

Ikayaki Requirements Document

Group Mavis
Helsinki 3.5.2006
Software Engineering Project
UNIVERSITY OF HELSINKI
Department of Computer Science

Table of Contents

Ikayaki Requirements Document.....	1
User Requirements.....	3
Requirements implemented in version 1.0.2.....	3
Requirements implemented in version 1.0.3.....	4
Requirements implemented in version 1.0.4.....	9
Requirements implemented in version 1.0.5.....	10
Requirements implemented in version 1.0.6.....	10
Requirements implemented in version 1.1.0.....	11
Requirements not implemented.....	12
Requirements notes.....	13
Requirements for versio 1.0.2.....	13
Requirements for version 1.0.3.....	13
Requirements for version 1.0.4.....	14
Requirements for version 1.0.5.....	14
Requirements for version 1.0.6.....	14
Requirements for version 1.1.0.....	14
Requirements not implemented.....	14

User Requirements

Requirements implemented in version 1.0.2

CONFIGURATION

Ikayaki shall not lose device configuration saved in configuration file.

CONFIGURATION FILE

Default device configuration should be stored in an external file.

Rationale: Stored default configuration facilitates restoration of defaults if they become changed. Default values need to be updated when hardware configuration is changed.

INTENSITY PLOT SCALING

Intensity plot shall rescale to maximum values. Plot should be redrawn for each measurement step.

Rationale: Up to 1.0.1 Ikayaki assumes that relative intensity of steps is always equal to or less than one. This should always be the case, but e.g. Degausser malfunctions might cause spikes in the intensity which won't then fit on the graph.

EXTENSION

Choosing export action from file menu shall add extension to the exported file.

Rationale file exported through the file menu is missing extension.

HEADERS

The save files shall contain and correctly display all header information.

In .DAT file the header should include Volume and Mass.

In thermal project file intensity label should read mAm^2/kg rather than Am^2/kg

ROWS

It shall be possible to remove from and add to rows in a measurement sequence prior to, and after the measurement. It shall be possible to modify active sequence when measurement process is stopped.

Rationale: Measurement sequences can take up to a month to complete. During that time it may become necessary to remove failed measurement steps from the sequence, or add new steps to get more data points.

Requirements implemented in version 1.0.3

DEGAUSSER FAILURE WARNING

Priority: 1

Ikayaki shall alert the user with an audible warning signal if degaussing sequence is not reported successful within a given time limit since its commencement. If time limit is reached Ikayaki should also attempt to ramp down the degausser by sending it a ramp down command.

Warning signal should use PC beeper and continue until user disables it.

Time limit shall be set to five (5) minutes by default, but shall be user configurable.

Rationale: The degausser may be damaged if it is left on for a prolonged period, especially at higher levels of intensity. User should know if there is a risk of this happening.

OPENING IKA FILES FAILURE

If an IKA file cannot be opened, Ikayaki shall notify user of the failure. Ikayaki should inform the user of the reason why it failed to open the file.

PRINTOUT

Priority: 2

Printout header shall contain all the information recorded in Ikayaki about the sample. The Area, Location, and Specimen identifier shall be listed topmost in a font more prominent than the other fields. Specimen field should include the type of the measurement sequence.

Printout shall contain all measurement steps for the data columns selected by the user, and Intensity and Stereoplot graphs.

See ATTACHMENT 1 : Model printout layout

STEREOPLOT

Priority: 1

Stereoplot shall be plotted according to formulas expressed in provided BASIC source code. Lines connecting points with opposite signs of inclination shall cross the equator.

Lines crossing the equator should form Great Circles.

Stereoplot shall have scales for both Inclination and Declination with ten (10) degree intervals. Scales should be faint enough so that data points are easily visible.

See ATTACHMENT 2: BASIC source code for stereoplot

See ATTACHMENT 1: Model of Stereoplot scales in printout model.

ERROR NOTIFICATION

Priority: 1

If Ikayaki detects signals indicating poor measurement data it shall pause the measurement sequence and inform the user of the cause. It shall be possible to suppress this notification function.

Ikayaki shall notify the user when values of Signal to Drift (S/D), Signal to Handler (S/H), or Signal to Noise (S/N) ratios are smaller than set threshold for those fields, or the value of Theta 63 is larger than the set threshold for that field.

For default threshold values see NOTIFICATION TRESHOLDS.

Rationale: Ikayaki should inform the user if a sample appears to be difficult to measure, but resolving the situation should be left to the user's expertise. Solving the problem may require steps not doable programmatically, e.g. poor signal may be ameliorated by cleaning the handler or using a larger sample.

