V_{ub} measurements with the BaBar detector

Daniele del Re

University of California San Diego

(on behalf of the BaBar collaboration)

Outline:

Inclusive $b \to ul\nu$ measurements:

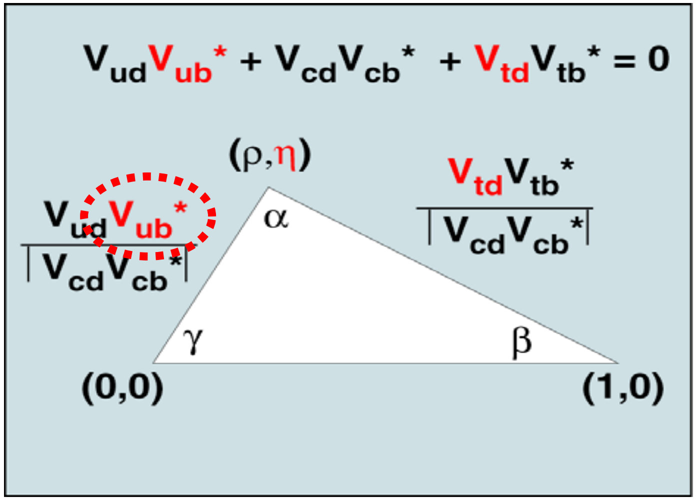
- Endpoint
- ν reconstruction
- m_X on recoil of Breco tags
- m_X vs q^2 on recoil of Breco tags

Exclusive $b \to ul\nu$ measurements:

- $B^0 \to \pi^+ l\nu$ on recoil of Partial tags
- $B \to (\pi,\rho,\omega,\eta,\eta',a_0)l\nu$ on recoil of Breco tags

$b \to ul\nu$ decays and V_{ub}

Charmless semileptonic B decays, $B \to X_u l\nu$, allow for the measurement of $|V_{ub}|$

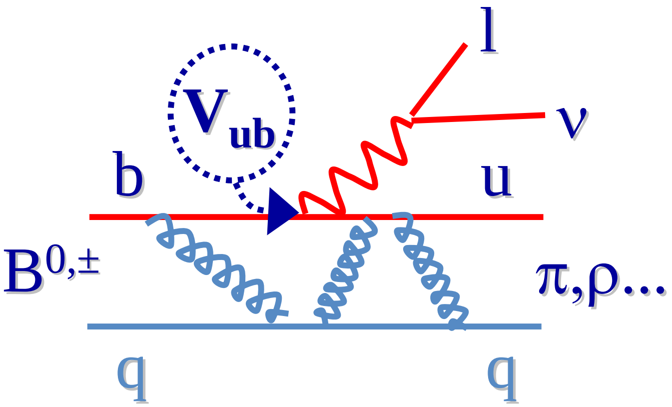


Experimentally challenging, because

- $B \to X_c l\nu$ background (50 times higher)
- Tight cuts are needed and signal is analyzed in limited region of phase space
- extrapolation introduces uncertainties

I will present two approaches:

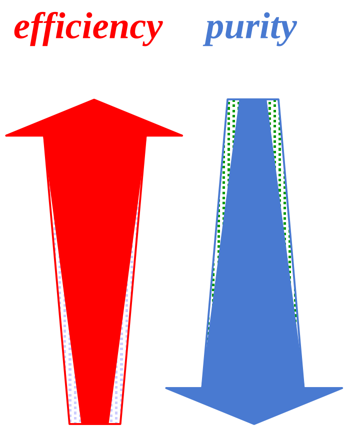
1. Inclusive: look at kinematic quantities inclusively, use duality assumption and study $b \to ul\nu$. Once total $B(b \to ul\nu)$ is obtained $|V_{ub}|$ can be extracted with small uncertainties.
2. Exclusive: study exclusive decays, use form factor to extract branching ratio and $|V_{ub}|$

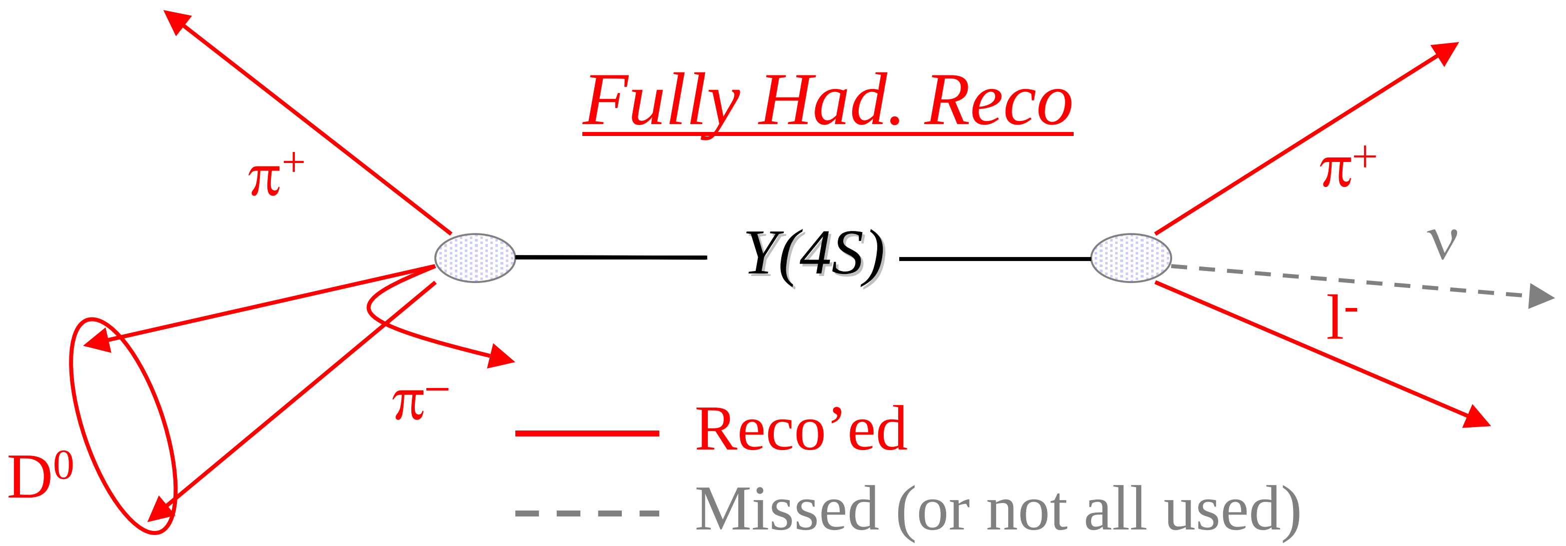


Three Experimental Techniques

Three ways of studying $B \to X_u l \nu$ decays in BaBar:

	Method	*signal*	*recoil*
Untagged	No recoil and ν reco from miss. momentum	$X_u\ l\ \nu$	$(nh^{\pm}, m\gamma)$
Partial Tags	Recoil of partially reconstructed D*	$X_u\ l\ \nu$	$\pi_{soft}\ l(D^0 \nu X)$
Breco Tags	Recoil of fully recon. $B \to D(*)X$	$X_u\ l\ \nu$	$D^{(*)}\ X$





Inclusive: Endpoint and ν Reco

Untagged

Endpoint:

- one high energy electron (2.0GeV<$E_{e<}$2.6GeV)
- cut on the missing momentum ($p_{miss} = p_{e^+e^-} - p_{vis}$) and event shape cuts
- Continuum bkg using off-peak data and on-peak for E_l>2.8GeV.
- BB_{bar} bkg fitting E_l spectrum (Deν, D^*eν, D^{**}eν, $D^{(*)}\pi$eν, X_ueν and non semileptonic components)

ν Reconstruction:

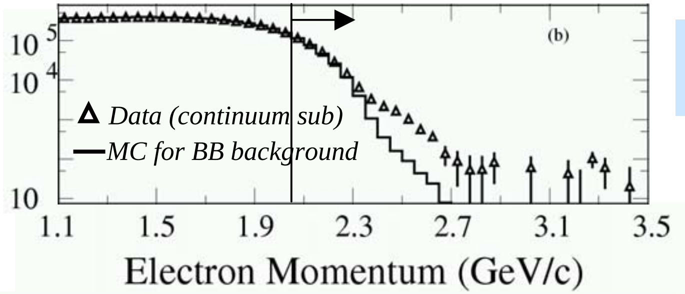
- Same approach as in the endpoint method (same p^*>2GeV/c) but it selects a refined subset of events (much better S/B)
- b→clν background separated by: $$s_h^{max} = m_B^2 + q^2 - m_B E_e \sqrt{\frac{1-\beta}{1+\beta}} - 2m_B\left(\frac{q^2}{4E_e}\right)\sqrt{\frac{1-\beta}{1+\beta}}$$

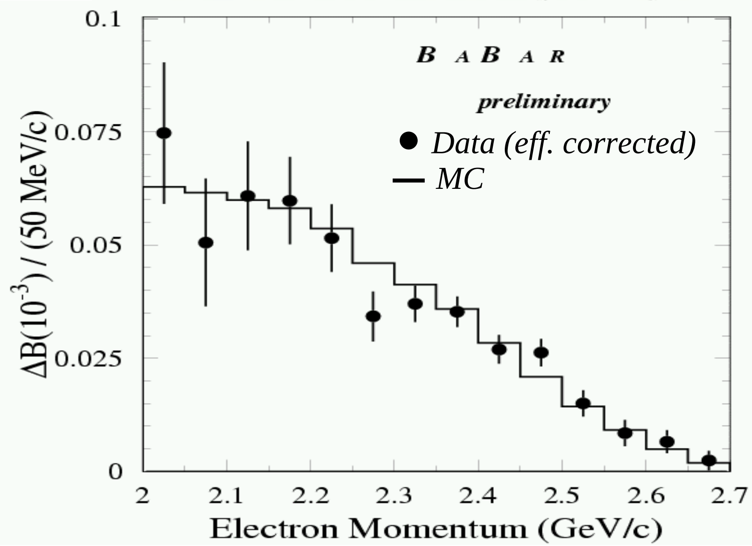
  where $\beta = 0.06$ is the boost of the B in the Υ(4S) rest frame. Less sensitive to non perturbative parameters than m_X
- efficiency and shape modeling checked using pure B→D^0lν(X) control sample

