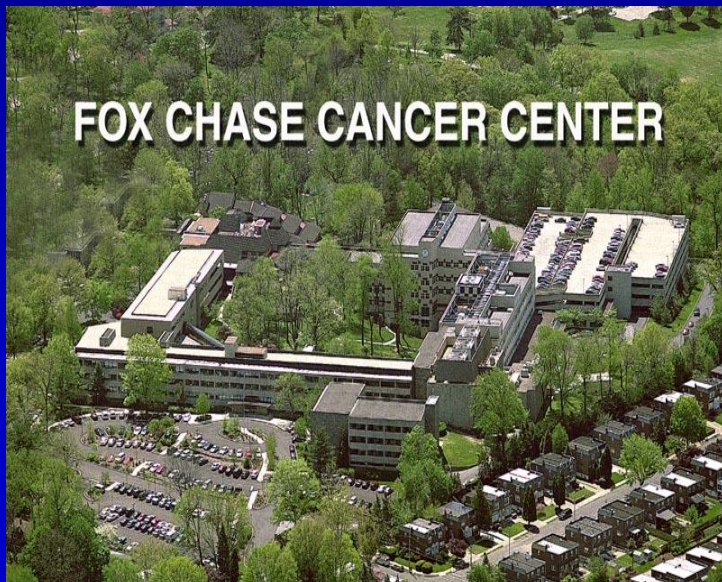


Investigation of Conformal Arc Therapy Utilizing Cobalt 60 Beams

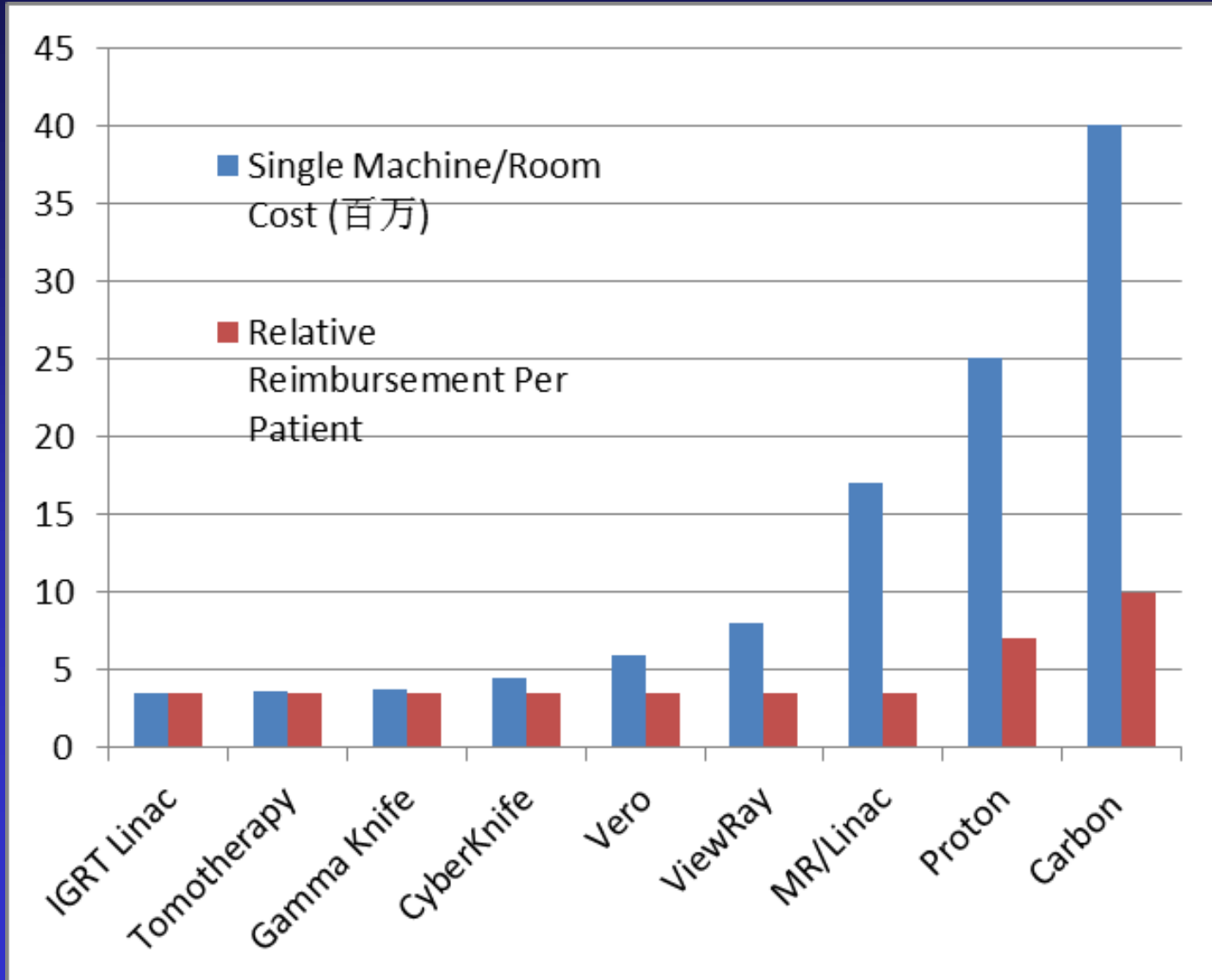


**Ahmed Eldib (1), Grisel Mora (2),
Omar Chibani (1), Jinsheng Li (1)
and Charlie Ma(1)**

**(1) Department of Radiation Oncology
FCCC, Philadelphia, PA 19111**

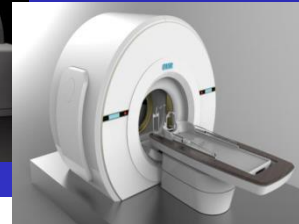
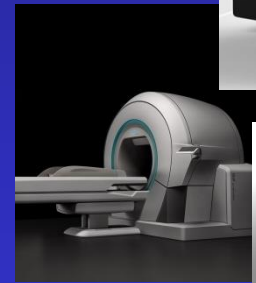
**(2) University of Lisbon - Center for
Nucl Phys, Lisbon, Portugal**

RT Equipment Cost & Reimbursement (US)



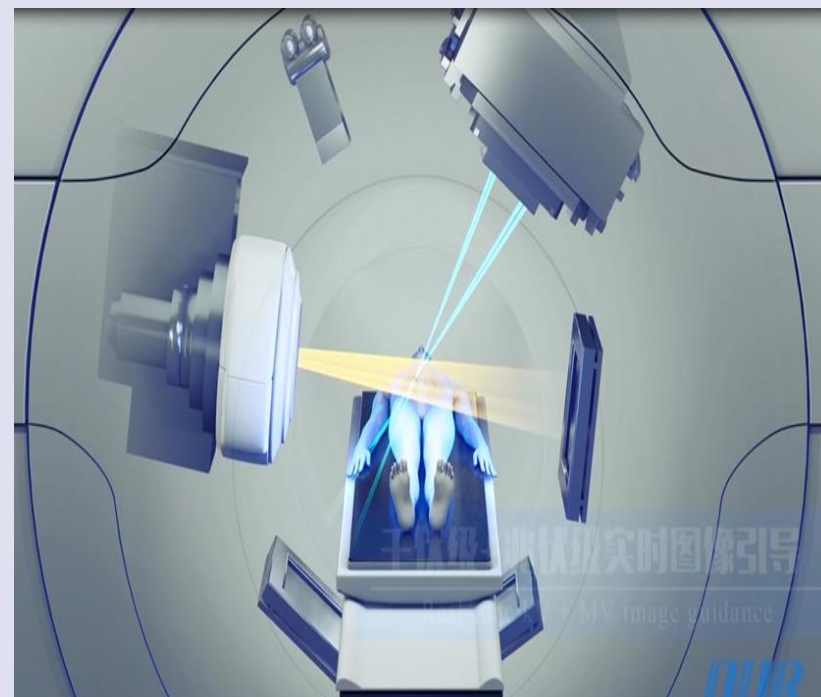
Rational Development of RT Equipment

- Future direction: functionality and cost-effectiveness
- What structure: L-shape vs. circular Gantry
- Particle type: Cobalt vs. X-rays vs. Protons



CybeRT- an Integrated SRS/SBRT/RT System

- A focusing head + a MLC head
- A low-dose kV CBCT
- A 6 degrees of freedom couch
- 35-68° noncoplanar angles
- Gating and tracking
- <0.5mm isocenter accuracy
- Advanced TPS
- 3DCRT, IMRT, VMAT, IGRT, SRS, SBRT



