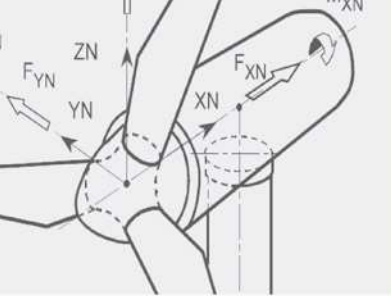# Format of Bladed Header Files

The header files have a %nn extension, e.g. powprod.%05. This contains information about how the data is stored.

Variable name	Type	Valid range	Description	Notes
FILE	char	File name, no path	Name of file containing the data: must be in same folder	
ACCESS	Char	D or S	D = Binary S = Ascii	
FORM	Char	F or U	Formatted/ Unformatted	Not used at present
RECL	Int	2,4,8	Record length for binary files	Normally 4
FORMAT	Char	I*2, I*4, R*4, R*8	Variable type for binary files. The * may be omitted.	Normally R4 or R*4
MISSING	*As FORMAT*		*Value denoting missing data*	*Optional*
HEADREC	*Int*	*>=0*	*No. of bytes at start of binary file, or no. of lines at start of ascii file, which are used to store header info rather than data*	*Optional, default=0*
CONTENT	Char		Description/source of data	
CONFIG	Char	type of data	e.g. STATIONARY, TRANSIENT, TABLE, etc.	
NDIMENS	int	1 - 5	The number of dimensions of the data file	
DIMENS	Int(NDIMENS)	>0	The number of elements in each dimension. The first dimension is used for defining the number of distinct variables within the data file. Potentially, each element of the first dimension can have different units and a different description. The last dimension is used for the independent variable	
GENLAB	char		Label that describes the whole of DIMENS(1)	Just for info
VARIAB	char(DIMENS(1))		List of variable names for each variable represented in DIMENS(1). Separated by spaces, names containing spaces to be enclosed in single quotes.	Abbreviated names are expanded by *Bladed* user interface
VARUNIT	char(DIMENS(1))	See list below	List of units for each variable represented in DIMENS(1) as in table below.	
VAROFFSET	*Real*		*Value (in SI units) = VARSCALE*(V - VAROFFSET) where V = Value in file*	*Optional, default = 0*
VARSCALE	*Real*			*Optional, default = 1*

FOR d = 2 to NDIMENS

AXISLAB	Char		Label for the variable represented by DIMENS(2) (in single quotes if it contains spaces)	
AXIUNIT	Char	See list below	Units for the variable represented by DIMENS(2) as in table below.	
AXIMETH	Int	1,2,3	Values of this variable: 1 = list of labels 2 = Start value and step (for regularly spaced values) 3 = list of values	

IF AXIMETH = 1

AXITICK	Char(DIMENS(d))	List of axis tick mark labels

ELSE IF AXIMETH = 2

MIN	Real	Start value
STEP	Real	Step size

ELSE IF AXIMETH = 3

AXIVAL	Real(DIMENS(d))	List of values

END IF
END FOR

Optional additional information at the end (usually omitted):

NVARS	Int	Number of additional items

followed by the items and their values, and optional units.
Further information may follow this, such as statistical summary information.

DATA FILE

The data values are stored in the file in sequential order. In the case of an ASCII file, line feeds are inserted to create a two-dimensional array of data, in the following way:
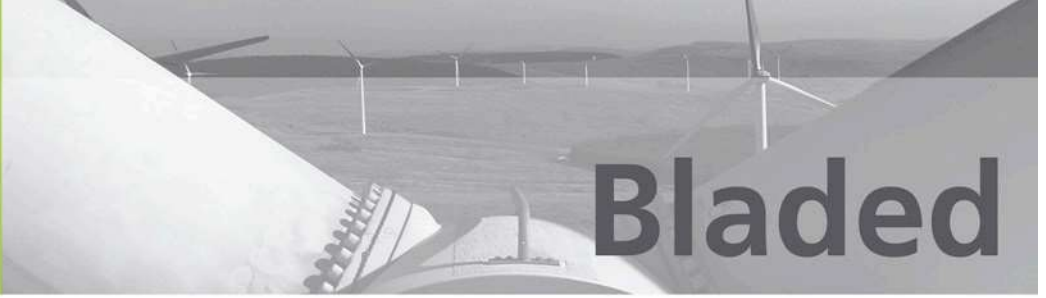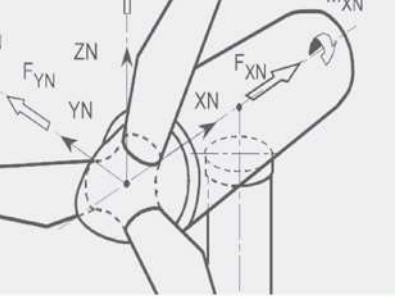
There is a column for each element of the first dimension which has more than one element, ie DIMENS > 1. Subsequent dimensions are grouped into rows.

However if the last dimension is the only one with more than one element, the data is stored as a single column.

