

# Introduction and news

- **Welcome to our first meeting in 2022!**
- **News item 1**: a few changes in our WG organisation, some very recent (Simone), some less so.  
**Conveners (and affiliation!) as of now are:**  
**Fulvio (theory), Aleko and Simone (CMS), Mika (LHCb), Aram and Daniel (ATLAS)**
- **News item 2**: we are now about to enter year 5 of our benchmarking work started in April 2018. Priority in 2022 has to be to document and publish even if we have to descope some aspects.
- **News item 3**: we are indeed reaching the end-game of ongoing calculations and this is a great achievement, thanks to all contributors!  
**Example of QED status overview in next slides**

# Summary of status of QED corrections

- Overall summary including update from KKMChh by Scott last November

## IFI Contribution to " $A_4$ " $\equiv \frac{8}{3} A_{FB}$ : Updated

The table shows the difference in  $A_4 \times 10^4$  with IFI on minus IFI off. The numbers are from Stefan Dittmaier's May presentation with new KKMChh results for 38 billion events. KKhhFoam is a soft photon approximation to KKMChh. It agrees when hard photon corrections are not important.

version	$89 < M_{ll} < 93$	$60 < M_{ll} < 81$	$81 < M_{ll} < 101$	$101 < M_{ll} < 150$
KKMChh	-2.2(2)	-16.7(6)	-2.4(2)	-59(1)
KKhhFoam	-3.8(6)	-17 (1)	-4.1(5)	-46(3)
KKMChh (NISR)	-3.1(6)	-17(1)	-3.2(5)	-60(3)
KKhhFoam (NISR)	-3.6(7)	-17(2)	-3.8(5)	-48(3)
MCSANC	-2.8(5)	-34(2)	-4.0(4)	-60(3)
WZGRAD2	-1.1(5)	-37(3)	-2.3(5)	-51(4)
POWHEG_ew	<b>-1.2(3)</b>	<b>-62(1)</b>	<b>-2.5(4)</b>	<b>-59(2)</b>
RADY (CMS)	-1.5(1)	-33.6(4)	-2.49(7)	-59.5(1)
A. Huss	-1.42(6)	-33.9(6)	-2.57(7)	-58.7(3)

## Next steps, outstanding issues for QED calculations

- Resolve issue of definition of ISR and IFI contributions:
  - formulae as discussed above by Powheg-EW
  - differences outside pole region : do these really correspond to somehow theoretical uncertainties related to these calculations or should we dig deeper?  
**Clearly, the most important numbers are those in the pole region which are in excellent agreement ...**
  - question of usage or not of QED PDFs raised initially by Alessandro and emphasised more recently by work reported by Scott  
**Here we need a definite decision on how to proceed but bearing in mind that QED PDFs are not used at all yet in any large-scale MC production of the experiments.**
- **Get missing updates (certainly from WZGRAD2 in February and possibly also from MC-SANC?)**
- **Associate an uncertainty to the QED calculations (Stefan?)**
- **Document these results starting with a nice pedagogical introduction linking the work presented based on pure  $\gamma^*/Z$  DY with the more correct and general framework of calculations including photon-induced processes (Alessandro)! Please also remember to start writing appendices for each calculation 😊**

# Theoretical uncertainties on virtual corrections (Ayres)

## Comments and discussion points

- Dependence of form factors on  $s = m_{\ell\ell}$  and box contributions not taken into account so far
- IFI box and other QED requires separate uncertainty estimate
- Large corrections for  $G_\mu$  scheme from photon exchange contribution:  
$$\alpha = \frac{\sqrt{2}G_\mu s_w^2 M_W^2}{\pi} (1 - \Delta r)$$
  
→ Anything different being done in generators?
- Plan for  $\mathcal{O}(\alpha\alpha_s)$ :  
include in analysis, or use available results for error estimate?  
[should be added in quadr. to  $\mathcal{O}(\alpha^2)$  estimate]

# Upcoming Meetings

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- LHC EW WE General Meeting
  - February 15-17
  - <https://indico.cern.ch/event/1108518/>
- As usual we plan to organize a precision subgroup meeting one day before the general meeting (February 14th)
  - The goal of the meeting would be to discuss the contributions from our subgroup to the General meeting
  - We expect to have a separate report on the pT V resumption benchmarking on the last day of the general meeting
  - **We expect also to have a separate report on the QED/EW status on the last day of the general meeting**
  - **As usual we will ask for speakers on a rotational basis, so we will be searching for two “victims” one of whom will probably have to cover also in a couple of slides the status of the documentation.**