Acuros XB算法与AAA算法在非均匀组织中的剂量计算准确性对比研究

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概述

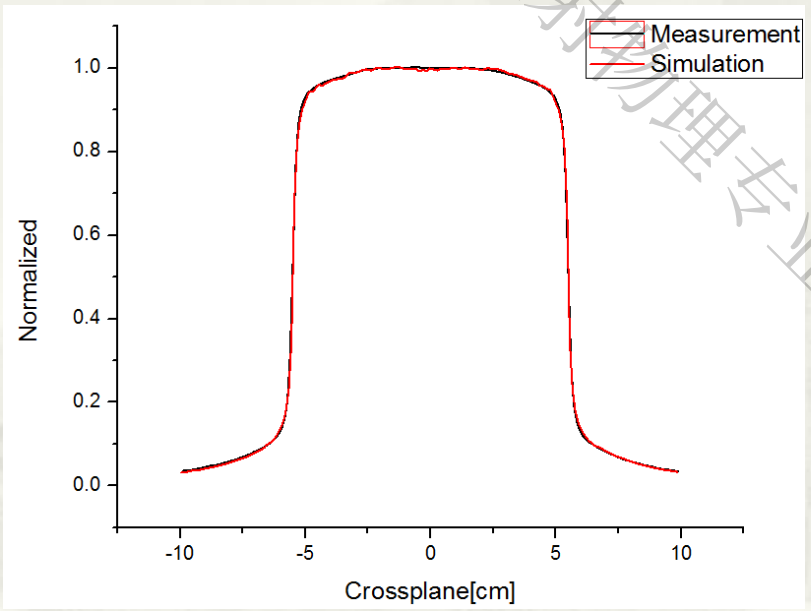
* 剂量精度——Dose Accuracy
  * AXB VS MC VS AAA
    * Inhomogeneous Phantom
    * Clinical Case
* 计算速度——Calculation Speed
  * AXB VS AAA
    * Single Workstation
    * Cloud Computing

剂量精度

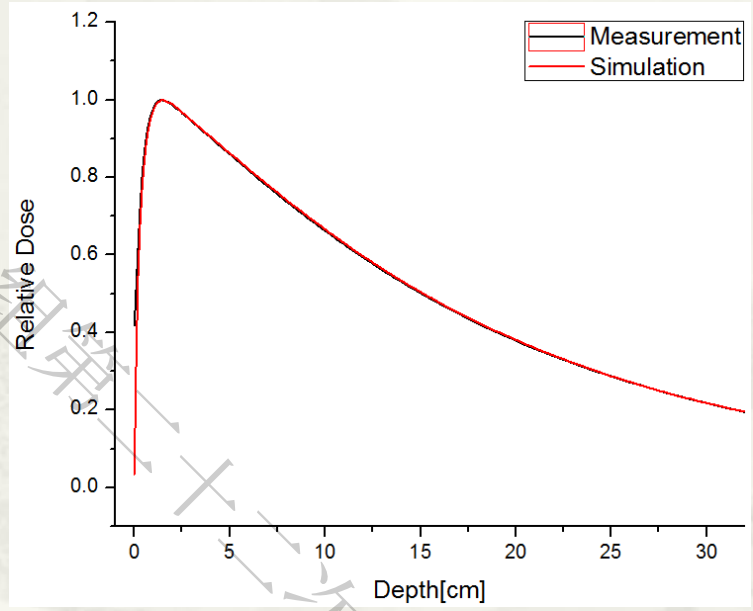
- Tools
  - AXB version 10.0.28
  - MC——BEAMnrc and DOSXYZnrc （National Research Council of Canada）
  - LA Truebeam 6 MV-Xray
  - MC VS Water Phantom Measurement

