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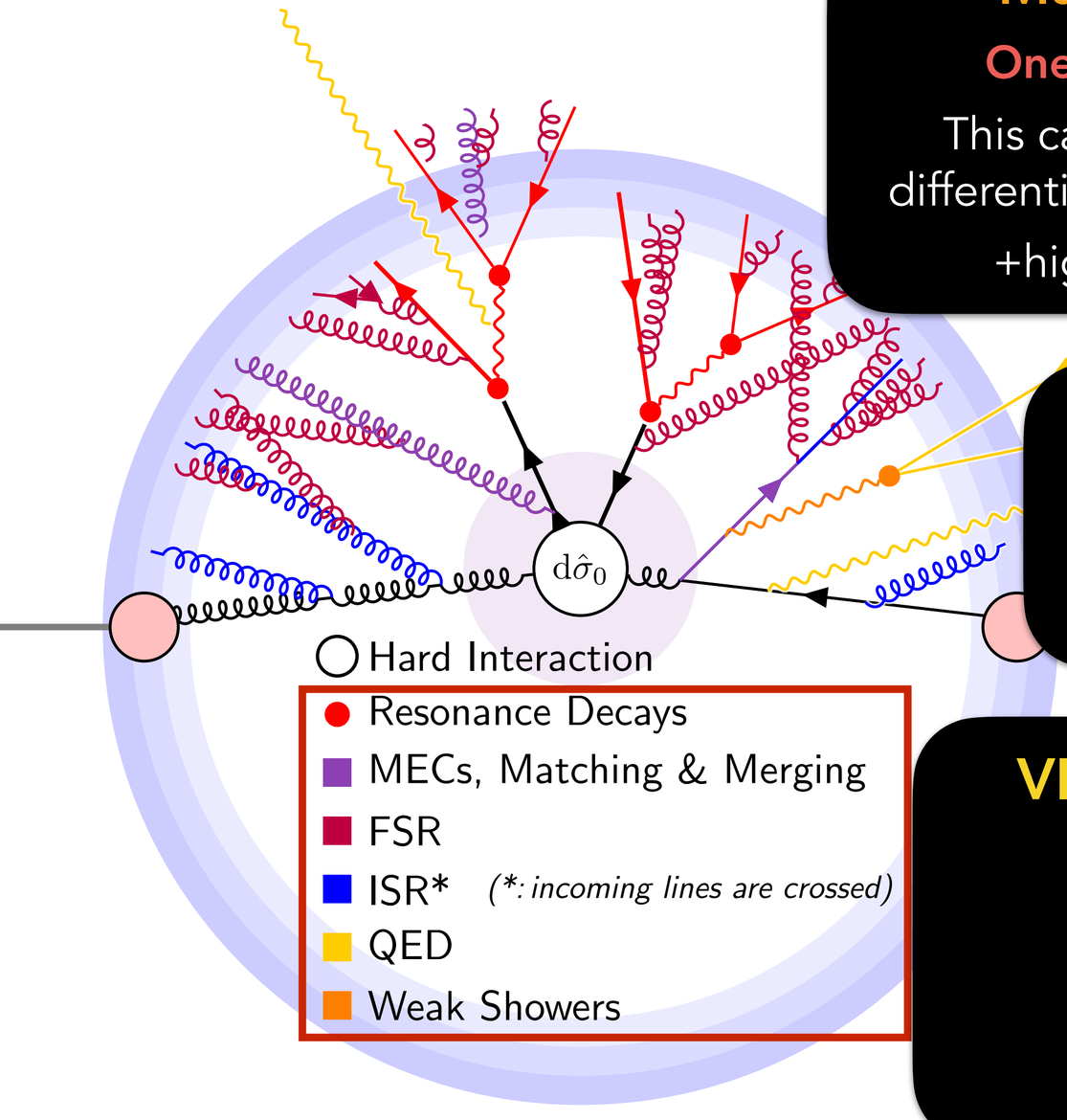
1: **Parton-Level** MC Models



Main Project: VINCIA sector showers [with C. Preuss]

One shower history instead of a factorial number [Villarejo & PS, '11]

This can be exploited to formulate comparatively simple and fully-differential ME+PS matching/merging strategies at LO, NLO, NNLO, …

+highly efficient: may even be ***faster than pure fixed order?***

VINCIA Resonance Decays [Brooks, PS, Verheyen, '19, '22]

New treatments of unstable particles: **Resonance-Final (RF) Showers** (initial-final coherence) and **Interleaved Resonance Decays** (decays as ~ shower branchings)

VINCIA QED (& Weak) Showers [Brooks, PS, Verheyen, '20, '22]

Unique **QED multipole** antenna shower [Verheyen & PS, '20]
(**all** soft & collinear limits whereas YFS captures only soft)

+ can be **interleaved** with QCD and/or resonance decays

Now considering applications to **QED in B decays**
[with LHCb / Warwick]

THE ROYAL SOCIETY
THE UNIVERSITY OF WARWICK
VINCIA
Australian Government
Australian Research Council
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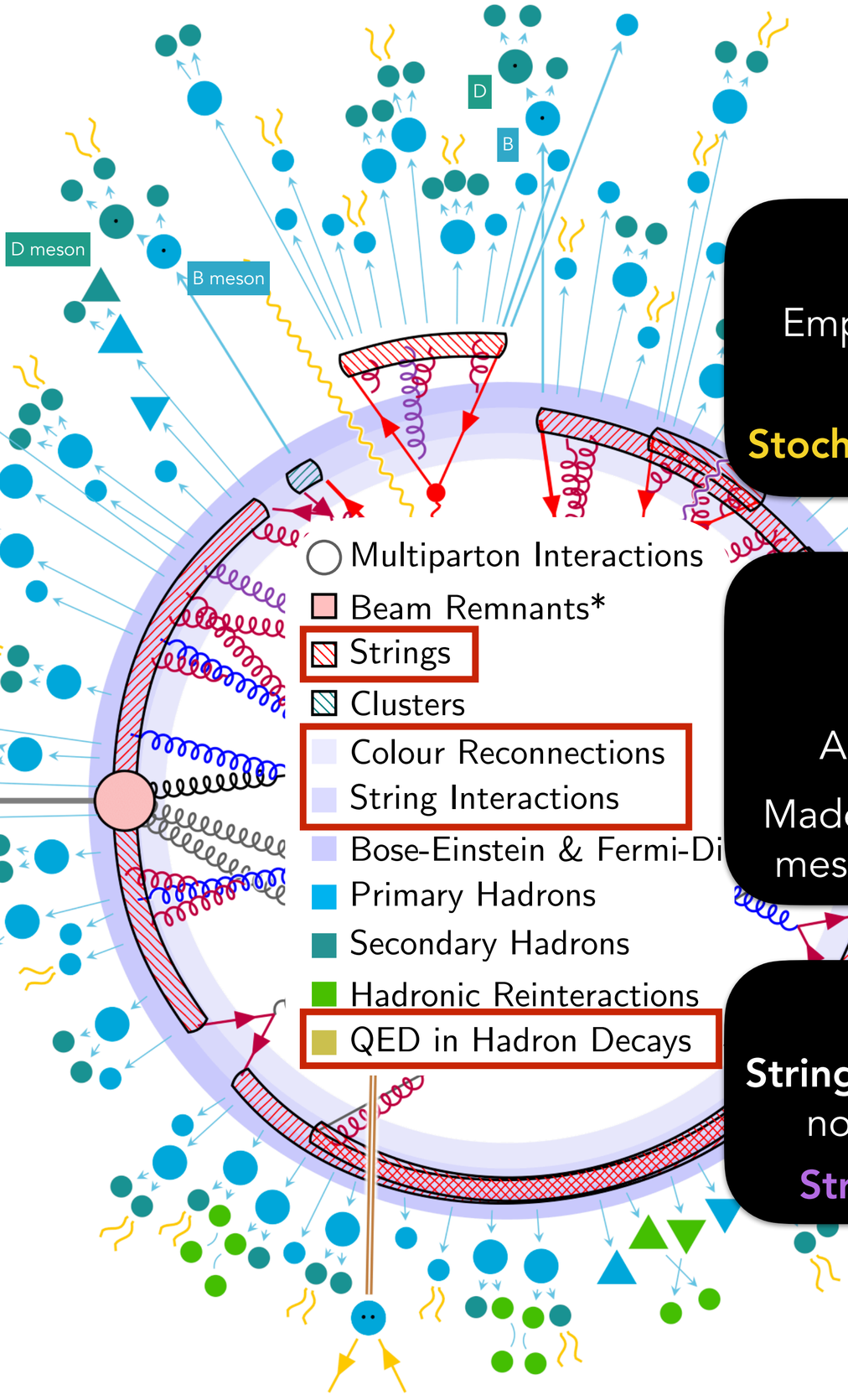
2: Hadron-Level MC Models



Colour Reconnections

Empirically known since ~ 80[s] to be important for Min-Bias/Underlying-Event description (*e.g.*, $\langle p_\perp \rangle (n_{\rm ch})$). Many models over the years.

Stochastic sampling of SU(3) correlations at end of shower [Christiansen & PS, '15]

String Junctions [with J. Altmann]

Y-shaped string topologies [Sjöstrand & PS, '02]

Arise naturally in QCD-CR model, e.g., according to $3 \otimes 3 = 6 \oplus \bar{3}$

Made a prediction of factor-10 enhancements in heavy-flavour baryon-to-meson ratios at LHC. Observed by ALICE! arXiv:2011.06079 arXiv:2106.08278

String Dynamics [with J. Altmann]

Strings with modified tension: invariant-time dependence (cooling down), non-trivial backgrounds / higher-representations (Casimir scaling), …

String-string interactions in momentum space: repulsion / attraction