Systematic error of
x-ray yield per stopped-K^-

in-flight events contamination

acceptance consistency
between experiment and simulation

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In- flight events

$$\phi^{-}(E) = \frac{C^{-}(E)}{\int_V d^3\vec{r} \cdot V(\vec{r}) \cdot \epsilon^{-}(E,\vec{r})'}. \qquad (34)$$

The number of vertices includes the events of in-flight decay/reaction

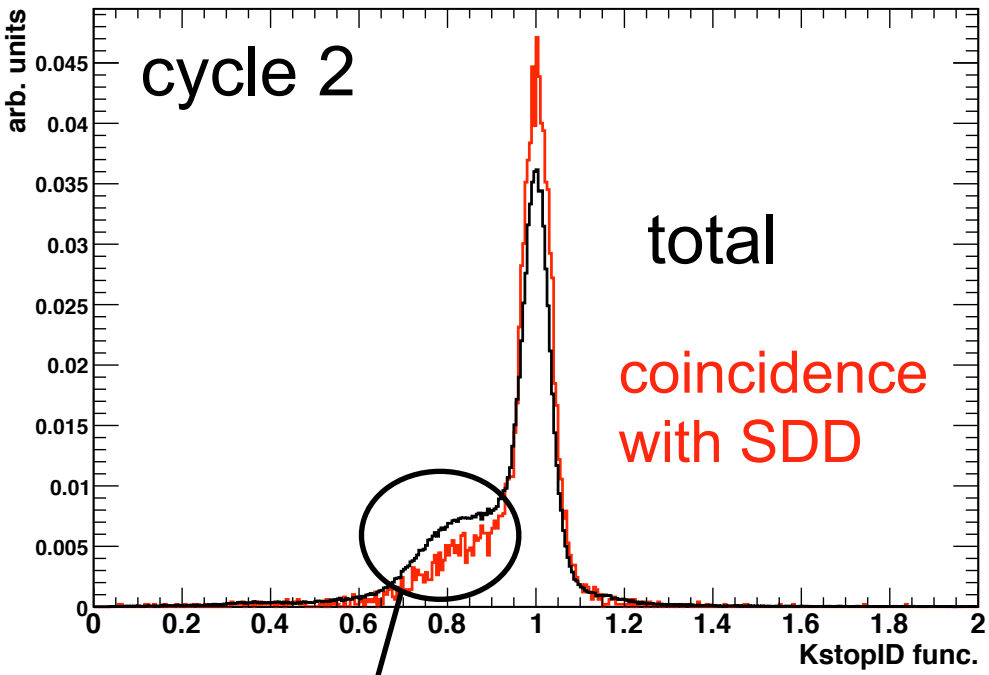
On the other hand, the count number of x-rays does not include these events, because the x-rays come from stopped K- on 4He.

These difference can be seen using “KstopID” distribution ...

In- flight events

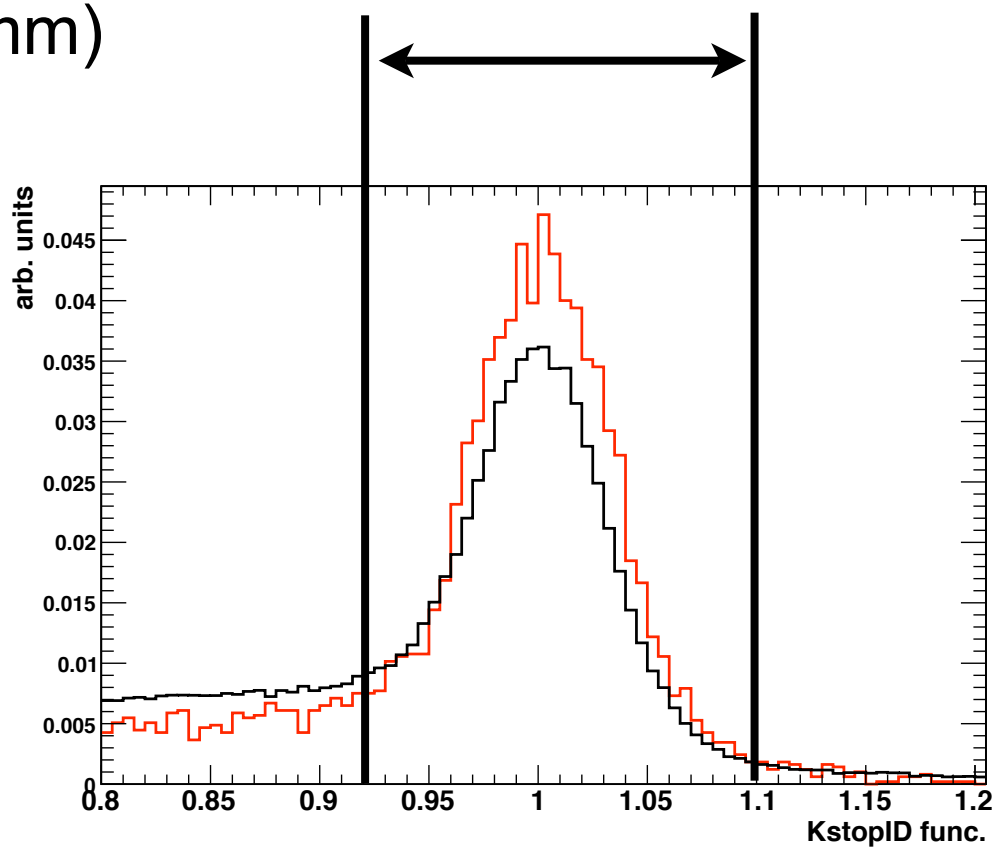
KstopID function (-60mm<z<80mm)

