What To take Home? or: What do I take Home?

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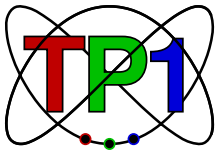


FCNLB II in 2019

Conclusions and Outlook

- Symmetry methods important for SM-parameter extractions
  - Precision extractions typically avoid direct calculation
  - Future challenge in non-leptonic B decays
- Smallness of NP poses new challenges to CPV interpretation
- Correlations and small effects in exp. data important
- New data show importance of previously neglected contributions
  - Precise measurements of rare modes feed back into theory
- Reparametrization invariance necessitates dynamical input
- Understanding SU(3) breaking essential for reducing uncertainties
  - Several hierarchies complicate analysis
  - Data-driven determination possible to some extent
- $b \to c\bar{c}s$: precision analysis of $\phi_{d,s}$ possible, SU(3) breaking critical
- $B \to PP$: $B \to \pi\pi$ and $B \to \pi K$ indicate missing contributions

  - QCD understanding critical for NP sensitivity!

(M. Jung)

QCD-Factorization / PQCD

... this I leave to Sebastian Jäger ....

Light Cone Sum Rules

- wish list (experiment):
  - more accurate measurements of pion and kaon form factors,
  - $B \to \gamma \ell \nu_\ell$
  - slope of $B \to \pi \ell \nu_\ell$, $B_s \to K \ell \nu_\ell$
  - to complete the observables in $B \to PP$
- wish list (theory):
  - B-meson DA, updated QCD SR estimates λ_B, $\lambda_{E,H}$, λ_{B_s} and other parameters
  - dipon and dikaon DAs
  - a method 2 for nonleptonic amplitudes?
  - B_c form factors

(A. Khodjamirian, Discussion: D. van Dyk)

A personal Comment:

LCQCD Sum Rule Estimates will become more important again

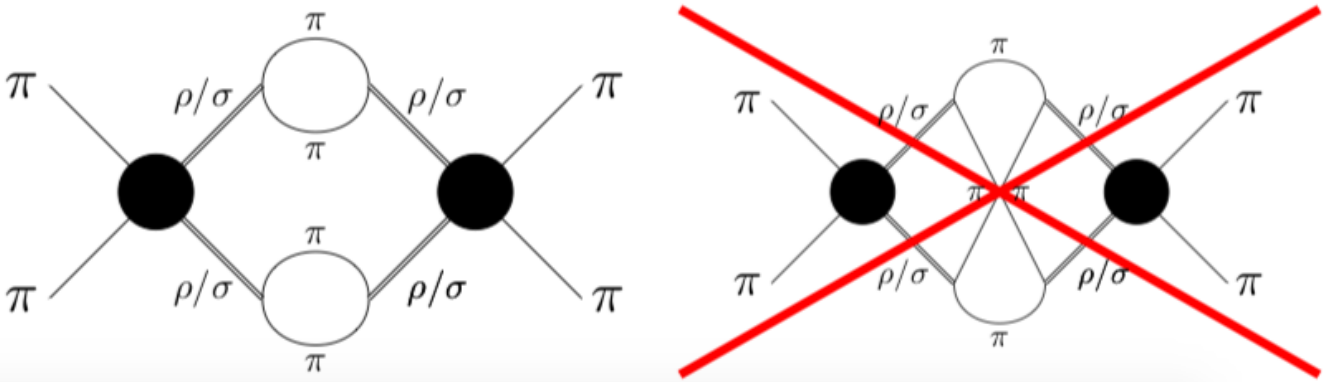
- Inverse Moment estimates
- B_c Form Factors
- Estimating Power Corrections in QCDF
- Multibody final States ??

