

FINITE TOP MASS EFFECTS IN

$$e^+e^- \rightarrow f\bar{f}$$

AT LEP ENERGIES

NON-UNIVERSAL, CHANEL DEPENDENT m_t - CORRECTIONS

$$Z \rightarrow b\bar{b}$$



Figure 1: *Vertex diagrams which contribute to Γ_b .*

$$\bullet S = M_Z^2, \quad V^{Zb\bar{b}}(M_Z^2)$$

$$\mathbf{V}^{Zb\bar{b}}(M_Z^2) = \mathbf{V}_0(M_Z^2) + \mathbf{V}_t(M_Z^2)$$

COMPLETE ONE LOOP CORRECTION $\mathcal{O}(\alpha)$

1. A.A.Akhundov, D.Yu.Bardin, T.Riemann,
*Nucl.Phys.***B276**(1986)1.
2. W.Beenakker and W.Hollik,
*Z.Phys.***C40**(1988)141.
3. J.Bernabeu, A.Pich and A.Santamaria,
*Phys.Lett.***200B**(1988)569.

• $S \neq M_Z^2$

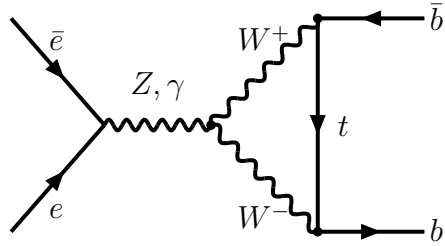
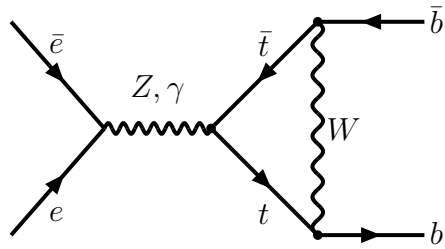


Figure 1: Vertex diagrams which contribute to $e\bar{e} \rightarrow b\bar{b}$.

GAUGE INVARIANCE:

+WW BOX DIAGRAM

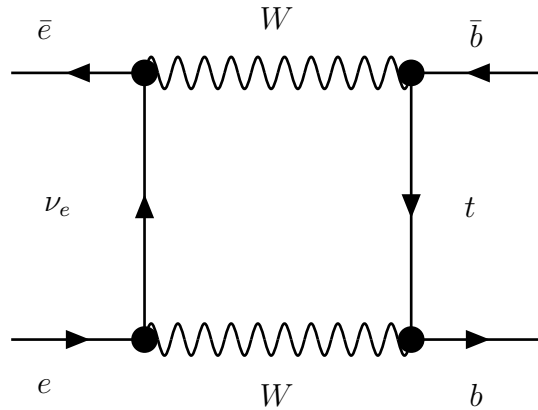


Figure 2: WW - boxes

$$R = \frac{\sigma_{e\bar{e}\rightarrow d\bar{d}}^{IBA} - \sigma_{e\bar{e}\rightarrow b\bar{b}}^{IBA}}{\sigma_{e\bar{e}\rightarrow d\bar{d}}^{IBA}}, \%$$

