IFR PROTOTYPE SOFTWARE

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University of Ferrara
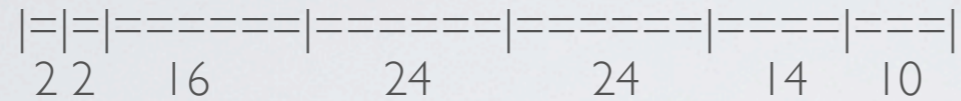
Outline

- Introduction
- GDML description of Prototype
- Status of prototype software
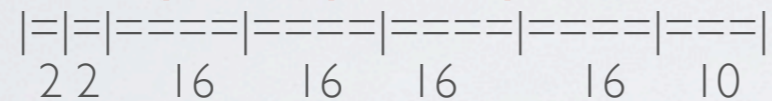- Background reminder
- Conclusions

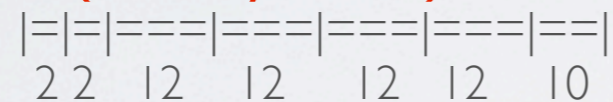# **Introduction**

In this year in full simulation we studied:
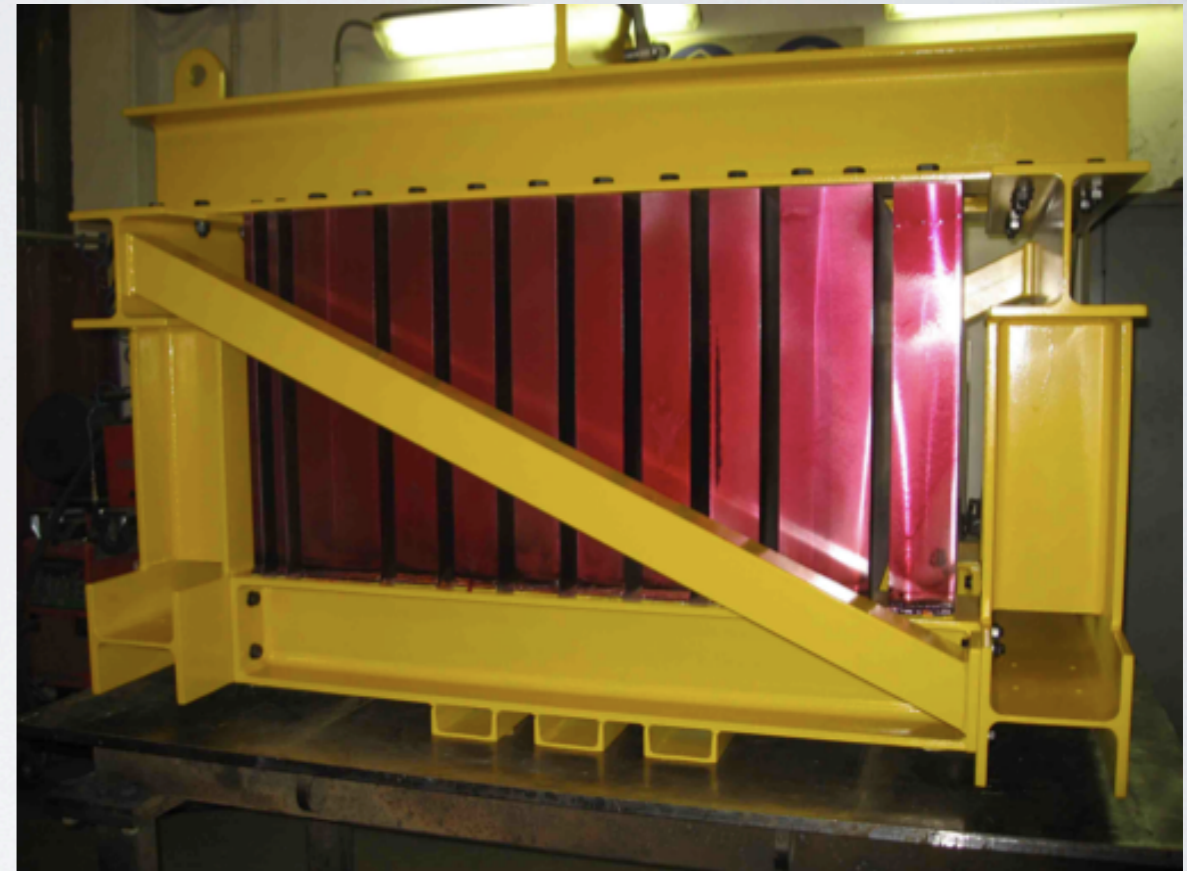- 920mm iron (8 layers)

|=|=|======|======|======|====|===|
  2 2   16   24   24   14   10

- 820mm iron (8 layers)

|=|=|====|====|====|====|===|
  2 2   16   16   16   16   10

- 620mm iron (8 layers)

|=|=|===|===|===|===|==|
  2 2 12   12   12   12   10

- 920mm iron (9 layers)

|=|=|===|===|=====|======|===|==|
  2 2 12   12   16   24   14 10
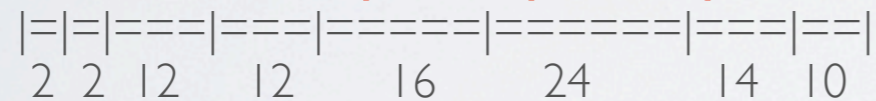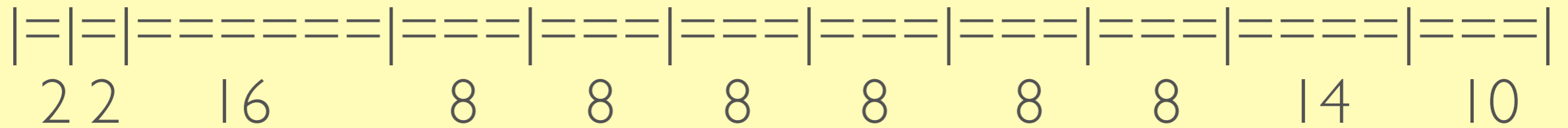
The Prototype can test all
these configurations and others!

Prototype

- Segmentation of prototype

|=|=|======|===|===|===|===|===|===|====|===|

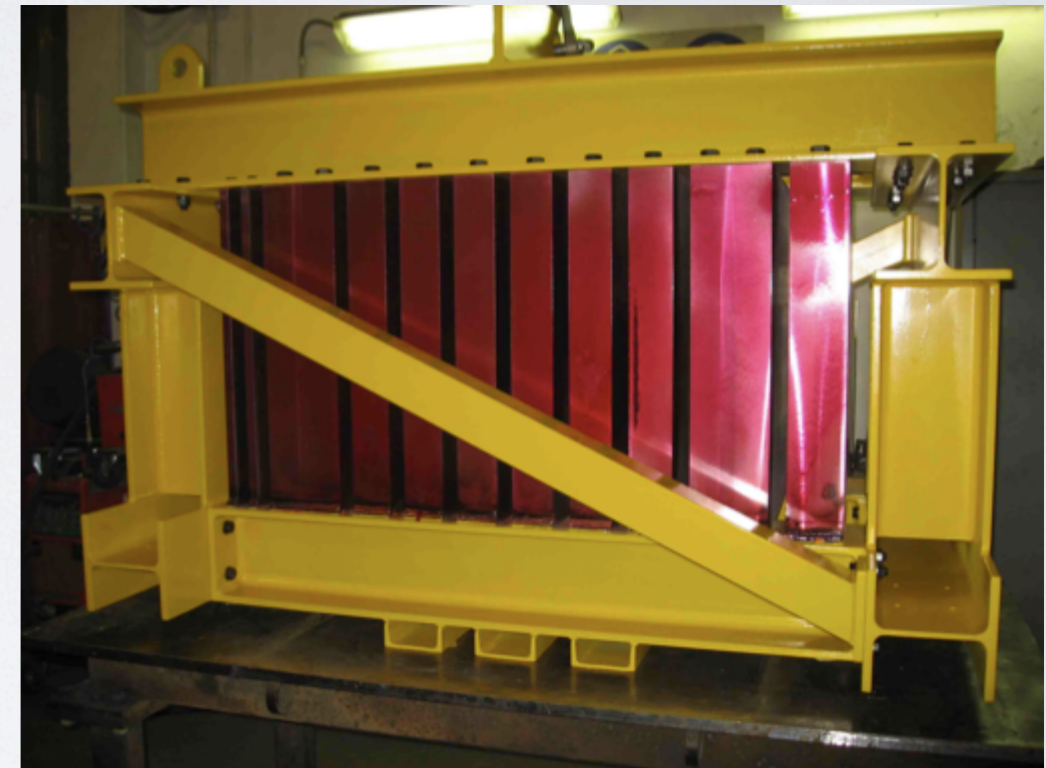2 2　　16　　　8　　8　　8　　8　　8　　8　　14　　10

For the test beam we will study these two configurations:

CP1

|=|=|======|===|===|===|===|===|===|====|===|

2 2　　16　　　8　　8　　8　　8　　8　　8　　14　　10

CP2

|=|=|======|===|===|===|===|===|===|====|===|

2 2　　16　　　8　　8　　8　　8　　8　　8　　14　　10
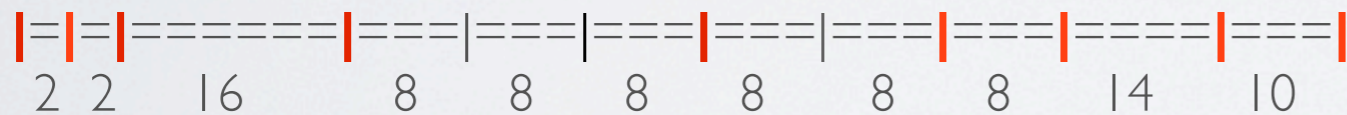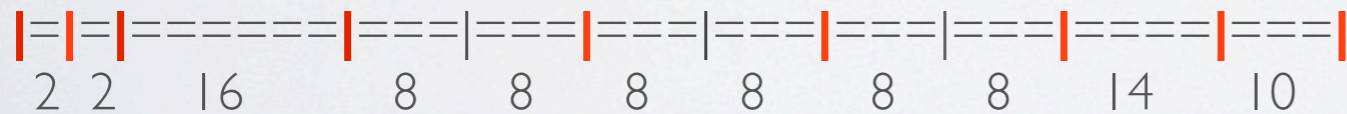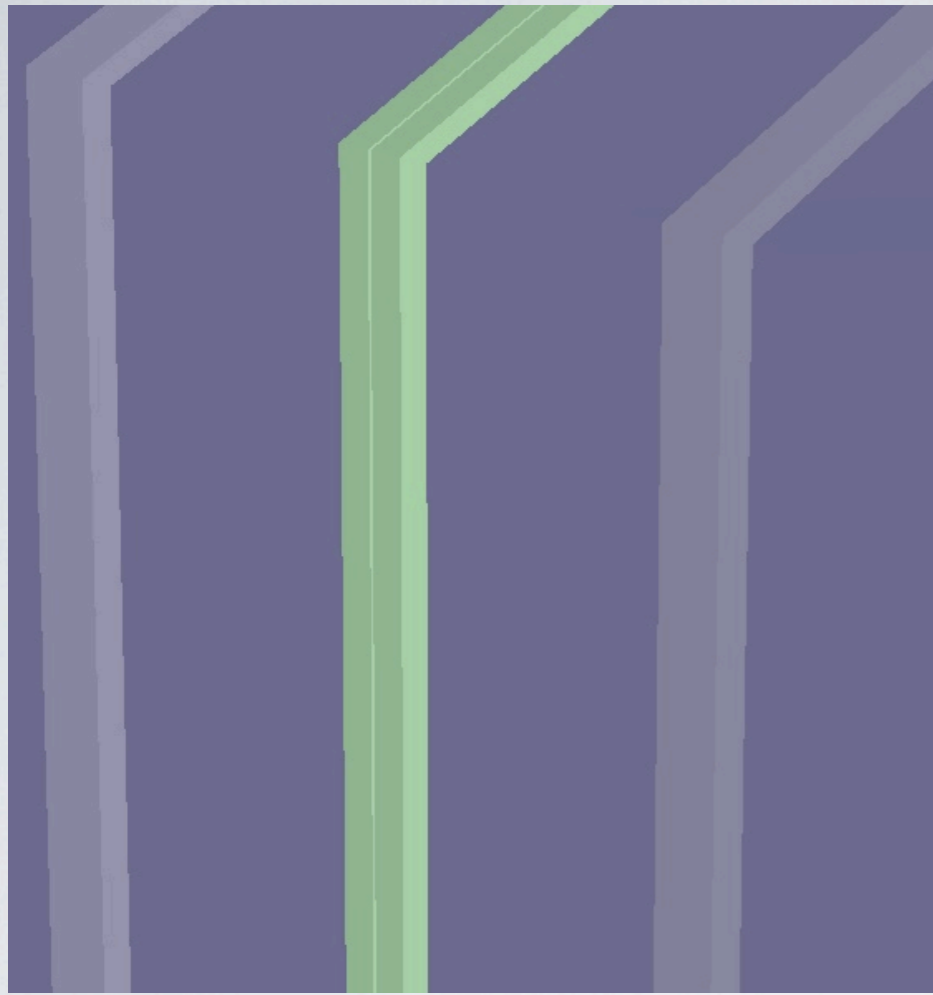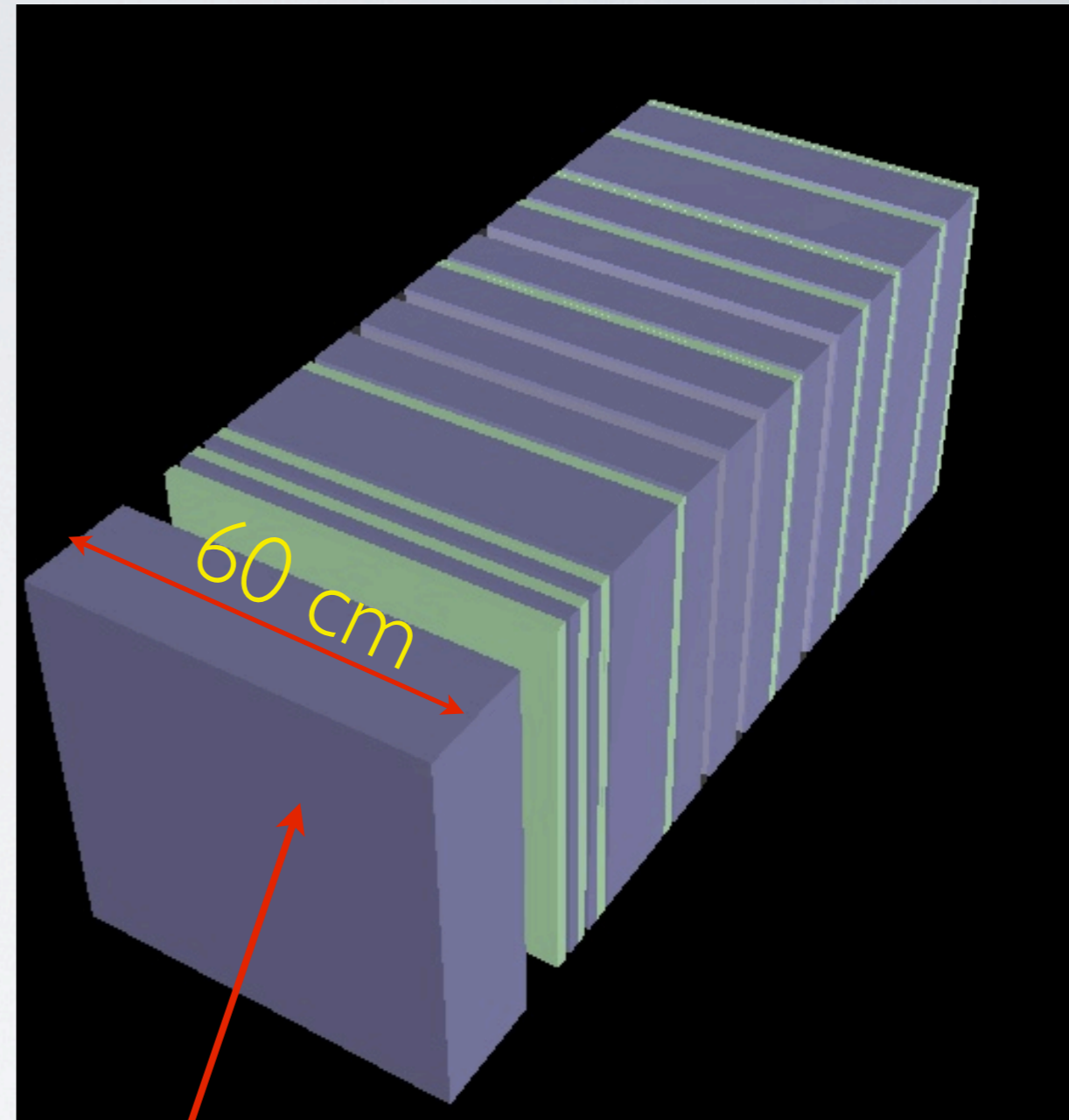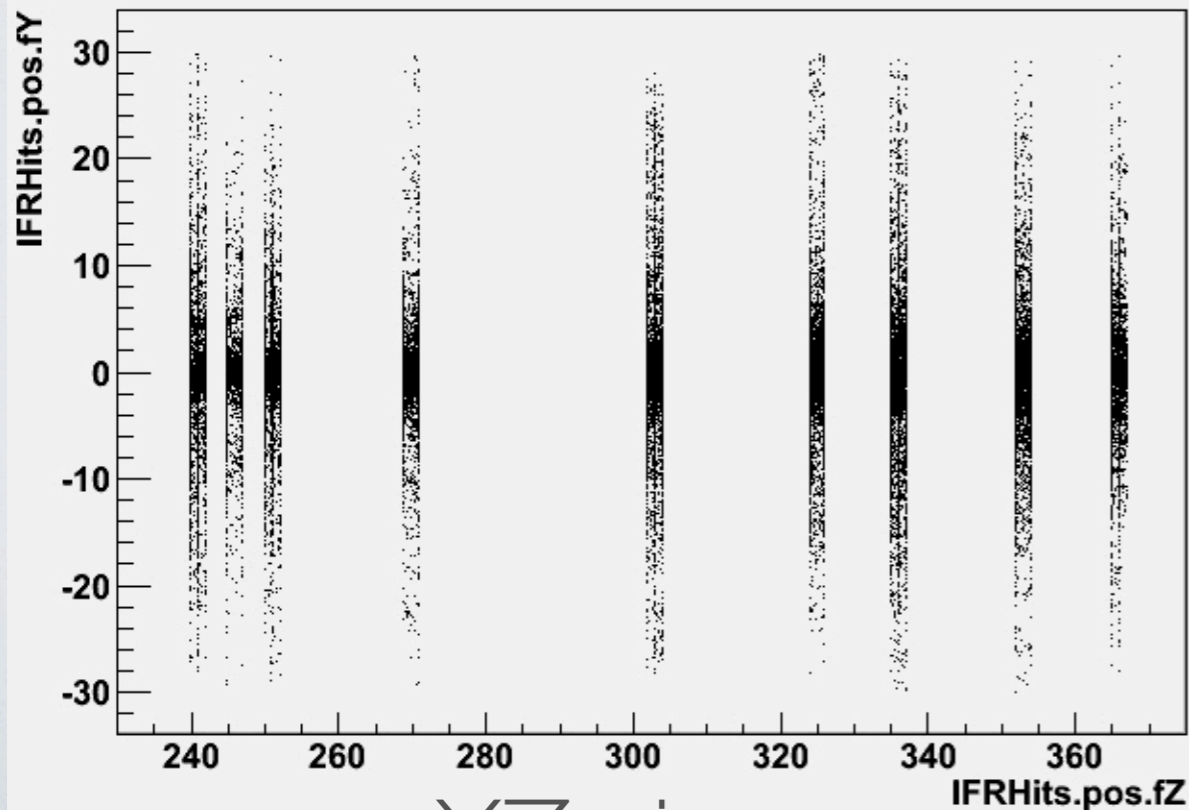
GDML description of Prototype
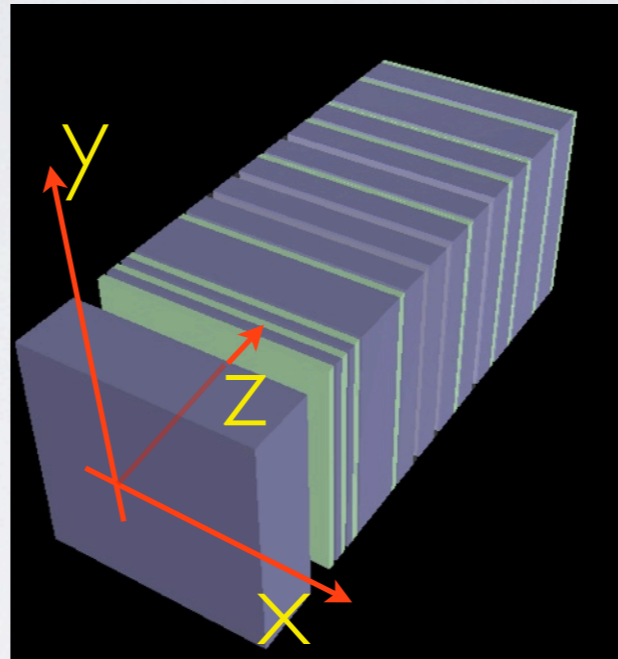

For simulating the binary readout one layer is composed by two scintillators 1cm thick with a gap of 1mm
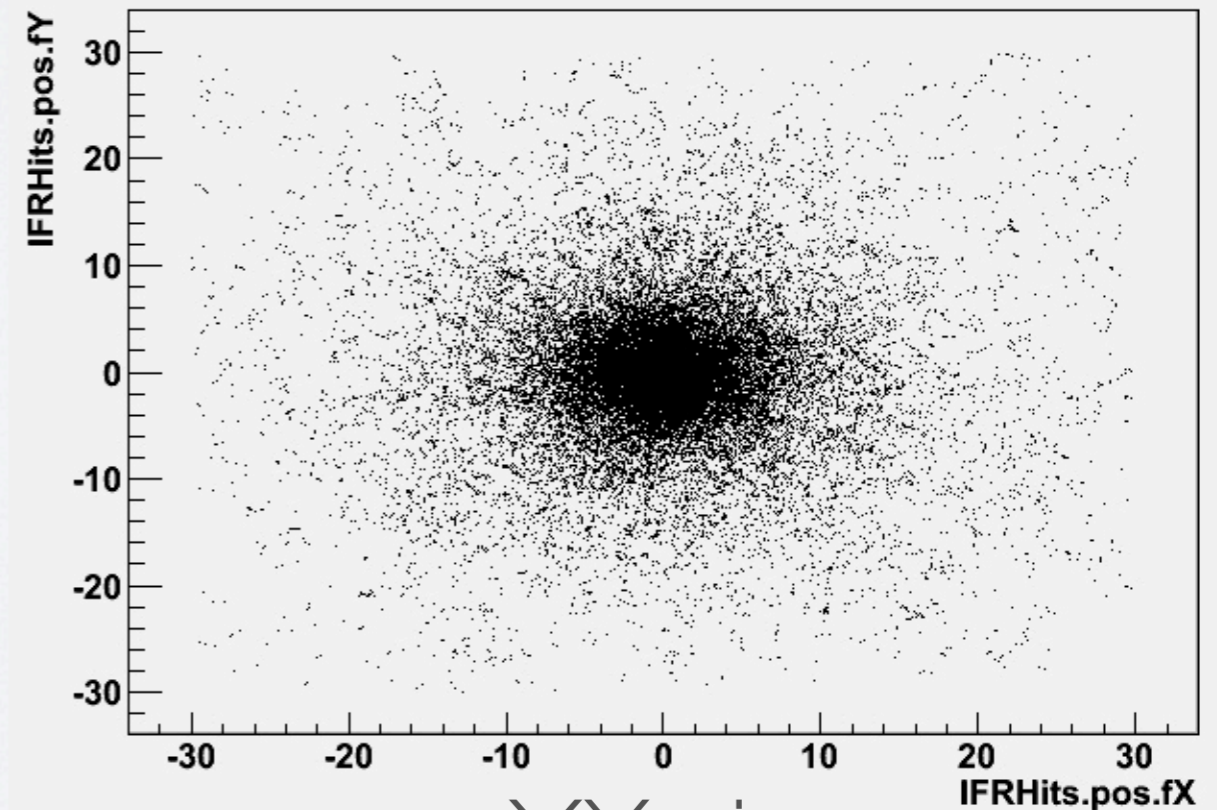
60 cm

18 cm of iron before the prototype

GDML description of Prototype (I)

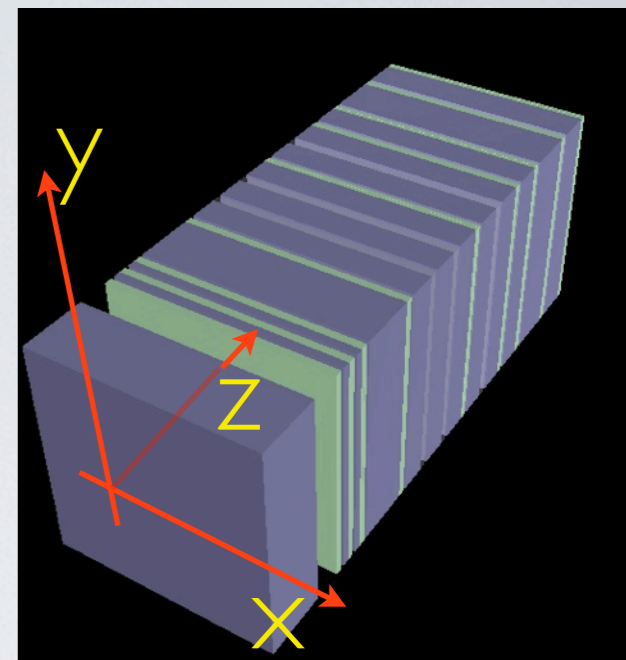We try to shot 1K muons along beam line for testing our geometry description in GEANT4
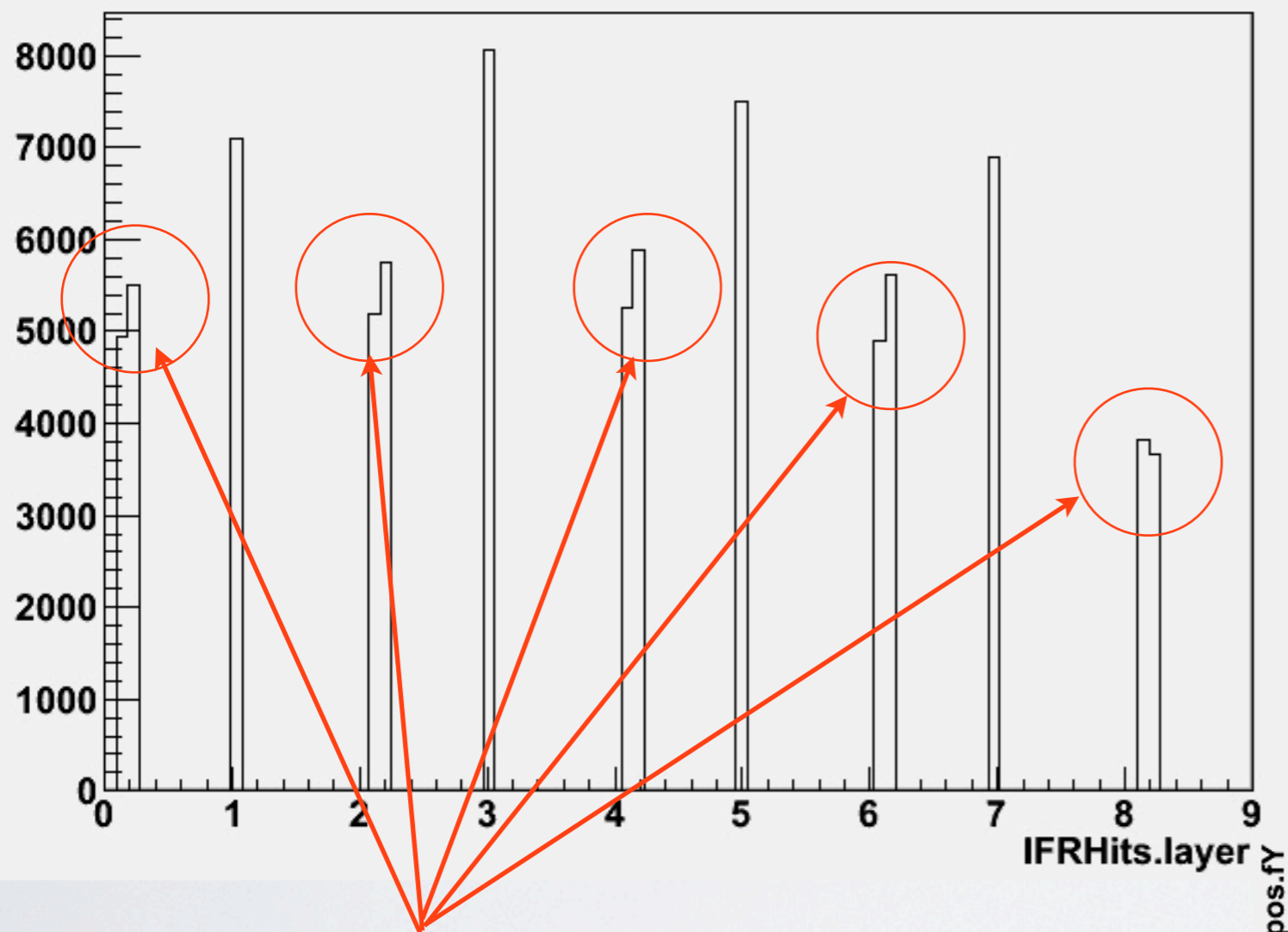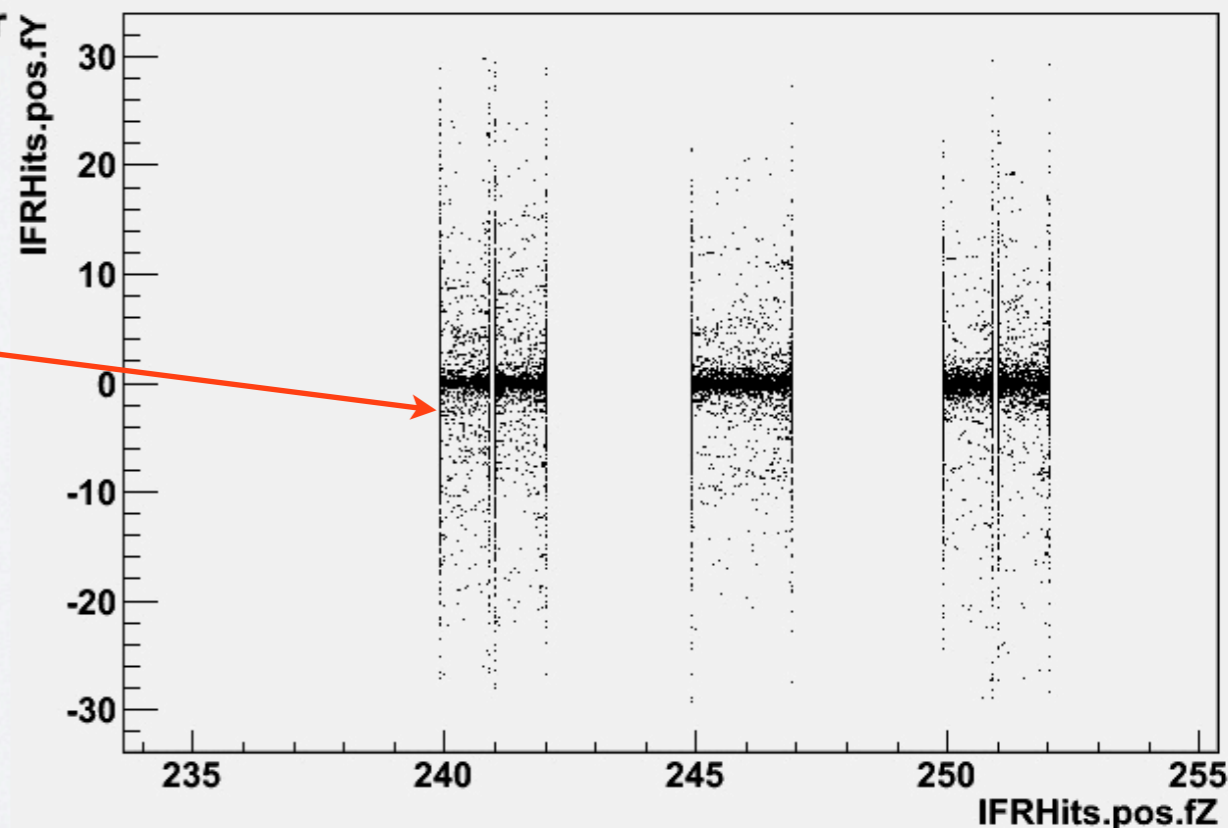

YZ view

XY view

GDML description of Prototype (II)

Binary readout = two scintillators separated by gap of 1mm

IFR prototype data flow

Cotta, Dal Passo, Malaguti

Online Detector Control

Andreotti

Online

Prototype FEE

TCP/IP

Online run control and DAQ

raw data (hex)

Andreotti, Busso, Manzali

Manzali, Cibinetto

Online Monitoring

raw data (root)

Prompt Calibration

Cibinetto

FEE maps

Event Reconstruction

calibration file

Extract time resolutions

Data Processing

hits (root)

Munerato, Gagliardi, Rotondo, Cibinetto

Detector Configuration

Analysis (IfrRootCode)

Data from other subdetectors

Iron layout Module position

Other

PMTs MWPC Cherenkov TOF

G4 Simulation

Munerato

rootuple for analysis

Analysis Tools (muon id, eff...)

