Upgrading of ISPP in version 4.4

A question about pairs and associated uncertainty was raised by Gunter and further comments were sent by Martin after a comparison with `MIZA`.

`MIZA` is based on JMS; unless something has changed with respect to JMS paper we have that JMS is an ansatz for re-summation of both soft photons and soft lepton pairs. For hadron pairs it is corrected numerically with an uncertainty of 30JMS.

`TOPAZO` version < 4.4, use an effective, naive, implementation of ISPP (**ONP = Y**) based on KKKS interfaced with soft photon re-summation. As shown by Gunter Quast the agreement with `MIZA` is perfect around the resonance but quickly deteriorates on the high energy side.

- **First comment**. One should remember that JMS is a generalization of KF ansatz for re-summation of both soft photons and soft lepton pairs. If one goes back to KF paper it is clearly stated the region of applicability of the result, energy of pairs not exceeding Δ, with $E \gg \Delta \gg 2m$. In other words, one should not simulate too hard pairs with the soft result (for instance $z_{\rm min} = 0.25\,s$ means that all primary pairs with, at least 50% of the nominal energy are accepted. Away from resonance hard pairs become important.

In order to have some partial improvement upon the present situation I have accelerated some old project of mine. It is not the global, up to LEP 2 energies, full 2f-4f interface but it amounts to the following changes in version 4.4 (**changes implemented already in April!!!**):

1. **ONP** has the additional value of **ONP = I**, where

2. KF result for virtual pairs and for soft and exponentiated pairs is used; it is also applicable to hadron pairs, because I use KKKS results for $\mathcal{O}\left(\alpha^2\right)$ and I write it in terms of moments. Then I match it to KF and generalize KF to soft and exponentiated hadrons pairs.

3. Next, I use generalized KF for V+S and cut to the same s' cut of IS QED radiation. Once an s' cut is introduced in one place then it should be used everywhere, even for photons + pairs.

4. Finally, I use soft only up to some cut that is compatible with $E \gg \Delta \gg 2\,m$. Above it I use KKKS but not added linearly, KKKS in convolution with IS QED radiation. The radiator used here is a LL radiator, with options `ORISPP = S` (second order) and `ORISPP = T` (third order). The last, posted, version of `TOPAZO` includes this option.

None of these approaches, including JMS, is the complete result. All of them are some sort of ansatz, more or less justified.

Now, some comparison: cross-sections at an MI point, at ALEPH bets-fit as given in Tab.(1): for ISPP[1] on and off; ISPP effect was taken as the difference. We report $\sigma_{\rm had}$ [nb] in Tab.(2): first entry is without pairs, second entry is with pairs and third entry is (with - without).

The improved ISPP treatment is not fully correct, as explained above, since hard pairs are taken from KKKS result which is only an approximation to the true answer. A new flag has been inserted corresponding to the value of Δ, the soft/hard separator in pairs. It helps in testing stability. Therefore `TCUTSET` has one more argument

```
      SUBROUTINE TCUTSET(IND,SOC,THMN,THMNP,ACLL,EOC,XCUT,XCUTF,XPCUT,
     #                   XSEPA)
```

and you set s' and $z_{\rm min}$ with

```
        VAL= 0.01D0
        CALL TCUTSET(IND,DMY,DMY,DMY,DMY,DMY,VAL,DMY,VAL,DMY)
```

Next, some SM numbers, i.e. the hadronic cross-section for $M_{_Z} = 91.1867\,$GeV, $m_t = 173.8\,$GeV, $M_{_H} = 100\,$GeV and $\alpha_{_S}(M_{_Z}) = 0.119$. In Tab.(3) first entry is `ONP = N`, second entry is `ONP = I` and third entry is with/without - 1 in per-mill.

[1] Here ISPP means **NON-SINGLET** Initial State Pair Production. **SINGLET** pairs are supposently subtracted together with two-photon contributions

PO	I/O
M_z[GeV]	91.1882
Γ_z[GeV]	2.4952
σ^0_h[nb]	41.560
R_l	20.728
A^{01}_{FB}	0.017319

Table 1: MI point, at ALEPH bets-fit.

$\sqrt{s}$[GeV]	`MIZA`	`TOPAZO`(ONP=Y)	`TOPAZO`(ONP=I)
88.464	5.2297	5.2187	-
	5.2170	5.2059	5.2063
	-0.0127	-0.0128	-0.0124
89.455	10.121	10.105	-
	10.094	10.079	10.079
	-0.027	-0.026	-0.026
90.212	18.238	18.227	-
	18.187	18.178	18.179
	-0.051	-0.049	-0.048
91.207	30.529	30.549	-
	30.449	30.471	30.470
	-0.080	-0.078	-0.079
91.238	30.589	30.609	-
	30.510	30.531	30.530
	-0.079	-0.078	-0.079
91.952	25.173	25.166	-
	25.121	25.117	25.112
	-0.052	-0.049	-0.054
92.952	14.503	14.484	-
	14.488	14.476	14.466
	-0.015	-0.008	-0.018
93.701	10.067	10.051	-
	10.064	10.059	10.046
	-0.003	0.008	-0.005

Table 2: Comparison with `MIZA`.

$\sqrt{s}$[GeV]	$s'/s = 0.01$	$s'/s = 0.1$	$s'/s = 0.5$	$s'/s = 0.9$
$M_z - 3$ [GeV]	4.45106	4.44444	4.43769	4.38335
	4.44069	4.43391	4.42705	4.37227
	-2.33	-2.37	-2.40	-2.52
$M_z - 1.8$ [GeV]	9.60037	9.59393	9.58742	9.52026
	9.57589	9.56929	9.56267	9.49497
	-2.55	-2.57	-2.58	-2.66
M_z [GeV]	30.43633	30.43005	30.42316	30.31927
	30.35752	30.35109	30.34409	30.23944
	-2.59	-2.59	-2.60	-2.63
$M_z + 1.8$ [GeV]	14.18153	14.17541	14.16813	13.98373
	14.16470	14.15846	14.15117	13.96556
	-1.19	-1.20	-1.20	-1.30
$M_z + 3$ [GeV]	8.19803	8.19206	8.18498	7.87534
	8.19800	8.19193	8.18460	7.87272
	-0.004	-0.02	-0.05	-0.33

Table 3: SM results.