Scottish Universities Research & Reactor Centre

A BRIEF AERIAL SURVEY IN THE VICINITY
OF SELLAFIELD IN SEPTEMBER 1990

D.C.W. SANDERSON, J.D. ALLYSON,
K.J.CAIRNS, P.A. MACDONALD

SCOTTISH UNIVERSITIES RESEARCH AND
REACTOR CENTRE, EAST KILBRIDE

East Kilbride Glasgow G75 0QF Telephone: 01355 223332 Fax: 01355 229898

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SUMMARY

A two day survey exercise was conducted by SURRC from 25th-26th September 1990 with the joint aims of demonstrating the potential of helicopters for emergency response and beginning the definition of baseline levels in the immediate vicinity of Sellafield. The aircraft used for this work was a twin engined AS 355 "Squirrel" helicopter chartered from Dollar Helicopters. It was loaded with an 8 litre NaI gamma spectrometry system at SURRC in East Kilbride on the afternoon of 24th September and flown down to Sellafield the same day. Over the following two days roughly 1300 gamma ray spectra were recorded from an area ranging south from an EW line linking Ennerdale Fell and St. Bees Head to beyond Ravenglass. Operations were conducted from the Sellafield helipad, the aircraft being refuelled at Barrow in Furness.

The flights were arranged to provide nominally 1km spaced parallel NS flight lines throughout the survey area, for the purpose of baseline mapping. Supplementary flights to improve spatial resolution are possible at a later stage. In addition a rapid response flight route was rehearsed involving definition of landward arcs at 10km, 5km and 2km radii from Sellafield plus the beachline from St. Bees Head to Ravenglass. The precise path was chosen to be navigable under most weather conditions and took roughly 40 minutes to fly. A survey aircraft arriving from East Kilbride could perform such a survey without pausing to refuel.

The results have been stored archivally and used to map the naturally occurring nuclides ^{40}K, ^{214}Bi, ^{208}Tl together with ^{137}Cs and total gamma ray flux. The maps presented are spatially smoothed, both by the inherent character of the aerial survey technique and by the colour contouring processes. This leads to a tendency to broaden spatial features, while slightly reducing maximum values, and should be taken into account when interpreting the maps. Greater spatial detail could be achieved with closer flight line spacing. Activity due to Sellafield was readily detected in the area and can be seen clearly in the maps. It is noted that the levels observed are generally comparable with those in BNFL annual reports and other research publications. Furthermore, with a few exceptions, naturally occurring radionuclides are the dominant radiation source in much of the survey area, and show considerable variations from place to place. ^{137}Cs due to marine discharges was most pronounced in the Irt, Mite and Esk estuaries and on the beachline close to the plant. The same nuclide was detected at lower levels in terrestrial areas due to a combination of global fallout, aerial discharges from the plant and the Chernobyl accident. ^{41}Ar and ^{16}N activities were detected in the immediate vicinity of Calder Hall. A small feature was detected at Drigg, probably associated with current operations on the site, and equivalent to an enhancement of less than twice the local natural background.

Radiation levels due to current activities on the Sellafield site fall off rapidly with distance from the perimeter, approaching natural levels within 0.5-1km at the time of the survey. Those from the marine, estuarine and tide washed environments are mostly attributed to past marine discharges, and can be expected to continue to receive attention in the future.

1. INTRODUCTION

A short aerial survey exercise was conducted in the vicinity of Sellafield on 25th and 26th September 1990 to demonstrate rapid mapping techniques capable of repetition or extension at short notice. The underlying aim was to rehearse possible emergency response survey techniques which could complement conventional ground based measurements in the event of an incident involving the release of radioactivity from the site.

Whereas ground level gamma ray measurements are capable of good spatial resolution, and environmental samples can be analysed with great sensitivity and precision in the laboratory, neither approach is particularly effective for comprehensive area mapping in an emergency. The practicalities of transport and resources involved lead inevitably to protracted evaluations with extremely low sampling densities using these approaches.

Aerial survey methods by contrast provide extremely rapid and effective means of locating areas of enhanced gamma ray activity, especially in remote locations or difficult terrain [1-7]. They have the abilities to conduct total area searches at regional or national level, and to operate in difficult terrain - including marine or estuarine environments - without unnecessarily exposing survey teams to contamination or radiation hazards. As such they have an important contribution to make to emergency response planning, which complements conventional measurements in allowing these to be effectively directed to areas of greatest need.

The radiation environment of Sellafield has been under study for many years for operational, regulatory, emergency response and research purposes. The majority of this work has been based at ground or sea level. However a brief aerial survey was conducted in October 1957 [8,9] immediately following the Windscale Fire. Although at that time the equipment available was not capable of spectral discrimination, the dominant nuclide, I-131, was estimated by scaling total counts to ground measurements. More recently the upland areas were surveyed by SURRC for MAFF following the Chernobyl accident[10] using a prototype spectrometer to estimate 137-Cs deposition. In this latter exercise more than 1800 gamma ray spectra were recorded in 36 hours flying from 45000 hectares of remote and rugged terrain. Spectral stripping and calibration to ground data were used.

The work reported here was conducted with the joint aims of exercising a potential emergency response role and beginning to define baseline levels in the immediate vicinity of the Sellafield plant.

2. SURVEY PLANS

Flights were planned as detailed below to fulfil the joint aims of emergency response exercise and initial baseline definition.

2.1 Requirements of the emergency grid.

The emergency grid was designed with the following requirements in mind.

2.1.1 It should be possible to conduct the initial exploratory measurements immediately on arrival at Sellafield (or Barrow) without stopping to refuel.

2.1.2 The results should, so far as possible, define range and trajectories of terrestrial deposition within a 10km radius of the site.

2.1.3 The flight path should be navigable under as wide a range of weather conditions as possible.

2.1.4 It should be possible to navigate the path and to reconstruct the data by dead reckoning in the event of failure of navigational equipment.

2.1.5 Radiological risks of flying into high dose rates, of contaminating aircraft, and of resuspending deposited activity should be minimised.

2.1.6 It should be possible to analyse the results rapidly and to compare them with previous results so that changes can be quantified and further survey actions defined.

2.2 Specification of the emergency grid

The above criteria were met respectively by the following means.

2.2.1 Fuel limitations on arrival set a practical design limit of 45 minutes flying time. At the nominal survey speed of 120 kph this sets a limit of 90 line km.

2.2.2 The grid was designed to define 10 km, 5km and 2km landward arcs from Sellafield plus the beachline from St. Bees head to Ravenglass.

2.2.3 Subject to 2.2.2 the grid avoids obstacles and high ground. The greatest elevation is Kinniside Common and Lank Rigg (541 m OSGB 1936 Datum) on the 10km arc. In extremis the flank of this hill could be skirted at lower altitude under conditions of poor visibility.

2.2.4 The flight plan is composed of a series of straight lines between readily visible landmarks which approximate the desired trajectory. Usually the precise flight path is recorded in real time from on board navigational instruments and used to reconstruct the data for mapping purposes. However in the event of failure of such systems the grid could be flown by line of sight, and the track reconstructed simply by noting the times and index numbers of each waypoint and interpolating between them. Procedures to reconstruct tracks on this basis have been tested successfully by SURRC while operating in the Niger Delta [11].

2.2.5 The order in which the grid is flown is such that the aircraft completes the most distant arcs and beachline sections before approaching the site in a semi-spiral. The equipment gives a real time display of radiation levels. In the event of extremely high activity being detected the aircraft can increase altitude - to decrease detector sensitivity and simultaneously reduce radiation levels to crew. If necessary the aircraft can break off without fully approaching the site. Finally, if the closest zones caused minor contamination of the aircraft this would not affect preliminary readings.

2.2.6 The equipment produces results which can either be analysed on board the aircraft after landing or readily transferred to commonly available PC's for simple analysis. Statistical analysis, working calibration and mapping can all be performed rapidly on site. Hard copy of tabular results can be produced from any printer in monochrome, suitable for facsimile transmission. Colour hard copy can be produced at later stages.

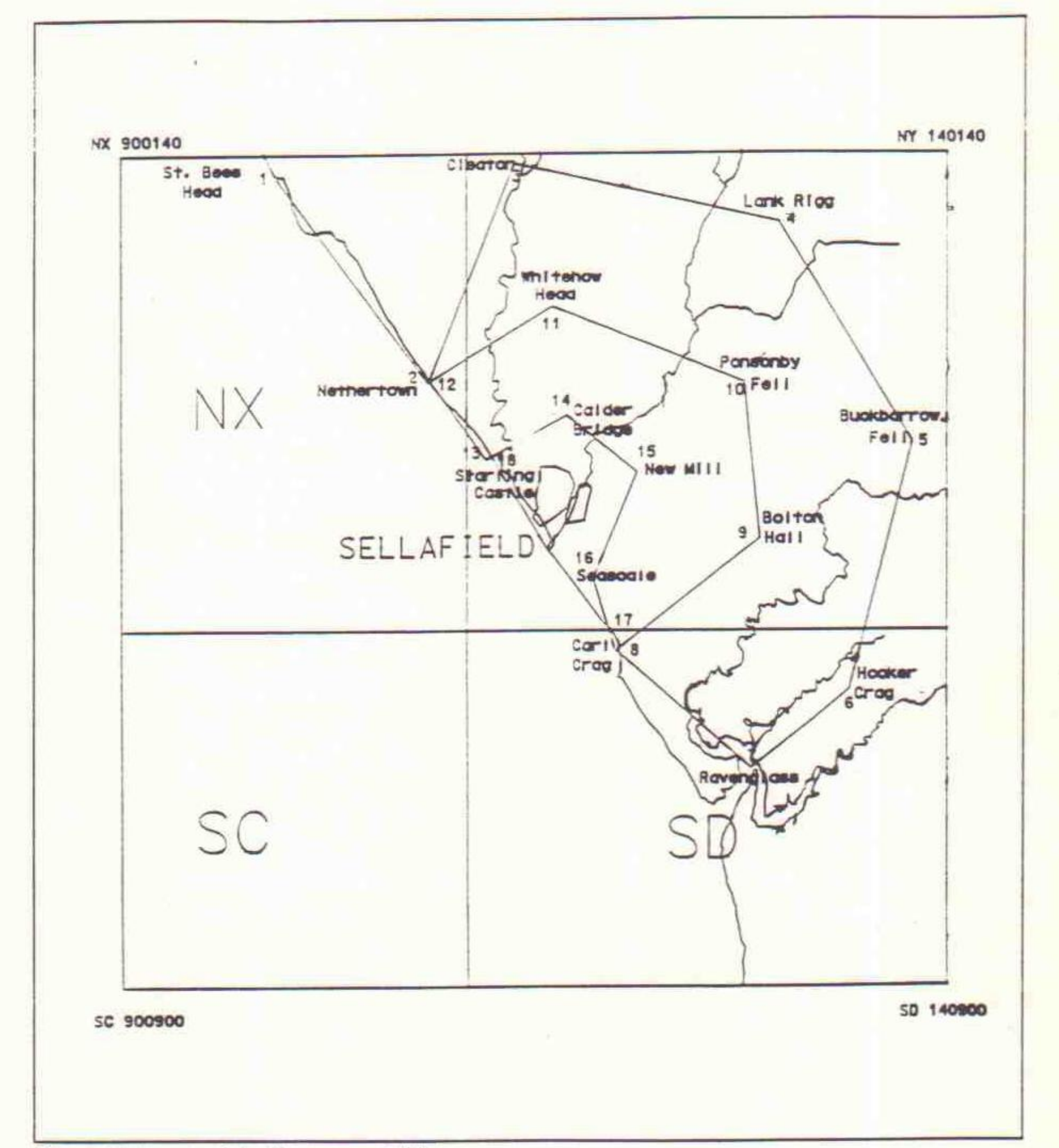


Figure 2.1 Layout of the Emergency Grid

2.3 The emergency grid.

The positions of the emergency response waypoints are listed below (Table 2.1) in order of execution and shown graphically in figure 2.1. Nominal flight altitude and speed are 75m and 120 kph (64.7 knots), although these may be varied on individual occasions to take account of weather or other circumstances. Radiometric data are to be recorded with 10 second integration time, interleaved with navigational fixes and time-averaged radioaltimetry.

When arriving from the north data would also be recorded along the coastal route to St. Bees Head, although there would be no constraints on flight speed and altitude specification would be at the pilots discretion. At the end of each grid flight the pilot is instructed to free fly to the landing point, which will usually be the Sellafield Helipad. Subject to fuel availability it may be possible to reconfirm any features of special interest en-route to landing.

Specific objectives of the September flights were to confirm the practicability of this grid, to rehearse its implementation with Dollar helicopters and four SURRC survey teams, and to acquire several sets of radiometric data for reference purposes. This latter function was focused on establishing existing levels and reproducibility of these flight lines, and providing test data to develop local mapping and presentation tools. Additional baseline information from the general vicinity is also required, as described below, and its generation formed a secondary fieldwork objective.

Table 1. Waypoints of the Emergency grid.

Point	Location	Latitude	Longitude	OS Ref.
1	St Bees Head	54°30.2'N	3°37.6'W	NX 945133
2	Nethertown	54°26.8'N	3°33.3'W	NX 990073
3	Cleator Village	54°30.3'N	3°31.0'W	NY 015137
4	Lank Rigg	54°29.5'N	3°23.9'W	NY 092120
5	Buckbarrow Fell	54°26.0'N	3°20.3'W	NY 130055
6	Hooker Crag	54°22.2'N	3°22.1'W	SD 112983
7	Ravenglass	54°21.0'N	3°24.8'W	SD 082960
8	Carl Crag	54°22.8'N	3°28.3'W	SD 045995
9	Bolton Hall	54°24.6'N	3°24.4'W	NY 087027
10	Ponsonby Fell	54°26.9'N	3°24.7'W	NY 082072
11	Whitehow Head	54°28.2'N	3°30.1'W	NY 025095
12	Nethertown	54°26.8'N	3°22.2'W	NX 990073
13	NW Starling Castle	54°25.6'N	3°31.8'W	NY 007050
14	NW Calder Bridge	54°26.5'N	3°29.6'W	NY 030063
15	Newmill	54°25.5'N	3°27.7'W	NY 050047
16	Seascale Clubhouse	54°23.8'N	3°29.0'W	NY 037015
17	Carl Crag	54°22.8'N	3°28.3'W	SD 045995
18	NW Starling Castle	54°25.6'N	3°31.8'W	NY 007050

2.4 Baseline Mapping

In addition to the emergency grid it is important to investigate the wider context. West Cumbria has received fallout from Global weapons tests, the 1957 Windscale fire and Chernobyl accidents in addition to the cumulative effects of marine and aerial discharges from Sellafield, Windscale and Calder Hall. All of these sources have added to the natural radiation environment. Establishing present levels is a prerequisite to detecting change in the future and therefore formed a secondary aim for the exercise. To provide for extension of initial survey beyond and between the sparse grid lines above, area baseline mapping is needed.