DOUBLE DECONVOLUTED \rightarrow

- NO ISR QED
 - NO FSR QED \times QCD
-

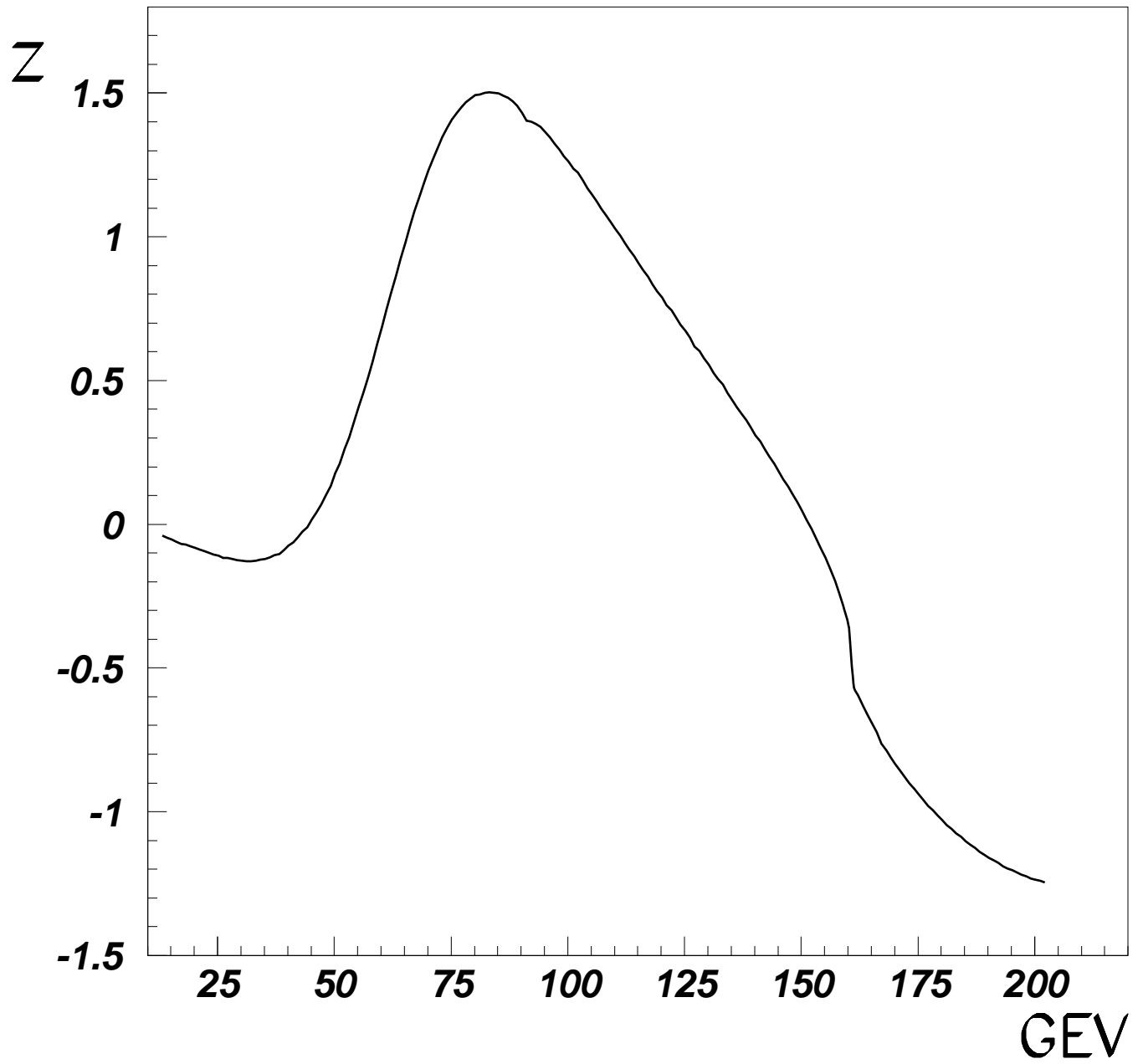
$\sigma_{e\bar{e}\rightarrow d\bar{d}}^{IBA} \rightarrow$ UNIVERSAL

$\sigma_{e\bar{e}\rightarrow b\bar{b}}^{IBA} \rightarrow$ UNIVERSAL + NON-UNIVERSAL

1	$V(s) + B(s, t)$
2	$V(M_Z^2)$
3	$V(s)$

$$A = \frac{1}{s - M_z^2 + iM_z\Gamma_z} \left[V^{Zbb}(s) + (s - M_z^2) \left(\frac{V^{\gamma bb}(s)}{s} + B^{WW}(s, t) \right) \right]$$

