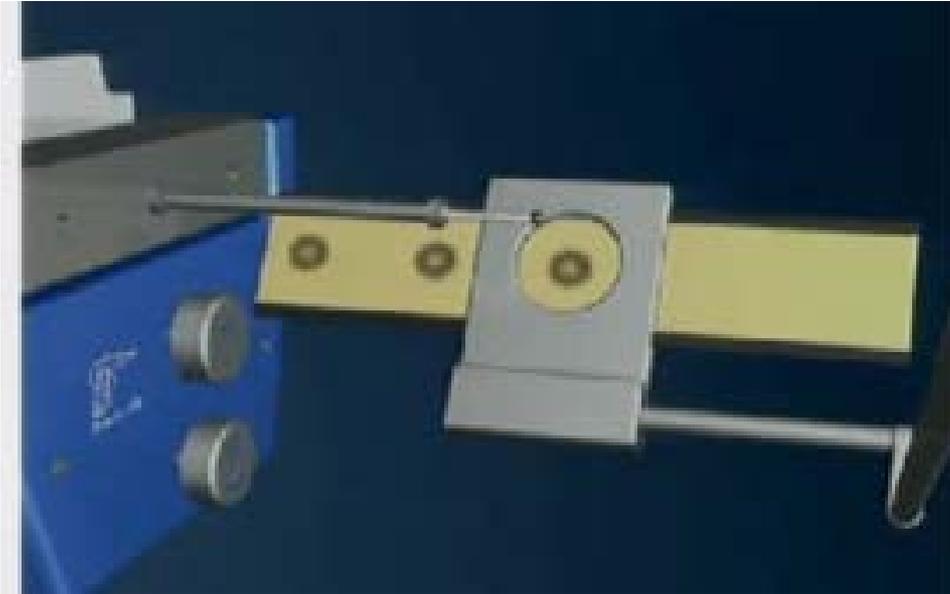
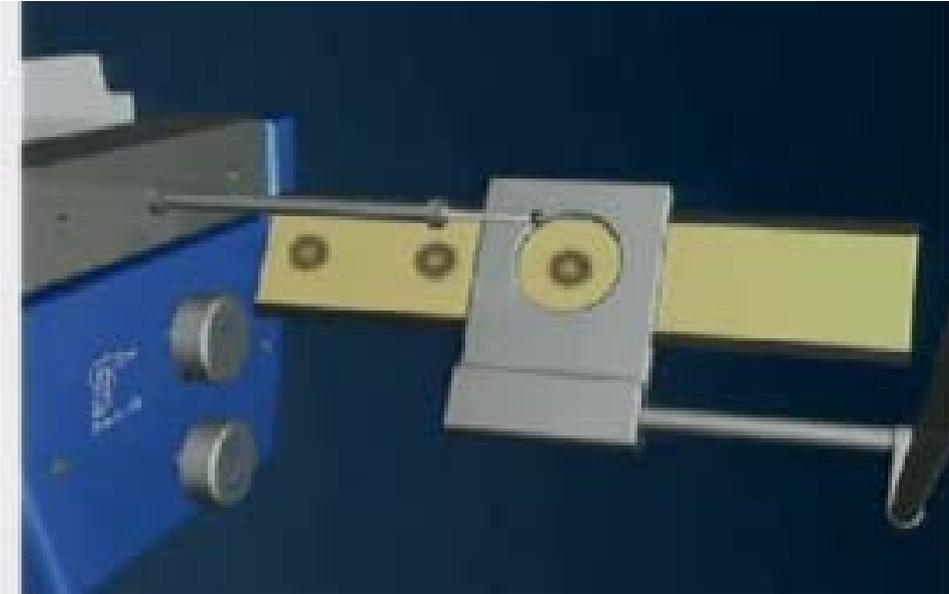


SRS QA Equipment

What test does this image depict and what is it used for?

