

# FAULT TRACE TOOL USER GUIDE

## Table of Contents

<b>Introduction .....</b>	<b>2</b>
<b>Requirements .....</b>	<b>2</b>
<b>Overview .....</b>	<b>2</b>
<b>User Interface Elements .....</b>	<b>3</b>
<i>Version.....</i>	<i>3</i>
<i>Input Area .....</i>	<i>4</i>
<i>Fault Study.....</i>	<i>4</i>
<i>Lightning Study.....</i>	<i>5</i>
<i>Bookmark.....</i>	<i>6</i>
<i>Legend.....</i>	<i>7</i>
<i>Help .....</i>	<i>7</i>
<i>Background Selector .....</i>	<i>7</i>
<i>Scalebar.....</i>	<i>8</i>
<i>Zoom Control.....</i>	<i>8</i>
<b>Map Area .....</b>	<b>9</b>
<i>Structures .....</i>	<i>9</i>
<i>Lightning .....</i>	<i>10</i>
<b>Appendix – Example Case Study .....</b>	<b>13</b>
<i>Open Browser.....</i>	<i>13</i>
<i>Enter Time .....</i>	<i>13</i>
<i>Select Line .....</i>	<i>14</i>
<i>Select Station.....</i>	<i>14</i>
<i>Enter Distance .....</i>	<i>15</i>
<i>Double Ended Fault Location .....</i>	<i>16</i>
<i>Determine AutoZoom .....</i>	<i>17</i>
<i>Structure details.....</i>	<i>17</i>

## INTRODUCTION

The Fault Trace Tool is a web-based tool for locating faults on a power system. This user manual provides a detailed description of the Fault Trace Tool's features and how to get started using them.

## REQUIREMENTS

Before using the Fault Trace Tool, you will need:

- Authorized account to access the tool
- Web browser (either MS Edge or Google Chrome)

## OVERVIEW

To start the tool, open a web browser and navigate to the following address:

<http://<<servername>>/openfft/>

Once the tool is opened, you will be presented with the following user interface:

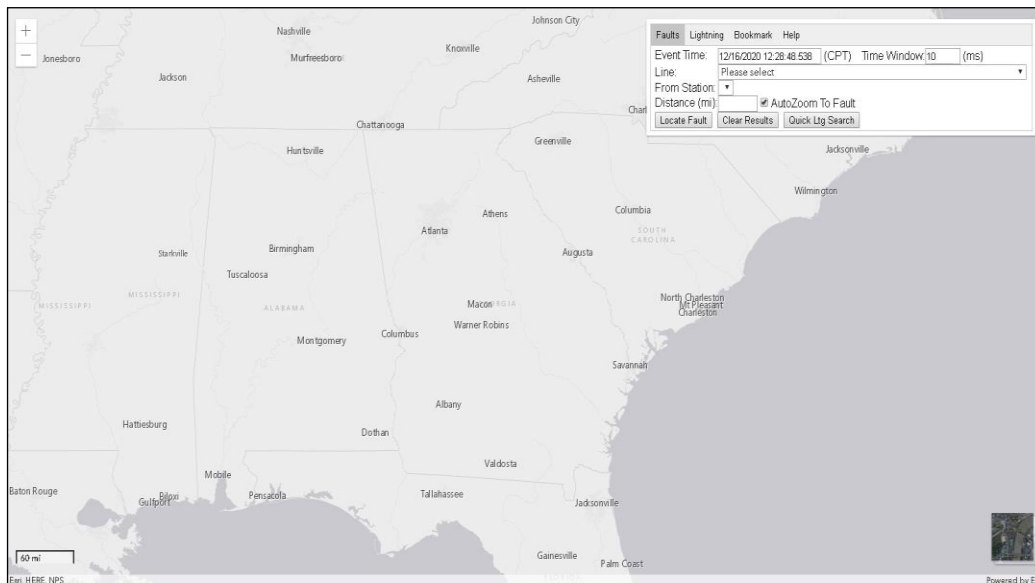


Figure 1 - Fault Trace Tool User Interface

## USER INTERFACE ELEMENTS

The user interface consists of six main regions: Version, Input Area, Background Selector, Scalebar, Zoom Control, and Map Area. Each of these regions is highlighted in the image below. Detailed descriptions of each region will be covered in subsequent sections.

