Heavy-Quark Expansion Matrix Elements session
Discussion kickoff

- ❑ General theoretical issues

✓ HQE on lattice:

Power divergences in perturbative renormalization (Sommer's talk)

$$\Delta c_k \sim g_0^{2(l+1)}\, a^{-p} \sim a^{-p}\,[\ln(a\Lambda)]^{-(l+1)} \xrightarrow{a\to 0} \infty$$

(see presentation by Sommer and Kronfeld)

✓ Errors assessment on Lattice (FLAG? General consensus?)

✓ Renormalons

Perurbative series are plagued by renormalon ambiguities, same order as the contribution from the condensate: calculating coefficient function to sufficiently high orders in perturbation theory as to make the uncertainty of the same order or smaller than the relevant power corrections

Martinelli-Sachrajda hep-ph/9605336

Lattice can overcome problem (by different way of subtraction)

Kronfeld hep-lat/0310063

Has a general consensus been reached? (separation of scales, renormalon.free schemes…)

✓ Duality violation (Turczyk talk)

quark level calculation at least approximate hadronic rates

= in HQE all possible sources of corrections to the parton picture stemming from QCD itself are properly accounted for

=whether a reaction can be treated by the OPE

Resonance physics (related to confining properties of QCD): exponentially suppressed contributions in the Euclidean →pure oscillations upon continuation to Minkowski kinematics

Example: two point current current correlation function not fully determined by its singularities at x2=0

$$\frac{1}{x^2+\rho^2}$$

In the Euclidean falls off as $e^{-Q\rho}$ →
upon analytic continuation Sin(-E ρ) (power suppressed)

Shifman, hep-ph/0009131;
Bigi, Uraltsev, hep-ph/0106346

- Duality Violation [Shifman, hep-ph/0009131]
  1. In Instanton model suppressed by $1/m_b^3$
  2. Supposedly will result in inconsitent fit $\Rightarrow$ Currently not observed

Turczyk talk

we expect duality violation to affect $\Gamma_{\rm sl}(B)$ only at a permill level.

Bigi, Uraltsev, hep-ph/0106346

It applies only to the totally integrated sl widths; cuts affect conclusions?

Strategies:
Observables that are doable (and comparable) in different methods?

Higher orders give consistent results?
(Lowest-lying state saturation ansatz (LLSA): about 50% error Heinonen, Mannel, hep ph/1407.4384

Possible a unified description (less model dependency?)

❑ More technical questions (courtesy of S. Turczyk)

1.) How would one treat the errors of Higher Orders theoretically: Gaussian, Box, and their correlation

2.) How should one treat the theoretical errors in respect to experimental one. This influences the fit and also the combination of errors.

3.) How should we include the higher orders
(Suggestions about fitting the higher orders)
Currently taking the estimate as a central value, and float these within a given uncertainty. Try to get the most important parameters from the corresponding observables additionally out of the fits.

5.) Is there maybe a way using the estimate of the higher order parameters to obtain the size of the hadronic tensor for a higher dimension
-> One would not need to compute the observables and include that in the fit, but rather take this as an indicator for the residual uncertainty?