Three (and more) body Final States

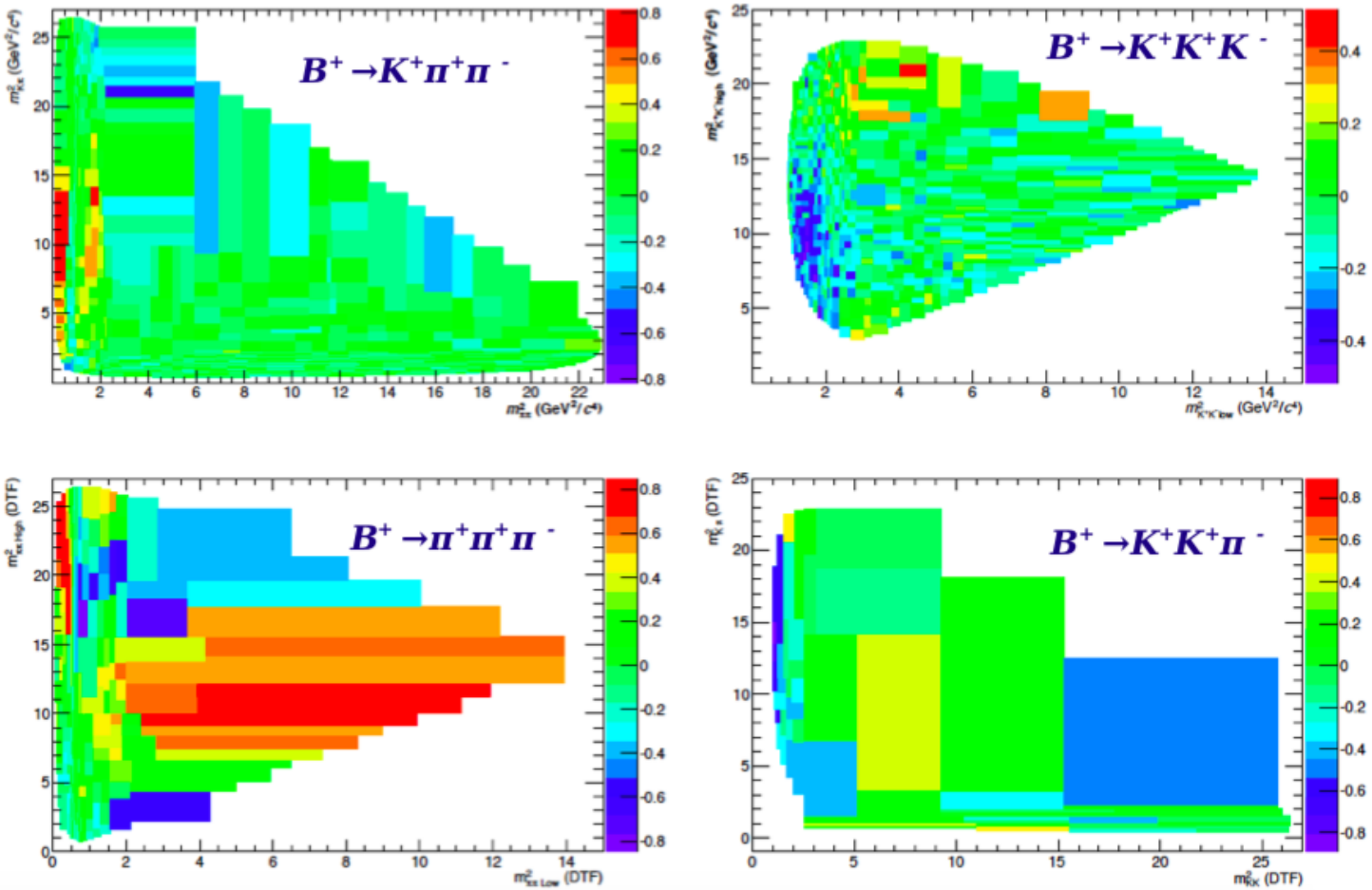
Going beyond 1 GeV: higher states and resonances

- $\pi\pi$ and $K\bar{K}$ coupled channels work up to 1.05 GeV
- beyond: strong coupling to 4π $\longrightarrow$ phase/inelasticity description??
- resonances, e.g. $\mathcal{B}(f_0(1500) \to 4\pi) = (49.5 \pm 3.3)\%$ PDG 2018
- idea: coupling to 4π *via* resonances, preserve unitarity Hanhart 2012