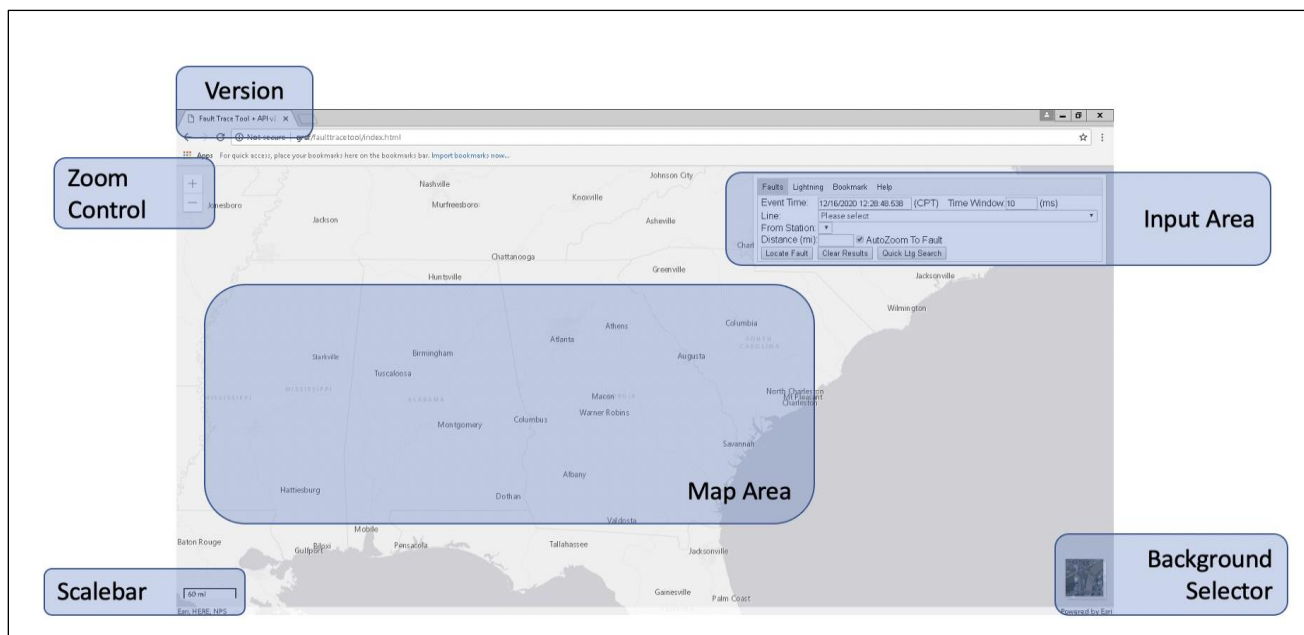


Figure 2 - Fault Trace Tool User Interface Regions

### Version

The version area of the map is located at the top and will help users identify which version of the Fault Trace Tool they are using. The version number will be updated once new features or bug fixes are deployed.



Figure 3 - Fault Trace Tool Version Display

## Input Area

The input area of the user interface is where the fault study and lightning study parameters are entered. The top of the input area has four tabs: Faults, Lightning, Bookmark, and Help. These tabs are used to enter parameters for a particular study type. The Bookmark tab will create a quick link to directly access (or email) the fault study parameters you have entered. The Help tab shows a link to the help document.

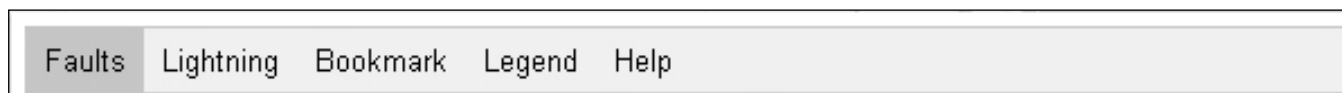


Figure 4 - Fault Trace Tool Tabs

## Fault Study

The Faults tab helps locate the faults along the line selected. Optionally, a quick lightning search can be conducted around the line of interest at the time and window specified. Select the Faults tab to begin.

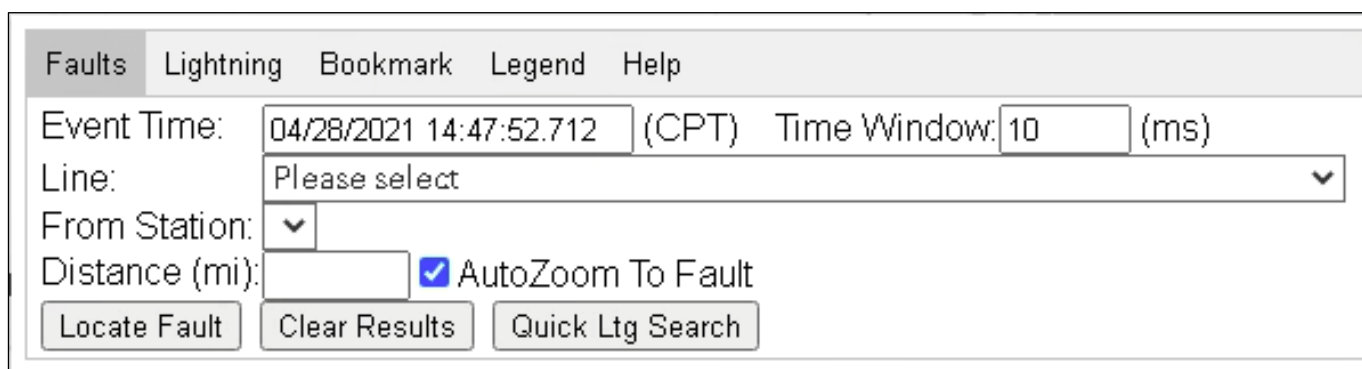


Figure 5 - Faults Tab

The workflow should follow this order:

1. Enter the Event Time. The time should be entered in the format MM/DD/YYYY HH:mm:ss.sss in Central Prevailing Time where:
  - a. MM – Is a two-digit month (e.g., January is 01)
  - b. DD – Is a two-digit day (e.g., The 1<sup>st</sup> of the month is 01)
  - c. YYYY – Is a four-digit year (e.g., 2020 is 2020)
  - d. HH – Is a two-digit hour (e.g., Midnight is 00, 1 PM is 13)
  - e. mm – Is a two-digit minute (e.g., 5 minutes past the top of the hour is 05)
  - f. SS – Is a two-digit second (e.g., 3 seconds past the top of the hour is 03)
  - g. .sss – Is a three-digit subsecond (e.g., .640 is 640 ms past the top of the second)
2. Enter the Time window. The default is 10 ms, but may be changed to as many as 999 ms. The window will be the time before and after the Event Time when lightning is searched around the line.

3. Select a line from the drop-down list. This will:
  - a. Show the line on the map.
  - b. Populate the station drop-down list with stations near the selected line.
4. Select a station from the drop-down list to highlight the station on the map.
5. Type in the distance to the fault from the selected station.
6. To zoom into the fault automatically, leave “AutoZoom To Fault” checked. To manually zoom to the fault area, uncheck the “AutoZoom To Fault” option.
7. Click the Locate Fault button.
  - a. An X will display at all locations that match the distance criteria.
  - b. The map will zoom to the faulted structure(s) if the AutoZoom option is enabled.
  - c. A list of the nearest structures will be displayed immediately under the input area.
8. For a double-ended fault location, repeat steps 2-5 above. New substation/fault pairs will receive new matching colors.
9. To clear the faults, click the Clear Results button.
10. Optionally, click the “Quick Ltg Search” button to locate lightning around the selected line. \*Note: Clicking the “Clear Results” button also clears any lightning displayed.

## Lightning Study

The Lightning Tab helps locate lightning around any arbitrary address or point. Click the Lightning tab to begin.

