



ISRS

International Stereotactic
Radiosurgery Society

THE MINIMUM STANDARDS FOR CRANIAL RADIOSURGERY CERTIFICATION

The intent of this document is to assist institutions who want to start the process of certification offered by ISRS. It illustrates minimum standards, whose compliance is the first step along the certification path.

THE MINIMUM STANDARDS FOR CRANIAL RADIOSURGERY CERTIFICATION

STANDARDS COMPLIANCE:

MANDATORY: An absolute requirement for certification.

STRONGLY RECOMMENDED: Failure to comply does not necessarily mean that certification won't be granted but will need individual assessment by the auditing team and expert group.

RECOMMENDED: A recommendation for centres striving to deliver the very best SRS service.

	FIELD OF APPLICATION	CRITERIA FOR COMPLIANCE	REQUIREMENT
STAFFING	Staffing levels	The following specialists should be integral members of the SRS team OR available for consultation: <ul style="list-style-type: none"> • Radiation Oncologist, • Neurosurgeon, • Neuroradiologist, • Medical Physicist, • Radiation Technologist* • Nurse Staffing levels should be proportional to the number and types of patients treated. *For countries where the profession of Radiation Technologists/Radiographers is established.	MANDATORY
		<ul style="list-style-type: none"> • There is an experienced SRS-trained medical physicist present during clinical treatments • Organisational diagram summarising responsibilities and reporting lines present • Job descriptions present for all staff involved in SRS 	MANDATORY
	Training	<ul style="list-style-type: none"> • Staff should have documented evidence that they have received specific SRS training • Staff should have access to continual education on at least a 2-yearly basis 	STRONGLY RECOMMENDED
FACILITIES AND EQUIPMENT	Imaging	CT images with 1.5mm slice thickness are used for planning, if applicable. <ul style="list-style-type: none"> • T1w MRI + Gd with 1.5mm slice thickness is used for imaging solid targets. • T2 weighted images (and/or appropriate sequences for each specific indication) are routinely acquired for benign targets. • For the targeting of AVMs, Digital Subtraction Angiography (DSA) (or CT angiography, MR angiography, rotational angiography) is used for delineating the nidus. • For functional indications a slice thickness of ≤1mm is used • Images for treatment planning of malignant targets are acquired ≤7 calendar days prior to treatment. 	MANDATORY
		<ul style="list-style-type: none"> • There is an established quality assurance procedure for checking geometrical distortion in MRI or a patient-specific method for verifying MR distortion. • There is an established quality assurance procedure for checking the image quality and stability of the CT and CBCT 	STRONGLY RECOMMENDED
	Treatment planning	<ul style="list-style-type: none"> • Target delineation is practiced for all solid targets on the appropriate MR sequence (e.g. T1 post-gad MR for brain metastases) • OARs at risk of receiving their respective tolerance dose are delineated using an appropriate imaging modality e.g. T2 weighted MR to contour the cochlea (CT also acceptable) or visualize the cranial nerves for vestibular schwannoma • For most targets a PTV expansion of 1mm is used unless it can be justified according to specific needs, according to the overall geometric and dosimetric accuracy of the system and the treated pathology. (e.g., for single isocentre treatments where some targets are at an extended distance from the isocentre). 	MANDATORY
		<ul style="list-style-type: none"> • Treatment planning creates plans with adequate conformity (e.g., Paddick Conformity Indices average >0.75 for the treatment of vestibular schwannoma)* • Treatment plans are created with adequate gradient (Gradient Index ≤3.5 for benign targets >1cc)* • A radiologist should be available for contouring consultation, if needed For centres that treat a limited range of indications certification can be applied for specific indications. * Treatment quality assessment parameters will be averaged for the last 10 vestibular schwannoma plans treated, or for inexperienced centres, via benchmark testing	STRONGLY RECOMMENDED
	Record and Verify	There is an R&V system documenting delivered treatments	STRONGLY RECOMMENDED
	Dose prescription	<ul style="list-style-type: none"> • A reference document of fraction schemes and dose ranges is in accordance with literature for different pathologies. If applicable, these are based on national or international guidelines • The treatment course, including the dose schedule, normal tissue constraints, and, if applicable, CTV/ITV and PTV margins, and IGRT instructions and tolerances, is clearly documented within the prescription 	STRONGLY RECOMMENDED
	Technical specifications	<ul style="list-style-type: none"> • MLC width at isocenter is ≤ 5mm • If using cones, diameters ≤ 5mm are available • The centre has documented evidence to demonstrate that submillimetre and sub-mandatory degree geometric accuracy is achieved for treatments in all 6 dimensions. • Fixed, relocatable head frames or a mask system are used for immobilization. For mask-based treatments, pre-treatment image guidance/verification and intrafraction monitoring is performed • For mask-based treatments, automatically gated motion management is employed. 	MANDATORY
	Multidisciplinary working	<ul style="list-style-type: none"> • Treatment plan approval involves more than one member of staff. 	MANDATORY

THE MINIMUM STANDARDS FOR CRANIAL RADIOSURGERY CERTIFICATION

STANDARDS COMPLIANCE:

MANDATORY: An absolute requirement for certification.

