Mid-term report

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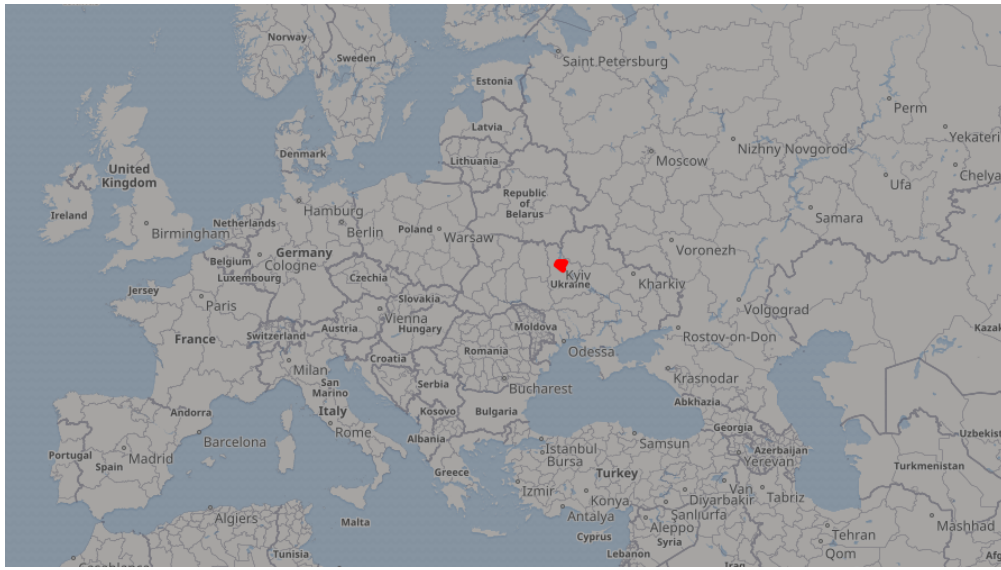
Advisors: prof.Sumisawa, Dr.Liventsev

Introduction

- From Ukraine, Kyiv, Taras Shevchenko National University of Kyiv
- 3 year undergraduate
- prof. Sumisawa - host researcher
- Started work as summer student in Belle 2 experiment EKLM group under supervision of Dr.Liventsev



Overview

- The Belle *II* detector is a general purpose spectrometer designed to study the decay of BB pairs created via e^+e collisions by the SuperKEKB particle accelerator.
- The detector aims at full reconstruction of all particles and provides an acceptance, in the lab frame, of $\theta = 17^\circ$ to 150° in the polar angle and $\varphi = 0^\circ$ to 360° in the azimuth angle.

SuperKEKB

- The SuperKEKB has a circumference of 3km and is located 10m below the ground
- It is an asymmetric e^+ e collider designed to operate at a center of mass energy of $\sqrt{s} = 10.58 GeV$ with the e^+ and e beams operating at 3.5 GeV and 7 GeV respectively.

