```
subroutine nml_reader ( parameters, dir_working )
3
    use input parameters
    use constants_and_parameters
4
    implicit NONE
6
    ! subroutine arguments
    type ( input deck ), intent ( out ) :: parameters
    character ( len = 64 ), intent ( out ) :: dir_working
9
10
11
    integer (lint)
                                          :: num intervals
12
   integer ( lint )
                                         :: io_status
13
    real
              ( dp )
                                         :: domain_a, domain_b
                                                                    ! x \in [ a, b ]
14
                                          :: xi_pressure, xi_density ! wall thickness
15
    real
              ( dp )
                                          :: eta_pressure, eta_density ! depth ( quadratic )
16
    real
              ( dp )
17
18
    character ( len = 64 )
                                         :: file_name_locator
    character ( len = 64 )
                                          :: file_name_domain, file_name_toy_pressure, file_name_toy_density
19
    character ( len = 99 )
                                          :: dir_nml, file_name, io_msg
20
21
NAMELISTS
23
24
   namelist / locator /
                                    file_name_domain, file_name_toy_pressure, file_name_toy_density
25
    namelist / domain /
                                    num_intervals, domain_a, domain_b
   namelist / toy_pressure /
                                    xi_pressure, eta_pressure
26
   namelist / toy_density /
                                    xi_density, eta_density
27
28
    call getcwd ( dir_working )
29
    print *, 'working directory = ', dir_working
30
31
32 | ! locator -----
33
34
    ! read command file
   dir_nml = trim ( dir_working ) // '/data/'
35
    file_name_locator = 'namelist locator.nml'
36
    file_name = trim ( dir_nml ) // file_name_locator
37
    write ( *, * ) 'reading namelist locator ', file_name
38
39
40
    ! open namelist
    open ( unit = io_unit_nml, file = file_name, delim = 'apostrophe', iostat = io_status, iomsg = io_msg )
41
42
   if ( io_status /= 0 ) then
                                                           ! can't open file
      write ( *, * )
43
      write ( *, * ) 'unable to open file ', file_name
44
      write ( *, * ) 'trying to read namelist locator'
write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
45
46
47
48
     stop 'error during file open'
49
50
    end if
51
52
    ! read namelist
    read ( unit = io_unit_nml, nml = locator, iostat = io_status, iomsg = io_msg )
53
    if ( io status /= 0 ) then
                                                           ! can't read file
54
      write ( *, * )
55
      write ( *, * ) 'unable to read file ', file_name
56
     write ( *, * ) 'trying to read namelist locator'
57
      write ( *, * ) 'io unit = ', io_unit_nml
58
     write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
59
60
61
     stop 'error during file read'
62
    end if
63
64
    ! close file
    close ( unit = io unit nml, iostat = io status, iomsg = io msg )
65
    if ( io_status /= 0 ) then
                                                          ! can't close file
66
67
      write ( *, * )
68
      write ( *, * ) 'unable to close file ', file_name
      write ( *, * ) 'trying to read namelist locator'
69
      write ( *, * ) 'io unit = ', io_unit_nml
70
      write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
71
72
73
      stop 'error during file close'
    end if
74
75
76 ! domain
               -----
77
78
    ! assemble file name
    file_name = trim ( dir_nml ) // file_name_domain
```

```
write ( *, * ) 'reading namelist domain in ', file_name
81
82
     I open namelist
     open ( unit = io_unit_nml, file = file_name, delim = 'apostrophe', iostat = io_status, iomsg = io_msg )
83
     if ( io_status /= 0 ) then
                                                                     ! can't open file
85
       write ( *, * )
        write (*, *) 'unable to open file ', file_name
86
       write ( *, * ) 'trying to read namelist domain'
87
       write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
88
89
90
91
     end if
92
     ! read namelist
93
     read ( unit = io_unit_nml, nml = domain, iostat = io_status, iomsg = io_msg )
94
     if ( io_status /= 0 ) then
                                                                      ! can't read file
95
       write ( *, * )
96
       write ( *, * ) 'unable to read file ', file_name
97
       write ( *, * ) 'trying to read namelist domain'
98
       write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
99
100
       write ( *, * ) 'iomsg = ', io_msg
101
     end if
102
103
104
     ! close file
     close ( unit = io_unit_nml, iostat = io_status, iomsg = io_msg )
105
     if ( io_status /= 0 ) then
                                                                   ! can't close file
106
       write ( *, * )
107
       write ( *, * ) 'unable to close file ', file_name
108
        write (*, *) 'trying to read namelist domain'
109
       write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
110
111
112
113
     end if
114
                          -----
115 ! toy_pressure
116
117
      ! assemble file name
     file_name = trim ( dir_nml ) // file_name_toy_pressure
     write ( *, * ) 'reading namelist toy_pressure in ', file_name
119
120
121
     ! open namelist
     open ( unit = io_unit_nml, file = file_name, delim = 'apostrophe', iostat = io_status, iomsg = io_msg )
122
     if ( io_status /= 0 ) then
123
                                                                      ! can't open file
      write ( *, * )
write ( *, * ) 'unable to open file ', file_name
124
125
        write (*, *) 'trying to open the update for the namelist toy_pressure'
126
       write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
127
128
129
130
     end if
131
132
      ! read namelist
     read ( unit = io_unit_nml, nml = toy_pressure, iostat = io_status, iomsg = io_msg )
133
     if ( io_status /= 0 ) then
134
                                                                     ! can't read file
       write ( *, * )
135
       write (*, *) 'unable to read file ', file_name
136
       write ( *, * ) 'trying to read the namelist toy_pressure'
137
138
       write ( *, * ) 'io unit = ', io_unit_nml
       write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
139
140
141
     end if
142
143
     ! close file
144
     close ( unit = io unit nml, iostat = io status, iomsg = io msg )
     if ( io_status /= 0 ) then
                                                                    ! can't close file
145
146
       write ( *, * )
147
       write ( *, * ) 'unable to close file ', file_name
       write ( *, * ) 'trying to close the namelist toy_pressure'
148
       write ( *, * ) 'io unit = ', io_unit_nml
write ( *, * ) 'iostat = ', io_status
write ( *, * ) 'iomsg = ', io_msg
149
150
151
152
     end if
153
154
155 ! toy_density
156
157
     ! assemble file name
     file_name = trim ( dir_nml ) // file_name_toy_density
```

230

232

236

233 ! 234 ! 235 !

231 end function timestamp

subroutine how_long_sub (io_unit_out, time_sec_fixed, descriptor)

```
238
       use kind_types
239
240
       implicit NONE
241
                                                                :: time_sec_volatile ! local copy of time
242
       real ( wp )
243
       real ( wp )
                                                                :: compare
                                                                                               ! convert to next larger unit
                                           intent ( in ) :: time_sec_fixed
                                                                                               ! time in seconds
244
        real ( wp ),
                                          intent ( in ) :: io_unit_out
                                                                                               ! where to write the results
        integer ( lint ).
245
        character ( len = 36 ), intent ( in ) :: descriptor
                                                                                               ! e.g. "elapsed CPU time (sec) :
246
247
248
     ! when do we convert to next higher unit (e.g. seconds to minutes)?
249
       compare = 0.5 \text{ wp}
250
       time sec volatile = time sec fixed
                                                                                ! destructible copy
251
252
       write ( io_unit_out, '( A, G10.5 )', advance = 'no' ) descriptor, time_sec_volatile
253
       time sec volatile = time sec volatile / 60
254
255
256
       if ( time_sec_volatile >= compare ) then
                                                                                ! minutes
          write ( io_unit_out, '( 5X, G10.5, "(min)" )', advance = 'no' ) time_sec_volatile
257
258
           time_sec_volatile = time_sec_volatile / 60
259
             if ( time_sec_volatile >= compare ) then
                                                                                ! hours
260
                 write ( io_unit_out, '( 5X, G10.5, "(hr)" )', advance = 'no' ) time_sec_volatile
261
262
                 time_sec_volatile = time_sec_volatile / 24
263
                 if ( time_sec_volatile >= compare ) then ! days
264
                   write ( io_unit_out, '( 5X, G10.5, "(day)" )', advance = 'no' ) time_sec_volatile
265
266
                 end if
                                                                                ! days
267
268
             end if
269
                                                                                 ! hours
270
271
          end if
                                                                                 ! minutes
272
       write ( io_unit_out, * )
273
274
275 end subroutine how_long_sub
276
              277 !
278 !
              279 !
280
function Taylor_polynomial_fcn (x, y) result (f)
282
283
       use constants_and_parameters
284
       implicit none
285
286 ! class ( Helios )
                                              :: self
287
       real ( wp ), intent ( in ) :: x, y
       real ( wp )
                                               :: f (1:t)
288
289
290
        ! basis polynomials for 10th order fit
       f = [ one, x, y, x**2, x * y, y**2, x**3, x**2 * y, x * y**2, y**3, x**4, x**3 * y, x**2 * y**2, y**3, x**4, x**3 * y, x**2 * y**2, x**4, x**3 * y, x**2 * y**2, x**4, x**3 * y, x**4, x**3 * y, x**4, x**3 * y, x**4, x**4, x**3 * y, x**4, x**4, x**5, x**4, x**5, x**4, x**5, x**6, x
291
                x * y**3, y**4, x**5, x**4 * y, x**3 * y**2, x**2 * y**3, x * y**4, y**5, x**6, x**5 * y,
                                                                                                                                                            &
292
                 x**4 * y**2, x**3 * y**3, x**2 * y**4, x * y**5, y**6, x**7, x**6 * y, x**5 * y**2,
                                                                                                                                                            &
293
                x**4 * y**3, x**3 * y**4, x**2 * y**5, x * y**6, y**7, x**8, x**7 * y, x**6 * y**2,
                                                                                                                                                            &
294
                 x**5 * y**3, x**4 * y**4, x**3 * y**5, x**2 * y**6, x * y**7, y**8, x**9, x**8 * y,
295
                                                                                                                                                            &
296
                 x**7 * y**2, x**6 * y**3, x**5 * y**4, x**4 * y**5, x**3 * y**6, x**2 * y**7, x * y**8, y**9, &
                x**10, x**9 * y, x**8 * y**2, x**7 * y**3, x**6 * y**4, x**5 * y**5, x**4 * y**6,
297
                 x**3 * y**7, x**2 * y**8, x * y**9, y**10 ]
298
300 end function Taylor_polynomial_fcn
301
302 !
         elapsed CPU time for Hilb (sec): 1971.3
                                                                                    32.855
                                                                                                    (min)
                                                                                                                   .54758
                                                                                                                                 (hr)
         elapsed CPU time for poly (sec) : 1010.7
303 !
                                                                                    16.846
                                                                                                    (min)
304
305
              306 I
307 !
308 !
              309
function Taylor_polynomial_otro_fcn ( x, y, a ) result ( f )
311
312
        use constants_and_parameters
313
       implicit none
314
315 ! class ( Helios )
                                              :: self
       real ( wp ), intent ( in ) :: x, y
316
```

