Combined analysis of collinear PDFs and FFs

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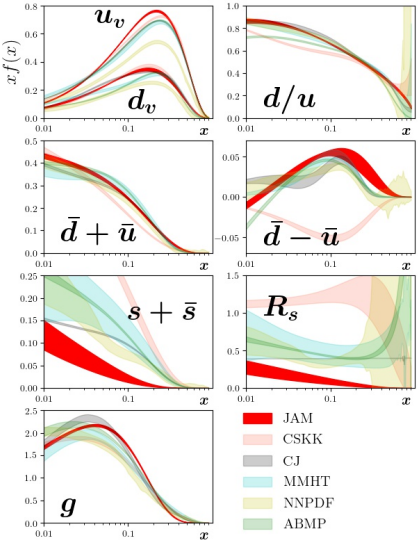
ODU/JLab

27th Workshop on Deep-Inelastic Scattering
and Related Subjects
DIS 2019
Turin, Italy

In collaboration with:
Carlota Andres, Jake Ethier,
Wally Melnitchouk

New JAM19: simultaneous PDF & FF(π, K) extraction



- ✓ DIS (p, d)
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- ✓ SIA $(\pi^{\pm}, K^{\pm})$
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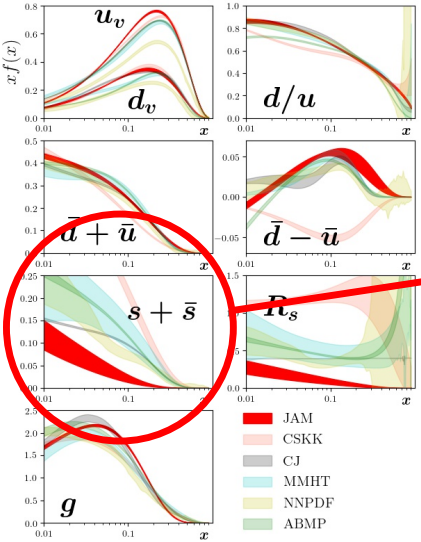

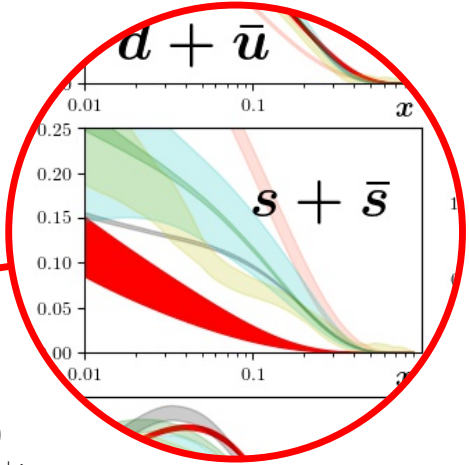

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Strong strange suppression

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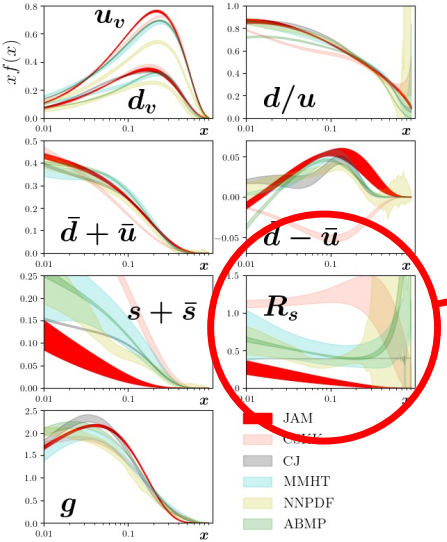

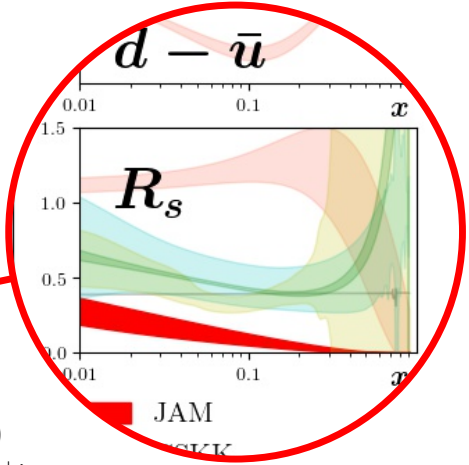

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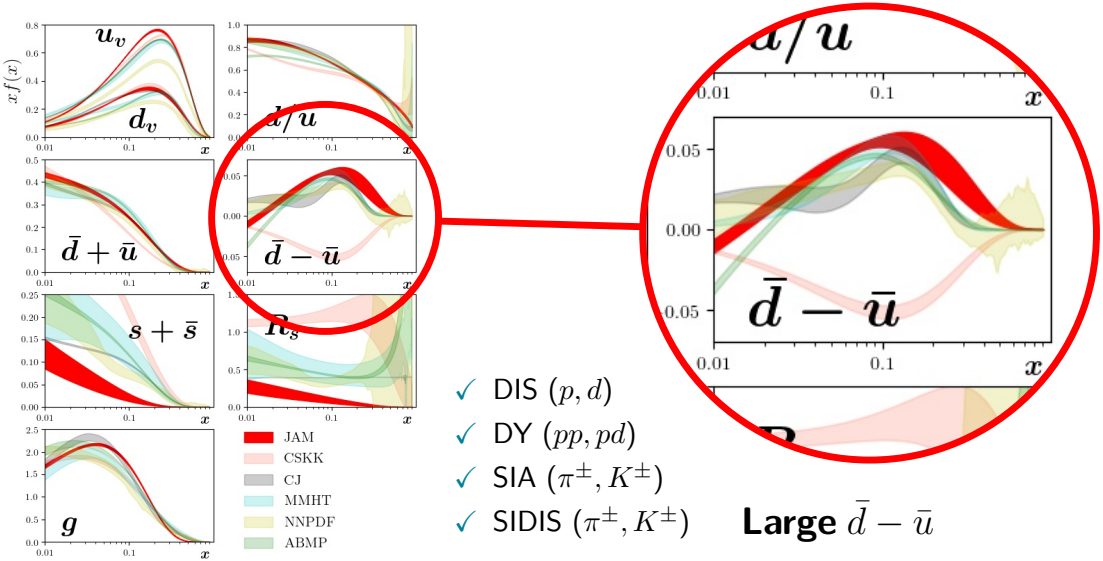

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Large $\bar{d} - \bar{u}$

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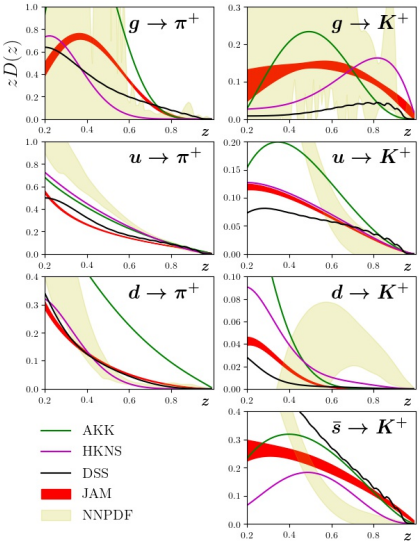

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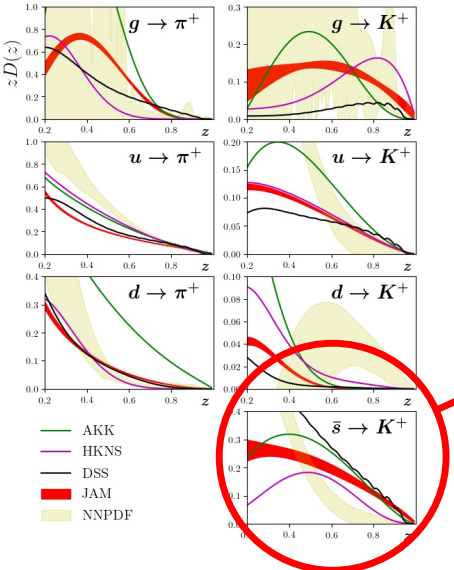