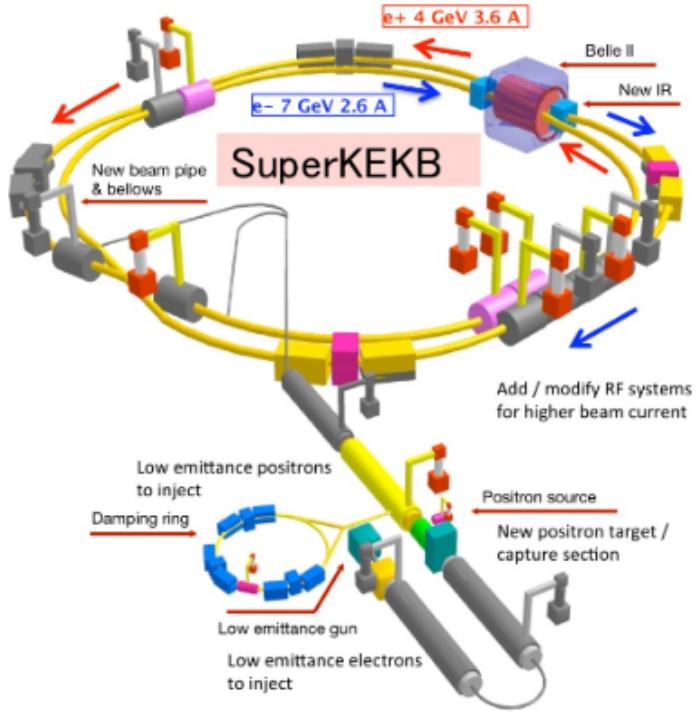
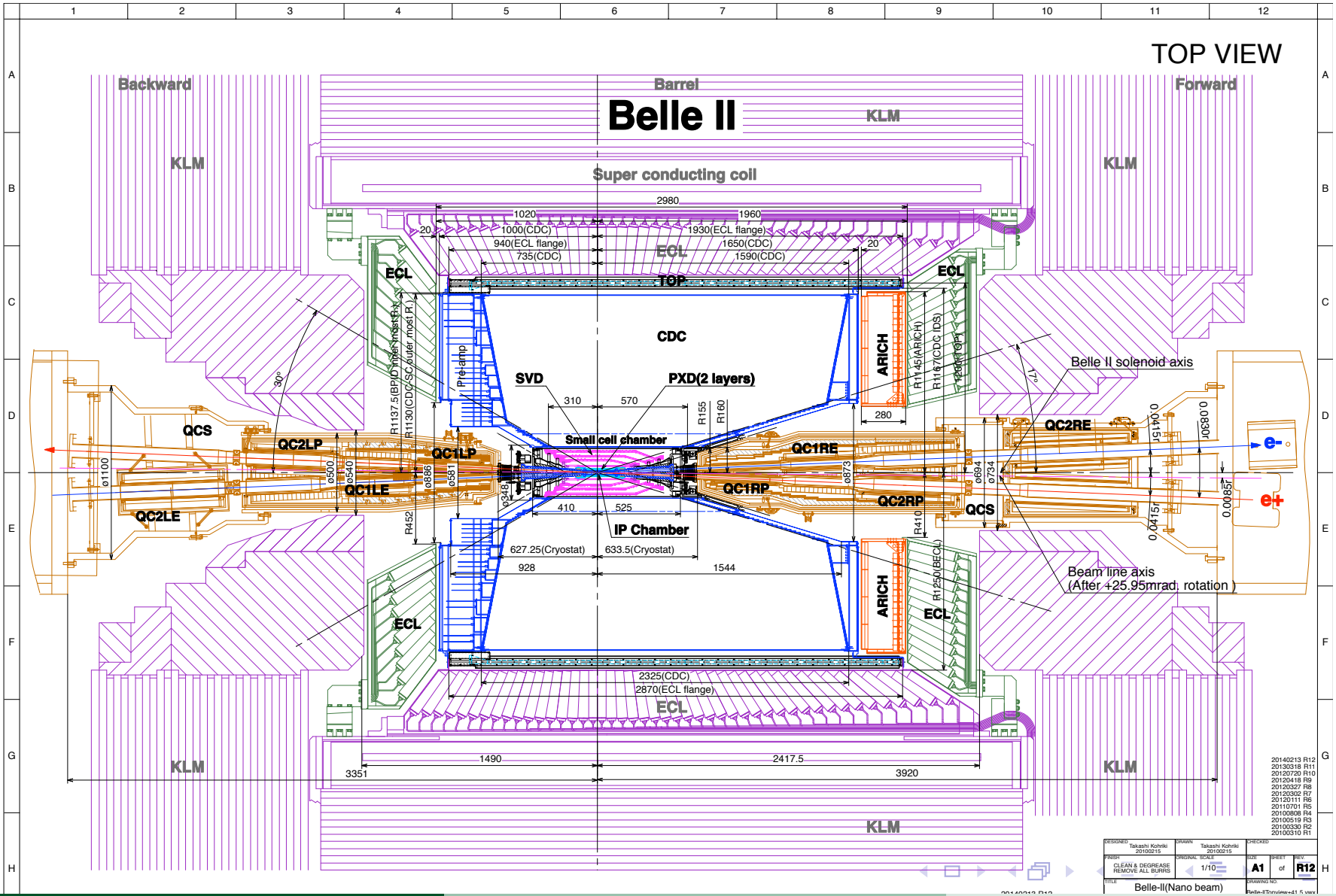


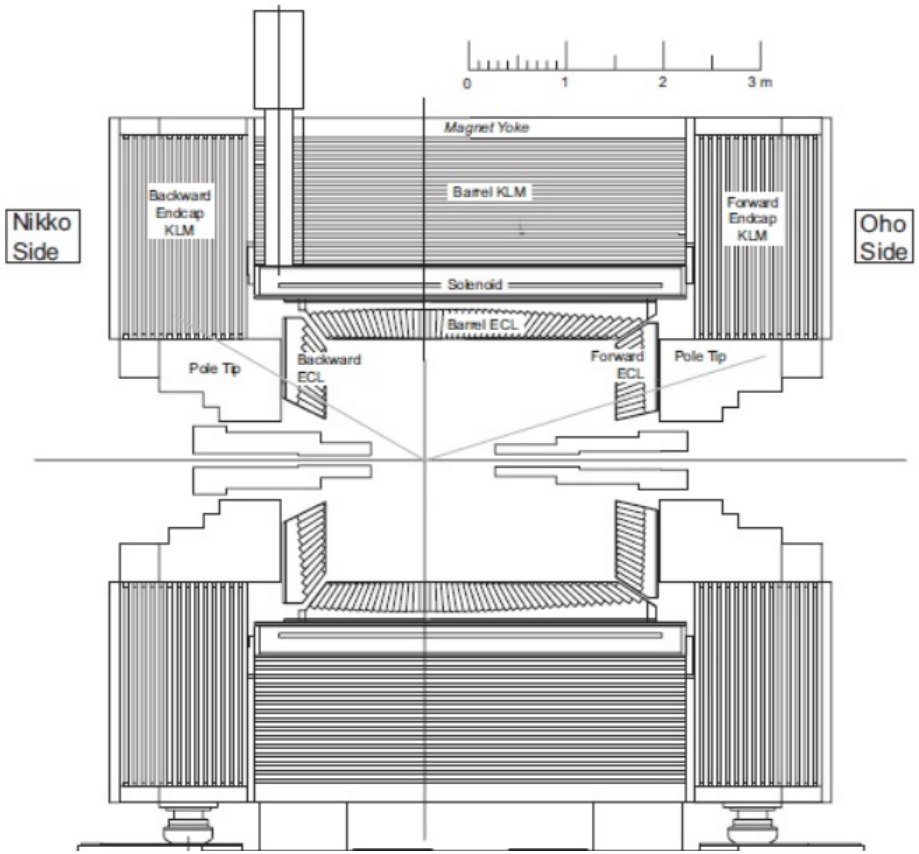
Figure 3.1 – Schematic of the SuperKEKB Accelerator [13].

