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Japanese Society of Radiological Technology

Effect of bed position on CT-AEC with a bed height compensation mechanism: Phantom study

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Disclosure of Conflict of Interest (COI)

We have nothing to declare for this study.

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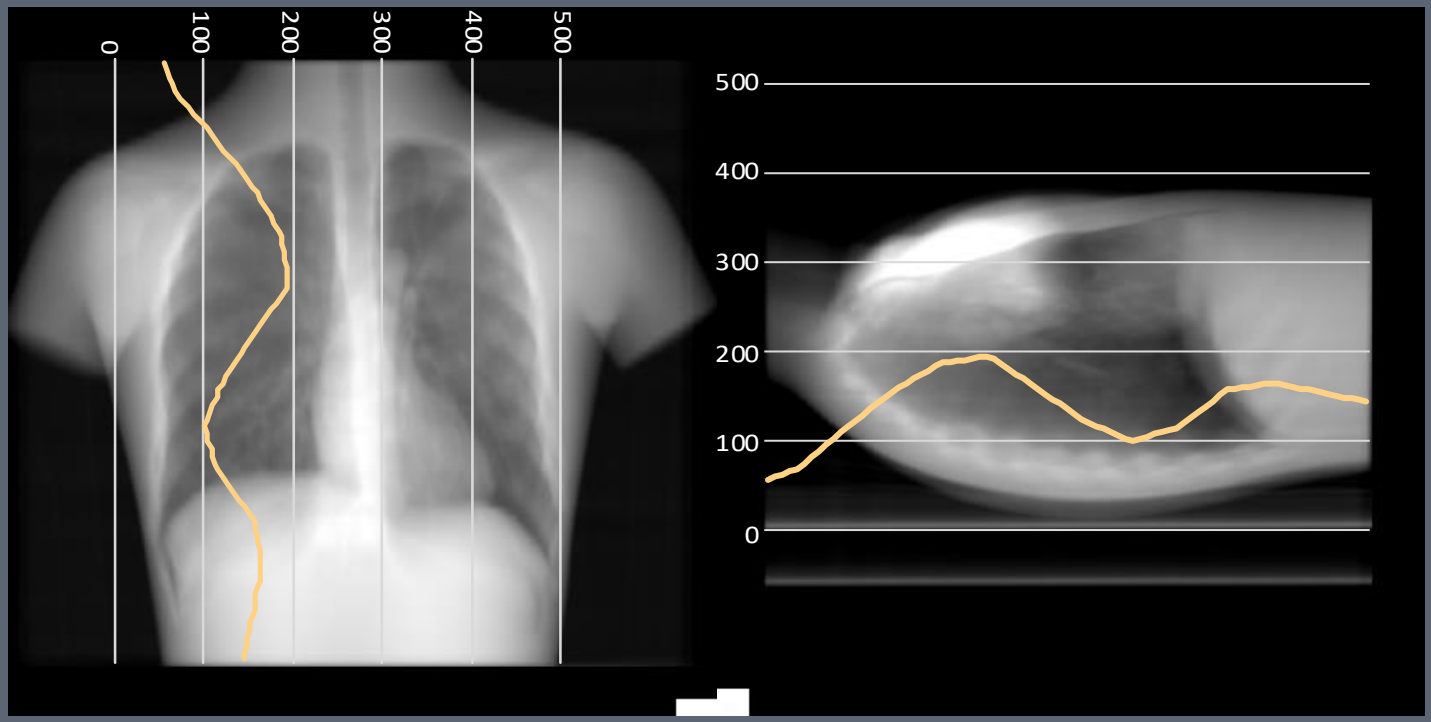
Background

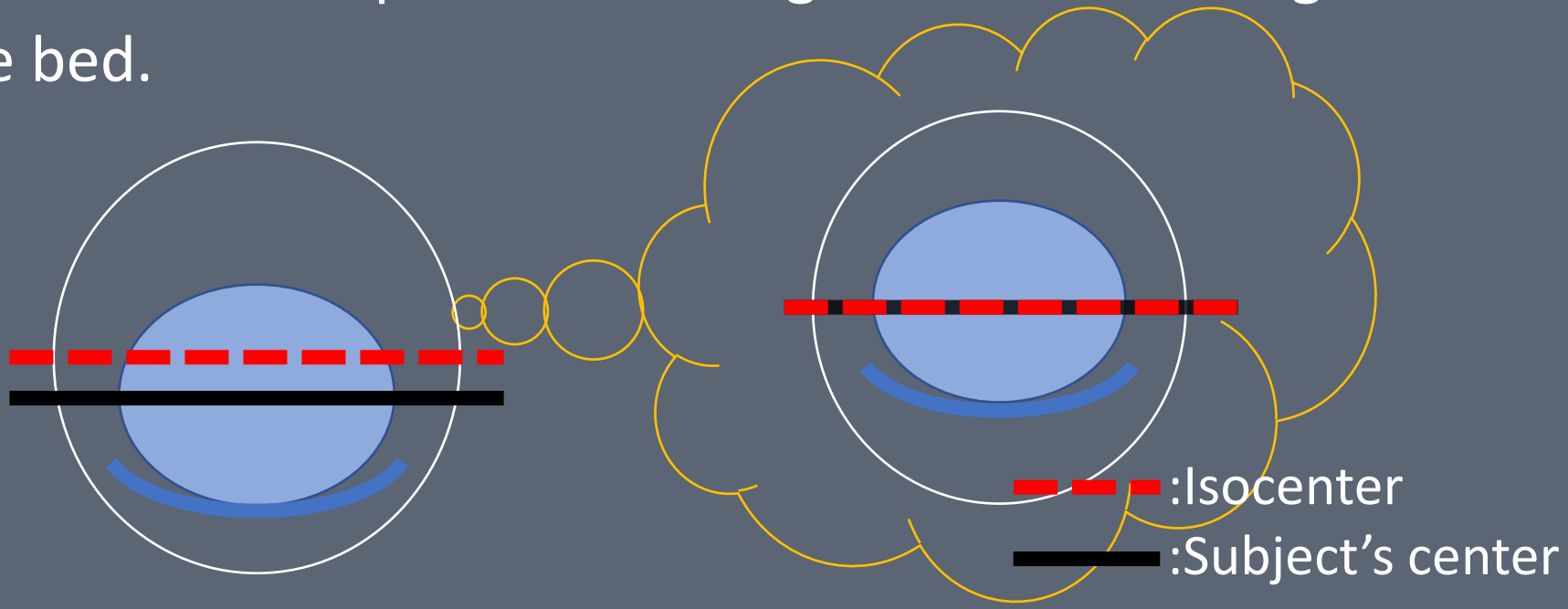
CT-AEC is the exposure dose reduction technique that modulates the tube current according to the size of the patient.



CT-AEC is affected for the table height, because the tube current is determined for the scout image.

Background

Some recent CT scanners is equipped with an " auto couch height positioning compensation (AHC) " that optimizes the exposure dose regardless of the height of the bed.