剂量精度

* Monte Carlo模型：Field 10cm×10cm Depth10cm



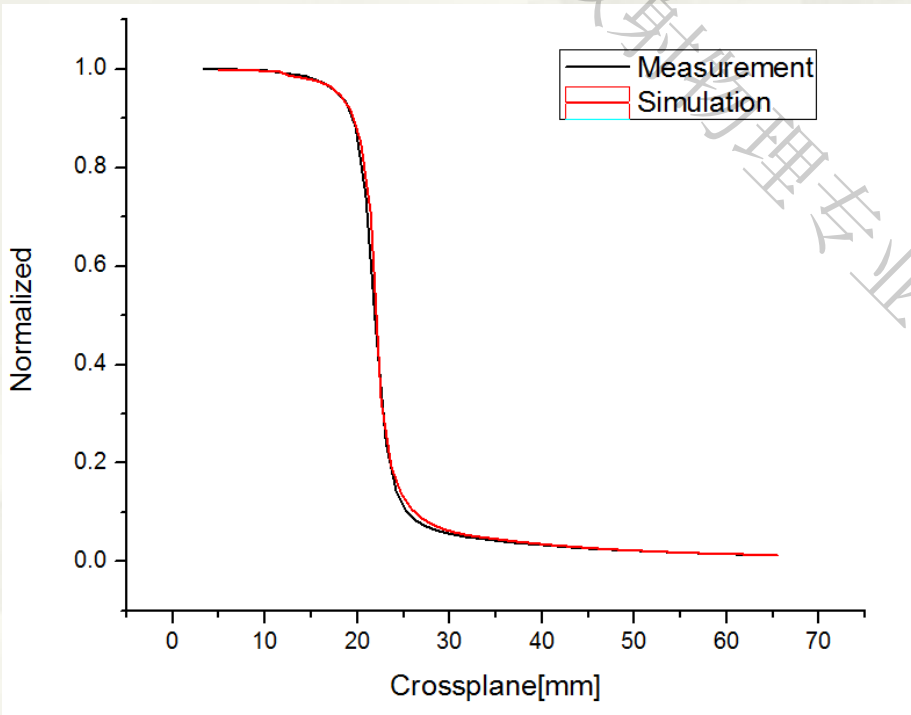
1mm 1% gamma 1D

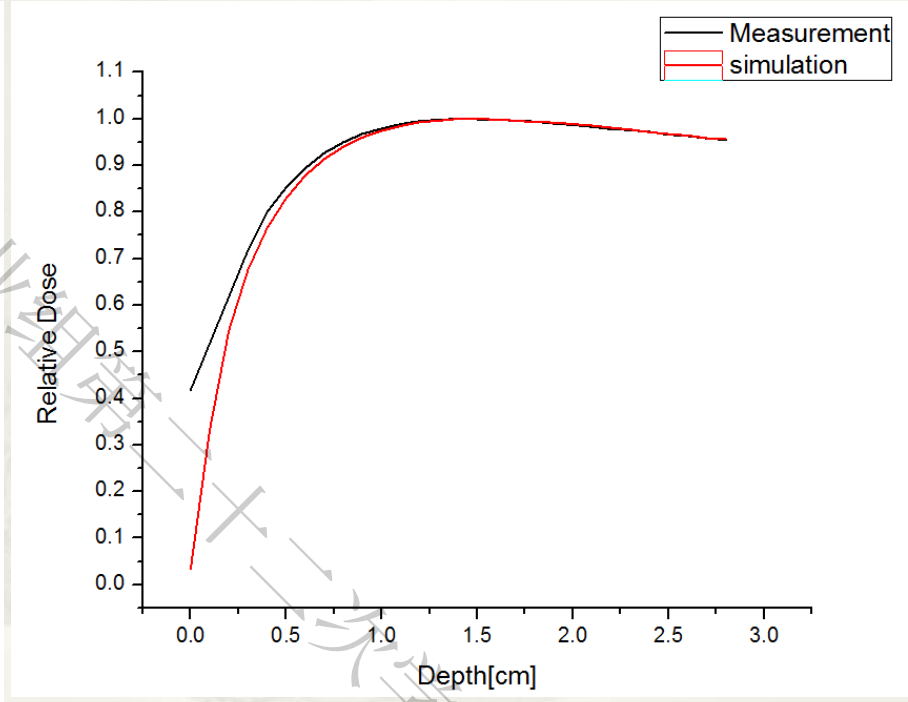


0.5mm 0.5% gamma 1D

剂量精度

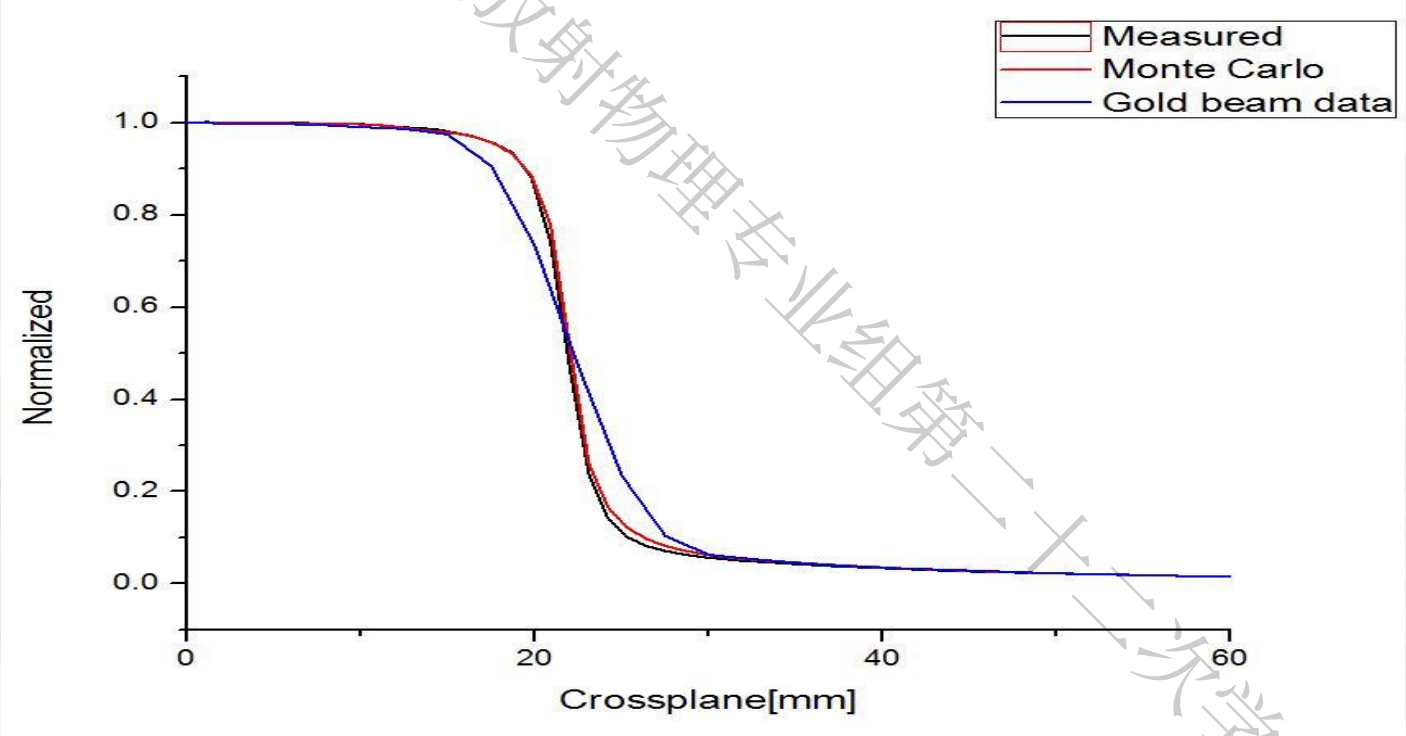
* 存在的问题





剂量精度

* Measurement VS MC VS Gold beam data



剂量精度

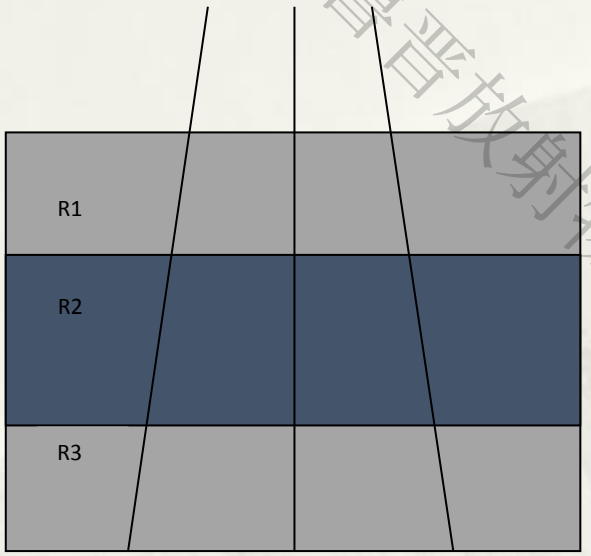


图 1

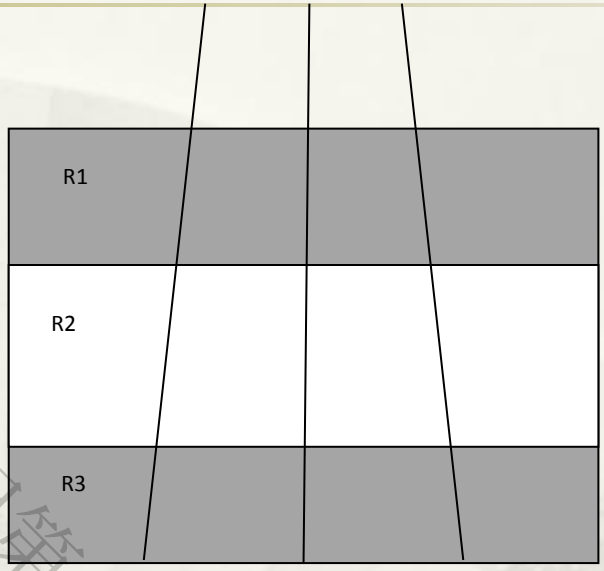
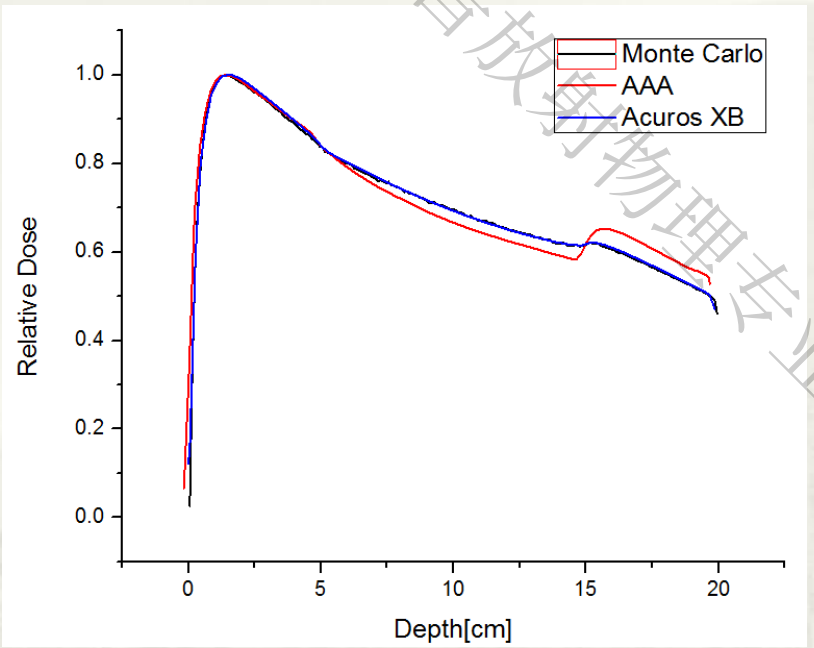