Courtesy of Cyber Medical Corp

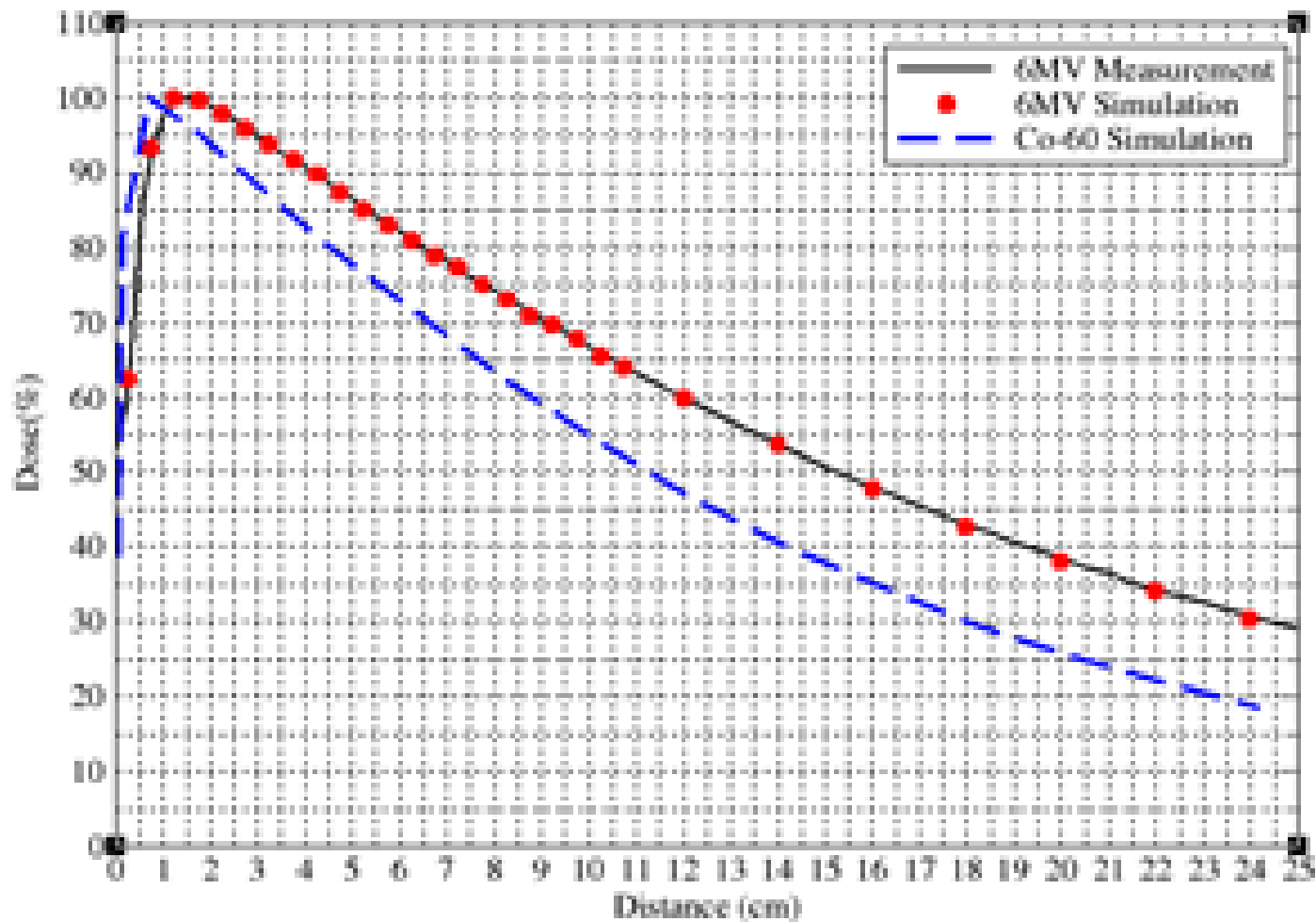
MC Studies of a Prototype Machine

- EGS4/MCSIM to simulate machine head and dose distribution – a feasibility study
- Lung SBRT requires accurate dose calculation
- Customized program for computation efficiency
- 10 keV for energy cutoffs and secondary particle generation

MC is an ideal tool for feasibility studies

Co-60 vs Linac: PPD Difference

1cm Co-60 source vs 6MV photon beam



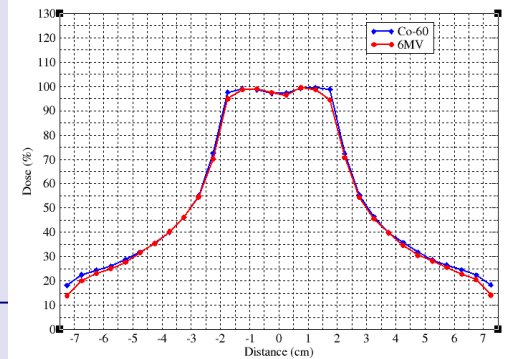
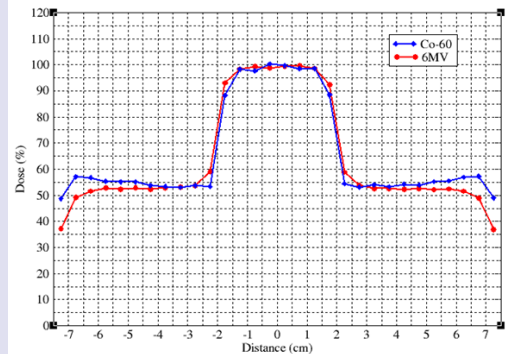
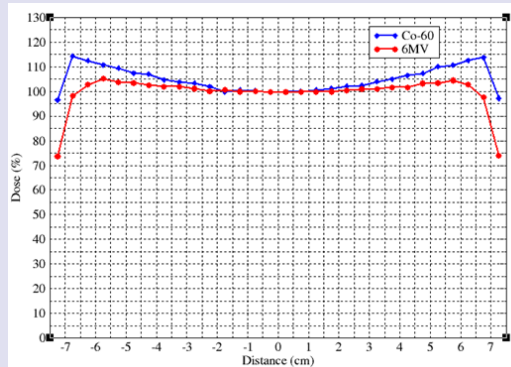
Co-60 vs Linac: Surface Dose Difference

Parallel opposed

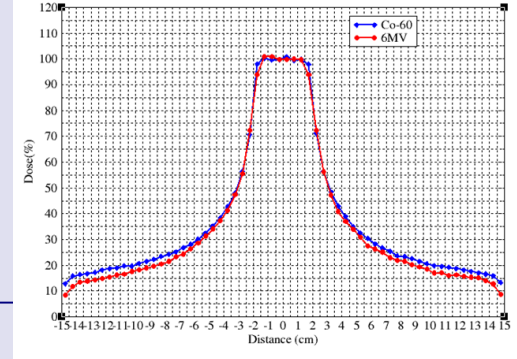
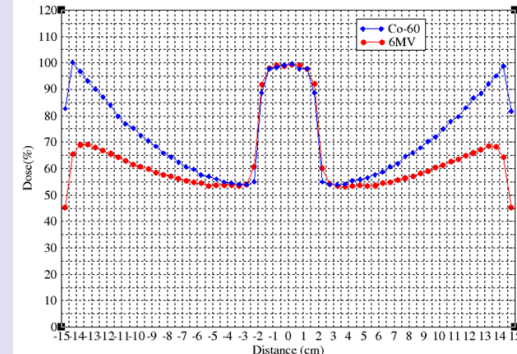
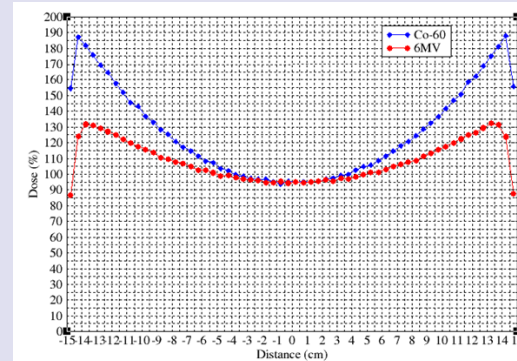
4 beam box

Arc

15cm phantom



30cm phantom

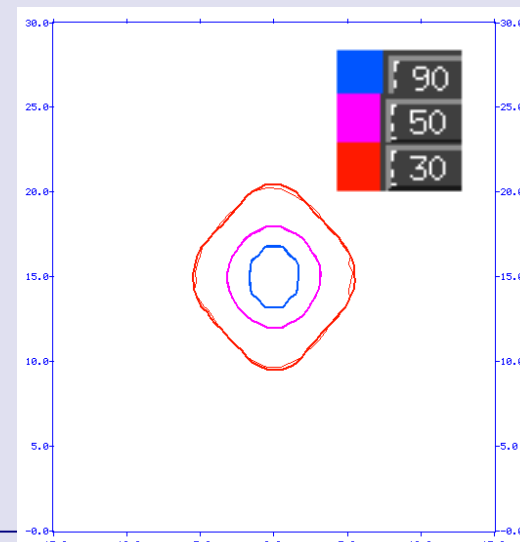
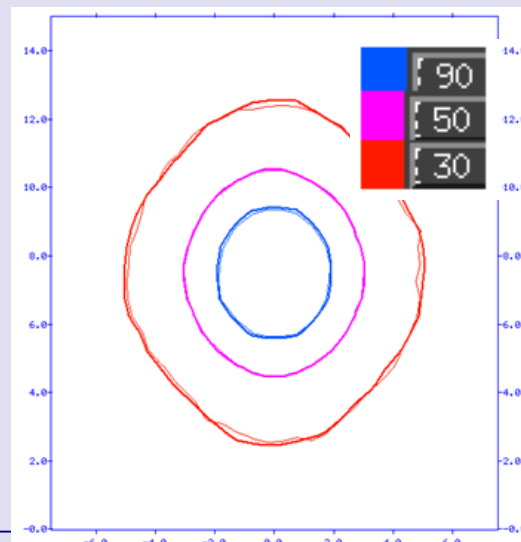
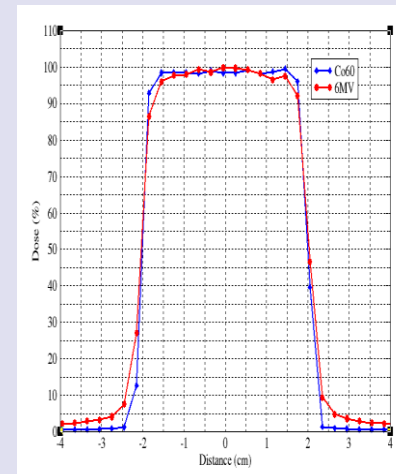
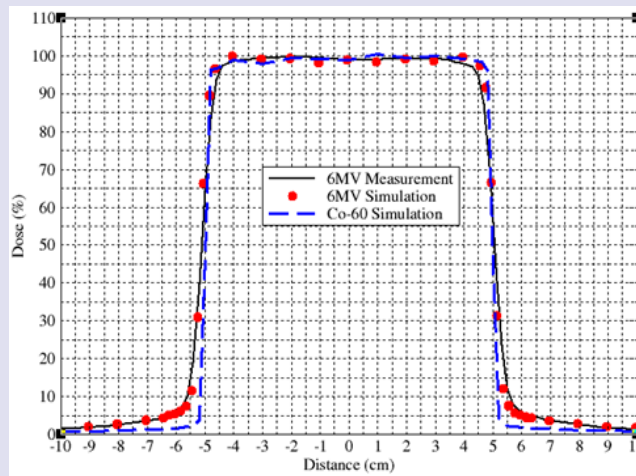