&

&

389

390 391 392

394 395

393 end function Taylor polynomial numr fcn

pts_temp (41) = 880.

pts_temp (42) = 895.5

473

pts_density (28) = 1.6552e24

amplitudes (44) = 3.954244052603308e-12

```
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                                                                                                                                           Page 9 of 441
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                                                                                                                            Printed For: Daniel M. Topa
         amplitudes ( 45 ) = 2.0693900935891672e-11
    634
         amplitudes ( 46 ) = 9.176926781774342e-15
         amplitudes ( 47 ) = 2.336029108025699e-14
    635
         amplitudes ( 48 ) = -3.141531600468888e-15
    636
    637
         amplitudes ( 49 ) = -1.1638326310642216e-15
    638
         amplitudes ( 50 ) = 1.1007121145273976e-14
         amplitudes ( 51 ) = -2.1918541928276306e-14
    639
         amplitudes ( 52 ) = -6.669977490849901e-15
    640
         amplitudes ( 53 ) = -3.8034383129835514e-14
    641
    642
         amplitudes ( 54 ) = -1.9607871266070757e-14
    643
         amplitudes (55) = -1.860011834805848e-13
    644
         amplitudes ( 56 ) = -2.332983643759252e-17
    645
         amplitudes ( 57 ) = -5.303633394923939e-17
         amplitudes ( 58 ) = -4.049134749433674e-18
    646
    647
         amplitudes ( 59 ) = 3.58033911425524e-17
         amplitudes ( 60 ) = -7.302864838764852e-17
    648
         amplitudes ( 61 ) = 5.4808551163430194e-17
    649
    650
         amplitudes ( 62 ) = 5.684005539976988e-17
    651
         amplitudes ( 63 ) = -1.0714476962340622e-17
         amplitudes ( 64 ) = 1.9387836389403417e-16
    652
    653
         amplitudes ( 65 ) = -4.023557181670727e-19
    654
         amplitudes ( 66 ) = 7.201436148129852e-16
    655
    656
         call HeB_emmissivity % put ( amplitudes = amplitudes )
    657
         ! errors in fit amplitudes describing surface for HeB_emmissivity
    658
         errors ( 1 ) = 5.46099085741523e-7
    659
         errors ( 2 ) = 2.0004854162703226e-7
    660
    661
         errors (3) = 3.555280234503944e-7
         errors ( 4 ) = 3.715695720353703e-8
    662
    663
         errors ( 5 ) = 4.784967238570551e-8
    664
         errors ( 6 ) = 1.0541108111467863e-7
         errors (7) = 3.749738312511331e-9
    665
    666
         errors ( 8 ) = 4.428693412163037e-9
         errors (9) = 7.282140309297076e-9
    667
         errors ( 10 ) = 1.674260145405657e-8
         errors ( 11 ) = 2.2629712683401844e-10
    669
    670
         errors ( 12 ) = 2.571260967823493e-10
    671
         errors (13) = 3.8965031379764e-10
         errors ( 14 ) = 6.795332092490787e-10
    672
    673
         errors ( 15 ) = 1.5870767889816303e-9
    674
         errors ( 16 ) = 8.629249602227025e-12
         errors ( 17 ) = 9.632774565536663e-12
    675
         errors ( 18 ) = 1.4023950434385113e-11
    676
    677
         errors ( 19 ) = 2.2634537228729617e-11
         errors ( 20 ) = 4.057272220729003e-11
    678
         errors ( 21 ) = 9.509711956030798e-11
    679
    680
         errors ( 22 ) = 2.1302179021994298e-13
         errors ( 23 ) = 2.375187737290941e-13
    681
         errors ( 24 ) = 3.3693705230396356e-13
    682
         errors ( 25 ) = 5.237118642284725e-13
    683
    684
         errors (26) = 8.704383259771408e-13
    685
         errors ( 27 ) = 1.588581544588943e-12
         errors ( 28 ) = 3.692174715943557e-12
    686
    687
         errors (29) = 3.39469807467315e-15
    688
         errors ( 30 ) = 3.849988369501383e-15
         errors ( 31 ) = 5.364861245480189e-15
    689
    690
         errors ( 32 ) = 8.135839861520653e-15
    691
         errors ( 33 ) = 1.3037116402311857e-14
         errors ( 34 ) = 2.2092288286160753e-14
    692
    693
         errors ( 35 ) = 4.080986118188312e-14
    694
         errors ( 36 ) = 9.262179170032775e-14
         errors ( 37 ) = 3.368944153258412e-17
    695
    696
         errors (38) = 3.970326590150679e-17
    697
         errors ( 39 ) = 5.505679352520148e-17
         errors (40) = 8.188238927380755e-17
    698
    699
         errors ( 41 ) = 1.2809489446503362e-16
         errors ( 42 ) = 2.0945014793371652e-16
    700
    701
         errors (43) = 3.605352596635136e-16
    702
         errors (44) = 6.660885121903273e-16
    703
         errors ( 45 ) = 1.4481064301036045e-15
    704
         errors (46) = 1.8923344194617965e-19
    705
         errors (47) = 2.373242186867052e-19
         errors ( 48 ) = 3.3709290402177625e-19
    706
    707
         errors (49) = 4.982692421235566e-19
         errors ( 50 ) = 7.643473670104698e-19
    708
    709
         errors ( 51 ) = 1.2206862090271791e-18
    710
         errors ( 52 ) = 2.0295666702453733e-18
```

