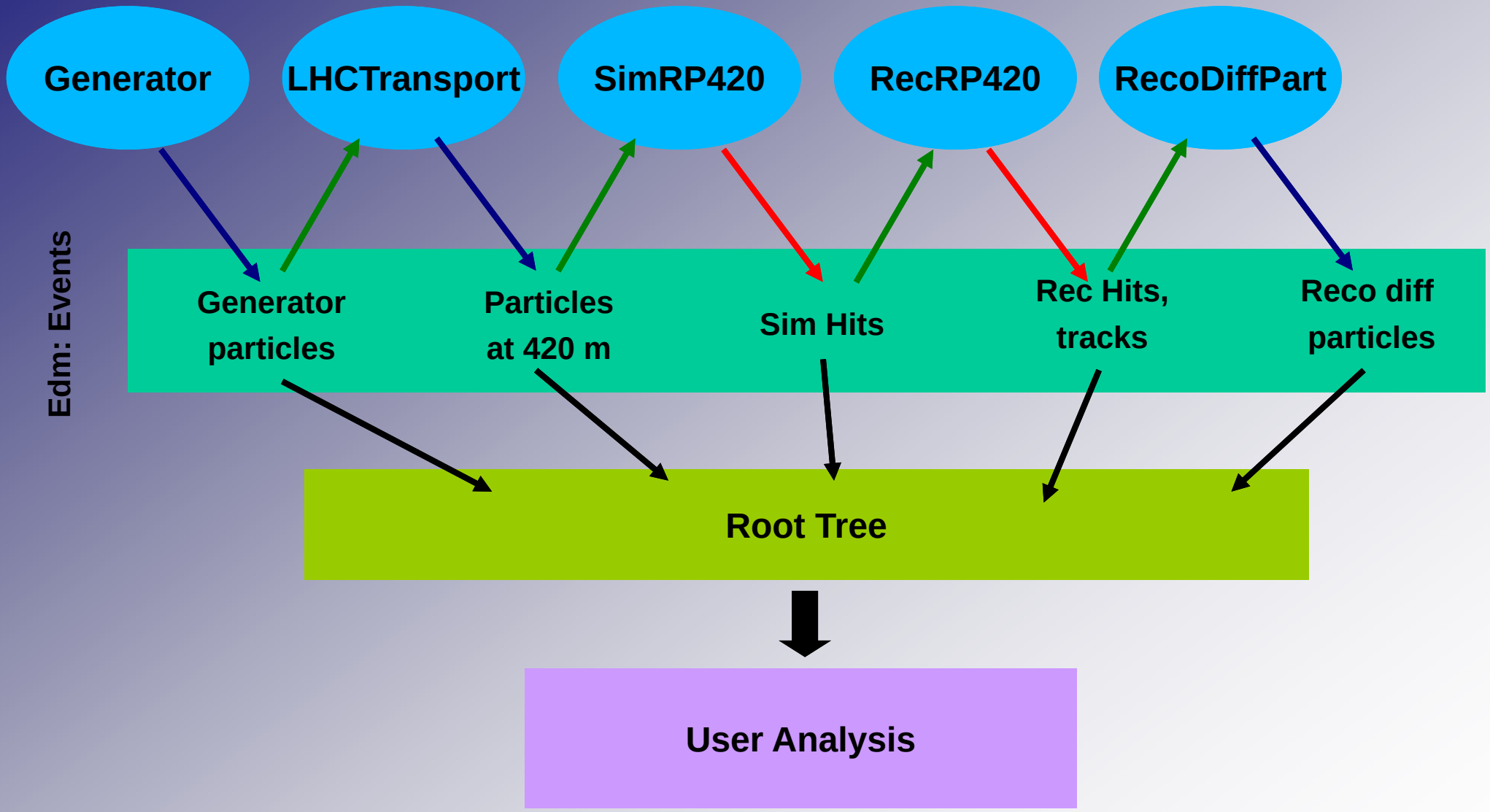
Full MC chain for diffractive processes

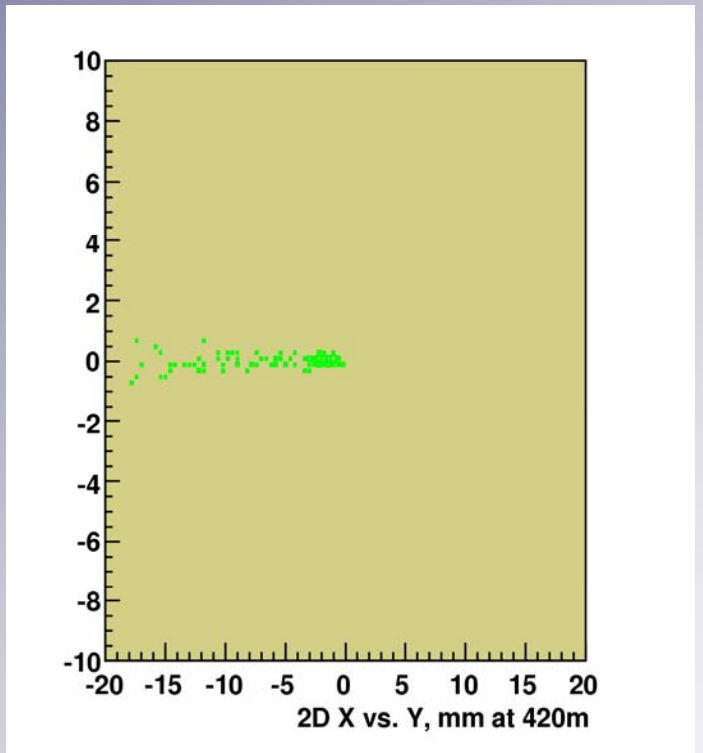


K. Datsko

Transport integration status

What has been done:

LHCTransport module takes initial particles from *edm::Event* propagates them through LHC beam to the RomanPots plane and puts their parameters back in to *edm::Event.* So *g4SimHits* module can find and use this information for creating tracks in detectors. For using LHCTransport module user just need to modify his *cfg* file



How to get code:

In working directory type:

- *scramv1 project CMSSW CMSSW_1_3_0_pre6* (the list of versions you can get by *scramv1 list CMSSW*)
- *cd CMSSW_1_3_0_pre6/src*
- *eval `scramv1 runtime -sh`* for zsh or *eval `scramv1 runtime -csh`* for tcsh
- *source /afs/cern.ch/cms/sw/cmsset_default.sh* for zsh or *.csh* for tcsh
- *project CMSSW*
- *cvs co -r V00-00-03 SimTransport*

