A FastScan Whole Body Counter Geometry That Is Independent Of Subject Size For Small Children To Large Adults

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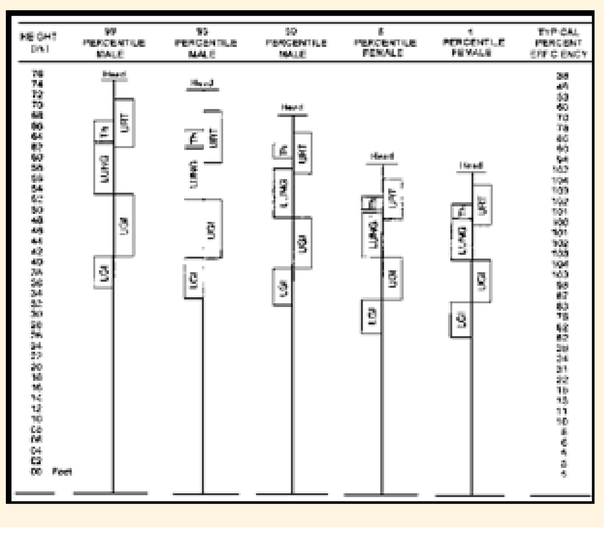
1 INTRODUCTION

- **Fukushima NPP accident has contaminated large areas with Cs-134 and Cs-137**
- **People drink the contaminated water and eat the contaminated food from the area**
- **To inform the public about the internal dose an *in-vivo* population monitoring project has been started**
- **The Fukushima Prefecture has purchased several Mobile FastScan Whole Body Counters for this project**

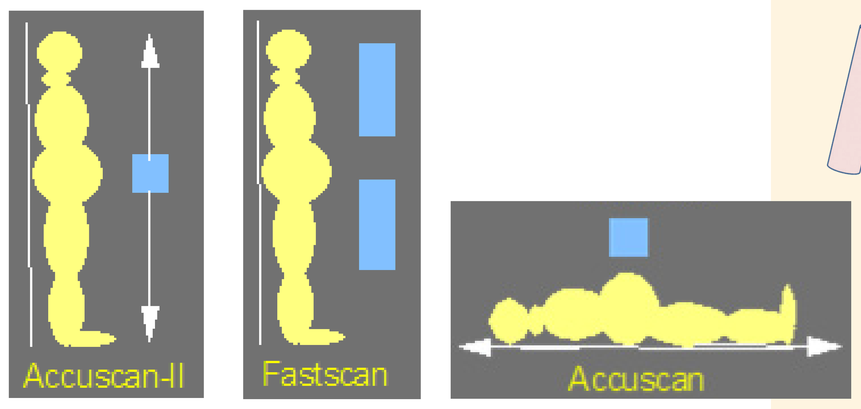
2 PROBLEM

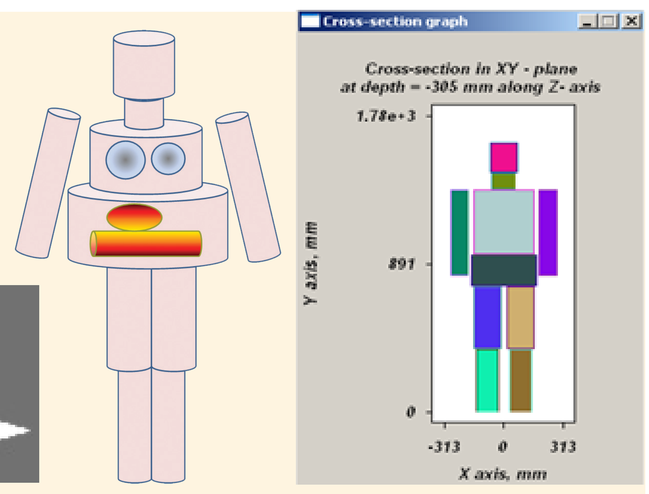
- **FastScan is designed for Radiation Workers**
- **It has 2 large [3x5x16”] NaI detectors for good sensitivity**
- **The counter has constant efficiency [+/- 15%] for important regions of the body**
  - One calibration used for all sizes of workers
  - Accurate from 170cm [Upper Respiratory Tract of 99th percentile adult males] to 75cm [Lower GI Tract of 1st percentile adult females]
  - Covers location of inhaled insoluble particles
  - Covers most of the body mass for soluble materials
- **FastScan is calibrated for Systemic depositions with BOMAB phantom of Reference Man size – 174cm height**
- **Problem: Population to be measured also includes people shorter than 1st percentile females of 145cm – children and others.**
  - Need method to calibrate for these small people
  - Need method to extend the “one calibration” process to small people