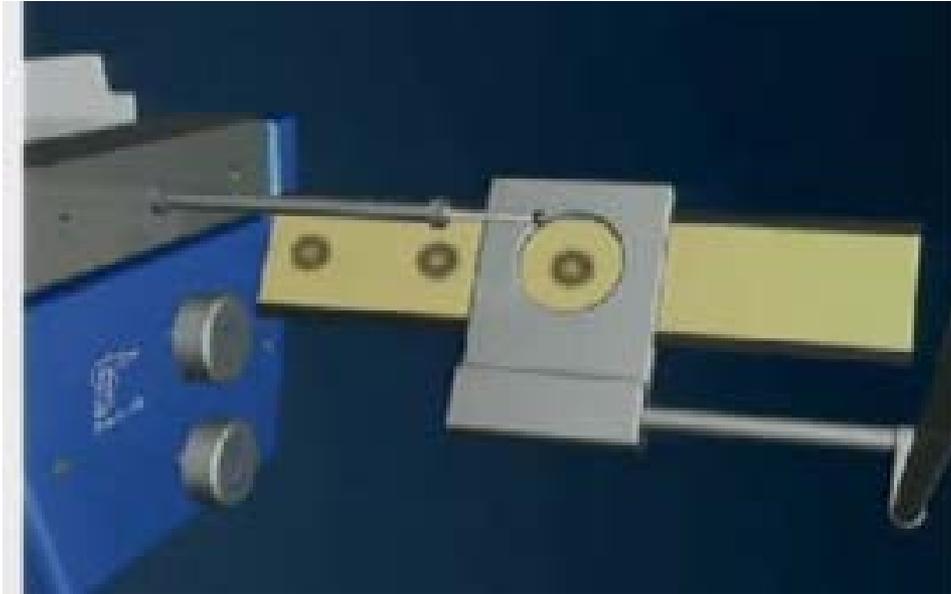


What test does this image depict and what is it used for?



- How is the test performed?
- How is the field defined?
- What is the pass criteria?
- What can cause the test to fail?

What test does this image depict and what is it used for?



- Winston Lutz test performed to verify isocenter of gantry, collimator, and couch are coincident for high dose/fraction treatments (SRS & SBRT).
- A phantom with a small bb is fixed to the couch and placed at the isocenter using room lasers (or crosshair). A field slightly larger than the bb is defined by either a cone or MLC and is used to expose either film or the EPID with varying couch, collimator, and gantry angles. The bb should remain at the center of the field for any angle.
- ≤ 0.5 mm
- Improper positioning of the phantom is most likely cause of failure (sagging phantom, misaligned, etc.). Mechanical isocenter may be unstable. Can also test using star shots, Varian Truebeam machines can use IsoCal test and engineers can perform IsoLock test. Varian STx isocenter spec = 0.75 mm

Review Question:

When performing the Winston-Lutz test, which of the following collimation techniques is inappropriate?

- A. Using cones to perform the test and cones to treat the patient
- B. Using cones to perform the test and MLC to treat the patient
- C. Using MLC to perform the test and MLC to treat the patient
- D. Using MLC to perform the test and cones to treat the patient

Review Question:

When performing the Winston-Lutz test, which of the following collimation techniques is inappropriate?

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- D. Using MLC to perform the test and cones to treat the patient**