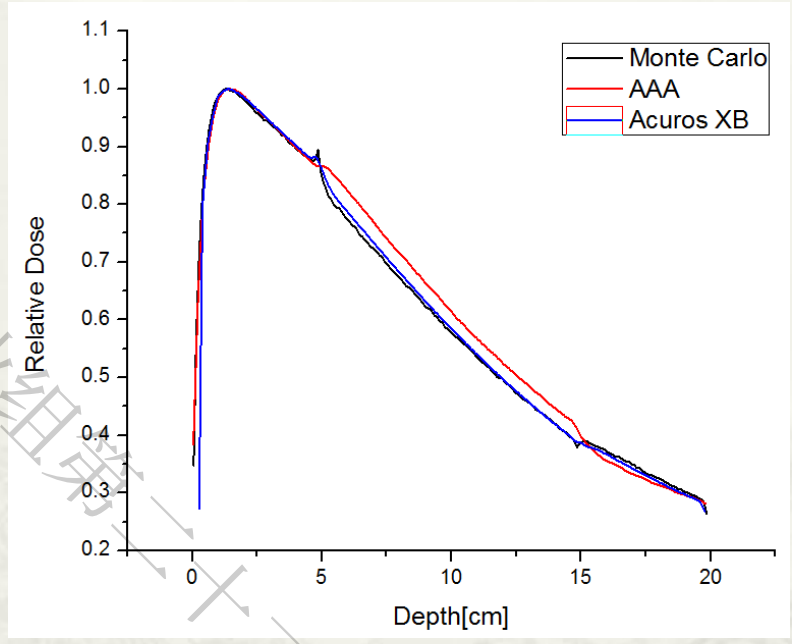
图 2

其中R1和R3部分为水，CT HU= 40，物质密度为1.0608 g /cm^{-3}，
图1 R2部分为肺组织，HU=-900，物质密度为0.111g cm^{-3}
图2 R2部分为骨组织，HU=1355，物质密度为1.85 g cm^{-3}
R1长5cm和R3，R2为10cm