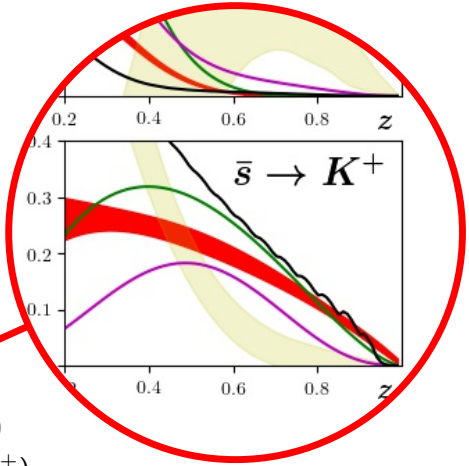

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Large $\bar{s} \to K^+$

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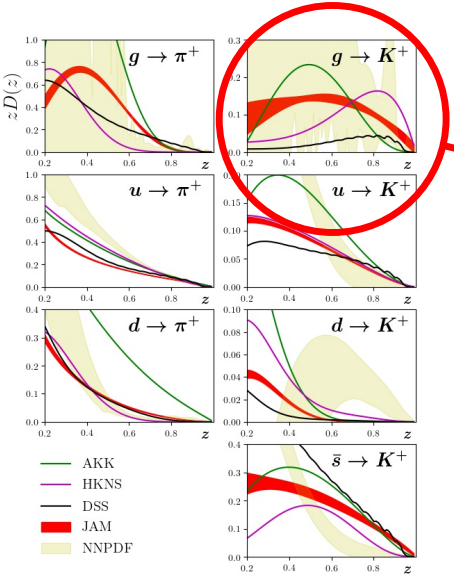

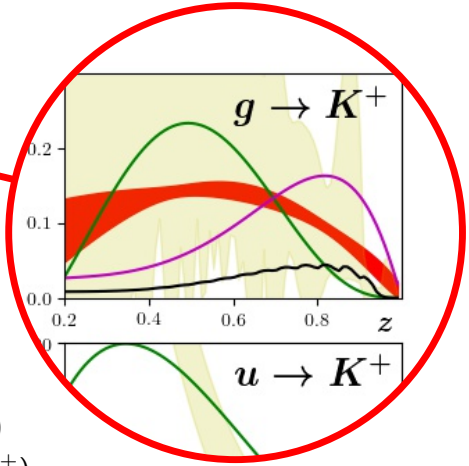

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Constraints on $g \to K^+$

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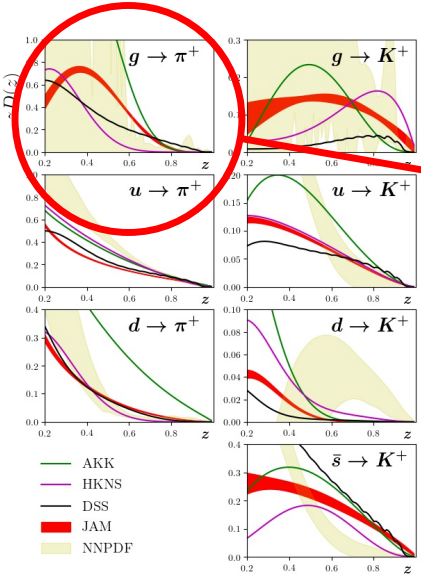

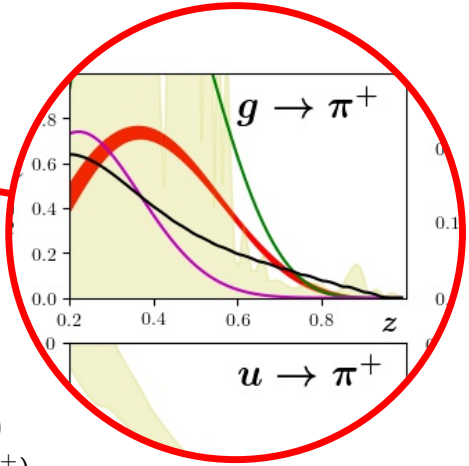

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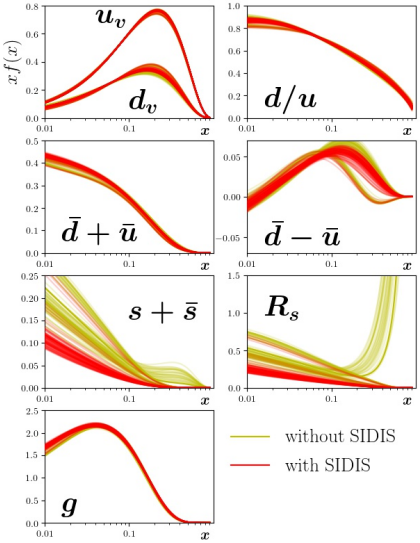
New JAM19: impact of SIDIS data on PDFs



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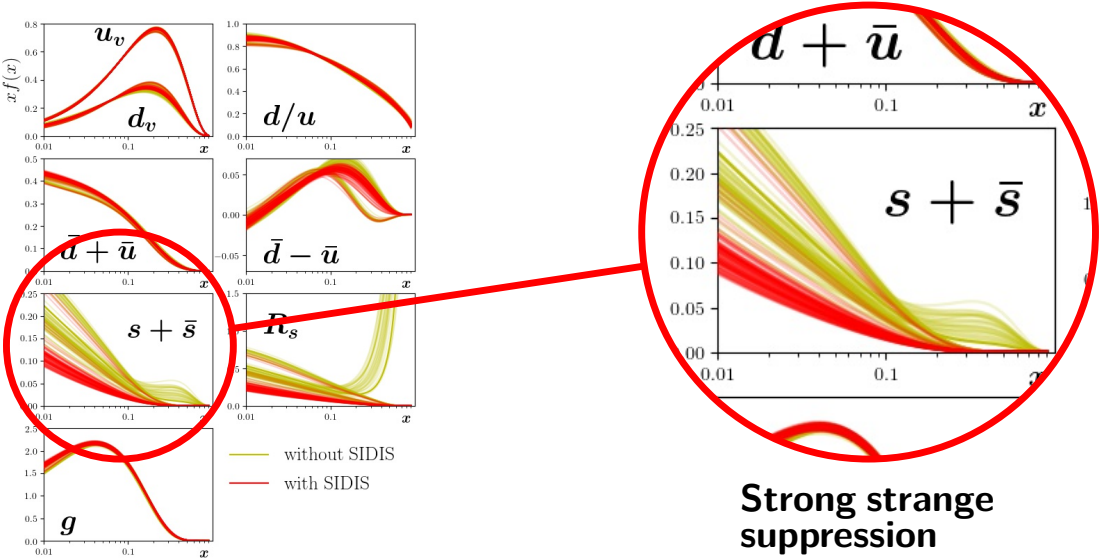

Strong strange suppression

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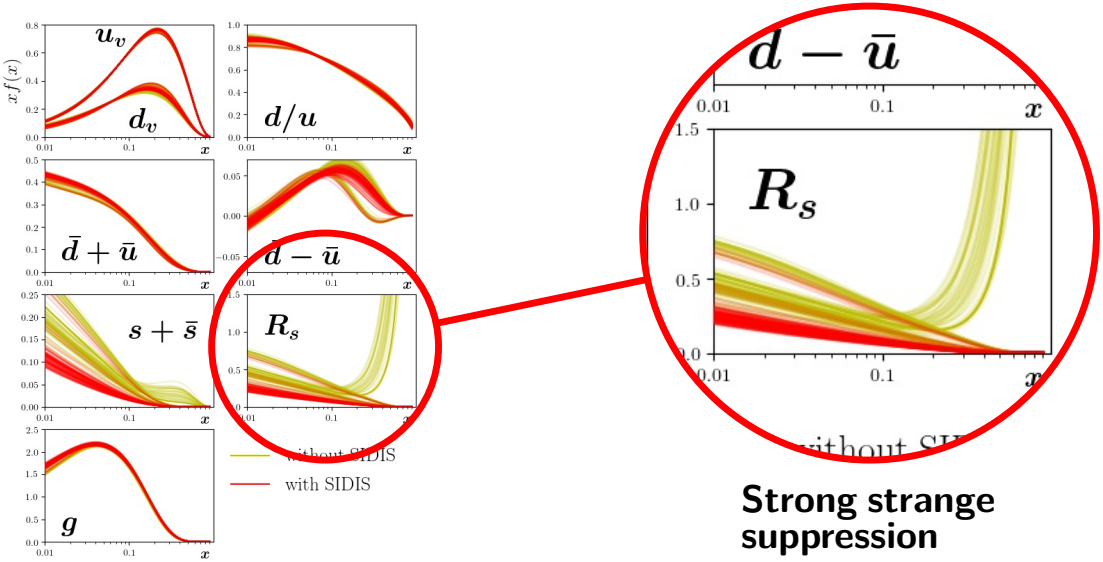

