# Dawn VIR .QUB Files: How to Open in ENVI

Version 3.0
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The following document describes the procedure to manually open Dawn VIR .QUB files using ENVI. At the end of the document is an IDL script that generates ENVI label files automatically and precludes the need to perform this task manually for each file.

1) Start ENVI (tested with ENVI 4.8) and from the main menu choose:
   File > Open Image File

   Navigate to and select the appropriate .QUB file.
   (Data end in *_1.QUB, quality control files end in *_1_QQ.QUB)
   (see section 6.1.3 in the VIR Software Interface Specification document)

2) In the version of ENVI that was tested (and this likely applies to older versions of ENVI), the program was not able to automatically read in the .QUB file. The following error message may appear:
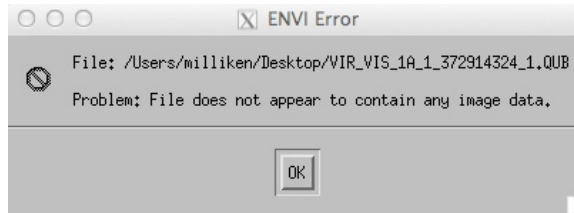
Click 'OK' and the following dialog window should appear:
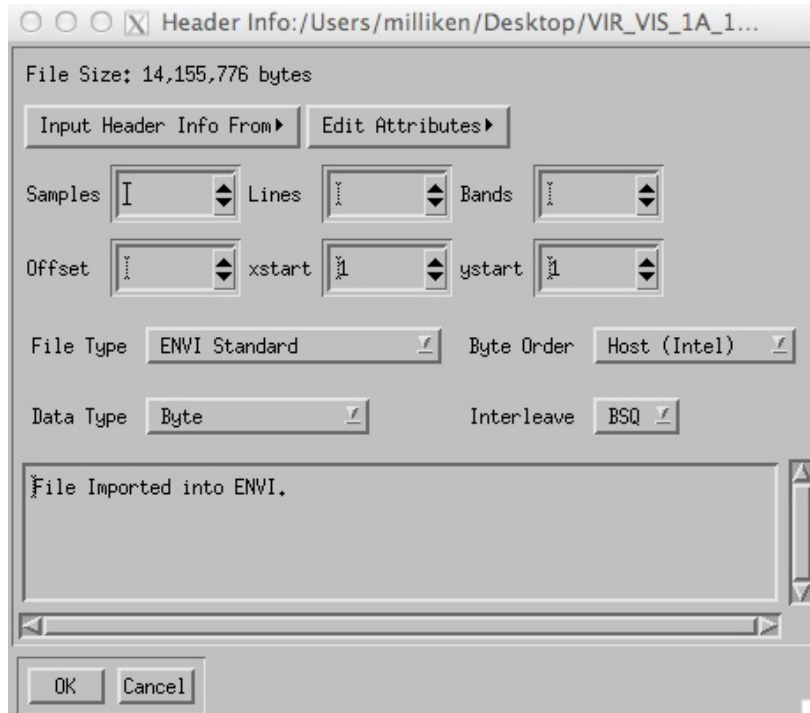
This window will be used to tell ENVI the dimensions of the data (lines, samples, bands, offset, data type, interleave, etc.). Once this information is entered correctly then ENVI should open the file in the correct manner.

The data dimensions are listed in the associated PDS label file.

3) Open the associated .LBL file in a text editor (Microsoft Word should also work). Scroll down to the following section:

Example for Level 1A EDR data (DN values):

```
/*    Standard cube Keywords */
AXES              = 3
AXIS_NAME         = ("BAND", "SAMPLE", "LINE")
CORE_ITEMS        = (432, 256, 64)
CORE_ITEM_BYTES   = 2
CORE_ITEM_TYPE    = "MSB_INTEGER"
```

Example for Level 1B RDR data (radiance values):

```
/*    Standard cube Keywords */
AXES = 3
AXIS_NAME = (BAND, SAMPLE, LINE)
CORE_ITEMS= (432, 256, 64)
CORE_ITEM_BYTES = 4
CORE_ITEM_TYPE = "IEEE_REAL"
```

These keywords contain the information you will need to fill out the dialog window shown above. In this example, the .QUB file has 432 bands, 256 samples, and 64 lines.

