Giulia Manca, Benjamin Audurier - LPCC HI WG kickoff meeting - July 7th 2021*

LHCb: perspective, wishes, proposals, and views on the working group

I. The LHCb detector
II. Wishes of LHCb for the Heavy Ion WG behaviour and the runs to come
III. Working proposals on WG activities and areas of interest
IV. Conclusions and outlook

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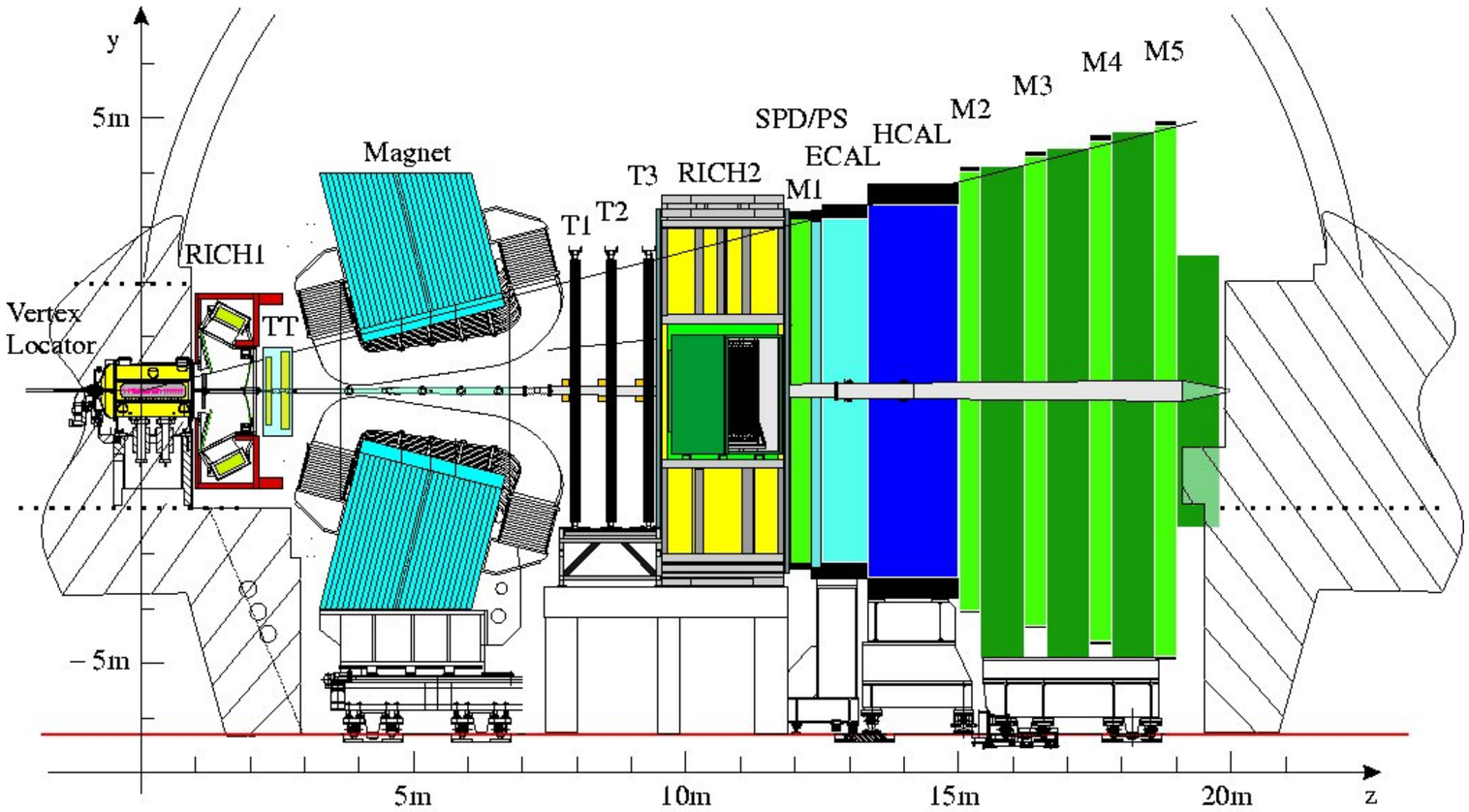
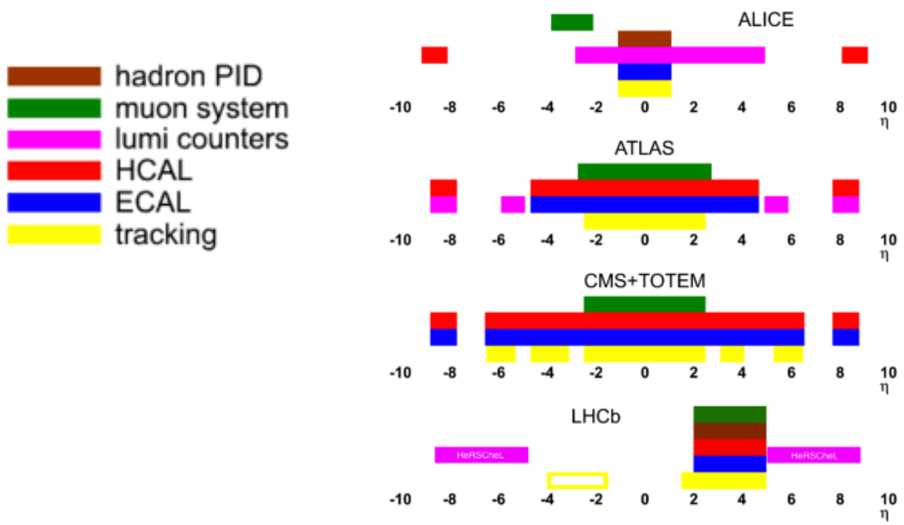
The LHCb detector