Figure 6 - Lightning Tab

The workflow should follow this order:

1. Enter the Start Time. The time should be entered in the format MM/DD/YYYY HH:mm:ss.sss in Central Prevailing Time where:
  - a. MM – Is a two-digit month (e.g., January is 01)
  - b. DD – Is a two-digit day (e.g., The 1<sup>st</sup> of the month is 01)

- c. YYYY – Is a four-digit year (e.g., 2020 is 2020)
  - d. HH – Is a two-digit hour (e.g., Midnight is 00, 1 PM is 13)
  - e. mm – Is a two-digit minute (e.g., 5 minutes past the top of the hour is 05)
  - f. SS – Is a two-digit second (e.g., 3 seconds past the top of the hour is 03)
  - g. .sss – Is a three-digit subsecond (e.g., .640 is 640 ms past the top of the second)
2. Enter the Stop Time window. The time should be entered in the same format as described in Step 1.
3. Type in the address or coordinates.
  - a. For an address, type in a single row (i.e., 2100 E. Exchange Pl, Tucker, GA), then click the “Get Coords” button.
  - b. For coordinates, type the latitude and longitude in the Lat/Lon fields.
4. Type in the distance to search from the coordinates/address specified.
5. To zoom into the fault automatically, leave “AutoZoom To Lightning” checked. To manually zoom to the fault area, uncheck the “AutoZoom To Lightning” option.
6. Click the Locate Lightning button.
  - a. A Red X will display at the point of interest, and an orange circle will show the search area (specified by the Distance field).
  - b. The map will zoom to the lightning study area if the AutoZoom option is enabled.
  - c. A list of the lightning found will be displayed immediately under the input area.
7. To clear the lightning results, click the Clear Results button.

## Bookmark

The Bookmark tab reveals a text box with a hyperlink that can be copied to your browser, an email, or a document for quickly recalling the fault study. Click the Bookmark tab to access the hyperlink.

Faults	Lightning	<b>Bookmark</b>	Legend	Help
<a href="http://_ /faulttracetool/?lineid=_ &amp;stationname=_ &amp;distance=2&amp;eventtime=202">http://_ /faulttracetool/?lineid=_ &amp;stationname=_ &amp;distance=2&amp;eventtime=202</a>				

Figure 7 - Bookmark Tab

## Legend

The Legend Tab displays a legend of the symbology for the map. Click the Legend tab to access it.

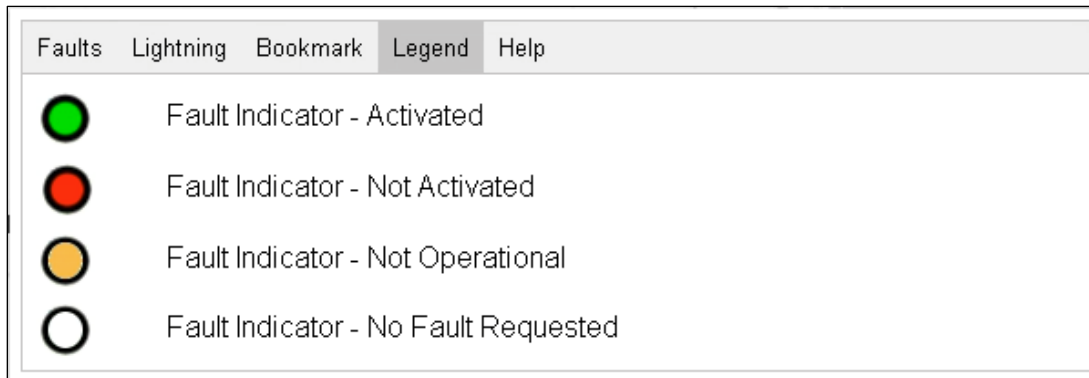


Figure 8 – Legend Tab

## Help

The Help tab reveals a hyperlink to the help documentation. Click the Help tab to access it.



Figure 9 - Help Tab

## Background Selector

The Background Selector in the bottom right corner enables the user to toggle between different map types. The default background is a light grey map. Click on the Background Selector to view the map background with satellite imagery. Subsequent clicks on the Background Selector will toggle the display between the available map types. *Figure 11* shows the same region with the two different map background options.

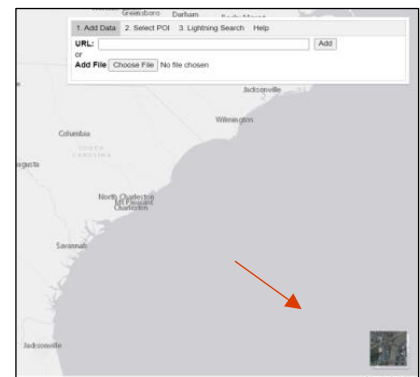
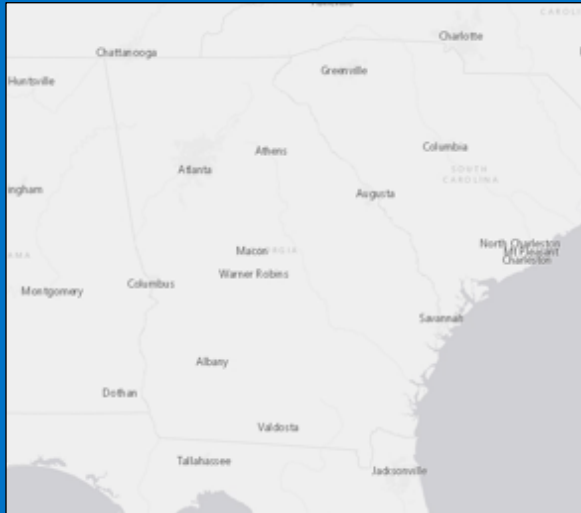


Figure 10 - Background Selector

## Default View



## Satellite View



Figure 11 – Background Views

## Scalebar

The Scalebar visually indicates the size and distance between features on the map. As you zoom in or out of the map display, the scalebar will change accordingly.

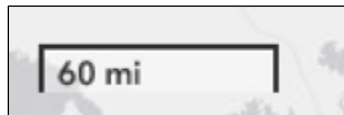


Figure 12 - Scalebar Display

## Zoom Control

The zoom control is used to zoom in and out of the map areas. Clicking the + symbol will zoom into the map. Clicking the – symbol will zoom out of the map. The map will be centered on the current center of the map after zooming.



Figure 13 - Zoom Control



If your computer has a scroll mouse, this can be accomplished using the mouse's scroll wheel. The act of pushing the scroll wheel up will zoom into the map. Pushing the scroll wheel down will zoom out of the map. The map will zoom with the center of the map being wherever the mouse is pointed.