Belle // detector

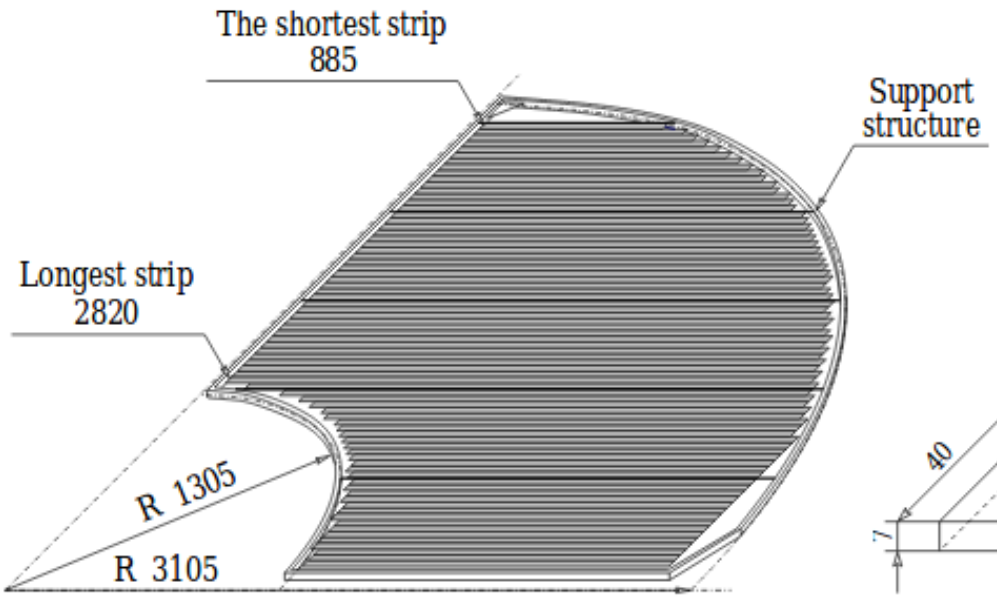


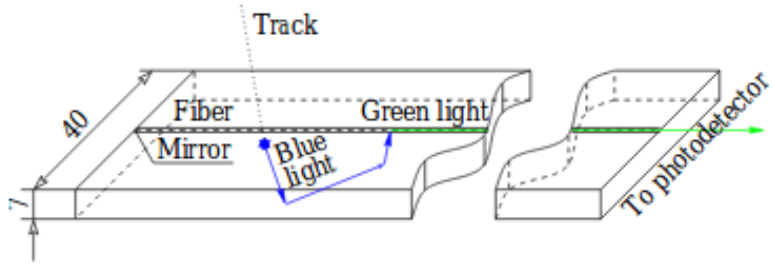
The Belle 2 KLM

- The KLM is designed to detect and distinguish muons from long-lived neutral kaons, K_L^0. It is the last subsystem in the detector, located right after the ECL,and sits outside the 1.5 T magnetic field of the solenoid.
- The detector consists of analternating sandwich of 4.7cm thick iron plates and active detector elements

