

Quick start guide for processing DV-AVI video files and detecting lunar impacts with LunarScan

This document does not necessarily describe LunarScan in vast detail but is more a step by step guide to getting started with processing your video for lunar impact detection and viewing the results of the data file of detected events (such as cosmic rays, bugs, planes, meteors, satellites, scintillating stars and more).

You need to be computer literate and must have a working knowledge of recording AVI files on a computer. You will also need loads of free disk space. Reading the LunarScan User's Guide will only help you as this is by no means a substitute. This is merely a cheat sheet. Another assumption is that the video camera and optics used provide an adequate signal to process.

Ideally, you must record your video or live camera feed to a DV-AVI file, 720x480 at a rate of 30 frames per second (or PAL equivalent). This equates to **12 GB of disk space per hour**. See the LunarScan User's Guide for additional information.

1) Split the large AVI file into 1GB segments (this will also use 12GB of disk space per hour of video)

Run VirtualDub

Open the AVI file

Select menu item "**Video**" and then select "**Direct Stream Copy**"

Select menu item "**File**" and then select "**Save Segmented AVI...**"

For the setting "**Limit number of video frames per segment:**" Type in **1000**

For the setting "**File Segment size limit in MB (50-2048)**" Type in **8000**

Type in a base file name and click the "**Save**" button. VirtualDub will split the big AVI into smaller files adding a number series and extension to the file name. An example would be naming the file "test_file". VirtualDub will save the segmented files as "test_file.00.avi, test_file.01.avi, test02_file.avi, etc..."

Within a few months, VirtualDub will no longer be needed. Code to process files larger than 1GB is being integrated and tested with a new version of LunarScan according to the author, Pete Gural.

2) Use LunarScan to analyze the split files

LunarScan needs to have two sub-directories named "AVIs" and "DATA" e.g.:

C:\LunarScan\AVIs C:\LunarScan\Data

Place the AVI files from VirtualDub into the LunarScan \AVIs folder or have VirtualDub save them to the folder when it is splitting the original file.

Due to the nature of the windows used, LunarScan will run best if you do not use other applications at the same time.

Run **LunarScan** and the main menu or start screen appears:

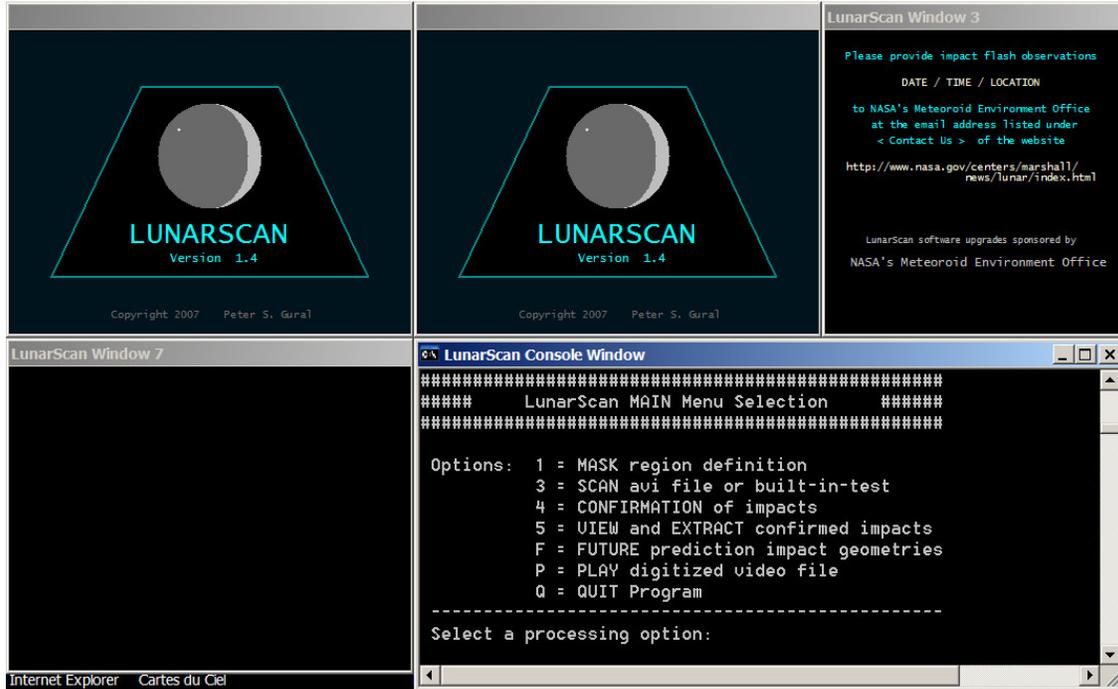


Figure 1

Initial setup is needed so that LunarScan processes the video correctly. You will need to block the Kiwi time stamp or it will trigger several detections a second. You can manually set up a region to process or alternatively, the whole frame can be processed which is set during the Scan (4) process mentioned later in the document.

Enter **1** for the “Mask region definition” screen.

On the next screen: type in **3** for DIGITIZED_AVI

Next entry: Is this a SPLIT AVI file (No=0, Yes=1): If the file was split up with VirtualDub and there is more than one file, **type 1, otherwise type in 0** if there is only one file to process (LunarScan will not currently work with AVI files larger than 1GB)

Next entry: AVI file: **type in the base name of the file** without any numbers; for instance if the files are called "test_file.00.avi, test_file.01.avi, test02_file.avi..." type in "test_file" as the base file name and hit enter. You are now ready to use the keys displayed in the upper right panel, to set the mask and processing region. See Figure 2 below for details.

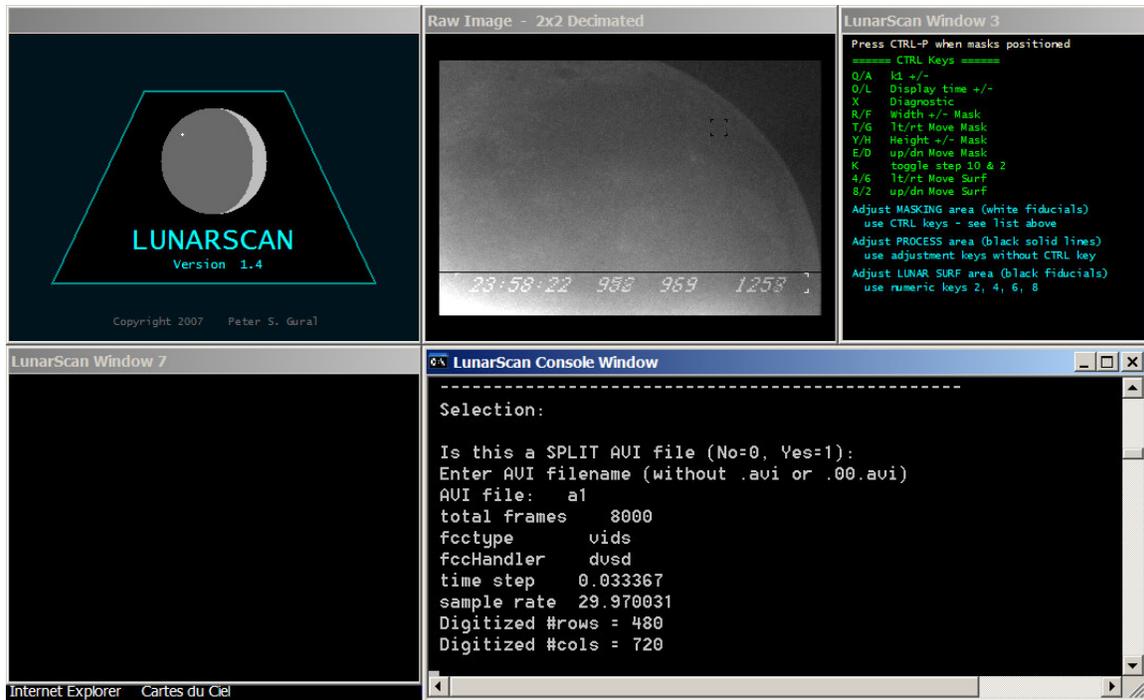


Figure 2

Mask region definition screen *after* entering the base file name

To set the processing area:

- R Increase the width of the processing region
- F Decrease the width of the processing region
- T Move the masking processing left
- G Move the masking processing right
- Y Decrease the height of the processing region
- H Increase the height of the processing region
- E Move the processing region down
- D Move the processing region up

To mask out the KIWI time stamp:

- CTRL-R Increase the width of the masking region
- CTRL-F Decrease the width of the masking region
- CTRL-T Move the masking region left
- CTRL-G Move the masking region right
- CTRL-Y Decrease the height of the masking region
- CTRL-H Increase the height of the masking region
- CTRL-E Move the masking region down
- CTRL-D Move the masking region up

Identify the Lunar Surface Region: Use these keys to move the "Lunar Surface Region" black square to a dark part of the moon. This region identifies the lunar surface so the background sky can be ignored by the application during processing.

- 4 Move the surface region left
- 6 Move the surface region right
- 2 Move the surface region down
- 8 Move the surface region up

Once you have set up the processing and masking regions and placed the lunar surface marker on a dark part of the moon, hit "**CTRL P**" to save the settings and return to the main menu.

Processing the video (refer to the main menu in Figure 1)

Type in "**3**" to **SCAN AVI File** and the screen below is displayed.

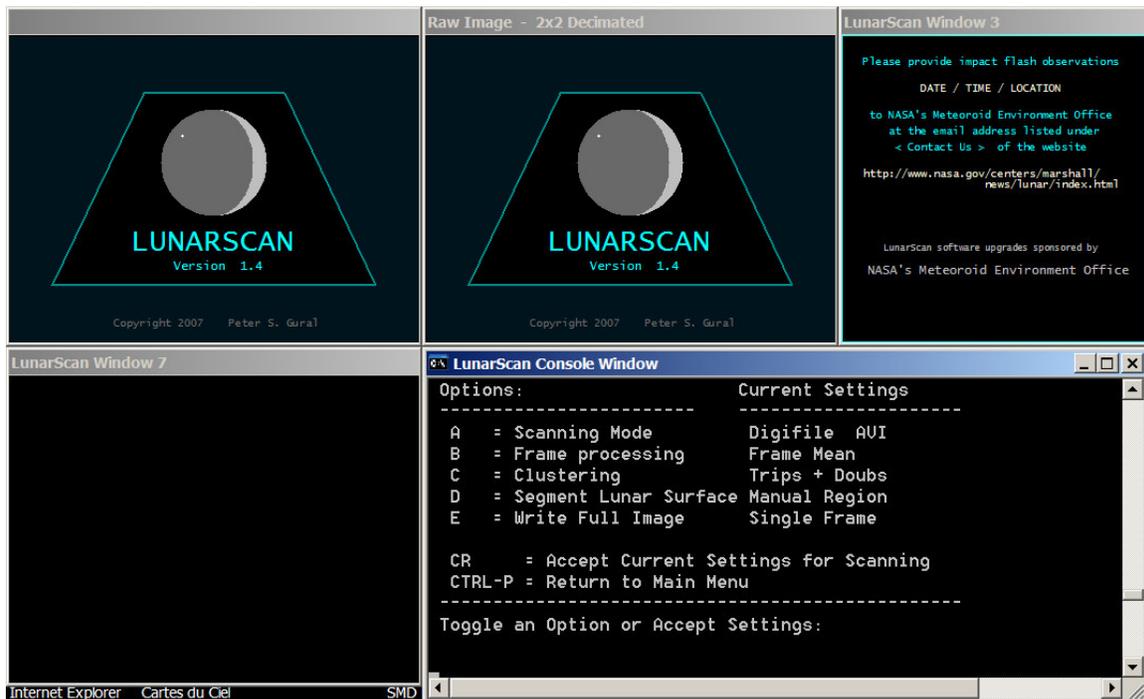


Figure 3

Use the "**B**" key to set the Frame Processing to "**Frame Mean**" or "**Register Mean**". See the LunarScan User's Guide for additional information.

