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WHY IS PIPSPRO BETTER AT LEAF SPEED?

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PIPSpro v5.2 features DynaLog file “Leaf Speed” Analysis for Varian Millennium Multi Leaf Collimators (MLCs) and 120HD® MLCs. This software is a departure from that of other vendors because it yields actual quantitative data that can be used to determine if your MLC’s need maintenance.

TG-142 specifies that MLC leaves cannot experience a loss of leaf speed greater than 5mm/s. Standard Imaging has created test cases and software that can identify exact loss of leaf speed, if any, for each MLC leaf.

There are two different types of tests that are meant to be executed at different leaf speeds, so that you can test the performance of your machine.

For “Simple” tests, a leaf gap spanning the entire field in the “Y” direction moves as a “front” for 13.5 cm, either right-to-left or left-to-right.

For “Complex” tests, every other leaf moves across the field for a time and then the leaves that were previously stationary move, and so forth. This occurs in four phases. Again, total leaf travel is 13.5 cm and leaves can move either right-to-left or left-to-right.

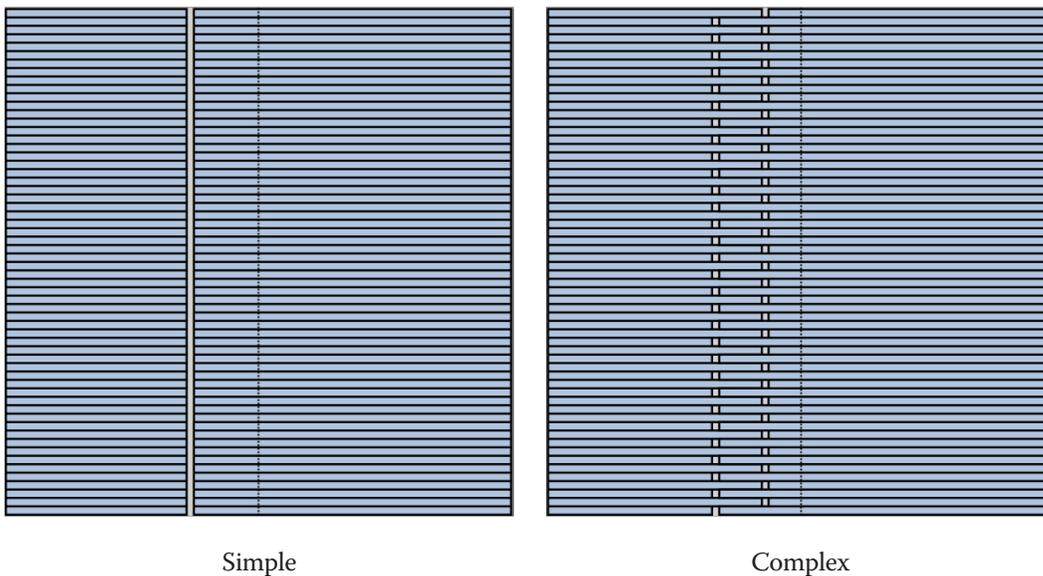
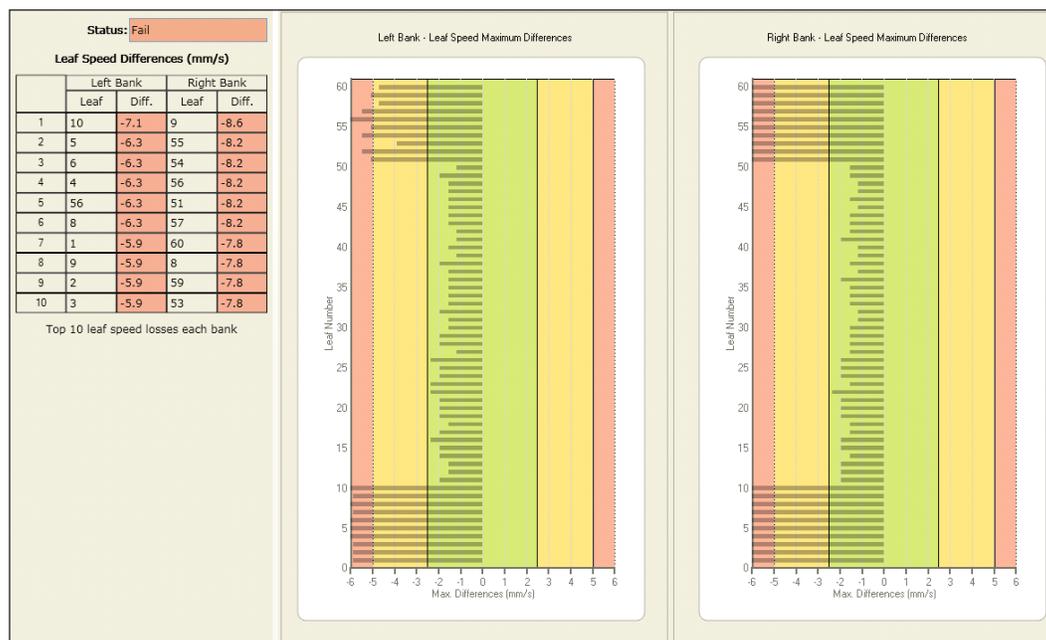