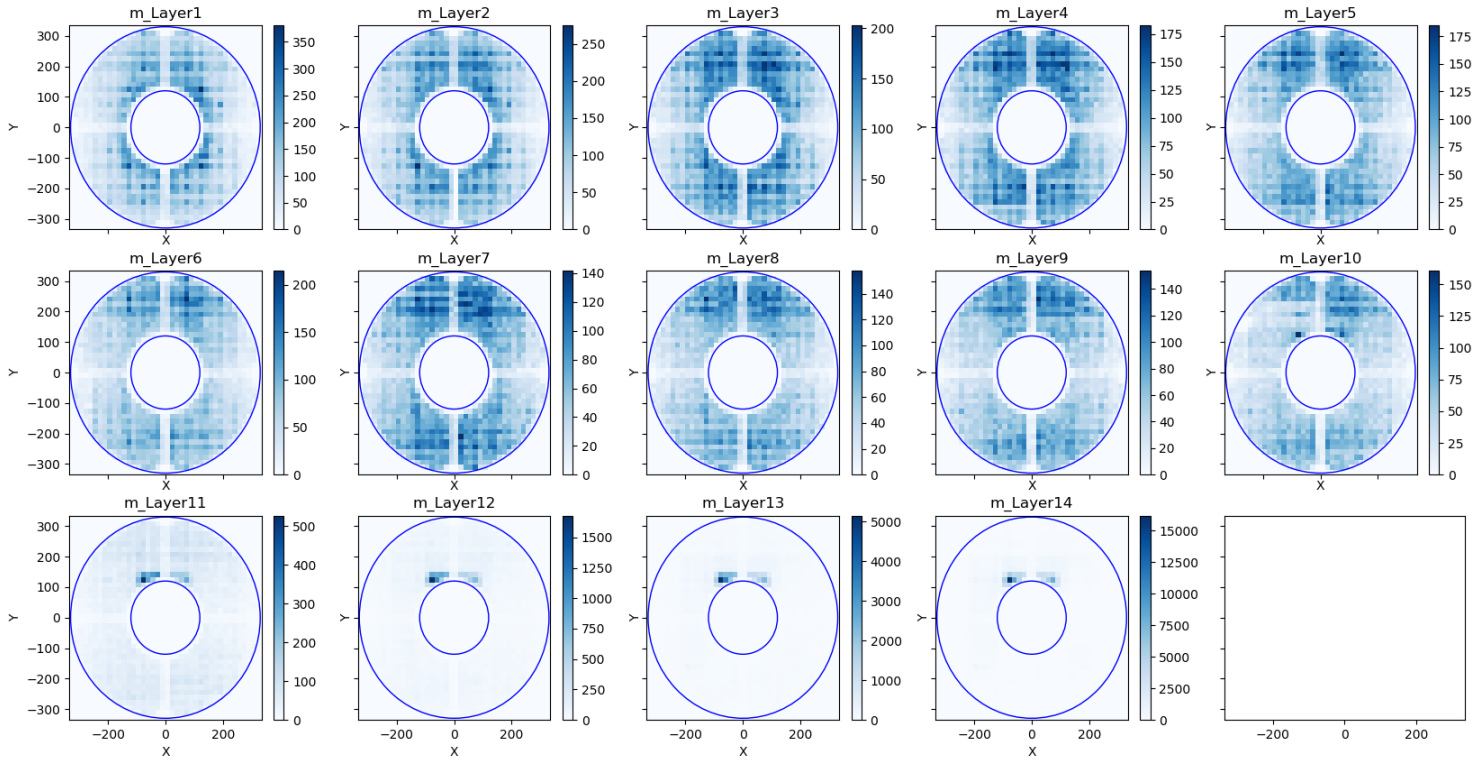


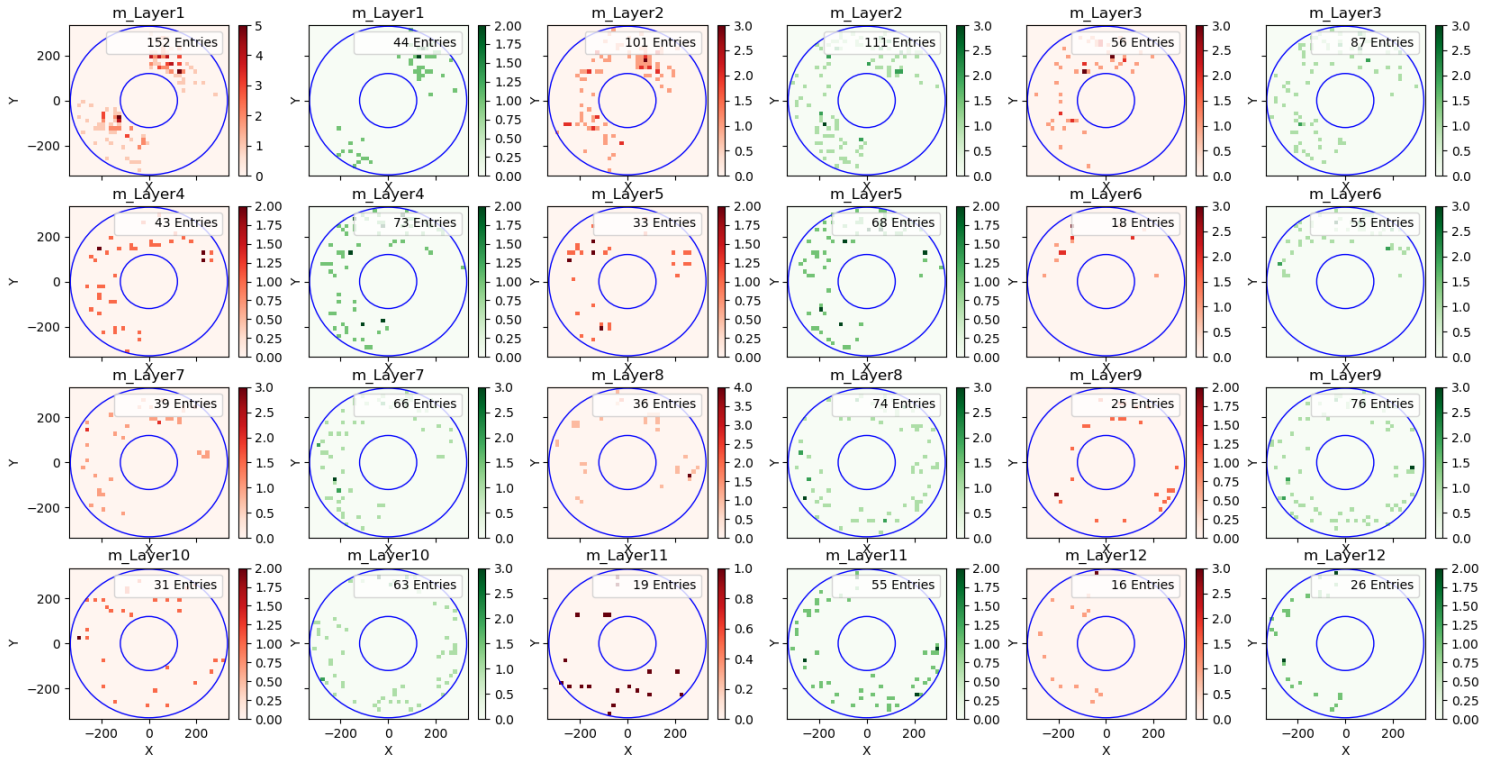
EKLM


The shortest strip
885
Support
structure
Longest strip
2820
R 1305
R 3105


Track
40
Fiber
Green light
Mirror
Blue
light
To photodetector

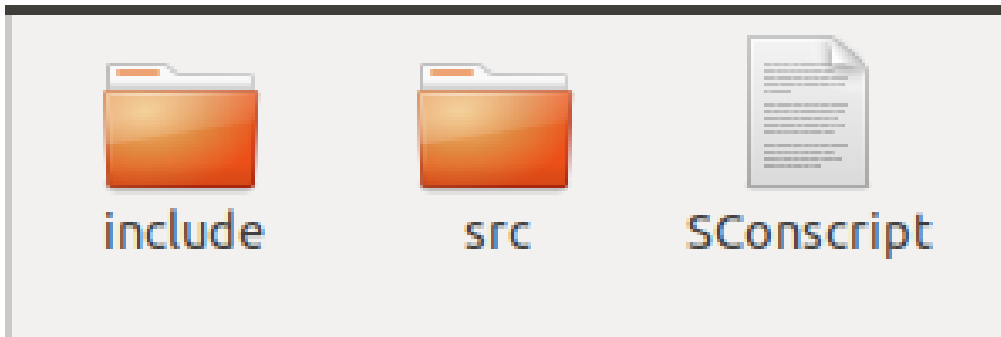
Before B2GM


m_Layer1
m_Layer2
m_Layer3
m_Layer4
m_Layer5
m_Layer6
m_Layer7
m_Layer8
m_Layer9
m_Layer10
m_Layer11
m_Layer12
m_Layer13
m_Layer14
X
Y


m_Layer1
152 Entries
m_Layer1
44 Entries
m_Layer2
101 Entries
m_Layer2
111 Entries
m_Layer3
56 Entries
m_Layer3
87 Entries
m_Layer4
43 Entries
m_Layer4
73 Entries
m_Layer5
33 Entries
m_Layer5
68 Entries
m_Layer6
18 Entries
m_Layer6
55 Entries
m_Layer7
39 Entries
m_Layer7
66 Entries
