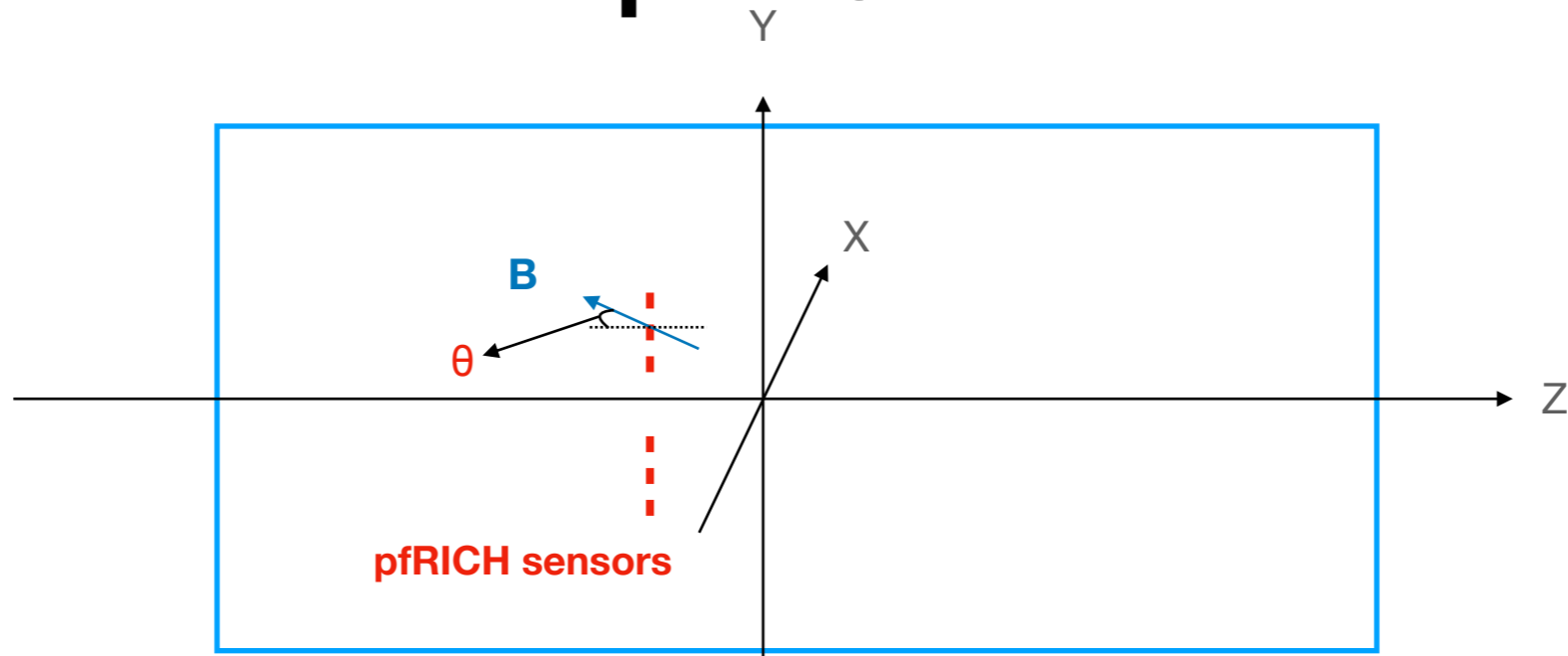


Magnetic field at ePIC

Zhengqiao Zhang

- The performance of HRPPDs or LAPPDs in a high magnetic field oriented at none-zero angles to the detector plane needs to be studied;
- The first step is to check the magnetic field in the position of HRPPDs in the EPIC solenoid;