Use the "**C**" key to set the Clustering to "**Trips + Pixel**" or "**Trips and Doubs**". Ideally, set it to "**Trips and Doubs**" to minimize the number of noise related detections. An impact is fat. Noise and cosmic rays are small.

Use the "**D**" key to set Segment Lunar Surface to "**Manual Region**". Change this to "**none**" if you want the whole screen analyzed and not the manually set region. Do not use the Histogram setting, it is not working properly.

Hit enter when done

Next entry - Is this a SPLIT AVI file (No=0, Yes=1): **type in 0 or 1**

Next entry - Enter AVI filename (without .avi or .00.avi): **type in an output file name to save the analysis to (do not include a file extension)**

Next entry - Enter some miscellaneous header information if you want

Next entry - **Enter the date/time in a specific format** e.g.: 12/17/2008 01:24:29

Next entry - **Hit enter** to run analysis. Processing may take a while and allow it to continue without interruption.

Adjusting the Detection Threshold:

If LunarScan detects several hits per minute, the detection threshold probably needs to be raised. Use the **CTRL Q keys to increase** the threshold. If no detections are occurring at all, use the **CTRL A key to decrease** the threshold. If you are detecting something every few minutes, it is probably set just right. I have found this setting to work best between 14 and 17 for my video system depending on the weather conditions, earth-shine illumination, camera settings, etc. Sloppy tracking or movement of your telescope from wind will cause detections. You will need to experiment with this setting for your particular system. It may take up to several seconds for LunarScan to readjust to a new threshold setting so change these settings slowly or give them time to settle out.

The text below was copied from the LunarScan documentation which you should read but is placed here for reference.

Once scanning is completed, you can view the resulting data

3) Viewing the results of processing

Run LunarScan and go to the main menu (Figure 1).

Enter **4** for "Confirmation of Impacts"

On the next screen hit Enter

Next entry: AVI file: **type in the base name of the file you output the data to** and hit enter

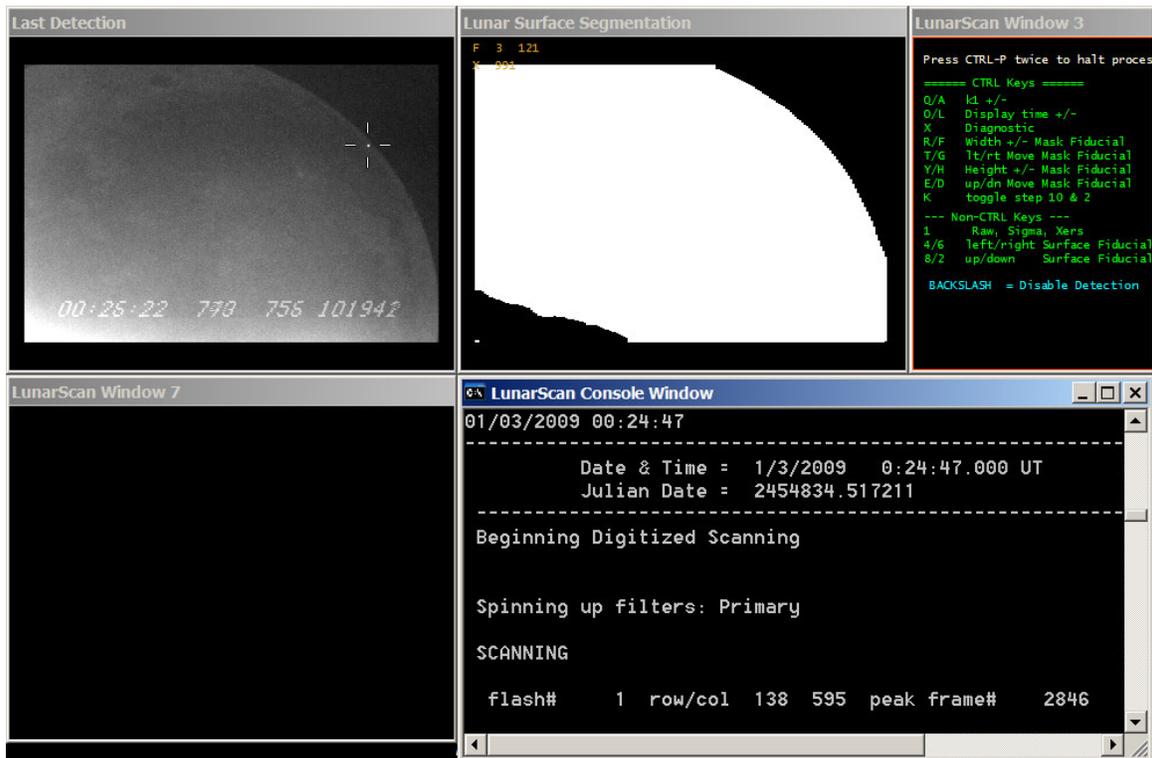
The screen will now display the first detection. Use the space key to cycle through the detections.

