1 General

- Providing results of MC programs including higher order corrections in form of Root n-tuples (filled with 4-momenta, not observables) with information about the input parameters, general set-up used etc. in the header would be useful.

- List of systematic uncertainties quoted by experimentalist will be revisted to take into account theoretical progress.

2 Electroweak corrections

- Tuned comparison of MC programs that include $\mathcal{O}(\alpha)$ corrections and multiple photon radiation: HORACE, WGRAD, SANC, Dittmaier *et al.*

  - Besides specifying the input parameters we need to choose the scale in the structure funtion/PS. Moreover, the tuned comparison will be done using the constant width approach and the G_μ scheme (we will need to specify which implementation of the G_μ scheme).
  - Choice of cuts and lepton ID requirements will be adjusted with respect to previous studies according to the CDF/D0 Run-II setup. Shifts in M_W in the e and μ cases should then be similar (see Ilja's talk).
  - Besides the comparison of kinematic distributions, we will also compare the shifts in M_W due to the exact $\mathcal{O}(\alpha)$ corrections including multiple photon radiation vs only including the exact $\mathcal{O}(\alpha)$ corrections. Each group should use their own fitting procedure.
  - Study of the ratio of p_T^γ in W and Z production.
  - Tuned comparisons of W/Z ratios, such as the ratio of the (scaled) $M_T(l\nu_l)$ and $M(ll)$ distributions (see Jan's talk for a list of relevant observables).
  - Should we also provide results for E_γ, $dR_{l\gamma}$ etc. (see Ilja's talk)? - yes.

- Study of the effect of a "lost" fermion pair in $q\bar{q}' \to l\nu\gamma \to l\nu_l l^+ l-$ production on M_W, where "lost" approx. means fermion energy smaller

than 500 MeV (will be precisely defined later). This can be done with truncated structure functions integrated with different upper bounds.

- Provide an estimate of the uncertainty in M_W due to unknown $\mathcal{O}(\alpha^2)$ corrections (two-photon radiation) beyond LL by (is it a 0.1 MeV, 1 MeV shift or larger ?)
  - varying the scale in the structure function/PS (truncated at 2nd order),
  - using the difference between exact $\mathcal{O}(\alpha)$ and $\mathcal{O}(\alpha)$ LL (see Ilya's talk), but keep in mind that LL is tuned to the exact $\mathcal{O}(\alpha)$, and
  - studying the shift in M_W due to two hard photons (tree-level $q\bar{q}' \to l\nu_l\gamma\gamma$ production with cuts, $E_\gamma >$? and $\theta_{l\gamma} >$?)
- Provide an estimate of the uncertainty in M_W due to unknown higher-order EW corrections by comparing shifts in M_W when using different implementations of the G_μ scheme, ie only $\Delta r\sigma_{LO}$ vs. in addition $\Delta r\delta\sigma, \Delta r^2\sigma_{LO}$ etc.
- Study of the shift in M_W due to uncertainties in input parameters (V_{ij}, m_t, M_H, Γ_W, ...). Should we also study the variation of the QED/QCD factorization scale in MSTR2004QED? We will not study photon-induced processes but refer to results from the Les Houches report, for instance.
- We will provide a section on the treatment of the W width in the available public codes with a re-clarification of using the two options fixed vs. running width as done for LEP EW precision physics.

3 QCD corrections

See also list of questions in Mark's talk.

- We will provide an estimate of the uncertainty in the $q_T(W)/q_T(Z)$ ratio
  - due to missing NNLO corrections with respect to NLO using the calculation by S.Catani, M.Grazzini *et al* (once the NNLO+NNLL calculation is finalized) and Resbos.

  - due to different resummation prescriptions by varying free parameters such as the resummation scale etc. using the resummed calculation by S.Catani, M.Grazzini *et al* and Resbos.

- Description of studies of ambiguities in the threshold resummaation (Borel vs. Mellin) and a statement, if these differences affect the W mass measurement.

- Statement on the measurement of the $q_\perp$ broadening in the $q_T(Z)$ spectrum at the Tevatron and the impact on M_W.

3.1 *PDF*s

- Study of the PDF uncertainty in the $q_T(W)/q_T(Z)$ ratio using the most recent CTEQ and MSTW PDFs as well as NNPDFs.

- Discussion of the impact of a joint $q_T(Z)$ and PDF global fit, ie PDFs are extracted reproducing the measured $q_T(Z)$, on the PDF uncertainty in M_W.

- Study of the difference in the $q_T(W)/q_T(Z)$ ratio when including or not including QED in PDFs. We will contact MSTW about the possibility of varying the QED and QCD factorization scales in the QED PDFs separately and for advice how to assess the impact of including or not including QED in the PDFs. When QED effects in PDFs are not relevant for M_W, then more recent PDFs can be used in MC programs that include EW corrections (although there are not consistent). See also Pavel's remarks in the attached PDF file.

4 EW-QCD interplay

- Comparison of QCD predictions (PS, NLO, NLO+PS) for $M_T(l\nu)$ (and shifts in M_W), such as MC@NLO, Herwig, MCFM, POWHEG, Resbos. If the difference in M_W is relevant, what does this mean for the combination of QCD and QED ?

- Study of the difference in the shift in M_W due to the full $\mathcal{O}(\alpha)$ EW and final-state QED radiation with and without initial-state QCD radiation (resummation, PS) when M_W is extracted from $p_T(l)$ and $M_T(l\nu)$.

- Study of the effect of a joint (ISR) QED and QCD parton shower on M_W. Can we use PHYTHIA for a quick estimate ?