See ATTACHMENT 3: GUI design for error notification function.

RAMP RATE

Priority: 2

Ikayaki shall allow different Degausser ramp rates to be used with different measurement steps of a single measurement sequence. This should be implemented through configuration option to allow the setting of ramp rate for different ranges of intensity.

Rationale: Lower levels of magnetization may require slower degausser ramp rates to avoid overshooting the target intensity level. On the other hand, when there is no danger of this, low ramp rate is unnecessary delay.

Suggested default ramp rates for different amplitudes:

- 1.1 to 10 ramp rate 9
- 10 to 50 ramp rate 7
- 50 to 120 ramp rate 5
- 120 to max ramp rate 3

MEASUREMENT WITH SEPARATED COMPONENTS

Priority: 1

Ikayaki shall provide a facility similar to AF measurement sequence that can measure magnetic components separately and avareage the results in each step.

During each step:

- Demagnetize x,y,z
- Demagnetize x position
- Measure x component of the magnetic direction
- Demagnetize y position
- Measure y component of the magnetic direction
- Demagnetize z position
- Measure z component of the magnetic direction
- Calculate D,I from x,y,z

Rationale: It has been suggested such a measurement type could yield better results than standard AF sequence, especially for difficult samples.

See ATTACHMENT 4: Gero AF sequence reference.

THETA 63

Priority: 1

Theta 63 shall be calculated according to formulas provided by the client in an Excel sheet.

See http://www.cs.helsinki.fi/group/mavis/docs/fisher_GTK.xls

SUSCEPTIBILITY NEGATIVE

Priority: 1

Susceptibility field in project details panel shall allow inputting of negative values.

SUSCEPTIBILITY UNDEFINED

Priority: 1

Negative values of susceptibility shall be distinguishable from an undefined value.

Note: versions up to 1.0.2 use "-1.0" to mark missing susceptibility.

SUSCEPTIBILITY AND Q

Priority: 1

Q value (Koenigsberger ratio) shouldn't be calculated when susceptibility is negative.

EXPORTING DATA

Priority: 1

Ikayaki shall provide a facility for exporting measurement data in an ASCII file. The file shall use an user-provided separator. This file shall have the same data as the printout; specifically, the same header information (see PRINTOUT) and all measurement data from user-chosen columns.

Set of separators to be provided: (" " ";" "tab" "space").

Rationale: Sometimes it is necessary to handle measurement data with different programs. While Excel is frequently used for this purpose, end user of the file may be a visitor using unspecified software, so format should be as general as possible.

NOTIFICATION TRESHOLDS

Priority: 1

Notification thresholds for the values of S/D, S/H, S/N and Theta 63 shall be user configurable, with the following default settings:

Threshold for the value of Signal to Drift (S/D): 10 (ten)
Threshold for the value of Signal to Handler (S/H): 10 (ten)
Threshold for the value of Signal to Noise (S/N): 10 (ten)
Threshold for the value of Theta 63: 1 (one).

NUMBER FORMAT

Priority: 2

Number format shall be configurable by user to use scientific (exponent) notation or decimal notation where applicable. Selection applies both to data displayed on the screen, and to the printed out measurement results.

Columns that shall be affected by the choice are:

Magnetic Intensity (J)
Magnetic Moment (M)
Mean X (geographic coordinates) (X')
Normalized Mean X (geographic coordinates) (X')
Mean Y (geographic coordinates) (Y')
Mean Z (geographic coordinates) (Z')
Mean X (sample coordinates) (X)
Mean Y (sample coordinates) (Y)
Mean Z (sample coordinates) (Z)

INTENSITY GRAPH LABELS

Priority: 2

The x-axis of intensity graph shall have three to four labels in addition to maximum value. These labels shall show rounded values between origin and maximum value.

The y-axis should show labels for value 1.0 and maximum value.

Origin should be displayed.

See ATTACHMENT 1: Example of labels in printout model

SAVE AS

Priority: 3

Ikayaki's project explorer should provide an option to save project files with an user defined path. ("Save as..." function.)

FREEZING AF

Priority: 1

Ikayaki should not stop responding during measurement sequence.

STEP SKIPPING

Priority: 1

Ikayaki shall not skip measurement steps. If a step cannot be successfully completed, program shall pause the sequence and notify user of the reason.