pfRICH

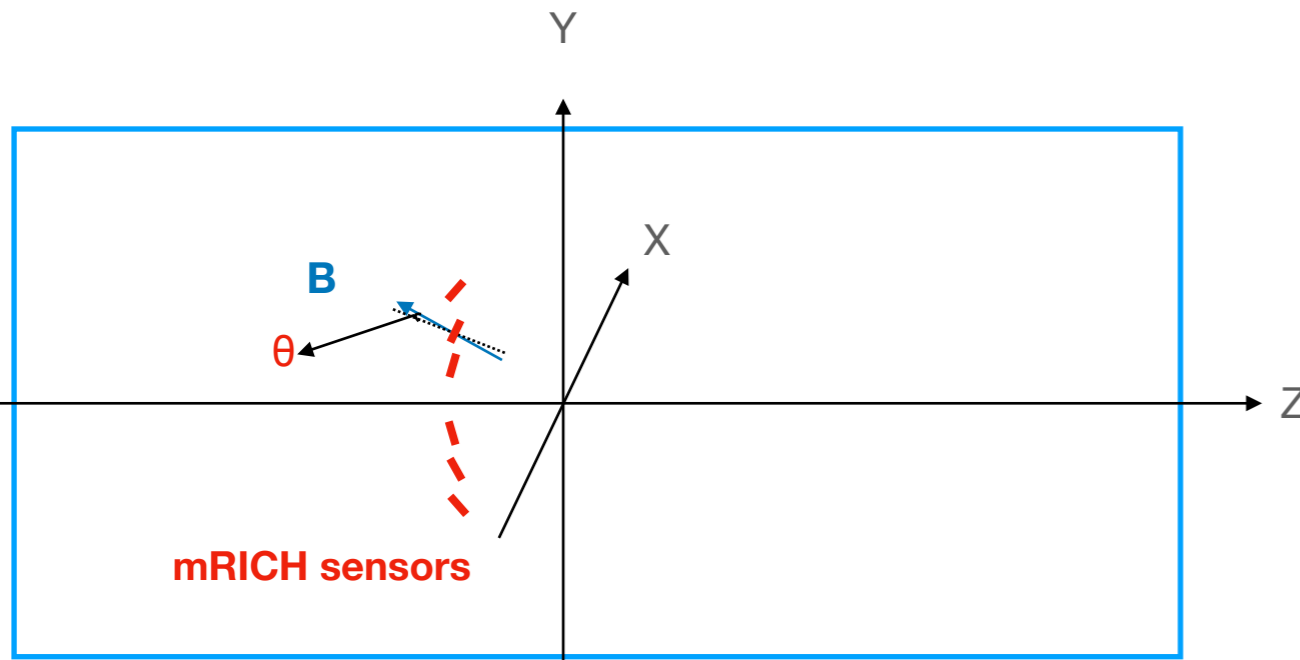


- Inner radius of pfRICH ~5.9cm;
- Outer radius of pfRICH ~65cm;
- The LAPPDs sit ~160 cm from the IP;
- To estimate the variation, I assume the sensor size 12cmX12cm and calculate the magnetic field at the four corners;

```
# HRPPD NO. is the number of the sensor
# X, Y, Z is the position of the sensor
# B is the magnetic field in the sensor
# theta is the angle between B and the sensor
# Minimum_theta and Maximum_theta is the minium and maximum angle between B and the sensor (assume sensor size is 12cmX12cm)
```

HRPPD NO.	X(mm)	Y(mm)	Z(mm)	B(T)	theta(degree)	Minimum_theta(degree)	Maximum_theta(degree)
1	-581.7	0	-1609.4	1.375	10.898	9.833	12.162
2	-465.3	0	-1609.4	1.358	8.619	7.554	9.850
3	-349	0	-1609.4	1.345	6.406	5.400	7.623
4	-232.7	0	-1609.4	1.336	4.244	3.327	5.467
5	-116.3	0	-1609.4	1.331	2.115	1.495	3.390
					.		
					.		
					.		
85	116.3	-581.7	-1609.4	1.377	11.128	9.772	12.591

mRICH

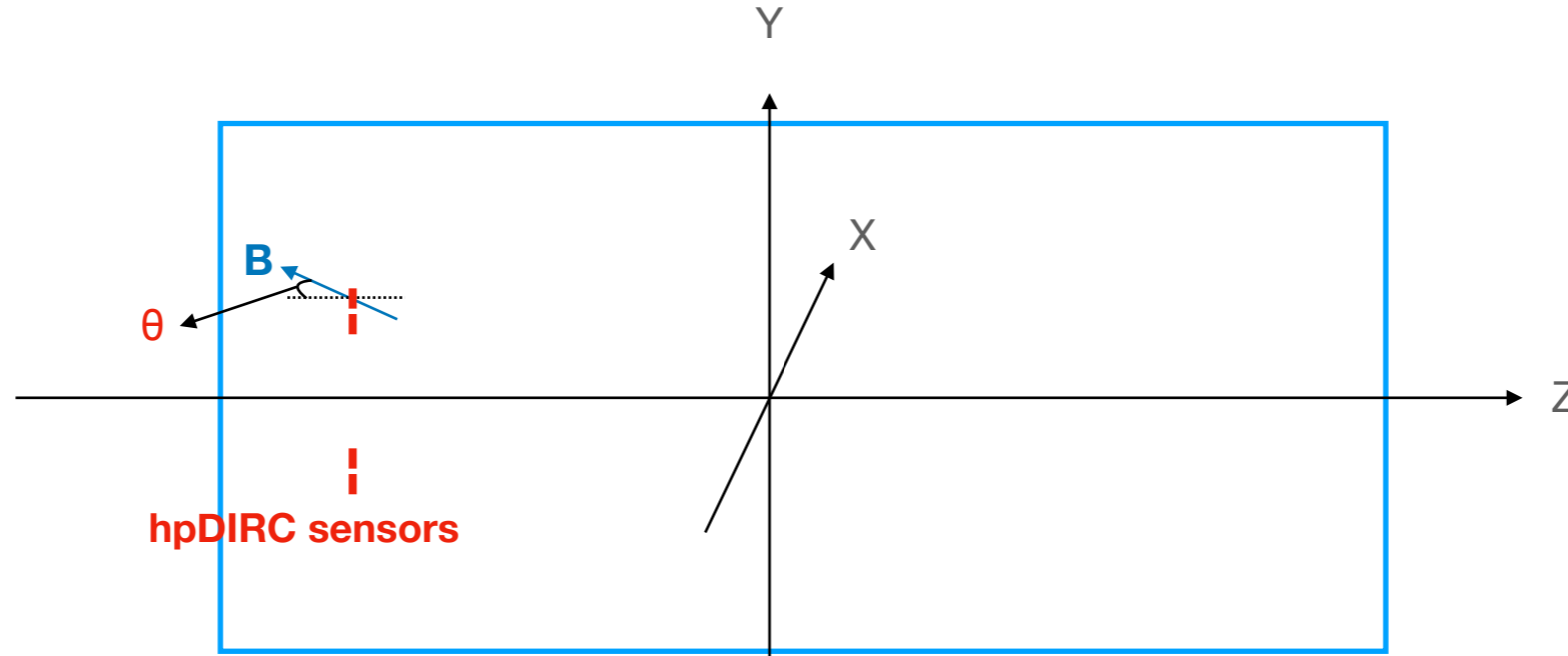


Radius is the distance between the sensor and the beam
 # Z is the position of the sensor in the beam direction
 # B is the magnetic field in the sensor
 # theta is the angle between B and the sensor

