TOPAZ0 4.0 - Most recent upgradings

There is an agreement on using the following idea. Define

$$\alpha(M_Z) = \frac{\alpha(0)}{1 - \Delta\alpha^{(5)}(M_Z) - \Delta_{\rm top}(M_Z)}, \tag{1}$$

Moreover one has $\Delta\alpha^{(5)}(M_Z) = \Delta\alpha_{\rm lept} + \Delta\alpha^{(5)}_{\rm had}$. In all codes the input should be $\Delta\alpha^{(5)}_{\rm had}$, i.e. the top contribution to $\Delta\alpha$ is left for the code.

Inside TOPAZ0 one has

$$\Delta\alpha_{\rm lept} = 0.0314976003, \tag{2}$$

including the recently computed $\mathcal{O}(\alpha^3)$ terms of hep-ph/9803313, and $\Delta\alpha^{(5)}_{\rm had} = 0.028037 \pm 0.00065$, Z. Phys. C67(1995)585 (DEFAULT). This gives $1/\alpha^{(5)}(M_Z) = 128.878 \pm 0.089$, to which one must add the top contribution (-0.0000573514 for $m_t = 175.6\,$GeV) and the $\mathcal{O}(\alpha\alpha_s)$ corrections induced by the $t - b$ doublet (-0.000010238 for $\alpha_s(M_Z) = 0.120$), giving a total of $1/\alpha(M_Z) = 128.887$.

Therefore, inside TOPAZ0, we have

OAL='Y' Default, uses $\Delta\alpha^{(5)}_{\rm had} = 0.028037$.

OAL='V' You are changing $\Delta\alpha^{(5)}_{\rm had}$ to your preferred value. This is done by calling subroutine TCAQED with the new value as argument.

There is a new option for the QED radiator:

ORAD='Y' It uses the order α^3 YFS radiator as reported by M. Skrzypek in Acta Phys. Pol. B23(1992)135. The typical cross section with $s'/s = 0.01$ at the peak is such that σ(ORAD= 'Y') and σ(ORAD= 'F', recommended choice) differ by less than $+0.010\%$. Far off-peak and in the LEP2 energy range the difference is within 0.025%.

Some results follow where we use $M_Z = 91.1867\,\mathrm{GeV}$, $m_t = 175.6\,\mathrm{GeV}$, $M_H = 300\,\mathrm{GeV}$ and $\alpha_s(M_Z) = 0.120$. First muons then hadrons:

$\sqrt{s}$	A	F	YFS	$10^4\times$ (1-YFS/F)
$M_Z - 3$	0.2273108	0.2272232	0.2272344	-0.49
$M_Z - 2$	0.4127331	0.4125448	0.4125672	-0.54
$M_Z - 1$	0.8717263	0.8712968	0.8713469	-0.58
M_Z	1.477885	1.477053	1.477146	-0.63
$M_Z + 1$	1.079730	1.078893	1.078970	-0.71
$M_Z + 2$	0.6288428	0.6282222	0.6282654	-0.69
$M_Z + 3$	0.4078866	0.4074442	0.4074661	-0.54

$\sqrt{s}$	A	F	YFS	$10^4\times$ (1-YFS/F)
$M_z - 3$	4.440190	4.437749	4.438007	-0.58
$M_z - 2$	8.293914	8.289398	8.289888	-0.59
$M_z - 1$	17.82327	17.81376	17.81482	-0.60
M_z	30.40242	30.38458	30.38652	-0.64
$M_z + 1$	22.14696	22.12900	22.13063	-0.74
$M_z + 2$	12.79886	12.78540	12.78632	-0.72
$M_z + 3$	8.220385	8.210627	8.211107	-0.58