m_Layer8
36 Entries
m_Layer8
74 Entries
m_Layer9
25 Entries
m_Layer9
76 Entries
m_Layer10
31 Entries
m_Layer10
63 Entries
m_Layer11
19 Entries
m_Layer11
55 Entries
m_Layer12
16 Entries
m_Layer12
26 Entries
X
Y

Write BASF2 module

- Module should estimates each EKLM layer CDC matching efficiency
- Module consists of source and include directories
- Should be implemented in C++

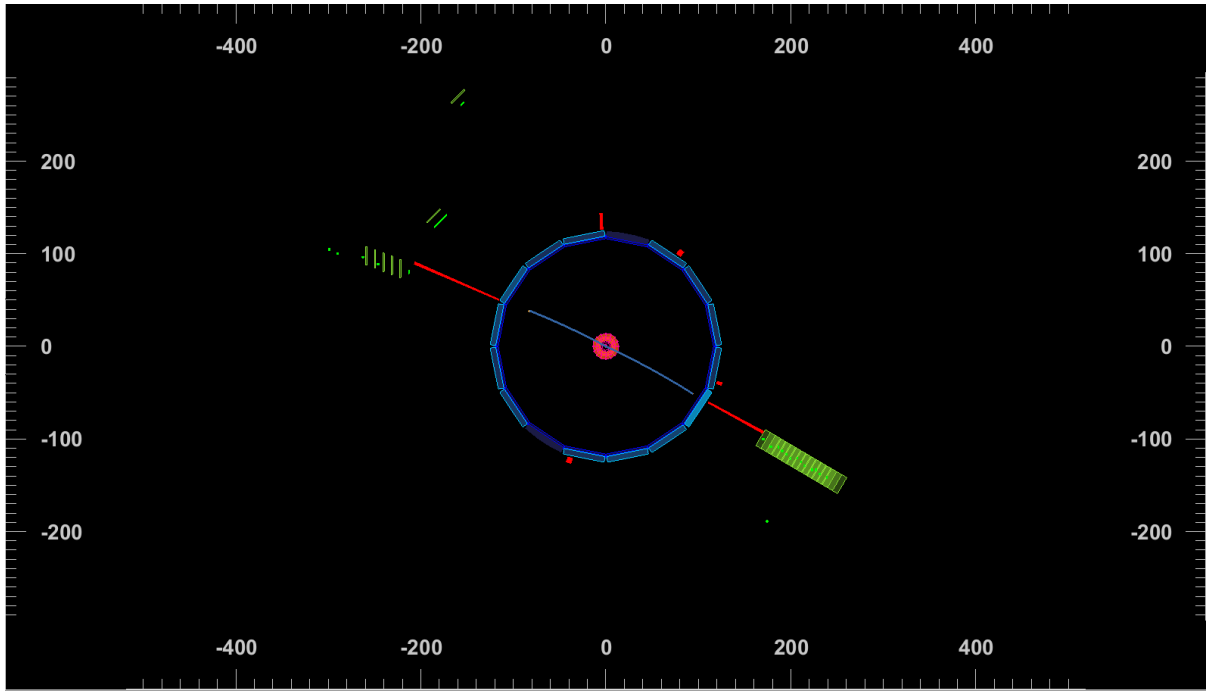


CDC matching efficiency of EKLM

- Extrapolate CDC tracks into the EKLM volume
- Determine position of extHit in each layer
- Match EKLM hit with track hit if $distance < d_{max}$ in same layer and same endcap
- Efficiency defined as $\varepsilon = N_{matched}/N_{extrapolated}$

