

## BaBar Tools Workshop

# Feedback from Semileptonic, Leptonic, Tau&QED, IHPS AWGs

- Jochen Dingfelder
- SLAC, Sep. 30, 2005

# Overview

- (1) Some feedback on **neutrals, tracking, PID** issues and impact on physics analyses
- (2) “Wish List” with **general issues**
- (3) A few **new tools** we can offer

Thanks to all the AWG conveners and members that gave feedback!

Special thanks to Gregory Dubois-Felsmann, George Lafferty, Mike Kelsey, Vera Luth, David Côté, Thorsten Brandt, Kerstin Tackmann, Will Roethel, Wolfgang Menges, Art Snyder, Denis Bernard, Swagato Banerjee, ...

# Neutrals: Single Photons and $\pi^0$

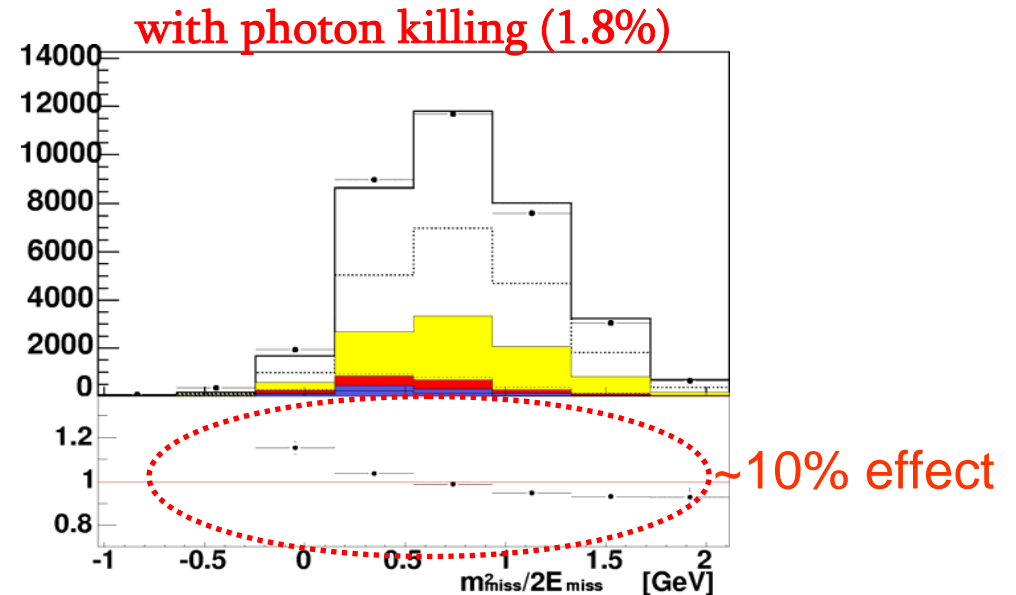
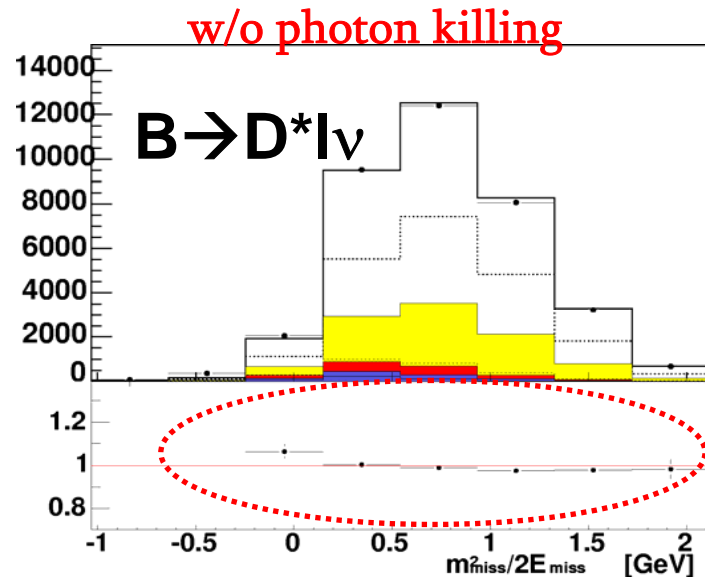
- **Single photon efficiency** error has large impact on **inclusive event reconstruction**:
  - E.g., it's the largest single error contribution for (semilep.) analyses with **neutrino reconstruction**.
  - Also important for analyses in Leptonic and Tau AWGs.
- **Can we improve on this?**