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Transport integration status

How to use:

- for compilation type in *SimTransport/HectorProducer* *scramv1 b*
- for configuring put in to your *cfg* file:

  - if you want to use CMSSW vertex smearing

  include "SimTransport/HectorProducer/test/HectorProdVtxSmear.cfi"

  path p1 = { VtxSmeared, LHCTransport, g4SimHits }

  - if you want to use HECTOR vertex smearing

  include "SimTransport/HectorProducer/test/HectorProdSelfSmear.cfi"

  path p1 = { LHCTransport, g4SimHits }

  - *replace g4SimHits.Generator.HepMCProductLabel = "LHCTransport"*
  - for changing some parameters from *HectorProdVtxSmear.cfi or HectorProdSelfSmear.cfi* add something like

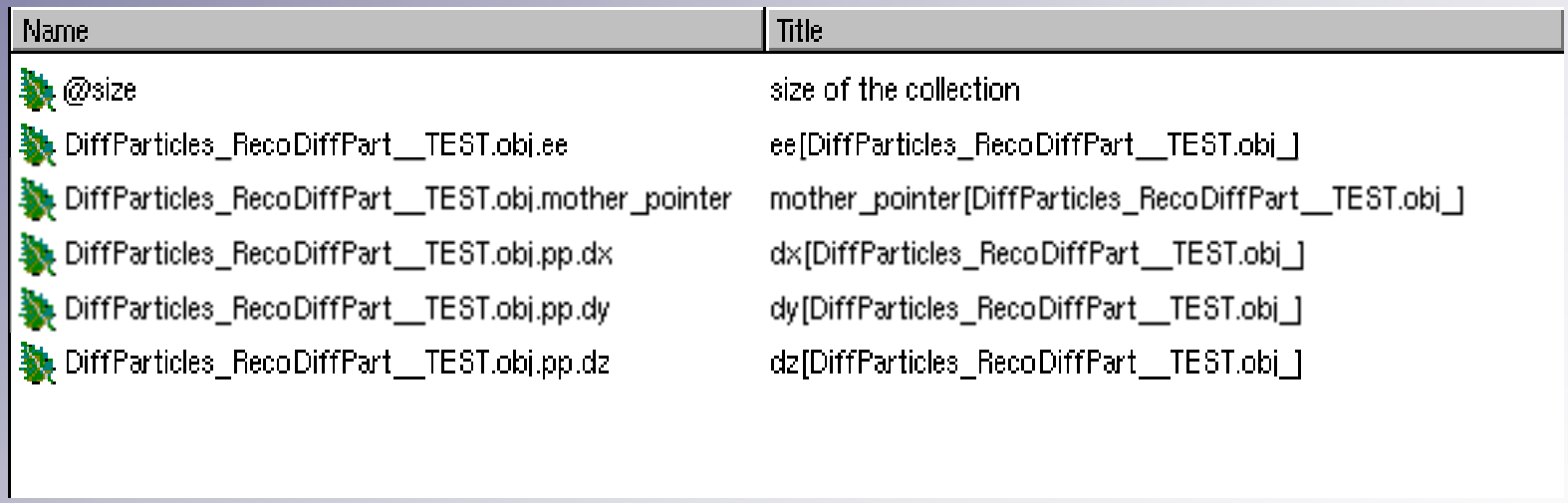
  replace LHCTransport.Hector.RP420f = 416. (for changing RP position)

Data formats

LHCTransport saves data in to *edm::Event* like HepMCProduct format. Therefore we don't need design new data format.