Radius(mm)	Z(mm)	B(T)	theta(degree)
60	-1727	1.230	0.788
89	-1727	1.230	1.166
118	-1727	1.231	1.540
147	-1727	1.231	1.910
176	-1727	1.232	2.278
205	-1727	1.233	2.641
234	-1727	1.235	2.995
263	-1727	1.236	3.346
292	-1727	1.238	3.683
321	-1727	1.239	4.018
350	-1727	1.241	4.339
379	-1727	1.243	4.649
408	-1727	1.246	4.948
437	-1727	1.249	5.234
466	-1727	1.251	5.511
495	-1727	1.254	5.771
524	-1727	1.258	6.018
553	-1727	1.261	6.246
582	-1727	1.265	6.462
611	-1727	1.269	6.658
640	-1727	1.274	6.836

- For mRICH, $z = -172.7\text{cm}$ and the radius is from 6.0cm to 64cm ;
- For mRICH, the modules will be installed in a projective fashion, namely a sensor normal will be pointing to the IP;

hpDIRC

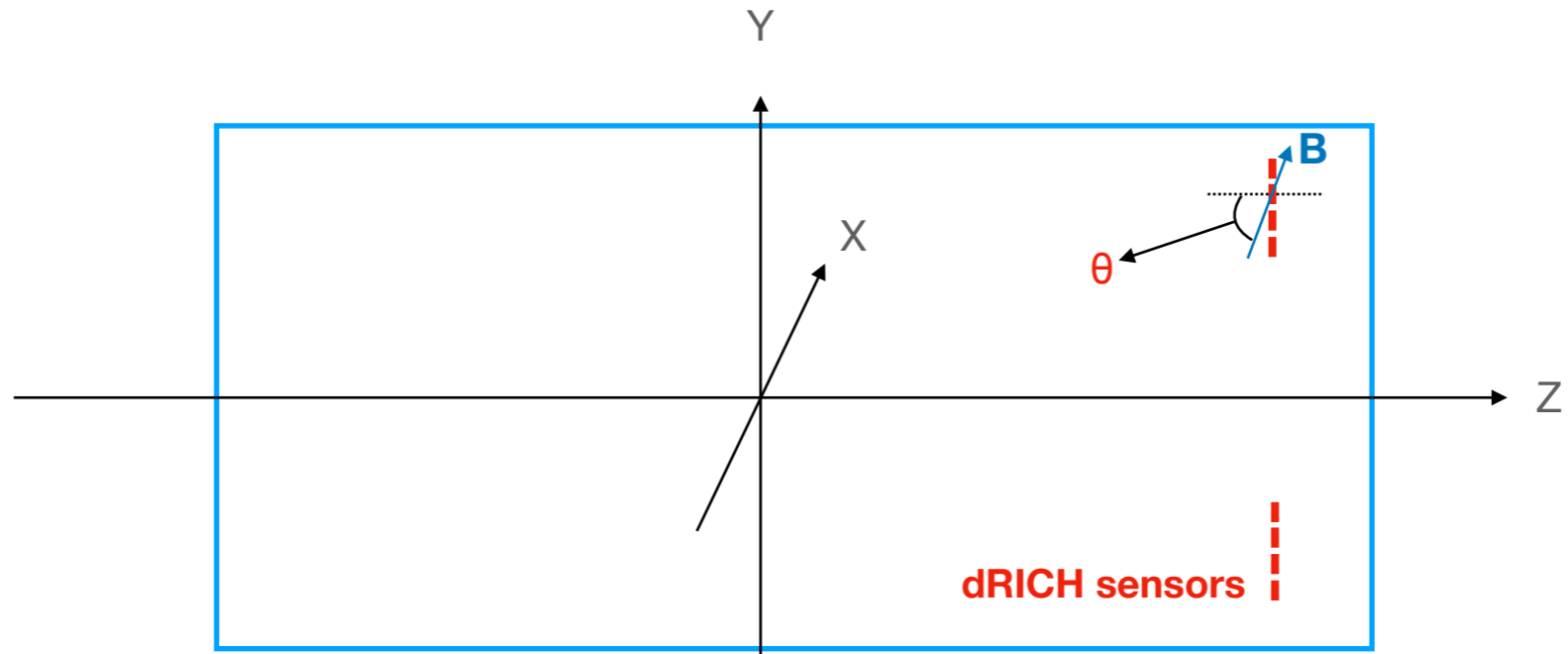


- For hpDIRC, $z = -303\text{cm}$, and the radius is from 70cm to 100cm
- I assume the sensors are in the XY plane;

Radius is the distance between the sensor and the beam line
 # Z is the position of the sensor in the beam direction
 # B is the magnetic field in the sensor
 # theta is the angle between B and the sensor
 # Minimum_theta and Maximum_theta is the minium and maximum angle between B and the sensor (assume sensor size is $10\text{cm} \times 10\text{cm}$)