Here an example:  $B \rightarrow \pi/\rho l \nu$  systematics

$q^2$ Range ( $\text{GeV}^2$ )	$\delta\mathcal{B}_\pi/\mathcal{B}_\pi$ (%)					$\delta\mathcal{B}_\rho/\mathcal{B}_\rho$ (%)				
	0–5	5–10	10–15	15–20	20–25	0–25	0–10	10–15	15–25	0–25
Track Efficiency	6.2	0.5	1.7	1.3	0.3	4.2	2.1	8.1	12.6	6.9
Photon Efficiency	5.5	5.7	9.5	1.5	9.7	6.0	18.5	9.6	12.7	14.1
Photon Energy Resolution	1.0	4.0	6.0	3.1	5.2	3.7	9.8	2.0	3.4	5.8
Neutrino Reconstruction	8.3	7.0	11.4	3.7	11.0	8.1	21.0	12.7	18.2	17.7

# Neutrals: Single Photons and $\pi^0$

- Missing mass distribution for  $B \rightarrow D^* l \nu$  sample:



- Tau&QED AWG raised concerns about large  $\pi^0$  efficiency error of 3%:
  - Example: PDG :  $\text{BF}(\tau \rightarrow \pi^+ \pi^0 \nu)$  has 0.5% error
  - BaBar: superior statistics, but 3% syst. error from  $\pi^0$
  - Even worse for  $\tau$  decays with several  $\pi^0$  !

# Neutrals: $K^0_L$ Correction & Systematics

- **Currently used  $K^0_L$  corr./syst.:** BAD 1055 (Runs 1-3, CM1):
  - $c\bar{c} \rightarrow D^{*\pm} X$ ,  $D^{*\pm} \rightarrow D^0 \pi^\pm$ ,  $D^0 \rightarrow K^0_L \pi^+ \pi^-$  and  $c\bar{c} \rightarrow D^{*\pm} X$ ,  $D^{*\pm} \rightarrow D^0 \pi^\pm$ ,  $D^0 \rightarrow K^0_S \pi^+ \pi^-$  control samples
  - $\epsilon_{K^0L\_DATA} = \epsilon_{K^0L\_MC} \times (70 \pm 20)\%$
  - $E_{K^0L\_DATA} = E_{K^0L\_MC} \times f(E)$
- We need **corrections for newer releases:**
  - compute  $\epsilon_{MC}/\epsilon_{DATA}$  as **function of  $K^0_L$  momentum**
  - more **reliable systematic errors** estimation (current error on efficiency correction is huge)!
- David Côté is pursuing this with Runs 1-4, 16-series release.
- Goal would be to have generic  $K^0_L$  corrections/systematics usable for everybody, similar to PID, tracking, etc.

# Neutrals: $K_s^0$ from Tau Decays

## Special request from Tau&QED AWG:

For analysis  $\tau \rightarrow K_s^0 \pi^- \nu$ , the **standard  $K_s$  list is not pure enough.**

→ tightening of cuts necessary

→ to **estimate systematics, more variables are needed in  $K_s$  ntuples**

→ Can more variables be added to  $K_s$  ntuples used by  $K_s$  task force to create efficiency correction tables?

# Tracking

**Track selection** also has large effect on **inclusive event reconstruction!**  
→ D. Brown's progress on tracking studies very welcome! → Time scale?

Currently there are several track lists, which have to be supported:

- In addition to **GTL**, many people use **ChargedTracks** for e.g. for  $K_s^0$ 's (increase efficiency for long-lived particle reco.)
- **Need tracking corrections, systematics for each list.**  
PID only supports **GTL**.
- **Clean-up** cuts (ghosts, loopers,...) applied **at analysis level**

## Suggestion:

- Create one **new standard track list** using new track definitions by D. Brown et al. that every analysis can use:
  - special treatment for **low-PT tracks** (e.g. needed for  $D^* \rightarrow D\pi_s$ )
  - **include clean-up** cuts in track definition
- **Produce one consistent set of PID/tracking corr. tables for this list**

# PID / Neutrals / Tracking

**PID**: → Lack of “official” **systematic errors on PID selectors**

→ systematics are generally different for each case (depending e.g. on kinematic cuts), but it would be nice to at least get some **official recipe** or “**guidance**”

→ some systematic estimates should be usable for everyone, e.g. provide **up-to-date efficiency vs. multiplicity** for electrons, ...