For RecoDiffPart module we need new data type. Therefore it has been designed new fomats of data DiffPartCollection (which is just *std::vector<DiffPart>*) and DiffPart. The DiffPart consist of:

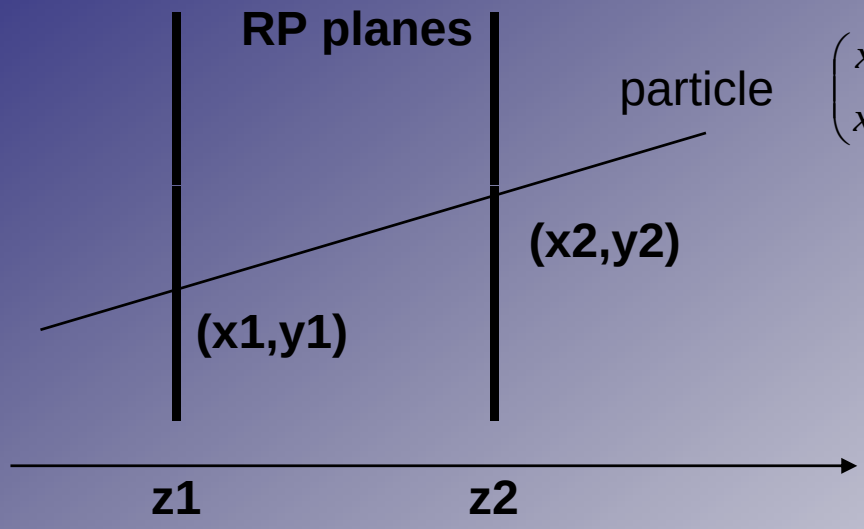
- for momentum of diffractive particle at IP (*CLHEP::HepLorentzVector*)
- pointer (bar code) of mather particle in the initial MC event
- *possible something else?*



Name	Title
@size	size of the collection
DiffParticles_RecoDiffPart__TEST.obj.ee	ee[DiffParticles_RecoDiffPart__TEST.obj_]
DiffParticles_RecoDiffPart__TEST.obj.mother_pointer	mother_pointer[DiffParticles_RecoDiffPart__TEST.obj_]
DiffParticles_RecoDiffPart__TEST.obj.pp.dx	dx[DiffParticles_RecoDiffPart__TEST.obj_]
DiffParticles_RecoDiffPart__TEST.obj.pp.dy	dy[DiffParticles_RecoDiffPart__TEST.obj_]
DiffParticles_RecoDiffPart__TEST.obj.pp.dz	dz[DiffParticles_RecoDiffPart__TEST.obj_]

DataProducer

We use Hector for reconstruction of diffractive particles at IP.



$$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} L_{x1} & D_1 \\ L_{x2} & D_2 \end{pmatrix} \begin{pmatrix} \Theta_x^* \\ \xi \end{pmatrix} + \begin{pmatrix} x^* v_{x1} \\ x^* v_{x2} \end{pmatrix}$$

$$\Downarrow$$

$$\begin{pmatrix} \Theta_x^* \\ \xi \end{pmatrix} = \frac{1}{\Delta} \begin{pmatrix} D_2 & -D_1 \\ -L_{x2} & L_{x1} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix},$$

with $\Delta = L_{x1} D_2 - L_{x2} D_1$

$$\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{pmatrix} L_{y1} & v_{y1} \\ L_{y2} & v_{y2} \end{pmatrix} \begin{pmatrix} \Theta_y^* \\ y^* \end{pmatrix}$$

$$\Downarrow$$

$$\begin{pmatrix} \Theta_y^* \\ y^* \end{pmatrix} = \frac{1}{\Delta} \begin{pmatrix} v_{y2} & -v_{y1} \\ -L_{y2} & L_{y1} \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \end{pmatrix},$$

with $\Delta = v_{y1} D_2 - v_{y2} D_1$

Hector reconstructs parameters of diffractive particles at IP by measurements at 2 planes. First one at the enter in RomanPot, second one at the exit. Since we can get some tracks (Reco/Sim Hits) from Sasha's Sim/RecoRP420 we can reconstruct kinematics at IP and store this information (*DiffParticleCollection*) in to *edm::Event* (ROOT file) for future using in physical analysis.