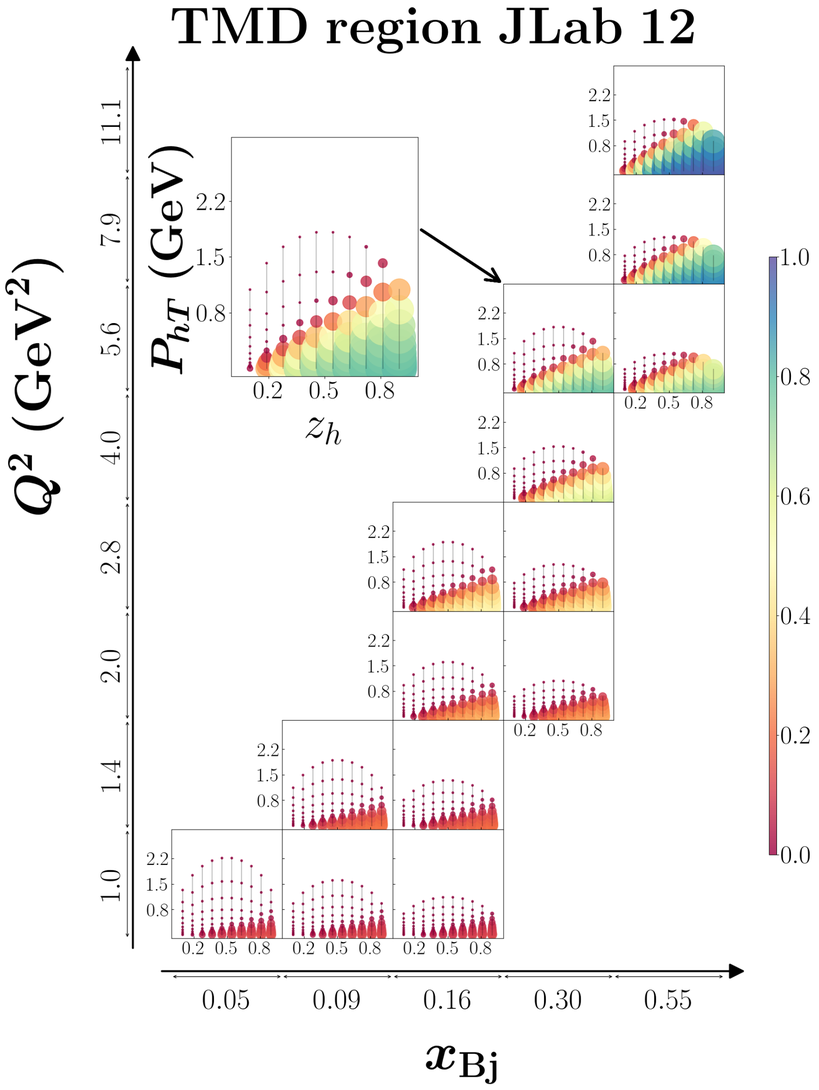
$$R_0 \equiv \max\left(\left|\frac{k_i^2}{Q^2}\right|, \left|\frac{k_f^2}{Q^2}\right|, \left|\frac{\delta k_T^2}{Q^2}\right|\right)$$

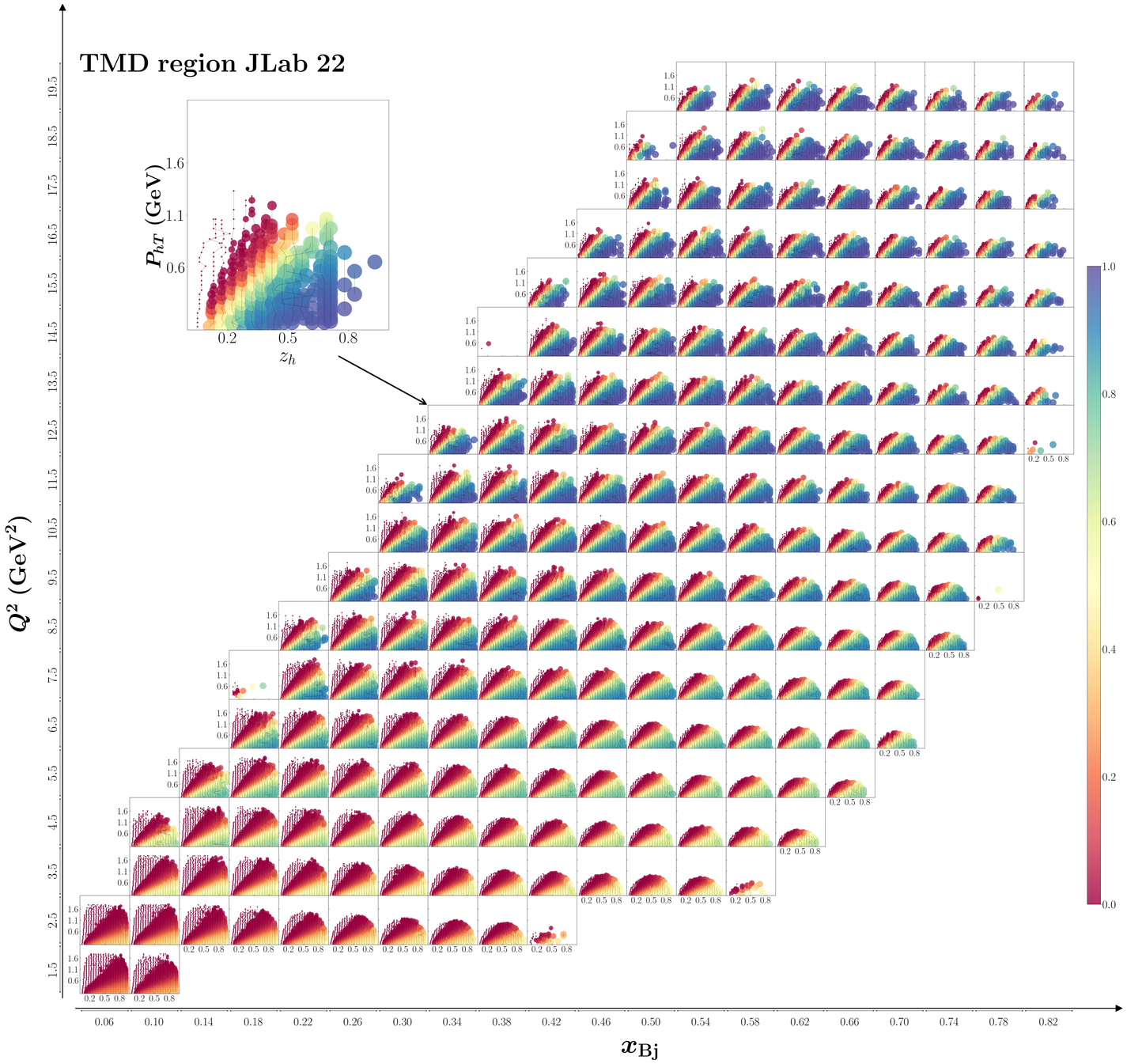
$$R_1 \equiv \frac{P_h \cdot k_f}{P_h \cdot k_i}$$

