A_{LR} with $B\overline{B}$ events

The left-right asymmetry is defined as

$$A_{LR} \equiv \frac{\sigma(e_R^+ e_L^- \to Z \to f\bar{f}) - \sigma(e_L^+ e_R^- \to Z \to f\bar{f})}{\sigma(e_R^+ e_L^- \to Z \to f\bar{f}) + \sigma(e_L^+ e_R^- \to Z \to f\bar{f})}$$

$$A_{LR} \equiv \frac{\sigma_L - \sigma_R}{\sigma_L + \sigma_R}$$

$$A_{LR} = \frac{\sigma_L - \sigma_R}{\sigma_L + \sigma_R} = \frac{4}{\sqrt{2}}\left(\frac{G_F s}{4\pi\alpha Q_f}\right) g_A^e g_V^f \langle Pol \rangle$$

$$\propto T_3^f - 2Q_f \sin^2\theta_W$$

With 70% polarized electron beam get unprecedented precision for neutral current vector couplings

Final State Fermion	SM g_V^f (M_Z)	World Average[1] g_V^f	Chiral Belle σ 20 ab^{-1}	Chiral Belle σ 40 ab^{-1}	Chiral Belle σ $\sin^2\Theta_W$ 40 ab^{-1}
b-quark (eff.=0.3)	-0.3437 ± .0001	-0.3220 ±0.0077 (high by 2.8σ)	0.002 Improve x4	0.002	0.003
c-quark (eff. = 0.3)	+0.1920 ±.0002	+0.1873 ± 0.0070	0.001 Improve x7	0.001	0.0007
Tau (eff. = 0.25)	-0.0371 ±.0003	-0.0366 ± 0.0010	0.0008	0.0006	0.0003
Muon (eff. = 0.5)	-0.0371 ±.0003	-0.03667±0.0023	0.0005 Improve x 5	0.0004	0.0002
Electron (1nb acceptance)	-0.0371 ±.0003	-0.03816 ±0.00047	0.0004	0.0003	0.0002

1 - Physics Report Vol 427, Nos 5-6 (2006), ALEPH, OPAL, L3, DELPHI, SLD

$\sin^2\Theta_W$ - all LEP+SLD measurements combined WA = 0.23153 ± 0.00016

$\sin^2\Theta_W$ - Chiral Belle combined leptons with 20 ab^{-1} have error ~ 0.00016

B-counting strategy

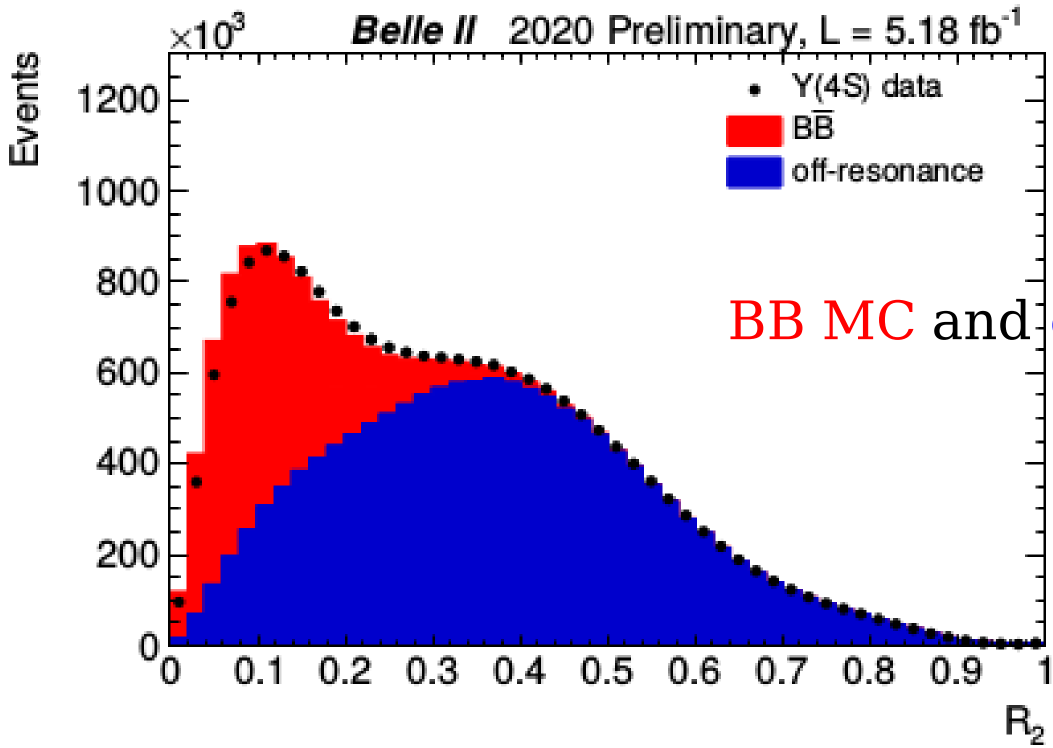
Selection

- Events must pass the hlt hadron skim
- #goodClusters >= 3
- #goodTracks >= 3
- E_{vis} > 4 GeV
- 0 GeV < p_z < 5 GeV
- 2 GeV < E_{ECL} < 7 GeV