Co-60 vs Linac: Penumbra Effect

10cm x 10cm

4cm x 4cm

Single field



4cm x 4cm Arc

15cm phantom

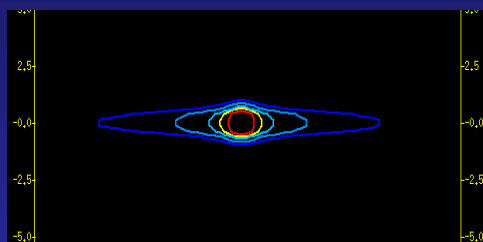
30cm phantom

Single Arc Dose Distribution

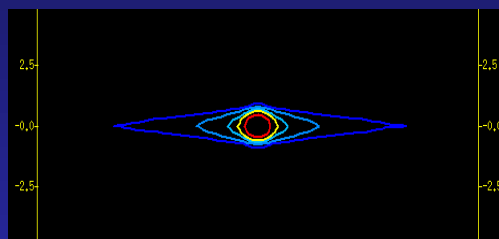
- the focusing effect

A 10mm collimator

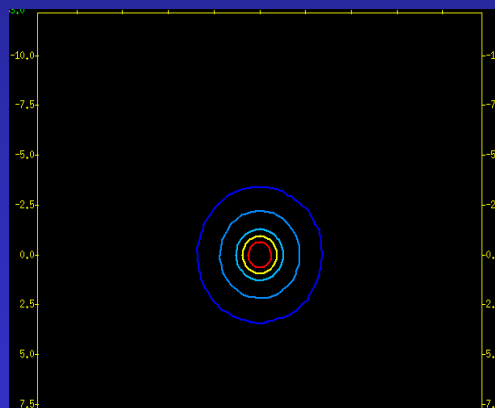
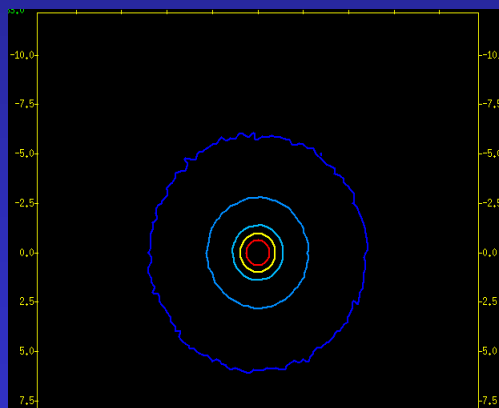
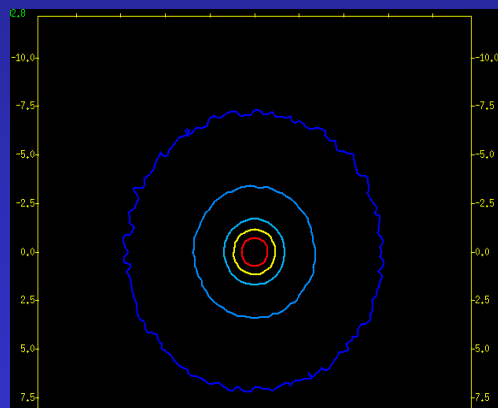
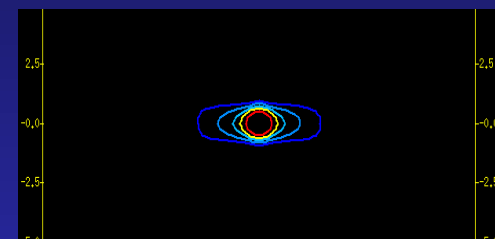
6MV Linac Beam



Co-60 MLC Beam

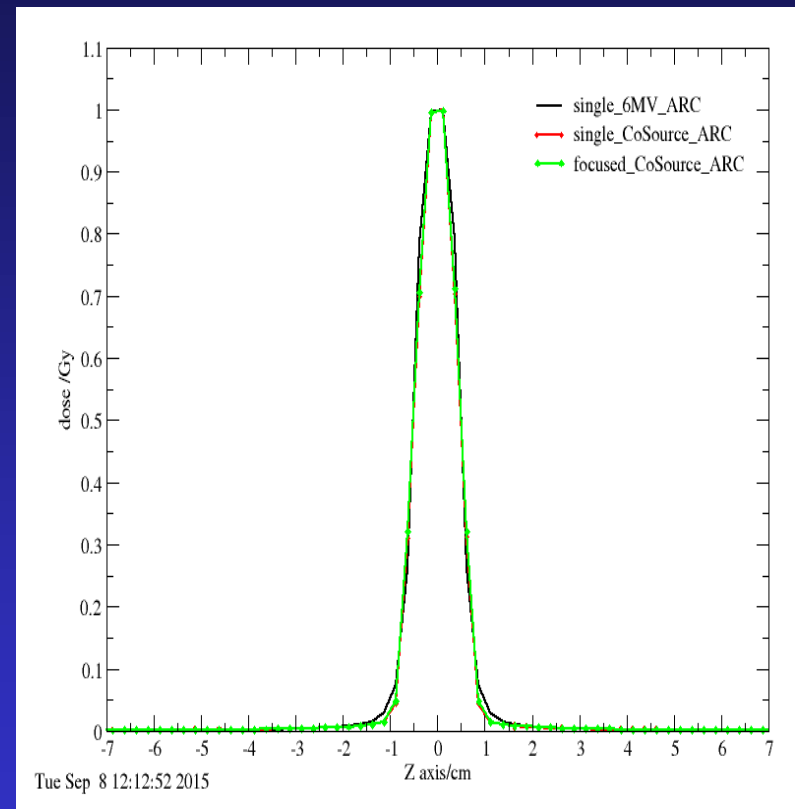
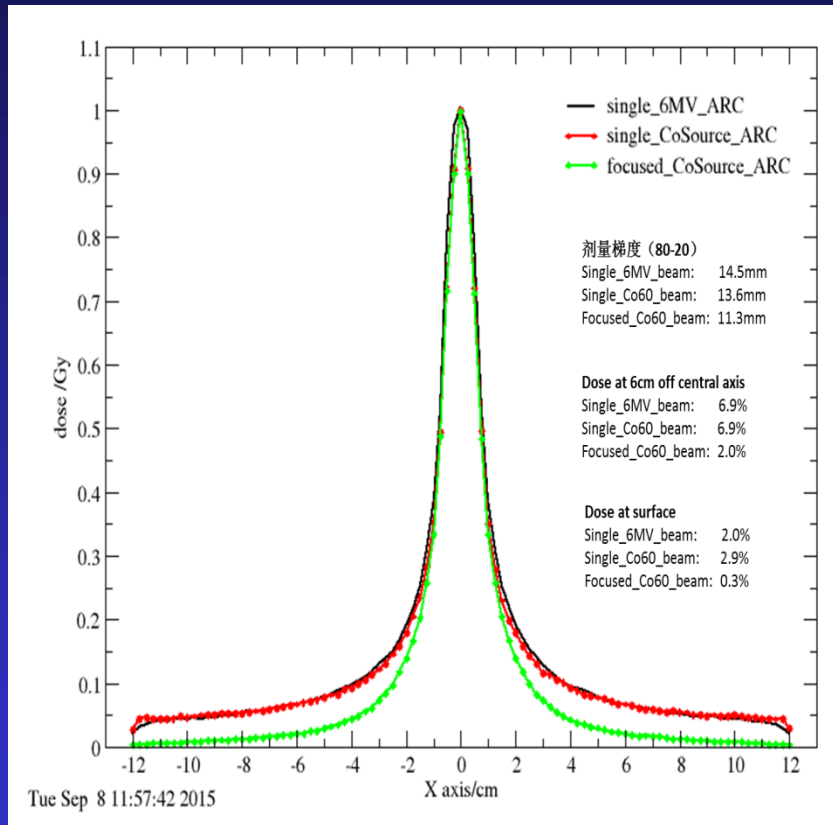


16 Co-60 focused Beams



Single Arc Dose Distribution

- the focusing effect A 10mm collimator



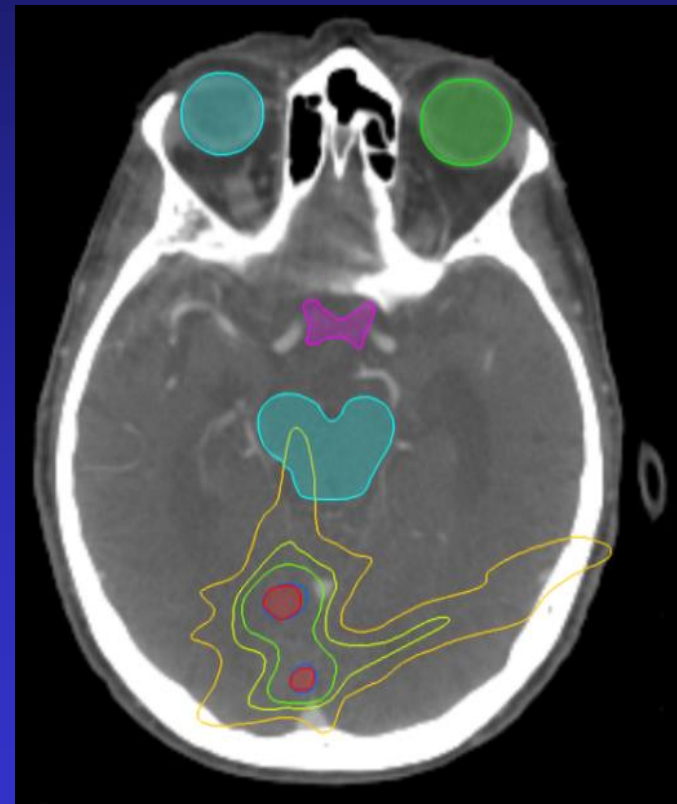
Single arc (360 degrees)	Axial penumbra (mm)	Off-center dose (6cm) (%)	Surface dose (%)
6MV beam	14.5	6.9	2.0
Co-60 single source	13.6	6.9	2.9
Co-60 multiple sources	11.3	2.0	0.3

Focusing Co-60 vs. CyberKnife: Brain

CyberRT



CyberKnife



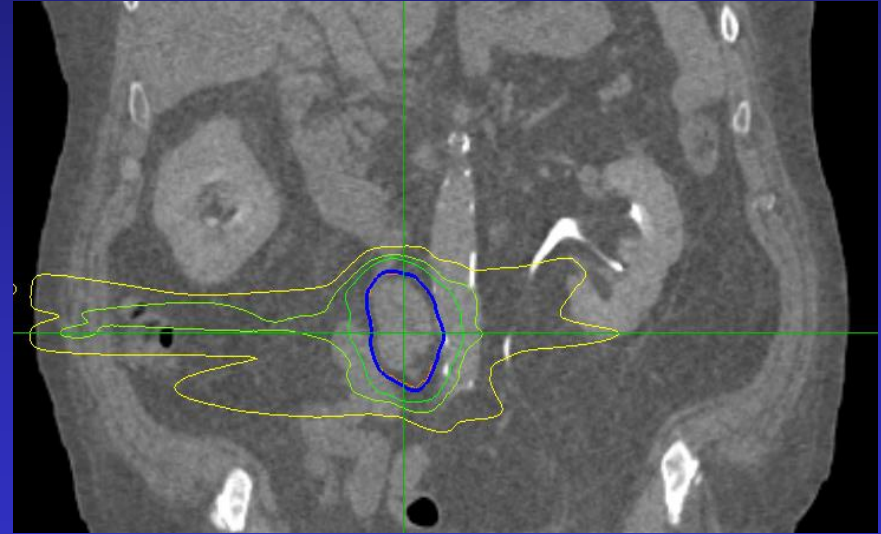
Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Paraspinal