剂量精度

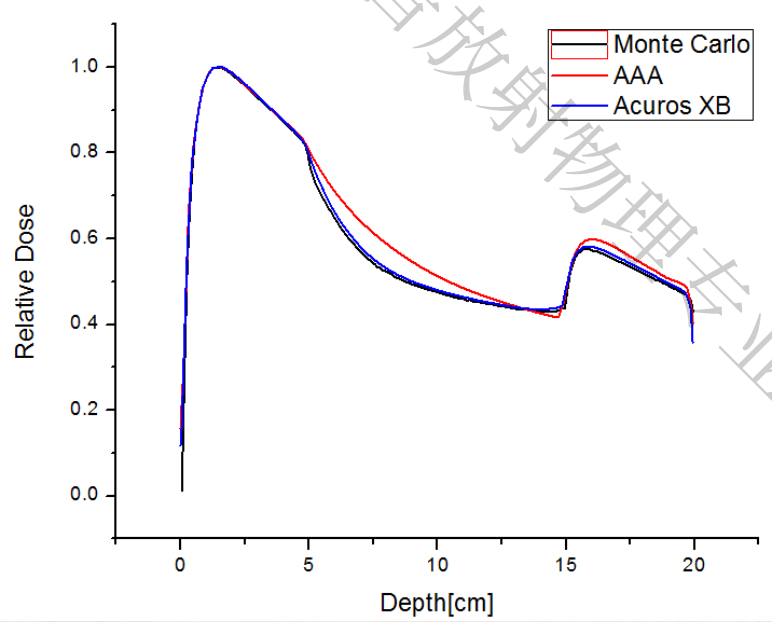


Field 10cm×10cm
water-Lung-water

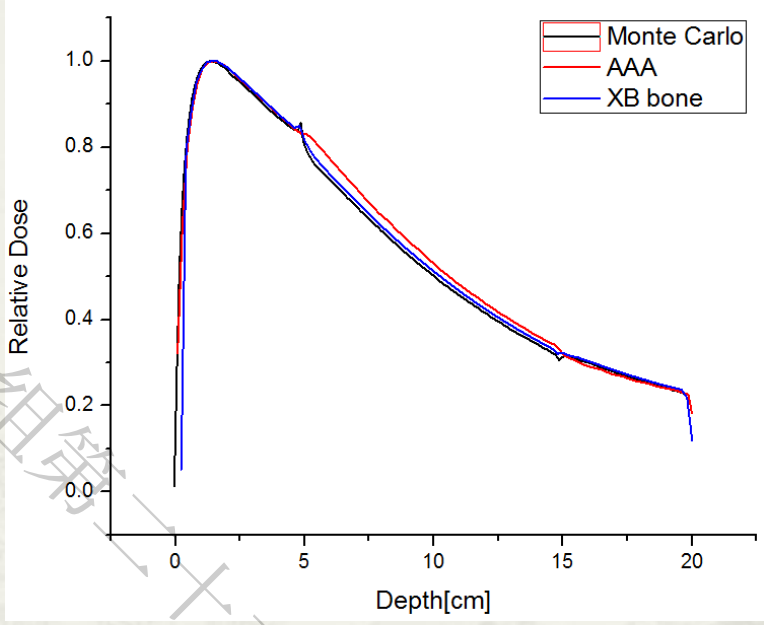


Field 10cm×10cm
Water-Bone-water

剂量精度



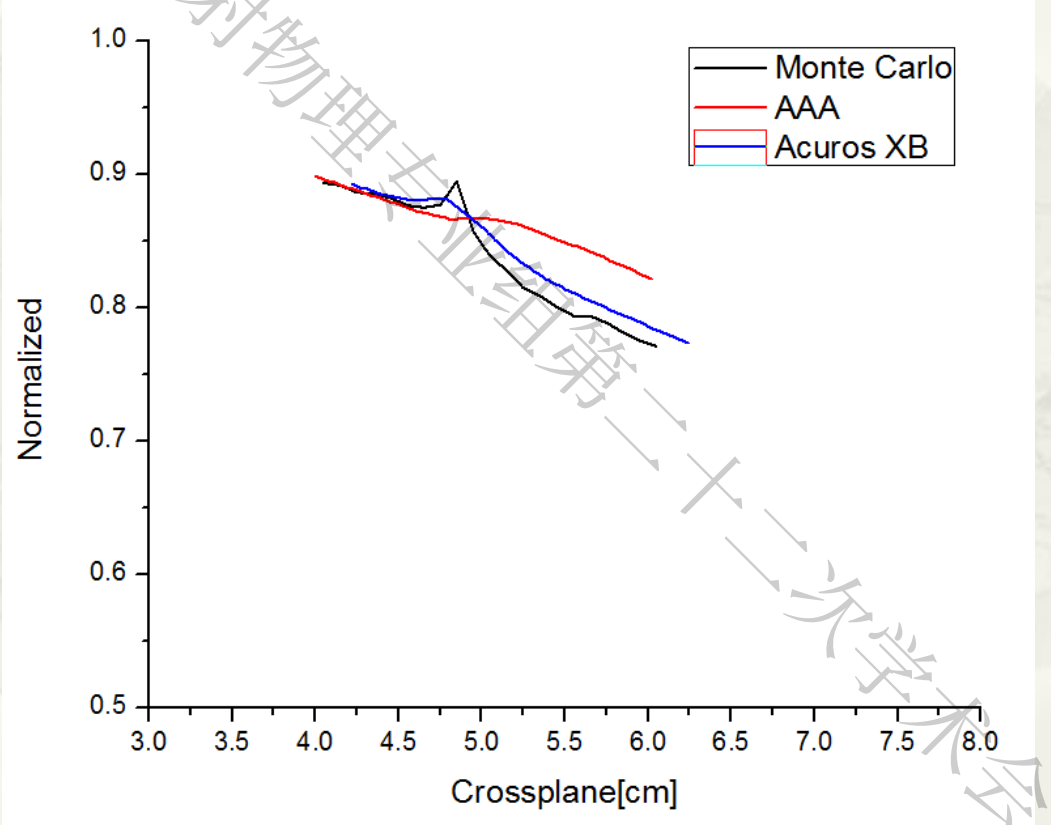
Field 3cm×3cm