Fig. 1 PIPSPRO

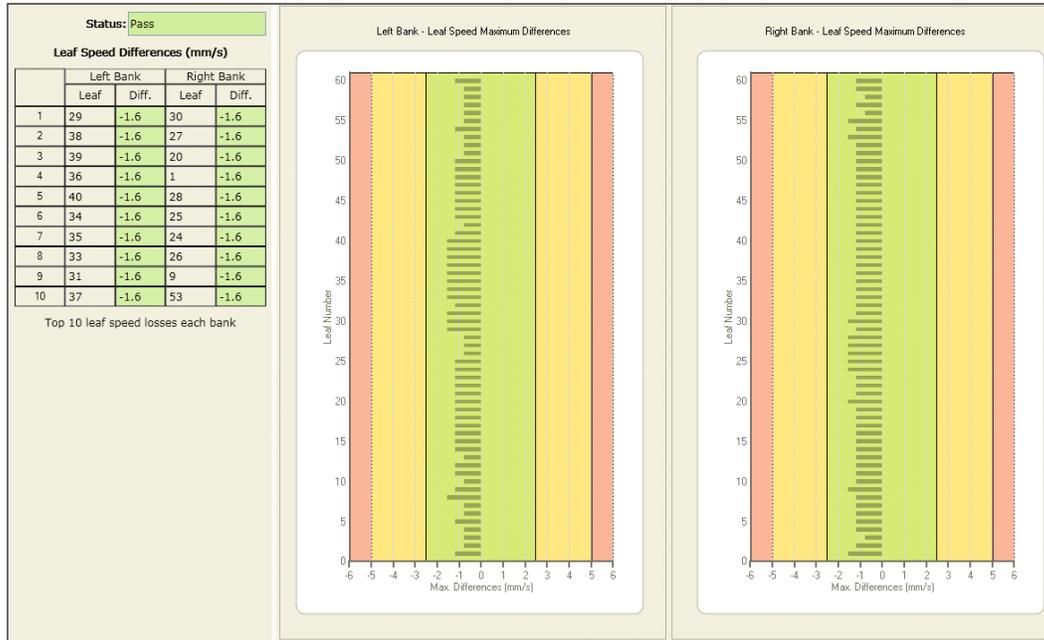
A frequent type of leaf speed error pattern can be seen below. Notice that the inner leaves that are often used in treatment are in the green region of the graph, denoting that they pass a more stringent 2.5 mm/s leaf speed loss alert threshold. The outer leaves either alert or fail, presumably because they are not used as often and have a dirt or lubricant buildup that can lead to them sticking. In the “whisker” graphs on the right, you can mouse and get tooltips that will identify the leaf and exact error. In the right-hand table, you can see the ten worst loss of leaf speed error per leaf bank.