Rationale: A skipped step is likely to invalidate subsequent steps. Since sample is demagnetized in AF sequence, measurements at lower intensities cannot be repeated.

NUMBER PRECISION

Priority: 1

Numerical data shall be precise to at least three significant digits, but shall always be precise to at least one decimal place.

The number of decimals should scale with the number of significant digits in the following fashion:

Figures with two or less significant digits preceding the decimal point should have three significant decimals.

Figures with three significant digits preceding the decimal point should be precise to two decimal places.

Figures with four or more significant digits preceding the decimal point should be precise to one decimal place.

Formatting shall apply to the following data columns:

Magnetic Intensity (J)

Magnetic Moment (M)

Mean X (geographic coordinates) (X')

Normalized Mean X (geographic coordinates) (X')

Mean Y (geographic coordinates) (Y')

Mean Z (geographic coordinates) (Z')

Mean X (sample coordinates) (X)

Mean Y (sample coordinates) (Y)

Mean Z (sample coordinates) (Z)

Example: 1234.5, 123.56, 12.345, 1.123

Rationale: Numbers should have enough precision to show differences between results, but unnecessary degree of precision makes representation harder to read.

OPENING IKA FILES

Priority: 2

It shall be possible to open any data file recording valid information about a measurement sequence. It shall be possible to open IKA files generated by previous versions of Ikayaki.

It is not necessary to support saving to older IKA formats.

Requirements implemented in version 1.0.4

THETA 63 DEFAULT

If a sample is not measured in more than one position Theta 63 should have a default value of 1 for all measurement steps recorded for that sample.

In versions up to 1.0.3 the value is undefined for measurements in one position, as it would be meaningless.

Rationale: Eraajo expects Theta 63 to have a defined value. This is a workaround to let Eraajo read data files for projects where Theta 63 is not defined.

ABOUT IKAYAKI

"About Ikayaki" window shall display information about the current project group, including URL of the group web page, and the name and the list of members of the project group.

COPY PROJECT

Ikayaki should provide a feature to allow creation of a new project based on an existing project. The copied project shall have the following sample data fields automatically filled with information from existing project:

- Area
- Site
- Longitude
- Latitude
- Rock type
- Comment

The new project shall not contain any measurement data, and may be of a different type from the parent project. It shall be possible to specify the project type upon creation of the new project.

Rationale: Samples from the same dig share the same information for several fields. It would expedite inserting data on new samples if these fields would be automatically filled.

Example: Samples DJ1-1a, DJ1-1b, and DJ1-2 all come from the same dig site and so have the same Area, Site, Longitude, Latitude, Rock type, Strike, Dip, and usually Comment.

Sample DJ2-1 comes from another dig in the same geographical area, and shares the same Area, Site, Latitude, Longitude, and probably Comment as the DJ1 samples.

Requirements implemented in version 1.0.5

PRINTOUT CLEANUP

All values in sequence table should be visible with no ellipses. (27,6 as opposed to 27...) Page break before graphs should be clean. (Currently label (N) gets split).

RAMP RATE SETTINGS

From labels and ranges should be continuously updated on screen as the fields are modified.

Requirements implemented in version 1.0.6

SIGNAL TO BACKGROUND

Ikayaki should contain error parameter for Signal to Background. This value shall be displayed in measurement details panel with other error parameters and shall trigger a warning if treshold is reached.

Rationale: This error parameter offers an estimation on the validity of measurement for sequences where sample is only measured in one position. Signal to noise parameter is meaningless for those mesurements.

See ATTACHMENT 5: Error parameter calculations

See requirement ERROR NOTIFICATION for function. Notification happens if value of error parameter calculation is less than treshold value.

See requirement NOTIFICATION TRESHOLDS for setting the treshold value. The default value shall be 10 (ten).

ERROR PARAMETERS

Signal to Noise, Signal to Holder, and Signal to Drift ratio should be calculated according to forlmulas provided by the client.

See ATTACHMENT 5: Error parameter calculations

Requirements implemented in version 1.1.0

COPY PROJECT UPDATE

When new project is created by copying an existing project file with copy project function (see COPY PROJECT), the new project should contain all the sample information from the original project file.

Rationale: This expedites experiments involving repeatedly demagnetizing and magnetizing a single sample, and creates very little extra work in measurements involving related samples from a single excavation site, in which cases some fields need to be changed.

ERROR NOTIFICATION UPDATE

Error notification should work for all project files as they are opened. In version up to 1.0.6 error notification only happens during measurement sequence.