**Applying PID, neutrals, tracking corrections is harder than it should be!**

→ the three types of corrections have **different interfaces**

→ **Documentation is differently organized** and sometimes **hard to find!**

→ **Can't we unify this and make it more user-friendly !?**

# List of General Issues

## ➤ Submitting/Monitoring Jobs:

- Everyone writes **own private tools** to submit jobs  
Would be better to **join effort to central tools instead!**
- **Simple Job Manager (SJM)** exists
  - submitting/bookkeeping/monitoring of ntuple/skim jobs
  - **what is the status – when is it fully usable?**
  - looking forward to talk by Will Roethel

## ➤ Skimming of signal MC:

- **control** of **which signal mode** gets skimmed
- **documentation** for analysts of how to **run own skims** over other modes and **get same results as prod. skim**

## ➤ Bug fixes for releases:

- Easy way to become aware of **availability of bug fixes**
- **Tool to be used in test release** that checks if all recommended bug fix tags are checked out and built?



# **New tools we can offer!**

# Form Factor Reweighting Package

Form-factor reweighting of semilep. B decays important for all analyses requiring a lepton (as signal or background).

XsIFFReweighting → standard tool to do so.

by David Côté

It can:

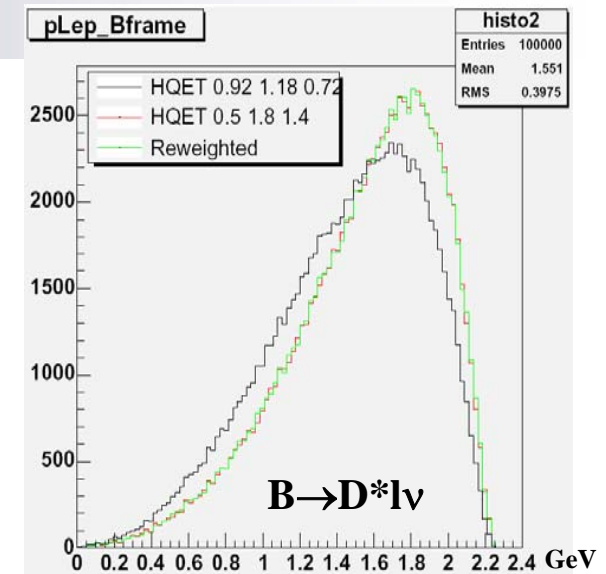
- Reweight B to pseudo-scalar and B to vector meson SL decays
- Use standard  $f^+(q^2)$ ,  $A_1(q^2)$ ,  $A_2(q^2)$ ,  $V(q^2)$  param. (e.g.  $B \rightarrow \pi/\rho l\nu$ )
- Use HQET R1, R2,  $\rho^2$  “linear” parametrization for  $B \rightarrow D^* l\nu$

Also, it is:

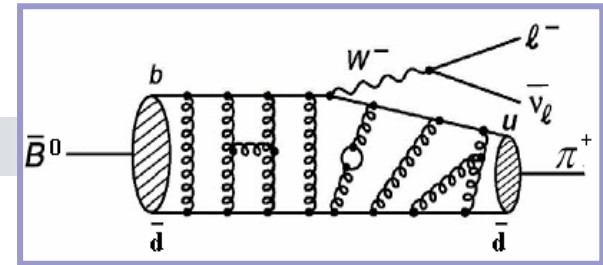
- Easy to use within the BaBar Framework or standalone
- Easy to implement new form-factor models
- Documented in **BAD 809** and **hep-ex/0409046** (Eur.Phys.J.C)

XsIFFReweighting is part of analysis-24.

V00-03-05 includes BaBar's latest  $B \rightarrow \pi l\nu$  &  $B \rightarrow D^* l\nu$  FF measurements.



