

Perfect procedure with my kit to detect meteors at LRO 16/12/2023:

After much iterative attempts to get this working, the following seems to work best, and was very effective during Geminids Dec 2023:

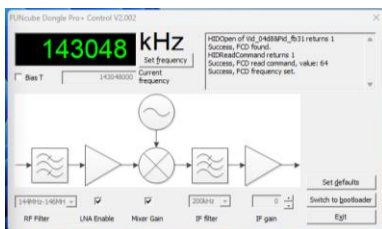
- FUNCube Dongle Pro Plus
- Moon aerial made by Bill Watson pointed SE horizontal-ish 45 degrees down on two poles above shed.
- Spectrum Lab Software.

Key Messages:

- *IN COLORGRAMME SELECT LIVE-SPECTRUM LAB*
- *DO NOT FORGET TO TICK CYCLICAL BOX UNDER COND ACTIONS SPECTRUM LAB.txt*
- *SELECT 143048KHZ IN FUNCUBE CONTROL SOFTWARE & LEAVE RUNNING – this frequency leads to meteors on screen whereas 148050 leads to large central continuous peak.*
- *OBS Studio needs to run for live YouTube stream.*
- *Finally fill screen with Spectrum Lab so it appears in YouTube stream.*

1. Setting frequency on FUNCube Dongle Pro+ Control V2.002 Programme:

148.048MHz set on FunCube Dongle frequency programme do not tick bias tee.



Do NOT close or minimise this box.

2. Run Spectrum Lab

Settings on Spectrum Lab:

SpecLab Configuration and Display Control

TRX Control | Memory | Filenames | Audio Files | Markers | System | Freq-Resp

Spectrum (1) | .. (2) | .. (3) | .. (4) | Radio DF | FFT | Audio I/O | AD/DA Server

Input Device / Stream / Driver
 0 Line (FUNcube Dongle V2.0) ...
 params: [?] other sources >>
 Ctrl [?] other destinations >>
 timeout/ms 500 latency/ms 0

Output Device / Pipe / Driver
 .1 ...
 params: [?] other destinations >>
 Ctrl [?] other destinations >>
 Output latency comp. 0 ms

16 bits/sample
 1 input chns 1 output chns
[I/O input adjustment...](#)

Audio Processing
 Nominal Sample Rate (in) 11025
 decimate input SR by 1
 Resample.. [nothing (don't resample)]
 Sample Rate Calibration Table [Hz]

Nominal	Input calib	Output calib
5512	5512.000	5512.000
8000	8000.000	8000.000
11025	11025.000	11025.000
12000	12000.000	12000.000
16000	16000.000	16000.000
22050	22050.000	22050.000
24000	24000.000	24000.000
32000	32000.000	32000.000
44100	44100.000	44100.000
48000	48000.000	48000.000
96000	96000.000	96000.000
192000	192000.000	192000.000
unused		
unused		
unused		

resample to nominal output S.R.
 use different sample rate for output :
 nominal: 11025 S/s
 Resampling quality: medium
 minimize latency (use small buffers)

Samplerate Calibrator
 Correct Frequency
 Displayed Frequency
 Calibrate Input SR
 Calibrate Output SR
 Continuous Calib...
[? about SR calib.](#)

Warning: Audio output device name doesn't match any of the detected devices. Shown: Settings for Analyser 1, channel 1 (L)
 Apply Close Help

SpecLab Configuration and Display Control

TRX Control | Memory | Filenames | Audio Files | Markers | System | Freq-Resp

Spectrum (1) | .. (2) | .. (3) | .. (4) | Radio DF | FFT | Audio I/O | AD/DA Server

Vertical Frequency Axis
 double-width waterfall lines
 optimum waterfall average
 triggered Spectrum [more...](#)
 peak detecting cursor
 emphasize MIN+MAX values
 show spectrum as bargraph
 show Radio Station List
 clear non-buffered WF area

Amplitude Grid (dB or %) Show: 3D Spectrum
 one pixel per FFT bin
 multi strip WF, 100 pix/strip
 non scrolling WF
 peak holding graph, hold time (s): 5
 long-term average_clr, half life (min): 0
 don't redraw WF after modifying settings

+ amplitude bar
 Maths: none
 Spectrum graph area (pix) 100
 resize by dragging f-scale
[Channels / Connections \(1\) ...](#)

Waterfall Scroll Interval
 185 ms sec min
 automatic: 75 % overlap
 smooth scroll, high CPU load