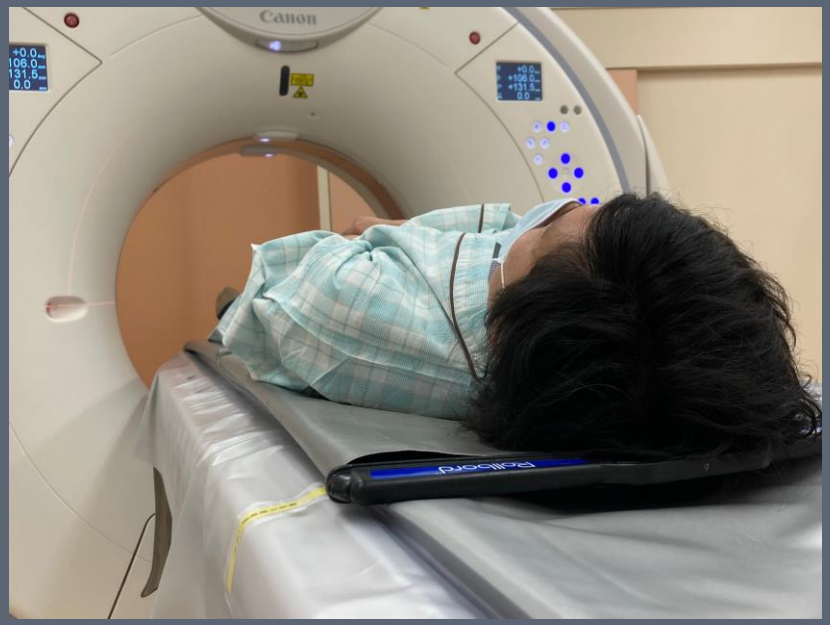


AHC corrects the output dose from the height of the CT gantry center, the table height set by the operator, and the estimated radius of the water equivalent thickness from the scout image.

Background

In the clinical practice, CT examinations are performed with a backboard or a pillow placed between the patient and the CT table.

Prone-position CT
for Diagnosing Inguinal Hernia



On backboard scan

Wider difference between the CT table and the patient may lead to a risk of CT-AEC malfunction.

Purpose

The purpose of this study is to evaluate the effect of **auto couch height positioning compensation (AHC) .**

CT scan with AHC : AHC-ON

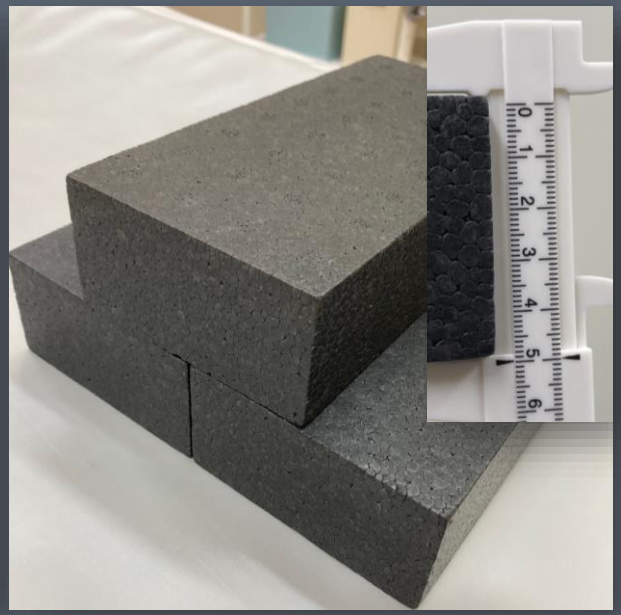
CT scan without AHC : AHC-OFF

Materials

Aquilion Prime SP/ iEdition (Canon Medical Systems Co.)

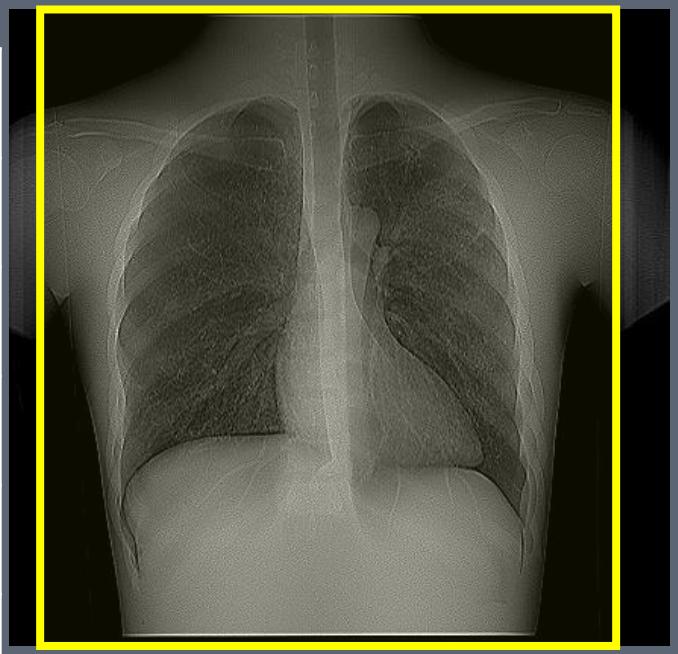
PBU-SS-2 phantom (Kyoto Kagaku Co., Ltd.)

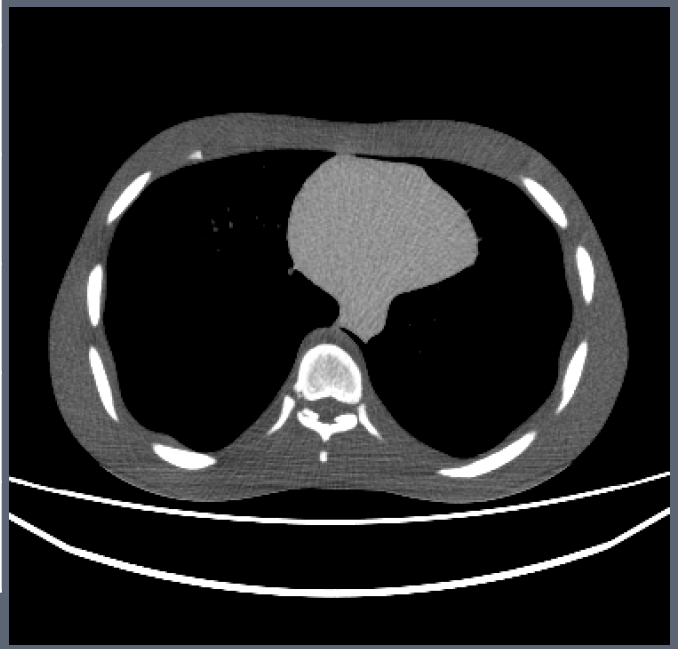
Expanded Polystyrene Spacer 2.5, 5, 10 cm



Methods Scan protocol

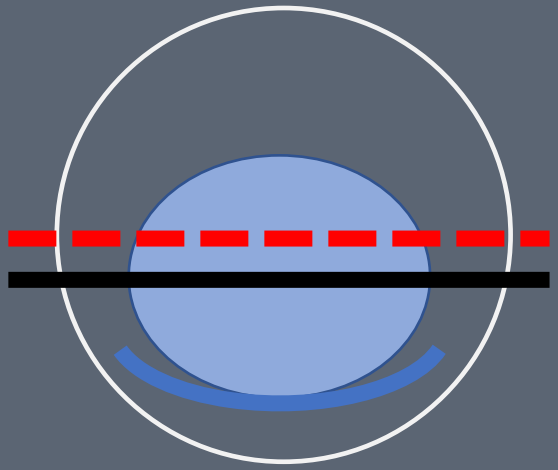
Tube voltage[kV]	120
FOV[mm]	500
Set SD value	15 (FC03, 5.0mm)
Maximum current[mA]	500
Minimum current[mA]	50
Pitch factor	0.813
Rotation time[s/rot]	0.5
Detector row[mm]	0.5 × 80
Slice thickness[mm]	5.0
Scan Length[mm]	410
Number of Scan	10

