

Weekly Update

Gavin Wilks

10/18/2022

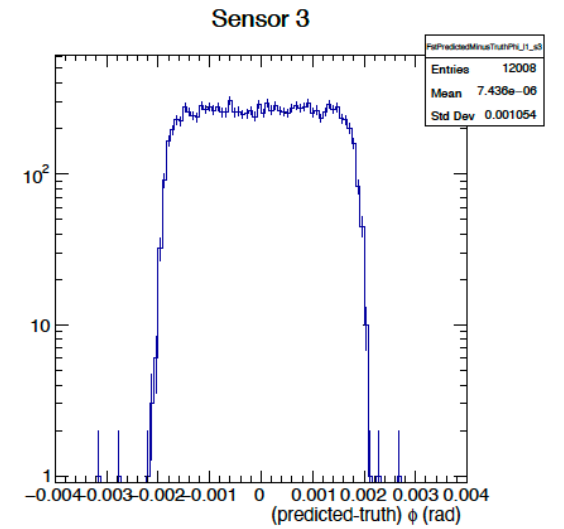
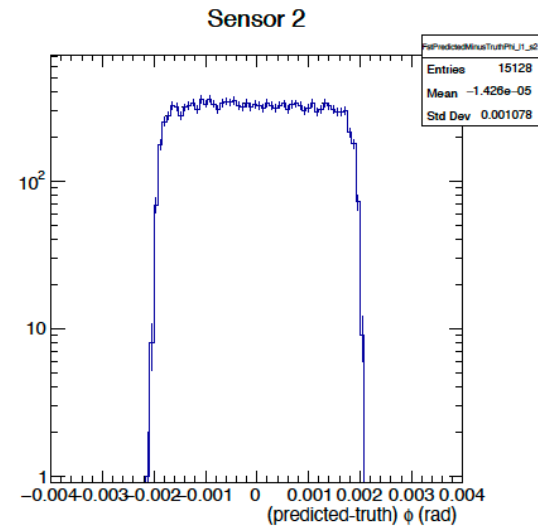
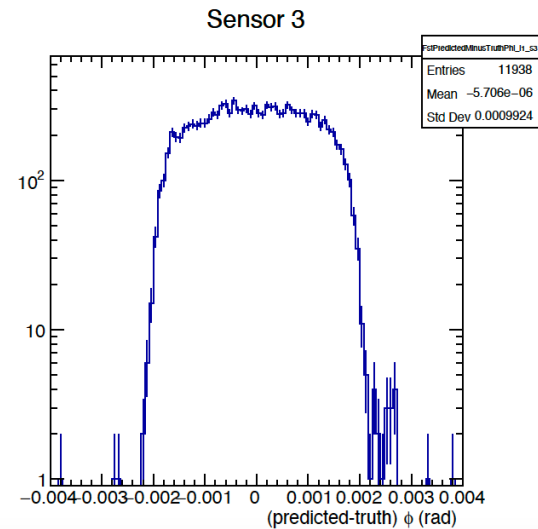
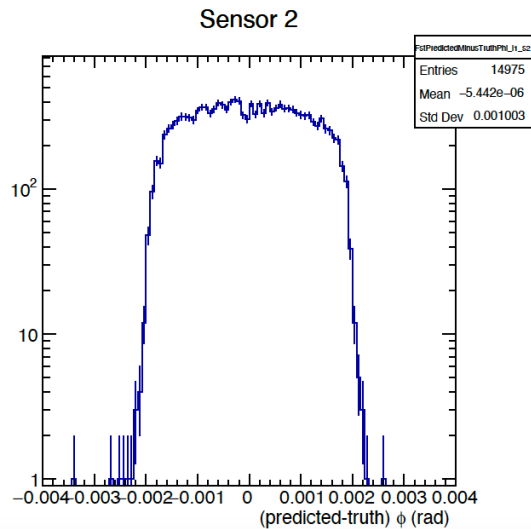
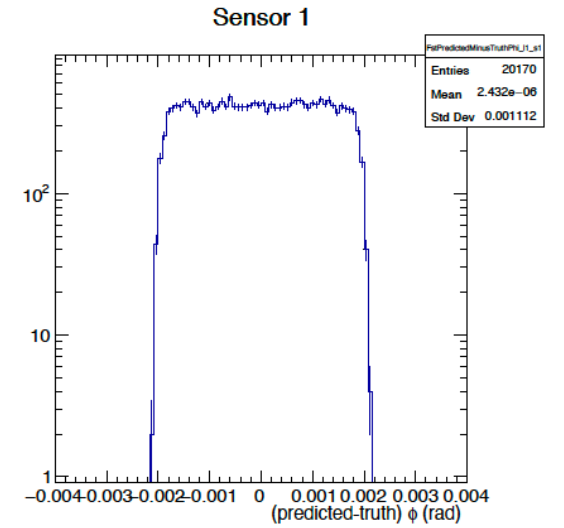
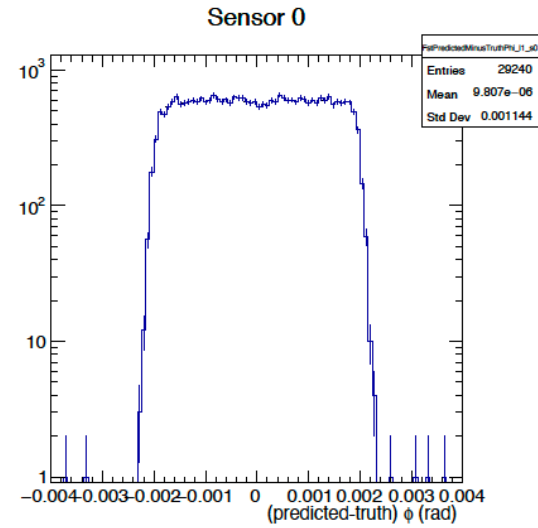
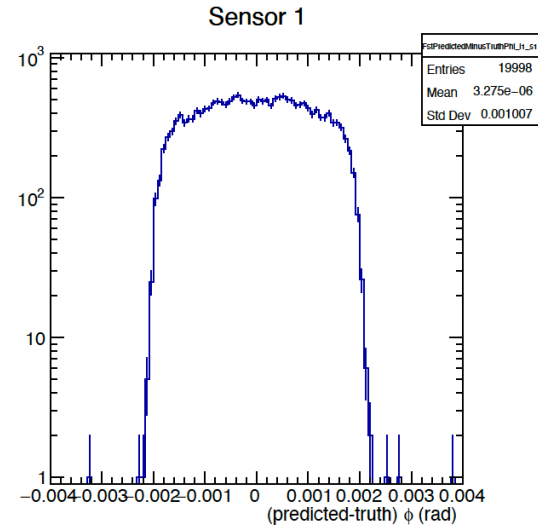
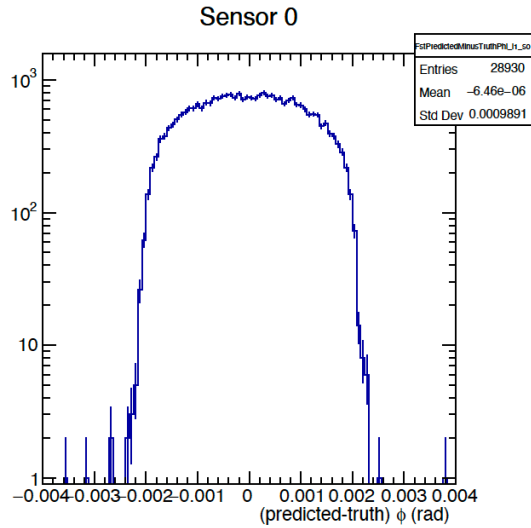
Single Sensor Alignment (inner)

- Misalign 1 inner sensor (sensorIdx = 36) in FST simulated geometry.
- Throw mu+ with particle gun with following settings:
 - $4.99 < p_T < 5.0$ GeV/c (uniform)
 - $2.9 < \eta < 4.4$ (uniform)
 - $0.9 < \phi < 1.7$ rad (uniform)
 - $B = 0$ T
- Require hit on sensor 36. Also, all 4 sTGC (default Tracking requirement).
- Fit with GenFit Kalman filter and then refit with GenFit GBL.
- Fix rotations about u-axis and v-axis, in addition to w translation by setting pre-sigma < 0.0.
- Matrix inversion used to solve for alignment parameters.
- ~75k tracks used for each trial.

ideal

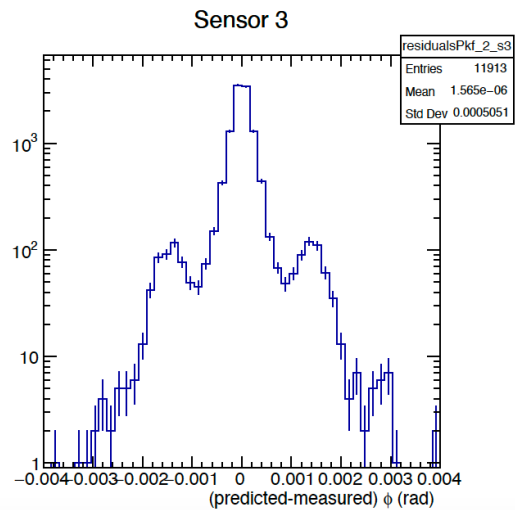
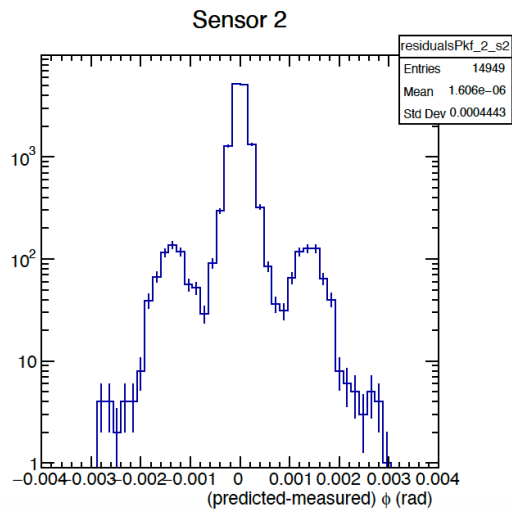
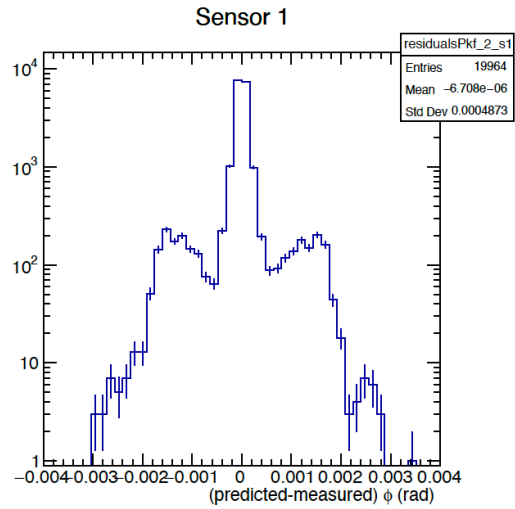
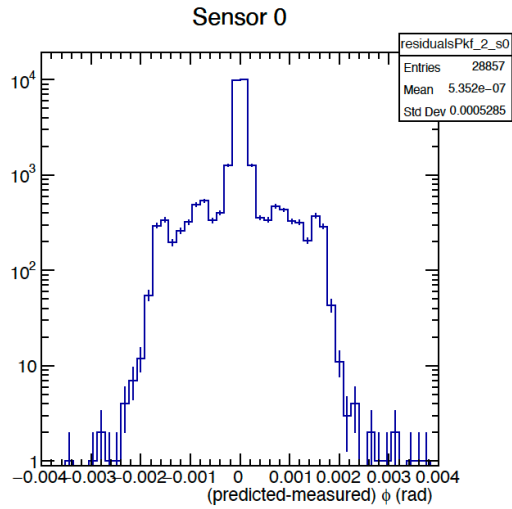
$p_T = [0.2, 2.0]$ GeV/c

$p_T = [4.99, 5.0]$ GeV/c

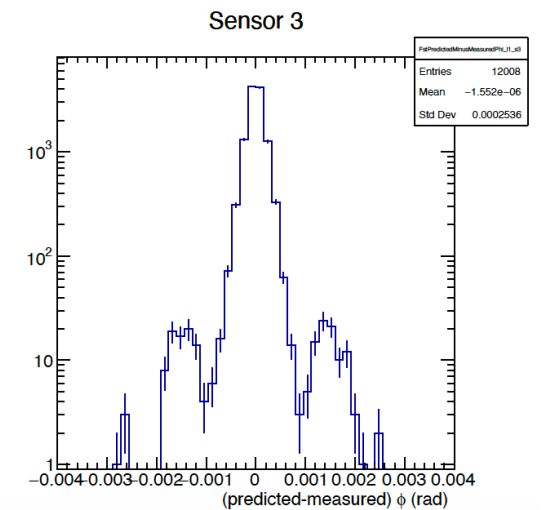
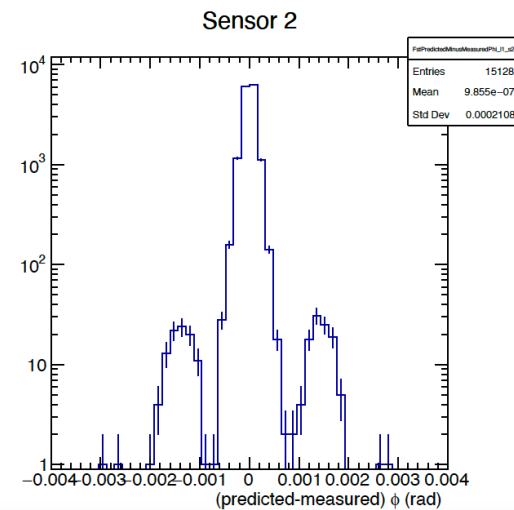
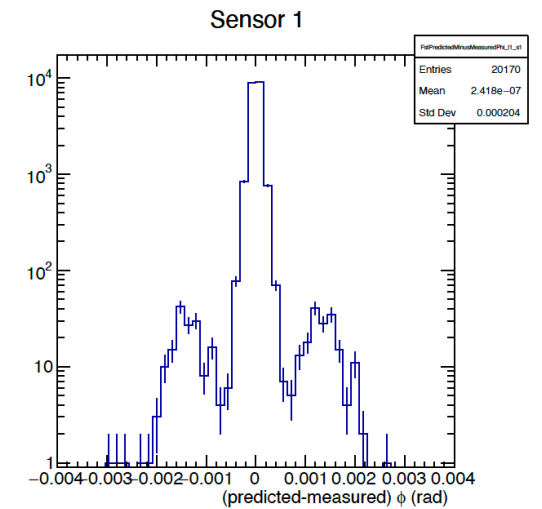
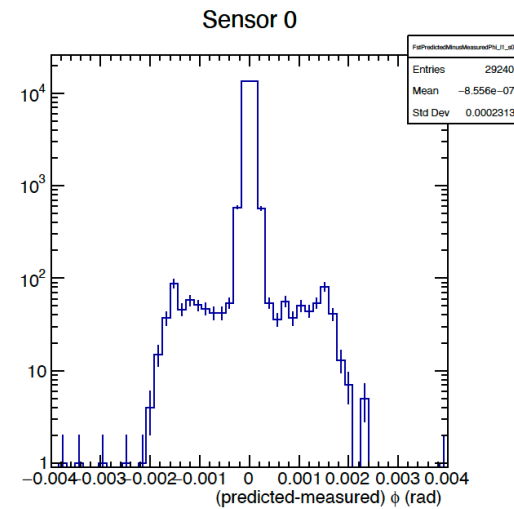


ideal

$p_T = [0.2, 2.0]$ GeV/c



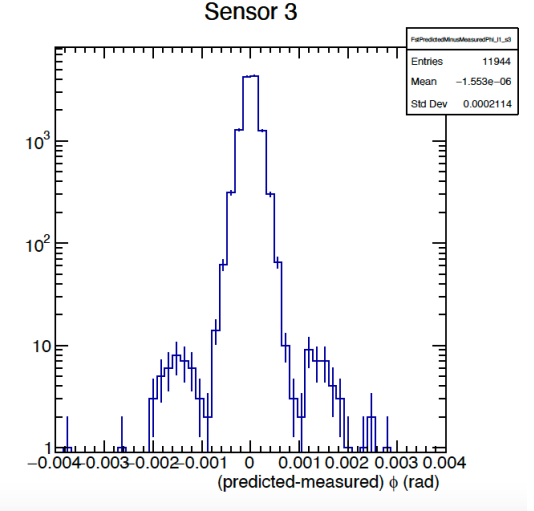
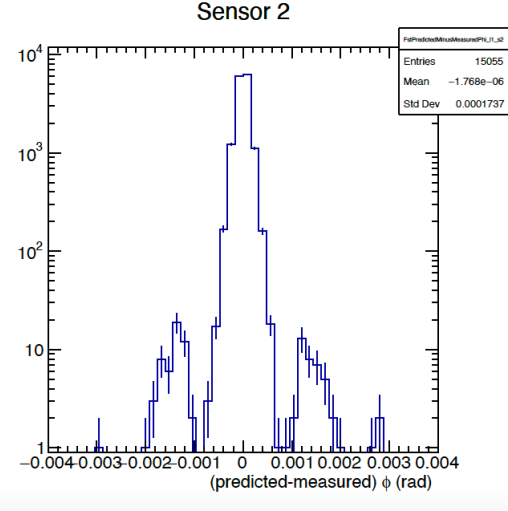
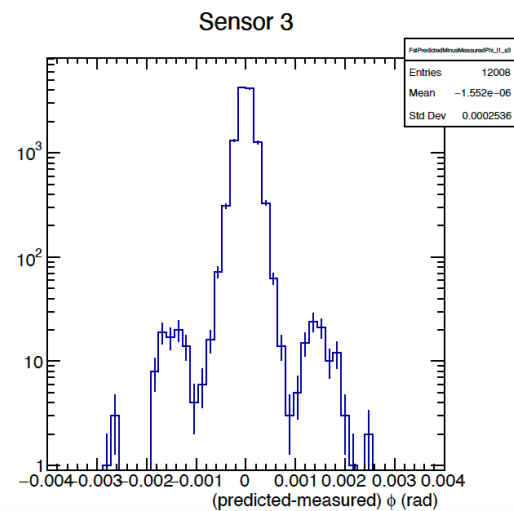
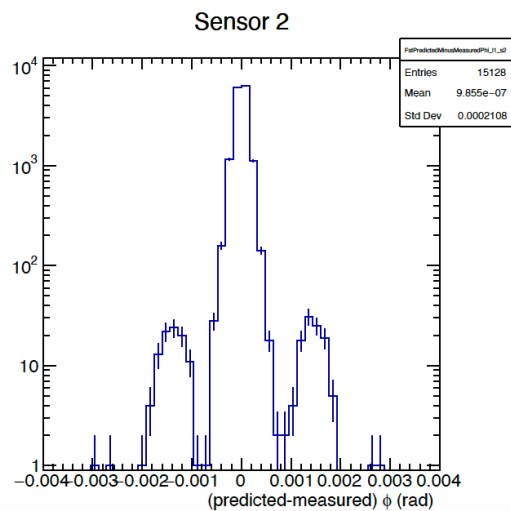
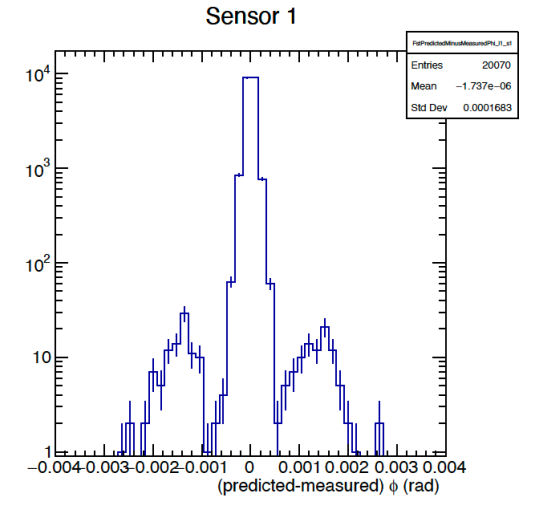
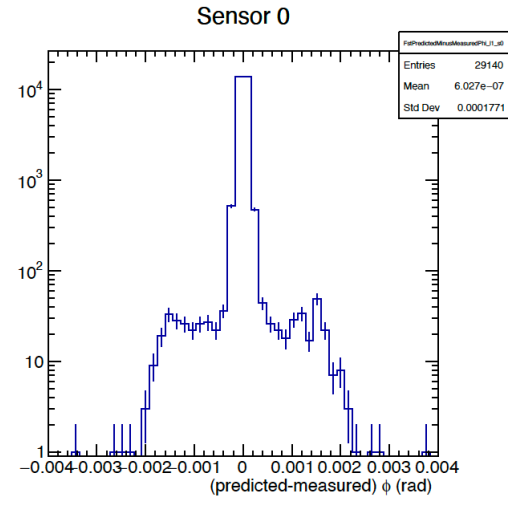
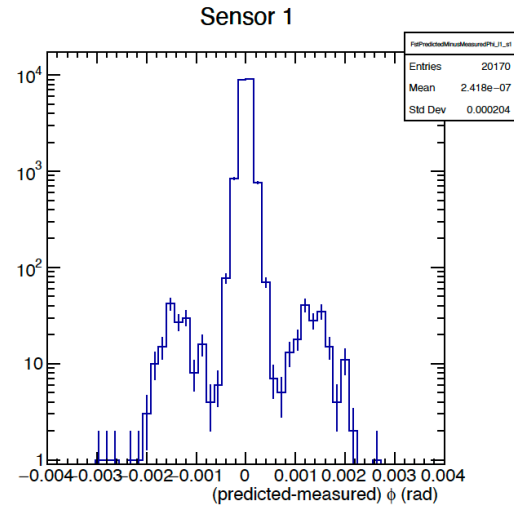
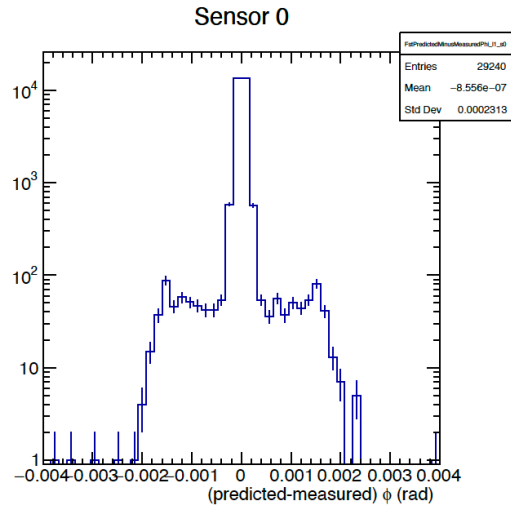
$p_T = [4.99, 5.0]$ GeV/c



ideal

$p_T = [4.99, 5.0] \text{ GeV}/c$

$p_T = [9.99, 10.0] \text{ GeV}/c$

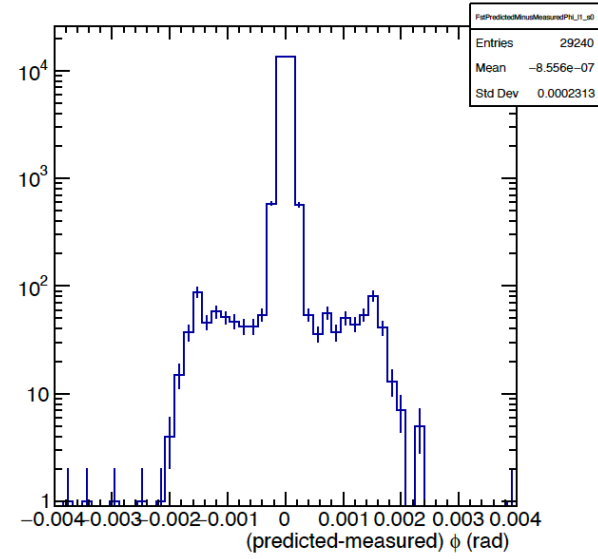


All the following residual plots are for sensor
36 with $p_T = [4.99, 5.0]$ GeV/c

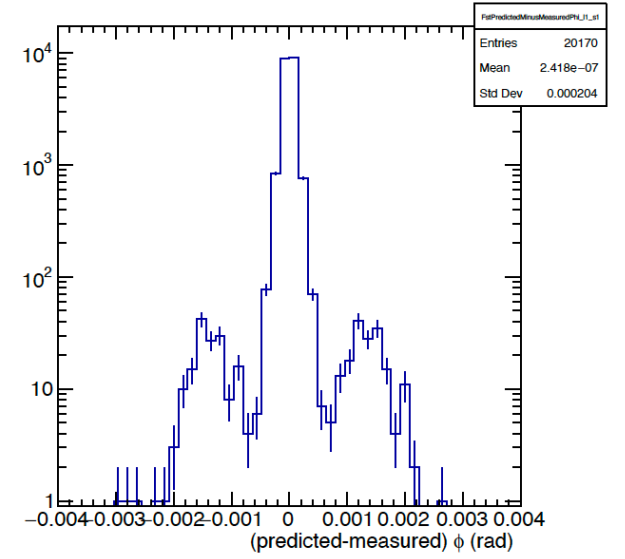
Ideal

- Sensor 36

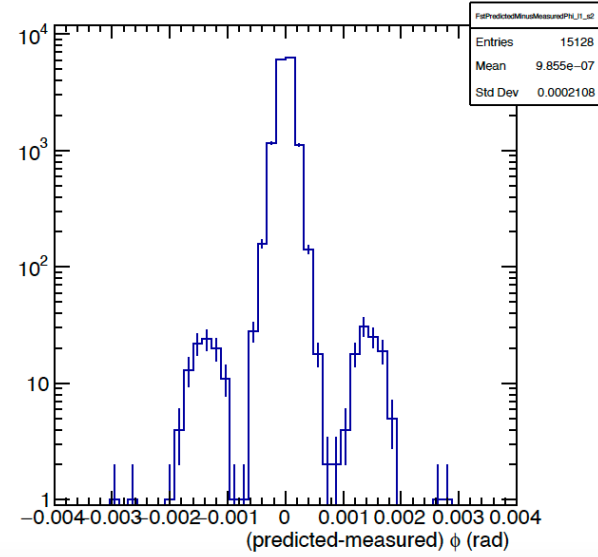
Sensor 0



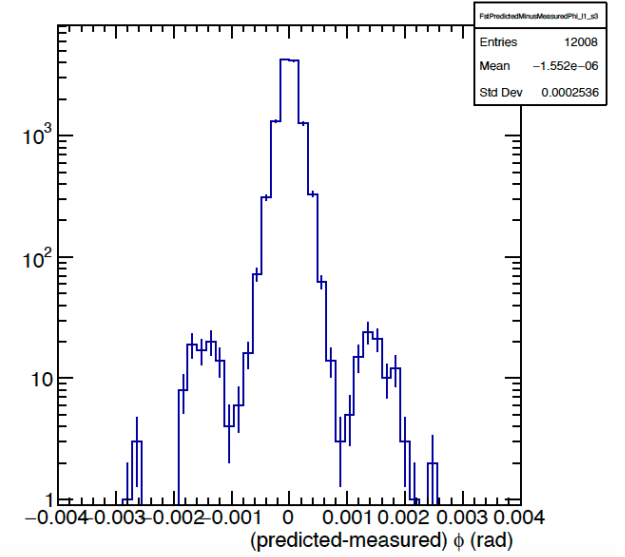
Sensor 1



Sensor 2

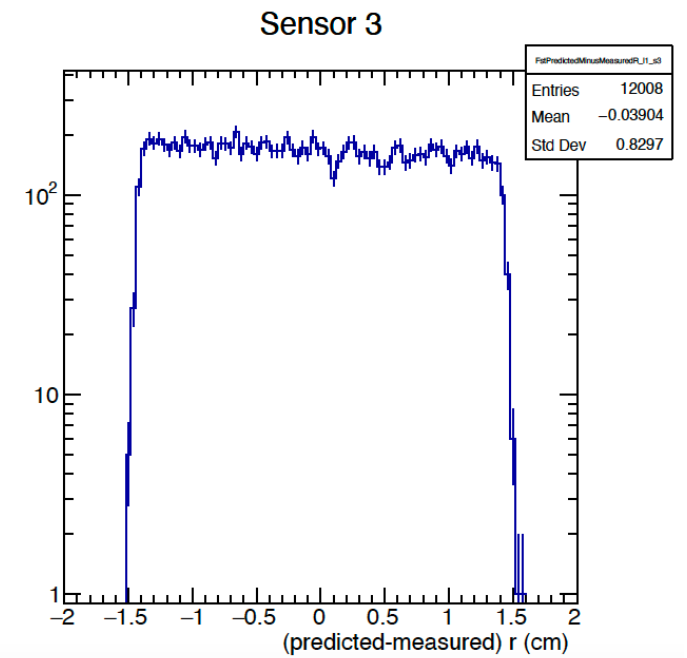
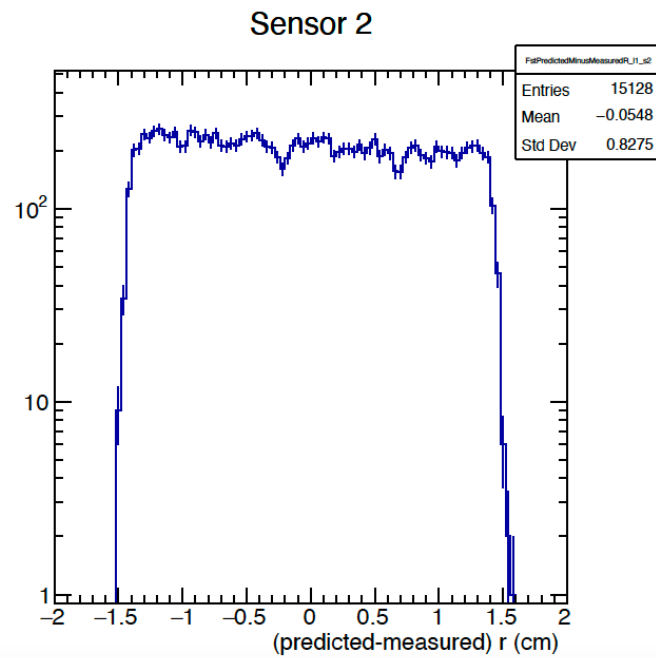
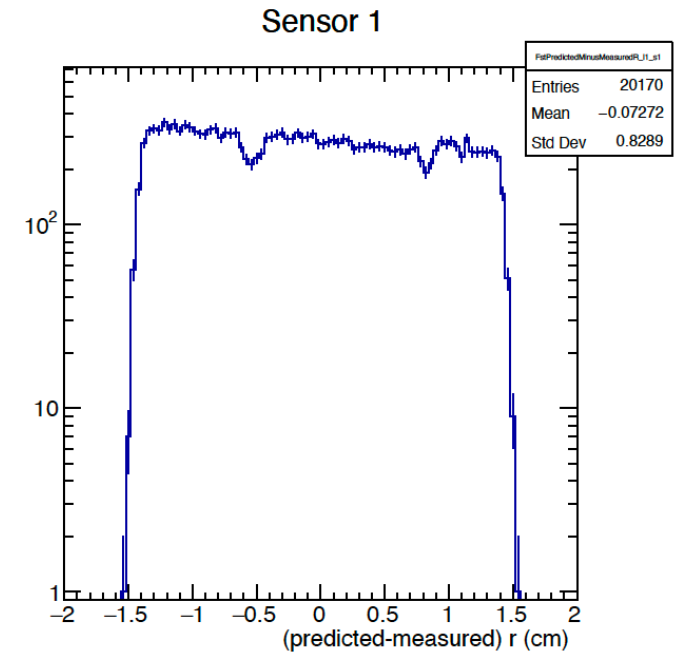
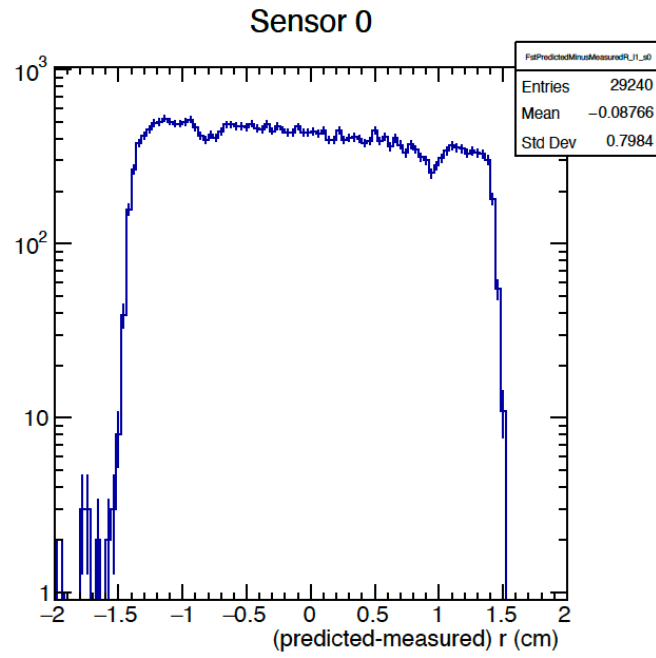


Sensor 3



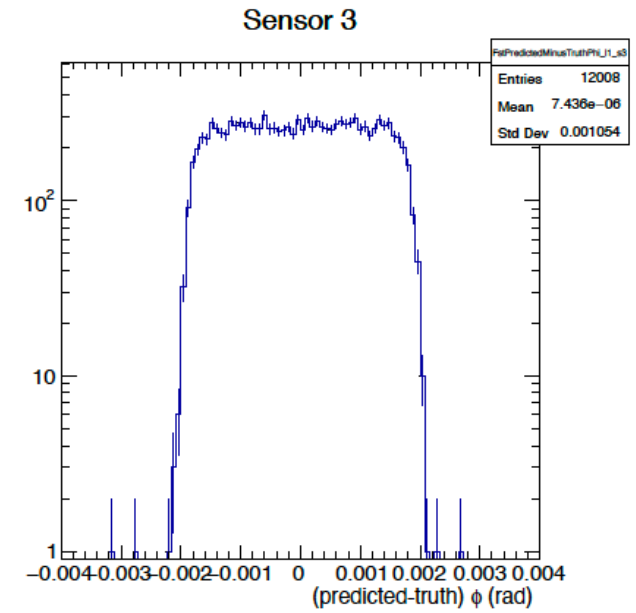
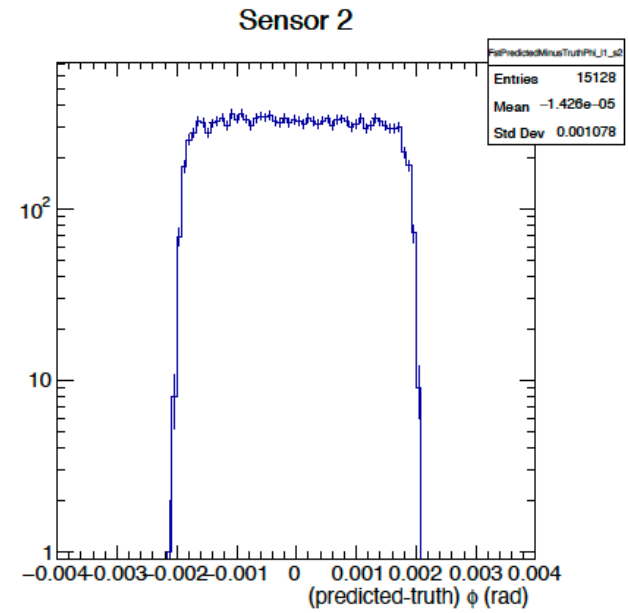
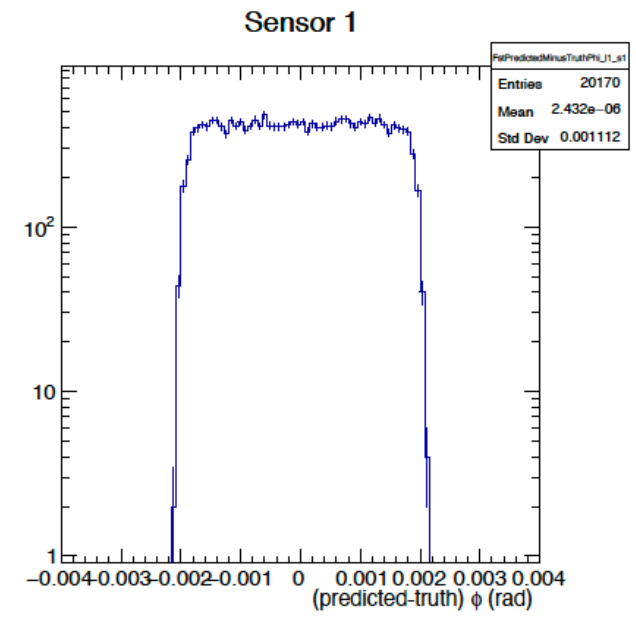
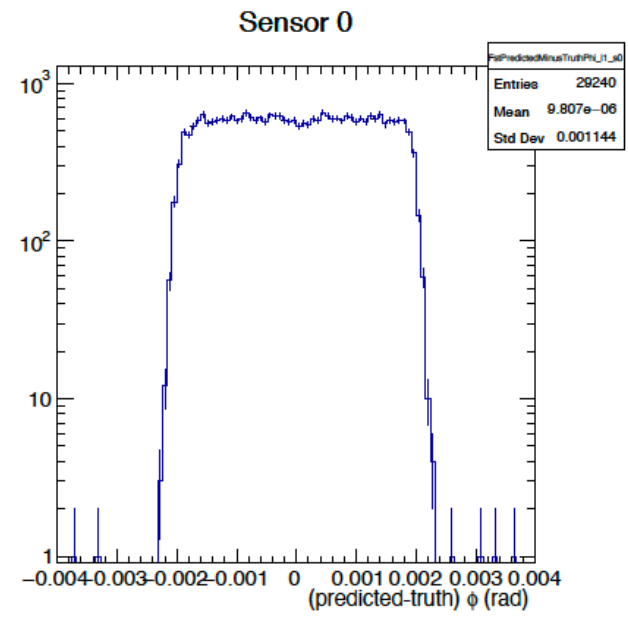
Ideal

- Sensor 36



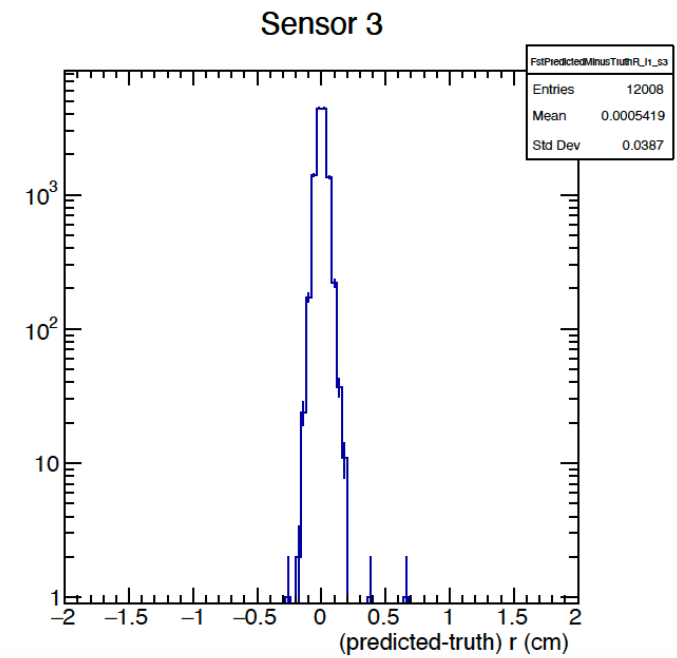
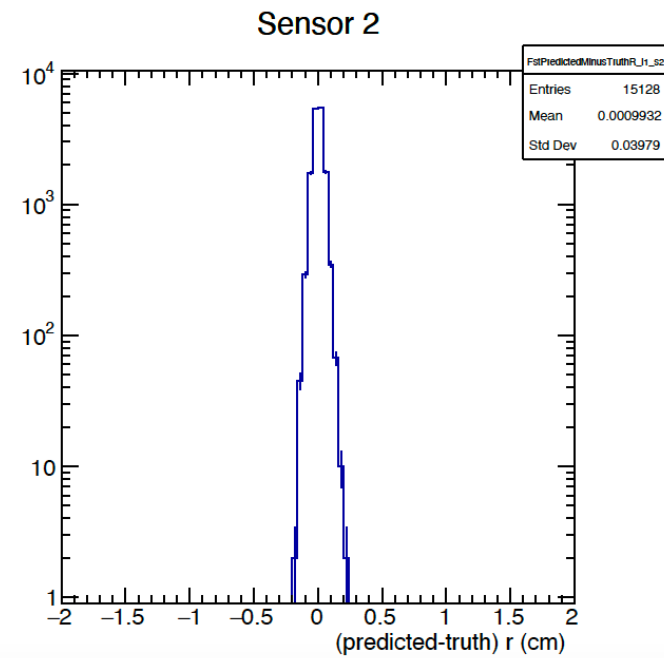
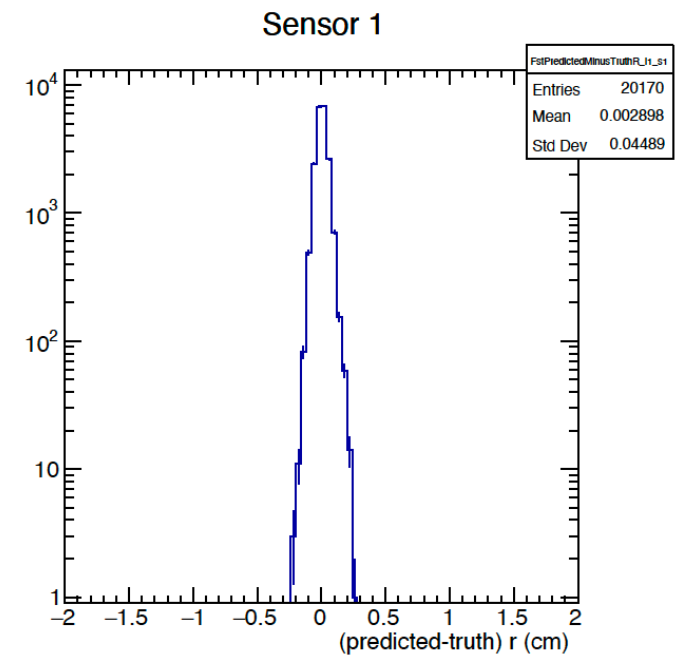
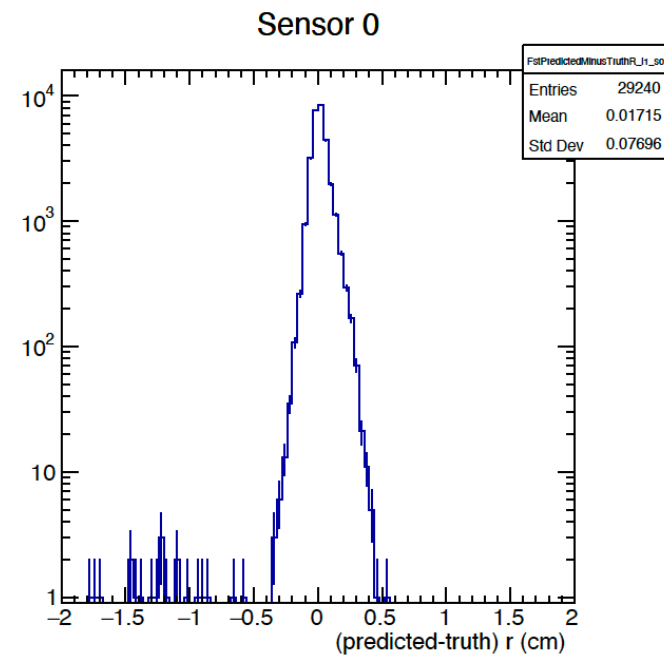
Ideal