normalized from 0 to 2

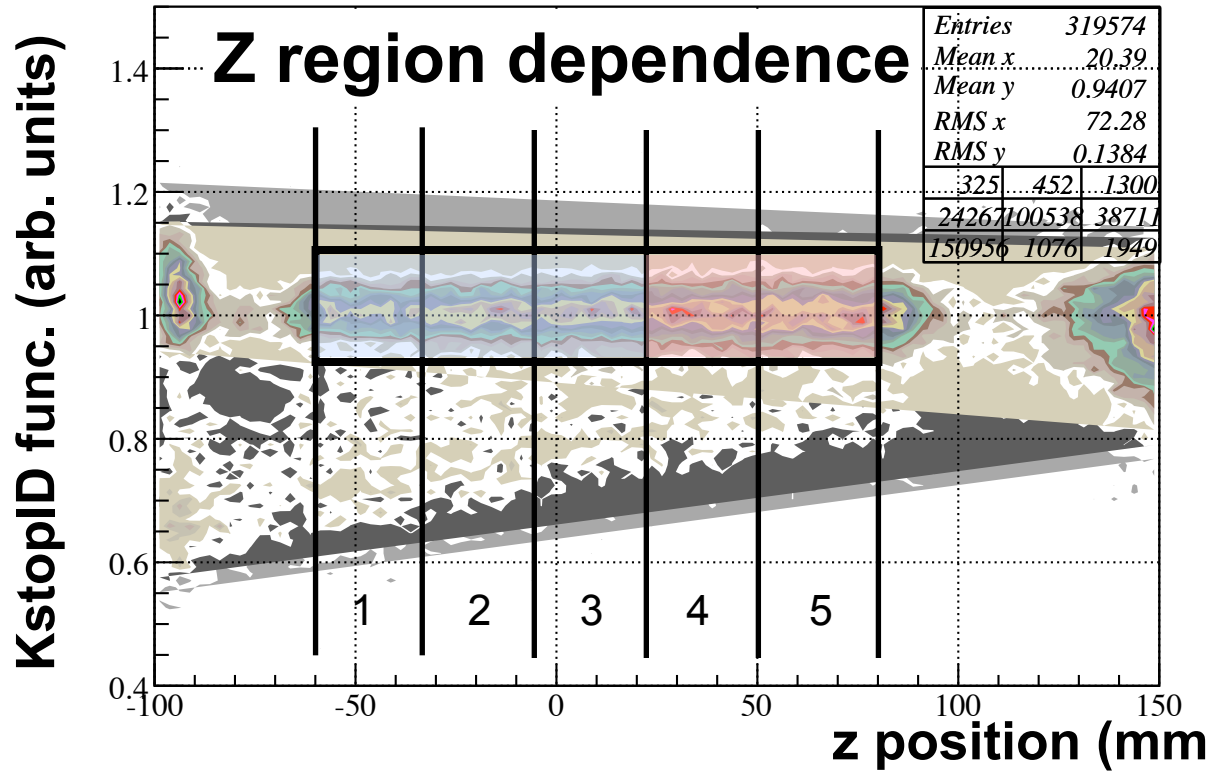


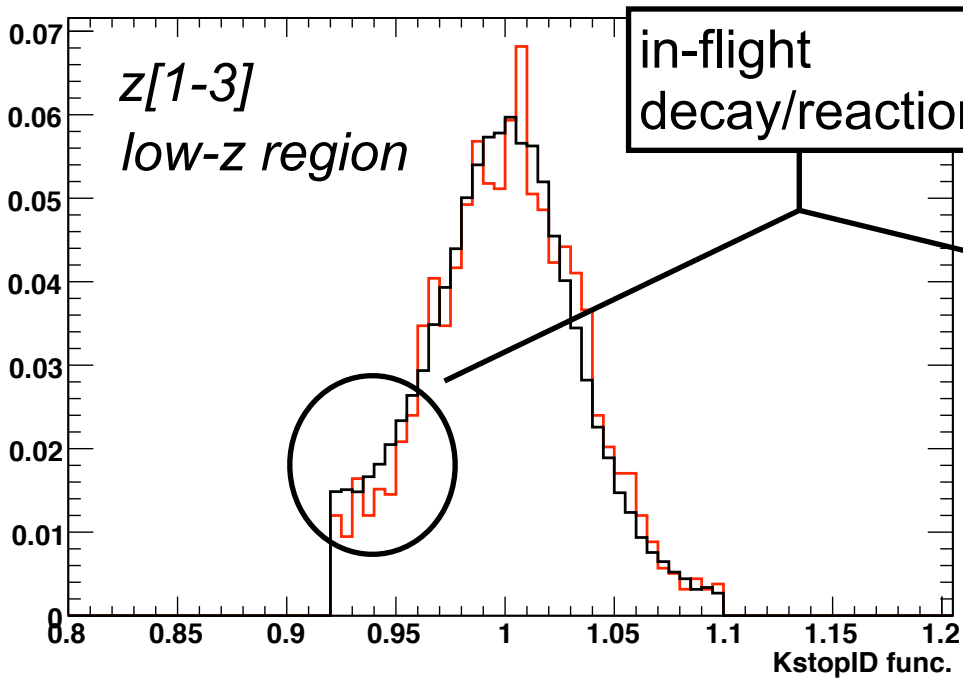
common “Stopped-K” cut

(0.92 < KstopID < 1.2)

