Elekta Profiles Comparison

Physicists before Zach did not leave him any documentation of how the ELEKTA and SBRT 6MV machines in RayStation were commissioned. All Zach knew is that K&S commissioned SBRT 6MV.

I contacted Elekta’s Steve Palefsky about the source of the AGL data. He said that Elekta has had the AGL program for three to five years now and that the AGL measurements are probably six or seven years old but that they are still very standard. The data is already shifted from effective point of measurement and converted from ionization to dose. All machines in Monaco are matched to the AGL data. Of course, RayStation likely asks for different info when commissioning a model, so the AGL data files as-is may not work. We can get the RayStation-specific AGL files for a cost.

Zach used [ScanDoseMatch](../../../Misc/SDMInstaller.exe) to compare profiles. The results of this investigation are in [T:\Physics\Elekta\Elekta Profiles Comparison](../../../Elekta/Elekta%20Profiles%20Comparison). The [Profiles](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles) folder contains raw profile data for each machine:

* [ELEKTA](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles/ELEKTA) machine in RayStation. Data is a CSV file for each 6, 10, and 18MV measured data, exported from RayPhysics.
* [SBRT 6MV](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles/SBRT%206MV). Data is a CSV file of measured 6MV profiles, exported from RayPhysics.
* [AGL](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles/AGL). The electron data is from Steve. The photon data, we already had; I don’t know its source.
* [E1](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles/E1%20Water%20Tank) and [E2](../../../Elekta/Elekta%20Profiles%20Comparison/Profiles/E2%20Water%20Tank) Water Tank. RFA300 ASCII files from 2022 water tank measurements on E1 and E2. The 100SSD profiles are for comparing with ELEKTA; the 90SSD, for SBRT 6MV.

The [Profile Comparisons](../../../Elekta/Elekta%20Profiles%20Comparison/Profile%20Comparisons) folder contains PDF reports exported from ScanDoseMatch. The reference and measured profiles are backward due to a quirk in ScanDoseMatch. The gamma criteria are 2%/1mm, the threshold is 10 percent, there is no shift, CAX/dmax normalization is applied, and the range of off-axis distance is left at the default (varies by profile).

There are reports for PDDs, crossline profiles, and inline profiles. Each PDD report is named *<reference>* vs *<measured>* - *<energy>*MV PDD *<field size>*x*<field size>* (e.g., E2 Water Tank vs ELEKTA - 6MV PDD 10x10). Each crossline or inline report is named *<reference>* vs *<measured>* - *<energy>*MV *<profile type>* *<field size>*x*<field size>* *<depth>*cm depth (e.g., AGL vs ELEKTA - 18MV Inline 30x30 5cm depth).

The spreadsheet [Elekta Profiles Comparison](../../med-phys-spreadsheets/Elekta%20Profiles%20Comparison.xlsx) contains a table of gamma pass rates (GPRs) for all the reports. Each GPR value hyperlinks to the appropriate report. The GPRs are highlighted green for passing (≥95 percent), yellow-to-green gradient for at action level but within tolerance (90–95 percent), red-to-yellow gradient for just barely failing (85–90 percent), and red for utter failure (≤85 percent).

The profile comparisons attempt to answer the following questions:

* Does ELEKTA come from the AGL?
  + AGL vs. ELEKTA
* Do the RayStation Elekta models come from measured E1 or E2 output?
  + E1 Water Tank vs. ELEKTA
  + E2 Water Tank vs. ELEKTA
  + E1 Water Tank vs. SBRT 6MV
  + E1 Water Tank vs. SBRT 6MV

All AGL vs ELEKTA PDDs have GPR 100 percent, but **the evidence is not convincing that ELEKTA was commissioned from the AGL**. This makes sense as Steve thinks he remembers Zach’s requesting the AGL data just to get a general feel for what the ELEKTA should look like.

All E1/E2 vs ELEKTA PDDs have GPR 100 percent except for 18MV 30×30, which still has good agreement. E2 agreements are generally worse than E1. For E2, the 6MV 30×30 profiles do not match at all, due to a beam shoulder. This could be due to poor setup/baselining, but it could also suggest that ELEKTA comes from E1 rather than E2.

E1/E2 vs SBRT 6MV only has data for 10×10 crossline/inline 1.5 cm and 10 cm depth, but all GPRs are good for both E1 and E2. E1 is a better match to SBRT 6MV than E1 is, though.

**Both ELEKTA and SBRT 6MV may have come from E1, and SBRT 6MV definitely did not come from E2.**

As expected, all crossline and inline GPRs generally decrease with larger field size and greater depth.