Requirements not implemented

HISTORY DATA

Configuration information and history data should be recorded in separate files. Currently both are in ikayaki.config.

Rationale: History data is more transient than system configuration data, and makes configuration file harder to read. It might be clearer to separate them.

Requirements notes

Requirements for versio 1.0.2

The most critical issue with Ikayaki 1.0.1 is the freezing measurement sequence, as this can ruin samples and potentially damage degausser. Solving this problem requires more information of the circumstances, however.

Prime requirement for the initial version, then, is logging facility to record data on the state of the program and its communication with the debugger.

Also, it would be prudent to start fixing the more straightforward errors in the software while more information is collected on rest of the requirements.

In addition to enabling the already present logging function, the changes to the initial version address few of the errors listed by the client that were deemed fastest to correct.

Note on configuration file: Ikayaki already stores configuration to file ikayaki.config which is read when the program starts. The reason for vanishing configurations is probably user accidentally deleting this file. This issue was addressed by moving the configuration to a new subfolder.

Requirements for version 1.0.3

Version 1.0.3 comprises majority of the maintenance work done on Ikayaki. While 1.0.2 was being prepared, client provided more detailed information on the outstanding requirements and prioritized them on a scale of one to three, one being most critical. Version 1.0.3 represents an effort to implement at least all the highest priority items and as many of the lower priority items as possible. These requirements include both correction of errors in the previous version of the software and implementation of new features.

STEREOPLOT

The connecting lines forming Great Circles was not implemented. This is a potential requirement for future versions.

Requirements for version 1.0.4

Requirements for version 1.0.4 are new features the clients thought of while team was working on version 1.0.3.

Requirements for version 1.0.5

Requirements for version 1.0.5 are corrections to requirements implemented during the project. Not everything works right the first time.

Requirements for version 1.0.6

Requirements for version 1.0.6 are last minute requests from the clients.

Requirements for version 1.1.0

Final release of the project wasn't supposed to contain any new features, but there were two final requests from the client we felt were safe to include. These requests were changes to features implemented earlier.

Requirements not implemented

HISTORY DATA

This was considered a cosmetic change the implementing of which would be more trouble than it was be worth.

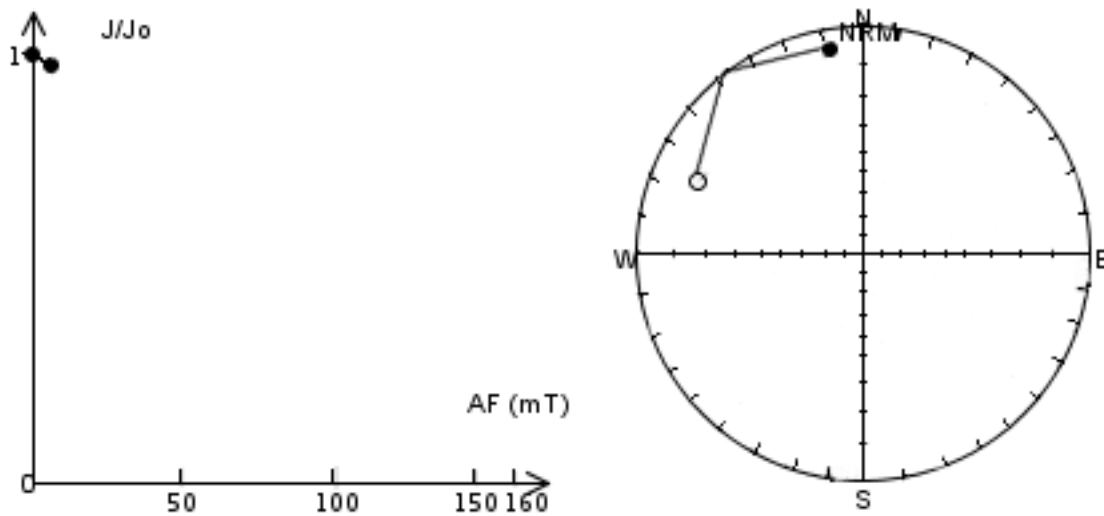
ATTACHMENT 1: PRINTOUT MODEL

**Area, Site : 0660, Karelia Valaam
Specimen : VG2-2a (AF-project)**

Operator / Date : Johanna / Aug 25, 2005 Latitude : 61.3 Sample type : hand
 Mass : 28.591 g Longitude : 31.0 Strike : 13.0
 Volume : 10.720 cm³ Susceptibility : 17500E-6 SI Dip : 85.0
 Density : 2667 kg/m³ Q : 1.52 Rock type : Diabase