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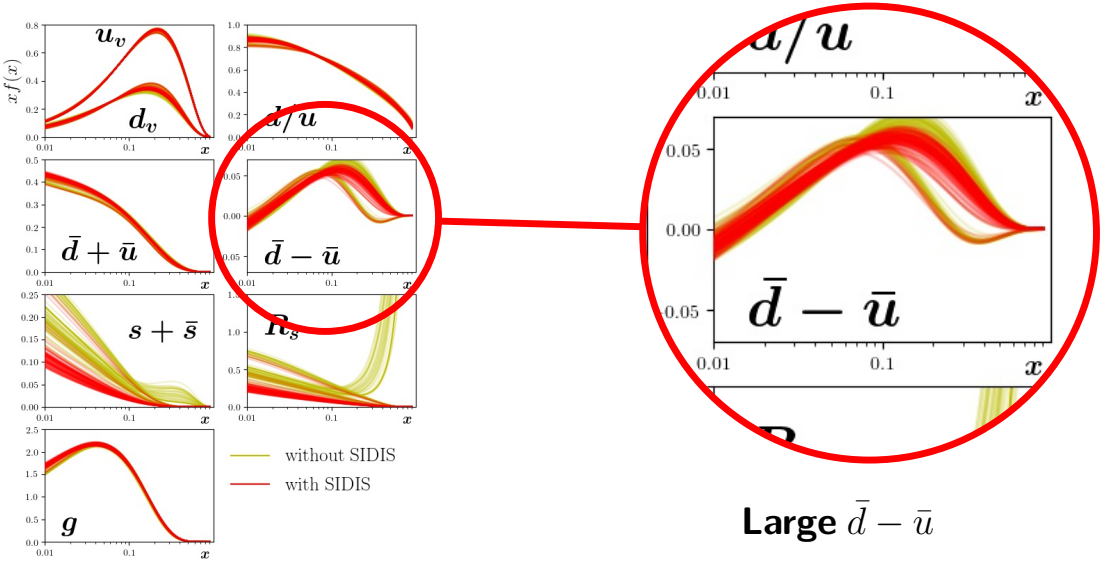
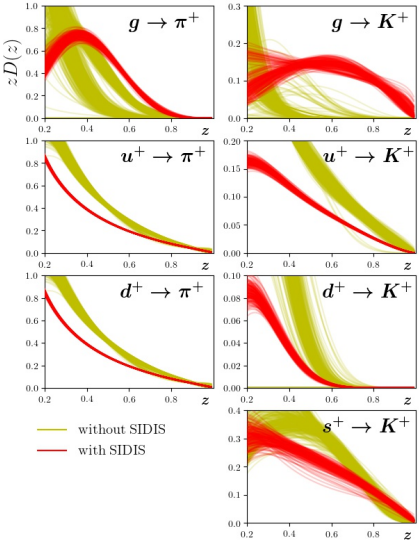


Large $\bar{d}-\bar{u}$

New JAM19: impact of SIDIS data on FFs



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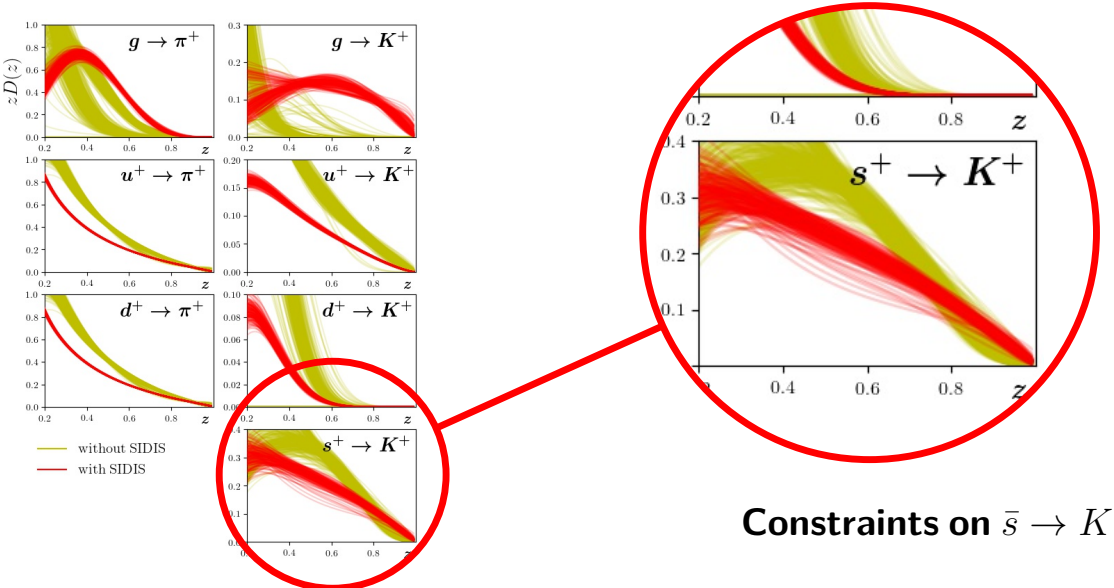

Constraints on $\bar{s} \to K^+$

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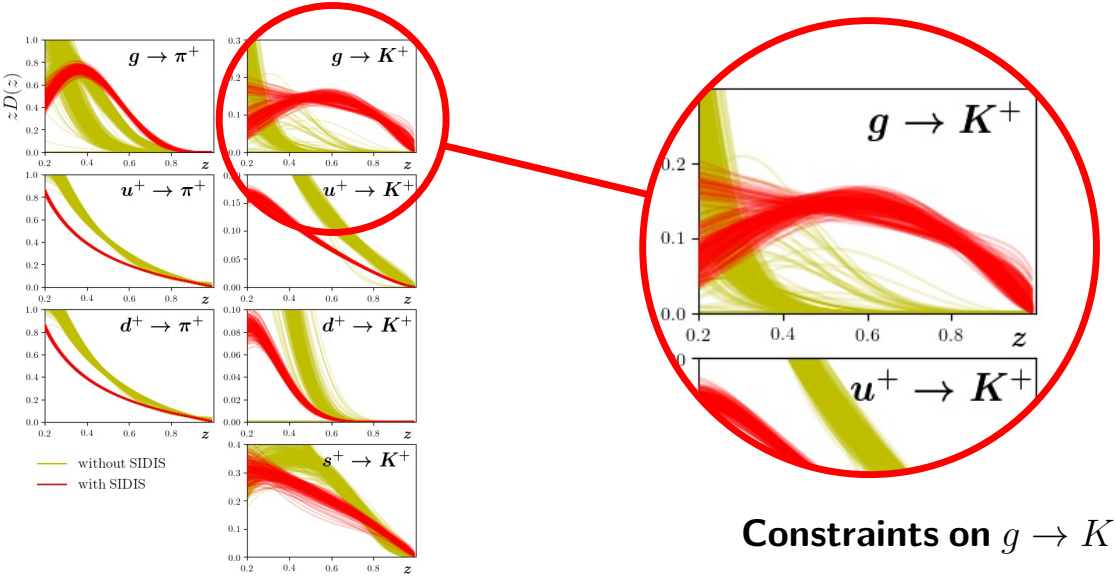

