Radiometric Data collected with an UAV: Pre-flight and Post processing

- Pre-flight consideration
  - Detector choice and calibration
  - MDA of a stripe
- Post-processing: NASVD
  - Noise reduction
  - Data reconstruction

Detector choice

NaI vs. BGO vs. CsI

Scintillator	Decay time(ns)	Density g/cm^3
NaI(Tl)	**250**	**3.67**
CsI(Na)	630	4.51
CsI(Tl)	1000	4.51
BGO	300	7.13

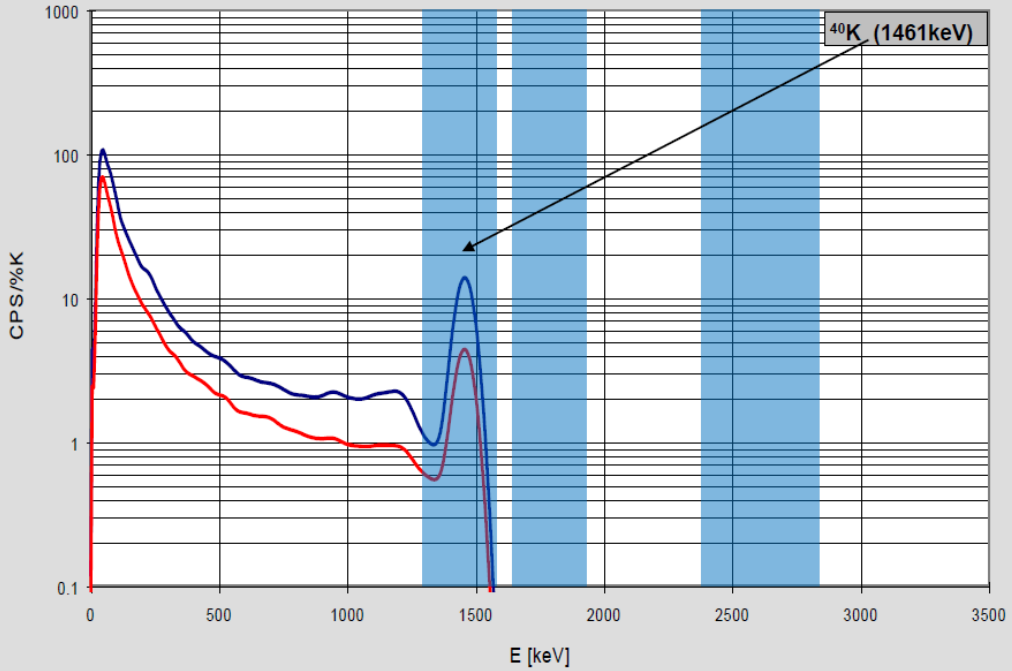
At the end of day:

- **Detection sensitivity $\propto$ Volume = Weight**
- **The shorter the decay time, the more it can handle high count rates**

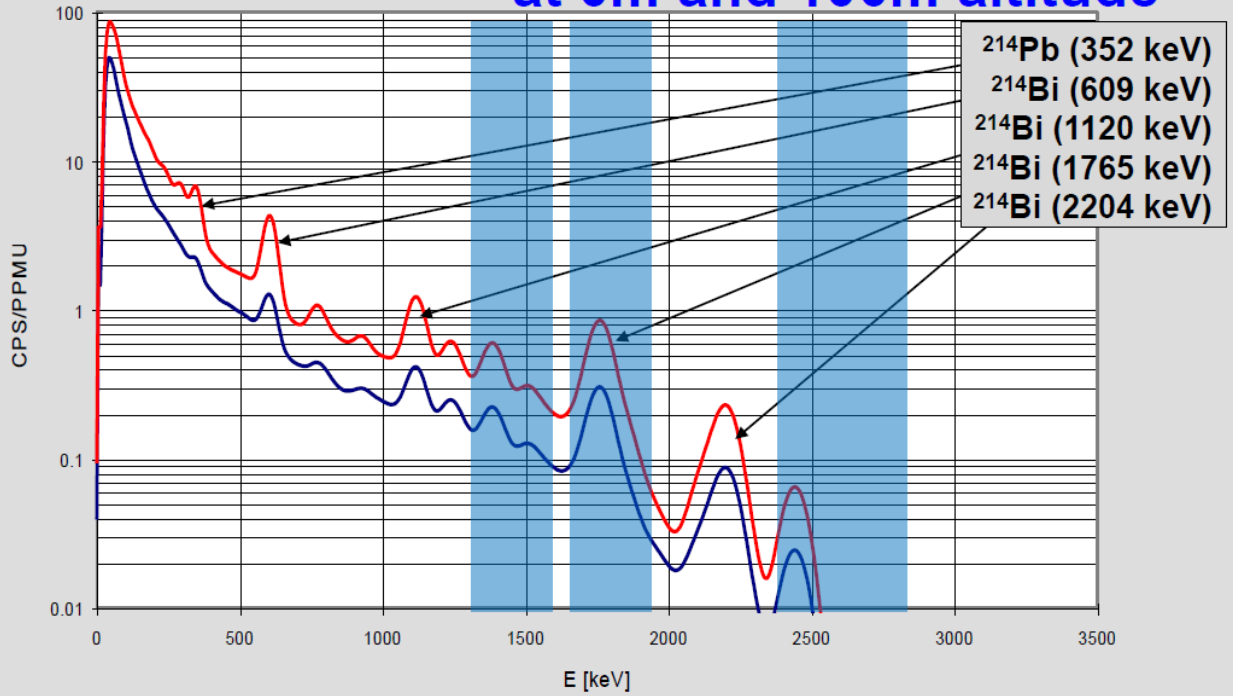
RS-500 AIRBORNE SYSTEMS to UAV?

Looking at K, U and Th series

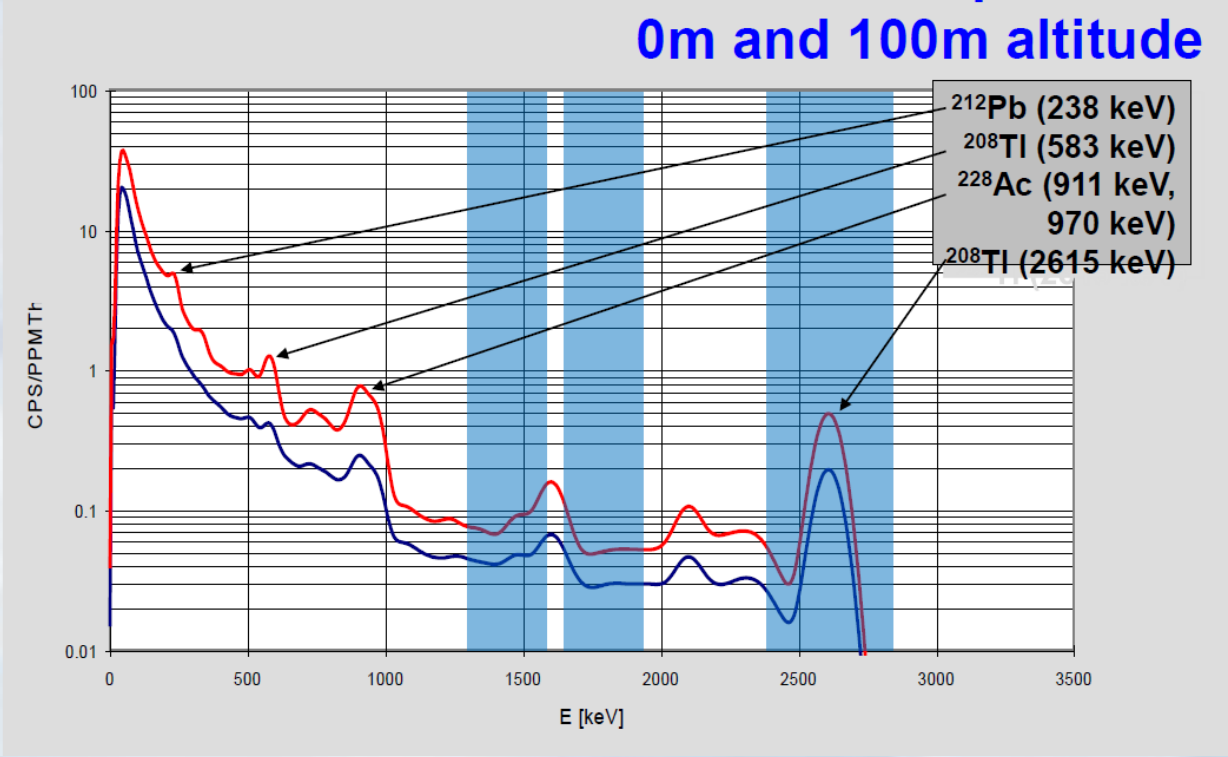
Monte Carlo simulated ^{40}K Spectra at 0m and 100m altitude



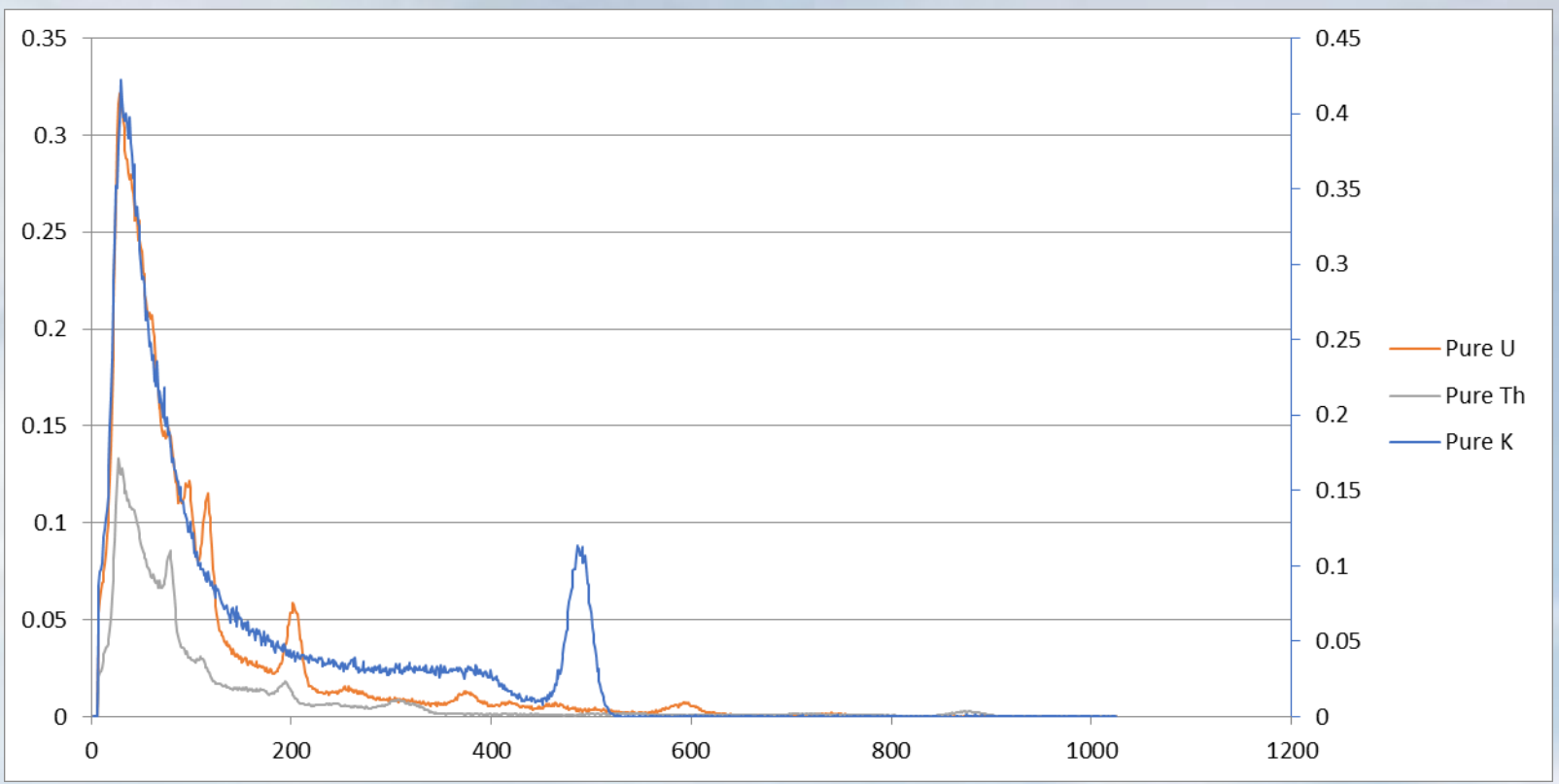
Monte Carlo simulated ^{238}U-series spectra at 0m and 100m altitude



Monte Carlo simulated ^{232}Th-series spectra at 0m and 100m altitude

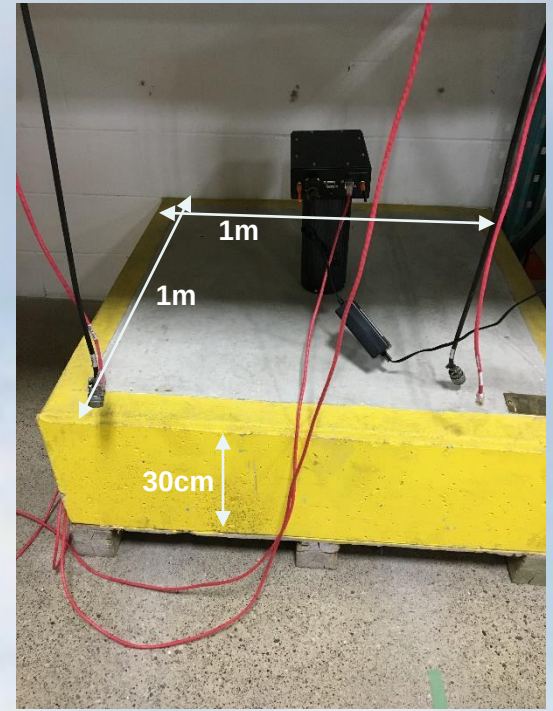


Detector Calibration (IAEA #323 or #1363)



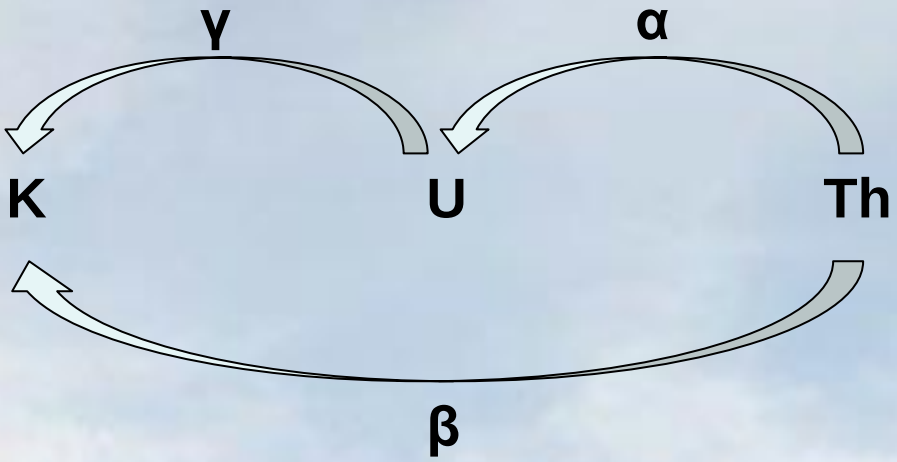
Calibration Pads

	BG-pad	K-pad	U-pad	Th-pad
K_conc(%)	1.41	8.71	1.34	1.34
U_conc(ppm)	0.97	0.32	52.9	2.96
Th_conc(ppm)	2.26	0.74	3.4	136



Pad	Geometric correction factor
K-Pad	1.17
U-Pad	1.17
T-Pad	1.19

The interaction between the Potassium (K), Uranium (U) and Thorium (Th) windows



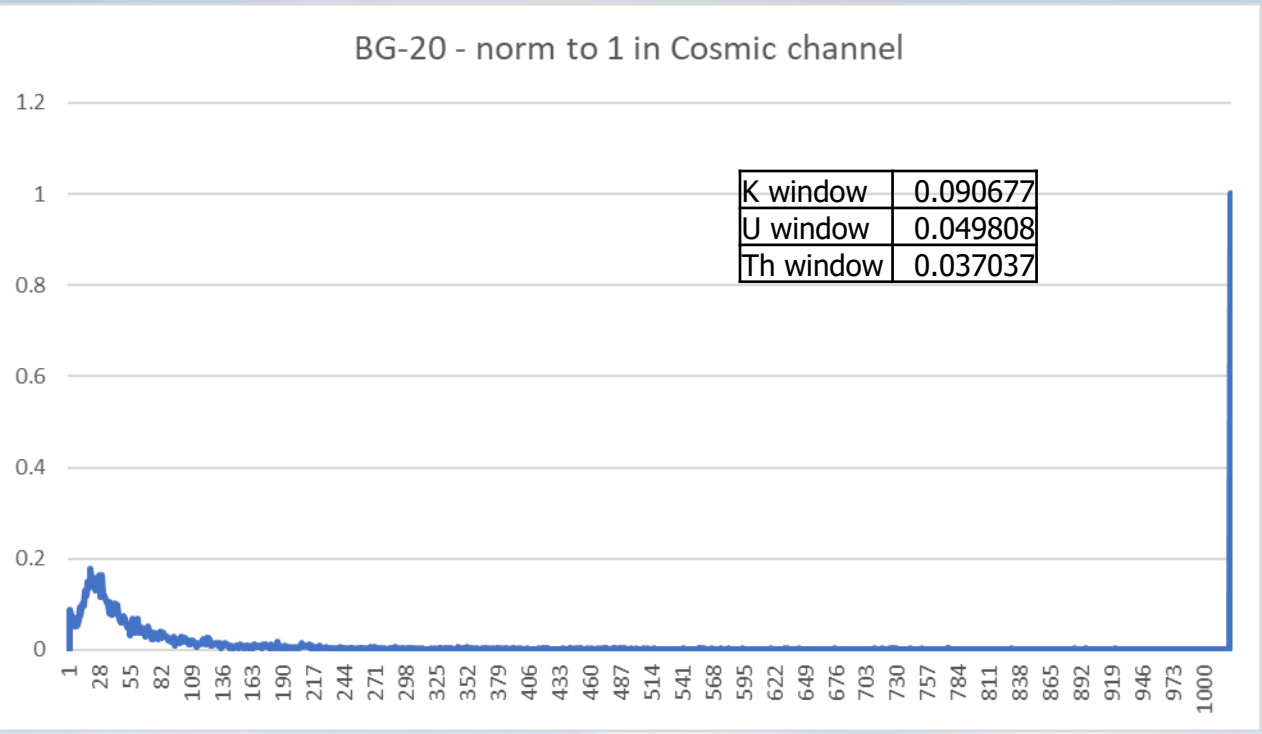
1	0.942	0.649
-0.001	1	0.474
0.001	0.042	1

	cps/(%,ppm,ppm)
K	3.817921
U	0.33207
Th	0.138849

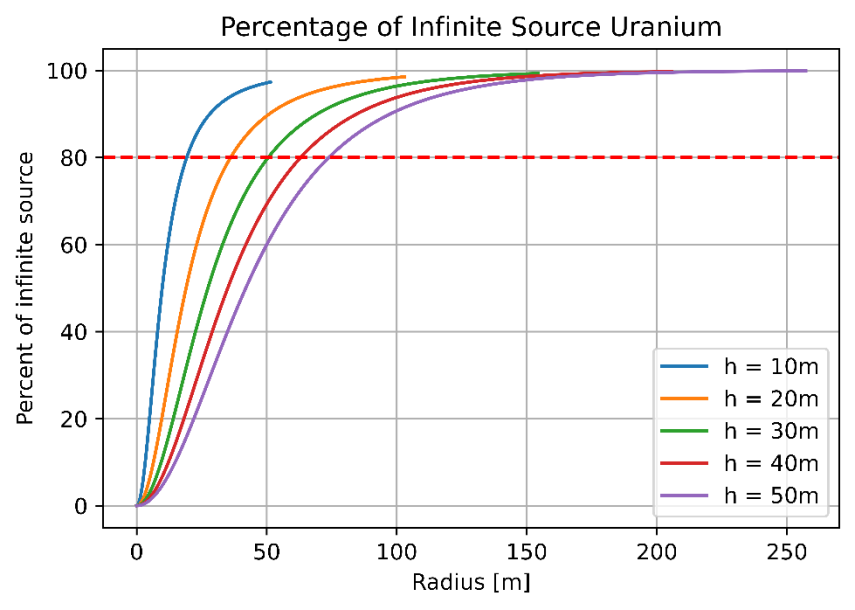
	Nominal values	UAV - Geo corrected
K [%]	7.3	7.33
U [ppm]	51.93	51.81
Th [ppm]	133.74	132.57

Cosmic stripping

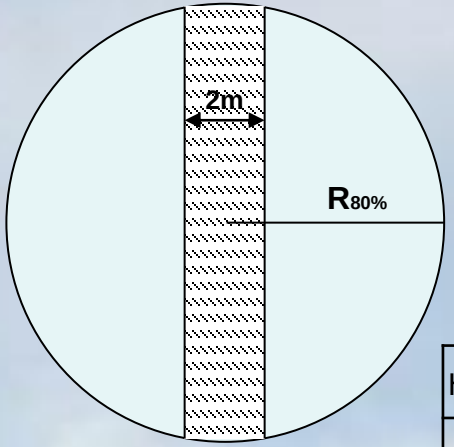
Lake Ontario – 2,000 m from shore



Application – 2m wide eU stripe SNR in a 5ppm eU Background



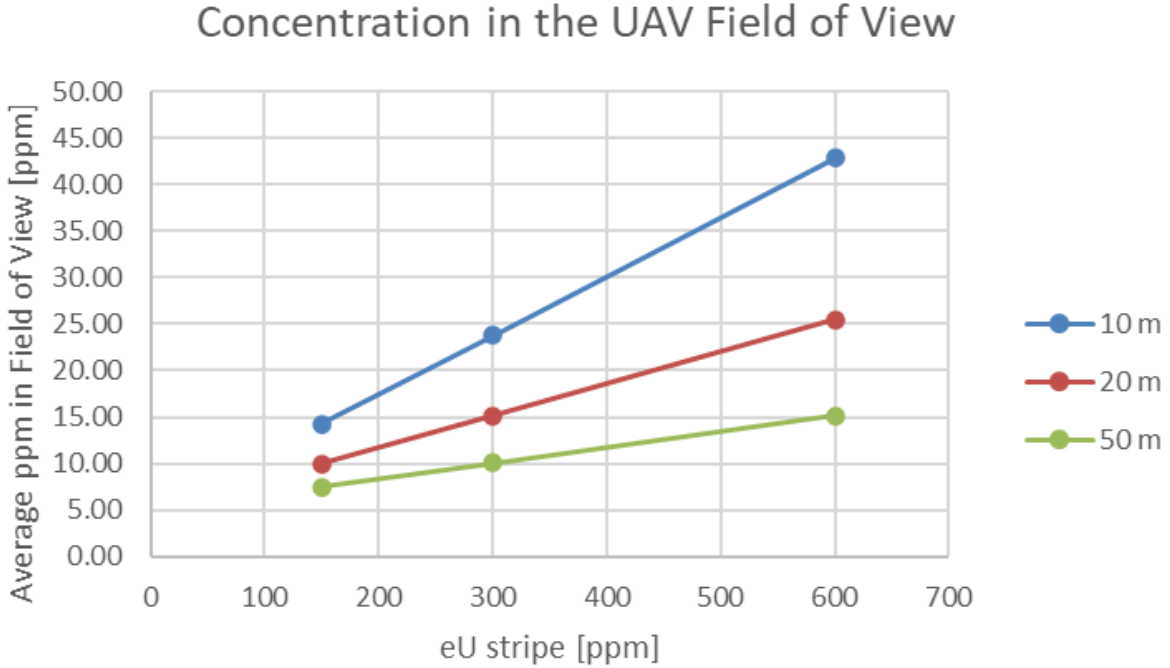
	cps/ppm @ contact	Height attenuation
U	0.33207	Assumption: -0.00828 (same as IAEA #323 16L)



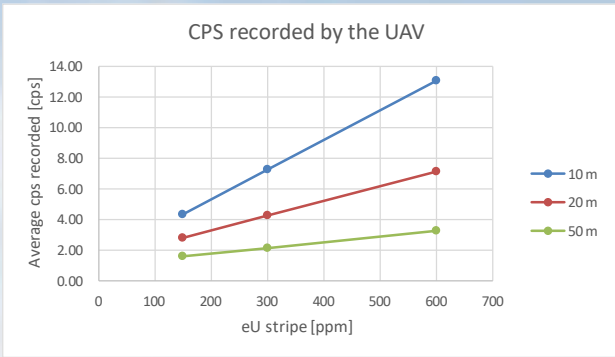
H [m]	Sensitivity at survey altitude [cps/ppm_eU]
10	0.3057
20	0.2814
50	0.2195

H [m]	radius for 80%	circle area [m2]	Stripe area [m2] (2m wide x diameter)
10	20	1257	80
20	37	4301	148
50	75	17671	300

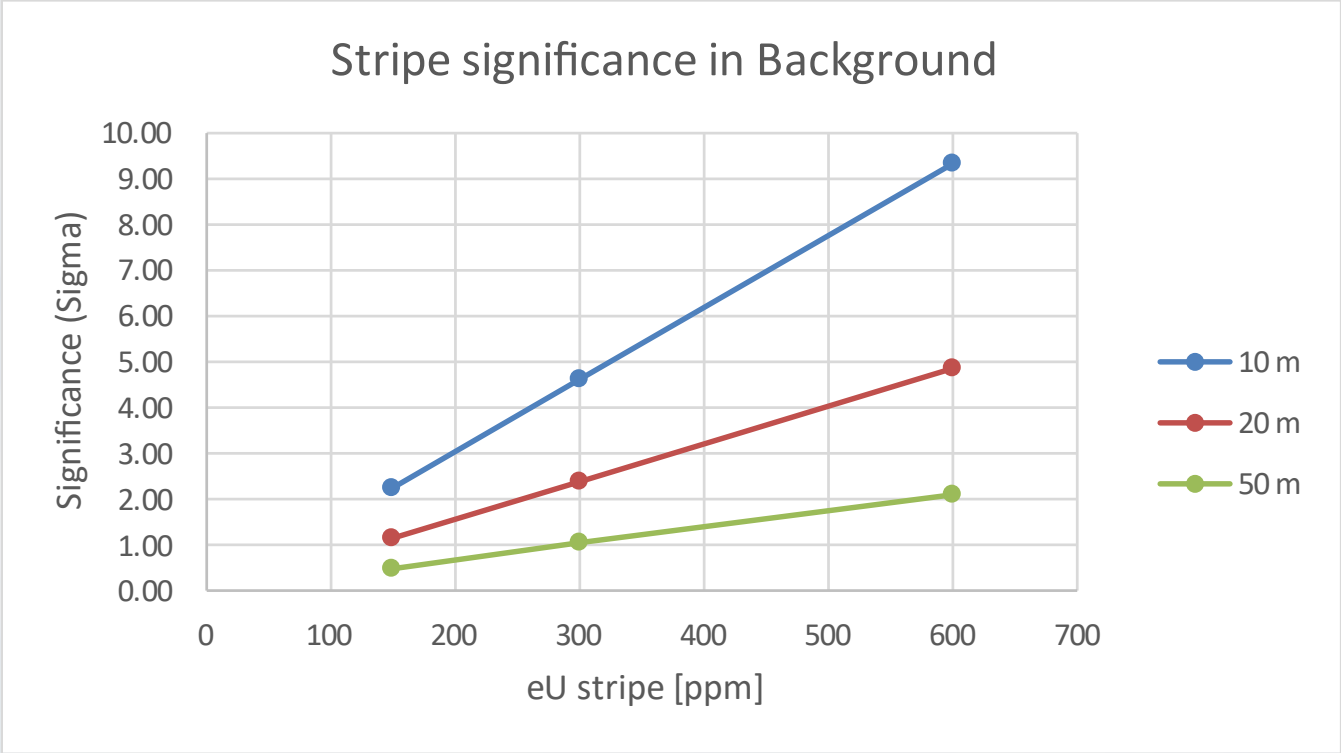
Application – 2m wide eU stripe SNR in a 5ppm eU Background



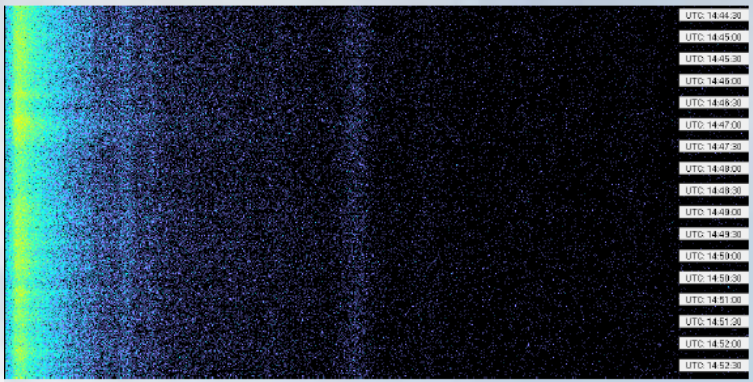
h [m]	5 ppm Bg [cps]
10	1.53
20	1.41
50	1.10

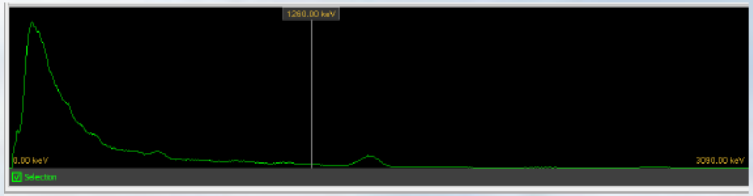


Application – 2m wide eU stripe SNR in a 5ppm eU Background



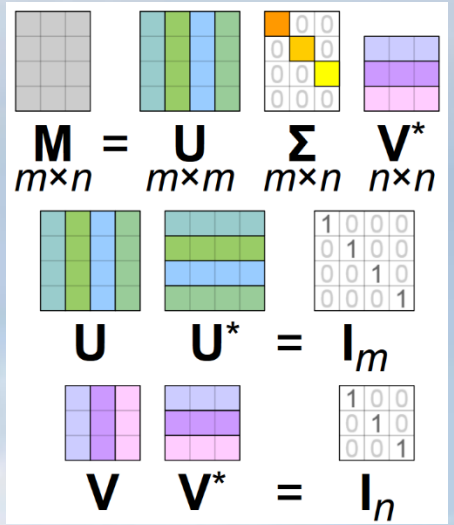
Post-processing data with NASVD - Spectral data as a matrix



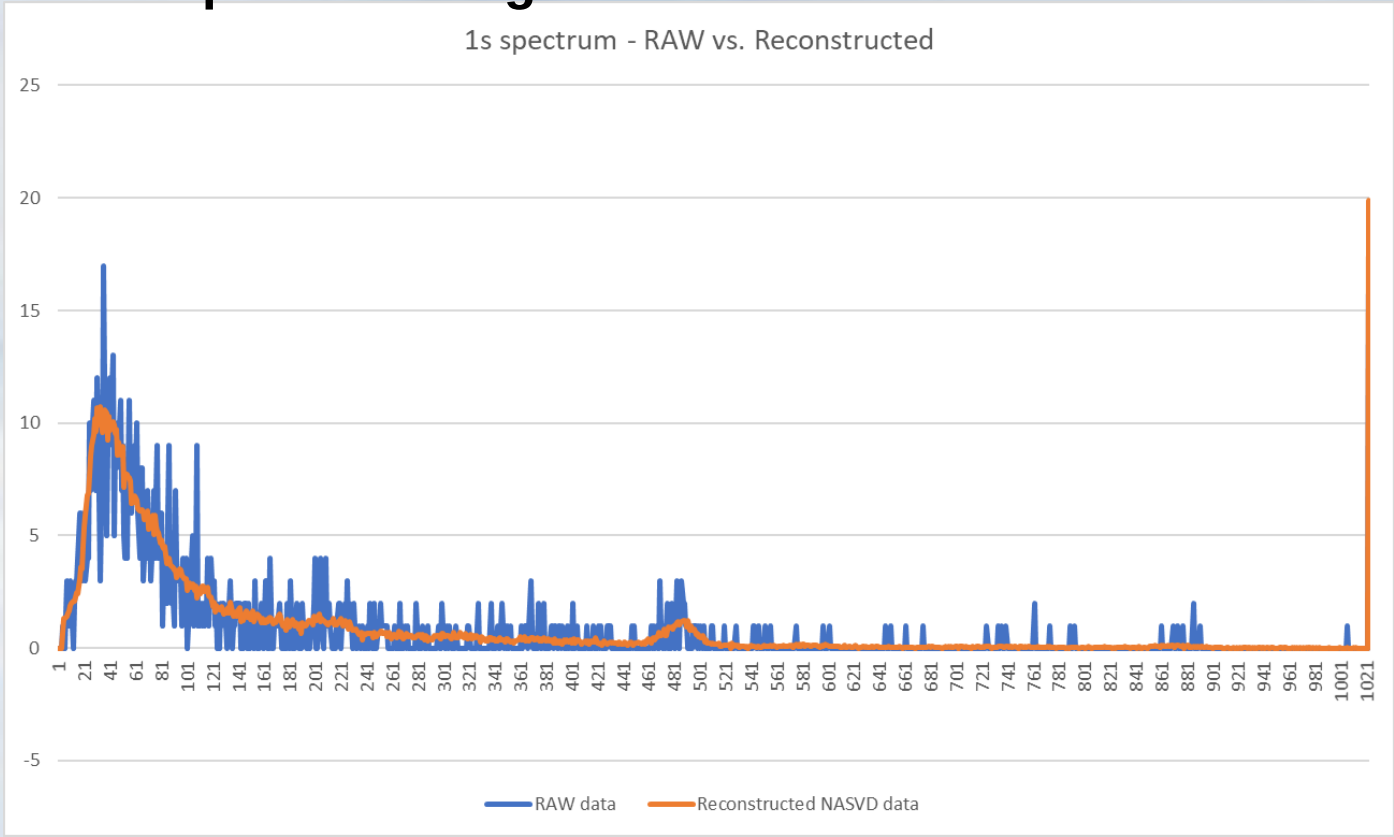


=

1	2	3	5	2
2	3	4	5	1
1	3	3	4	2
2	2	4	4	1
2	3	3	5	2
1	2	4	5	1



Example: 1s spectrum Original vs. Reconstructed



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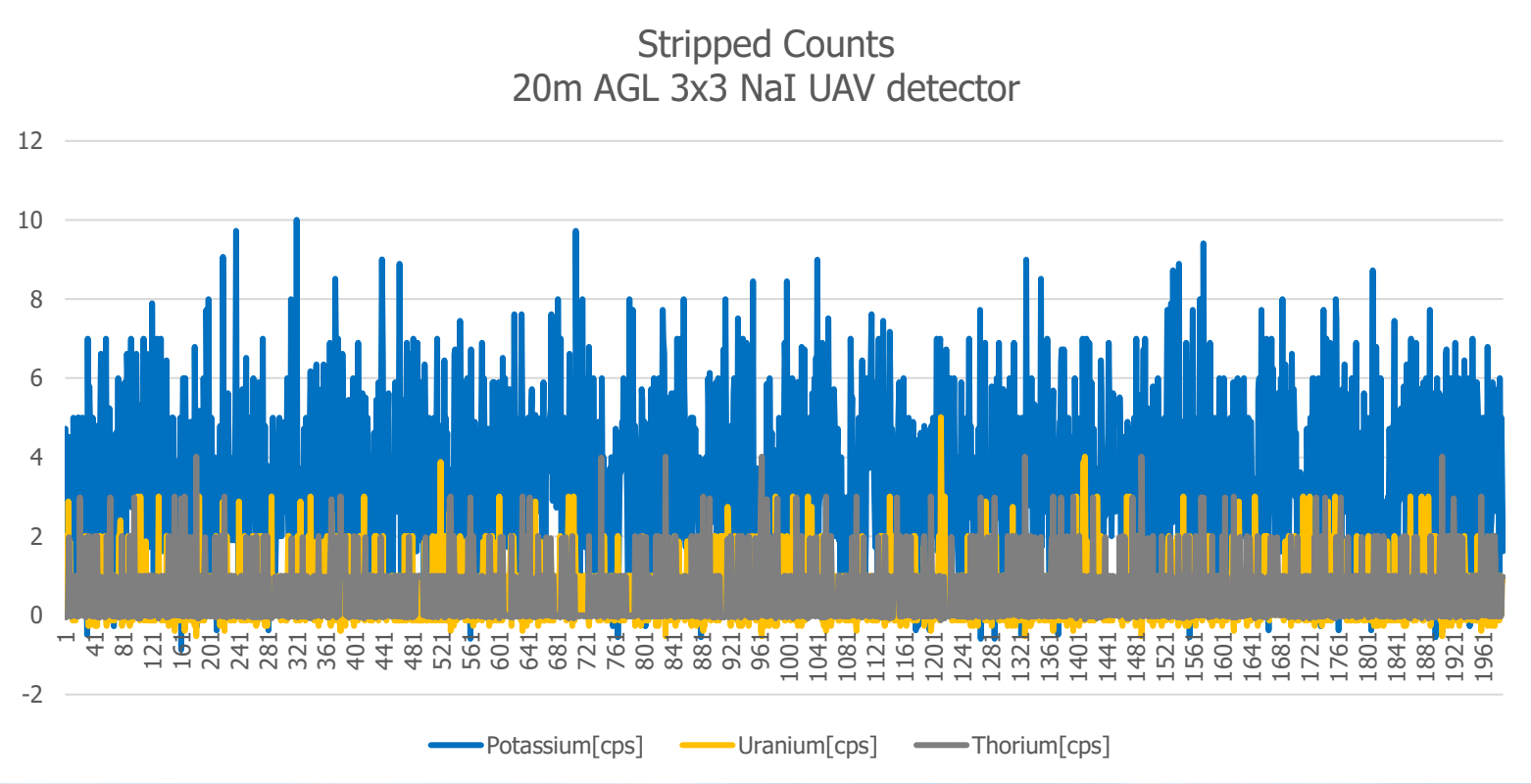
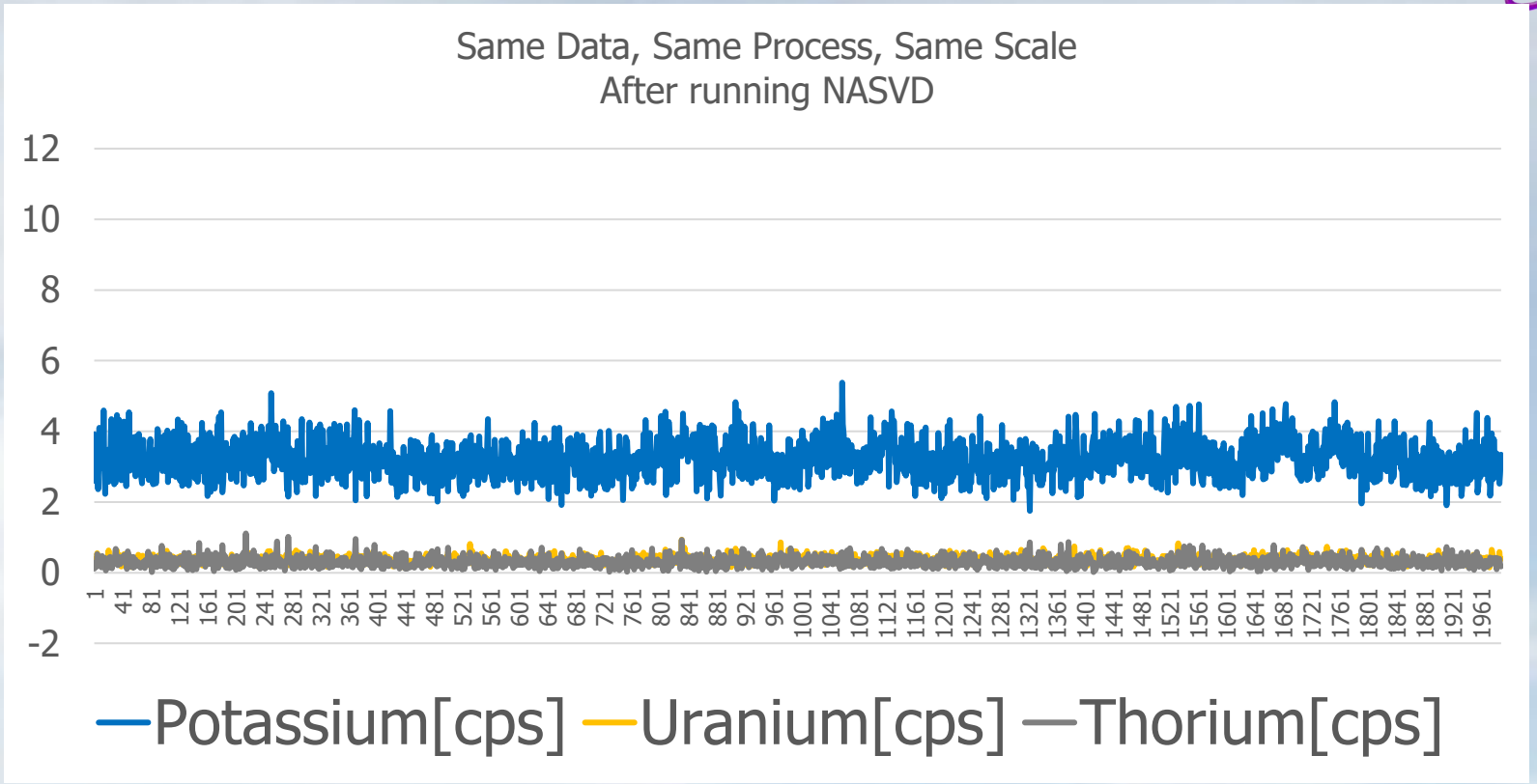
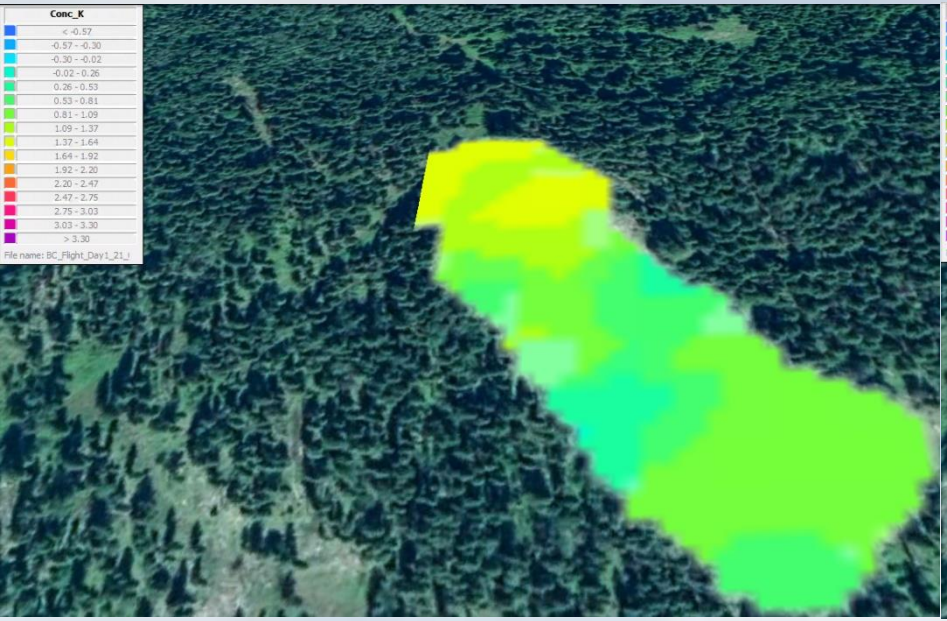
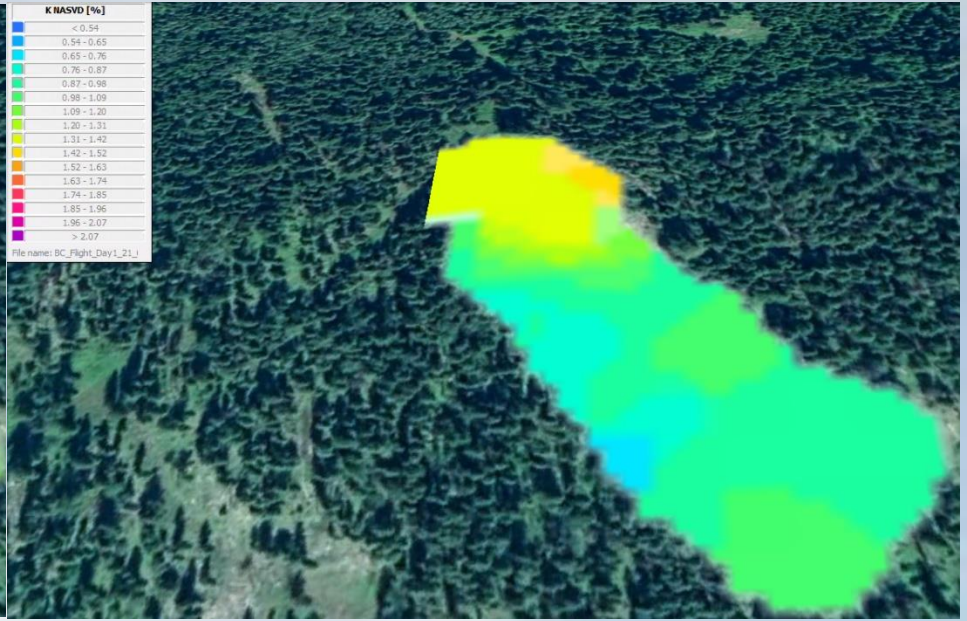



Same Data, Same Process, Same Scale
After running NASVD
12
10
8
6
4
2
0
-2
1
41
81
121
161
201
241
281
321
361
401
441
481
521
561
601
641
681
721
761
801
841
881
921
961
1001
1041
1081
1121
1161
1201
1241
1281
1321
1361
1401
1441
1481
1521
1561
1601
1641
1681
1721
1761
1801
1841
1881
1921
1961
Potassium[cps]
Uranium[cps]
Thorium[cps]

Radiation Solutions Inc. (RSI)





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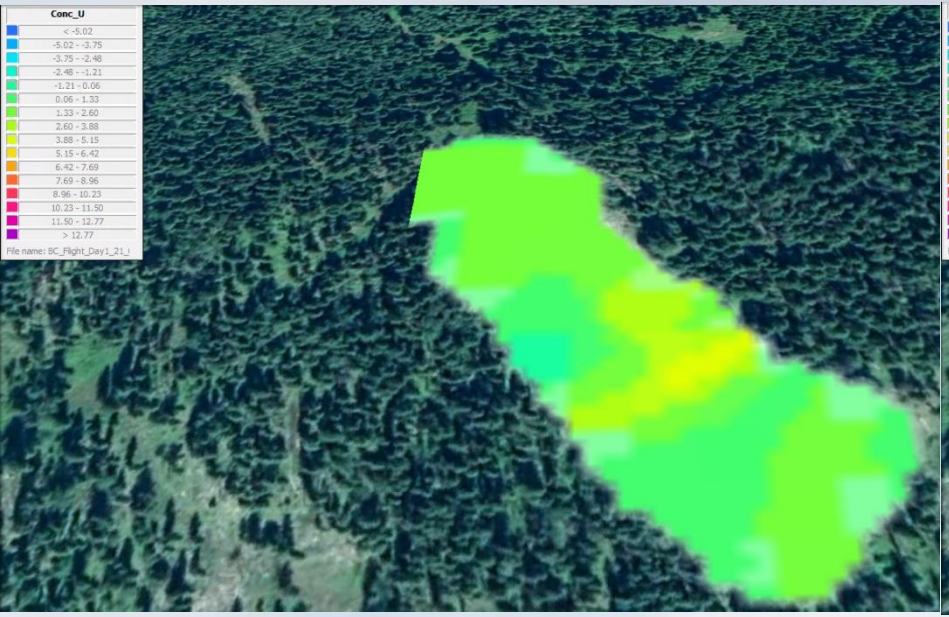

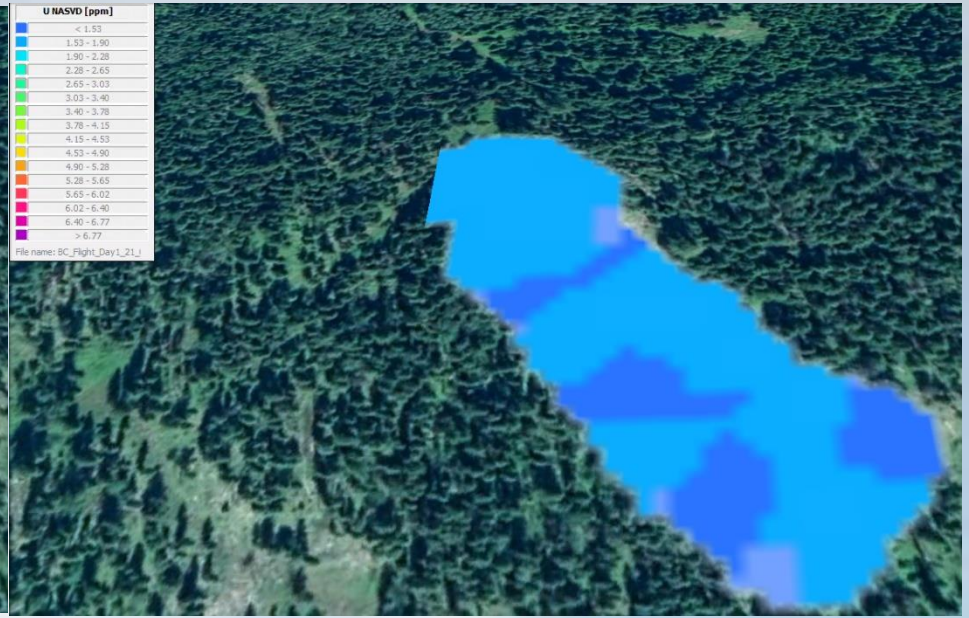

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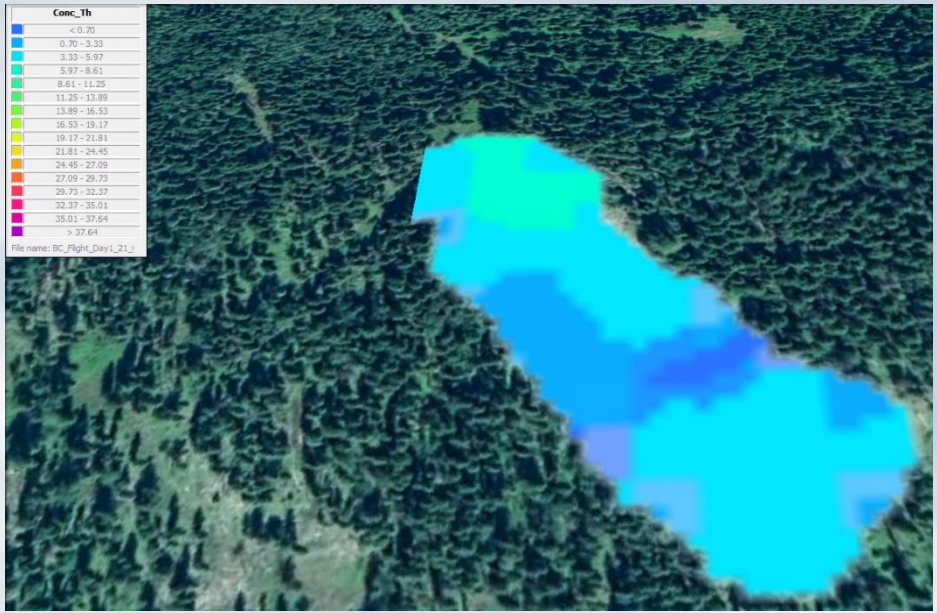

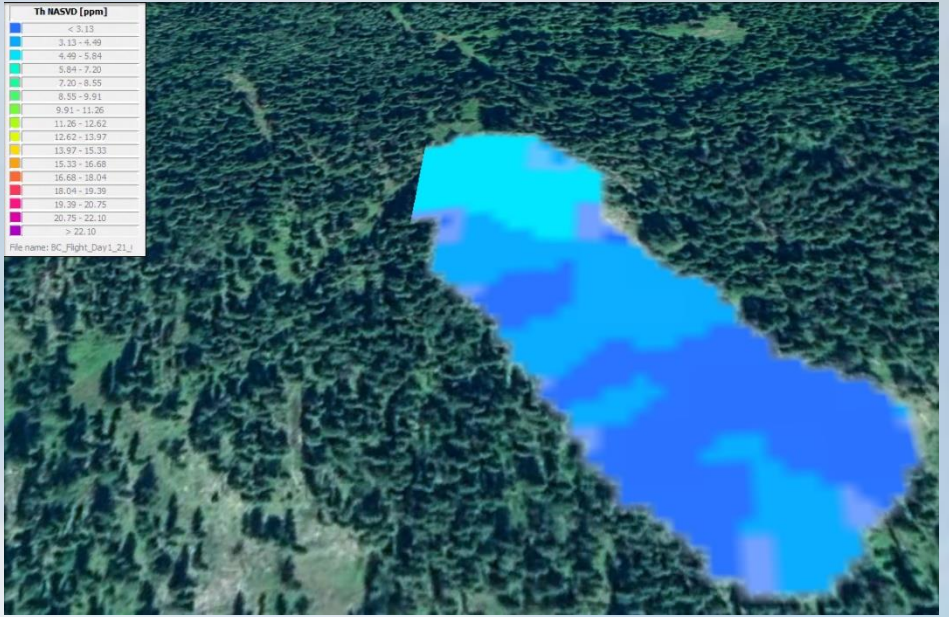

Conclusion

- Pre-flight
- NASVD in post processing

Thank you for your attention

✉ martinburtartn@radiationsolutions.ca
✆ +1-905-890-1111