HVP Discussion

Gilberto Colangelo

b
UNIVERSITÄT
BERN

AEC
ALBERT EINSTEIN CENTER
FOR FUNDAMENTAL PHYSICS

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Comparison between DHMZ19 and KNT19

	DHMZ19	KNT19	Difference
$\pi^+\pi^-$	507.85(3.38)	504.23(1.90)	3.62
$\pi^+\pi^-\pi^0$	46.21(1.45)	46.63(94)	−0.42
$\pi^+\pi^-\pi^+\pi^-$	13.68(0.30)	13.99(19)	−0.31
$\pi^+\pi^-\pi^0\pi^0$	18.03(0.55)	18.15(74)	−0.12
K^+K^-	23.08(0.44)	23.00(22)	0.08
$K_S K_L$	12.82(0.24)	13.04(19)	−0.22
$\pi^0\gamma$	4.41(0.10)	4.58(10)	−0.17
Sum of the above	626.08(3.90)	623.62(2.27)	2.46
$[1.8, 3.7]\,\mathrm{GeV}$ (without $c\bar{c}$)	33.45(71)	34.45(56)	−1.00
J/ψ, $\psi(2S)$	7.76(12)	7.84(19)	−0.08
$[3.7, \infty)\,\mathrm{GeV}$	17.15(31)	16.95(19)	0.20
Total $a_\mu^{\mathrm{HVP,\,LO}}$	694.0(4.0)	692.8(2.4)	1.2

2π: comparison with the dispersive approach

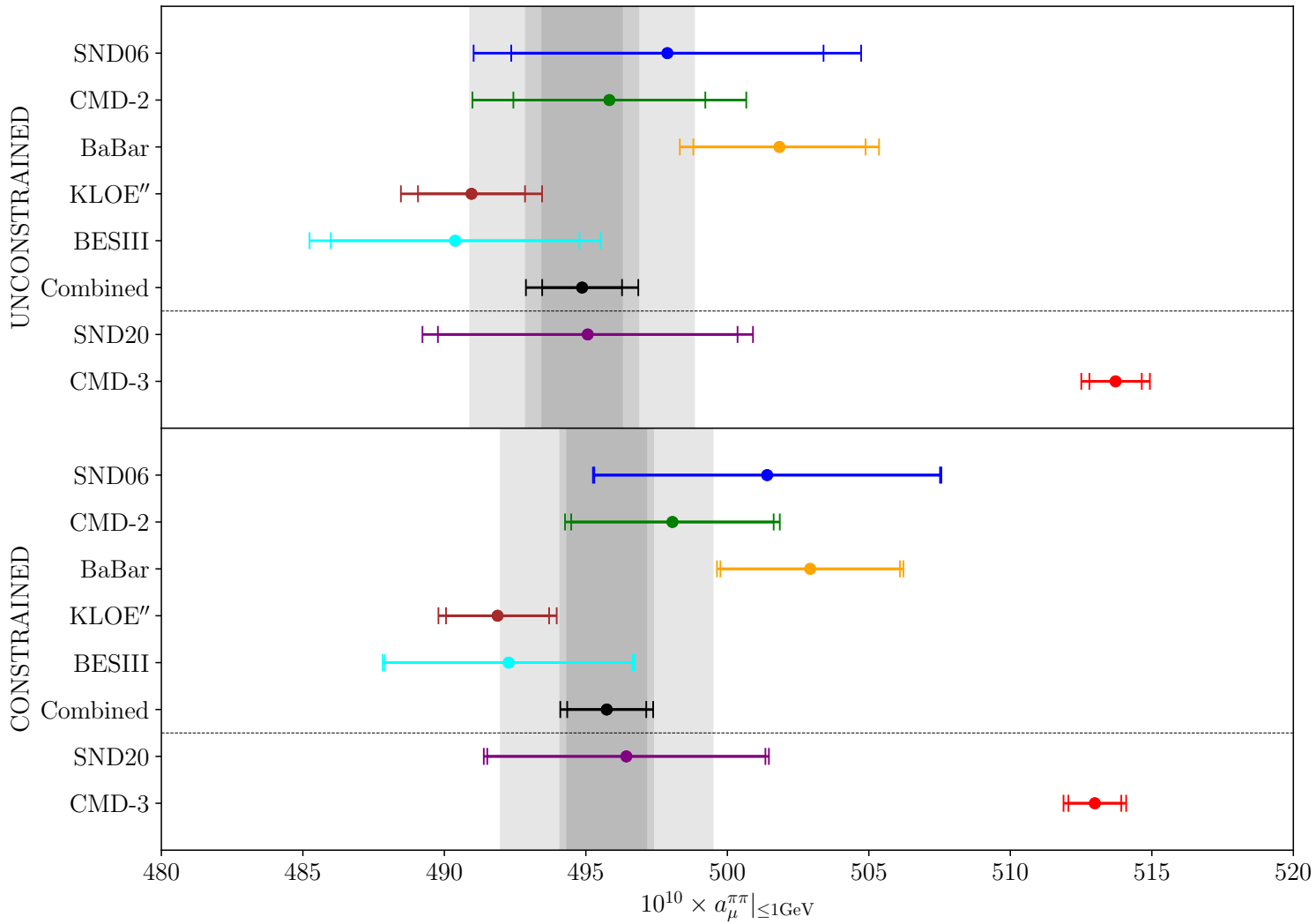
2π channel described dispersively $\Rightarrow$ more theory constraints