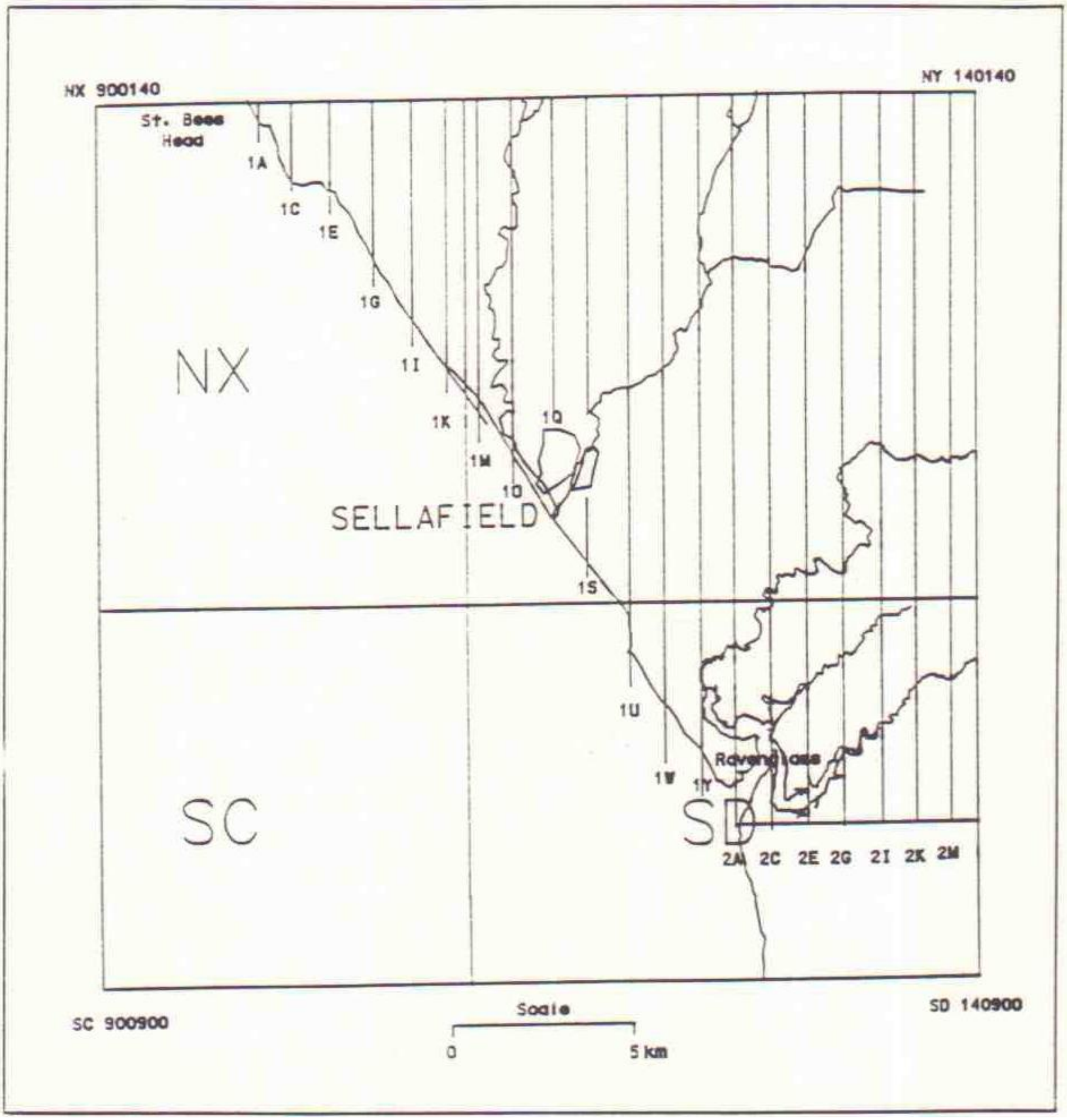


Figure 2.2 Flight plan for initial baseline mapping

Within the time available during this exercise it was decided to measure the area enclosing the emergency grid with a nominal 1km line spacing. Target flight lines were oriented N-S with a northern boundary from St Bees head (NX 140940) to Ennerdale Fell (NY 140130) and a southern boundary from Newbiggin (SD 940070) to Waberthwaite Fell (SD 940130). The western boundary followed the beachline. The outline of this flight plan is shown in figure 2.2. Additional readings were taken in the southern area to bring line spacing down to roughly 500m. It is hoped that the scale of spatial detail can be further enhanced in future surveys.

3. FIELDWORK

3.1 Detector Description

The spectrometer comprised an 8 litre NaI detector coupled to an instrumentation power supply, multichannel analyser and data logging computer. The whole facility was powered from an uninterruptible power supply capable of several hours sustained operation without external power. In practice this is not necessary as mains power on the ground, and 28 V dc from the helicopter are usually available.

The detector consisted of two identical 10x10x40 cm NaI scintillators, operated through a bifet summing amplifier and trimmed to give composite energy resolution of 8.5% at 662 keV (24th September 1990). Resolution of better than 9% was maintained throughout the survey. Although recent SURRC surveys have been conducted with larger detector arrays (up to 40 litres of NaI are available) the decision to use a more modest detector for this project was based on consideration of the primary objective of the work. For emergency response it is important to provide for the possibility of repeating the work under conditions of higher radiation levels than during exercises. Dead-time constraints of higher volume systems could compromise performance under these circumstances, therefore a smaller detector was selected. Baseline mapping can be conducted using larger detectors for extra sensitivity, however this was a secondary aim during this exercise.

3.2 Installation at SURRC

The Aerospatiale twin Squirrel helicopter arrived at SURRC shortly before lunch time landing at the first of three designated landing sites on the NEL campus. Since this was the first occasion on which Dollar helicopters had flown this equipment an engineer was present to oversee the installation.

The only electrical connections between the aircraft and the spectrometer are supplementary 28 V dc supply to replenish battery power during flight and an auxiliary radioaltimeter output used to log the flight ground clearance through an analogue to digital converter.

Neither of these connections has safety implications for the aircraft since the first comes through circuit breakers and is fused at the spectrometer input side, and the second is a fully buffered output with no implications for radioaltimeter function. In extremis the spectrometer could be operated without either connection although endurance between recharge would be limited to 6 hours and the ability to correct for altitude variations would be lost thus adding to the constraints of flight paths and data interpretation.

The equipment was firmly secured with restraining straps and tested in situ. Installation time on this occasion was more than one hour, however this could probably have been reduced significantly if needed. The possibility of remounting the spectrometer on a baseplate with quick release couplings was discussed as an option for minimising installation time. It was agreed to explore this before subsequent exercises, and to define a design for submission to CAA for approval as a permanent installation.

By 1430 the aircraft and equipment was ready for lift off for Sellafield and in flight spectrometer tests.

3.3 Flight Testing

Functional tests of the spectrometer were made immediately after lift off, confirming operation and the correct position for the natural 40-K peak (at 1462 keV). Thereafter the aircraft was directed to Myres Hill, near Eaglesham where a brief radioaltimeter calibration was performed. This comprised touching down briefly to reset the barometric altimeter and then hovering at successive heights while the spectrometer recorded average voltages from the auxiliary radioaltimeter output. The spectrometer software used interrogates a bipolar 14 bit adc and then calculates both input voltage and height above ground. The effective adc zero and conversion gain are adjustable in software so that true height readings can be obtained. These parameters were adjusted using the data shown in table 2.

Table 2. Radioaltimeter calibration 24/9/91.

Ground Clearance /feet	Radioaltimeter reading /V
0	0.004
50	0.44
100	0.96
200	1.90
300	2.80
400	3.60

From Eaglesham Moor a test line of data were also recorded, labelled EGLB1 and comprising readings taken while the helicopter flew towards the Wigton Peninsula at 100-120 knots and approximate survey height (80-100m). The test line was terminated near Wigton at a previous SURRC calibration site, again confirming detector operation and traceability to earlier surveys.

After refuelling at Carlisle the aircraft landed briefly at the Sellafield helipad to rendezvous with the rest of the SURRC survey team before transferring to Barrow in Furness overnight. The detector was supplied with LV and EHT power overnight. Meanwhile a temporary field base was established at the helipad. A complete set of spare parts for the spectrometer and a computer for preliminary analysis were brought to this location by car from SURRC.

3.4 Recording

The recording technique adopted in flight comprises the accumulation of a series of energy spectra with 10 s integration time labelled with time and date of acquisition, time averaged radioaltimetry data and positional information. This provides all the information needed to form maps automatically once on the ground. The integration time and survey height and speed are defined after consideration of the spatial response of the detector, performance data for the helicopter, and the counting statistics of the 8 l. detector.

The field of view of the detector varies with survey height and gamma ray energy[12-14]. There is also a slight topographic influence. However the most important feature for practical purposes is the influence of aircraft height. A static detector receives 90% of its signal from a centre weighted zone with diameter at 662 keV of roughly 4-5 times the ground clearance. At 80-100 m altitude this means and effective spatial smoothing of 300-500 m. Allowing the aircraft to transit a distance up to this circle of investigation within each reading leads to a safe and economical flight without loss of spatial detail. It is extremely important to take the spatial characteristics of these data into account when interpreting features recorded, and when making comparisons with ground based results.

For this survey navigation was performed via the aircraft Decca system. Positional fixes were entered manually every two readings and interpolated positions calculated. The detector display during flight shows the position, acquisition status, average height above ground and integrated counts, gross and net rates within 8 spectral regions of interest. This display is updated every 10 seconds in flight, and all data plus full pulse height spectra are recorded on hard disc.

Procedures for archival backup and data transfer have been developed on previous SURRC surveys. They are described more fully in section 4. The essential feature is that duplex backup copies of all data and initial reductions are made on the aircraft and transferred to a ground based computer before clearing the primary copies and resuming survey. Flight data from several days work can be stored on board if needed, however in practice data are fully backed up on a daily basis or more frequently.

3.5 Field Measurements

The aerial survey team returned to the Sellafield helipad for 0830 on 25th September, the helicopter arriving from Barrow in Furness at 0900. After initial resolution checks the first sortie commenced. On this flight the emergency grid was flown for the first time (file ERA01), starting at 0930, and finishing 39 minutes later (1009) during which period 158 individual spectra had been recorded along grid path. On accomplishing this the rest of the mornings flight was taken up with beginning baseline lines BNF2M,2K,2I,2G,2E,2C and 2A - thus recording a further 272 spectra. On landing duplex copies of full spectra (on tape streamer) and compressed summary files (on 3.5" floppy disc) were made and the aircraft redirected to Barrow for refuelling, and a lunch break. In the afternoon the second aerial survey team collected data from lines BNF1Y,1W,1U,1S,1Q,1O,1M,1K,1I,1G, and 1E (230 spectra) - , and then again reflew the emergency response grid (file ERA02) - this time starting at 1454 and finishing 37 minutes later at 1531. A minor problem manifested itself at this stage just one minute short of completing the flight, in the form of a power supply failure from the 28 V dc helicopter input to the radiometric equipment, due to an underrated fuse. This was replaced and work resumed. Meanwhile at the helipad, during the second flight the data from the first flight were reduced and analysed, as described below. Following the second flight these results were also backed up, reduced and added to the growing body of data.

The following morning once again the survey teams met the helicopter at the Sellafield pad. Routine preflight 662 keV resolution tests were performed, and the third team leader conducted another emergency grid exercise. On this occasion the operation took 40 minutes from 0903 to 0943, and again resulted in 158 measurements. This was followed by baseline mapping of lines BNF1K,1I,1G,1E,and 1C (46 spectra). After data backup on landing and refuel at Barrow the fourth practice run was conducted from 1140-1220 (40 minutes this time producing 142 readings). By this stage the baseline target of 1km nominal spacing had been met, also. To supplement readings from the estuaries of the Esk, Mite and Irt - which were known to be of interest - extra short flight sections were undertaken to approach 500 m. line spacing over this key area. These were recorded contiguously with the final short stretch of line BNF1A, forming an extra set of 136 spectra. The final flight undertaken in the series comprised a short demonstration flight to show BNFL staff the system in action.

This flight included sections of the lower Esk valley, a vertical profiling run close to the ^{41}Ar plume from the Calder Hall station, and a brief successful test to establish whether the activity of surface sea-water in the vicinity of the Sellafield marine discharge pipeline was detectable. Despite the high dilution factors at the discharge this latter feature was readily detected.

4. DATA ANALYSIS

Each full record stored by the spectrometer includes quality assurance information on acquisition time, positional fixes, radioaltimetry data, a table of integrated count rates in preselected regions of interest together with estimates of their associated poisson errors, plus the full spectra recorded over 511 channels. Gain stabilisation is achieved using the natural 40-K peak. A gain monitor is based on comparing the ratio of two windows arranged to bisect the 1462 keV full energy peak. If this ratio is significantly different from 1 then gain adjustments can be made. Keeping the gain monitor between 0.7 and 1.3 is equivalent to better than +-1% gain shift, and this in turn has been shown previously to have a negligible effect on spectral characteristics.

The acquisition speed during survey is extremely high - so much so that within 36 hours of arriving more than 1300 gamma spectra had been recorded with 10 s integration.

The emphasis of SURRC data handling procedures has been to allow such sets to be reduced rapidly and in a manner which automatically leaves a traceable quality assurance trail. A suite of programmes has been developed in the "AERO" package, capable of flexible reduction, analysis, mapping, statistical summarisation and spectral display. Production of mapped survey data follows five main stages described below together with a brief statement on quality assurance and a summary of the present status of the calibration. During the survey all steps up to display of preliminary maps were conducted on the afternoon of 26th September. Preparation of hard copies of maps and archival results was conducted afterwards at SURRC. It is intended that future exercises should develop the ability to transfer results to BNFL staff during, or immediately after the survey work.

4.1 Summary file formation.

The first stage of data reduction is the formation of compressed summary files - each containing a series of single line entries for each spectral observation. These comprise the positions, altitudes and 6 integrated count rate estimates at preselected energy windows. Windows were chosen, as in previous SURRC surveys to estimate ^{137}Cs, ^{134}Cs, ^{40}K, ^{214}Bi, ^{208}Tl and the total dose rate using an integrated window above 450 keV. Each line of survey data was initially assigned a single summary file. Formation of summary files, and tabular printout was conducted during the exercise in a manner which kept pace with the previous flight. Numerical assessments were therefore available on the day of flying.

4.2 Background Subtraction

The second stage of data analysis was to link the summary files forming the survey area together into area records of net count rate. Detector background count rates (recorded at high altitude or over clean water) were subtracted at this stage. A complete summary file describing the net data set is formed in the process, together with a header which records the background count rates used. This net file is also printable in tabular form, and is available for mapping or for subsequent calibration.

4.3 Spectral Stripping.

Spectral interferences occur with NaI spectroscopy due to the combined effects of unresolved full energy peak overlap (line interference) and scattering both in transport from source to detector and also within the detector. This leads to multiple contributions to net count rates within each integrated window, particularly when approaching background count rates. These are deconvoluted using a matrix stripping method which depends on values for the fractional interference from pure nuclide sources into each region of interest. A matrix of fractional interferences between each channel is assembled and inverted. Stripped counts for each channel are obtained by matrix multiplication of the inverse stripping matrix and a vector representing net count rates. Again a full file copy of the data set is produced in printable form, available for mapping or further analysis.

As with previous surveys the stripping matrix is estimated by laboratory measurements of pure nuclide sources.

4.4 Altitude Correction and Calibration.

The final conversions to calibrated data combine altitude corrections with sensitivity estimates. Stripped data are first converted to standardised values at 100m altitude. The form of the altitude dependence is exponential integral, however a simple exponential approximation is adequate for survey heights over 30m above ground. Coefficients were determined in 1990 during the SURRC survey of Ayrshire [15]. Calibration is achieved using a set of linear equations determined by comparison of ground based readings from known sites with aerial survey data. Again a fully printable file of calibrated values is automatically produced which can be used for mapping or other statistical evaluations.

4.5 Mapping

The fifth stage in map production is to read in the previously formed summary file, which may be raw, net, stripped or calibrated data, and to follow the sequence of operations detailed below. Since latitude and longitude are used to locate the observations these must be converted to a local mapping grid. Usually OS grid references are used, where available. The AERO program performs the conversions automatically when prompted with latitude and longitude of the grid origin and intersecting angle. Six figure OS coordinates are calculated by default. This produces an implicit set of x and y values for each observation. The spectral region for plotting must then be chosen from the regions of interest already defined. This becomes the associated z value for each location. Before mapping z values can be examined statistically (histograms, summary statistics) and assigned to up to 15 colour codes with linear or logarithmic coding. Once colour coded the raw map - comprising a series of coloured squares for each observation can be displayed immediately on any PC with EGA or VGA screen. Screen capture routines and hard copy can be used to produce working copies. These raw maps can thereafter be interpolated to form smooth contours using an algorithm which allows control of spatial resolution, range of search, and spatial weighting function for adjacent observations. This final step however is somewhat time consuming and might not be conducted during an emergency.

4.6 Quality Assurance

Attention is given to quality assurance at all stages of the work. The recording technique and data nomenclature are designed to make checks of spectrometer operation possible in flight, and to enable rapid checks on all data during reduction and analysis. The archive for each survey is fully retrievable, doubly backed up, and use has been made of ASCII text only files for all data storage to enable quality assurance checks to be made. The data reduction stages are all self recording, and the archive is so structured that primary data can be examined where any unusual features have been located. Finally the algorithms used have been tested with known data.

4.7 Status of the stripping and calibration constants

The values of stripping factors and calibration constants used in this work are shown in appendix A. These represent current SURRC working values at the time of the survey. Such values are under continual review, and may therefore be subject to future change. Their status is as follows.

The stripping factors are based on laboratory measurements of pure nuclides. Since it is not practicable to duplicate the full scale of field conditions, such values are necessarily approximations to optimal values. Work is in progress at SURRC to explore means of determining optimal stripping factors, by monte-carlo simulation of field geometries, by scaled experiments with absorbers, and finally by least squares analysis of residuals in stripped data from locations where individual nuclides are known to be absent. There is evidence that air path scattering leads to overstripping of ^{137}Cs and understripping of ^{134}Cs since the former is largely influenced by full energy peak interference (with 608 keV from 214-Bi) and the latter by scattering from all higher energy sources. The overall effect is to leave second order systematic errors in stripped count rates. This does not however produce systematic errors in calibrated data - since spectra from standard sites are also affected, but does mean that analytical precision cannot approach the limit of poisson statistics. It is likely that stripping matrices will be modified once the work in progress is completed.

The calibration data themselves depend on comparison between ground sites where inventories have been estimated by gamma spectroscopy of collected cores with correlated aerial survey data. The values used here derive from an SURRC 1990 analysis of available data.

It is implicit in the calibration process that the vertical distribution of activity in the survey area is comparable with that from calibration sites. Equally it is vital that the spatial association, and spatial variability of deposition be considered when comparing aerial survey and ground measurements. This latter point cannot be overemphasised. The aerial survey readings are spatially smoothed over 10^4-10^5 m^2 whereas soil cores typically represent sampling areas of $10^{-2}m^2$, or less. Where high levels of spatial variability, or small scale localised features, are encountered this can lead to confusion.

The original calibration performed 1988 used data obtained from 12 sites in SW Scotland selected from over 50 analysed to maximise Cs contrast. An extremely good correlation between aerial and ground based data was obtained. The resulting working calibration was concordant in West Cumbria (1988) with spatially matched results from 1400 soil samples collected by MAFF on a 200m cartesian grid, however the high degree of spatial variability exhibited by the latter, and the relatively small numbers of associated aerial survey observations limited more detailed conclusions. SURRC surveys in 1989 were calibrated by re-flying calibration sites and lines through West Cumbria using new detectors and projecting sensitivity estimates onto them, and collecting a limited number of extra cores from each survey to confirm traceability. Procedures for overlaying two or more aerial survey data sets and cross comparing their results were developed for this purpose.

Finally in 1990 a new set of local calibration sites was defined in Ayrshire with ground samples collected in a manner which attempts to overcome the problem of spatial matching. In this work each site has a pattern of 17 soil sampling locations laid out on three concentric arcs around a marked centre with an area density which approximates the field of view of a static aerial survey detector. Aerial survey readings are taken on these sites while hovering at various heights above the centre marker, thus providing better counting statistics than obtained during dynamic calibration measurements, and data to determine altitude corrections.

The unweighed mean of the 17 soil cores gives a better ground estimate of mean activity than single cores or other sampling configurations. These new sites produced a total of over 150 soil samples for high resolution gamma spectroscopy. A preliminary analysis of roughly half of these data together with old sites was used to determine 1990 working values which were used to calibrate these data. The working values are not significantly different from those used in earlier surveys - suggesting that sensitivity estimates may be approaching final values. For ^{137}Cs they are also within error of theoretical sensitivity estimates based on laboratory efficiency determination and geometrical integration of uniform activity distributions. Absolute uncertainties in resulting sensitivity estimates are believed to be better than +-20%.

5. RESULTS

Archival copies of the September flight results have been kept both on computer and as tabular printouts for future reference. Colour maps of the nuclides quantified have also been produced and are presented below.

5.1 Preliminary Baseline

The preliminary baseline maps for Gamma dose rate, 137-Cs, 40-K, 214-Bi, 208 Tl and gamma dose rate are shown in figures 5.1 to 5.5. When interpreting these maps it is essential to consider the effects of spatial smoothing, especially if comparisons with ground based readings are contemplated. The overall gamma ray dose rate estimates show a pattern predominantly influenced by the natural sources of radioactivity, but with notable exceptions in the vicinity of Calder Hall, in the estuaries of the Esk, Mite and Irt, and to some extent along the beachline. Close to Calder Hall the signals are influenced by ^{16}N activity in the Magnox station cooling circuit, and the emission of ^{41}Ar, both of which produce local enhancements to radiation readings at aerial survey heights. Elsewhere the contribution of potassium and Th series activities seems to control total radiation estimates - although the other sources are also clearly contributing.

The ^{137}Cs map shows a number of interesting features. Areas in proximity to the marine discharges (beach, estuaries) show clear evidence of residual activity - which in the estuarine environment is the dominant dose contributor. The effects of spatial smoothing in the estuarine areas tend both to broaden and to lower peak activity estimates. A higher resolution aerial survey of these areas would be needed to map them with greater precision. To the NE of Sellafield there is also evidence of enhanced deposition of Cs, which may be in part associated with the long term integrated aerial discharges from the site. This features also merges with the upland areas which have received relatively high burdens of Chernobyl fallout. To the SE of Sellafield, and independently of the estuarine system, there is also a zone of enhanced terrestrial Cs. This coincides with the trajectory of the plume from the 1957 Windscale fire. These latter two terrestrial features represent modest activity levels in comparison to natural sources, but nonetheless testify to the sensitivity of the survey technique. Close to Calder Hall Cs estimates are artificially depressed due to the presence nuclides which have not been incorporated into the stripping model. Further work is needed to quantify Cs in the presence of Ar and N signals.