Leaf Speed results showing typical outer leaf failure pattern.

Fig. 2 PIPspro

Well-calibrated and maintained leaves easily pass the leaf speed test as shown below...



Leaf Speed results for well-calibrated and maintained MLC leaves.

Fig. 3 PIPSpr

When other systems claim that they can calculate leaf speed, they are actually using the third "Ling" test, which cannot distinguish anything except **gross** leaf speed errors. In this test, the gantry is placed at each of the cardinal angles and dose is delivered in each of four multi-port-like apertures at different dose rates and leaf speeds. Notice that there is a constant dose per centimeter. So each region is supposed to get a known constant dose. The test consists of determining if the constant dose was received in each region and fails if the average and standard deviation dose is outside of some thresholds. **It is pretty obvious that this test will not yield the type of quantitative results required by TG-142 and provided by PIPSpr.**

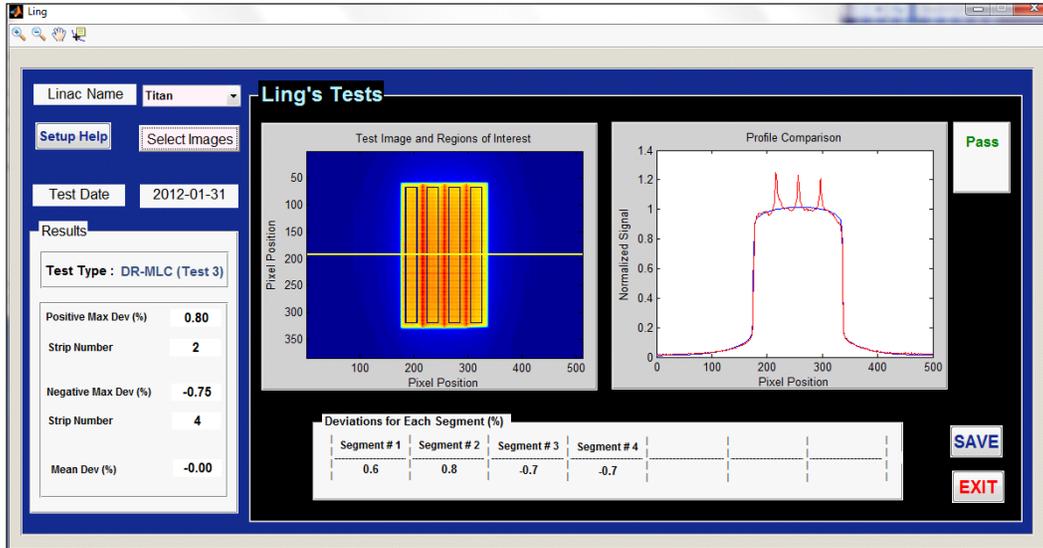


Fig. 4 Example of Ling's Test¹

Region	Leaf Speed (cm/s)	Dose Rate	Degrees	Constant Dose
1	0.46	138	0	~300 MU/cm
2	0.92	277	90	~300 MU/cm
3	1.84	554	180	~300 MU/cm
4	2.76	554	270	~200 MU/cm

LEAF SPEED TEST COVERAGE

PIPSpro Leaf Speed can also test VMAT performance. A user is also able to run leaf speed tests at different speeds and directions and with different collimator and gantry settings. In fact, because of Quick Selects in PIPSpro, each test with different parameters can be individually tracked and trended. Other systems can only track and trend one set of test parameters.

¹ Ling CC, Zhang P, Archambault Y, et al. Commissioning and Quality Assurance of RapidArc Radiotherapy Delivery System. Int J Radiat Oncol Biol Phys 2008;72:575-581