CybeRT



CyberKnife



Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Lung

CybeRT



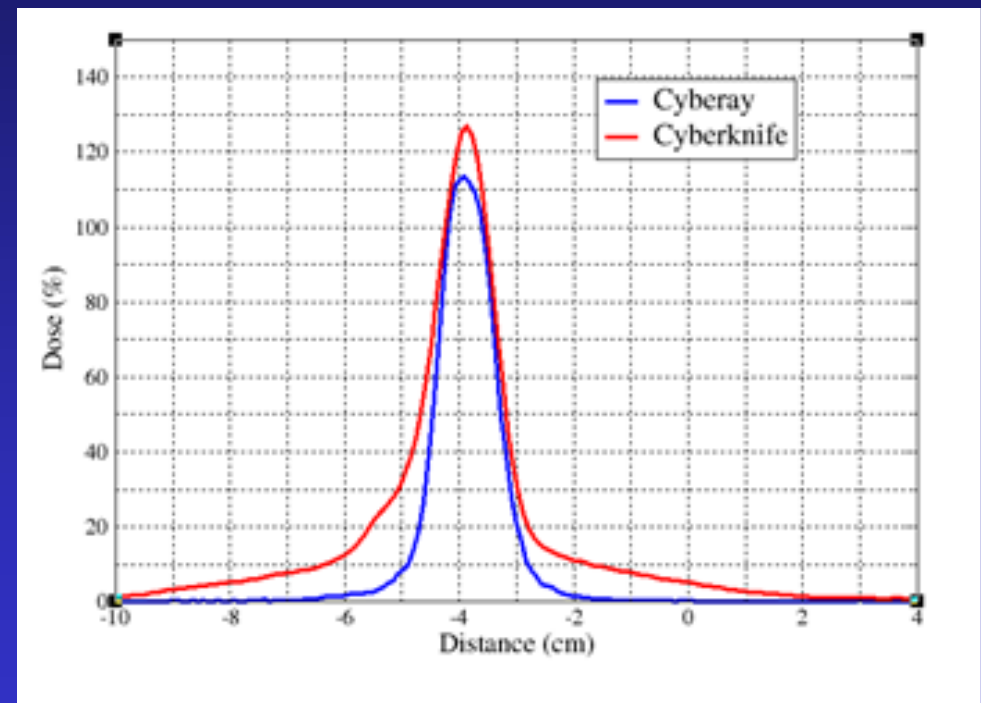
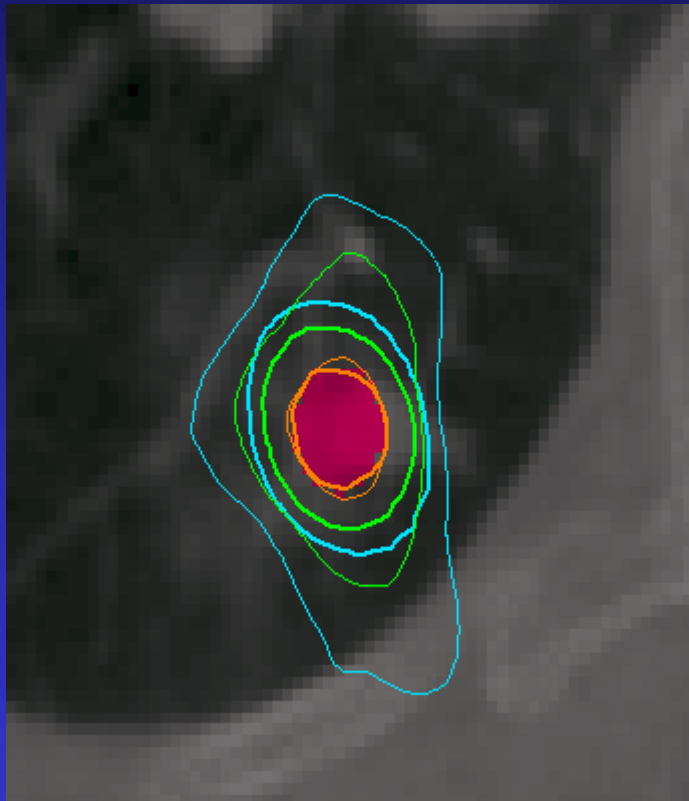
CyberKnife



Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Lung

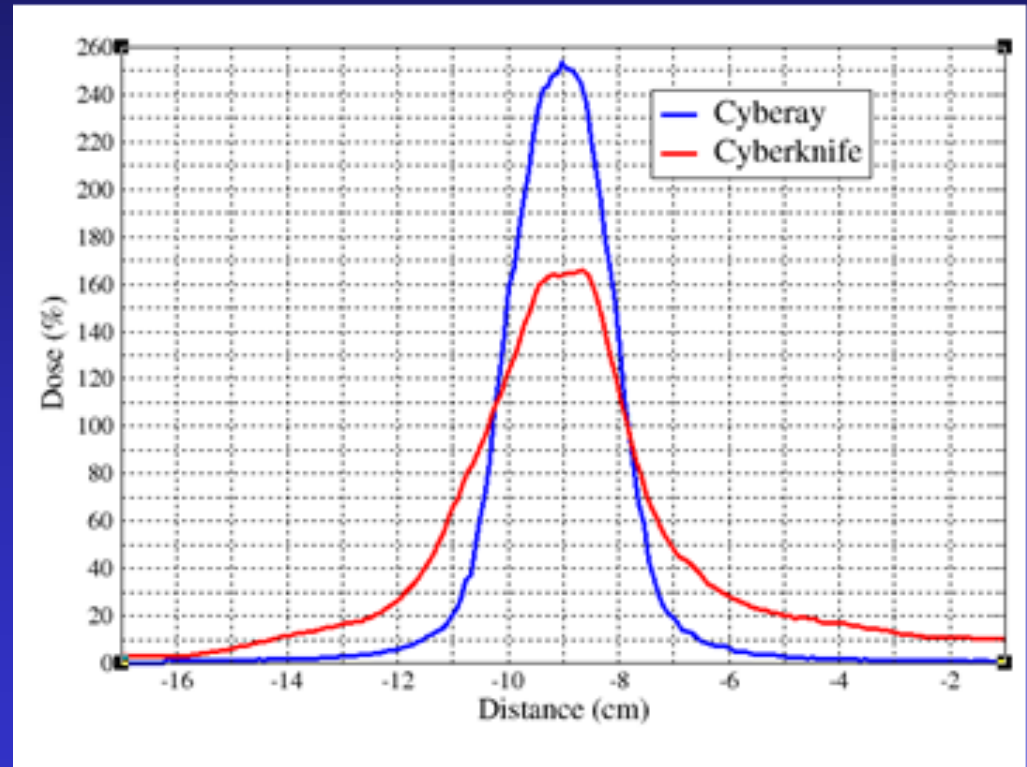
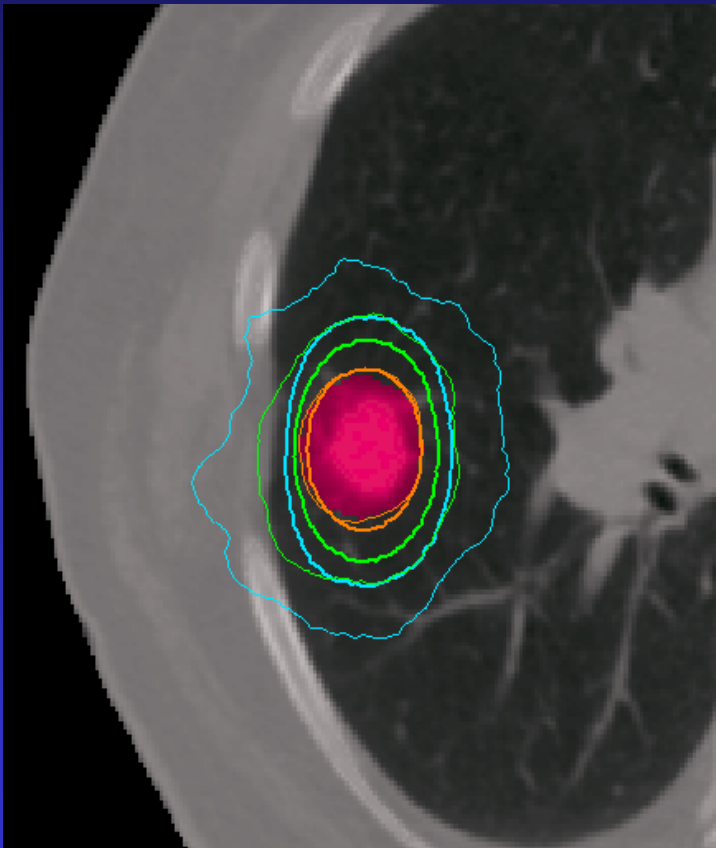
Thick lines: CybeRT
Thin lines: CyberKnife



Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Lung

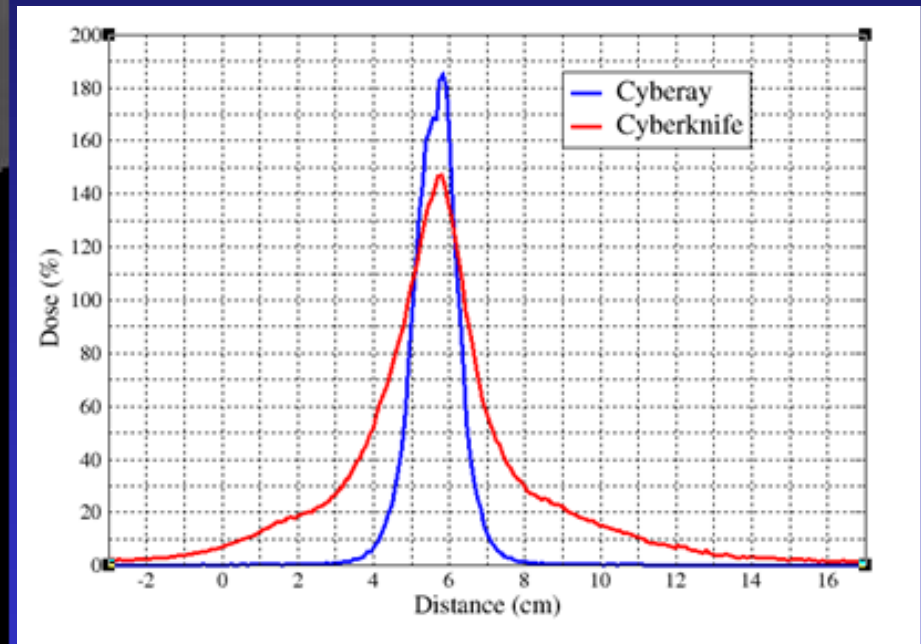
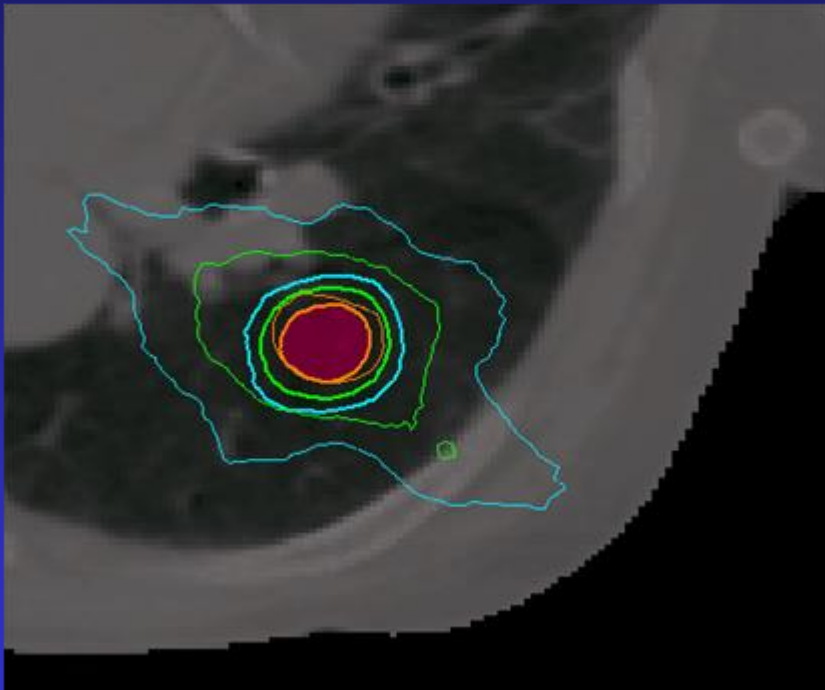
Thick lines: CybeRT
Thin lines: CyberKnife



Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Lung

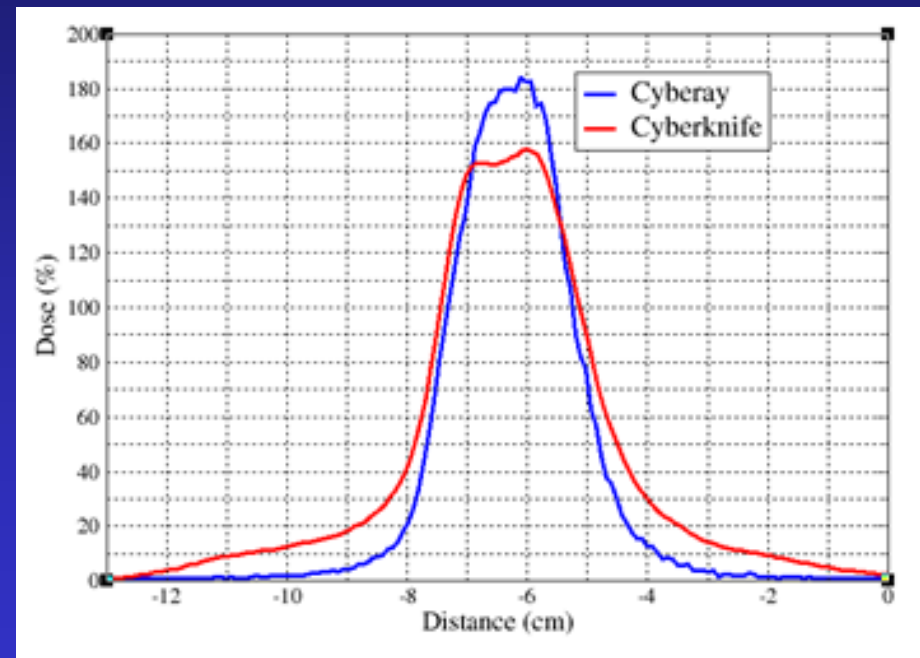
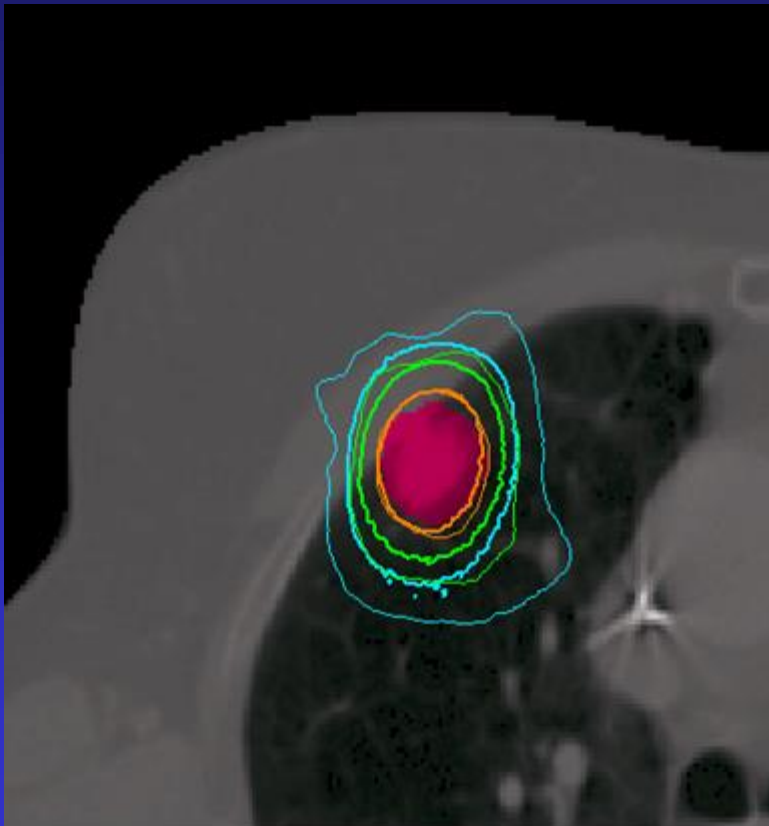
Thick lines: CybeRT
Thin lines: CyberKnife



Re-computed using Monte Carlo simulation

Focusing Co-60 vs. CyberKnife: Lung

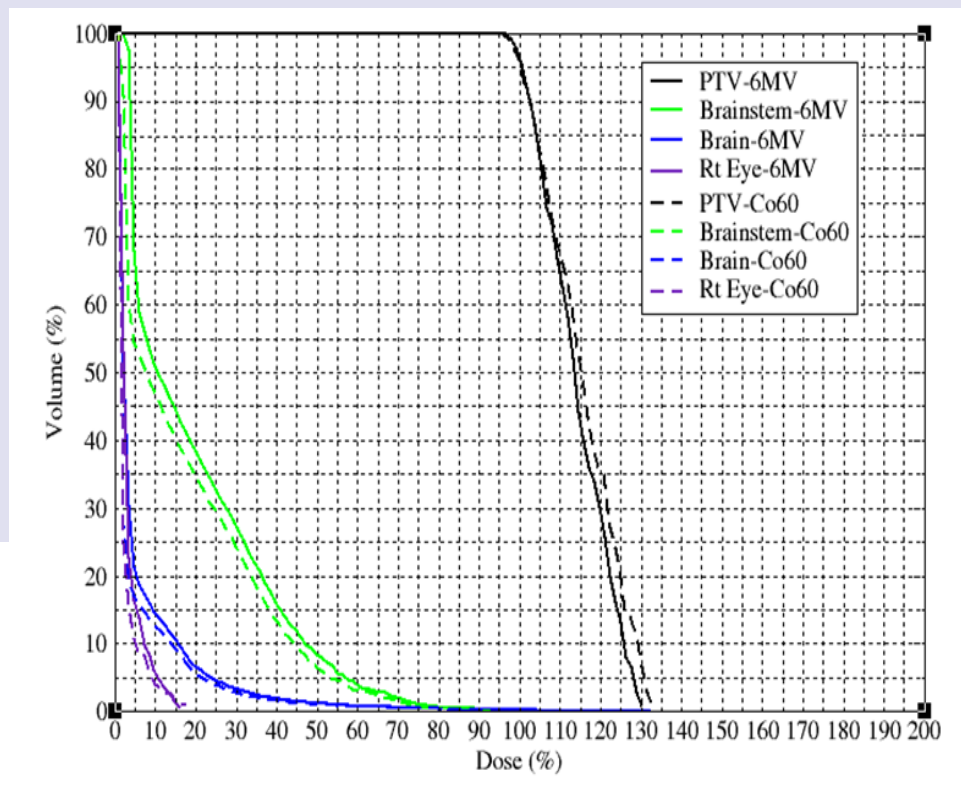
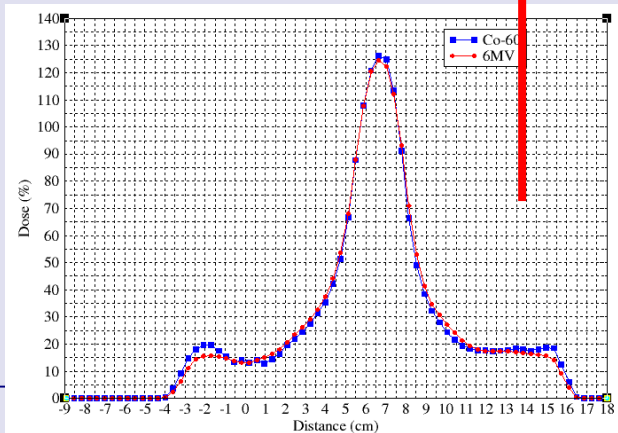
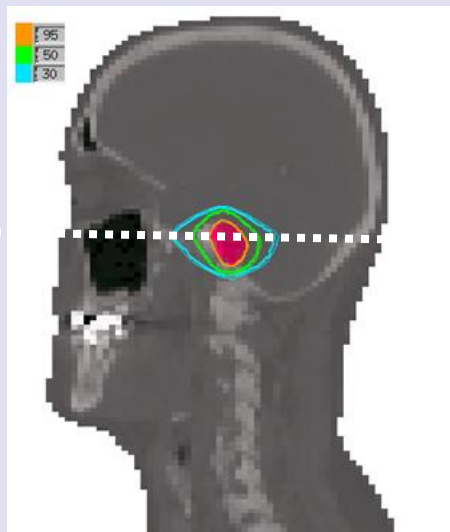
Thick lines: CybeRT
Thin lines: CyberKnife