errors (53) = 3.5024679361292665e-18

array (2, 1) = 1.50395e18

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                                                                                                                                Page 12 of 441
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                                                                                                                    Printed For: Daniel M. Topa
        array (3, 30) = 1.10933e20
        array (3, 31) = 1.1446e20
   871
   872
        array (3, 32) = 1.17974e20
   873
                 3, 33 ) = 1.21482e20
        array (
   874
        array (3, 34) = 1.24985e20
   875
        array (3, 35) = 1.28409e20
   876
                 3, 36 ) = 1.31834e20
        array (
        array (3, 37) = 1.35248e20
   877
   878
        array (3, 38) = 1.38653e20
   879
                 3, 39 ) = 1.42061e20
        array (
   880
        array (
                 3, 40 ) = 1,45463e20
   881
        array (3, 41) = 1.48865e20
                 3, 42 ) = 1.52253e20
   882
        array (
        array (3, 43) = 1.55629e20
   883
   884
        array (3, 44) = 1.59022e20
                 3, 45 ) = 1.62402e20
   885
        array (
        array (3, 46) = 1.6577e20
   886
   887
        array (3, 47) = 1.69151e20
   888
                 3, 48 ) = 1.72531e20
        array (
                 3, 49 ) = 1.75914e20
   889
        array (
   890
        array (3, 50) = 1.79274e20
   891
        array (3, 51) = 1.82613e20
        array (4, 1) = 4.5686e18
   892
   893
        array (4, 2) = 1.03241e19
   894
        array (4, 3) = 1.64253e19
   895
        array (4, 4) = 2.29785e19
        array (4, 5) = 3.00889e19
   896
        array (4, 6) = 3.77058e19
   897
   898
        array (4, 7) = 4.56615e19
        array (4, 8) = 5.37778e19
   899
   900
        array (4, 9) = 6.1307e19
   901
        array (4, 10) = 6.88937e19
   902
        array (4, 11) = 7.64759e19
   903
        array (4, 12) = 8.40904e19
   904
        array (4, 13) = 9.17241e19
        array (4, 14) = 9.93374e19
   905
        array (4, 15) = 1.06986e20
   906
   907
        array (4, 16) = 1.14635e20
   908
        array (4, 17) = 1.22053e20
        array (4, 18) = 1.29058e20
   909
   910
        array (4, 19) = 1.36011e20
        array (4, 20) = 1.42942e20
   911
        array (4, 21) = 1.49846e20
   912
   913
        array (4, 22) = 1.56709e20
   914
        array (4, 23) = 1.63553e20
   915
        array (4, 24) = 1.70364e20
        array (4, 25) = 1.77157e20
   916
   917
        array (4, 26) = 1.83923e20
        array (4, 27) = 1.90652e20
   918
        array ( 4, 28 ) = 1.97375e20
   919
        array (4, 29) = 2.04077e20
   920
   921
        array (4, 30) = 2.10755e20
   922
        array (4, 31) = 2.17429e20
        array (4, 32) = 2.24074e20
   923
   924
        array (4, 33) = 2.30703e20
        array (4, 34) = 2.37327e20
   925
        array (4, 35) = 2.43796e20
   926
   927
        array (4, 36) = 2.5025e20
        array (4, 37) = 2.56687e20
   928
        array (4, 38) = 2.63109e20
   929
   930
        array (4, 39) = 2.69518e20
   931
        array (
                 4, 40 ) = 2.75916e20
        array (4, 41) = 2.82331e20
   932
   933
        array (4, 42) = 2.88708e20
        array (4, 43) = 2.95051e20
   934
        array (4, 44) = 3.01426e20
   935
   936
        array (4, 45) = 3.07778e20
        array (4, 46) = 3.14112e20
   937
        array (4, 47) = 3.2047e20
   938
        array (4, 48) = 3.26817e20
   939
   940
        array (4, 49) = 3.33145e20
   941
        array (4, 50) = 3.39447e20
   942
        array (4, 51) = 3.45724e20
                 5, 1 ) = 8.05883e18
   943
        arrav (
   944
        array (
                 5, 2) = 1.84774e19
   945
        array ( 5, 3 ) = 2.95756e19
        array ( 5, 4) = 4.15858e19
   946
   947
        array (5, 5) = 5.463e19
        array (5, 6) = 6.85898e19
```

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                                                                                                                                 Page 13 of 441
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                                                                                                                     Printed For: Daniel M. Topa
         array (5, 7) = 8.31928e19
        array (5, 8) = 9.8093e19
   950
        array ( 5, 9) = 1.11935e20
   951
                 5, 10 ) = 1.25892e20
   952
         array (
   953
                 5, 11 ) = 1.39837e20
        array (
   954
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        array (9, 36) = 2.52034e21
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        array (9, 37) = 2.58453e21
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        array (9, 38) = 2.64867e21
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        array ( 9, 39 ) = 2.71243e21
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         array (12, 43) = 8.3565e21
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         array (12, 44) = 8.53434e21
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
                                                                                                                                      Page 18 of 441
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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         array (15, 49) = 2.11233e22
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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         array (19, 39) = 3.89875e22
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        array (19, 40) = 3.9917e22
   1696
   1697
         array (19, 41) = 4.08456e22
   1698
         array (19, 42) = 4.17688e22
        array ( 19, 43 ) = 4.2686e22
   1699
   1700
         array (19, 44) = 4.36097e22
   1701
         array (19, 45) = 4.45264e22
         array (19, 46) = 4.54362e22
   1702
         array (19, 47) = 4.63434e22
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   1704
        array (19, 48) = 4.72455e22
         array ( 19, 49 ) = 4.81434e22
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         array (19, 50) = 4.90402e22
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   1707
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         array ( 20,
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        array (20, 6) = 5.16971e21
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         array ( 20, 16 ) = 1.86294e22
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        array (20, 17) = 1.99913e22
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         array (20, 21) = 2.51932e22
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         array (20, 22) = 2.64759e22
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        array (20, 23) = 2.77609e22
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         array (20, 24) = 2.9035e22
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         array (20, 25) = 3.0301e22
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   1734
         array (20, 27) = 3.28192e22
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         array (20, 28) = 3.40694e22
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        array (20, 29) = 3.53144e22
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        array (20, 30) = 3.65531e22
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        array ( 20, 31 ) = 3.77861e22
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
                                                                                                                                       Page 23 of 441
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   1739
         array (20, 32) = 3.90112e22
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         array (20, 33) = 4.02321e22
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         array (20, 36) = 4.37684e22
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         array ( 20, 37 ) = 4.49187e22
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         array (20, 39) = 4.72053e22
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         array (20, 43) = 5.17151e22
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   1753
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   1756
         array ( 20, 49 ) = 5.83504e22
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         array (20, 50) = 5.94413e22
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         array (21, 17) = 2.33665e22
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         array ( 21, 18 ) = 2.49163e22
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         array (21, 19) = 2.64536e22
         array ( 21, 20 ) = 2.79853e22
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   1779
         array (21, 21) = 2.95117e22
   1780
         array (21, 22) = 3.10278e22
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   1782
         array (21, 24) = 3.40576e22
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         array (21, 25) = 3.55534e22
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         array (21, 27) = 3.85355e22
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   1786
         array (21, 28) = 4.00157e22
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         array (21, 31) = 4.44157e22
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         array ( 21, 32 ) = 4.58662e22
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         array (21, 35) = 5.0124e22
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   1805
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   1807
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         array ( 21, 50 ) = 7.00204e22
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   1811
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   1813
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         array ( 22, 5 ) = 5.2565e21
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         array (22, 6) = 6.81449e21
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         array (22, 7) = 8.52171e21
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         array ( 22, 8 ) = 1.03027e22
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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        array (23, 41) = 7.86318e22
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   1902
         array (23, 42) = 8.04535e22
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   1903
        array (23, 44) = 8.40609e22
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         array ( 23, 45 ) = 8.58512e22
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   1906
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   1907
   1908
         array (23, 48) = 9.11985e22
         array (23, 49) = 9.29658e22
   1909
        array (23, 50) = 9.47239e22
   1910
   1911
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   1914
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   1917
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        array (24, 10) = 1.77623e22
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         array (24, 11) = 2.01469e22
         array ( 24, 12 ) = 2.25802e22
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        array (24, 13) = 2.50551e22
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   1925
         array (24, 14) = 2.75249e22
         array ( 24, 15 ) = 3.00302e22
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        array ( 24, 16 ) = 3.25463e22
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   1928
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         array ( 24, 18 ) = 3.74233e22
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   1932
        array (24, 22) = 4.69276e22
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   1934
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        array ( 24, 25 ) = 5.40004e22
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   1937
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         array (24, 27) = 5.86511e22
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         array ( 24, 28 ) = 6.09721e22
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   1940
         array (24, 29) = 6.3282e22
   1941
        array (24, 30) = 6.55787e22
         array ( 24, 31 ) = 6.78701e22
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         array (24, 33) = 7.24158e22
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        array (24, 42) = 9.15904e22
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   1954
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   1957
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   1959
   1960
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         array (24, 50) = 1.0792e23
         array ( 24, 51 ) = 1.09918e23
   1962
   1963
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         array (25, 2) = 2.06771e21
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   1965
         array (25, 3) = 3.53166e21
   1966
         array (25, 4) = 5.29544e21
   1967
         array (25,
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         array ( 25, 6 ) = 9.57077e21
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   1969
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        array (25, 8) = 1.46055e22
   1970
   1971
         array (25, 9) = 1.71469e22
   1972
         array ( 25, 10 ) = 1.98109e22
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        array (25, 11) = 2.25006e22
   1974
        array (25, 12) = 2.52481e22
   1975
         array (25, 13) = 2.80477e22
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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         array (25, 14) = 3.08441e22
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         array (25, 15) = 3.36849e22
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         array (25, 16) = 3.65405e22
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         array (25, 17) = 3.93581e22
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         array (25, 18) = 4.20893e22
   1981
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         array (25, 20) = 4.75209e22
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   1983
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         array (25, 26) = 6.36825e22
   1988
         array (25, 27) = 6.63353e22
   1989
   1990
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         array (25, 29) = 7.16368e22
   1991
         array (25, 30) = 7.42671e22
   1992
   1993
         array ( 25, 31 ) = 7.6891e22
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         array ( 25, 33 ) = 8.20978e22
   1995
   1996
         array ( 25, 34 ) = 8.46867e22
   1997
         array (25, 35) = 8.71477e22
         array (25, 36) = 8.95984e22
   1998
   1999
         array (25, 37) = 9.20311e22
   2000
         array (25, 38) = 9.44472e22
   2001
         array (25, 39) = 9.68642e22
         array (25, 40) = 9.92678e22
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         array (25, 41) = 1.01664e23
   2003
   2004
         array (25, 42) = 1.04051e23
         array ( 25, 43 ) = 1.06424e23
   2005
         array (25, 44) = 1.08783e23
   2006
   2007
         array (25, 45) = 1.11132e23
   2008
         array ( 25, 46 ) = 1.13474e23
         array ( 25, 47 ) = 1.15811e23
   2009
   2010
         array (25, 48) = 1.18135e23
         array (25, 49) = 1.2045e23
   2011
         array ( 25, 50 ) = 1.22753e23
   2012
   2013
         array (25, 51) = 1.25043e23
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         array (26, 1) = 8.70451e20
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   2015
   2016
         array (26, 3) = 3.86007e21
   2017
         array (26, 4) = 5.7975e21
         array ( 26, 5 ) = 8.06363e21
   2018
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         array (26, 7) = 1.32325e22
         array ( 26, 8 ) = 1.60902e22
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   2023
         array (26, 10) = 2.18871e22
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   2036
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   2039
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   2042
         array (26, 29) = 8.02228e22
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   2043
   2044
         array (26, 31) = 8.61678e22
   2045
         array (26, 32) = 8.91183e22
         array (26, 33) = 9.20601e22
   2046
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   2048
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         array ( 26, 36 ) = 1.00541e23
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   2050
         array (26, 37) = 1.03294e23
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         array ( 26, 38 ) = 1.06033e23
         array ( 26, 39 ) = 1.0877e23
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   2053
         array (26, 40) = 1.1149e23
         array (26, 41) = 1.14199e23
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   2138
         array (28, 23) = 7.54035e22
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         array (28, 24) = 7.9173e22
         array ( 28, 25 ) = 8.29391e22
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         array (28, 26) = 8.67033e22
   2141
         array ( 28, 27 ) = 9.04469e22
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   2143
         array ( 28, 28 ) = 9.41934e22
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   2145
         array (28, 30) = 1.01634e23
         array (28, 31) = 1.05343e23
   2146
         array ( 28, 32 ) = 1.09032e23
   2147
   2148
         array ( 28, 33 ) = 1.12712e23
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   2149
         array ( 28, 35 ) = 1.19847e23
   2150
   2151
         array ( 28, 36 ) = 1.23307e23
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         array (28, 37) = 1.26749e23
         array ( 28, 38 ) = 1.30174e23
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   2154
         array ( 28, 39 ) = 1.33594e23
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         array (28, 40) = 1.36993e23
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         array (28, 46) = 1.57097e23
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   2162
         array (28, 47) = 1.604e23
         array ( 28, 48 ) = 1.63685e23
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         array ( 28, 49 ) = 1.6696e23
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   2165
         array (28, 50) = 1.70219e23
         array ( 28, 51 ) = 1.73461e23
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         array (29, 2) = 2.79041e21
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         array (29, 3) = 4.78785e21
         array ( 29,
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         array (29,
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   2172
         array (29, 6) = 1.32151e22
         array ( 29,
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   2173
   2174
         array (29, 8) = 2.04038e22
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         array (29, 9) = 2.40864e22
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         array (29, 11) = 3.19345e22
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   2178
         array (29, 12) = 3.60024e22
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         array (29, 13) = 4.01611e22
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         array (29, 34) = 1.2733e23
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         array (29, 36) = 1.34988e23
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         array (29, 37) = 1.3879e23
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         array (29, 42) = 1.5757e23
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         array ( 29, 46 ) = 1.72316e23
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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         array (31, 24) = 1.0006e23
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        array (31, 31) = 1.34486e23
   2299
   2300
         array (31, 32) = 1.39361e23
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         array ( 31, 33 ) = 1.44232e23
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         array (31, 35) = 1.53672e23
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/Users/dantopa/Dropbox/fortran/data reduction/lima/sub routines.f90
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        array (42, 7) = 2.31119e22
   2837
         array (42, 8) = 2.86843e22
   2838
         array ( 42, 9 ) = 3.44104e22
        array (42, 10) = 4.07104e22
   2839
         array ( 42, 11 ) = 4.71969e22
   2840
   2841
         array (42, 12) = 5.40424e22
        array (42, 13) = 6.12094e22
   2842
   2843
        array (42, 14) = 6.84776e22
         array (42, 15) = 7.61133e22
```

