reconstruction of rfb files, Theo van Soest/UMC Utrecht, t.l.vansoest@umcutrecht.nl
based on RFx2PTW/Bert van der Leije/DDHK Rotterdam and Radpy/Stephen Flounder

++++++
syntax information:

*variables for structural information
UPPERCASE_WORD: variable with value to set conditions

*assignment
UPPERCASE_WORD:= value

*conditional blocks:
 ---if (condition)
 ..
 ---

*repeated structure:
<<MEASUREMENT REPEAT LOOP START>>
 ..
 N:= value
<<MEASUREMENT REPEAT LOOP UNTIL N=0>>

*comments on structure
==DATA STRUCTURE START==

*used data types
smallint   signed integer 2 bytes (C++: int16_t)
double   double precision float 8 bytes
string   length-prefixed strings (Pascal-type string, size stored in byte[0])
string2   length-prefixed string with data starting at byte[2], byte[0]=length,byte[1]=0
[]   byte at current position of file pointer

*example: the structure starts with a string which takes 15 bytes,
                followed by the number of groups as two-byte smallint

*type   length contents   description
string   1+14   'Version:6.3.14'   VERSION:= 63; version string
smallint   2   70   GROUPS:= 70
++++++

==DATA STRUCTURE START==
*type   length contents   description

READ_SUBHEADER:= true
string   1+14   'Version:6.3.14'   VERSION:= 63; version string
smallint   2   70   GROUPS:= 70
smallint   2   -1
string2   1+1+5 $0'CBeam'   [number of bytes|x0|CBeam] look for this structure