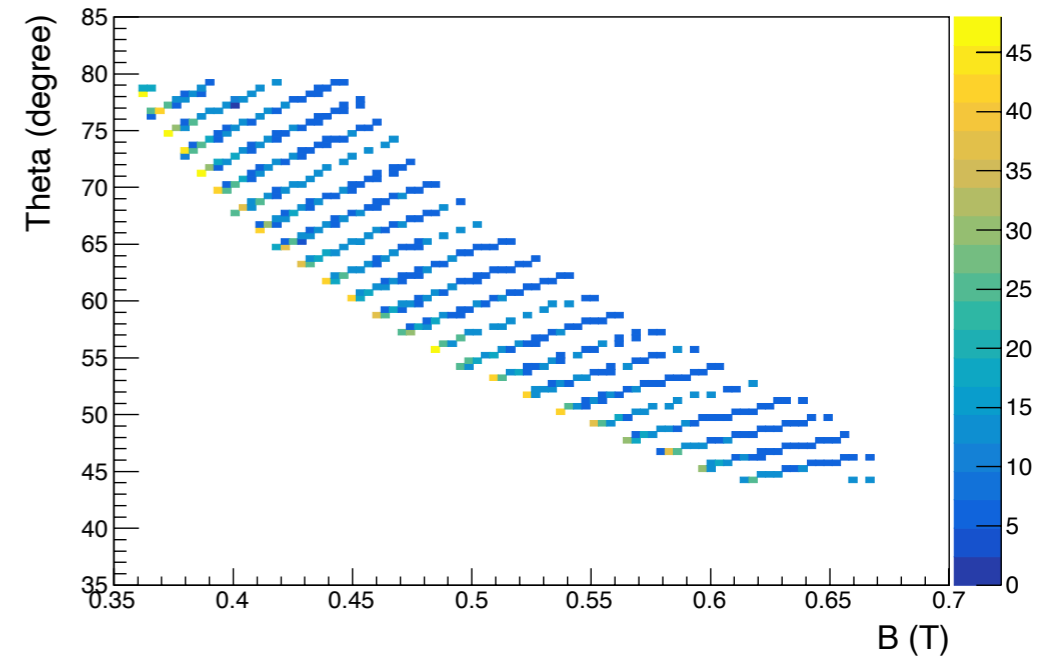
Radius(mm)	Z(mm)	B(T)	theta(degree)	Minimum_theta(degree)	Maximum_theta(degree)
700	-3030	0.331	20.576	18.228	23.011
720	-3030	0.329	21.262	18.889	23.723
740	-3030	0.327	21.937	19.549	24.442
760	-3030	0.325	22.634	20.211	25.175
780	-3030	0.322	23.340	20.894	25.919
800	-3030	0.320	24.058	21.575	26.657
820	-3030	0.318	24.778	22.259	27.409
840	-3030	0.315	25.520	22.961	28.187
860	-3030	0.313	26.266	23.672	28.973
880	-3030	0.310	26.999	24.391	29.762
900	-3030	0.308	27.768	25.122	30.571
920	-3030	0.305	28.554	25.866	31.391
940	-3030	0.302	29.339	26.605	32.216
960	-3030	0.300	30.132	27.354	33.067
980	-3030	0.297	30.956	28.131	33.931
1000	-3030	0.295	31.773	28.917	34.798

dRICH

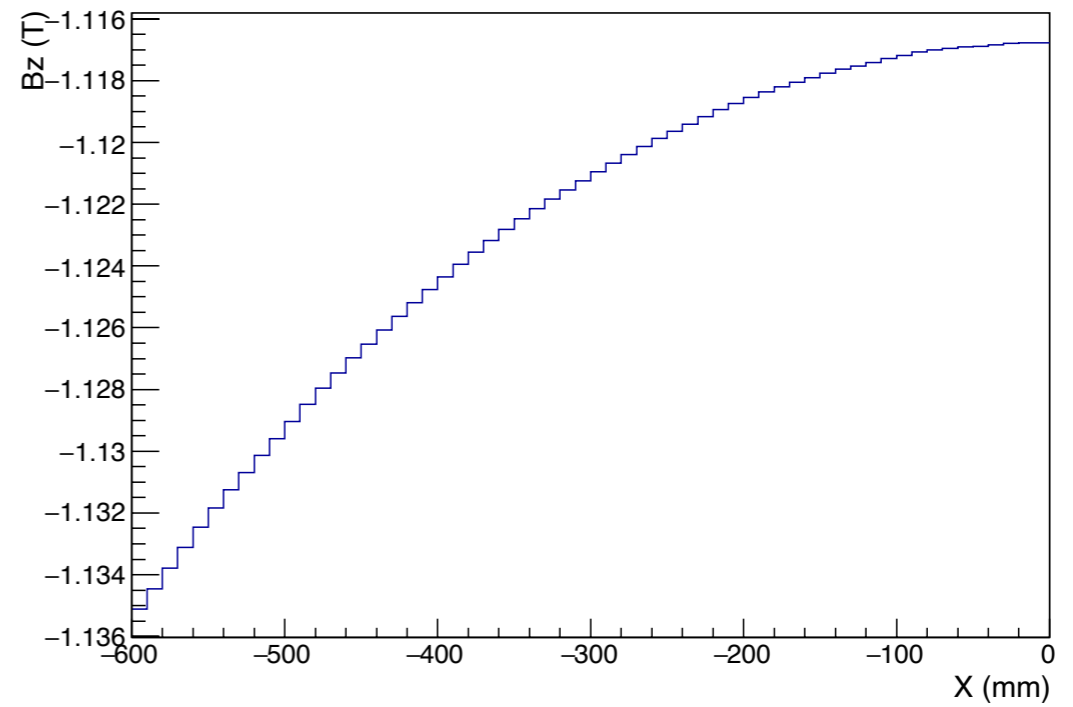
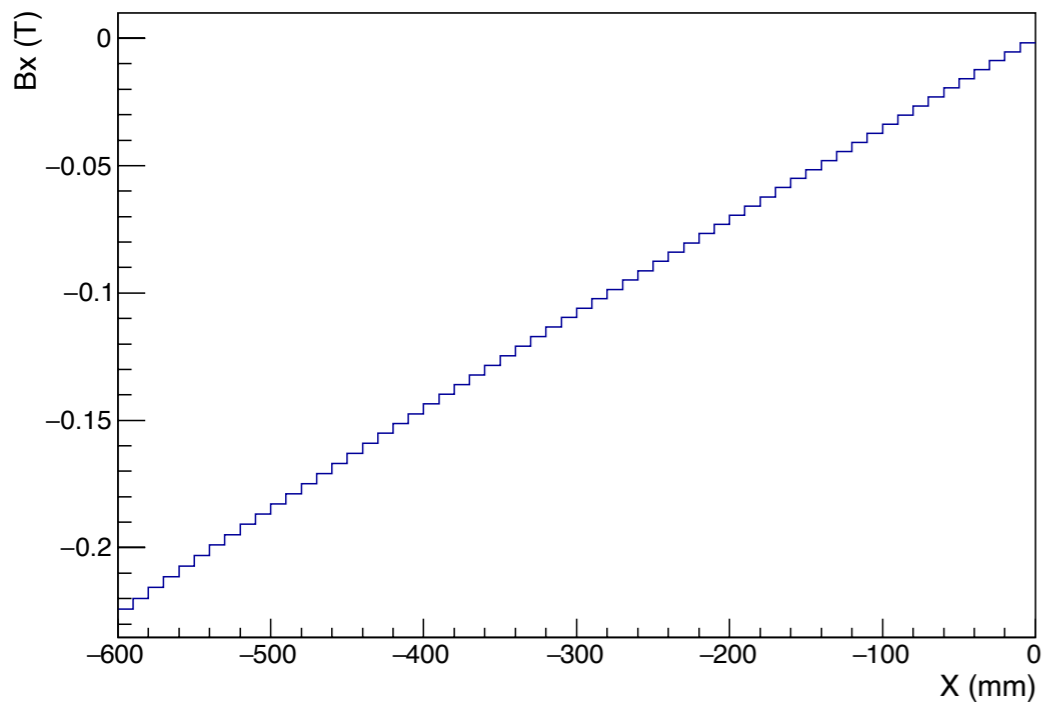


```
# Sensor_NO. is the number of the sensor
# X, Y, Z is the position of the sensor, Z is the beam line direction
# B is the magnetic field in the sensor
# theta is the angle between B and the sensor
# Here I assume the sensors are in the XY plane
```