STRONGLY RECOMMENDED: Failure to comply does not necessarily mean that certification won't be granted but will need individual assessment by the auditing team and expert group.

RECOMMENDED: A recommendation for centres striving to deliver the very best SRS service.

	FIELD OF APPLICATION	CRITERIA FOR COMPLIANCE	REQUIREMENT
PATIENT	Patient Selection	Patients are discussed prior to treatment at a multidisciplinary tumour board meeting	STRONGLY RECOMMENDED
	Minimum numbers	<ul style="list-style-type: none"> On average, ≥ 50 intracranial SRS patients are treated per year (applies to established centres only). For certification of benign indications: ≥ 10 benign target treatments per year For certification of vascular indications: ≥ 10 vascular target treatments per year (an allowance can be made for previous experience). Surgical and endovascular management opinions should be available. For certification of functional targets ≥ 10 functional treatments per year (an allowance can be made for previous experience). Surgical and pain management opinions should be available. 	STRONGLY RECOMMENDED
	Follow up	<ul style="list-style-type: none"> Patients are routinely followed up Patient data including follow up and complications are routinely stored in a clinical database and reviewed at a multidisciplinary meeting if needed. 	RECOMMENDED
PHYSICS QUALITY CHECKS	QA Equipment	<ul style="list-style-type: none"> A chamber for absolute dose calibration is available with a valid calibration certificate traceable to a national standard laboratory in conformance with local regulation One or more detectors appropriate for small field dosimetry are available 	MANDATORY
	Frequency	<ul style="list-style-type: none"> Treatment unit output measurements for linacs are performed daily. Independent treatment plan specific QA is available and performed for SRS treatments. Eg. Independent MU calculation and/or patient specific QA measurements A timeout is performed prior to initiating treatment Radiation versus mechanical isocentre/beam position tests are performed on a planned and systematic basis (Recommended on a daily basis, mandatory on a monthly basis) If image guidance is used, the imaging isocenter is verified to match the treatment isocenter on regular basis. If surface guidance is used a QA programme, tailored for SRS is performed on a regular basis 	MANDATORY
		<ul style="list-style-type: none"> The commissioning/acceptance of the treatment platform has been documented. The SRS equipment has undergone an independent dosimetrical audit for SRS related treatments (For new centres the audit performed at the ISRS certification visit can be used) 	STRONGLY RECOMMENDED
	ISRS dosimetrical audit	<p>For the ISRS independent dosimetrical audit:</p> <ul style="list-style-type: none"> Dosimetric accuracy must be achieved within 3% if measured with a chamber or 5% is measured with OSLDs A Gamma criteria of 5%/1mm global and 3%/2mm local, with a 10% of max thresholds: <ul style="list-style-type: none"> Both criteria $\geq 95\%$ Pass Both criteria $\geq 90\%$ needs improvement Either criteria $< 90\%$ Fail 	STRONGLY RECOMMENDED
QUALITY SYSTEM	Procedures and Protocols	<ul style="list-style-type: none"> For linac platform QA, AAPM Task Group 142 SRS/SBRT or similar tolerance levels should be followed. There is a written procedure for plan checking There is a written procedure for treatment for the main disease indications available There is a written procedure for Quality Assurance checks A log of all system services, failures, errors, changes, and upgrades is maintained There is a written list of dose tolerances There is a written schedule of QA checks Procedures are reviewed on a yearly basis 	STRONGLY RECOMMENDED
	Quality and event reporting	<ul style="list-style-type: none"> The centre has an established Quality Program (policies and procedures) There is a Quality Management Team that has regular documented meetings There is a culture of open communication. Events are reported and remedial action is taken when needed Clinical peer review is performed Quality management meetings are regularly held Audits are routinely performed to improve departmental processes 	STRONGLY RECOMMENDED

