Event Data Visualization in 3D

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- Requirements:
  - Why do we need event display?
  - Who will be the main users?
  - Should it be standalone or integrated application
- Towards the implementation:
  - Visualization of the SimpleOutput simulated hits:
  - Example in
    http://www-f9.ijs.si/~rok/belle2/eventdisplay/

- Required Changes in basf2

Requirements for event display

"Visualization of" and "GUI to":

- detector geometry
- event data:
  - simulation data: kinematics, hits, digits
  - raw data
  - reconstructed objects: clusters, tracks, ...
  - physics objects
- reconstruction & analysis algorithms
- calibration and alignment data

Usage:

- experts: visual debugging, development of algorithms
- non-experts: understand detector, event structure, ...
- presentations, demonstrations ... outreach

TEve from ROOT

Use of TEve classes from root:

http://root.cern.ch/root/htmldoc/GRAF3D_EVE_Index.html

Geometry:

- TGeo-interface classes
  a) Direct usage via TGeoPainter: requires geometry and can be slow
  b) Extracted shape-data: standalone, fully configurable

Hits, clusters : TEvePointSet
Tracks : TEveTrack

Digits, raw-data:

TEveQuadSet – set of rectangles, lines or hexagons

TEveBoxSet – set of boxes (calorimeters)

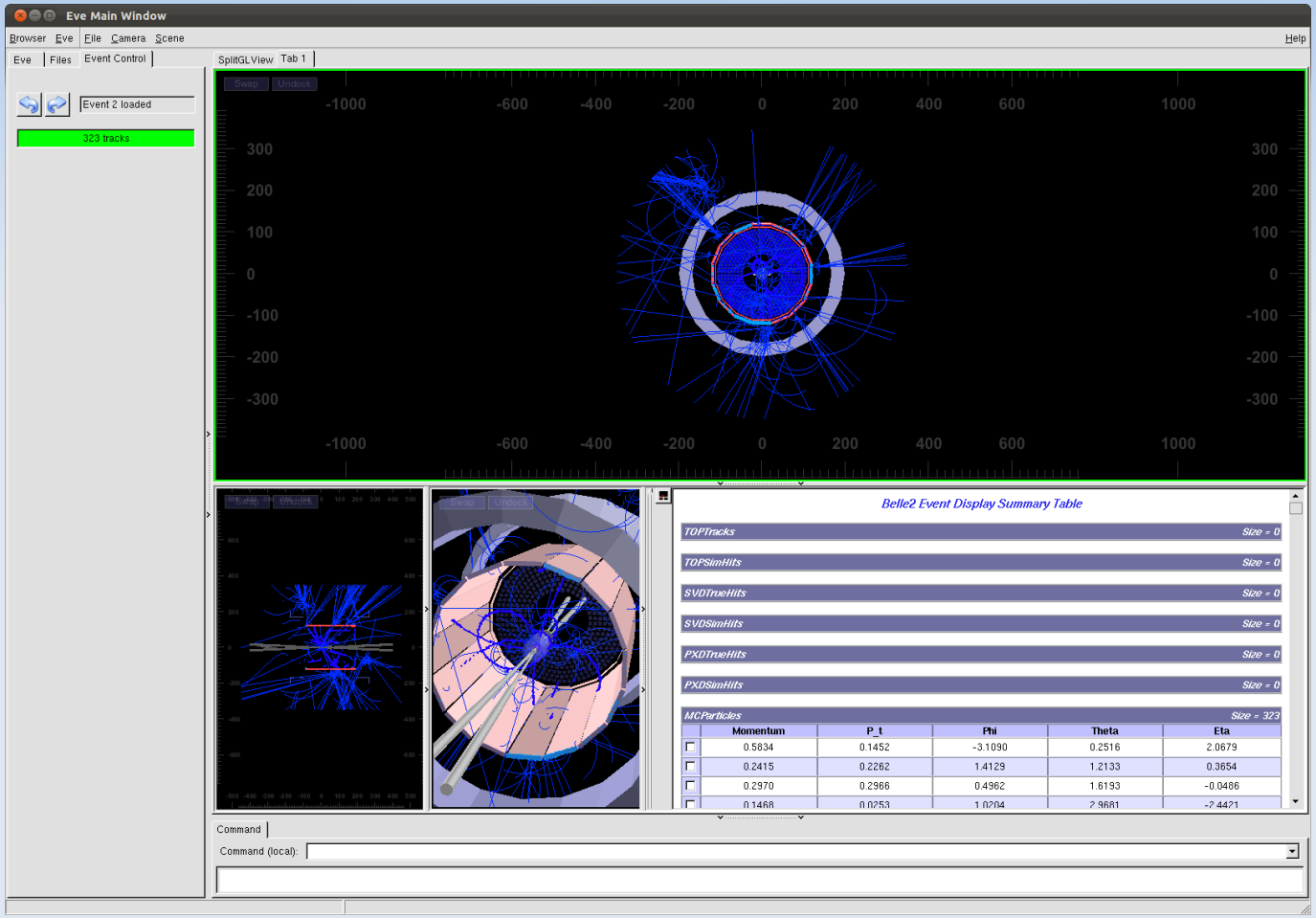
TEveTriangleSet – arbitrary triangle mesh