<<GROUP REPEAT LOOP START>>

```
string          1+19    'U02'                   linac
?               2       ?                       ?
double          8       10                      energy [MeV]
smallint        2       0                       modality (Photon=0,Electron=1,Proton=2,Neutron=3,Cobalt=4,Isotope=5)

 ---if (VERSION < v60)
 ?              2       ?                       ?
 double         8                               TG fieldsize [mm]
 ?              2       ?                       ?
 double         8                               AB fieldsize [mm]
 ---
                                                                                $3c
smallint        2       -1                      wedge type (0:Hard,1:Dynamic,2:Enhanced,3:Virtual,4:Soft)
?               2       1                       ?
smallint        2       0                       wedge angle
?               2       1                       ?
smallint        2       0                       gantry angle
?               2       1                       ?
smallint        2       90                      colimator angle
?               2       1                       ?
double          8       1000                    ssd [mm]
?               2       1                       ?
double          8       1000                    sad [mm]
string          1+9     'Undefined'             APPLICATOR

 ---if (VERSION > v50) and ((APPLICATOR='') or (APPLICATOR[1]<>#0))
 smallint       2       0                       medium (0:air,1:water,2:film)
 ---

 ---if (VERSION > v53)
 string         1+13    'Radiotherapie'         clinic                          $6a
 string         1+3     'UMC'                   adres
 string         1+0     ''                      telefoon
 string         1+0     ''                      e-mail
 ?              2       1                       ?
 double         8       -200                    TGmin field setting [mm]
 ?              2       1                       ?
 double         8       200                     TGplus field setting [mm]
 ?              2       1                       ?
 double         8       -200                    ABmin field setting [mm]
 ?              2       1                       ?
 double         8       200                     ABplus field setting [mm]
 smallint       2       0                       gantryscale (0:CW_180_Down,1:CCW_180_Down,2CW_180_Up,3:CCW_180_Up)
 ---
READ_SUBHEADER:= TRUE


<<MEASUREMENT REPEAT LOOP START>>

==SUBHEADER START: USE IF READ_SUBHEADER=TRUE==                                  $a8

 ---if (READ_SUBHEADER = true)
  ---while ([]<>$80) and (([]<>$FF) or ([+1]<>$FF))
```

```
  byte          1
  ---


  --- ([]=$80)
  ?             1       $80                     padding
  ---


  --- ([]<>$80)
  ?             4       ?                       ?
  string2       1+1+13  x0'CProfileCurve'       MEASUREMENTTYPE
  ---
 ---

==SUBHEADER END==


===measurement start==
longword        4       (04/02/2002 14:19)      measurement datetime 7-8 hour difference for Europe, where
defined???
longword        4       (04/02/2002 14:19)      modification datetime
byte            1       2                       quantity (1:Relative optical density,2:Relative dose,3:Relative
ionisation,4:Absolute dose,5:Charge)

 ---if (VERSION > v50)
 double         8       0                       radius *0.1 [mm]
 double         8       0                       calibration factor

  ---if (VERSION > v51)
  double        8       0                       temperature
  double        8       0                       pressure
  string        1+0     ''                      calibration date
  double        8       -1                      detector offset [mm]
  ---
 ---

 ---if (VERSION <= v50)
 double         8       ?                       ?
 double         8       ?                       ?
 ---

string          1+4     'IC04'                  detector name
smallint        2       4                       detector type (1:Single diode,2:LDA-11,3:LDA-25,4:Ion chamber
(cylindrical),5:Ion chamber (plane parallel),6:Stereotactic,7:Film,8:CA24,9:BIS-2G')
string          1+7     'RM, JdK'               operator
string          1+0     ''                      comment



 ---if (quantity=4) or (measurement type='CSinglePointCurve') {absolute dose measurement | untested!!!}
 ?              6       ?                       ?
 smallint       2       n                       number of measurements (NM)
```

```
?              2       ?                       ?

 ---if (VERSION > v60)
 ?              291     ?                       ?
 ---

double         8       value                   crossline
double         8       value                   inline
double         8       value                   beam
double         8       value                   crossline_ref
double         8       value                   inline_ref

 ---if (VERSION > v60)
 double         8       value                   crossline_ref
 ---

double         8       value                   beam_ref

 ---if (VERSION > v60)
 double         8       value                   inline_ref
 ---

 double         8       0                       temperature
 double         8       0                       pressure

 double * NM    8 * NM  values                  all measurments

 --- ([] <> #0) {zero value is error}
 ?              2       ?
 ---
--- (end absolute)



---if (VERSION > v53)
smallint       2       1                       mapping crossline: -z=-3, -y=-2, -x=-1, +x=1, +y=2, +z=3
smallint       2       -2                      mapping inline   : -z=-3, -y=-2, -x=-1, +x=1, +y=2, +z=3
smallint       2       -3                      mapping beam     : -z=-3, -y=-2, -x=-1, +x=1, +y=2, +z=3
smallint       2       1                       measurements per point
smallint       1       1                       ?
double         8       10.5                    scanspeed [mm/s]
smallint       2       13                      ?
smallint       2       6                       ?
smallint       2       2438                    origin x  (*0.1 [mm])           $116
smallint       2       2425                    origin y  all at bottom corner of tank
smallint       2       3620                    origin z  center of tank is (2400,2400,2400)
double         8       0                       isocenter crossline     [mm]
double         8       0                       isocenter inline        [mm]
double         8       -1                      isocenter  beam         [mm]
double         8       0                       normalization crossline [mm]
double         8       2.5                     normalization inline    [mm]
double         8       121.4                   normalization beam      [mm]
double         8       100                     norm value field
```

```
 double         8       0                       norm value reference            $154
 double         8       0                       dark current field              $15c
 double         8       -96.3                   dark current reference
 double         8       300                     HV field
 double         8       300                     HV reference
 smallint       2       42                      gain field                      $17c
 smallint       2       45                      gain reference                  $17e
 string         1+4     'HIGH'                  range field
 string         1+4     'HIGH'                  range reference
 double         8       94                      water surface correction (motor unit) [mm]
 smallint       2       2                       ?
 smallint       2       1                       ?
 double         8       0                       reference min
 double         8       0                       reference max
 double         8       0                       reference avg
 double         8       -1                      ?
 smallint       2       4                       ?
 double         8       1.09051254089422        renormalization value
 double         8       0                       curve offset, equal to detector offset
 string         1+14    #13#10'commissioning'   setup comment
 smallint       2       0                       ?
 double         8       -243.4                  point a: crossline [mm]         $1d9
 double         8       242.4                   point a: inline    [mm]
 double         8       18.9                    point a: beam      [mm]
 double         8       -243.5                  point b: crossline [mm]
 double         8       -237.5                  point b: inline    [mm]
 double         8       19.4                    point b: beam      [mm]
 double         8       236.3                   point c: crossline [mm]
 double         8       -237.5                  point c: inline    [mm]
 double         8       18.9                    point c: beam      [mm]
 double         8       236.4                   point d: crossline [mm]
 double         8       242.4                   point d: inline    [mm]
 double         8       18.9                    point d: beam      [mm]
 ?              10      ?                       ?
 ---


 ---if (VERSION <= v53)

  ---if (VERSION < v52)
  ?             8       ?                       ?
  ---

  ---if (VERSION >= v52)
  ?             10      ?                       ?
  ---

 ---


double          8       236.4                   crossline start [0.1 mm]        $243
double          8       0                       inline    start [0.1 mm]
double          8       50                      beam      start [0.1 mm]
```

```
double          8       -243.2                  crossline end   [0.1 mm]        $25B
double          8       0                       inline    end   [0.1 mm]
double          8       50                      beam      end   [0.1 mm]
smallint        2       1200                    number of points (NP)
<<REPEAT START NP times>>
 double         8       -243.2 (first point)    position [0.1 mm]
 double         8       5.8 (first point)       value
<<REPEAT END NP times>>

byte            1       var                     N                               $4d75


 ---if (N>0)
  ---while ([]<>$80) and (([]<>$FF) or ([+1]<>$FF))
  byte          1
  ---

  ---if ([]=$FF)
  READ_SUBHEADER:= TRUE
  ---

  ---if ([]<>$FF)
  READ_SUBHEADER:= FALSE
  byte          1
  ---
 ---


 ---if (N=0)
 READ_SUBHEADER:= TRUE

  ---if (VERSION>50)
  byte * 3      3       *                       ?
  byte          1       3                       N                               $4d75

   ---if (N>0) and (VERSION>63) and (MEASUREMENTTYPE='CTMRCurve')
   READ_SUBHEADER:= FALSE
   ---
  ---

 NEXT_MEASUREMENT
 ---


<<MEASUREMENT REPEAT LOOP UNTIL N=0>>

GROUPS:= GROUPS-1

 ---if (GROUPS>0)
  --- WHILE ([]<>$80)
  byte          1
  ---
```

```
  byte          1
 ---

<<GROUP REPEAT LOOP UNTIL GROUPS=0>>


<<GROUP REPEAT LOOP UNTIL GROUPS=0>>
==DATA STRUCTURE END==
```