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                                                                                                                                     Page 38 of 441
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                                                                                                                        Printed For: Daniel M. Topa
   2924
         array (43, 44) = 3.23643e23
   2925
         array (43, 45) = 3.32099e23
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         array (43, 46) = 3.40559e23
         array ( 43, 47 ) = 3.4901e23
   2927
        array (43, 48) = 3.57419e23
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   2929
         array (43, 49) = 3.65816e23
         array ( 43, 50 ) = 3.74209e23
   2930
        array (43, 51) = 3.82585e23
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   2932
         array (44, 1) = 1.3815e21
   2933
         array (44, 2) = 3.52068e21
   2934
        array (44, 3) = 6.0693e21
   2935
         array (44, 4) = 9.26161e21
         array ( 44,
   2936
                      5) = 1.32059e22
        array (44, 6) = 1.75422e22
   2937
   2938
         array (44, 7) = 2.26247e22
         array (44, 8) = 2.81434e22
   2939
        array (44, 9) = 3.3837e22
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   2941
         array ( 44, 10 ) = 4.01318e22
         array (44, 11) = 4.66282e22
   2942
         array ( 44, 12 ) = 5.35114e22
   2943
   2944
         array ( 44, 13 ) = 6.07428e22
   2945
         array (44, 14) = 6.80904e22
         array (44, 15) = 7.58414e22
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   2947
         array (44, 16) = 8.37529e22
         array (44, 17) = 9.17478e22
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   2949
         array (44, 18) = 9.98247e22
         array (44, 19) = 1.07955e23
   2950
        array (44, 20) = 1.16278e23
   2951
   2952
         array (44, 21) = 1.24714e23
         array ( 44, 22 ) = 1.33185e23
   2953
        array (44, 23) = 1.41862e23
   2954
   2955
        array (44, 24) = 1.50564e23
   2956
         array ( 44, 25 ) = 1.59349e23
   2957
         array (44, 26) = 1.68238e23
   2958
         array ( 44, 27 ) = 1.77136e23
         array (44, 28) = 1.86145e23
   2959
        array ( 44, 29 ) = 1.95193e23
   2960
   2961
         array (44, 30) = 2.04256e23
         array (44, 31) = 2.13406e23
   2962
        array ( 44, 32 ) = 2.22546e23
   2963
   2964
         array (44, 33) = 2.3173e23
        array (44, 34) = 2.40932e23
   2965
         array ( 44, 35 ) = 2.49661e23
   2966
   2967
         array (44, 36) = 2.58453e23
   2968
        array (44, 37) = 2.67221e23
         array ( 44, 38 ) = 2.75973e23
   2969
         array (44, 39) = 2.84744e23
   2970
   2971
        array (44, 40) = 2.93476e23
        array ( 44, 41 ) = 3.02209e23
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         array ( 44, 42 ) = 3.10959e23
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        array (44, 43) = 3.19686e23
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         array (44, 44) = 3.28436e23
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   2976
         array ( 44, 45 ) = 3.37147e23
        array (44, 46) = 3.45837e23
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   2978
        array (44, 47) = 3.54544e23
         array ( 44, 48 ) = 3.63211e23
   2979
        array (44, 49) = 3.71854e23
   2980
   2981
         array (44, 50) = 3.80504e23
   2982
         array (44, 51) = 3.89147e23
        array (45, 1) = 1.36239e21
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   2984
         array (45, 2) = 3.46392e21
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         array (45, 3) = 5.97063e21
        array (45, 4) = 9.11475e21
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   2987
         array ( 45, 5 ) = 1.30091e22
        array (45, 6) = 1.72942e22
   2988
         array ( 45, 7 ) = 2.23311e22
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   2990
         array (45, 8) = 2.78097e22
         array (45, 9) = 3.34729e22
   2991
   2992
         array (45, 10) = 3.97496e22
   2993
         array (45, 11) = 4.62353e22
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        array (45, 12) = 5.31212e22
   2995
         array (45, 13) = 6.03669e22
   2996
         array ( 45, 14 ) = 6.77357e22
         array (45, 15) = 7.55256e22
   2997
   2998
         array (45, 16) = 8.34851e22
   2999
         array ( 45, 17 ) = 9.15397e22
   3000
         array (45, 18) = 9.96964e22
   3001
         array (45, 19) = 1.07913e23
         array (45, 20) = 1.1633e23
```

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                                                                                                                         Printed For: Daniel M. Topa
   3082
         array (46, 49) = 3.80707e23
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         array (46, 50) = 3.89799e23
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   3086
        array (47, 2) = 3.31343e21
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         array ( 47,
                     4 ) = 8.71817e21
   3088
        array (47, 5) = 1.2465e22
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   3090
         array (47, 6) = 1.65946e22
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         array (47, 7) = 2.14713e22
        array (47, 8) = 2.67936e22
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   3093
         array (47, 9) = 3.23159e22
         array (47, 10) = 3.84708e22
   3094
        array (47, 11) = 4.48463e22
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   3096
         array ( 47, 12 ) = 5.16429e22
         array (47, 13) = 5.88126e22
   3097
        array (47, 14) = 6.61159e22
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   3099
         array ( 47, 15 ) = 7.38763e22
         array (47, 16) = 8.18178e22
   3100
         array ( 47, 17 ) = 8.98715e22
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   3102
         array ( 47, 18 ) = 9.80662e22
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         array (47, 19) = 1.06334e23
         array (47, 20) = 1.14825e23
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   3105
         array (47, 21) = 1.23465e23
        array (47, 22) = 1.32161e23
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   3107
         array (47, 23) = 1.41096e23
         array (47, 24) = 1.50072e23
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        array (47, 25) = 1.59156e23
   3109
         array ( 47, 26 ) = 1.68377e23
   3110
         array ( 47, 27 ) = 1.77622e23
   3111
   3112
        array (47, 28) = 1.87013e23
   3113
        array (47, 29) = 1.96462e23
         array ( 47, 30 ) = 2.05943e23
   3114
   3115
        array (47, 31) = 2.1554e23
   3116
         array (47, 32) = 2.25128e23
         array (47, 33) = 2.34761e23
   3117
        array (47, 34) = 2.44452e23
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   3119
         array (47, 35) = 2.5367e23
        array (47, 36) = 2.62988e23
   3120
        array (47, 37) = 2.72289e23
   3121
   3122
         array (47, 38) = 2.81582e23
        array (47, 39) = 2.90887e23
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         array ( 47, 40 ) = 3.00156e23
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         array (47, 41) = 3.09444e23
   3125
   3126
        array (47, 42) = 3.18765e23
         array ( 47, 43 ) = 3.28072e23
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         array (47, 44) = 3.37387e23
   3128
   3129
        array (47, 45) = 3.467e23
        array (47, 46) = 3.5605e23
   3130
         array ( 47, 47 ) = 3.65334e23
   3131
        array (47, 48) = 3.74576e23
   3132
         array ( 47, 49 ) = 3.83891e23
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   3134
         array ( 47, 50 ) = 3.93176e23
        array (47, 51) = 4.02421e23
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   3136
        array (48, 1) = 1.27948e21
         array ( 48,
   3137
                     2) = 3.23052e21
        array (48, 3) = 5.56387e21
   3138
   3139