Winston-Lutz test

A system for stereotactic radiosurgery with a linear accelerator

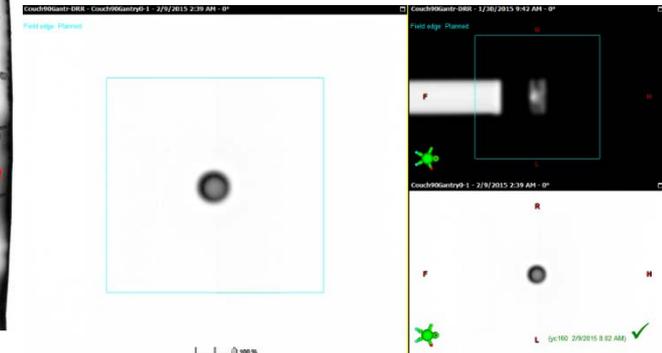
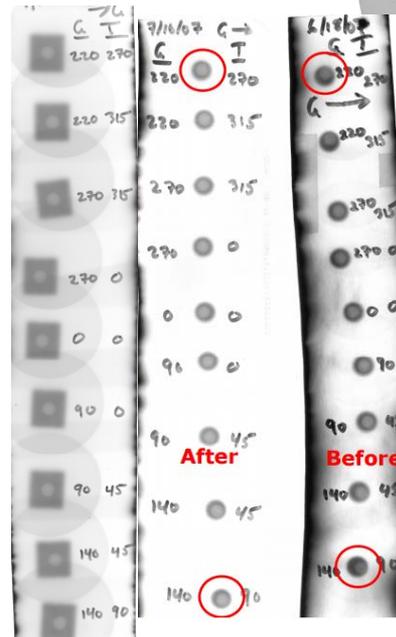
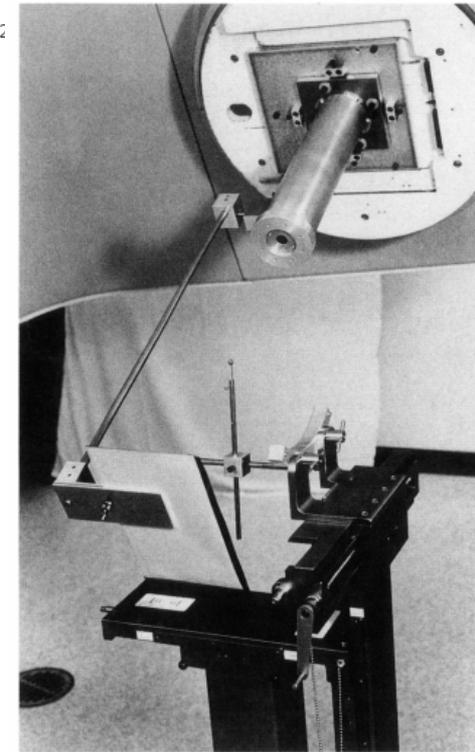
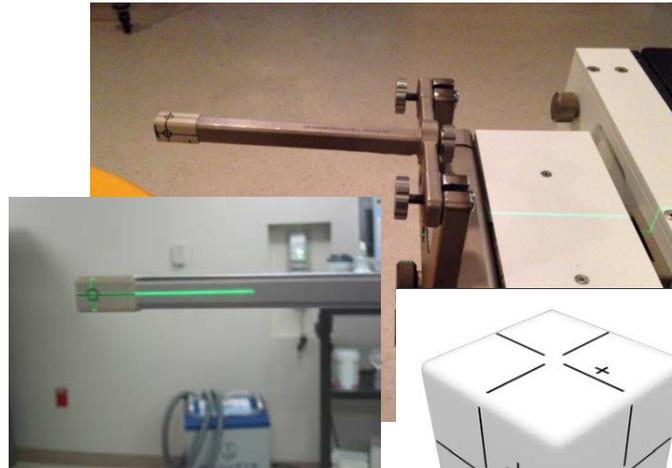
Wendell Lutz, Ph.D.^{1,2}, Ken R. Winston, M.D.^{1,2}, Nasser Maleki, Ph.D.^{1,2}

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² The Department of Neurosurgery of The Children's Hospital, Harvard Medical School, Boston, Massachusetts, U.S.A.

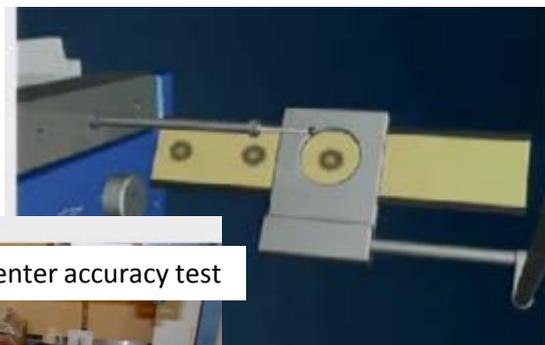
Accepted 28 August 1987, Available online 17 December 2

- Maintaining a tight isocenter is critical to SRS
- On Tx days, test is performed in the morning
 - Can be delivered with cones or MLC
 - May use film or EPID
 - Couch fixed multiple gantry angles (gantry iso)
 - Gantry fixed, multiple couch angles (couch iso)
- Does not verify kV iso