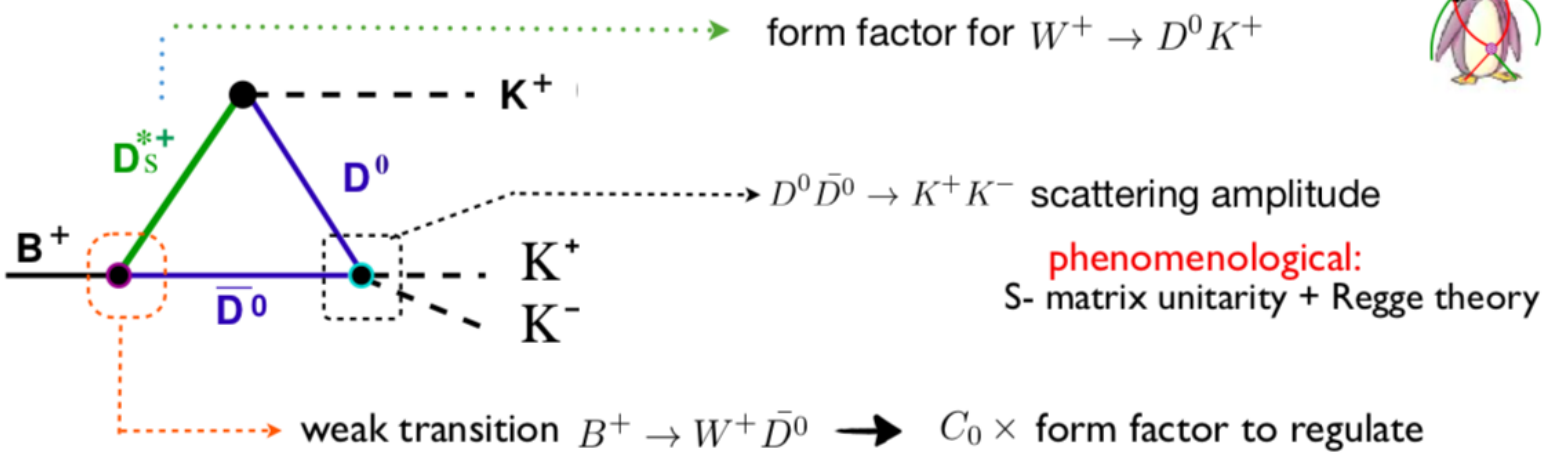
  $\longrightarrow$ Omnès at low energies, unitary isobar model above
- 4π in general very complicated; approximations:
  - vector form factor: 4π phase space only + $\pi\omega$ Hanhart 2012
  - scalar form factor: isobars $\rho\rho$ or $\sigma\sigma$ Ropertz, Hanhart, BK 2018
- neglect crossed-channel effects, other channels



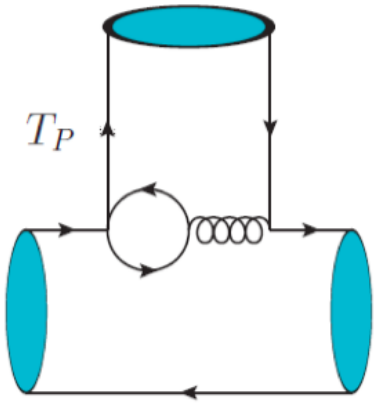
(B. Kubis)



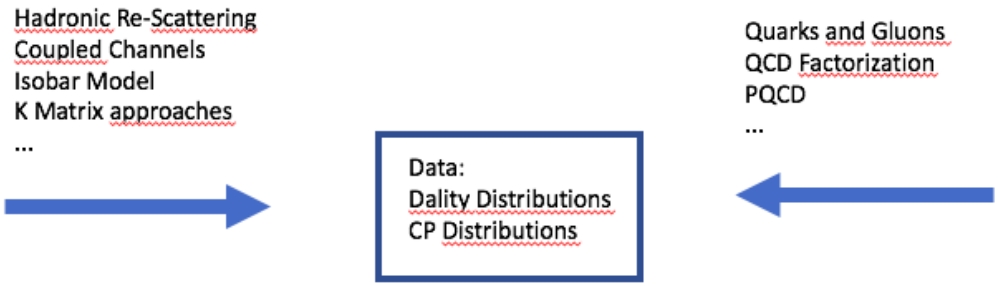
(I. Bediga)



(P. Magalhaes)



Duality of the Charm Loop with the hadronic picture?



- Modelling is currently unavoidable
- Beautiful Fits to data (Miranda, Diaz, ...)

A remark on fitting:

- Effective Hamiltonian

$$H_{\text{eff}} = O_1 + O_2 e^{i\gamma}$$

- Take the matrix element

$$\langle \pi\pi\pi | H_{\text{eff}} | B^+ \rangle = \mathcal{A}_1(s_{12}, s_{23}) + \mathcal{A}_1(s_{12}, s_{23}) e^{i\gamma}$$
$$\langle \overline{\pi\pi\pi} | H_{\text{eff}} | B^+ \rangle = \mathcal{A}_1(s_{12}, s_{23}) + \mathcal{A}_1(s_{12}, s_{23}) e^{-i\gamma}$$

- Fitting $\mathcal{A}_1$ and $\mathcal{A}_2$ for γ fixed may give better insights into QCD dynamics.

Prospects

- Increase in precision for two/body decays: QCD Corrections, Inverse moments, Power Suppressed terms
- Three or more body decays: Close the gap!!
- Experimental Prospects are very good (Gershon)

Thank You for Comming

Have a safe trip home