TRIDENT
Smarter Pigging

Track PIGs reliably, safely and
cost effectively over the internet.

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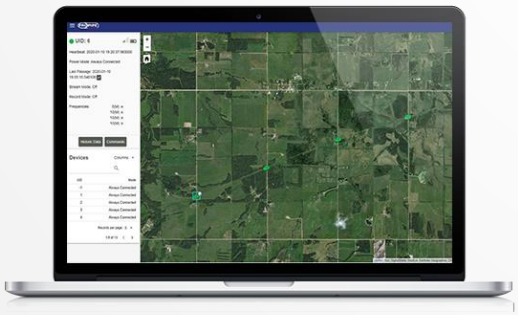
Apex AGM Training Agenda

- Apex AGM Capabilities Overview
- Hardware Review
- Standard Operation
- PigView Mobile Bluetooth Application
- PigView Web – Basic Operation
- PigView Web - Pre Run Setup
- PigView Web – Live Remote Tracking

Apex AGM Overview and Capabilities



- Detect PIGS using Magnetic Bodies, ELF Transmitters, or passively with a Geophone
- Integrated Cellular Communications, Bluetooth and GPS
- Interface to Iridium Satellite Modems for Worldwide Remote Access
- Raw Recording of Sensor Data and Detections to Removeable Readable Storage
- Access to PigView Software Suite
  - PigView Mobile Android Application – Setup, Config, Field Tracking and Cellular Link
  - PigView Web – Web Based Application –Configuration, Live Tracking over the Internet
  - PigView Analytics – View data from AGMs – Detections or RAW, push data to cloud
  - Firmware Updater

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Apex AGM Hardware

- **Power Button and LED Indicator**
  - Slow Flash – ON and Booted
  - Fast Flash – On and Booted and Connected to Internet
  - Turn On – Single Push, Versions that Beep Will Beep On Boot
  - Turn Off - Hold for More than 5 seconds – Blue Light Solid, Then OFF (~20 seconds)
- **Internal Electromagnetic Antenna**
  - Always Fold Out When Deployed
  - Deploy PARALLEL To the Pipeline
  - Fold In During Travel
- **Cellular Antenna**
  - Install Hand Tight and Upright
- **Batteries**
  - 6 x D Cell alkaline
  - About 6 days in Active mode at room temperature
  - DO NOT OVERTIGHTEN SCREWS ON BATTERY COMPARTMENT – HAND TIGHT ONLY

Apex AGM Hardware

- **USB Port**
  - Firmware Updates Only
- **SD Card**
  - Removable Storage -
  - ONLINE, OFFLINE, ROOT folers
  - .ofl, .onl files – passage (trip) files – can be viewed I Pig View Analytics OR PigView Mobile Android App
  - .agm – raw data file
  - Can Be Viewed in PigView Analytics
- **GEO Port**
  - Connect External Geophone
- **MAG Port**
  - Connect External "Swamp" Antenna
- **SAT Port**
  - Attach External Satellite Modem, External Power In, RS232 Data Link
  - Dust cap

Apex AGM Standard Ops

- **Install Batteries**
  - Remove Lid – **Make Sure all Screws are Disengaged Before Pulling Off**
  - Try to use Fresh Batteries
  - **DO NOT OVERTIGHTEN LID – Torque Spec**
  - Battery Status can be viewed through Bluetooth or web interface
  - Release Batteries from NON Spring End First
  - Check that SD CARD is INSTALLED
- **Install Cell Antenna**
  - Make sure Antenna is Hand tight
- **Press Power Button Once Briefly**
  - Wait for solid Blue Light, then flashing, wait for fast flash if using cell (~90 seconds)
- **Setup Settings over Bluetooth or Cell**
  - Settings are Stored in Non-Volatile Memory and Survive the Next Power Cycle
- **Deploy With Antenna Out and Parallel to Pipe**

Only These Need to Be Done After Initial Setup

Apex AGM Non-Standard Ops

- **Satellite Setup**
  - **BEFORE POWER UP – Attach Iridium Modem to SAT Port**
  - You **MUST** Use Fresh Batteries
  - Hardware Versions 2 and Above are Best
  - LIMIT FALSE DETECTIONS WITH SATELITE LINK – Data is Expensive!
    - Turn OFF Before Picking up and Driving around
    - Use MAG ONLY if Possible
    - External Antennas Are Ideal
  - Check Bluetooth Link if Possible, under CELLULAR ENABLE Tab – check for SAT ON
  - Look For Satellite Icon on PigView Web Interface
  - SAT LOW BATT indicates the Battery Power is Not High Enough For Transmission