Implementation in Belle2

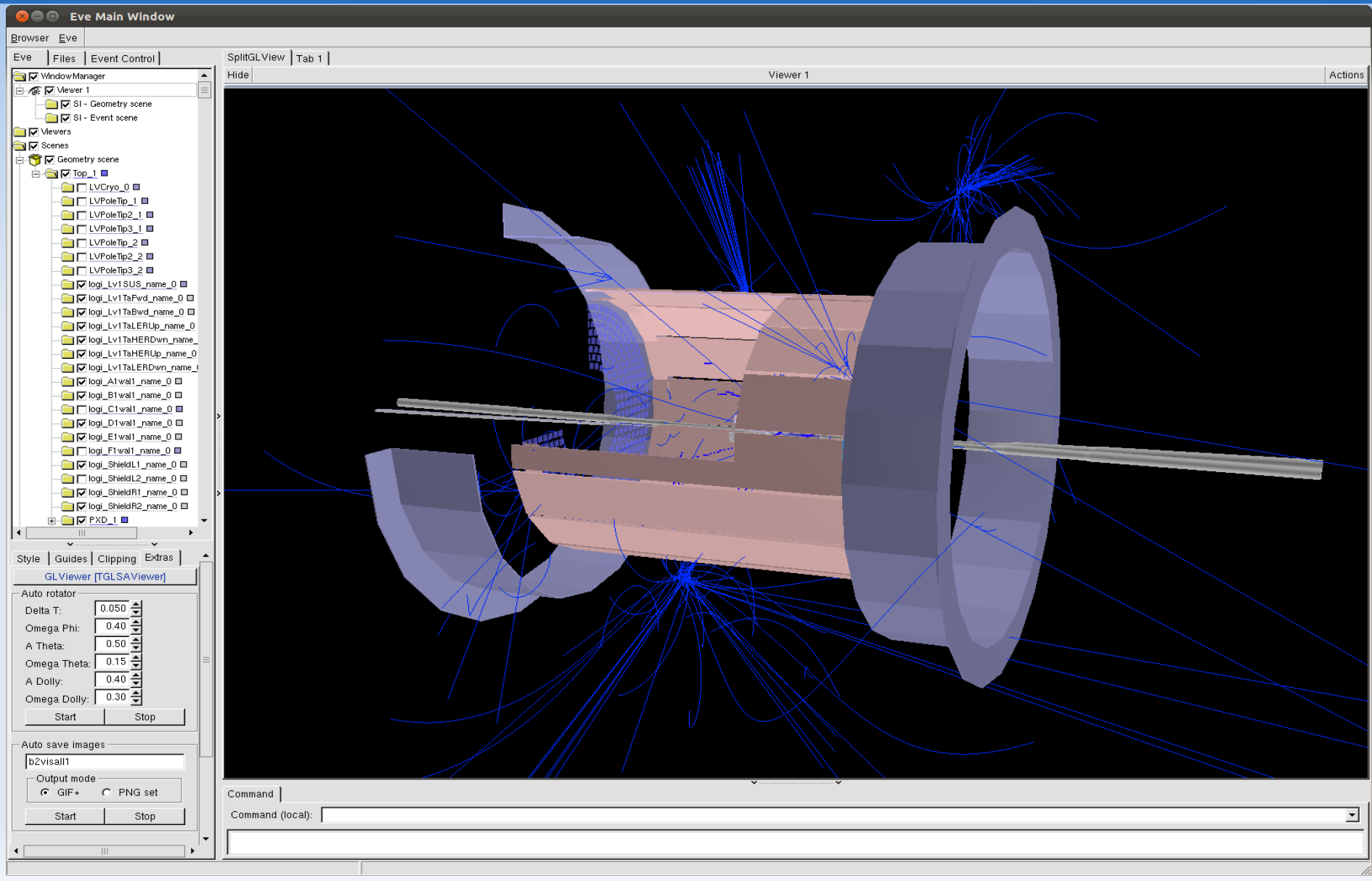
Do we need a standalone application:
→ does not need the whole software installation (lightweight),
→ can be installed on the desktops of the users and easily used by many non experts
→ needs the separate distribution of the libdataobjects.so library
→ cannot use all the features of the basf2
→ can be used to visualize the events and walk forward and backward through the data
→ can be connected to basf2 through some event server