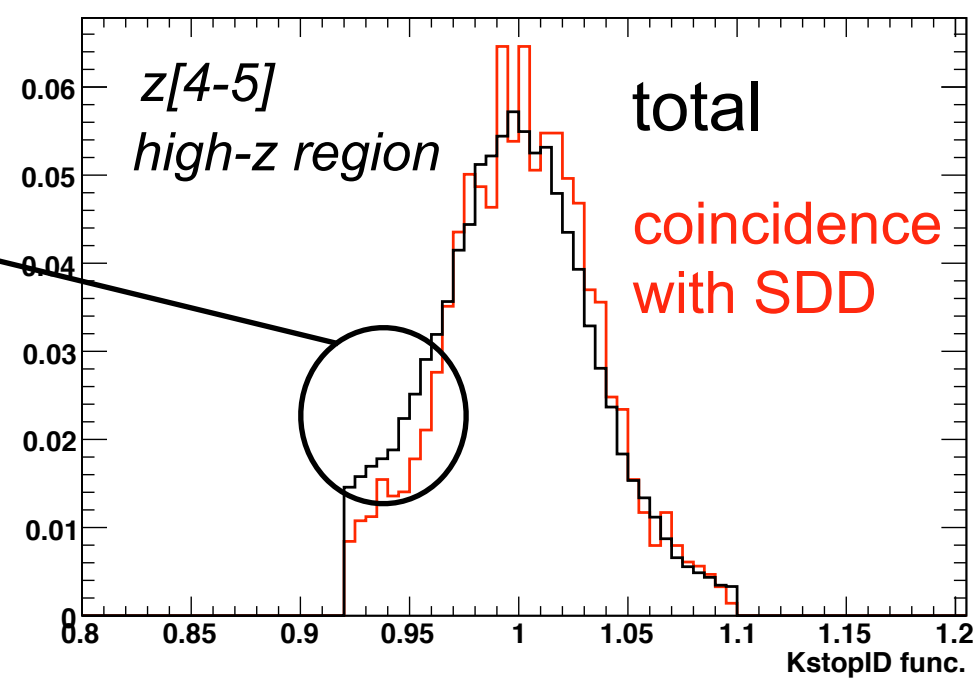


in-flight decay/reaction

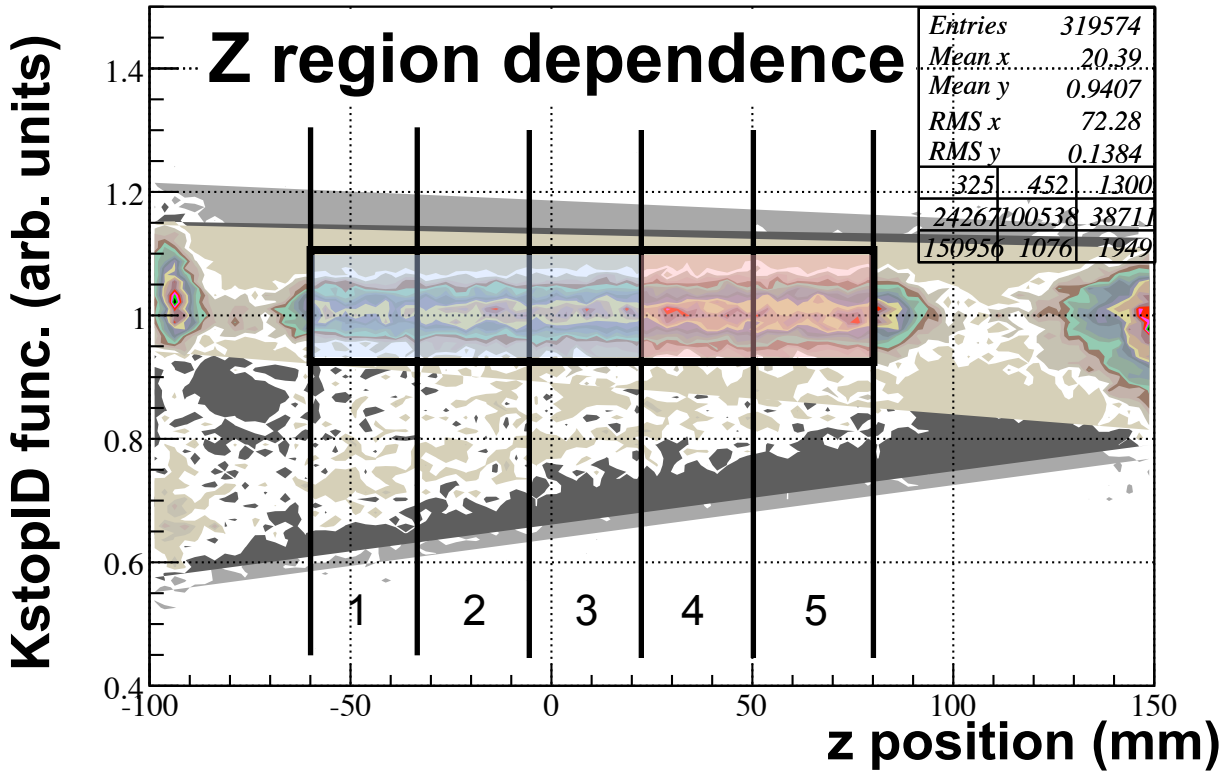




in-flight decay/reaction



larger contamination...



KHeX Lα yield / stopped-K

z[1-3] low-z region