Apex AGM Non-Standard Ops

- **External Swamp Antenna**
  - Connect to MAG Port
  - Place Far From Box if On Land – Best Performance
  - If Tracking Under Water – Try To Limit Wave Motion
  - Get as Close to Pipe As possible – Signal is Much Weaker in Salt Water
  - Live Tracking is Much More Important – Especially using ELF ONLY

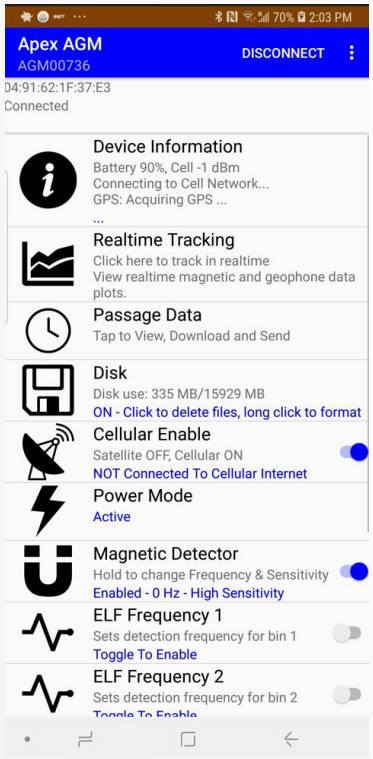
Apex AGM Non-Standard Ops

- **Geophone Tracking**
  - Connect to GEO Port
  - Place Far From Box if Possible – Geophones Have Magnets in them!
  - Geophone Vibration is Recorded in Raw data
  - Snippet is sent as passage – no Detection on Geophone
  - Listen Live from anywhere with the internet
  - Stream and Listen Over Bluetooth
  - Count Welds and Get Instantaneous Speeds
  - Great For Live Tracking

Apex AGM Non-Standard Ops

- Other Accessories
  - External Power Adapter
  - Receiver Handle
  - Light Kit
  - Cabled Cell Antenna
  - Y Adapter
  - ** External Power Pack
  - ** Internal Power Pack
  - ** Solar Charging

PigView Mobile – Android Bluetooth Application for Apex AGM



- **Application For Setup, In The Field Tracking, Cellular Relay, and Downloading Data**

  - Get Basic Device Info – Firmware Version, Hardware Version, Battery Levels
  - Stream Real Time ELF, MAG, And Geophone Audio
  - Get Disk Usage and Format Disk
  - View and Download Passage Data (.onl, .ofl, .agm files)
  - Relay Passage Data to Server if Connected to Internet – Tether to Cell Phone For Best Use Case
  - All Device Settings Can Be Set
  - Best Use is Line of Sight

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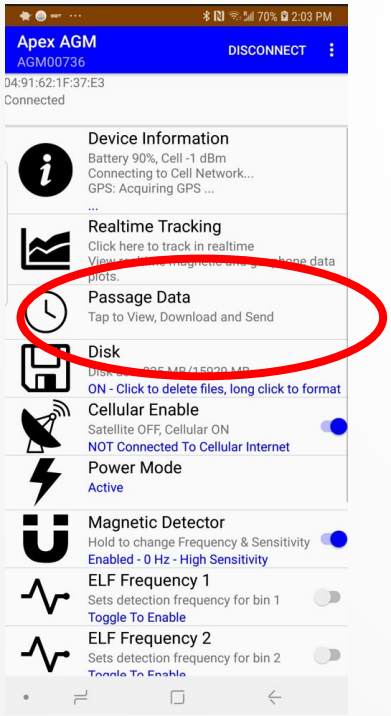
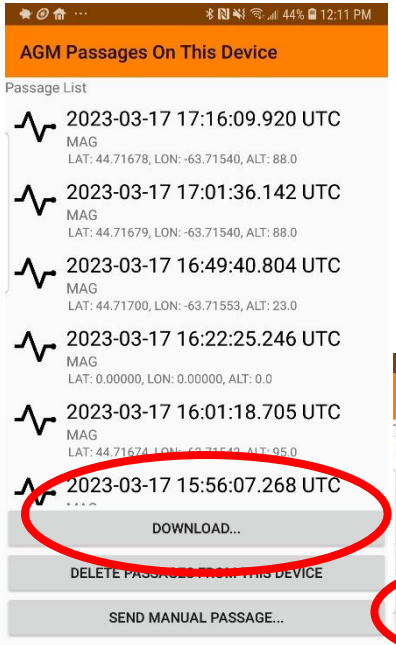
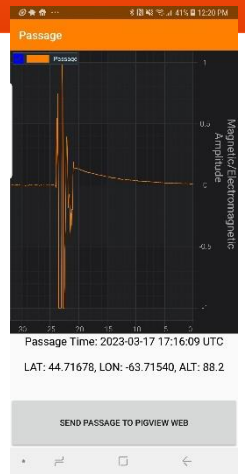
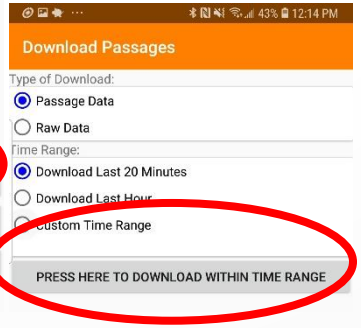
PigView Mobile – Android Bluetooth Application for Apex AGM