If your computer is equipped with a trackpad, the zoom feature can also be activated using the scroll feature of your trackpad. On Macs, this is done with a pinch and zoom gesture. On Windows, this is usually performed by sliding fingers across the trackpad's surface. Usually, scrolling up on the trackpad will result in zooming in, while scrolling down on the trackpad will result in zooming out. The map will zoom with the center of the map being wherever the mouse is pointed.

## MAP AREA

The map area is where the results of the Fault Trace Tool are displayed.



Figure 14 - Map Area

## Structures

When structures are displayed on the screen, as in *Figure 15*, click on a structure. A window will appear and display the distance of that structure to the end of the selected line.

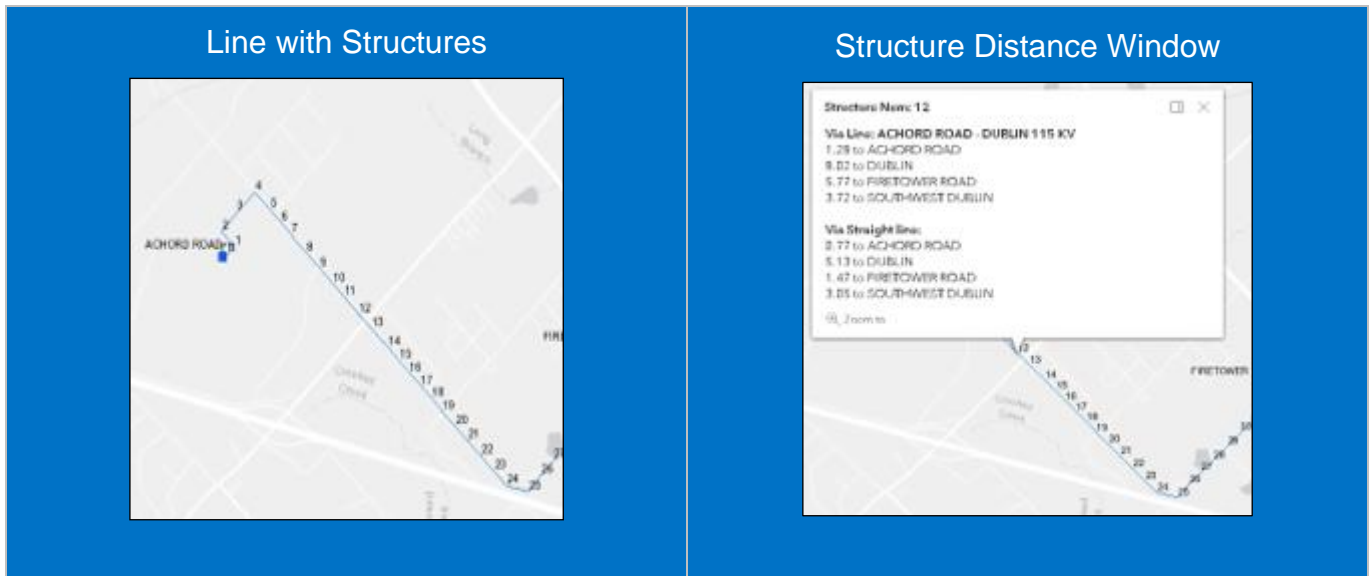


Figure 15 – Structure Distance Display

Distances are shown via the selected line and via a straight line. All distances will be displayed if there are multiple paths between a structure and a substation.

## Lightning

When lightning is displayed on the screen, as seen in *Figure 16*, the results of the lightning data are shown at the bottom of the input area.

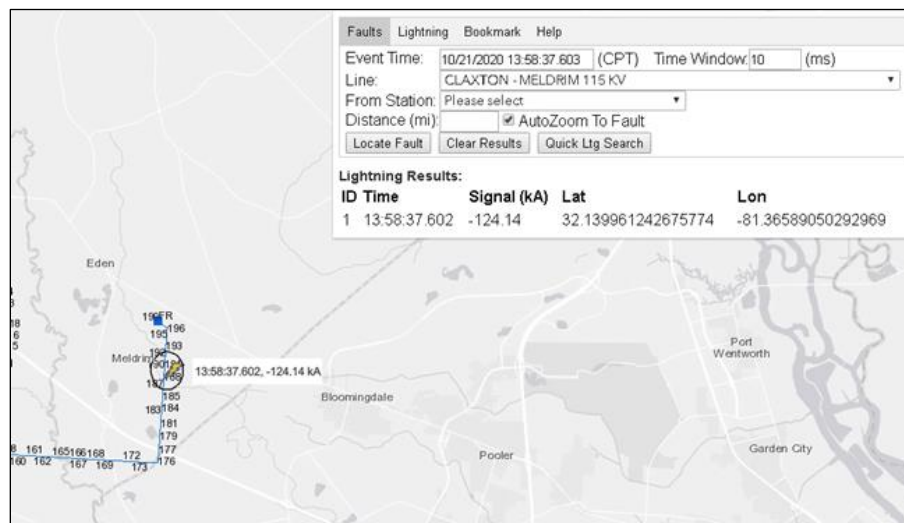


Figure 16 - Lightning Results with Table

Click on a lightning event to show the details of that lightning strike. The 99% confidence ellipse is shown.

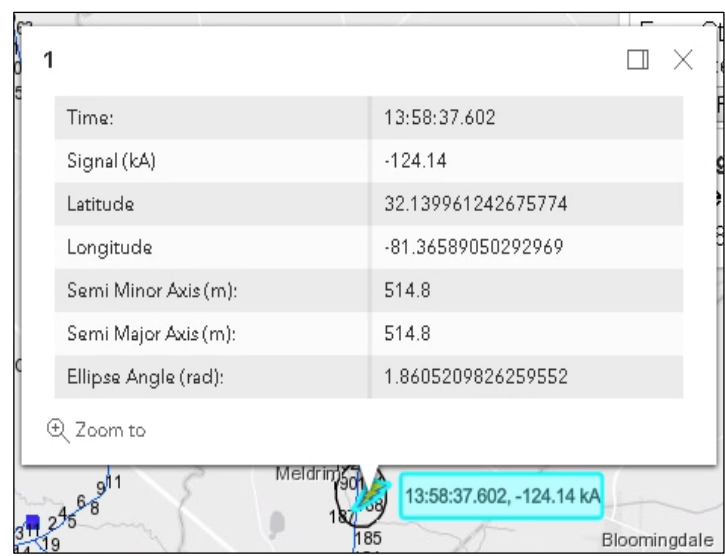


Figure 17 - Lightning Details Window

FAULT INDICATORS

A black circle will appear when a fault indicator is present on the line. When the fault indicator status changes during an event, the circle’s color will be filled in green. If the fault indicator status does not change, the circle’s color will be red. If the fault indicator is not operational, the color will be orange.

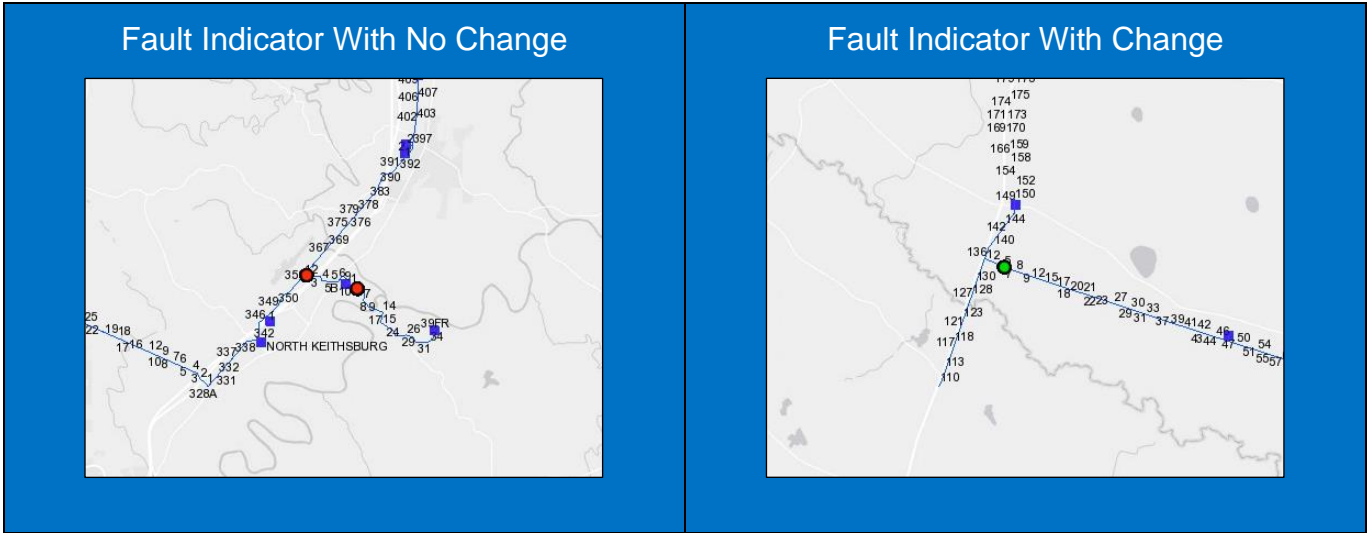


Figure 18 – Fault Indicators

Clicking on a fault indicator will reveal the data from the eDNA system. If the indicator has multiple phases being monitored, the data from each phase will be displayed. In the example below, the phases are denoted by P1, P2, and P3. In this case, the indicators did not change status.

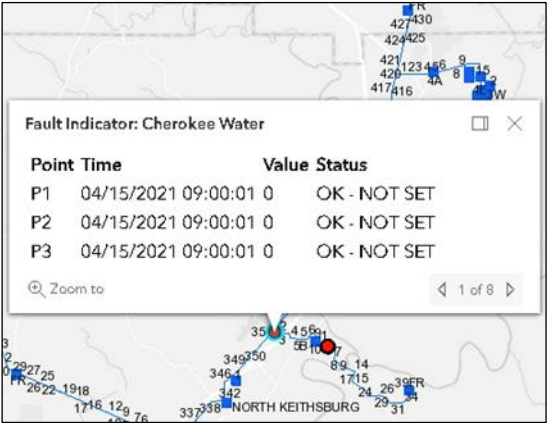


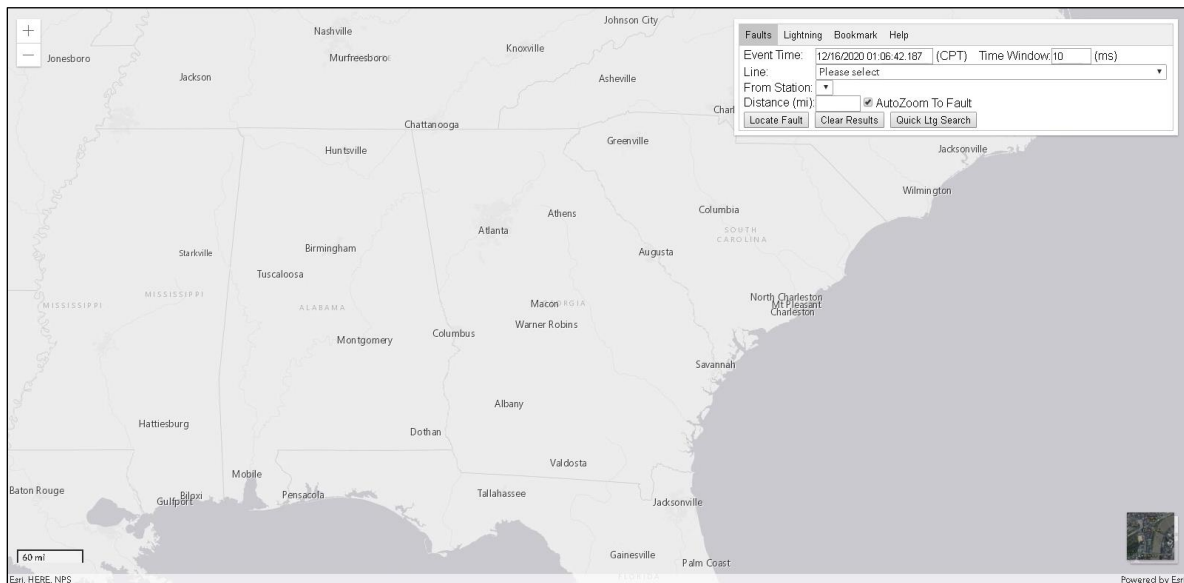
Figure 19 - Fault Indicator Details

## APPENDIX – EXAMPLE CASE STUDY

### Open Browser

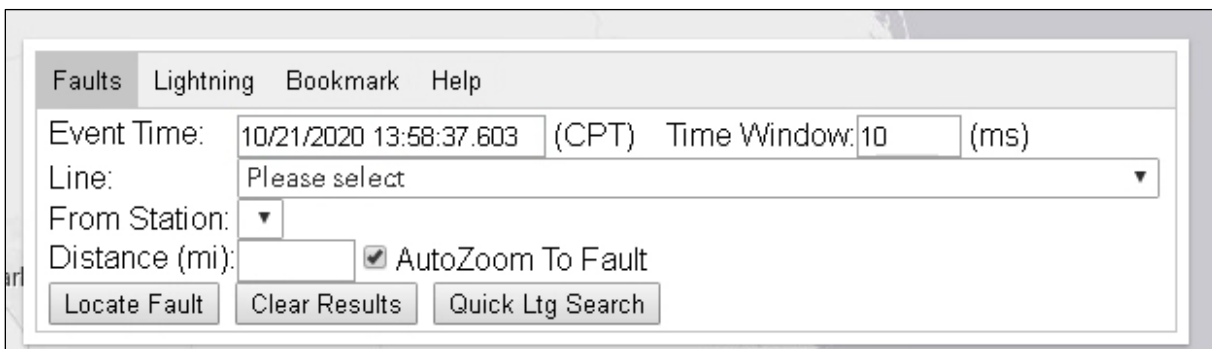
Navigate to <http://<<Servername>>/openfft/>

By default, the Faults tab is selected.



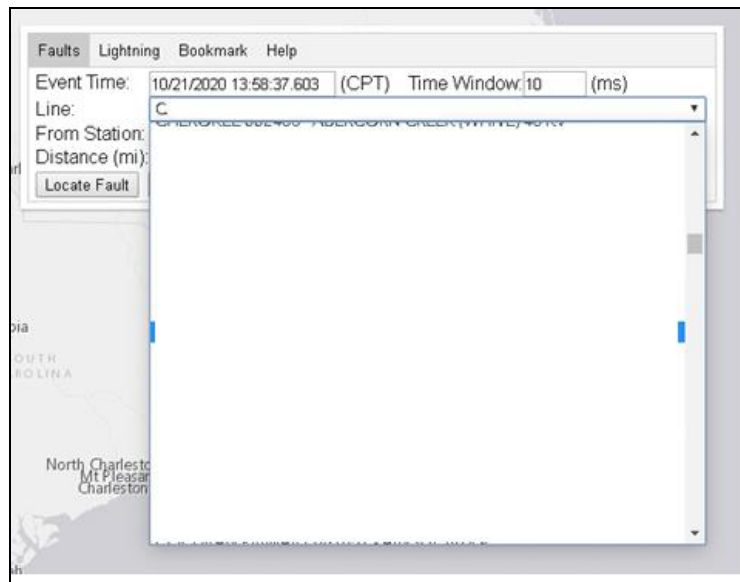
### Enter Time

Enter the Event Time and Time Window for the event. The Time Window will look at the specified number of milliseconds before and after the Event Time.



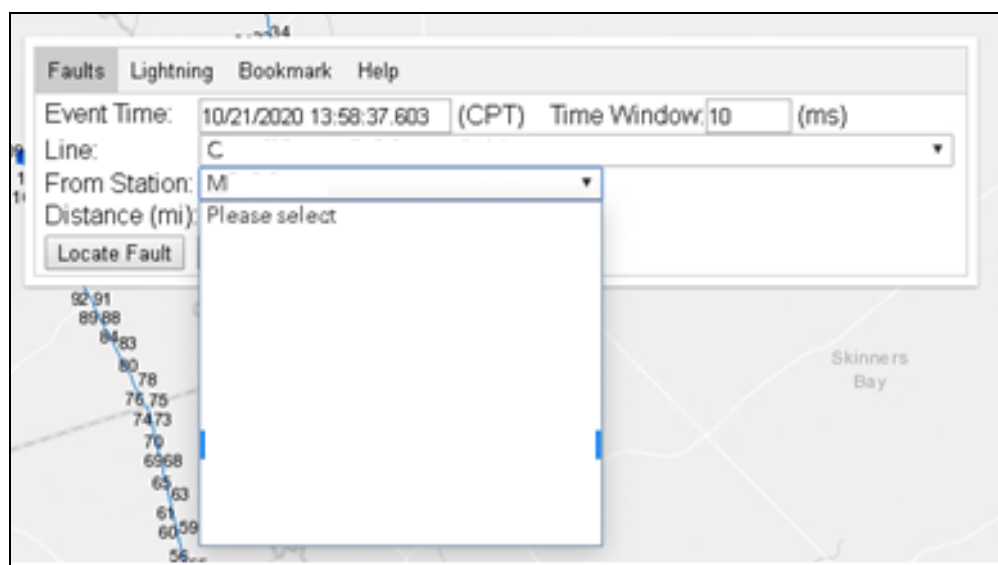
## Select Line

Select a line from the Line Drop Down List. The selected line will be displayed on the map.

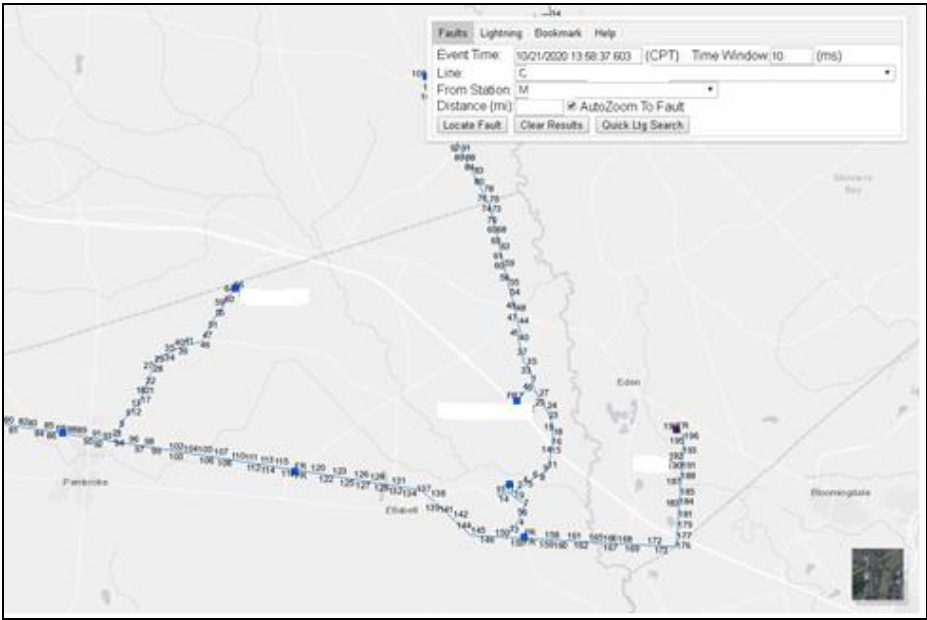


## Select Station

Select a station from the Station Drop Down List. The list has been pre-populated by stations along the line.

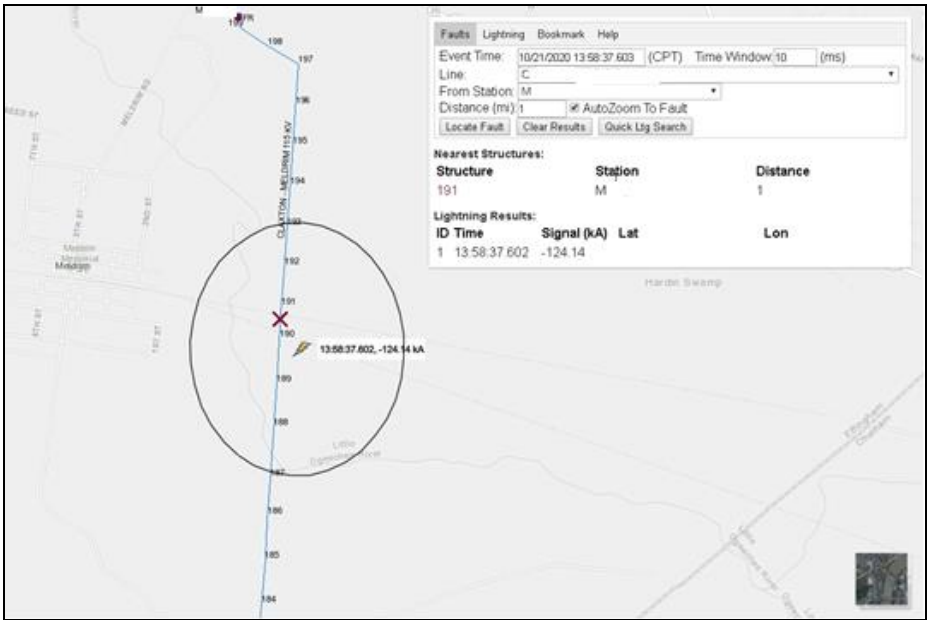


In this case, the C line was chosen. A purple marker appears on the M substation.



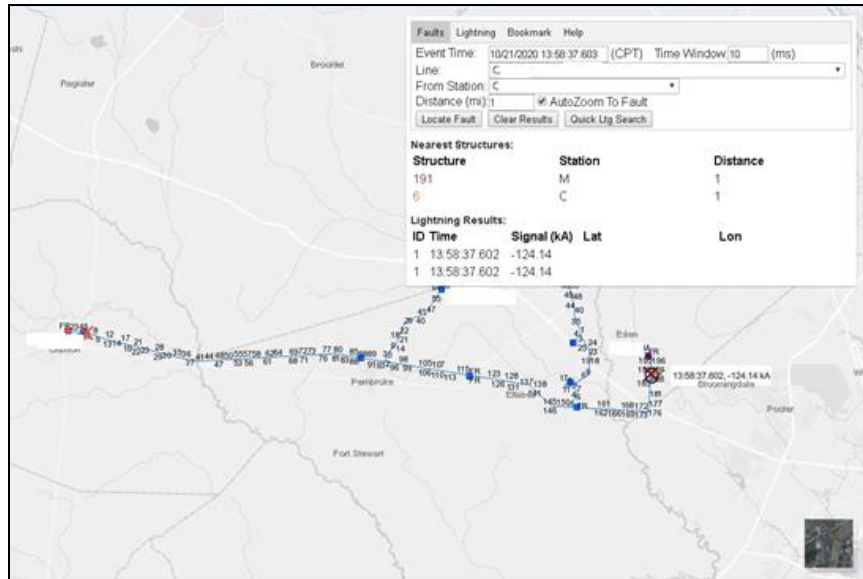
## Enter Distance

Enter the distance from the M station to locate the fault. An X is placed at the relevant location on the map, and listed in the table below the input area.

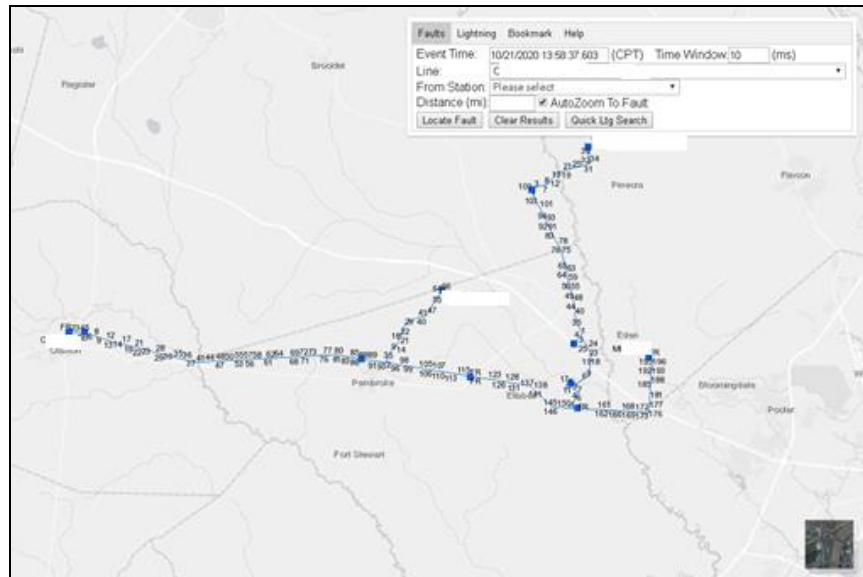


## Double Ended Fault Location

To run a fault study from a different endpoint of the line, select the other station. Enter the distance from that station. Click the Locate Fault button. The new station/fault will appear in a new color (in this case, red). Notice the table in the input area also shows the structure number in the corresponding fault color.