$$R_2 \equiv \frac{|k^2|}{Q^2}$$

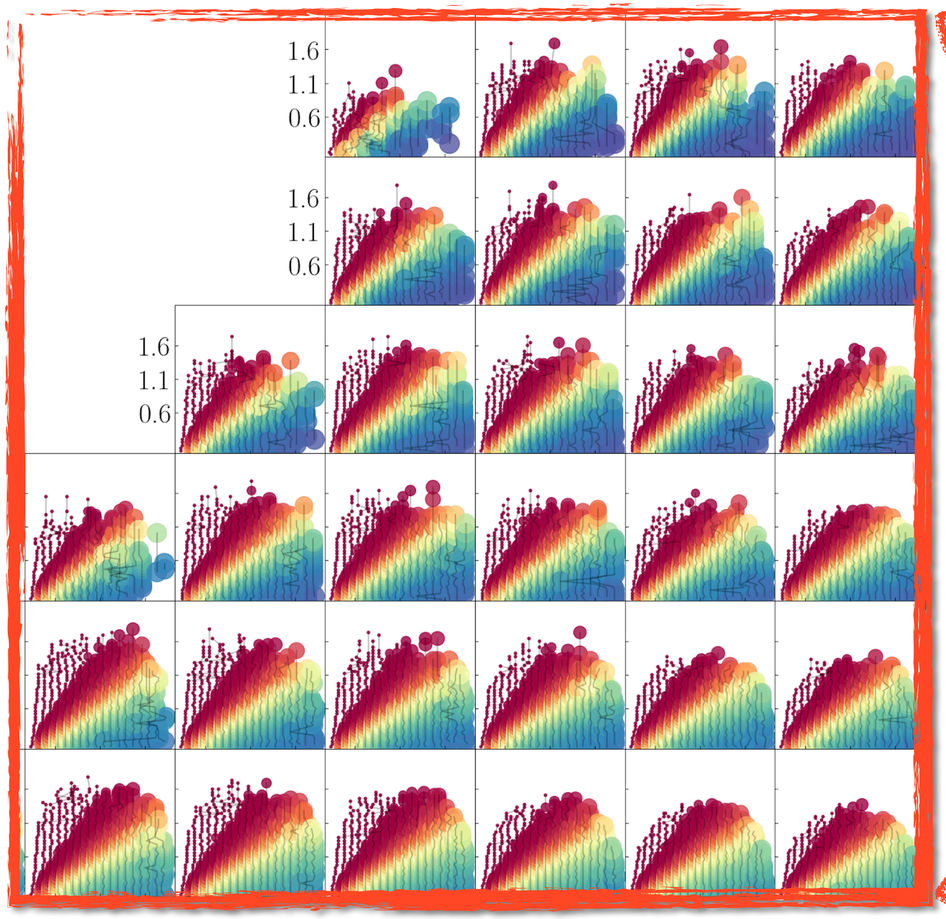
} **Small**

TMD region π^+

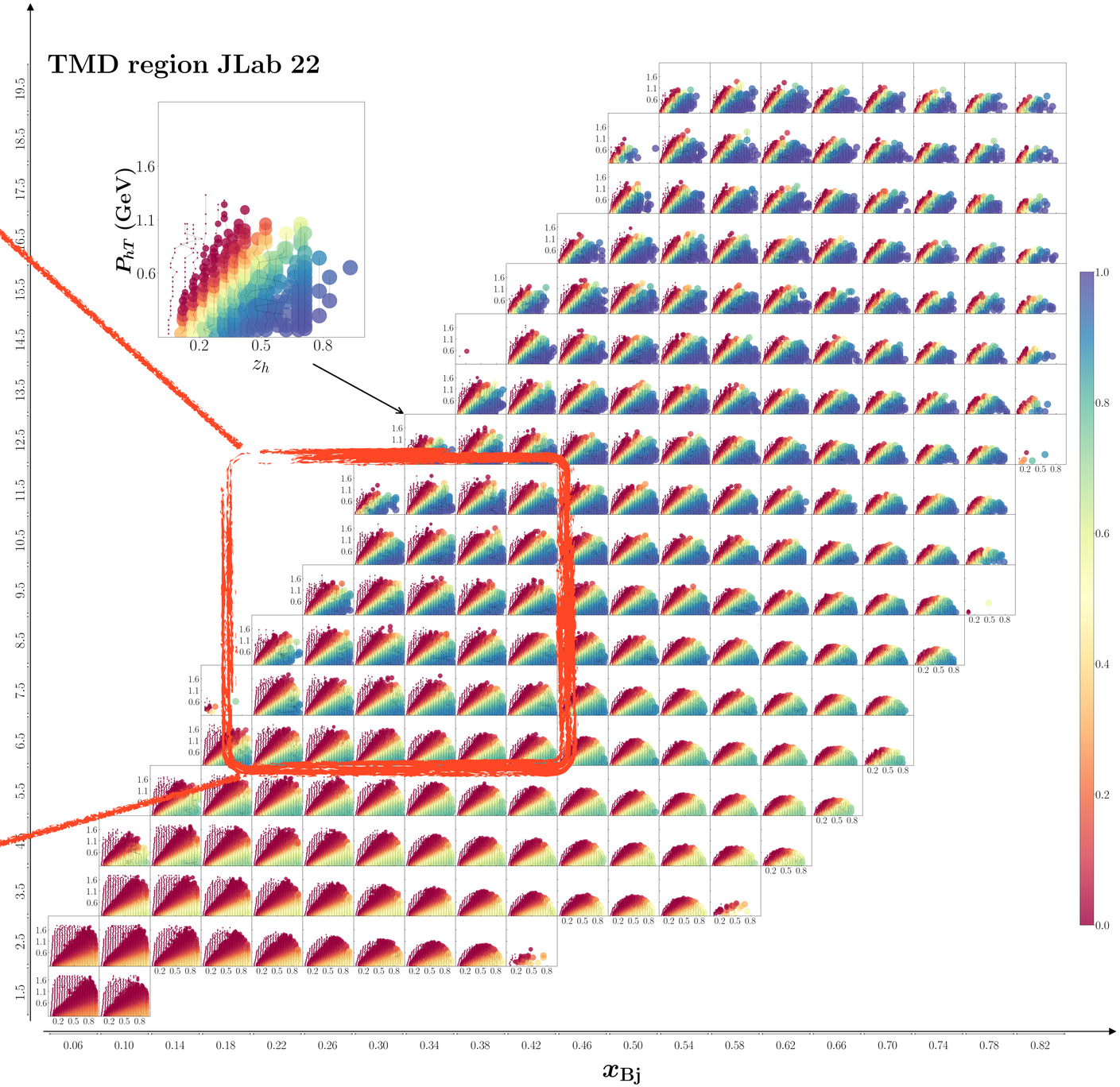




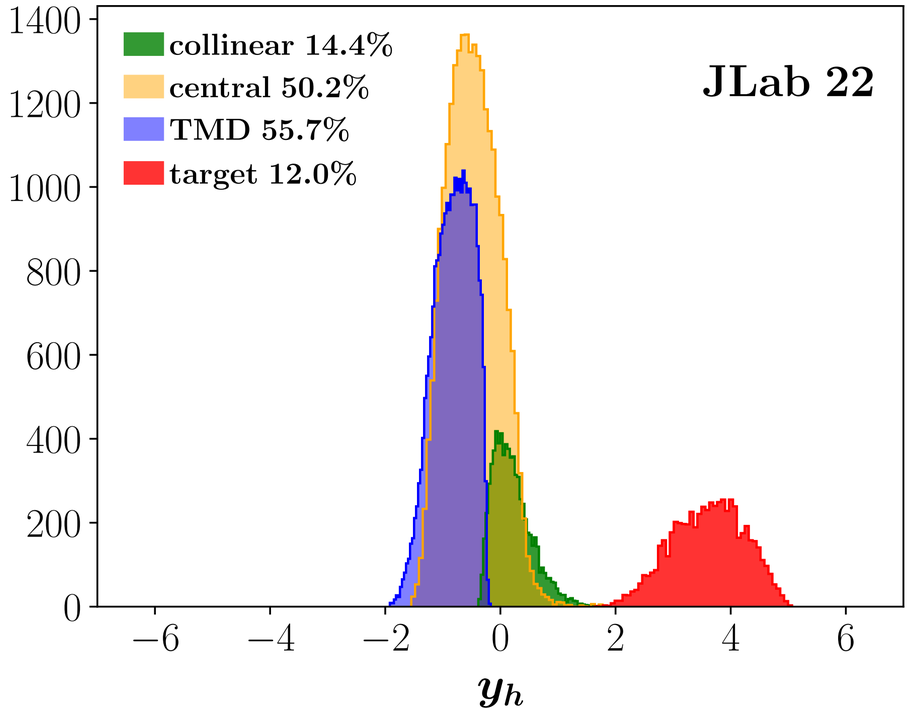