10.1142/S0217751X15300227

LHCb : **single arm spectrometer fully instrumented** in pseudo-rapidity range $2 < \eta < 5$





- Track reconstruction **down to $p_T = 0$**.
- Precision **vertex reconstruction.**
- LHCb is tailored for heavy-flavour production measurements.
  - Many precise HF results in pp and pPb .
  - Limitations in central PbPb collisions to be reduced (see next slide)
  - List of published papers available here.

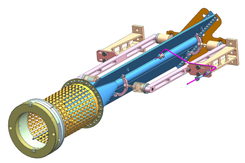
LHCb detector : season 3 (2021)

New Tracking system :
- pixel VELO
- Silicon upstream detector (UT)
- Scintillating tracking fibre (SciFi)

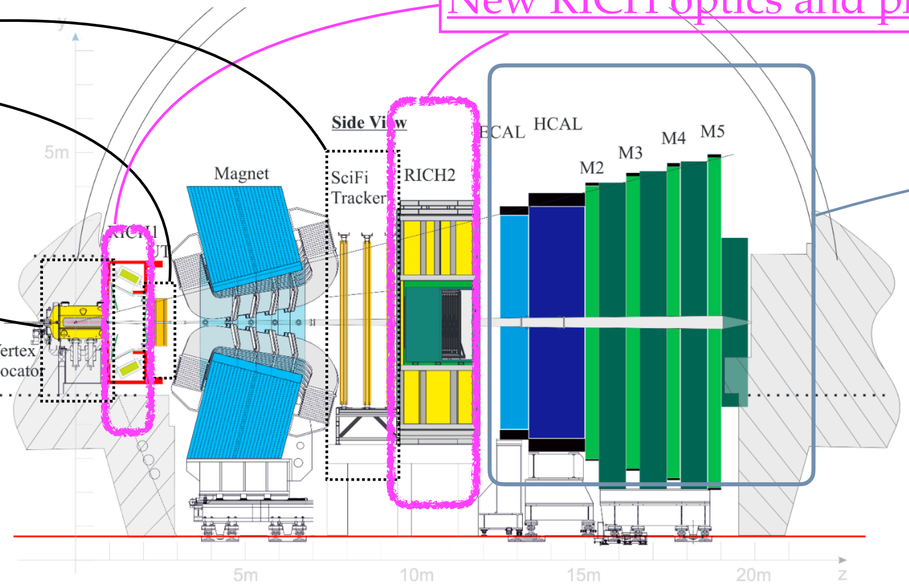
New RICH optics and photodetectors

[CERN-LHCC-2012-007]

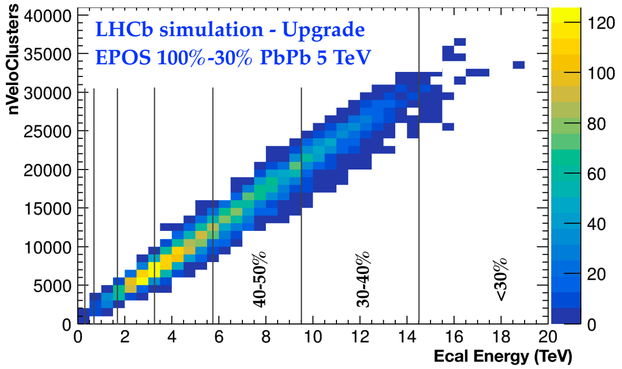
New electronics for muon and calorimeter systems

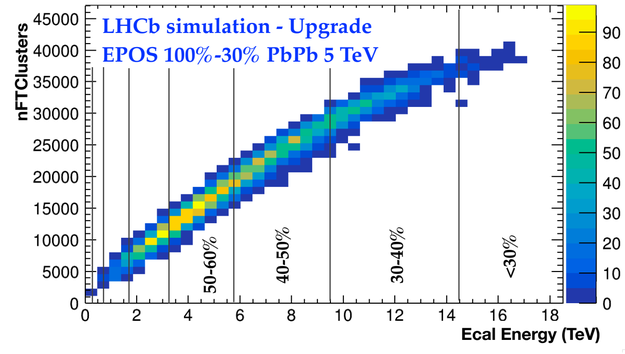


New SMOG2 cell for fixed-target data



LHCB-FIGURE-2019-021





- **Replace the entire tracking system.**
  - Better performance in pp/pPb/SMOG data
  - Higher reach in centrality (~30%) in PbPb collisions.

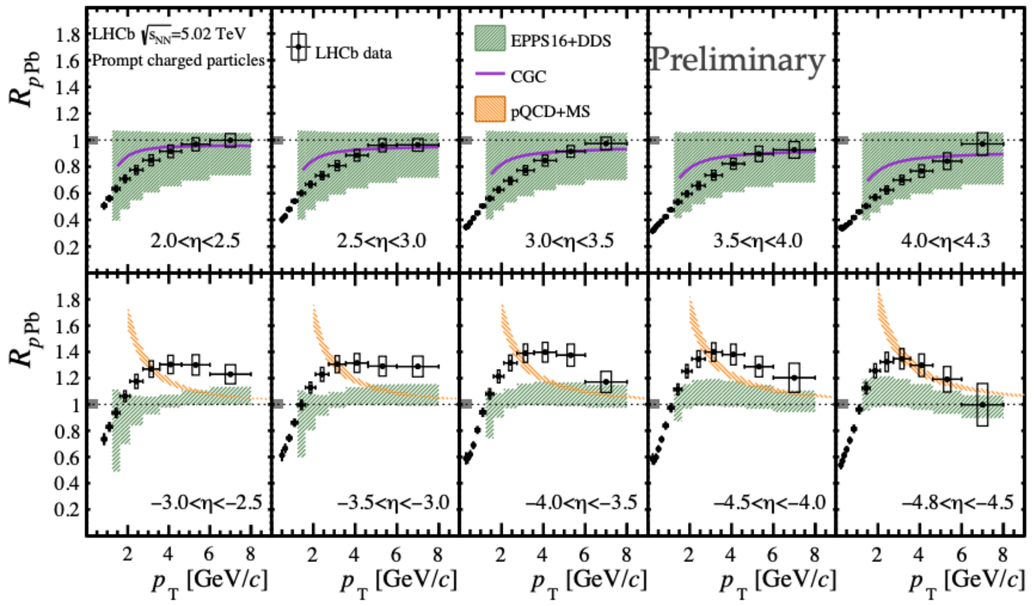
Wishes on the working group

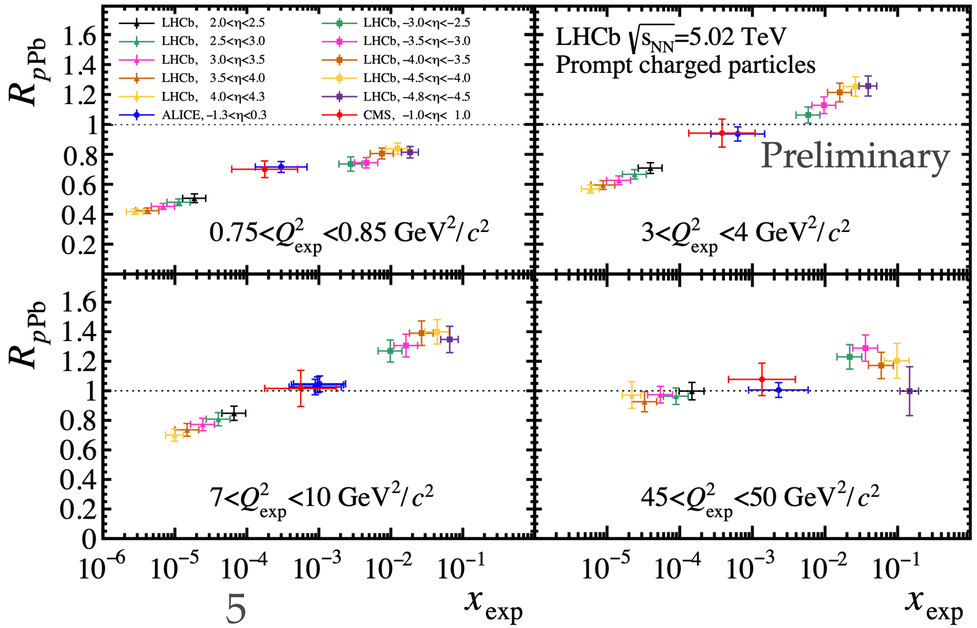
- Expectations for the WG:
  - Platform to discuss heavy-ion specific LHC points.
    - Special runs, colliding energy and species etc.
  - Platform to **discuss** physics analysis (see next slides for suggestion) => **decisions** to be taken in other contexts.
    - Share knowledges on common analysis.
    - Propose MC common tunes.
    - Propose common definitions/analysis standards to be used by all experiments.
    - Discussion with theorists.
    - Organise dedicated workshops.
  - As for the HONEXCOMB project, production of common papers => more involving where needed to touch the data
- The WG should not:
  - Interfere with the decision of the experiments or the LHC
  - Be inactive.

Physics case: charged particles production in pPb

LHCb-PAPER-2021-015

- New results to be published by LHCb for the prompt charged particles production in pPb.
- Nice agreement between ALICE/CMS/LHCb -> strong constrains on nPDFs.
- Could we get more out of these data ?