Waterfall Time Grid
 enabled Interval: 60 sec min automatic
 Style: dotted lines user-defined time label format:
 Labels: hour:min:sec YYYY-MM-DD hh:mm:ss

[More spectrum display settings on the next >>](#) and on the ["Radio Direction Finder" tab >>>](#)

Warning: Audio output device name doesn't match any of the detected devices. Shown: Settings for Analyser 1, channel 1 (L)
 Apply Close Help

SpecLab Configuration and Display Control

TRX Control | Memory | Filenames | Audio Files | Markers | System | Freq-Resp

Spectrum (1) | .. (2) | .. (3) | .. (4) | Radio DF | FFT | Audio I/O | AD/DA Server

Amplitude Range & Spectrogram Options

Range: -100.625 - -65 dB

Offset: 0 -> 0 dB
(expression) (calculated)

individual range/contrast/brightness per chnl

Visual AGC: off Ref: -100 dB

Special display options

show REMOTE spectrum (via CI-V)

"stereo-color" waterfall for dual input

show correlation [...more](#)

show labels like Ch1, Ch2, Correlation

TIME-reassigned spectrogram display

FREQUENCY-reassigned display

Options for the Frequency Axis

grid in graph

grid in waterfall ... dotted

Split frequency scale

Logarithmic LSB mirror

place freq scale on "other" side

Frequency scale style: Ruler

Fixed size (0=auto): 0 pixel

Radio Freq Offset [Hz]: 0.0

Spectrum display widths [percent along freq.-scale]

Ch1	Ch2	Ch3	Ch4	Correlation
50	0	0	0	33

[See also: amplitude calibration](#)

[<< Basic display settings on the previous tab](#) [Spectrum Colours and Trigger Options >>>](#)

Warning: Audio output device name doesn't match any of the detected devices.

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Apply Close Help

SpecLab Configuration and Display Control

TRX Control | Memory | Filenames | Audio Files | Markers | System | Freq-Resp

Spectrum (1) | .. (2) | .. (3) | .. (4) | Radio DF | FFT | Audio I/O | AD/DA Server

Options for Triggered Spectrogram

triggered spectrum

controls: one LINE in spectrogram

The trigger input can be configured in the [circuit window](#) (set source, level, threshold, ...)

Averages (one per line): 0 Reset

Fonts

Freq. scale: Courier New, 8 pt

Waterfall: Arial, 8 pt

Spec. graph: Arial, 8 pt

Display Colours / Pens

Spectrum graph background

Pen 1 Pen 2 Pen 3 Pen 4 Pen 5

Pen 6 Pen 7 Pen 8 width: 0 pixel

Radio Station Frequency Markers

Frequency scale background

Frequency scale foreground

Amplitude bar background

Waterfall background

Waterfall grid

Spectrum graph grid transparent

Wf. Label Text transparent

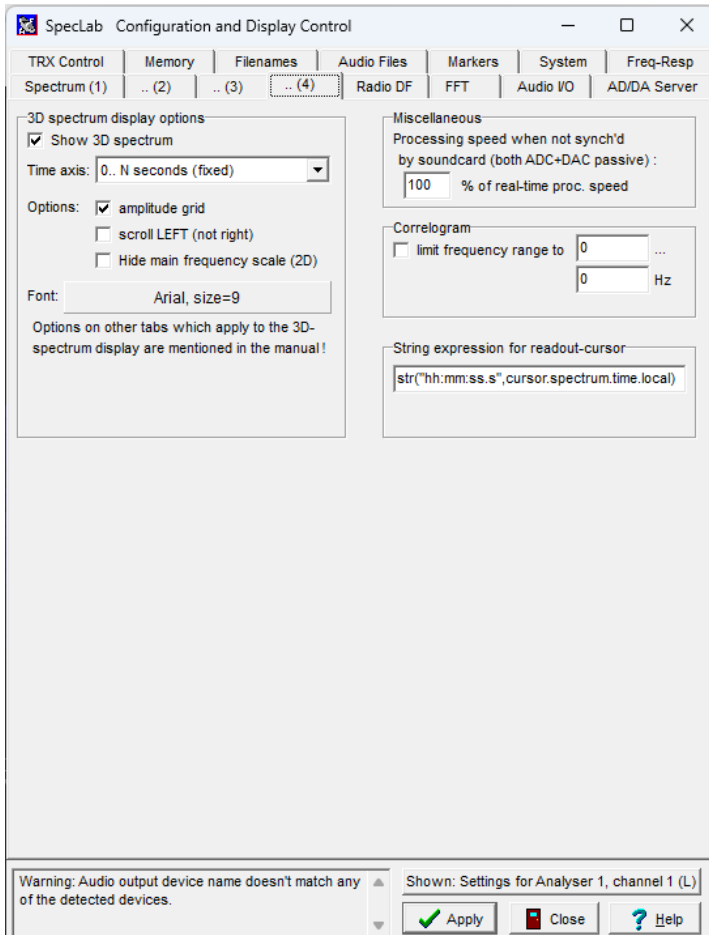
Cursor Text transparent

[<< more display settings on previous tab](#)