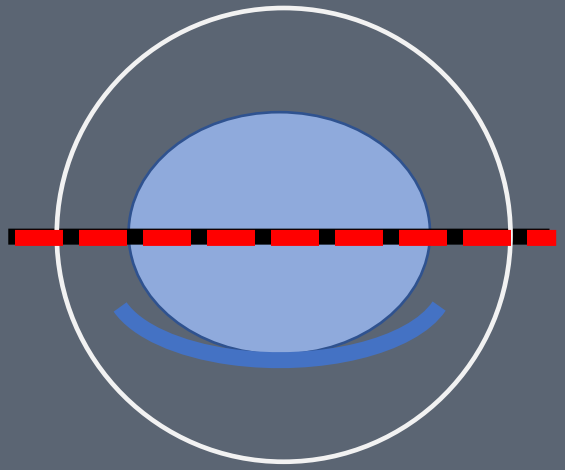


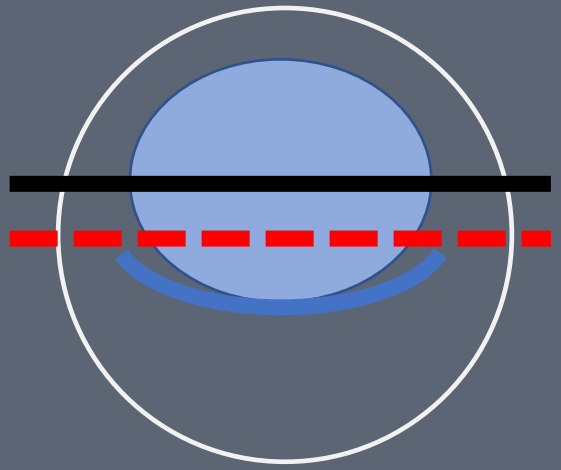


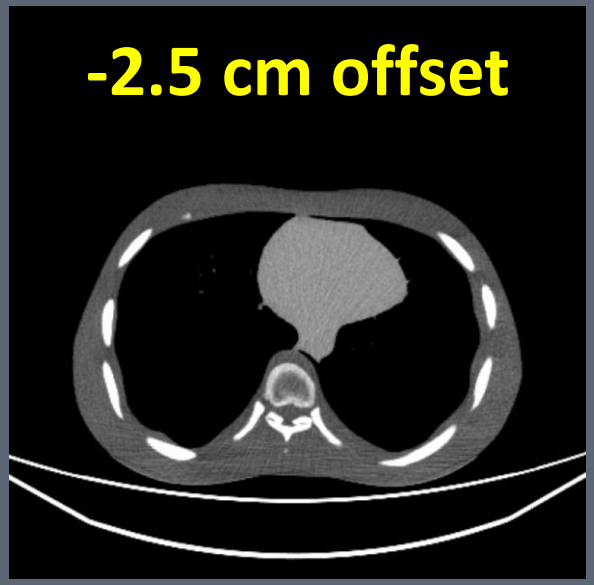
Methods Study I

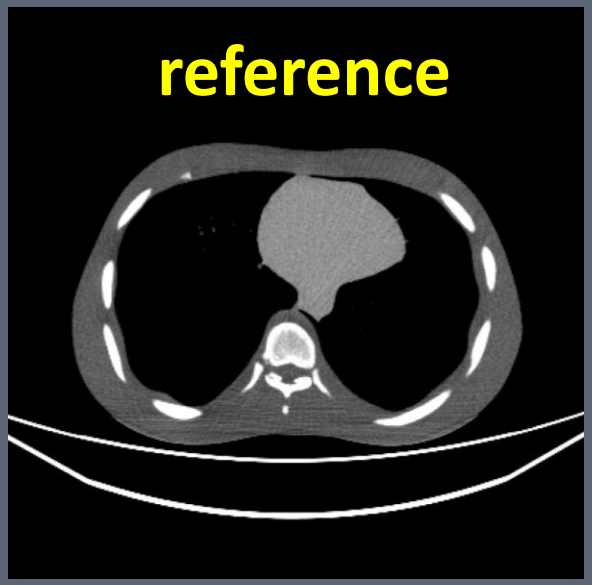
Evaluation of exposure dose and image quality when both the CT table and phantom heights are varied.

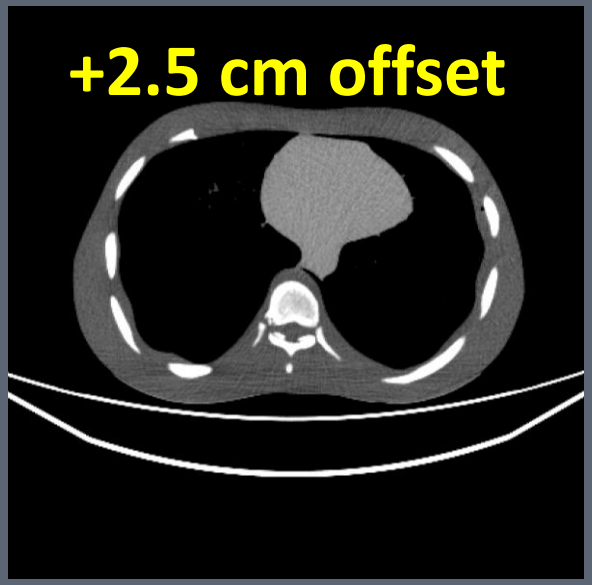






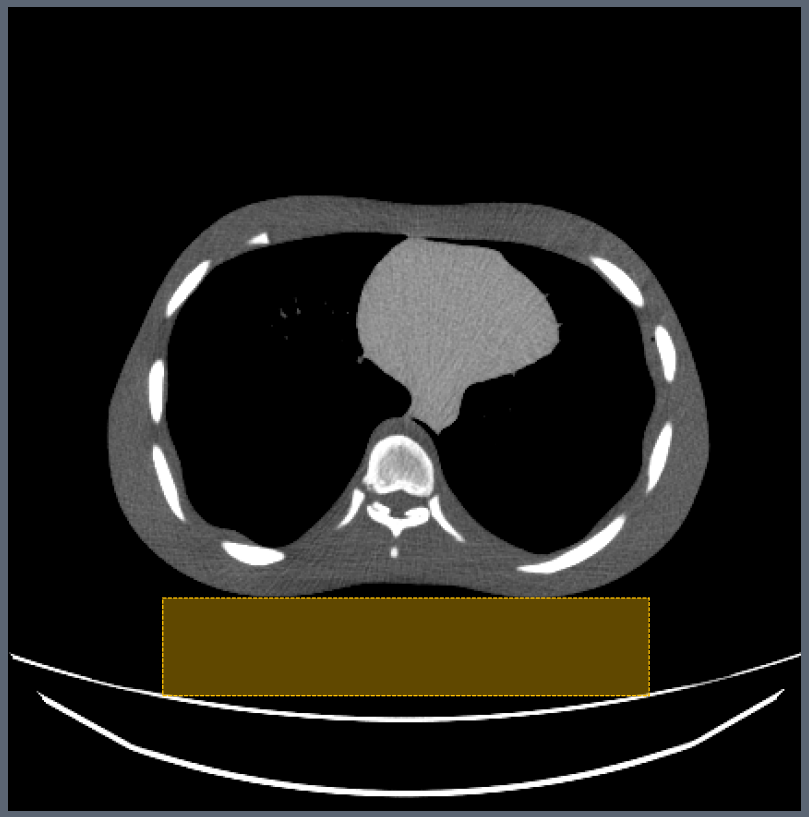






Methods Study Ⅱ

Evaluation of exposure dose and image quality when the CT table height is varied using spacers while keeping phantom height constant.