Constraints on $g \to K^+$

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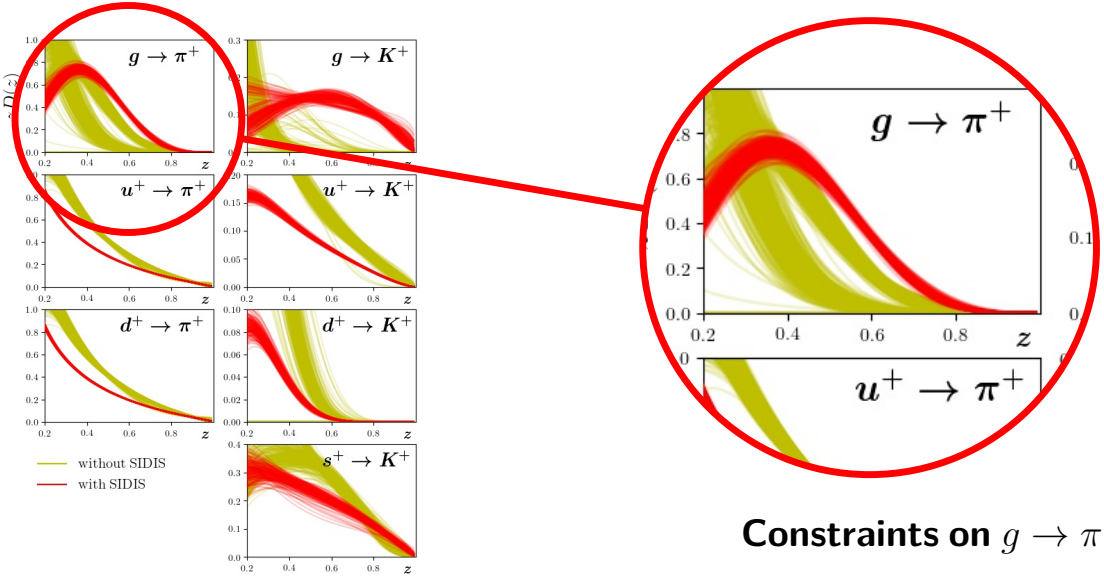
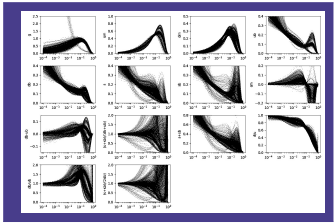


Constraints on $g \to \pi^+$

JAM19 multi-step strategy

PDFs



+DIS (No HERA)

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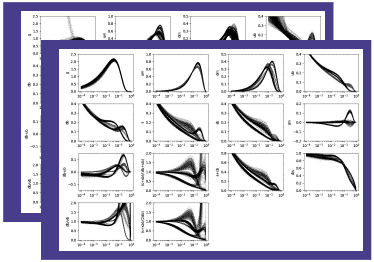

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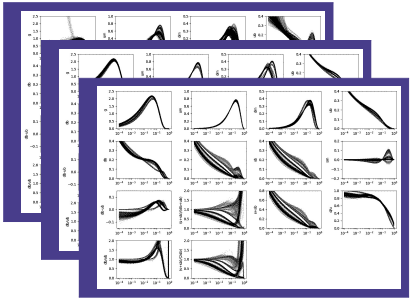

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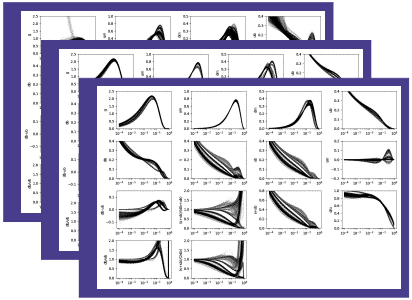
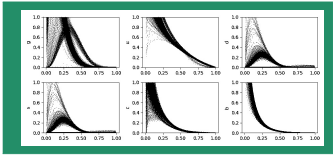


pion FFs



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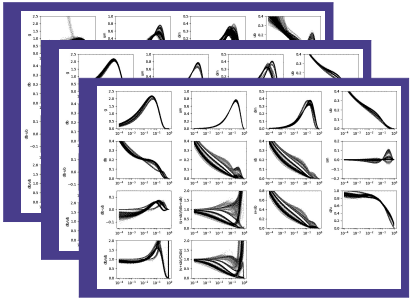

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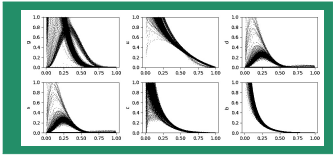
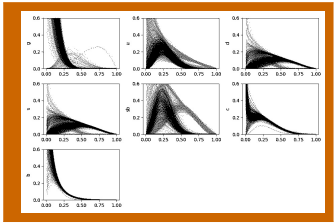


kaon FFs



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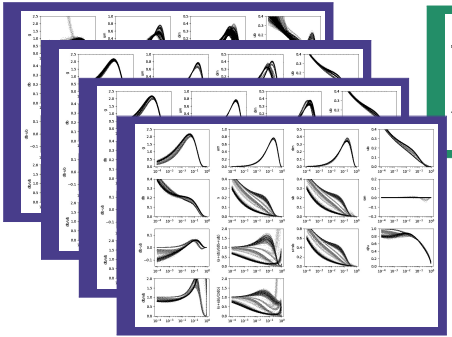

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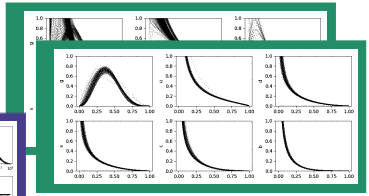

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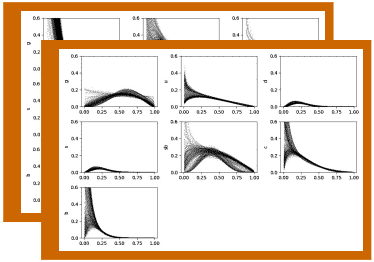

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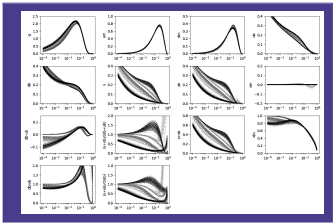
Discriminating multiple solutions



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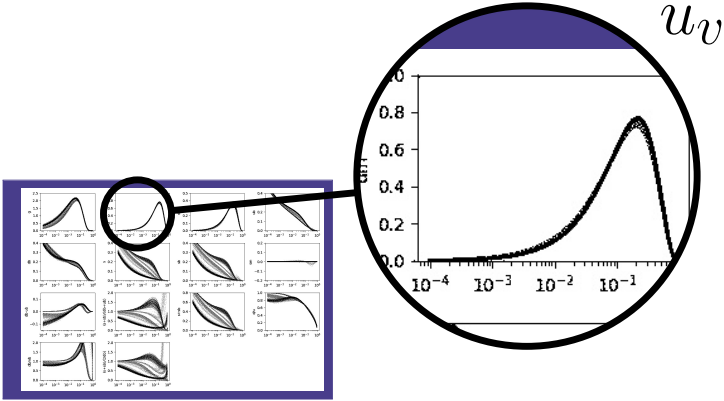

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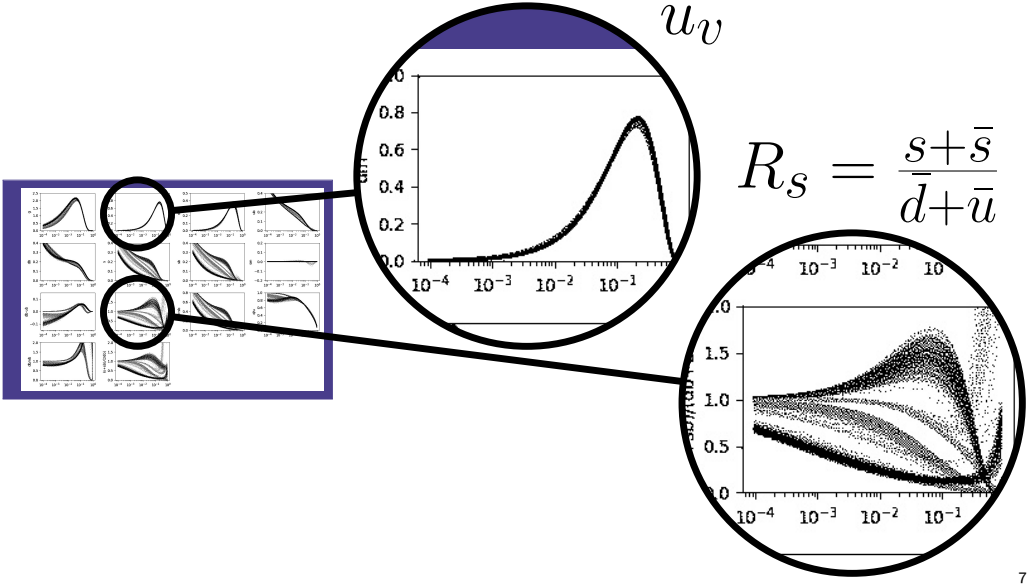

