

8th Belle II VXD Workshop



SynRad Background simulation

Yuri Soloviev

DESY

Phase3/2 - Summary

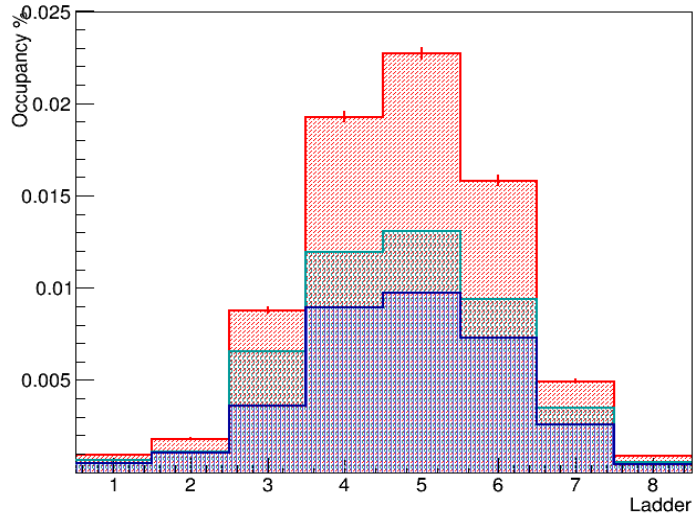
Phase1 - Status

Phase2/3 Summary

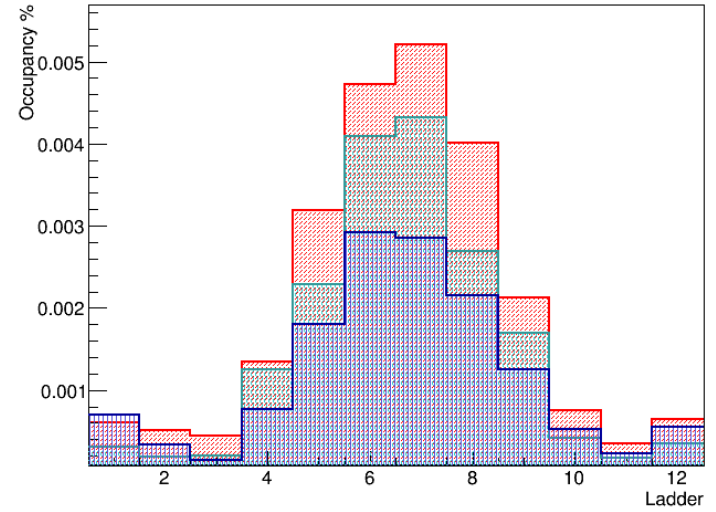
Color Code:

Phase3,gold 10 μm ; Phase2,gold 6.6 μm ; Phase3,gold 5 μm ;