         array ( 48,
                     4 ) = 8.49963e21
   3140
         array ( 48,
                     5 ) = 1.21623e22
        array (48, 6) = 1.62024e22
   3141
   3142
         array (48, 7) = 2.09852e22
   3143
         array (48, 8) = 2.62126e22
        array (48, 9) = 3.16452e22
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   3145
         array ( 48, 10 ) = 3.77185e22
        array (48, 11) = 4.40158e22
   3146
         array ( 48, 12 ) = 5.07394e22
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   3148
         array (48, 13) = 5.78459e22
         array (48, 14) = 6.50921e22
   3149
   3150
         array (48, 15) = 7.28055e22
   3151
         array (48, 16) = 8.07065e22
   3152
        array ( 48, 17 ) = 8.8729e22
   3153
         array (48, 18) = 9.69096e22
   3154
         array ( 48, 19 ) = 1.05169e23
        array (48, 20) = 1.13664e23
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   3156
         array (48, 21) = 1.22316e23
   3157
         array ( 48, 22 ) = 1.3103e23
        array ( 48, 23 ) = 1.40001e23
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   3159
        array (48, 24) = 1.49016e23
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        array ( 48, 25 ) = 1.58146e23
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array (53, 6) = 1.39395e22 array (53, 7) = 1.81353e22

array (54, 34) = 2.31363e23 array (54, 35) = 2.40897e23

array (56, 11) = 3.52292e22 array (56, 12) = 4.09183e22

array (57, 39) = 2.67653e23 array (57, 40) = 2.77345e23

array (59, 16) = 6.09266e22 array (59, 17) = 6.75927e22

array (60, 44) = 3.00998e23array (60, 45) = 3.10771e23

array (62, 21) = 8.79164e22 array (62, 22) = 9.51126e22

array (63, 49) = 3.31141e23array (63, 50) = 3.4089e23

array (65, 26) = 1.15066e23 array (65, 27) = 1.22718e23

array (67, 3) = 2.67732e21array (67, 4) = 4.09176e21

array (68, 31) = 1.41546e23 array (68, 32) = 1.49484e23

array (70, 8) = 1.15335e22array (70, 9) = 1.41154e22

array (71, 36) = 1.66165e23 array (71, 37) = 1.73898e23

array (73, 13) = 2.43426e22array (73, 14) = 2.78432e22

array (74, 41) = 1.88145e23array (74, 42) = 1.9587e23

array (76, 18) = 3.94824e22array (76, 19) = 4.36236e22

array (77, 46) = 2.08279e23array (77, 47) = 2.15954e23

array (79, 23) = 5.5637e22array (79, 24) = 6.02687e22

array (80, 51) = 2.26587e23array (81, 1) = 3.61554e20

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array (1, 17) = 0.000027334933450060333 array (1, 18) = 0.000028983704769216213

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array (2, 45) = 0.00023524347152223895 array (2, 46) = 0.0002401664143553676

array (4, 20) = 0.0003504461396967592

array (4, 21) = 0.00036743079679531514

array (4, 22) = 0.0003843145890414608 array (4, 23) = 0.00040115163903892847

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array (7, 26) = 0.0021413606370822838

array (7, 27) = 0.002219831032139155array (7, 28) = 0.002298259605184051

array (9, 3) = 0.0003687961624803816

array (9, 4) = 0.0005279239978085818 array (9, 5) = 0.000702589940644673

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array (12, 9) = 0.004022192460214074 array (12, 10) = 0.004562360646646568

array (13, 36) = 0.023329078276641102

array (13, 37) = 0.023925632375689305 array (13, 38) = 0.024519923165854163

array (15, 13) = 0.013555544691100525

array (15, 14) = 0.014779232160305729 array (15, 15) = 0.016012292680430036

array (16, 41) = 0.054981945034007884

array (16, 42) = 0.05621643242277605 array (16, 43) = 0.05744501552750067

array (18, 18) = 0.036866371529280705

array (18, 19) = 0.03907162161953933 array (18, 20) = 0.041268999331073246

array (19, 46) = 0.11177722134340852

array (19, 47) = 0.11400904071186303 array (19, 48) = 0.11622831347672505

array (21, 23) = 0.08007539823084747

array (21, 24) = 0.08378451866936033 array (21, 25) = 0.08746436369949069

6003

array (23, 1) = 0.0016104203545861588 array (23, 2) = 0.004159319457125069

array (24, 28) = 0.1499973740400272

array (24, 29) = 0.15568000142009011 array (24, 30) = 0.1613301552379136

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6239

6240

array (27, 33) = 0.25127528032155116

array (27, 34) = 0.25934200839602467 array (27, 35) = 0.26699297646909953

array (29, 10) = 0.06884028373151445

array (29, 11) = 0.07856144139735222 array (29, 12) = 0.08856895683930119

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array (32, 15) = 0.14511034893483

array (32, 16) = 0.15838416351202708 array (32, 17) = 0.1715873726925369

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array (35, 21) = 0.25894346922308636 array (35, 22) = 0.2746267237137141

array (36, 48) = 0.7052901220855287

array (36, 49) = 0.7205502362197034array (36, 50) = 0.7357488473950914

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array (43, 8) = 0.06999235715550833 array (43, 9) = 0.0840595599010548

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array (44, 36) = 0.6358237601950414 array (44, 37) = 0.6573940779007392

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array (46, 14) = 0.16464418066918024

7187 7188

array (47, 40) = 0.7384180758064375

array (47, 41) = 0.7612676550549003 array (47, 42) = 0.7841984182089617

array (49, 17) = 0.21484732384397912

array (49, 18) = 0.23487047311843695 array (49, 19) = 0.25510322447644007

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array (50, 46) = 0.8804308677634538 array (50, 47) = 0.9045055859509492

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array (52, 23) = 0.32606779844297323 array (52, 24) = 0.3480784773335845

array (53, 50) = 0.9645546147920055

array (53, 51) = 0.9890254120340877 array (54, 1) = 0.002634316692231696

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array (55, 28) = 0.417613722537913 array (55, 29) = 0.44081263859228476

array (57, 4) = 0.01536577357766345

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array (58, 33) = 0.5062468665047111 array (58, 34) = 0.5301616769993609

array (60, 9) = 0.05267533806766866

array (60, 10) = 0.06354586302731366 array (60, 11) = 0.07494236129050318

array (61, 37) = 0.5626376993571299

array (61, 38) = 0.5853716530430736 array (61, 39) = 0.6085312072038218

array (63, 14) = 0.10233627115780332

array (63, 15) = 0.11595819248173353 array (63, 16) = 0.13010830121572456

array (64, 42) = 0.6345149772320587

array (64, 43) = 0.6571751273674583 array (64, 44) = 0.6803371416465581

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8214 8215 array (66, 17) = 0.12947974097692372

array (66, 18) = 0.14349405117791356 array (66, 19) = 0.15782374855156198

array (66, 20) = 0.17289344952533287 array (66, 21) = 0.1885164311163496

array (67, 47) = 0.6996441504689026

array (67, 48) = 0.722323981551114 array (67, 49) = 0.745126818550899

array (69, 24) = 0.2147024228730775

array (69, 25) = 0.23085875812269316 array (69, 26) = 0.24762446468796817

array (71, 1) = 0.0013389241534361683

array (71, 2) = 0.0032365536646718025 array (71, 3) = 0.0055282277126176066

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array (72, 30) = 0.28806881038615184 array (72, 31) = 0.30555533162840787

array (74, 6) = 0.014379118511622482

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array (75, 34) = 0.32587344909320703

array (75, 35) = 0.34251122950420554 array (75, 36) = 0.3596508740589042

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8767

8768

array (77, 10) = 0.031361364694194

array (77, 11) = 0.0372444917199018

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array (78, 39) = 0.37440174369432444

array (78, 40) = 0.3911502294311392 array (78, 41) = 0.40819146925177896

8846 8847

8925 8926 array (80, 15) = 0.05877987574500885 array (80, 16) = 0.06641362298962343

array (80, 17) = 0.07440777757272854 array (80, 18) = 0.08297587776723181

array (81, 44) = 0.4193259649105368

array (81, 45) = 0.4361039720675692 array (81, 46) = 0.4530714083376649

9004

9084

pts temp (61) = 1190.

pts_temp (62) = 1205.5 pts_temp (63) = 1221.

pts density (44) = 2.5768e24

 $pts_density (45) = 2.6344e24$

 $pts_density (46) = 2.692e24$

pts density (47) = 2.7496e24

pts_density (48) = 2.8072e24 pts_density (49) = 2.8648e24

9159

9160 9161

9162

9163