Figure 5.1 Gamma Ray Dose Rates

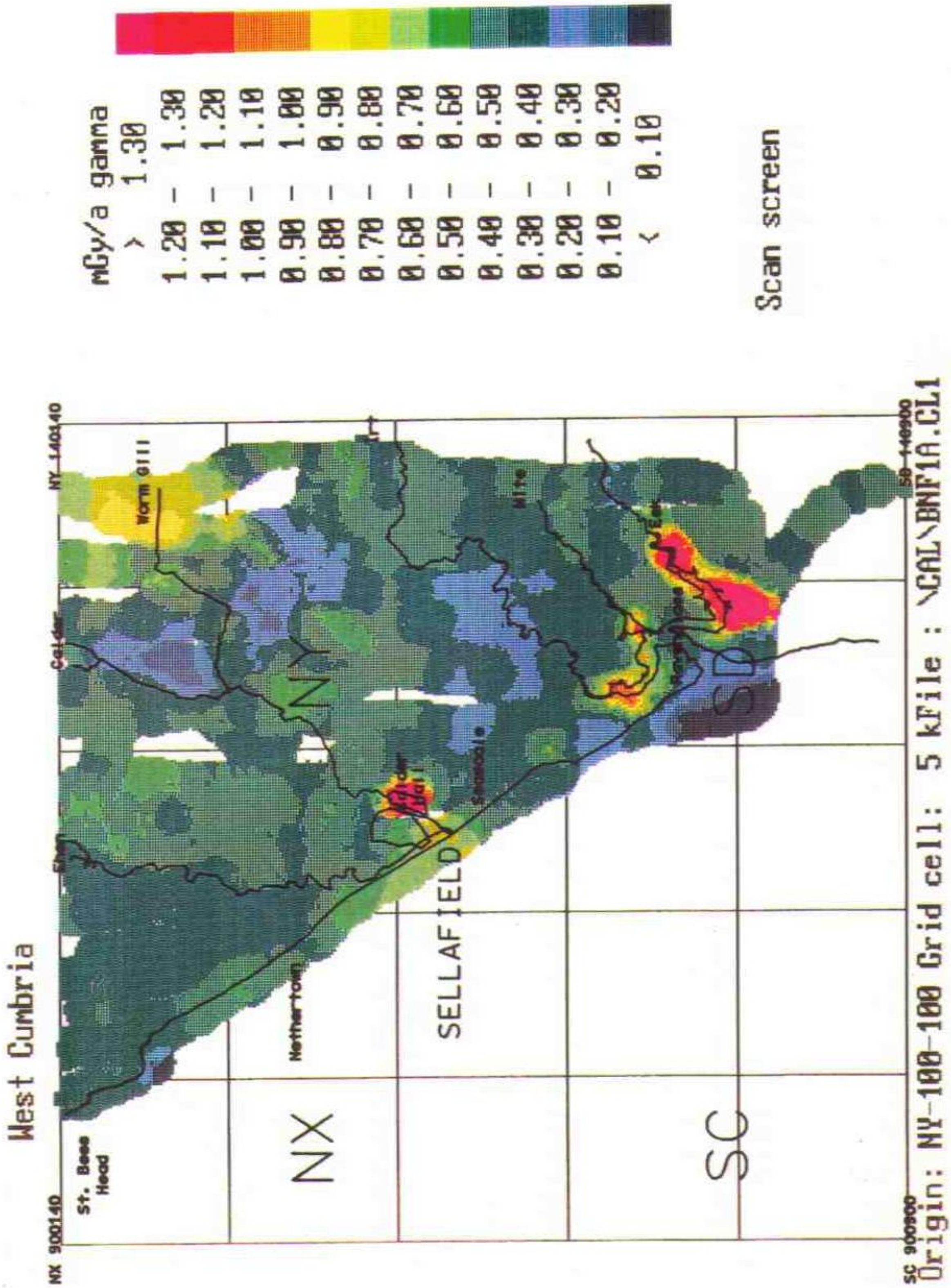


Figure 5.2 ^{137}Cs

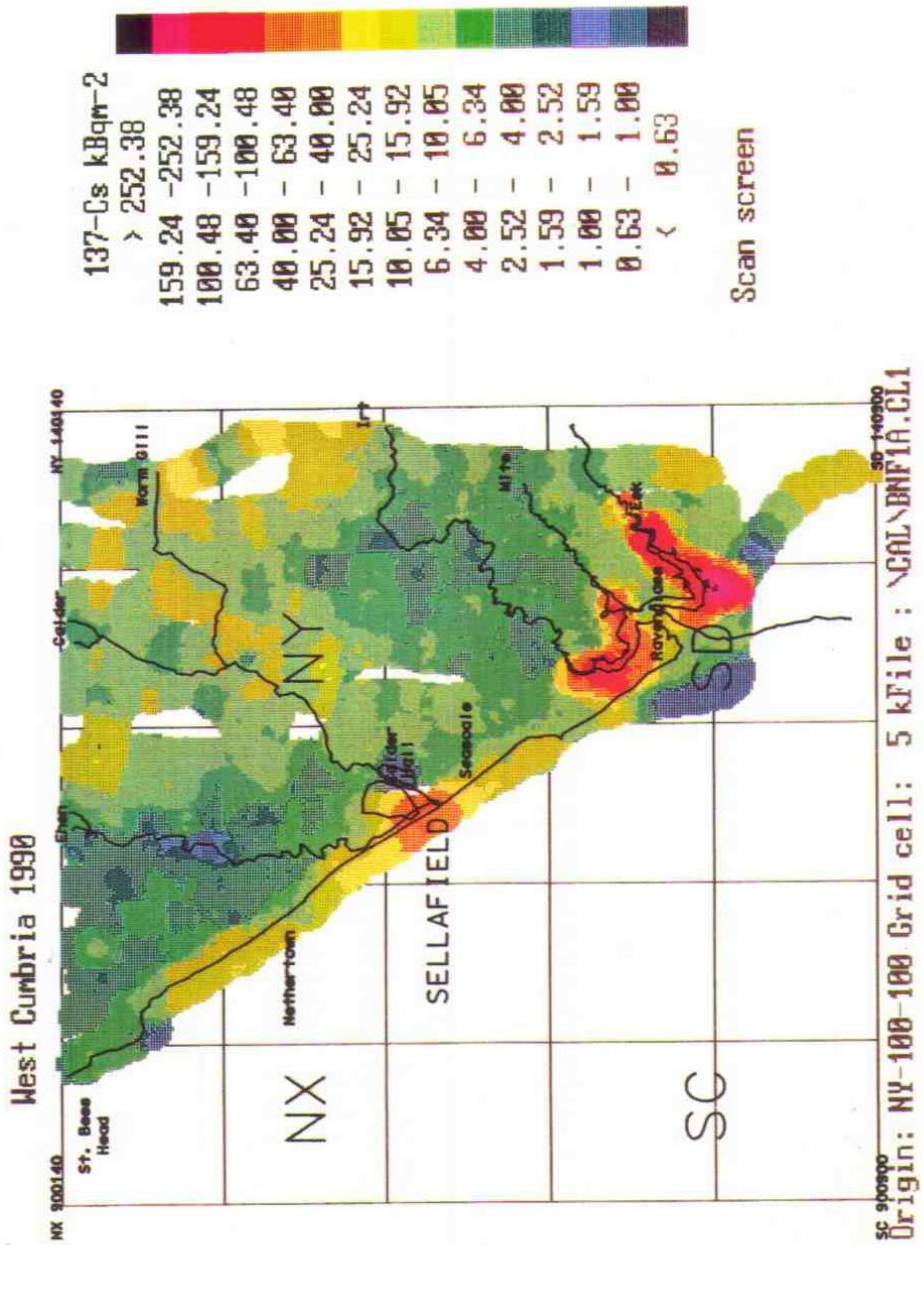


Figure 5.3 ^{40}K map

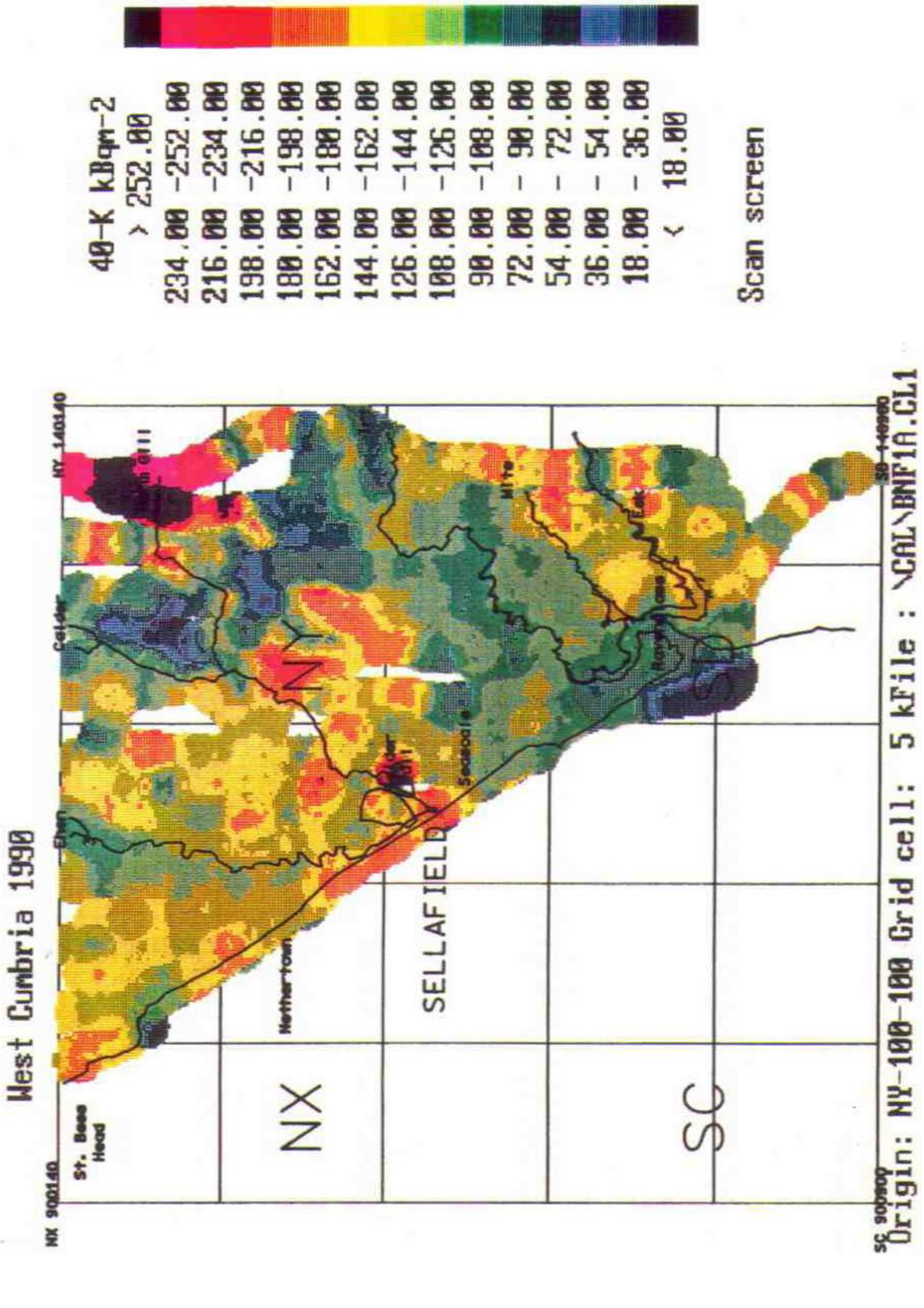


Figure 5.4 ^{214}Bi

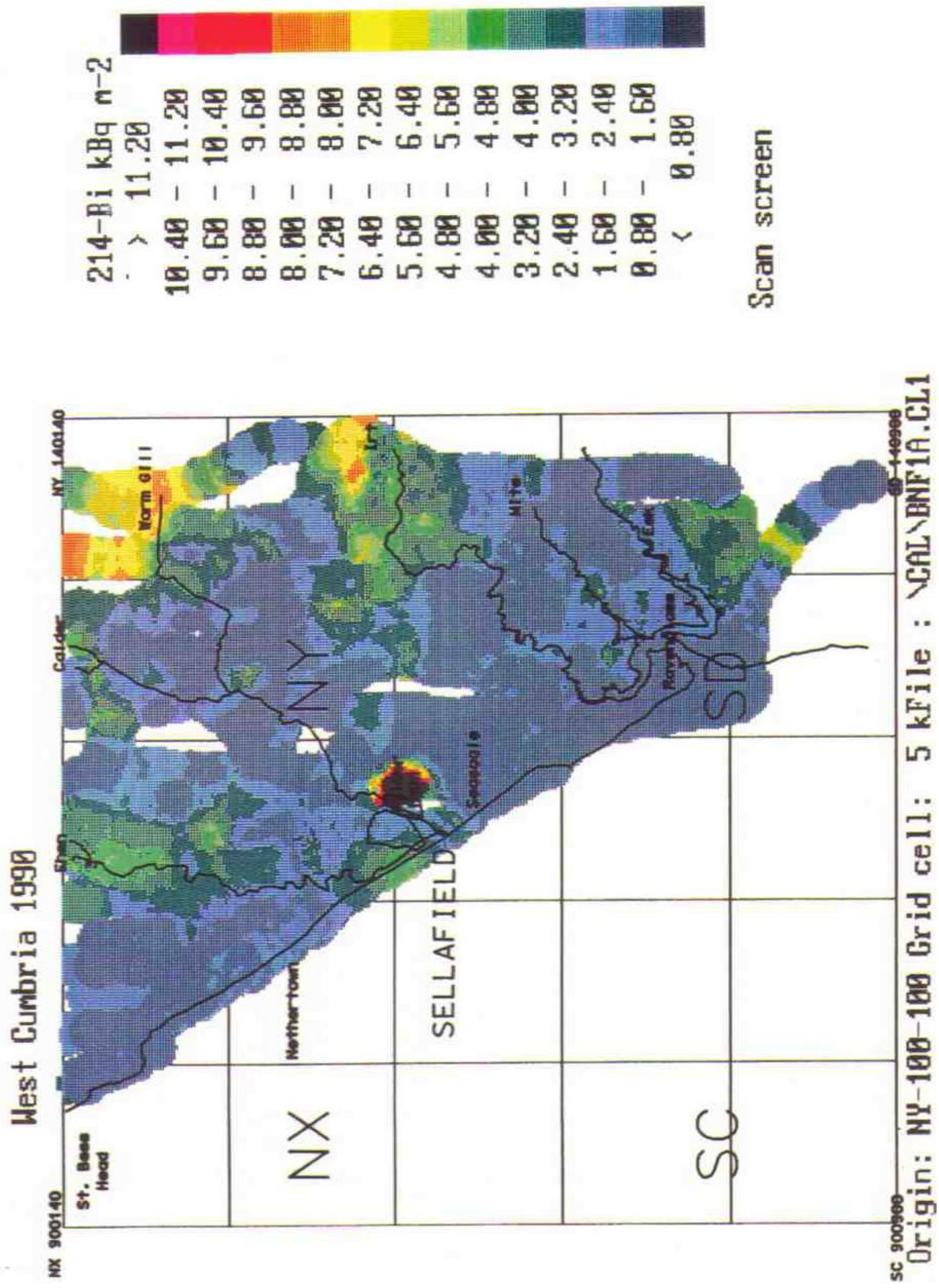
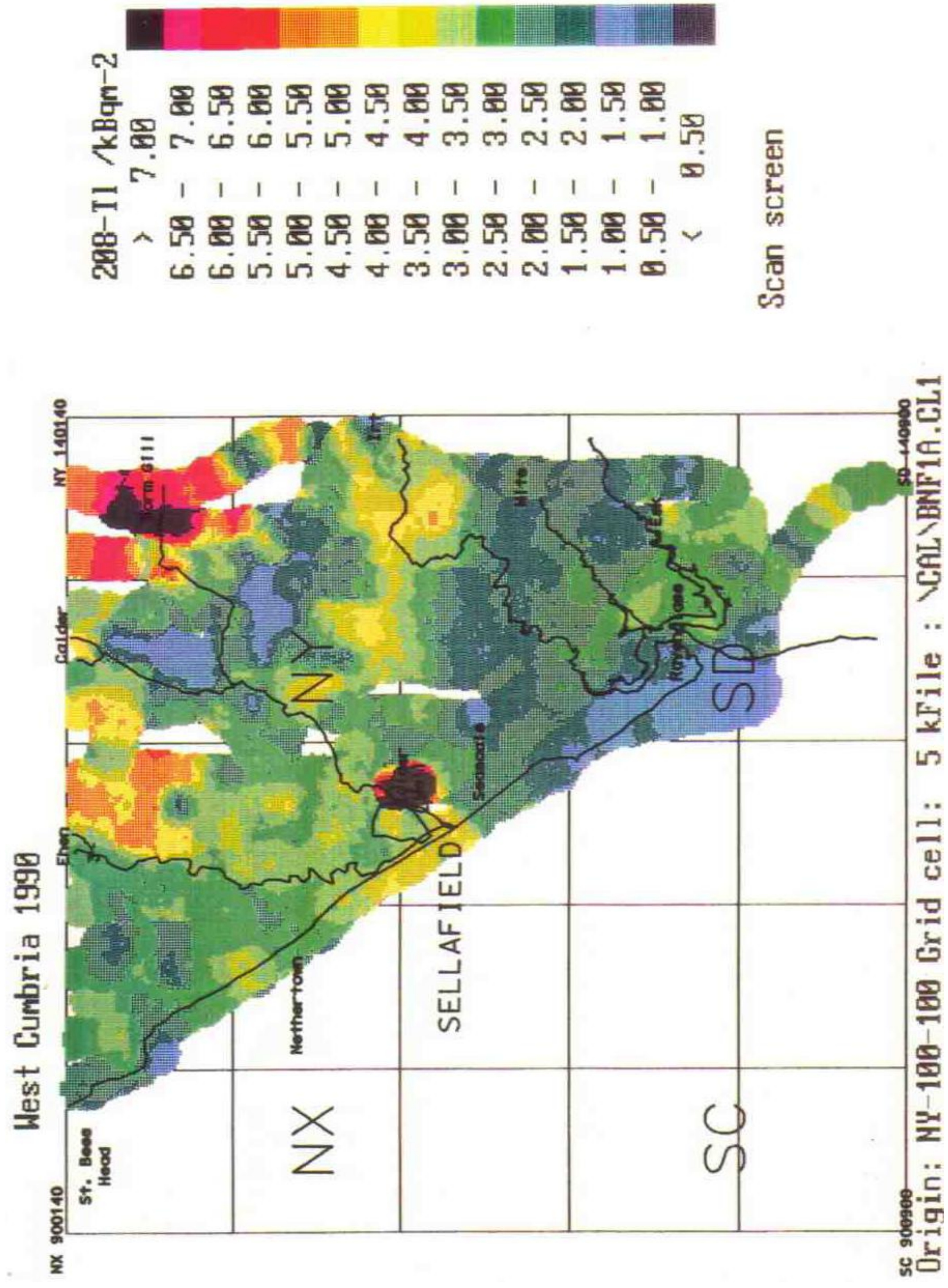


Figure 5.5 ^{208}Tl



The ^{40}K, ^{214}Bi, and ^{208}Tl maps convey information mainly about the geological and geomorphological background to the area. All three maps show unresolved influence from the Calder Hall site - in the case of ^{40}K mainly due to line interference from ^{41}Ar, for ^{214}Bi and ^{208}Tl due to scattering from the high energy ^{16}N lines. These apart the following underlying geological features are notable. In the top NE corner of the area near Worm Gill high levels of K, U (from 214-Bi) and Th (from 208-Tl) are associated with the margins of the Ennerdale granophyre, also believed to be responsible for the ^{214}Bi and K, Th feature further south in the upper Irt. This latter feature forms a ceiling to the Eskdale granite whose western margin is visible to the East of Ravenglass and across the upper reaches of the Mite and the Esk, especially in the enhanced K levels. Between the Ehen and Calder valleys in the north of the area the outline of the underlying Skiddaw Slates is well defined by Tl and K maps, but to a lesser extent by ^{214}Bi. To the east of this feature and to the West of the granophyre near Worm Gill is an area of low K,U, and Th which correlates spatially with the underlying Borrowdale volcanic series. The low potassium values in the upper reaches of the Ehen valley are possibly associated with underlying Carboniferous limestone. This is not however well matched in detail by the associated ^{214}Bi enhancement, suggesting the possibility of mobility of U series activity in this area, possibly due to radon migration from deeper layers. The eastern boundary of the Permo-Triassic rocks (St Bees sandstone) running down the coastal margins is not however evident in the radiometric data - particularly in the lower Irt. Again there may be explanations relating to fluvial or fluvaeo-glacial sediment movements in this area. Further interpretative work of these data in conjunction with other environmental and geographical data would be of interest.

5.2 Emergency response grids

Data from the emergency response flights have been plotted individually, and stored archivally in computer readable form so that they can be retrieved for juxtaposition with any future surveys. Minor variations in the exact track occurred between the first and subsequent flights - as the pilot and navigator improved their recognition of the waypoints. This leads to minor differences in raw data which are reconciled when the result are compared with the baseline maps. It was also noted that the results in the estuaries and along the beachline were sensitive to the state of the tide for obvious reasons. It is important that these factors should be considered in any rapid assessment of data recovered in future flights.

6. CONCLUSION

The fieldwork has confirmed the overall viability of the emergency response concept, and the practicability of the planned flight paths. Providing that equipment and expertise are maintained in a state of preparedness it should be possible to furnish data describing changes to the 10, 5 and 2km boundaries of the site within a single day, and to consolidate this to form area maps shortly thereafter. Clearly such information would be of considerable value in an emergency.

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APPENDIX A.

SUMMARY OF DETECTOR CALIBRATION : BNFL EXERCISE SEPT. 1990

1) Detector

8 l NaI detector - box of 2 10x10x40cm NaI crystals
Resolution 8-9% at 662 keV
DPS MkII power supply
Locland Computer
Recording with MCA27 software
Radalt 10 mV/ft output

2) Windows

Window	Nuclide	Channels	Background (cps)
1	^{137}Cs	95-130	22
2	^{134}Cs	125-150	10.5
3	^{40}K	220-270	9.8
4	^{214}Bi	270-318	4.8
5	^{208}Tl	390-480	4.2
6	>450 keV	75-500	85

3) Stripping Factors

Window	1	2	3	4	5
1	1	0.0235	0	0	0
2	1.82	1	0.032	0	0
3	0.54	0.236	1	0.085	0
4	3.88	1.005	0.905	1	0.06
5	2.77	1.44	0.445	0.296	1

4) Calibration Constants

a: exponential altitude coefficient
b: slope of calibration line
c: calibration intercept

Window	Nuclide	a	b	c
1	^{137}Cs	0.00962	0.396	-3.37
2	^{134}Cs	0.0075	0.261	0.05
3	^{40}K	0.006	5.38	-9.6
4	^{214}Bi	0.0066	1.212	-0.67
5	^{208}Tl	0.004	0.490	-0.2
6	>450 keV	0.0062	0.0014	0.0

5) Mapping Coordinates

Latitude and Longitude of Grid Origins (NY 000 000)

54.40^{o}N, 3.53^{o}W
Grid Angle 1^{o}

Plotting Origin NY -100,-100

APPENDIX B. DATA FROM EMERGENCY GRID SURVEYS

Summary file ERA01.SM1
Count Rate /cps
Ch1 (137-Cs):570-768 keV Ch2 (134-Cs):708-861 keV Ch3 (40-K):1317-1623 keV
Ch4 (214-Bi):1623-1908 keV Ch5 (208-Tl):2337-2883 keV Ch6 (Total):450-3000 keV

Filename	Start	Alt/m	Position		Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
ERA01001	09:30:10	110.9	54' 30.4	3' 37.7	104	40	43.7	9	8.10	351
ERA01001	09:30:22	78.68	54' 30	3' 37.3	120	47.6	46.6	10.3	8.60	398
ERA01002	09:30:38	73.73	54' 29.7	3'36.82	118	46	51.5	12.3	11	403
ERA01002	09:30:54	100.9	54' 29.5	3'36.28	108	39.2	43.9	8.8	10.5	364
ERA01003	09:31:10	93.04	54'29.25	3'35.88	105	35.5	40.4	9.39	8.3	343
ERA01003	09:31:26	93.28	54'28.95	3'35.63	120	38.1	37.2	10.1	11.3	374
ERA01004	09:31:42	90.65	54'28.68	3' 35.3	140	48.3	46	9.3	9.89	444
ERA01004	09:31:55	90.56	54'28.43	3' 34.9	136	47.3	46.9	12.1	10.4	438
ERA01005	09:32:12	89.29	54'28.15	3'34.58	161	50.2	56.1	12.7	13.3	510
ERA01005	09:32:26	89.49	54'27.85	3'34.33	167	51.4	53.7	10.7	14.2	527
ERA01006	09:32:42	91.60	54'27.58	3'34.05	132	45.9	49.4	12.5	12.2	445
ERA01006	09:32:55	93.30	54'27.33	3'33.75	145	45	48.2	12.4	11.3	447
ERA01007	09:33:11	81.35	54'27.28	3'33.47	131	43.1	43.3	11.5	10.4	429
ERA01007	09:33:26	93.75	54'27.43	3'33.22	105	42.1	45	11.1	10.4	362
ERA01008	09:33:42	90.87	54'27.65	3'33.02	103	40.6	41.5	9.39	9.2	350
ERA01008	09:33:59	82.66	54'27.95	3'32.88	104	39.7	42.1	11	10.4	352
ERA01009	09:34:15	71.62	54' 28.3	3'32.72	108	44.1	50.9	11.9	13.4	395
ERA01009	09:34:32	77.65	54' 28.7	3'32.58	127	48	47	12.4	11.5	419
ERA01010	09:34:49	87.63	54'29.05	3'32.38	124	46.6	49.9	12.9	13.9	417
ERA01010	09:35:16	97.32	54'29.35	3'32.13	103	37.4	39.3	10.6	9.60	340
ERA01011	09:35:32	97.92	54'29.65	3' 31.9	105	40.6	39.6	13.1	9.10	362
ERA01011	09:35:45	86.45	54'29.95	3' 31.7	114	43.6	37.7	14.6	10.5	377
ERA01012	09:36:02	84.39	54' 30.2	3'31.48	112	40	39.4	15.7	11.6	380
ERA01012	09:36:15	85.22	54' 30.4	3'31.23	113	43.1	43.1	11.5	10.8	376
ERA01013	09:36:31	74.38	54' 30.5	3'30.88	117	43.6	41.2	11.7	13.2	385
ERA01013	09:36:46	87.29	54' 30.5	3'30.43	119	42.1	41.4	14.3	12	398
ERA01014	09:37:02	69.55	54'30.45	3'29.95	146	55.6	57.6	16.7	15.3	504
ERA01014	09:37:24	58.83	54'30.35	3'29.45	178	59.7	58.8	14.9	16.2	549
ERA01015	09:37:40	63.97	54'30.28	3'28.93	188	56.8	52.7	12.3	13.5	534
ERA01015	09:37:57	68.38	54'30.23	3'28.38	126	35.3	27.3	8.3	11	347
ERA01016	09:38:13	99.32	54'30.18	3' 27.8	135	42.9	42.8	13.7	14.1	421
ERA01016	09:38:31	91.29	54'30.13	3' 27.2	120	46.8	47.2	16.4	13.9	414
ERA01017	09:38:47	56.28	54'30.08	3'26.68	142	49.8	51.2	14.3	13.5	455
ERA01017	09:39:03	56.63	54'30.03	3'26.23	124	41	38.8	12.2	11.8	388
ERA01018	09:39:20	123.1	54'29.98	3' 25.7	81.8	29	27.9	7.7	9.10	271
ERA01018	09:39:32	87.14	54'29.93	3' 25.1	84.8	26.5	27.6	9.8	6.8	264
ERA01019	09:39:49	67.56	54'29.85	3' 24.6	97.6	29.2	30.7	8.7	8.8	307
ERA01019	09:40:12	64.16	54'29.75	3' 24.2	145	47.4	42	13	12.2	433
ERA01020	09:40:28	79.90	54' 29.5	3' 23.9	128	47.3	40.8	13.9	11.3	398
ERA01020	09:40:42	121.4	54' 29.1	3' 23.7	118	35.2	37.2	10.2	8.89	354
ERA01021	09:40:58	120.9	54'28.73	3'23.43	104	37.9	36.1	10.8	9.3	339
ERA01021	09:41:13	121.7	54'28.38	3'23.08	110	43.9	43.5	12.1	11.4	387
ERA01022	09:41:29	103.0	54'28.05	3'22.63	80.1	23.3	23.2	8.2	6.5	241
ERA01022	09:41:43	87.45	54'27.75	3'22.08	163	62.6	62.6	15.2	15.2	549
ERA01023	09:41:59	96.39	54'27.45	3'21.72	66.6	21.2	18.6	7.6	6.5	213
ERA01023	09:42:18	78.00	54'27.15	3'21.58	119	36.2	31.9	9.60	8.10	348