3 METHOD TO DEVELOP CONSTANT EFFICIENCY GEOMETRY

- **Created mathematical BOMAB family**
  - Started with ANSI/HPS N13.35-2009 BOMAB calibration phantom dimensions
    - Reference Man + 5 other sizes, including female, 10yr child, 4yr child
  - Used these dimensions to create additional phantom dimensions down to 65cm tall
- **Used ISOCS Mathematical efficiency calibrations instead of building the phantoms and filling them with radioactive sources**
  - Experimental version of ISOCS used
    - allows for elliptical cylinders
    - allows multiple shapes to be included in the same model
    - validated by comparison to BOMAB phantom
  - Rectangular NaI detectors converted to circular equivalent
    - validated by comparison to rectangular detector using MCNP
- **Retained FastScan special geometry of constant distance between face of detector and opposite side of subject; i.e. subject stands facing detectors with back against the rear shield wall**
  - This geometry has very little change with subject diameter
- **Used the special ISOCS software to compute efficiency for small people under various hypothetical geometries, with the goal of finding a simple solution that results in a constant efficiency for all sizes of individuals for Systemic radio-cesium activity**

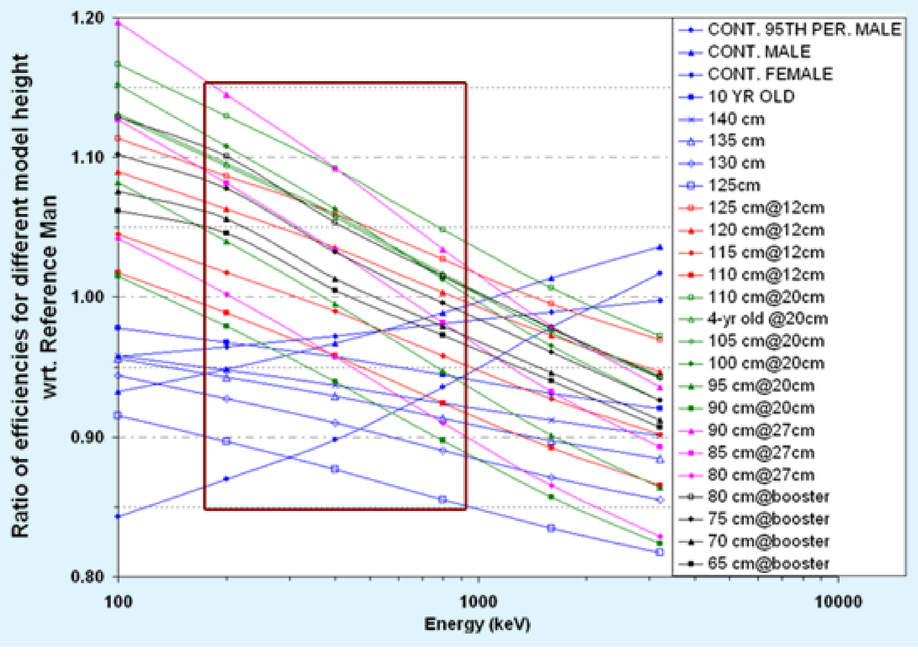




4 RESULT AND CONCLUSION

- **All subjects with back against rear wall**
- **Subjects >125cm tall can stand on floor as normal**
- **Elevate small people to get most of their body within the constant-efficiency portion of the FastScan**
- **Standard BOMAB efficiency used for all subject sizes**
- **Accuracy within 15%, 300-1500 keV, for systemic distributions, using a single efficiency calibration.**

Height [cm]	Measurement mode
>125	Stand on floor
110-125	Stand on 12cm platform
90-109	Stand on 20cm platform
80-89	Stand on 27cm platform
70-79	Stand on 31cm platform
65-79	Sit on 50cm booster chair
<65	Held by adult at mid-height



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