- Sensor 36



Ideal

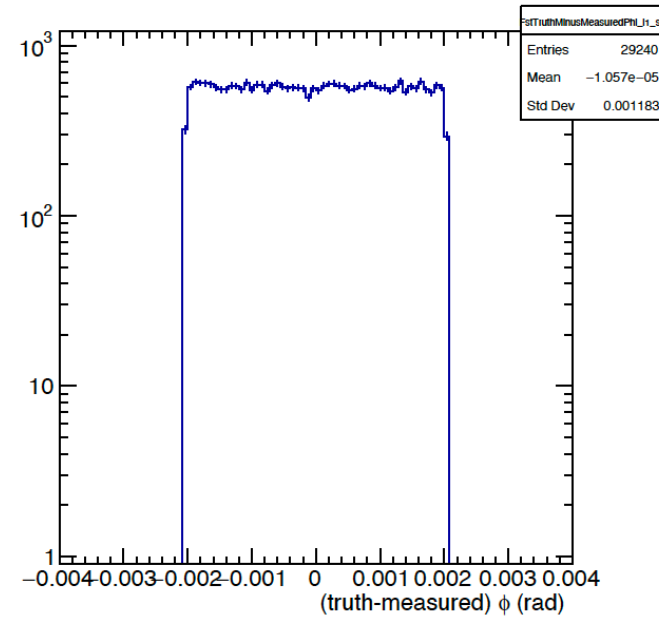
- Sensor 36



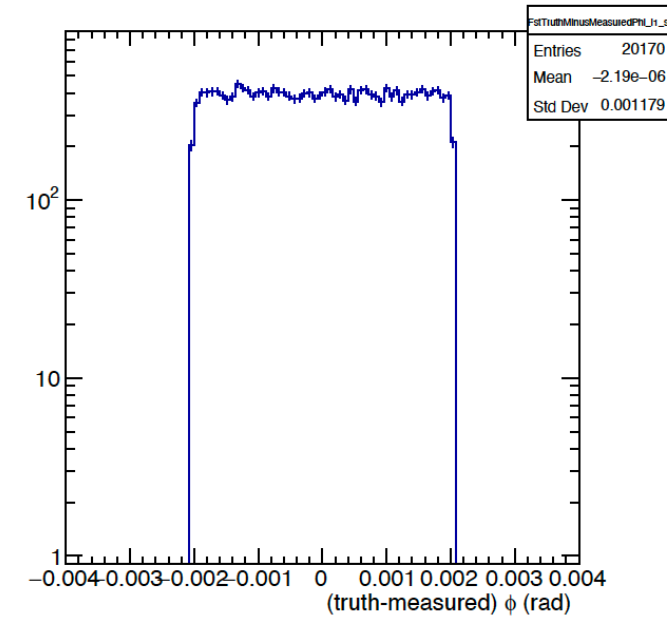
Ideal

- Sensor 36

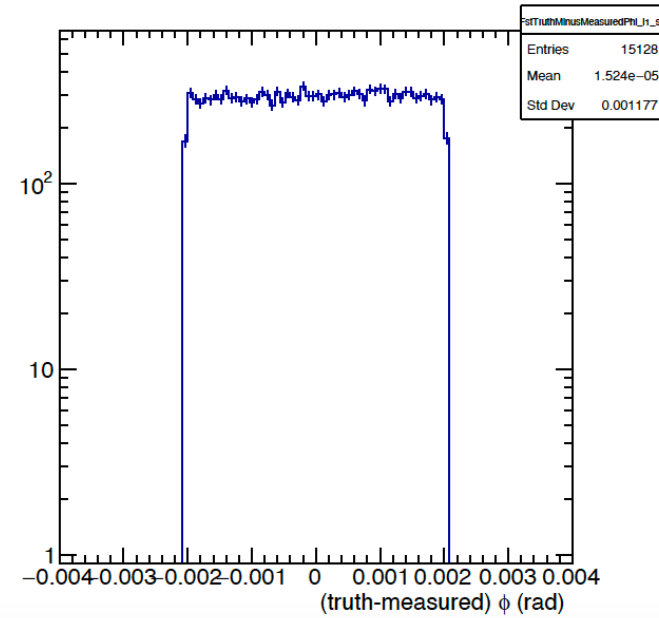
Sensor 0



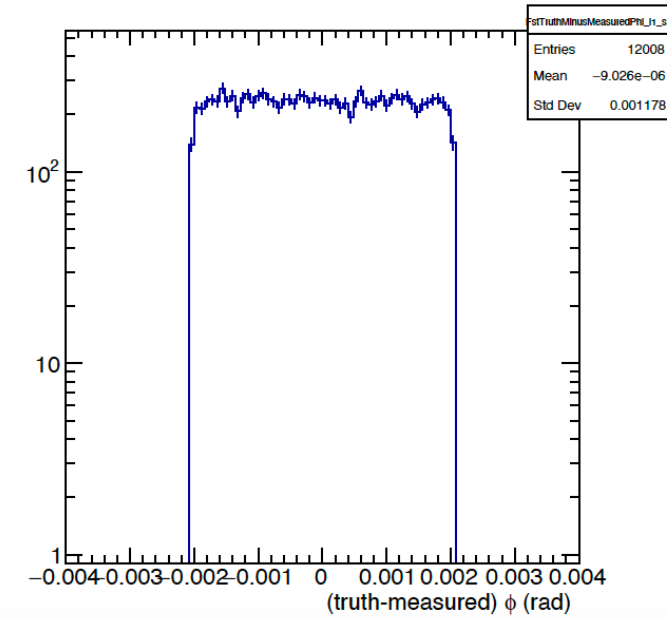
Sensor 1



Sensor 2

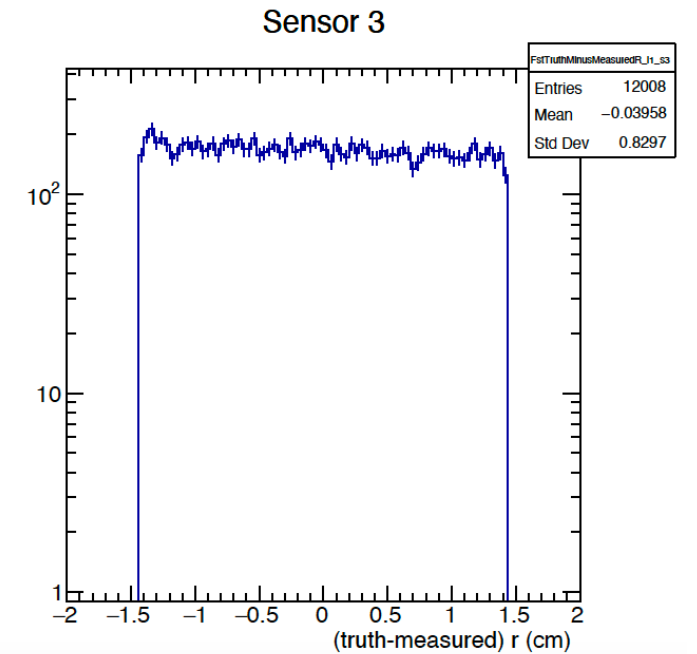
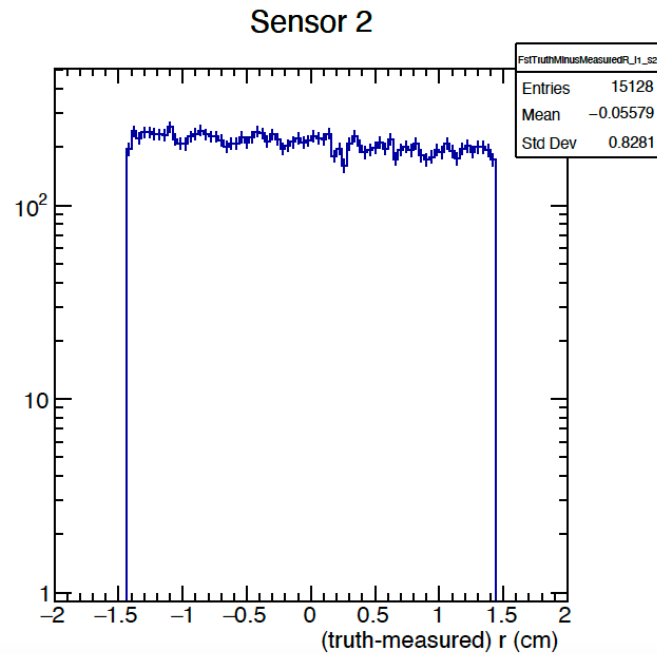
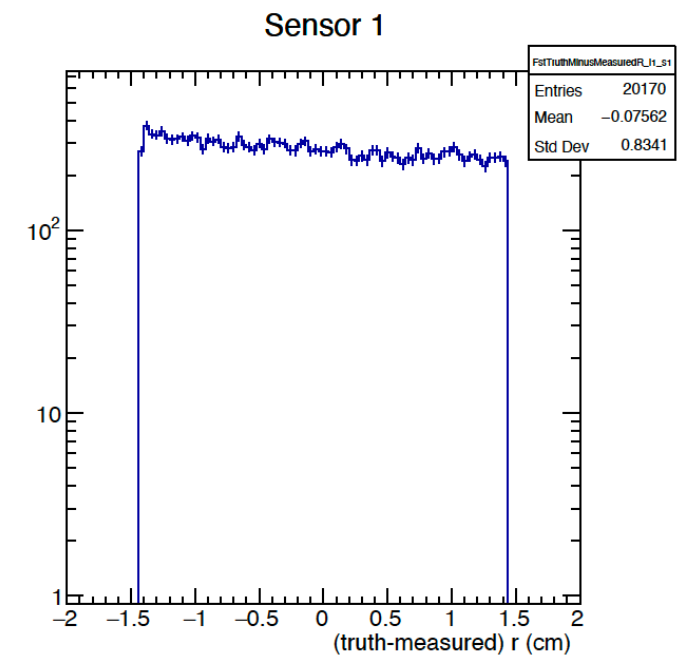
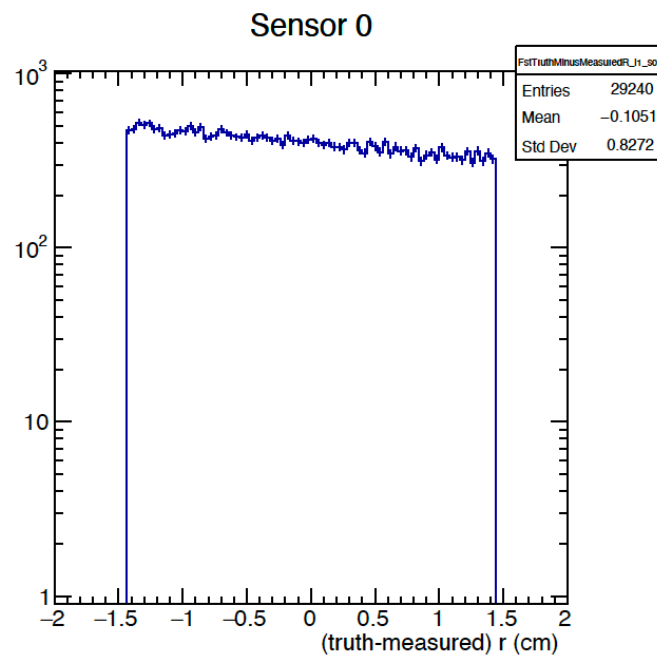


Sensor 3

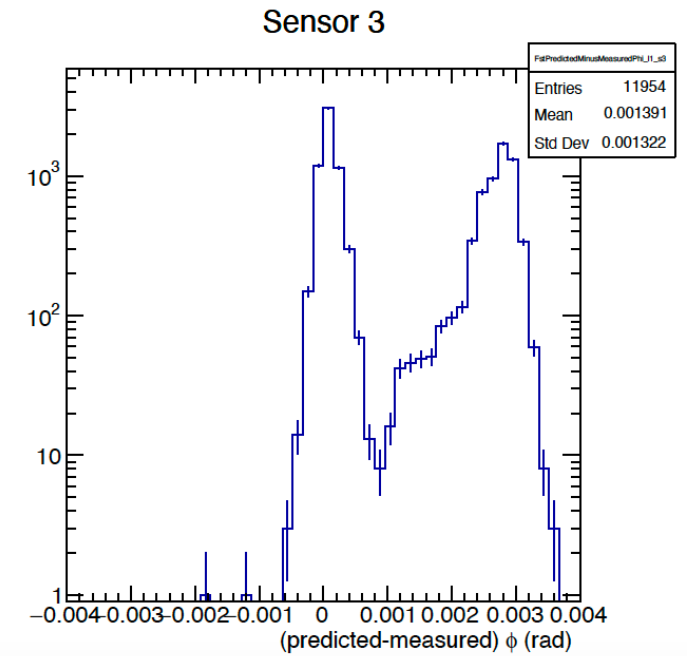
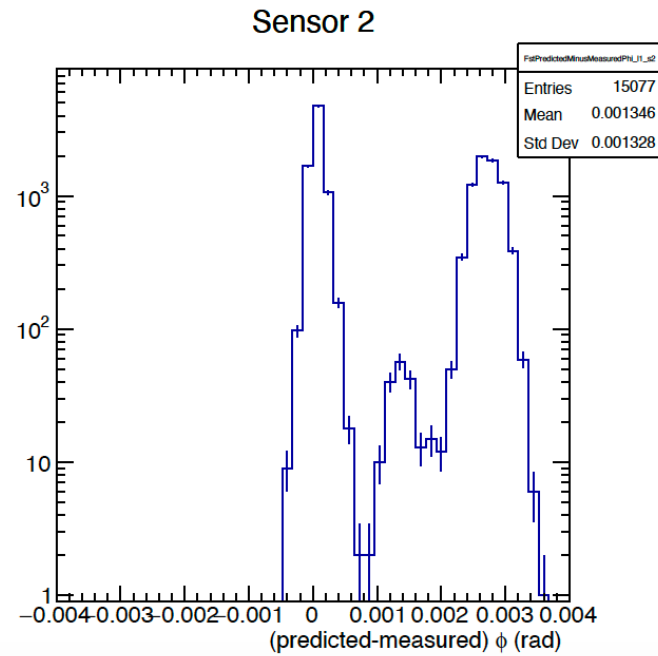
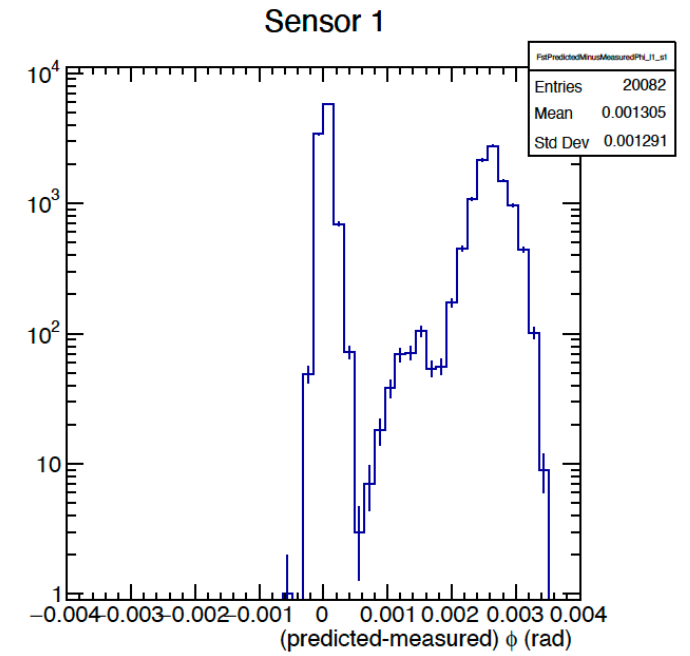
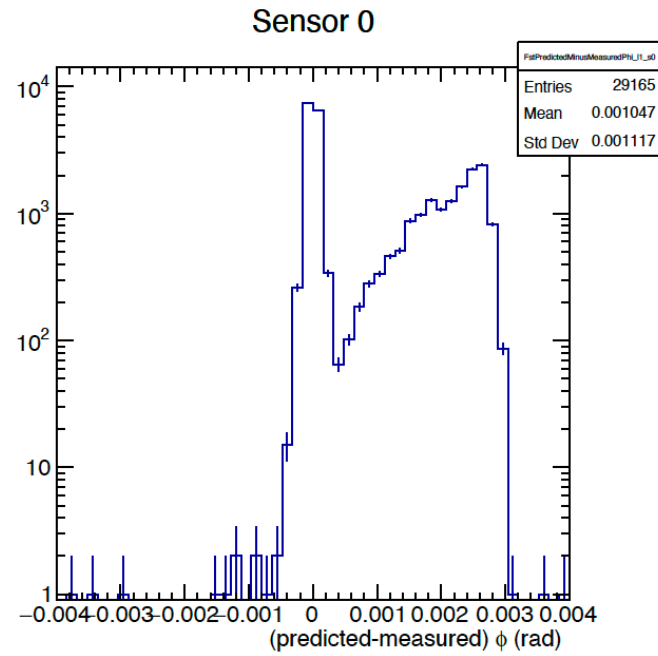


Ideal

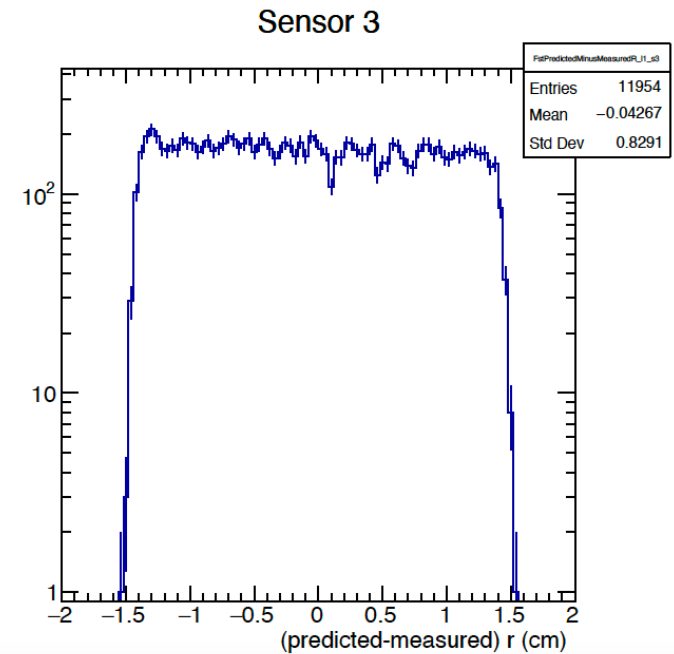
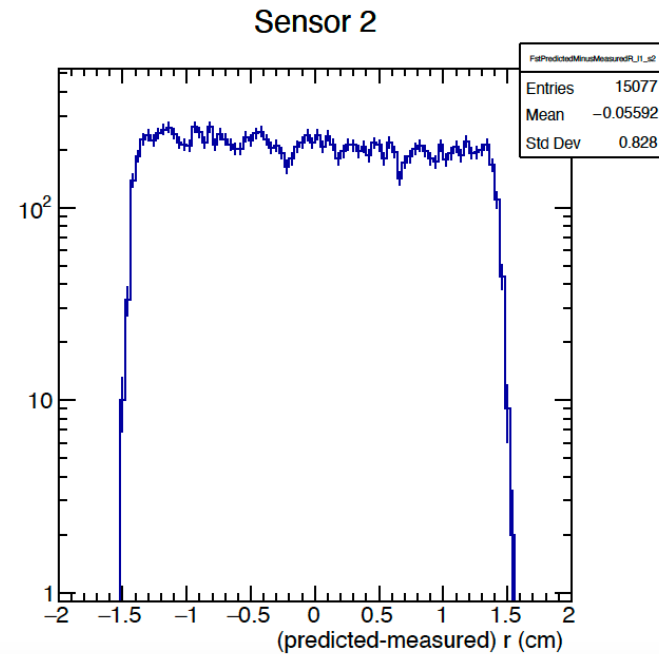
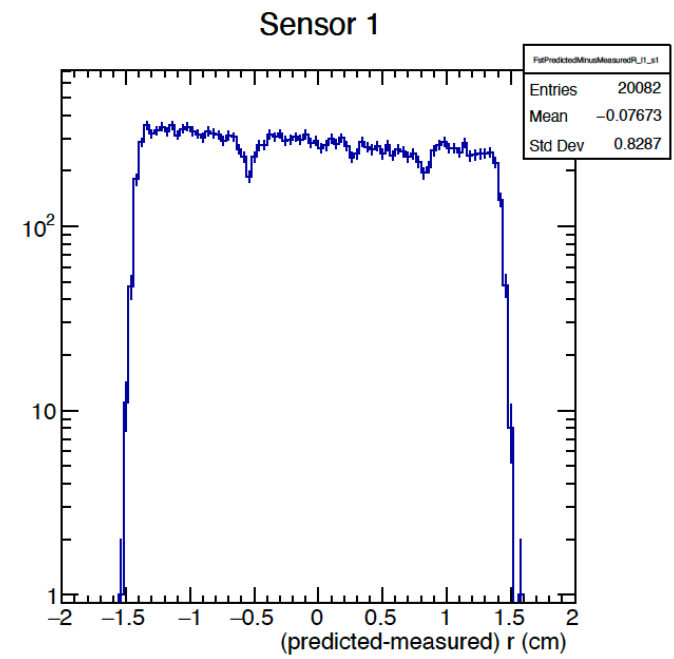
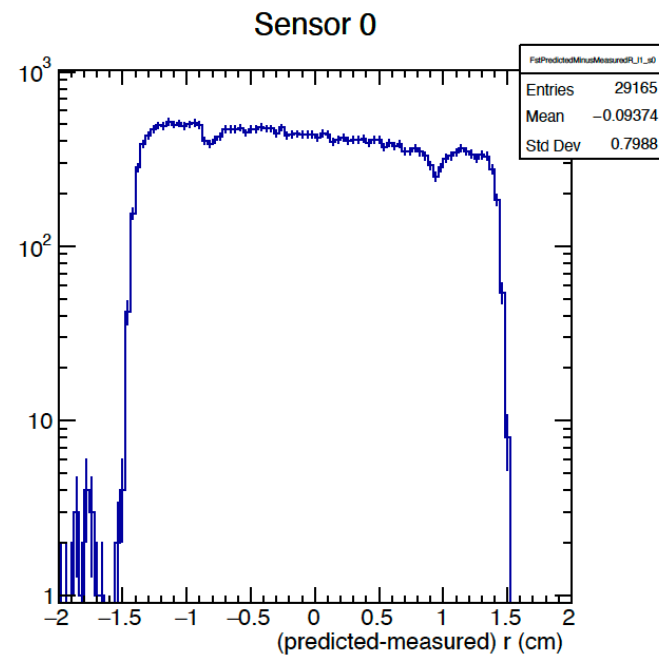
- Sensor 36