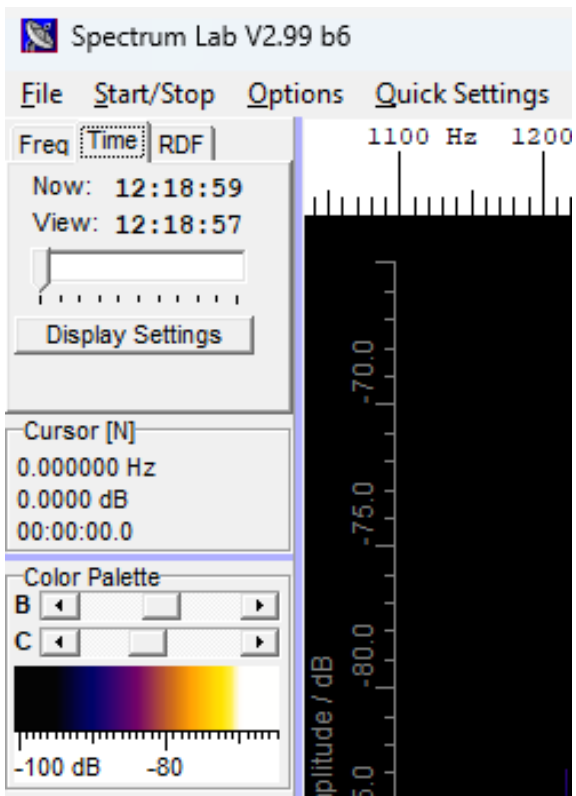
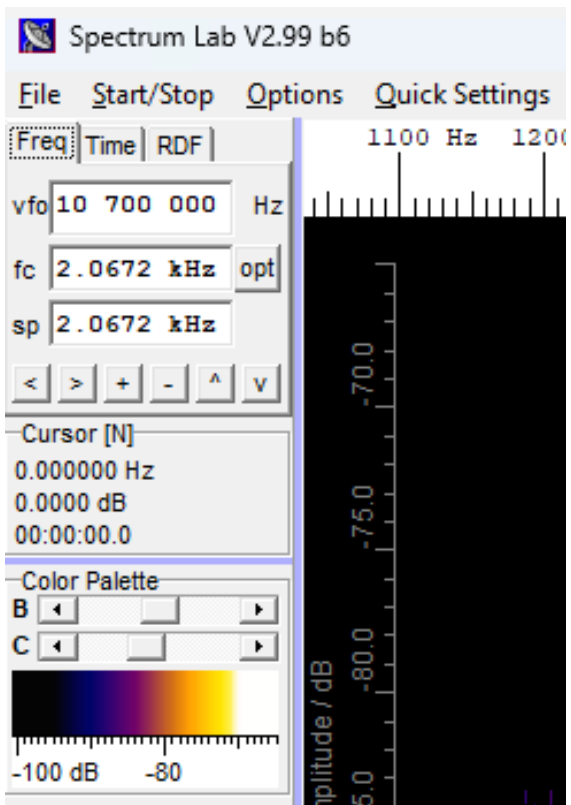
Warning: Audio output device name doesn't match any of the detected devices.