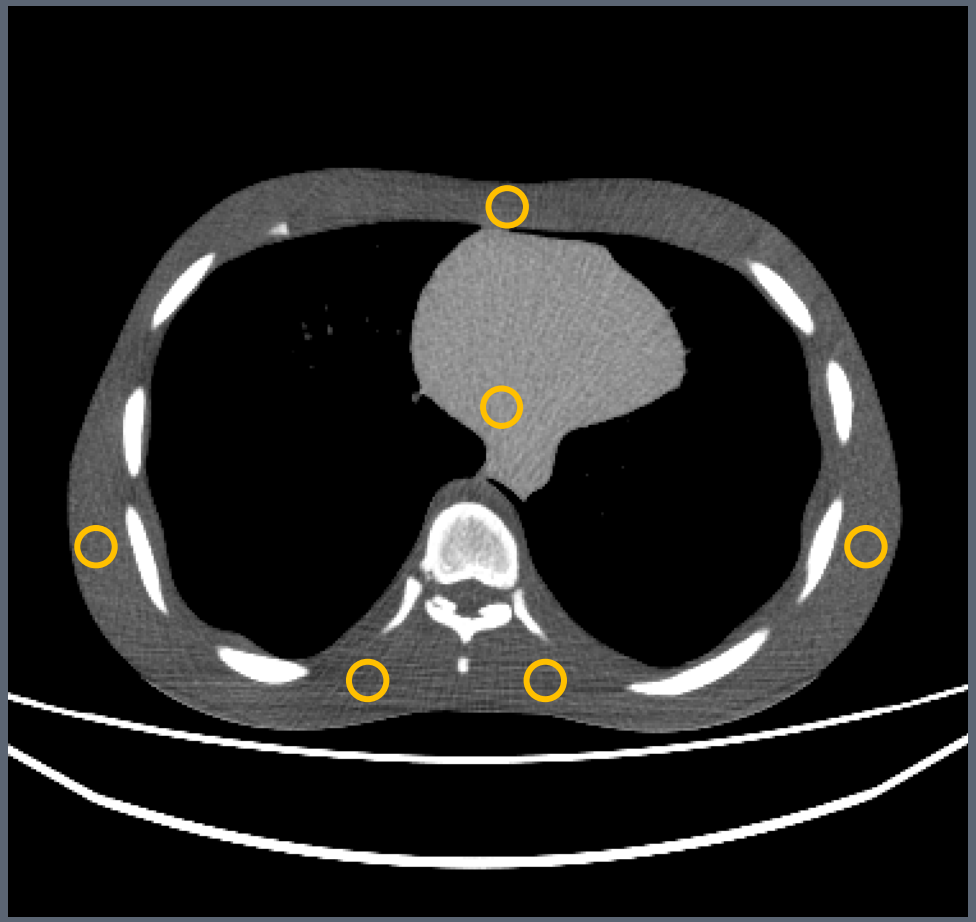


Reference, With 2.5cm, 5.0cm, 10.0cm spacer

Method Image anarysis

$CTDI_{vol}$ and DLP values were obtained from the CT console.

Standard deviation was obtained from six regions of interest (ROIs) in the same level of the axial image.



Method Statistical analysis

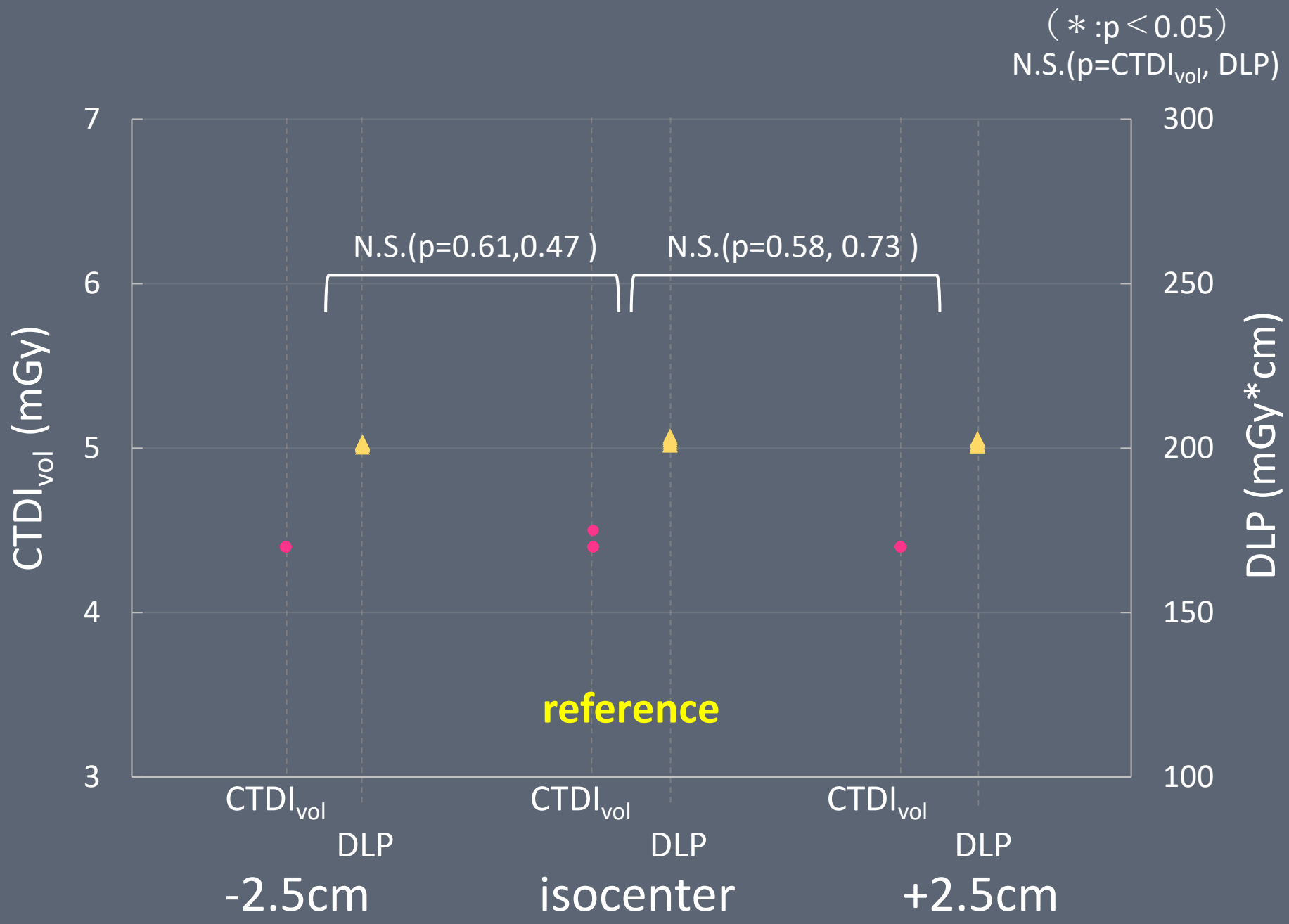
We used the Kruskal-Wallis analysis of variance.