Inclusive: Endpoint and ν Reco

Untagged

Endpoint





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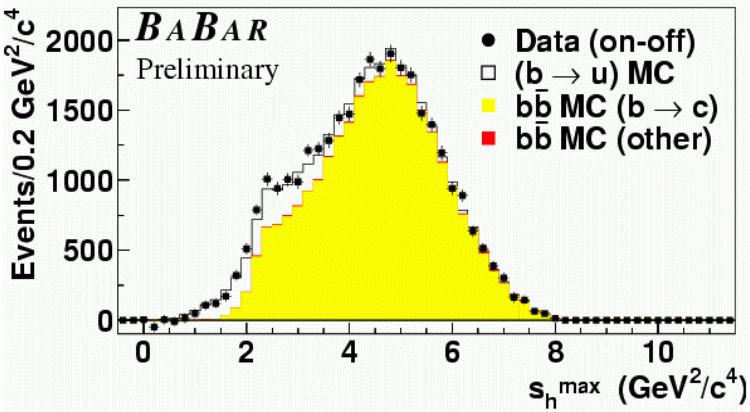
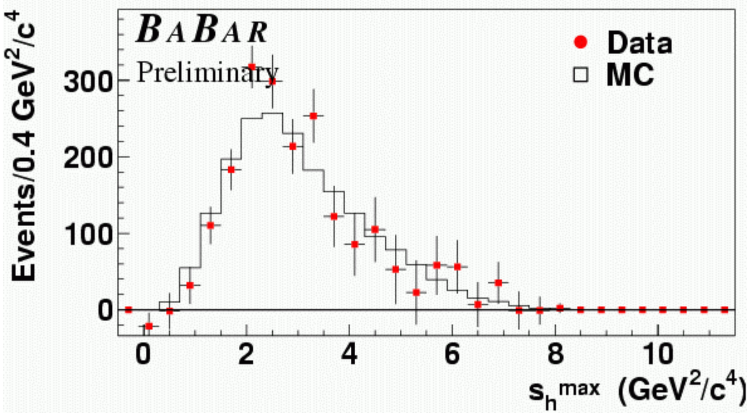
ν reco





$$B(B \to X_u e\nu) = (1.73 \pm 0.22_{exp} \pm 0.33_{(m_b,a)\,syst}) \times 10^{-3}$$

$$|V_{ub}| = (3.94 \pm 0.25_{exp} \pm 0.37_{(m_b,a)\,syst} \pm 0.19_{HQET}) \times 10^{-3}$$

$$B(B \to X_u e\nu) = (2.37 \pm 0.22_{stat} \pm 0.26_{det\,syst} \pm 0.34_{bkg\,syst}{}^{+0.60}_{-0.30}{}_{(m_b,a)\,syst}) \times 10^{-3}$$

$$|V_{ub}| = (4.63 \pm 0.21_{stat} \pm 0.25_{det\,syst} \pm 0.34_{bkg\,syst}{}^{+0.59}_{-0.29}{}_{(m_b,a)\,syst} \pm 0.21_{HQET}) \times 10^{-3}$$

Inclusive: m_X vs. q^2

Breco Tags

Extension of the already published result (PRL92,071802).

- Recoil selection and reconstruction of X system:
  - One and only one lepton with p*> 1 GeV/c
  - Correlation between lepton charge and B_{reco} flavor
  - Cut on the missing mass: $M_{miss}^2 < 0.5 GeV^2$,
  - charge conservation: $Q_{tot}=0$
  - Partially reconstructed neutrino to reject $B^0 \to D^* l \nu$ events
  - kinematic fit (2-C): improve hadronic mass resolution
  - Kaon veto
- Systematics due to lepton ID and tag normalization reduced by measuring a ratio of BRs $R_{u/sl} = \frac{B(B \to X_u l\nu)}{B(B \to X l\nu)}$
- m_X <1.7GeV and q^2>8GeV^2 using the approach by Bauer et al. Dependence on shape function parameters is much reduced

This approach and sample have been also used to unfold the m_X spectrum.

Breco Tags

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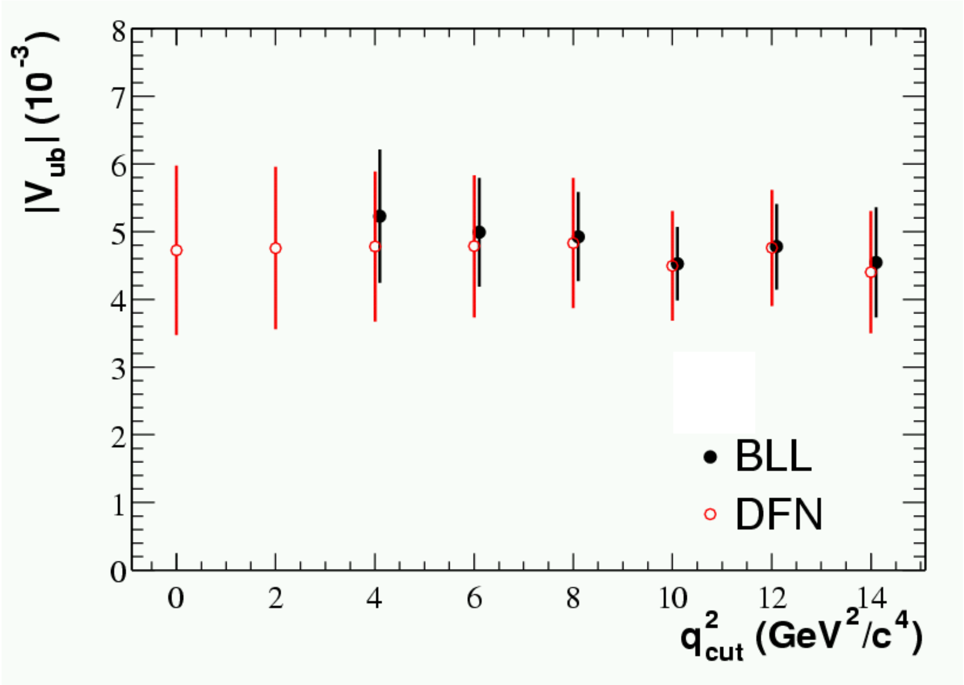
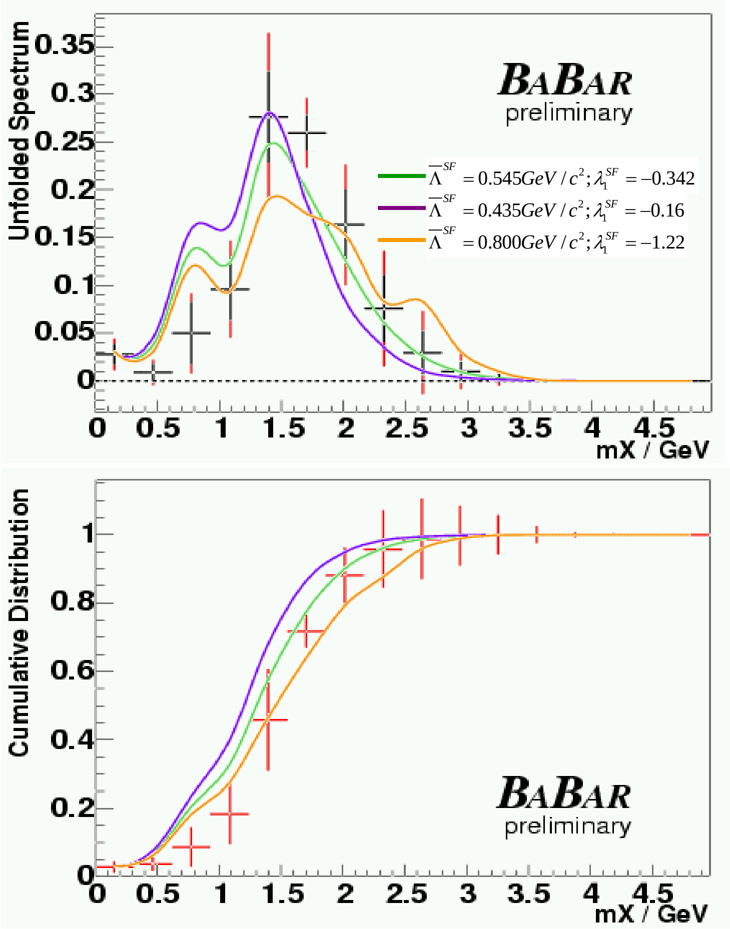
Stability of $|V_{ub}|$ as a function of the q^2 cut



Unfolded m_X spectrum and cumulative distribution for $b \to u l \nu$ decays



$$\Delta B(B \to X_u l\nu) = (0.88 \pm 0.14_{stat} \pm 0.13_{exp\ syst} \pm 0.02_{(m_b, a)\ syst}) \times 10^{-3}$$

$$|V_{ub}| = (4.92 \pm 0.39_{stat} \pm 0.36_{exp\ syst} \pm 0.46_{theo\ syst}) \times 10^{-3}$$

Exclusive Decays on Recoil

Partial Tags

Breco Tags

- Semil Tags ($B^0 \to D^* l \nu$): measurement in bins of q^2(0-8-16GeV^2/c^4)
  Signal yields are extracted by fitting M_ν^2 (event missing mass).

$$B(B^0 \to \pi^- l^+ \nu) = (1.46 \pm 0.27_{stat} \pm 0.28_{syst}) \times 10^{-4}$$

- Breco Tags ($B \to D^{(*)} X$): 9 $B \to X_u l \nu$ modes: $X_u = \pi^+, \pi^0, \rho^+, \rho^0, \omega, \eta, \eta', a_0^0, a_0^+$
  Approach similar to the inclusive analysis but resonances are exclusively and fully reconstructed on recoil.

$$B(B^0 \to \pi^- l^+ \nu) = (1.08 \pm 0.28_{stat} \pm 0.16_{syst}) \times 10^{-4}$$

$$B(B^0 \to \rho^- l^+ \nu) = (2.57 \pm 0.52_{stat} \pm 0.59_{syst}) \times 10^{-4}$$

(upper limits for $\eta, \eta', a_0^0, a_0^+$, results in backup slides)