Is it better to be integrated in basf2:
→ can use all the features of basf2
→ once the next event is simulated/loaded, the previous event cannot be visualized

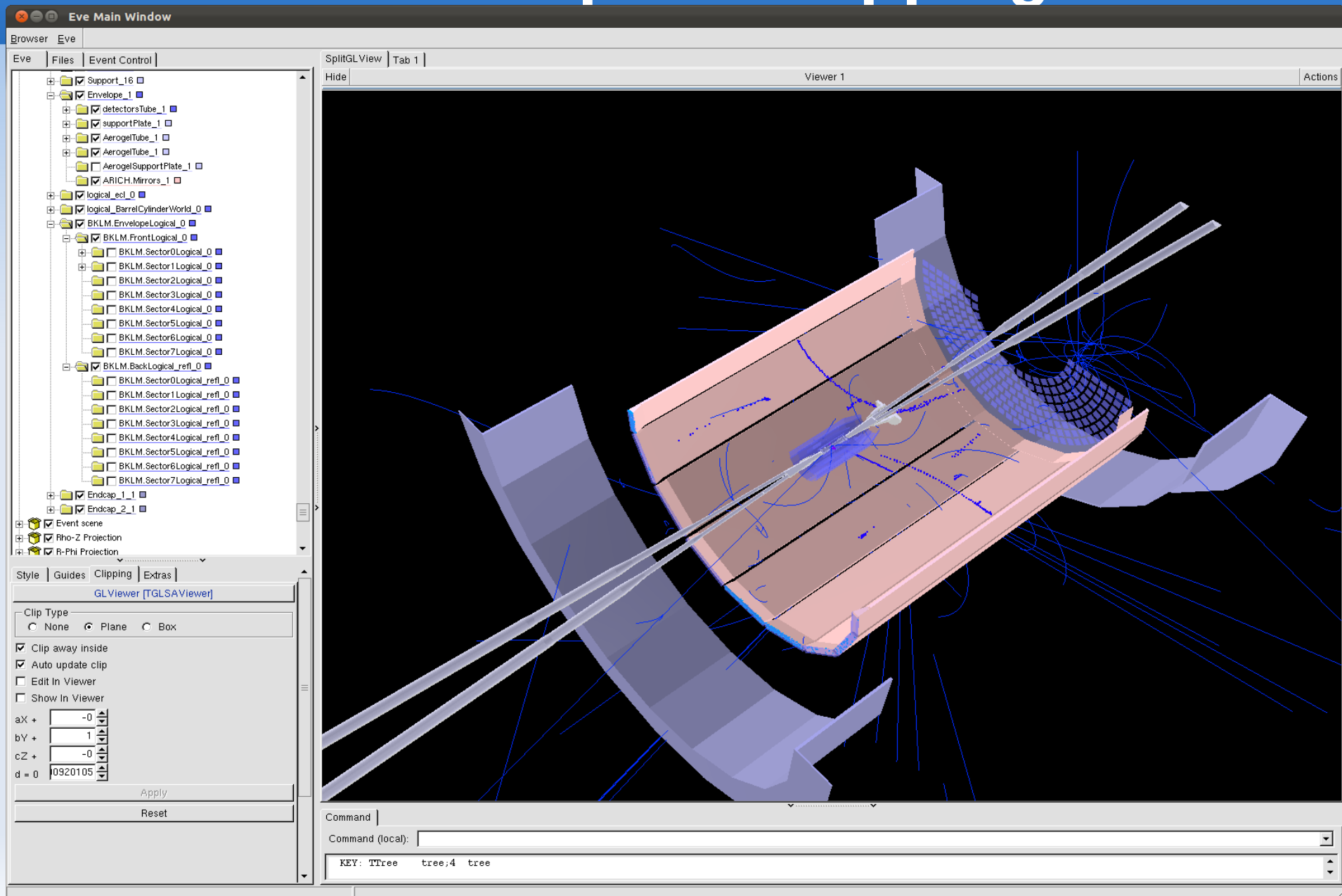
Graphical display



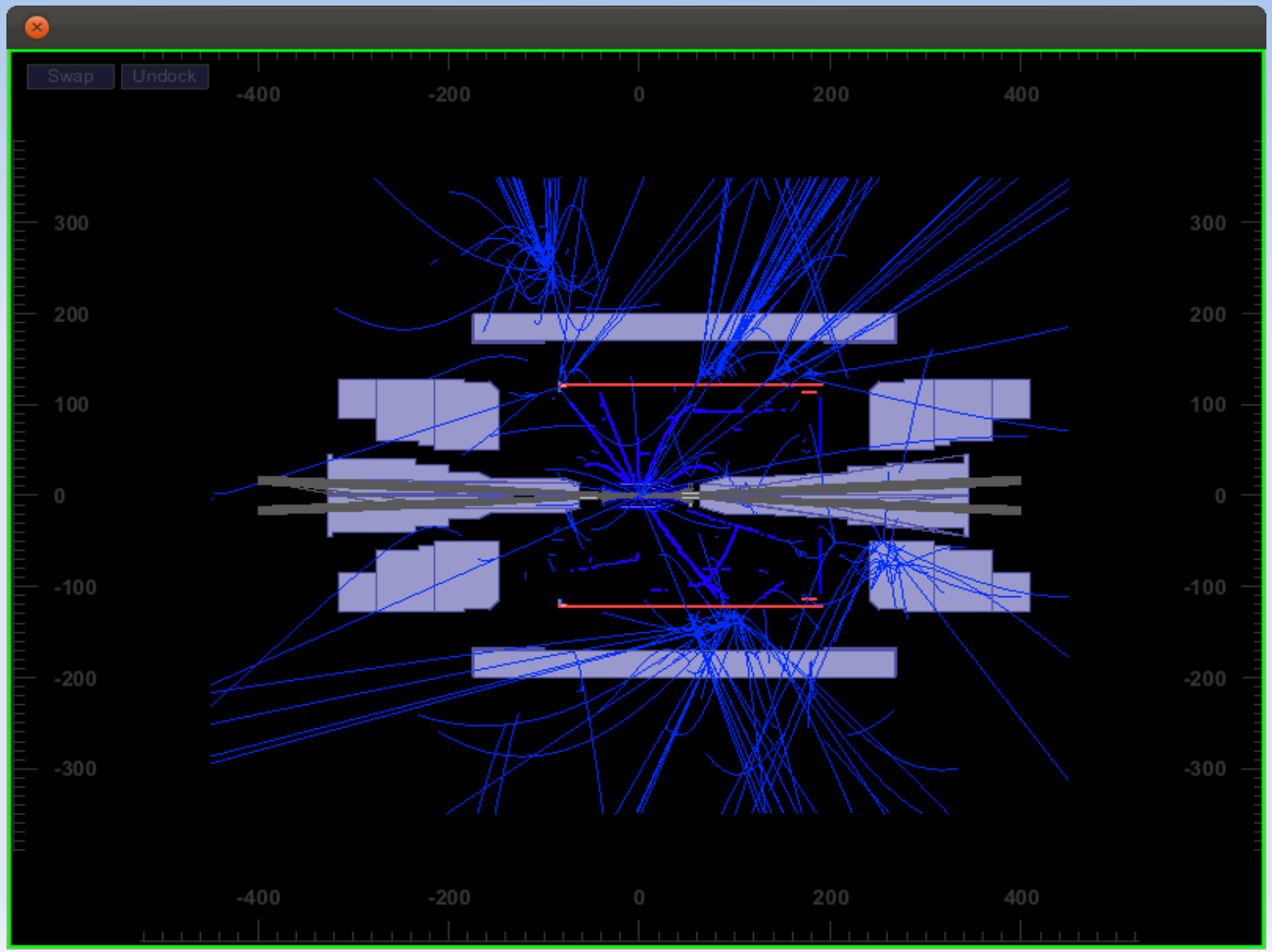
3D view: box clipping



3D view: plane clipping



Side Projection



Required changes in basf2

Datastore store classes to libdataobjects.so

Virtual classes: e.g Belle2SimHit with the method getGlobalPosition(), which return the global position of the hit.

Distribution of the compiled libdataobjects.so

Conclusions

In Belle2 we need an event displays used by experts and non experts to visualize

- Detector geometry
- Event data:
  - Kinematics, hits, clusters, tracks,...
  - Raw data

- Alignment and calibration

  By use of TEve classes in Root the event displays can be easily integrated
- First example was implemented:
  - Standalone
  - Uses Simpleoutput root files
  - Allows event 3D and projections visualization of simulated hits,
  - For outreach we can produce animated drawings of the events:

http://www-f9.ijs.si/~rok/belle2/eventdisplay/b2visall.gif