Data Analysis

8

Just to have an idea of the amount of work to be done, the IfrRootCode package alone has **about 7000 lines** of code with this structure.
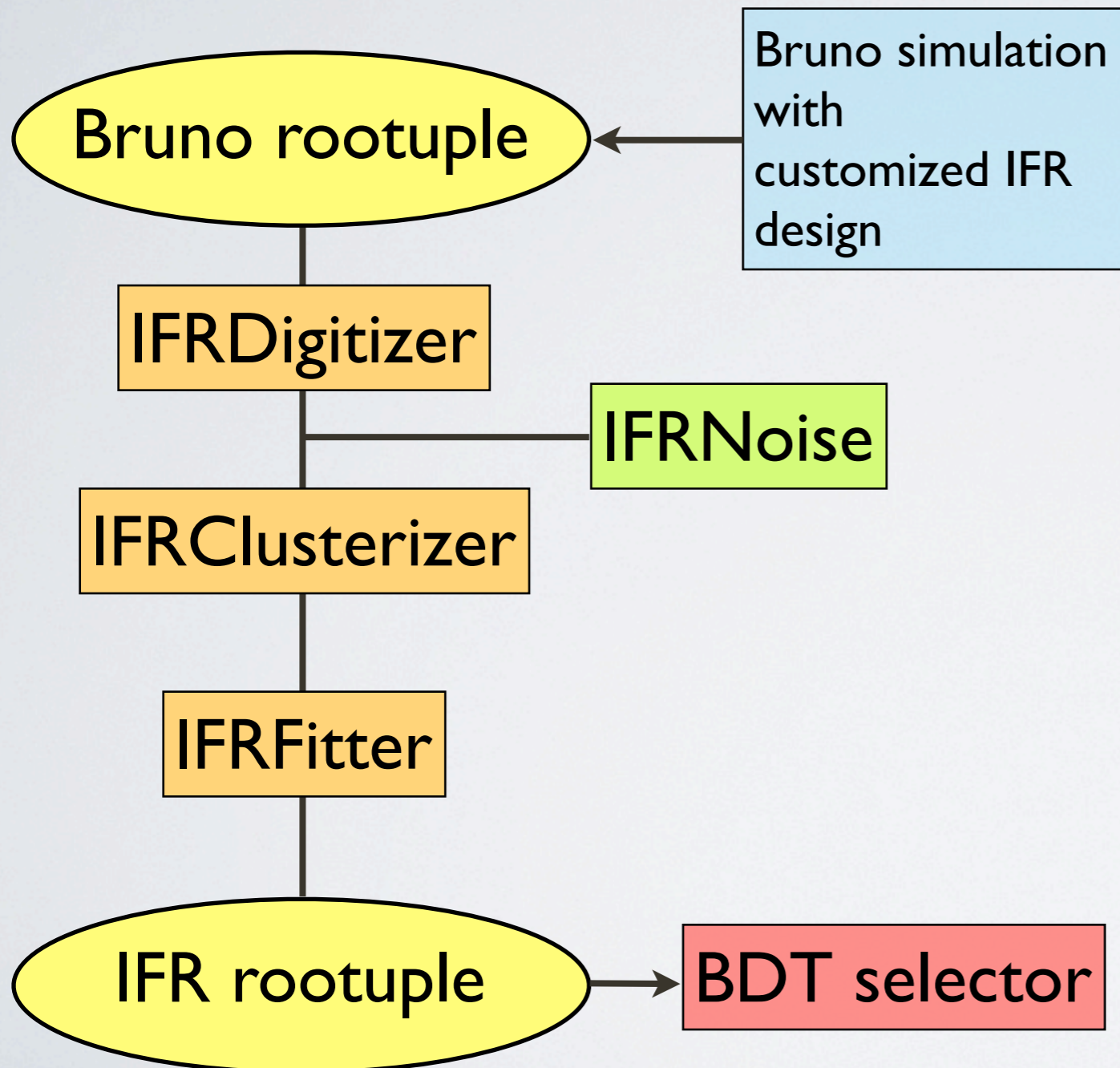
Bruno rootuple

Bruno simulation with customized IFR design

IFRDigitizer

IFRNoise

IFRClusterizer

IFRFitter

IFR rootuple → **BDT selector**

Recent improvements

1. added digitization for Binary Readout
2. fixed some bugs in the endcap clusterization
3. implemented new numbering scheme to account for prototype simulation
4. z resolution change with hit position for Time Readout
5. different bar size for Time and Binary readout
6. efficiency can be set by layer
7. random number management improved
8. swimmer improved
9. code compatible with 8 and 9 layers configurations

still a lot to do!!

Status of prototype software

Our idea is to reuse the software developed for full simulation (IfrRootCode):

- **new digitization**
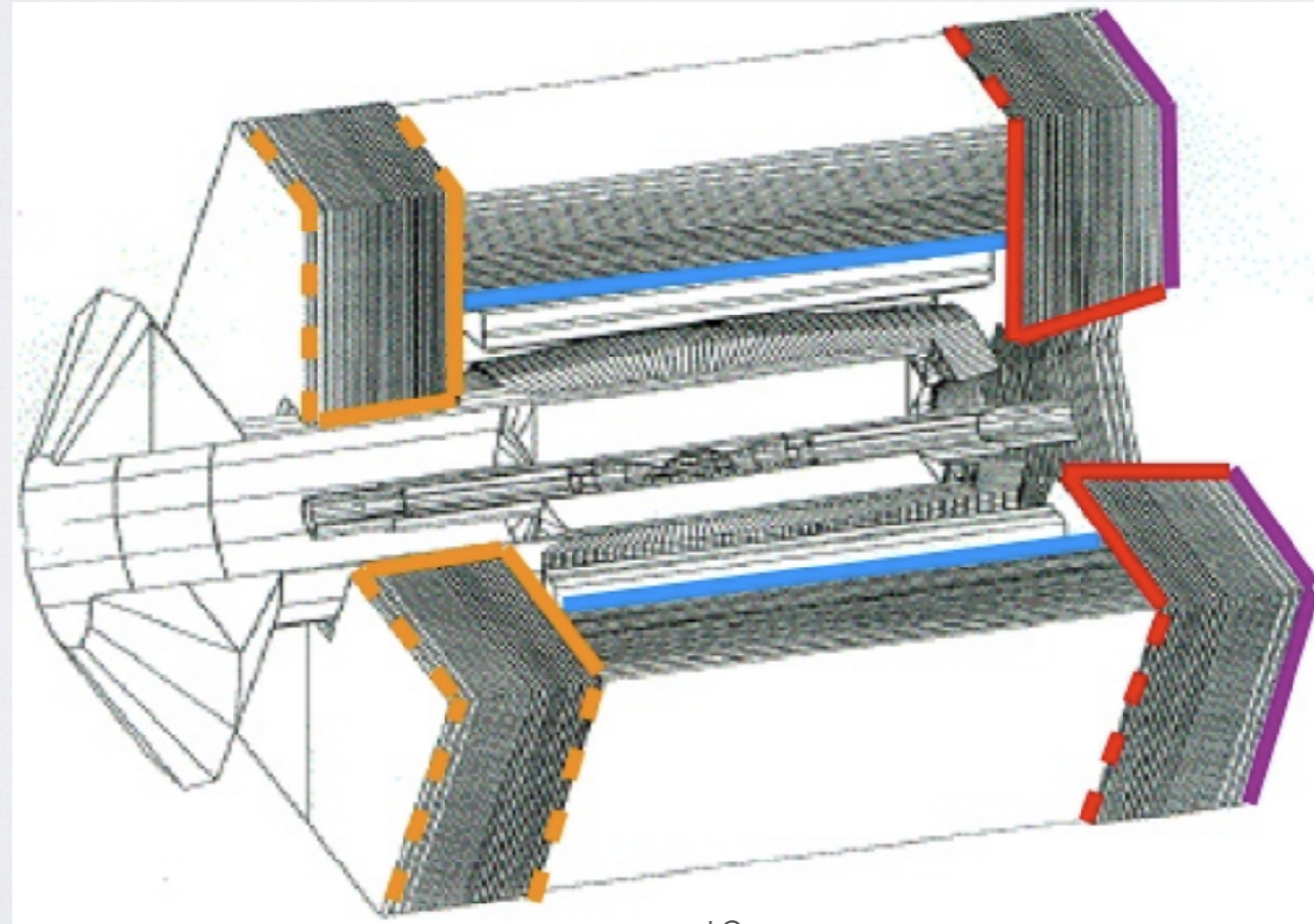- **new clusterization**
- **new tracking**
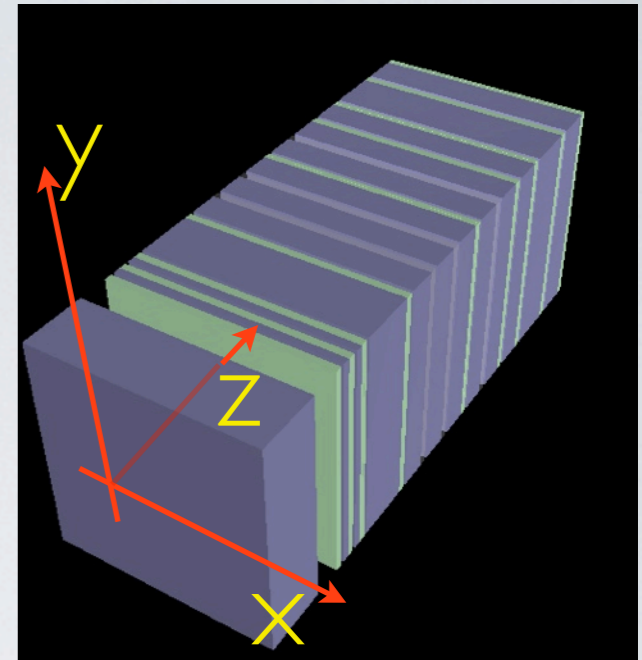
Now some bugs have been fixed in the IfrRootCode and **new tracking is in progess**.

