

Forward physics and heavy ions at LHC CERN yellow report

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Chapter on Forward Heavy-Ions

- ❖ A dedicated chapter on heavy-ion physics in the forward physics
- ❖ We expect about 20-25 pages in total
- ❖ **Particular scope:** Particular focus on low-x physics, and electromagnetic processes

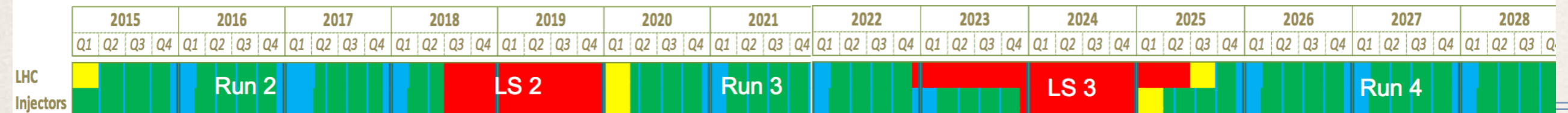
Chapter on Forward Heavy-Ions

- ❖ Cover material on $A+A$ and $p+A$ collisions, so far $A = \text{Pb}$
- ❖ Discuss published LHC results on heavy-ion physics in the forward region
- ❖ Discussion with theorists about new ideas, measurements that could be interesting
- ❖ Prospects of new measurements, specific requirements

Chapter on Forward Heavy-Ions

- ❖ What would be the requirements in terms of luminosity and running conditions to perform new measurements relevant for Forward HI
- ❖ What would be the impact of the already planned / discussed LHC upgrades on these measurements, for both Run2 and Run3
- ❖ Complementarity of each experiment for future measurements

Timeline of future HI running at the LHC



~0.3-1.5 nb⁻¹ PbPb

LS2

~2-4 nb⁻¹ PbPb

LS3

~10 nb⁻¹ PbPb

Experiments request/goal:

