Pi0 efficiency with D->KSpi0?

From last PGM (Koga-san)

π0 efficiency measurements with MC14

π0 momentum (GeV)	0.2-1.0	0.2-3.0	0.4-5.0	0.2-4.5
signal mode	η→3π0	D→Kππ0	τ→3ππ0ν	$\omega\gamma_{ISE}$, ω→πππ0
reference mode	η→γγ	D→Kπ	τ→3πν	--(tag and probe)
output	$\varepsilon_{data}/\varepsilon_{MC}$	$\varepsilon_{data}/\varepsilon_{MC}$	$\varepsilon_{data}/\varepsilon_{MC}$	$\varepsilon_{data},\varepsilon_{MC},\varepsilon_{data}/\varepsilon_{MC}$
bin	single bin	momentum	momentum	momentum
multiplicity	high	high	low	low
analyzer	Koga	Koga	Zuzana	Mirra
status	**accepted**	**accepted**	writing B2N thesis	writing B2N
precision	~4% (PDF model)	~4%(D decay BR)	~2%	not yet (?)

π0 momentum (GeV)	0.05-0.2	0.05-0.2
signal mode	B→D*π	B→D*π
reference mode	--	-- (tag and probe)
output	$\varepsilon_{data}/\varepsilon_{MC}$	$\varepsilon_{data},\varepsilon_{MC},\varepsilon_{data}/\varepsilon_{MC}$
bin	single bin	momentum-theta
multiplicity	high	high
analyzer	Koga	Dey
status	**accepted**	writing B2N
precision	~5% (stat.)	~5%(stat.) not yet (?)

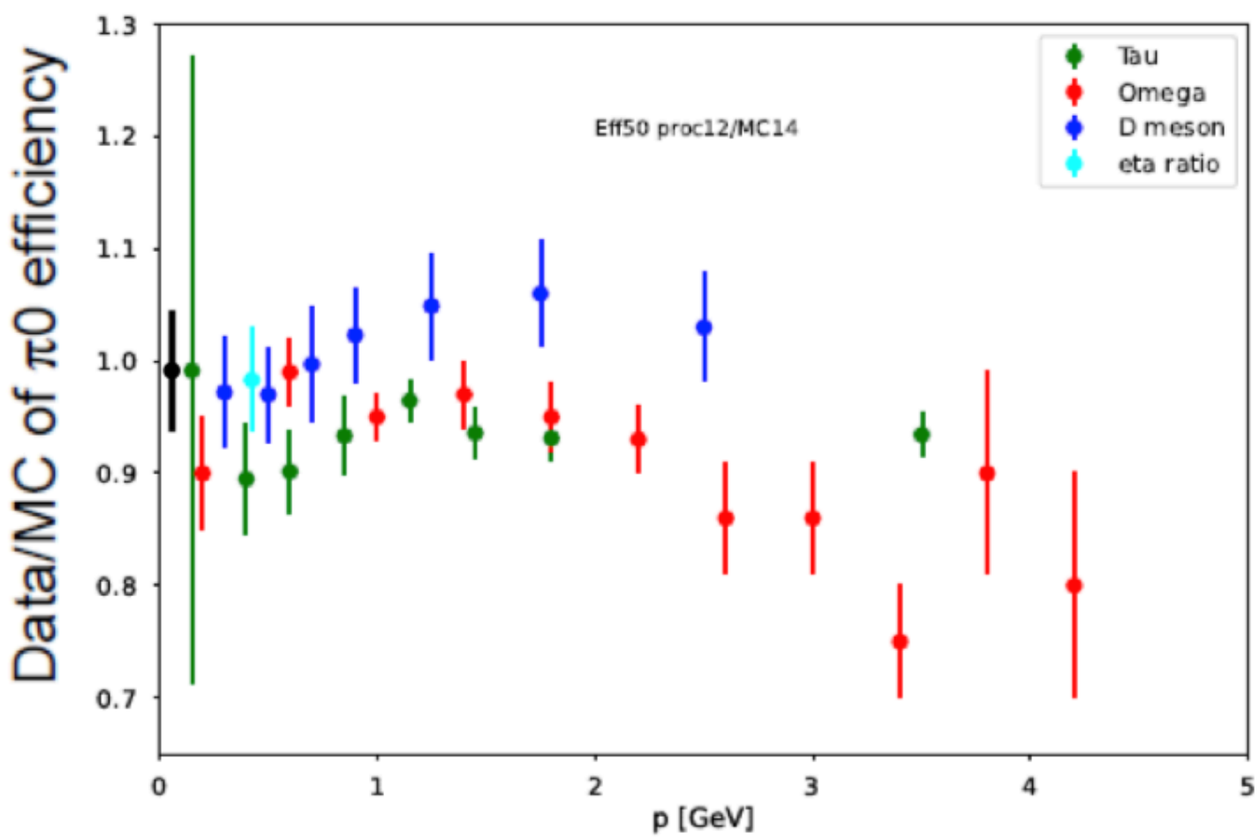
From last PGM (Koga-san)