ERA01024	09:42:34	71.23	54'26.95	3'21.15	172	55.3	49.7	13.7	14.3	504
ERA01024	09:42:48	68.24	54'26.85	3'20.45	151	42.8	37.1	12.4	11.1	432
ERA01025	09:43:04	96.96	54'26.68	3'19.83	125	38.3	33.1	13.2	10.5	381
ERA01025	09:43:18	146.2	54'26.43	3'19.28	125	40.8	38.5	12.8	11.5	374
ERA01026	09:43:34	216.5	54'26.15	3'19.13	60.6	20.8	21.6	9.10	6.1	215
ERA01026	09:43:57	152.4	54'25.85	3'19.38	75.7	25.2	21.6	8.7	9.60	247
ERA01027	09:44:13	94.83	54'25.58	3' 19.7	119	45.7	37.8	15	13.7	395
ERA01027	09:44:29	90.70	54'25.33	3' 20.1	133	46.6	48	12.3	11.7	428
ERA01028	09:44:45	72.27	54'25.08	3'20.45	147	51.4	50.6	14.3	13.8	465
ERA01028	09:44:58	84.25	54'24.83	3'20.75	126	42.8	46.8	13.6	14.4	407
ERA01029	09:45:15	84.18	54'24.53	3'21.05	108	44.1	42	11.9	10.2	370
ERA01029	09:45:31	72.58	54'24.18	3'21.35	111	40.5	40.1	11.8	11	359
ERA01030	09:45:47	138.2	54'23.85	3'21.58	83.2	28.5	30.1	8.8	7.8	275
ERA01030	09:46:04	80.42	54'23.55	3'21.72	95.7	36.8	38.2	11.3	9.3	326
ERA01031	09:46:20	76.78	54'23.23	3'21.85	125	47.6	51.9	11.3	10	417
ERA01031	09:46:34	79.64	54'22.88	3'21.95	116	44.9	41.6	13.2	9	380
ERA01032	09:46:51	126.9	54'22.63	3' 22	106	45.8	54.2	10.7	9.5	391
ERA01032	09:47:06	93.09	54'22.48	3' 22	97.3	37.1	35.5	8.10	7.4	308
ERA01033	09:47:22	65.44	54'22.28	3'22.18	143	47.2	48.8	9.60	8.5	427
ERA01033	09:47:37	58.62	54'22.03	3'22.53	147	51.9	55.2	12.7	11.3	471
ERA01034	09:47:53	71.92	54' 21.8	3'22.98	158	54.4	52	12.7	10.5	491
ERA01034	09:48:06	96.74	54' 21.6	3'23.53	122	45.9	49.2	12.4	13.2	413
ERA01035	09:48:22	96.99	54' 21.4	3'24.03	100	42.5	38.6	10.1	10.4	340
ERA01035	09:48:35	112.8	54' 21.2	3'24.48	93.8	35.5	29.8	8.8	10.9	301
ERA01036	09:48:52	116.0	54'21.18	3' 24.9	101	31.1	28.4	9.39	9.2	314
ERA01036	09:49:05	96.45	54'21.33	3' 25.3	141	32.2	33.9	10.9	7.4	383
ERA01037	09:49:22	85.91	54' 21.5	3'25.68	385	51.2	37.9	10.3	11.2	840
ERA01037	09:49:34	79.20	54' 21.7	3'26.03	282	39.9	34.5	10.8	7.7	646
ERA01038	09:49:51	78.58	54'21.88	3' 26.4	641	68.1	38	8.5	6.1	1282
ERA01038	09:50:04	70.56	54'22.03	3' 26.8	93.7	25.8	24.5	6.4	7.1	270
ERA01039	09:50:20	67.42	54'22.23	3'27.13	98.4	27.4	30	7.9	5.4	284
ERA01039	09:50:32	71.41	54'22.48	3'27.38	99.6	26.5	32.4	7.9	8	294
ERA01040	09:50:49	79.90	54' 22.7	3'27.68	91.6	32.1	34.1	9.3	7.4	297
ERA01040	09:51:02	74.98	54' 22.9	3'28.03	113	31.8	31.6	8.7	5.9	320
ERA01041	09:51:19	93.20	54' 23.1	3' 28	213	99.9	60.1	11.8	9	737
ERA01041	09:51:32	90.82	54' 23.3	3' 27.6	106	41.5	35.1	11.7	8.8	353
ERA01042	09:51:48	74.41	54'23.48	3' 27.2	112	35.3	39.6	8.7	10.3	354
ERA01042	09:52:02	74.33	54'23.63	3' 26.8	113	40.9	43	11.4	9.60	368
ERA01043	09:52:18	83.96	54'23.78	3'26.38	90.4	29.1	35.4	9.7	7.7	297
ERA01043	09:52:33	81.80	54'23.93	3'25.93	107	37.3	42	10.4	10.5	355
ERA01044	09:52:49	77.43	54'24.08	3'25.53	105	36.5	39.3	12.8	9.10	341
ERA01044	09:53:02	76.28	54'24.22	3'25.18	96.7	32.3	40.8	10.8	7.3	326
ERA01045	09:53:18	64.22	54' 24.4	3' 24.8	99.9	36.9	39	11	10.1	338
ERA01045	09:53:32	74.03	54' 24.6	3' 24.4	104	37.2	39.1	9.7	9.89	339
ERA01046	09:53:48	94.24	54'24.85	3' 24.2	86.8	30.6	36.3	10	8.5	296
ERA01046	09:54:02	94.66	54'25.15	3' 24.2	101	40.8	41.6	11.4	9.8	351
ERA01047	09:54:18	71.16	54'25.43	3'24.33	141	51.3	51.3	14.2	12.7	458
ERA01047	09:54:31	68.94	54'25.68	3'24.58	127	43.8	41.7	13.4	11.8	403
ERA01048	09:54:47	96.71	54'25.97	3' 24.7	139	53.5	54.7	14.3	12.2	472
ERA01048	09:55:05	104.0	54'26.33	3' 24.7	121	48.3	51.3	13.4	12.2	427
ERA01049	09:55:21	83.88	54' 26.6	3'24.78	137	51.2	50.5	14.3	14.2	460
ERA01049	09:55:39	53.81	54' 26.8	3'24.93	172	56.6	55.7	13.7	11.9	502
ERA01050	09:55:56	81.56	54' 27	3'25.25	110	37.5	34.1	8.2	8.3	333
ERA01050	09:56:10	83.20	54' 27.2	3'25.75	148	53.7	56.9	12.5	11.3	479
ERA01051	09:56:26	90.78	54'27.33	3'26.33	161	59	61.8	14	14.7	528
ERA01051	09:56:41	134.0	54'27.38	3'26.97	116	49.2	46.8	10	10.5	407

ERA01052	09:56:58	80.91	54'27.45	3'27.55	122	43.5	42.4	12	9.3	384
ERA01052	09:57:13	95.17	54'27.55	3'28.05	109	40.6	39.9	12.1	10.7	373
ERA01053	09:57:30	68.27	54'27.65	3'28.55	129	46.4	49.2	12	12.5	426
ERA01053	09:57:42	78.65	54'27.75	3'29.05	134	44.6	50.4	11.4	11.6	426
ERA01054	09:57:58	110.3	54' 27.8	3'29.55	111	45	41.4	13.1	10.1	377
ERA01054	09:58:13	94.52	54' 27.8	3'30.05	110	41.6	39.2	13.2	11.4	366
ERA01055	09:58:29	58.80	54'27.72	3'30.63	132	51	59.8	13	13.7	465
ERA01055	09:58:41	78.84	54'27.58	3'31.28	127	48.9	50.8	14.5	14.6	440
ERA01056	09:58:58	92.14	54'27.48	3'31.85	115	43	42.9	13.2	12.3	380
ERA01056	09:59:17	81.14	54'27.43	3'32.35	102	41	47.5	12	10.9	371
ERA01057	09:59:33	88.20	54'27.28	3'32.82	103	39.8	42	9.5	10.7	353
ERA01057	09:59:46	91.19	54'27.03	3'33.28	104	38.7	43.4	13.3	10.3	366
ERA01058	10:00:03	89.12	54' 26.8	3'33.25	116	36.1	35	9.60	8.8	356
ERA01058	10:00:20	74.04	54' 26.6	3'32.75	148	49.4	48.7	11.7	11.6	473
ERA01059	10:00:36	75.48	54'26.38	3'32.35	174	54.5	58.4	14.4	15.1	541
ERA01059	10:00:49	79.11	54'26.13	3'32.05	170	48.2	54.7	14.6	11.3	514
ERA01060	10:01:05	88.96	54' 26	3'31.73	171	53	51.5	14.7	13.5	509
ERA01060	10:01:18	88.30	54' 26	3'31.38	115	40.2	37.3	12	9.3	370
ERA01061	10:01:34	90.48	54'26.13	3'31.05	113	43.2	40.1	15	12.7	382
ERA01061	10:01:46	81.88	54'26.38	3'30.75	110	41.1	43.7	10.3	10.9	367
ERA01062	10:02:03	72.00	54'26.53	3'30.38	134	50	49.2	16.4	13.4	441
ERA01062	10:02:16	64.90	54'26.58	3'29.93	129	48.6	49.7	13.4	12.5	427
ERA01063	10:02:32	81.82	54' 26.5	3'29.45	102	40	39.4	11.2	10.7	347
ERA01063	10:02:49	66.35	54' 26.3	3'28.95	140	48.6	56.2	11.7	13.9	454
ERA01064	10:03:05	74.06	54' 26.1	3' 28.5	131	46.6	46.1	12.6	12.3	433
ERA01064	10:03:21	70.84	54' 25.9	3' 28.1	139	48.5	49.6	13.5	11.1	446
ERA01065	10:03:37	76.24	54'25.65	3'27.98	116	44.8	43.9	12.5	10.1	382
ERA01065	10:03:52	59.86	54'25.35	3'28.13	123	39.3	42.4	9.3	10.4	385
ERA01066	10:04:08	79.28	54'25.05	3'28.33	128	42.8	46.7	12.6	10.8	404
ERA01066	10:04:26	78.02	54'24.75	3'28.58	112	41.5	40.7	10.3	11.1	364
ERA01067	10:04:42	65.49	54'24.43	3'28.78	121	45.7	49	11.9	11.6	405
ERA01067	10:04:55	63.79	54'24.08	3'28.93	112	38.4	41.3	12.1	11.1	368
ERA01068	10:05:11	70.26	54' 23.8	3'28.88	119	42.8	49.1	11.5	9.2	401
ERA01068	10:05:29	65.66	54' 23.6	3'28.63	123	44.2	47.8	13.1	10.7	406
ERA01069	10:05:45	73.47	54'23.35	3' 28.4	104	35.3	39.2	10.1	9.2	328
ERA01069	10:05:57	76.36	54'23.05	3' 28.2	126	42.6	40.7	9	10.2	389
ERA01070	10:06:14	53.80	54' 23	3'28.25	206	74.3	50.1	9.7	8.60	621
ERA01070	10:06:28	64.14	54' 23.2	3'28.55	168	47.7	49.8	10.5	12.7	493
ERA01071	10:06:44	66.09	54'23.43	3'28.85	139	48.2	48.7	9.89	8.89	446
ERA01071	10:06:57	65.27	54'23.68	3'29.15	166	51.4	51.6	12.6	12.9	498
ERA01072	10:07:14	70.36	54'23.93	3'29.47	127	34.9	38.6	8.8	9.7	379
ERA01072	10:07:29	71.67	54'24.18	3'29.83	152	53.1	48	9	8.10	497
ERA01073	10:07:45	78.82	54'24.43	3'30.15	207	74.8	66	11.3	11.1	676
ERA01073	10:08:00	76.44	54'24.68	3'30.45	261	65	73.2	16.6	13	764
ERA01074	10:08:17	71.91	54'24.93	3'30.75	237	58.9	62.9	15.2	13.2	669
ERA01074	10:08:33	70.83	54'25.18	3'31.05	179	49.5	48.8	11.1	11.2	520
ERA01075	10:08:49	73.14	54'25.43	3'31.33	187	55.4	57	14	14.5	562
ERA01075	10:09:04	73.07	54'25.68	3'31.58	188	56.2	53	12.9	12.8	567

Summary file ERA02.SM1
Count Rate /cps
Ch1 (137-Cs):570-768 keV Ch2 (134-Cs):708-861 keV Ch3 (40-K):1317-1623 keV
Ch4 (214-Bi):1623-1908 keV Ch5 (208-Tl):2337-2883 keV Ch6 (Total):450-3000 keV

Filename	Start	Alt/m	Position		Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
ERA02001	14:54:40	116.9	54'30.33	3'37.58	88.5	31.6	36	8.3	7.9	297
ERA02001	14:54:52	49.37	54'29.97	3'37.13	144	51.6	59	14.2	12.7	472
ERA02002	14:55:08	78.72	54' 29.7	3'36.63	124	49.6	50	13.1	11.3	414
ERA02002	14:55:23	93.77	54' 29.5	3'36.08	84	29.1	32.8	9.5	7.3	275
ERA02003	14:55:39	78.17	54'29.23	3'35.68	81.9	28.3	33.2	8.60	9.39	280
ERA02003	14:55:53	73.15	54'28.88	3'35.43	96.3	34.5	37.6	9.39	7.9	323
ERA02004	14:56:09	69.84	54'28.55	3'35.13	101	39.2	43.2	9.2	10.2	348
ERA02004	14:56:24	70.17	54'28.25	3'34.77	131	39.5	43.2	9.10	9.89	399
ERA02005	14:56:41	76.43	54'27.98	3'34.43	143	42.6	45.9	13.6	11.9	451
ERA02005	14:56:55	82.80	54'27.73	3'34.08	103	34.3	35.2	9.7	11	336
ERA02006	14:57:11	88.88	54'27.48	3'33.78	71.2	29.7	30.8	7.9	7.4	256
ERA02006	14:57:25	102.9	54'27.23	3'33.53	63.8	22.5	22.4	7.5	7.4	216
ERA02007	14:57:41	96.01	54'27.23	3'33.28	98.9	35.6	37	11.3	8.7	330
ERA02007	14:57:55	88.92	54'27.48	3'33.03	102	37.6	44.6	9.60	9.2	345
ERA02008	14:58:11	71.81	54'27.73	3'32.85	109	42.7	43.1	9.10	10.5	374
ERA02008	14:58:25	68.51	54'27.98	3'32.75	118	47.2	46.3	10.7	11.2	385
ERA02009	14:58:41	64.30	54'28.23	3'32.63	124	50.1	52.4	14	9.60	422
ERA02009	14:58:55	61.94	54'28.48	3'32.48	127	49	46.4	12.1	12.9	422
ERA02010	14:59:11	75.62	54'28.75	3'32.33	118	45.4	44.9	12.8	11.6	401
ERA02010	14:59:24	82.31	54'29.05	3'32.18	101	43.8	40.6	13.3	10.4	361
ERA02011	14:59:41	96.75	54'29.35	3' 32	105	41.2	38	11.8	9.10	354
ERA02011	14:59:54	106.8	54'29.65	3' 31.8	101	42.6	36.5	12.4	10.9	348
ERA02012	15:00:10	97.29	54'29.95	3'31.63	103	42.4	38.2	11.8	10.9	355
ERA02012	15:00:26	97.98	54'30.25	3'31.48	91.2	36.6	36.4	9.89	10.9	324
ERA02013	15:00:43	92.20	54'30.45	3' 31.2	97.6	38.3	36.2	13.9	10.5	340
ERA02013	15:00:59	95.13	54'30.55	3' 30.8	99.8	35.4	32.9	10.4	10.2	333
ERA02014	15:01:16	79.37	54'30.55	3'30.43	123	46.4	45.9	12.4	11.5	409
ERA02014	15:01:31	61.78	54'30.45	3'30.08	183	64.6	62.1	15.4	19.6	583
ERA02015	15:01:47	58.20	54'30.38	3'29.65	187	56.8	58.4	14.3	17.1	553
ERA02015	15:02:00	72.29	54'30.33	3'29.15	172	57.3	54.4	13.8	16.3	536
ERA02016	15:02:17	50.43	54'30.28	3'28.73	140	37.4	30.2	9.5	10.3	379
ERA02016	15:02:31	56.97	54'30.23	3'28.38	153	43	41	10	11.9	445
ERA02017	15:02:48	65.98	54'30.15	3'27.93	186	57.9	56.9	15	13.4	555
ERA02017	15:03:00	70.46	54'30.05	3'27.38	159	58.5	60	15.6	15.9	512
ERA02018	15:03:17	81.49	54' 30	3' 26.9	143	54.1	54.4	13.3	14.3	479
ERA02018	15:03:30	63.79	54' 30	3' 26.5	146	54	45.2	11.9	14.7	461
ERA02019	15:03:46	80.53	54'29.98	3'26.03	146	54	44.4	12	13.5	453
ERA02019	15:03:59	57.86	54'29.93	3'25.48	72.4	18.4	18.6	6.7	6.3	201
ERA02020	15:04:15	92.61	54'29.85	3'24.98	85.6	29.2	25.9	8	6.6	265
ERA02020	15:04:28	60.12	54'29.75	3'24.53	153	50	42.7	12.6	12.5	456
ERA02021	15:04:44	67.07	54'29.55	3'24.18	114	32.9	31.6	11.2	9.5	336
ERA02021	15:04:58	57.90	54'29.25	3'23.93	120	33.3	21	8.39	10.2	319
ERA02022	15:05:14	103.8	54'28.93	3'23.58	150	52.8	52.6	16.1	11.3	484
ERA02022	15:05:28	64.53	54'28.58	3'23.13	146	51.9	50.1	14	13.2	468
ERA02023	15:05:44	85.57	54'28.25	3'22.73	105	37.9	30.5	11.6	9.10	333
ERA02023	15:05:58	56.78	54'27.95	3'22.38	174	61.5	60.4	13.7	13	551
ERA02024	15:06:14	74.12	54'27.63	3' 22.1	103	29.4	26.8	8.89	8.8	296
ERA02024	15:06:28	54.14	54'27.28	3' 21.9	141	43.5	38	11.4	10.8	413