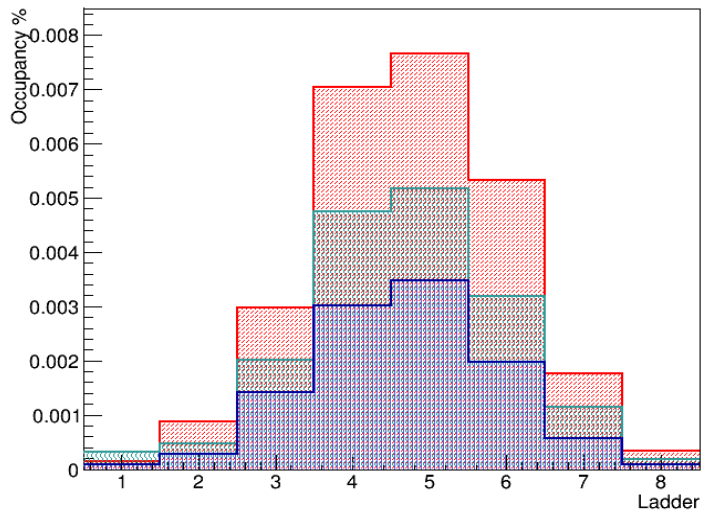
Layer 1, Sensor 1



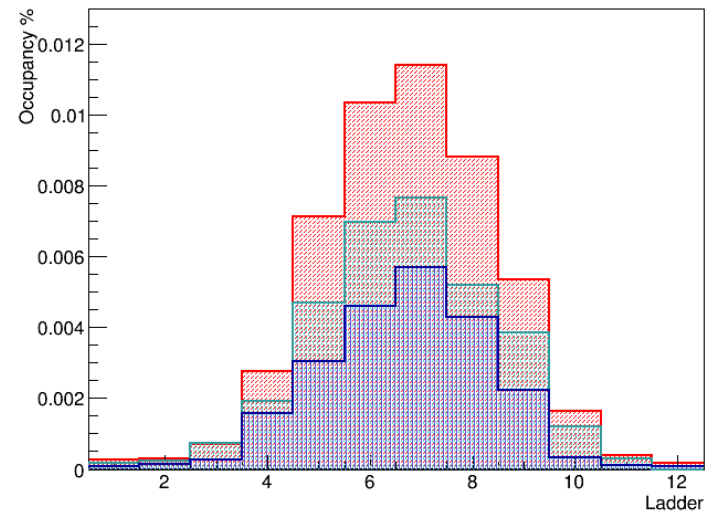
Layer 2 Sensor 1



Layer 1 Sensor 2



Layer 2 Sensor 2



Phase2/3 Summary

10 μ m	6.6 μ m	5 μ m
(0.01 — 0.05)%	(0.015 — 0.1)%	(0.025 — 0.15)%

All values are for the ladder 5 sensor 1 which is expected to be most loaded.

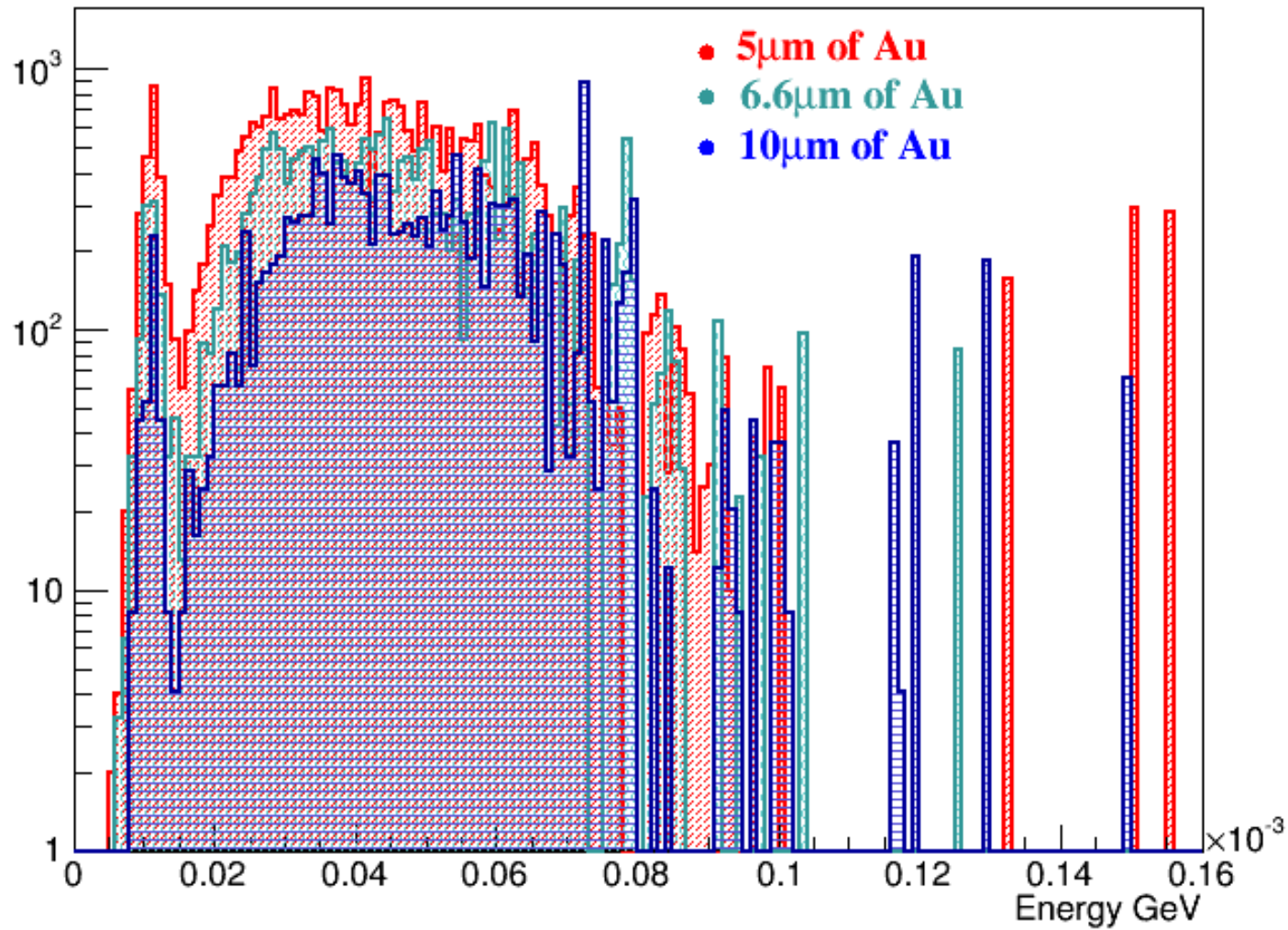
Minimal value \rightarrow Ideal alignment and tail's fraction of $5e-7$ beyond $10\sigma_x$ and $30\sigma_y$.