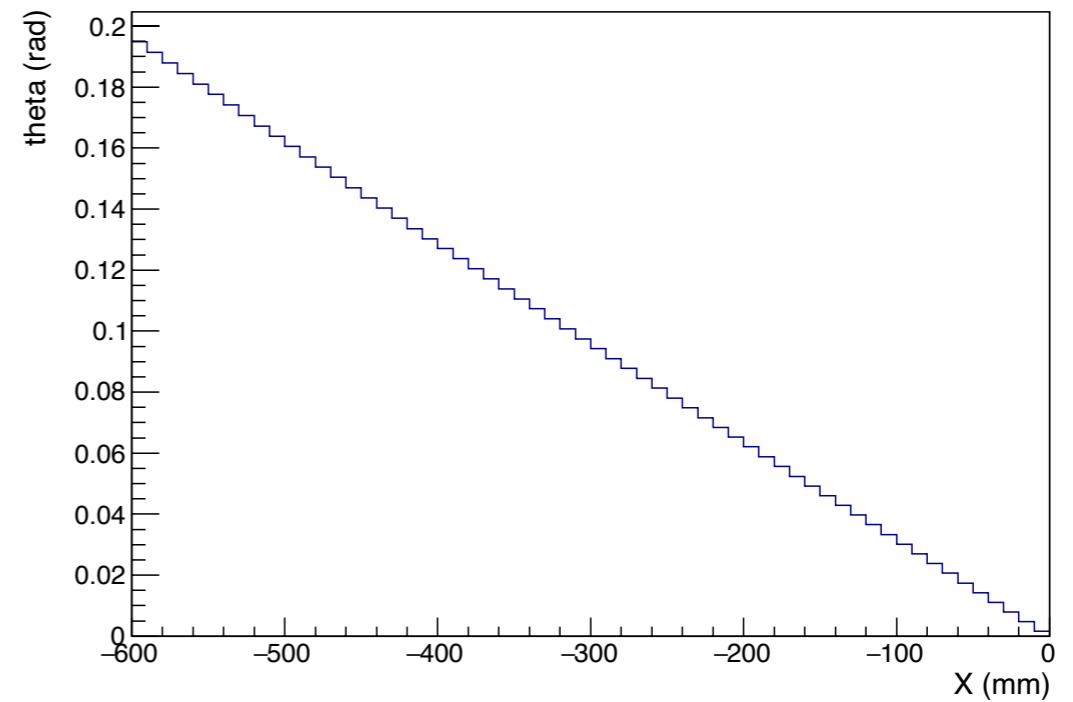
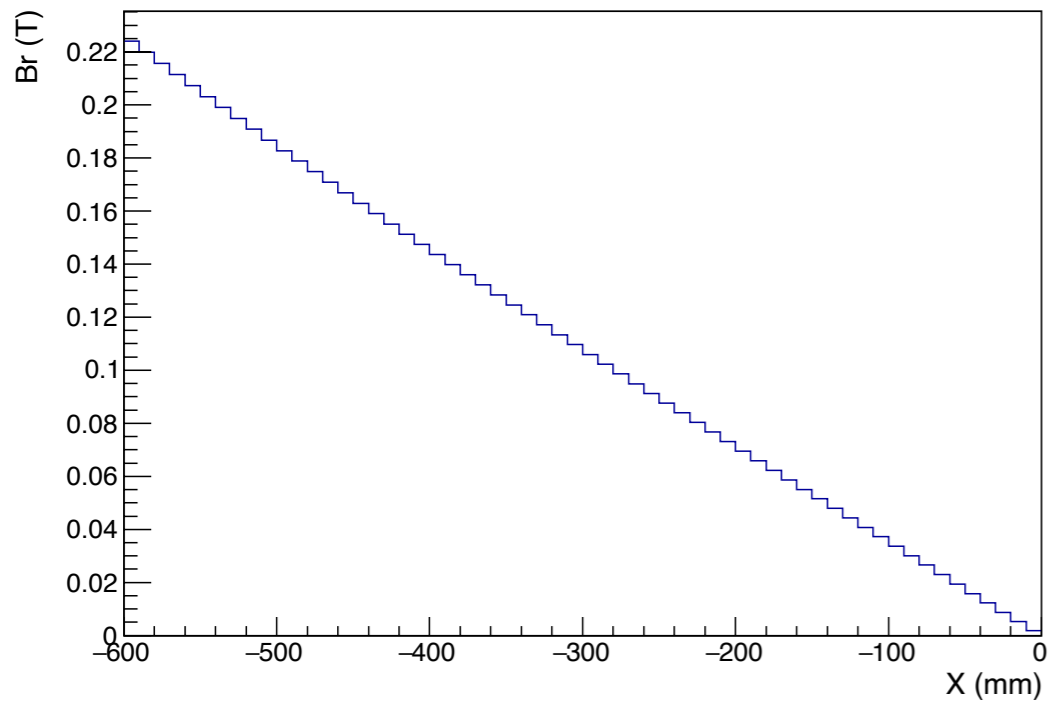
Sensor_NO.	X(mm)	Y(mm)	Z(mm)	B(T)	theta(degree)
1	1790.9	178.73	2433.86	0.366691	78.9332
2	1790.9	153.19	2438.16	0.365091	78.7615
3	1790.9	-79.22	2446.82	0.361942	78.4114
4	1713.31	58.51	2444.52	0.379982	73.0633
5	1713.31	32.64	2445.7	0.379544	73.0146
6	1713.31	6.75	2446.21	0.379355	72.9935
7	1713.31	-19.15	2446.05	0.379414	73.0001
8	1713.31	-45.04	2445.22	0.379722	73.0345
			.		
			.		
			.		
5290	952.02	-1428.71	2440.13	0.381612	73.2422
5291	929.7	-1441.59	2442.66	0.380675	73.1389
5292	929.7	-1441.59	2442.66	0.380675	73.1389