# XslFFReweighting

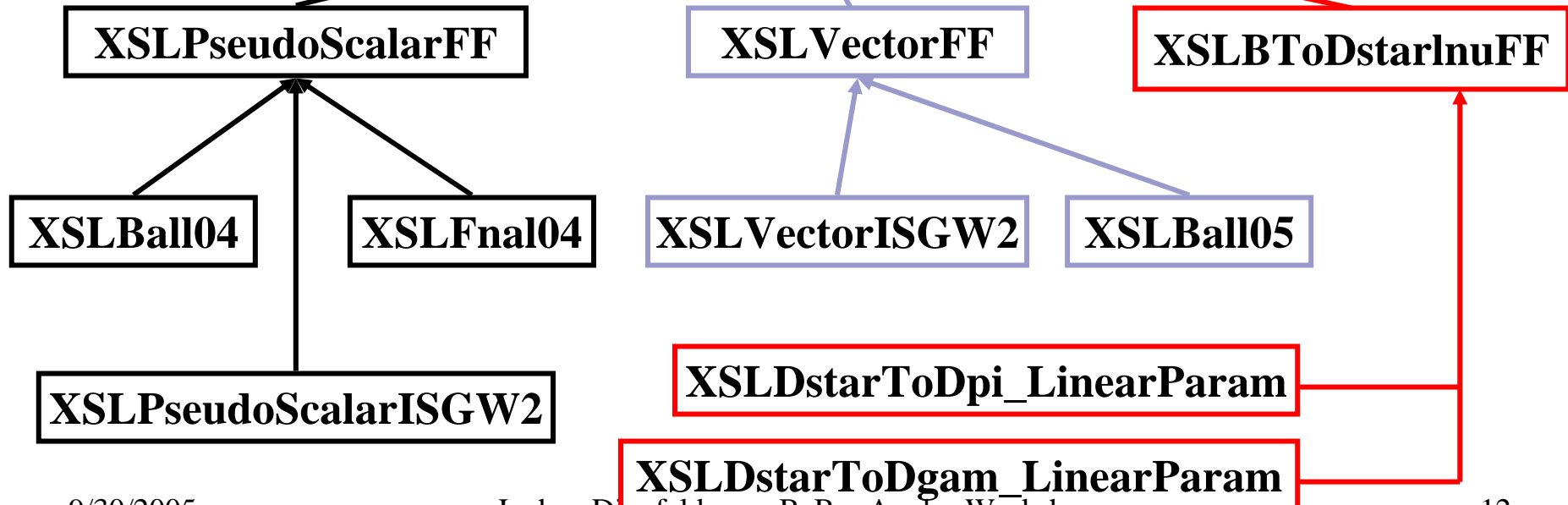


Code's nice'neasy-to-use  
object oriented structure

**“interface”**  
**XSLEvtFFWeight**

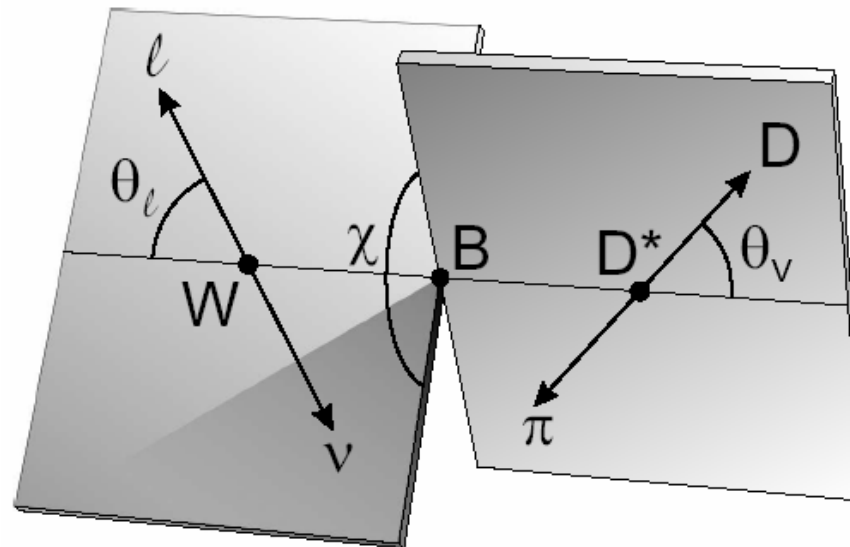
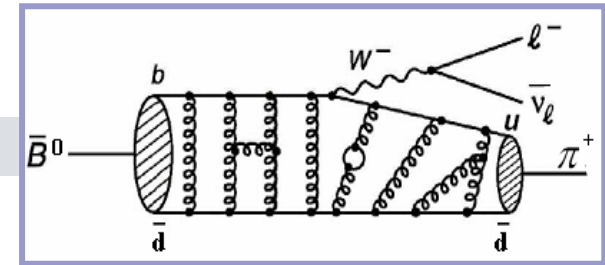
```

FromFLATQ2ToThisModel()
FromPHSPToThisModel()
FromISGW2ToThisModel()
FromSP4ToThisModel()
FromSP5ToThisModel()
FromSP6ToThisModel()
    
```



# XsIFFReweighting

“Kinematics Tool”



**XsIFFReweighting/XSLKin** is another very useful class providing  $q^2$ ,  $\theta_l$ ,  $\theta_\pi$ ,  $\chi$  given the  $B$ ,  $D^*$ ,  $l$  and  $D^0$  HepLorentzVector in LAB frame.