At this point, you should be able to decide which events to investigate further by researching them in the AVI files. The User Guide has information on how to save events to a log file.

Standard Deviation settings (Important)

Std dev factor for minimum median = 3.500000
 Std dev factor for maximum median = 15.000000

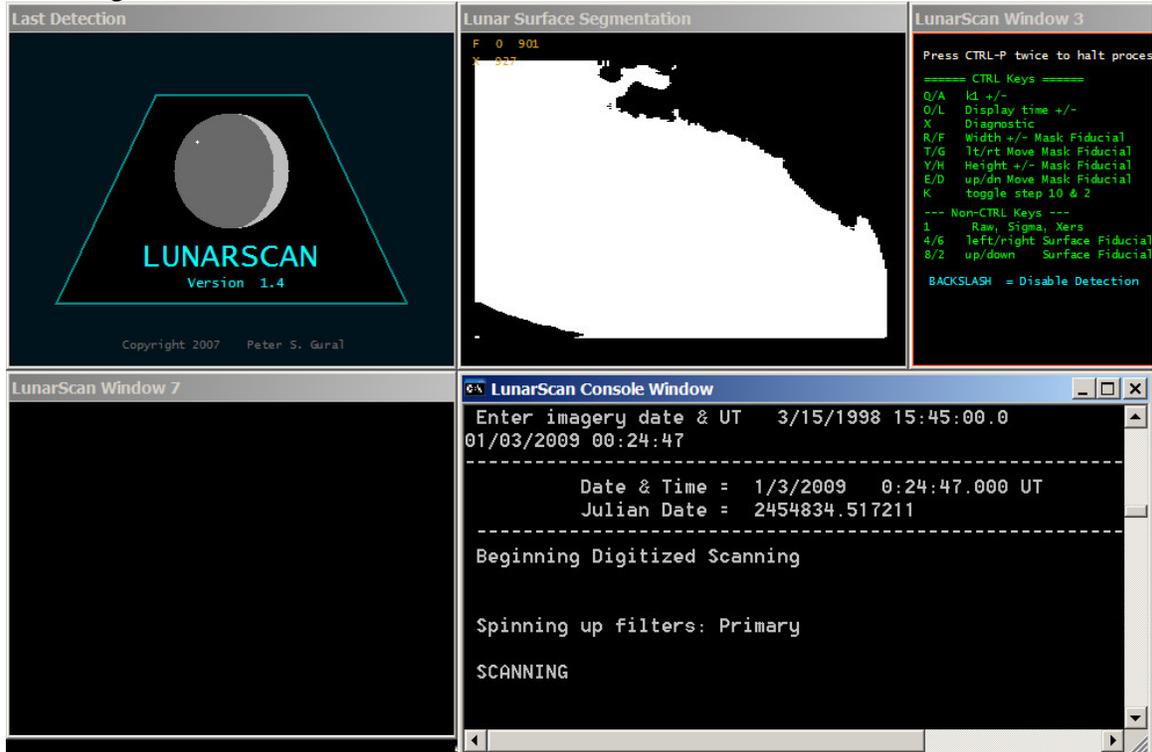
The two standard deviation settings in the **LUNARSCAN_SETTINGS.TXT** file may need to be adjusted for each video session, depending on the moon's brightness and contrast and the placement of the Lunar Surface Marker over the moon's surface. When scanning video, you must use the "1" key to cycle through the 4 view types that can be displayed. The third view setting should give you a view like the one below:



In the case of the above image, the Lunar Surface Marker sits over top of one of the darker mare regions and the settings used are Std dev factor for minimum median = 3.500000; Std dev factor for maximum median = 15.000000. Notice how the bottom left corner is omitted. Also notice the recorded event near the lunar limb.

Below is the same scan with the lunar surface marker placed over top of a medium illuminated portion of the (shadowed) lunar surface, using the same Std Dev settings. Notice how the area where the candidate event occurs is no longer being scanned. Also notice how the omitted region in the lower left corner is somewhat smaller in size.

Raising the Std dev factor for minimum median could correct this although that requires restarting.



The Std Dev settings can be altered a better response if needed. The Std dev factor for minimum median seems to alter the low end of the brightness scale and the Std dev factor for maximum median seems to alter the higher end. You should experiment with these settings during the scan to make sure the scan is going well.

In the case of the above image, raising the lower setting to 7.5 (or so) should cause the upper limb area to also be scanned but again, it requires restarting LunarScan where moving the lunar surface marker is easier.

The placement of the lunar surface marker is extremely important.

-end gv

Extracts from LunarScan 1.4 User Guide by Pete Gural

Frame Processing: The “frame mean” option keeps a running mean and standard deviation tied to the focal plane independent of any shifts occurring in the FOV. This is the fastest mode of operation but with higher false alarm rate so should be run with a higher k1 threshold (typically 14). The “registered mean” option registers each frame to align the mean and standard deviation estimate as well as the frame differencing. Currently this mode runs very slow but with a lower false alarm rate permitting lower thresholds nearer to k1=10 for fainter detection.

Clustering: Sets the clustering algorithms to search for exceedances that are three horizontal adjacent pixels, or to search for triplets that also have a single pixel two rows above or below, or to search for triplets that have an adjacent pair of exceedance pixels two rows above or below the triplet (recommended to lower false alarms).

Preparing the AVI file(s) on Hard Disk

Prior to execution start, the user must store a video sequence onto the hard disk of the processing computer. For digital video this is typically done by connecting a DV camcorder to an IEEE 1394 (firewire) port on the PC. Running a third party program such as Windows MovieMaker can then play the videotape in the camcorder and create an AVI format video file on the hard disk. Other software and/or video digitizing hardware/software may be used. It is recommended to store the video data in DV AVI format to avoid compression losses induced by switching from the data's native format (DV) as typically stored on the camcorder. Storing in an uncompressed format is also not recommended as this would use up 60 Gbytes for every hour of video.

Next, since the AVI file is most likely greater than 1 Gbyte in size, the file will need to be split into smaller chunks to permit use of the VFW interface. It is recommended to use VirtualDub for this processing step and a copy has been included on the distribution disk. Execute VirtualDub and open the AVI file. Set the "video" drop down menu to "direct stream copy". Set the "file" drop down to "save segmented AVI" and fill in the output filename and check the box for "limit number of video frames per segment.." while also entering the value 8000 frames. Press "save" and VirtualDub will split the file into a series of smaller AVI files, each with less than 1 Gbytes of data. The naming convention uses the name specified by the user with a concatenation of .00.avi, .01.avi, ... The *LunarScan* software will recognize this numbering sequence when running through the video.