- Downloading Data - Bluetooth









- If the Device is Connected to the Internet – Passages will go to cloud Automatically
- Also Stored in folder on Device – ApexAgm/serialnumber
- Delete From This Device – Delete From tablet Only
- Raw data can also be downloaded and pushed

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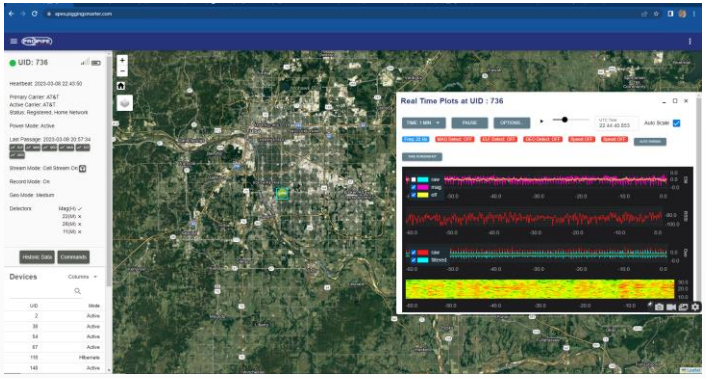
PigView Web

- **Web Based Application For Setup, Remote Tracking, Downloading and Reporting Data**
  - Setup , Configure, Download Multiple AGMS at Once
  - Passages and Historic Data Sent to Internet In Real Time – No Need to Download Individual Boxes
  - Stream Real Time MAG, ELF, and Geophone Audio
  - Live Pig Location on Pipeline Overlay During Pig Run
  - Automatic Notification Of Passages via Text or Email
  - Get Data From the Field Through to Data Analysis Fast and Easy



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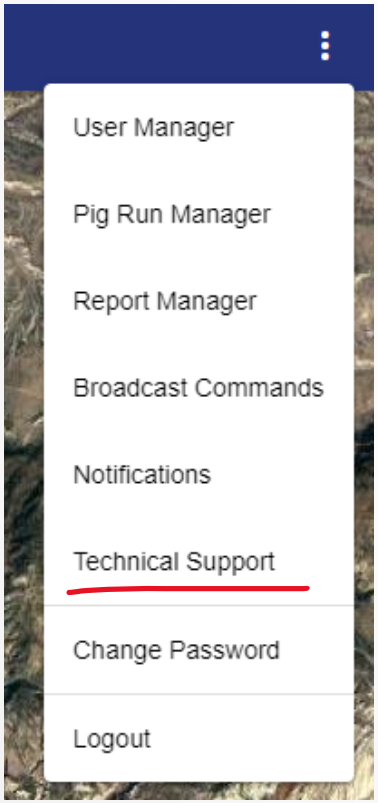

- Technical Support
  - Documentation
  - Latest firmware Update files
  - Supporting Software Downloads
    - PigView Analytics
    - PigView Mobile
    - Firmware Updater
    - More
  - Training Videos
  - Good Idea to check this regularly for new firmware updates
    - Get bug fixes
    - Latest Features
  - Please let us know your feature suggestions or about any bugs

