11th March 2011

Public information to responsible persons

Below you will find an enumeration of areas that either are taken over from ZFITTER or were compared with intensive use of ZFITTER. You can see by the names that we have always placed value on the fact who carried out these calculations.

The 2-loop corrections of order O(g^4 mt^2/mw^2) for the electroweak form factors are taken over from the Fortran code m2tcor5_11.f and translated into C++ code (EW2Loop.cxx). These calculations and Fortran routines are from the external contributors Degrassi and Gambino, and this was quoted in our program. The classes Vertex.cxx, ZfitterFermionPart.cxx and ZFitterBosonPart.cxx also contain corrections to the electroweak form factors rho and kappa. They were quoted according to the publications cited in our program. This part was intensively compared with the implementation of ZFITTER (therefore similar names). Calculations, that were not published, but had been implemented in ZFITTER (dizet6_42.f), have been taken over with reference to the corresponding lines in dizet6_42.f. The class ZFitterQCDCorrection.cxx contains also corrections to the electroweak form factors. This class is based on the package bkqcdl_5_14.f, which in turn is based on a library of B. Kniehl. All these corrections work together in the program parts Z0Zfitter and WZFitter. This part was taken from theory papers, but was in addition compared closely with ZFITTER. Differences or additions were taken over with reference to the corresponding line in the ZFITTER code. The form factors are needed in the SM part of Gfitter for the calculation of the Z and W widths, e.g.

```
      GammaZ_f =
  Gamma0*rhof*sqrt(1.0-4.0*RatioMfMZ)*(C1*RadiatorFunctionVector + C2
  *RadiatorFunctionAxial)   <- no exact formula
```

The radiator functions are programmed following the ZFITTER paper (or from "The Standard Model in the Making", Bardin and Passarino, Oxford, 1999). They were supplemented by higher orders in Gfitter.

The observables which are relying on the form factors are: GammaZtot, sigma0had, R0C, R0b, R0lep, GammaWtot.

For questions regarding the ZFITTER code, M. Awramik gave advise.

[one author of Gfitter/GSM]