

Introduction: summary of where we stand after Durham

- **In Durham, we saw progress on several fronts in terms of the theoretical issues related to the measurement of the weak mixing angle at the LHC**
- **We also had some very lively discussions concerning the running width versus fixed width (and complex mass) schemes, the size of the impact of photon-induced processes on the asymmetries, and the SM input parameters used for the interpretation and how these should be optimally chosen.**
- **All of the above will be discussed further today by the various speakers.**
- **This introduction summarises with a few numbers where we stand in terms of the impact of QED ISR and IFI effects, based on the most recent results from the various calculations.**

Weak mixing angle at the LHC: theoretical issues in interpretation

- Most of the work over past year has focused on so-called EW corrections and on QED ISR and IFI which until now were assumed to be small effects at the Z pole at the LHC based on the experience from LEP and naïve extrapolation arguments
- EW corrections progressed a lot until last fall (see overview by Elzbieta today). Comparisons between DIZET, Powheg EW and MC-SANC appear to be in reasonable agreement. But ...
- QED ISR and IFI effects became then the focus of the work by the same people (Fulvio, Serge) plus Scott for KKMC-hh, and recently Doreen with ZGRAD2.
- HORACE and MC-SANC have also been used to evaluate impact of photon-induced processes (see talk by Alessandro in Durham and further work by Serge and Lidia presented today).
- All of the above work has been done at LO QCD. At least NLO QCD is required to complete it and possibly more (eg how to assess competition between gluons and photons in ISR if such an assessment were required?). In the near future, only Powheg EW may provide a comparison of LO vs NLO QCD for these effects.
- And then, there is the matter of the overall impact of QCD on predictions for asymmetries when going from NLO to NNLO (NNLOJET vs DYTurbo).
- **Beyond the weak mixing angle, the question of W mass is not to be forgotten!**

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- Caveats:

- LO QCD, reference is LO EW with LUXQED PDF from NNPDF3.1
- Mass window is 66 to 116 GeV for KKMC-hh (effects smaller near pole)
- Still need to understand value of A_{FB} quoted by KKMC-hh!

$80 < m_{\mu\mu} < 102$ GeV	$A_{FB}(LO)$	$\Delta A(ISR)$ (10^{-4})	$\Delta A(IFI)$ (10^{-4})
Total phase space			
MC-SANC	0.0459	-0.4±0.1	-1.8±0.1
Powheg EW	0.0448	0.0±0.6	1.3±0.8
KKMC-hh	0.0200	-1.8±0.2	0.3±0.1
Fiducial phase space			
MC-SANC	0.0189	-0.3±0.1	-0.4±0.1
Powheg EW	0.0189	0.1±0.4	0.4±0.4
KKMC-hh	0.0121	0.3±0.3	1.1±0.1