When the tracking will be ok we can start with prototype digitization and clusterization software!

BACKGROUND REMINDER

HOT REGIONS

- FWD endcap inner layers and small radii (it's the hottest region): neutrons, photons, electrons
- Barrel innermost layers: mostly neutrons. This is a crucial region because SiPM should go there.
- BWD endcap inner layers and small radii: BWD endcap outer layers should be shielded by the SOB and additional iron.
- FWD endcap outer layer for the beam halo(final focus simulated up to 3m from IP).

4
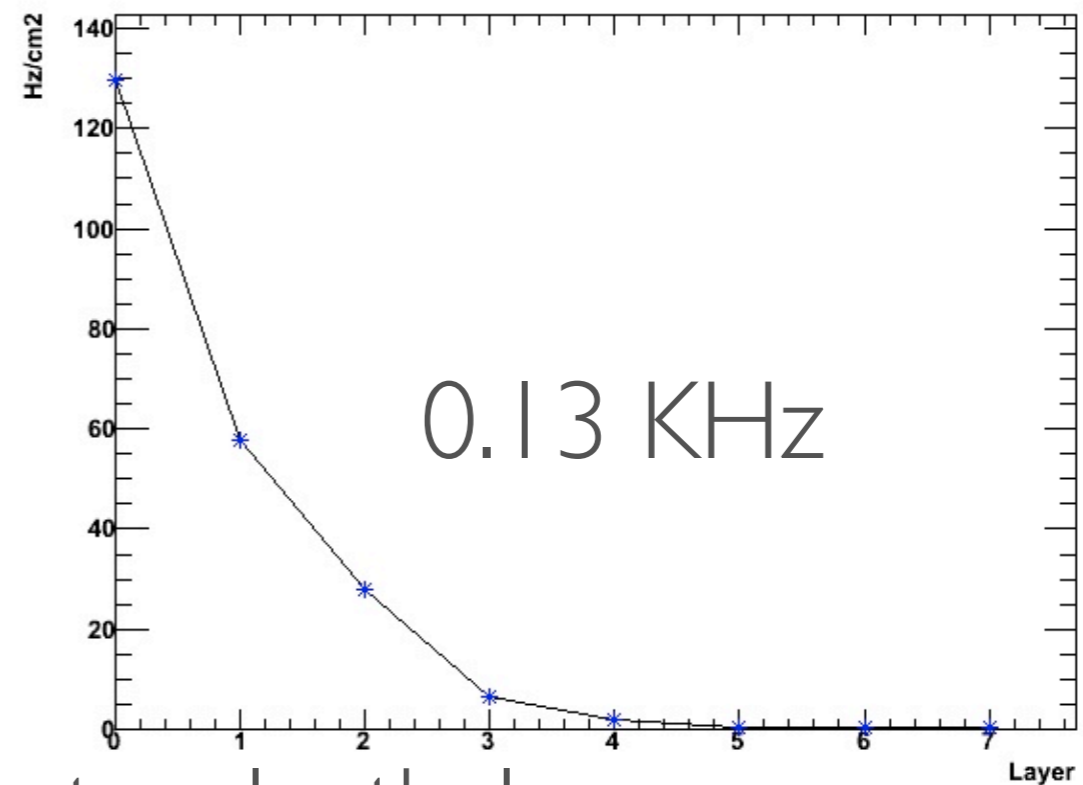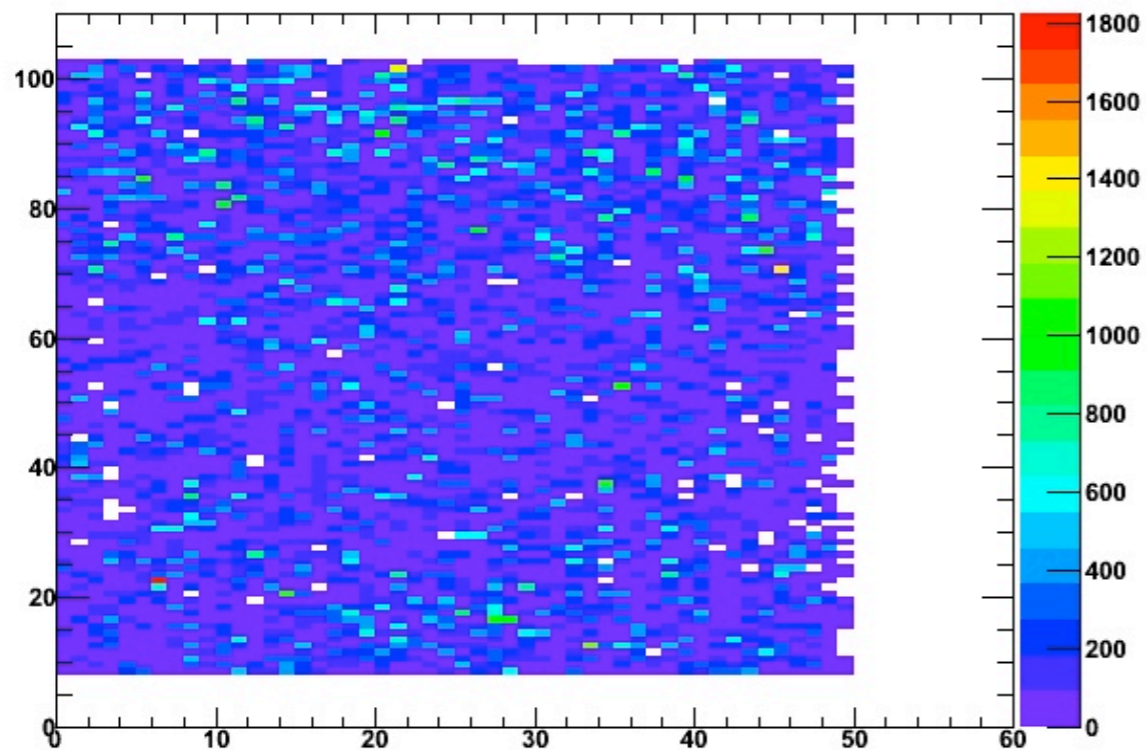
Barrel Layer 0 without polyethylene