```
pts_density ( 50 ) = 2.9224e24
9165
9166
      pts_density ( 51 ) = 2.98e24
9167
9168
      call LyB_emmissivity % put ( pts_density = pts_density )
9169
9170
      lr_fit_density % intercept_value = 4.2399999999999925e22
9171
      lr_fit_density % intercept_error = 1.6282460071720295e7
      lr_fit_density % slope_value = 5.76e22
9172
      lr_fit_density % slope_error
                                       = 18240.24653292042
9173
9174
      lr_fit_density % error_rms
                                       = 1.9756314628630587e8
9175
      call LyB_emmissivity % put ( pts_density_lr = lr_fit_density )
9176
9177
      ! fit amplitudes describing surface for LyB_emmissivity
9178
9179
      amplitudes ( 1 ) = 0.0021921701482280898
      amplitudes ( 2 ) = -0.0004623632160475309
9180
      amplitudes ( 3 ) = -0.0023560926172369358
9181
9182
      amplitudes ( 4 ) = 0.00015059872723458337
9183
      amplitudes ( 5 ) = 0.000032150826714164894
9184
      amplitudes ( 6 ) = 0.0009675606755047556
9185
      amplitudes ( 7 ) = -0.00002334707802707271
9186
      amplitudes ( 8 ) = -1.1691501776692117e-6
      amplitudes ( 9 ) = -8.919278198843113e-6
9187
9188
      amplitudes ( 10 ) = -0.0001877004846652377
9189
      amplitudes ( 11 ) = 1.900030808632479e-6
      amplitudes ( 12 ) = 4.669173743625287e-7
9190
      amplitudes ( 13 ) = -3.062519007220629e-7
9191
      amplitudes ( 14 ) = 1.2075467335377396e-6
9192
      amplitudes ( 15 ) = 0.000020325132609573095
9193
      amplitudes ( 16 ) = -8.98076365203725e-8
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9195
      amplitudes ( 17 ) = -4.4613225913988334e-8
9196
      amplitudes ( 18 ) = 2.1909506625587748e-8
9197
      amplitudes ( 19 ) = 1.1721679018486075e-8
9198
      amplitudes ( 20 ) = -8.009549597304535e-8
      amplitudes ( 21 ) = -1.33412817422127e-6
9199
      amplitudes ( 22 ) = 2.603017454137819e-9
9200
      amplitudes ( 23 ) = 1.80975099729384e-9
9201
9202
      amplitudes ( 24 ) = -2.087263628196518e-10
9203
      amplitudes ( 25 ) = -1.0032486581953281e-9
      amplitudes ( 26 ) = -6.31629623165388e-10
9204
9205
      amplitudes ( 27 ) = 3.222263062980872e-9
9206
      amplitudes ( 28 ) = 5.509499113308253e-8
      amplitudes ( 29 ) = -4.699179571197963e-11
9207
9208
      amplitudes ( 30 ) = -3.584220009297348e-11
9209
      amplitudes ( 31 ) = -4.148521395250884e-13
      amplitudes ( 32 ) = 1.0350610441643411e-11
9210
      amplitudes ( 33 ) = 1.8327666470990294e-11
9211
9212
      amplitudes ( 34 ) = 4.255977373240179e-11
      amplitudes ( 35 ) = -8.701249392160974e-11
9213
      amplitudes ( 36 ) = -1.4382288857102105e-9
9214
9215
      amplitudes ( 37 ) = 5.154743361041708e-13
      amplitudes ( 38 ) = 3.4410006637352137e-13
9216
9217
      amplitudes ( 39 ) = 5.99678017466744e-14
9218
      amplitudes ( 40 ) = 9.225170800569056e-14
9219
      amplitudes ( 41 ) = -5.585964907067584e-13
      amplitudes ( 42 ) = 2.271441961429616e-13
9220
      amplitudes ( 43 ) = -1.5273142196473045e-12
9221
      amplitudes ( 44 ) = 1.5681047057470785e-12
9222
9223
      amplitudes ( 45 ) = 2.3012386850518616e-11
      amplitudes ( 46 ) = -3.144176383780476e-15
9224
9225
      amplitudes ( 47 ) = -1.2994594757773358e-15
9226
      amplitudes ( 48 ) = -1.6487815860639987e-15
      amplitudes ( 49 ) = 6.849432405760734e-16
9227
9228
      amplitudes ( 50 ) = -3.544772306209628e-16
9229
      amplitudes ( 51 ) = 6.4907219337607275e-15
      amplitudes ( 52 ) = -6.646557246172247e-15
9230
9231
      amplitudes ( 53 ) = 2.3346077500914548e-14
9232
      amplitudes ( 54 ) = -1.647887690788941e-14
      amplitudes ( 55 ) = -2.0590084836887864e-13
9233
9234
      amplitudes ( 56 ) = 8.175636685722749e-18
9235
      amplitudes ( 57 ) = 2.0538370466091003e-19
9236
      amplitudes ( 58 ) = 1.167468955309094e-17
9237
      amplitudes ( 59 ) = -1.7010086456561836e-17
      amplitudes ( 60 ) = 3.081309297024668e-17
9238
      amplitudes ( 61 ) = -4.7430518588942676e-17
9239
9240
      amplitudes ( 62 ) = 1.6206866860658108e-17
9241
      amplitudes ( 63 ) = 1.6459247655025577e-17
9242
      amplitudes ( 64 ) = -1.225660514812491e-16
      amplitudes ( 65 ) = 7.334148942153032e-17
```

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9317

9318 9319

9320

9321

call LyB_emmissivity % put (errors = errors)

sf_quality % error_norm_L1 = 0.047571173423273785

sf_quality % error_norm_Linf = 0.01776271401382923 sf_quality % error_maximum = 0.001794595764476048

= 0.011561263576205212

! quality measures for surface fit

sf quality % error norm L2

array (2, 20) = 1.72716e18

array (2, 21) = 1.85428e18array (2, 22) = 1.98534e18

9399

array (3, 49) = 1.16223e19array (3, 50) = 1.19975e19

9559

array (5, 26) = 1.71883e19

array (5, 27) = 1.80987e19

9638

array (7, 3) = 4.57681e18

array (7, 4) = 6.53422e18

array (8, 31) = 9.44891e19array (8, 32) = 9.84967e19

array (10, 8) = 5.15117e19 array (10, 9) = 5.83601e19

array (11, 36) = 3.6532e20 array (11, 37) = 3.77891e20

array (13, 13) = 2.45712e20 array (13, 14) = 2.65147e20

array (14, 41) = 1.11789e21 array (14, 42) = 1.15057e21

array (16, 18) = 8.24278e20 array (16, 19) = 8.71138e20

array (17, 46) = 2.92654e21 array (17, 47) = 2.99994e21

array (19, 23) = 2.22176e21 array (19, 24) = 2.31969e21

array (20, 51) = 6.5064e21array (21, 1) = 6.10231e19

array (22, 28) = 5.2894e21 array (22, 29) = 5.47637e21

array (24, 5) = 1.03448e21array (24, 6) = 1.33687e21

array (25, 33) = 1.10976e22 array (25, 34) = 1.14195e22

array (27, 10) = 4.40596e21array (27, 11) = 4.96135e21

array (28, 38) = 2.08909e22 array (28, 39) = 2.13539e22

array (30, 15) = 1.15496e22array (30, 16) = 1.24149e22

array (31, 43) = 3.62812e22 array (31, 44) = 3.69556e22

array (33, 20) = 2.41121e22array (33, 21) = 2.5327e22

array (34, 48) = 5.90203e22array (34, 49) = 5.99579e22

array (36, 25) = 4.39699e22array (36, 26) = 4.56406e22

array (38, 2) = 1.4991e21array (38, 3) = 2.78415e21

array (39, 30) = 7.30367e22array (39, 31) = 7.52491e22

array (41, 7) = 1.43074e22array (41, 8) = 1.7596e22

array (42, 35) = 1.12615e23array (42, 36) = 1.15116e23

array (44, 12) = 3.98999e22array (44, 13) = 4.46057e22

array (45, 40) = 1.62324e23array (45, 41) = 1.65411e23

array (47, 17) = 7.77272e22array (47, 18) = 8.34163e22

array (48, 45) = 2.23713e23array (48, 46) = 2.27467e23

array (50, 22) = 1.26797e23 array (50, 23) = 1.33573e23

array (51, 50) = 2.96495e23 array (51, 51) = 3.00909e23

array (53, 27) = 1.87801e23array (53, 28) = 1.9569e23

array (55, 4) = 1.09411e22array (55, 5) = 1.61682e22

12166

array (56, 32) = 2.6069e23