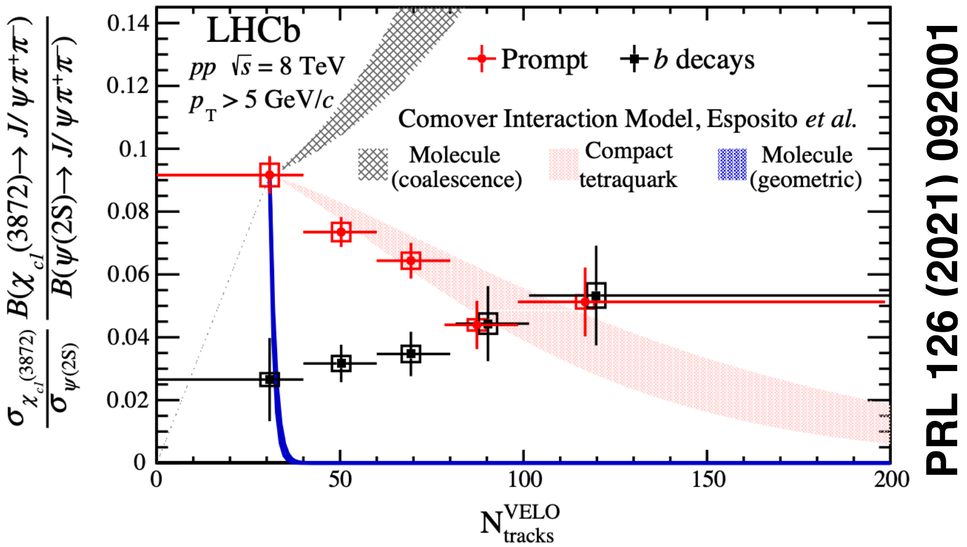




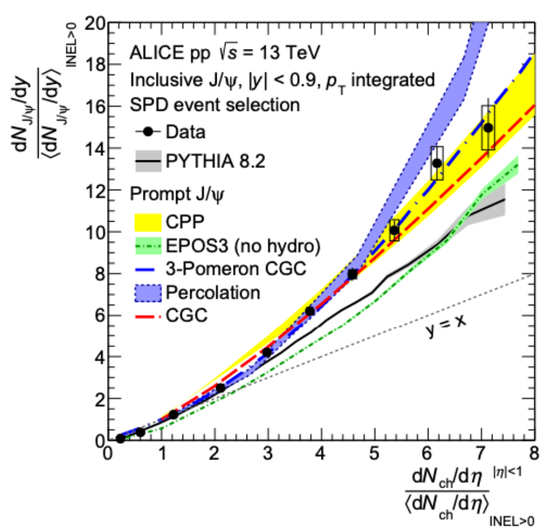
$$x_{\mathrm{exp}} = \frac{Q^2_{\mathrm{exp}}}{\sqrt{s_{NN}}} e^{-\eta}$$