ERA02025	15:06:44	74.85	54'26.98	3'21.63	98.8	31.5	24.8	9.60	7.3	298
ERA02025	15:06:57	73.30	54'26.73	3'21.28	94.2	29.5	24.7	10	6.7	286
ERA02026	15:07:13	88.29	54'26.38	3' 21.1	158	50.9	46.9	15.3	12.8	475
ERA02026	15:07:26	75.14	54'25.93	3' 21.1	129	47.3	38.1	11.3	11.6	404
ERA02027	15:07:43	81.00	54'25.58	3'21.08	138	45.1	38.7	14.6	13.5	413
ERA02027	15:07:56	95.27	54'25.33	3'21.03	117	49.4	45.9	12.2	13.1	411
ERA02028	15:08:12	77.44	54'25.03	3'21.05	145	55.5	57.2	15.4	15.5	491
ERA02028	15:08:24	68.24	54'24.68	3'21.15	137	47.9	48.4	14.8	16.4	460
ERA02029	15:08:41	75.70	54'24.33	3'21.28	113	38.6	39.8	9.39	11.3	356
ERA02029	15:08:53	104.0	54'23.97	3'21.43	96.8	33.3	34.5	10.1	8.39	308
ERA02030	15:09:09	74.87	54'23.63	3'21.58	98.9	37.3	38.5	8.60	7.1	333
ERA02030	15:09:22	94.17	54'23.28	3'21.72	136	50	56.6	11.1	10	432
ERA02031	15:09:39	74.00	54'22.98	3'21.85	108	41.2	41.9	11.1	8.8	365
ERA02031	15:09:52	85.74	54'22.73	3'21.95	141	57.4	64.3	11	6.8	478
ERA02032	15:10:08	58.69	54'22.48	3' 22.1	115	36.1	34.3	6.5	7.6	341
ERA02032	15:10:21	66.42	54'22.23	3' 22.3	134	44.7	47	9.60	8.2	414
ERA02033	15:10:37	59.32	54' 22	3'22.65	107	41.1	37	8.60	8.3	337
ERA02033	15:10:50	67.19	54' 21.8	3'23.15	155	52.3	53.4	9.39	9.89	475
ERA02034	15:11:06	63.61	54' 21.6	3'23.58	151	57.1	55.6	13.6	11.7	490
ERA02034	15:11:19	70.88	54' 21.4	3'23.93	141	52.8	47.9	12.5	11.2	452
ERA02035	15:11:35	86.21	54'21.25	3'24.28	101	37.2	38.2	11.5	10.5	346
ERA02035	15:11:47	88.29	54'21.15	3'24.63	85.3	29.2	25.7	8.2	7.9	282
ERA02036	15:12:03	87.47	54'21.18	3'24.95	56.9	18.6	14.6	5.5	4.7	175
ERA02036	15:12:16	87.92	54'21.33	3'25.25	94	26	21.4	6.7	4.6	270
ERA02037	15:12:32	74.03	54' 21.5	3'25.58	237	35.5	28.1	6.5	6.7	550
ERA02037	15:12:46	63.70	54' 21.7	3'25.93	134	40.9	38.5	10.7	9.2	408
ERA02038	15:13:02	67.88	54'21.88	3' 26.3	642	64.4	36.3	8.5	7.6	1276
ERA02038	15:13:16	68.66	54'22.03	3' 26.7	252	37.6	29.7	7.1	6	549
ERA02039	15:13:33	70.48	54' 22.2	3'27.05	108	32.8	29.8	8.5	5.9	322
ERA02039	15:13:45	68.82	54' 22.4	3'27.35	112	36.3	33.5	6.2	7.9	326
ERA02040	15:14:02	75.88	54' 22.6	3'27.68	106	34.7	40.6	7.8	8.3	335
ERA02040	15:14:15	73.71	54' 22.8	3'28.03	107	31.7	33.2	7.4	6.7	313
ERA02041	15:14:31	88.53	54' 23	3'28.13	127	34.5	29	7.2	7.5	352
ERA02041	15:14:46	82.00	54' 23.2	3'27.98	103	35	32.7	8.39	7.7	325
ERA02042	15:15:03	77.97	54' 23.4	3'27.65	115	41.5	43.1	10	10	381
ERA02042	15:15:15	75.35	54' 23.6	3'27.15	122	44.9	47.4	9	8	423
ERA02043	15:15:32	77.21	54'23.78	3' 26.7	105	35.1	41.2	10.2	7.7	337
ERA02043	15:15:44	68.77	54'23.93	3' 26.3	115	39.7	42.6	12.2	10.2	367
ERA02044	15:16:01	64.10	54'24.08	3'25.88	117	43.4	36.8	10.6	9.8	371
ERA02044	15:16:13	72.61	54'24.22	3'25.43	108	39	37.8	10	6.9	353
ERA02045	15:16:29	65.76	54'24.35	3'25.08	107	39.2	40.7	9.7	8.7	354
ERA02045	15:16:44	67.72	54'24.45	3'24.83	105	38.9	42.6	11.8	9.3	354
ERA02046	15:17:00	74.53	54' 24.6	3'24.58	99.6	33.4	38.8	9.3	7.7	321
ERA02046	15:17:14	79.32	54' 24.8	3'24.33	98.1	34	39.9	8.3	9.7	320
ERA02047	15:17:30	83.86	54' 25	3' 24.2	106	43.5	43.8	11.5	10.6	367
ERA02047	15:17:43	63.84	54' 25.2	3' 24.2	128	47	55.6	12.6	11	427
ERA02048	15:17:59	68.90	54'25.38	3' 24.3	129	46.9	49.1	13.9	10.6	429
ERA02048	15:18:13	54.01	54'25.53	3' 24.5	133	46.2	45.1	11.8	10.8	426
ERA02049	15:18:30	35.77	54'25.73	3'24.63	176	67.6	72.7	16	14.3	584
ERA02049	15:18:42	53.34	54'25.98	3'24.68	182	70.1	68.3	14.5	17.8	590
ERA02050	15:18:59	78.87	54'26.23	3' 24.7	151	62.2	62.7	13.7	15.1	533
ERA02050	15:19:11	97.85	54'26.48	3' 24.7	139	54.1	54.5	13.2	13.5	475
ERA02051	15:19:27	79.36	54' 26.7	3' 24.8	142	51.4	46.1	12.6	9.60	434
ERA02051	15:19:40	63.69	54' 26.9	3' 25	148	46.6	41.1	12.9	9.89	432
ERA02052	15:19:57	69.35	54'27.05	3'25.33	124	40.5	34.6	9.39	8.3	362
ERA02052	15:20:10	56.11	54'27.15	3'25.78	169	65.7	60.7	14.2	13.3	545

ERA02053	15:20:26	75.69	54'27.25	3'26.28	178	72.3	73.6	16.6	14	615
ERA02053	15:20:39	119.9	54'27.35	3'26.83	122	47.2	44.5	10.3	11.2	398
ERA02054	15:20:55	68.02	54'27.43	3'27.38	128	43.3	48	11.3	10.7	410
ERA02054	15:21:08	78.33	54'27.48	3'27.93	128	48.3	48.1	12.4	8.39	417
ERA02055	15:21:25	74.60	54'27.55	3'28.45	121	44.8	47.1	8.5	10.5	390
ERA02055	15:21:37	79.49	54'27.65	3'28.95	134	50.7	49.8	11	9.8	428
ERA02056	15:21:54	102.9	54'27.75	3'29.48	102	41.6	42.2	10.5	11.7	364
ERA02056	15:22:08	108.1	54'27.85	3'30.03	112	40.5	42.2	12.1	11.9	375
ERA02057	15:22:24	69.14	54'27.83	3'30.58	114	49.8	55.9	11.4	11.2	419
ERA02057	15:22:38	74.51	54'27.68	3'31.13	125	49.5	52.7	14.7	12	441
ERA02058	15:22:54	77.79	54'27.55	3'31.63	123	43.4	50	15.3	13.6	417
ERA02058	15:23:07	80.86	54'27.45	3'32.08	103	44.2	45.1	12	12.2	362
ERA02059	15:23:23	81.41	54'27.35	3'32.55	97.7	33.4	40.2	11.1	10.3	342
ERA02059	15:23:36	81.00	54'27.25	3'33.05	110	40.3	43.3	9.10	11.1	371
ERA02060	15:23:52	90.84	54'27.08	3'33.18	112	43	42	12	10.5	362
ERA02060	15:24:05	69.90	54'26.83	3'32.93	118	45.8	45.5	10.8	10.7	393
ERA02061	15:24:22	82.30	54'26.55	3'32.58	118	42	43.7	9.2	9.10	385
ERA02061	15:24:35	82.96	54'26.25	3'32.13	115	39.6	36.7	11.2	9.2	366
ERA02062	15:24:51	91.63	54'26.08	3'31.73	115	36.1	39.1	9.89	10	365
ERA02062	15:25:05	85.88	54'26.03	3'31.38	113	42.4	37.9	11	9.10	364
ERA02063	15:25:21	81.86	54'26.08	3'31.03	116	39.5	45.1	13.4	11.6	387
ERA02063	15:25:34	65.55	54'26.22	3'30.68	128	47	46.7	11.3	12.1	413
ERA02064	15:25:50	62.50	54'26.38	3'30.35	141	51.7	57.5	13.6	14.4	477
ERA02064	15:26:02	61.11	54'26.53	3'30.05	134	48.8	54.6	13.2	12	461
ERA02065	15:26:19	75.32	54'26.55	3'29.68	118	42.7	43.9	10.1	9.60	381
ERA02065	15:26:31	69.67	54'26.45	3'29.23	129	57.2	58.1	12.7	14.8	469
ERA02066	15:26:48	74.03	54'26.33	3'28.83	131	43.5	48.6	11.8	11.7	422
ERA02066	15:27:00	76.72	54'26.18	3'28.47	132	42.9	43.2	10.1	10	411
ERA02067	15:27:16	78.95	54' 26	3'28.13	135	45.4	50.5	11.1	12.1	431
ERA02067	15:27:29	82.92	54' 25.8	3'27.78	118	43.6	48.5	12.5	9.7	395
ERA02068	15:27:45	71.61	54'25.45	3'27.83	109	39.2	38.6	9.8	9.10	357
ERA02068	15:27:58	75.55	54'24.95	3'28.28	119	42	41.4	10.4	9.39	380
ERA02069	15:28:14	58.80	54'24.58	3' 28.6	132	47.5	53.9	12.1	12.9	431
ERA02069	15:28:47	69.43	54'24.33	3' 28.8	120	39.7	52.2	12.2	9.60	403
ERA02070	15:29:04	83.12	54'24.08	3'28.88	103	34.9	34.3	7.9	9.60	332
ERA02070	15:29:16	106.1	54'23.83	3'28.83	103	38.9	34.5	8.89	8.2	333
ERA02071	15:29:32	84.53	54'23.55	3'28.68	102	36.3	40.7	10.5	9.60	339
ERA02071	15:29:46	86.18	54'23.25	3'28.43	101	31.9	36.7	8.60	7.4	319
ERA02072	15:30:02	102.4	54' 23.1	3'28.33	116	39.4	32.8	8	7.9	356
ERA02072	15:30:15	75.77	54' 23.1	3'28.38	64.6	20.7	22.9	5.2	5.4	209
ERA02073	15:30:31	68.97	54'23.15	3' 28.5	136	37.2	38.6	8.7	7.7	385
ERA02073	15:30:44	78.08	54'23.25	3' 28.7	114	35.6	39.5	9.2	8.7	344
ERA02074	15:31:00	81.81	54' 23.5	3'28.95	103	31	36.9	9.3	7.9	319
ERA02074	15:31:16	89.58	54' 23.9	3'29.25	125	35.1	31.6	8.10	8.5	357

Summary file ERA03.SM1
Count Rate /cps
Ch1 (137-Cs):570-768 keV Ch2 (134-Cs):708-861 keV Ch3 (40-K):1317-1623 keV
Ch4 (214-Bi):1623-1908 keV Ch5 (208-Tl):2337-2883 keV Ch6 (Total):450-3000 keV