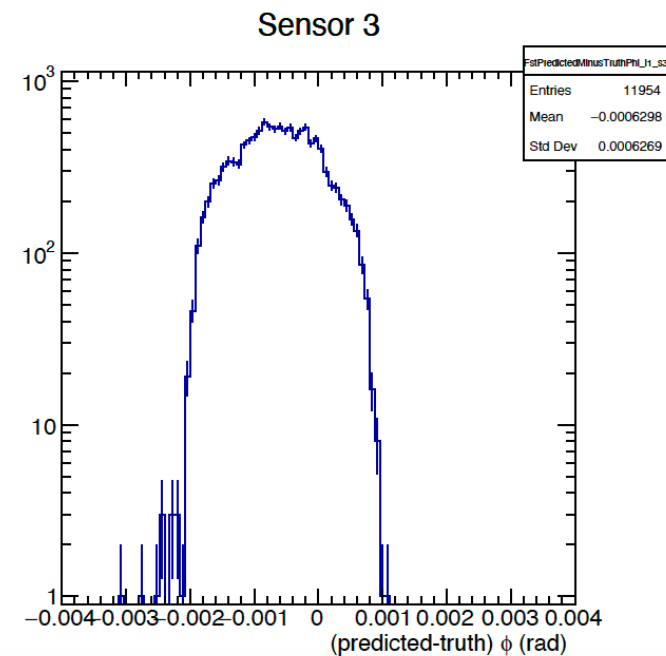
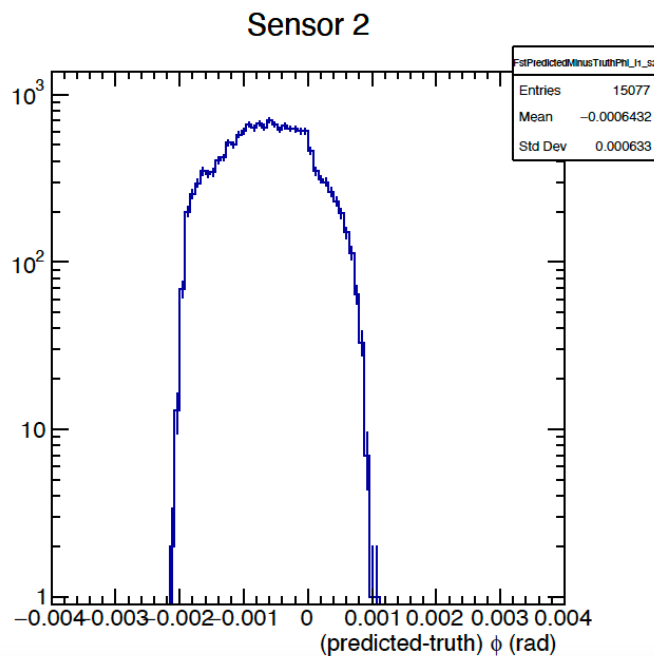
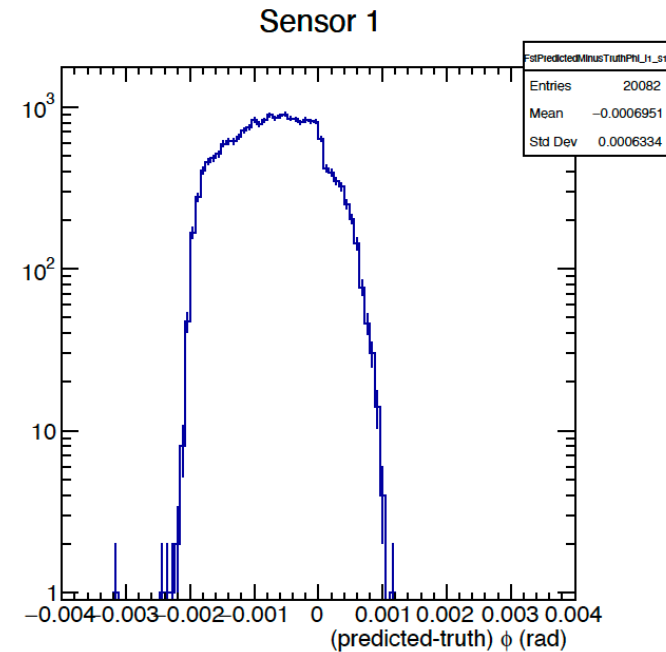
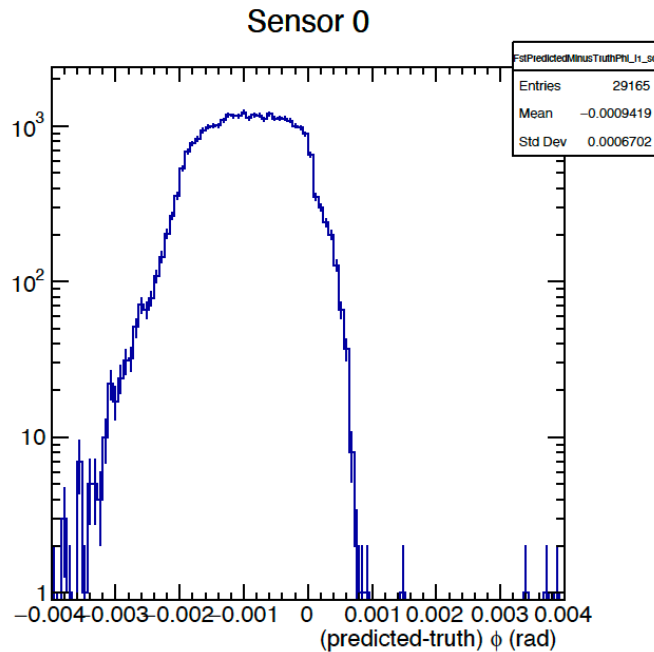
- Sensor 36
- 2 mrad rotation around z-axis



- Sensor 36
- 2 mrad rotation around z-axis

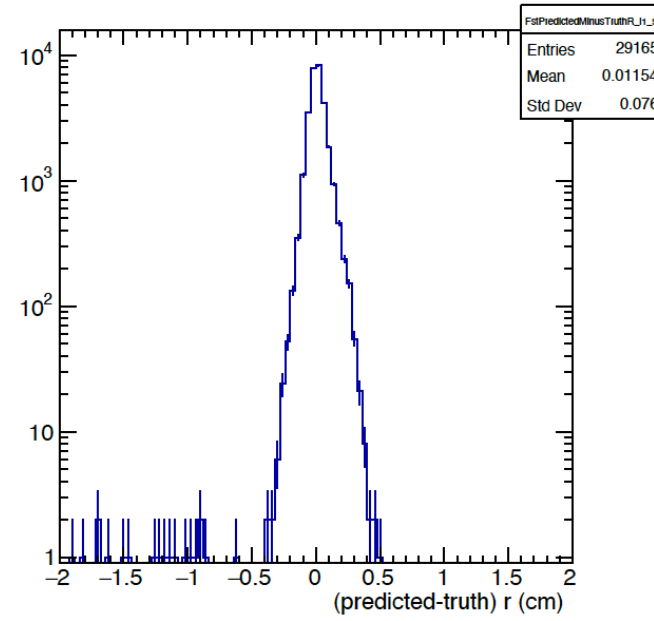


- Sensor 36
- 2 mrad rotation around z-axis

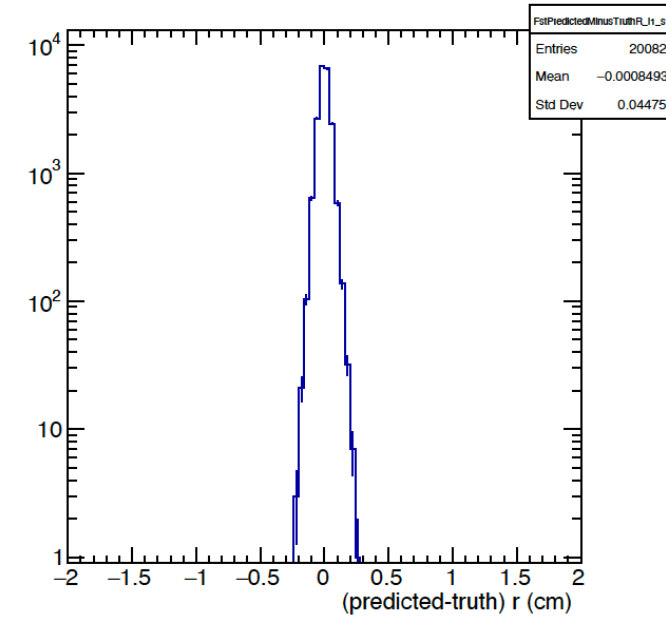


- Sensor 36
- 2 mrad rotation around z-axis

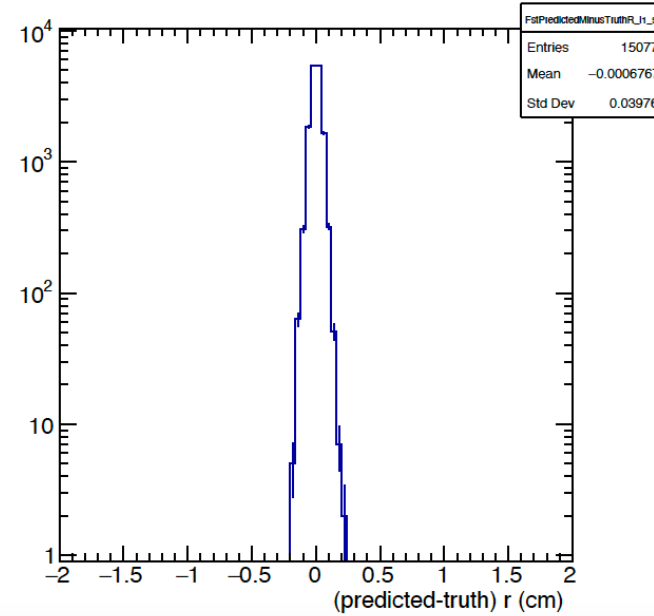
Sensor 0



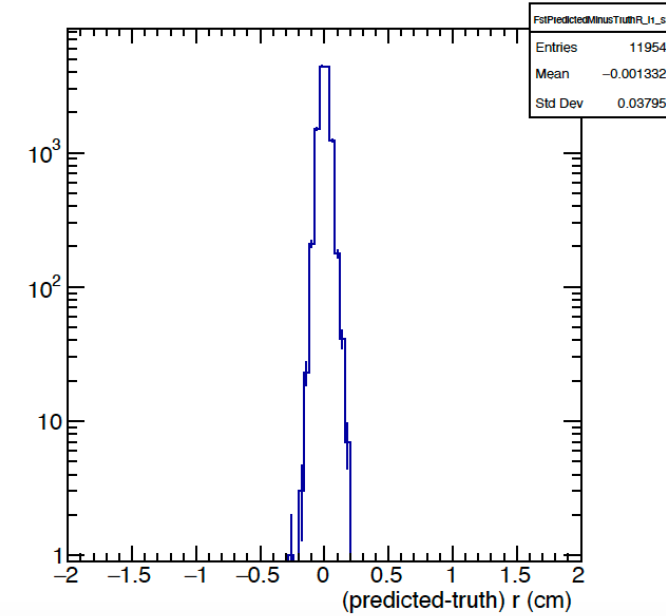
Sensor 1



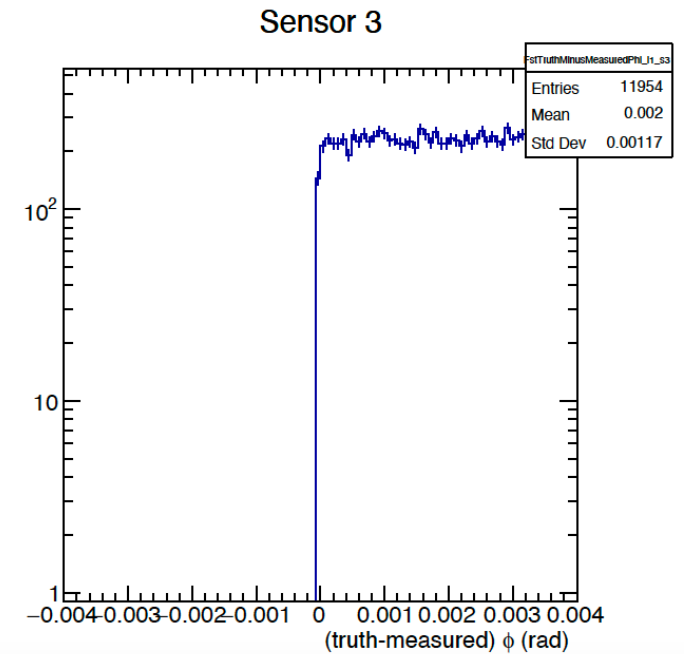
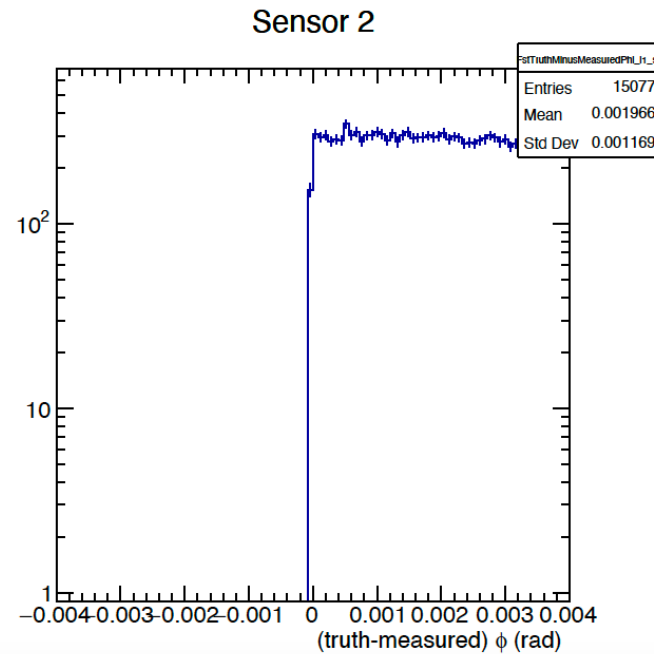
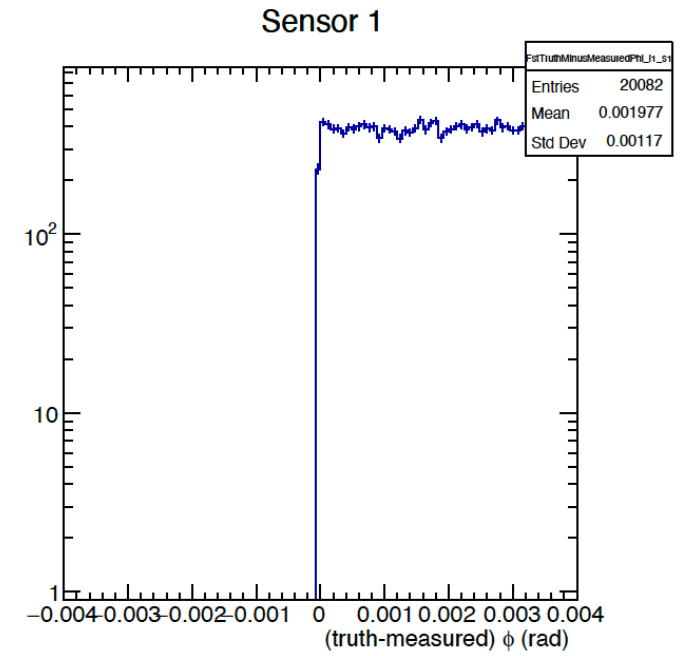
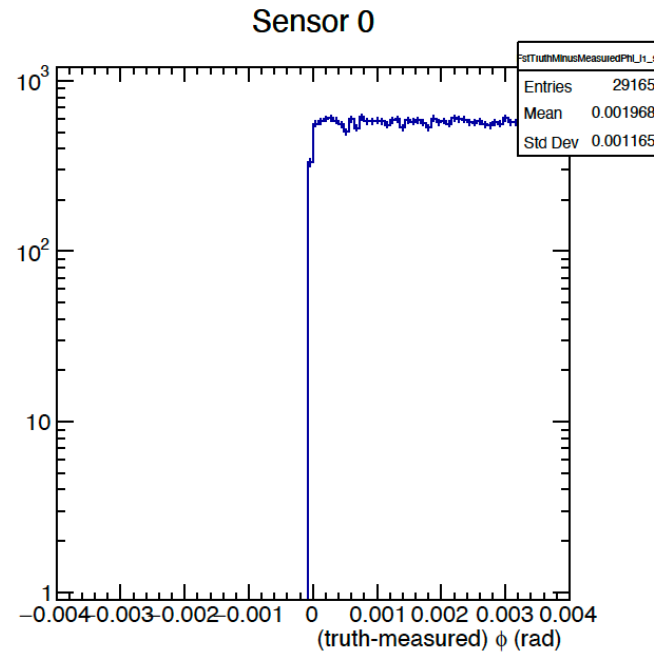
Sensor 2



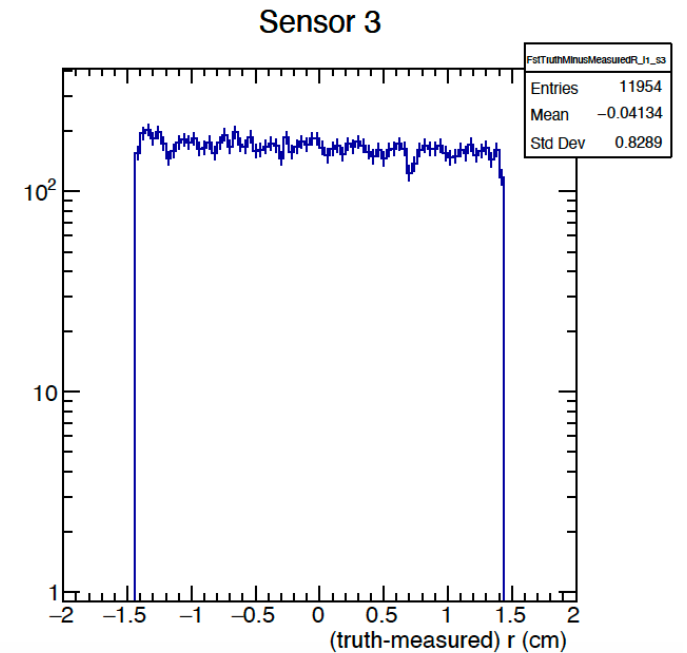
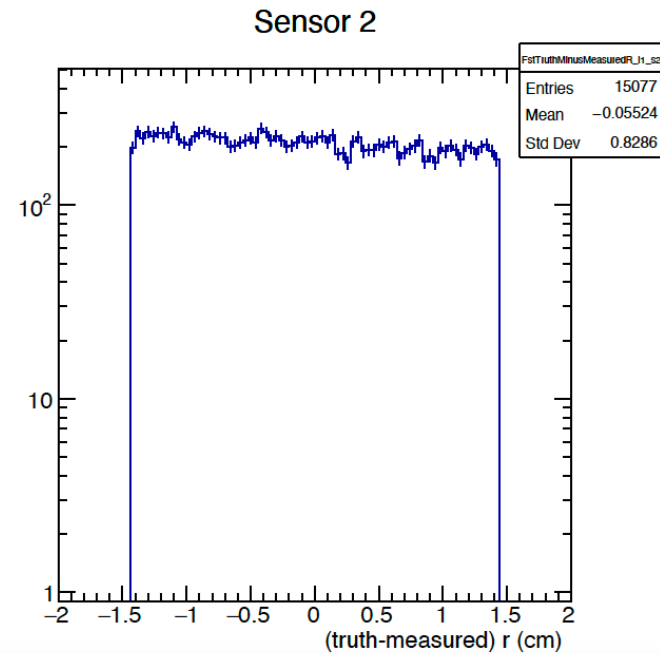
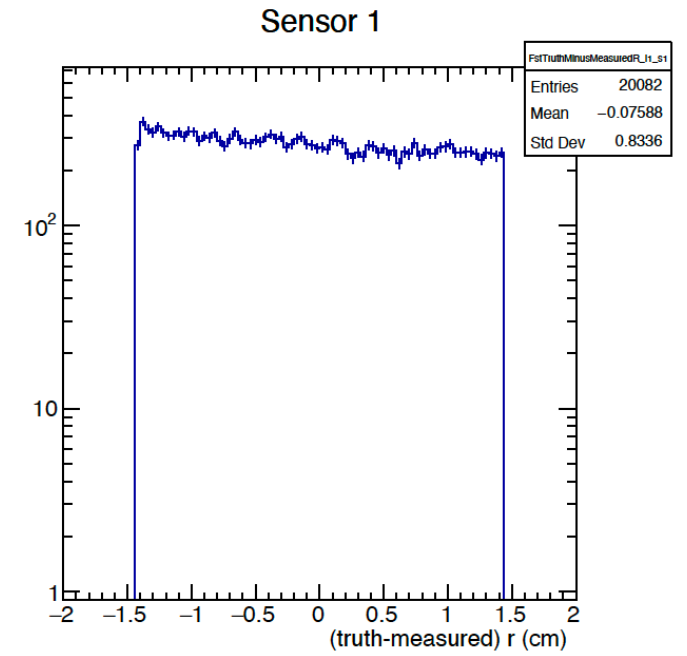
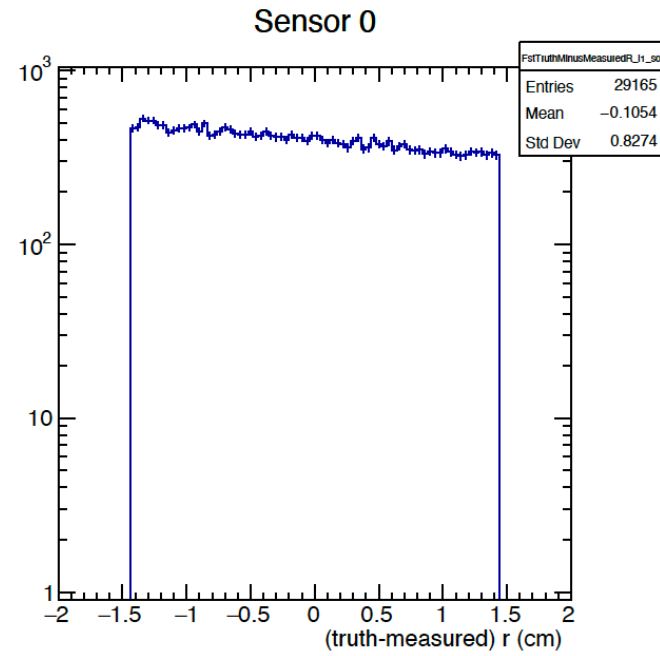
Sensor 3



- Sensor 36
- 2 mrad rotation around z-axis

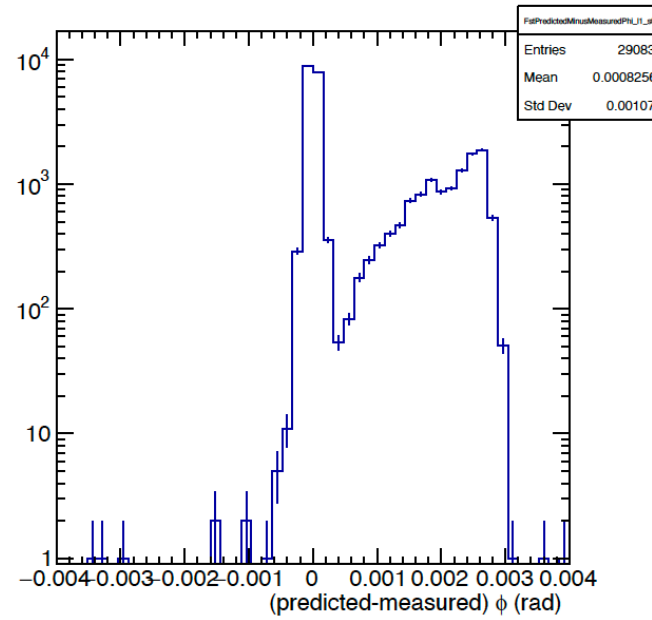


- Sensor 36
- 2 mrad rotation around z-axis

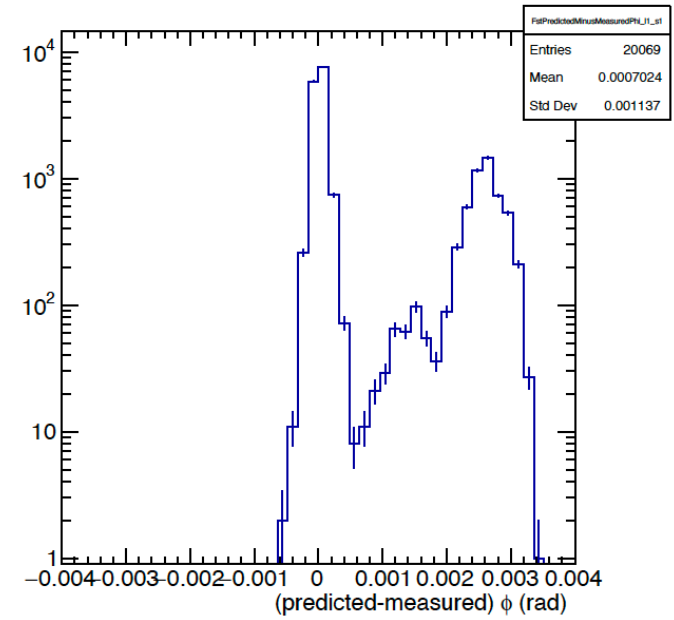


- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$

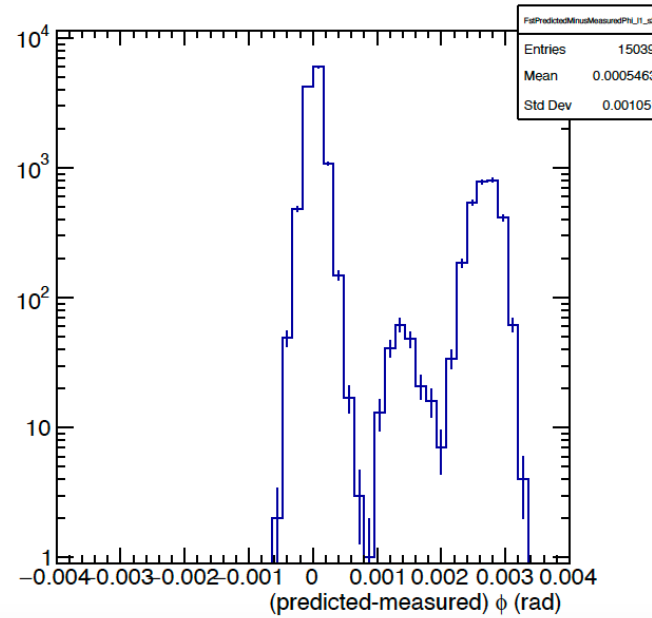
Sensor 0



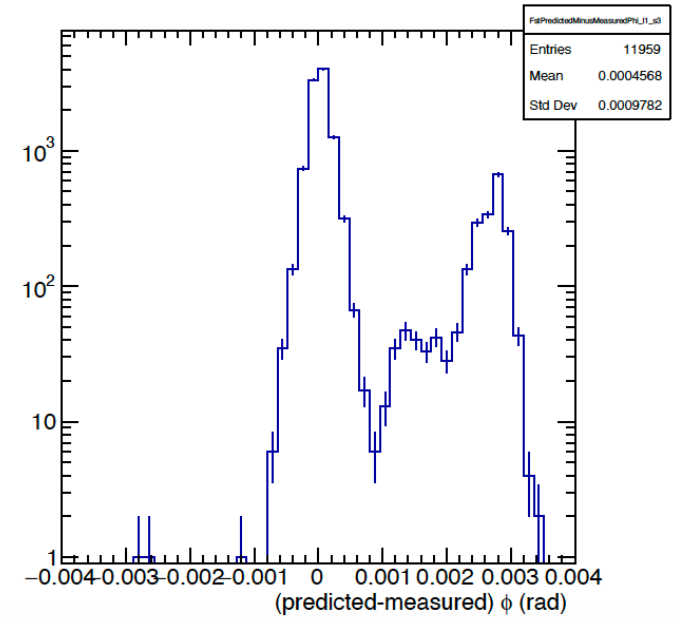
Sensor 1



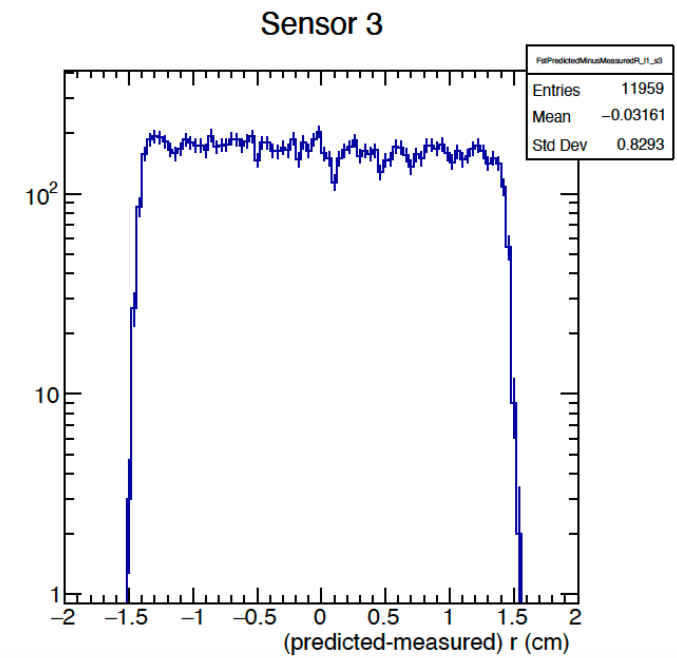
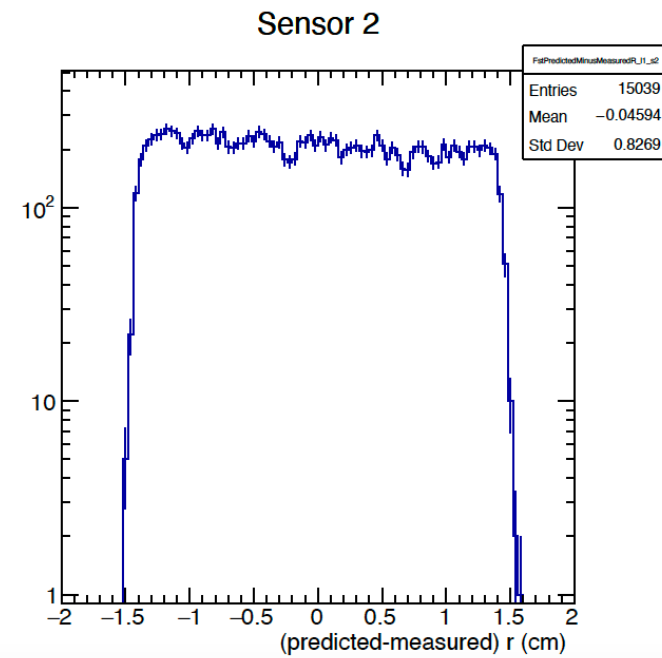
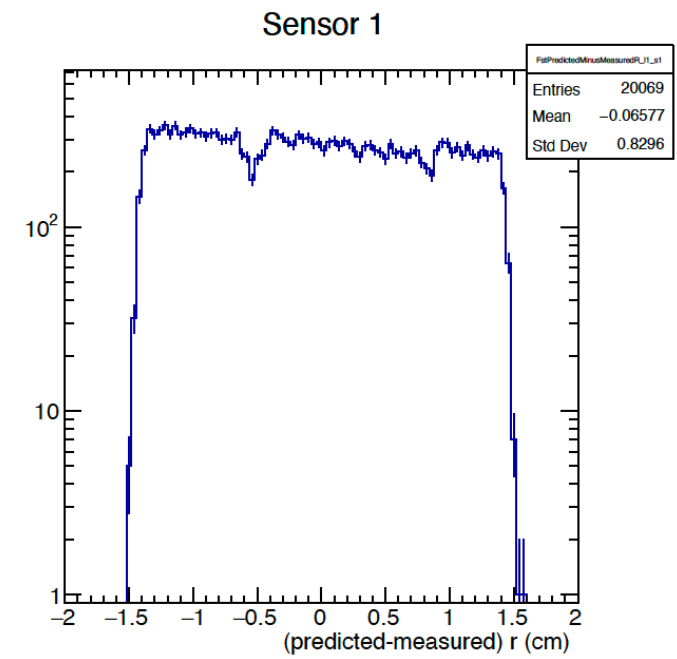
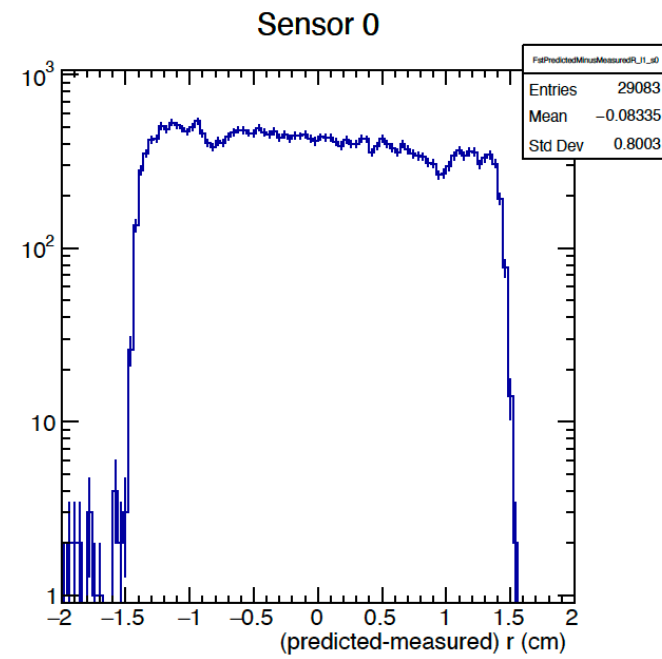
Sensor 2



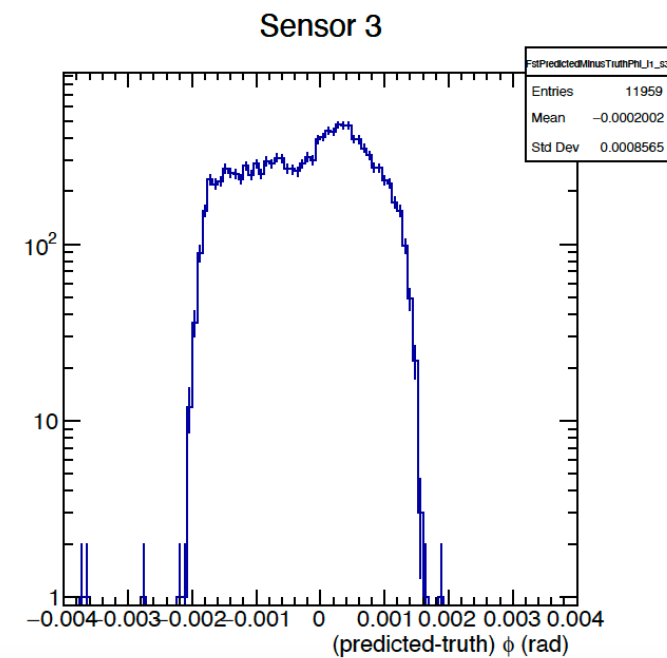
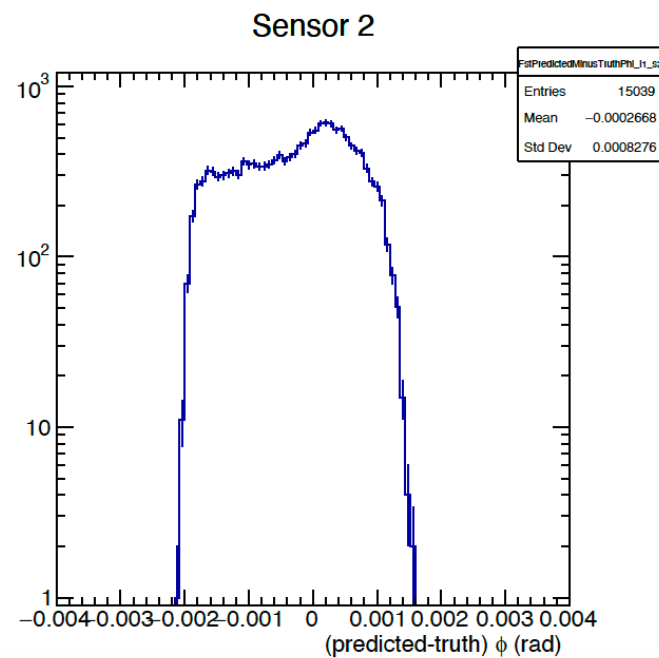
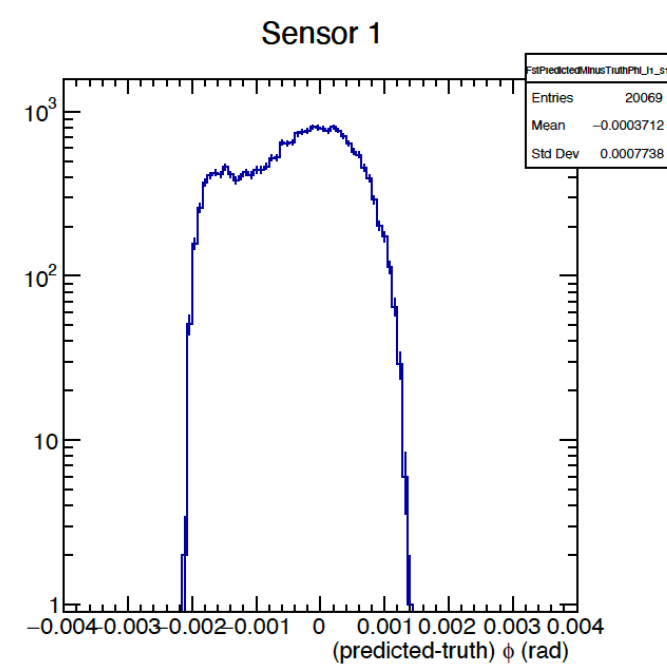
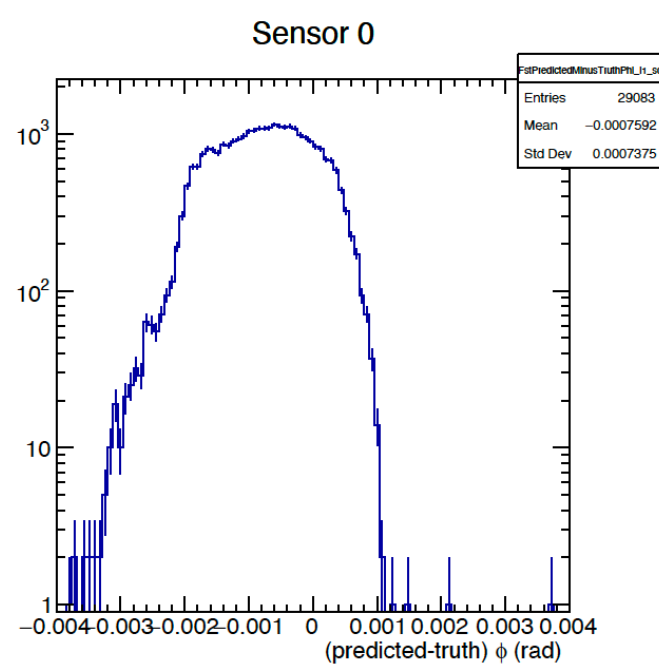
Sensor 3



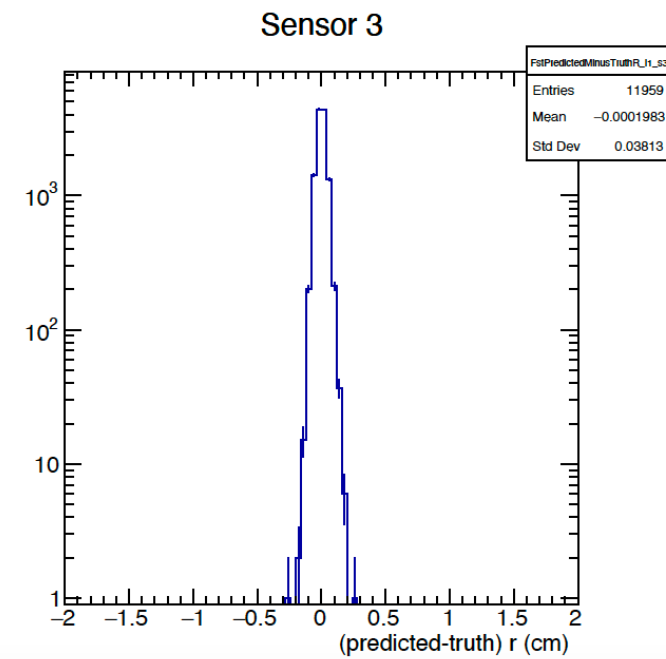
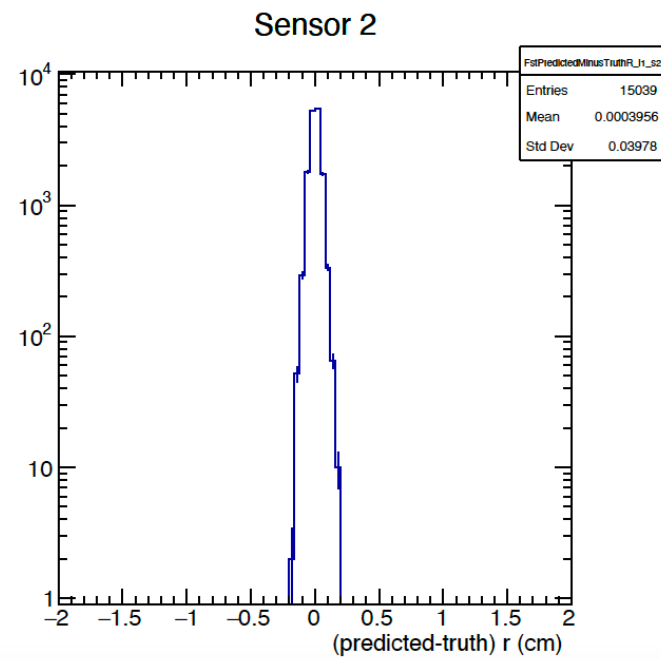
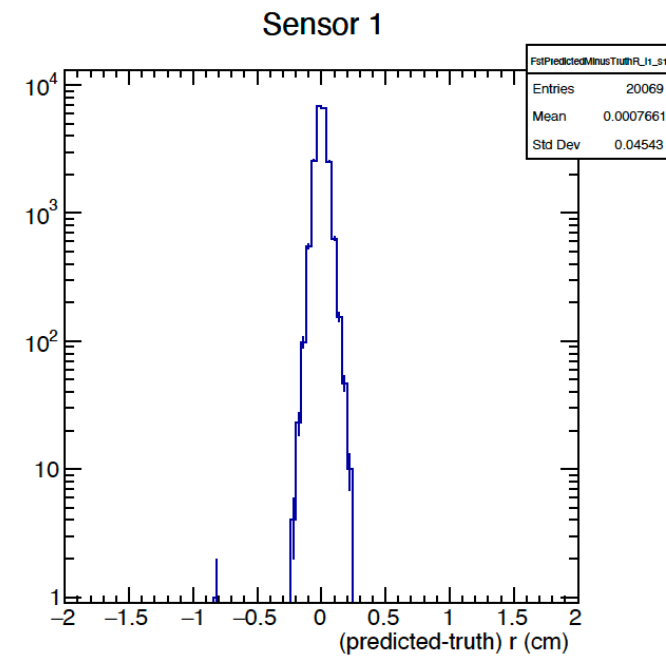
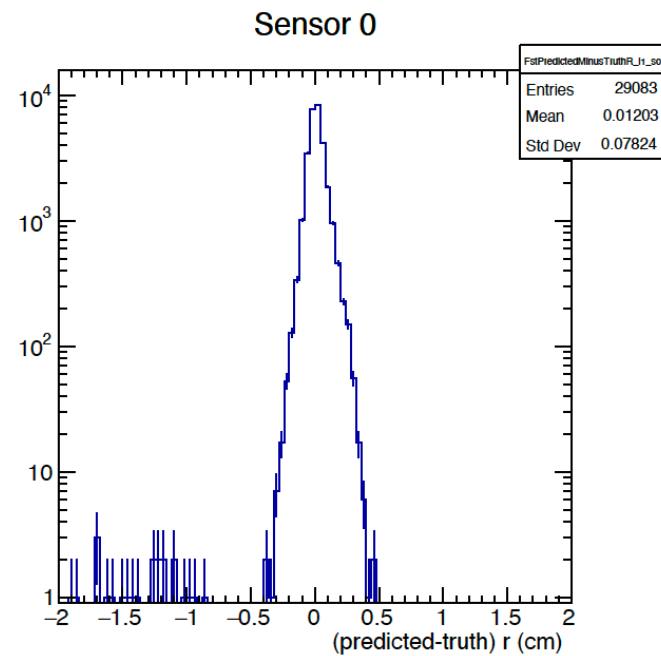
- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$



- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$

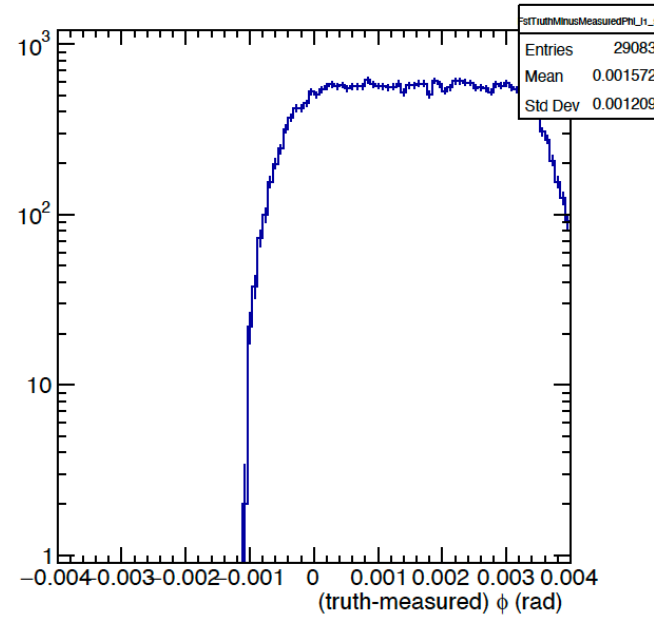


- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$

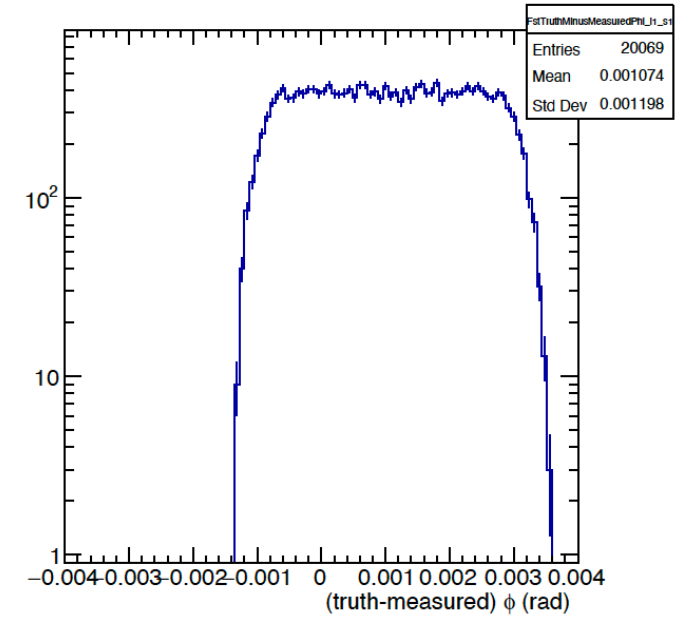


- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$

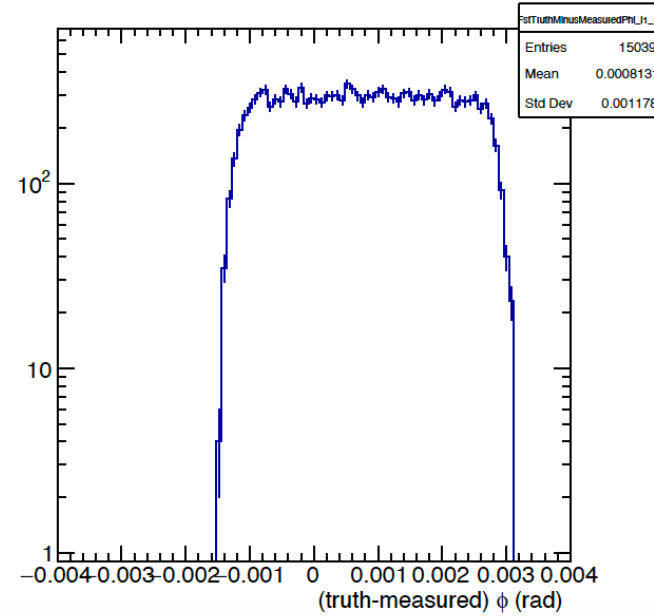
Sensor 0



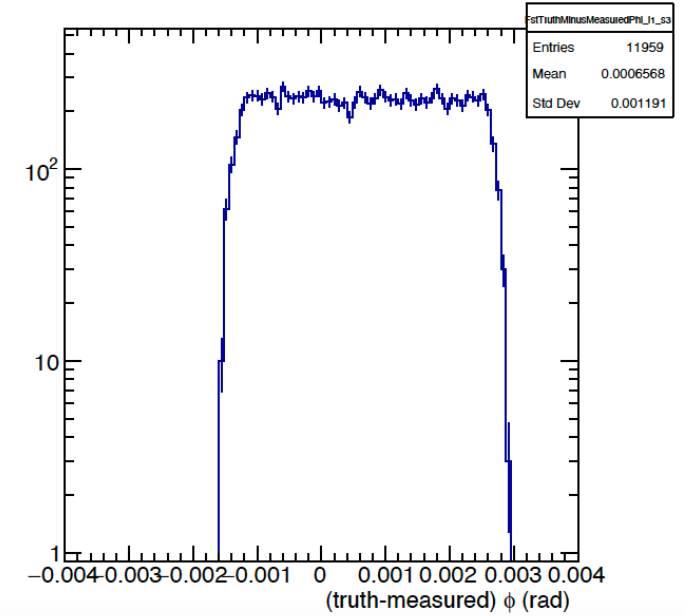
Sensor 1



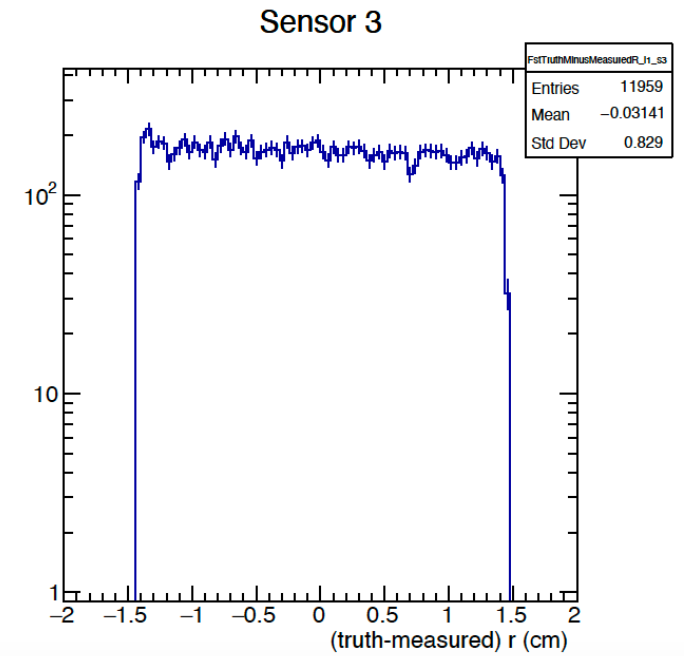
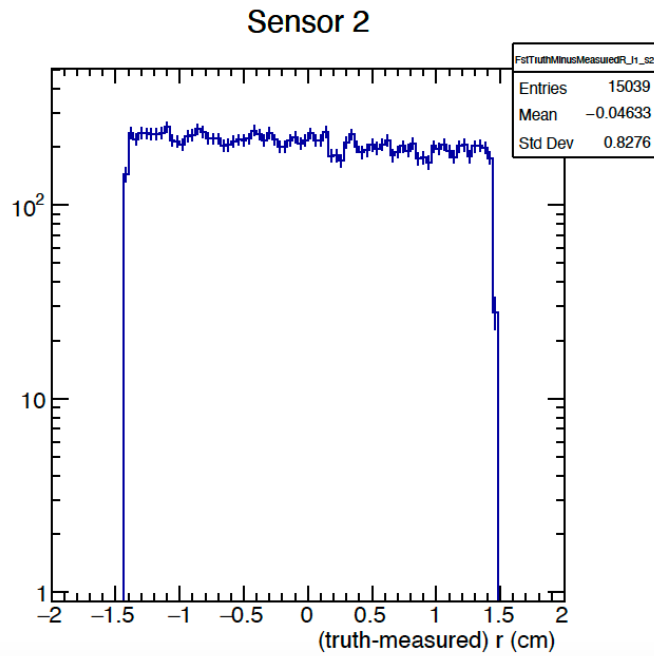
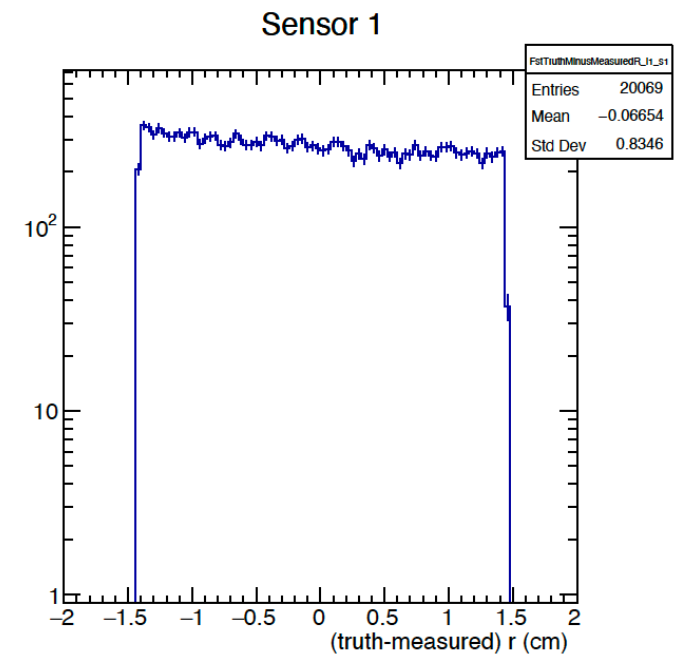
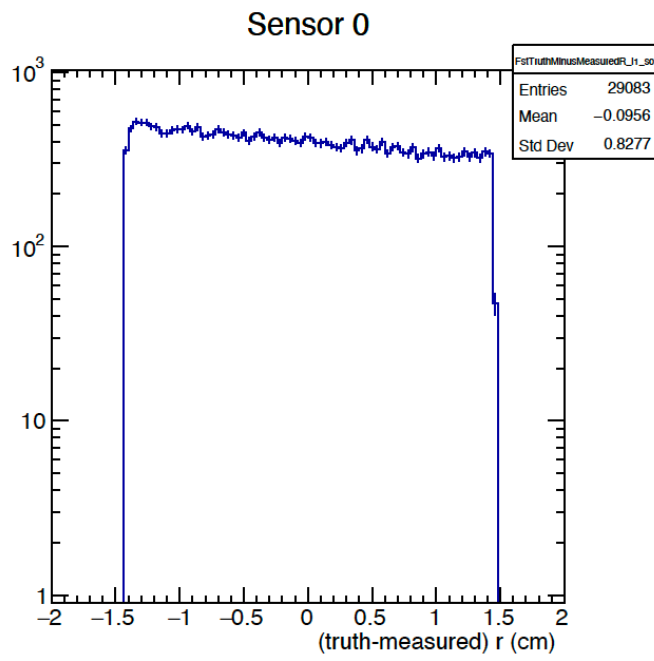
Sensor 2



Sensor 3

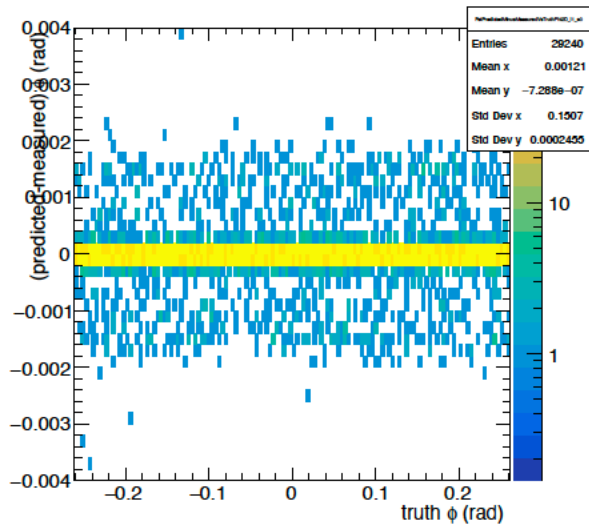


- Sensor 36
- $\Delta u, \Delta v = 100 \mu\text{m}$

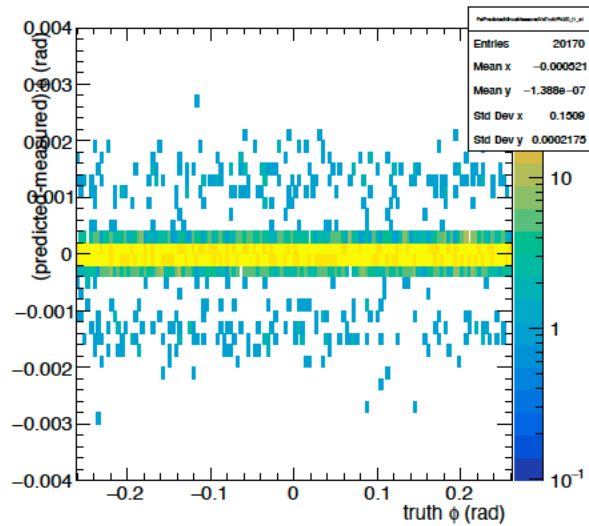


$p_T = [4.99, 5.0] \text{ GeV}/c$

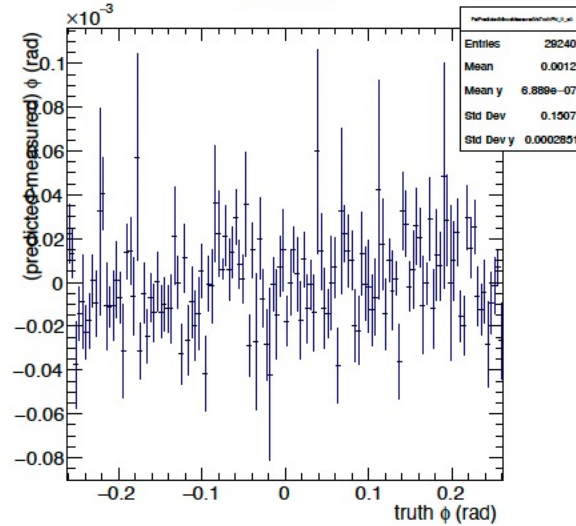
Sensor 0



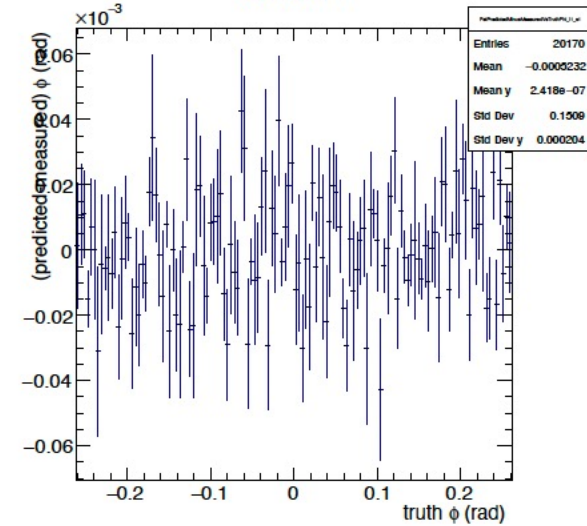
Sensor 1



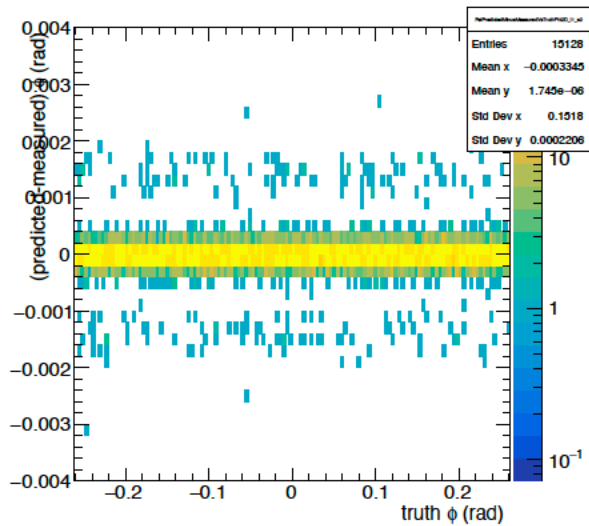
Sensor 0



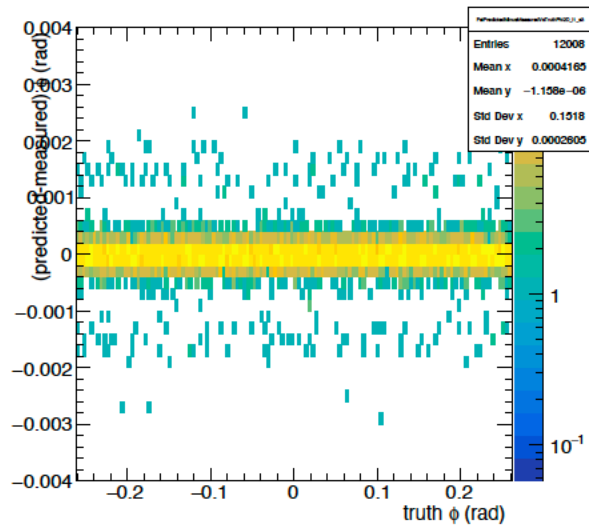
Sensor 1



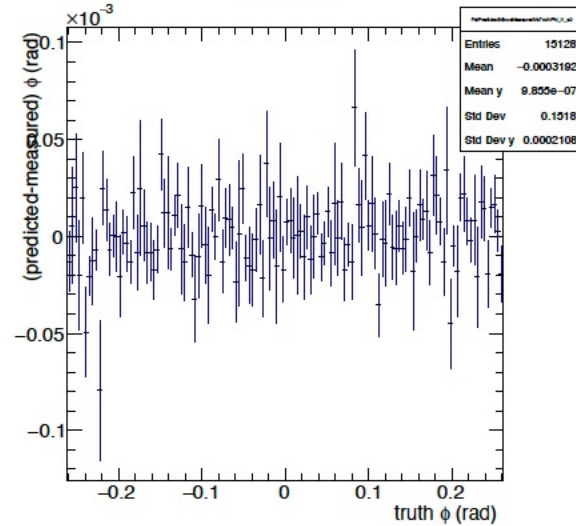
Sensor 2



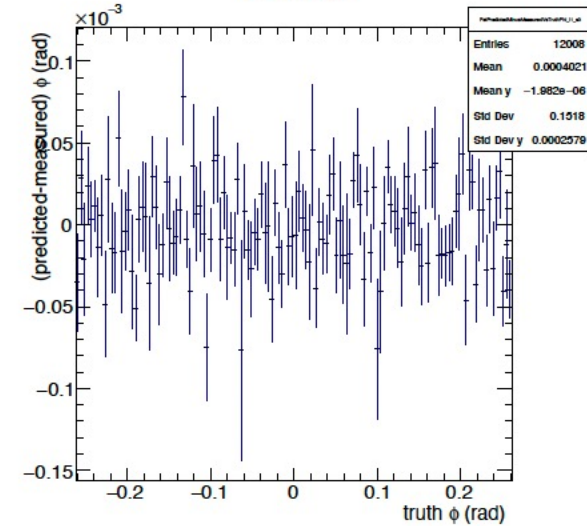
Sensor 3



Sensor 2



Sensor 3



$p_T = [0.2, 2.0]$ GeV/c

Parameter	Input	Output	Error	Global Corr.
Δu (μm)	50.0	47.7	3.1	
Δv (μm)	50.0	30.2	1.6	
$\Delta\gamma$ (mrad)	2.00	2.07	0.02	

$p_T = [4.99, 5.0]$ GeV/c

Parameter	Input	Output	Error	Global Corr.
Δu (μm)	50.0	43.8	2.8	0.006
Δv (μm)	50.0	32.3	1.4	0.955
$\Delta\gamma$ (mrad)	2.00	2.05	0.02	0.955

Parameter	Input	Output	Error	Global Corr.
Δu (μm)	50.0	43.4	2.8	0.004
Δv (μm)	50.0	43.0	1.4	0.955
$\Delta\gamma$ (mrad)	1.00	0.97	0.02	0.955

Parameter	Input	Output	Error	Global Corr.
Δu (μm)	0	-3.8	2.8	0.006
Δv (μm)	100.0	85.1	1.4	0.955
$\Delta\gamma$ (mrad)	1.00	1.05	0.02	0.955

Inner sensor (36)
Misaligned

More alignment results

$p_T = [4.99, 5.0] \text{ GeV}/c$

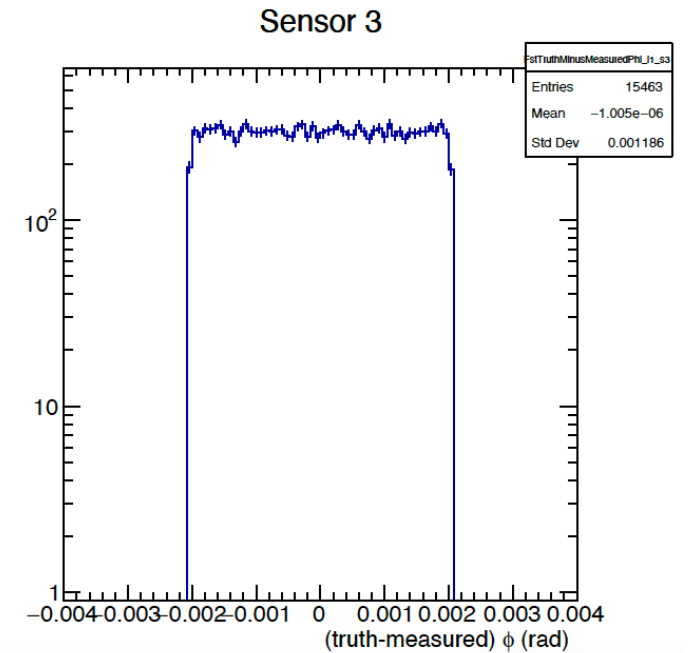
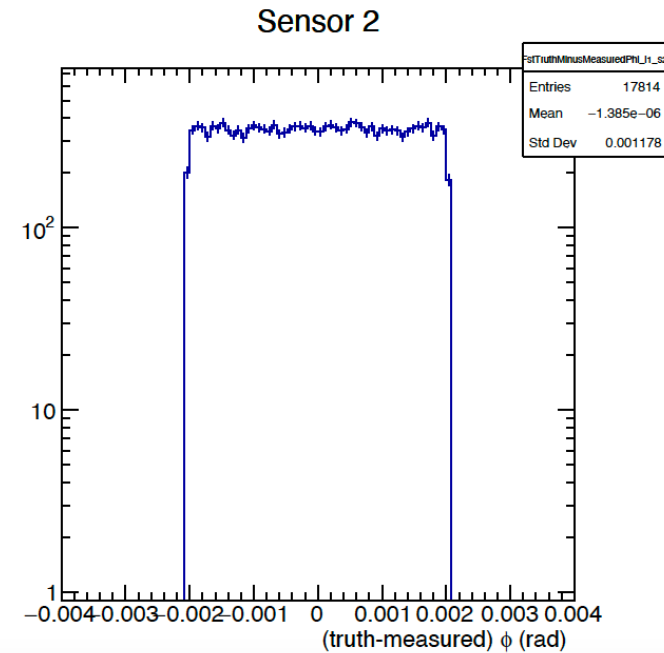
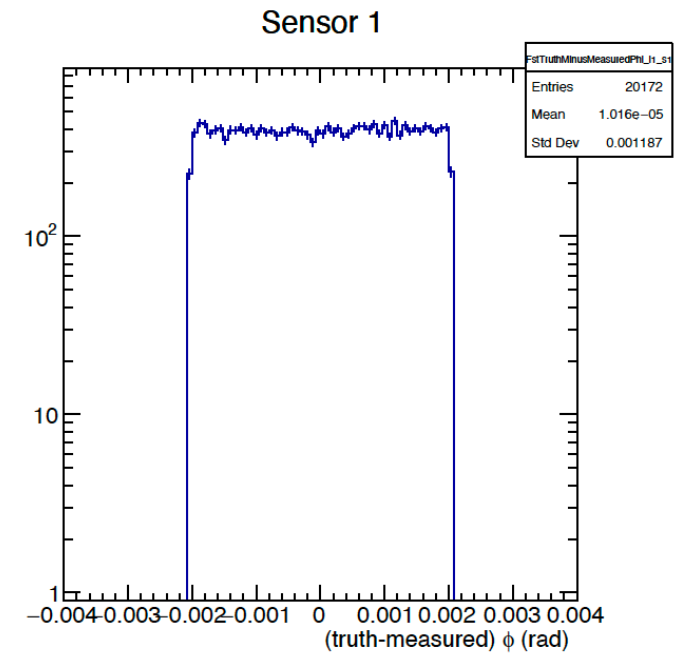
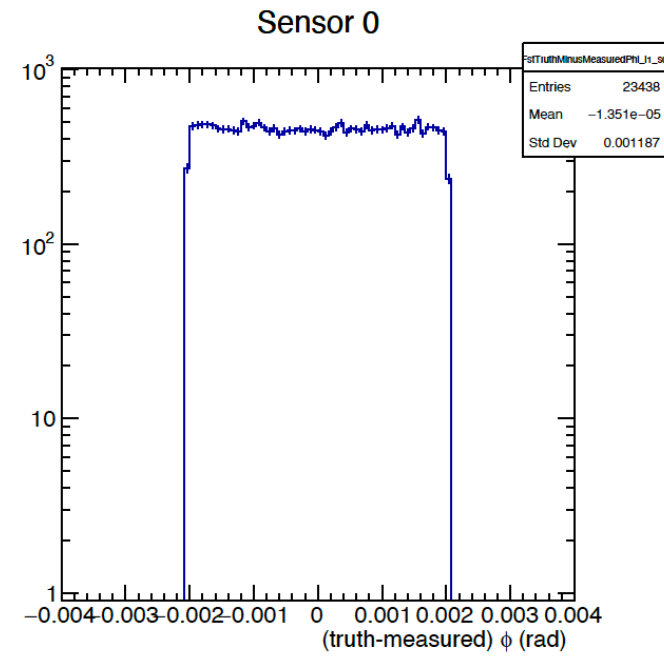
Parameter	Input	Output	Error	Global Corr.
$\Delta u \text{ (}\mu\text{m)}$	0.0	-2.1	2.7	0.004
$\Delta v \text{ (}\mu\text{m)}$	0.0	-13.6	1.4	0.955
$\Delta\gamma \text{ (mrad)}$	2.00	2.04	0.02	0.955

Parameter	Input	Output	Error	Global Corr.
$\Delta u \text{ (}\mu\text{m)}$	100.0	99.7	2.7	0.003
$\Delta v \text{ (}\mu\text{m)}$	100.0	90.0	1.4	0.955
$\Delta\gamma \text{ (mrad)}$	0.00	0.05	0.02	0.955

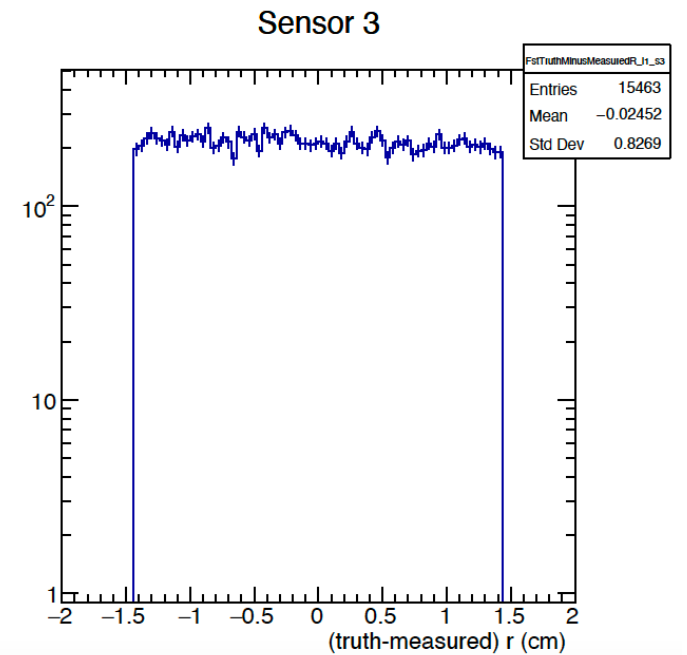
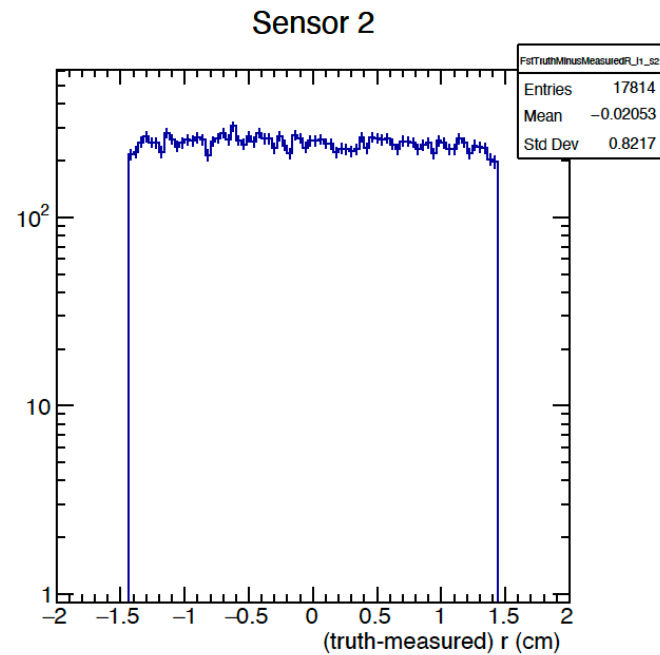
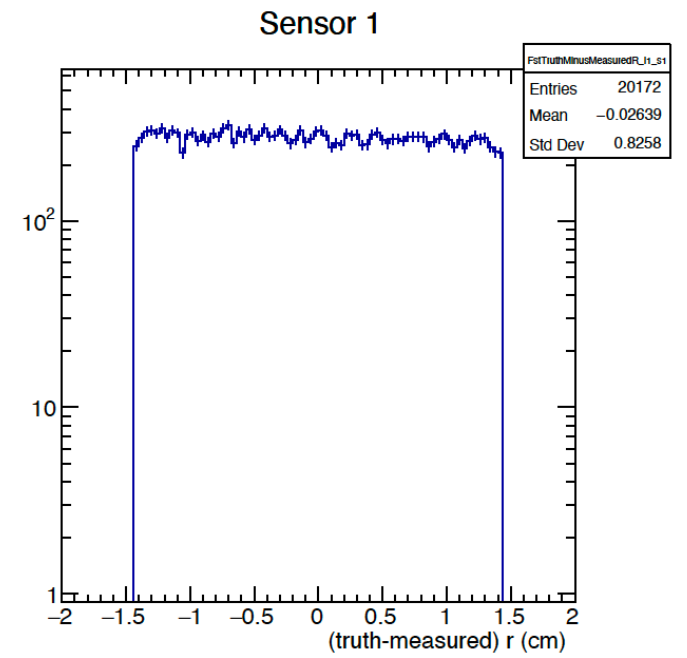
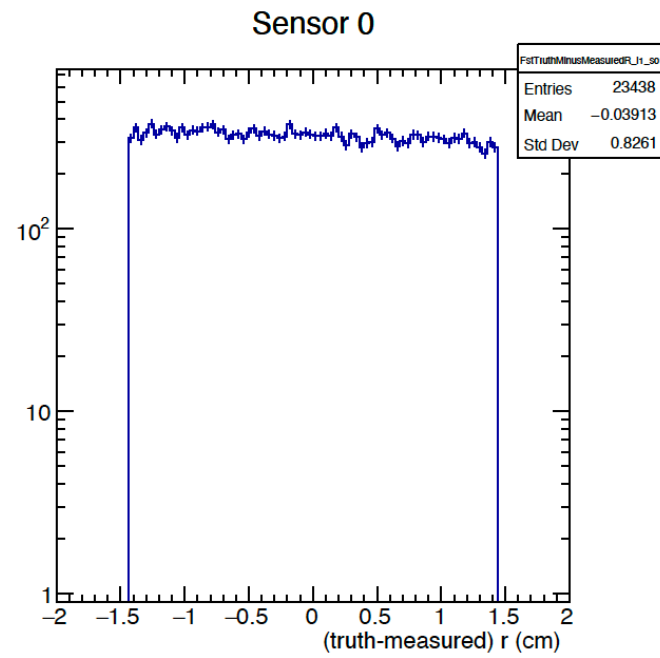
Single Sensor Alignment (outer)

- Misalign outer sensor (sensorIdx = 37 || 38) in FST simulated geometry.
- Throw mu+ with particle gun with following settings:
 - $4.99 < p_T < 5.0$ GeV/c (uniform)
 - $2.3 < \eta < 3.2$ (uniform)
 - $0.9 < \phi < 1.7$ rad (uniform)
 - $B = 0$ T
- Require hit on sensor 37 || 38. Also, all 4 sTGC (default Tracking requirement).
- Fit with GenFit Kalman filter and then refit with GenFit GBL.
- Fix rotations about u-axis and v-axis, in addition to w translation by setting pre-sigma < 0.0.
- Matrix inversion used to solve for alignment parameters.

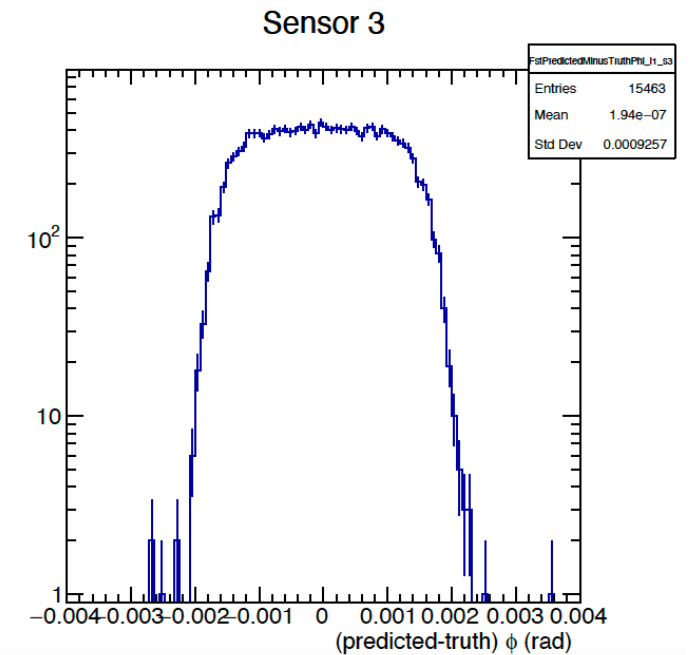
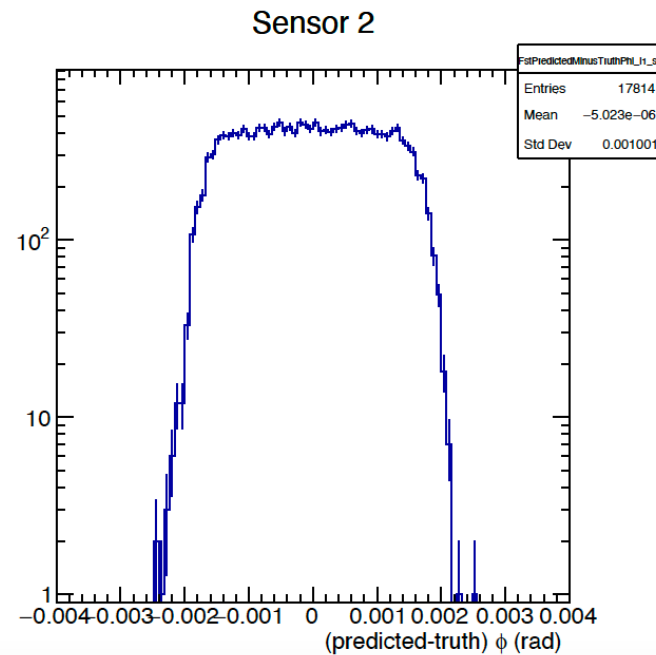
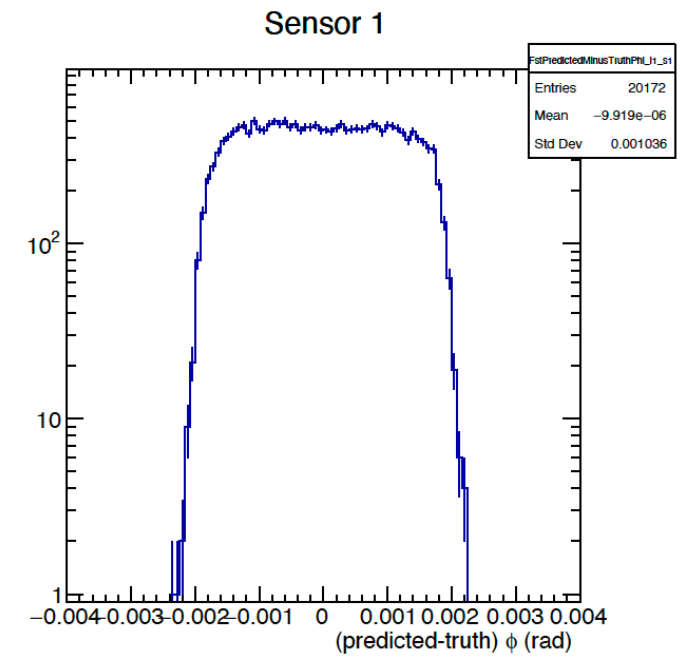
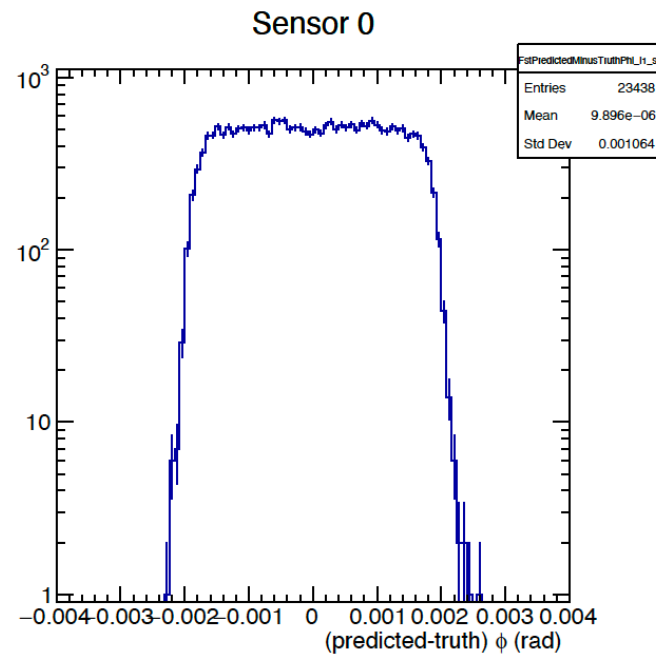
- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c



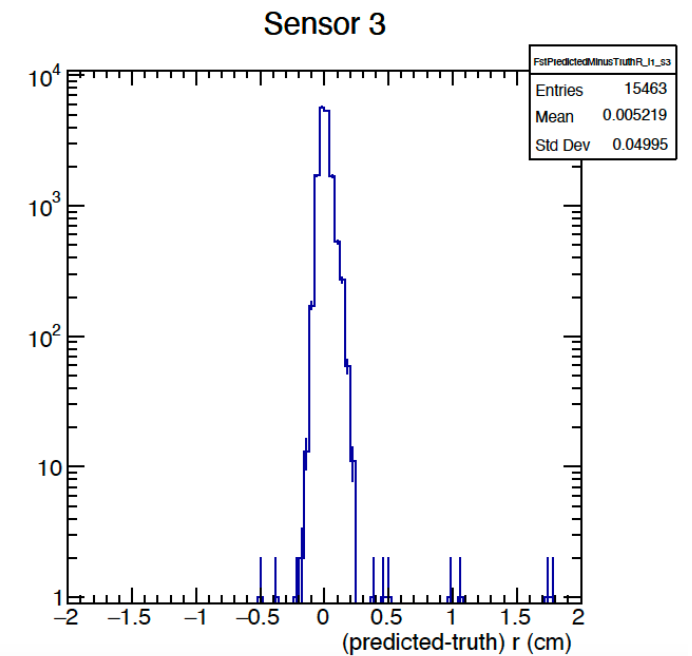
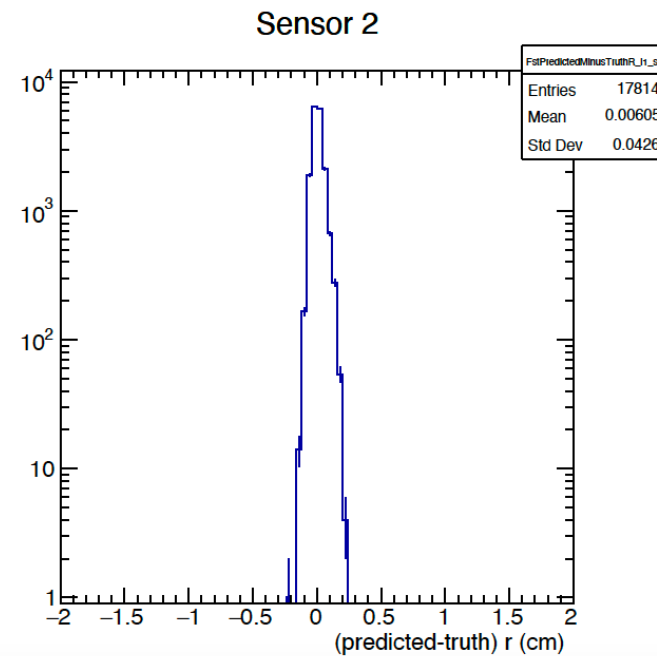
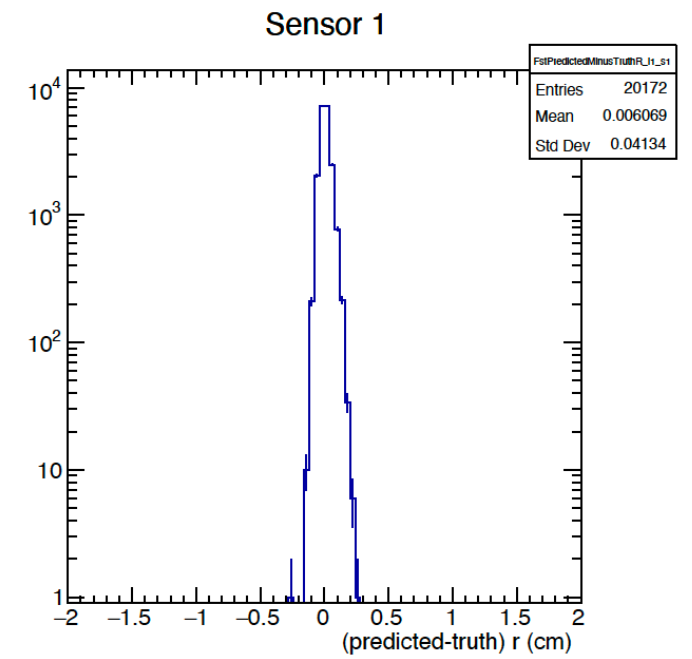
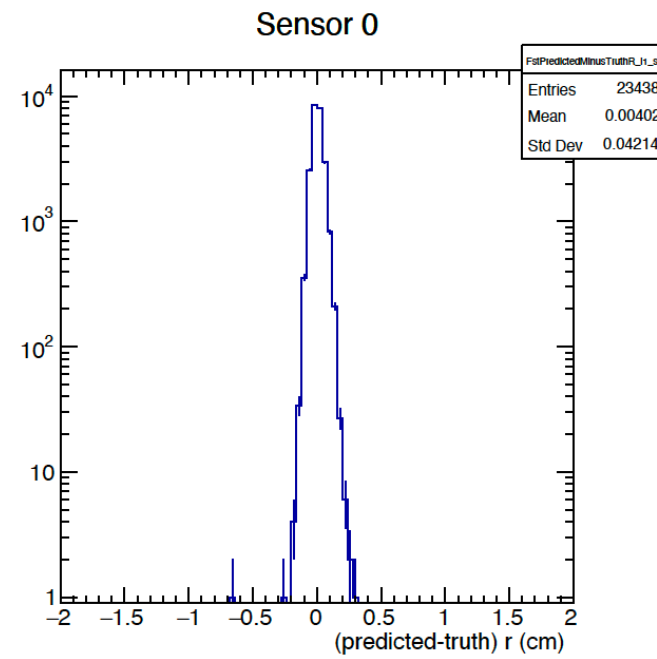
- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c



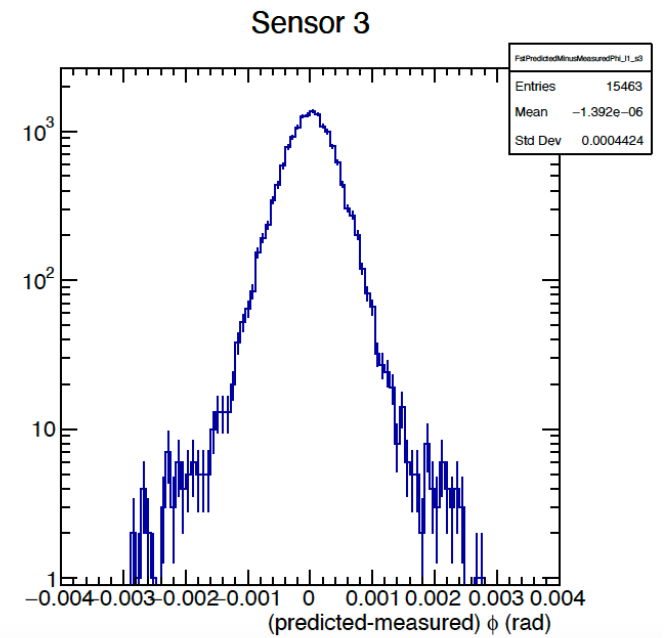
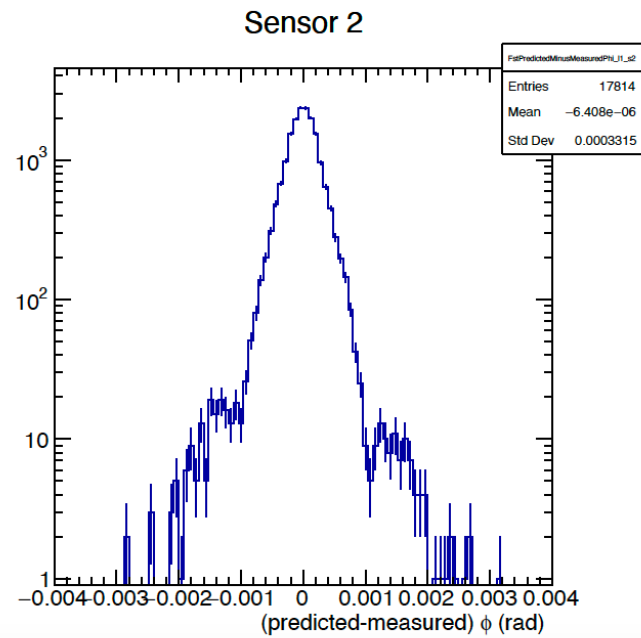
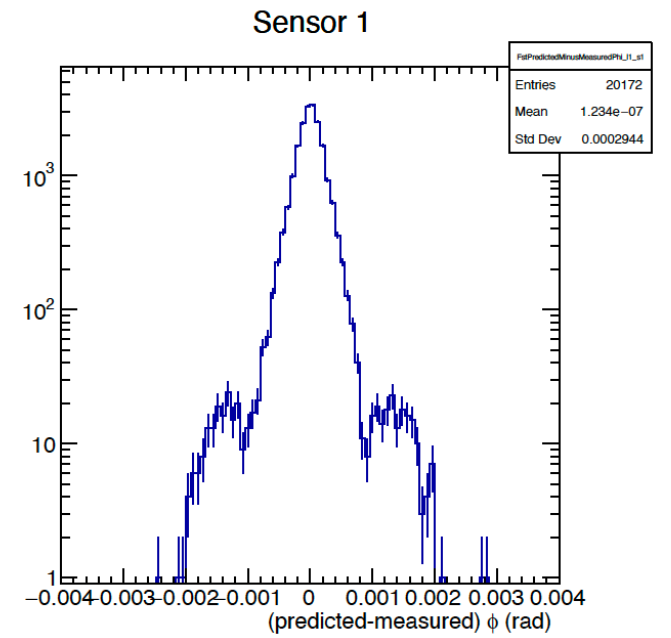
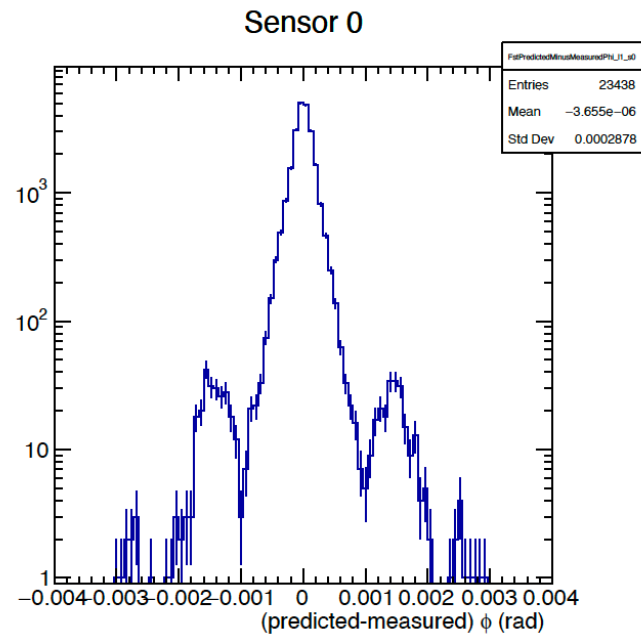
- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c



- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c

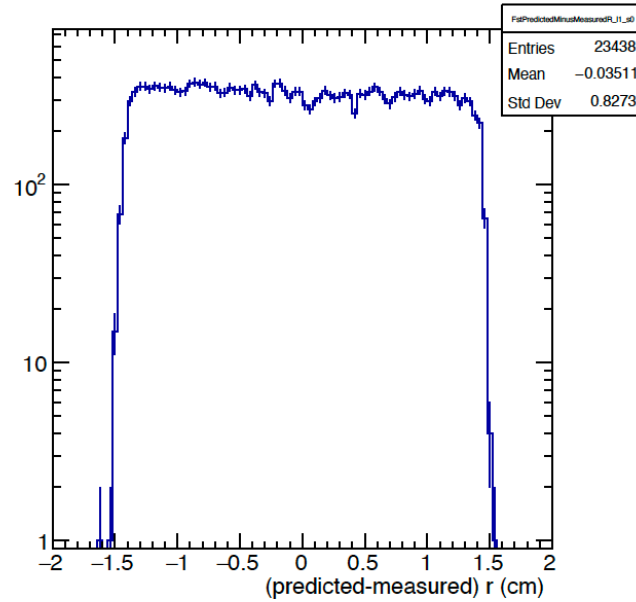


- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c

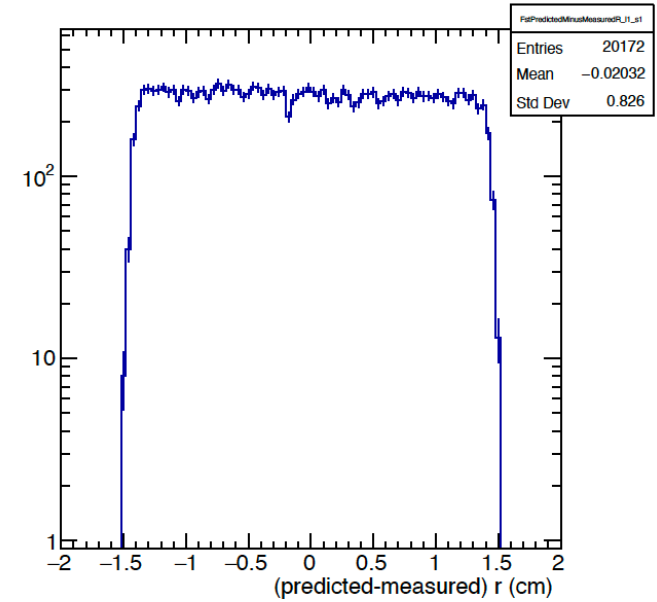


- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c

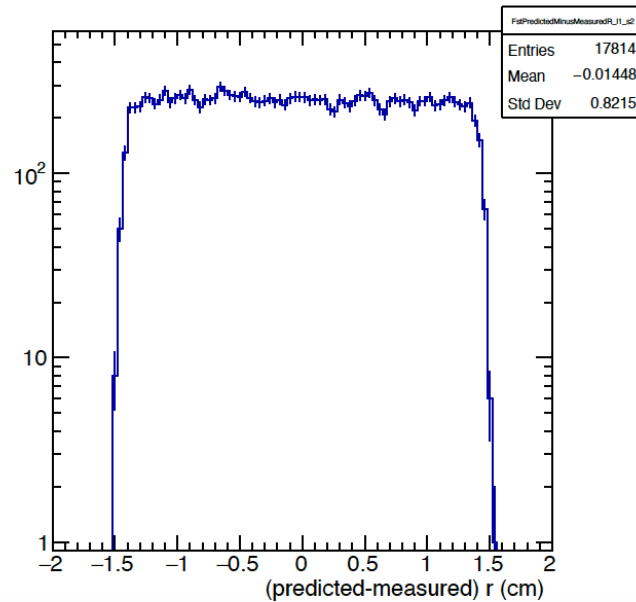
Sensor 0



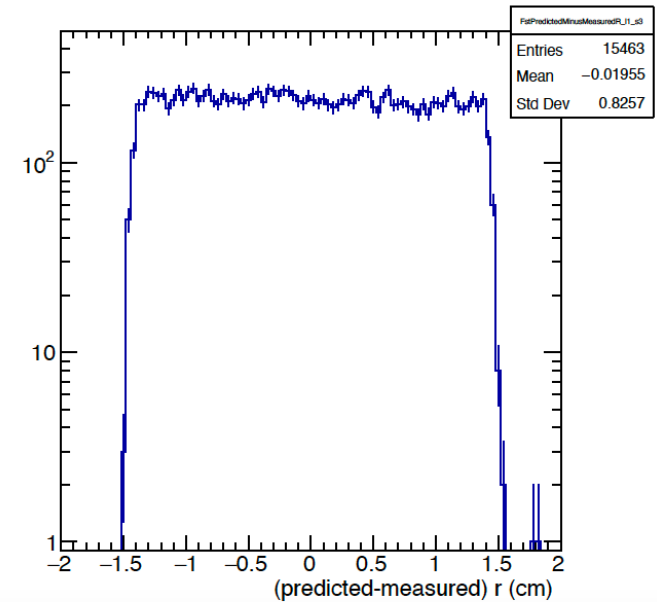
Sensor 1



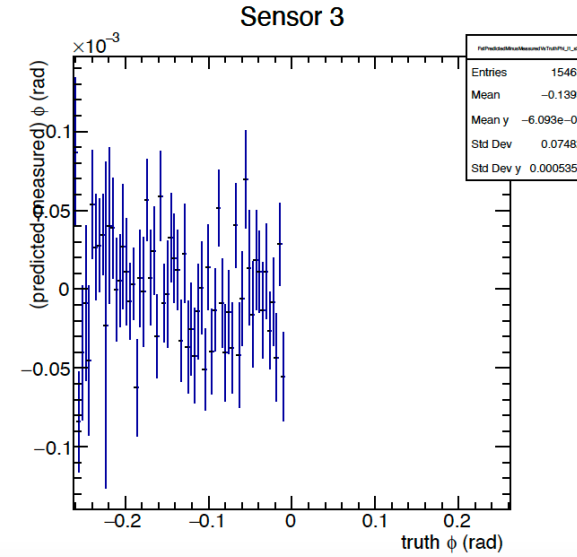
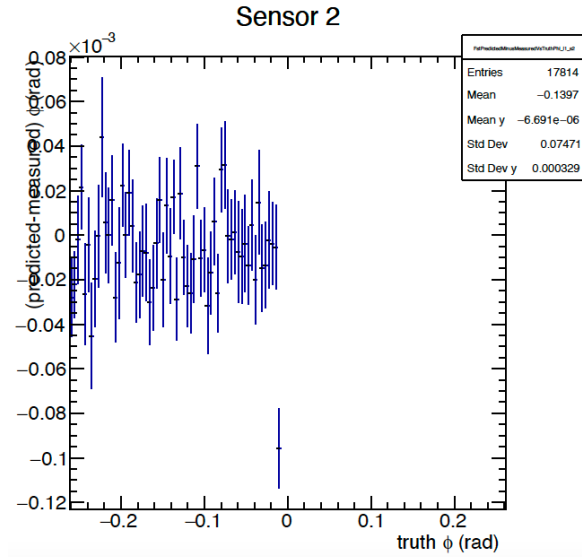
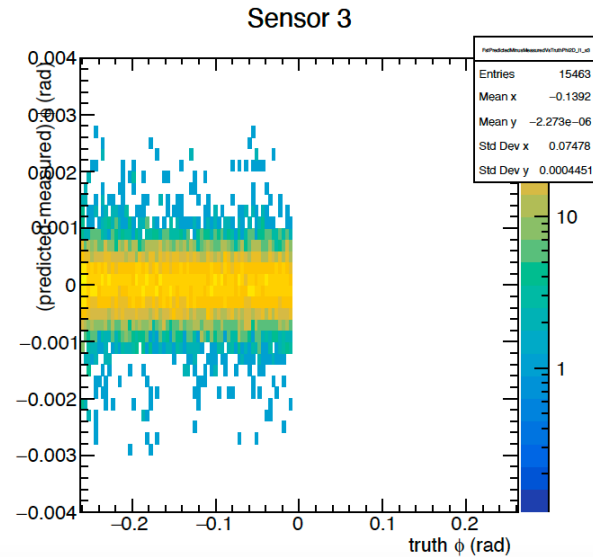
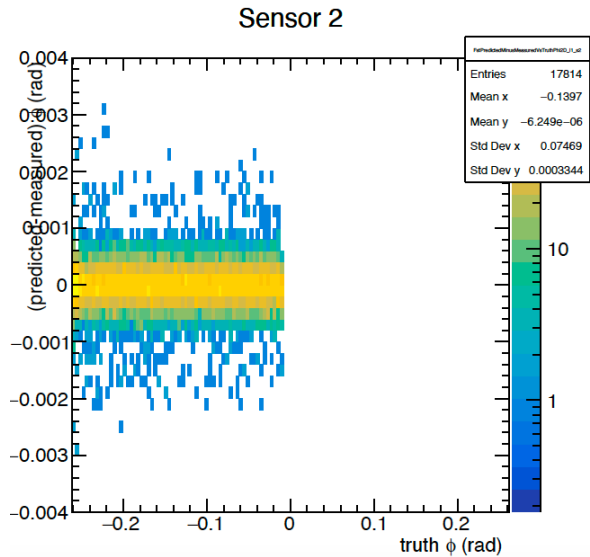
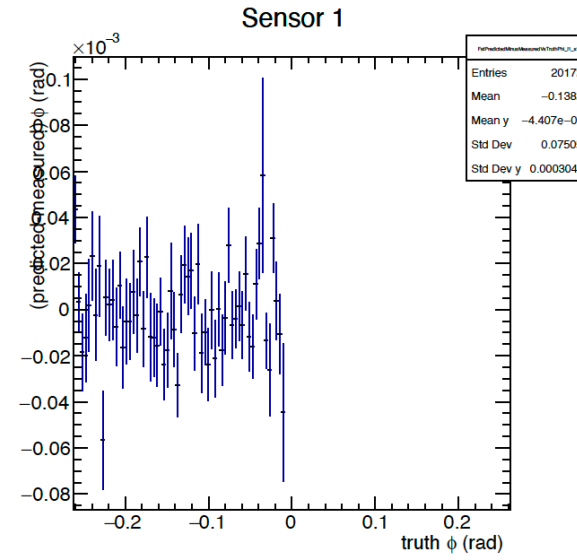
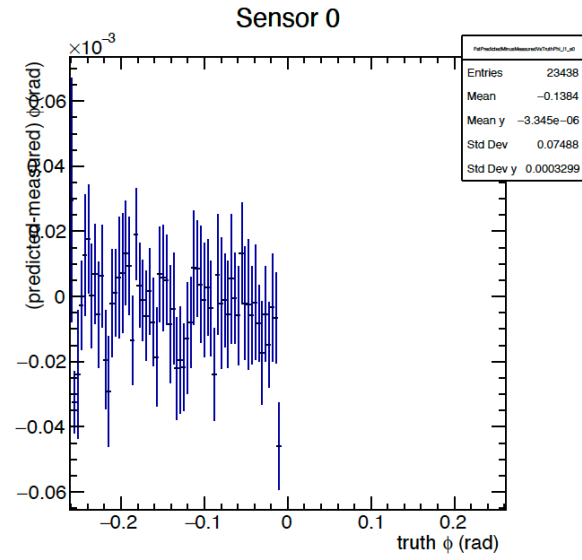
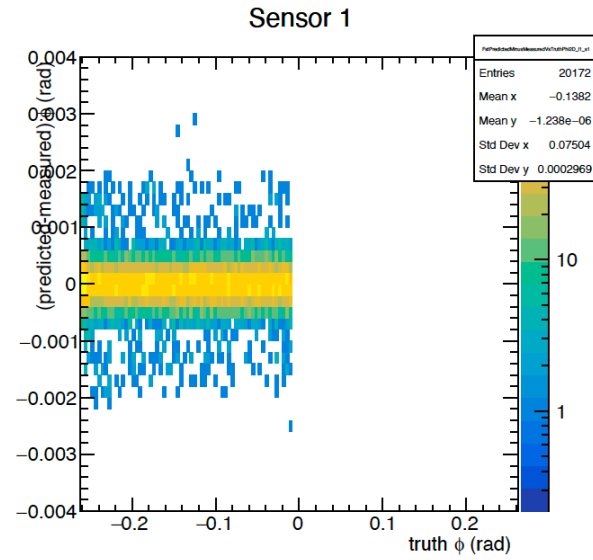
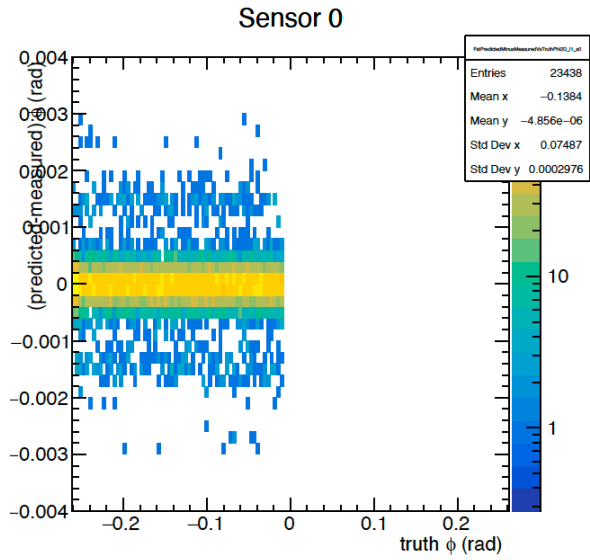
Sensor 2



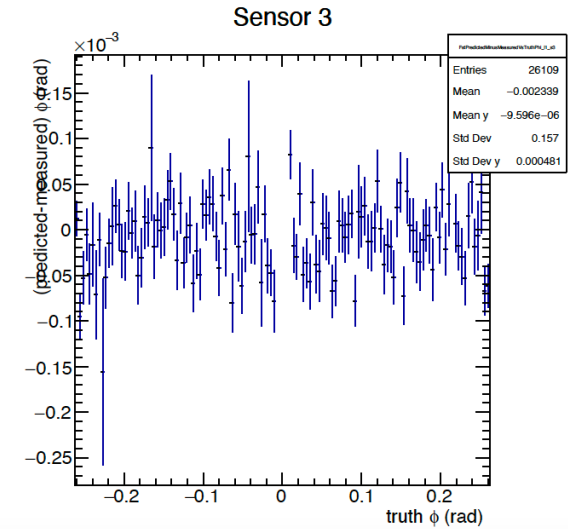
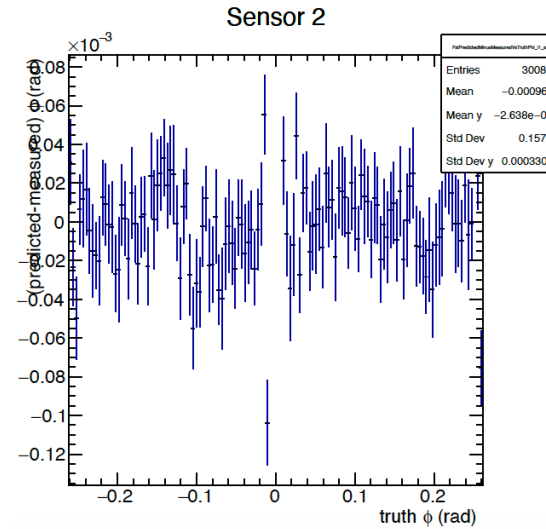
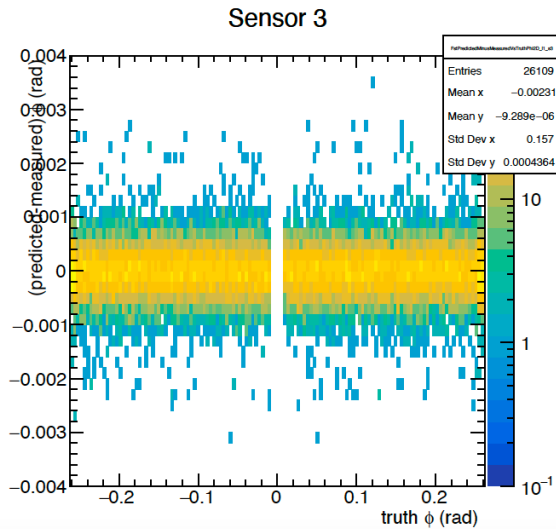
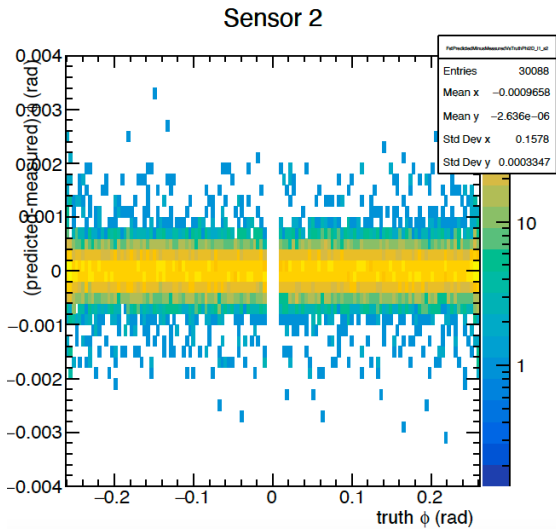
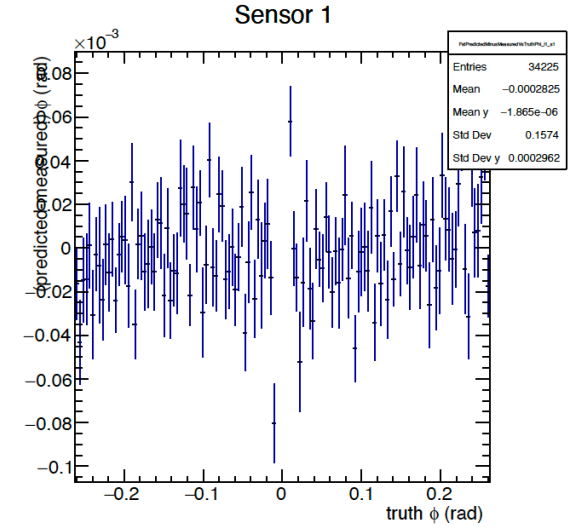
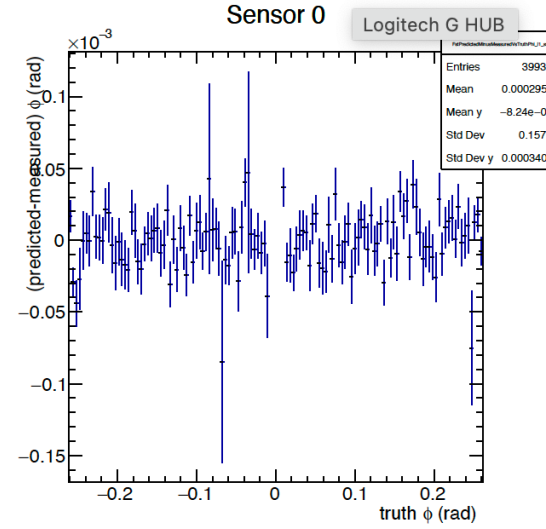
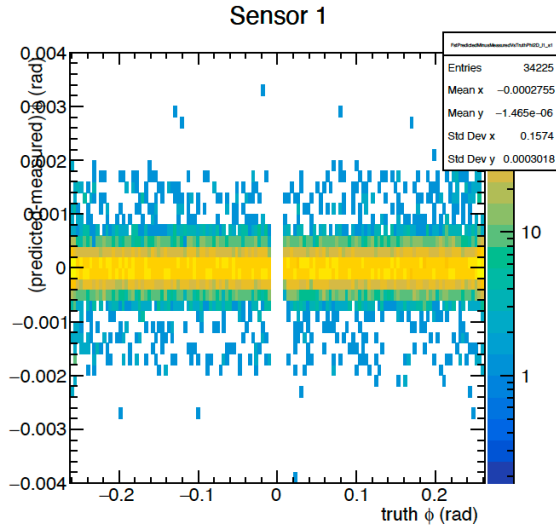
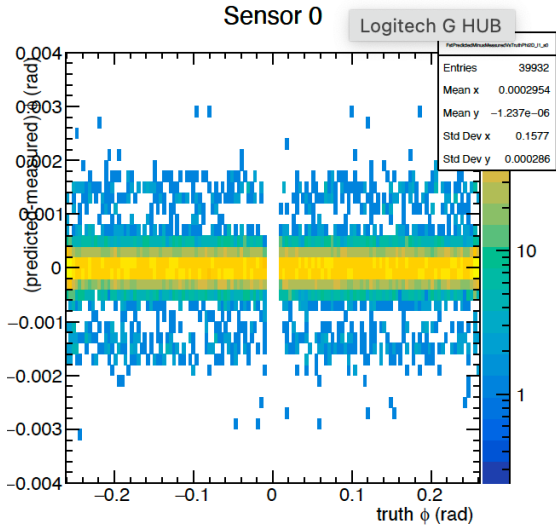
Sensor 3



- Outer Sensor 37
- $p_T = [4.99, 5.0]$ GeV/c



- Outer Sensors 37 & 38
- $p_T = [4.99, 5.0] \text{ GeV}/c$



Outer sensors (37,38)

Sensor	Parameter	Input	Output	Error
37	Δu (μm)	0.0	-37.8	13.3
	Δv (μm)	0.0	4.3	7.9
	$\Delta\gamma$ (mrad)	0.00	1.29E-3	3.7E-2
Sensor	Parameter	Input	Output	Error
37	Δu (μm)	0.0	-166.2	14.7
	Δv (μm)	0.0	12.8	8.7
	$\Delta\gamma$ (mrad)	1.0	0.98	0.04

Sensor	Parameter	Input	Output	Error
37	Δu (μm)	100.0	-95.3	19.3
	Δv (μm)	100.0	116.3	11.3
	$\Delta\gamma$ (mrad)	1.00	0.98	0.05
38	Δu (μm)	100.0	321.0	19.3
	Δv (μm)	100.0	127.3	11.3
	$\Delta\gamma$ (mrad)	1.00	0.92	0.05

Sensor	Parameter	Input	Output	Error
37	Δu (μm)	0.0	57.0	14.2
	Δv (μm)	0.0	15.8	8.5
	$\Delta\gamma$ (mrad)	0.00	-0.04	0.04
38	Δu (μm)	0.0	-76.3	14.3
	Δv (μm)	0.0	-8.4	8.5
	$\Delta\gamma$ (mrad)	0.00	-0.01	0.04

Sensor	Parameter	Input	Output	Error
37	Δu (μm)	100.0	-120.0	22.9
	Δv (μm)	100.0	115.3	13.5
	$\Delta\gamma$ (mrad)	1.00	0.98	0.06
38	Δu (μm)	-100.0	-305.0	22.9
	Δv (μm)	-100.0	-90.2	13.4
	$\Delta\gamma$ (mrad)	-1.00	1.11	0.06