

Automated Imaging and MLC QA with Pylinac

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INTRODUCTION

Pylinac is a TG-142 quality assurance (QA) tool based on the popular Python language. In addition to high-level modules for automatically analyzing images and data generated by linear accelerator, you can also customize your own analysis tool. In a typical radiation oncology department, IT department routinely imposes many restrictions to software installation and web traffic. I identified a portable option of python implementation and a way to circumvent the network restrictions to send text or email notifications when QA results fall outside the predefined thresholds.

AIM

To automate the analysis of routine linac imaging and MLC QA with pylinac tools.

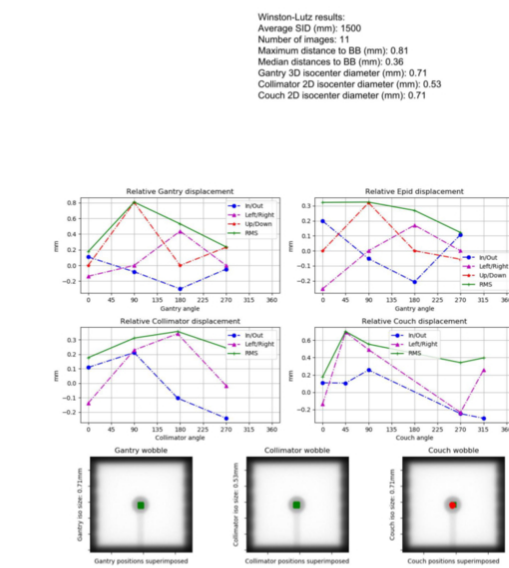
METHOD

To avoid the restriction of program installation, I used a free open source portable distribution of the Python programming language WinPython. It lives entirely in its own directory, without any OS installation and is highly customizable, you can pick and install any packages as needed. The WinPython folder can be moved to any location including network and USB drive with most of the application settings. This is useful in large institution settings, as the whole program and scripts can be put into a network location and run from there. In this centralized configuration, multiple sites can reuse the same script that has the site specific settings coded in.

RESULTS

A customized script was written to analyze MLC leaf position accuracy in addition to other common QA tests such as Picket Fence, Winston-Lutz, gantry speed and leaf speed, as well as MV and kV imaging qualities. The script can automatically scan the preset folder and generate reports, and when QA test fails, send a text or email to the responsible party. It can also be scaled up easily by simply editing the machine list, folder list and contact person list. The text or email functionality is through mailgun.net. Otherwise, a native python method can be utilized to send text through email. The caveat is, for institutions that have tight web security, the proxy and ssl/smtp protocol need to be coded in. The generated pdf reports can be sorted and combined within the script through calls to external utility programs. In this way, the whole process can be fully automated.

Pylinac Winston-Lutz Analysis



Generated with Pylinac version 2.2.6

A sample pdf report for Winston-Lutz test.

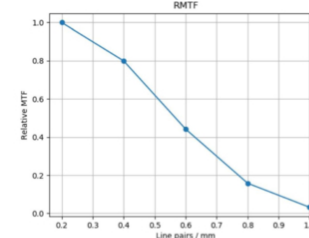
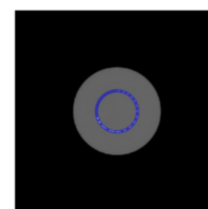
Pylinac H193938 Static MLC Analysis

Static MLC results:
Nominal field sizes : 10cm, 24cm, 2cm, 1cm
Deviations for field sizes in x direction are (mm): 0.22, 0.00, 0.00, 0.00
Deviations for field sizes in y direction are (mm): 0.45, 0.23, 0.00, 0.22
Leaf position deviation (mm): -0.96, 0.06

A sample output pdf report for customized static MLC QA task.

Pylinac CatPhan 604 Analysis

- CTP528 Results -
MTF 80% (lp/mm): 0.40
MTF 50% (lp/mm): 0.57
MTF 30% (lp/mm): 0.70

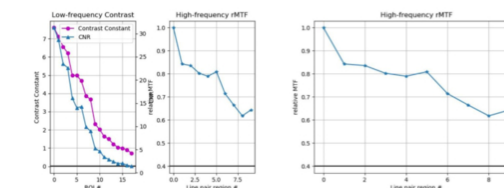
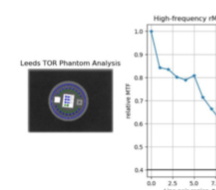


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Reports for CBCT CatPhan test and kV imaging test with Leeds phantom.

Pylinac Leeds TOR-18 Analysis

Leeds TOR18 results:
MTF 80% (lp/mm): 5.81
Median Contrast: 0.15
Median CNR: 7.1



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CONCLUSIONS

The linac imaging and MLC QA used to be a very time consuming task at my institution because the data collection, analysis and report generation are all done manually. With the python script utilizing pylinac tools, the analysis and report generation are automated and only take a couple minutes.

ACKNOWLEDGEMENTS

I want to acknowledge my colleagues at Banner MD Anderson Cancer Center for recommending pylinac toolset.

REFERENCES

<https://pylinac.readthedocs.io/en/stable/>
<https://winpython.github.io/>
<https://www.mailgun.com/>

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