



## A Comparison of Novalis Tx™ and CyberKnife

Feature	CyberKnife	Novalis Tx™	Added benefits of Novalis Tx
Immobilization	Frameless <sup>1</sup>	Frameless and Frame-Based <sup>A</sup>	<ul style="list-style-type: none"> <li>Decide which treatment is best – Frameless or Frame-Based</li> </ul>
Treatment Planning	MultiPlan treatment planning system with SRS <sup>2</sup>	iPlan treatment planning with SRS <sup>B</sup> and IMRS & IMRT and Conformal Arcs and Dynamic Conformal and IGRT and Eclipse treatment planning system with RapidArc <sup>C</sup> treatment	<ul style="list-style-type: none"> <li>Plan for radiosurgery with cone planning or MLC planning</li> <li>Do IMRT, 3D conformal, IGRT and other standard techniques when the machine is not doing SRS or SBRT</li> <li>Have the power to do RapidArc™ radiotherapy technology treatments for radiosurgery or IGRT</li> </ul>
Setup Localization	Room-based stereo x-ray with 2D KV-KV match <sup>1,4</sup>	Room-based stereo x-ray with 2D-3D KV match <sup>H</sup> and machine-based imaging <sup>D</sup> and cone-beam CT <sup>D</sup> (CBCT) 3D imaging and MV-BEV <sup>E</sup> (beam's eye-view) and True KV-fluoro <sup>D</sup>	<ul style="list-style-type: none"> <li>Visualize soft tissue via cone-beam CT on a radiosurgical device</li> <li>Localize with image matching using 2D-KV, 2D-MV, 3D-KV or KV-fluoro</li> </ul>
Treatment Delivery	<p>6 MV 800<sup>3,4</sup> MU at 80 cm</p> <p>12 Cones<sup>4</sup> + “variable” iris collimator with 12 fixed apertures<sup>5</sup></p> <p>Fixed Beam Positions<sup>4</sup></p> <p>Anterior Beam Delivery<sup>4</sup> [severely limited (22°) posterior beams<sup>4</sup>]</p>	<p>6 MV and HighX (10 – 20 MV) 1000 MU at 100 cm<sup>A</sup></p> <p>Cones and HD120 MLC<sup>F,G</sup> with Shaped Beam Radiosurgery</p> <p>Fixed Beam Positions<sup>A</sup> and Continuous arc delivery with RapidArc<sup>A</sup></p> <p>Anterior Beam Delivery<sup>A</sup> and full 180° posterior beams</p>	<ul style="list-style-type: none"> <li>Have a powerful linear accelerator</li> <li>Have up to 3 energies, including high X, to penetrate deeper into tissues more efficiently</li> <li>Use cones for SRS or shaped beams that conform to complex shapes of tumors from all beam angles</li> <li>Continuously and optimally modulate the beam power, gantry speed, and HD120 MLC leaf shape</li> <li>Design the treatment to deliver dose and spare tissue from any direction</li> </ul>
Intra-Fraction Motion Management	<p>Room-Based x-ray shots<sup>4</sup> (brain and body)</p> <p>Optical tracking via infrared<sup>6</sup> (body only)</p>	<p>Room-Based x-ray shots<sup>H</sup> (brain and body)</p> <p>6D Optical Gating<sup>I</sup> (brain and body) and Gated Marker Block<sup>J</sup> and Machine-based MV-BEV<sup>E</sup></p>	<ul style="list-style-type: none"> <li>Provides intra-fraction localization via Snap Verification</li> <li>Treat what you planned to treat with respiratory gating. With tracking you may treat structures you did not intend to treat</li> <li>See what you treat while you treat and minimize any doubt about “how much” and “where”</li> </ul>
Information Systems	DICOM RT Image, Dose, Import-Export <sup>2</sup>	DICOM RT Image, Dose, Import-Export Sophisticated data base <sup>K</sup> with record and verify	<ul style="list-style-type: none"> <li>Provides a comprehensive DICOM-RT based information system with the ARIA oncology information</li> <li>Provides a sophisticated networked &amp; wireless system for plan review with iPlan Net</li> </ul>
Treatment Times	35 – 90 minute treatments typical <sup>3, 7</sup>	2 – 20 minute treatments typical <sup>L,M,N,O</sup>	<ul style="list-style-type: none"> <li>Novalis Tx treats efficiently with shaped beams, RapidArc and high linac output</li> </ul>

# References

## CyberKnife references

1. CyberKnife product brochure. 500070.A
2. MultiPlan Treatment Planning System brochure. 500079.A
3. CyberKnife Robotic Radiosurgery Sys – New System Configurations. 500359.A
4. CyberKnife Site Planning Guide, PN027264.A
5. IRIS Variable Aperture Collimator for the CyberKnife Robotic Radiosurgery System: Design, Beam, Properties, and Clinical Benefits. 50034.A
6. Synchrony Respiratory Tracking System brochure. 500071.A
7. 52 min average treatment time based on 11 published case studies: 500092.A – RCC brain metastasis, 500089.A – optic meningioma, 500100.A – grade 2 optic meningioma, 500287.A – anaplastic astrocytoma, 500101.A – multiple myeloma at clivus & C1, 500094.A – nasopharyngeal carcinoma, 500095.A – peripheral nerve sheath tumor at C5, 500101.A – T5 solitary breast metastasis, 500093.A – non-small cell lung cancer, 500097.A – low-risk, organ-confined prostate cancer

**Note:** All of the above documents were based on material obtained 11/07 to 5/08 time frame either at [www.accuray.com](http://www.accuray.com) or at trade shows.

## Novalis Tx references

- A. Novalis Tx Spec Sheet, RAD 10011B
- B. iPlan RT Dose Flier, RT-F-E-iPlan Dose 1006 Q:3.000
- C. RapidArc Brochure, RAD 10008B
- D. On-Board Imager Spec Sheet, RAD 9502G and 4DITC Product Brief, RAD 2768
- E. PortalVision aS1000 Spec Sheet, RAD 2553B
- F. HD120 MLC Product Brief, RAD 9997B
- G. HD120 MLC Specifications, RAD 9998C
- H. ExacTrac X-Ray 6D Spec Sheet, ETX-TS-E-SYS Rev 11 - Oct 2007
- I. ExacTrac Infrared Tracking Platform 5.x Spec Sheet, ET-TS-E-SYS Rev 8 - Oct 2007
- J. RPM Respiratory Gating System, RAD 5616A
- K. ARIA Oncology Information System specification, RAD 2749E
- L. Andrews DW, Bednarz G, Evans JJ, Downes B. A review of 3 current radiosurgery systems. *Surg Neurol.* 2006 Dec;66(6):559-564.
- M. Pawlicki T, Kim GY, Hsu A, Cotrutz C, Boyer AL, Xing L, King CR, Luxton G. Investigation of linac-based image-guided hypofractionated prostate radiotherapy. *Med Dosim.* 2007 Summer; 32(2):71-79.
- N. Crocker IR, Waller A, Davis LW, Fox TH, Linac Radiosurgery: A Retrospective Analysis of Treatment Efficiency, proceedings of the 90th American Radium Society meeting, Dana Point, CA, May 2008
- O. Data on file, August 2008. Varian Medical Systems.

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