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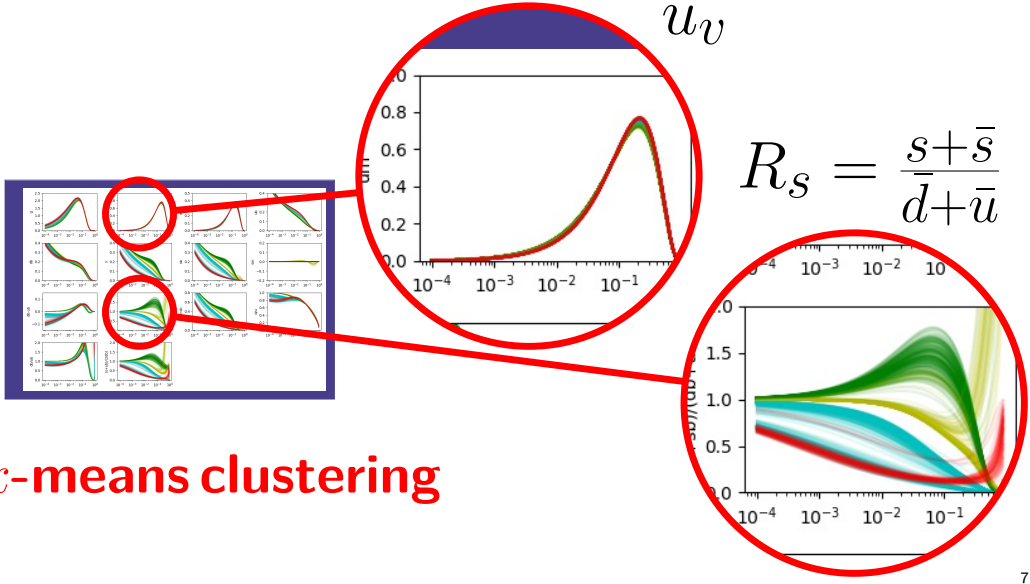
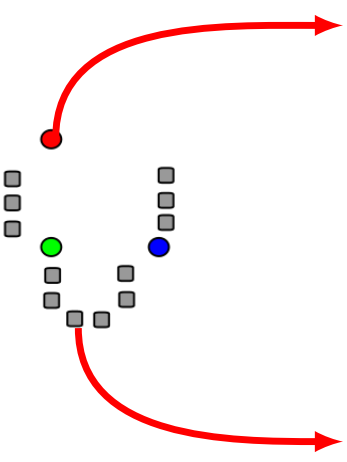


k-means clustering

k-means clustering: 2D example (α, β)

e.g $f(x) = x^{\alpha}(1-x)^{\beta}$



k-means clustering: 2D example (α, β)

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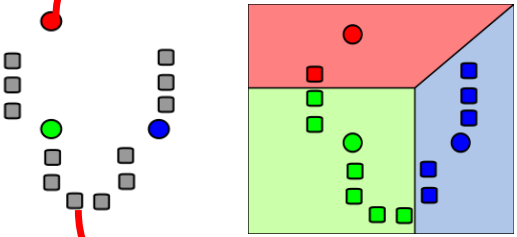
(α^*, β^*): centroid



define clusters

(α_i, β_i): replica

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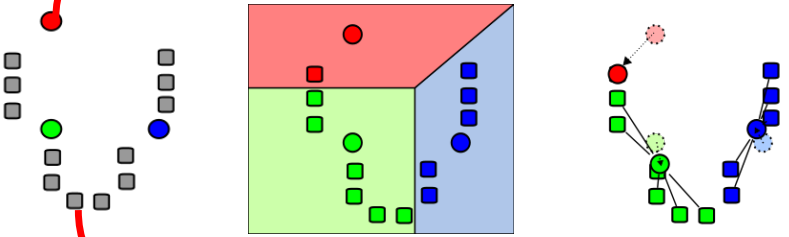

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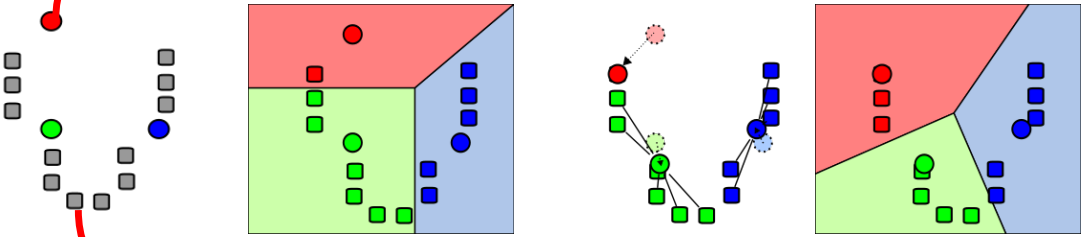
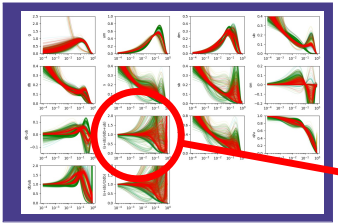
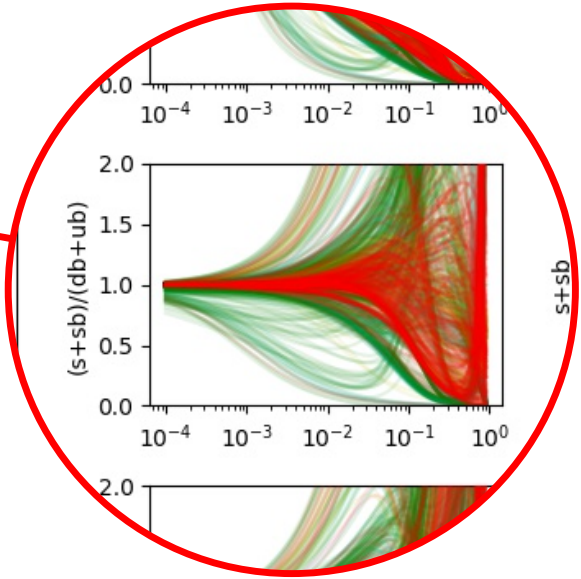


(α_i, β_i): replica

Constraints on R_s

PDFs





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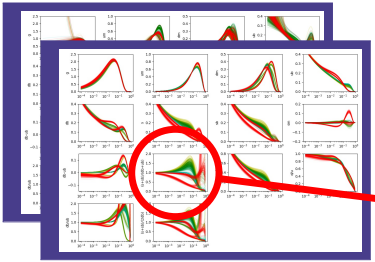

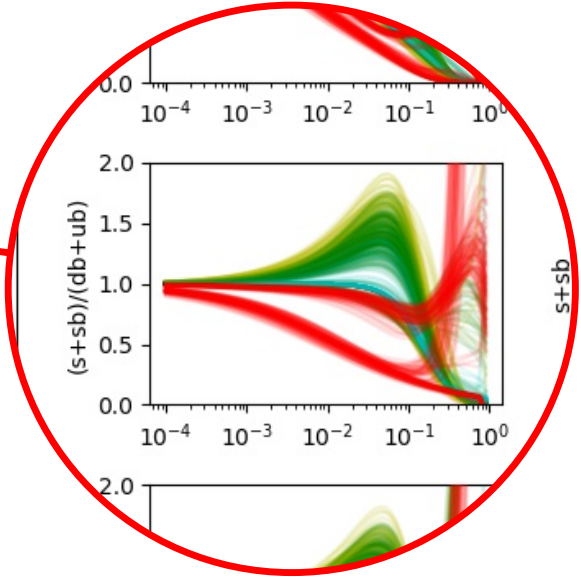

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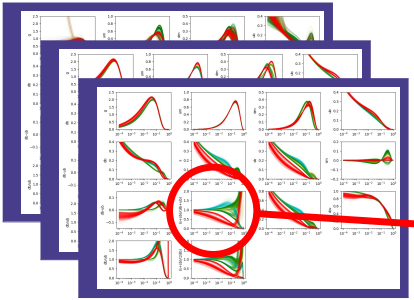

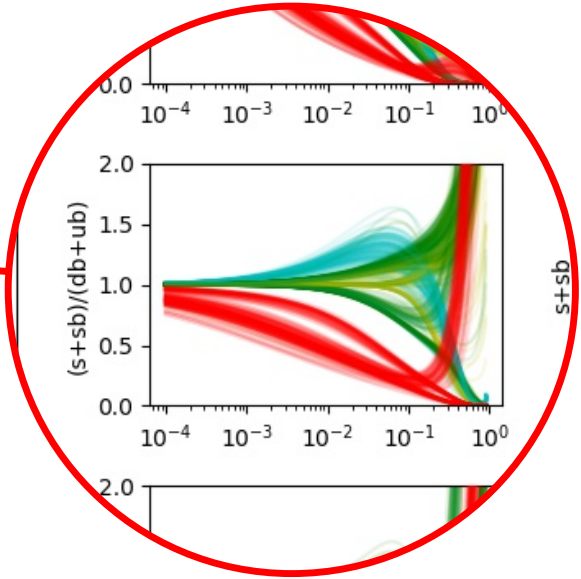

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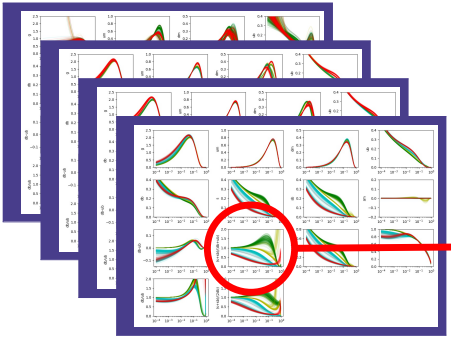