Hits

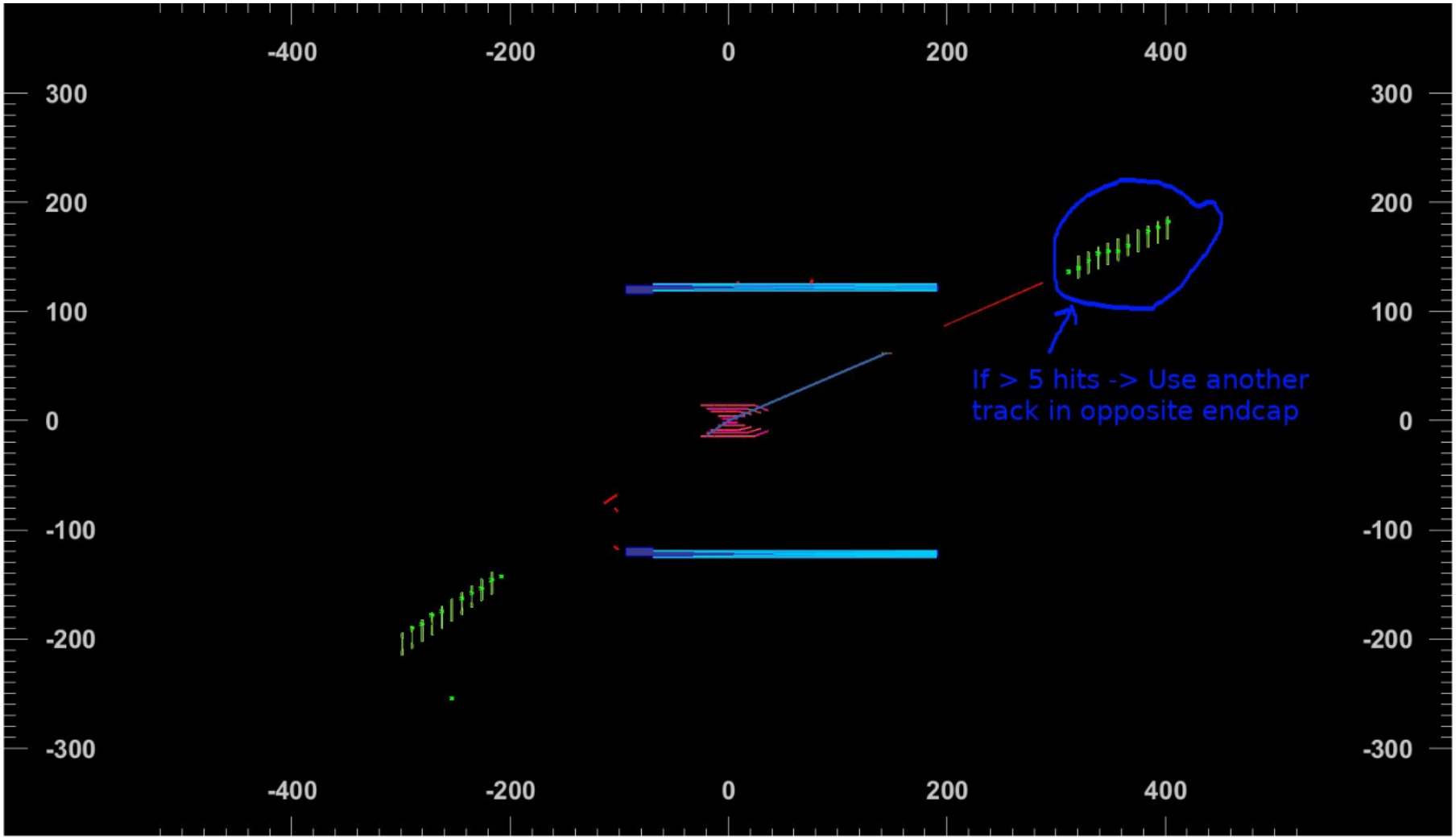
- Digits (1dhits)
- Hit2d
- ExtHit



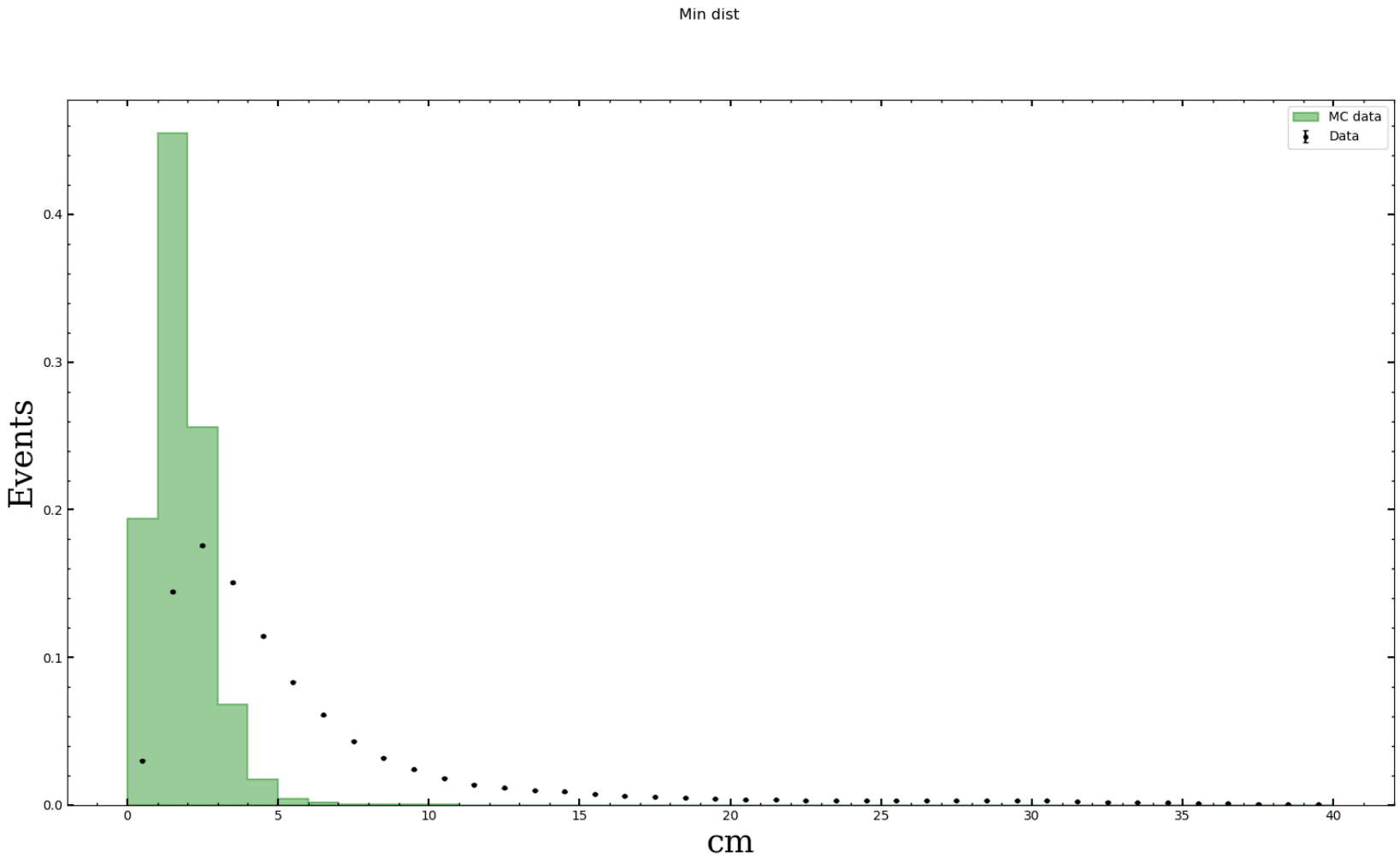
Selection variables

Variable	Cut	Comment
nTracks	2	Only 2 tracks required
maxAngleTTLE	< 0.785	HLTmumu2trk cut
nCDCHits	nCDCHits > 4	CDC hits
dz	abs(dz) < 5cm	particle came from IP
dr	abs(dr) < 1cm	particle came from IP
clusterE	clusterE > 0	lost energy in ECL
clusterEoP	clusterEoP < 0.8	$\frac{clusterE}{p}$
My own MuID	5 hits	To find muons events

My 'MuID'


-400
-200
0
200
400
300
200
100
0
-100
-200
-300
If > 5 hits -> Use another
track in opposite endcap