As of the writing of this document, the following values apply for the Dawn VIR data:

EDR data (Level 1A)

Interleave: BIP (band interleaved by pixel)
Byte order: MSB (in ENVI this is equivalent to 'Network IEEE')
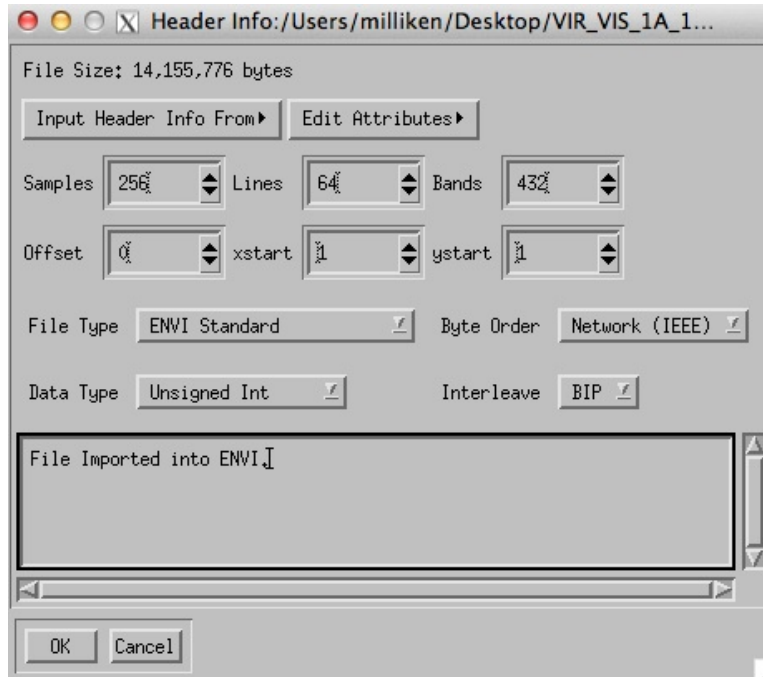**Data type:** 16-bit integer (i.e., Unsigned Int)

RDR data (Level 1B)

Interleave: BIP (band interleaved by pixel)

Byte order: IEEE (MSB; in ENVI this is equivalent to 'Network IEEE')
Data type: 32-bit real (i.e., Floating Point)

Using the above information for the EDR (Level 1A) example, the completed ENVI dialog window for this cube should appear as:


Click 'OK' and the .QUB file should open in ENVI and appear in the 'Available Bands List' window.

ENVI should now have created a new ENVI header file for this image (*.QUB.HDR).

Note that the wavelengths for each band will still need to be entered for the image. This can be done by choosing File > Edit ENVI Header from the main menu, selecting the file you just opened, and then choosing Edit Attributes > Wavelengths. Alternatively, you can cut and paste the wavelength information from the .LBL file into the ENVI .QUB.HDR header file.

An example ENVI header file for an EDR cube with VIR wavelength information is provided below.