Re-computed using Monte Carlo simulation

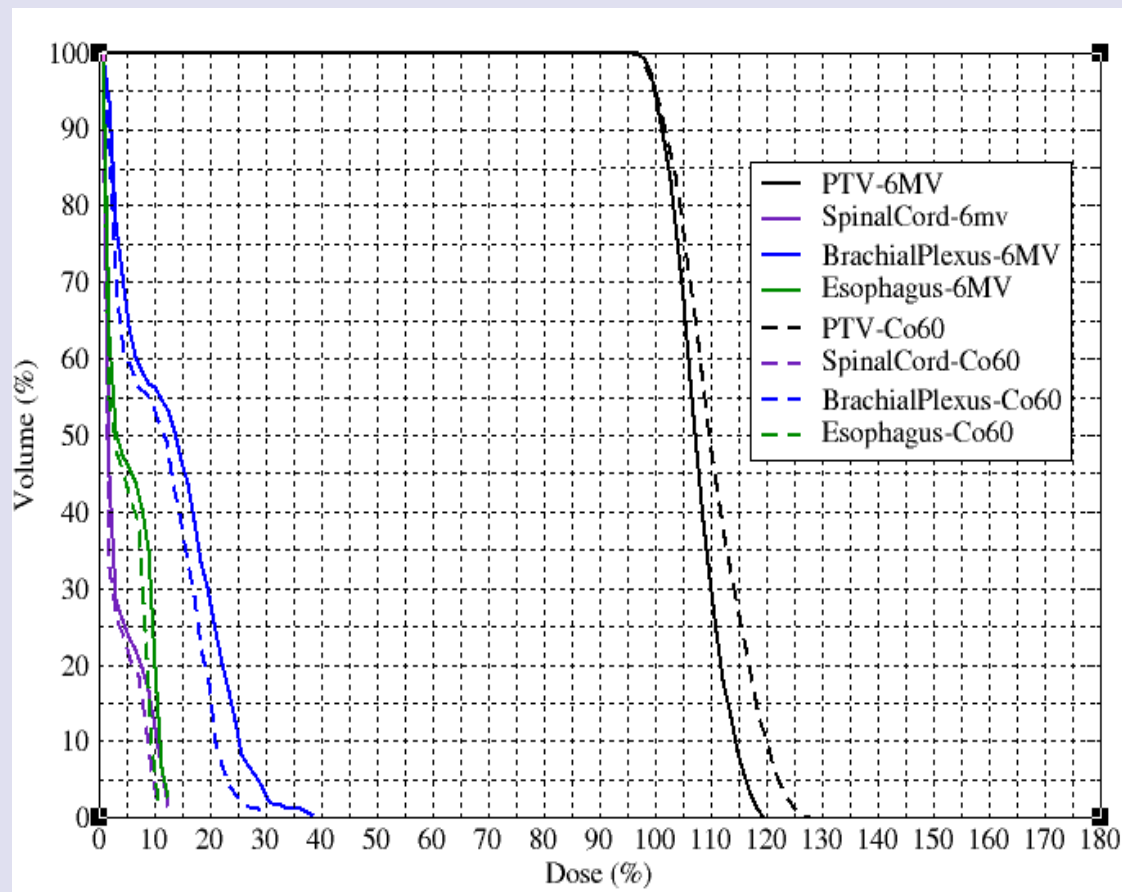
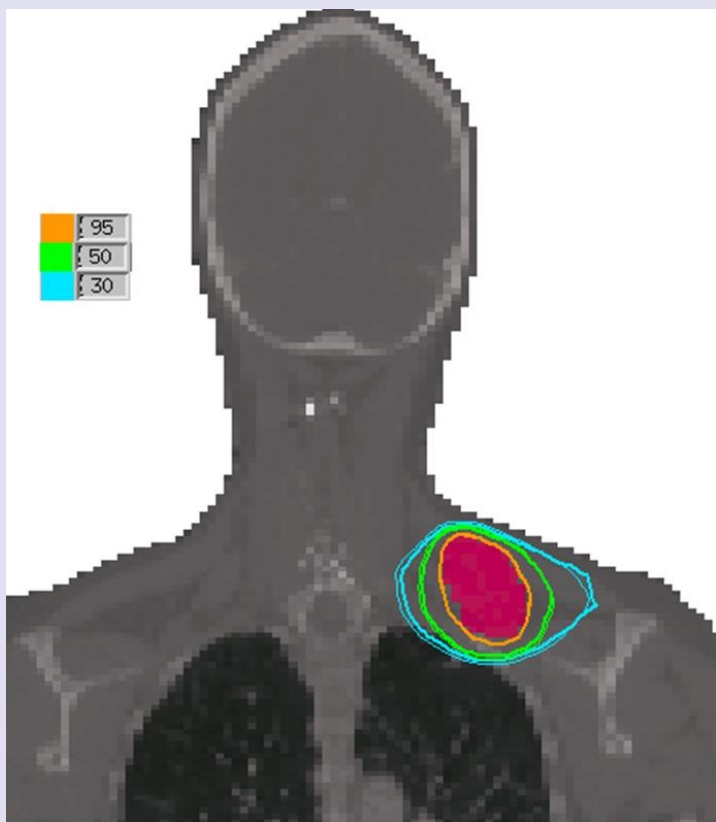
MLC Head Co-60 vs Linac: H&N

1cm Co-60 source vs 6MV photon beam

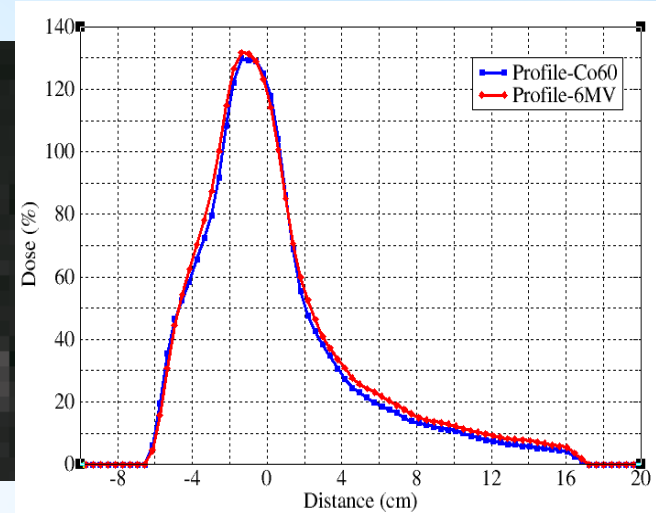
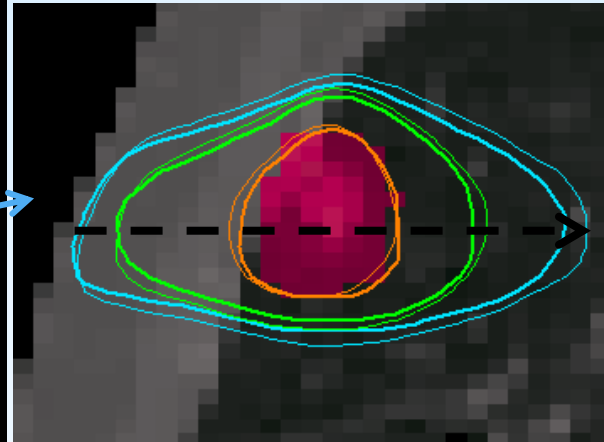
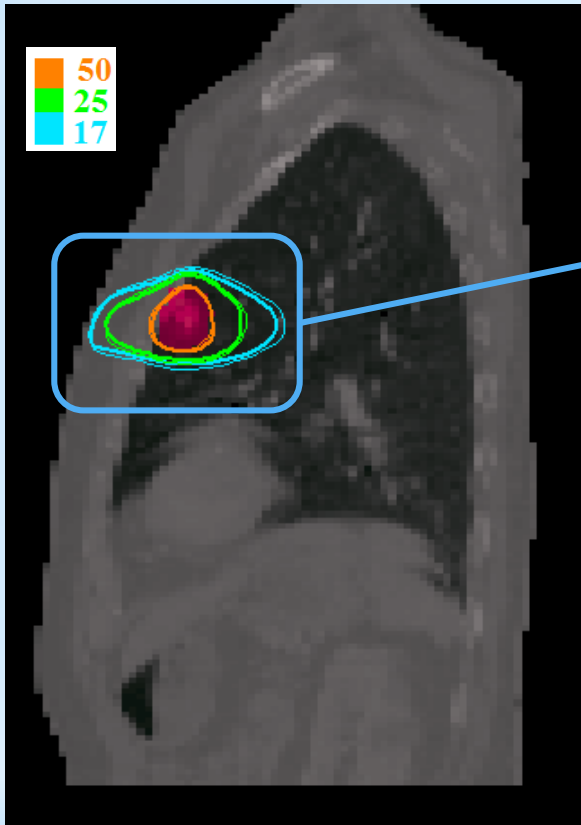


