

Voyager PLS Channel to Energy/Charge Conversion

| | | | | |
|---|--|-------------|---|----------------|
| 266 | H. S. BRIDGE ET AL. | | | |
| TABLE I Summary of instrument characteristics | | | | |
| Energy and velocity range | | | | |
| Ion | Mode | Energy (eV) | Velocity ^a (km sec ⁻¹) | |
| H ⁺ | M/L | 10-5950 | 44-1069 | |
| He ⁺⁺ | M/L | 20-11900 | 31-756 | |
| Na ⁺ | M/L | 10-5950 | 9.2-223 | |
| S ⁺ | M/L | 10-5950 | 7.7-189 | |
| e ⁻ | E ₁ | 10-140 | (1.89-7.1) × 10 ³ | |
| e ⁻ | E ₂ | 10-5950 | (1.89-45.8) × 10 ³ | |
| Energy/charge scan | | | | |
| Mode | Resolution ^b ($\Delta E/\bar{E}$) | k | Steps | Detector |
| M | 0.20-0.036 | 1.03663 | 128 | -Z and lateral |
| L | 1.00-0.29 | 1.33352 | 16 | -Z and lateral |
| E ₁ | 0.37-0.099 | 1.07461 | 16 | lateral |
| E ₂ | 1.00-0.29 | 1.33352 | 16 | lateral |

Table 1 from Bridge et al. [1977] -

<http://lasp.colorado.edu/home/mop/files/2015/04/Bridge1977.pdf>

In the above Energy/charge scan table, the number of steps for each mode is equivalent to the number of channels.

M-Mode = 128 channels

L/E2-Modes = 16 channels

E1-Mode = 16 channels

JNE - Number of samples taken per cup for one mode.

<http://space.mit.edu/home/gsg/doc/Voyager/pdf/vgranl.pdf>

Can also be found at:

[http://lasp.colorado.edu/home/mop/files/2015/04/Voyager Internal Memo Gordon 1996.pdf](http://lasp.colorado.edu/home/mop/files/2015/04/Voyager%20Internal%20Memo%20Gordon%201996.pdf)

JNE M-Mode = 64

JNE L/E2-Modes = 8

JNE E1-Mode = 32

i = channel number

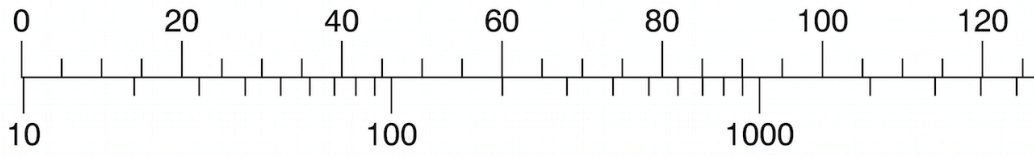
$$E_i = \left(60 * 10^{\frac{i}{JNE}} \right) - 50$$

Where E_i is the lower modulator voltage for the ith energy window

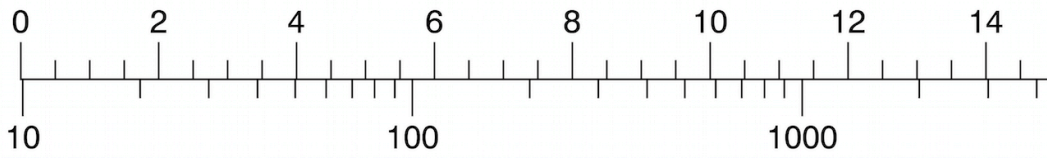
<http://web.mit.edu/jbelcher/www/VoyagerInterstellar.pdf>

Conversion Rulers –Channel numbers on top of axis, Energy values below (eV) below.

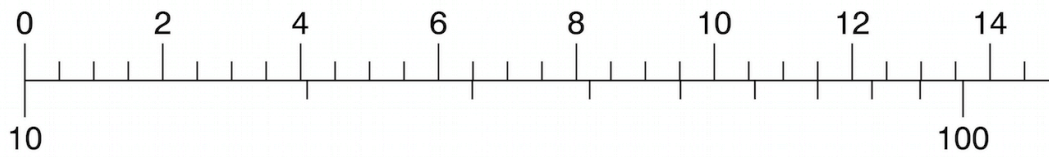
M-Mode:



L/E2-Modes:



E1-Mode:



IDL CODE – pulled from VIPER reanalysis: Voyager_PLS.pro

```
;-----  
; conversion functions: conversionM, conversionLE2, conversionE1  
;-----  
;  
;-----  
;  
; conversionM  
; function that converts an array of channels into an array of energies  
; (to be used with M-Mode Voyager data)  
;  
; INPUT: channelArray - an array of channels representing energy levels  
; (should be 128 channels ranging from 1 to 128)  
;  
; OUTPUT: converts channelArray into an array of energy values, energyArray  
; and returns energyArray  
; (steps in energyArray are logarithmic between 10eV and 5950eV)  
;  
;-----  
FUNCTION conversionM, channelArray  
  energyArray = 60. * 10.^(channelArray / 64.) - 50. ; conversion formula for M  
  modes  
  return, energyArray ; return an array of the energies corresponding to the  
  channels  
END ; conversionM  
  
;  
;-----  
;  
; conversionLE2  
; function that converts an array of channels into an array of energies  
; (to be used with L-mode or E2-mode Voyager data)  
;  
; INPUT: channelArray - an array of channels representing energy levels  
; (should be 16 channels ranging from 1 to 16)  
;  
; OUTPUT: converts channelArray into an array of energy values, energyArray  
; and returns energyArray  
; (steps in energyArray are logarithmic between 10eV and 5950eV)  
;  
;-----  
FUNCTION conversionLE2, channelArray  
  energyArray = 60. * 10.^(channelArray / 8.) - 50. ; conversion formula for L and  
  E2 modes
```

```

    return, energyArray      ; return an array of the energies corresponding to the
channels
END      ; conversionLE2

;
;-----
;
; conversionE1
; function that converts an array of channels into an array of energies
; (to be used with E1-mode Voyager data)
;
; INPUT: channelArray - an array of channels representing energy levels
;       (should be 16 channels ranging from 1 to 16)
;
; OUTPUT: converts channelArray into an array of energy values, energyArray
;         and returns energyArray140eV)
;
;-----
FUNCTION conversionE1, channelArray
    energyArray = 60. * 10.^(channelArray / 32.) - 50. ; conversion formula for E1
modes
    return, energyArray      ; return an array of the energies corresponding to the
channels
END      ; conversionE1

```