Also corresponding pp reference

PbPb	PbPb	pPb?
5.1TeV	5.1TeV	8.2TeV

Also corresponding pp reference

ArAr	pPb	PbPb
	5-8 TeV	

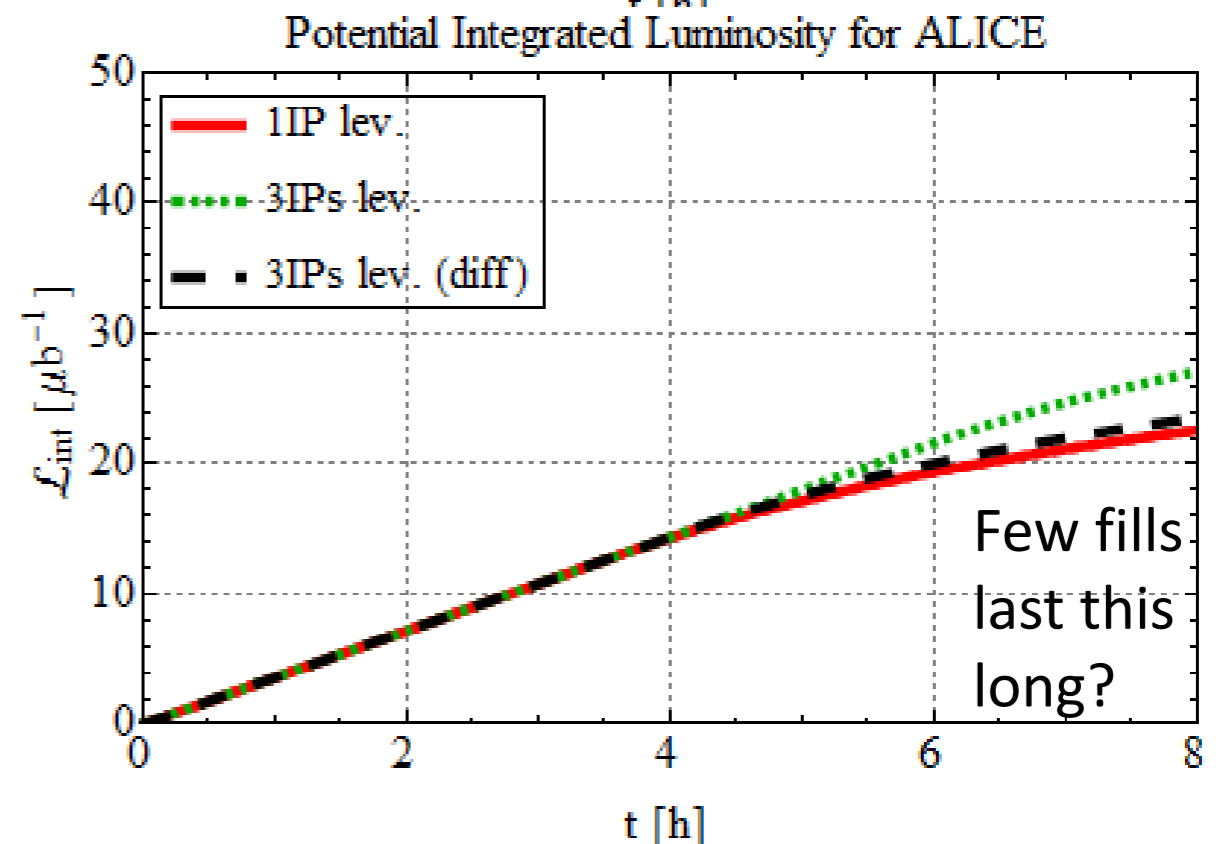