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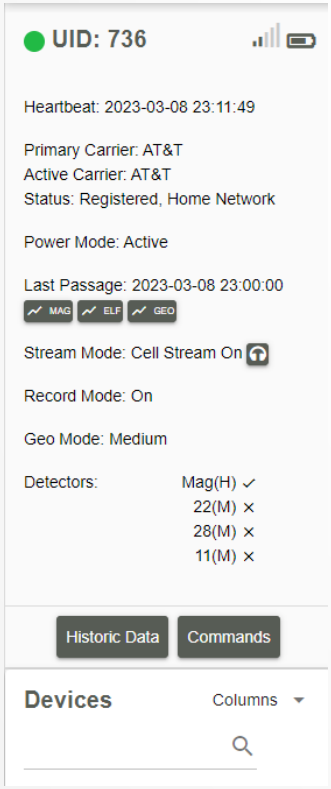
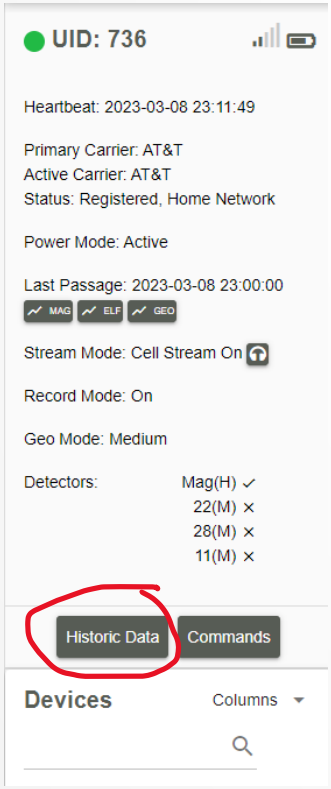
PigView Web

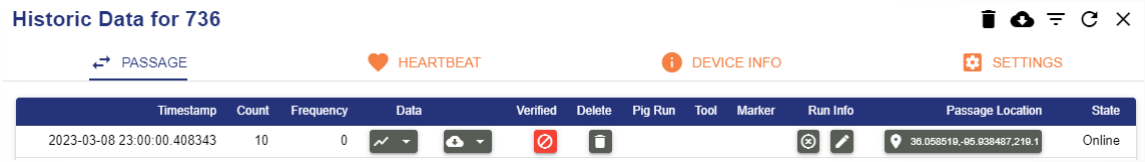


- **Passive View**
  - This is The View You Will See On Login with No Active Pig Runs
  - All AGMS in Your Account Will be Visible With Last Known Locations
  - Green AGMS – Connected To Internet
  - Black AGMS – NOT Connected To Internet
  - View Signal Strength, Battery Level and Basic Status
  - Select an AGM by Clicking on The Device OR Searching The Device List
  - Last Passage – View Time And waveforms From Last Passage
  - Stream Mode Icon – Start Real Time Streaming From Remote AGM
  - Historic Data – View Historic Passage Data, Status and Settings
  - Commands – Send Commands to the Box

PigView Web



- Historic Data
  - Passages Tab – View Historic Passage Data From AGMs
    - Recommendation – DO NOT DELETE PASSAGES
    - View Waveforms, Lat, Lon, Alt Data
    - Download in Basic Spreadsheet



  - Heartbeat Tab – Basic Device Status – Periodic Message

  - Device Info – Firmware, Hardware Versions
  - Settings – Historic Settings of the Device

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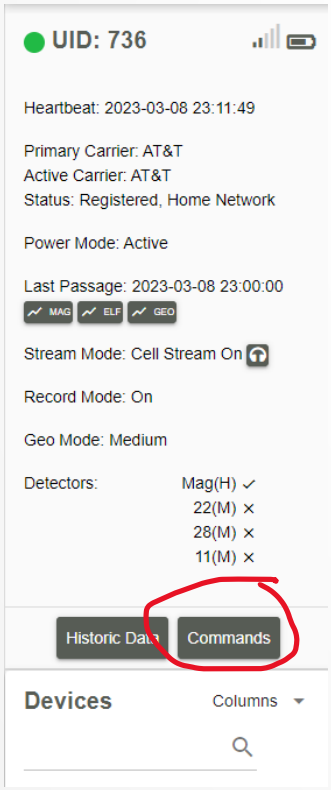
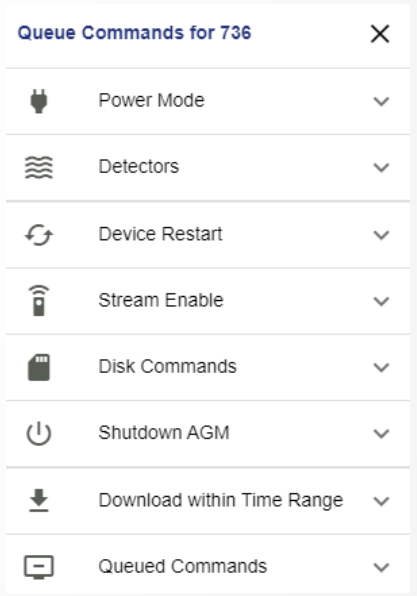
PigView Web