TMD region π^+

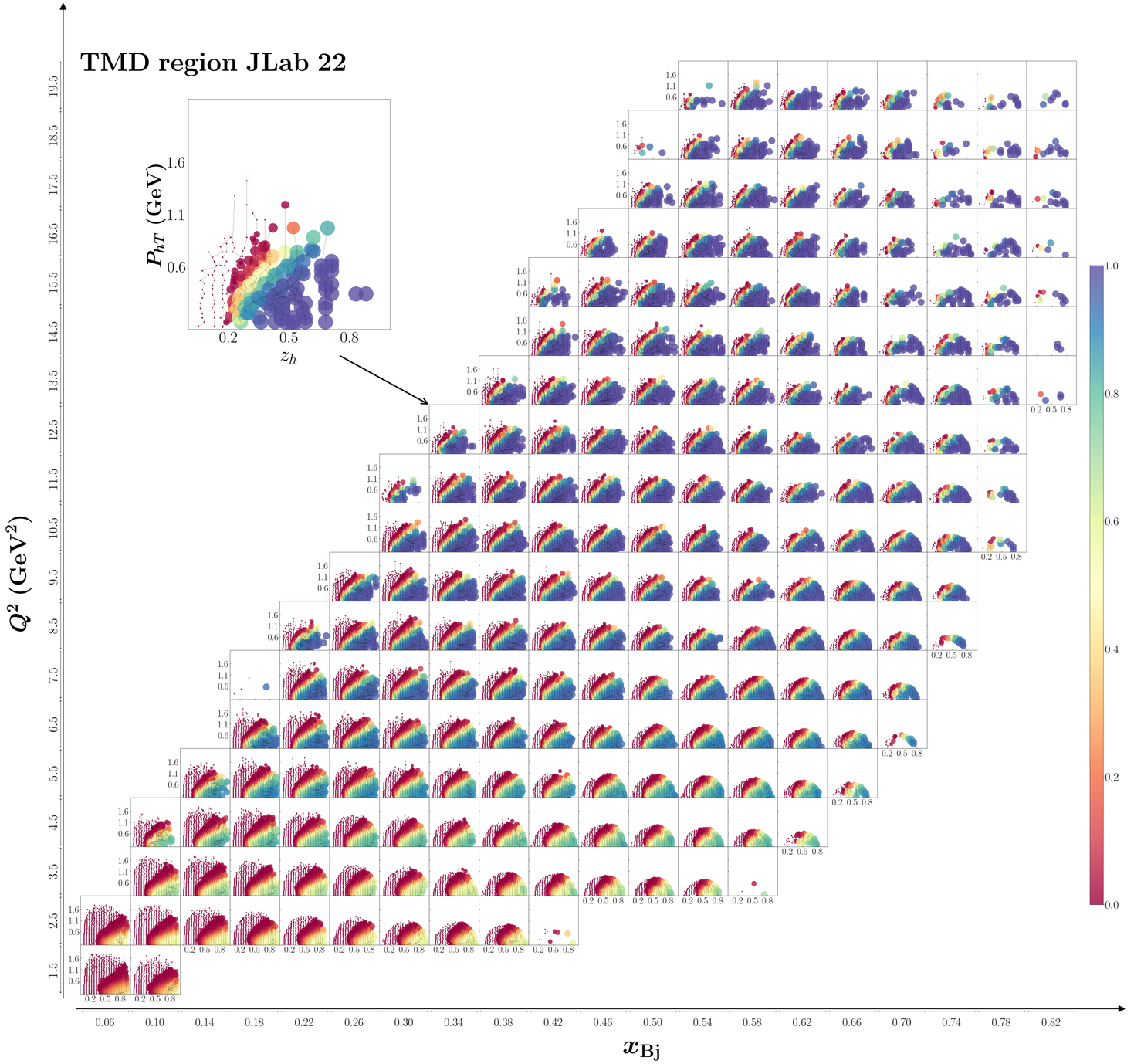


$$Q^2 = [6; 12]$$
$$x_{Bj} = [0.20; 0.44]$$

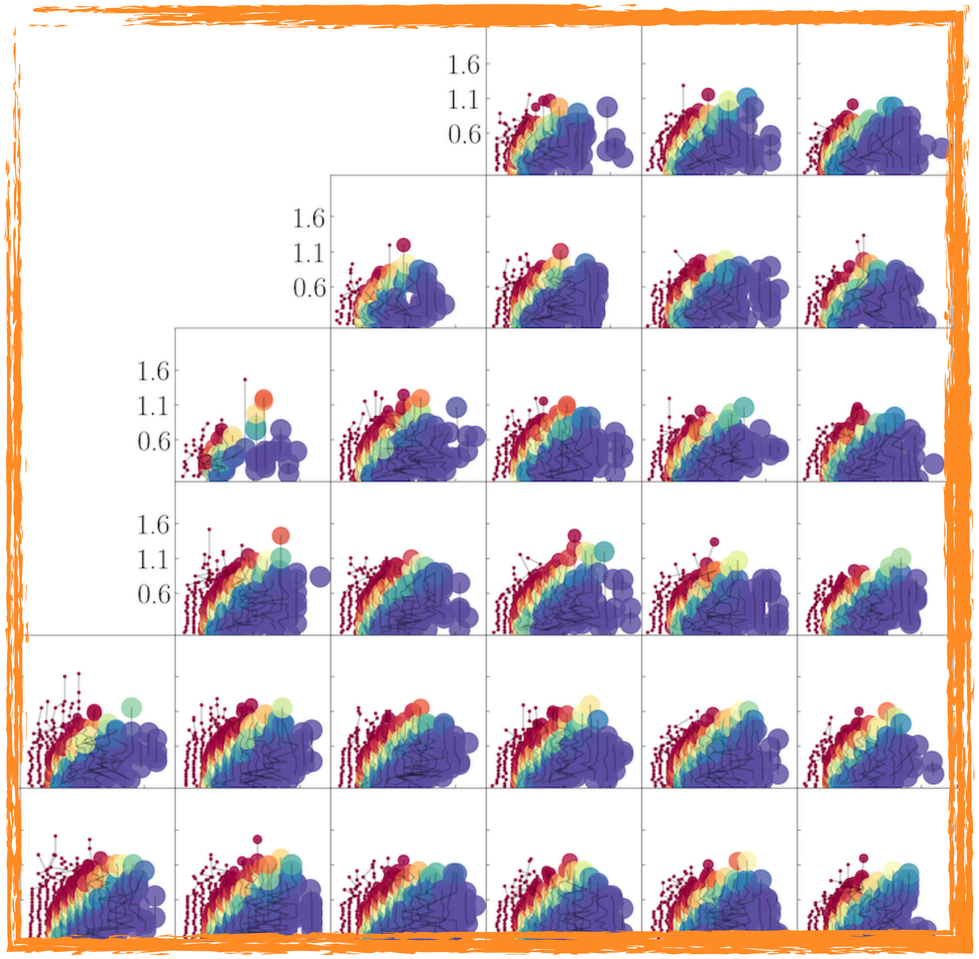


TMD region K^+


collinear 14.4%
