ULTIMA Gold uLLT for ultra low level counting.

Overview

ULTIMA Gold™ uLLT is perfect for ultra low level LSC applications using QUANTULUS® or Tri-Carbs in low level mode. The ultra low background, high efficiency and good sample uptake is optimal for environmental monitoring applications. Of course, all counting conditions have to be optimized for best results.

Ultra low backgrounds

Most industrial raw materials that are used for LSC cocktail production are manufactured with potassium catalysts. Potassium is always contaminated with a trace amount of naturally radioactive ^{40}K (0.0119%). This natural isotope may result in increased background values in the higher energy channels.

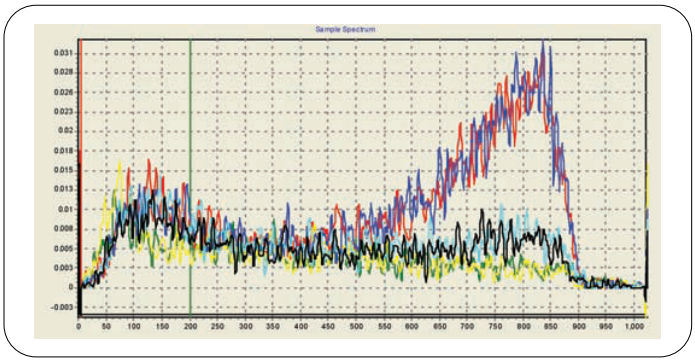
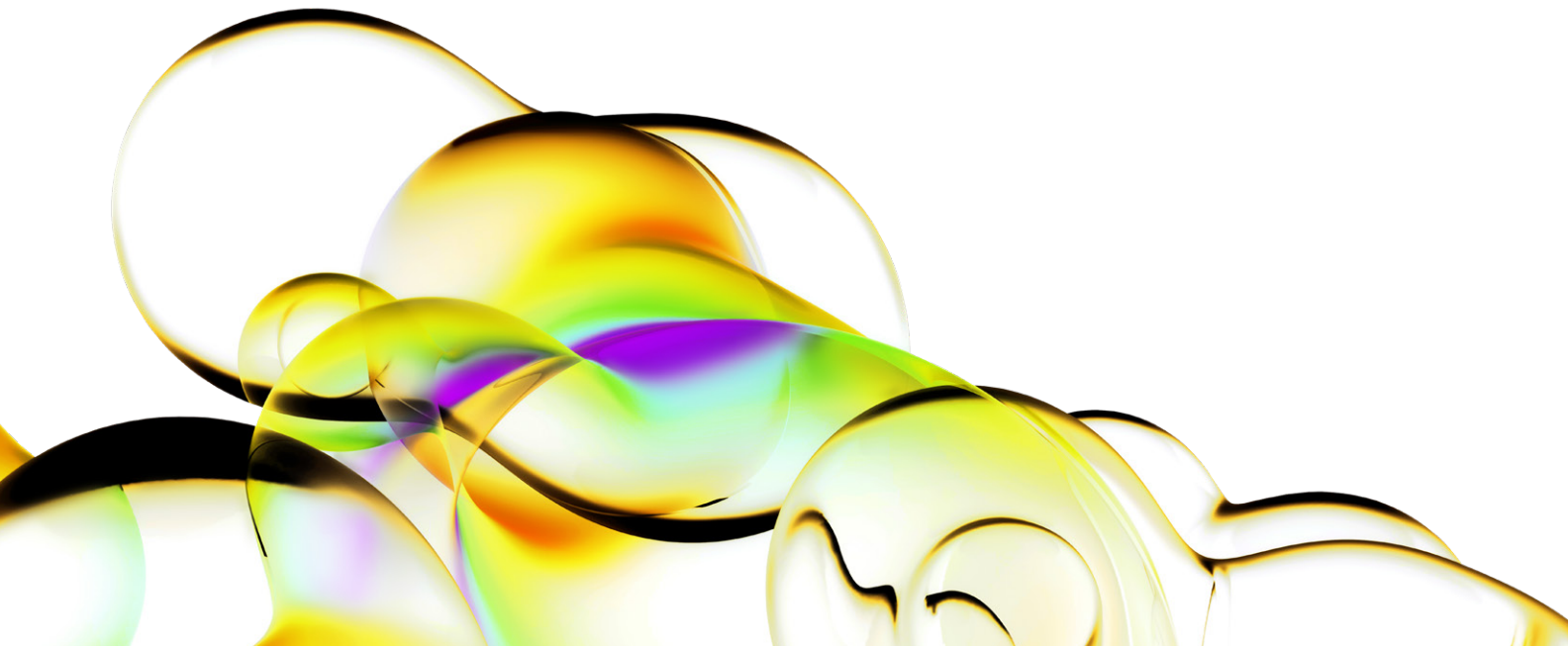


Figure 1: QUANTULUS spectra for different lots of UG-LLT and UG-uLLT



This effect is observed in the QUANTULUS spectrum shown in Figure 1 below; the peak in the 600 – 900 energy channel for the red and blue graph are caused by ^{40}K contamination of the cocktail, the other graphs are for different lots of ULTIMA Gold uLLT, produced with potassium free raw materials. A high background in the 600 – 900 channel can mask low levels of Yttrium-90 or Strontium-90.

Another source of background is caused by chemiluminescent effects; short bursts of light with low energy as result of chemical reactions. This effect can be seen in the low energy channels of QUANTULUS (0 – 200; random). To produce a good ultra low level cocktail it is important to guarantee low background levels in these channels by reducing chemiluminescence to avoid masking low tritium levels (^{3}H). As can be seen in the table below UG-uLLT has a 10-15% lower randomsignal than UG-LLT and a much lower 40K signal as UG-LLT.