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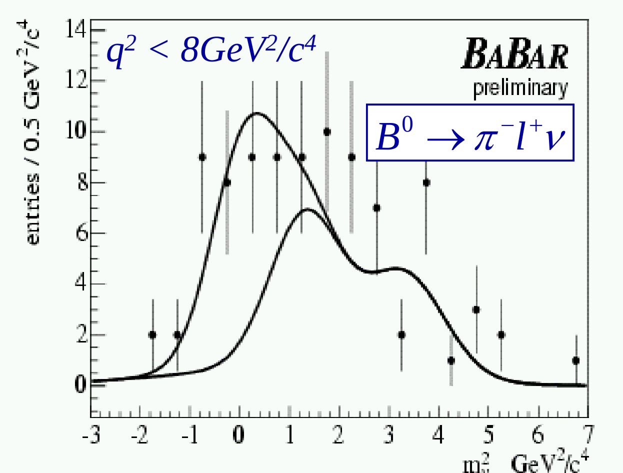
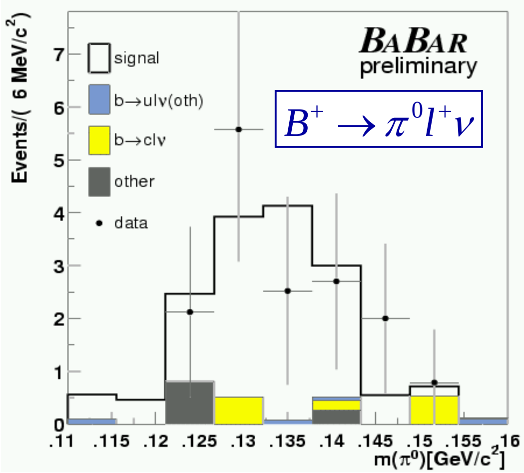
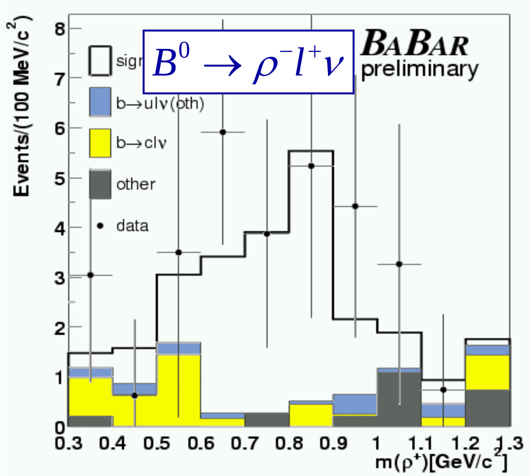
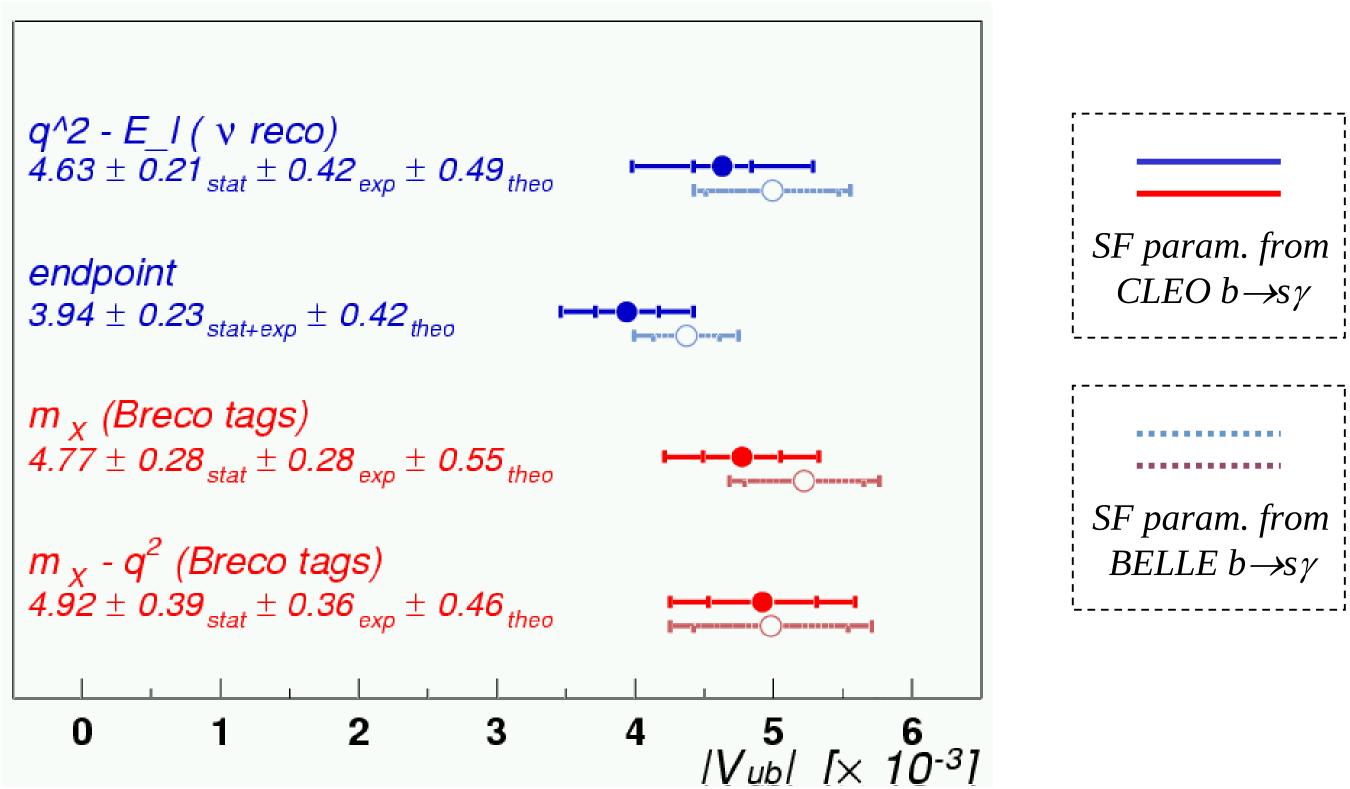






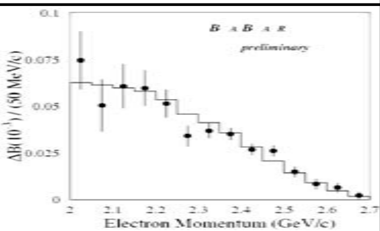
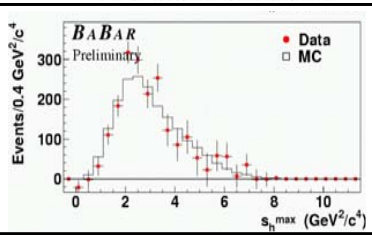
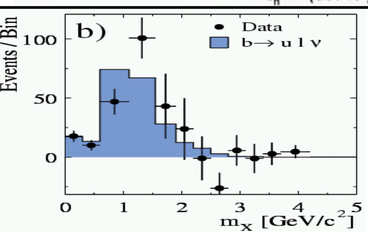
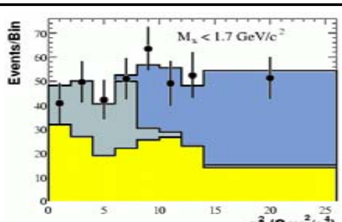
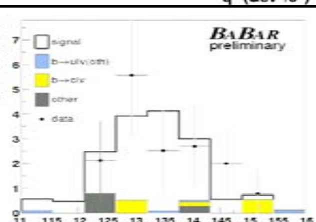
Conclusions

We measured $|V_{ub}|$ with different experimental inclusive techniques:



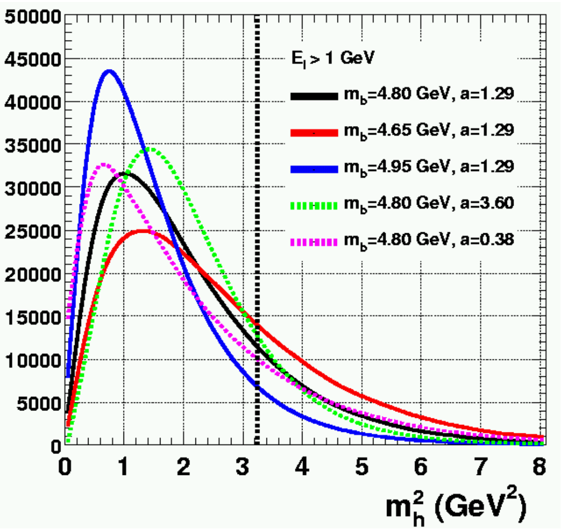
- Dominant error from modellization of non-perturbative effects (Shape Function, SF).
  Fitted on $b \to s\gamma$ events; two fits available not yet combined: CLEO(2001), Belle(2004)
- We measured the unfolded m_X distribution. In future $b \to u l \nu$ decays can be used to put constraints on SF parameters.

V_{ub} measurements with BaBar

	method	S/B	Pros&Cons	$V_{ub}(\times 10^{-3})$
	*Untagged* *inclusive* Electron spectrum endpoint E_e>2.0GeV Total rate using DeFazio-Neubert	0.05→0.2	•High statistics •Duality valid for tight E_e cuts? •Bkg subtraction	$3.94 \pm 0.23_{exp} \pm 0.42_{theo}$
	*Untagged* *inclusive* E_e vs q^2 and neutrino reconstruction E_e>2.0GeV and s_h<3.5 GeV^2/c^4 Total rate using DeFazio-Neubert	~0.5	•High statistics •Lower syst. on shape functions •Bkg subtraction	$4.63 \pm 0.47_{exp} {}^{+0.62}_{-0.36 theo}$
	*Breco Tags* *inclusive* m_X analysis (1-D) m_X<1.55 GeV/c^2 Total rate using DeFazio-Neubert	~1.7	•Low background •High resolution •Low statistics •Shape func. syst.	$4.77 \pm 0.40_{exp} {}^{+0.69}_{-0.45 theo}$
	*Breco Tags* *inclusive* m_X vs q^2 analysis m_X<1.7 GeV/c^2 and q^2 >8.0 GeV^2/c^4 V_{ub} using Bauer et al.	~2	•Low background •Very small syst. on SF param. •Small statistics	$4.92 \pm 0.53_{exp} \pm 0.46_{theo}$
	*Partial Tags* *Breco Tags* *exclusive* Total rate using Form Factors calc.	1→20	•Very small bkg •~no cut on kinem •Small statistics	$(B(B^0 \to \pi^- l^+ \nu) = (1.22 \pm 0.26) \times 10^{-4})$

BACKUP SLIDES

Incl. Decays: Theory and Uncertainties



Relevant issues

- hadronization effects and Fermi motion (b quark mass)
- non-perturbative parametrizations (Shape Function, SF) affected by large uncertainties.

