Dear colleagues, in our last 4f sub-group meeting we have foreseen a condensed list of items that should be addressed before the next general meeting. In the following, please find additional recommendations,

Jorgen, Reisaburo, Hywel, Martin, Marco and Giampiero.

0.1 Proposal section 2.1

Five groups of observables are defined. For each group, the observables are ordered in decreasing priority. Here we specify in more detail the flavour content:

A $\mathcal{O}(\alpha)$ or *exponentiation* for:

1. CC03 total W-pair cross section,
2. NC02 total Z-pair cross section.

B WW like: (all charged leptons visible)

1. $u\overline{d}c\overline{s}$
2. $u\overline{d}d\overline{u}$
3. $u\overline{d}\mu^-\overline{\nu}_\mu$
4. $u\overline{d}e^-\overline{\nu}_e$
5. $\mu^-\nu\tau^+\nu$
6. $\mu^-\nu\mu^+\nu$
7. $e^-\nu\mu^+\nu$
8. $e^-\nu e^+\nu$

C single-W like - $We\nu$ ([one] electron down the beam pipe, other $q/e/\mu$ visible)

1. $u\overline{d}e^-\nu_e$
2. $mu\nu e^-\nu_e$
3. $e\nu e^-\nu_e$

D ZZ-like: (all charged leptons visible)

1. $u\overline{u}u\overline{u}$
2. $b\overline{b}b\overline{b}$
3. $u\overline{u}\mu\mu$
4. $u\overline{u}ee$
5. $u\overline{u}\nu_\mu\nu_\mu$
6. $u\overline{u}\nu_e\nu_e$
7. $\mu\mu\tau\tau$

8. $\mu\mu\mu\mu$
9. $ee\mu\mu$
10. $ee\nu_\mu\nu_\mu$
11. $eeee$

E single-Z like - Zee ([one] electron down the beam pipe)

1. $u\overline{u}ee$
2. $b\overline{b}ee$
3. $\nu_\mu\nu_\mu ee$
4. $\mu\mu ee$
5. $eeee$

0.2 Technicalities

Technical input parameters for calculations are summarized in Section 4 of the proposal. The priority in CM energies is in decreasing order: 200 GeV, 189 GeV, 183 GeV. In addition to the cuts specified in the proposal (Section 2.1) for the various final states, the invariant mass needs a more precise definition in case radiative photons are present in the event.

From a calculational point of view, there is always a minimal invariant mass (energy and separation angle) below which photons are not *resolved.* Thus we need to specify fermion-photon invariant mass or fermion-photon energies and separation angles,

- below which the the photon are combined with the fermion and
- above which the photons are not included in the mass calculation.

A *bare* mass would set these cuts rather tight, excluding photons from the $f\overline{f}$ mass, a *calo* mass would set the separation cuts looser. Theorists like cuts on $M(\gamma - \text{nearest} f)$. Experimentalists like cuts on energies and angles.

In the following we list both **TH-cuts** and **EXP-cuts**. Results with these cuts must be provided within the fixed deadline (see below) and you have a choice, remembering that experiments agree with one conclusion, i.e. they prefer the angles, but if nothing can be produced then they would accept invariant masses.

TH cuts :

bare $M(\overline{f}f + (\gamma))$ including photons if $M(f+\gamma) < 5\,\text{GeV}$,

calo $M(\overline{f}f + (\gamma))$ including photons if $M(f+\gamma) < 25\,\text{GeV}$.

EXP-cuts :

bare : $M(\overline{f}_1 f_2 + (\gamma))$, photons less than 1 GeV or less than 1° away from f_1 or f_2 are included;

calo : $M(\overline{l}_1 l_2 + (\gamma))$, photons less than 1 GeV or less than 10° away from charged leptons are included,
$M(\overline{q}_1 q_2 + (\gamma))$, photons less than 1 GeV or less than 25° away from quarks $q_1 q_2$ are included, which takes at least the major difference between fermions - quarks versus leptons - into account.

These definitions serve for benchmarking distributions, not so much to mimic an actual experimental strategy, which is of course fermion dependent.

In other words this is an approximation to the experimental side: if the fermion is a muon, they can separate even 0° opening angles. In addition, for identified photons we still may or may not choose to recombine the photon with the fermion.

0.3 Histograms

For the comparison of distributions histograms must be provided. There are two different scenarios. CC03-like calculations with both radiative and non-radiative events (item 1 of Sect. 2.1) and calculations with visible photons (radiative events only), i.e. CC11, Sect. 2.1 item 5 and CC20 Sect. 2.1 item 4.

For technical reasons all histograms must include the whole boundaries of the corresponding variable, i.e. energies start from 0 GeV and angles go from 0° to 180°. Therefore, those calculations that include non-radiative events must provide histograms for

E_γ	0 GeV $\div$ 50 GeV	100 bins
$\cos\theta_\gamma$	$-1 \div +1$	100 bins
$\theta^{\dagger}_{f-\gamma}$	$0° \div 180°$	100 bins
bare mass	40 GeV $\div$ 120 GeV	160 bins
calo mass	40 GeV $\div$ 120 GeV	160 bins

† Opening angle between photon and nearest charged(!) final-state fermion.

Those calculations that include only radiative events will start filling the histograms at $E_\gamma = 1\,\mathrm{GeV}$, $\cos\theta_\gamma = 0.985(0.997)$ and $\theta_{f-\gamma} = 5°$. The *complete* calculations are invited to include this second set of histograms for comparisons.

Please provide for each histogram either an HBOOK RZ file or a simple ascii file. For MC generators, statistical errors should be included, in particular if the distribution is made using weighted events. Thus, please provide three numbers per bin: ¡lower edge of bin¿ ¡integral over bin¿ ¡its statistical error¿.

The histograms should be normalized to the total cross section.

0.4 Timescale

Note that current planning calls for the next plenary meeting of the LEP2-MC workshop on October 12-13. In order to understand the results provided, the deadline for submission of results is September 20th. **Official** collection site is `giampiero@to.infn.it`. Let's summarize the present situation:

- **so called** $\mathcal{O}(\alpha)-$CC03. Contributions from `BBC`, `DDRW` and `KORALW/YFSWW`.
- **visible** γ. Contributions from `CompHEP, DDRW, GRACE` and `PV+ALPHA`.
- **SF,** p_t**, QEDPS and all that**. Contributions for CC10(CC11) and CC20 from `GRACE` and `PV+ALPHA`.
- **Single-**W **comparisons**. All.
- **QED corrections to single-**W. Typical example would be QEDPS (or similar techniques) for t-channel, `EXCALIBUR/GRACE/PV+ALPHA/?`.
- **Fermion-loop in single-**W. Contributions from `EXCALIBUR` and `WPHACT`.
- **running** α for $Z^*\gamma$ and also for $e\nu W$. `EXCALIBUR/?`.