Maximal value \rightarrow Maximal misalignment and halo with tail's fraction of $1e-5$ beyond $10\sigma_x$ and $30\sigma_y$.

Phase2/3 Summary

Energy Spectrum

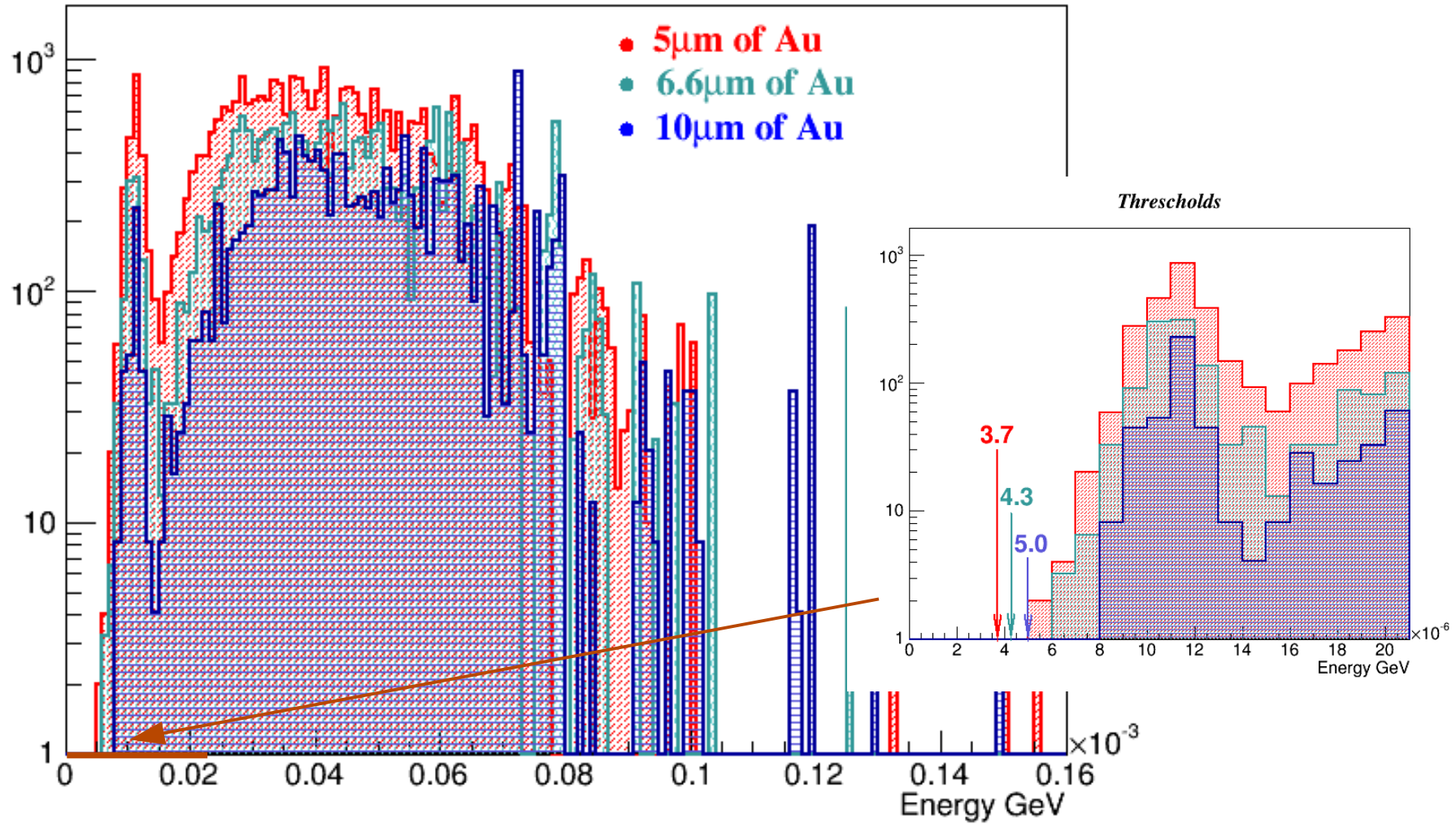
Energy of SR photons in PXD



Phase2/3 Summary

Energy Spectrum

Energy of SR photons in PXD



Status of Phase1

- Magnets around IP in Phase1:

HER:

$$\text{ZHQLC2LE(BEND)} \quad dS = (5.24827 - 5.59267)\text{m}$$

$$\text{QLC2LE(QUAD)} \quad dS = (5.839 - 6.398)\text{m}$$

$$\text{BLC1LE(BEND)} \quad dS = (7.50549 - 11.105490)\text{m}$$

LER:

$$\text{BLCWRP(BEND)} \quad dS = (5.538129 - 7.768419)\text{m}$$

$$\text{BLC1RP(BEND)} \quad dS = (8.268419 - 10.498709)\text{m}$$

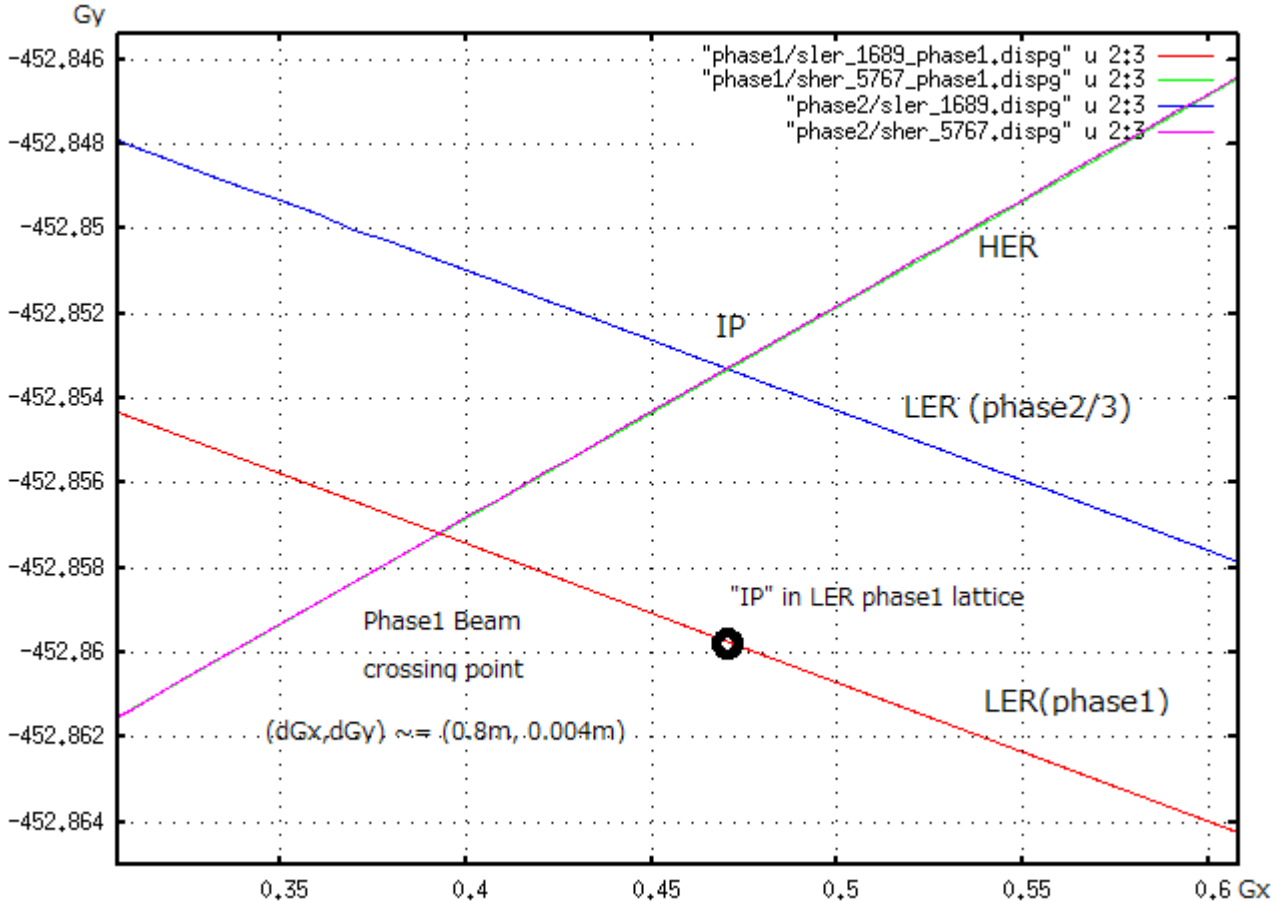
Correction magnets are not taken into account.