Now that the cube is opened in ENVI it can be loaded as grayscale or RGB and spectral information can be extracted (example below). Note that the EDR cubes are in DN and the RDR files are in radiance, NOT I/F. None of the .QUB files are map-projected.
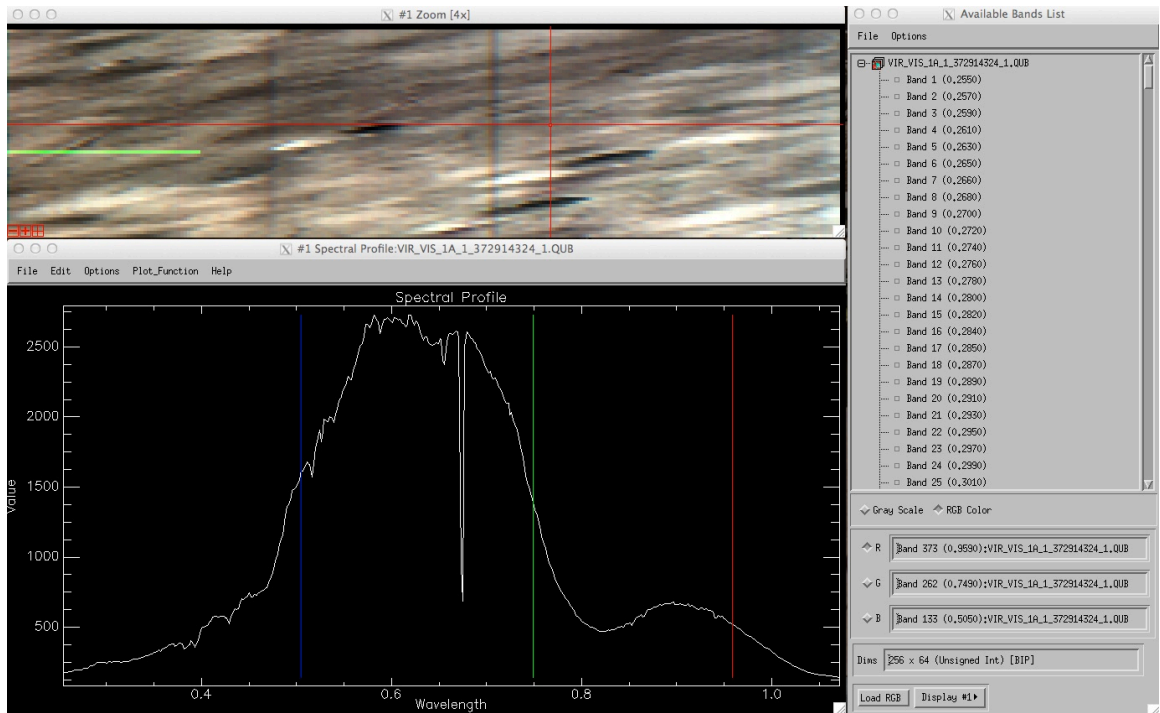
Example ENVI Header File (for EDR Level 1A .QUB file):

```
ENVI
description = {File Imported into ENVI.}
samples = 256
lines   = 64
bands   = 432
header offset = 0
file type = ENVI Standard
data type = 12
interleave = bip
sensor type = Unknown
byte order = 1
wavelength units = Micrometers
wavelength= {0.255, 0.257, 0.259, 0.261, 0.263, 0.265, 0.266, 0.268,
0.270, 0.272, 0.274, 0.276, 0.278, 0.280, 0.282, 0.284, 0.285, 0.287,
0.289, 0.291, 0.293, 0.295, 0.297, 0.299, 0.301, 0.302, 0.304, 0.306,
0.308, 0.310, 0.312, 0.314, 0.316, 0.318, 0.319, 0.321, 0.323, 0.325,
0.327, 0.329, 0.331, 0.333, 0.335, 0.336, 0.338, 0.340, 0.342, 0.344,
0.346, 0.348, 0.350, 0.352, 0.354, 0.355, 0.357, 0.359, 0.361, 0.363,
0.365, 0.367, 0.369, 0.371, 0.372, 0.374, 0.376, 0.378, 0.380, 0.382,
0.384, 0.386, 0.388, 0.389, 0.391, 0.393, 0.395, 0.397, 0.399, 0.401,
0.403, 0.405, 0.407, 0.408, 0.410, 0.412, 0.414, 0.416, 0.418, 0.420,
0.422, 0.424, 0.425, 0.427, 0.429, 0.431, 0.433, 0.435, 0.437, 0.439,
0.441, 0.442, 0.444, 0.446, 0.448, 0.450, 0.452, 0.454, 0.456, 0.458,
0.459, 0.461, 0.463, 0.465, 0.467, 0.469, 0.471, 0.473, 0.475, 0.477,
0.478, 0.480, 0.482, 0.484, 0.486, 0.488, 0.490, 0.492, 0.494, 0.495,
0.497, 0.499, 0.501, 0.503, 0.505, 0.507, 0.509, 0.511, 0.512, 0.514,
0.516, 0.518, 0.520, 0.522, 0.524, 0.526, 0.528, 0.529, 0.531, 0.533,
0.535, 0.537, 0.539, 0.541, 0.543, 0.545, 0.547, 0.548, 0.550, 0.552,
0.554, 0.556, 0.558, 0.560, 0.562, 0.564, 0.565, 0.567, 0.569, 0.571,
```

```
0.573, 0.575, 0.577, 0.579, 0.581, 0.582, 0.584, 0.586, 0.588, 0.590,
