

# Towards a GAUDI Integration of Full and Fast Simulation (for Tracking)

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# DD4hep - Review

- full detector description based ROOT Geometry
- flexible XML input
  - needs only one corresponding constructor in C++
  - changing the detector features without recompiling

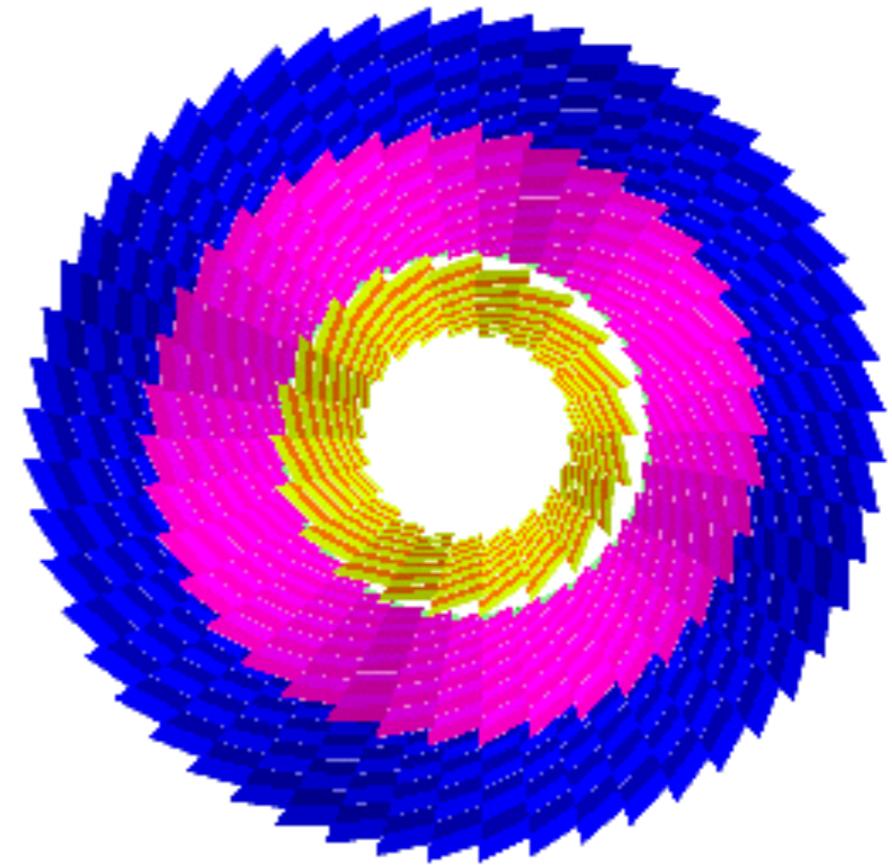
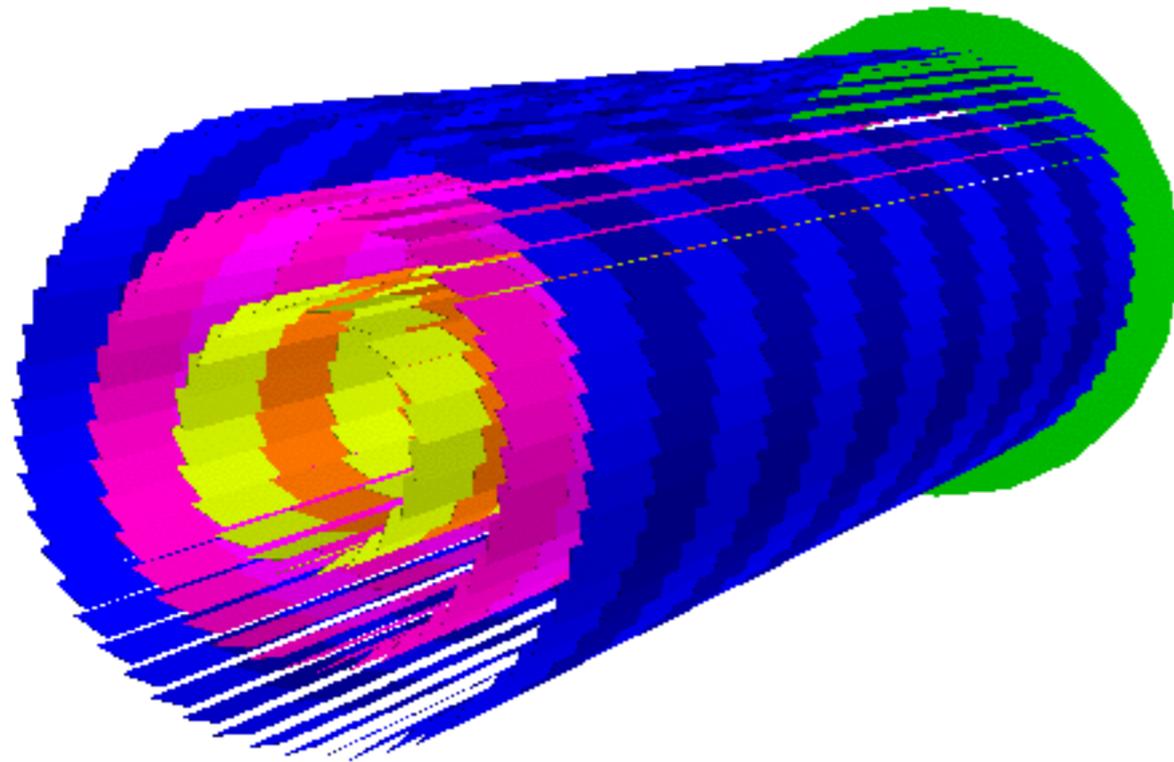
```
<detector id="0" name="Tracker0" type="TestTracker1" readout="TrackerReadout">
  <box width="box_width" thickness="box_thick" length="box_length" repeat="pixelcounter0"
    deltaphi="360.*deg/pixelcounter0"/>
  <layer id="0" vis="TrackerVis0" radius="radius0" dz="0*layerpos" material="Silicon"/>
  <layer id="1" vis="TrackerVis01" radius="radius01" dz="1*layerpos" material="Silicon"/>
  <layer id="2" vis="TrackerVis0" radius="radius0" dz="2*layerpos" material="Silicon"/>
  <layer id="3" vis="TrackerVis01" radius="radius01" dz="3*layerpos" material="Silicon"/>
  <layer id="4" vis="TrackerVis0" radius="radius0" dz="4*layerpos" material="Silicon"/>
  <layer id="5" vis="TrackerVis01" radius="radius01" dz="5*layerpos" material="Silicon"/>
  <layer id="6" vis="TrackerVis0" radius="radius0" dz="6*layerpos" material="Silicon"/>
  <layer id="7" vis="TrackerVis01" radius="radius01" dz="-1*layerpos" material="Silicon"/>
  <layer id="8" vis="TrackerVis0" radius="radius0" dz="-2*layerpos" material="Silicon"/>
  <layer id="9" vis="TrackerVis01" radius="radius01" dz="-3*layerpos" material="Silicon"/>
  <layer id="10" vis="TrackerVis0" radius="radius0" dz="-4*layerpos" material="Silicon"/>
  <layer id="11" vis="TrackerVis01" radius="radius01" dz="-5*layerpos" material="Silicon"/>
  <layer id="12" vis="TrackerVis0" radius="radius0" dz="-6*layerpos" material="Silicon"/>
</detector>
```