Example 1:

NDIMENS = 3
DIMENS = 5, 4, 3

If the datafile is ASCII it will have the following form:

```
A111 A211 A311 A411 A511
A121 A221 A321 A421 A521
A131 A231 A331 A431 A531
A141 A241 A341 A441 A541
A112 A212 A312 A412 A512
A122 A222 A322 A422 A522
A132 A232 A332 A432 A532
A142 A242 A342 A442 A542
A113 A213 A313 A413 A513
A123 A223 A323 A423 A523
A133 A233 A333 A433 A533
A143 A243 A343 A443 A543
```

Example 2:

```
NDIMENS = 3
DIMENS  = 1,5,3
```

If the datafile is ASCII it will have the following form:

```
A111 A121 A131 A141 A151
A112 A122 A132 A142 A152
A113 A123 A133 A143 A153
```
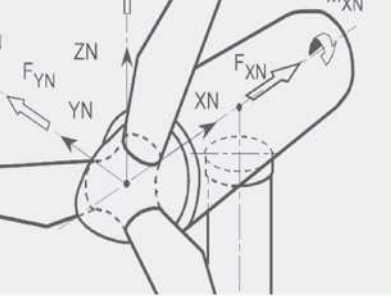
Example 3:

```
NDIMENS = 2
DIMENS  = 1, 3
```

If the datafile is ASCII it will have the following form:

```
A11
A12
A13
```

In general, the last dimension is the only one likely to have a large number of elements. This arrangement ensures that line lengths are unlikely to be too long, and maximises the readability of the datafile if you want to view it directly.

UNITS

The following values and combinations are allowed (not all the meanings are shown; the others should be obvious):

| Label	Meaning	Label	Meaning	Label	Meaning
L	Length (m)	FLL		-	No units
L/T	Speed (m/s)	FLTT/AA		N	No units
A	Angle (rad)	T	Time (s)	FL/L	
A/T		1/T		LLL	
M	Mass (Kg)	P	Power (W)	F/LL	
M/L		PT		LLL/A	
MLL		A/P		Q	Reactive power (VA)
F	Force (N)	A/PT		I	Current (A)
FL	Torque (Nm)	A/PTT		V	Voltage (V)
F/L		M/LLL		VI	
FL/A		M/LT			
FLT/A		L/TT			

Normal *Bladed* output consists of 2 and 3 dimensional files. Typical examples are shown below.

Example of a 2D header file (drive train variables from a 600s simulations with output at 20Hz, ascii data):

```
FILE            powprod.$05
ACCESS          S
FORM            F
RECL            0
FORMAT          n/a
CONTENT         POWPROD
CONFIG          STATIONARY
NDIMENS         2
DIMENS          10      12000
GENLAB          'Drive train variables'
VARIAB          OMEGA AZIMUTH GENSPD  GENPOS LOSSTRQ BRRTQ GBXTQ
                PALMTQ PALVEL PALDISP
VARUNIT         A/T A A/T A FL FL FL FL A/T A
AXISLAB         'Time'
AXIUNIT         T
AXIMETH         2
MIN             0.00000000E+00
STEP            0.50000000E-01
NVARS           0
```
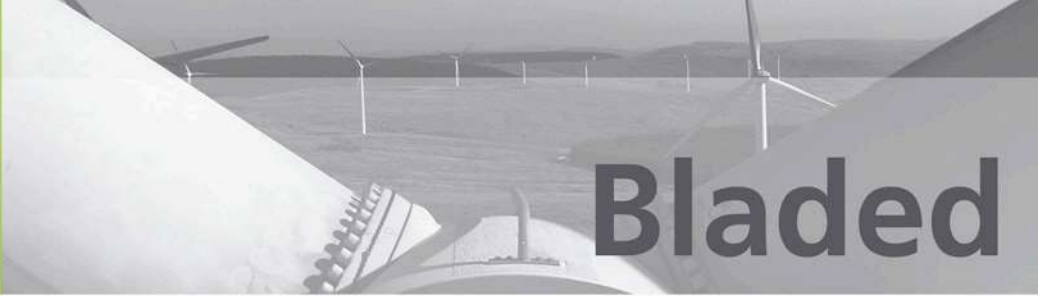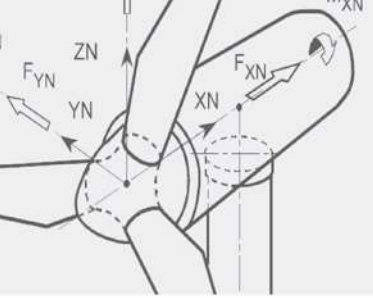
Example of a 3D header file (blade loads at three blade stations variables from a 600s simulations with output at 20Hz, 4-byte real binary data):

```
FILE            powprod.$15
ACCESS          D
FORM            U
RECL            4
FORMAT          R*4
CONTENT         POWPROD
CONFIG          STATIONARY
NDIMENS         3
DIMENS          6       3     12000
GENLAB          'Blade 1 Loads'
VARIAB          B1GLMX B1GLMY B1GLMZ B1GLFX B1GLFY B1GLFZ
VARUNIT         FL FL FL F F F
AXISLAB         'Blade station radius'
AXIUNIT         L
AXIMETH         3
AXIVAL          1.000  3.542  9.033
AXISLAB         'Time'
AXIUNIT         T
AXIMETH         2
MIN             0.00000000E+00
STEP            0.50000000E-01
NVARS           0
```