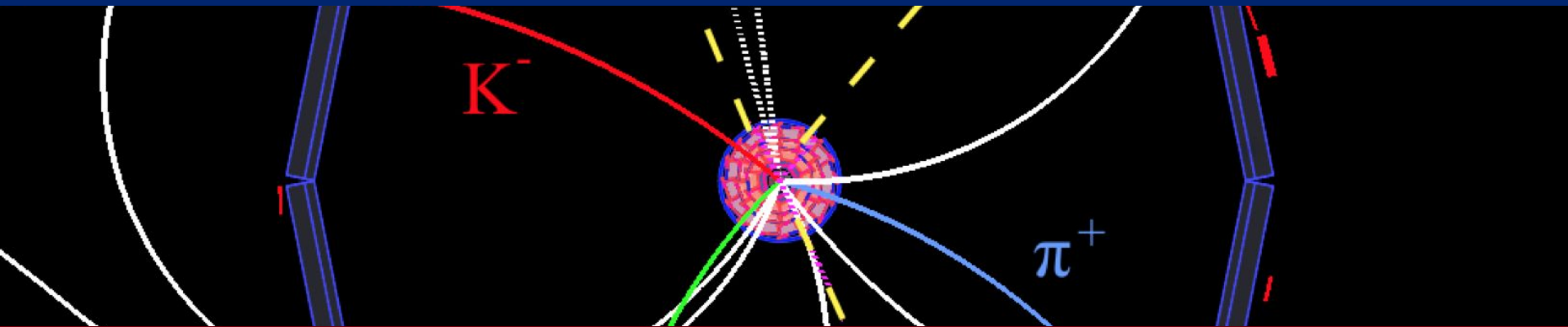


Inclusive $|V_{ub}|$ Measurement at Belle

Signal extraction: Asimov fit 2D



Inclusive Analysis Meeting

30 Apr 2020

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Signal Extraction

Sample selections:

- • BDT > 0.825
- • Remove continuum & bad-tag
- • Mbc > 5.27
- • Merge residual $B \rightarrow Xc\ell\nu$, continuum and the events with fake & secondaries leptons into a background template
- • Define signal region template: true $M_X < 1.7$ GeV (except 2D 'Mx-q2')

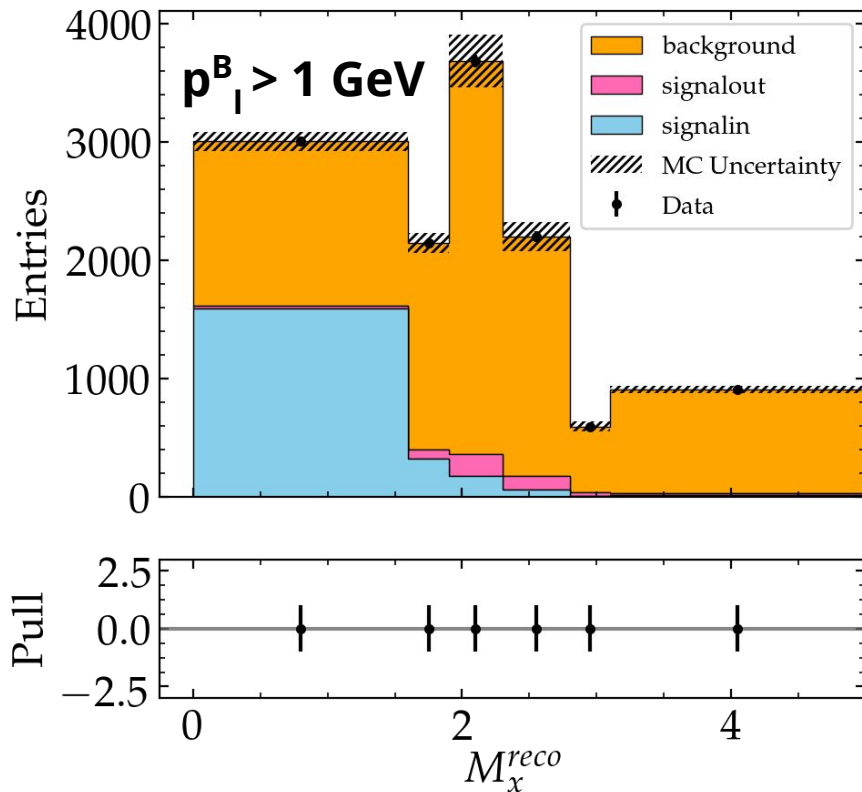
BaBar: Phys.Rev. D86: 032004 (2012)

TABLE III: List of the fitted numbers of signal events N_u , the number of events generated outside the kinematic selection N_u^{out} , the efficiencies, the partial branching fractions $\Delta\mathcal{B}(\overline{B} \rightarrow X_u\ell\bar{\nu})$ and the χ^2 per degree of freedom for the different selected regions of phase space. The first uncertainty is statistical, the second systematic. The $p_\ell^* > 1$ GeV requirement is implicitly assumed.