Comparison of measurements

-(Need to finalize all results with internal review for reliable comparison)

-~2σ tension is seen at high momentum region

- -We are discussing the reason but no conclusion yet.
- -If your physics channel is useful to validate this difference, please let us know. You can test different corrections.



-τ

-ω

-D

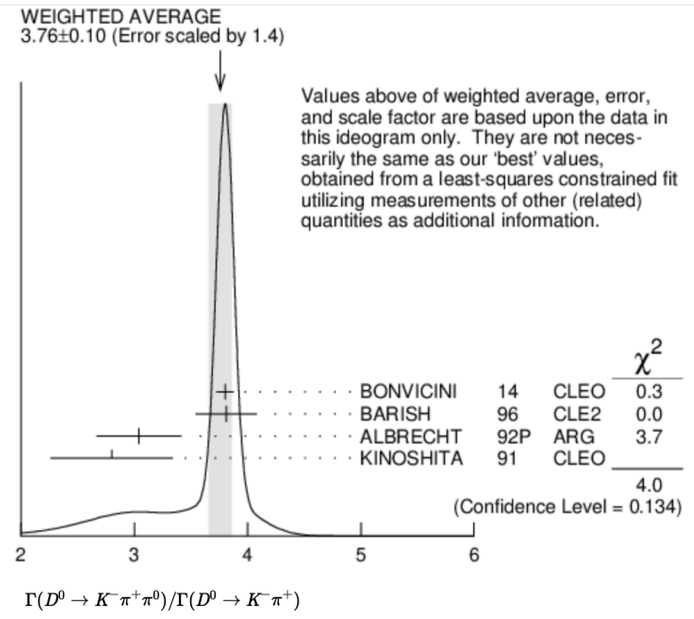
-η

-B->πD*

Issue with Kpipi0?

- D efficiency dominated by irreducible 3.6% uncertainty on BR(Kpipi0)/BR(Kpi). Tension due to a bias on the BR?
  If using only CLEO last result, the efficiency is ~4% lower…

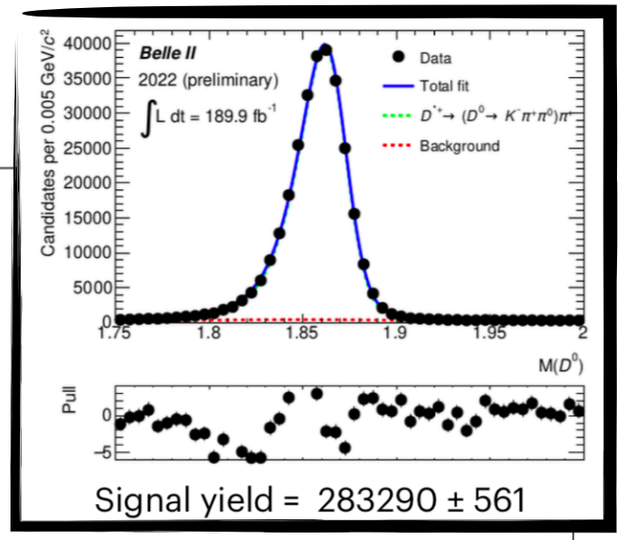
VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
3.65 ± 0.13	**OUR FIT** Error includes scale factor of 2.1.			
3.76 ± 0.10	**OUR AVERAGE** Error includes scale factor of 1.4.	See the ideogram below.		
3.802 ±0.022 ±0.073		BONVICINI	2014	CLEO
3.81 ±0.07 ±0.26	10k	BARISH	1996	CLE2
3.04 ±0.16 ±0.34	931	[1] ALBRECHT	1992P	ARG
2.8 ±0.14 ±0.52	1050	KINOSHITA	1991	CLEO