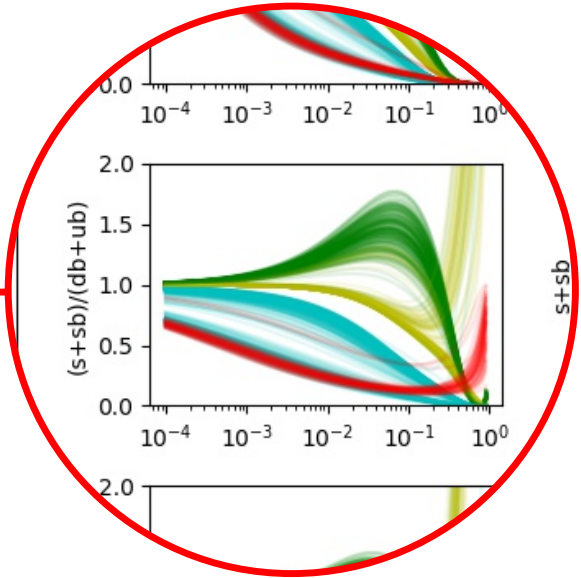

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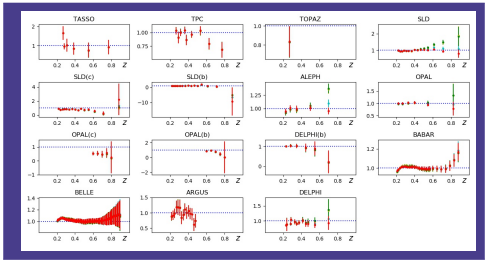
+SIA + SIDIS