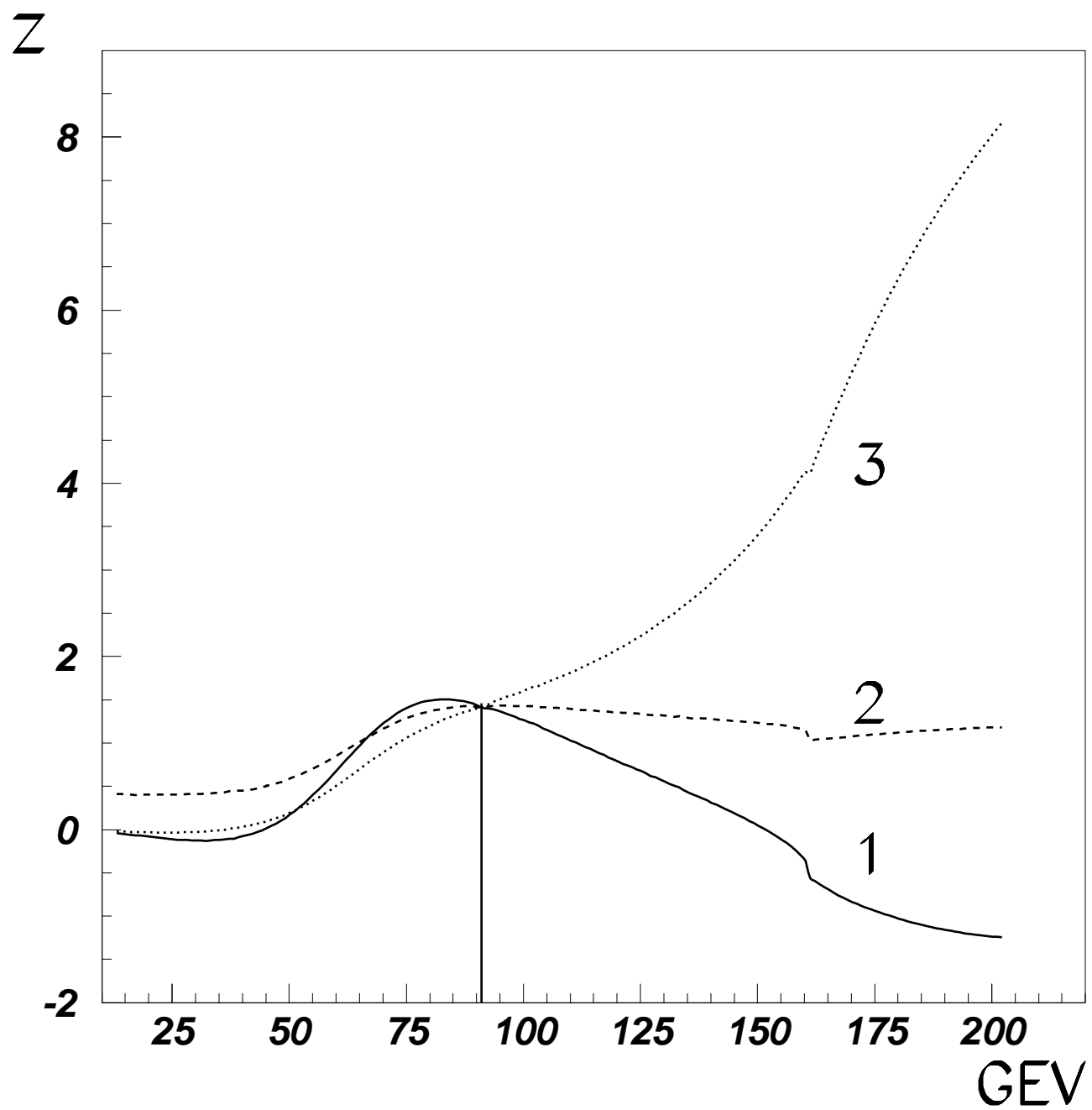
$$\begin{aligned} V &= V_0 + V_t \\ B &= B_0 + B_t \end{aligned}$$



$$R = \frac{\sigma_{e\bar{e}\rightarrow d\bar{d}}^{IBA} - \sigma_{e\bar{e}\rightarrow b\bar{b}}^{IBA}}{\sigma_{e\bar{e}\rightarrow d\bar{d}}^{IBA}}, \%$$

preserve gauge cancellation	$V(s) + B(s, t)$
	$V(M_Z^2)$
	$V(s)$

wrong result 2 and 3 are owing to
**VIOLATION OF GAUGE
 CANCELLATION !**



- THE OFF-RESONANCE CONTRIBUTIONS FROM $V^{AB,NAB}(s)$ and $B^{WW}(s)$ ARE VANISHINGLY SMALL AT LEP1 ENERGIES
- HOWEVER, THEY ARE VERY IMPORTANT BEYOND RESONANCE, IN PARTICULAR AT LEP2
- TO PRESERVE GAUGE CANCELLATION IT IS NECESSARY TO ADD BOX CONTRIBUTION
- NEW COMPARISON WITH TOPAZ0 AND WOH IS WELCOME