7.3±0.2 %

c.f. total 6.1±0.1 %

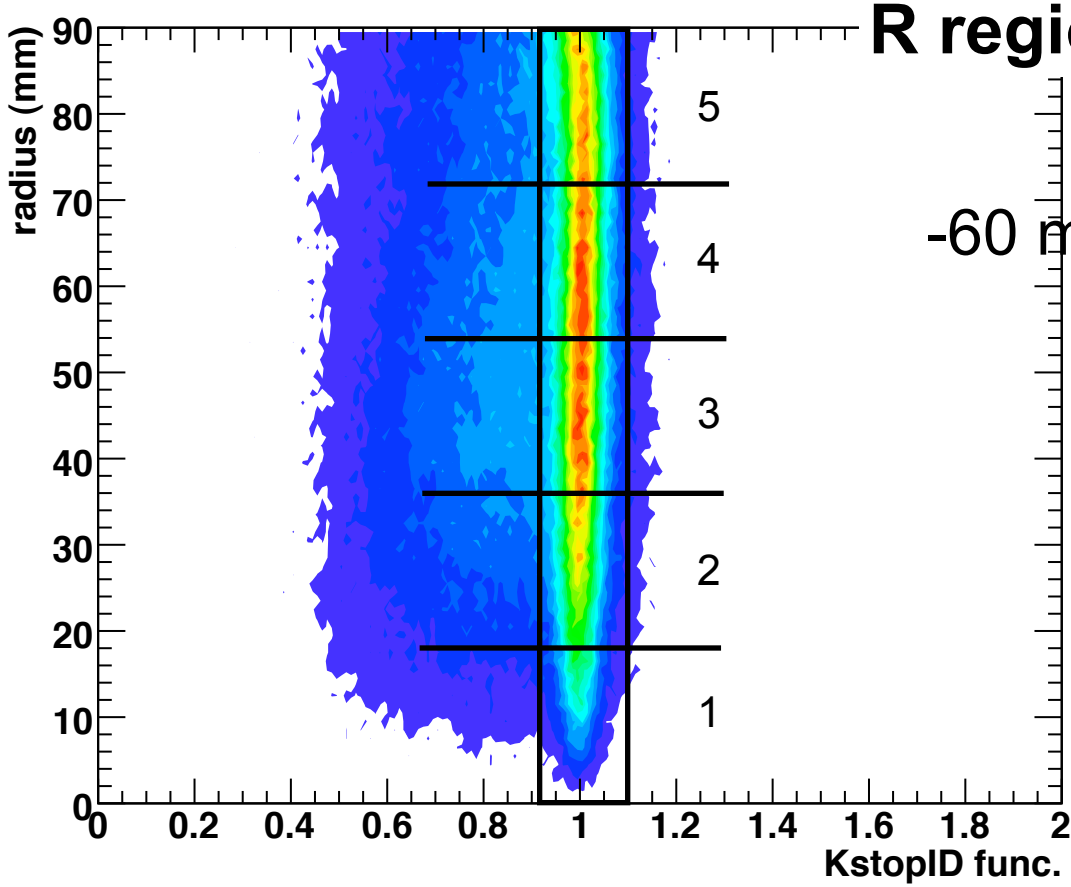
z[4-5] high-z region

5.5±0.2 %

corresponds ~15% contamination, too large !?

smaller yield due to the in-flight-event contamination ?