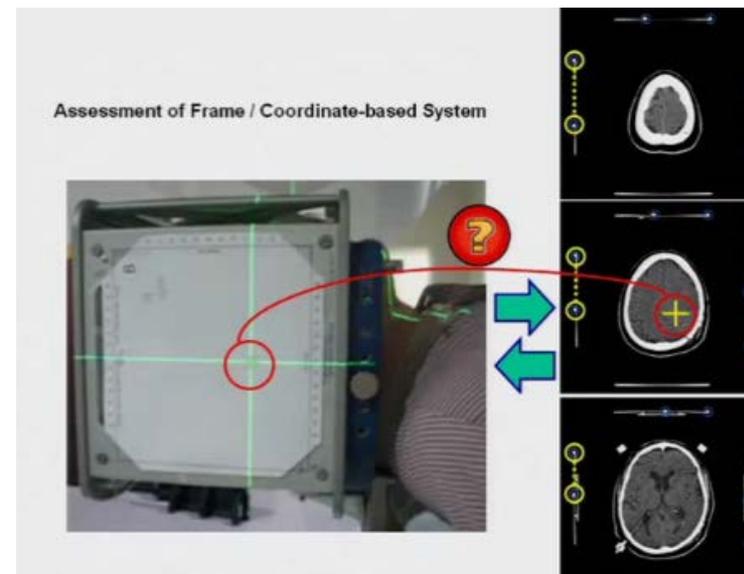
SRS QA

- QA critical: Consequences of errors profound
- Accurate localization:
 - Assessment of frame/coordinate-based system
 - Laser & template approach or IGRT
 - Use phantom with known geometry
 - Image guidance: 2D or CBCT
 - End-to-end assessment → ~ 1 mm accuracy
- Mechanical precision:
 - Isocentric accuracy: **Winston-Lutz test (DAILY)**
 - Is the projection of the ball within the field?
 - ≤ 0.5 mm over wide range of couch and gantry angles
 - we do: G270T0, G0T90, G45T45, G90,T0, G180T0, G180T270, G135T315, G0T0
 - MLC = 1.5 x 1.5 cm² on STx, 1.6 x 1.6 cm² on E3
 - Verifies lasers, mechanical iso (which can shift), cone mount/MLC position
 - Perform daily after any service
 - Perform with Cones and/or MLC
 - Lasers, kV and MV isocenter coincidence (DAILY)
- Patient Safety:
 - Collision potential
 - Secondary collimator position interlock & checklist (jaws in appropriate position)
- Full localization & dosimetry end-to-end
 - Many phantoms available, IROC/RDS services
- Patient specific QA
 - Standard IMRT QA phantom or small field detector and film?
 - Be aware of your equipment and its limitations
 - Detector spacing/size impacts small fields in SRS
 - Are you comfortable with Arcs?
 - Are there dose rate dependencies?



Winston-Lutz-type Tests

Vendor version of isocenter accuracy test





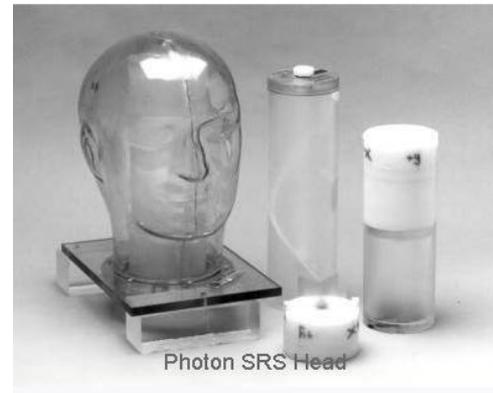
End-to-end SRS phantoms

Typically have imaging (CT and MR) and dosimetry inserts. Can use film, ion chambers, diodes, etc. Requires good spatial resolution, spatial accuracy, and accurate high dose calibration.



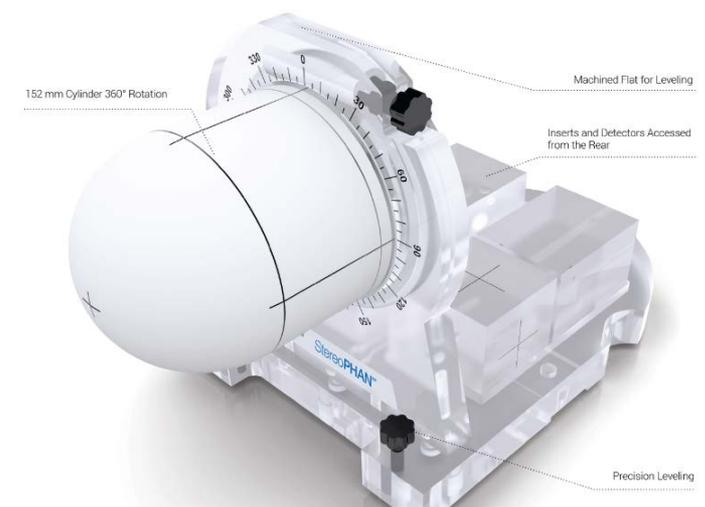
Lucy phantom (Standard Imaging)

STEEV phantom (CIRS)



IROC-H SRS Phantom

StereoPHAN (SunNuclear)



- <http://www.aapm.org/meetings/amos2/pdf/59-17160-8941-53.pdf>
- <http://www.jacmp.org/index.php/jacmp/article/view/3645/2354>
- <http://www.standardimaging.com/phantoms/lucy-3d-qa-phantom/>
- <http://www.cirsinc.com/products/all/104/steev-stereotactic-end-to-end-verification-phantom-patient/>
- <http://www.sunnuclear.com/solutions/machineqa/ster-eophan>