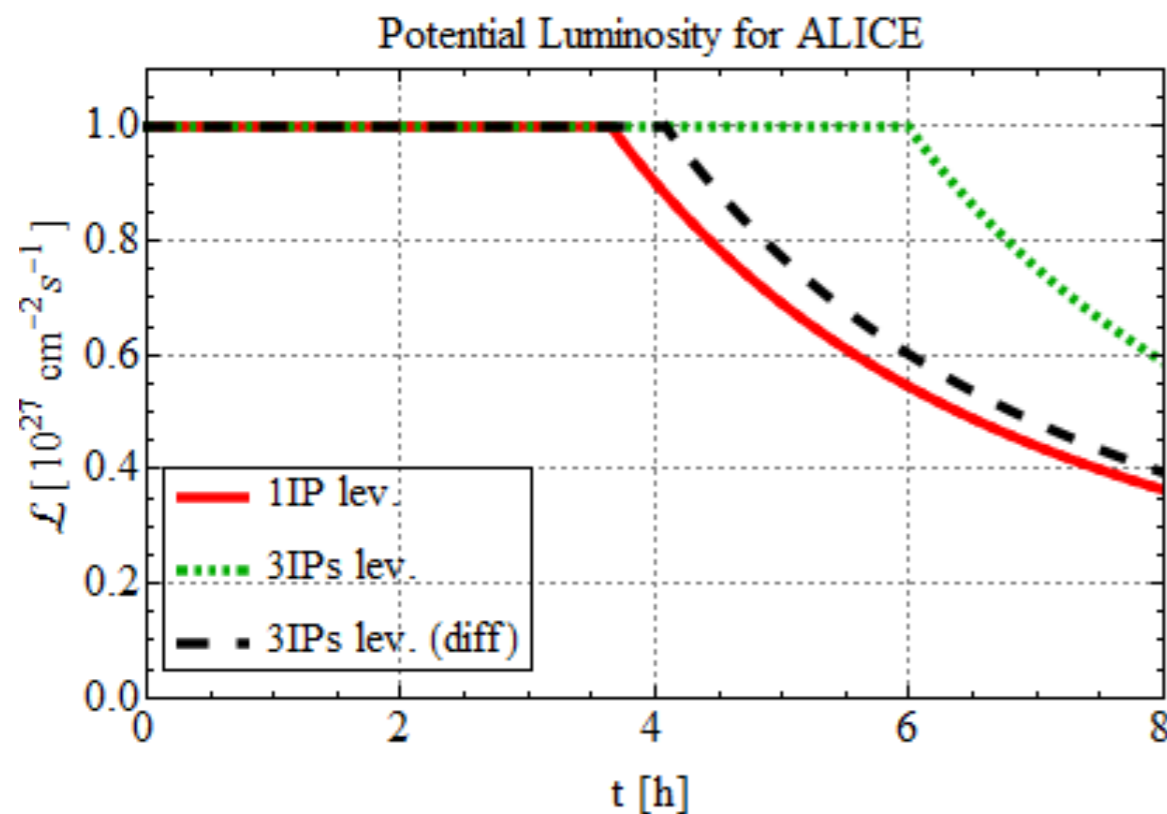
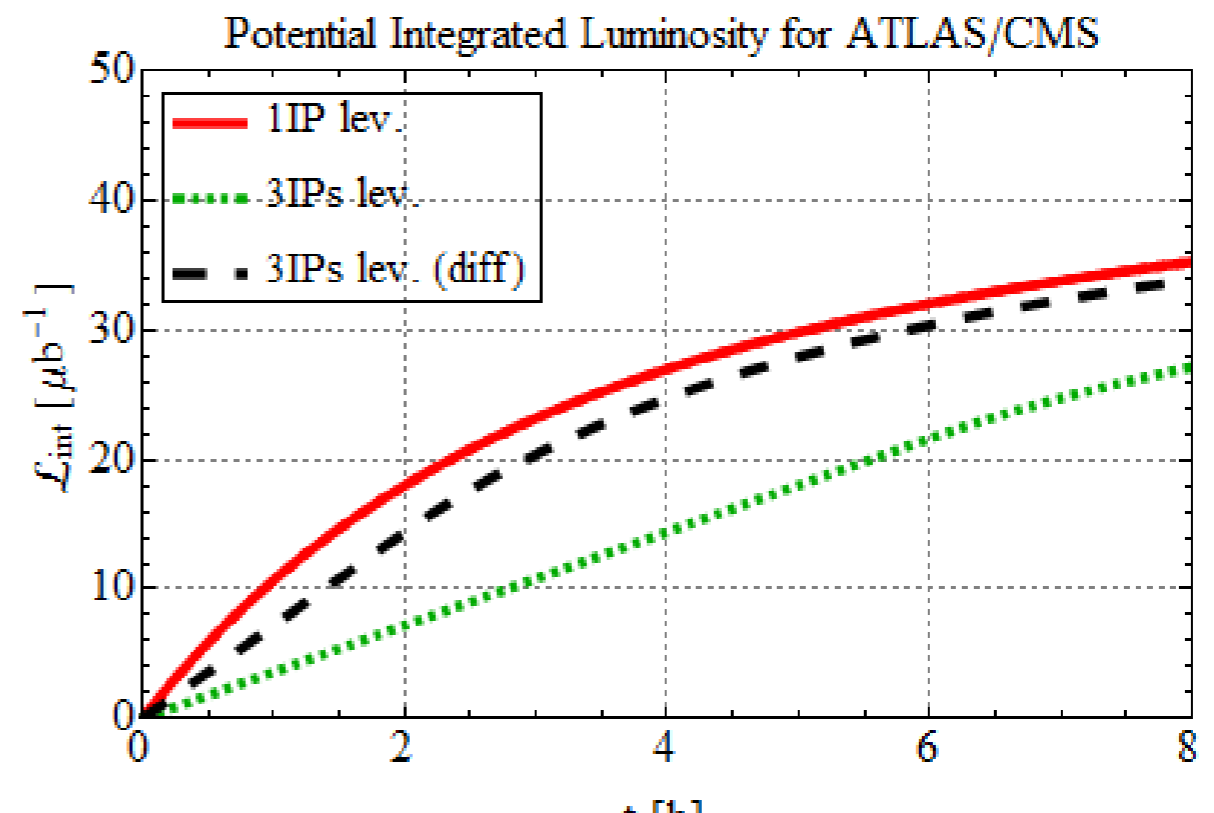
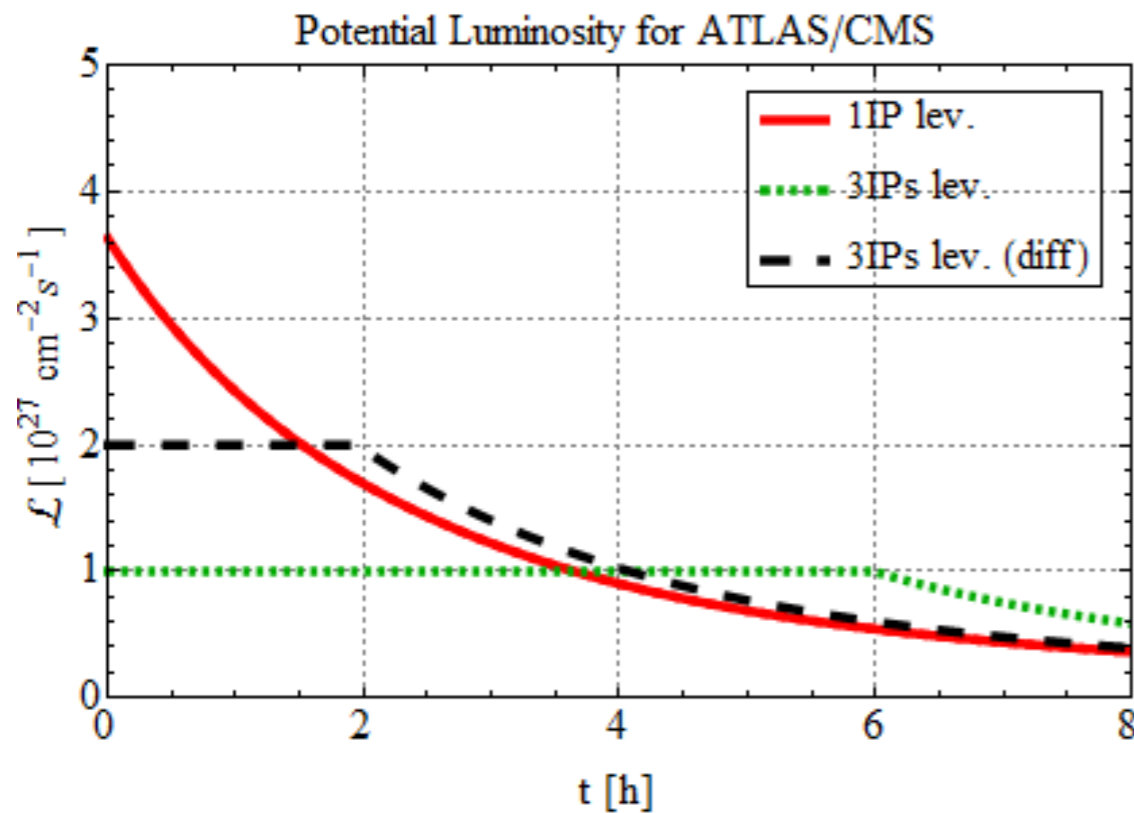
PbPb	pp (?)
	5.5 TeV