Filename	Start	Alt/m	Position		Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
ERA03001	09:03:51	64.35	54'30.48	3'37.75	123	52.2	60.5	10	10.2	443
ERA03001	09:04:03	51.01	54'30.23	3'37.45	134	53.4	57.3	12.3	9	452
ERA03002	09:04:19	40.13	54' 30	3'37.15	172	58.7	65	14	12.6	536
ERA03002	09:04:33	51.23	54' 29.8	3'36.85	138	52.4	66.1	13.6	14.3	479
ERA03003	09:04:50	72.02	54' 29.6	3' 36.5	120	44.7	45.2	10.2	11	393
ERA03003	09:05:04	72.69	54' 29.4	3' 36.1	125	35.6	41.9	10.8	9.39	388
ERA03004	09:05:20	58.47	54'29.18	3' 35.8	131	36.4	43.9	11.9	10.5	399
ERA03004	09:05:34	64.61	54'28.93	3' 35.6	147	42.3	43.6	10.7	9.3	425
ERA03005	09:05:50	69.35	54'28.65	3'35.33	163	50.8	56.4	13.4	10.5	505
ERA03005	09:06:03	66.39	54'28.35	3'34.97	158	46.2	48	11	11.5	473
ERA03006	09:06:19	69.35	54'28.08	3'34.65	188	58.4	64.1	15.2	13.4	582
ERA03006	09:06:33	73.78	54'27.83	3'34.35	194	58.4	68.3	14.6	15.4	602
ERA03007	09:06:49	77.24	54' 27.6	3'34.08	144	52.2	47.9	11.9	11.8	462
ERA03007	09:07:02	79.55	54' 27.4	3'33.83	161	45.8	47.6	13.5	11	490
ERA03008	09:07:18	93.05	54'27.33	3'33.58	164	48.6	52.6	11	10.3	496
ERA03008	09:07:31	74.64	54'27.38	3'33.33	117	46.5	47.4	11.1	10.3	405
ERA03009	09:07:48	78.20	54'27.53	3'33.13	111	46.4	40.2	13.2	10.5	372
ERA03009	09:08:02	79.06	54'27.78	3'32.98	114	47.1	46.5	11.3	10.3	392
ERA03010	09:08:18	86.57	54' 28	3'32.83	103	43.7	38.1	10.2	10.6	362
ERA03010	09:08:32	76.85	54' 28.2	3'32.68	111	41.4	46.6	11.7	10.9	376
ERA03011	09:08:48	74.76	54' 28.4	3'32.55	111	42.1	48.9	12.5	11.2	397
ERA03011	09:09:01	70.93	54' 28.6	3'32.45	121	48	47.3	14	11.2	404
ERA03012	09:09:17	73.43	54' 28.8	3'32.33	120	45.6	44.9	12.1	11	401
ERA03012	09:09:30	84.11	54' 29	3'32.18	109	43.2	43.5	11.9	9	375
ERA03013	09:09:47	97.43	54'29.23	3'32.02	102	39.9	35.6	13	9.8	356
ERA03013	09:10:00	96.80	54'29.48	3'31.88	105	39.4	38.9	12.3	10.9	360
ERA03014	09:10:16	90.84	54'29.73	3'31.72	103	40.3	40.8	11	9.7	351
ERA03014	09:10:29	87.02	54'29.98	3'31.58	112	43.5	34.7	13.7	11.1	369
ERA03015	09:10:45	84.66	54' 30.2	3'31.43	113	40.5	38.9	12.6	12.3	368
ERA03015	09:10:59	84.51	54' 30.4	3'31.28	110	46.1	38	14.5	9.89	375
ERA03016	09:11:15	95.95	54' 30.5	3' 31	99.2	36.8	32.1	12.8	9.39	323
ERA03016	09:11:28	95.33	54' 30.5	3' 30.6	111	44.6	41	13.2	9.10	370
ERA03017	09:11:44	64.05	54'30.48	3'30.25	170	60.7	61.1	16.8	17.2	553
ERA03017	09:11:57	95.36	54'30.43	3'29.95	139	53.5	51.5	12.6	13.3	462
ERA03018	09:12:13	58.32	54'30.38	3'29.53	178	61	58	14.6	17.8	550
ERA03018	09:12:28	52.97	54'30.33	3'28.98	188	53.2	46.6	11	13.6	520
ERA03019	09:12:45	58.05	54'30.25	3'28.45	152	43	36.8	10.8	13.2	423
ERA03019	09:12:58	51.76	54'30.15	3'27.95	164	53.4	49.9	12.7	14.2	501
ERA03020	09:13:14	77.87	54'30.08	3'27.48	164	59.1	60.2	16.3	18.1	542
ERA03020	09:13:27	84.78	54'30.03	3'27.03	144	55.4	59.1	15.1	16.5	501
ERA03021	09:13:44	82.52	54'29.98	3'26.55	118	46	45.7	10.5	12.9	400
ERA03021	09:13:58	57.37	54'29.93	3'26.05	151	51.4	48.1	12.7	13.3	468
ERA03022	09:14:14	89.94	54' 29.9	3'25.55	68	21.2	19.1	7.1	7.3	204
ERA03022	09:14:27	95.01	54' 29.9	3'25.05	84.3	28.7	25.4	7.5	10.4	255
ERA03023	09:14:43	65.25	54'29.83	3' 24.6	149	52.2	44.9	12.4	13.5	464
ERA03023	09:14:56	58.63	54'29.68	3' 24.2	140	48.4	43.3	11.1	10.4	440
ERA03024	09:15:12	60.66	54'29.43	3'23.88	149	45.4	35.7	10.8	8.2	407
ERA03024	09:15:27	138.5	54'29.08	3'23.63	119	43.8	41.6	10.4	11	396

ERA03025	09:15:43	81.76	54'28.73	3' 23.3	126	44.7	44	11.6	9.60	404
ERA03025	09:15:56	112.1	54'28.38	3' 22.9	136	51.2	50.3	14.4	12	465
ERA03026	09:16:12	114.7	54'28.08	3' 22.5	85.1	29	27.7	8.39	7.8	274
ERA03026	09:16:25	136.6	54'27.83	3' 22.1	148	54.4	55.7	13.8	11.6	499
ERA03027	09:16:42	73.30	54'27.53	3'21.83	113	32.5	25.6	9.39	8.7	312
ERA03027	09:16:54	65.14	54'27.18	3'21.68	137	42.6	39.9	10.8	12.2	418
ERA03028	09:17:11	75.50	54'26.85	3'21.38	112	31.1	29.6	8.89	9.5	329
ERA03028	09:17:24	64.16	54'26.55	3'20.93	139	41.2	37.9	11.1	9.5	396
ERA03029	09:17:40	155.7	54'26.25	3'20.75	114	41.1	37.6	13.9	11.8	381
ERA03029	09:17:53	138.0	54'25.95	3'20.85	88.8	32.1	28.5	10.4	11.3	302
ERA03030	09:18:09	90.10	54'25.65	3'20.88	102	40.3	27.8	13.6	12.5	343
ERA03030	09:18:22	109.0	54'25.35	3'20.83	110	44.4	42.9	11.3	12	382
ERA03031	09:18:38	83.52	54'25.03	3'20.88	125	49.2	48.2	13.2	14.5	435
ERA03031	09:18:52	76.15	54'24.68	3'21.03	128	51.1	53.3	13.7	14.3	451
ERA03032	09:19:08	82.77	54'24.35	3'21.18	116	39.5	40.4	10.2	10	370
ERA03032	09:19:21	67.28	54'24.05	3'21.33	106	37.4	38.3	11.5	8.5	338
ERA03033	09:19:37	86.43	54'23.73	3' 21.5	102	40.4	39.4	10.7	7.7	354
ERA03033	09:19:50	69.35	54'23.38	3' 21.7	103	40	48.1	10.8	9.39	361
ERA03034	09:20:06	66.58	54'23.05	3'21.85	109	43.6	46	12.4	10.4	382
ERA03034	09:20:19	91.99	54'22.75	3'21.95	136	58.3	60.5	10.7	9	470
ERA03035	09:20:36	80.01	54'22.45	3'22.05	115	45.2	40.8	9	7	367
ERA03035	09:20:49	64.64	54'22.15	3'22.15	144	44	48.3	9.60	6.7	423
ERA03036	09:21:06	57.26	54'21.95	3'22.45	128	41.7	42.6	11	10.5	403
ERA03036	09:21:20	41.29	54'21.85	3'22.95	133	42.3	43.1	8.5	7.9	402
ERA03037	09:21:36	77.22	54' 21.7	3' 23.4	132	49.5	50.6	13.1	11.6	434
ERA03037	09:21:52	82.14	54' 21.5	3' 23.8	144	53	54.9	13.2	12.9	474
ERA03038	09:22:08	97.37	54' 21.3	3' 24.2	103	39	42.5	9.8	7.9	332
ERA03038	09:22:22	94.66	54' 21.1	3' 24.6	123	37.9	35.7	11	10.5	379
ERA03039	09:22:38	96.71	54' 21.1	3'24.97	112	30.8	33.6	10.1	7.3	339
ERA03039	09:22:50	94.63	54' 21.3	3'25.33	173	34	34.5	10.1	8.10	444
ERA03040	09:23:07	88.18	54' 21.5	3'25.68	352	48.7	36.4	11.6	9.5	801
ERA03040	09:23:20	81.34	54' 21.7	3'26.03	198	38.8	34.1	7.9	8	490
ERA03041	09:23:36	84.12	54'21.85	3'26.43	685	75.4	40.4	11	7.9	1372
ERA03041	09:23:50	79.11	54'21.95	3'26.88	103	27.2	26.1	7.3	6.5	292
ERA03042	09:24:06	69.16	54'22.18	3'27.28	100	31	32.8	7.3	7	298
ERA03042	09:24:23	65.92	54'22.53	3'27.63	109	38.7	43.8	9.60	9.10	348
ERA03043	09:24:39	63.08	54'22.85	3'27.78	121	32.9	35	7.4	6.8	337
ERA03043	09:24:52	74.61	54'23.15	3'27.73	131	42.3	32.7	9.10	7.2	388
ERA03044	09:25:08	74.49	54'23.38	3'27.45	195	83.7	54.2	12.2	11.3	665
ERA03044	09:25:33	68.13	54'23.53	3'26.95	124	43.9	42.9	10.3	9	383
ERA03045	09:25:49	86.79	54' 23.7	3'26.48	97.9	33.9	35.1	10.2	7.3	305
ERA03045	09:26:03	83.93	54' 23.9	3'26.03	109	39.3	43.2	9.8	10.1	370
ERA03046	09:26:19	94.32	54' 24.1	3'25.63	99.7	37.3	40	11.1	9.2	340
ERA03046	09:26:32	88.89	54' 24.3	3'25.28	96.6	38.4	37.1	8.39	5.9	327
ERA03047	09:26:48	96.68	54'24.48	3' 24.9	97	37.8	37.7	8.10	9.8	328
ERA03047	09:27:00	106.0	54'24.63	3' 24.5	78.7	34	31	8.60	6.4	283
ERA03048	09:27:16	107.6	54'24.85	3' 24.3	84.6	33.3	36.5	9.7	8.7	309
ERA03048	09:27:29	87.52	54'25.15	3' 24.3	98.9	38.9	37.1	9.39	9	331
ERA03049	09:27:45	75.25	54' 25.4	3'24.43	113	43.1	40.5	10.7	13.3	375
ERA03049	09:27:58	58.38	54' 25.6	3'24.68	130	47.4	47.6	14.1	13.1	427
ERA03050	09:28:14	78.90	54'25.88	3'24.75	149	60.6	60	13.5	14.5	506
ERA03050	09:28:28	71.15	54'26.23	3'24.65	149	61.6	60.3	14.7	14	514
ERA03051	09:28:44	87.44	54'26.53	3'24.68	148	53.9	54.4	12.2	12.2	484
ERA03051	09:28:57	80.09	54'26.78	3'24.83	130	45.2	47.5	11.6	11.4	417
ERA03052	09:29:13	58.43	54'26.98	3'25.13	126	39.6	33.5	10.8	10.6	372
ERA03052	09:29:28	88.42	54'27.13	3'25.58	133	45.9	42.2	9.2	8.89	403

ERA03053	09:29:44	69.43	54'27.25	3'26.05	183	66.2	71.4	15.4	12.3	586
ERA03053	09:29:58	98.95	54'27.35	3'26.55	156	54.4	60.1	10.8	12.4	513
ERA03054	09:30:14	67.07	54'27.43	3'27.08	138	49.7	50.5	11.1	12.1	442
ERA03054	09:30:27	79.91	54'27.48	3'27.63	130	43.8	44.5	10.3	10.4	407
ERA03055	09:30:44	102.5	54'27.55	3'28.15	103	40.4	40	10.3	10.5	347
ERA03055	09:30:57	62.83	54'27.65	3'28.65	129	47.7	52	11.3	11.8	434
ERA03056	09:31:13	83.99	54'27.73	3'29.15	127	48.2	47.4	12.1	10.9	423
ERA03056	09:31:29	107.5	54'27.78	3'29.65	132	55.8	51.6	14.1	11.5	485
ERA03057	09:31:45	89.86	54'27.78	3'30.15	138	60	54.5	9.8	8.5	509
ERA03057	09:31:57	70.70	54'27.73	3'30.65	135	59	62.9	12.9	9.7	513
ERA03058	09:32:14	82.14	54'27.65	3'31.18	145	56.7	55.3	13.4	12.2	523
ERA03058	09:32:28	74.93	54'27.55	3'31.73	129	57.3	55.3	12.1	10.3	479
ERA03059	09:32:45	69.17	54'27.45	3'32.22	130	52.7	57.9	13.6	12.5	481
ERA03059	09:32:59	76.07	54'27.35	3'32.68	129	48.8	49.6	12.2	10.6	438
ERA03060	09:33:15	69.90	54'27.18	3'32.98	128	49.7	44.5	10.1	10.7	425
ERA03060	09:33:29	82.62	54'26.93	3'33.13	129	45.3	50.8	13.5	10.9	434
ERA03061	09:33:46	72.26	54' 26.7	3' 33	164	55.2	57.5	13.5	11.4	526
ERA03061	09:34:00	73.71	54' 26.5	3' 32.6	178	56.6	58.8	15.6	11.3	557
ERA03062	09:34:16	72.51	54'26.28	3'32.25	198	57.5	62.8	14.2	11.4	594
ERA03062	09:34:29	71.95	54'26.03	3'31.95	209	64.4	67.6	15.9	15.4	658
ERA03063	09:34:46	75.28	54'25.98	3'31.63	178	55.8	56.6	14.4	14	555
ERA03063	09:35:01	73.80	54'26.13	3'31.28	162	56.3	55.2	13.5	12.4	515
ERA03064	09:35:17	74.28	54'26.33	3' 30.9	142	55.8	50.5	12.2	9.10	483
ERA03064	09:35:30	71.23	54'26.58	3' 30.5	145	62.5	63.5	14.6	15.5	549
ERA03065	09:35:46	71.54	54'26.68	3'30.15	159	64.3	61	10.8	11.8	563
ERA03065	09:36:02	75.29	54'26.63	3'29.85	190	93.6	90.5	14.5	11.3	774
ERA03066	09:36:18	66.34	54'26.55	3'29.48	233	114	112	12.5	12.5	947
ERA03066	09:36:31	87.13	54'26.45	3'29.03	157	67.9	66.3	14.5	15	572
ERA03067	09:36:47	82.50	54'26.33	3'28.63	122	42.5	48.3	11.5	12	409
ERA03067	09:37:02	86.83	54'26.18	3'28.28	129	43.1	44.7	11.3	11.1	417
ERA03068	09:37:19	76.54	54' 26	3'28.03	135	46.6	50	12.4	12.6	440
ERA03068	09:37:32	92.30	54' 25.8	3'27.88	120	40.9	40.9	11	10.2	390
ERA03069	09:37:48	68.38	54'25.55	3'27.93	114	42.3	40.7	9.10	9.10	366
ERA03069	09:38:01	68.63	54'25.25	3'28.18	128	40.2	44.3	8.5	10.4	400
ERA03070	09:38:18	83.52	54'24.93	3'28.43	123	50.2	45.2	11.5	12.3	425
ERA03070	09:38:30	83.73	54'24.58	3'28.68	116	47	49.6	10.5	9.2	408
ERA03071	09:38:47	88.40	54'24.28	3'28.88	127	53.5	45.7	10.1	8.8	442
ERA03071	09:39:02	90.41	54'24.03	3'29.03	112	39.2	42.8	10	11.5	377
ERA03072	09:39:18	109.9	54'23.78	3'28.98	128	39.2	38.7	8.8	9.7	395
ERA03072	09:39:31	76.10	54'23.53	3'28.73	139	42.1	45.3	11.4	11	429
ERA03073	09:39:47	90.79	54'23.28	3'28.55	129	42.3	41.1	12.2	9.2	403
ERA03073	09:40:00	99.82	54'23.03	3'28.45	123	37.1	38	8.89	9.39	376
ERA03074	09:40:16	94.11	54'23.03	3'28.45	92.8	32	26.8	6.8	5.9	287
ERA03074	09:40:29	76.89	54'23.28	3'28.55	124	37.6	47.3	9.3	10	397
ERA03075	09:40:45	83.66	54'23.55	3'28.78	152	46.3	51.6	13.2	10.7	475
ERA03075	09:40:58	87.51	54'23.85	3'29.13	148	46.4	46.7	11.5	10.9	463
ERA03076	09:41:14	94.03	54' 24.1	3'29.47	143	41.1	46.1	10.9	9	444
ERA03076	09:41:32	89.20	54' 24.3	3'29.83	169	44.8	45.7	10.1	10.3	485
ERA03077	09:41:48	81.60	54'24.55	3'30.15	225	64	58.6	16.3	13.9	662
ERA03077	09:42:00	82.56	54'24.85	3'30.45	236	59.5	65.3	16.3	14.7	690
ERA03078	09:42:17	82.82	54'25.08	3'30.73	214	55.9	58.2	15.9	11.6	622
ERA03078	09:42:34	83.42	54'25.22	3'30.98	202	55.6	54.4	14	15.1	603
ERA03079	09:42:50	84.75	54'25.43	3'31.25	200	59.4	55.5	14.9	12.8	601
ERA03079	09:43:02	82.98	54'25.68	3'31.55	194	58.8	61.2	15.8	14.4	599

Summary file ERA04.SM1
Count Rate /cps
Ch1 (137-Cs):570-768 keV Ch2 (134-Cs):708-861 keV Ch3 (40-K):1317-1623 keV
Ch4 (214-Bi):1623-1908 keV Ch5 (208-Tl):2337-2883 keV Ch6 (Total):450-3000 keV