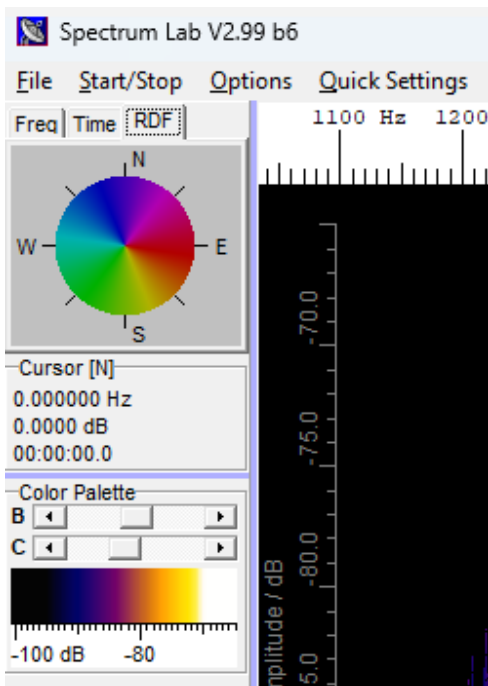
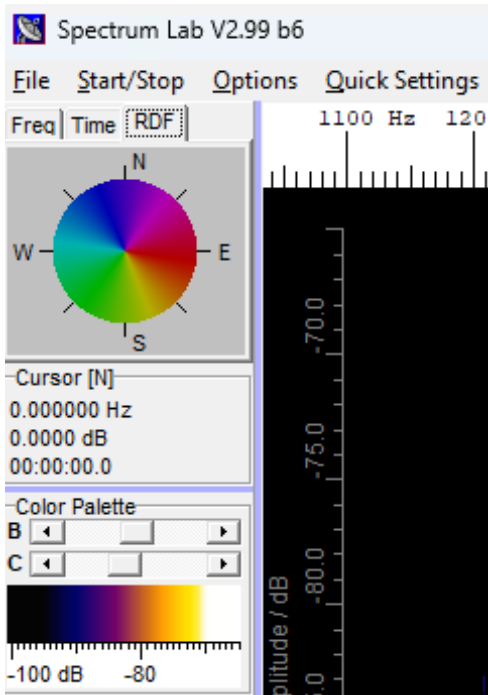
Shown: Settings for Analyser 1, channel 1 (L)

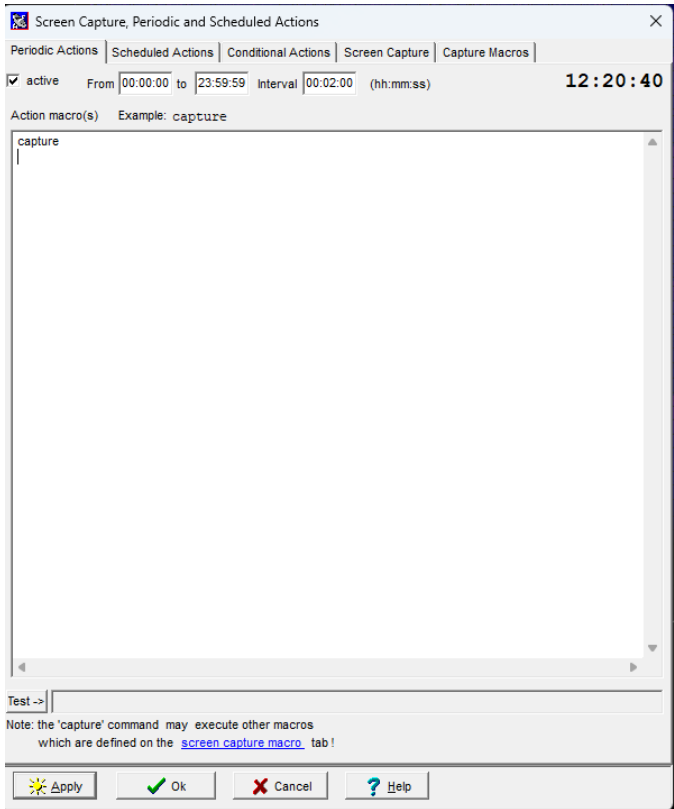
Apply Close Help



Set 3D display and on sliders on screen tick arrow to remove high signal on left and to display values as per screenshots below:

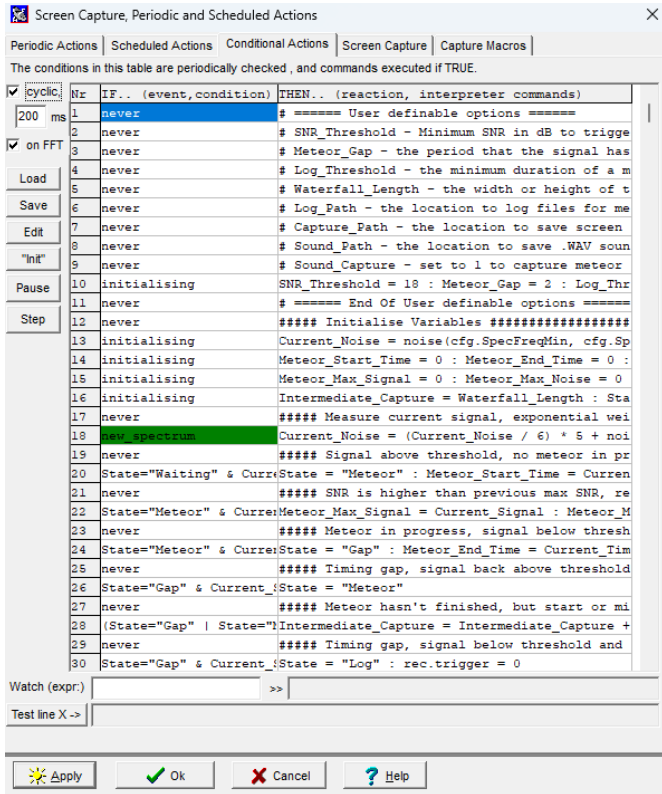






<Conditional actions> settings under <file> see below – note that <Cyclic> has been ticked – annoyingly this automatically gets unticked when Spectrum Lab restarted and data not collected unless ticked. I have lost lots of data this way!

Also note SNR_Threshold = 18. This works well as of 16/12/2023 with FCD Pro+ and Moxon at LRO.



Conditional actions:

Make sure tick box at top of conditional actions box saying <cyclical> is ticked. I forgot to do this after computer crashed and restarted and lost 2 weeks data until I ticked it again!
Cyclical set to around 300ms as default is fine.

Here is copy of content of the effective .USR text file that defines the conditional actions:

