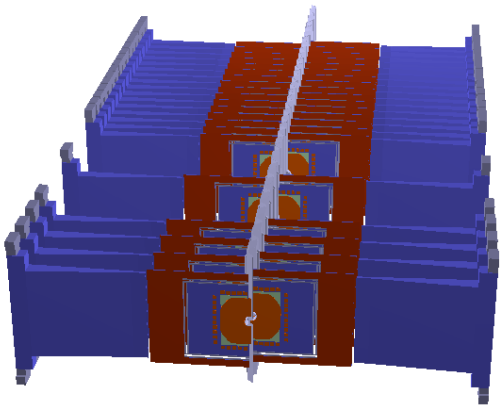
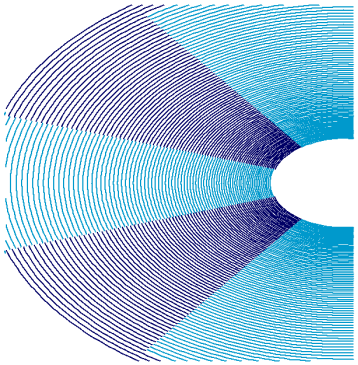
VeloLite Code Structure

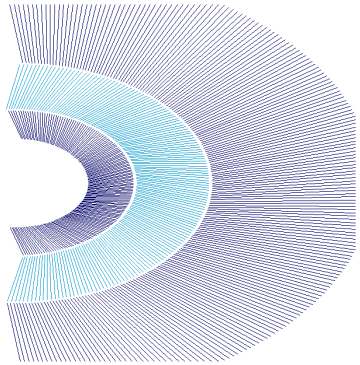
Upgrade Detectors Code Review
12 June 2012

VeloLite

- working title for the Velo upgrade strip option
- conceptually similar to the existing Velo (R and ϕ measuring sensors), but with
  - reduced thickness,
  - larger number of strips, reduced strip pitch and strip lengths.







- Incorporating upgrade detector in existing Velo software by means of XML parameters and class configurables is not possible without major code modifications
  - number of strips is limited to 2048,
  - existing detector element not flexible enough.
- $\rightarrow$ implement VeloLite as new, independent detector, while profiting as much as possible from existing code base

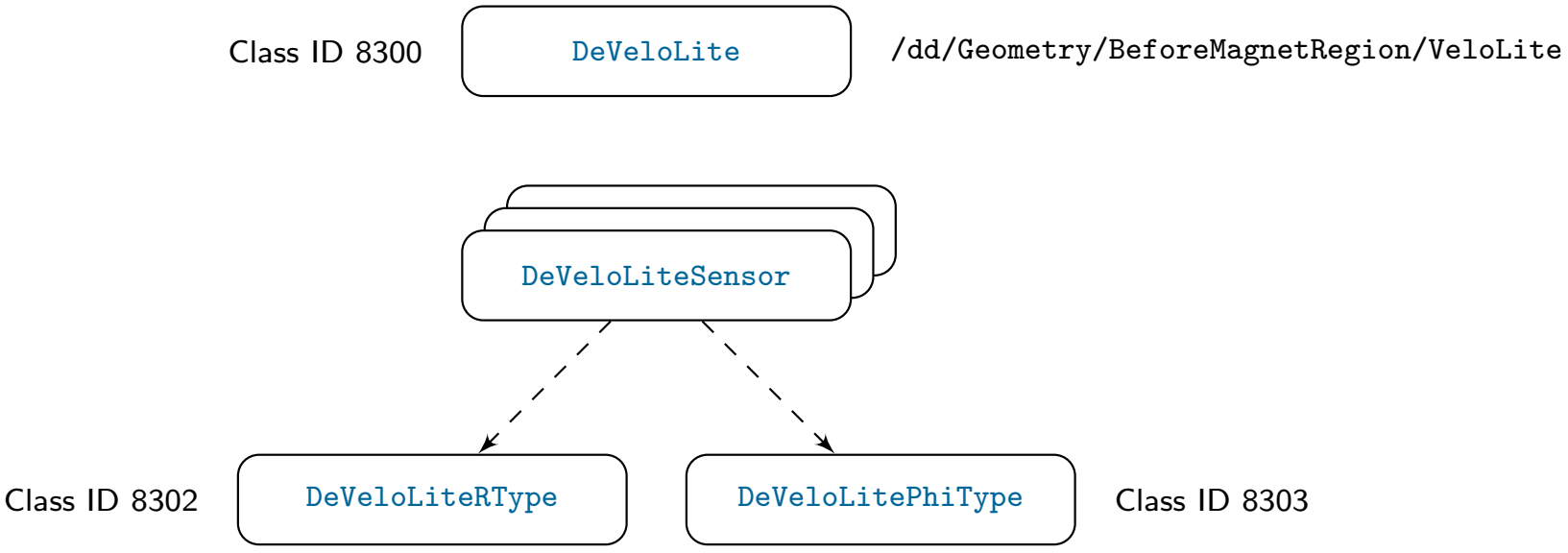
Scope of this Review

1. detector element
2. algorithms required for simulation (Gauss and Boole)
3. "event model"
4. monitoring classes