0.592, 0.594, 0.596, 0.598, 0.600, 0.601, 0.603, 0.605, 0.607, 0.609,
0.611, 0.613, 0.615, 0.617, 0.618, 0.620, 0.622, 0.624, 0.626, 0.628,
0.630, 0.632, 0.634, 0.635, 0.637, 0.639, 0.641, 0.643, 0.645, 0.647,
0.649, 0.651, 0.652, 0.654, 0.656, 0.658, 0.660, 0.662, 0.664, 0.666,
0.668, 0.670, 0.671, 0.673, 0.675, 0.677, 0.679, 0.681, 0.683, 0.685,
0.687, 0.688, 0.690, 0.692, 0.694, 0.696, 0.698, 0.700, 0.702, 0.704,
0.705, 0.707, 0.709, 0.711, 0.713, 0.715, 0.717, 0.719, 0.721, 0.723,
0.724, 0.726, 0.728, 0.730, 0.732, 0.734, 0.736, 0.738, 0.740, 0.741,
0.743, 0.745, 0.747, 0.749, 0.751, 0.753, 0.755, 0.757, 0.758, 0.760,
0.762, 0.764, 0.766, 0.768, 0.770, 0.772, 0.774, 0.775, 0.777, 0.779,
0.781, 0.783, 0.785, 0.787, 0.789, 0.791, 0.793, 0.794, 0.796, 0.798,
0.800, 0.802, 0.804, 0.806, 0.808, 0.810, 0.811, 0.813, 0.815, 0.817,
0.819, 0.821, 0.823, 0.825, 0.827, 0.828, 0.830, 0.832, 0.834, 0.836,
0.838, 0.840, 0.842, 0.844, 0.846, 0.847, 0.849, 0.851, 0.853, 0.855,
0.857, 0.859, 0.861, 0.863, 0.864, 0.866, 0.868, 0.870, 0.872, 0.874,
0.876, 0.878, 0.880, 0.881, 0.883, 0.885, 0.887, 0.889, 0.891, 0.893,
0.895, 0.897, 0.898, 0.900, 0.902, 0.904, 0.906, 0.908, 0.910, 0.912,
0.914, 0.916, 0.917, 0.919, 0.921, 0.923, 0.925, 0.927, 0.929, 0.931,
0.933, 0.934, 0.936, 0.938, 0.940, 0.942, 0.944, 0.946, 0.948, 0.950,
0.951, 0.953, 0.955, 0.957, 0.959, 0.961, 0.963, 0.965, 0.967, 0.968,
0.970, 0.972, 0.974, 0.976, 0.978, 0.980, 0.982, 0.984, 0.986, 0.987,
0.989, 0.991, 0.993, 0.995, 0.997, 0.999, 1.001, 1.003, 1.004, 1.006,
1.008, 1.010, 1.012, 1.014, 1.016, 1.018, 1.020, 1.021, 1.023, 1.025,
1.027, 1.029, 1.031, 1.033, 1.035, 1.037, 1.039, 1.040, 1.042, 1.044,
1.046, 1.048, 1.050, 1.052, 1.054, 1.056, 1.057, 1.059, 1.061, 1.063,
1.065, 1.067, 1.069, 1.071}
```