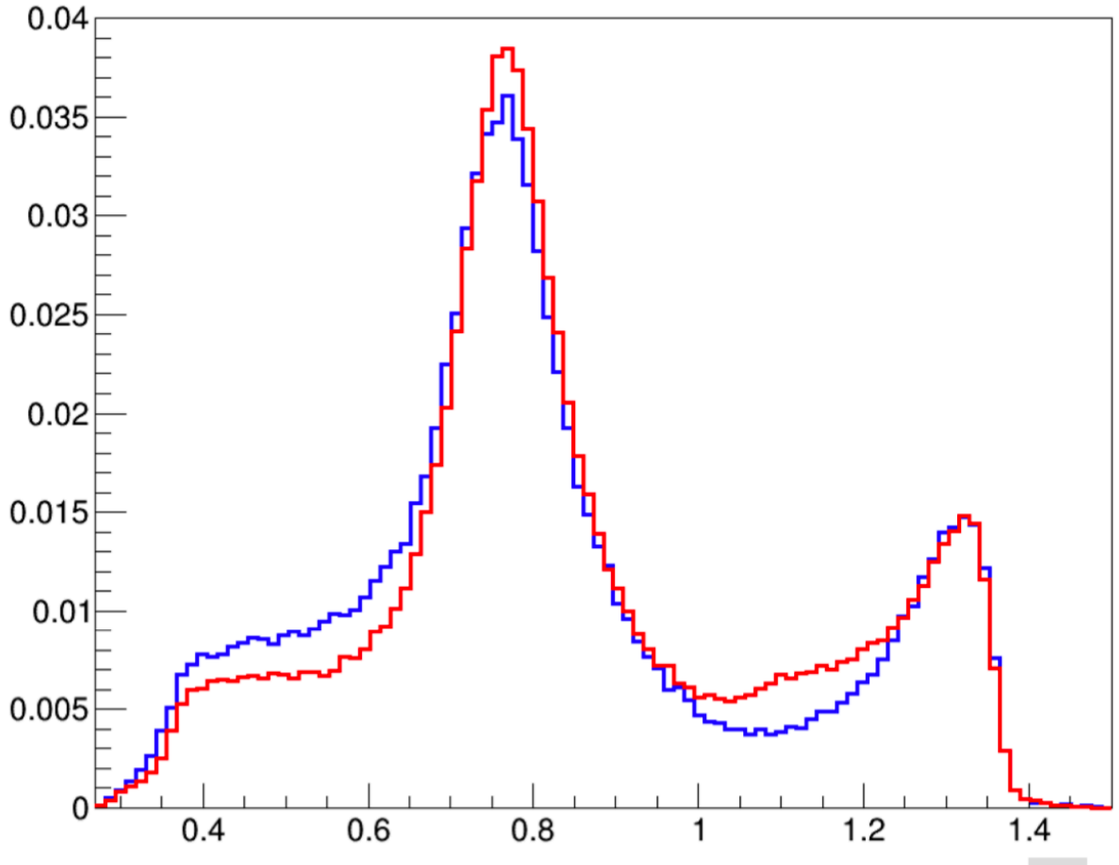


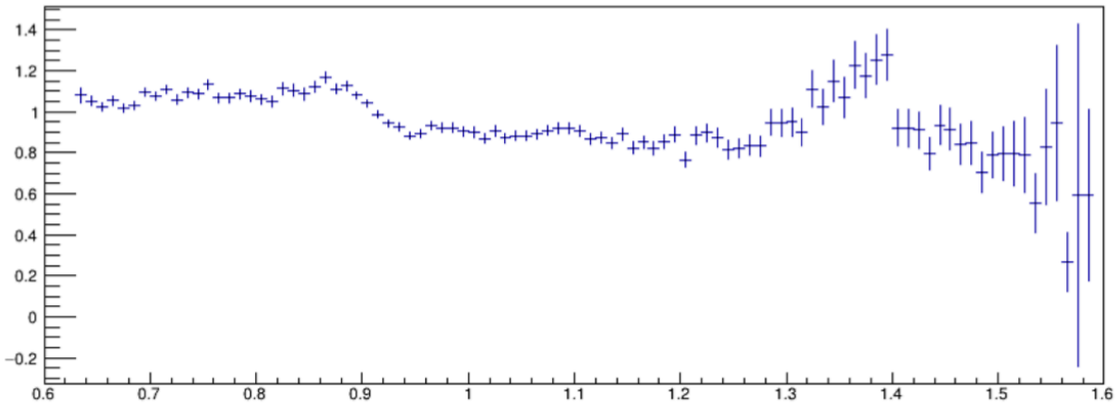
- Another source of MC/data difference is Dalitz modelling:
  - how can we disentangle resonances mis-modelling and Dalitz-dependent pi0 efficiency?
  - pi0 momentum cut (bin) should sculpt the Dalitz plane