Trying to find optimal d_{max}

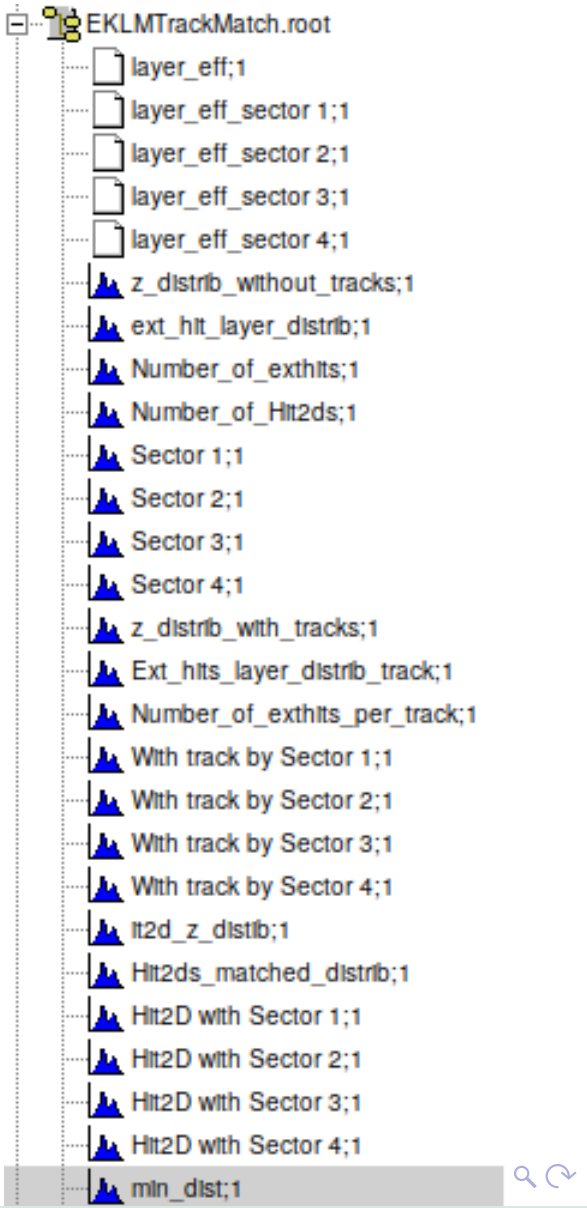


I used:

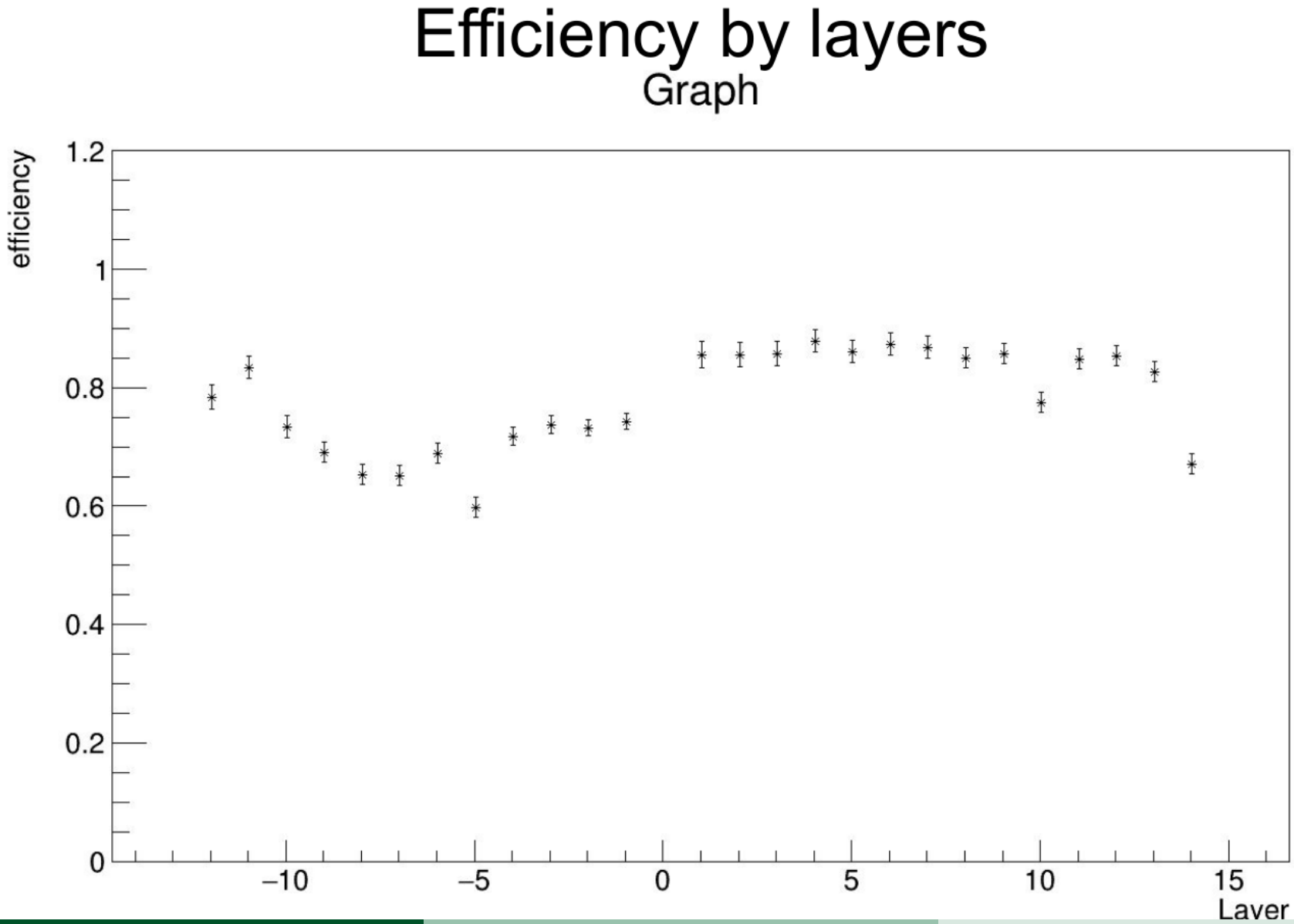
- bucket6 10 runs HLTmumu2trk skims
- $ee- > \mu\mu\gamma$ MC sample genereted by Giuseppe Finocchiaro for BKLM study

Module output

- Module make such root file with some characteristics



Efficiency by layers



Status

- Was implemented
  - Main part of module was written
  - Found and added MC data
  - Compare parameters with MC
- In progress
  - Need to solve some technical problems (mismatch of 2d hits for example)
  - Need to commit module in some of basf2 brunches?
  - Next step use 1D hits

Hit2ds mismatch