THE MINIMUM STANDARDS FOR CRANIAL RADIOSURGERY CERTIFICATION

REFERENCES

- AAPM-RSS Medical Physics Practice Guideline 9.a. for SRS-SBRT. Halvorsen et al., (2017) <https://doi.org/10.1002/acm2.12146>
- A comprehensive evaluation of treatment accuracy, including end-to-end tests and clinical data, applied to intracranial stereotactic radiotherapy. Seravalli E et al. *Radiat Oncol* 116, 113, 2015.
- ACR-ASTRO Practice Parameter For The Performance Of Stereotactic Radiosurgery. Chao et al., (2020) DOI: 10.1097/COC.0000000000000706
- A Novel Method for Quality Assurance of the Cyberknife Iris Variable Aperture Collimator. Heidorn SC, Kremer N, Fürweger C: Cureus, May 2016.
- A quality assurance method with submillimeter accuracy for stereotactic linear accelerators. Grimm J. et al. *JACMP*, Vol 12, No 1, Winter 2011
- A simple dose gradient measurement tool to complement the conformity index. Paddick I, Lippitz B. *J Neurosurg (Suppl)* 105:195-201, 2006
- Association Nationale des Neuro-Oncologues d'Expression Française, *Metastases Cerebrales De L'Adulte [ANOCEF guidelines for the management of brain metastases]*. Rhun et al., (2015) DOI: 10.1016/j.canrad.2014.11.006
- Clinical commissioning and use of the Novalis Tx linear accelerator for SRS and SBRT. Kim et al. *JACMP*, Vol 13, No 3, 2012
- Detectors assessment for stereotactic radiosurgery with cones. Garnier N et al. *J Appl Clin Med Phys*. 2018 Nov;19(6):88-98
- End to End tests on first clinical EDGETM. Scheib S. et al. *Med. Phys.* 41, 257, 2014
- Evaluation of the systematic Accuracy of a frameless, multiple image modality guided, linear accelerator based stereotactic radiosurgery system (technical note). Wen N. et al. *Med Phys* 43 (5), May 2016, 2527
- Geometrical Accuracy of the Novalis stereotactic radiosurgery system for trigeminal neuralgia. Rahimian J. et al. *J. Neurosurg (Suppl 3)* 101, 2004, 351
- Intracranial Stereotactic Positioning Systems: Report of the AAPM Task Group 68. Lightstone et al., (2005) <https://doi.org/10.1118/1.1945347>
- Megavoltage Photon Beam Dosimetry In Small Fields And Non-Equilibrium Conditions: The report of AAPM Task Group 155. Benedict et al., (2021). <https://doi.org/10.1002/mp.15030>
- Performance evaluation of a CyberKnife G4 image-guided robotic stereotactic radiosurgery system. Antypas C. et al. *PMB* 53, 2008, 4697
- Process Management and Quality Assurance for Intracranial Stereotactic Treatment. Nederlandse Commissie Voor Stralingsdosimetrie, Report 25 of the Netherlands Commission on Radiation Dosimetry. (2015). <https://doi.org/10.25030/ncs-025>
- Quality and safety considerations in stereotactic radiosurgery and stereotactic body radiation therapy: Executive summary. Solberg et al., (2012). <https://doi.org/10.1016/j.prro.2011.06.014>
- Quality assurance for robotic radiosurgery: The report of AAPM Task Group 135. Dieterich et al., (2011) <https://doi.org/10.1118/1.3579139>
- Quality assurance in stereotactic space. A system test for verifying the accuracy of aim in radiosurgery. Mack et al. *Med Phys* 29 (4), 2002, 561
- Quality assurance in stereotactic radiosurgery/radiotherapy according to DIN 6875-1. Mack et al. *Stereotact Funct Neurosurg* 2004, 82, 235
- Quality assurance of a system for improved target localization and patient setup that combines real-time infrared tracking and stereoscopic X-ray imaging. Verellen D. et al. *Radiotherapy and Oncology*, 67, 2003, 129
- Quality assurance of immobilization and target localization systems for frameless stereotactic cranial and extra-cranial hypofractionated radiotherapy. Solberg T. et al. *Int. J. Radiat. Oncol. Biol. Phys.* 71, 1, Supp, 2008, S131
- Quality assurance of medical accelerators: The report of AAPM Task Group 142. Klein et al., (2009) DOI: 10.1118/1.3190392
- Recommendations on the Practice of Calibration, Dosimetry, and Quality Assurance for Gamma Stereotactic Radiosurgery: The report of AAPM Task Group 178. Petti et al., (2021) <https://doi.org/10.1002/mp.14831>
- Report 25 of the Netherlands Commission on Radiation Dosimetry October 2015 Process Management and Quality Assurance for Intracranial Stereotactic Treatment
- Small Fields and Non-Equilibrium Condition Photon Beam Dosimetry. AAPM Task Group Report 155.
- Small field MV photon dosimetry. IPEM report 103. Aspradakis M, et al., IPEM, 2010
- Stereotactic body radiation therapy: The report of AAPM Task Group 101. Benedict et al., (2010) <https://doi.org/10.1118/1.3438081>
- The use of TLD and GafChromic film to assure submillimeter accuracy for image-guided radiosurgery. Ho A et al. *Medical Dosimetry*, 33, 1, 36, 2008.
- TRS483 Dosimetry of Small Static Fields Used in External Beam Radiotherapy: An International Code of Practice for Reference and Relative Dose Determination
- UK Consensus on Normal Tissue Dose Constraints for Stereotactic Radiotherapy. Hanna et al (2018) doi: 10.1016/j.clon.2017.09.007
- Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom