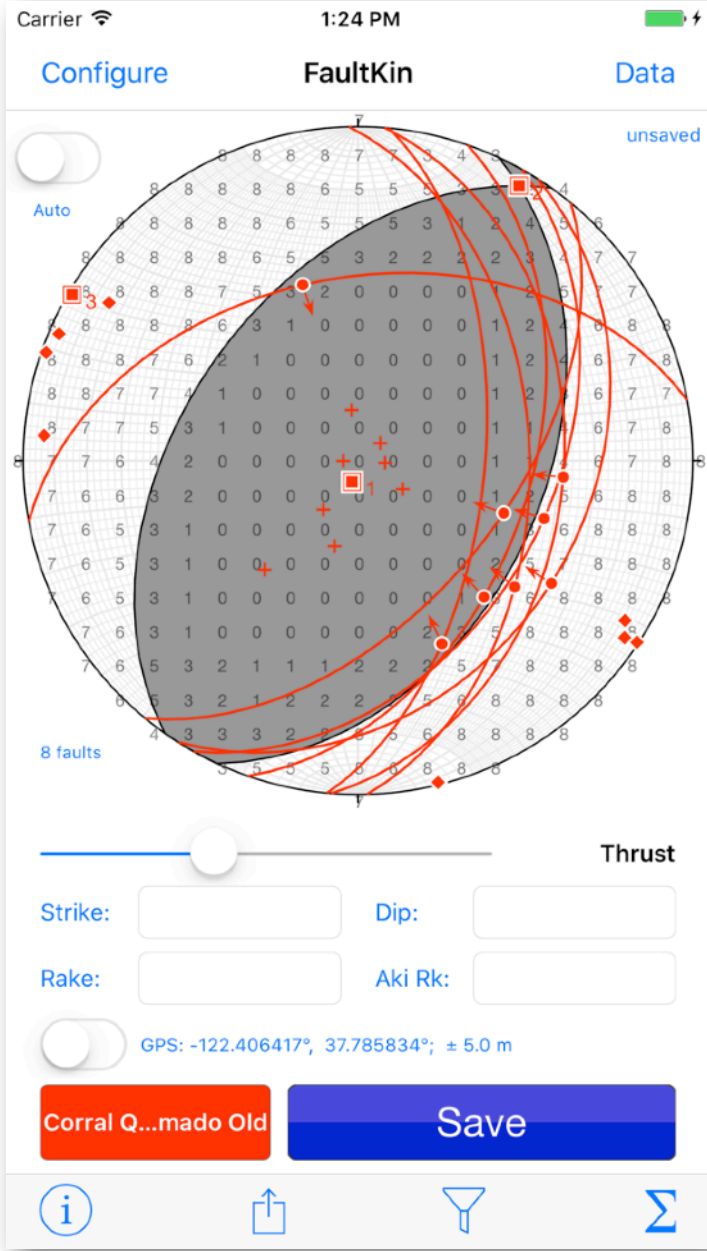


# FaultKin Mobile for iOS

v. 1.0

Richard W. Allmendinger © 2017



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## Disclaimer

FaultKin Mobile is provided “as is” with no without any warranty, explicit or implicit. The author will not be liable for direct, indirect, incidental, or consequential damages resulting from any defect in this software or this user's manual, even if he has been previously been made aware of the defect. Furthermore, I make no systematic effort to inform all users of either bug fixes or upgrades. Recall that your iOS device is very sensitive to magnetic fields and the compass bearings can easily be off by 10-20°! Use this app at your own risk. This program should not be used as a sole source of navigation data This program may not be sold or offered as an inducement to buy any other product.

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## Privacy Statement

FaultKin Mobile will capture the location of the device, only with the users express consent, to tag observations with the place they were collected. The program is fully usable, though less convenient, without access to device location. Location data, if collected, remain on the device as long as the user chooses to leave it there but is not accessible to any other program on the device. The user may choose to send location tagged data to a different computer or person via the iOS sharing panel (email, iCloud Drive, etc.) or via iTunes File Sharing. FaultKin Mobile never sends any data to the author or to any other third party, except in the case where the user elects to display the position of a datum in the iOS Maps program. For iOS Maps functionality, a single latitude-longitude pair, without any other information, is sent to the Maps program.

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## Purpose

FaultKin Mobile is designed to help you collect, visualize, and analyze fault slip data on the go. It is a companion to my FaultKin program for desktop computers, but it can also be used to measure faults on the outcrop. The app has the following features:

- Provide automatic data entry as a geologist's compass by reading the iOS device orientation and converting it to strike and dip of planes and/or trend and plunge of lines.
- Provide manual data entry via either tapping and dragging on the stereonet or by typing values into text fields
- Groups of faults can be assigned different tags. You will probably want to do this based on location or other criteria. For example, you may want to have a tag labeled "Corral Quemado-Older" and another "Corral Quemado-Younger".

- Carry out basic calculations such as: rotations about any axis, unfolding faults around local bedding, or measure angles between lines and between planes
- Plot P & T axes, (unweighted) moment tensor axes, P-T dihedral, fault plane solutions, and contour P & T axes.
- View the plots from any orientation, not just looking straight down into the lower hemisphere
- Stamp each entry with time date and, if enabled by the user, location. See the location of a datum in the iOS Maps program
- Provide basic input and output of data using standard iOS conventions
- Work on both iPhones or iPads, both in portrait mode only.

The desktop version of FaultKin will soon be updated so that it can read and write FaultKin Mobile files, which are simple tab separated text files.

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## Data Input

All fault slip data require, at a minimum, three sets of entries: (1) Orientation of the fault plane; (2) orientation of striations (slickensides, striae, slickenlines, etc.); and (3) sense of shear in current geographic coordinates. FaultKin Mobile requires that you enter these types of data and, in addition, allows you to enter a great deal more data about your observation. The main screen of FaultKin Mobile is structured about collection those three sets of entries.

FaultKin Mobile enables three basic forms of data input: by typing, by tapping, or by using the device orientation. All measurements are associated with a data tag — usually the location perhaps modified by a subset (e.g., “older,” “younger”) — which is set using the colored button to the left of the Save button. When you tap that button, a panel will slide up from the bottom enabling you to “tag” your observation with an existing tag or you can define a new tag. FaultKin Mobile provides a way of defining your own categories and the color they are plotted in as described later in this document. The data tag button changes name and color to reflect the tag type selected, providing you with a rapid visual clue to the currently set data type. You can assign a data tag any time prior to tapping the Save button to record a measurement. Data tags can be reassigned in the Datum Details View described below.

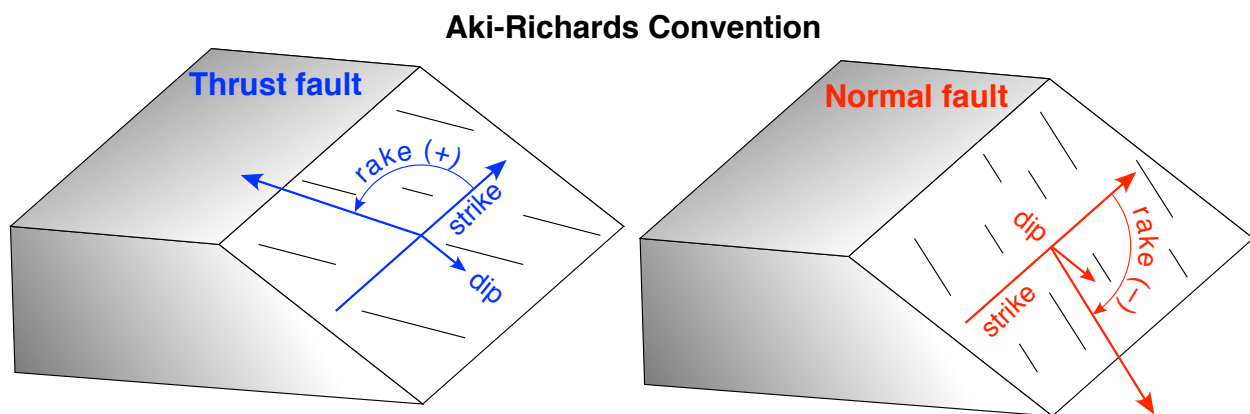
In all cases, when you enter the data, it will appear interactively in magenta on the stereonet. Your device can record the longitude and latitude of the phone at the time the

data are recorded if you turn on the GPS switch at the bottom of the screen. *Note that continuous use of GPS will deplete your device's battery charge quickly so you should only turn this on while you are actively making a measurement and then turn it off again.* All data are stamped with time and date of measurement. The data are not recorded, however, until you tap the Save button!

Each time you tap the Save button, FaultKin Mobile writes all of the data currently in memory to a file in the hidden documents folder of the device called "RecoveryFile". Should you, heavens forbid, experience a crash or (more likely) carry out a calculation that unexpectedly changes your data, you can open this file and read its contents back into the program (see below) for further analysis.

## Input By Typing

Tap on the Strike text box and type a value on the keyboard that appears automatically. Then, tap on the Dip text box and enter that value, followed by the Rake (assuming you have set Rake and not trend as default in Settings). Instead of typing, you can also tap the microphone button on the keyboard and dictate your results. You set the sense of slip using the horizontal slider above the strike and dip entry boxes.



## Input By Tapping and Dragging

You can also enter data by tapping and dragging directly on the stereonet. The active point is, by default, not directly beneath your finger but offset up and to the left of the tip of your finger so you can actually see it. You can change or eliminate this offset in the Settings View. You set the strike and dip of the fault plane automatically by dragging the pole to the plane. When you lift your finger, the active point remains where you left it. After the plane has been set, you will need to type in the value of the rake (or trend) of the striae. If you have trend set as default, the program will automatically calculate and enter the correct plunge for you; if you have set Rake as default, then the program will

calculate the rake using the Aki-Richards convention (for brevity referred to as the “Aki Rake” on the screen). Alternatively, if you enter the Aki Rake, the program will calculate the traditional lower hemisphere rake and set the correct sense of slip for you.

While you are tapping and dragging, by default FaultKin Mobile changes the underlying grid to help you make the measurement. The entire underlying stereonet grid is rotated so that the great circles are parallel to the plane that you are drawing. This behavior can be turned off or on in Settings.

## Input Using Device Orientation

Your iOS device has sensors that enable it to determine its exact orientation and position in space. You take advantage of this in FaultKin Mobile by toggling on the Auto switch in the upper left corner of the stereonet view. Because accurate device orientation with respect to True North requires your location, activating auto data collection will also turn on the GPS switch. All measurements are with respect to True North as determined by the device.

To measure a fault slip datum, place your phone back flush against the fault surface with the long axis parallel to the slickensides on the surface. Set the sense of slip using the slider. When you tap Save, the entire fault-slip datum will be recorded all at once.

Although the active plane and/or line is shown interactively as you move your device around, no numbers appear in the text boxes until the device is held stably for 1 second without significant motion (i.e., user accelerations in any direction). Then the device will start measuring the orientation once every tenth of a second. The value and  $\pm$  that you see in the text boxes are the average and standard deviation (1 sigma) of those multiple measurements. If you hold the phone still against the rock for 3 seconds, you will see the average and standard deviation of thirty measurements.

Note that it is possible to move the phone slowly enough that it doesn't trigger the user acceleration but the device changes orientation significantly. This will cause errors to accrue. For that reason, the app will automatically reset the statistics and start averaging over again if errors exceed  $3^\circ$ . If you try to save a measurement with an error greater than  $3^\circ$ , FaultKin Mobile will present you with a message box alerting you to the fact that

The uncertainty that you see does not reflect systematic errors due to, say, nearby magnetic fields but only the average and standard deviation of those multiple measurements. FaultKin Mobile does not save the calculated, random errors because their low values could be misleading: it is quite possible to have low random errors but much

larger systematic errors which are impossible to record. A good practice is to calibrate the device magnetometer at every outcrop or before every measurement by taking it through a couple of figure-8's, even if not prompted by the device.

You can tap the Save button at any time all for text boxes have numbers in them. However, there may be times when you will want to freeze your measurement to inspect it before recording it. In that case, simply touch your finger to the Stereonet and then release it; when you lift your finger from the glass, the value will be frozen (and auto orientation and location collection turned off). If you like the value, you can record it and then turn Auto back on to collect more data.

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## Inspecting Entered Data

### Data List View

To see a list of the data that you have entered, tap the “Data” button at the top right of the stereonet view to see the Data List view. All of the existing observations are displayed and color dot on the right hand side corresponds to the data tag color assigned to each datum. If you have previously filtered your data (i.e., hidden some data types by unchecking them) you can toggle between seeing all data by clicking the button in the upper right corner of the screen. Tap it when it says “Filtered” to see the subset of unchecked points; the name of the button will change to “All Data” which you can tap to again list all measurements (changing the name back to “Filtered”).

The buttons at the bottom of this view allow you to save, share, or open data files as explained in a subsequent section. The Trash Can button will erase all entered data from the program, but any saved data, as well as data in the RecoveryFile will remain on the device and can be read back into the program at any time.

You return to the Stereonet View by tapping the “FaultKin” button in the upper left corner.

Tapping on any datum in the list will bring up the...

### Datum Details View

#### Basic Info

Here you can see all of the details about a single measurement or “datum”. You can get to this screen by tapping a measurement in the Data List View, or directly from the Stereonet View by double tapping on the Strike/Rake labels. This will enable you to en-

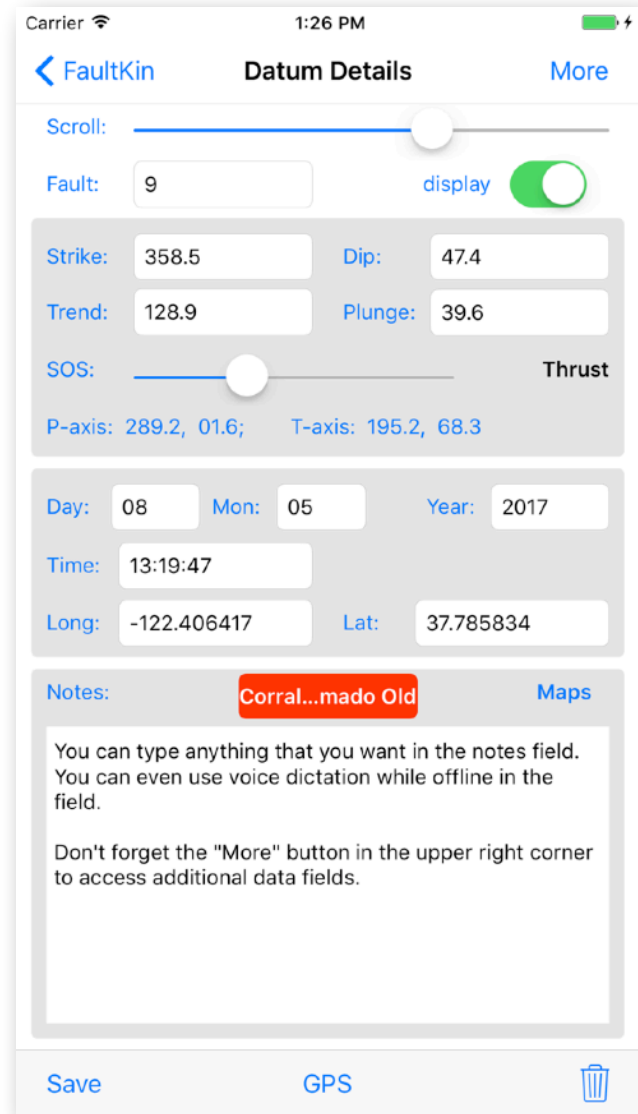


ter additional information in the notes field immediately for your most recent measurement.

In the Datum Details View, you can scroll through all of your measurements with the horizontal slider at the top of the screen. The display switch below and to the right of the slider determines whether the datum is plotted on the stereonet. The Trash Can button in the lower right hand corner will delete the datum (a message box will check to be sure). You can see the location of the measurement (if location data have been entered) in the Apple Maps program by tapping the Maps button. The return to FaultKin button in the uppermost left corner in Maps will take you right back to where you were in the FaultKin app.

You can edit any of the text fields by tapping on them, erasing the existing information (if any) and then typing in the new information. If you change the number of the datum, the corresponding information will be displayed. With the exception of the notes field, any changes that you make are not recorded until you tap the “Save” button in the lower right hand corner. Anything that you type in the Notes field, and anything in the More Details View (described below), is attached to the measurement immediately without needing to press Save Changes. Note that you can use voice dictation in iOS even if you are not connected to the Internet.

The data tag of the measurement can also be changed on this screen by tapping the data tag button. FaultKin Mobile will display the standard data tag picker screen where you can select a different existing data tag or, by tapping the “New” button in the upper left, define a new data tag for the datum. To have the data tag change “stick”, you must tap the “Save” button in the lower left.



The “GPS” button on the toolbar at the bottom of the screen when pressed will allow you to add the current location of the device to the longitude and latitude fields in case you forgot to turn on GPS on the Stereonet View. You must press the “Save” button for those to be recorded.

### More Detail View

The More Details view is accessed by tapping the “More” button at the top right. This view provides access to additional parameters that you can attach to a fault slip datum. Some of these attributes are generated for you automatically. For example, you can set the default geologist’s name in the Setting View of the app and that will automatically be entered here. The field number is generated automatically by adding to the data tag a sequential number out of the total number of measurements. The Place name is initially assigned the same text as the data tag. All of these can be changed for an individual datum in this screen simply by tapping and typing in a new value.

The second group box pertains to scaling information for the observation. You can enter a value (in meters) for the displacement, gouge thickness, or trace length. You can also specify whether this is the same fault as measured in the previous measurement using the “same as previous” switch. These data can be used by the desktop FaultKin program to calculate weighted moment tensor sums.

The third group box is where you enter information about bedding and lithology. FaultKin Mobile can measure the bedding for you if you toggle on the “use device orientation” switch at the top of this box: turn on the switch, place the phone on a bedding surface and, when you are satisfied with the measurement, tap the Save Bedding button. Alternatively, you can just type in the bedding values. The upper unit and lower unit text boxes can hold whatever text you want.

Carrier 1:28 PM

< Datum Details More Details

Field No.: Location 4-4

Geologist: Allmendinger

Place: Location 4

Displ: 57.0 Gouge: 0.0

Length: 0.0 (all units in meters)

same as previous measurement

use device orientation Save Bedding

Strike: 165.0 Dip: 31.0

Upper Unit: Ordovician sandstone

Lower Unit: Miocene eolian strata

(all changes here are recorded immediately)

All data entered on this screen are saved immediately to the fault slip datum attributes.

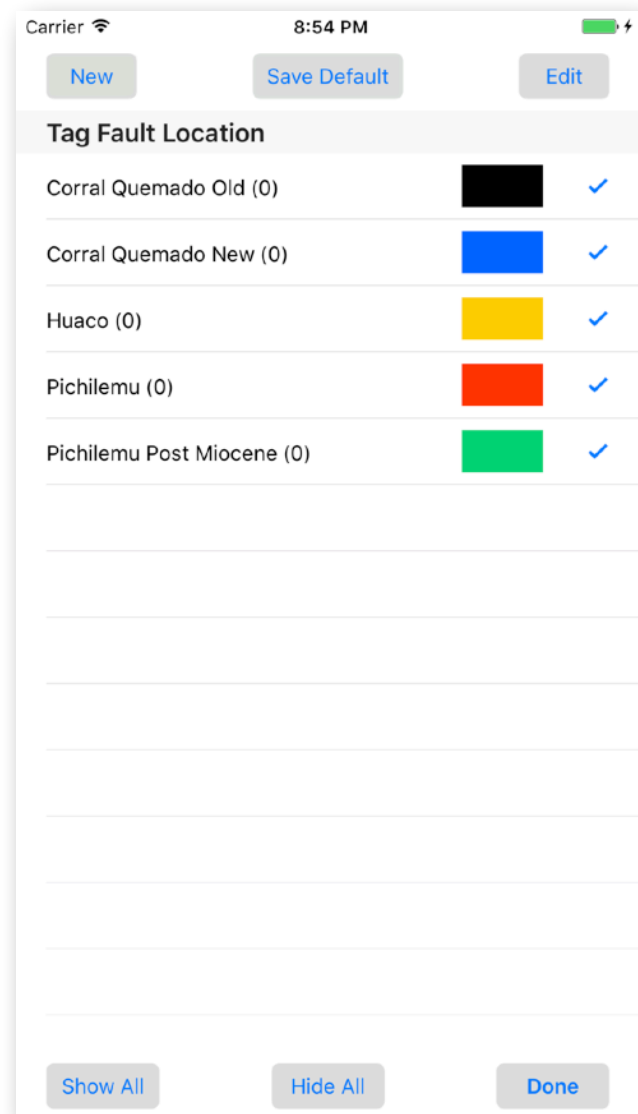
You return to the Datum Details View by tapping the button of that name in the upper left corner, and return to the Data List view by tapping the Data List Button in the upper left corner of the Datum Details View.

## Filtering Your Data

### Basic Use

Chances are, you will want to see subsets of the total number of types of data you have collected. Because FaultKin Mobile tags all of your input data with its data tag, this is easy to accomplish in the app. Simply tap the Filter button at the bottom of the Stereonet View and a panel will slide up from the bottom showing all of the pre-defined data tags, their colors, and the number of entered observations of each type (view to the right). Tap any data tag (or several) to toggle the checkmark at the right hand side; When you tap the Done button in the lower right, you will be returned to the Stereonet View and only the checked observations will be plotted. The Filter Data panel doubles as a legend for the plot itself so if you forget what data type is shown in red with a triangle, just pull up the filter data panel. The Show All button at the bottom left of the panel will toggle on all observations.

The Hide All button does just what it says! You might want to use this button if you didn't want to be distracted, or biased, by already collected data when you are collecting new data. Just be aware that as soon as you press the Save button, the observation will disappear because Hide All is turned on!



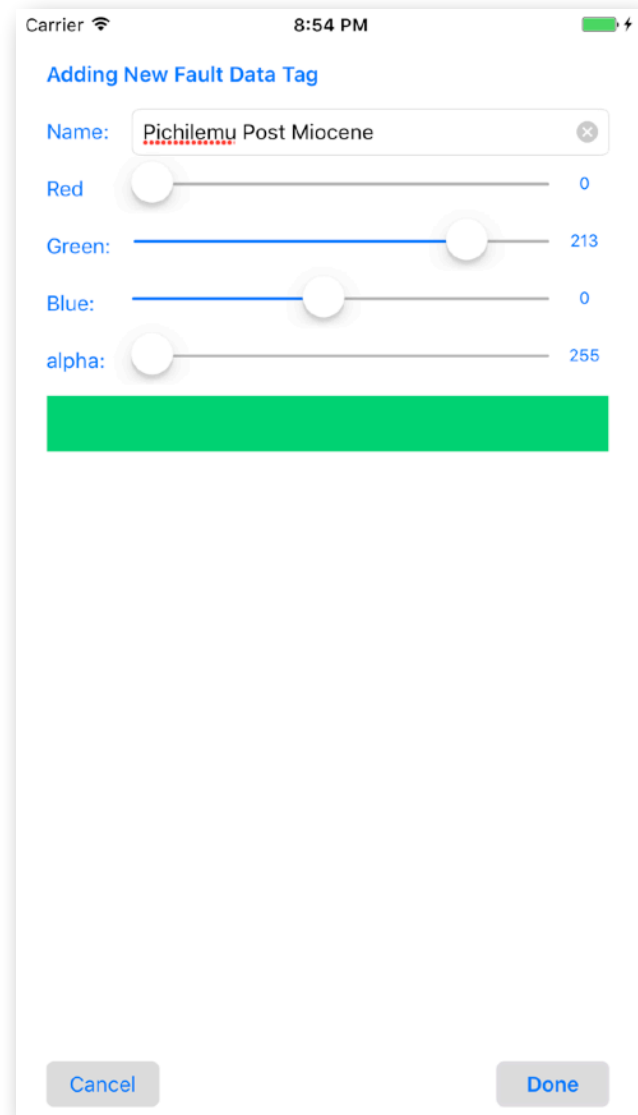
## Editing or Adding New Data Types

If you don't like the built-in data types, you can edit your own or add new ones within the app. To edit an existing data tag, tap the Edit button in the upper right corner of the Filter Data Types view. The button will turn red to show you that it is waiting for you to select which tag to edit. Tap the data tag you want to edit and you will be taken to the Editing Data Types screen shown on the next page. If you want to add a new data tag instead, tap the New button in the upper left to go directly to the editing screen.

Once you are in the Editing Data Tags screen, you can change the name of the data type by tapping the text field to the right of the "Name:" label. You can put anything you want in this text field, including names with spaces or punctuation.

You change the color used to represent the data type by adjusting the Red, Green, and Blue sliders just below the name text field. The number to the right of each slider tells you the value in case you want to enter specific values. Each slider varies between 0 and 255. If all sliders are set to 0 (far left) you will get black for a color; if they are all set to 255, you will get white. The fourth slider controls the alpha channel (i.e., transparency). The rectangle beneath the sliders changes color as you move the sliders to show you the color you are selecting.

The buttons at the bottom of the Editing Data Types screen determine what happens to the changes that you make. "Cancel" will return you to the previous screen with no changes, even if you had changed some of the settings. "Done" will apply the changes you have made to the data type that you originally tapped to get to this screen in the



first place. If you are editing an existing tag, you will also see a button to delete the tag completely. You can only delete a tag that has not been assigned to any measurements.

To combine two data tags (and their corresponding measurements) into a single type, tap one of the two and then change its name to the other data tag. For example, let's say you have three measurements of the "Hualfín" data type and four which have been tagged as "Gualfín". You decide that you would like to combine all as "Hualfín". Tap on the "Gualfín" data tag and then change its name to "Hualfín". You will be asked to confirm that you want to combine the two. If you answer affirmatively (i.e., "combine"), you will have seven measurements tagged as slickensides and the "Gualfín" data tag will be deleted.

## Configuring Your Plot

To determine what you see on your plot, tap the "Configure" button in the upper left corner of the Stereonet View. Here you will use a series of segmented buttons and switches to specify what shows up on the plot. Most of these are self-explanatory. Note that you can also specify whether planes are displayed as Strike and Dip, Dip Azimuth and Dip, or Poles. If you specify Poles, it only affects data input, but does not change the plot. Great Circles always plot as great circles. Likewise, you can also determine whether you want to show your location as UTM or Lat & Long. If you choose UTM, a new text box will appear on appropriate screens for the UTM zone. Note that all data are saved using strike and dip and latitude and longitude, regardless of what is specified here.

If you choose Moment Tensor Sum or Fault Plane solution, the appropriate statistics and information will be displayed in the text box at the bottom of the screen

Carrier 1:29 PM

← FaultKin Configure Plot

Projection:  Area  Angle  Polar

Planes as:  S & D  D & D Az  Poles

Location as:  Lat & Long  UTM

Plot:  Faults & Striae  P & T Axes  Both

Contour:   Kamb  1% area

Moment Tensor Sum:   All  by Tag

PT Dihedra:   P-axes  T-axes

Fault plane solution:

----- Moment Tensor Sum | 2017-05-08 13:29:37-----

for Data type Corral Quemado Old

Axis	Eigenval	Trend	Plunge
1.	7.3153	195.7,84.6	
2.	-0.2615	030.3,	05.2
3.	-7.0537	300.2,	01.3

----- Fault Plane Solution | 2017-05-08 13:29:37-----

Fault	Strike	Dip	Trend	Plunge	Slip Sense	A-R rake
1.	024.9	43.9	125.3	43.4	TL	082.5
2.	215.3	46.6	-065.1	46.1	TR	097.2

P-axis: 300.2, 01.3; T-axis: 195.7, 84.6

i Σ

for your reference. Moment Tensor Sum calculations can be carried out for the entire group of lines (“All”) or separately by data type tag (“by Tag”). Contouring displays contour lines only, not filled contours. The program uses the Robin and Jowett (1986) smoothing routine to produce smoother contours on screen. Either Kamb or 1% area contouring can be selected. Contours are always done separately by data type and use the same ink color as that assigned to the data type. Both P and T axes are contoured but the T axes contours have an alpha channel transparency of 50% so that they appear distinct from the P-axes contours. Finally, PT Dihedra and Fault Plane Solution can only be applied to the entire group of showing fault slip data, regardless of how many different data tags on the screen. Thus, you will probably want to filter the data to show a single tag before selecting either of those options. Note that you can access the Settings, Calculations, or Filter screens directly from the menu bar at the bottom of the screen.

When you return to the FaultKin View using the button in the upper left of the screen, all of your changes will appear as you specified.

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## Calculations

FaultKin Mobile can perform a number of common calculations by tapping the “ $\Sigma$ ” button from the tool bar at the bottom of either the Stereonet View or Configure Plot View. Before carrying out a calculation, be sure that the switch on the Settings View entitled “Calculations replace existing data” is set the way that you wish. If it is turned on, a calculation will replace what ever data have been entered in the lines or planes array. For example, if you have a group of faults and tap “Rotate”, the existing fault data will be erased and replaced with the rotated data. The default setting for FaultKin Mobile is with “Calculations replace existing data” turned off. In this case, the results of the calculation will be appended to the existing fault data and a new data tag and color defined to represent the results of the calculation. For example, if you have a data tag called "Hualfín" and do a rotation, the new fault data tag will be called “Hualfín rotated” etc.

### Rotate Data

Rotate data works just the way it does in a stereonet program. You enter the azimuth and plunge of the rotation axis, as well as the magnitude. Positive magnitudes produce a clockwise rotation looking in the direction of the rotation axis; negative values will produce a counterclockwise rotation. Tapping the “Rotate” button will immediately perform the rotation and return you to the screen from which you called up Calculations. All of the buttons on this view work the same way. If you have turned on “Calculations replace

existing data”, rotation will immediately replace whatever data was in the lines and/or planes array. Otherwise, a the result of the rotation will be appended to the existing arrays and a new data set with the suffix “ rotated” will be added to the list of data sets. If you have an unexpected result, you can read in the “RecoveryFile” to return to the data at the time of entry of the last observation.

## Unfold Data

If you have collected bedding attitude data at the site of each fault measurement, then you can ask FaultKin Mobile to unfold the fault data by restoring local bedding to horizontal. This allows you to perform a fold test in the field. If bedding hasn’t been entered, the fault datum remains unaffected.

## Fault from P & T Axes

There may be times when you wish to calculate a fault orientation from known P & T axes, perhaps most commonly working with earthquake data. Of course, there are two possible fault planes associated with each set of P & T axes and FaultKin Mobile will calculate both. You enter the trend and plunge of the P-axis and the trend of the T axis. The app will calculate the correct T-axis plunge so that the two axes are orthogonal. As soon as sufficient data have been entered, the two possible planes, their slip directions and slip senses will be displayed. If you want to add one of the planes to the plot, tap the “Add” button next to that value.

## Angle Between...

It is not so easy to implement routines for getting angles between lines and planes without taking up a lot of very precious space in iOS! In the current implementation, tapping either part of the 2 Lines|2 Planes segmented button will return you to the Stereonet view. The program will then calculate the angle between the lines, or poles, that repre-

The screenshot shows the FaultKin Mobile app interface. At the top, it displays 'Carrier', signal strength, '1:29 PM', and battery level. The main content is divided into three sections:

- Rotate Data:** Contains three input fields for 'Azimuth', 'Plunge', and 'Magnitude'. Below them is a note: 'Positive rotation is clockwise looking in the azimuth and plunge of the axis'. A 'Rotate' button is on the right.
- Unfold faults using bedding:** A single 'Unfold' button.
- Fault from P & T Axes:** Contains input fields for 'P-axis' (Trend: 125, Plunge: 20) and 'T-axis' (Trend: 20, Plunge: 35.4). Below these are two rows of calculated fault orientations: '167.8/49.3; 339.4/09.7; SOS = TL' and '069.4/80.3; 077.8/40.7; SOS = TR'. Each row has an 'Add' button.

At the bottom, there is a section titled 'Angle Between...' with a segmented button for '2 Lines | 2 Planes' and a note: 'tap and drag the two lines, or the two planes, on the stereonet'. A 'Cancel' button is at the very bottom right.

sent the next two taps on the screen (actually triggered by the release of your finger from the screen). Once you have tapped on each of the lines (or poles to planes), a message box will appear with the calculated angles. Because it is difficult to tap very precisely on the screen, you should view the results as approximate only (unless your finger is much steadier than mine!).

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## Getting Data In and Out of the Program

Because iOS hides its file structure from the user, data I/O is not as straightforward as on the desktop versions of Stereonet. Here are your current options:

### The Document Folder on the Device

Each app in iOS has its own private document folder where it can store its files. To save your data to this private folder, navigate to the Data List View. At the bottom of the screen enter a “Project Title” that will become the name of the saved file. Tap the “Save” button on the toolbar at the bottom of the screen. A message box will confirm that you have saved the file. Note that this will overwrite any file of the same name that is already in the hidden documents folder. This allows you to re-save a file easily after entering more data but it has the distinct drawback that you might inadvertently wipe out an unrelated file that has the same name (since the files are mostly hidden). You can avoid this by...

### Getting a List of Files Already Saved to the Device

In the Data List View, tap the “Open” button on the toolbar at the bottom of the screen. A new view will slide up from the bottom listing all of the files saved in the hidden Documents folder on the device, along with their modification date and time. If you just want to see what’s in there, tap the Cancel button at the bottom of the screen and you will return to the Data List View. You can also delete files from this screen by toggling on the “Delete Files” switch and then tapping on the file you want to delete. The file will be gone instantaneously so be sure you know what you are doing!

If you want to open one of those files, tap on the file name and it will be opened. If you have any data already entered, the app will give you the option of either replacing the entered data with the data in the opening file, or Appending the data in the file to the data already entered in the program. The “RecoveryFile” behaves just like any other file (except that you cannot delete it from within the program): just tap on it to recover your data from an unexpected operation.



## Using iTunes File Sharing to Manage Data in the Documents Folder

At the present time, the only way to upload data to the device, or erase files from the device, is via iTunes file sharing. To use this, you must attach your device to your desk/laptop computer and launch iTunes. In the apps pane for your device, you will see a list of all programs on the device, if you select FaultKin Mobile, you will see in the list on the right all of the files on the device that FaultKin Mobile can open. To save one of these files to the desktop just drag it out of the iTunes window to the desktop or other folder. Likewise, you can drag files that you have prepared on your desktop to the device but dragging those files to the Stereonet iTunes file sharing window. To erase a file from the device, select it in the Window and press the delete key. Yes, it is cumbersome, I know... See Apple's web page for instructions on how to use iTunes File Sharing.

## Importing data from the Clipboard

FaultKin Mobile can input data from the clipboard if the format of the text on the system Clipboard is identical to the app's output file format. To do so, copy the text that you want from wherever it is stored (e.g., an email message, text file in DropBox or iCloud Drive, etc.), making sure to include the header row and the complete list of data, even blank spaces, sequential tabs, etc. In FaultKin Mobile, go to the Data List View and tap the Open button. The first entry in the list that appears is the option to import from the clipboard. Tap on the line that says: "tap for Clipboard text" and FaultKin Mobile will try to import the text. If you already have data entered into the program, you will be asked whether you want to Append or Replace the data.

## Data Output via Sharing

Probably the most convenient way to access the data that you have entered in FaultKin Mobile is via the standard iOS Sharing Panel (see the graphic at right). From the Data List View, tap the "Share" button on the toolbar at the bottom. The standard sharing panel will slide up. From here, you can send the data to any program on your device that can read text, including Mail, Notes, etc. You can also copy the text to the system clipboard and then paste it manually in whatever application you want that can accept text.

If you use a Mac on the desktop, you can also use either Air Drop or iCloud Drive to transfer files. For the former, select Air Drop and tap on the name of the person who you have permission to air drop files to (usually your self, but you can also use this to send a data file to another person). A file with a non-descriptive name like "text-8525A5A16D63-1 3.txt" will be saved to the Downloads Folder on the receiving Mac.

Finally, an option that is particularly useful if you use iCloud Drive is the option to “Add to iCloud Drive”. This will place a text file wherever you specify in your iCloud Drive; I have set up a separate folder in iCloud Drive to receive these files. If a file with the name generic name “Text File.txt” already exists, iCloud Drive will give you the option of renaming the file. In general, you will want to use this only for transferring rather than storing the data. I recommend adding a folder to your iCloud Drive called “FaultKin Files” or some other equally clever name in which to save your data files.

In all cases, the data saved via Sharing is exactly the same format as the files stored in your hidden documents folder on the device and sharable via iTunes Sharing. If you use text pasted into Mail, for example, once you open the message in Mail copy the text that it contains (including the header line) and you can then paste it into desktop Stereonet.

### **Saving/Sharing the Current Image of the Plot**

You can capture the current image of the plot to save to your Photos album, or email, AirDrop, or save to iCloud Drive using the Sharing panel in the Stereonet View. The image saved/shared is simply a .png file at resolution of the screen. In other words, this is not a publication quality figure, simply a quick and easy way to send a plot of your results to a collaborator, advisor, etc.

### **Interacting with FaultKin on the Desktop**

The most recent version of FaultKin for the desktop recognizes and can import FaultKin Mobile files directly, without the need to parse the columns. In the desktop version, simply choose File>Import Text File and select the FaultKin Mobile file that you have saved using one of the above methods. On import, the data type tags of FaultKin Mobile are interpreted as separate locations in the desktop Stereonet. The desktop version also recognizes and uses the same colors as the Mobile version.

FaultKin on the desktop can also write files that can be read by FaultKin Mobile. Choose File>Export Text File>FaultKin Mobile Format. The file saved will contain all of the checked faults and each location name will be assigned a different data type tag in FaultKin Mobile. If you use the same data set names as the built in or custom tags, then those data will be imported into those categories. If your data set names are different, they will be treated as new categories and append onto the ones already in the program. In desktop FaultKin, save your data set that you want to read in. Then drag the file to the iTunes file sharing window and the file will now be available on your device.

The file that FaultKin Mobile can read is a simple text file that can be edited (or prepared) in a text editor or spreadsheet. All of the tab-separated columns must exist and

have the appropriate text or numeric entries in order for the file to be read on the iOS device. Thus you can prepare your own FaultKin Mobile files from scratch in text editor or spreadsheet. The column headings must be exactly the same, however, as those written by FaultKin Mobile. The digits in the Color column represent the RGB values (0-255) of the assigned color, all run together. Red, with no blue or green, would be written 2550000 and cyan, a combination of blue and green would be written 00255255. Strikes and dips are given exclusively using right hand rule. Note that while you can use dip azimuth and dip while in FaultKin Mobile, the app only saves data using strike and dip with right hand rule and thus, if you prepare a file in say a spreadsheet, your bedding orientations need to be as strike and dip.

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## Settings for the App

From the toolbar that the bottom of either the Stereonet View or the Configure Plot view, you can tap “Settings” to bring up a sheet where you can change some app related settings. These include:

- Stereonet Grid determines whether the background of the plot on the Stereonet View has no grid, a light gray grid, or a dark gray grid. If you are projecting the stereonet for a class to see, you probably want to choose “Dark” but light is the setting for everyday use.
- Whether or not to change or rotate the grid while interactively entering data via tapping and dragging in the stereonet
- Lines with negative plunges can either be displayed on the stereonet by projecting them into the lower hemisphere (the default) or by plotting them in the upper hemisphere with a hollow circle.
- “Calculations replace existing data” switch has already been described in a previous section.
- If the “use rake for strike” switch is turned on, then striae will be entered by specifying the rake; if it is turned off then you will enter the trend of the striae and the program will calculate the plunge. For automatic data entry, either will do!
- Lines and planes weight: here you specify how thick the great circles that represent planes are drawn and how big the points that represent lines are drawn.
- Setting the offset of the active point from where the user taps the screen. The default settings of  $-35$  and  $-35$  move the active point up to to the left by 35 pixels

from where the user taps the screen which is useful for a right handed user using his/her index finger. If you are left handed, you might want to set these for  $\Delta X = 35$  and  $\Delta Y = -35$  (up and to the right). If you are using an iPad Pro with an Apple Pencil, you might want to set these to 0 and 0.

- You can change the view direction for the stereonet just the same way you do in desktop Stereonet: by specifying the direction that the user is looking. You might want to do this if, for example, you had just measured a bunch of planes in a road cut and now wanted to see what they looked like in the same projection as looking at the road cut.
- Enter the name of the geologist that will be used as the default value for all measurements. This will usually be the same as the own of the iPhone!
- Documentation will load the online version of this document into Safari.
- About displays the current version, acknowledgments, and disclaimers

The settings screen can be scrolled by dragging a finger on the screen, which will be necessary to see all options while using an iOS device smaller than an iPad.

Once you have everything the way you like it, tap Save Defaults and the next time you launch FaultKin Mobile, the app will use your preferred options rather than mine. Save Defaults also saves the planes, projection, and location formats that are set on the Plot Configuration page. So, if you prefer to use Dip Azimuth and Dip with equal angle projection and UTM for location, set those options before tapping Save Defaults.

The Restore Defaults button will reinstate the app's built-in options for your current session. If you want to make those the permanent defaults, you must tap the Save Defaults button after restore the defaults.

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