array (56, 33) = 2.69714e23

array (58, 9) = 4.61225e22array (58, 10) = 5.49938e22

array (59, 37) = 3.41852e23array (59, 38) = 3.50894e23

array (61, 14) = 9.97122e22 array (61, 15) = 1.11106e23

array (62, 42) = 4.30101e23 array (62, 43) = 4.39994e23

array (64, 19) = 1.66908e23 array (64, 20) = 1.79891e23

array (65, 47) = 5.26538e23 array (65, 48) = 5.37225e23

array (67, 24) = 2.45083e23array (67, 25) = 2.59651e23

array (69, 1) = 1.32352e21array (69, 2) = 4.11224e21

array (70, 29) = 3.33625e23array (70, 30) = 3.49648e23

array (72, 6) = 2.49175e22array (72, 7) = 3.29113e22

array (73, 34) = 4.3148e23 array (73, 35) = 4.47332e23

array (75, 11) = 7.2313e22array (75, 12) = 8.42084e22

13193

array (76, 39) = 5.28556e23

array (76, 40) = 5.45181e23

array (78, 16) = 1.37552e23 array (78, 17) = 1.52323e23

array (79, 44) = 6.30133e23array (79, 45) = 6.47532e23

array (81, 21) = 2.14989e23 array (81, 22) = 2.31839e23

array (1, 38) = 1.6843659738976288e-6 array (1, 39) = 1.7603694395134673e-6

array (3, 14) = 2.427734463682785e-6

array (3, 15) = 2.641064005511877e-6 array (3, 16) = 2.8613943821184376e-6

13586 13587

13667

array (4, 43) = 0.000024355420009945084

array (4, 44) = 0.000025221120250711154

array (6, 19) = 0.000022101961009652838

array (6, 20) = 0.000023572397538099492 array (6, 21) = 0.000025084630095068344

13744 13745

array (7, 48) = 0.00014703603721643088 array (7, 49) = 0.00015144813047730563

13903

array (9, 24) = 0.0001332903683361923

array (9, 25) = 0.00014000385541757072 array (9, 26) = 0.00014683097545149383

array (11, 1) = 7.268654977195311e-6

array (11, 2) = 0.000017641279865621027 array (11, 3) = 0.00002909091004151036

13981 13982

array (12, 30) = 0.0005628386024659738 array (12, 31) = 0.000584974824072044

array (14, 7) = 0.00021671654739239513 array (14, 8) = 0.00025161753733432356

14220

array (15, 35) = 0.0016960334257741256

array (15, 36) = 0.0017494800972468886

array (17, 12) = 0.0009301564685038733 array (17, 13) = 0.0010119108064191881

array (18, 40) = 0.004200986966439799 array (18, 41) = 0.004313418283164517

array (20, 16) = 0.0026082186870122303

array (20, 17) = 0.0027763432117427806 array (20, 18) = 0.0029407714002008985

array (21, 45) = 0.009072836541058752 array (21, 46) = 0.009280993824358224

array (23, 21) = 0.006437453268885988

array (23, 22) = 0.006741832846598911 array (23, 23) = 0.007041079349558952

array (24, 50) = 0.017647174241057894 array (24, 51) = 0.017997607817698717

array (26, 26) = 0.01376850279419772

array (26, 27) = 0.014274495964494607 array (26, 28) = 0.014776570757117535

array (28, 4) = 0.0018252092764255501 array (28, 5) = 0.0025813908612045433

array (29, 32) = 0.027300881316383946 array (29, 33) = 0.028082336437159957

array (31, 8) = 0.007846985147020449

array (31, 9) = 0.009228461441009384 array (31, 10) = 0.01062822349747678

array (32, 36) = 0.0468326878951646

array (32, 37) = 0.04786309061082596 array (32, 38) = 0.048885917796317686

array (34, 14) = 0.02412856275154895 array (34, 15) = 0.026180486526810716

array (35, 42) = 0.07891375203773586 array (35, 43) = 0.08033259659347541

array (37, 19) = 0.04861985995225605 array (37, 20) = 0.051320275232557576

array (38, 46) = 0.1203050121462163

array (38, 47) = 0.12219484569836542 array (38, 48) = 0.12407697310775574

array (40, 24) = 0.08511615205784123 array (40, 25) = 0.08866581039267821

array (42, 1) = 0.0008250590486589097 array (42, 2) = 0.002676385397280156

array (43, 29) = 0.1357221303295755 array (43, 30) = 0.14023740753586442

array (45, 6) = 0.01914425573768745 array (45, 7) = 0.024675176437065856

array (46, 34) = 0.20171805936612952 array (46, 35) = 0.2066669703683363

array (48, 10) = 0.05086443729648733

array (48, 11) = 0.05868199259379747 array (48, 12) = 0.0667334750382428

array (49, 39) = 0.27997197989271005 array (49, 40) = 0.2858103626269049

array (51, 16) = 0.11643535296800622 array (51, 17) = 0.1263587750398896

array (52, 44) = 0.37267818340673264 array (52, 45) = 0.37946220128624225

array (54, 20) = 0.1780458337118684

array (54, 21) = 0.1895083945340818 array (54, 22) = 0.20092001644653376

array (55, 49) = 0.479405648364062 array (55, 50) = 0.4871601177808215

array (57, 25) = 0.26479349090969484

array (57, 26) = 0.27792397449512224 array (57, 27) = 0.29098131503063585

array (59, 3) = 0.009478049037581484 array (59, 4) = 0.015316784425766974

array (60, 31) = 0.3813809002205895 array (60, 32) = 0.39605130623188173

array (62, 8) = 0.05255704583904731 array (62, 9) = 0.06395508404222955

array (63, 36) = 0.49577271190817734 array (63, 37) = 0.5102968318196419

array (65, 13) = 0.12224722134660729 array (65, 14) = 0.13773095195042373

array (66, 41) = 0.6159336816577201 array (66, 42) = 0.6314987839045657

array (68, 18) = 0.21158714660093403 array (68, 19) = 0.22976580675630845

array (69, 46) = 0.7449501849504041 array (69, 47) = 0.7617600251716764

array (71, 22) = 0.2945483448398274

array (71, 23) = 0.31508194997724953 array (71, 24) = 0.3356939226681508

array (72, 50) = 0.8640061721958913

array (72, 51) = 0.8820359339996554

array (73, 1) = 0.001718159198373065

17141 17142

17143

17222

array (74, 28) = 0.43180389025495

array (74, 29) = 0.45448999086126546

17301

array (76, 5) = 0.023428218048623835

array (76, 6) = 0.03197576710659203

17379

17380

array (77, 32) = 0.5357688989521402

array (77, 33) = 0.5601856163644531

array (77, 34) = 0.5846598033159839

array (79, 10) = 0.0785898328166888 array (79, 11) = 0.09295826252190816

17538

array (80, 38) = 0.689128976607223

array (80, 39) = 0.7128181818980713

pts_temp (3) = 291.

pts_temp (4) = 306.5 pts_temp (5) = 322.

17615 17616

17696

call HeB_opacity % put (pts_temp = pts_temp)

17771 17772

17773

17774

amplitudes (2) = -0.000579971935079587 amplitudes (3) = 0.013491513093118145

amplitudes (4) = 0.000705772299406241

amplitudes (5) = 0.0017457021909730829 amplitudes (6) = 0.0002283434934670554

amplitudes (7) = -0.00012192079890502465

17853

errors (14) = 2.881158371643523e-10

errors (15) = 6.72905976452356e-10 errors (16) = 3.658722545721064e-12

array (1, 14) = 73.0913array (1, 15) = 78.1096

array (2, 42) = 210.693array (2, 43) = 215.327

array (4, 19) = 111.327array (4, 20) = 116.27

array (5, 47) = 248.329array (5, 48) = 252.867

array (7, 24) = 148.212

array (7, 25) = 153.2

18248

array (9, 1) = 15.7314array (9, 2) = 23.2792

array (10, 29) = 183.612 array (10, 30) = 188.582

array (12, 7) = 61.5709

array (13, 34) = 216.823 array (13, 35) = 221.498

array (15, 12) = 99.0153

array (16, 39) = 245.935 array (16, 40) = 250.46