MLC Head Co-60 vs Linac: Shoulder

1cm Co-60 source vs 6MV photon beam

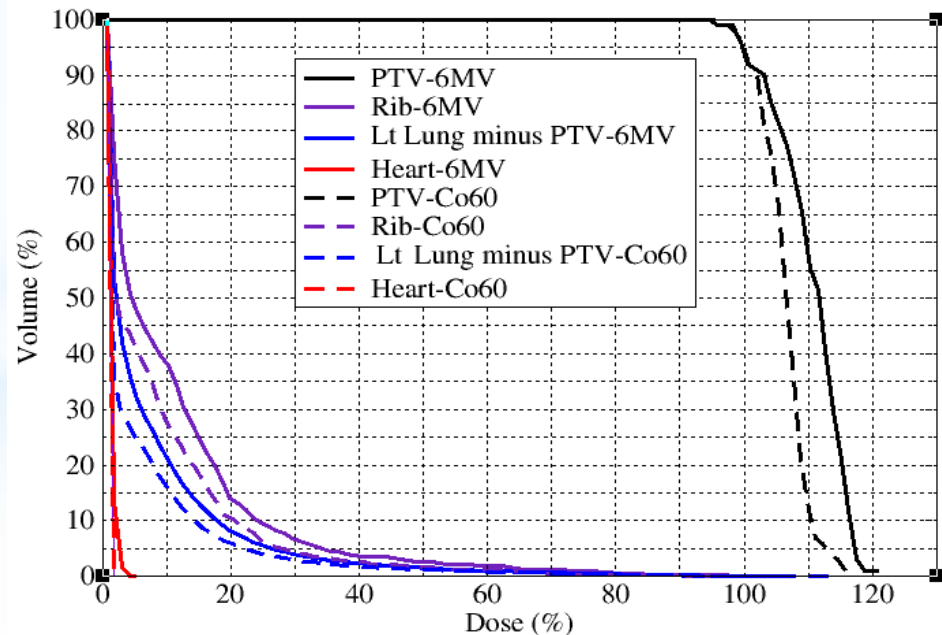


MLC Head Co-60 vs Linac: Lung

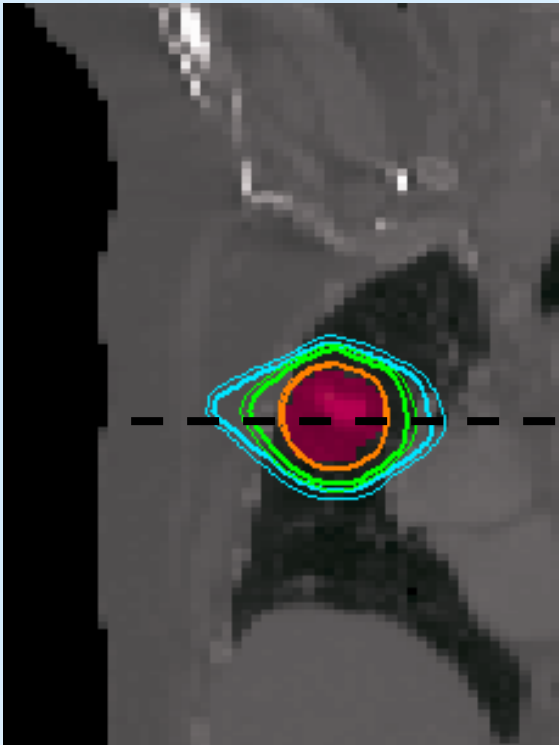


Thick line: Co-60
Thin line: 6MV

CI=1.15 for 6mv
CI=1.25 for co60

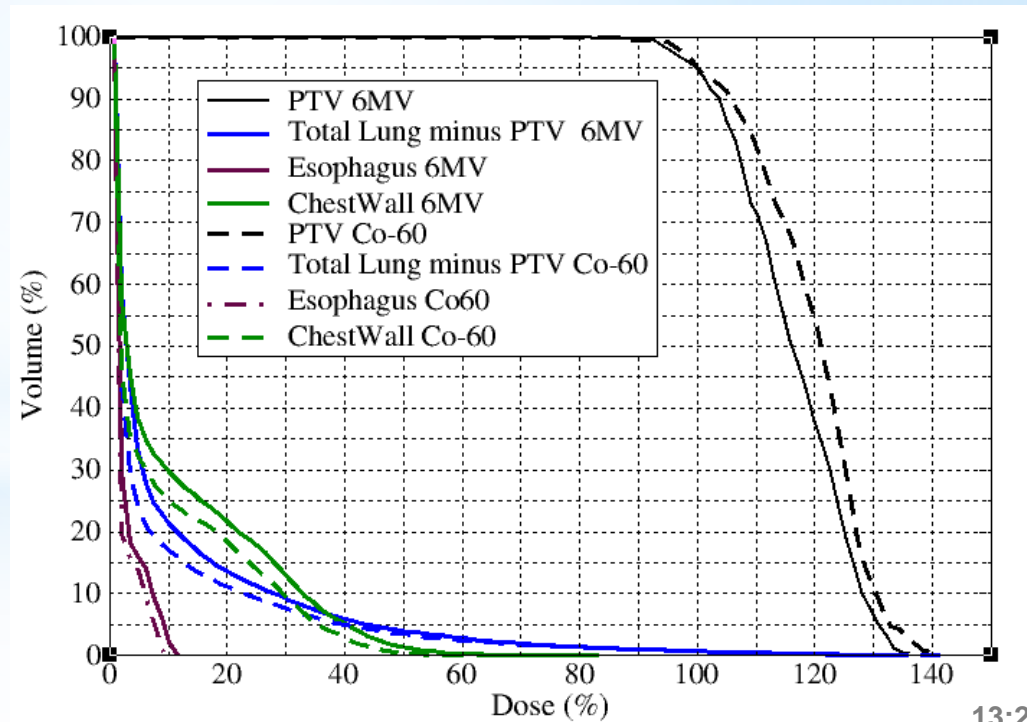
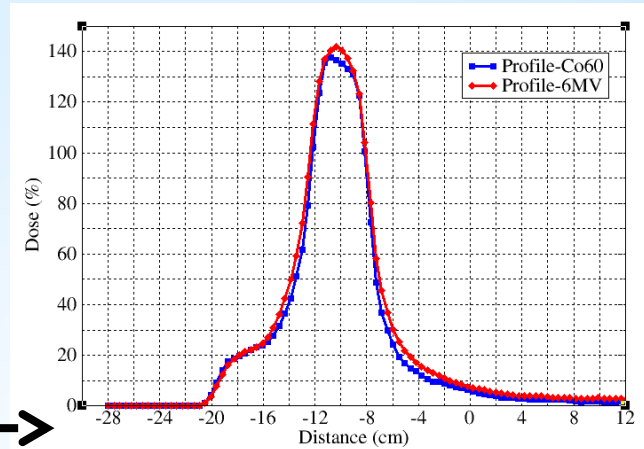


MLC Head Co-60 vs Linac: Lung



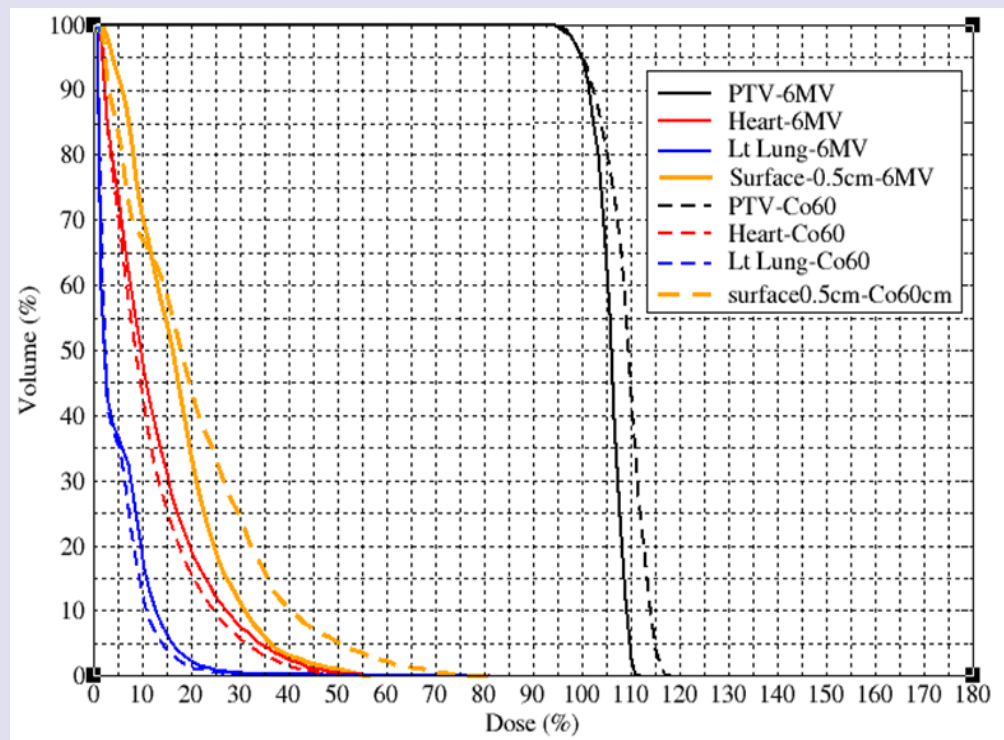
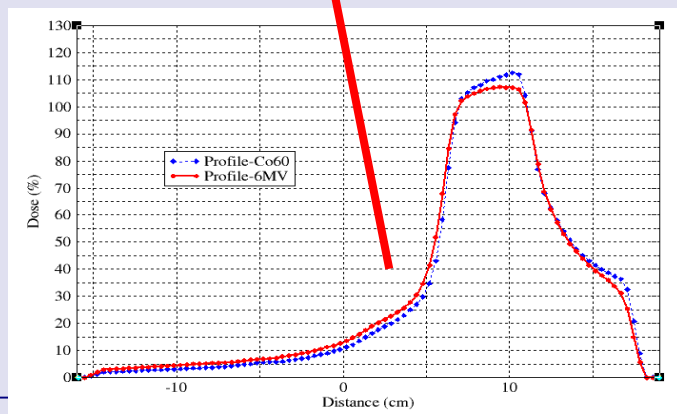
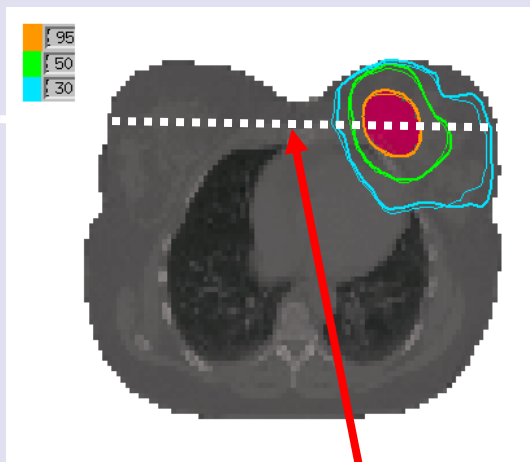
Thick line: Co-60
Thin line: 6MV