Package	**Project**	**Description**
VeloLite/VeloLiteMoniSim	Gauss	monitoring of MCHits
Det/VeloLiteDet	LHCb	detector element
VeloLite/VeloLiteDigitisation	Boole	digitisation and clustering
VeloLite/VeloLiteAssociators	Lbcom	MC truth association
VeloLite/VeloLiteDAQ	Lbcom	raw bank encoding
Event/VeloLiteEvent	LHCb	event classes (temp. location)

Detector Element

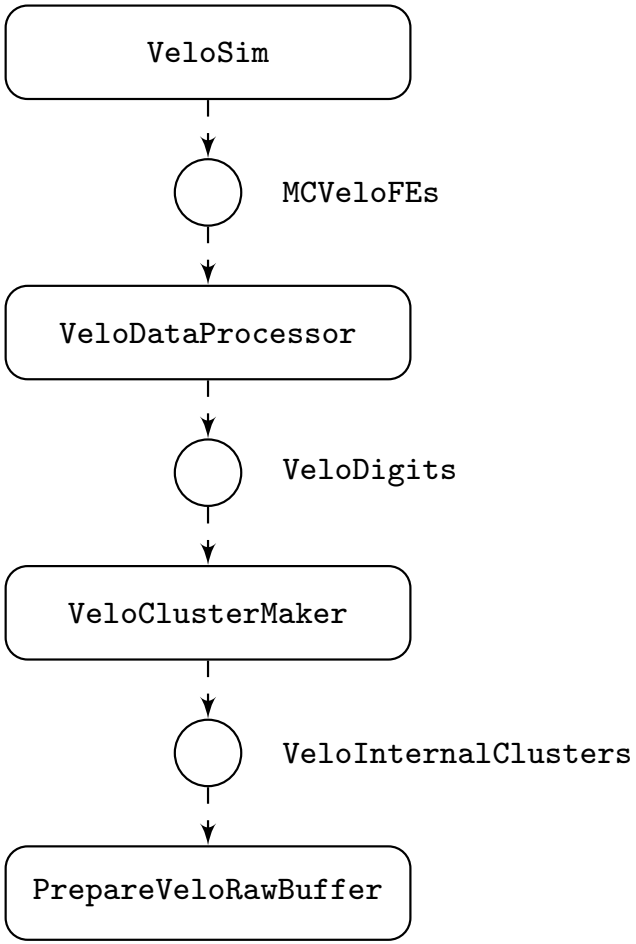
- same structure as current Velo



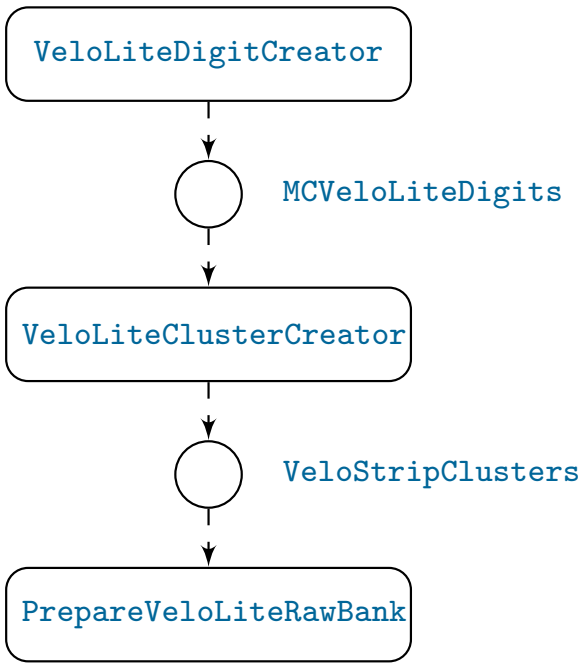
e. g. `/dd/Structure/LHCb/BeforeMagnetRegion/VeloLite/VeloLiteLeft/Module00/RPhiPair00/Detector-00`

- implemented strip layout corresponds to Hamamatsu prototype
- removed some functionality not needed at the present stage
  (e. g. strip noise map, dead channels etc.)

Velo digitisation sequence
(`VeloTell1Processing = False`)



VeloLite digitisation sequence



Boole

Digitisation

- simulation of signal induced in a strip adapted from `VeloSim`,
- use energy deposition from GEANT4,
- estimate noise in strips based on strip length,
- no pedestal and CM-noise simulation for now,
- linear charge to ADC conversion.

Clustering

- based on `VeloClusterMaker`,
- produce directly `VeloStripClusters`

To Do

- adapt front-end response, ADC range and noise level to new strip chip
- modelling of radiation damage

Event Classes

MCVeloLiteDigit

- class ID 4301
- locations: `MC/VeloLite/Digits`, `MC/VeloLite/PuDigits`
- signal, noise, cmnoise, pedestal of a strip in electrons
- ADC value
- VeloLiteChannelID
- references to MCHits

VeloStripCluster

- class ID 4302
- location: `Raw/VeloLite/Clusters`
- indices, channel IDs and ADC values of strips in cluster
- VeloStripLiteCluster

VeloStripLiteCluster

- channel ID and inter-strip position
- type (R, ϕ, pile-up)
- high threshold flag