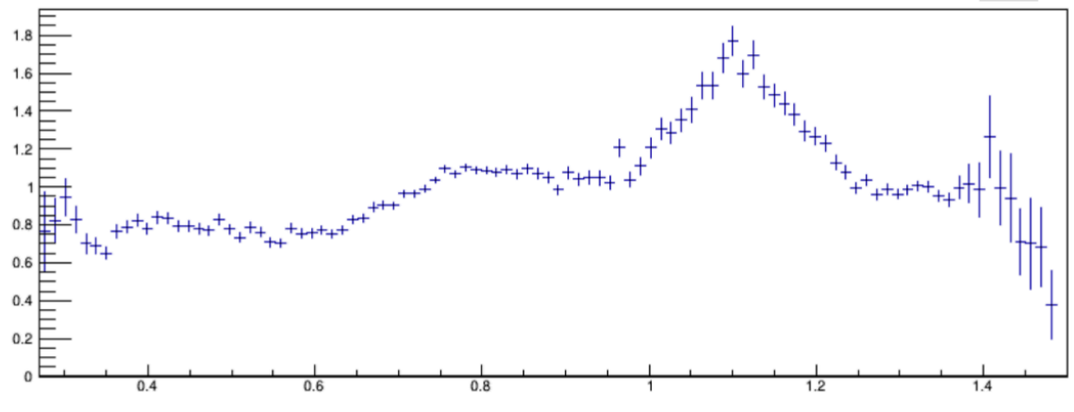
Dalitz Kpipi0 data/MC comparison

Clean Kpipi0 sample









Proposal

$$\varepsilon(\pi^0) = \frac{N(D^0 \to K_S\pi^0)}{N(D^+ \to K_S\pi^+)} \frac{N(D^+ \to K^-\pi^+\pi^+)}{N(D^0 \to K^-\pi^+)} \frac{\mathcal{B}(D^+ \to K_S\pi^+)}{\mathcal{B}(D^+ \to K^-\pi^+\pi^+)} \frac{\mathcal{B}(D^0 \to K^-\pi^+)}{\mathcal{B}(D^0 \to K_S\pi^0)}$$

2.4% + 1.9% = 3.1%

$\Gamma(D^+ \to K^0_S\pi^+)/\Gamma(D^+ \to K^-2\pi^+)$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.167 ± 0.004	**OUR FIT** Error includes scale factor of 2.4.				
0.162 ± 0.009	**OUR AVERAGE** Error includes scale factor of 4.5.				
0.171 ±0.002 ±0.002		BONVICINI	2014	CLEO	All CLEO-c runs
0.1530 ±0.0023 ±0.0016	10.6k	LINK	2002B	FOCS	γ nucleus, $\overline{E}_\gamma \approx 180$ GeV

$\Gamma(D^0 \to K^0_S\pi^0)/[\Gamma(D^0 \to K^-\pi^+) + \Gamma(D^0 \to K^+\pi^-)]$

VALUE (10^{-2})		*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
31.3 ± 0.6	**OUR FIT**					
30.4 ±0.3 ±0.9		20k	MENDEZ	2010	CLEO	e^+e^- at 3774 MeV

References:

MENDEZ	2010	PR D81 052013	Measurements of D Meson Decays to Two Pseudoscalar Mesons

- Precision not sufficient for clarifying the tension, however two-body decay for pi0, no issue with Dalitz, better suited for studies in pi0 momentum and costheta.
- Can we tune Kpipi/Kpi kinematic to cancel pi+ efficiency on KSpi+ (check kinematic overlap)?
- Still might have an issue with BR(KSpi+)/BR(Kpipi)…