0.13 KHz
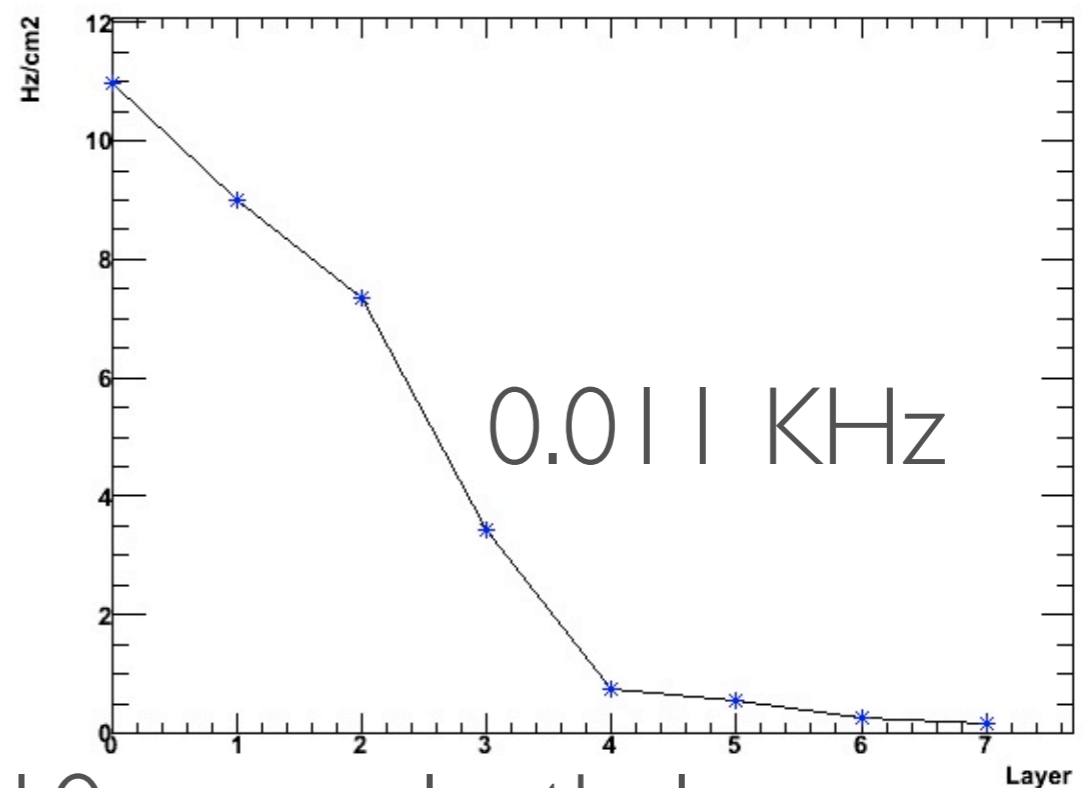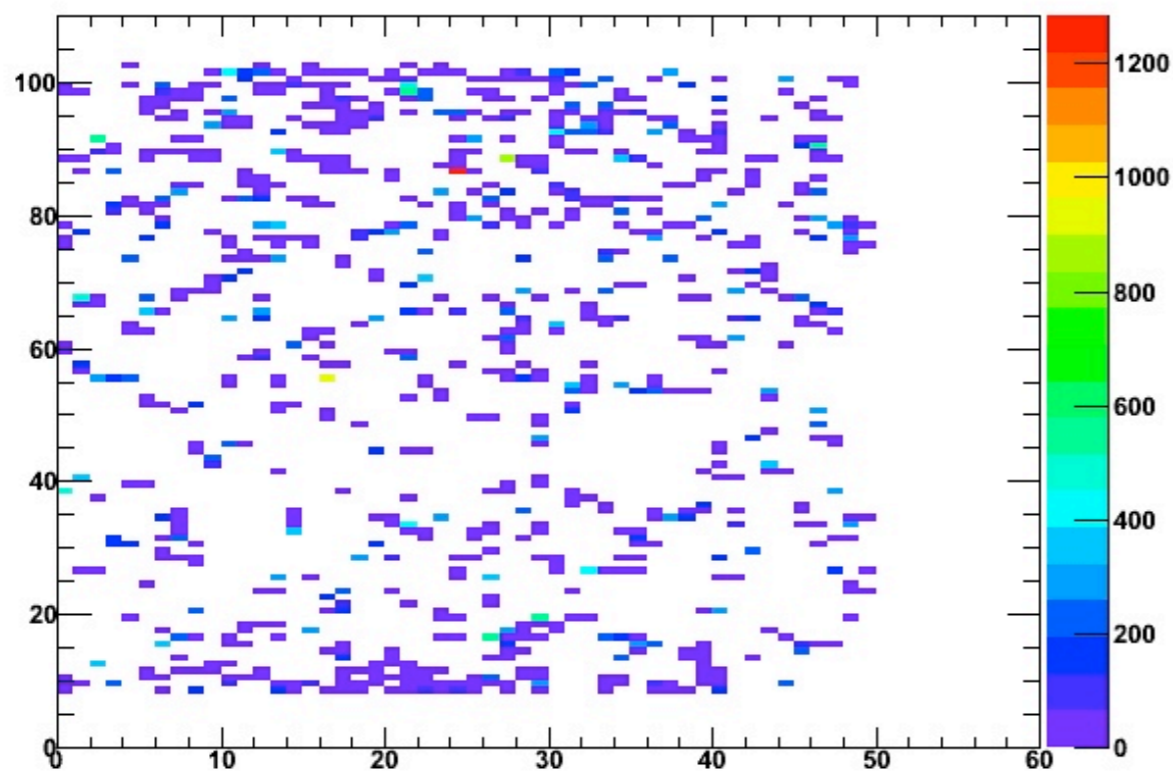
Barrel Layer 0 with 10 cm polyethylene

0.011 KHz

one order of magnitude reduced

Conclusions

- GDML model for prototype done;
- With this model we can test our code using full simulation package;
- Some bugs have been fixed in IfrRootCode and new tracking are going to be tested;
- When the tracking will be tested and will be ok, we can start with prototype digitization and clusterization.
- Concerning to background studies we are expecting the final focus extension above 3m from IP.