- ◆ Run 2 (LS1→LS2): Pb-Pb ~1/nb or more, at $\sqrt{s_{NN}} \sim 5.1$ TeV
- ◆ LS2: major ALICE and LHCb upgrades, important upgrades for ATLAS and CMS, LHC collimator upgrades
- ◆ Run 3 + Run 4: Pb-Pb >10/nb, at $\sqrt{s_{NN}} \sim 5.5$ TeV
- ◆ pp reference and p-Pb in both Runs 2 and 3-4

Levelling in Run 2

- Before the upgrade (LS2), ALICE luminosity must be levelled at $L = 1 \times 10^{27} \text{ cm}^{-2}\text{s}^{-1}$
- ATLAS and CMS are not limited in peak L .
- Luminosity decay dominated by burn-off: largely a conversion of stored beam particles to events.
 - Higher luminosity experiments consume beam reducing everyone's luminosity very quickly and reducing the time that ALICE can run at levelled value.
- Should ATLAS, CMS be levelled also?
- Compare 3 possibilities
 - Levelling only in ALICE
 - Levelling all experiments to $L = 1 \times 10^{27} \text{ cm}^{-2}\text{s}^{-1}$
 - Levelling ATLAS, CMS at $L = 2 \times 10^{27} \text{ cm}^{-2}\text{s}^{-1}$

Comparison of levelling scenarios for Run 2



Chapter Structure

About 20-25 pages long

- ❖ Introduction
- ❖ General overview, discuss published results from all experiments
- ❖ Prospects for new measurements, impact from planned / proposed? Potential of planned LHC upgrade
- ❖ Discussion and summary

Chapter draft

- ❖ The section on UPC is already well advance (12 pages long already), work together with Guillermo Contreras
 - ❖ To be updated after interesting discussions during the photon-induced workshop at CERN this week
- ❖ CMS HI already prepared a document last year. We will ask for an update with emphasis in our activities. In contact with Igor Katkov
- ❖ We will put the draft in the SVN prepared by Paula Collins.

Paper draft

CONTENTS

- I. Introduction
 - II. UPC processes at the LHC
 - III. The photon flux at the LHC
 - IV. UPC measurements with lead ions at the LHC during Run1
 - V. UPC measurements with lead ions at the LHC after Run1
 - VI. Recommendations
- References

For discussion

- ❖ There are some overlaps between Chapter 6 (forward physics) and Chapter 8, as in the case of forward jets in heavy-ions
- ❖ My suggestion is to keep the experimental part of these measurements / requests in the heavy-ion chapter as the heavy-ion runs have their own requests

Ongoing

- ❖ In contact with some of experiments representatives in the LHC WG, requested inputs from them and their experiments. In particular, general outlines about LHC upgrades, running conditions, luminosity, etc.
- ❖ Discussion with theorists

LHC Forward Physics and Diffraction WG

joint with

Future directions in forward heavy-ion physics

Program:

Forward physics

Low- x physics

Diffraction

Heavy ion physics

QCD at the LHC

Ultra-peripheral collisions

LHC upgrade

Future experiments

Students lectures

Lawrence and Kansas City, USA

September 3-6, 2014

<http://cern.ch/lawrence2014>