central 50.2%
TMD 55.7%
target 12.0%
JLab 22
y_h

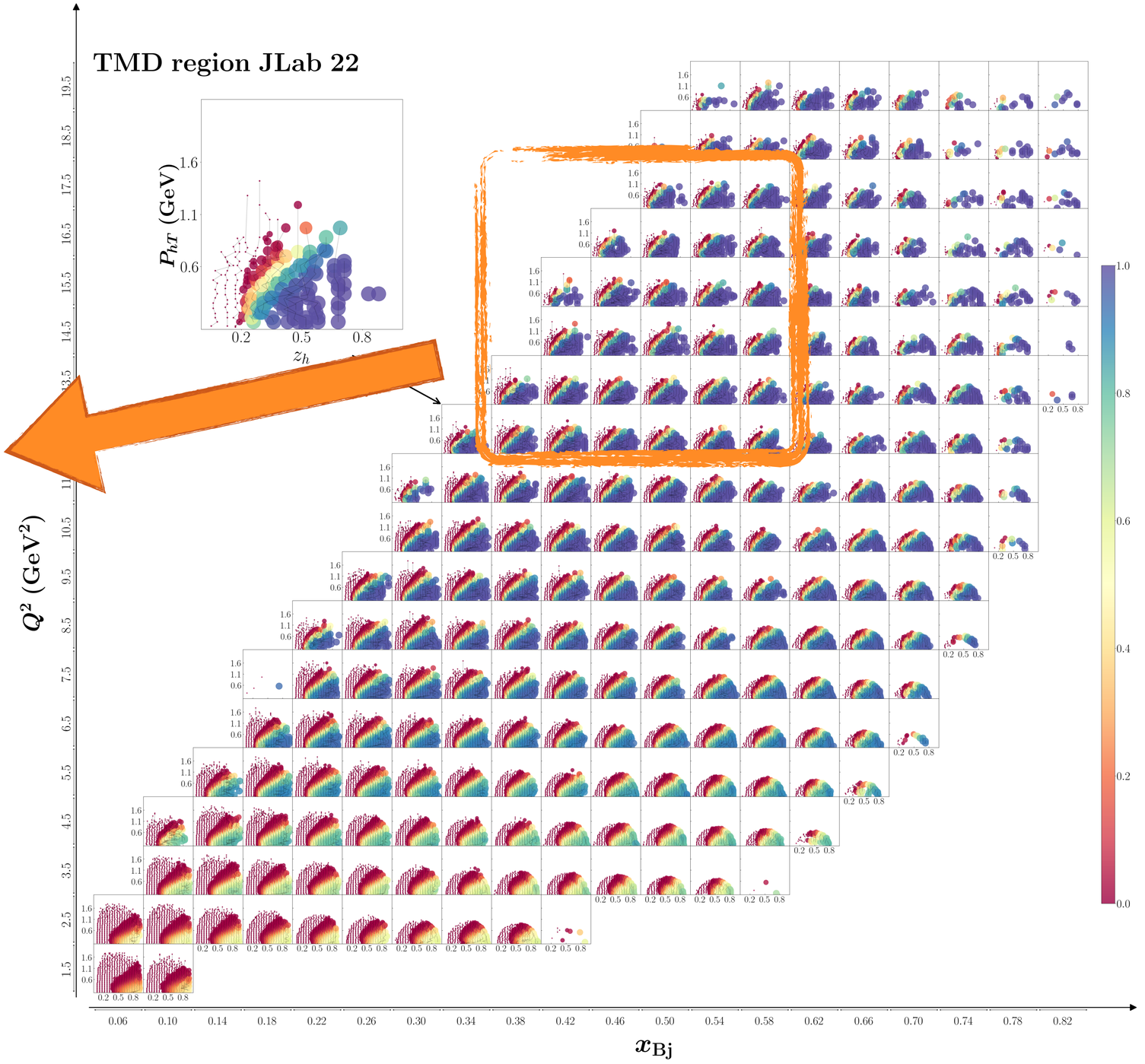

TMD region JLab 22
P_{hT} (GeV)
z_h
Q^2 (GeV^2)
x_{Bj}

TMD region K^+



$Q^2 = [12; 18]$