; Exported "Conditional Actions" for Spectrum Lab

```
if( never ) then # ===== User definable options =====
if( never ) then # SNR_Threshold - Minimum SNR in dB to trigger an event, increase if noise is being
interpreted as meteors, reduce if meteors are not being logged
if( never ) then # Meteor_Gap - the period that the signal has to drop below the threshold to be
considered the end of a meteor event (in seconds)
if( never ) then # Log_Threshold - the minimum duration of a meteor event that will be logged (in
seconds)
if( never ) then # Waterfall_Length - the width or height of the waterfall display in seconds, subtract
20% to be sure of screenshot containing start and end of events
if( never ) then # Log_Path - the location to log files for meteor events (remember to double escape
backslashes, including trailing backslash)
if( never ) then # Capture_Path - the location to save screen captures of meteor events (format as
above)
if( never ) then # Sound_Path - the location to save .WAV sound capture of meteor events (format as
above)
if( never ) then # Sound_Capture - set to 1 to capture meteor sounds, 0 to disable sound capture
if( initialising ) then SNR_Threshold = 18 : Meteor_Gap = 2 : Log_Threshold = 0.05 : Waterfall_Length
= 30 : Log_Path = "c:\spectrum\logs\\" : Capture_Path = "c:\spectrum\captures\\" : Sound_Path =
"c:\spectrum\sounds\\" : Sound_Capture = 1
if( never ) then # ===== End Of User definable options =====
if( never ) then ##### Initialise Variables
#####
#####
if( initialising ) then Current_Noise = noise(cfg.SpecFreqMin, cfg.SpecFreqMax) * 6 : Current_Signal =
peak_a(cfg.SpecFreqMin, cfg.SpecFreqMax): Current_Signal = 0 : Current_SNR = 0 :
Current_Peak_Frequency = 0 : Current_Time = 0
if( initialising ) then Meteor_Start_Time = 0 : Meteor_End_Time = 0 : Daily_Meteor_Count = 0 :
Midnight_Flag = 0 : Hourly_Meteor_Count = 0 : Hourly_Meteor_Duration = 0 :
Hourly_Meteor_Longest = 0 : Hourly_Flag = 0 : Logging = 1 : Capture_Time = 0
if( initialising ) then Meteor_Max_Signal = 0 : Meteor_Max_Noise = 0 : Meteor_Max_SNR = 0:
Meteor_Max_Peak = 0 : Meteor_Count = 0
if( initialising ) then Intermediate_Capture = Waterfall_Length : State = "Waiting" : Queued = 0
if( never ) then ##### Measure current signal, exponential weighted average of noise and peak
frequency after each FFT calculation #####
if( new_spectrum ) then Current_Noise = (Current_Noise / 6) * 5 + noise(cfg.SpecFreqMin,
cfg.SpecFreqMax) : Current_Signal = peak_a(cfg.SpecFreqMin, cfg.SpecFreqMax) :
Current_Peak_Frequency = peak_f(cfg.SpecFreqMin, cfg.SpecFreqMax) : Current_SNR =
Current_Signal - (Current_Noise / 6) : Current_Time = time
if( never ) then ##### Signal above threshold, no meteor in progress so start of new meteor event
#####
```



```

if( State="Waiting" & Current_SNR>=SNR_Threshold ) then State = "Meteor" : Meteor_Start_Time =
Current_Time : rec.filename = Sound_Path + "event" + str("YYYYMMDD", now) + "_" + str("hhmmss",
now) + "_" + str(Daily_Meteor_Count + 1) + ".wav"
if( never ) then ##### SNR is higher than previous max SNR, record new max (subtraction gives SNR
in dB) #####
if( State="Meteor" & Current_SNR>=Meteor_Max_SNR ) then Meteor_Max_Signal = Current_Signal :
Meteor_Max_Noise = (Current_Noise / 6) : Meteor_Max_Peak = Current_Peak_Frequency :
Meteor_Max_SNR = Current_SNR : rec.trigger = Sound_Capture
if( never ) then ##### Meteor in progress, signal below threshold so start timing gap in case of short
break in meteor signal #####
if( State="Meteor" & Current_SNR<SNR_Threshold ) then State = "Gap" : Meteor_End_Time =
Current_Time
if( never ) then ##### Timing gap, signal back above threshold so resume current meteor event
#####
if( State="Gap" & Current_SNR>=SNR_Threshold ) then State = "Meteor"
if( never ) then ##### Meteor hasn't finished, but start or middle of event needs to be captured
before it scrolls off #####
if( (State="Gap" | State="Meteor") & (Current_Time - Meteor_Start_Time)>=Intermediate_Capture
& Logging ) then Intermediate_Capture = Intermediate_Capture + Waterfall_Length :
capture(Capture_Path + "event" + str("YYYYMMDD", now) + "_" + str("hhmmss", now) + "_" +
str(Daily_Meteor_Count + 1) + ".jpg", 100)
if( never ) then ##### Timing gap, signal below threshold and gap duration exceeded so log meteor
event #####
if( State="Gap" & Current_SNR<SNR_Threshold & (time - Meteor_End_Time)>=Meteor_Gap ) then
State = "Log" : rec.trigger = 0
if( never ) then ##### Log last meteor event
#####
#####
if( State="Log" & (Meteor_End_Time - Meteor_Start_Time)>=Log_Threshold & Logging ) then
Daily_Meteor_Count = Daily_Meteor_Count + 1 : Hourly_Meteor_Count = Hourly_Meteor_Count + 1
: Hourly_Meteor_Duration = Hourly_Meteor_Duration + (Meteor_End_Time - Meteor_Start_Time)
if( continuation ) then sp.print("                    Event: ", str(Daily_Meteor_Count), " Dur: ",
str(Meteor_End_Time - Meteor_Start_Time) + "s", " Time: ", str("hh : mm : ss", Meteor_Start_Time))
if( continuation ) then Queued = Queued + 1 : queue_event(now + max(1, (Waterfall_Length -
(Meteor_End_Time - Meteor_Start_Time))), 0)
if( continuation ) then fopen(Log_Path + "event_log_" + str("YYYYMM", Meteor_Start_Time) +
".csv",a,r)
if( continuation ) then fp(str("YYYY/MM/DD",Meteor_Start_Time) + "," +
str("hh:mm:ss",Meteor_Start_Time) + "," + str(Daily_Meteor_Count) + "," + str(Meteor_Max_Signal)
+ "," + str(Meteor_Max_Noise) + "," + str(Meteor_Max_SNR) + "," + str(Meteor_Max_Peak) + "," +
str(Meteor_End_Time - Meteor_Start_Time))
if( continuation ) then fclose
if( never ) then ##### Reset and wait for next meteor event
#####
#####
if( State="Log" & Hourly_Meteor_Longest<(Meteor_End_Time - Meteor_Start_Time) ) then
Hourly_Meteor_Longest = (Meteor_End_Time - Meteor_Start_Time)
if( State="Log" ) then Intermediate_Capture = Waterfall_Length : Meteor_Max_Signal = 0 :
Meteor_Max_Noise = 0 : Meteor_Max_SNR = 0 : Meteor_Max_Peak = 0
if( continuation ) then State = "Waiting"

