

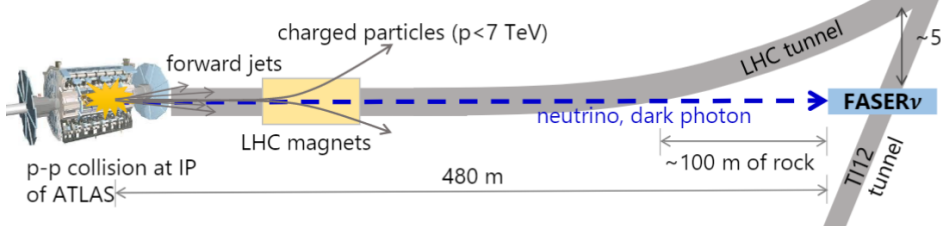
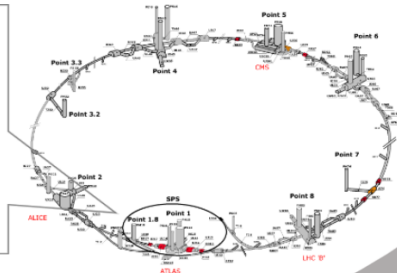
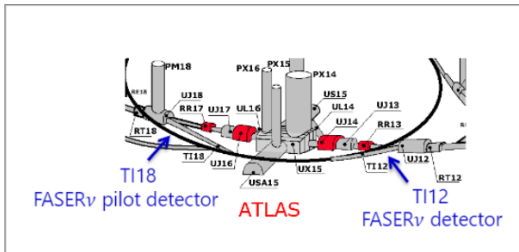


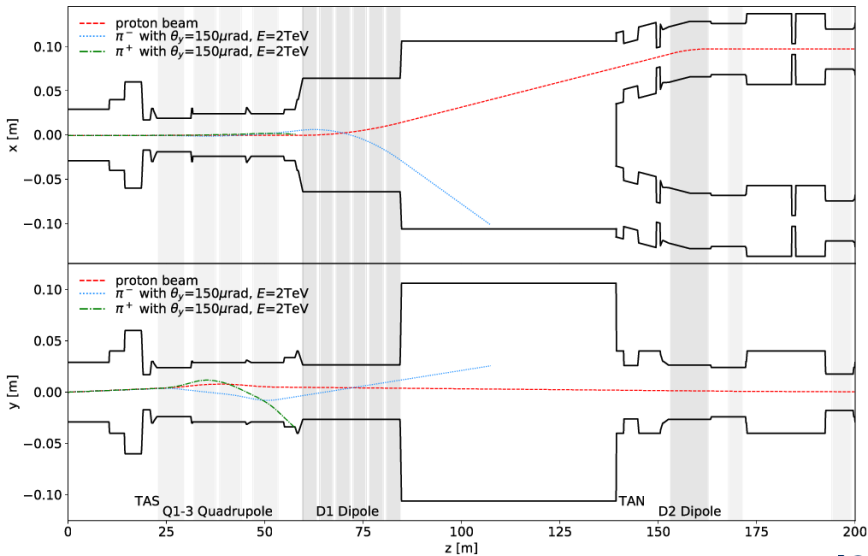
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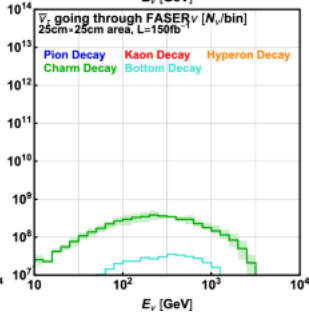
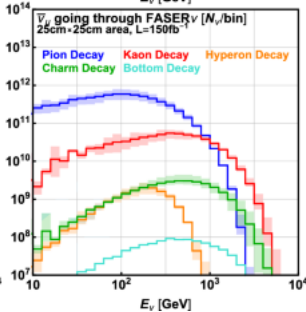
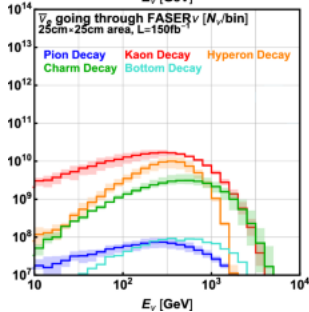
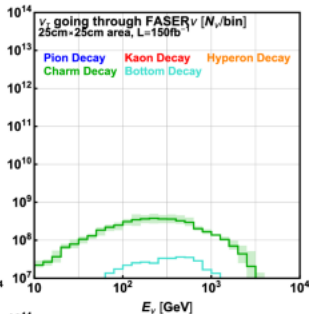
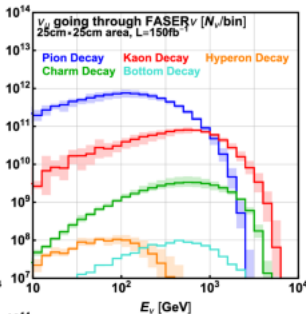
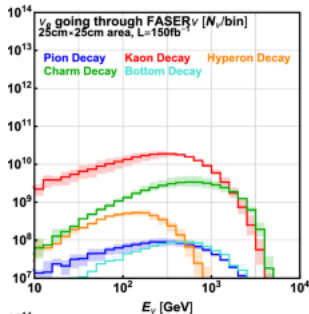
The charged Kaon Fragmentation Function

Hamed Abdolmaleki
(IPM- SoP and SoPA)

FASER ν







Kaon FFs

1 Same as Pion FFs strategy

1 Data-sets: Belle20, BaBar,

2 Parameterization form: $D_i^{K^\pm}(z, Q_0) = \frac{\mathcal{N}_i z^{\alpha_i} (1-z)^{\beta_i} [1 + \gamma_i (1-z)^{\delta_i}]}{B[2 + \alpha_i, \beta_i + 1] + \gamma_i B[2 + \alpha_i, \beta_i + \delta_i + 1]}$,
and $i = u + \bar{u}, s + \bar{s}, \dots$

3 theory calculation: (APFEL)

2 Differ on decomposition: $D_{u^+}, D_{d^+}, D_{s^+}, D_{c^+}, D_{b^+}$ and D_g

$$D_q = D_{\bar{q}} = \frac{1}{2} D_{q^+}$$

NOTE: This analysis is the same as Our Pion FFs analysis in data and methodology but defer on decomposition.



- FitA: We impose a $x > 0.02$ cut for $\sqrt{s} = M_Z$ and a $x > 0.075$ cut for other C.M
- FitB: Like FitA, We exclude Belle data.
- FitC: Like FitA, We exclude BaBar data.
- FitD: Like FitA, we impose a $x > 0.2$ cut for BaBar
- FitE: Like FitD, we impose a $x > 0.2$ cut for Belle
- FitF: We impose a $x > 0.1$ cut for BaBar and a $x > 0.2$ cut for Belle (same of FitE in our Pion Paper)



Dataset	FitA	FitB	FitC	FitD	FitE	FitF
SLD b_{tag}^k	86 / 35	121 / 35	89 / 35	90 / 35	90 / 35	89 / 35
DELPHI $_{TOT}^k$	26 / 22	18 / 22	16 / 22	17 / 22	16 / 22	20 / 22
TASSO $_{22}^k$	21 / 6	21 / 6	10 / 6	8.1 / 6	6.3 / 6	16 / 6
TPC $_{TOT}^k$	39 / 13	35 / 13	5.3 / 13	17 / 13	21 / 13	63 / 13
ALEPH $_{TOT}^k$	51 / 18	30 / 18	16 / 18	19 / 18	18 / 18	24 / 18
SLD c_{tag}^k	124 / 35	146 / 35	41 / 35	44 / 35	42 / 35	125 / 35
OPAL $_{TOT}^k$	14 / 10	16 / 10	8.8 / 10	8.5 / 10	8.7 / 10	7.3 / 10
TASSO $_{34}^k$	2.0 / 5	2.2 / 5	0.80 / 5	0.50 / 5	0.38 / 5	2.1 / 5
TASSO $_{14}^k$	18 / 9	17 / 9	15 / 9	13 / 9	14 / 9	16 / 9
TASSO $_{12}^k$	6.8 / 3	7.0 / 3	5.8 / 3	4.5 / 3	4.2 / 3	6.9 / 3
DELPHI $light_{tag}^k$	26 / 22	31 / 22	24 / 22	23 / 22	24 / 22	22 / 22
DELPHI b_{tag}^k	18 / 22	16 / 22	15 / 22	16 / 22	16 / 22	25 / 22
SLD $_{TOT}^k$	34 / 35	30 / 35	14 / 35	18 / 35	17 / 35	18 / 35
SLD $light_{tag}^k$	100 / 35	68 / 35	60 / 35	62 / 35	62 / 35	79 / 35
BABAR k	151 / 43	203 / 43	-	30 / 28	25 / 28	247 / 43
BELLE2020 k	95 / 32	-	13 / 32	102 / 32	75 / 28	98 / 28
Correlated χ^2	8.9	8.5	3.3	1.5	1.2	7.3
Log penalty χ^2	+12	+8.7	+2.8	+9.2	+9.3	+13
Total χ^2 / dof	834 / 327	778 / 295	341 / 284	483 / 312	450 / 308	877 / 323
	2.55	2.64	1.2	1.54	1.46	2.7



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TASSO $_{12}^k$	6.8 / 3	7.0 / 3	5.8 / 3	4.5 / 3	4.2 / 3	6.9 / 3
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TASSO $_{12}^k$	6.8 / 3	7.0 / 3	5.8 / 3	4.5 / 3	4.2 / 3	6.9 / 3
DELPHI light $_{tag}^k$	26 / 22	31 / 22	24 / 22	23 / 22	24 / 22	22 / 22
DELPHI b_{tag}^k	18 / 22	16 / 22	15 / 22	16 / 22	16 / 22	25 / 22
SLD $_{TOT}^k$	34 / 35	30 / 35	14 / 35	18 / 35	17 / 35	18 / 35
SLD light $_{tag}^k$	100 / 35	68 / 35	60 / 35	62 / 35	62 / 35	79 / 35
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	2.55	2.64	1.2	1.54	1.46	2.7

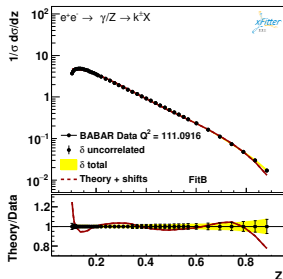
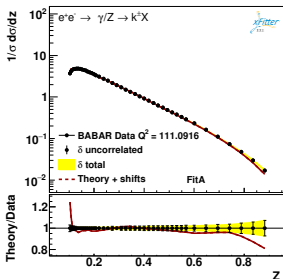


- Note that when we exclude Babar data on Fit C the total χ^2 and individual χ^2 for the Belle and other data sets especially for SLD decreased. This mean there are intention between Babar and other data sets, We expect similar behavior when we exclude Belle data on Fit B, But we could see the individual χ^2 for Babar and also SLD data increased. this means Belle data more compatible with other data than Babar.
- we follow the strategy that we used for Pion paper, We see that there are tension between Babar and Belle data which is solve by impose the $x > 0.2$ cut for belle data and a $x > 0.1$ for Babar data, by comparison Fits presented on table and data description plot, we find that we couldnt solve this tention in Kaon FFs case by impose a cut on the data.
- I recommend, we could extract Kaon FFs by Fit C where we exclude Babar data.

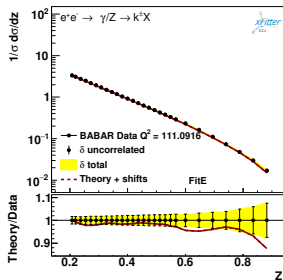
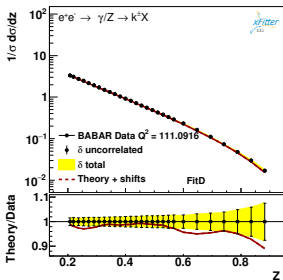


BaBar

$x > 0.075$

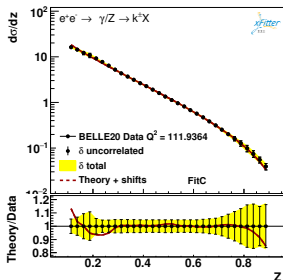
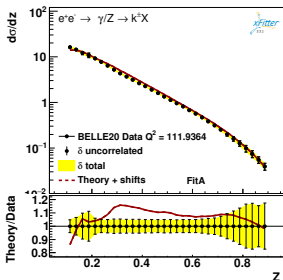


$x > 0.2$

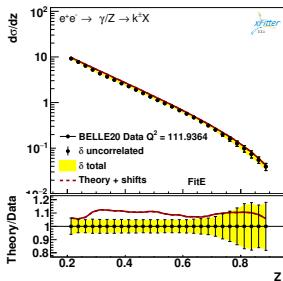
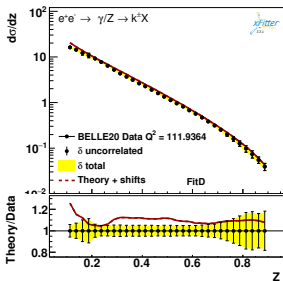


Belle

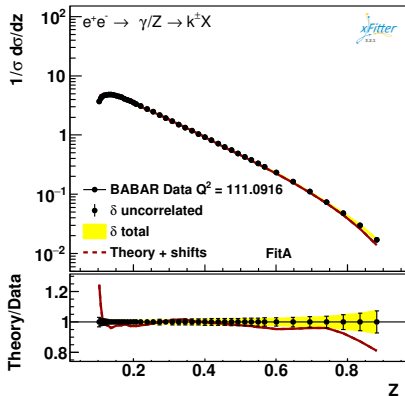
$x > 0.075$



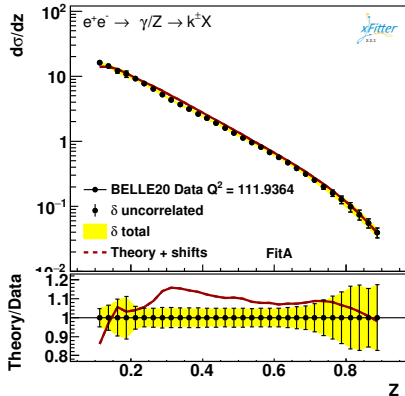
$x > 0.2$



Fit A



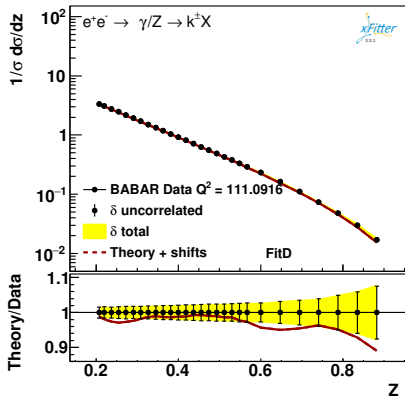
$x > 0.075$



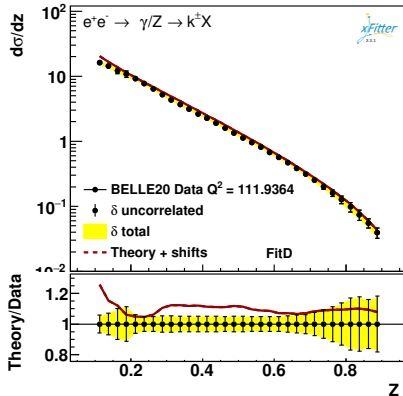
$x > 0.075$



Fit D



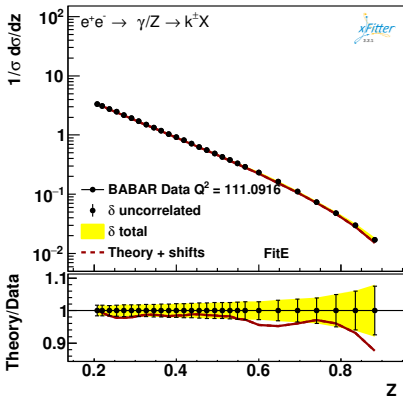
$x > 0.2$



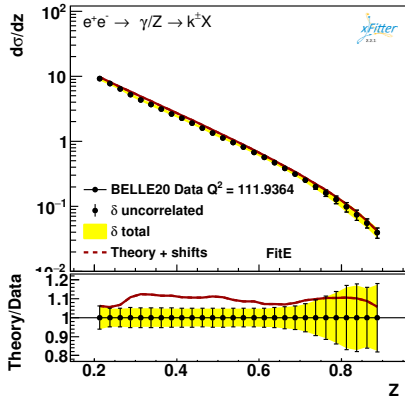
$x > 0.075$



Fit E



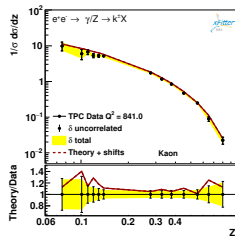
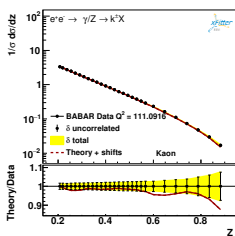
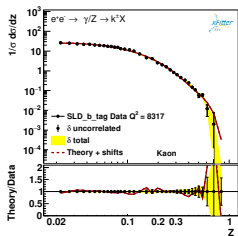
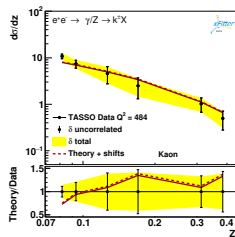
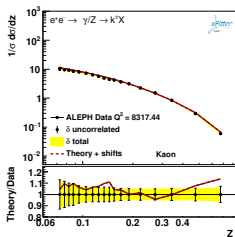
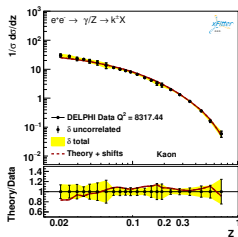
$x > 0.2$



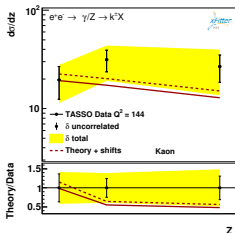
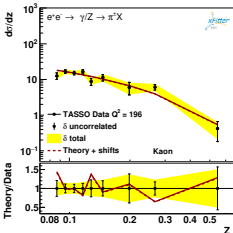
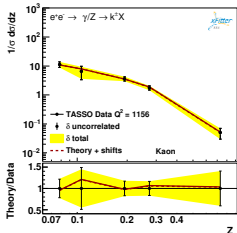
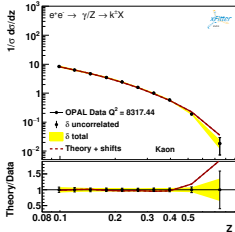
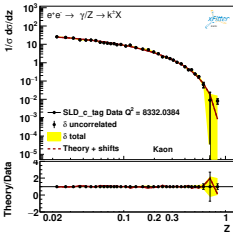
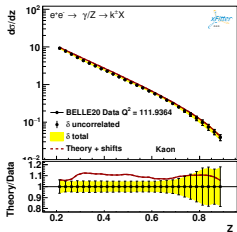
$x > 0.2$



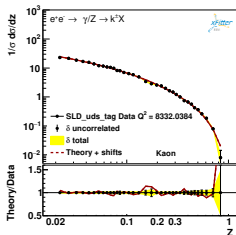
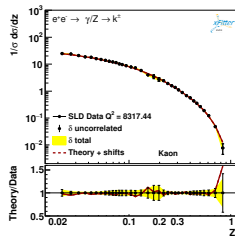
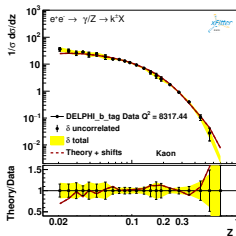
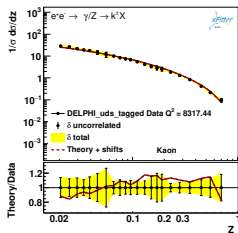
Fit Results



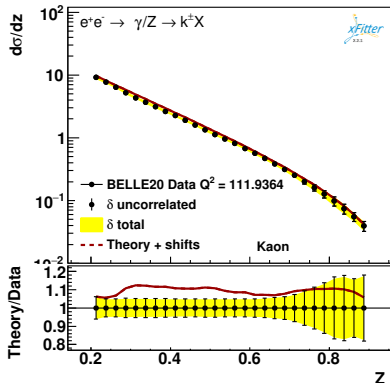
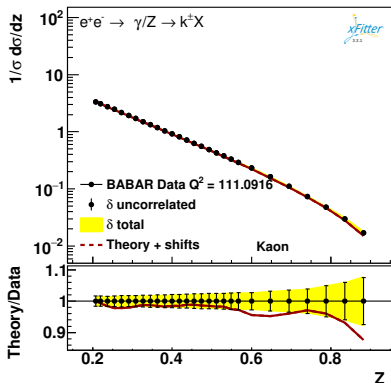
Fit Results



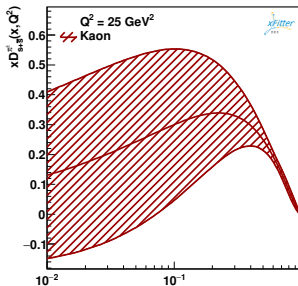
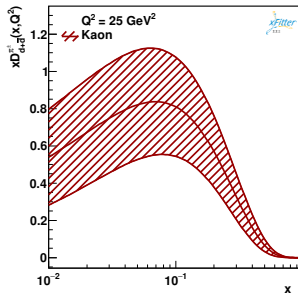
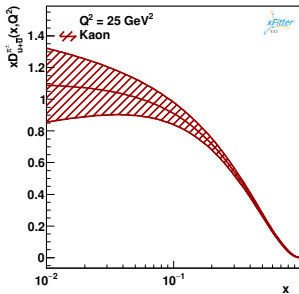
Fit Results



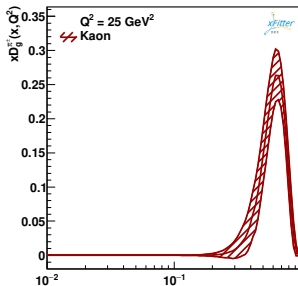
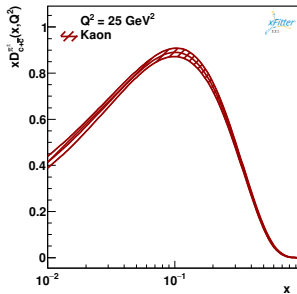
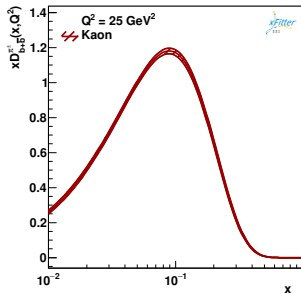
Fit Results



Fit Results



Fit Results



Fit Results



Fit Results

Dataset	Kaon
BABAR ^k	25 / 28
BELLE2020 ^k	75 / 28
SLD b _{tag} ^k	90 / 35
DELPHI _{TOT} ^k	16 / 22
TASSO ₂₂ ^k	6.3 / 6
TPC _{TOT} ^k	21 / 13
ALEPH _{TOT} ^k	18 / 18
SLD c _{tag} ^k	42 / 35
OPAL _{TOT} ^k	8.7 / 10
TASSO ₃₄ ^k	0.38 / 5
TASSO ₁₄ ^k	14 / 9
TASSO ₁₂ ^k	4.2 / 3
DELPHI light _{tag} ^k	24 / 22
DELPHI b _{tag} ^k	16 / 22
SLD _{TOT} ^k	17 / 35
SLD light _{tag} ^k	62 / 35
Correlated χ^2	1.2
Log penalty χ^2	+9.3
Total χ^2 / dof	450 / 308
χ^2 p-value	0.00



Fit Results

Parameter	Kaon
'ABp'	0.2355 ± 0.0042
'ACp'	0.2874 ± 0.0053
'ASp'	0.204 ± 0.080
'Adp'	0.229 ± 0.082
'Ag'	0.0817 ± 0.0085
'Aup'	0.369 ± 0.021
'BBp'	0.135 ± 0.026
'BCp'	-0.474 ± 0.038
'BSp'	-0.58 ± 0.45
'Bdp'	-0.60 ± 0.13
'Bg'	7.7 ± 2.3
'Bup'	-0.991 ± 0.070
'CBp'	11.61 ± 0.25
'CCp'	4.67 ± 0.18
'CSp'	1.46 ± 0.28
'Cdp'	5.34 ± 0.89
'Cg'	4.7 ± 1.1
'Cup'	2.09 ± 0.12
Fit status	converged
Uncertainties	migrad-hesse