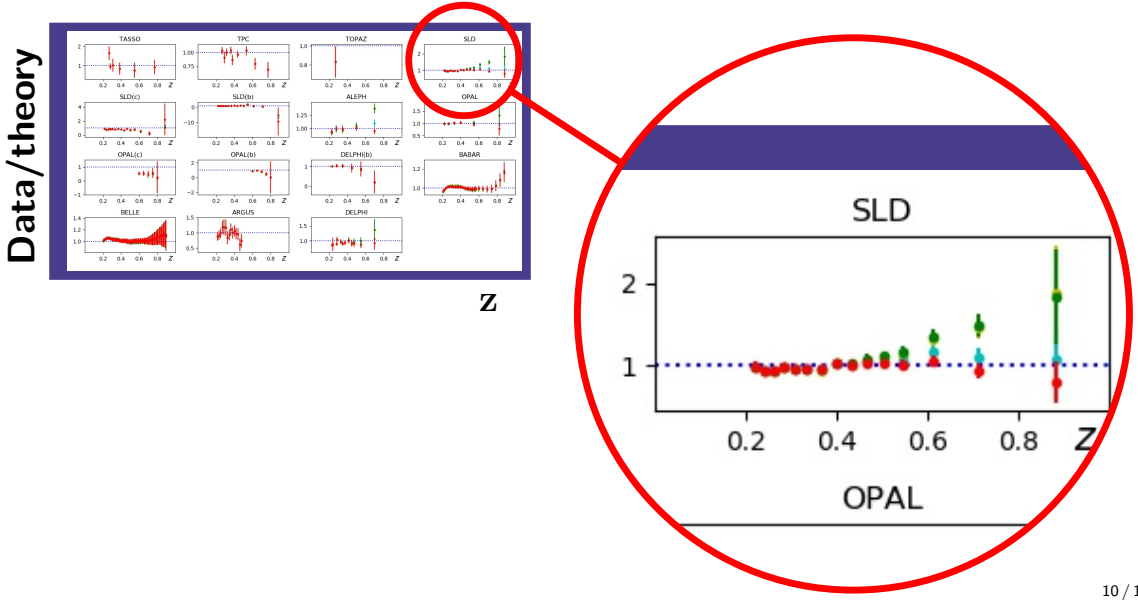
SIA Kaon ($\pm$) data

Data/theory

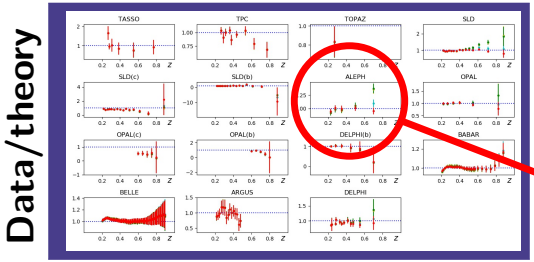


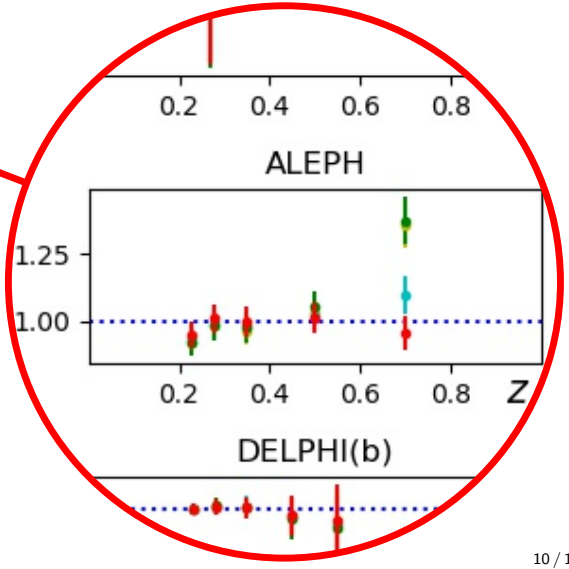
z

SIA Kaon (±) data

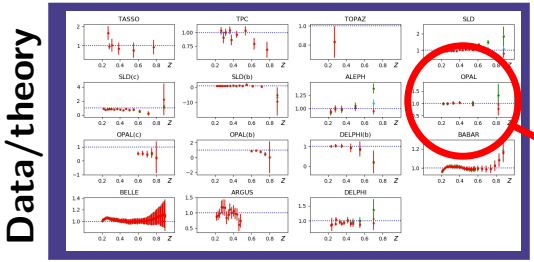


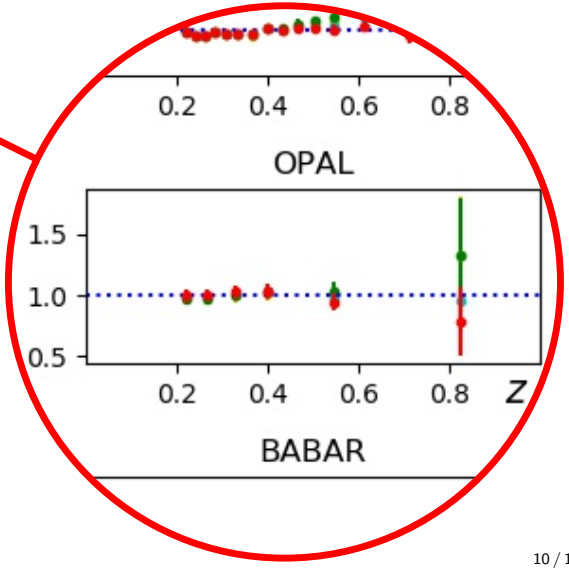
SIA Kaon (±) data





SIA Kaon (±) data





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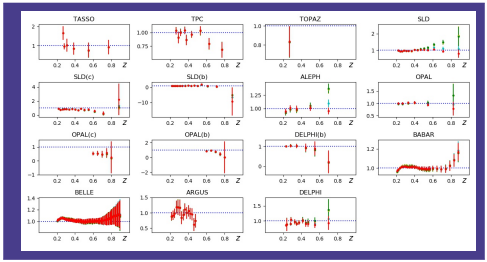
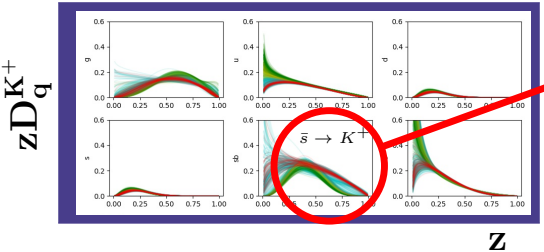
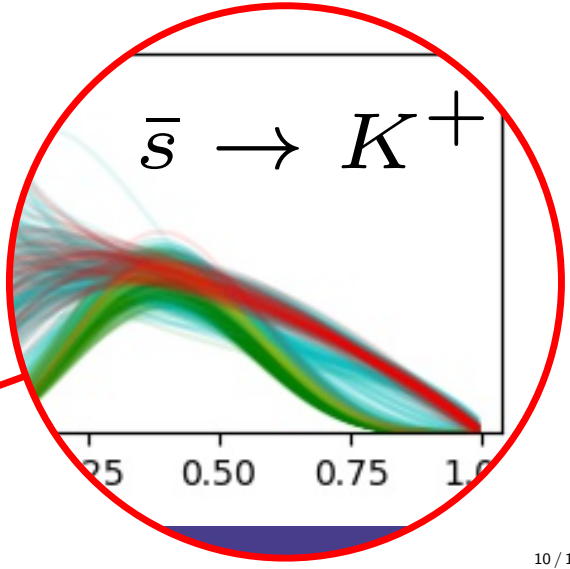
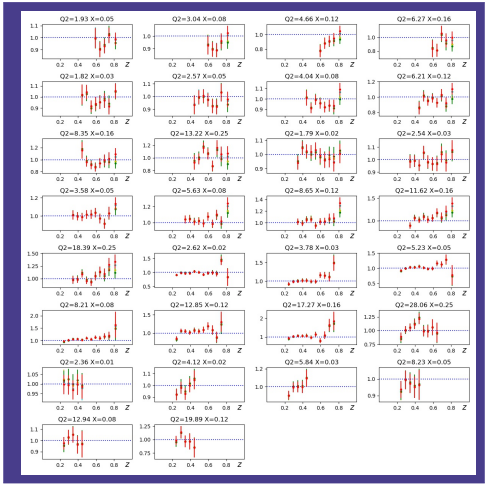






SIDIS Kaon (+) data

Data/theory



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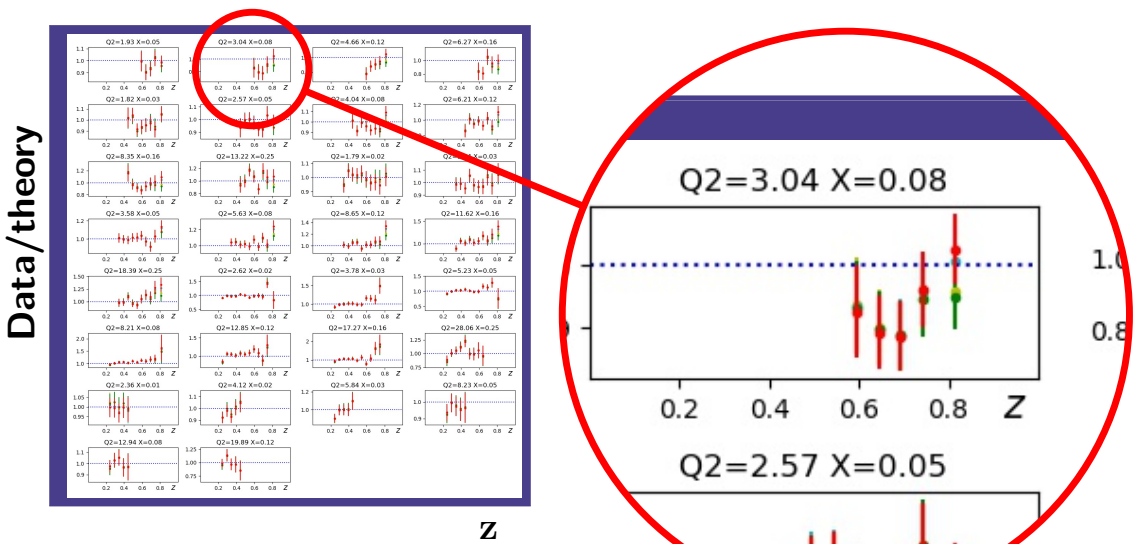

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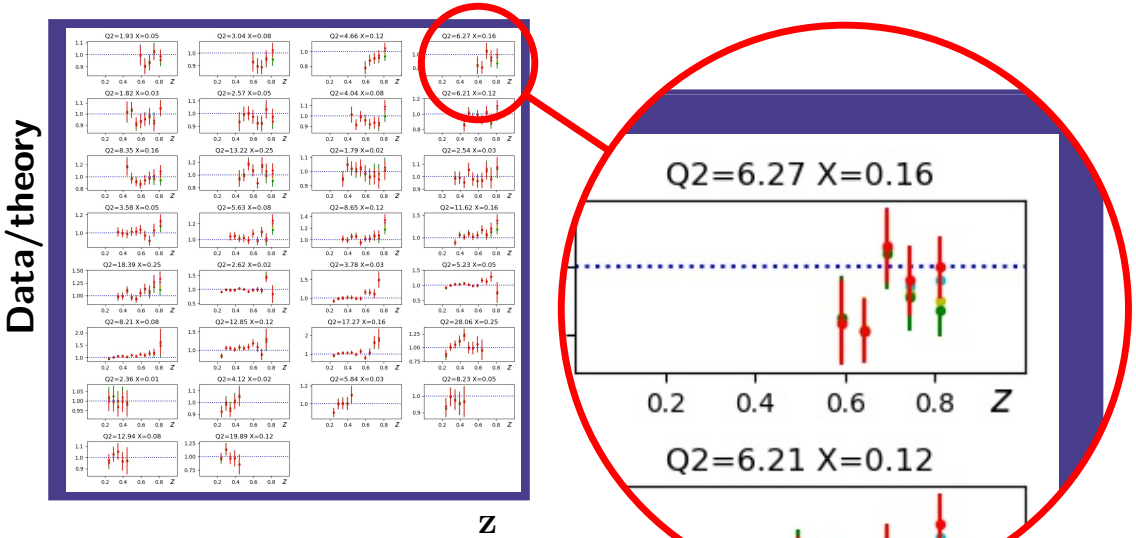

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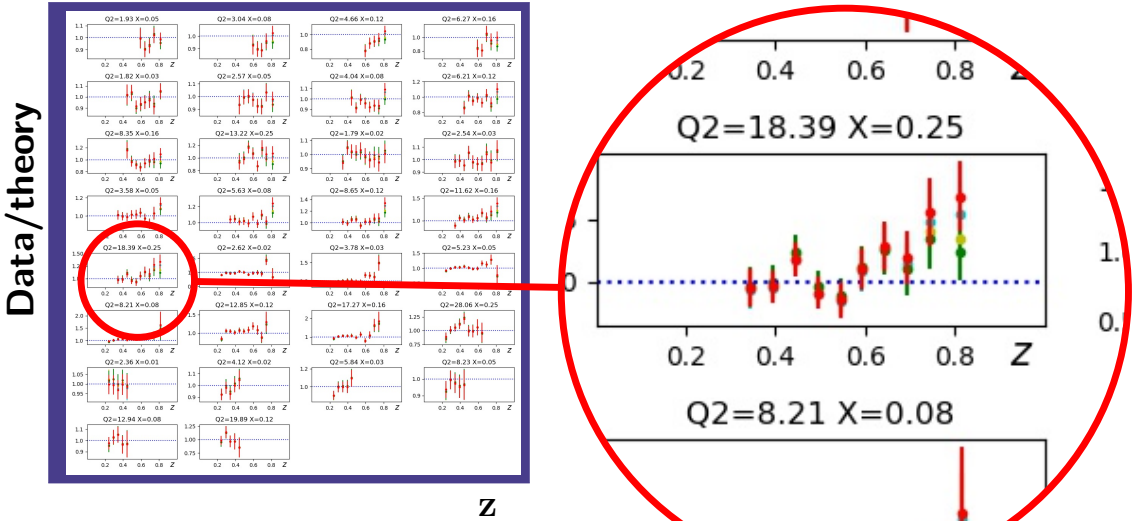
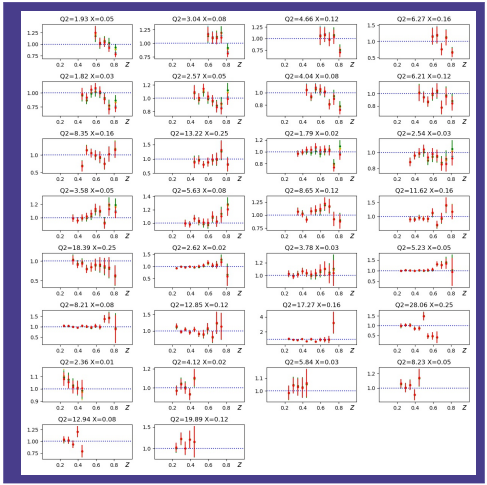