R region dependence



cycle 2

-60 mm < z < 80 mm

KHeX Lα yield / stopped-K

r[1-2] low-r region

7.5±0.2 %

c.f. total 6.1±0.1 %

r[3-5] high-r region

5.7±0.2 %

? ? ?

~15% contamination ???

It's true that the x-ray yield decreases due to an ***in-flight events contamination***.

But the amount is too large to explain the yield in "low-z region."

In addition, a radius dependence shows a ***target cut effect***.

Next → check a consistency between experiment and simulation, especially for acceptance.

Radius

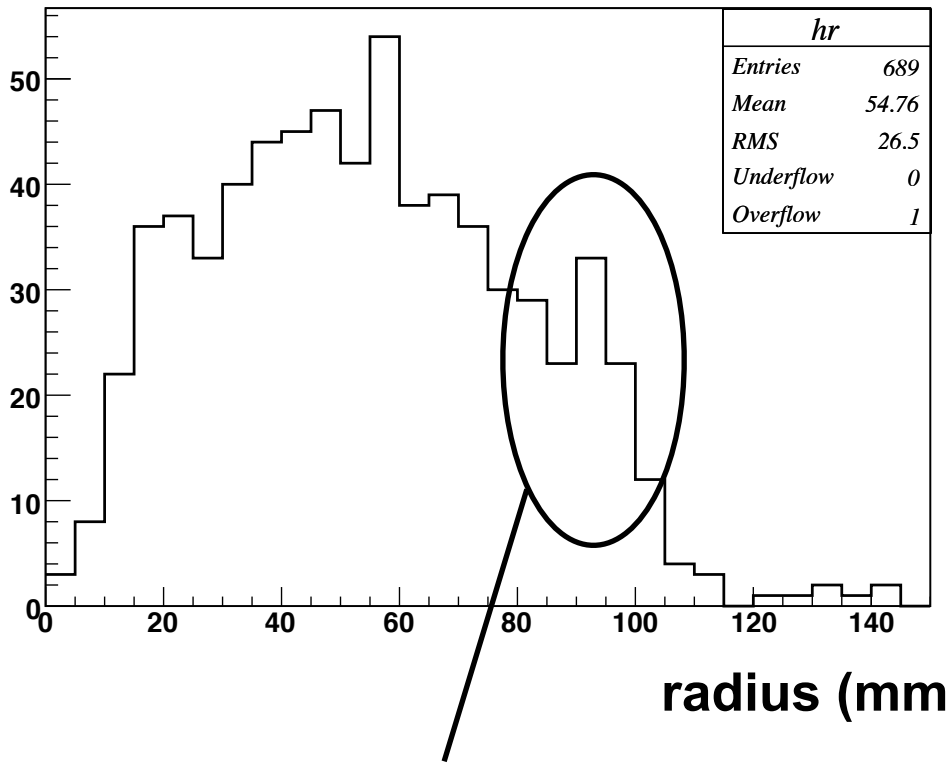
experiment

cycle 1

coincided events with SDD2

2000 ch < ADC < 2400 ch

(KHeX Lα loosely selected)



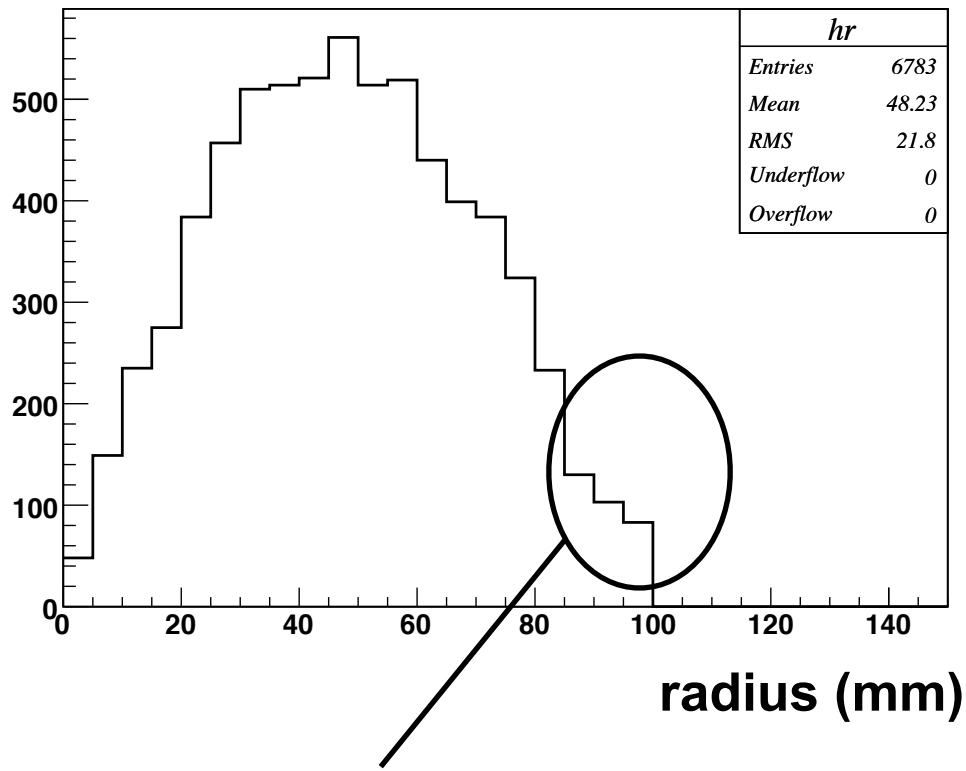
evetns ?

