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Upgrade of the ATLAS Luminosity Monitor for HL-LHC

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The ATLAS physics program for HL-LHC assumes that luminosity will be measured with a precision of at least 1%, the proton-proton collision rate being as large as 200 interactions per bunch crossing. In order to reach this goal, ATLAS will have several luminosity monitors. Among them, LUCID-3 will be one of the few with enough acceptance to measure absolute luminosity during van der Meer scans, when the proton-proton collision rate goes down to 10-4 interactions per bunch crossing.

The baseline LUCID-3 detector consists of photomultipliers (PMTs) placed close to the proton beam pipe in a highly radioactive environment. The sensitive area of the detector is the PMT window acting as Cherenkov radiator. The position of the detector is such that the acceptance is sufficiently high in vdM runs and sufficiently low in physics runs in order to avoid hit saturation, even at the highest collision rates. The same detector principle was used during Run-2 to provide the official ATLAS luminosity measurement at LHC.

An alternative option is based on the usage of radiation hard optical fibers acting both as Cherenkov radiators and light-guides, routing light towards PMTs located in a less radioactive area.

The PMT gain will be continuously monitored with a ^{207}Bi radioactive source deposited on the PMT window. In the case of the fiber detector, LED light will be injected directly on the PMT, and simultaneously through the fibers, in order to monitor the deterioration of the fiber light transmission.

Prototypes of both detectors are installed at LHC and will be operational during Run-3. They will be presented together with the first results, if available.

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