Two approaches to extract $|V_{ub}|$ and estimate theo. systematics:

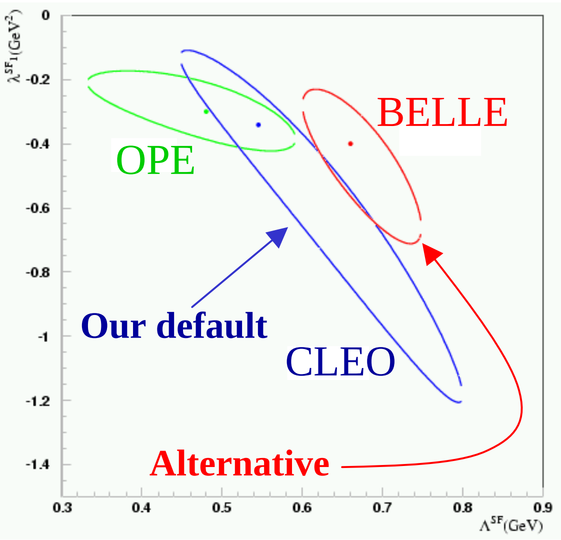
1. DeFazio-Neubert paper (*DFN*), tri-differential parametrization (E_e,m_X,q^2) to extrapolate.
   $|V_{ub}|$ extracted by

$$|V_{ub}| = 0.00424\sqrt{\frac{B(B \to X_u l\nu)}{0.002}\frac{1.61ps}{\tau_B}} \times (1 \pm 0.028_{OPE} \pm 0.039_{m_b})$$

2. q^2 vs m_X approach by Bauer et al. (*BLL*).
   partial BR with q^2 vs m_X cut. $|V_{ub}|$ is extracted using

$$|V_{ub}| = \sqrt{\frac{192\pi^3}{\tau_B G_F^2 m_b^5}\frac{\Delta B(B \to X_u l\nu; m_X < 1.7GeV/c^2, q^2 > 8GeV^2/c^4)}{G}}$$

   Dependence on SF (here in G) is much reduced.



Theo. uncertainties on non-perturbative effects are evaluated using λ^{SF} and Λ^{SF} ellipse from $b \to s\gamma$ from CLEO. Belle ellipse as an alternative.

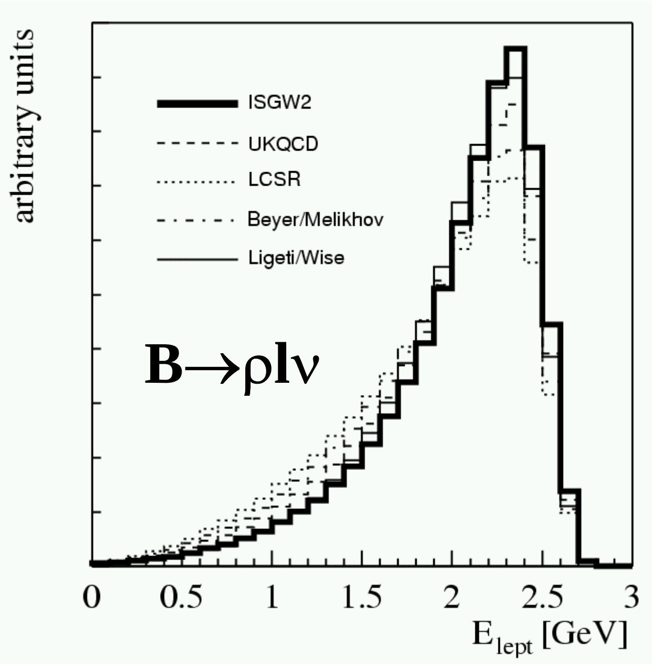
Excl. Decays: Theory and Uncertainties

- primary challenge is calculation of the form factors (containing hadronization effects and non-pert. contributions)
- Large uncertainties both extrapolation to full phase space and determination of $|V_{ub}|$
- different theoretical models predict different q^2 distributions.
- discriminate among models by a precise measurement of differential BRs.

The differential branching ratio can be related to $|V_{ub}|$ by the following relation

$$\frac{dB(B^0 \to \pi^- l^+ \nu)}{dq^2 d(\cos\theta_{Wl})} = |V_{ub}|^2 \tau_{B^0} \frac{G_F^2 k_\pi^3}{32\pi^3} \sin^2\theta_{Wl} \left| f(q^2) \right|^2$$

The bigger the integrated region the smaller the uncertainty on $|V_{ub}|$



Inclusive: Endpoint Method

Untagged

- one high energy electron ($p^* > 1.1$GeV)
- cut on the missing momentum ($p_{miss} = p_{e^+e^-} - p_{vis}$) and event shape cuts

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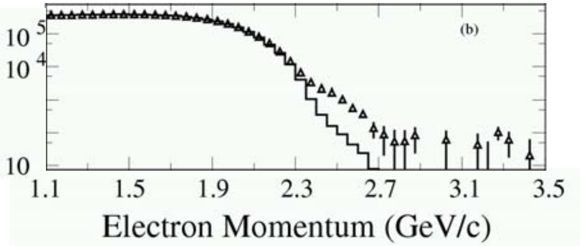
- Continuum bkg using off-peak data and on-peak for $E_l > 2.8$GeV.
- BB_{bar} bkg fitting E_l spectrum ($De\nu$, $D^*e\nu$, $D^{**}e\nu$, $D^{(*)}\pi e\nu$, $X_u e\nu$ and non semileptonic components)

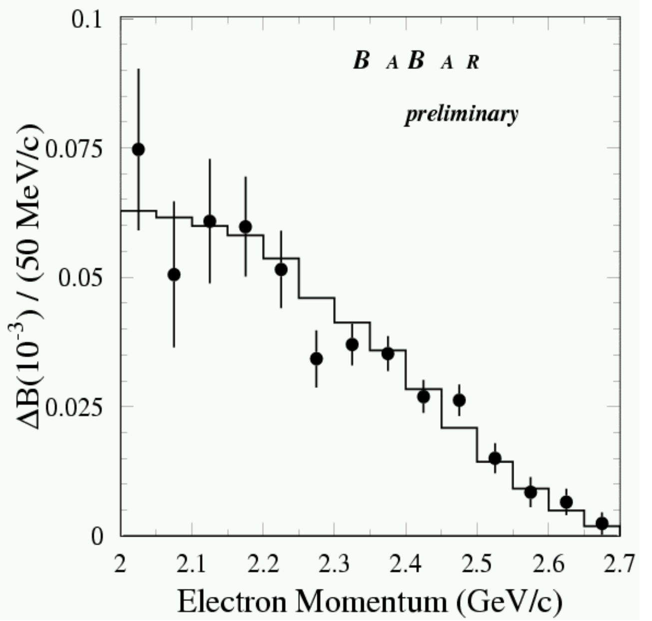


- For $2.0\text{GeV} < E_l < 2.6\text{GeV}$ we obtain (using *DFN*):

$$B(B \to X_u e\nu) = (1.73 \pm 0.22_{exp} \pm 0.33_{(m_b,a)\ syst}) \times 10^{-3}$$

$$|V_{ub}| = (3.94 \pm 0.25_{exp} \pm 0.37_{(m_b,a)\ syst} \pm 0.19_{HQET}) \times 10^{-3}$$

Results are stable by applying tighter cuts on E_l.



Main exp. systematics from signal modeling (~2-8%) and event selection efficiency (~6%), and D(*,**)eν description (~3%)

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Same approach as in the endpoint method but it select a refined subset of events (much better S/B) :

- one high energy electron (p^*>2GeV/c) is identified
- visible 4-momentum by using charged tracks (with particle ID) and energy deposits in the calorimeter
- missing momentum defined as $p_{miss} = p_{e^+e^-} - p_{vis}$ and used to estimate neutrino
- cuts on the missing momentum and on the event shape.

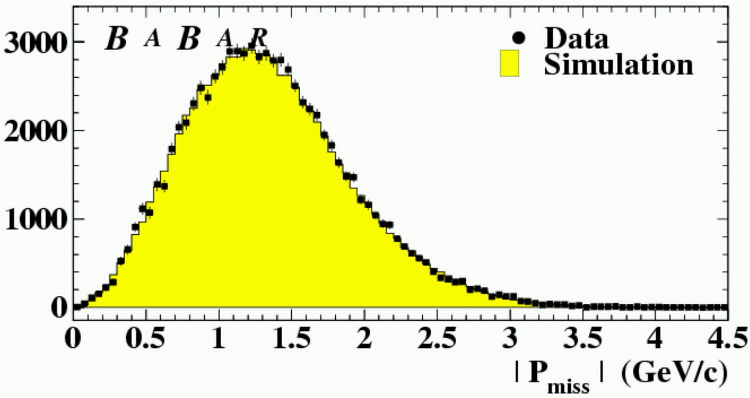
- b→clν background separated by:

$$s_h^{\max} = m_B^2 + q^2 - m_B E_e \sqrt{\frac{1-\beta}{1+\beta}} - 2m_B \left(\frac{q^2}{4E_e}\right)\sqrt{\frac{1-\beta}{1+\beta}}$$

where $\beta = 0.06$ is the boost of the B in the $\Upsilon(4S)$ rest frame. Less sensitive SF parameters than m_X

- efficiency and shape modeling checked using a pure $B^0 \to D^{*+} l \nu (X)$ control sample

Data-MC agreement for p_{miss}



Inclusive: ν Reconstruction Method

- BR extracted by applying the following cuts
  $E_l > 2$GeV and $s_h < 3.5$ GeV^2/c^4
- The region $s_h > 4.25$ GeV^2/c^4 is used to normalize the MC bkg to the data
- De Fazio-Neubert parametrization to extrapolate to full phase space

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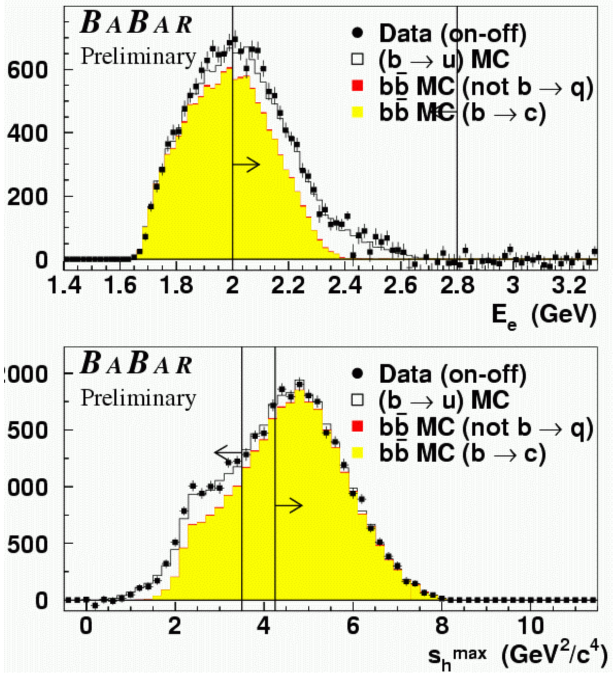