- **Commands**
  - Apex AGM Web Portal is Two-Way Communications
  - Commands Sent While Offline Will Be Queued and Sent On Next Connection
  - Power Mode
    - Active – Device Always Detecting, Always Connected to Internet – Most Common Setting
    - Low Power – Device Always Detecting, Only Connects To Internet on Passage, AND Preset Schedule. Device will accept any Queued Commands on Connection To Internet.
    - Hibernate - AGM Is OFF, Not Detecting. Will Connect To The Internet On A Preset Schedule
  - Detectors
    - Enable, Disable and Set Sensitivity
  - Restart, Shutdown – Not Recommended!
  - Stream Enable – Alternate Spot for Starting And Stopping Stream



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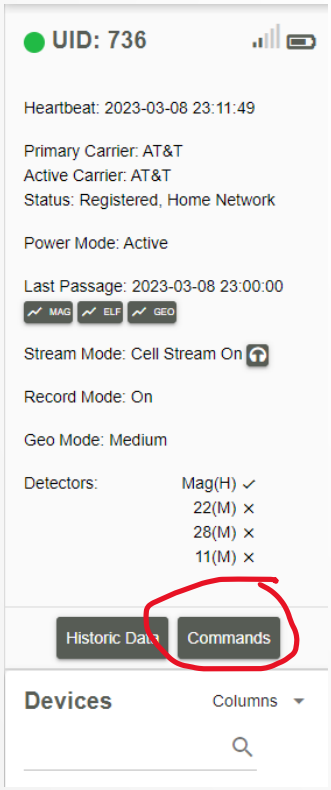
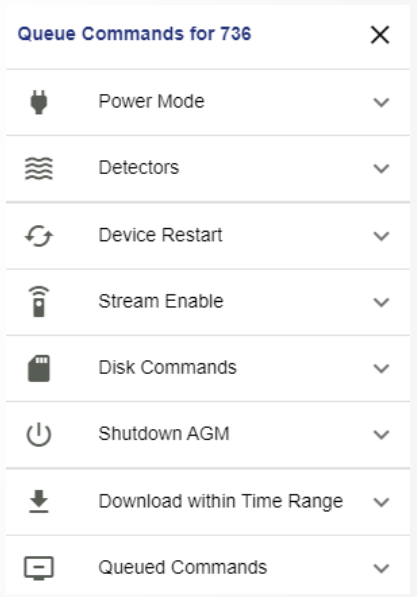


- **Commands**
  - Download Within Time Range – Passages
    - Download Passages To Server Between Start And Stop Dates/Times in UTC
  - Download Within Time Range – Raw
    - Download Raw Data to Server – Limited to Five Minute Section **
- **Queued Commands**
  - List Of Presently Queued Commands
  - Check This if Commands Are Not Going Out – You may have a large list especially in areas with sporadic internet



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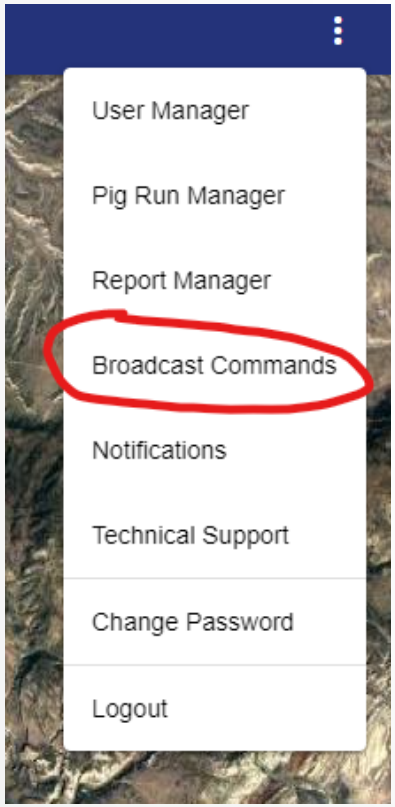
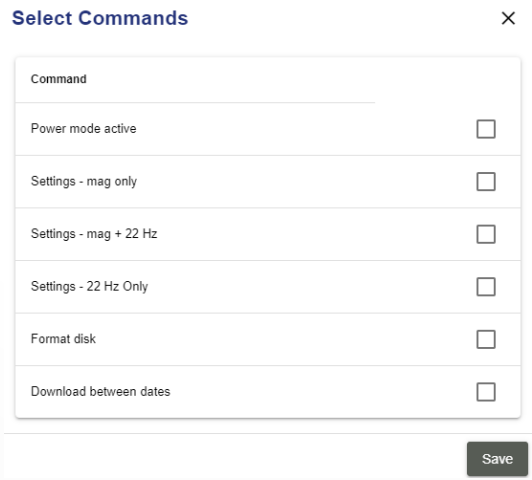