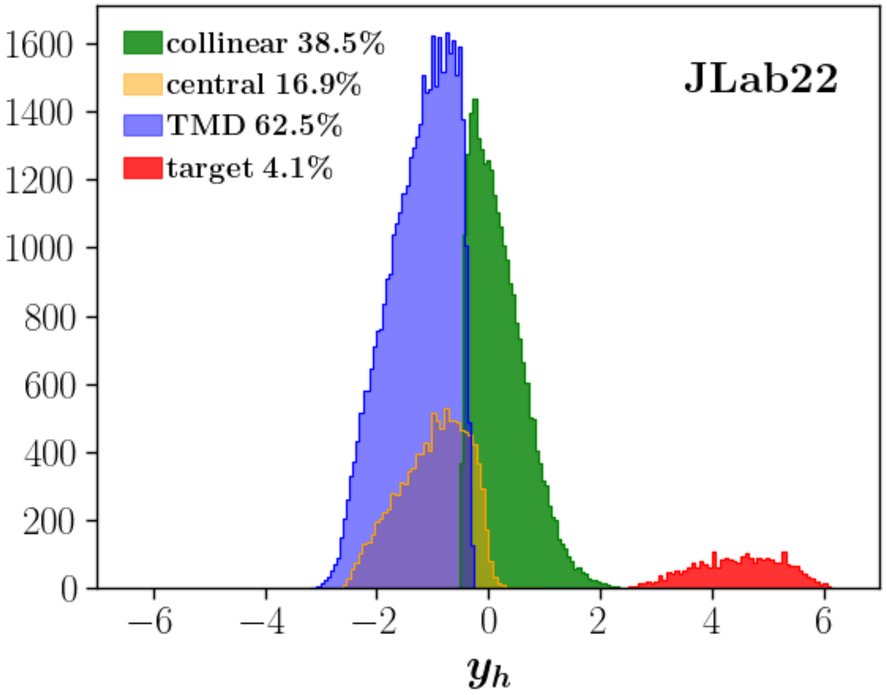
$x_{Bj} = [0.36; 0.60]$

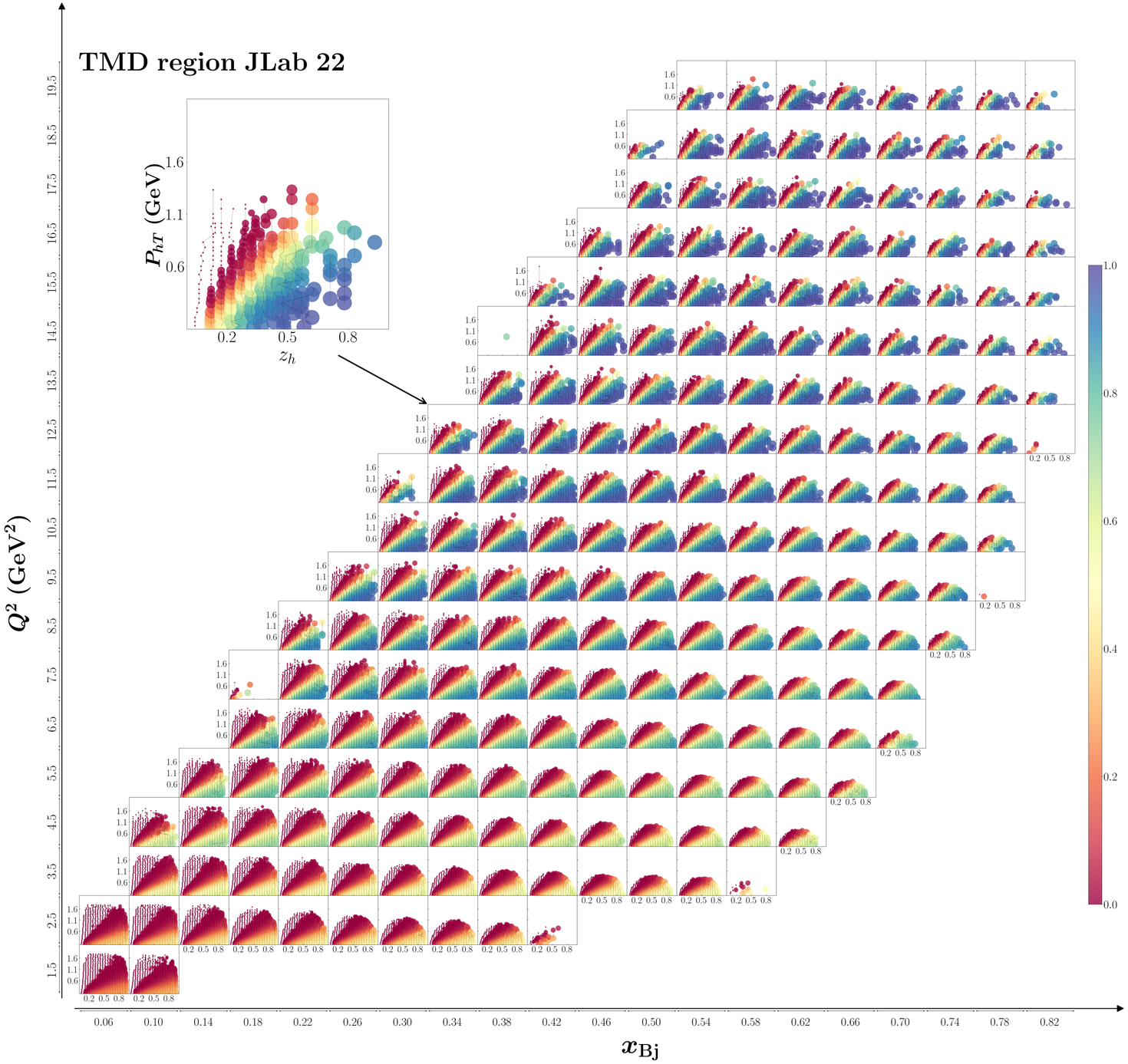


Summary

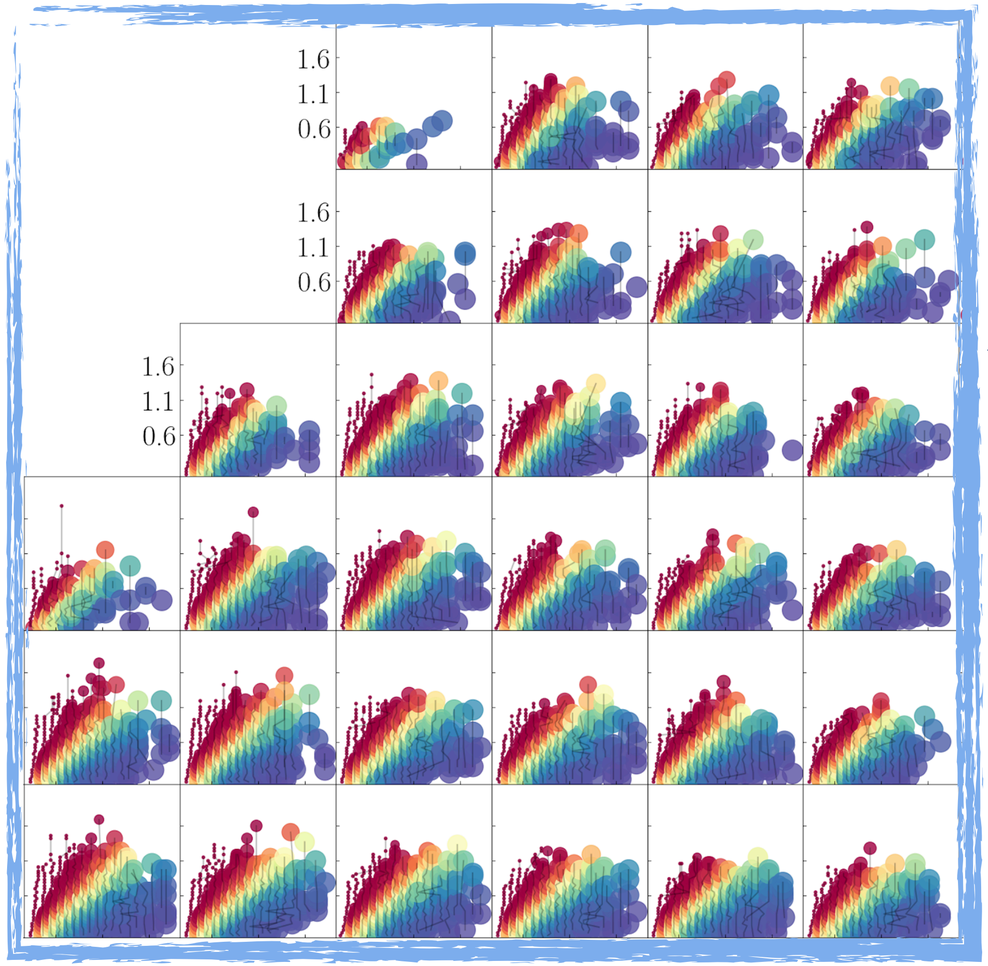
- Affinity will help us to assess if we can apply the specific theory to the specific dataset.
- New data with higher statistics and precision will help us to understand the details of non-perturbative dynamics