To clear the faults from the map, click the Clear Results button. Selecting a new line will also clear all of the faults and lightning from the map display.





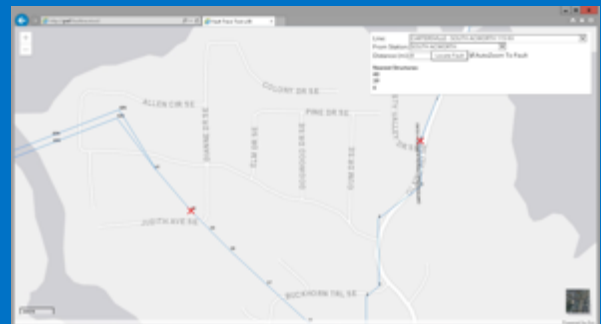
## Determine Autozoom

When AutoZoom To Fault is enabled, the system automatically zooms to the structure(s) where the fault has been located. If the feature is disabled, the map display will remain the same. Examples of both with the same fault parameters are shown below:

### AutoZoom To Fault Disabled

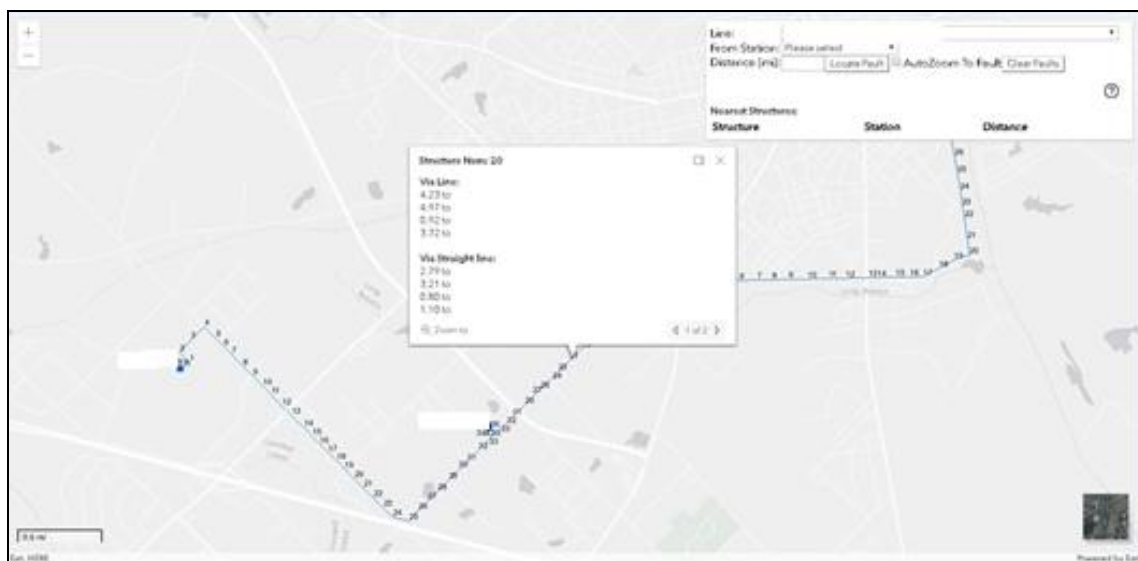


### AutoZoom To Fault Enabled (Default)

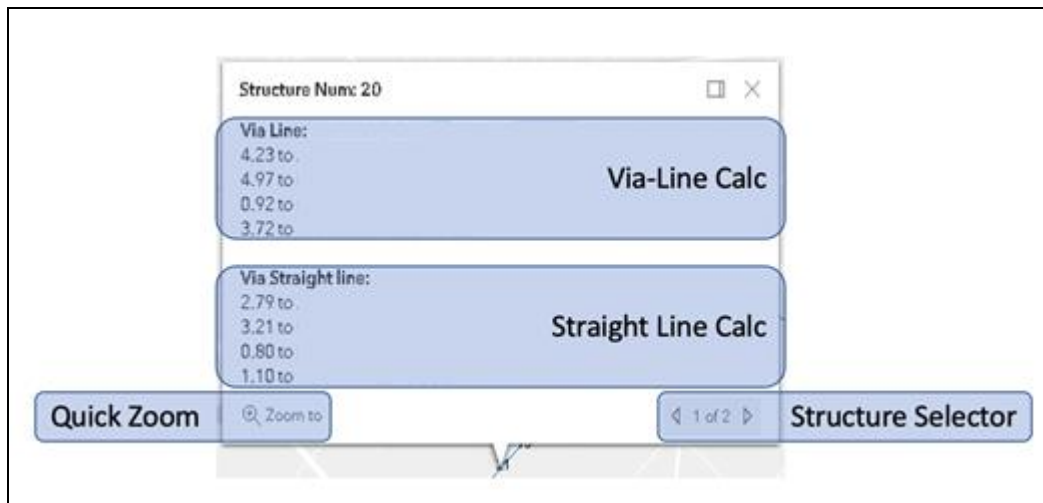


## Structure Details

When the structure is clicked on the map, a popup window appears. The window shows the structure's distance to the stations near the line.



There are several components to the structure detail window. These areas are described below.



The Via-Line Calc is performed by computing the distance from the structure to the station by following the actual line back. If there are multiple paths, multiple distances will be reported.

The Straight Line Calc is performed by computing the shortest distance between each station and the selected structure. This does not follow the path of the line.

The Structure Selector appears when there are multiple structures close by. You can navigate between the structures by using the arrows to the left or right of the record counter.

The Quick Zoom button enables the zoom feature to zoom in to the structure currently being viewed.

The window can be closed by selecting the X in the upper righthand corner of the window.