Water-Lung-water



Field 3cm×3cm
Water-Bone-water

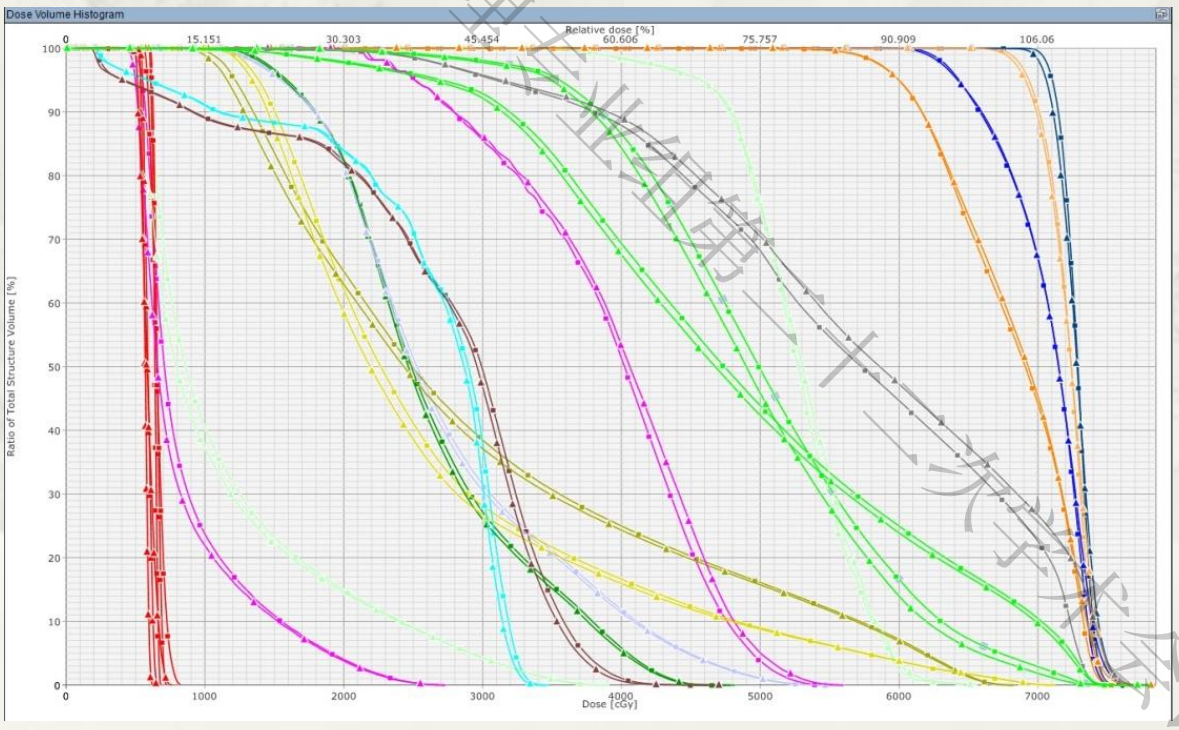
剂量精度

* 交界面



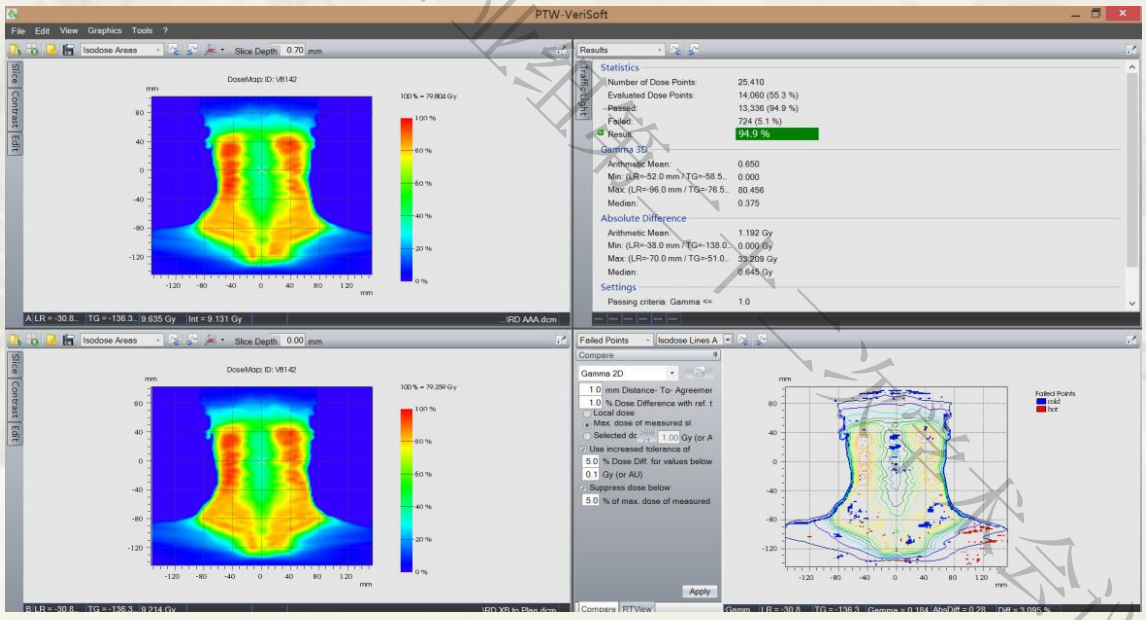
剂量精度

- AXB VS AAA（NPC）
  - cavity mean dose 2.2% higher
  - mandible mean dose 1.9%lower