Comments : No comment

#	AF (mT)	D (°)	I (°)	J (mA/m)	J/Jo	θ63 (°)	X (mA/m)	Y (mA/m)	Z (mA/m)	M (Am ²)
1	0	37,4	12	1.060E3	1	0,9	9.441E2	2.566E2	-4.072E2	1.136E-5
2	2,5	40,3	8,5	1.034E3	0,98	0,9	9.086E2	1.939E2	-4.538E2	1.108E-5



ATTACHMENT 2: STEREO PLOT SOURCE CODE

Wulff

```

4000 REM ***** WULFFIN STEREOKUVA *****
SCREEN 12
COLOR BRED%,0
LOCATE 1,1:PRINT "
LOCATE 6,1:PRINT "
"
LOCATE 7,1:PRINT "
"
LOCATE 8,1:PRINT "
"
LOCATE 9,1:PRINT "
"
LOCATE 10,1:PRINT "
"
VIEW (1,160)-(319,478),,1:CLS
' VIEW (1,120)-(319,348),,1:CLS
WINDOW (0,0)-(318,318)
REM PRINT G$
KX=159 : KY=159 : SS=140
CIRCLE (KX,KY), SS,10
LINE (KX,KY-SS)-(KX,KY+SS),10
LINE (KX-SS,KY)-(KX+SS,KY),10

FOR F=10 TO 80 STEP 10
  CE=SS*TAN(PI/4-F*PI/360)
  XI=(SS*SS-CE*CE)/(2*CE)
  RI=SQR(SS*SS+XI*XI)
  CX=XI-RI
  LINE (KX+CX,KY-2)-(KX+CX,KY+2),10
  LINE (KX-CX,KY-2)-(KX-CX,KY+2),10
  LINE (KX-2,KY+CX)-(KX+2,KY+CX),10
  LINE (KX-2,KY-CX)-(KX+2,KY-CX),10
NEXT F

FOR F=0 TO 350 STEP 10
  CO=COS (PI*F/180) : SI=SIN (PI*F/180)
  LINE (KX+(SS-1)*CO,KY+(SS-1)*SI)-(KX+(SS-5)*CO,KY+(SS-5)*SI),10
NEXT F

FOR F=1 TO DMGLKM%
  I1=I(F) : I2=ABS(I(F)) : DD=D(F)
  CE=SS*TAN(PI/4-I2*PI/360)
  XI=(SS*SS-CE*CE)/(2*CE)
  RI=SQR(SS*SS+XI*XI)
  X2=XI-RI
  XL=X2*COS((DD+90)*PI/180):XLL(F)=XL
  YL=-X2*SIN((DD+90)*PI/180):YLL(F)=YL
  IF F=1 THEN CIRCLE (KX+XL,YL+KY),3,14 ELSE CIRCLE (KX+XL,YL+KY),3,12
  IF I1<0 THEN 4010
  IF F=1 THEN PAINT (KX+XL,YL+KY),14 ELSE PAINT (KX+XL,YL+KY),12