array (18, 16) = 127.594 array (18, 17) = 133.891

array (19, 44) = 270.688 array (19, 45) = 275.02

array (21, 21) = 157.083 array (21, 22) = 162.704

array (22, 49) = 289.401 array (22, 50) = 293.507

array (24, 26) = 180.946 array (24, 27) = 186.175

array (26, 3) = 30.474array (26, 4) = 37.9853

array (27, 31) = 198.294 array (27, 32) = 203.116

array (29, 8) = 62.2522 array (29, 9) = 68.7916

array (30, 36) = 208.05array (30, 37) = 212.138

array (32, 13) = 85.5505array (32, 14) = 91.3004

array (33, 41) = 210.485array (33, 42) = 214.168

array (35, 18) = 101.163array (35, 19) = 105.953

array (36, 46) = 207.474array (36, 47) = 210.763

array (38, 23) = 109.72array (38, 24) = 113.856

array (39, 51) = 200.182array (40, 1) = 8.37167

array (41, 28) = 113.394 array (41, 29) = 116.958

array (43, 5) = 20.8433array (43, 6) = 24.3841

array (44, 33) = 113.364 array (44, 34) = 116.447

array (46, 11) = 35.5767

array (47, 39) = 112.344

array (49, 16) = 42.8884

array (50, 43) = 104.68array (50, 44) = 106.785

array (52, 20) = 44.6907array (52, 21) = 46.979

array (53, 48) = 98.8147array (53, 49) = 100.64

array (55, 25) = 46.9262array (55, 26) = 48.9011

array (57, 2) = 4.26666

array (57, 3) = 5.53754

array (58, 30) = 47.6991 array (58, 31) = 49.4013

array (60, 7) = 9.06795array (60, 8) = 10.3107

array (61, 35) = 47.3326array (61, 36) = 48.6995

array (63, 12) = 12.7743 array (63, 13) = 13.9336

array (64, 41) = 47.0526

array (66, 17) = 15.5388 array (66, 18) = 16.584

array (67, 45) = 44.012array (67, 46) = 45.0395

array (69, 22) = 17.4336array (69, 23) = 18.3728

array (70, 50) = 41.9405array (70, 51) = 42.8384

array (72, 27) = 18.6595array (72, 28) = 19.4957

21646

array (74, 4) = 2.38831

array (74, 5) = 2.83679

array (75, 32) = 19.3652array (75, 33) = 20.108

array (77, 9) = 4.04988

array (77, 10) = 4.50737

array (78, 37) = 19.5551 array (78, 38) = 20.172

array (80, 14) = 5.472array (80, 15) = 5.91607

22041

array (81, 42) = 19.3938

array (81, 43) = 19.94

array (2, 7) = 0.13693630537067755

array (2, 8) = 0.15473557519149 array (2, 9) = 0.17130012870616035

22199

array (3, 36) = 0.6254438029251551

array (3, 37) = 0.640877756751931

22278

array (5, 13) = 0.27501830066475325

array (5, 14) = 0.29348465099799215

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array (6, 42) = 0.7649400489504281

22355

array (8, 17) = 0.38285541947921414

array (8, 18) = 0.40053855922582726 array (8, 19) = 0.41809155319963087

array (9, 45) = 0.8489941957588243

array (9, 46) = 0.8640377122671715

array (9, 47) = 0.8789677683581975

22513 22514

array (11, 23) = 0.5180735403572597 array (11, 24) = 0.5354530066339839

array (12, 51) = 0.9678339716894501 array (13, 1) = 0.05237992936208035

array (14, 28) = 0.6289510646488181 array (14, 29) = 0.6459734643180903

array (16, 5) = 0.16154687100896728 array (16, 6) = 0.18755533573007566

array (17, 32) = 0.7121842919671847

array (17, 33) = 0.728776209464856 array (17, 34) = 0.7452212958342294

22908

array (19, 10) = 0.28906903852154026 array (19, 11) = 0.3124655776944935

23068

array (20, 38) = 0.8106078669221964

array (20, 39) = 0.8255445971554178

array (22, 15) = 0.3985663502070977 array (22, 16) = 0.4204341771102031

array (23, 43) = 0.872513872855282 array (23, 44) = 0.8865829646031064

23305

array (25, 20) = 0.4846794698827632

array (25, 21) = 0.5033971016696575

23384

array (26, 48) = 0.9121215697136611

array (26, 49) = 0.9252963264073069

23461 23462 array (28, 23) = 0.5120668123814335 array (28, 24) = 0.5295063459379159

array (28, 25) = 0.546748992299635 array (28, 26) = 0.5637480324712235

23542

array (30, 2) = 0.06441841334696559

array (30, 3) = 0.08717990789003008

23621

array (31, 30) = 0.5863767115846004

array (31, 31) = 0.6016905308518598

array (33, 7) = 0.1563280255193035array (33, 8) = 0.1763734778959652

23778

array (34, 34) = 0.590945161917326

array (34, 35) = 0.6037428295769337 array (34, 36) = 0.6164470592458063

array (36, 12) = 0.22173662127651528 array (36, 13) = 0.23871363677885904

array (37, 40) = 0.59907093004018 array (37, 41) = 0.6103268708526589

array (39, 17) = 0.2644314426073594 array (39, 18) = 0.27846048950201147

array (40, 45) = 0.5806135897989048array (40, 46) = 0.5905013314613343

array (42, 22) = 0.28672841685362666 array (42, 23) = 0.29873353012753506

array (43, 50) = 0.5529659557546153 array (43, 51) = 0.5616189811109028

24332

array (45, 27) = 0.29594707576097123

array (45, 28) = 0.306205899729463

array (47, 4) = 0.04188984636651923 array (47, 5) = 0.05095800336735836

array (48, 32) = 0.29605820022852397 array (48, 33) = 0.3048870892316593

24569

array (50, 9) = 0.07244940865064535

array (50, 10) = 0.08063858112435522

array (51, 37) = 0.2879117422648644 array (51, 38) = 0.2949446196032277

array (53, 13) = 0.0867200594927696

array (53, 14) = 0.09381000074690325 array (53, 15) = 0.1010728022838968

24725 24726

array (54, 42) = 0.2748441055534543 array (54, 43) = 0.2808628469852323

array (56, 18) = 0.10134076909304061

array (56, 19) = 0.10749599673271373 array (56, 20) = 0.11368426137625391

24883 24884

array (57, 46) = 0.25443758208402345

array (57, 47) = 0.25966443654432164 array (57, 48) = 0.2648602562434114

24962 24963

array (59, 24) = 0.11513989178906249 array (59, 25) = 0.12051124142789028

25122

array (61, 1) = 0.005097803246808664

array (61, 2) = 0.008194638596167873

array (62, 29) = 0.11863714229943247 array (62, 30) = 0.12328634975272203

array (64, 6) = 0.017382062518038123 array (64, 7) = 0.0204539032048757

25359

array (65, 34) = 0.1190913176758269

array (65, 35) = 0.12287221922949979

array (67, 11) = 0.027325766862775876array (67, 12) = 0.03026779548391365

array (68, 39) = 0.11628383976134762 array (68, 40) = 0.11956751772146601

array (70, 16) = 0.03500813834888089 array (70, 17) = 0.03772584905083253

array (71, 44) = 0.11262707725250848 array (71, 45) = 0.11550396624581952

array (73, 21) = 0.04056603026206907 array (73, 22) = 0.043030123560596927

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pts_density (11) = 6.76e23 pts_density (12) = 7.336e23

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errors (36) = 4.172934366042466e-14

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array (7, 45) = 24.342

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26859

array (9, 22) = 12.4808

array (9, 23) = 12.9537

26938

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array (12, 27) = 17.2259 array (12, 28) = 17.7487

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! HELIOS output normalized

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