Results:

$$B(B \to X_u e\nu) = (2.37 \pm 0.22_{stat} \pm 0.26_{det\ syst} \pm 0.34_{bkg\ syst}{}^{+0.60}_{-0.30(m_b,a)\ syst}) \times 10^{-3}$$

$$|V_{ub}| = (4.63 \pm 0.21_{stat} \pm 0.25_{det\ syst} \pm 0.34_{bkg\ syst}{}^{+0.59}_{-0.29(m_b,a)\ syst} \pm 0.21_{HQET}) \times 10^{-3}$$

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Main experimental systematics are from: Neutrals (~6%), K_L (~7%), $B \to X_c l\nu$ modeling: (7%), stability in scans (~12%)

Inclusive: m_X vs. q^2

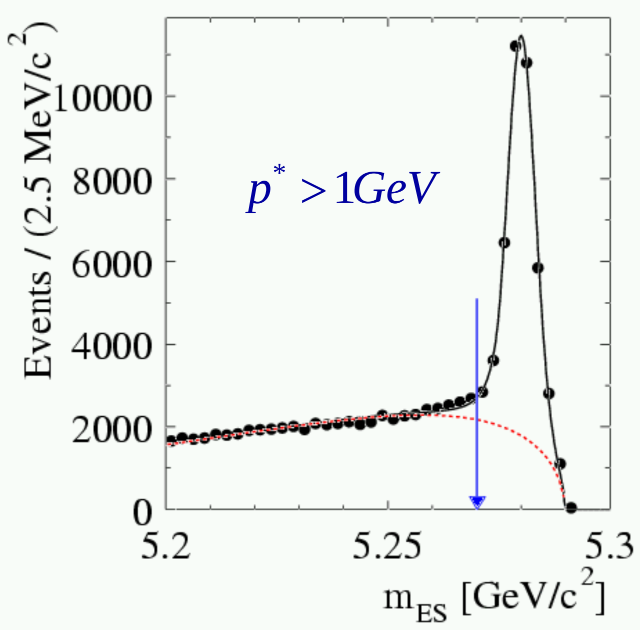
Breco Tags

For Breco tags the reconstructed modes are (~1000 modes):

$B \to D(*)\pi, D(*)\pi\pi^0, D(*)3\pi,$ etc...

The eff. is ~0.4% corresponding to ~4000 B/fb^{-1} (~2500 B/fb^{-1} B^+ and B ~1500 B/fb^{-1} B^0)

The sample has low purity but it improves a lot once cuts on recoil are applied.



Recoil selection and reconstruction of X system:

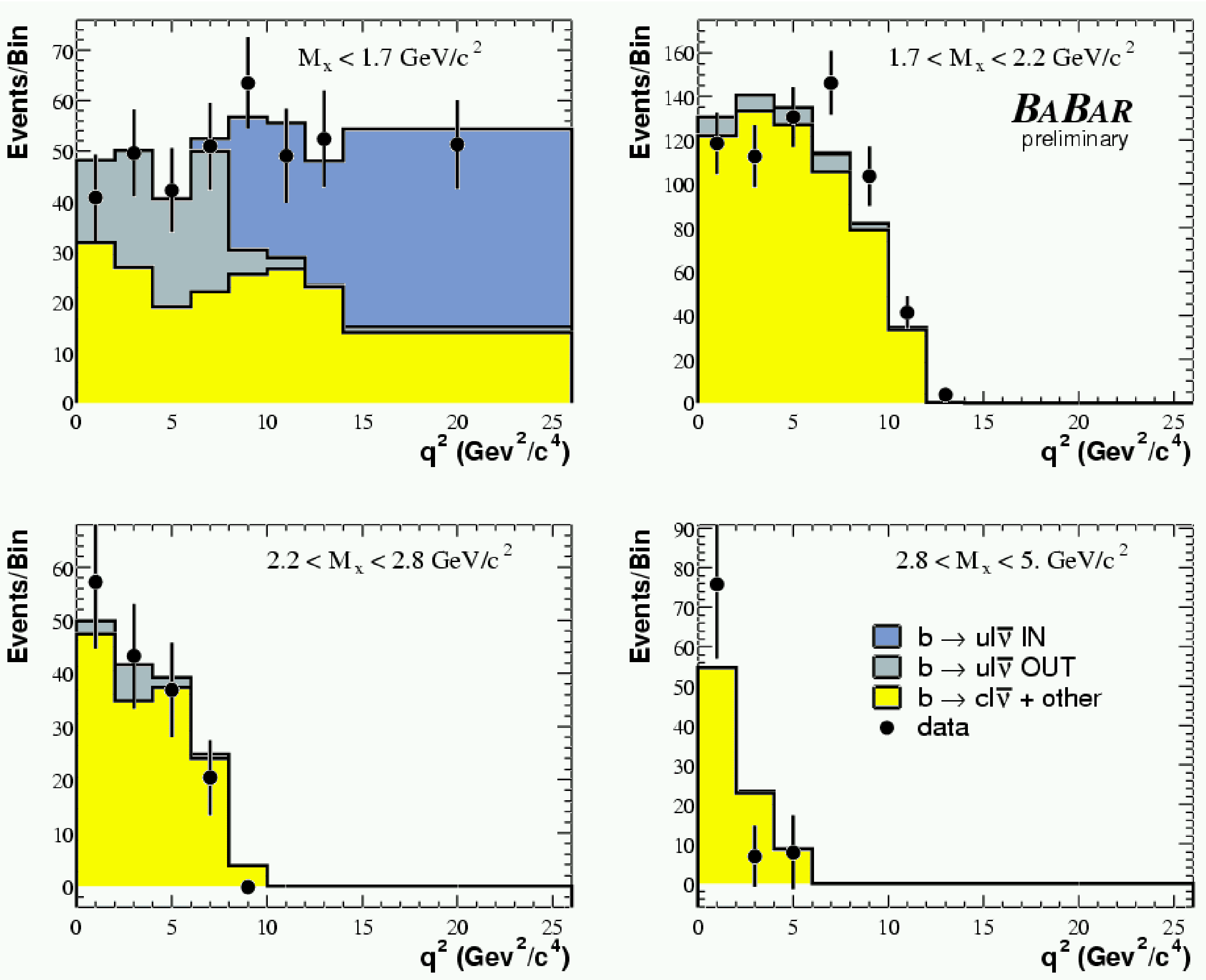
- One and only one lepton with p*> 1 GeV/c
- Correlation between lepton charge and B_{reco} flavor
- Cut on the missing mass: $M_{miss}^2 < 0.5 GeV^2$,
- charge conservation: $Q_{tot}=0$
- Partially reconstructed neutrino to reject $B^0 \to D^* l \nu$ events
- kinematic fit (2-C): improve hadronic mass resolution

Separate $B \to X_u l\nu$ in signal enriched and depleted based on veto on $K^\pm$ and K_S

Systematics reduced by measuring $R_{u/sl} = \dfrac{B(B \to X_u l\nu)}{B(B \to X l\nu)}$

Inclusive: m_X and m_X vs. q^2

Breco Tags



Breco Tags

m_X spectrum can be converted in a universal variable by unfolding detector and selection effects.

relationship between measured and true spectra is:

$\vec{x}_{meas} = \hat{A}\ \vec{x}_{true}$ where $\hat{A}$ is the detector response matrix, in general is non-invertible.

Unfolding method is based on procedure specified in hep-ph/9509307.

Systematics effects are properly taken into account.

First and second moment of the $b \to u l \nu$ m_X distribution are extacted:

	$M_{X,0}$ (GeV/c^2)	$\mathcal{M}$	$\sigma(\mathcal{M})$	Correlation	σ_{stat}	σ_{det}	σ_{sig}	$\sqrt{\sigma^2_{bkg} + \sigma^2_{breco}}$
$\mathcal{M}_1$	1.86	1.363	0.089		0.063	0.023	0.018	0.039
$\mathcal{M}'_2$	1.86	0.143	0.037	−0.824	0.027	0.010	0.006	0.015
$\mathcal{M}_1$	5	1.602	0.244		0.150	0.075	0.061	0.142
$\mathcal{M}'_2$	5	0.271	0.095	0.782	0.048	0.036	0.022	0.069

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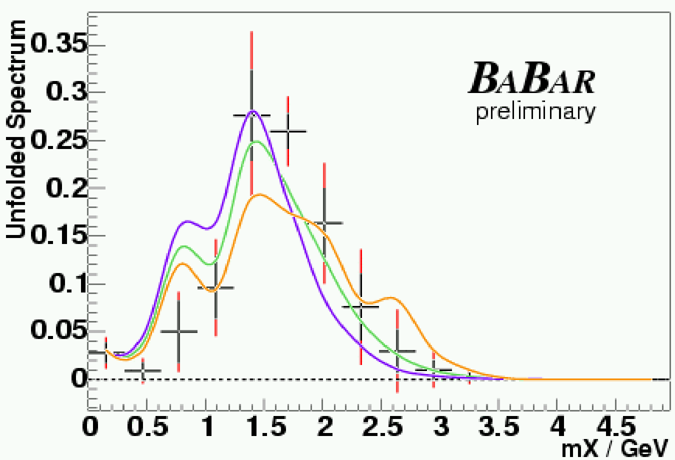
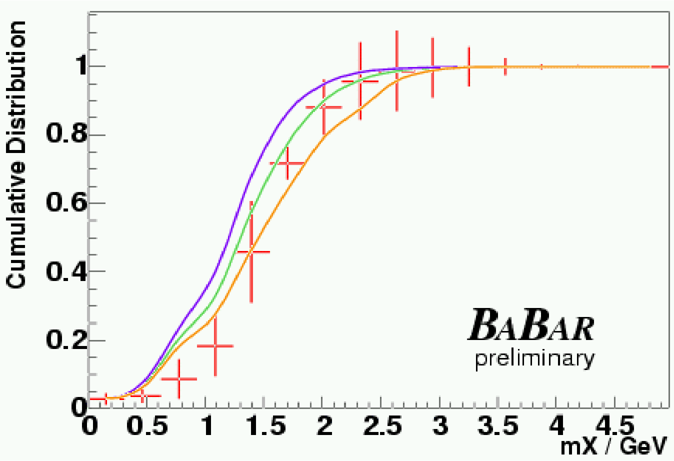
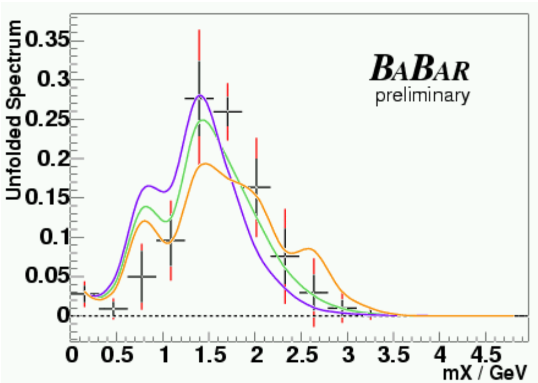
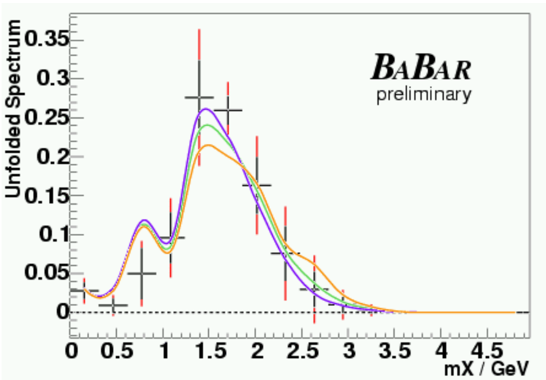