Definition of goodTracks and goodClusters

goodClusters: E > 0.1 GeV, θ in CDC acceptance

goodTracks: pt > 0.1 GeV, |d0| < 1cm, |z0| < 2cm



BB MC and off-resonance data

B-counting strategy (M.Merola)

Motivation of B-counting

- N_{BB} important input for branching ratio measurements
- $N_{BB} = L \cdot \sigma_{BB}$ has high uncertainty due to the uncertainty on σ_{BB} (2-5%)

$$N_{BB} = (N_{had}^{on-res} - R_{lumi} \cdot N_{had}^{off-res} \cdot \kappa)/\varepsilon_{BB}$$

Number of selected hadronic events in on-peak data

Estimated number of non-BB events in on-peak data

Efficiency of hadronic selection for BB events

$$R_{lumi} = \frac{L^{on}}{L^{off}}$$

Ratio of measured luminosities

$$k = \frac{\sum_i \varepsilon_i \cdot \sigma_i}{\sum_i \varepsilon_i' \cdot \sigma_i'}$$

Efficiencies and cross sections of non-BB processes in on-peak and off-peak (primed quantities) data.

B-counting strategy (M.Merola)

$$N_{BB} = \left(N_{had}^{on-res} - R_{lumi} \cdot N_{had}^{off-res} \cdot \kappa\right) / \varepsilon_{BB}$$

Evaluation of N_{BB} per each «bunch» of data. For the data subtraction we consider the closest off-resonance to the on-resonance data.

For the measurement we need:

- $R_{lumi} = \frac{L^{on}}{L^{off}}$: evaluation of luminosity of the on and off-resonance data samples

- $k = \frac{\sum_i \varepsilon_i \cdot \sigma_i}{\sum_i \varepsilon_i' \cdot \sigma_i'}$: evaluation of the efficiencies of each process *i* at the two cms energies. Need MC samples at E_{cms} = 10.579 GeV (on-resonance) and E_{cms} = 10.519 GeV (off-resonance). Since the efficiencies may depend on the backgrounds and beam conditions —> use run-dependent MC

- ε_{BB} : evaluation of BB selection efficiency —> use run-dependent MC

B-counting strategy (M.Merola)

Source	systematics on $N_{B\overline{B}}$ (%)
luminosity measurement	0.9
selection efficiency	0.5
beam energy spread and shift	0.5
tracking efficiency	0.1
trigger efficiency	0.2
Total	1.1

In order to evaluate the systematic uncertainties we need:

- Stat.+syst. uncertainties on the luminosity determination of on and off-resonance data samples

see next slide

- MC samples with cms energy shifted up and down by 2 MeV w.r.t. nominal energies, in order to evaluate the beam energy spread effect on the efficiencies (on and off-resonance)

systematics from luminosity

Bhabha dominated measurement

	Source	on-peak (%)	off-peak (%)
correlated (Systematic error on the generator model)	Cross section	±0.1	±0.1
	CM energy	±0.3	±0.1
	θ_{cm} range	±0.2	±0.2
	IP position	±0.3	±0.1
	ECL location	±0.2	±0.1
uncorrelated	MC statistics	±0.1	±0.1
correlated	Beam backgrounds	±0.1	±0.1
	Cluster reconstruction	±0.2	±0.2
uncorrelated	E_{cm} distributions	±0.1	±0.1
	θ_{lab} distributions	±0.1	±0.1
	θ_{cm} distributions	±0.1	±0.1
	ϕ_{cm} distributions	±0.1	±0.1
correlated	Material effects	±0.1	±0.1
	Overlapping clusters	±0.1	±0.1
uncorrelated	Colliding backgrounds	±0.1	±0.1
	Quadrature sum of uncorrelated uncs.	±0.25	±0.25

Uncertainties on N_{BB} due to luminosity measurement: 0.9%

Summary

- try to describe (or more exactly gather the information) the mesurement of N(BB) at Υ(4S)
- will complete this part soon → A_{LR}
- will also investigate the other possibilities (B-tagging ?)