Ananthanarayan, Caprini, Das (19), GC, Hoferichter, Stoffer (18) WP(20)

Energy range	CHS18	DHMZ19	KNT19
$\leq 0.6\,\mathrm{GeV}$	110.1(9)	110.4(4)(5)	108.7(9)
$\leq 0.7\,\mathrm{GeV}$	214.8(1.7)	214.7(0.8)(1.1)	213.1(1.2)
$\leq 0.8\,\mathrm{GeV}$	413.2(2.3)	414.4(1.5)(2.3)	412.0(1.7)
$\leq 0.9\,\mathrm{GeV}$	479.8(2.6)	481.9(1.8)(2.9)	478.5(1.8)
$\leq 1.0\,\mathrm{GeV}$	495.0(2.6)	497.4(1.8)(3.1)	493.8(1.9)
$[0.6, 0.7]\,\mathrm{GeV}$	104.7(7)	104.2(5)(5)	104.4(5)
$[0.7, 0.8]\,\mathrm{GeV}$	198.3(9)	199.8(0.9)(1.2)	198.9(7)
$[0.8, 0.9]\,\mathrm{GeV}$	66.6(4)	67.5(4)(6)	66.6(3)
$[0.9, 1.0]\,\mathrm{GeV}$	15.3(1)	15.5(1)(2)	15.3(1)
$\leq 0.63\,\mathrm{GeV}$	132.8(1.1)	132.9(5)(6)	131.2(1.0)
$[0.6, 0.9]\,\mathrm{GeV}$	369.6(1.7)	371.5(1.5)(2.3)	369.8(1.3)
$\left[\sqrt{0.1}, \sqrt{0.95}\right]\,\mathrm{GeV}$	490.7(2.6)	493.1(1.8)(3.1)	489.5(1.9)

Comparison between CMD-3 and other experiments

Leplumey and Stoffer, arXiv:2501.09643



Comparison between CMD-3 and other experiments

Leplumey and Stoffer, arXiv:2501.09643

Discrepancy w/ CMD-3	$a_\mu^{\pi\pi}\big\vert_{\leq 1\,\mathrm{GeV}}$	
	unconstrained	constrained
SND06	2.0σ	1.8σ
CMD-2	3.3σ	3.7σ
BaBar	2.9σ	2.8σ
KLOE″	7.4σ	8.9σ
BESIII	4.2σ	4.5σ
SND20	3.0σ	3.2σ
Combination	4.4σ [7.3σ]	4.4σ [8.1σ]