In Tri-Carb® this better performance is also detected. The table below shows background levels in 3 energy windows (A=low energy, B=mid-energy, C=high energy channel) for ULTIMA Gold LLT and ULTIMA Gold uLLT. The percentage of luminescence is also given in the last column. A good performance is seen across the spectrum for UG-uLLT.

Table 1: Background levels in QUANTULUS for UG-LLT and UG-uLLT.

LSC Cocktail	Random	Tritium	Net tritium	40K	SQPE
ULTIMA Gold LLT	0.135	1.097	0.962	8.546	918
ULTIMA Gold uLLT	0.111	0.887	0.766	3.788	921
ULTIMA Gold LLT with sample	0.260	1.359	1.100	5.789	814
ULTIMA Gold uLLT with sample	0.226	1.214	0.988	3.124	818

Table 2: Background levels in Tri-Carb for UG-LLT and UG-uLLT

LSC Cocktail	cpm A	cpm B	cpm C	tSIE	% Lum
UG-LLT ref	3,87	5,61	7,2	729	1
UG-uLLT	3,56	4,29	5,82	759	0

High efficiency

A LSC cocktail with a high counting efficiency allows more accurate results and shorter counting cycles. The efficiency depends on the amount of sample added (dilution), but should be as high as possible at maximum sample loads. The efficiency also depends on the count mode selected: normal count mode (0 – 18.6 keV — Figure 2) or Low Level count mode (0 – 18.6 keV — Figure 3). Overall, ULTIMA Gold uLLT has a similar counting efficiency as ULTIMA Gold LLT as can be seen from the figures below.

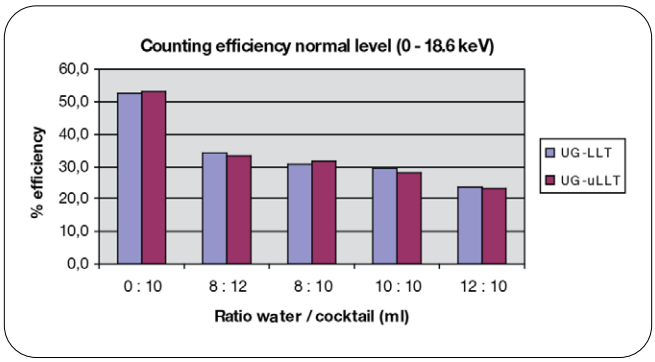


Figure 2: Counting efficiency for tritium in normal count mode in Tri-Carb

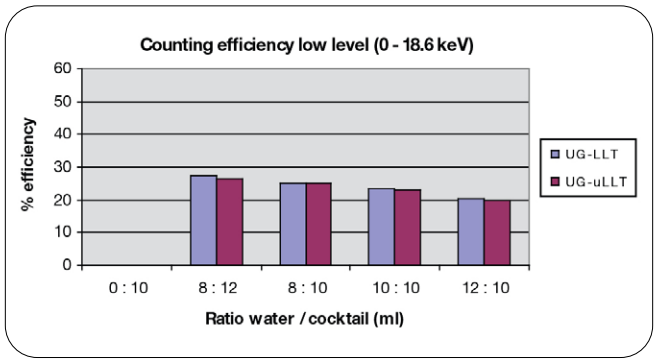


Figure 3: Counting efficiency for tritiumin low level countmode in Tri-Carb

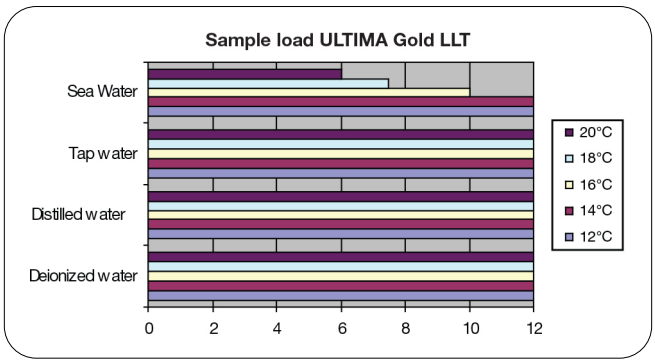


Figure 4: Sample load capacities for UG-LLT

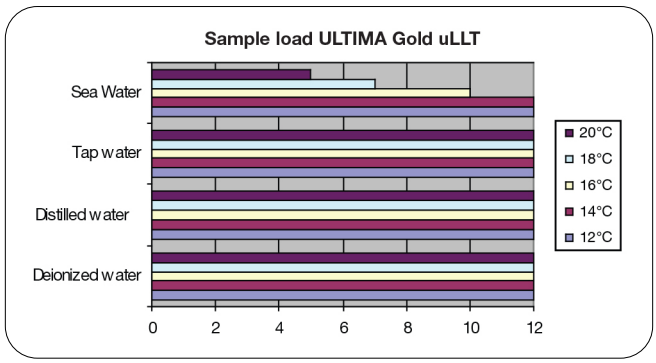


Figure 5: Sample load capacities for UG-uLLT

High sample uptake

Low level applications are preferably done with larger amounts of sample to reduce the counting times. As can be seen from the data below, higher sample loads are offset by a reduction in efficiency. For low level environmental monitoring applications, sample quantities of 8 - 10 mL added to 10 mL LSC cocktail are considered optimal.
In Figures 4 and 5 below you will find an overview of sample capacities for different water samples. The sample uptake for ULTIMA Gold LLT is comparable to ULTIMA Gold uLLT.

Ordering information

ULTIMA Gold uLLT is available in 3 formats, dispensed in glass amber bottles:

6013683	ULTIMA Gold uLLT	500mL Sample
6013681	ULTIMA Gold uLLT	1 Liter
6013687	ULTIMA Gold uLLT	4 x 2.5 Liter

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