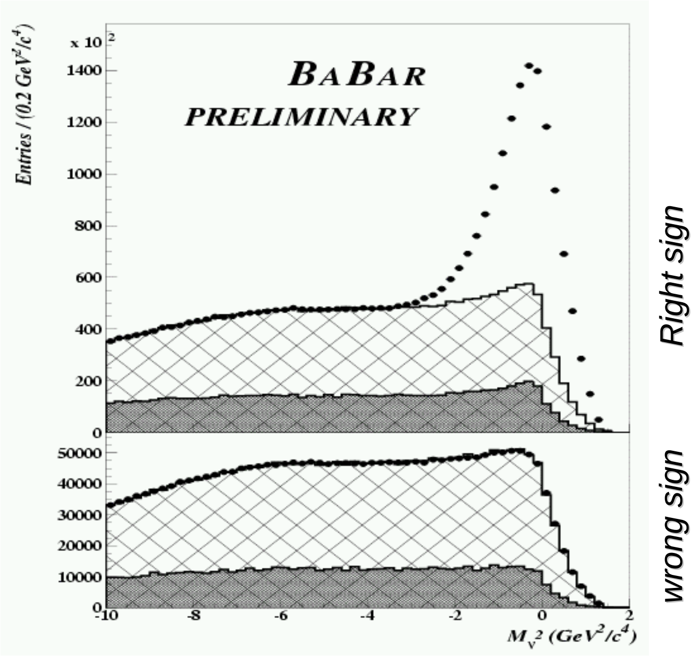
	CLEO ellipse	*BELLE ellipse*	
ν reco	$\lvert V_{ub}\rvert = (4.63 \pm 0.47_{exp}{}^{+0.62}_{-0.36 theo}) \times 10^{-3}$	$\lvert V_{ub}\rvert = (4.99 \pm 0.48_{exp}{}^{+0.29}_{-0.32 theo}) \times 10^{-3}$	Shift as expected. Theo. error reduced
Endpoint	$\lvert V_{ub}\rvert = (3.94 \pm 0.23_{exp} \pm 0.42_{theo}) \times 10^{-3}$	$\lvert V_{ub}\rvert = (4.37 \pm 0.24_{exp} \pm 0.29_{theo}) \times 10^{-3}$	Shift as expected. Theo. error reduced. With Belle ellipse cut variation on E_e shows results that are less consistent among them
m_X	$\lvert V_{ub}\rvert = (4.77 \pm 0.40_{exp}{}^{+0.69}_{-0.45 theo}) \times 10^{-3}$	$\lvert V_{ub}\rvert = (5.22 \pm 0.43_{exp}{}^{+0.33}_{-0.32 theo}) \times 10^{-3}$	Shift as expected. Theo. error reduced
m_X vs q^2	$\lvert V_{ub}\rvert = (4.92 \pm 0.53_{exp} \pm 0.46_{theo}) \times 10^{-3}$	$\lvert V_{ub}\rvert = (4.98 \pm 0.56_{exp} \pm 0.47_{theo}) \times 10^{-3}$	Small change demonstrates that this method is less affected by SF params. With Belle ellipse theo. error is larger with respect to the others methods
unfolding			Unfolded spectrum seems to prefer Belle ellipse. Comparison with expected m_X shape is better.

Exclusive: $B^0 \to \pi^+ l^- \nu$

Partial Tags

Partially reco'ed sample is selected by following variables combined in a likelihood ratio:

- Some preselection cuts on shape and multiplicity
- lepton mom. (p*>1.3GeV)
- soft pion mom. (50MeV<p_π <200MeV)
- lepton-π Vtx probability



Signal yield is extracted via M_ν^2 (mis. mass squared)

D* is assumed to be collinear with the soft π

Then:

$$E_D^* = \frac{E_{\pi_s} M_{D^*}}{M_\pi} \quad \Rightarrow \quad M_\nu^2 = (p_{B^0} - p_l - p_{D^*})^2$$

<u>Additional cuts to:</u>

- remove b-b_{bar} background (like the charge correlation of the two reconstructed leptons and quantities related to the remainder of the event)
- remove continuum background (like the invariant mass and the opening angle of the two electrons)

Exclusive: $B^0 \to \pi^+ l^- \nu$

Partial Tags

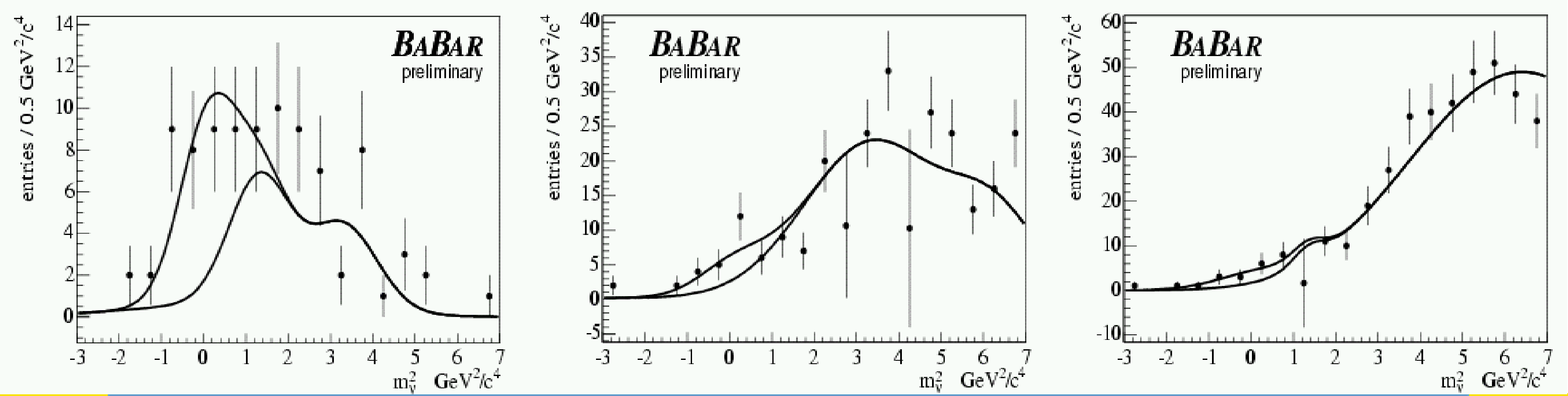
- Measurement is performed in bins of q^2
- Three bins: *($q^2 < 8GeV^2$; $8GeV^2 < q^2 < 16GeV^2$; $q^2 > 16GeV^2$)*
- Signal yields are extracted by fitting M_ν^2 (missing mass of the full event).

We obtain:

$$B(B^0 \to \pi^- l^+ \nu) = (1.46 \pm 0.27_{stat} \pm 0.28_{syst}) \times 10^{-4}$$

Main experimental systematics are due to detector (~8%), background composition (~10%) and shape of BB_{bar} background (~15%)

$80fb^{-1}$



Exclusive: $B \to (\pi,\rho,\omega,\eta,a_0)\, l\nu$

Breco Tags

$9\ B \to X_u l \nu$ modes are studied:

$X_u = \pi, \pi^0, \rho^+, \rho^0, \omega, \eta, \eta', a_0^0, a_0^+$

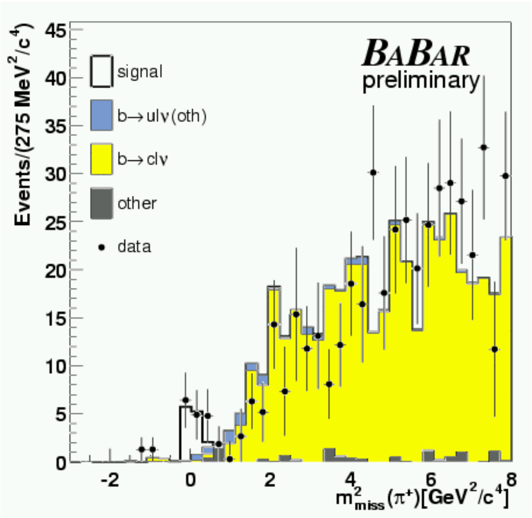
Resonances are exclusively reconstructed on the recoil.

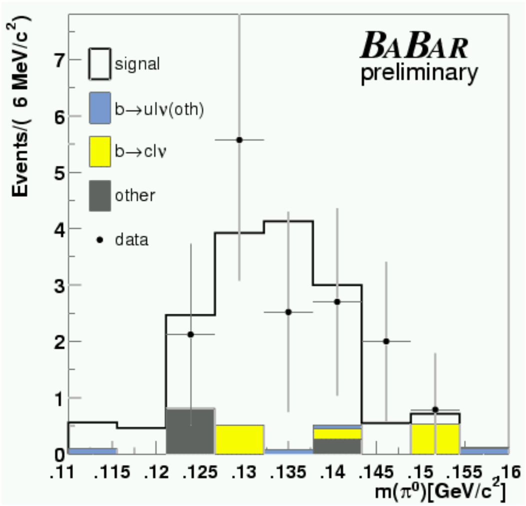
Similar cuts as for the inclusive m_X analysis, such as p*>1GeV and miss. mass squared of the event.

Further per mode cuts to reject $b \to c$ and crossfeed background are used

$80 fb^{-1}$

	Mass(MeV)	Width(MeV)	Decay modes
$\pi^\pm l\nu$	139.57	-	-
$\pi^0 l\nu$	134.98	-	$\gamma\gamma$
$\rho^\pm l\nu$	775	150	$\pi^0\pi^\pm$
$\rho^0 l\nu$	775	150	$\pi^-\pi^+$
$\omega l\nu$	782.6	8.5	$\pi^-\pi^+\pi^0$ (89%)
$\eta l\nu$	547.8	-	$\gamma\gamma$ (39.4%) $\pi\pi^+\pi^0$(22.6%) $\pi^0\pi^0\pi^0$(32.5%)
$\eta' l\nu$	957.8	-	$\rho^0\gamma$(29.5%) $\eta\pi^-\pi^+$ (44.3%)
$a_0^\pm l\nu$	985	50-100	$\eta\pi^\pm$ (~all)
$a_0^0 l\nu$	985	50-100	$\eta\pi^0$ (~all)





Exclusive: B→ (π,ρ,ω,η,a_0) lν

Breco Tags

Similar approach to the inclusive analysis but resonances are exclusively and fully reconstructed on recoil.