$$Q^2_{\mathrm{exp}} = m^2 + p_T^2$$

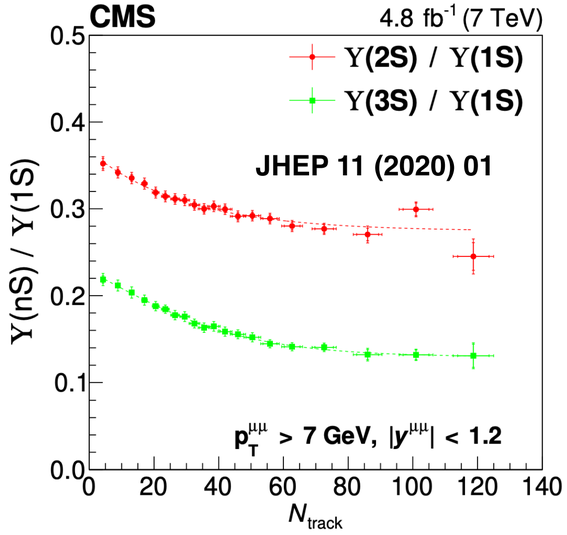
Physics case: multiplicity



PRL 126 (2021) 092001

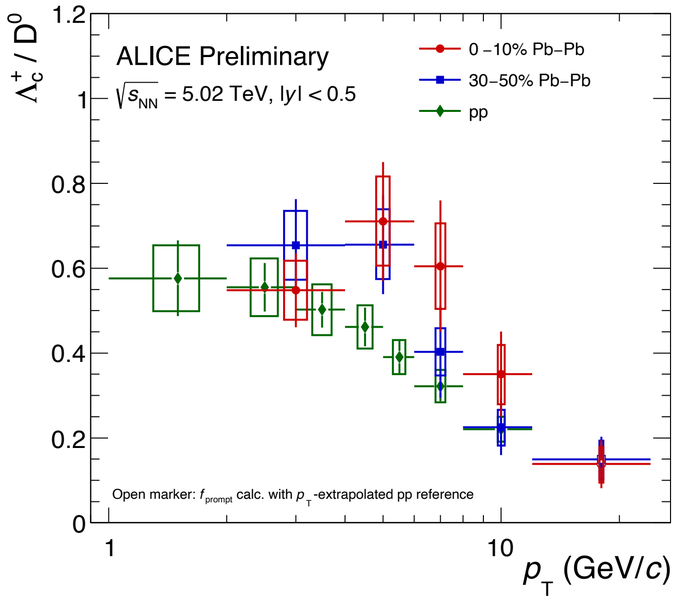


PLB 810 (2020) 135758

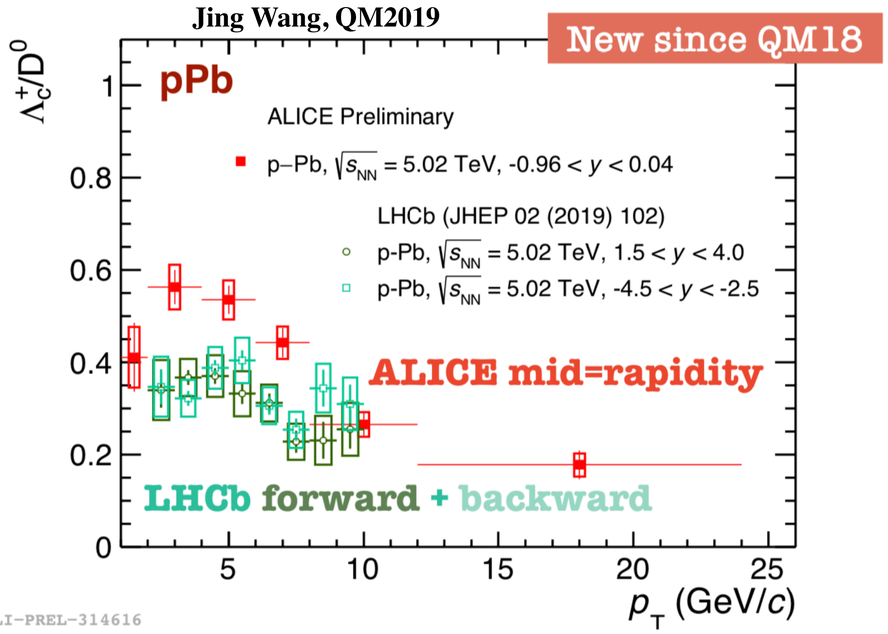


- Many different variables/quantities used for multiplicity studies.
- Difficult to do comparisons between experiments.
- Could be useful to discuss and set standard metric for futur studies of this kind.
  - Written document ?

Physics case: Λ_c/D^0



ALI-PREL-323761



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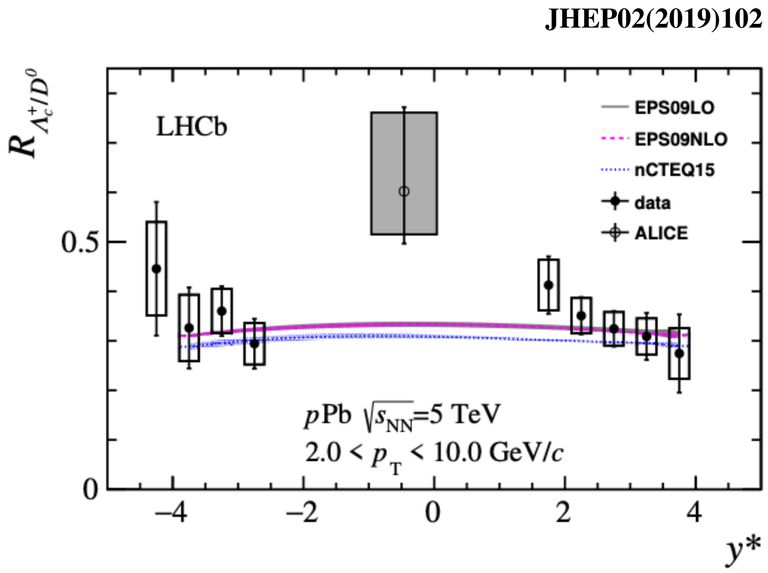


- Nice completion of rapidity coverage between ALICE and LHCb…
- …and very different rapidity dependance !
- Probably too soon for a common paper (many results are preliminary), but this could be a nice project once all Run 2 data are published.
  - Example of paper: evolution of the p_T dependence of the ratio with rapidity and colliding system.

