NAA of Rope Filaments at CRL
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Introduction:

Inconsistencies in Th/U concentrations of rope filament samples as measured by neutron activation gamma-ray spectroscopy at CRL have prompted us to have the samples packaged off-site. Samples of kevlar and vectran filament have been wrapped in saran wrap at Guelph and shipped to CRL where they have been neutron activated. After irradiation the saran wrap was removed, the samples rewrapped and gamma counted in the CRL well detector.

Results:

Four kevlar and four vectran samples, each about 1.5 grams, have been measured. The results are tabulated in Table 1.

Table 1. Th and U Limits in Filament Samples

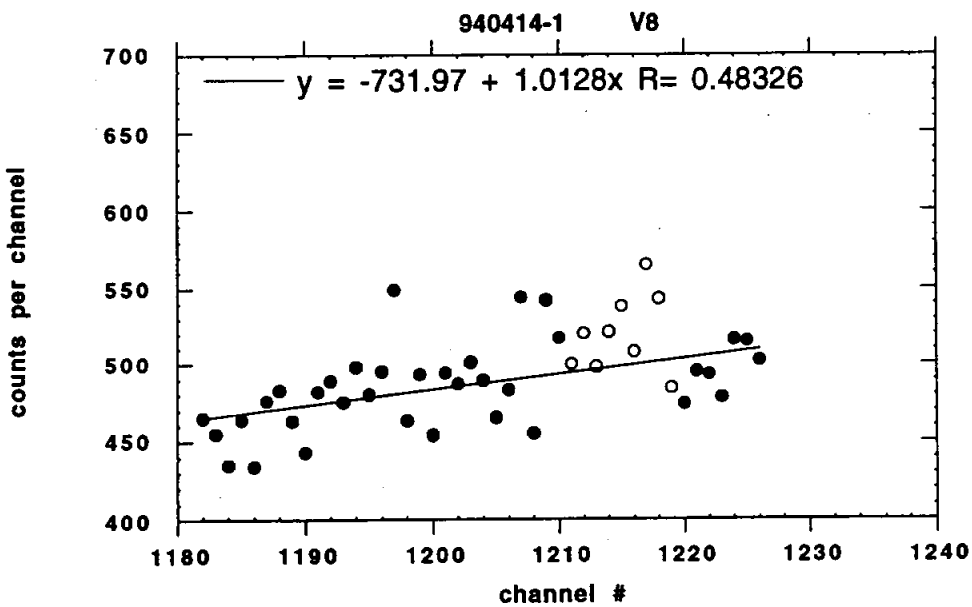
Sample ID	Weight gms	days from irradiation	count hours	bkgd c/sec/g	U limit, ppt 2 sigma	Th limit, ppt 2 sigma
K1	1.63	13	20	0.22	1070	100
K2	1.6	16	26	0.22	1300	65
K4	1.44	12	24	0.23	700	80
K9	1.42	15	20	0.2	1700	90
V5	1.39	8	24	0.072	125	36
V6	1.54	15	24	0.034	340	35
V7	1.45	11	20	0.027	240	36
V8	1.42	8	21	0.049	116	28

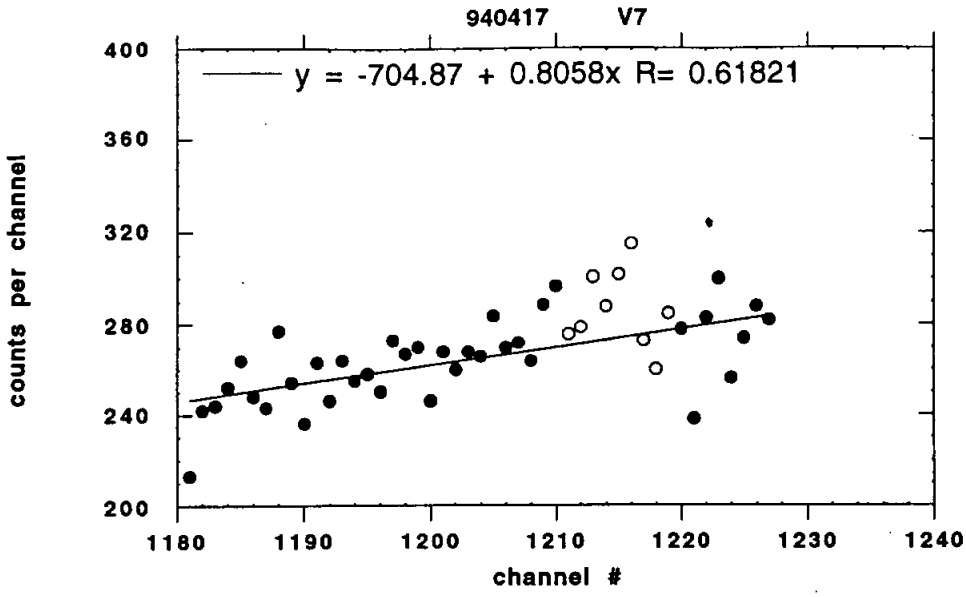
The background near the 2.4 day Np and 27 day Pa peaks limits the sensitivity of the measurements. Initially 15 hour Na is the dominant source of this background and the gamma counting is delayed for several weeks to accomodate this fact. Later 28 day Cr is the main source of background. Listed in the table is the background near the Pa peak. The vectran has significantly less contamination as compared to the kevlar and so the Th/U limits attainable for the

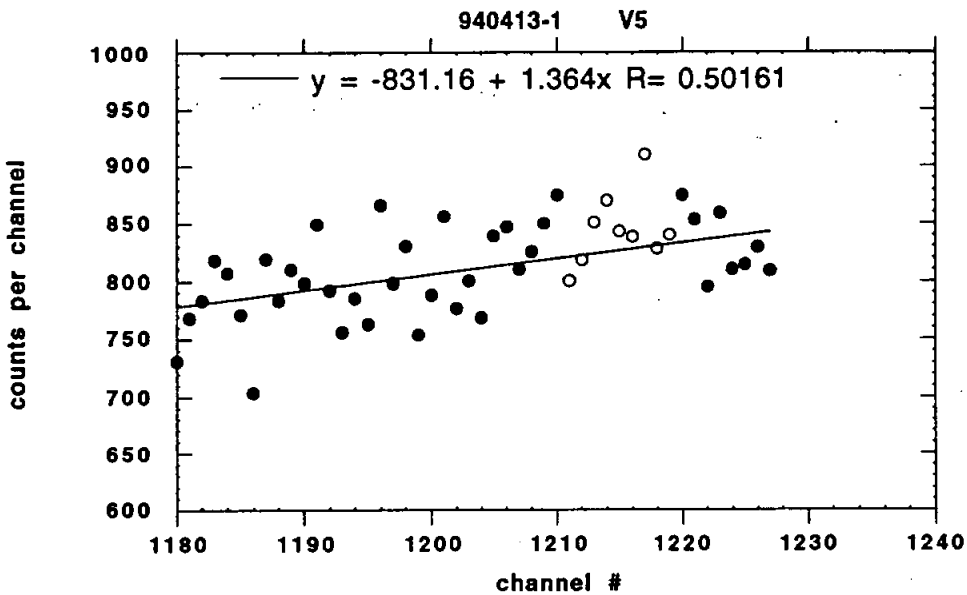
vectran samples are significantly lower. However, there is no evidence that the Th/U levels in the vectran are lower than in the kevlar.

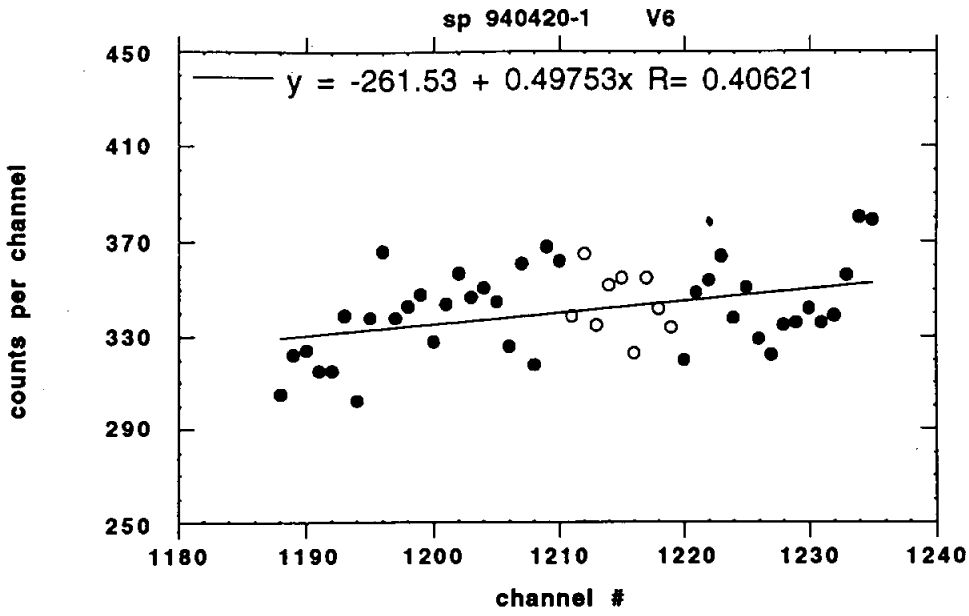
The shape of the filament samples are different from the shape of the Th/U monitors which go deeper into the well of the detector. This means that the counter efficiency for the monitors is higher than for the samples. Tests of the counter efficiency with a point source in various locations demonstrated that this systematic uncertainty is less than 50% but it does make the limits quoted in Table 1 worse by some amount, less than 50%.

The table lists the vectran Th concentration at the 2 sigma limit but in three of the four samples a Pa peak greater than 1 sigma was observed. The spectra in the vicinity of the 310 keV Pa peak are shown in figures 1 to 4. The measured concentration was 27±14, 28±18, and 31±18 in the three spectra with a peak, V8, V7 and V5.




940417 V7
y = -704.87 + 0.8058x R= 0.61821
counts per channel
channel #
400
360
320
280
240
200
1180
1190
1200
1210
1220
1230
1240


940413-1 V5
y = -831.16 + 1.364x R= 0.50161
counts per channel
channel #
1000
950
900
850
800
750
700
650
600
1180
1190
1200
1210
1220
1230
1240



Conclusions:

These results suggest that previous rope samples packaged and measured at CRL were contaminated during the handing process at CRL. Several possible explanations of the source of this contamination are being explored.

Both the kevlar and vectran filaments have Th concentrations acceptable to SNO. Only the vectran is known to have acceptable U concentrations. The kevlar may. The sensitivity of the NAA technique is limited by non Th/U contaminations in the filaments with the vectran sensitivity three times better than the kevlar sensitivity. The relative ease with which acceptable Th/U concentrations can be measured in vectran make it the preferred candidate for SNO.