Region of phase space	N_u	N_u^{out}	$\epsilon_{\text{sel}}^u \epsilon_{\text{kin}}^u$	$(\epsilon_\ell^{\text{sl}} \epsilon_t^{\text{sl}}) / (\epsilon_\ell^u \epsilon_t^u)$	$\Delta\mathcal{B}(\overline{B} \rightarrow X_u\ell\bar{\nu}) (10^{-3})$	χ^2/ndof
$M_X < 1.55$ GeV	1033 ± 73	29 ± 2	0.365 ± 0.002	1.29 ± 0.03	$1.08 \pm 0.08 \pm 0.06$	7.9/8
$M_X < 1.70$ GeV	1089 ± 82	25 ± 2	0.370 ± 0.002	1.27 ± 0.04	$1.15 \pm 0.10 \pm 0.08$	6.6/8
$P_+ < 0.66$ GeV	902 ± 80	54 ± 5	0.375 ± 0.003	1.22 ± 0.03	$0.98 \pm 0.09 \pm 0.08$	3.4/9
$M_X < 1.70$ GeV, $q^2 > 8$ GeV ²	665 ± 53	39 ± 3	0.386 ± 0.003	1.25 ± 0.03	$0.68 \pm 0.06 \pm 0.04$	23.7/26
$M_X - q^2$	1441 ± 102	0	0.338 ± 0.002	1.18 ± 0.03	$1.80 \pm 0.13 \pm 0.15$	31.0/29
$p_\ell^* > 1.0$ GeV	1470 ± 130	8 ± 2	0.342 ± 0.002	1.18 ± 0.03	$1.81 \pm 0.16 \pm 0.19$	21.6/14
$p_\ell^* > 1.3$ GeV	1329 ± 121	61 ± 5	0.363 ± 0.002	1.18 ± 0.09	$1.53 \pm 0.13 \pm 0.14$	20.4/14

Asimov test on 1D

- Local and global Cov included in BinFit
- 2 round of fits, 2nd with fixed bin para. to extract purely postfit stat. error



$$N_{u \text{ in}} = 2169 \pm 103 \text{ (syst.)} \pm 101 \text{ (stat.)} \\ \pm 144 \text{ (total)}$$

BaBar : 1470 ± 130 (stat. only)
scale to int. lumi: 2430 ± 215 (stat. only)

- Signal yields obtained by Asimov fit agree well as expected

Asimov test on 2D

- Mx-q2 ($p^*_l > 1 \text{ GeV}$)
- Mx bins=[0.,1.6, 2, 2.3, 5.0], q2 bins=[0., 2., 4., 6., 8., 10., 12., 14., 26.]
- Two templates: signal B->Xulnu, background (all other resicul MC)

Valid	Valid Param	Accurate Covar	PosDef	Made PosDef
True	True	True	True	False
Hesse Fail	HasCov	Above EDM		Reach callim
False	True	False		False

1st Fit

\pm	Name	Value	Hesse Error	Minos Error-	Minos Error+	Limit-	Limit+	Fixed?
0	signal_yield	2490.08	118.946					No
1	background_yield	8927.34	136.224					No
2	signal_binpar_0	0.000100577	0.190602					No
3	signal_binpar_1	-0.000101214	0.161957					No
4	signal binpar 2	6.98597e-05	0.141916					No

total error

Valid	Valid Param	Accurate Covar	PosDef	Made PosDef
True	True	True	True	False
Hesse Fail	HasCov	Above EDM		Reach callim
False	True	False		False

2nd Fit

Name	Value	Hesse Error	Minos Error-	Minos Error+	Limit-	Limit+	Fixed?
signal_yield	2490.07	95.9036					No
background_yield	8927.16	125.038					No
signal_binpar_0	4.62719e-05	2.31359e-06					Yes
signal_binpar_1	-1.83593e-06	-9.17966e-08					Yes
signal binpar 2	1.22062e-05	6.10314e-07					Yes

stat. error

$$N_{\text{sig}} = 2490 \pm 70 \text{ (syst.)} \pm 96 \text{ (stat.)}$$

$$\text{BaBar} : 1441 \pm 102 \text{ (stat. only)}$$