Differences were considered statistically significant at $p < 0.05$.

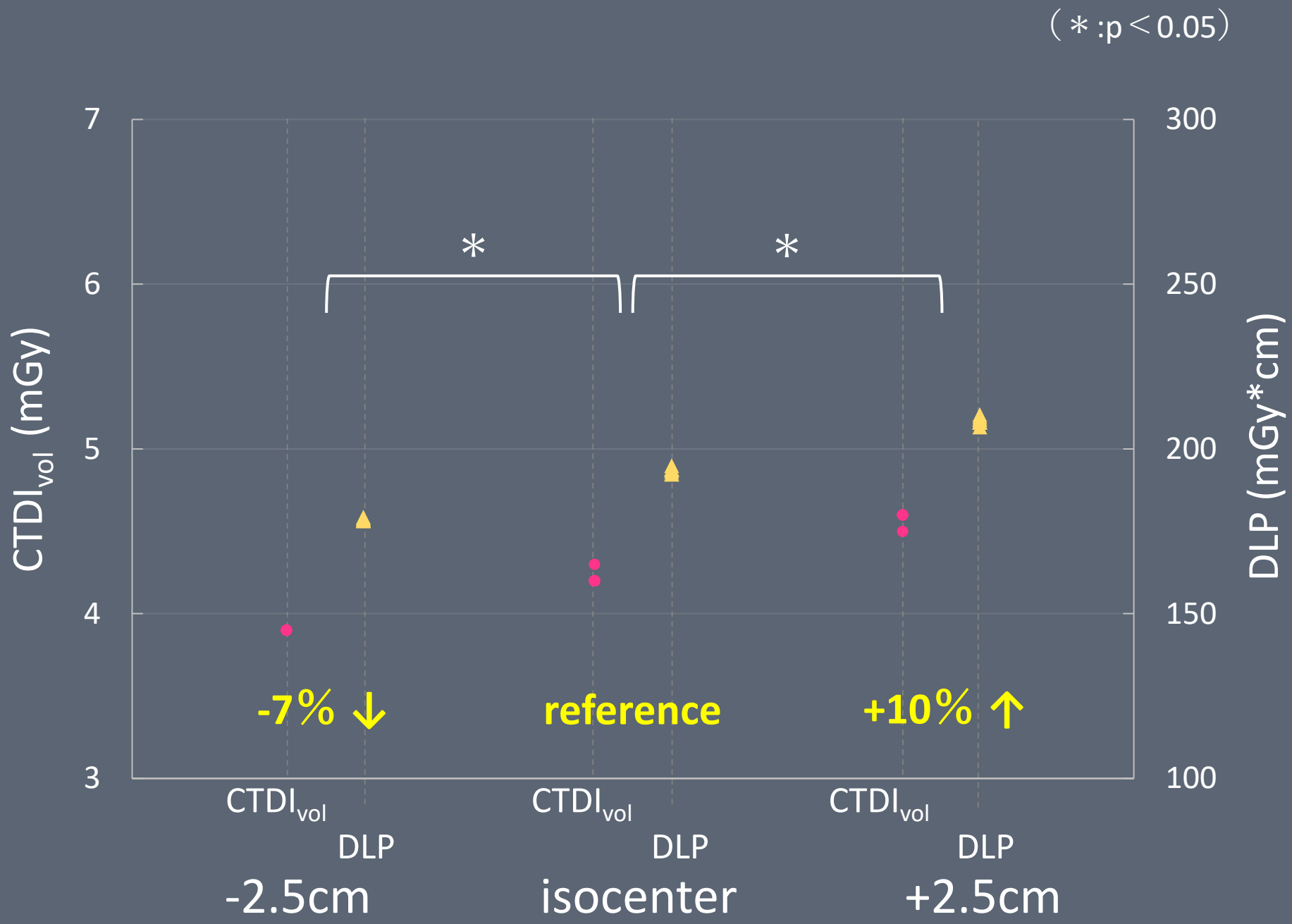
Statistical analyses were performed using the free statistical software “EZR(ver.1.55)”.