CI=1.13 for 6mv
CI=1.15 for co60

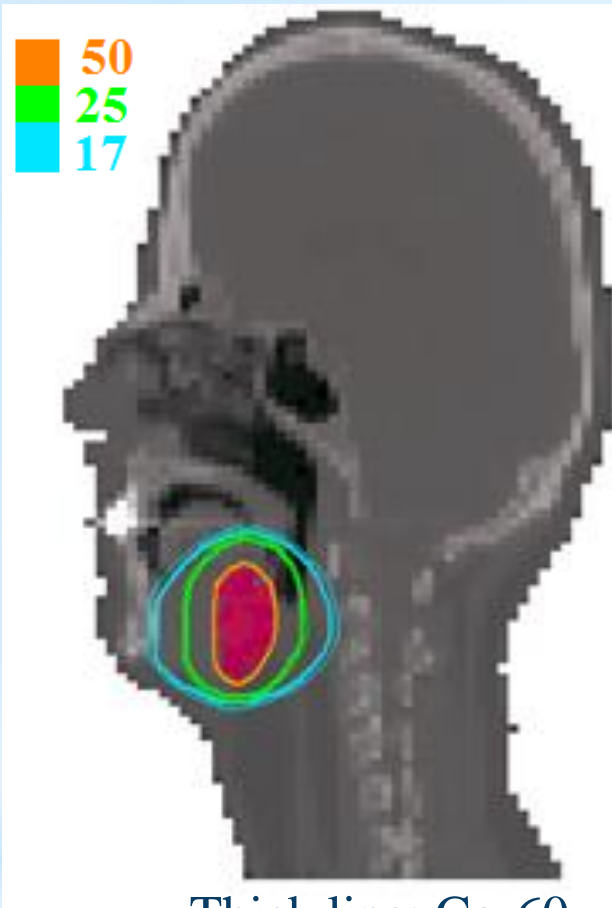


MLC Head Co-60 vs Linac: Breast

1cm Co-60 source vs 6MV photon beam



MLC Head Co-60 vs Linac: Tonsil gland

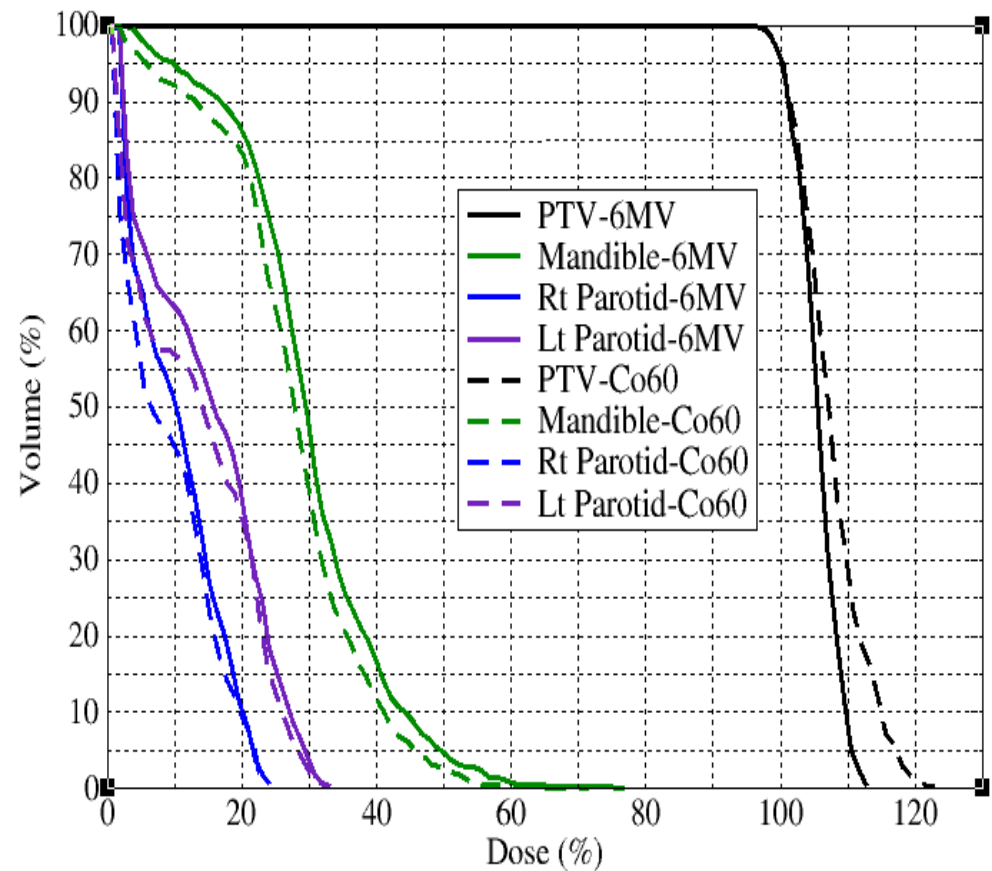


Thick line: Co-60

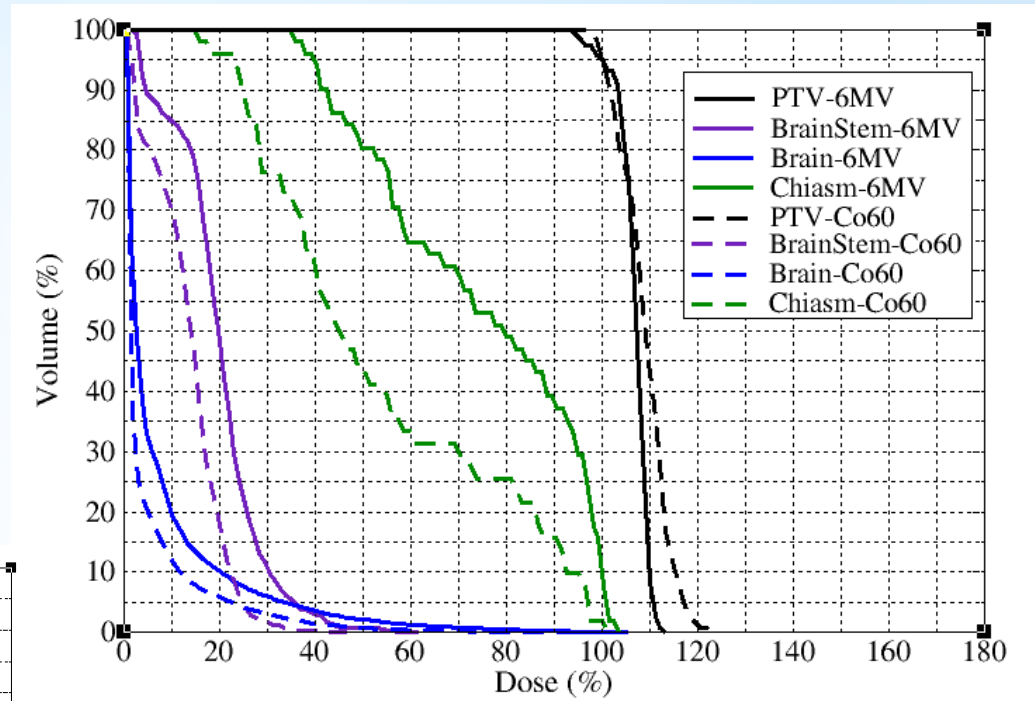
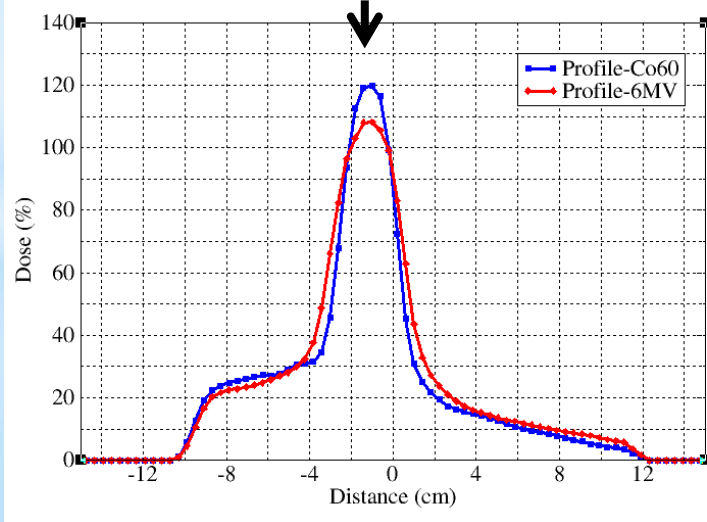
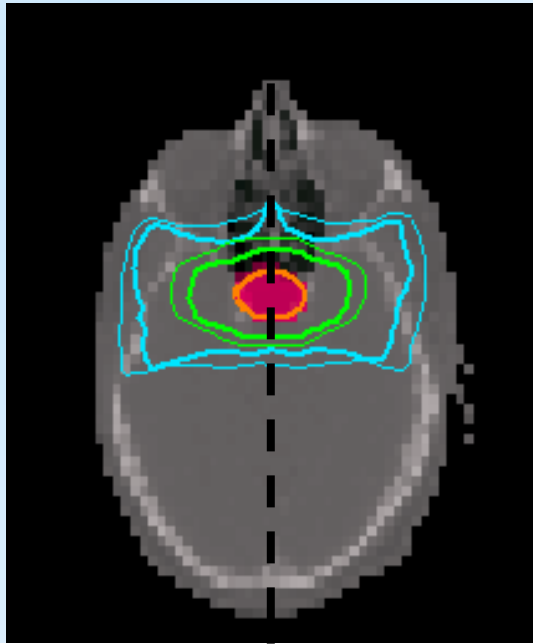
Thin line: 6MV

CI=1.19 for 6mv

CI=1.2 for co60



MLC Head Co-60 vs Linac: Pituitary gland





Thank You