- Effective length of the magnet = magnet length $\pm 1/2$ length of the slope of the field at each edge.

For the bend magnets constant field inside effective length, for the quad magnet field = field gradient * deviation from the central orbit inside effective length.

Status of Phase1

- IP position in Phase1 (Nakayama-san) : $\sim +7.75\text{cm}$ along Z and $\sim +0.4\text{cm}$ along X.



Status of Phase1

- ParticleGun parameters:

$$\epsilon_{\text{HER}x} = 4.45\text{nm} \quad \epsilon_{\text{LER}x} = 1.95\text{nm} \quad \epsilon_y/\epsilon_x = 10\%$$

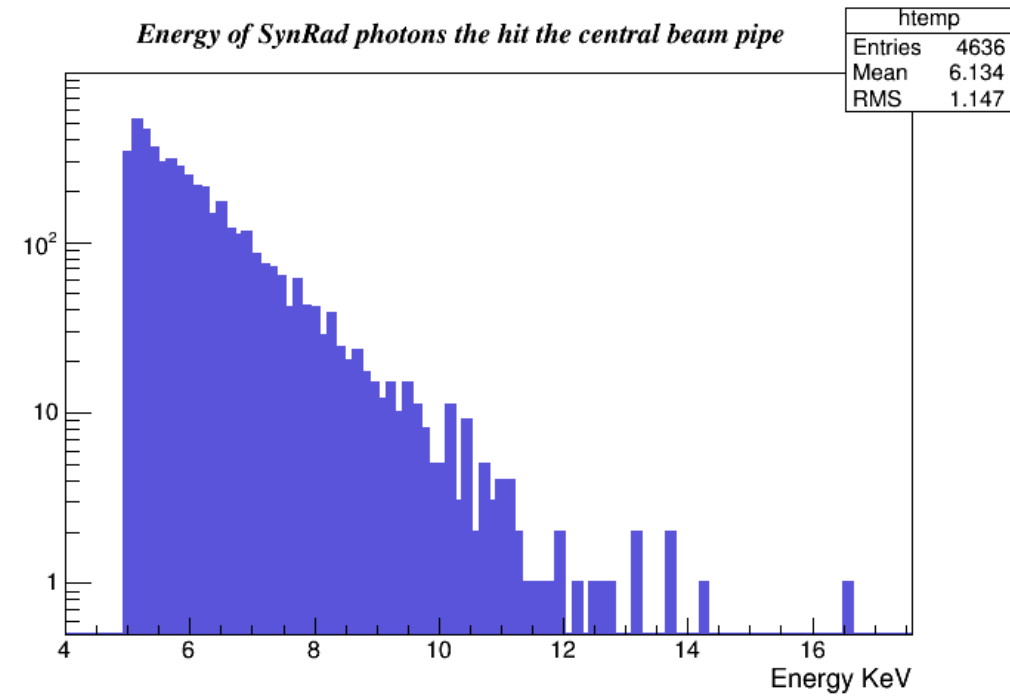
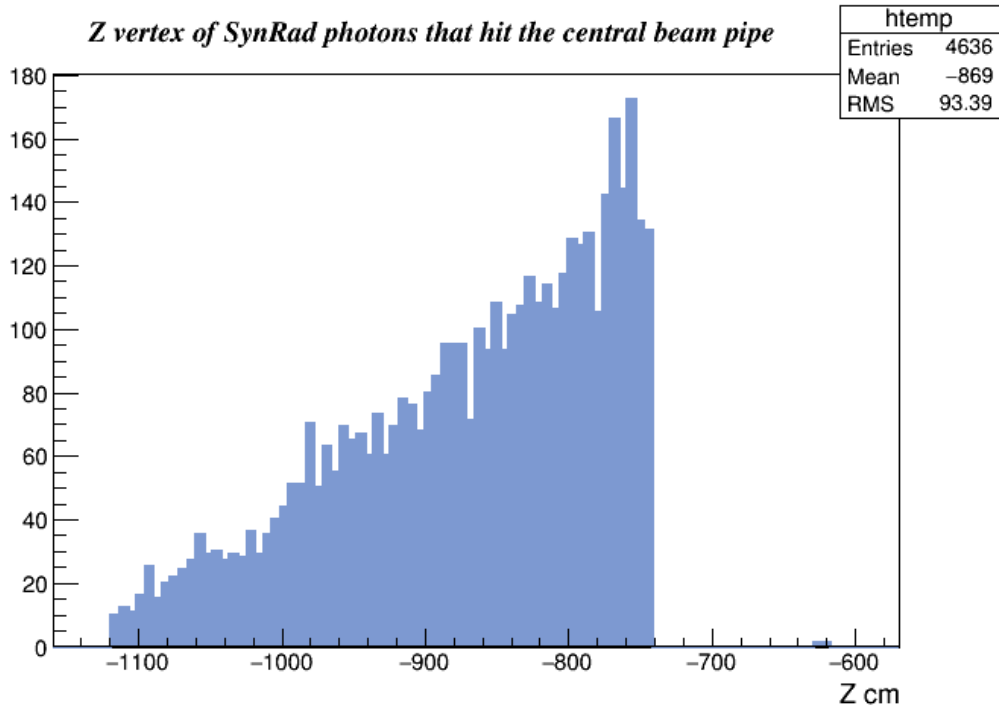
(Y.Ohnishi “Commissioning tools and optics”, March 13, 2015, Super KEKB.)