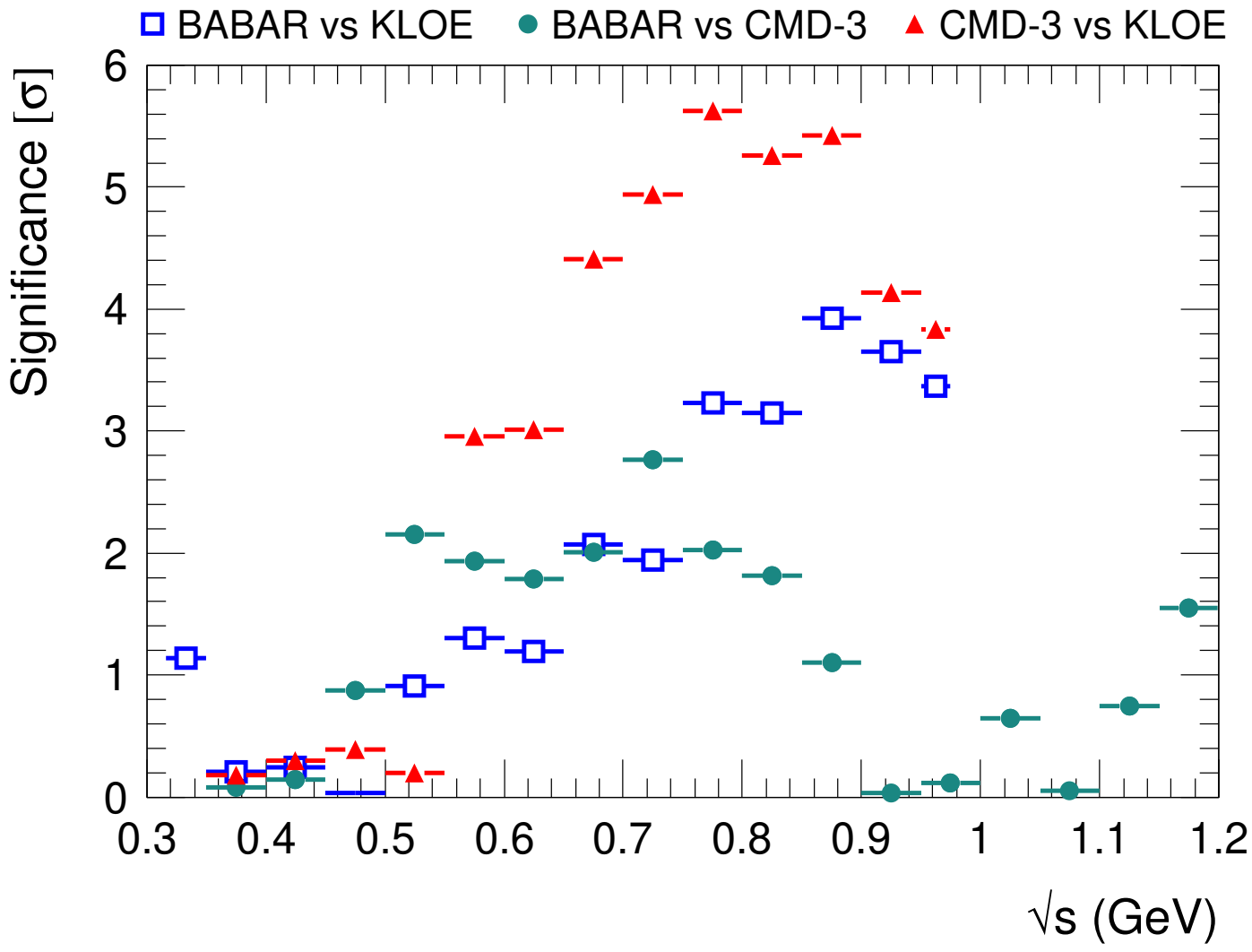
Uncertainties in brackets exclude KLOE-BaBar systematic eff.