```

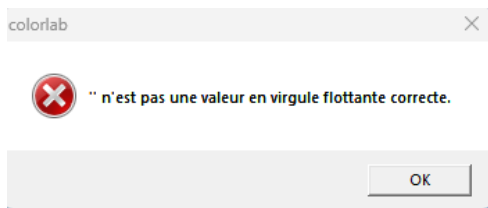
```

if( never ) then ##### Capture a screenshot of the display at end of event (see also Screen Capture
tab) #####
if( queued_event ) then capture(Capture_Path + "event" + str("YYYYMMDD", now) + "_" +
str("hhmmss", now) + "_" + str(Daily_Meteor_Count - Queued + 1) + ".jpg", 100)
if( continuation ) then Queued = Queued - 1
if( never ) then ##### Increment the hourly flag (this will happen multiple times during the last five
seconds of the hour) #####
if( str("mmss", Current_Time)="5955" ) then Hourly_Flag = Hourly_Flag + 1
if( never ) then # If the hourly flag has just been triggered, log and then reset the meteor count to
zero for the new hour, if the hourly flag has been triggered already, do nothing
if( Hourly_Flag=1 ) then fopen2(Log_Path + "hourly_log_" + str("YYYYMM", Current_Time) +
".csv",a,r)
if( continuation ) then fp2(str("YYYY/MM/DD", Current_Time) + "," + str("hh", Current_Time) + "," +
str(Hourly_Meteor_Count))
if( continuation ) then fclose2
if( continuation ) then fopen4(Log_Path + "RMOB-" + str("YYYYMM", Current_Time) + ".dat",a,r)
if( continuation ) then fp4(str("YYYYMMDDhh", Current_Time) + "," + str("hh", Current_Time) + "," +
str(Hourly_Meteor_Count))
if( continuation ) then fclose4
if( continuation ) then fopen5(Log_Path + "RMOB_Dur-" + str("YYYYMM", Current_Time) + ".dat",a,r)
if( continuation ) then fp5(str("YYYYMMDDhh", Current_Time) + "," + str("hh", Current_Time) + "," +
str(Hourly_Meteor_Count) + "," + str(Hourly_Meteor_Duration) + "," + str(Hourly_Meteor_Longest)
+ "," + str(Current_Noise))
if( continuation ) then fclose5
if( continuation ) then Hourly_Meteor_Count = 0 : Hourly_Meteor_Duration = 0 :
Hourly_Meteor_Longest = 0
if( never ) then # If the current time is on the hour, reset the hourly flag ready to trigger again at the
end of the next hour
if( str("mmss", Current_Time)="0000" ) then Hourly_Flag = 0
if( never ) then ##### Increment the midnight flag (this will happen multiple times during the last
fice seconds of the day) #####
if( str("hhmmss", Current_Time)="235955" ) then Midnight_Flag = Midnight_Flag + 1
if( never ) then # If the midnight flag has just been triggered, log and then reset the meteor count to
zero for the new day, if the midnight flag has been triggered already, do nothing
if( Midnight_Flag=1 ) then fopen3(Log_Path + "daily_log_" + str("YYYYMM", Current_Time) +
".csv",a,r)
if( continuation ) then fp3(str("YYYY/MM/DD", Current_Time) + "," + str(Daily_Meteor_Count))
if( continuation ) then fclose3
if( continuation ) then Daily_Meteor_Count = 0
if( never ) then # If the current time is midnight, reset the midnight flag ready to trigger again at the
end of the next day
if( str("hhmmss", Current_Time)="000000" ) then Midnight_Flag = 0
if( never ) then #####
#####
#####
if( never ) then # TODO: upload to web site? auto image display online, auto generate colourgramme
via web.

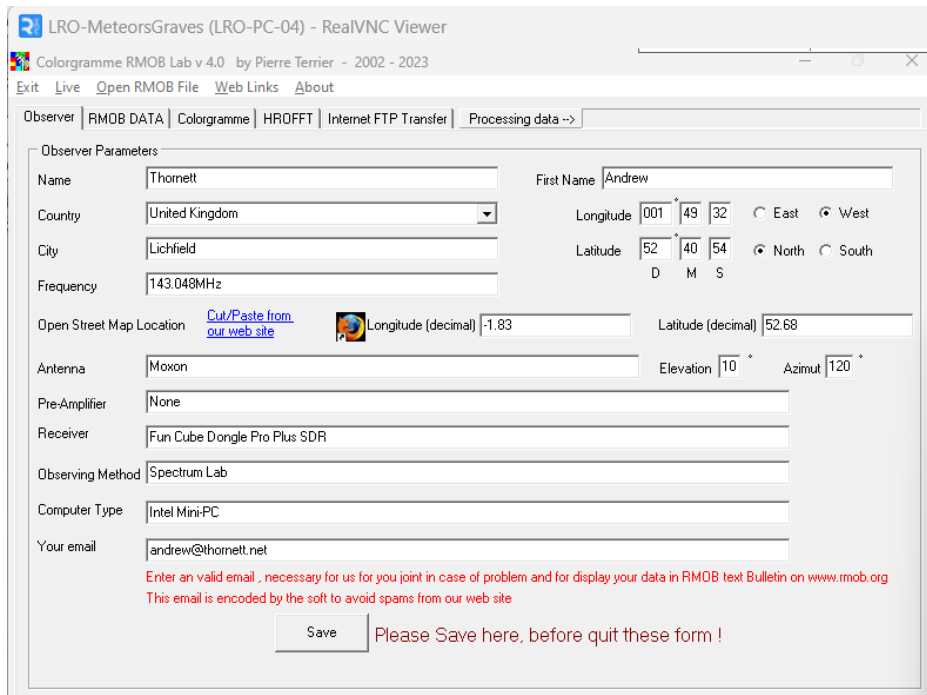
```

3. Run Colorgramme:

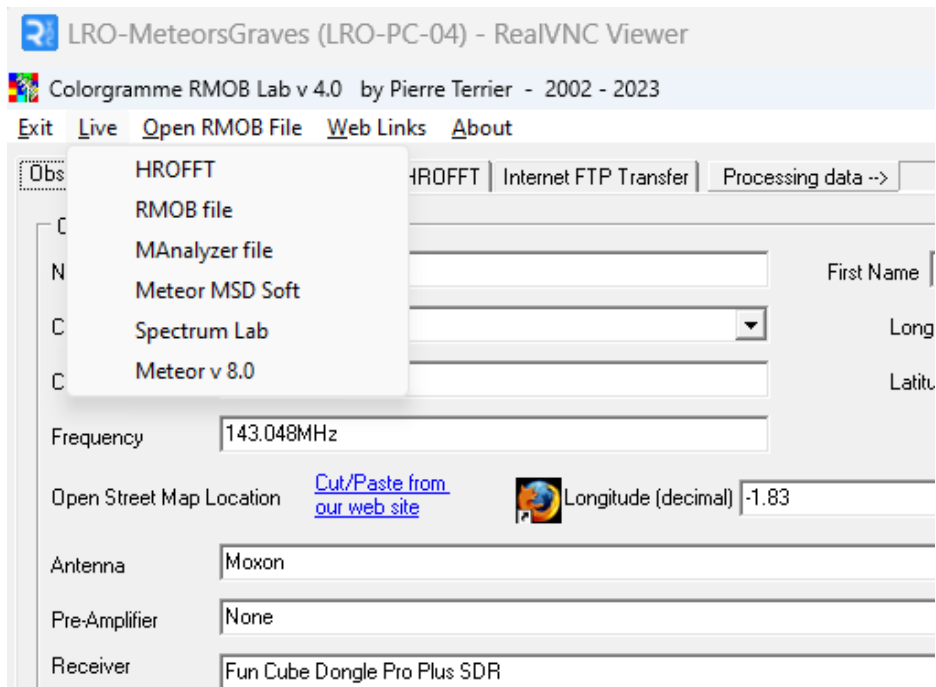
When Colorgramme opens, the following error appears which you can just click <OK> on – it is telling you that source of data not set – we are going to sort that out next:



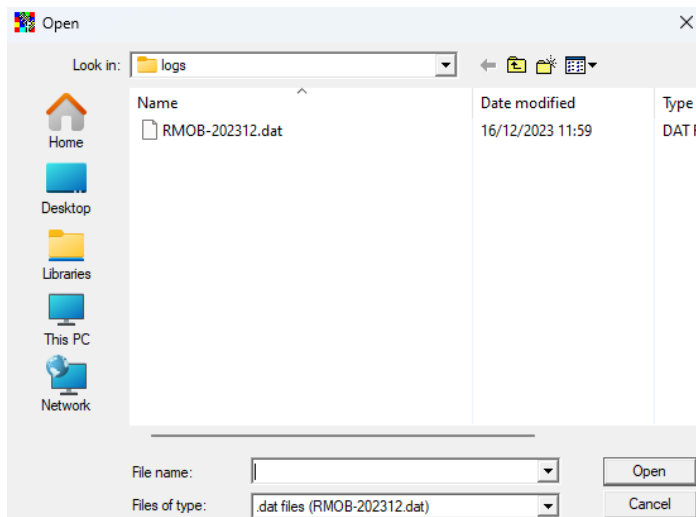
The following screen appears – ignore red text – email already entered:



Click on <Live> next to <Exit> at top to get this drop down menu:



Click on <Spectrum Lab> and then select whatever RMOB .dat file appears, for example below:



Now this tab should open and the red circle next to text <Live Spectrum Lab> should be slowly flashing to indicate data is being collected, and software is working properly.

Do NOT close Colorgramme or minimise it.