```



```

4010 NEXT F
      GOSUB 4100
      GOTO 4910

4100 REM ***** ISOYMPYRAN PIIRTO *****
      FOR F=1 TO DMGLKM%:DD(F)=D(F):II(F)=I(F):NEXT F
      FOR K=1 TO DMGLKM%-1
        GOSUB 4430
        VAIHTO=0
        IF II(K)>0 AND II(K+1)<0 THEN 4560
        IF II(K)<0 AND II(K+1)>0 THEN
          SWAP II(K),II(K+1)
          SWAP DD(K),DD(K+1)
          VAIHTO=1:GOTO 4560
        END IF
        IF II(K)<0 AND II(K+1)<0 THEN 4170 ELSE 4180
4170 IF DD<180 THEN DD=DD+180 ELSE DD=DD-180
4180 REM
        QQ=1
        IF II<0 THEN QQ=-1
        IF II<0 THEN II=ABS(II)
        II=90-II
        CE=SS*TAN(PI/4-II*PI/360)
        XI=(SS^2-CE^2)/(2*CE)
        RI=SQR(SS^2+XI^2)
        CO=COS((DD-90)*PI/180):SI=SIN((DD-90)*PI/180)
        ALKU=YLL(K)*CO+XLL(K)*SI
        LOPPU=YLL(K+1)*CO+XLL(K+1)*SI
        IF ALKU<LOPPU THEN ASKEL=1 ELSE ASKEL=-1
        FOR YP=ALKU TO LOPPU STEP ASKEL
          XP=-(SQR(RI^2-YP^2))+XI
          IF QQ=-1 THEN GOTO 4360
          YL=-XP*SI+YP*CO
          XL=XP*CO+YP*SI
          IF (QQ=1 AND YP=ALKU) THEN
            PSET (KX+XL,YL+KY):GOTO 4400
          ELSE
            LINE -(KX+XL,YL+KY):GOTO 4400
          END IF
4360 REM
          YL=XP*SI+YP*CO
          XL=-XP*CO+YP*SI
          IF YP=ALKU THEN PSET (KX+XL,YL+KY) ELSE LINE -(KX+XL,YL+KY)
4400 NEXT YP
4410 NEXT K

      RETURN

4430 D1=DD(K)*PI/180:I1=II(K)*PI/180
      D2=DD(K+1)*PI/180:I2=II(K+1)*PI/180
      LX=SIN(D1)*COS(I1)*SIN(I2)-SIN(I1)*SIN(D2)*COS(I2)
      LY=-COS(D1)*COS(I1)*SIN(I2)+SIN(I1)*COS(D2)*COS(I2)
      LZ=COS(D1)*COS(I1)*SIN(D2)*COS(I2)-SIN(D1)*COS(I1)*COS(D2)*COS(I2)
      DD=ATN(LY/LX)*(360/(2*PI))
      IF LX>=0 AND LY<=0 THEN 4520