simulation

cycle 1

coincided events with SDD2

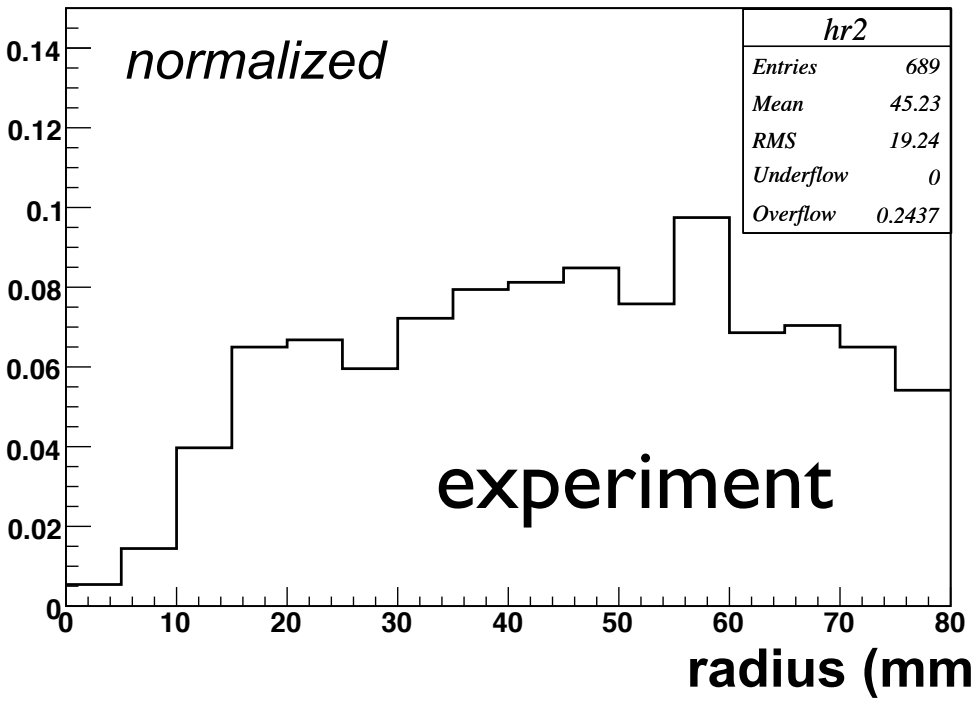
KHeX Lα