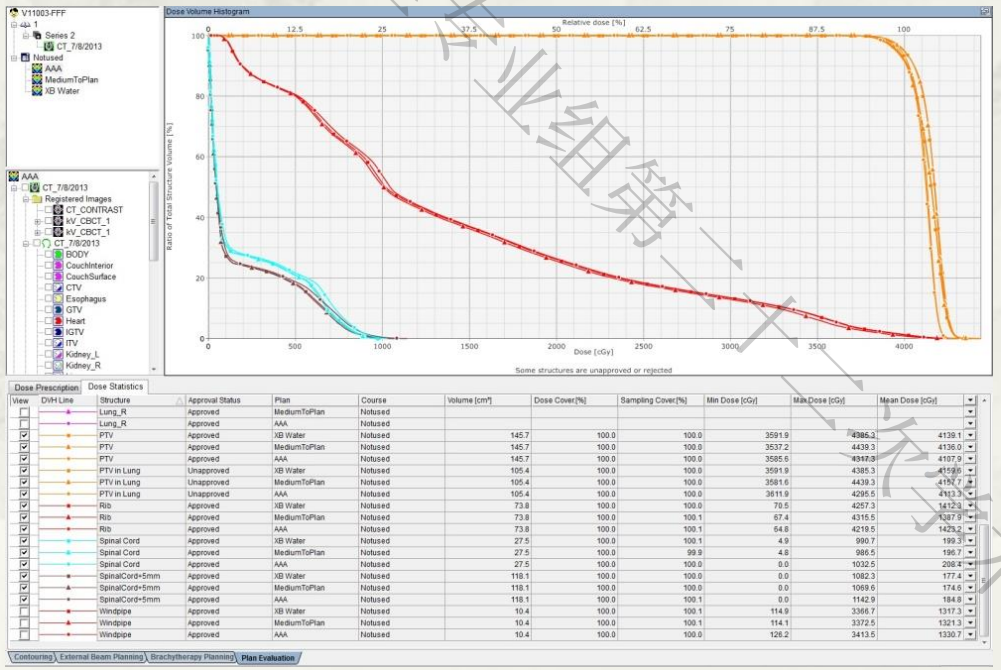
剂量精度

- AXB VS AAA（NPC）
  - Gamma 3D：2mm, 2%
  - 通过率： 91.8%（local dose）97.7%（Max dose）

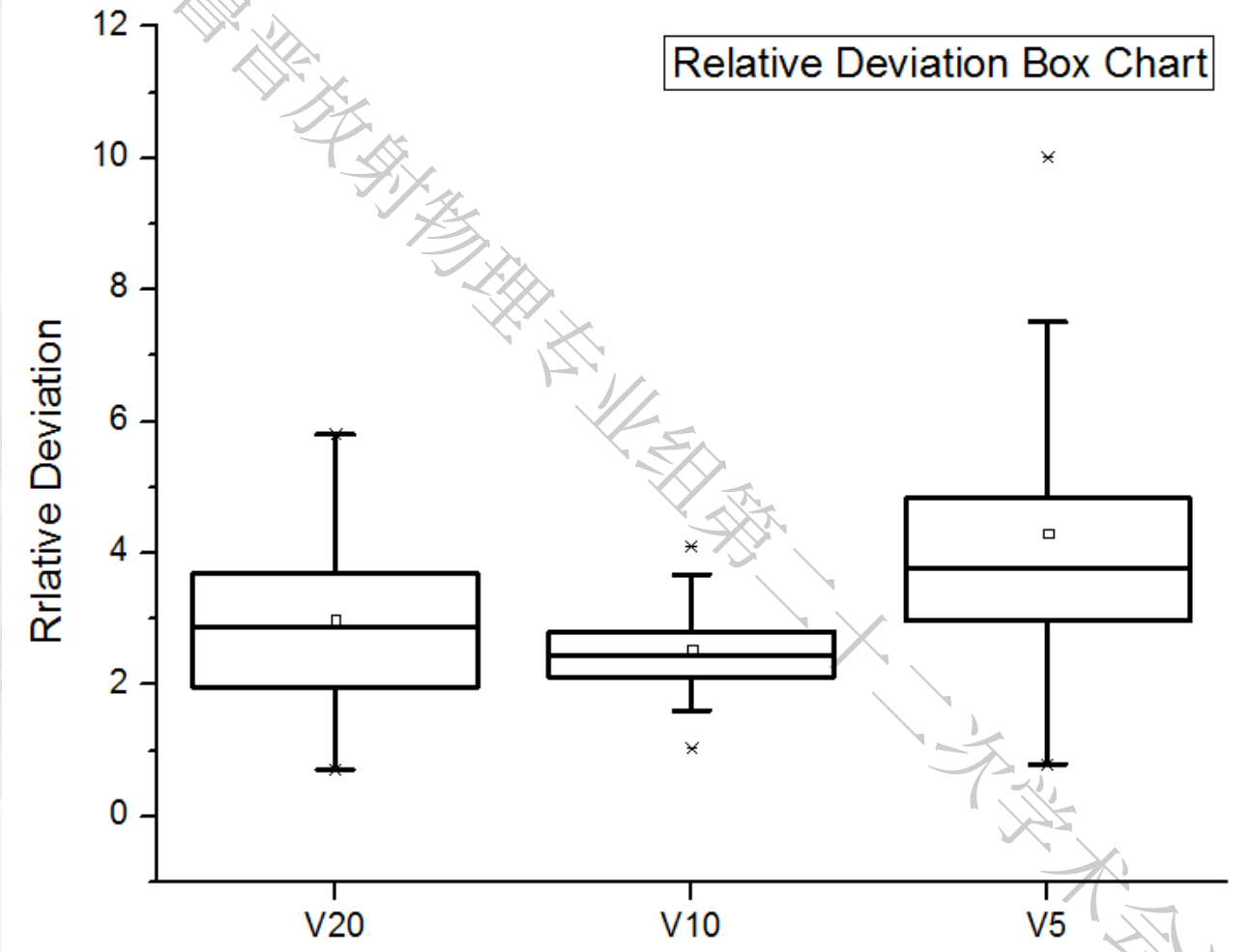


剂量精度

* AXB VS AAA（SBRT-Lung cancer）
  * PTV in Lung　mean dose 1.1% higher
  * Ribs　　mean dose 1.9% lower



剂量精度



计算速度

- AXB VS AAA —— Single Workstation
  - 2 Arc NPC, 计算网格 0.2cm
  - Dual Intel 6 core CPU 3.33GHz, 24G RAM

Algorithm	AXB	AAA
计算时间	13'03"	26'10" (2mm) 17'07"(2.5mm)

计算速度

- AXB VS AAA

  ——Single Workstation with different CPU

  - 2 arc NPC, 2mm calculation grid
  - (ECA914) Dual Intel 6 core CPU 3.33GHz
  - (ECE610) Dual Intel 4 core CPU 2.4GHz

Algorithm	AXB	AAA
ECA914	13'03"	26'10"
ECE610	23'38"	50'30"

计算速度

* AXB VS AAA

  —— Cloud Computing(more than 10 Eclipse)

Algorithm	AXB	AAA
ECA914	13'03" Dose to plan A11 9’10”	26'10"
Cloud Computing	9'20" Dose to field A11 6’37”	5'28"

总结

- AXB提高了计算速度
- SBRT 中AXB提高了剂量计算精度
- AXB对硬件依赖性强

Thanks!

谢谢！