Combination: NA7 + all data sets other than SND20 and CMD-3

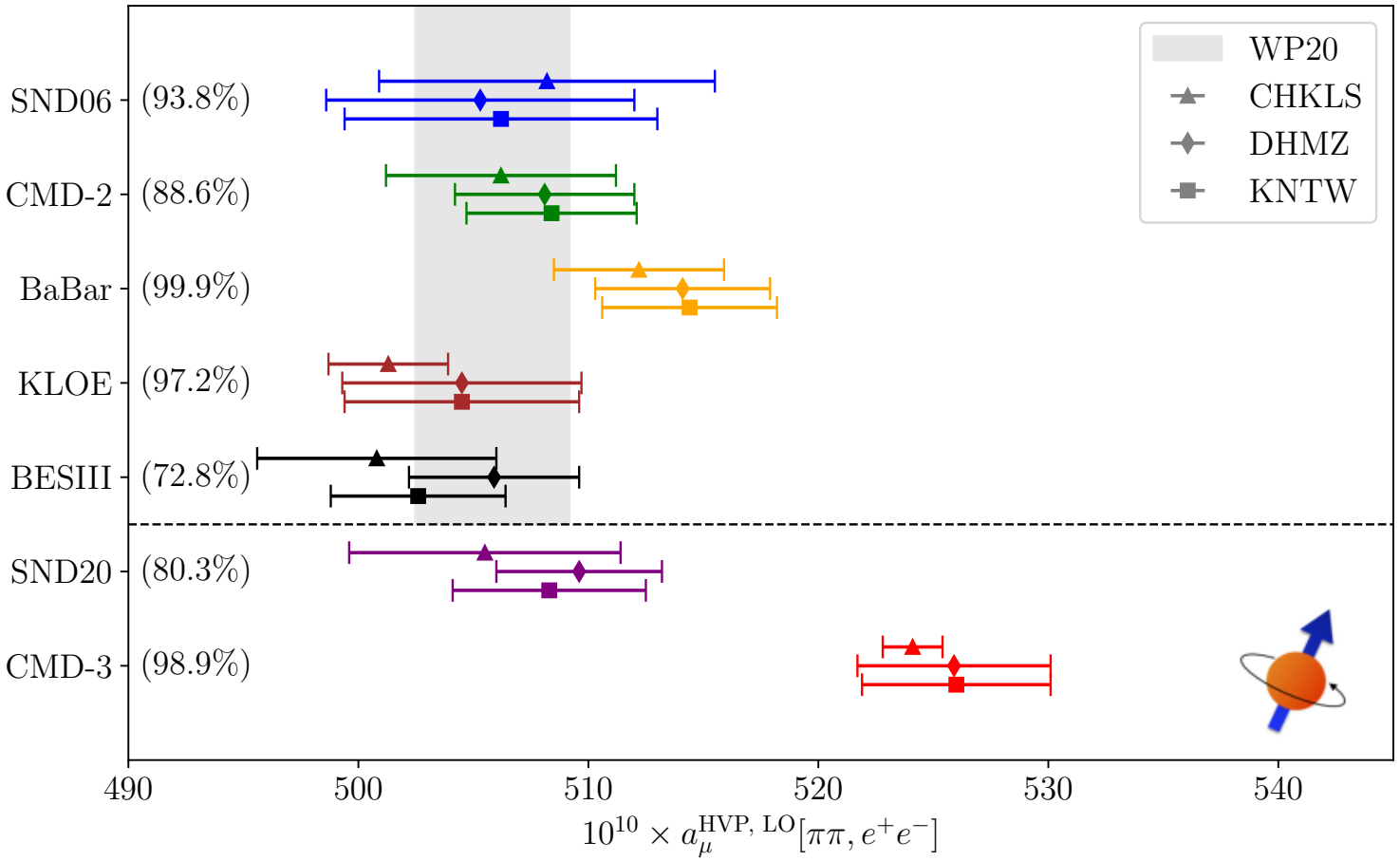
Comparison between CMD-3 and other experiments