→ change dimensions of detector fast

→ add more layers easily

# DD4hep - Review

- description of materials, and sensitive detectors
- easy visualisation with ROOT displayer



- Full Simulation: conversion to Geant4 via DD4HEP framework
- Fast Simulation and reconstruction:
  - plan to use reconstruction geometry (like CMS/ATLAS do in their fast simulation)
  - DDRec/DDSurface packages are not complete enough for usage at this stage

# Work plan

## ▸ GAUDI

- use **one** framework for full/fast simulation and reconstruction

## ▸ DD4hep

- detector description
- description for sensitive detectors and hits
- implementation via GAUDI services:
  - > able to steer geometry building in GAUDI

## ▸ Full Simulation based on Geant4

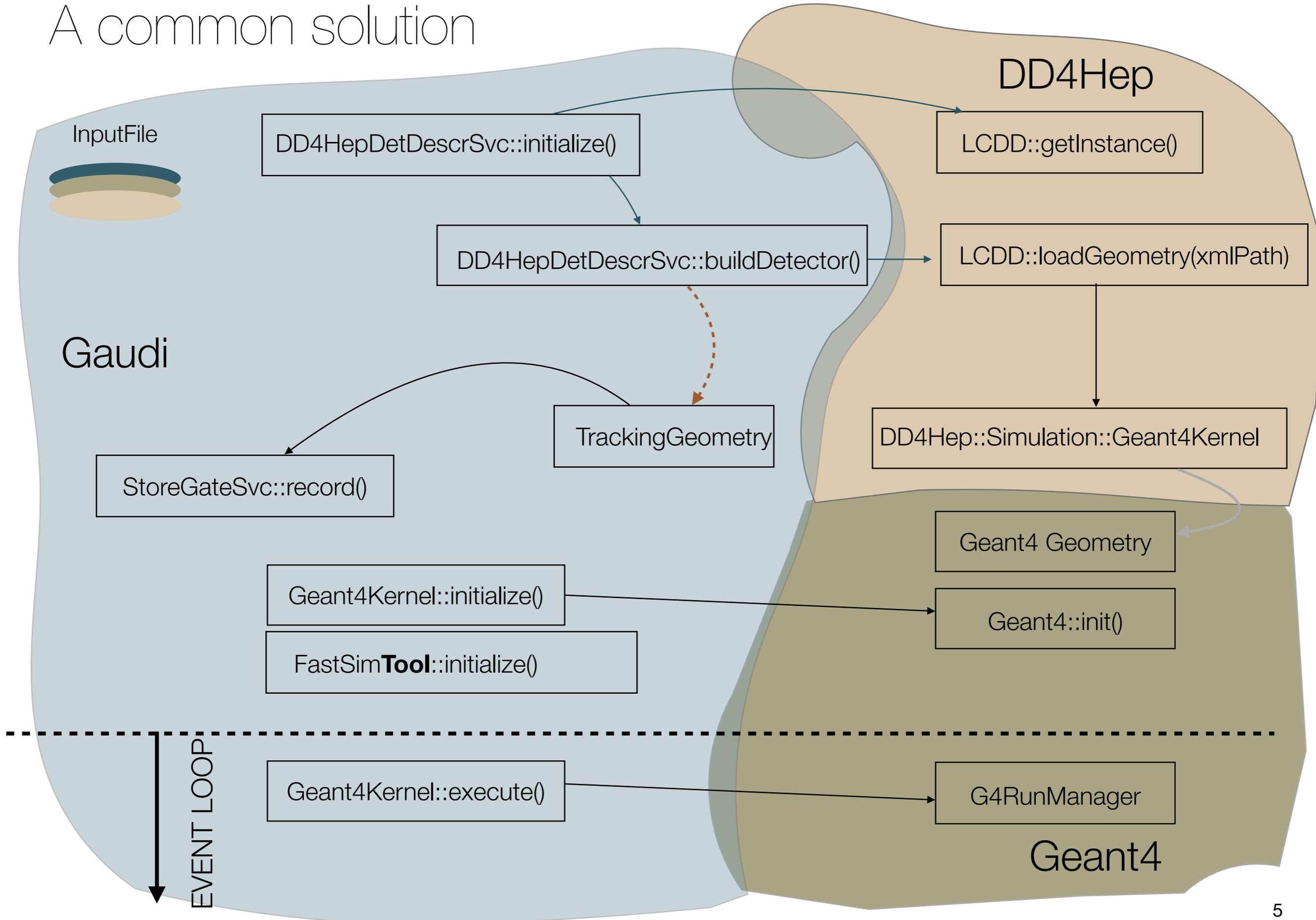
## ▸ Implement Geometry based on TGeo

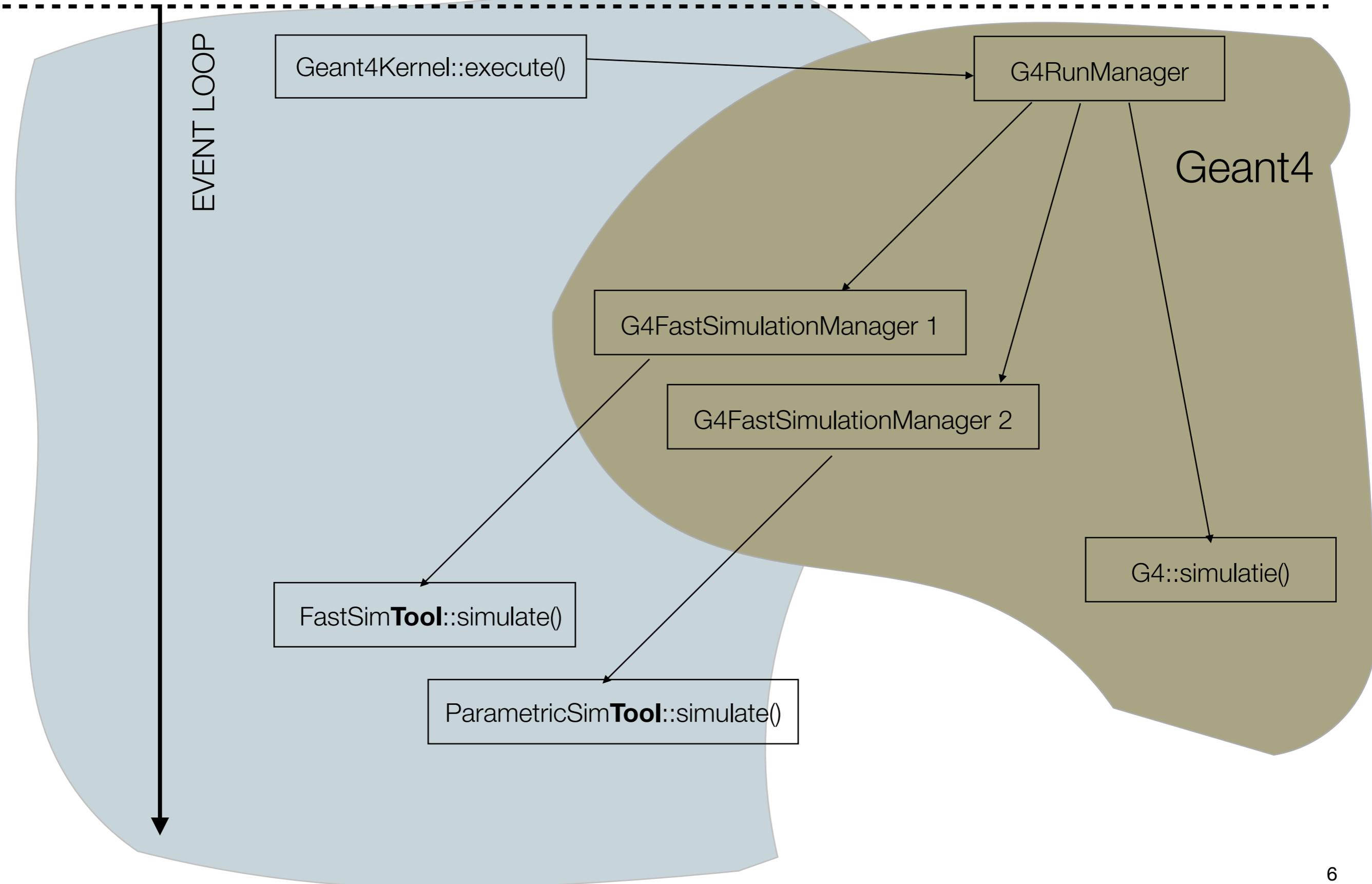
- ambitious plan: `typedef Surface<Box> PlaneSurface;`
- compatible with DD4hep

## ▸ Fast Simulation based on reconstruction geometry

- eventually use a truth based tracking (hit connecting by truth information)  
as a first step to achieve some tracking performance numbers

# A common solution





# Summary

- able to design tracker in DD4hep
- able to access and build DD4hep Geometry in/from GAUDI
- able to access TGeo manager in GAUDI
  - need to learn how to access the sensitive detector elements

# Next Step

- create a surface description for usage as a reconstruction geometry