Bone Marrow Transplantation 2013: 48, 452–458

Results Study I AHC-ON

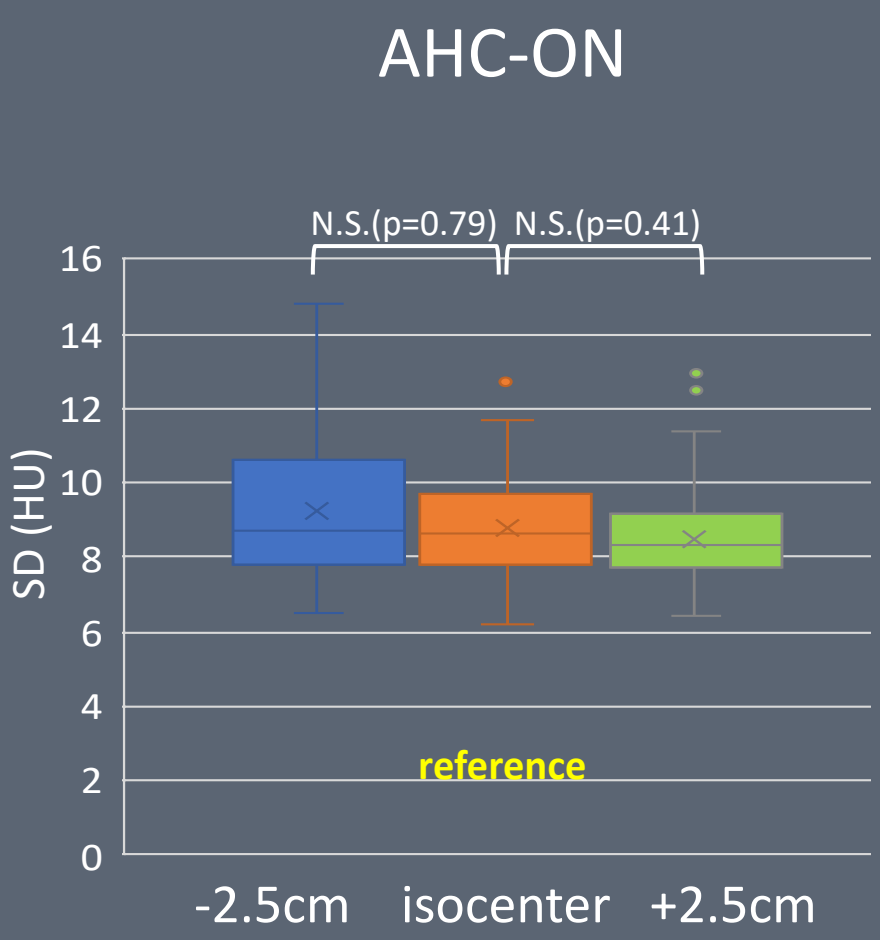


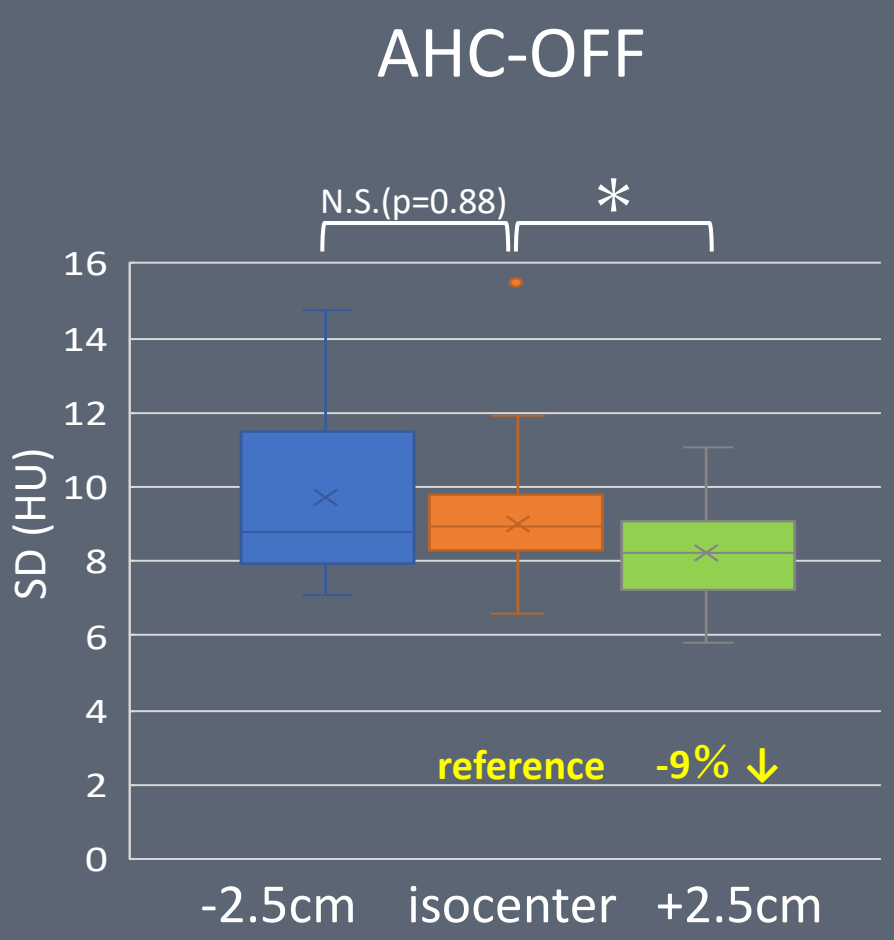
Results Study I AHC-OFF



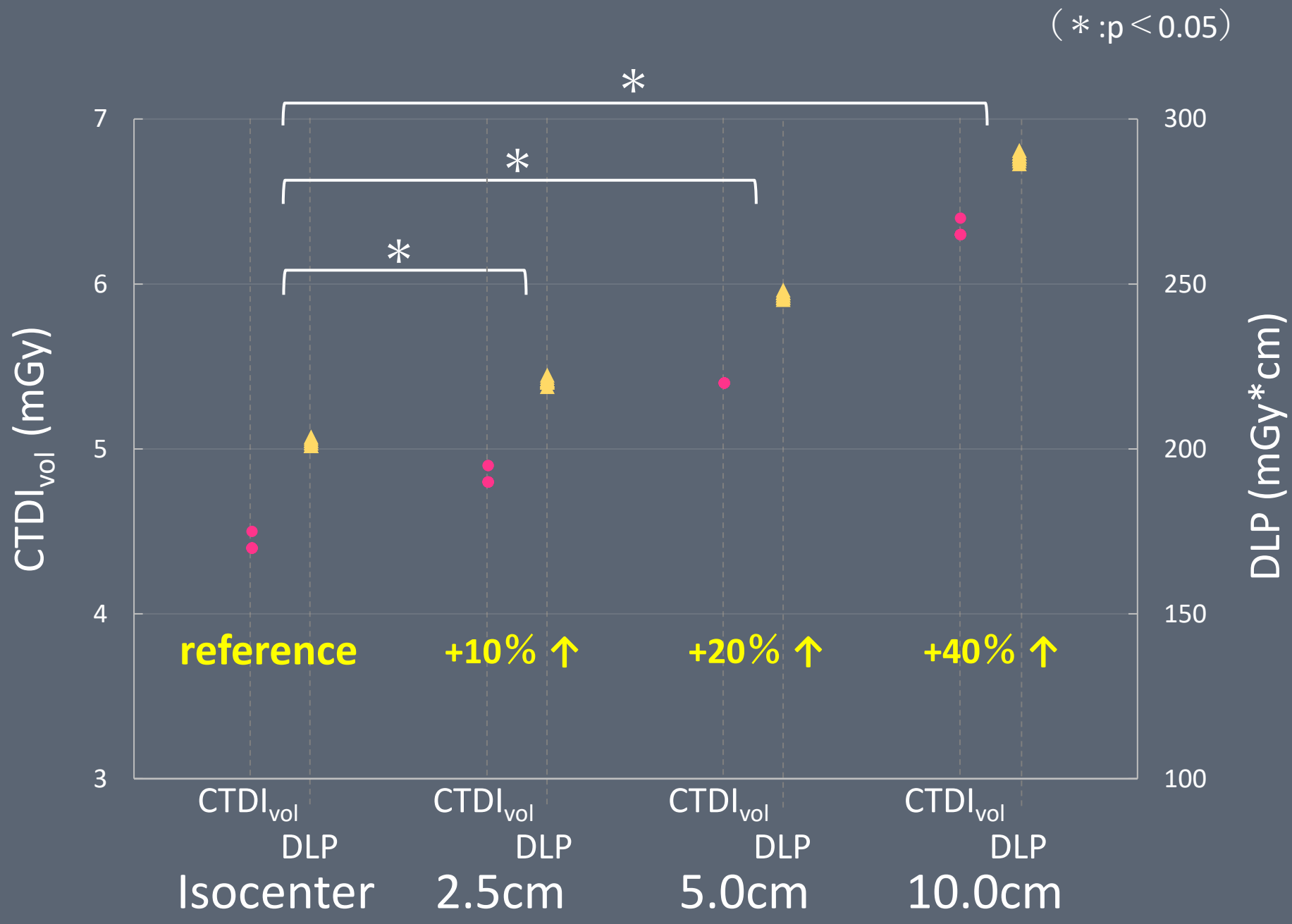
Results Study I SD

（＊:p＜0.05）



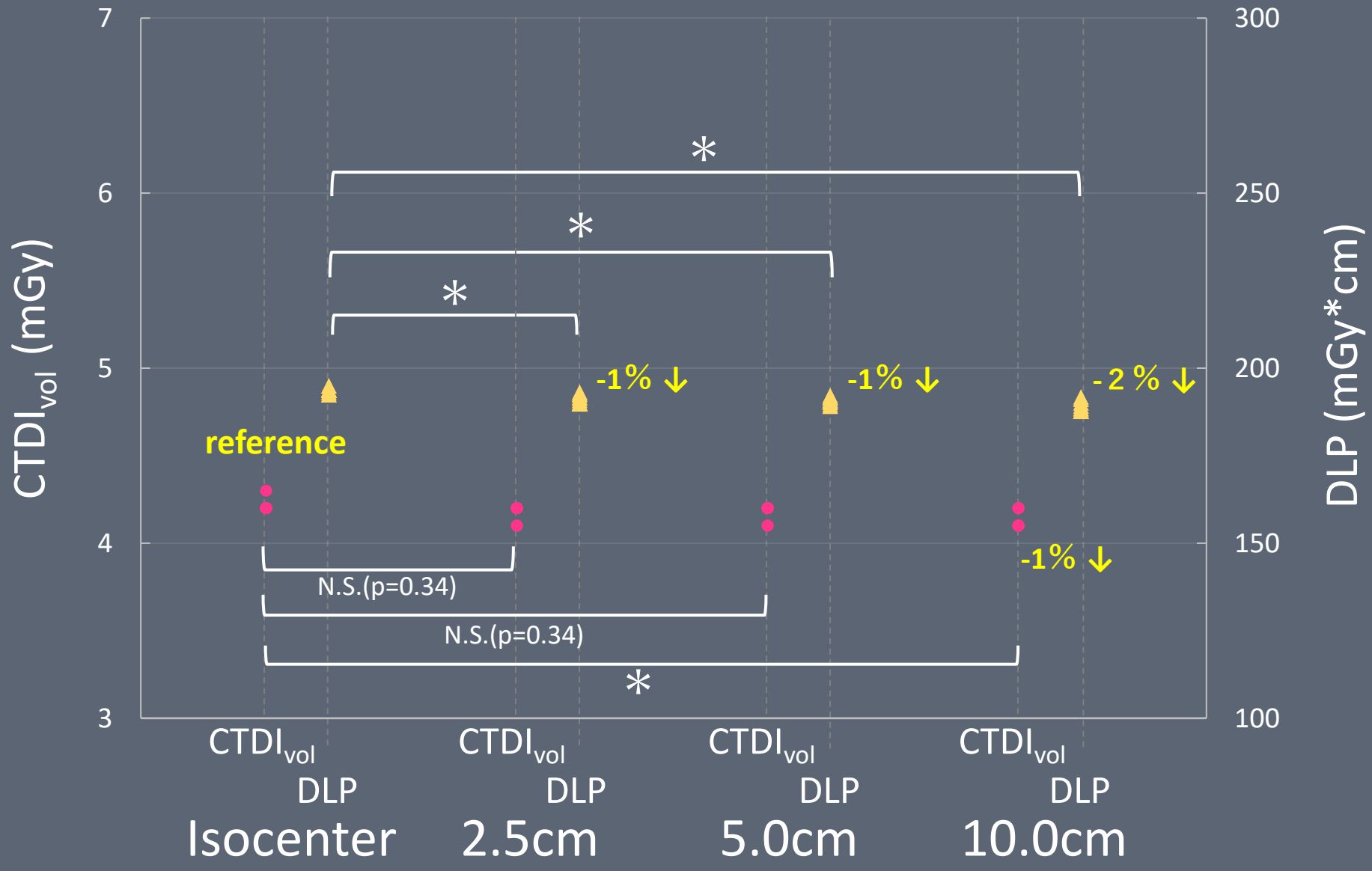


Results Study Ⅱ AHC-ON



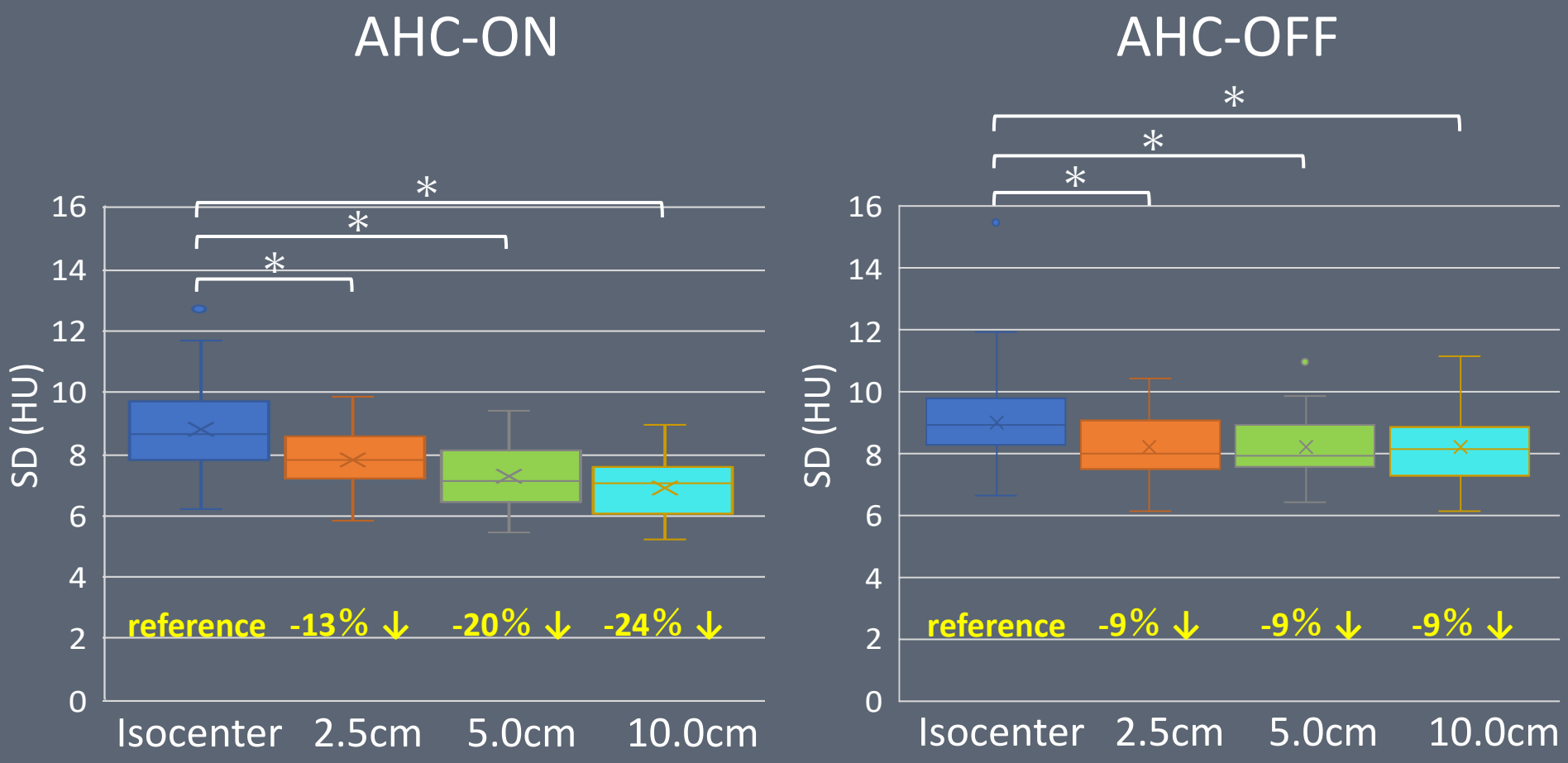
Results Study Ⅱ AHC-OFF

（＊:p＜0.05）



Results Study Ⅱ SD

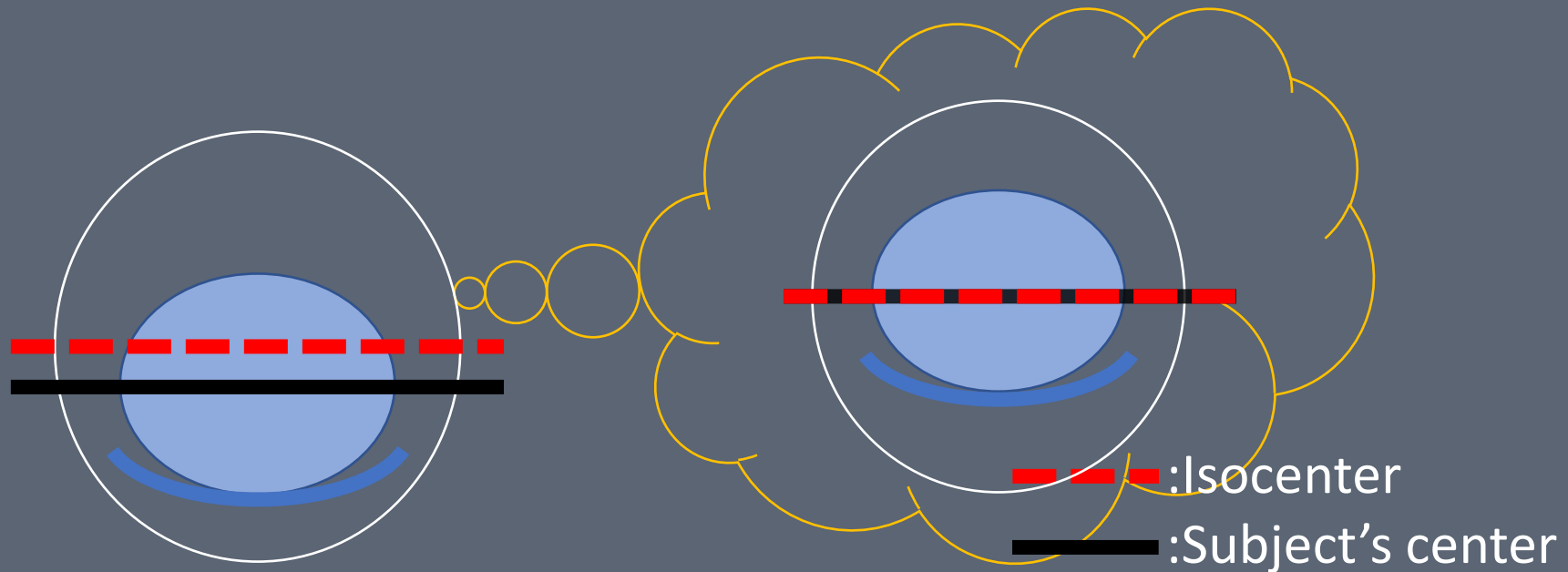
（＊:p＜0.05）



Discussions Study I