Comparison according to DHLMZ

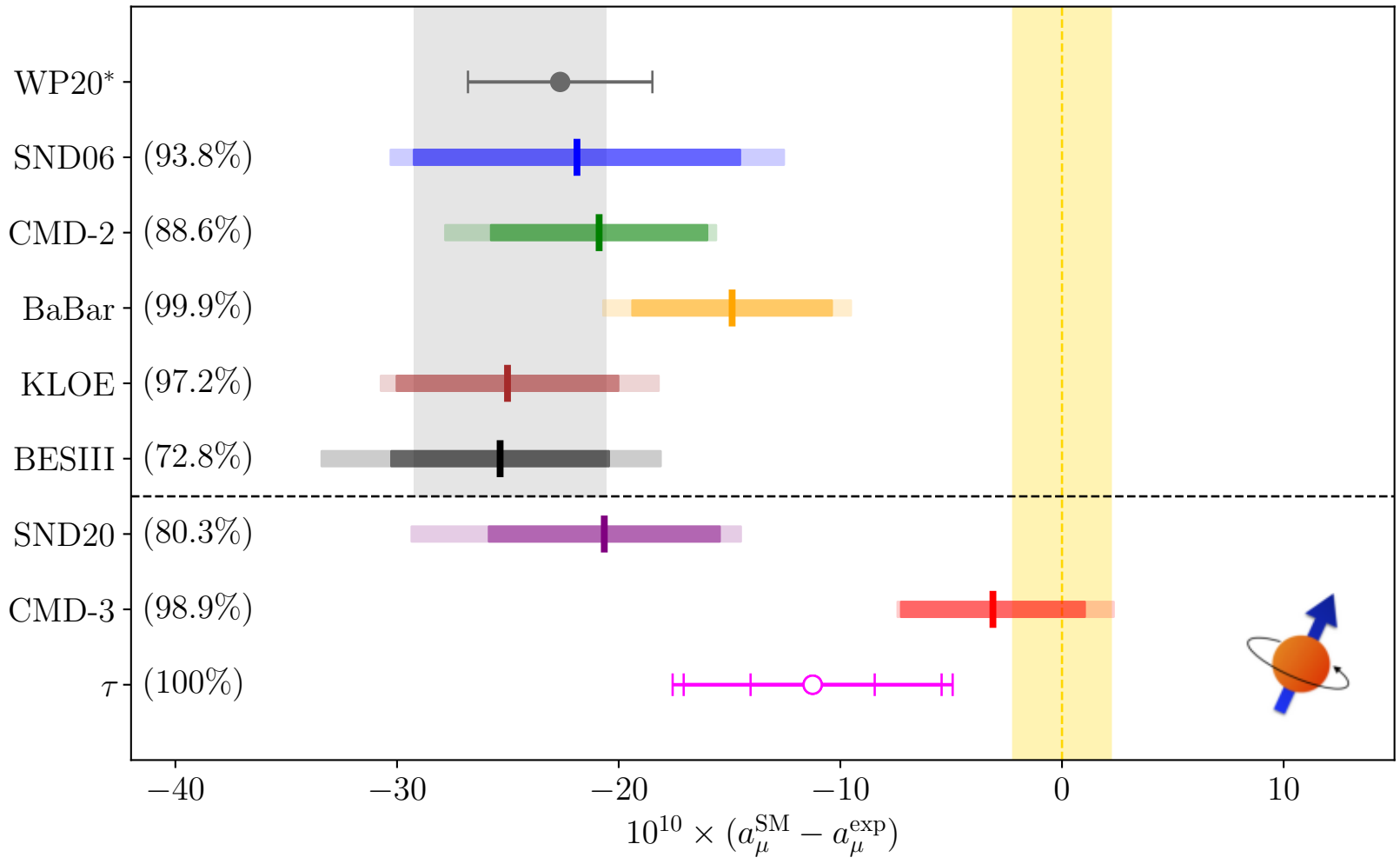
Davier, Hoecker, Lutz, Malaescu, Zhang (23)