```

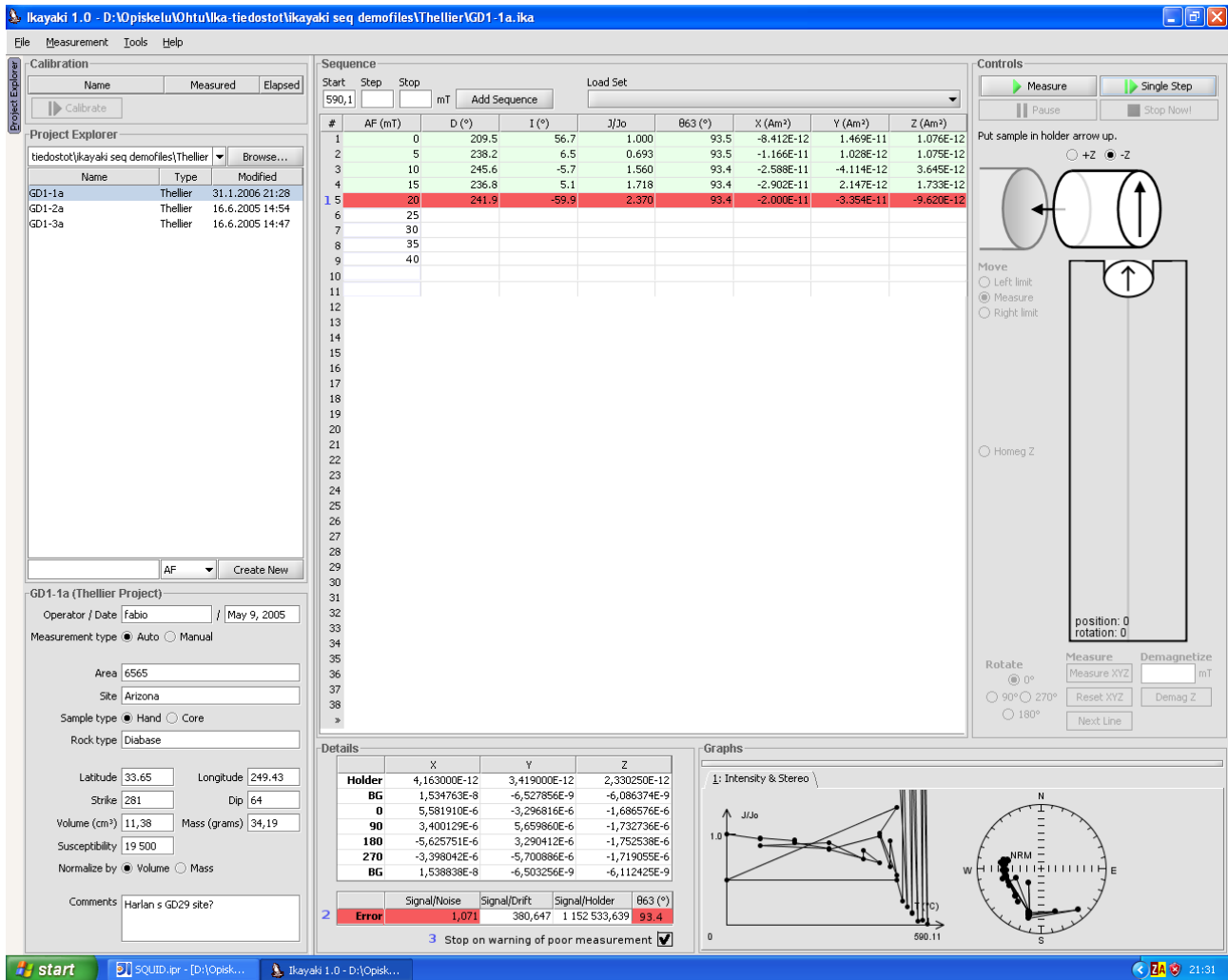
```

IF LX>=0 AND LY>=0 THEN 4540
IF LX<0 THEN 4530
4520 DD=DD+360:GOTO 4540
4530 DD=DD+180
4540 II=ATN(LZ/SQR(LX*LX+LY*LY))*(180/PI)
RETURN

4560 REM
IF VAIHTO=1 THEN 4580 ELSE 4590
4580 SWAP XLL(K),XLL(K+1):SWAP YLL(K),YLL(K+1)
4590 QQ=1
IF II<0 THEN QQ=-1
IF II<0 THEN II=ABS(II)
II=90-II
CE=SS*TAN(PI/4-II*PI/360)
XI=(SS^2-CE^2)/(2*CE)
RI=SQR(SS^2+XI^2)
CO=COS((DD-90)*PI/180):SI=SIN((DD-90)*PI/180)
S1=SS
EKA1=SS-(YLL(K)*CO+XLL(K)*SI)
EKA2=SS+(YLL(K+1)*CO+XLL(K+1)*SI)
TOKA1=SS+(YLL(K)*CO+XLL(K)*SI)
TOKA2=SS-(YLL(K+1)*CO+XLL(K+1)*SI)
IF EKA1+TOKA2<EKA2+TOKA1 THEN S1=SS ELSE S1=-SS
FOR FF=1 TO 2
IF FF=1 THEN ALKU=YLL(K)*CO+XLL(K)*SI:LOPPU=S1
IF FF=2 THEN LOPPU=YLL(K+1)*CO+XLL(K+1)*SI:ALKU=S1
IF FF=2 AND DD<180 THEN DD=DD+180 ELSE DD=DD-180
IF ALKU<LOPPU THEN ASKEL=1 ELSE ASKEL=-1
FOR YP=ALKU TO LOPPU STEP ASKEL
XP=-(SQR(RI^2-YP^2))+XI
IF FF=1 THEN GOTO 4780
IF FF=2 THEN GOTO 4790
4780 IF QQ=-1 THEN GOTO 4830 ELSE 4800
4790 IF QQ=1 THEN GOTO 4830 ELSE 4800
4800 YL=-XP*SI+YP*CO
XL=XP*CO+YP*SI
IF Y=ALKU THEN PSET (KX+XL,YL+KY) ELSE LINE -(KX+XL,YL+KY)
GOTO 4870
4830 REM
YL=XP*SI+YP*CO
XL=-XP*CO+YP*SI
IF YP=ALKU THEN PSET (KX+XL,YL+KY) ELSE LINE -(KX+XL,YL+KY)
4870 NEXT YP
NEXT FF
IF VAIHTO=1 THEN
SWAP II(K),II(K+1)
SWAP DD(K),DD(K+1)
SWAP XLL(K),XLL(K+1)
SWAP YLL(K),YLL(K+1)
VAIHTO=0
END IF
GOTO 4410

```

ATTACHMENT 3: ERROR NOTIFICATION DESIGN



Ikeyaki warns user if it detects indications of poor quality measurements.

After measurement step is done, Ikeyaki checks values of S/D, S/H, S/N, and Theta 63 against given thresholds, and if values meet warning criteria, Ikeyaki stops the measurement sequence and alerts the user by highlighting the step in question [mark 1 in picture], and by highlighting the specific values that triggered the warning in details panel [2].

User can suppress the warnings by unchecking the "Stop on warning" checkbox [3] next to error detail fields. The box is checked by default.

New projects should have the box checked by default. Saved projects should save the state of the checkbox. (If user has unchecked the box in a given project the selection should persist if user loads the same project later.)