Filename	Start	Alt/m	Position		Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
ERA04001	11:40:17	87.46	54'30.45	3'37.73	114	43.7	44.6	10.3	9	380
ERA04001	11:40:29	61.98	54'30.15	3'37.38	136	47.4	55.3	12.5	10.9	437
ERA04002	11:40:46	48.58	54' 29.9	3'36.95	157	58.8	62.9	15.7	13.2	502
ERA04002	11:41:02	59.87	54' 29.7	3'36.45	132	45.1	47.8	10.6	12.5	426
ERA04003	11:41:19	85.97	54'29.45	3'36.08	115	36.7	40.6	10.8	10.7	370
ERA04003	11:41:37	76.15	54'29.15	3'35.83	124	40.4	43.1	12.7	8.60	398
ERA04004	11:41:53	66.91	54'28.83	3'35.47	136	38.3	42.3	10	11.3	407
ERA04004	11:42:10	65.31	54'28.47	3'35.03	169	52.6	57.2	15.1	12.7	513
ERA04005	11:42:27	67.08	54'28.15	3'34.65	187	55.3	61.9	13.3	12.8	559
ERA04005	11:42:44	76.70	54'27.85	3'34.35	189	55.1	61.8	17	13.2	574
ERA04006	11:43:01	78.76	54'27.55	3'34.03	137	39.7	45.2	11.7	11.1	423
ERA04006	11:43:17	85.78	54'27.25	3'33.68	160	42.8	46.5	10.3	9.8	461
ERA04007	11:43:33	73.95	54'27.25	3'33.35	133	49.5	51.1	13	11.2	431
ERA04007	11:43:50	75.95	54'27.55	3'33.05	111	43.9	46.5	11.7	10.3	382
ERA04008	11:44:07	79.03	54'27.85	3'32.83	106	43.8	41.2	11.1	11	365
ERA04008	11:44:23	72.83	54'28.15	3'32.68	106	39	42.3	12.2	11.4	371
ERA04009	11:44:40	73.44	54'28.43	3'32.52	124	48.4	43	12.2	11.7	402
ERA04009	11:44:55	74.53	54'28.68	3'32.38	121	45	43.8	12.4	11	401
ERA04010	11:45:12	70.56	54'28.95	3'32.18	117	47.2	44.6	12.2	12.5	395
ERA04010	11:45:28	73.42	54'29.25	3'31.93	114	42.7	46.1	13.2	9.8	389
ERA04011	11:45:45	70.53	54'29.58	3'31.72	126	47.1	39.9	13	11.9	410
ERA04011	11:46:01	67.02	54'29.93	3'31.58	136	51.4	47.7	13.7	11.8	449
ERA04012	11:46:18	80.54	54'30.23	3'31.43	107	39.6	45.2	14.4	9.2	379
ERA04012	11:46:35	87.30	54'30.48	3'31.28	98	43.4	36.3	14.6	9.89	353
ERA04013	11:46:52	87.77	54' 30.6	3'30.98	105	37.6	35.8	12.6	9.89	342
ERA04013	11:47:08	89.92	54' 30.6	3'30.53	109	40.6	40	12.1	14	376
ERA04014	11:47:25	49.36	54'30.55	3' 30.1	181	66.8	66.6	17.4	17.6	590
ERA04014	11:47:40	60.13	54'30.45	3' 29.7	170	60.5	50.8	14.7	16.4	517
ERA04015	11:47:57	38.17	54'30.35	3'29.28	238	75	81	16.3	20.1	717
ERA04015	11:48:17	49.98	54'30.25	3'28.83	199	57.7	50.8	12.5	14	548
ERA04016	11:48:34	68.22	54'30.18	3' 28.4	144	40.6	28.9	9.3	10.6	385
ERA04016	11:48:51	82.21	54'30.13	3' 28	144	50.4	41.2	12	11.5	442
ERA04017	11:49:08	78.68	54'30.08	3'27.53	126	50.2	47.5	12.4	11.5	420
ERA04017	11:49:29	71.82	54'30.03	3'26.98	164	58	59.7	16	15.3	520
ERA04018	11:49:46	62.93	54'29.98	3' 26.4	134	43.8	45.1	10.8	11.5	415
ERA04018	11:50:02	80.47	54'29.93	3' 25.8	162	50.4	53.3	12.4	16.4	497
ERA04019	11:50:19	66.85	54'29.88	3' 25.3	72.1	19.4	14.7	6.6	5.5	191
ERA04019	11:50:36	72.56	54'29.83	3' 24.9	100	30.3	26.1	10.1	9.89	299
ERA04020	11:50:53	56.46	54'29.72	3' 24.5	171	52.3	53.9	13.6	13.9	504
ERA04020	11:51:10	60.31	54'29.58	3' 24.1	154	45.2	45.8	12.9	12.6	467
ERA04021	11:51:27	71.77	54'29.33	3'23.78	163	53.4	43.2	11.4	12.4	476
ERA04021	11:51:43	116.4	54'28.97	3'23.53	127	45.2	43.6	12.4	11.6	413
ERA04022	11:52:00	70.74	54'28.63	3'23.28	139	53.2	50.1	12.6	12	452
ERA04022	11:52:17	92.14	54'28.28	3'23.03	140	50.5	49.4	12.9	12.9	451
ERA04023	11:52:34	57.25	54'27.95	3'22.65	114	36.9	32.8	8.10	8.60	336
ERA04023	11:52:50	107.6	54'27.65	3'22.15	181	66.5	64.7	17.6	12.5	579
ERA04024	11:53:07	58.48	54'27.33	3' 21.8	92.9	27.6	24.7	9	8.3	287
ERA04024	11:53:26	57.92	54'26.97	3' 21.6	125	36.6	31.2	10.8	10	354

ERA04025	11:53:43	83.03	54'26.63	3'21.43	105	29	23.6	8.60	9.39	300
ERA04025	11:53:59	121.0	54'26.28	3'21.28	127	48.5	37.7	13.4	12.1	401
ERA04026	11:54:16	101.0	54'25.95	3'20.98	116	39.3	38.7	12.2	13.6	385
ERA04026	11:54:32	76.87	54'25.65	3'20.53	105	34.9	29.1	12.9	10.5	336
ERA04027	11:54:49	101.4	54'25.35	3'20.45	112	44.5	41	14	10.5	399
ERA04027	11:55:05	88.79	54'25.05	3'20.75	146	57.5	50.3	14.4	15.2	481
ERA04028	11:55:22	76.91	54'24.75	3' 21	143	56.7	55.9	16.3	14.1	486
ERA04028	11:55:39	74.75	54'24.45	3' 21.2	139	48.5	46.8	14.8	12.6	451
ERA04029	11:55:56	72.64	54'24.15	3' 21.4	110	36.9	38.4	9.8	10.2	355
ERA04029	11:56:12	91.75	54'23.85	3' 21.6	89.6	37.8	35.5	10.4	8.39	315
ERA04030	11:56:29	70.67	54'23.53	3'21.75	109	40.2	44.7	8.8	8.39	367
ERA04030	11:56:47	58.57	54'23.18	3'21.85	128	53.1	57.8	10.2	11.3	454
ERA04031	11:57:04	88.48	54'22.85	3'21.95	126	50.5	51.2	12.5	10.6	436
ERA04031	11:57:21	75.27	54'22.55	3'22.05	115	45.2	43.8	11.9	8	372
ERA04032	11:57:38	64.52	54'22.28	3'22.35	135	46.1	48.1	10	7.8	410
ERA04032	11:57:55	56.97	54'22.03	3'22.85	108	37.6	33.4	9.39	10.2	341
ERA04033	11:58:12	67.51	54'21.78	3'23.35	138	48.5	50.2	13.3	10.8	439
ERA04033	11:58:28	71.13	54'21.53	3'23.85	163	56	56.3	15.2	13.4	511
ERA04034	11:58:45	79.58	54' 21.3	3'24.33	111	40.6	38.2	9.8	9.89	359
ERA04034	11:59:02	79.32	54' 21.1	3'24.78	150	41.6	45.1	13.1	11.7	451
ERA04035	11:59:19	71.09	54'21.13	3'25.18	141	35.8	36.5	8.8	10.1	394
ERA04035	11:59:35	65.85	54'21.38	3'25.53	291	51.8	40	10.1	8	687
ERA04036	11:59:52	56.58	54'21.63	3' 25.9	271	44.8	42.3	10.3	8.3	640
ERA04036	12:00:09	59.61	54'21.88	3' 26.3	802	82.6	48.1	10.2	9	1580
ERA04037	12:00:27	63.46	54' 22.1	3'26.73	159	30.8	24.4	7.1	5.8	373
ERA04037	12:00:45	63.94	54' 22.3	3'27.18	104	30.2	30.2	5.7	5.9	297
ERA04038	12:01:02	70.37	54'22.55	3'27.58	105	34.7	37.3	9.10	8.2	332
ERA04038	12:01:19	74.00	54'22.85	3'27.93	108	30.9	31	6.6	6.6	308
ERA04039	12:01:36	86.25	54'23.13	3'27.85	418	210	105	16	12.6	1475
ERA04039	12:01:52	80.26	54'23.38	3'27.35	108	39.3	38.4	11.1	9.3	355
ERA04040	12:02:09	60.32	54' 23.6	3'26.85	113	41.5	44	12.3	10.4	375
ERA04040	12:02:29	81.78	54' 23.8	3'26.35	97.6	35.6	31.4	8.5	7.6	307
ERA04041	12:02:46	69.73	54' 24	3'25.85	114	42.1	44.3	10.7	9.89	373
ERA04041	12:03:02	67.89	54' 24.2	3'25.35	121	46.9	44.5	10.3	10.4	384
ERA04042	12:03:19	63.11	54' 24.4	3' 24.9	108	42	41.9	8.8	9.5	368
ERA04042	12:03:35	62.81	54' 24.6	3' 24.5	108	35.7	46.2	11.7	9.5	364
ERA04043	12:03:52	76.94	54'24.85	3'24.35	112	41	41.5	10.2	10.3	365
ERA04043	12:04:09	60.75	54'25.15	3'24.45	123	50.2	46.3	11.4	9.5	416
ERA04044	12:04:26	49.10	54' 25.4	3' 24.6	143	52	54.6	15.3	12.7	478
ERA04044	12:04:42	46.41	54' 25.6	3' 24.8	169	60.4	66	17.3	13.6	560
ERA04045	12:04:59	71.39	54'25.88	3'24.85	152	62.5	58.8	15.4	14.8	526
ERA04045	12:05:17	80.17	54'26.23	3'24.75	162	64.1	61	14.1	14.5	555
ERA04046	12:05:34	66.59	54'26.53	3' 24.8	169	66.1	60.4	15.4	13.3	560
ERA04046	12:05:50	39.87	54'26.78	3' 25	203	71.4	77	12.1	14.6	668
ERA04047	12:06:08	72.54	54'27.03	3'25.33	118	39.9	32.2	11.6	7.5	371
ERA04047	12:06:24	50.27	54'27.28	3'25.78	182	58.7	70.4	12.4	11.1	574
ERA04048	12:06:41	77.32	54'27.43	3'26.35	155	53.8	48.8	10.6	9.7	477
ERA04048	12:06:58	113.3	54'27.48	3'27.05	132	46	52.8	12.9	9.7	440
ERA04049	12:07:16	77.89	54'27.55	3' 27.7	126	47.5	47.7	10.5	10.7	414
ERA04049	12:07:33	76.02	54'27.65	3' 28.3	109	40.3	49.7	9.8	9	384
ERA04050	12:07:50	52.64	54'27.73	3'28.88	152	52.6	62.2	12.7	11	495
ERA04050	12:08:07	79.11	54'27.78	3'29.43	129	47.6	46.9	11	13.1	425
ERA04051	12:08:24	104.1	54'27.75	3'30.03	103	39.2	38.6	10.7	9.10	356
ERA04051	12:08:43	65.05	54'27.65	3'30.68	117	46.2	55.1	12.2	11.6	417
ERA04052	12:09:00	76.70	54'27.55	3'31.33	116	48.5	45.3	13.4	12.4	407
ERA04052	12:09:16	94.90	54'27.45	3'31.97	110	41.5	47	12.4	11.9	385

ERA04053	12:09:33	79.42	54'27.33	3'32.58	101	42.2	40.2	12.4	10.1	356
ERA04053	12:09:50	67.49	54'27.18	3'33.13	114	46.7	43.7	12.5	8.89	387
ERA04054	12:10:07	73.22	54'26.98	3' 33.2	142	48.8	54.6	12.1	13.9	461
ERA04054	12:10:25	66.27	54'26.73	3' 32.8	166	54.3	55.6	12.5	16.1	514
ERA04055	12:10:42	69.62	54'26.45	3'32.43	199	60.5	64.1	15.2	15.9	601
ERA04055	12:10:58	64.38	54'26.15	3'32.08	192	60.9	59.1	14.7	14.7	571
ERA04056	12:11:15	70.58	54'26.03	3' 31.7	205	57.5	59.3	16.8	13.1	607
ERA04056	12:11:34	71.70	54'26.08	3' 31.3	147	48.5	41.6	12.2	10.1	436
ERA04057	12:11:51	65.74	54' 26.2	3' 30.9	134	47.2	46.7	13.2	10.9	417
ERA04057	12:12:07	53.61	54' 26.4	3' 30.5	137	48.6	53.1	12.5	15.1	454
ERA04058	12:12:25	63.83	54'26.55	3'30.13	134	53.8	60.2	15.2	15.2	478
ERA04058	12:12:42	61.58	54'26.65	3'29.78	133	46.6	49.3	13.5	11.2	418
ERA04059	12:12:59	65.87	54'26.63	3'29.38	112	42.5	45.3	12.4	11.3	392
ERA04059	12:13:15	62.73	54'26.48	3'28.93	157	60.2	64.1	16.5	15.3	534
ERA04060	12:13:32	68.70	54' 26.3	3'28.55	156	53.2	51.1	12.9	11.5	503
ERA04060	12:13:49	71.37	54' 26.1	3'28.25	211	93.4	90.1	13.5	13.8	805
ERA04061	12:14:06	85.16	54'25.88	3'28.08	155	58.2	62.1	14.3	10.7	539
ERA04061	12:14:23	65.34	54'25.63	3'28.03	131	48.5	42.9	9.8	9.7	434
ERA04062	12:14:40	65.72	54'25.35	3' 28.1	135	45.3	43.9	10.4	8.2	421
ERA04062	12:14:56	75.91	54'25.05	3' 28.3	154	58.2	56.3	11.6	10.8	506
ERA04063	12:15:13	79.78	54'24.78	3' 28.5	125	48.6	47.5	10.9	10	427
ERA04063	12:15:30	62.42	54'24.53	3' 28.7	130	49.9	52.6	13.1	12.5	448
ERA04064	12:15:47	69.55	54'24.28	3'28.85	116	43.5	43.2	11.3	10	393
ERA04064	12:16:03	71.43	54'24.03	3'28.95	125	39.5	45.3	9.60	9	398
ERA04065	12:16:21	75.29	54'23.78	3' 28.9	166	50	48.4	13.1	11.3	492
ERA04065	12:16:37	67.75	54'23.53	3' 28.7	137	44.9	53.6	12.5	9.5	442
ERA04066	12:16:54	71.94	54'23.28	3'28.58	128	41.7	43.3	12.7	9.39	405
ERA04066	12:17:10	74.46	54'23.03	3'28.53	138	41.1	41.1	10.9	8.89	418
ERA04067	12:17:28	60.41	54'23.03	3'28.58	105	31.2	34.6	9.39	7.4	332
ERA04067	12:17:46	60.30	54'23.28	3'28.72	181	47.6	51.7	12.3	8.60	528
ERA04068	12:18:03	67.31	54'23.55	3'28.93	190	55	62.4	14.1	13.3	574
ERA04068	12:18:19	71.30	54'23.85	3'29.18	162	44.4	45.7	12.1	10.9	471
ERA04069	12:18:36	69.17	54'24.13	3'29.53	171	46.2	45.4	10.8	8.89	475
ERA04069	12:18:52	66.01	54'24.38	3'29.98	185	48.4	48.6	11.5	10.1	525
ERA04070	12:19:10	70.74	54'24.63	3'30.33	276	65.9	76	15	14.7	755
ERA04070	12:19:26	74.53	54'24.88	3'30.58	251	58.2	61.9	14.2	15.1	711
ERA04071	12:19:44	71.72	54'25.13	3' 30.9	223	49.9	52.5	14.5	12.5	603
ERA04071	12:20:00	73.43	54'25.38	3' 31.3	210	59.4	62	16.8	13.1	618