Without AHC correction, expose dose varied approximately from -7% to +10% depending on the bed height. However, with AHC correction, expose dose was shown to be almost constant.

Our results showed that the AHC correction can keep the dose constant, even if the bed height is not accurate due to human error.

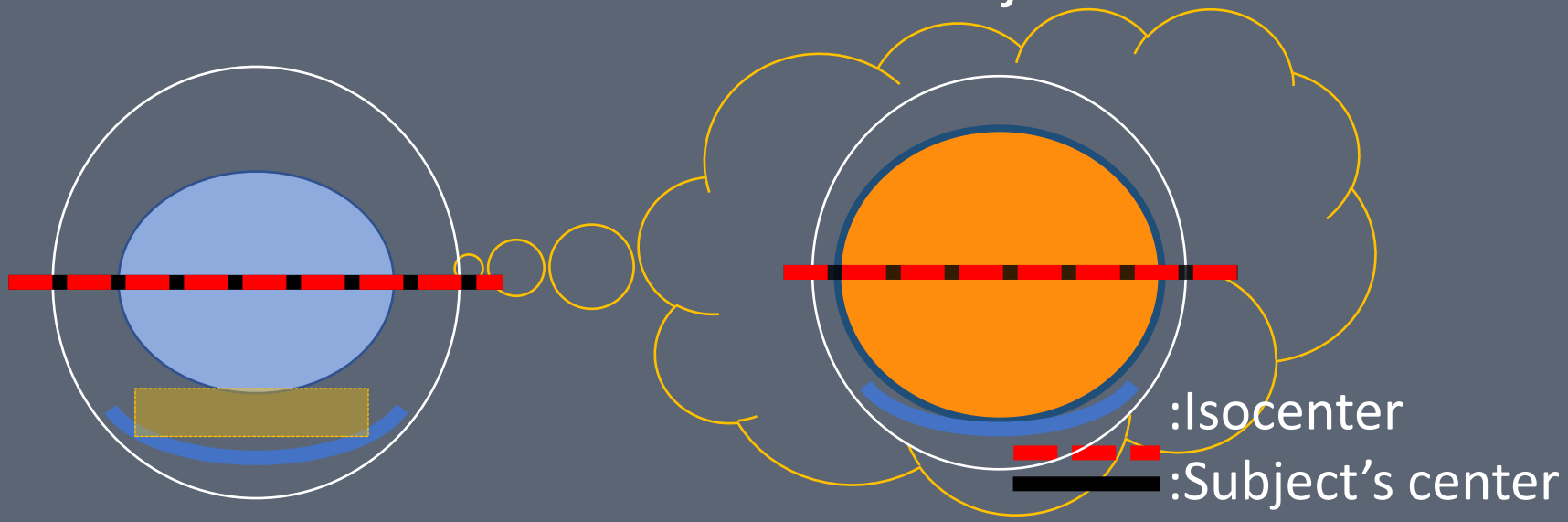


Discussions Study Ⅱ

When using the spacers and keeping the phantom height constant, the exposure dose was found to increase with increasing thickness of the spacer.

Additionally, the image noise decreased using the spacers and keeping the phantom. For our results suggested the possibility of excessive doses.

We think that CT-AEC with AHC may have overestimated the thickness of the subject.



Limitations

This correction mechanism is exclusive to Canon Medical Systems.

This study was conducted at a single facility.

This study is based on phantom measurements.

Conclusion

CT-AEC with AHC enables examinations to be performed at an appropriate exposure dose regardless of the bed height.

It is recommended to avoid using **CT-AEC with AHC** when placing boards or other objects between the patient and the CT table, as it may be result in excessive output dose.