ATTACHMENT 4: GYRO AF MEASUREMENT SEQUENCE REFERENCE

Let's assume I need to demagnetize a specimen with the following AF sequence:

0, 5, 10, 20, 30 mT

0 means that I measure the sample without demagnetizing, whereas 5 I measure the sample after a 5 mT AF-treatment, and so on.

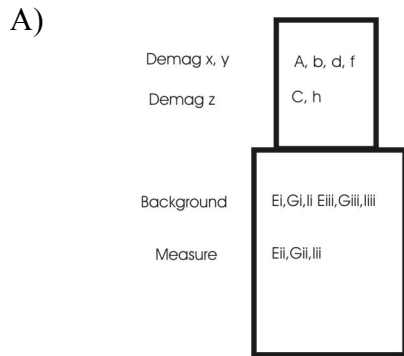
In the following the procedure for the new measurement:

- 1) 0 mT: there is no demagnetization here. So you might measure:
 - a. X position:
 - i. Background
 - ii. Measure X
 - iii. Background
 - b. Y position:
 - i. Background
 - ii. Measure Y
 - iii. Background
 - c. Z position:
 - i. Background
 - ii. Measure z
 - iii. Background
 - d. Calculate mean X, Y, Z and Decl + Incl.
- 2) 5 mT (See example in figure 1):
 - a. Demagnetize the x position at 5 mT
 - b. Demagnetize the y position at 5 mT
 - c. Demagnetize the z position at 5 mT
 - d. Demagnetize the x position at 5 mT
 - e. Perform the measurement of x position
 - i. Measure background (BG)
 - ii. Go to measurement position and measure x according to the number of rotations
 - iii. Measure BG again
 - f. Demagnetize the y position at 5 mT
 - g. Perform the measurement of y position
 - i. Measure background (BG)
 - ii. Go to measurement position and measure y according to the number of rotations
 - iii. Measure BG again
 - h. Demagnetize the z position at 5 mT
 - i. Perform the measurement of z position
 - i. Measure background (BG)
 - ii. Go to measurement position and measure z according to the number of rotations

iii. Measure BG again

j. Compute the mean x, y and z, and calculate D, I. For this point basically follows the old procedure.

3) 10 mT: repeat points a) to j) with 10 mT, and so on.



B)

Details			
	X	Y	Z
BG	Ei	Gi	Ii
0			
90	Eii	Gii	Iii
180			
270			
BG	Eiii	Giii	Iiii
	Signal/Noise	Signal/Drift	Signal/Holder
Error		J	

C)

Sequence								
Start	Step	Stop	Load Set					
0			mT	Add Sequence				
#	AF (mT)	D (°)	I (°)	J/Jo	B63 (°)	X (mA/m)	Y (mA/m)	Z (mA/m)
1	0							
2	5		J					

Figure 1: A) position of the sample in the magnetometer. A to J refer to the points in the explanation. B) Table. The table of details for each steps is filled according to each single measurement as mentioned in points Ei-iii; Gi-iii and Ii-iii. C) The final result can be calculated using the actual procedure. Mean values of X, Y, and Z can be transformed into D,I.

ATTACHMENT 5: ERROR PARAMETER CALCULATIONS

Signal to noise:

$$SN = \frac{\textit{Total_moment_of_sample}}{\textit{sqrt}[(\textit{stdev}M_{xi})^2 + (\textit{stdev}M_{yi})^2 + (\textit{stdev}M_{zi})^2] + 10^{-15}}$$

where i are multiple rotation positions (0°, 90°, 180°, 270°) and 10⁻¹⁵ just prevents dividing by zero

Signal to drift:

$$SD = \frac{\textit{Total_moment_of_sample}}{\textit{sqrt}[(B_{x1} - B_{x2})^2 + (B_{y1} - B_{y2})^2 + (B_{z1} - B_{z2})^2] + 10^{-15}}$$

where B₁ and B₂ are background BEFORE and background AFTER the measurement

Signal to background:

$$SB = \frac{\textit{Total_moment_of_sample}}{\textit{sqrt}[(\frac{B_{x1} + B_{x2}}{2})^2 + (\frac{B_{y1} + B_{y2}}{2})^2 + (\frac{B_{z1} + B_{z2}}{2})^2]}$$

where B₁ and B₂ are background BEFORE and background AFTER the measurement

Signal to holder:

$$SH = \frac{\textit{Total_moment_of_sample}}{\textit{Total_moment_of_empty_holder}}$$