LHC Minimum Bias and Underlying Event Working Group
Conveners' meeting on the restart of activities for run 2,
16/03/2015

Minutes of the discussion, including remarks and further developments emerged from relevant action items undertaken after the mtg

0) First open meeting: the selected dates are November 19-20. This allows participants from overseas to attend the MPI@LHC workshop, taking place the following week in Trieste.

1) Common tune:
o there was unanimity to adopt Pythia8 with the Monash tune as a default for data vs MC comparisons. Following discussion with Peter Skands, it's recommended to use PY8 versions not before 8.185. 8.2 is ideal, but no changes of relevance to MB or UE studies have appeared after 8.185.

Action item: collect more details, and document them, on the MC generation parameters used by all experiments, including e.g. cross sections used for various subprocess components etc.

2) Set of common plots:

o It was agreed to adopt as a baseline the set of Run I common plots, as documented on the WG web page (see under "documents", the minutes of the May 31, 2010 meeting). The relevant text is attached below in Appendix. In particular:

a) We reiterated the definition of "charged particle" used in the common plots: this includes hadrons and leptons, with mean lifetime tau > 0.3E-10 s, produced directly or from decays of shorter-lifetime particles. No particle level correction (e.g. no correction to subtract Dalitz decays)

b) pT threshold: stick to 500 MeV as threshold (as for Run I common plots). Will consider moving to 100 MeV on a longer time scale

c) acceptance: show dN/deta plots for all available acceptance of each expeirment, in bins of 0.2 starting from eta=0. For plots integrated in eta (e.g. dN/dpt, etc), consider only tracks within abs(eta)<0.8, to have a common phase space for ALICE, ATLAS and CMS.

3) Further possible distribution to be considered for common plots/comparisons:

Various experiments have indicated interest in breaking down the samples in finer subsets, in multiplicity or in eta. It is premature to try identify a new set of common plots at this time, but this can be discussed at a later stage following some more detailed discussion. Unless people are happy with the concrete proposals put fwd by ATLAS and ALICE below here:

ATLAS:
Define new MB plots, MB5 and MB6. MB5: dNchg/deta (binning as in MB1) and MB6: dNchg/dpt (binning as in MB2):
- track selection: pt>500MeV, letal< 0.8, 2.5
- bins to be defined: e.g. nch = [0,10], [10, 20], [20, 40], [40,60]
- purpose: to probe in detail particle production at high parton density/centrality. Link with Heavy Ion collisions and modelling of cosmic rays
- benefit of comparision: at high multiplicity there may be systematic effects due to tracking in dense environment, worth cross-checking between experiments

ALICE: fwd/central correlation (for discussion on a longer time scale)
- Measure dNchg/deta and dNchg/dpt in different multiplicity bins (similar to MB5 and MB6 above). However, these multiplicity bins are defined with a forward detector (in a common phase space window).
- These bins should be few (for example 5) and simply slice the (measured) cross-section into classes.
- The technology used for this may be different in different experiments (charged particles in ALICE, calorimetry in ATLAS/CMS) but as long as the response of the detector is linear to the activity the corrections to be applied may not be that large. Such a result is interesting for MC tuning (forward - central correlations, multiplicity fluctuations). In addition (and therefore relevant for this WG), producing it in identical phase space regions may allow to learn how sensitive we are to using charged particles vs calorimetry in these selections and how large the selection biases are.

4) We need to define a common tracking acceptance, in the forward region, which allows comparisons between TOTEM, LHCb, ALICE. This exercise can start any time, through dedicated meetings of the experts of these experiments.
Action item: ALICE, LHCb, TOTEM conveners to stimulate this effort

5) Hadron level definition of final states, agreements to facilitate the comparisons of results on inelastic cross sections:

Inelastic -> agree on common extrapolation recipe
NSD definition determined by the MC flag -> need to maintain, for comparison with lower energies...
NSD enhanced, operational definition: based on particle-level activity in the final state, e.g. defined by double-sided activity, and by the presence of particles above threshold in the eta range corresponding to the detector level eta range

Action item: organize a meeting of experts from all experiments, in May/June, to discus these issues.

APPENDIX: COMMON PLOT DEFINITIONS, from the minutes of the May 31 2010 WG meeting
MB plots (total of 6 plots for each energy):
General statements:
- For all plots, events entering the plots are required to have at least 1 track with letal<0.8 and (a) pt>0.5 GeV or (b) pt>1GeV
- distributions are corrected to the particle level, accounting for trigger/tracking/etc efficiencies. No subtraction of specific contributions, like diffraction. - sqrt(S)=900 and 7000 GeV
- "charged particles" include leptons
- no particle-level corrections to subtract electrons from Dalitz decays

1. MB1(a) and (b): d Nchg/deta: - definition: include all tracks above 500 MeV (for plot (a)) and above 1 GeV (plot (b)), over the available eta range (namely this can extend beyond 0.8 for ATLAS/CMS). Binning: bin-size=0.2 in eta, starting at 0.
2. MB2 (a) only : d Nchg/dpt: - definition: include tracks with letal<0.8, and all pt values. Binning: 100 MeV in the region [0-1GeV], and free binning beyond
3. MB3 (a) and (b): d N/ d Nchg: - definition: include tracks within letal<0.8, with pt>500Mev (plot (a)) and pt>1 GeV (plot (b)). Bbinning: 1 unit of Nchg in the range [0.5 - 10.5], and free beyond that
4. MB4 (a) only: <pt> vs Nchg: - definition: include tracks within letal<0.8, with pt>500Mev. Binning: same as MB3

UE plots (total of 12 plots for each energy)

1. (UE1) Average charged particle density and average PTsum density in the "toward", "away", "transverse" region as defined by the leading charged particle, PTmax, for all charged particles with pT >= PTmin and letal < 0.8 (range covered by ALICE) with PTmin = 0.5 GeV/c. The average densities in the "toward" (not including PTmax), "away", and "transverse" region would be plotted versus PTmax in bins of size 0.5 GeV/c with the first bin equal to 0.5-1.0 GeV/c. (6 plots)
2. (UE2) Average charged particle density and average PTsum density in the "toward", "away", "transverse" region as defined by the leading charged particle, PTmax, for all charged particles with pT >= PTmin and letal < 0.8 (range covered by ALICE) with PTmin = 1.0 GeV/c. The average densities in the "toward" (not including PTmax), "away", and "transverse" region would be plotted versus PTmax in bins of size 0.5 GeV/c with the first bin equal to 1.0-1.5 GeV/c. (6 plots)

To enhance the non-diffractive contributions, the proposal is to repeat the above plots requesting the presence of several central tracks. Numbers between 3 and 6 have been going around. We need to fix this criterion.