SIDIS Kaon (-) data

Data/theory



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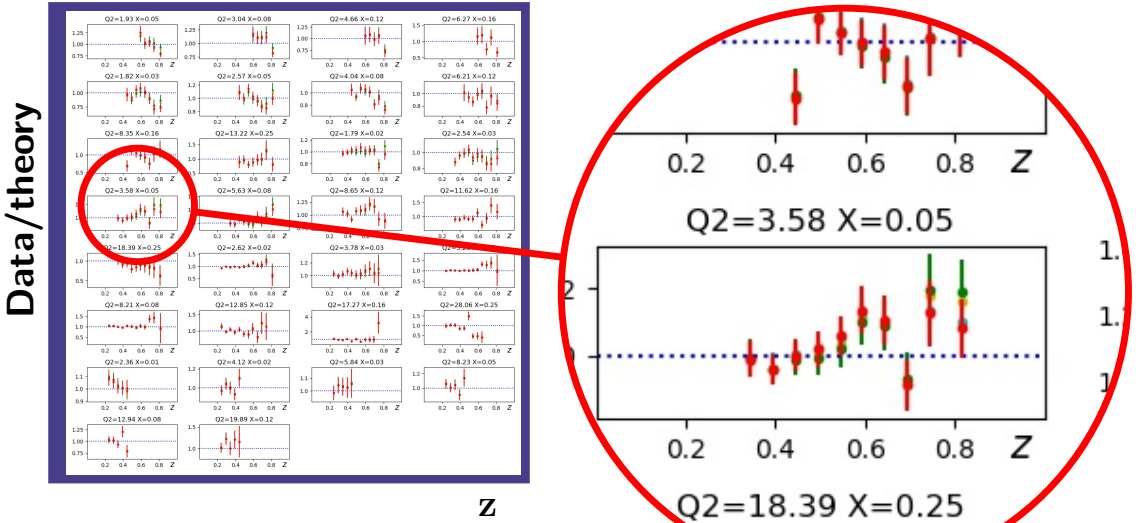

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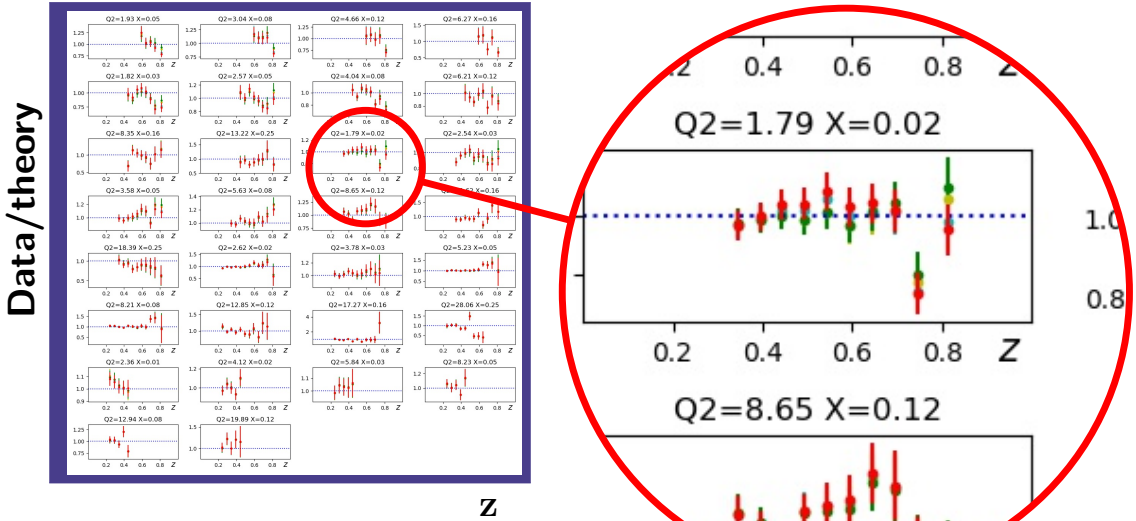

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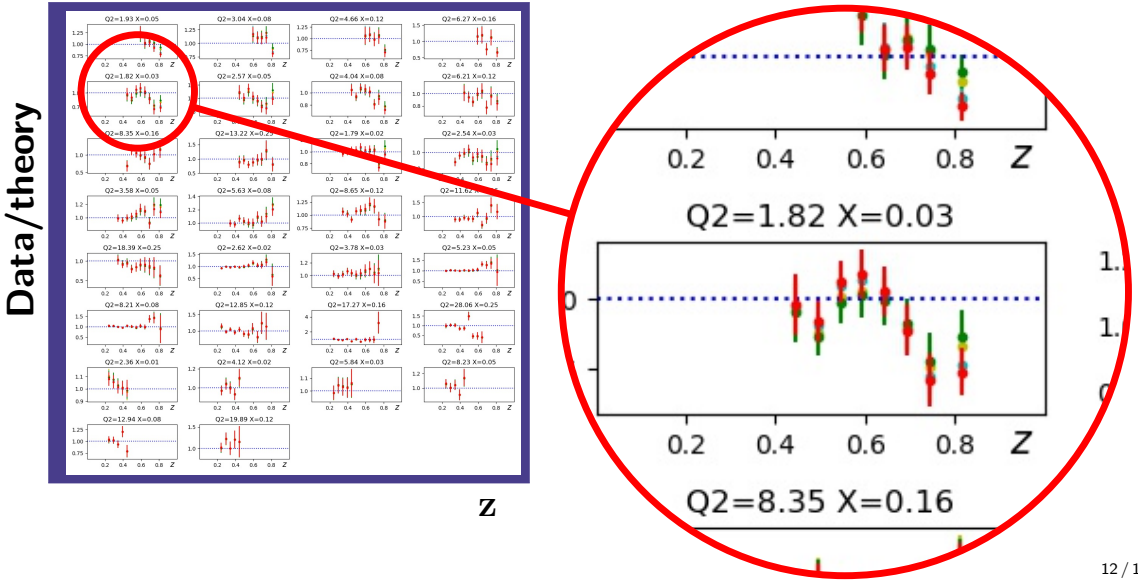
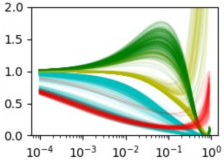


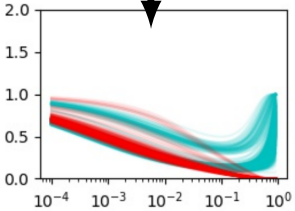
JAM19 sample selection criteria

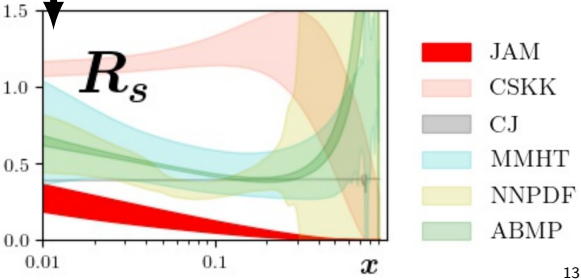
- Apply k-mean clustering
- Classify clusters by increasing order in "extended" reduced Chi2

$$\frac{\chi^2}{N_{\rm tot}} + \sum_{\rm exp} \frac{\chi^2_{\rm exp}}{N_{\rm exp}}$$

- Perform a new sampling with flat priors around best cluster







Summary and outlook

- **New JAM19 PDF & FF combined analysis**
  - data: DIS, SIDIS, DY, SIA
  - JAM19 methodology: MC (multi-steps), k-means, extended reduce Chi2
  - Strong suppression of nucleon strange PDF
- **Future**
  - Inclusion of jets
  - Inclusion of Tevatron W/lepton asymmetry
  - Inclusion of LHC W/Z and W+c data