We measure:

$$B(B^0 \to \pi^- l^+ \nu) = (1.08 \pm 0.28_{stat} \pm 0.16_{syst}) \times 10^{-4}$$

$$B(B^0 \to \rho^- l^+ \nu) = (2.57 \pm 0.52_{stat} \pm 0.59_{syst}) \times 10^{-4}$$

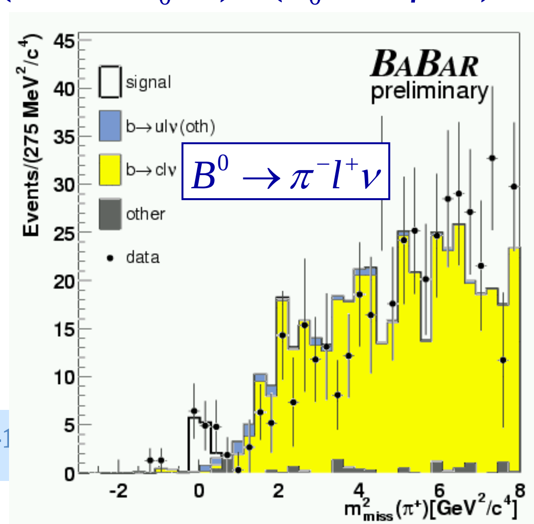
$$B(B^+ \to \eta l \nu) < 1.2 \times 10^{-4} (90\% CL)$$
$$B(B^+ \to \eta' l \nu) < 4.5 \times 10^{-4} (90\% CL)$$
$$B(B^+ \to a_0^0 l \nu) B(a_0^0 \to \eta \pi^0) < 5.3 \times 10^{-4} (90\% CL)$$
$$B(B^+ \to a_0^+ l \nu) B(a_0^+ \to \eta \pi^+) < 3.3 \times 10^{-4} (90\% CL)$$

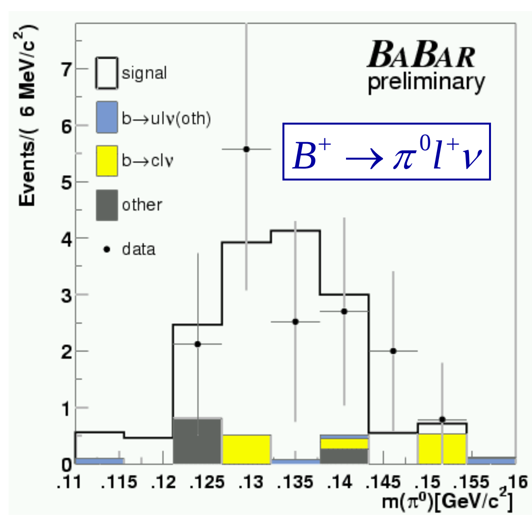
These two results make use of:

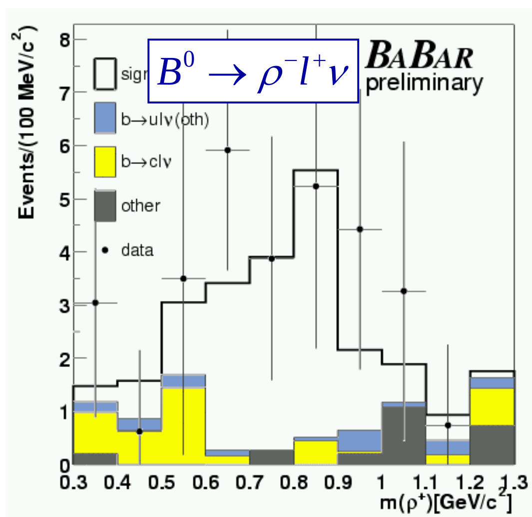
$$\begin{cases} B(B^0 \to \pi^- l^+ \nu) = 2B(B^+ \to \pi^0 l^+ \nu) \\ B(B^0 \to \rho^- l^+ \nu) = 2B(B^+ \to \rho^0 l^+ \nu) \\ B(B^+ \to \rho^0 l^+ \nu) = B(B^+ \to \omega l^+ \nu) \end{cases}$$

Systematics are dominated by MC statistics.
Large systematics due to non-resonant contribution in B → ρlν.
Theoretical systematics are small (~ 4-7%)

80fb^{-1}

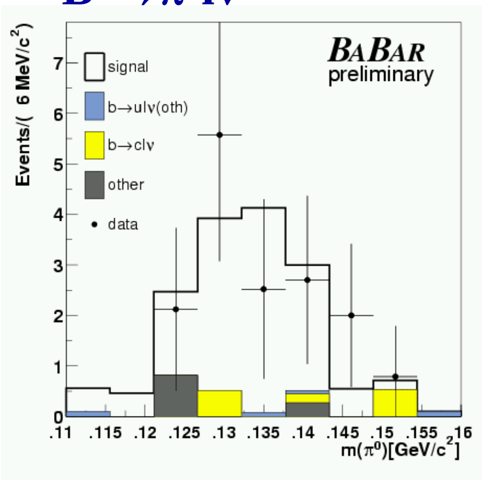




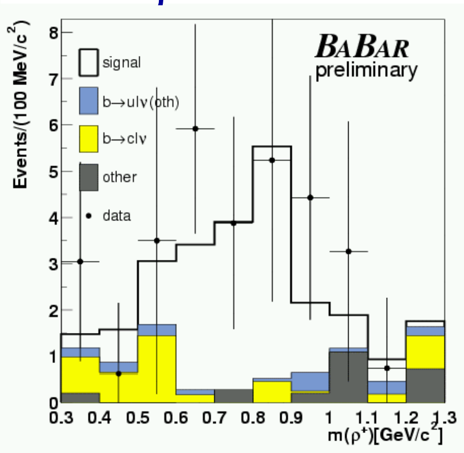


Results ($80 fb^{-1}$)

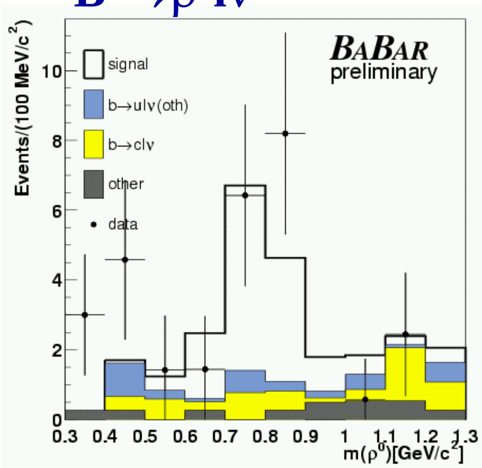
$B^{\pm}\to\pi^{0}l\nu$



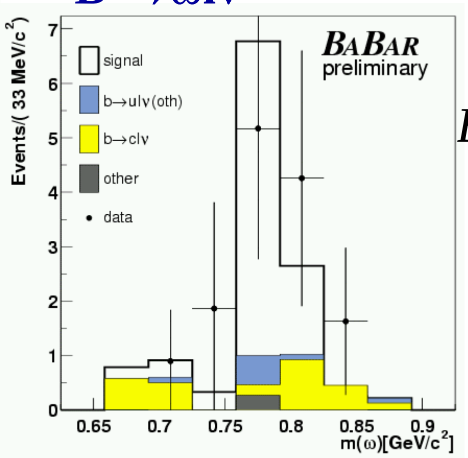
$B^{0}\to\rho^{\pm}l\nu$



$B^{\pm}\to\rho^{0}l\nu$



$B^{0}\to\omega l\nu$



$$B(B^{0}\to\pi^{+}l\nu)=(0.89\pm0.34_{stat}\pm0.12_{syst})\times10^{-4}$$

$$B(B^{+}\to\pi^{0}l\nu)=(0.91\pm0.28_{stat}\pm0.14_{syst})\times10^{-4}$$

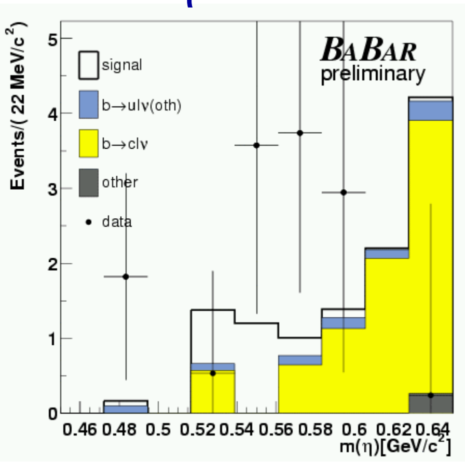
$$B(B^{0}\to\rho^{+}l\nu)=(3.5\pm1.1_{stat}\pm0.7_{syst})\times10^{-4}$$

$$B(B^{+}\to"\rho^{0}"l\nu)=(1.04\pm0.39_{stat}\pm0.16_{syst})\times10^{-4}$$

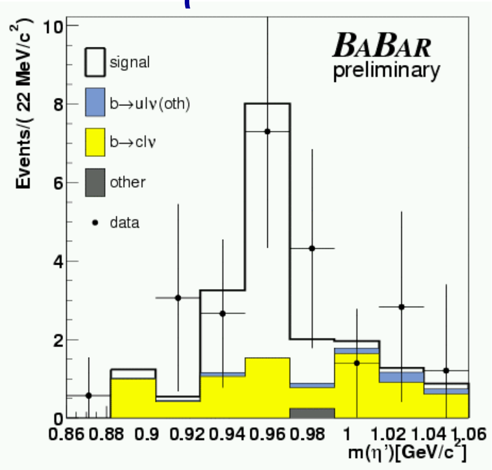
$$B(B^{+}\to\omega l\nu)=(1.26\pm0.55_{stat}\pm0.24_{syst})\times10^{-4}$$

Results (80fb^{-1})