IDL script for the automatic generation of ENVI header files

```
;*******************************************************************
;Procedure make_vir_envi_header
;DESCRIPTION: This procedure uses the PDS .LBL files to generate ENVI
header files.
;Input: none.  Upon executing program, file selection widget appears
;Output: ENVI header file with same name as selected .LBL file but .HDR
extension instead

;USAGE:
; 0) generate a txt file with this script.  Save it as
make_vir_envi_header.pro under a directory that is accessed by your
PATH statement
; 1) issue command .r make_vir_envi_header.pro
; 2) use widget to select file or files with .LBL extension.  You can
select all files, including the _HK.LBL files, and the script will
automatically filter out the _HK.LBL files.
; 3) ENVI header files will be automatically generated and writen to
the working directory.
; 4) Now you can use the File-->Open Image File option in ENVI to open
the files normally.
; Creation: Eldar Noe Dobrea 8-8-2013
 ;*******************************************************************

fname=dialog_pickfile(/multiple_files,filter='*.LBL')
txt=''

for fnum=0,n_elements(fname)-1 do begin
  type='IMG'
  If strpos(fname(fnum),'QQ') NE -1 then type = 'GEO'
  ver='1A'
  If strpos(fname(fnum),'_1B_') NE -1 then ver = '1B'
  If strpos(fname(fnum),'HK') EQ -1 then begin
  openr,1,fname(fnum)

  readf,1,txt

  ;Import dimensions
  while strpos(txt, 'CORE_ITEMS') eq -1 do readf,1,txt
  print,txt
  core=strmid(txt,strpos(txt,'(')+1,strlen(txt)-1)
  core2=strmid(core,0,strpos(core,')'))
  axes=strsplit(core2,',',/extract)
  band=axes(0)
  sample=axes(1)
  line_dim=axes(2)

  ;Import bands if not geometry file
  If type NE 'GEO' then begin
    while strpos(txt, 'BAND_BIN_CENTER') eq -1 do readf,1,txt
    line=''
    wvl=[0.]
    stop=0
    while (stop eq 0) do begin
      readf,1,line
```

```
      if strpos(line,'(') ne -1 then
line=strmid(line,strpos(line,'(')+1)
      if strpos(line,')') ne -1 then begin
          line=strmid(line,0,strpos(line,')'))
          stop=1
      endif
      wvl=[wvl,strsplit(line,',',/extract)]
    Endwhile
    good=where(wvl ne 0)
    wvl=wvl(good)
    wvl2=strcompress(wvl,/remove_all)
    wvl2(0:n_elements(wvl2)-2)=wvl2(0:n_elements(wvl2)-2)+','
  EndIf
  close,1

  If type eq 'IMG' and ver eq '1A' then data_type = '12' ;set to
unsigned integer
  If type eq 'IMG' and ver eq '1B' then data_type = '4' ;set to
floating point
  If type eq 'GEO' and ver eq '1A' then data_type = '2'
  If type eq 'GEO' and ver eq '1B' then data_type = '4' ;set to
floating point
  ;Prepare header
  fbase=strmid(fname(fnum),0,strlen(fname(fnum))-3)
  openw,1,fbase+'QUB.HDR'
  ;for i=0,n_elements(wvl)-1 do printf,1,wvl(i)
  printf,1,'ENVI'
  printf,1,'description = {'
  printf,1,'  ENVI header generated by make_vir_envi_header.}'
  printf,1,'samples = ',sample
  printf,1,'lines   = ',line_dim
  printf,1,'bands   = ',band
  printf,1,'header offset = 0'
  printf,1,'file type = ENVI Standard'
  printf,1,'data type = '+data_type
  printf,1,'interleave = bip'
  printf,1,'sensor type = Unknown'
  printf,1,'byte order = 1'
  If type eq 'IMG' then printf,1,'wavelength units = Micrometers'
  If type eq 'GEO' then printf,1,'wavelength units = Unknown'
  If type eq 'IMG' then printf,1,'wavelength = {',wvl2,'}'

  close,1
  EndIf
EndFor

End
```