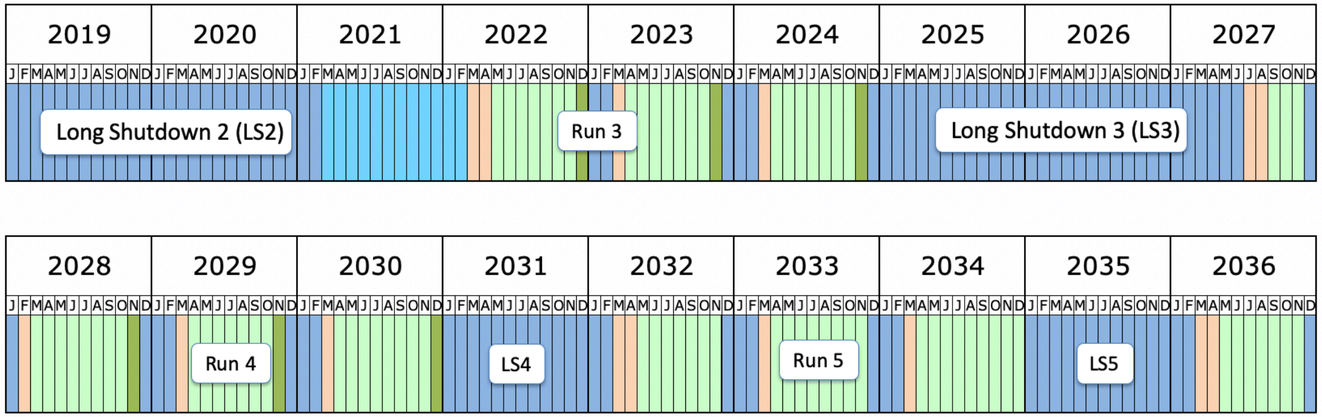
Heavy-ion specifics: run conditions

- Discussion on next PbPb Run 3 conditions ongoing.
  - Discussions already quite advanced, probably too late for the WG to discuss
- However, the same questions will be asked again for the next HI runs
  - Luminosity take-off
  - Use the Yellow report as a baseline ?
  - **Interests for a special OO/pO run (confirmed)**
    - **Could be recorded in collider and fixed-target mode with new SMOG 2 device !**

Link to R. Bruce talk, LHCB IFT meeting

Filling scheme	$\mathcal{L}_{tot}$ IP1/5	$\mathcal{L}_{tot}$ IP2	$\mathcal{L}_{tot}$ IP8
1240b_1240_1200_0	2.5 [2.6]	2.7 [2.8]	0 [0]
1240b_1144_1144_239	2.4 [2.5]	2.7 [2.8]	0.18 [0.21]
1240b_1088_1088_398	2.4 [2.4]	2.6 [2.7]	0.30 [0.34]
1240b_1032_1032_557	2.3 [2.3]	2.5 [2.6]	0.39 [0.44]
1240b_976_976_716	2.2 [2.2]	2.5 [2.6]	0.46 [0.50]
733b_733_702_468	1.7 [1.8]	1.9 [1.9]	0.35 [0.36]

Luminosity estimation for several PbPb filling scheme



Longer therm LHC schedule

Conclusions and outlook

- LHCb results contribute to enlarged nuclear physics program at the LHC
  - Many precise results from large pPb/Pbp datasets at √sNN = 8 TeV.
  - Unique results with the fixed-target program at LHC.
  - Mostly targeting HF production, but will evolve.
- Two (document) propositions
  - Multiplicity metric.
  - Λ_c/D^0 production ratio versus rapidity.
- **LHCb is looking forward to a fruitful collaboration with the other experiments within the WG, where we can bring a unique perspective.**