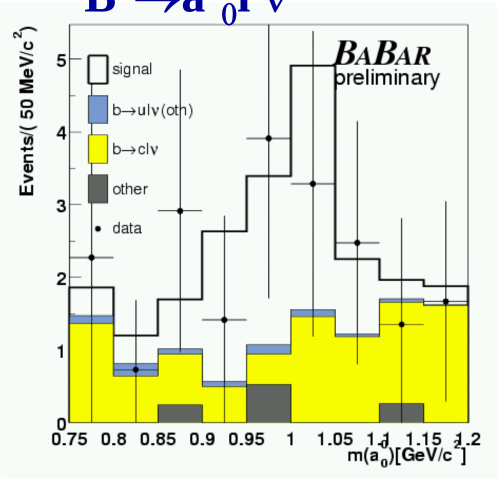
$B^{\pm} \to \eta l \nu$



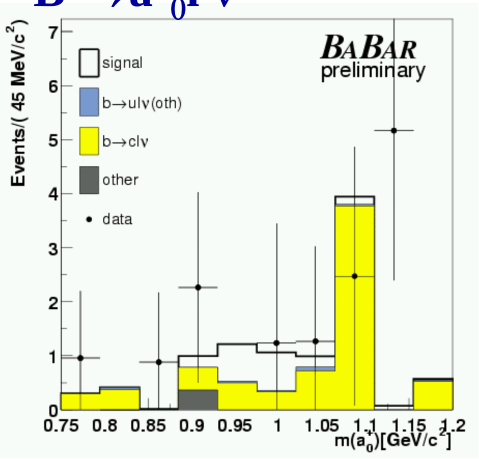
$B^{\pm} \to \eta' l \nu$



$B^{\pm} \to a^0_0 l \nu$



$B^0 \to a^{\pm}_0 l \nu$



$$B(B^+ \to \eta l \nu) = (0.39 \pm 0.41_{stat} \pm 0.22_{syst}) \times 10^{-4}$$

$$\Rightarrow \quad B(B^+ \to \eta l \nu) < 1.2 \times 10^{-4} (90\% CL)$$

$$B(B^+ \to \eta' l \nu) = (2.7 \pm 1.2_{stat} \pm 0.5_{syst}) \times 10^{-4}$$

$$\Rightarrow \quad B(B^+ \to \eta' l \nu) < 4.5 \times 10^{-4} (90\% CL)$$

$$B(B^+ \to a_0^0 l \nu) B(a_0^0 \to \eta \pi^0) =$$

$$(2.7 \pm 1.4_{stat} \pm 0.9_{syst}) \times 10^{-4}$$

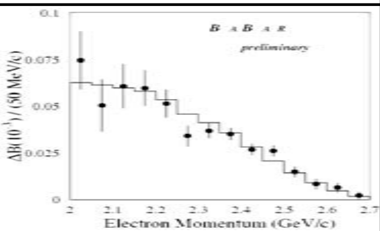
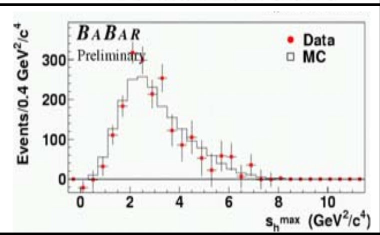
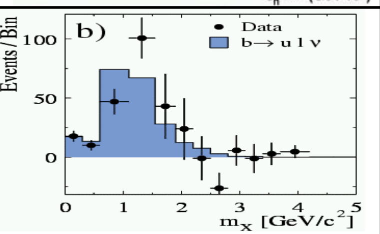
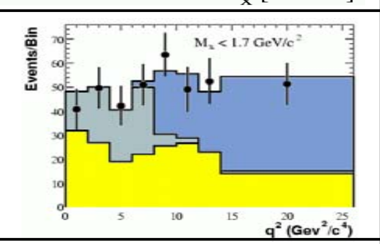
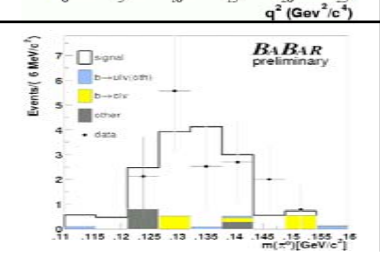
$$\Rightarrow \quad B(B^+ \to a_0^0 l \nu) < 5.3 \times 10^{-4} (90\% CL)$$

$$B(B^+ \to a_0^+ l \nu) B(a_0^+ \to \eta \pi^+) =$$

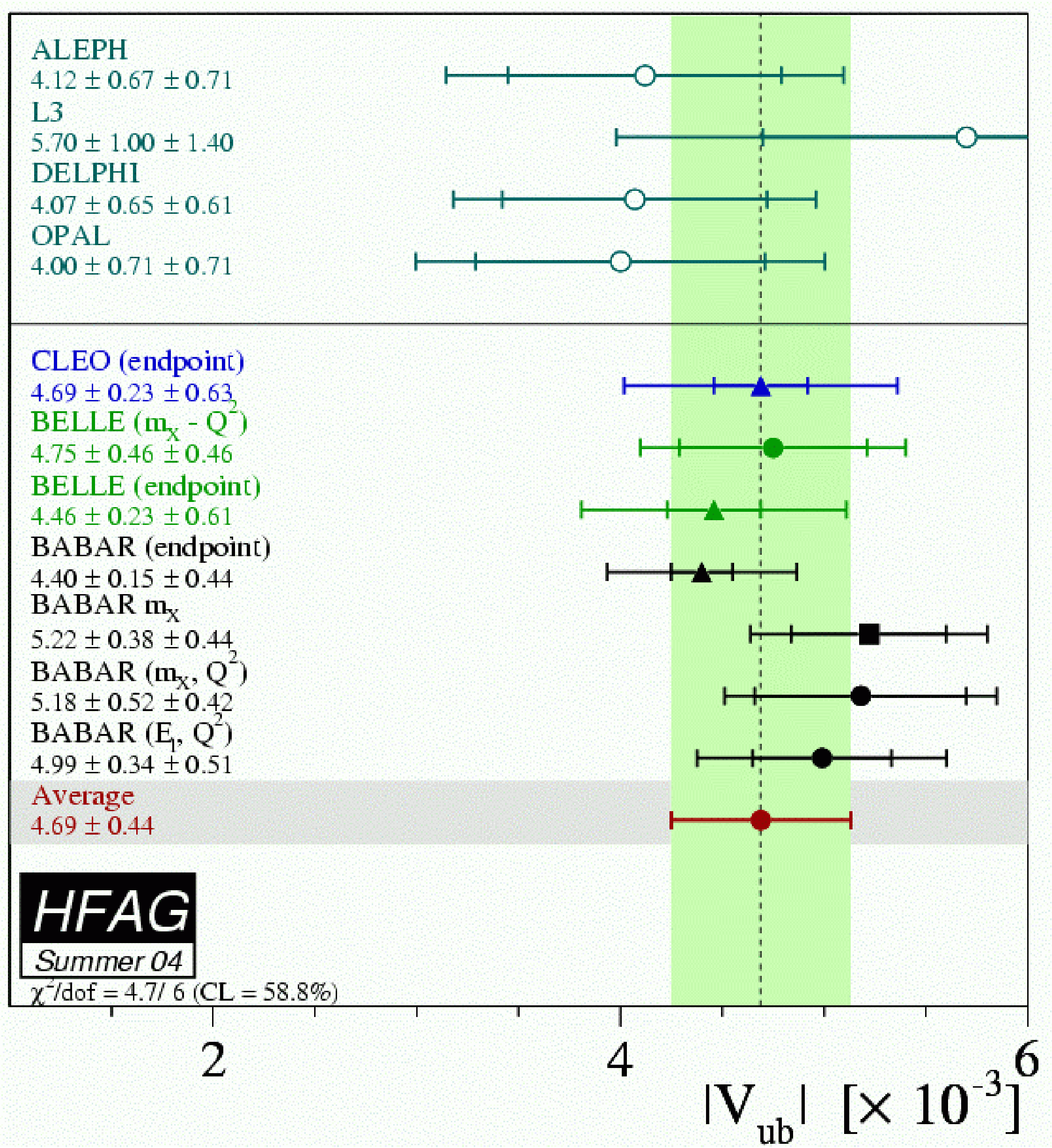
$$(0.7 \pm 1.6_{stat} \pm 0.3_{syst}) \times 10^{-4}$$

$$\Rightarrow \quad B(B^+ \to a_0^+ l \nu) < 3.3 \times 10^{-4} (90\% CL)$$

V_{ub} measurements with BaBar

	method	S/B	Results
	*Untagged* *inclusive* Electron spectrum endpoint E_e>2.0GeV Total rate using DeFazio-Neubert	0.1→1	$\|V_{ub}\| = (3.94 \pm 0.23_{exp} \pm 0.42_{theo}) \times 10^{-3}$
	*Untagged* *inclusive* E_e vs q^2 and neutrino reconstruction E_e>2.0GeV and s_h<3.5 GeV^2/c^4 Total rate using DeFazio-Neubert	~0.3	$\|V_{ub}\| = (4.63 \pm 0.47_{exp}{}^{+0.62}_{-0.36\,theo}) \times 10^{-3}$
	*Breco Tags* *inclusive* m_X analysis (1-D) m_X<1.55 GeV/c^2 Total rate using DeFazio-Neubert	~1.7	$\|V_{ub}\| = (4.77 \pm 0.40_{exp}{}^{+0.69}_{-0.45\,theo}) \times 10^{-3}$
	*Breco Tags* *inclusive* m_X vs q^2 analysis m_X<1.7 GeV/c^2 and q^2 >8.0 GeV^2/c^4 Total rate and V_{ub} using Bauer et al.	~2	$\|V_{ub}\| = (4.92 \pm 0.53_{exp} \pm 0.46_{theo}) \times 10^{-3}$
	*Partial Tags* *Breco Tags* *exclusive* Total rate by using Form Factors calc.	1→20	$B(B^0 \to \pi^- l^+ \nu) = (1.22 \pm 0.19_{stat} \pm 0.18_{syst}) \times 10^{-4}$ $B(B^0 \to \rho^- l^+ \nu) = (2.57 \pm 0.52_{stat} \pm 0.59_{syst}) \times 10^{-4}$

V_{ub} measurements



Conclusions for Exclusive Decays

We also developed novel methods to measure EXCL. CHARMLESS decays:

- Breco tags:

$$B(B^0 \to \pi^- l^+ \nu) = (1.08 \pm 0.28_{stat} \pm 0.16_{syst}) \times 10^{-4}$$

$$B(B^0 \to \rho^- l^+ \nu) = (2.57 \pm 0.52_{stat} \pm 0.59_{syst}) \times 10^{-4}$$

- Semil tags:

$$B(B^0 \to \pi^- l^+ \nu) = (1.46 \pm 0.27_{stat} \pm 0.28_{syst}) \times 10^{-4}$$

AVERAGE

$$B(B^0 \to \pi^- l^+ \nu) = (1.22 \pm 0.19_{stat} \pm 0.18_{syst}) \times 10^{-4}$$