Backup



1.7T



- Position_Y of HRPPD is 0mm;
- Position_Z of HRPPD is -1609.4mm;
- $B_y = 0$;
- Theta is the polar angle of the magnet field in the HRPPD plane;

- Oba et al., 1981

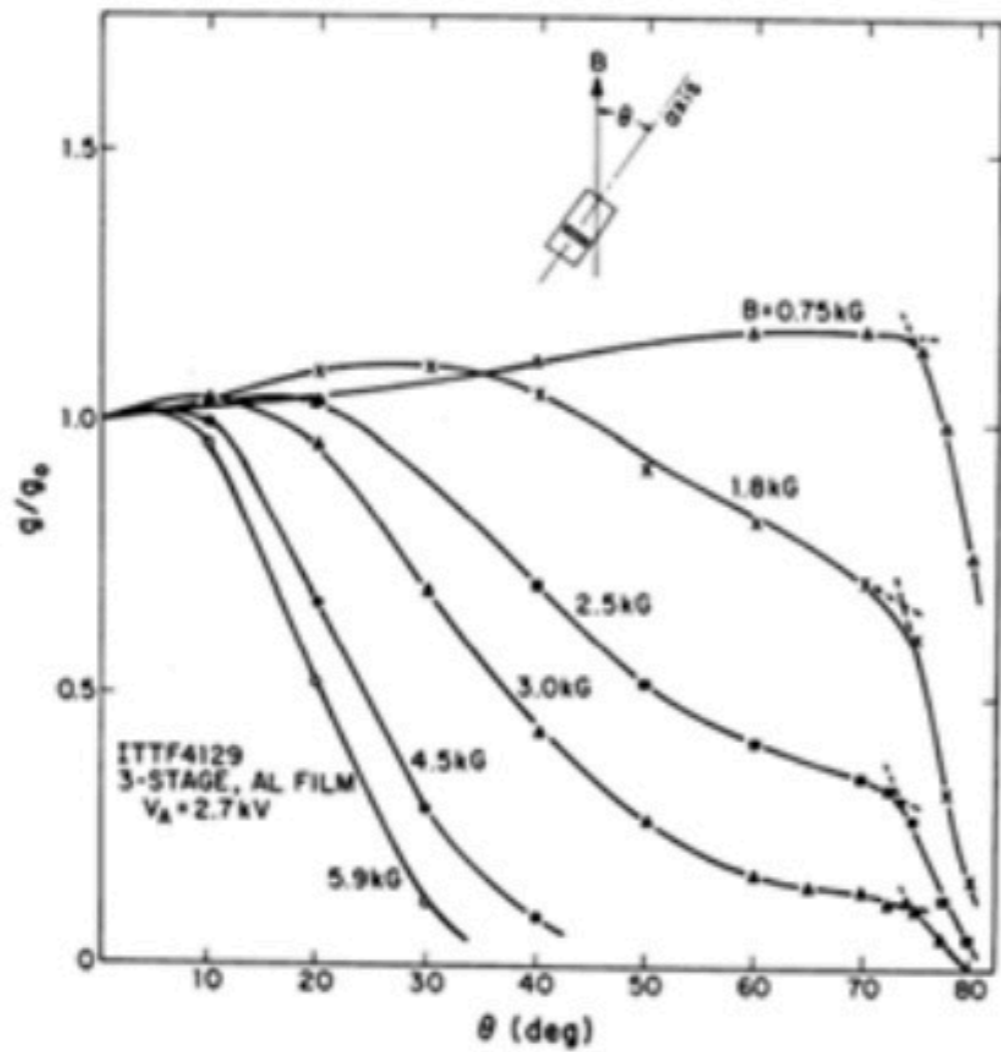


Fig. 11. Dependency of the output degradation in F4129 on the off-axis magnetic field.

