Innovations/Impact:

PyPlanScoring performs structure volume upsampling and dose trilinear interpolation, in order to improve the calculation accuracy on DVHs from any complex or small strucures. It was built using Python 3.x and open source packages.

Key Results:

- Built using only open source python packages
- High computation performance using Numba compiler targeting both CPU or NVIDIA/GPU without having to switch languages.
- Full DICOM RT parsing - IMRT, VMAT or proton IMPT.
- 3D dose extraction and trilinear interpolation
- Accurate DVH calculation
- Volume up-sampling with voxels up to 0.2 mm3
- Adaptive rasterisation

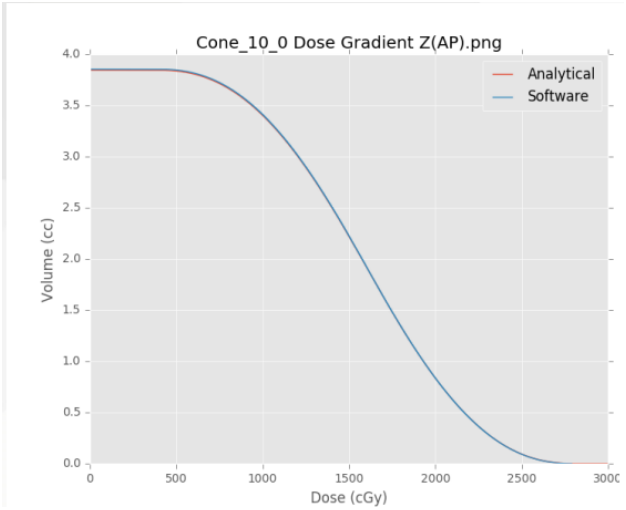

Illustration 2: Absolute DVH comparison - voxel size (0.2 mm3)

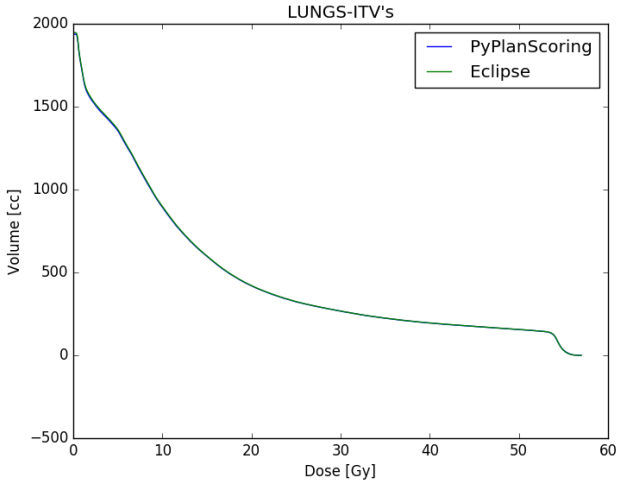

Illustration 1: LUNG SBRT case - Lungs-ITV's- PyPlanScoring versus Eclipse

	BODY_P	CHEST WALL	D2CM LN	D2CM PRIMARY	ESOPHAGUS	GREAT VESSELS	HEART	LUNGS-ITV's	PTV_LN	PTV_PRIMARY	SPINAL CORD	TRACHEA
max	0.2	0	0.2	0.5	1	0.9	1.7	0	-0.1	0.1	0.3	2.4
mean	0	-0.4	0	-0.3	0	0.1	0.4	-0.1	-0.9	-0.5	-0.3	0.8
min	-1.2	-1.6	-0.2	-0.7	-1.3	-0.4	0	-0.4	-7.1	-1.2	-2.1	-1.2
std	0.1	0.4	0.1	0.3	0.7	0.3	0.6	0.1	1.5	0.1	0.4	1.3

Table 1: Difference % - DVH volumes - PlanIQ versus PyPlanScoring

	count	Range (%)
Total Volume (cc)	2	[-3.90 0.60]
Dmin[Gy]	0	[-0.20 2.60]
Dmax[Gy]	0	[-0.40 0.00]
Dmean[Gy]	0	[-0.80 0.70]
D99%[Gy]	8	[-14.40 5.20]
D95%[Gy]	2	[-4.20 3.20]
D5%[Gy]	0	[-0.70 0.90]
D1%[Gy]	0	[-1.10 2.70]
D0.03cc[Gy]	11	[0.20 10.00]

Table 3: Test 2 - Calculated versus Analytical DVH - Clinical grid sizes

	count	Range (%)
Total Volume (cc)	0	[-0.70 0.50]
Dmin[Gy]	0	[-0.10 2.60]
Dmax[Gy]	0	[-0.40 0.00]
Dmean[Gy]	0	[-0.20 0.30]
D99%[Gy]	0	[-1.90 1.90]
D95%[Gy]	0	[-1.30 0.40]
D5%[Gy]	0	[-0.30 0.20]
D1%[Gy]	0	[-0.10 0.20]
D0.03cc[Gy]	8	[-0.10 5.80]

Table 2: Test 1 - calculated versus Analytical DVH - varying dose grid resolution.