TMD region π^-



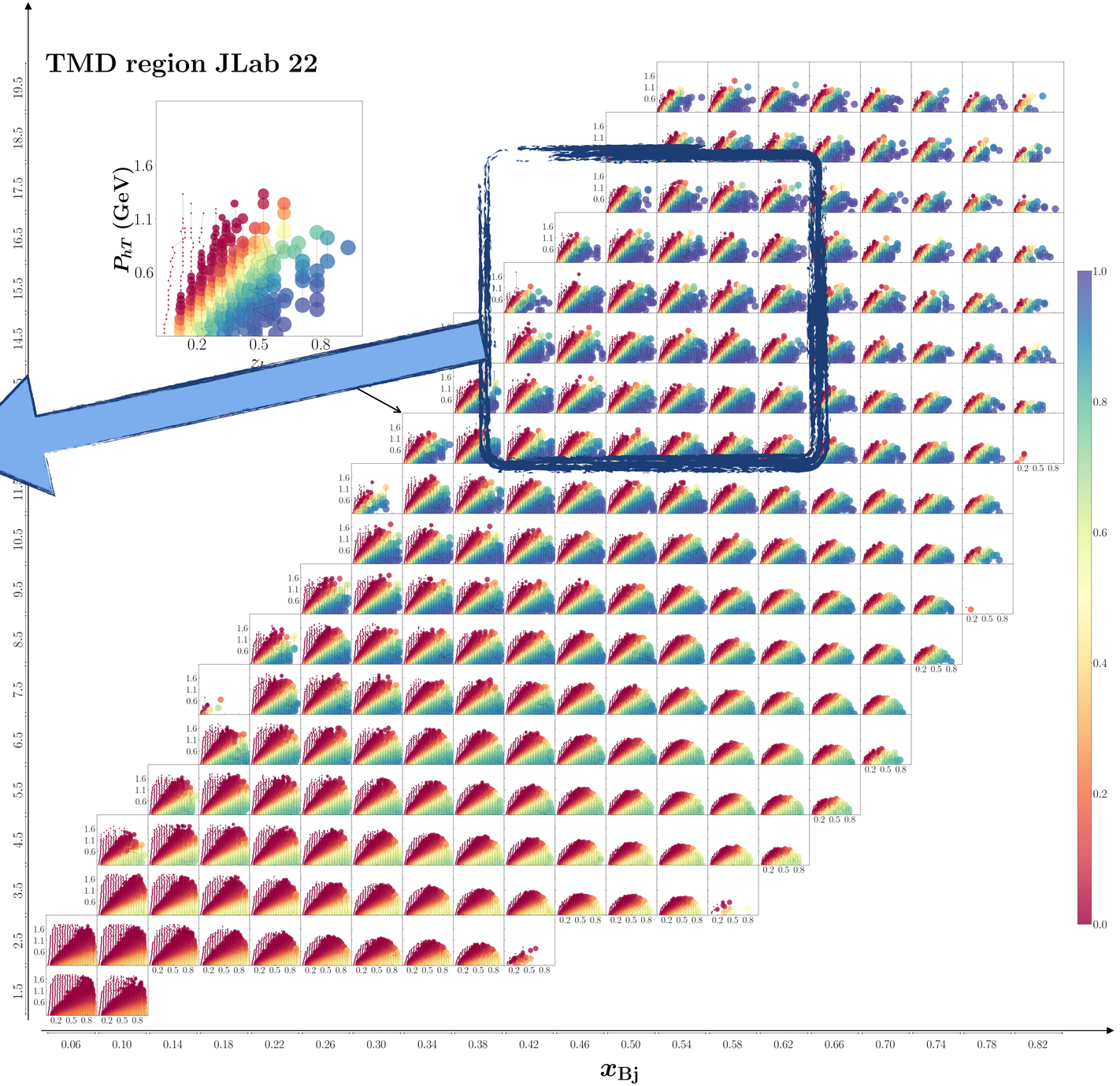


TMD region π^-

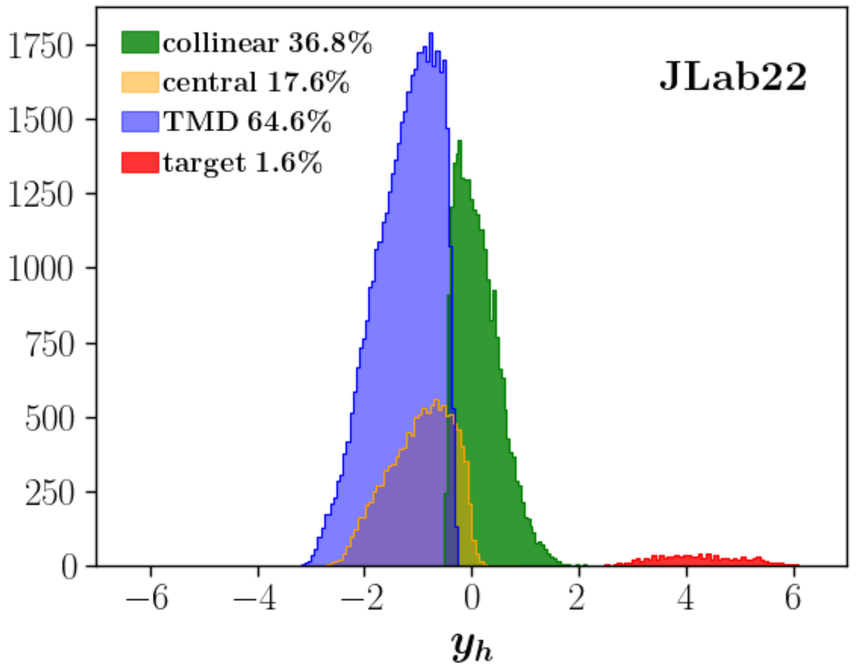


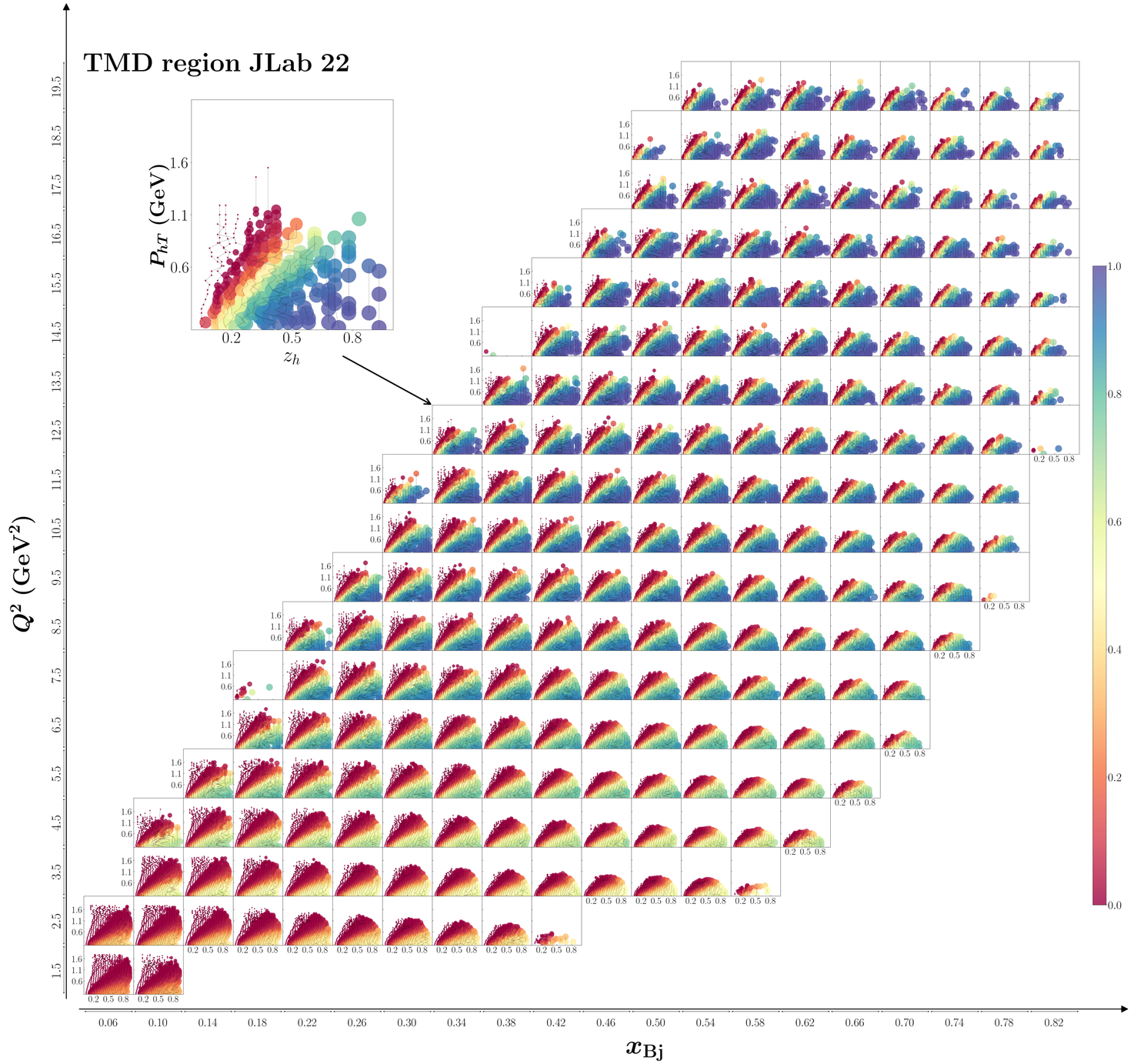
$Q^2 = [12; 18]$

$x_{Bj} = [0.40; 0.64]$

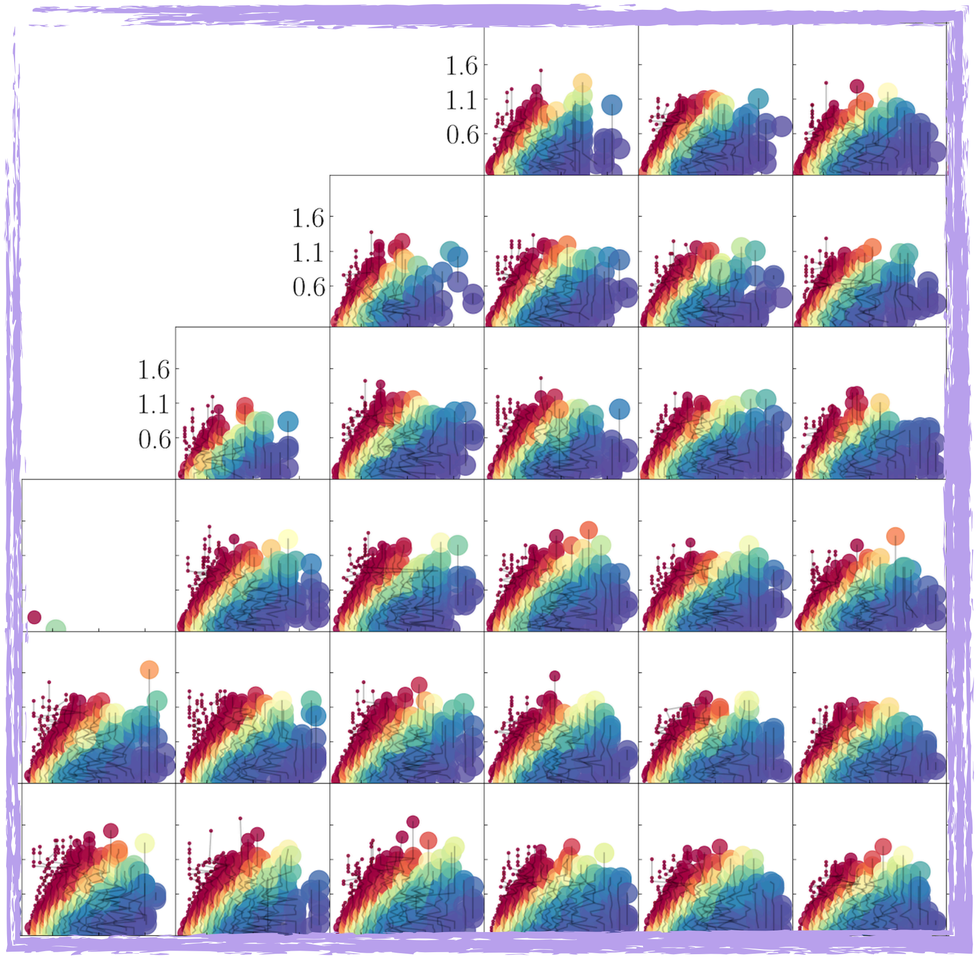


TMD region π^0





TMD region π^0



$Q^2 = [12; 18]$

$x_{Bj} = [0.36; 0.60]$