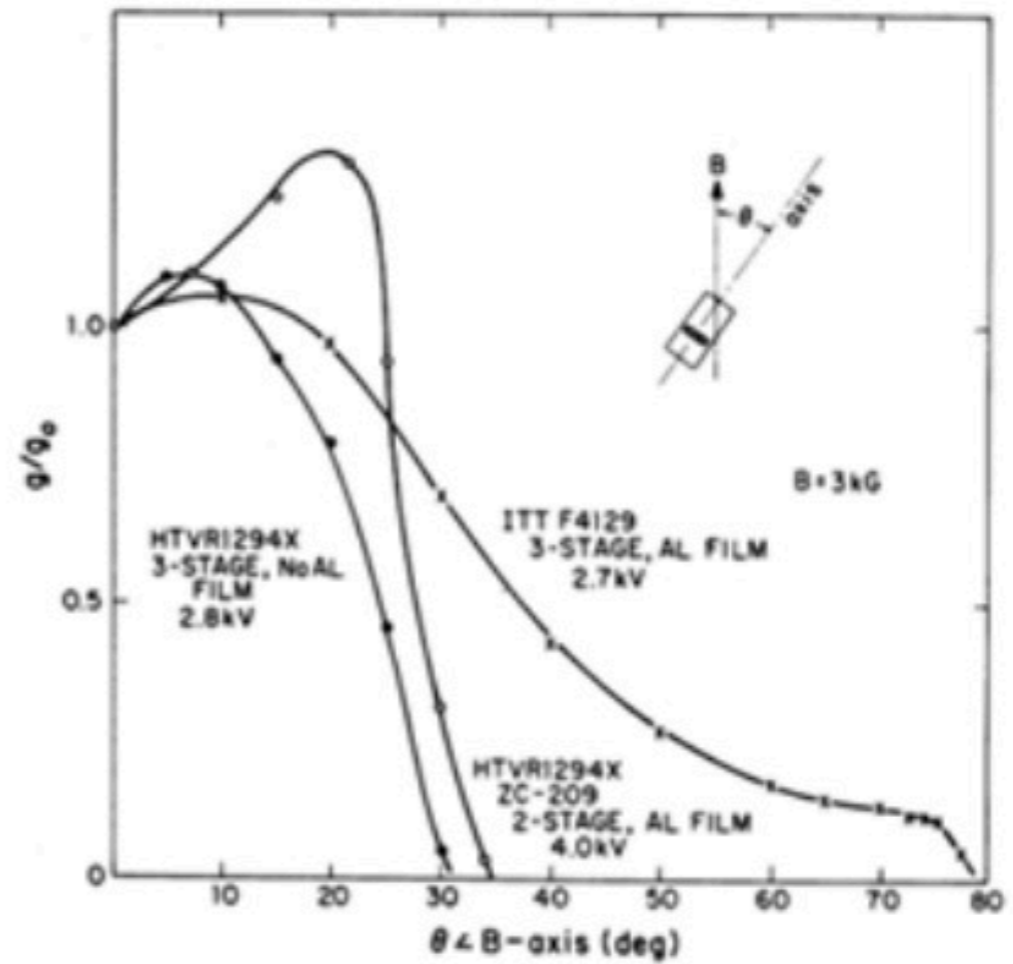
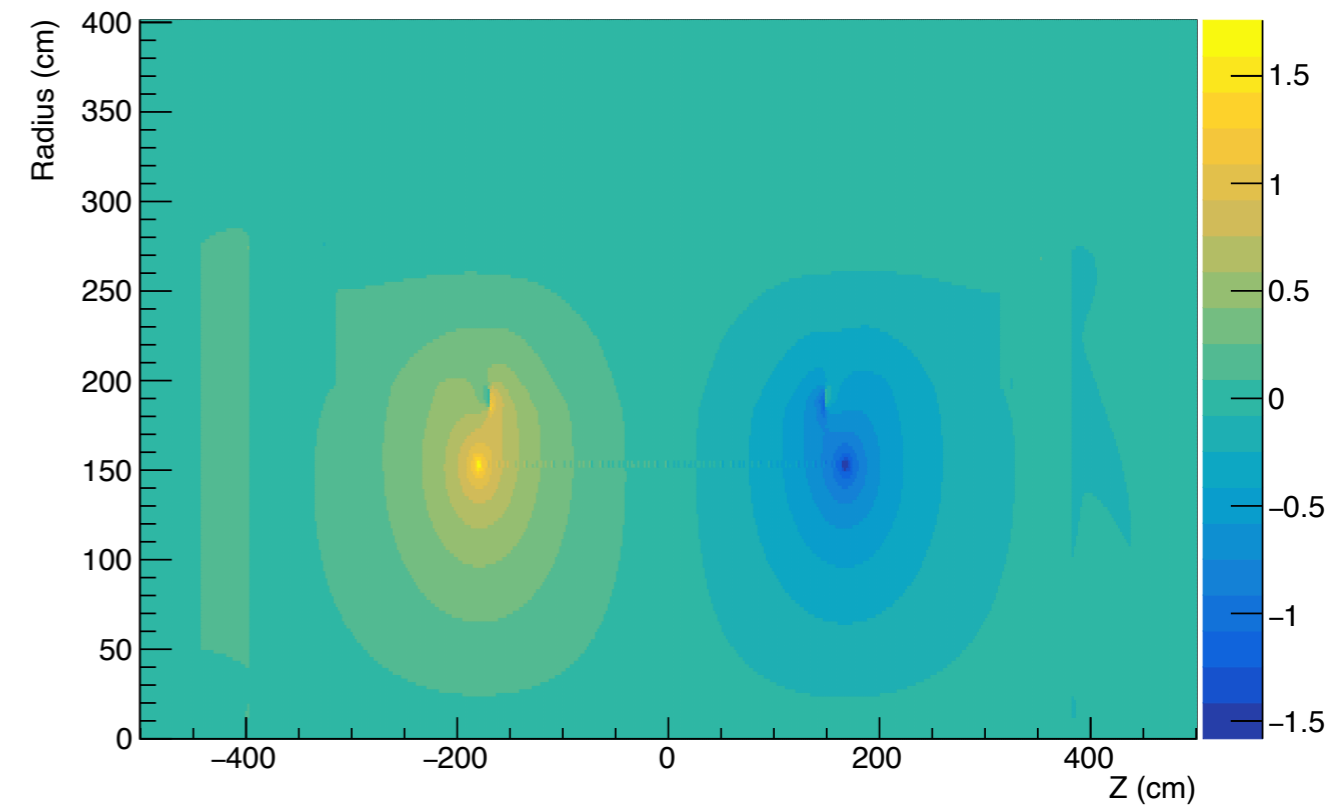
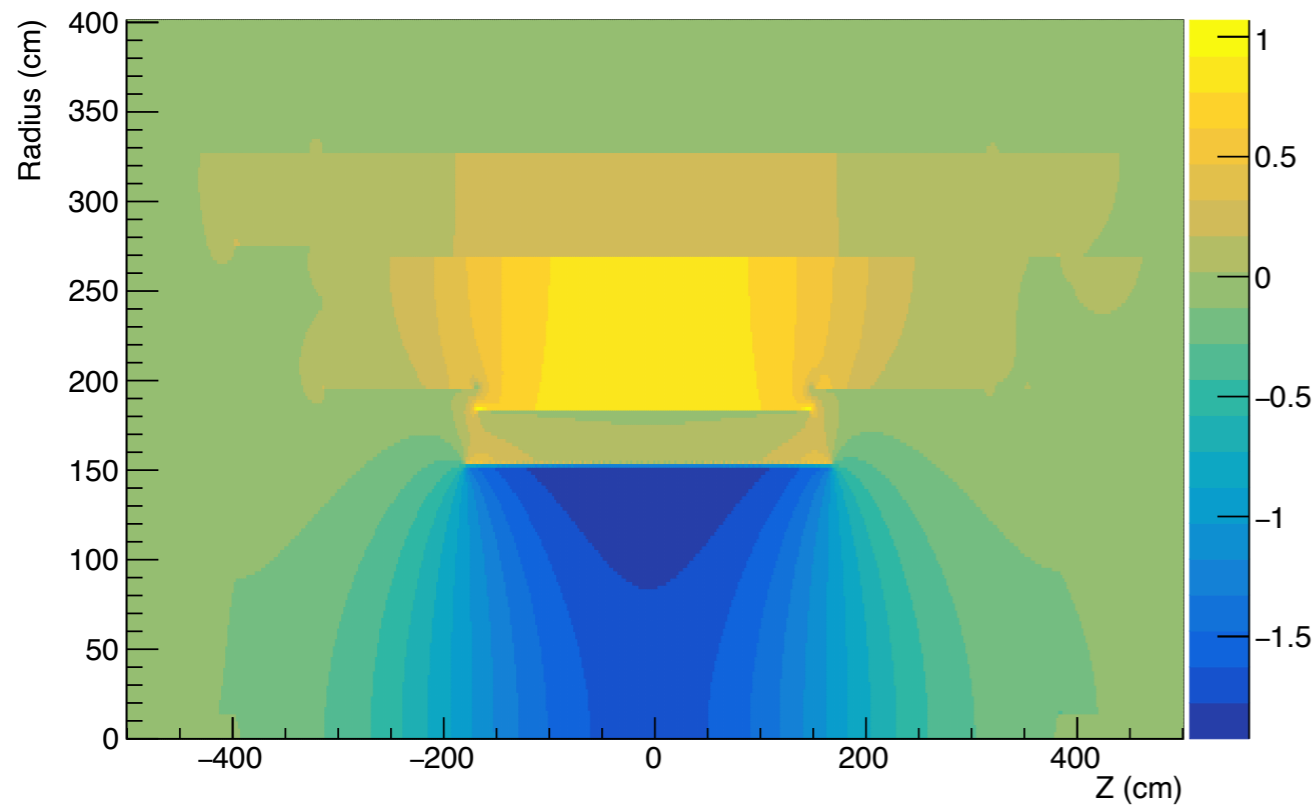


Fig. 10. Output degradation in three MCP-PMTs in the off-axis magnetic field.

ePIC solenoid magnetic field (Tesla) in **Z direction**;

ePIC solenoid magnetic field (Tesla) in **radial direction**;

1.7 T



2.0 T