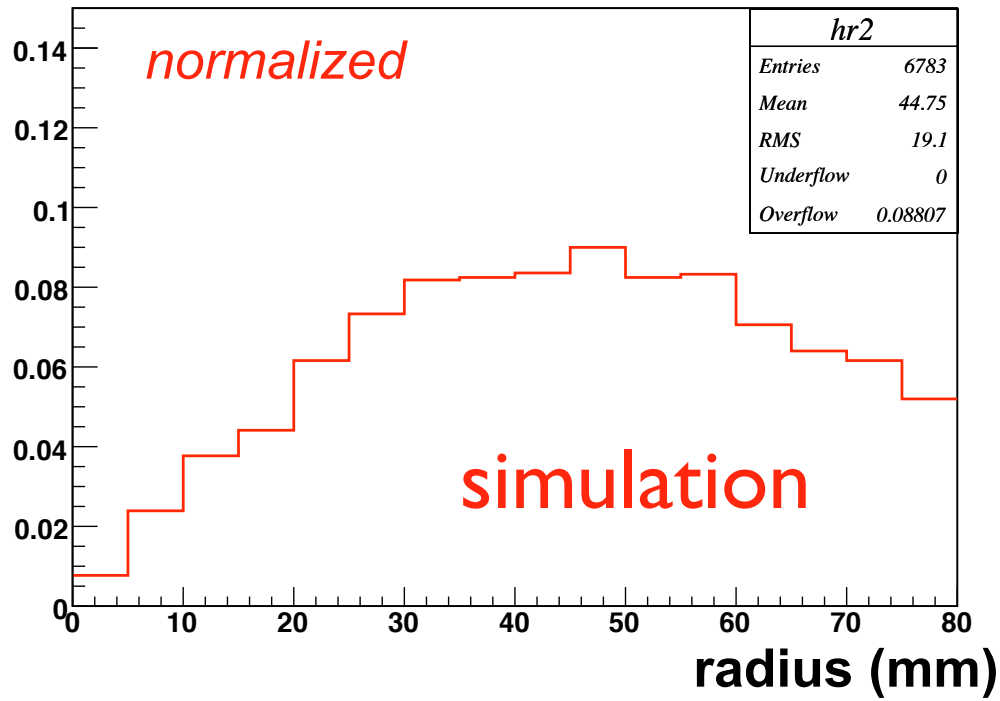


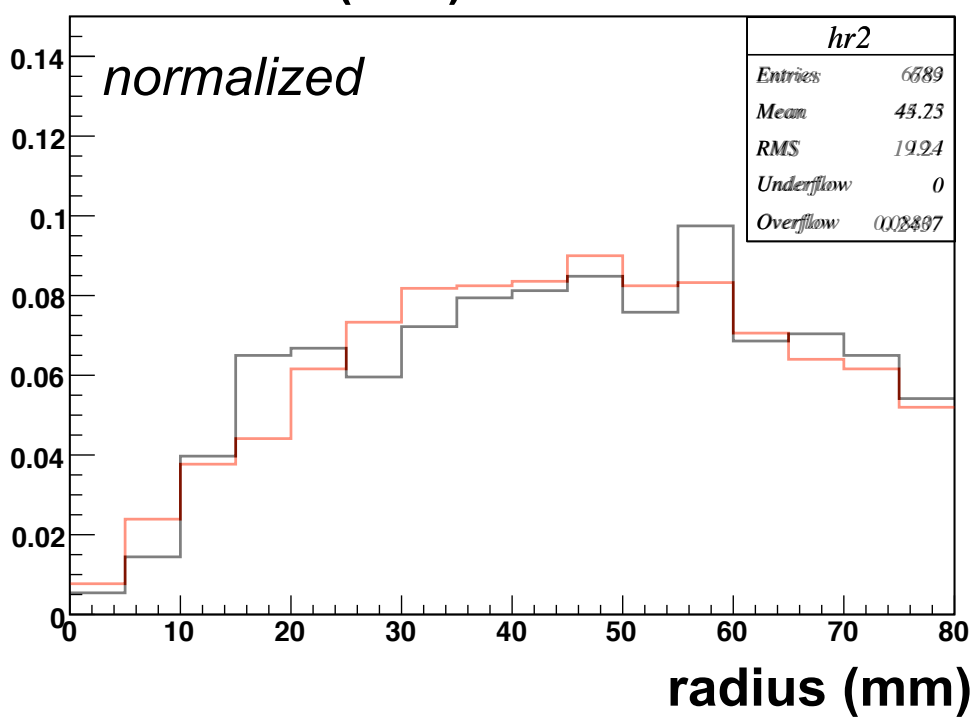
low acceptance near the Al-target flame

(r > 80 mm)