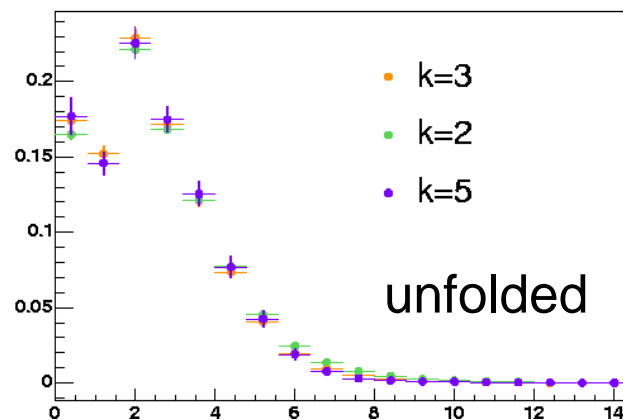
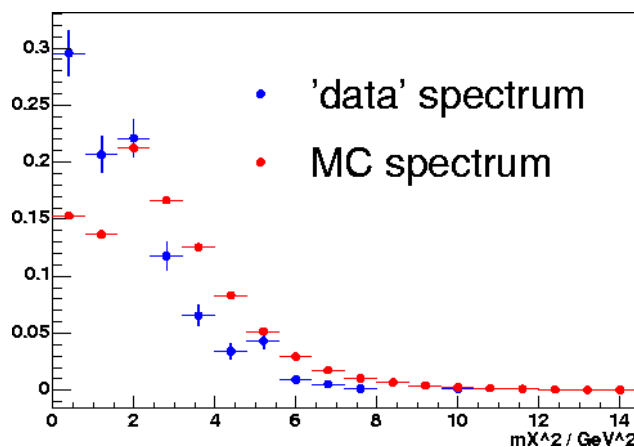
# Unfolding Tool(s)

- Package: **RooUnfHistoSvd**

by Kerstin Tackmann

- Tool to **unfold 1D spectra** from e.g. acceptance or resolution effects
- Can be compiled as shared library and loaded into ROOT
- Method uses singular value decomposition of the **detector response matrix provided as 2d histogram**
- **Covariance matrix** of unfolded spectrum can be **determined using toys**

→ Tim Adye has been working on a ROOT framework to allow usage of different unfolding methods with consistent interface. Includes also unfolding of 2D histograms (see talk at Dec04 CM).



# $\gamma \rightarrow e^+ e^-$ Finder in CompositionSequences

Swagato Banerjee studied  $\gamma \rightarrow e^+ e^-$  conversions in events  $e^+ e^- \rightarrow \mu^+ \mu^- \gamma$

→ **New conversion finder** with **higher purity** than default:

	Efficiency	Purity
New Conversion finder	96.6%	<b>87.5%</b>
GammaToEE_Default	99.7%	77.4%

[see Talk at:](#)

[\\$BFROOT/www/Organisation/CollabMtgs/2003/detDec2003/Tues1e/swagato.ps](#)

→ implementation in SimpleComposition ?

Speaking of SimpleComposition: there is a question about making **new variables** available in **SimpleComposition** (e.g. total PT of event, Dalitz mass<sup>2</sup> for 3-body decays, ...)

→ **general call for input with a HN forum ?**

# Extension of Barlow Fit in ROOT

**TFractionFitter** = ROOT implementation of Barlow&Beeston  
**binned max.-likelihood fit**

Added feature:

by Art Snyder

**Weight histogram** that is used to weight each histogram  
entering the fit **can be parameter-dependent**.

- allows us to fit not only relative proportions of each type of distribution, but to adjust the shapes of the component distributions for different parameters.
- new class “TBinWeighter” should be added to ROOT.

**Hope all this feedback is useful !**