α and β from sher_5767_phase1.disp file for S = 11.61m
(generation point for HER).

- The thickness of the Al beam pipe wall – 4mm → $E_{\text{thr}} = 14\text{KeV}$.
The value of 5KeV (10 μm of Au) kept in simulation.
- Developing beam pipe geometry code for Phase1.
- Primary simulation for HER is done.
2.5e+10 events → 1a of HER current.

Status of Phase1

Some results of primary simulation:



All SR photons hits (with energy $> 5\text{KeV}$) in the central beam pipe are originated from the BLC1LE magnet.

According to energy spectrum of SR photons in central beam pipe it is very unlikely that there will be significant contribution of SR background in phase1.
($E_{thr} = 14\text{KeV}$ for 4mm Al, for normal incidence).

Conclusions and plans

- Phase3 : As expected from simulation the occupancy in PXD is still below the limit even with gold plate thickness of $5\mu\text{m}$.
- Phase2: The maximal occupancy ($6.6\mu\text{m}$ of gold) is expected to be 0.04% for the tail's fraction $1\text{e-}5$ beyond $10\sigma_x$ and $30\sigma_y$ and 0.006% for tail's fraction $5\text{e-}7$.
The hit rates for Phase2 (SynRad):

position of ladder5 and sensor1:

~400kHz - ideal alignment only and tails fraction $5\text{e-}7$.

~2.5MHz - misalignment 0.5mm and tails fraction $1\text{e-}5$.

position of ladder1 which will be installed in Phase2:

	Sensor 1	Sensor 2
Layer 1	(20 — 120) KHz	(10 — 60) KHz
Layer 2	(10 — 60) KHz	(5 — 30)KHz

The minimal value correspond to ideal alignment and fraction of tails $5\text{e-}7$.
The maximal value correspond to misalignment 0.5mm and fraction of tails $1\text{e-}5$.

Conclusions and plans

- Phase1: Primary simulation shows that SynRad background is coming mainly from BLC1LE magnet. Its unlikely that there will be significant contribution of SynRad background in phase1 due to the thickness of Al beam pipe walls.

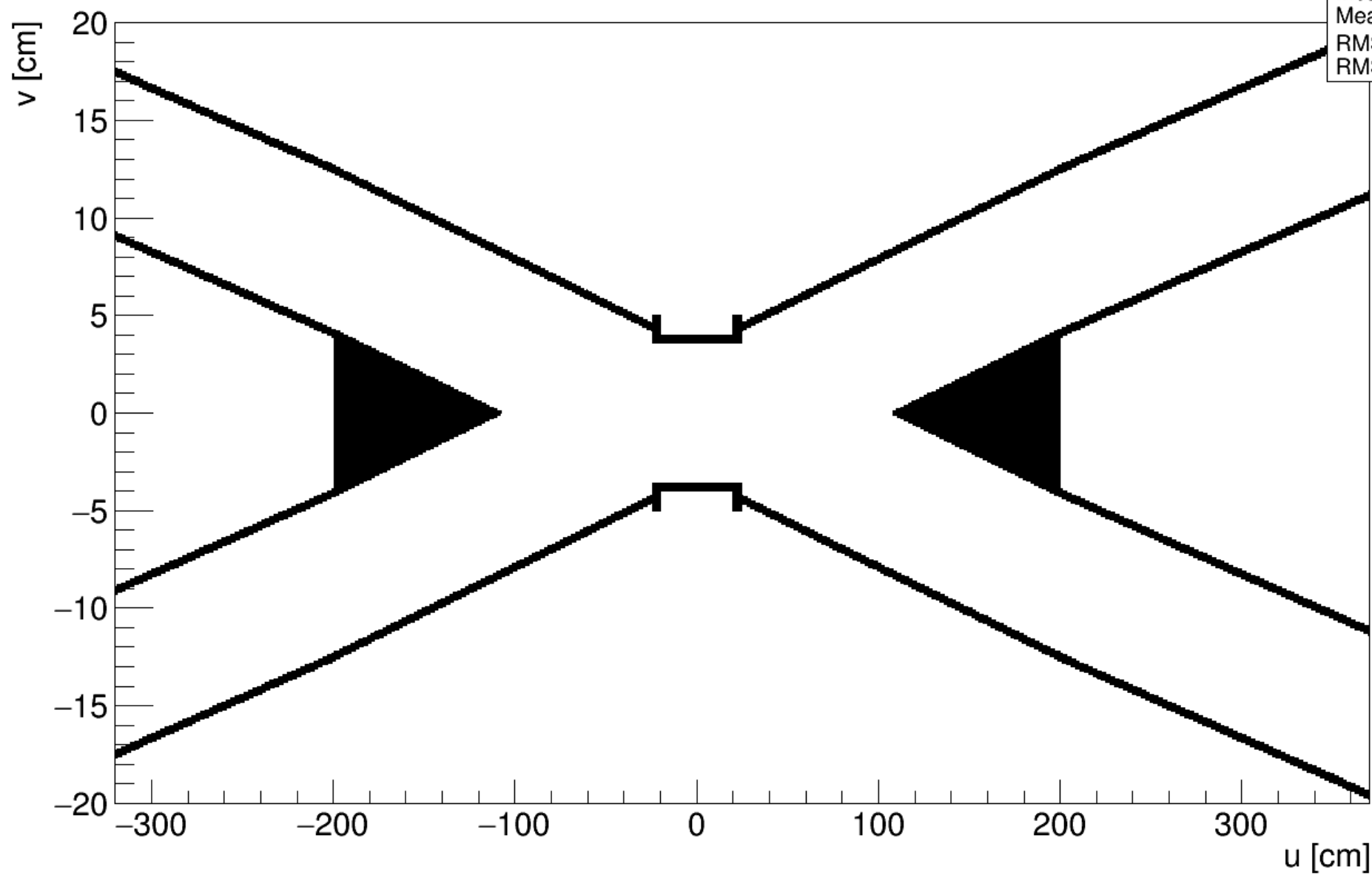
Plans: Perform primary simulation for LER.

Do final simulation including phase1 subdetectors for HER and LER, using HEPEvt data file obtained from primaty simulations.

Thank you for your attention

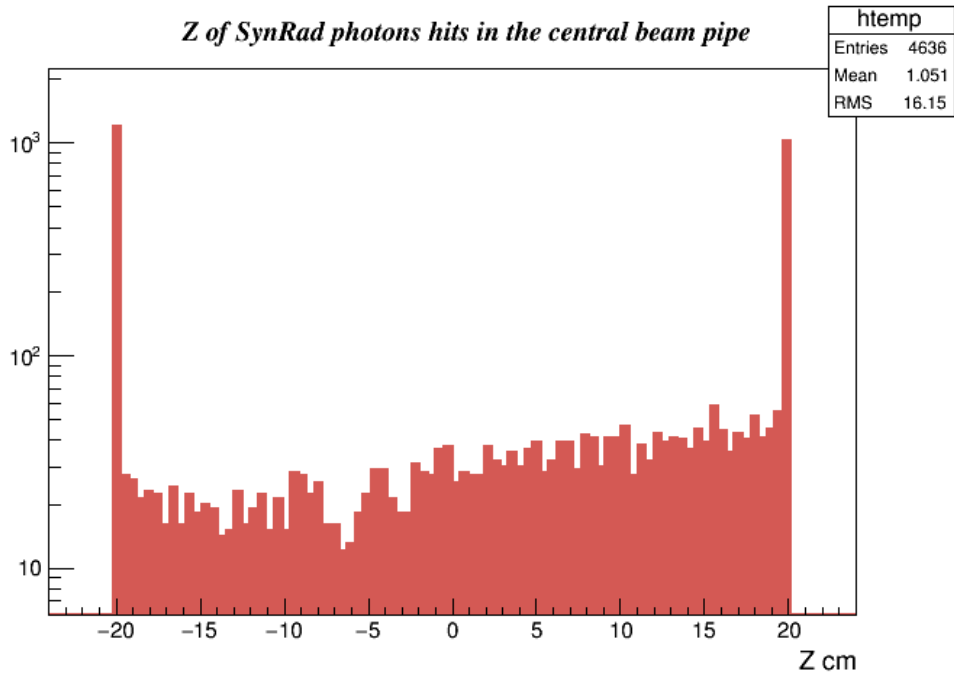
Additional materials

All_Materials_x0

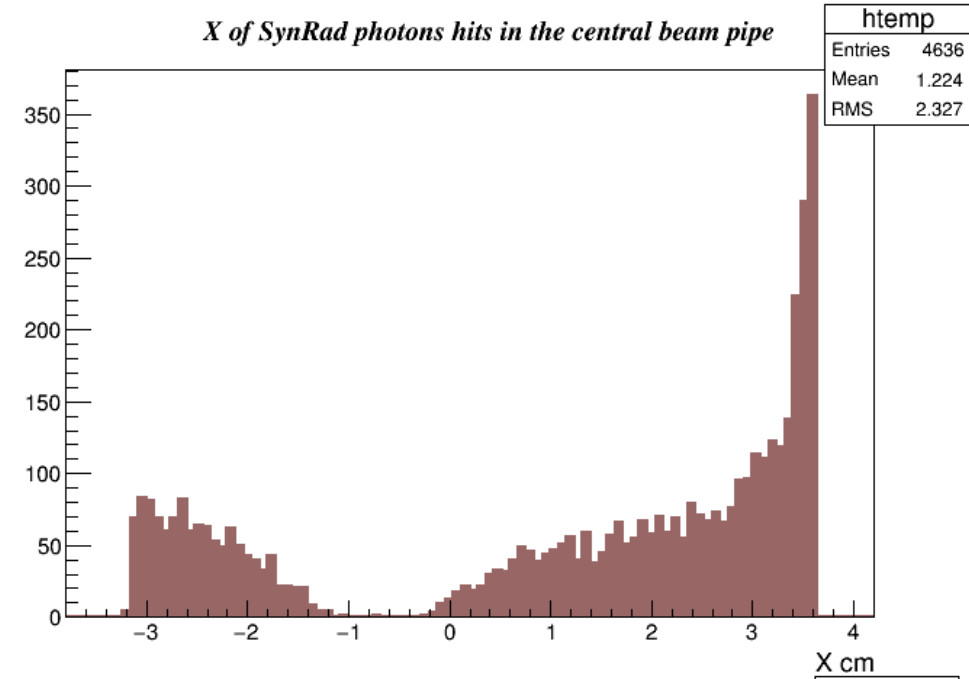


All_Materials_x0	
Entries	79892
Mean x	17.19
Mean y	-0.01572
RMS x	198.2
RMS y	7.699

Z of SynRad photons hits in the central beam pipe



X of SynRad photons hits in the central beam pipe



Y of SynRad photons hits in the central beam pipe