Region (radius < 80 mm) is more suitable to compare

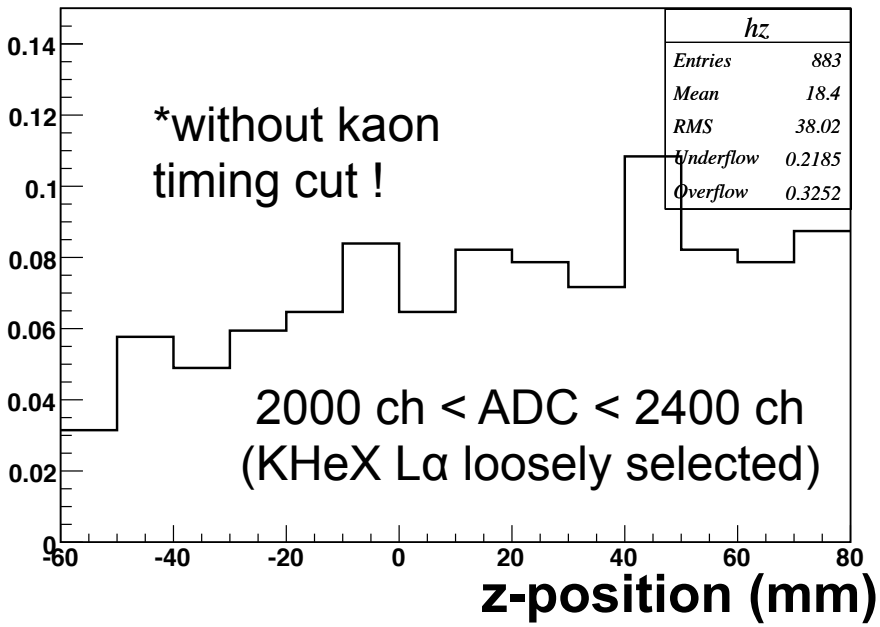




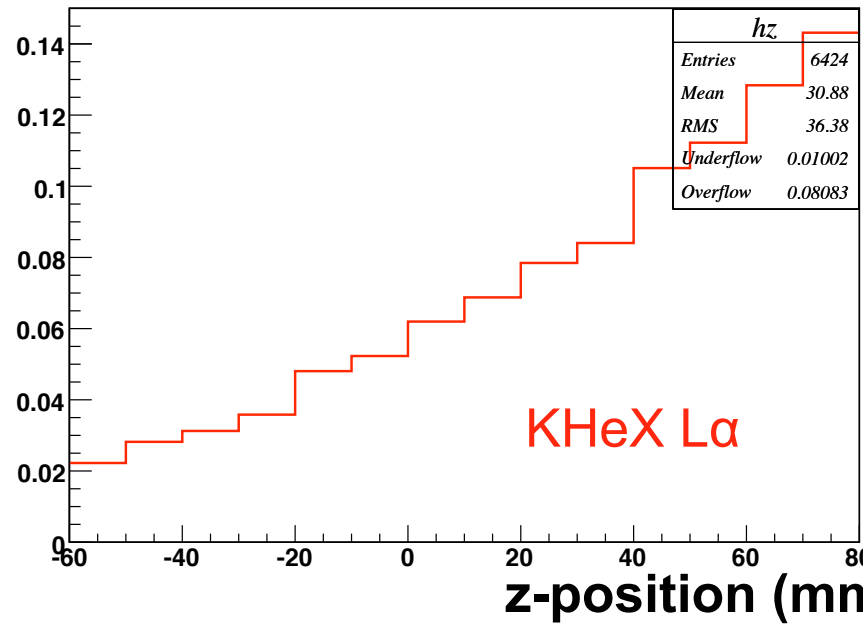


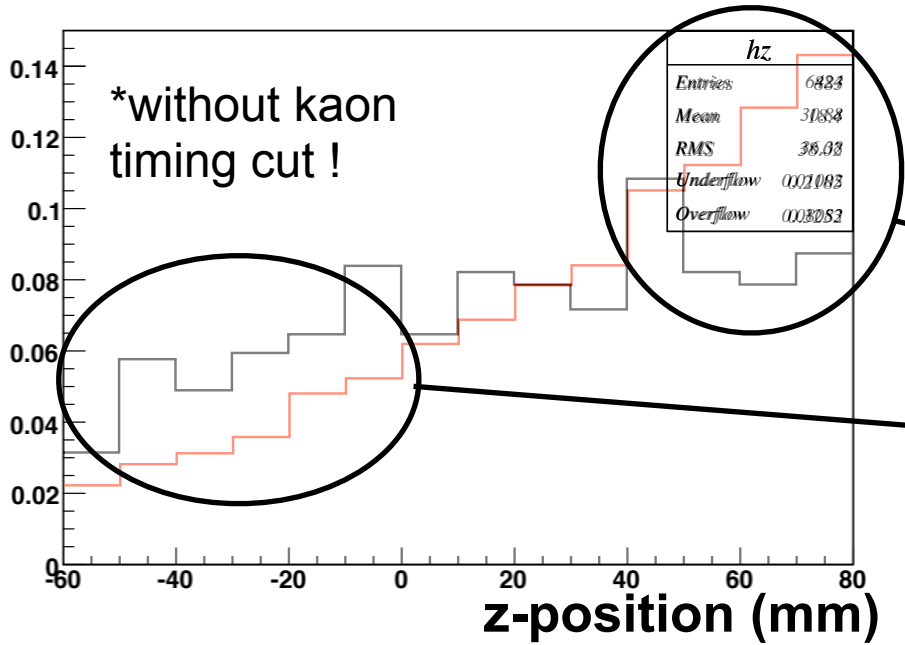
experiment Z-position simulation

cycle 1
coincided events with SDD2



cycle 1
coincided events with SDD2





This difference makes x-ray yields

smaller in low-z region

larger in high-z region

Acceptance z-dependence has a large difference between experiment and simulation

Mainly this z-dependence affects the changes of the x-ray yield in the low-/high-z region, I think

Can take these changes into accounts as systematic errors ?

KHeX Lα yield / stopped-K

z[1-3] low-z region

-60 mm < z < 24 mm

r[1-3] low-r region

r < 54 mm

z[4-5] high-z region

24 mm < z < 80 mm

r[1-3] low-r region

r < 54 mm

Cycle 1

7.8±0.3 % *c.f. total 6.2±0.2 %* 6.2±0.2 %

Cycle 2

7.9±0.3 % *c.f. total 6.1±0.1%* 5.8±0.2 %

sys ±0.1% (@ SDD z-positon ±2mm)