Comparison between different e^+e^- experiments



Comparison between e^+e^-- and τ-based HVP



My (incomplete) list of discussion points

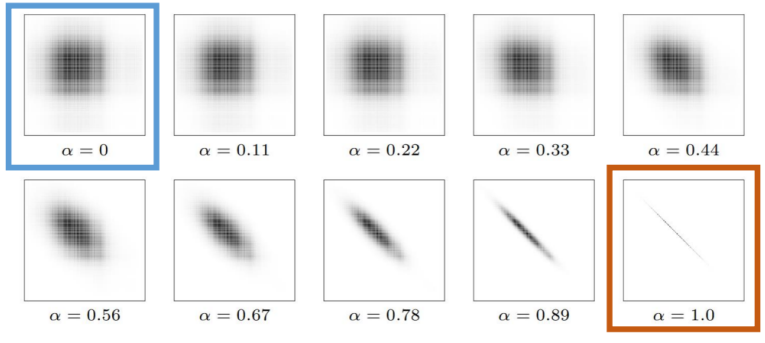
1. How to improve on systematic covariance matrices?
2. Are there particular aspects of the integration method, be it for a particular channel or region, where one way of doing it has clearly shown to be better than other and should be adopted by all groups?
3. Or viceversa things that should be avoided?
4. What channels need a dedicated discussion beyond the 2π channel? The 3π channel, for example?
5. Any need to update, revisit the high-energy part? ($\rightarrow$ Diogo's talk)
6. New insights for what concerns the treatment of radiative channels/corrections?

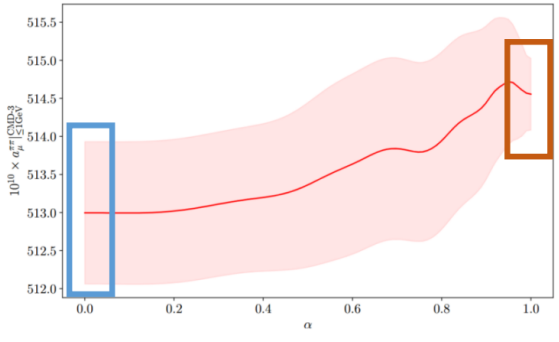
Thomas' slides on exp. covariance matrices

COMMENT ABOUT THE DATA CORRELATIONS OF CMD-3

- Some concerns have been raised about the impact of **correlations in CMD-3 data**
  - For **direct integration**, **fully correlated covariance** is clearly the **most conservative**
  - However, it is less clear *a priori* whether this choice is conservative or not in our framework

- In our last analysis, we implemented a "decorrelation scheme" to evaluate this:





Leplumey, Stoffer, arXiv:2501.09643

- Smaller correlations lead to **higher value of $a_\mu^{\pi\pi}$** and **smaller uncertainty**!
  - Full correlations allow global scale effects → analyticity constraints seem to pull the VFF down
  - Zero/negative correlations constrain the fit to be closer to the central values of the data points

Thomas' slides on exp. covariance matrices

COMMENT ABOUT THE DATA CORRELATIONS OF CMD-3

- To assess this issue, we tried **tuning the covariance *a posteriori*** to get the largest posterior uncertainty in $a_\mu^{\pi\pi}$ ($\rightarrow$ expected to be the most conservative choice)

$$\mathrm{Corr}(\sigma_i, \sigma_j) = \mathrm{sign}\left(\frac{\partial a_\mu^{\pi\pi}}{\partial \sigma_i} \times \frac{\partial a_\mu^{\pi\pi}}{\partial \sigma_j}\right)$$

- However, the *a posteriori* conservative covariance **depends on the starting point**
  - Starting from the fully correlated best-fit point, the conservative option is consistently the fully correlated covariance matrix
  - Starting from the uncorrelated best-fit point, the conservative option contains **anti-correlations** between different energy regions, but **the overall uncertainty remains smaller**

- Without a clear prescription yet, we decided to **stick to the full corr. prescription**
  - This makes the interpretation and comparison with other results easier
  - This choice **does not overestimate the discrepancy** with other experiments