- Broadcast Commands
  - Send Batch Commands to Multiple AGMS at the same time
  - Commands are Queued and Received By All AGMS on Connection to Internet



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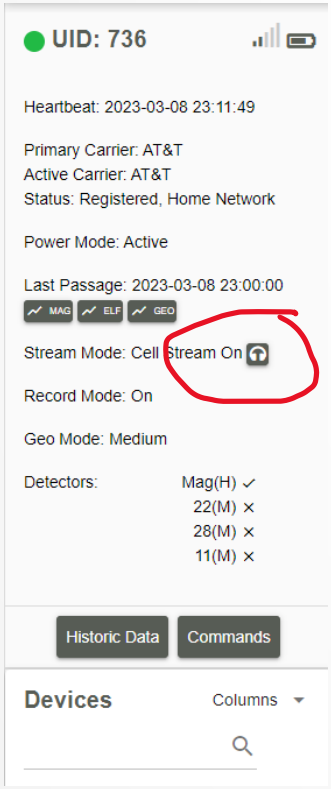
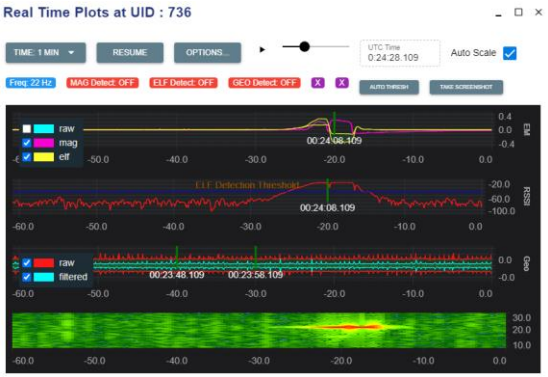


- **Real Time Streaming**
  - Press The Streaming Icon To Enable Streaming Live ELF, MAG And Geophone Audio (If Geophone Connected)
  - Close The Streaming Window To End Streaming Session
    - Caution: Only Admins Can Enable Disable Stream
    - If Stream Is Disabled, it ends Streaming to All users listening to Stream
    - If You're Having Issues Refreshing the Browser window Often Helps
  - **All Streamed Data is Backed up in the Cloud and Timestamped**



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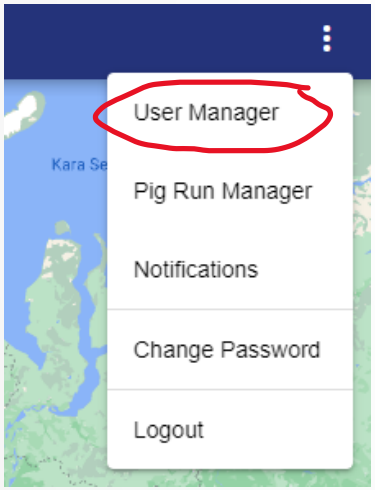
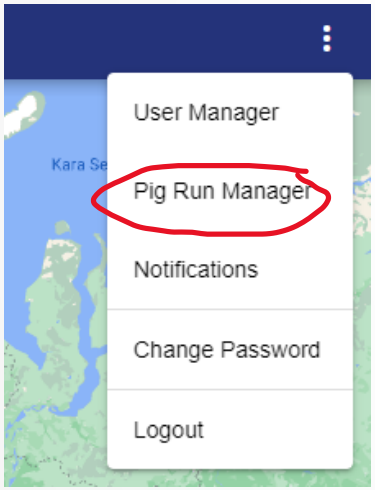


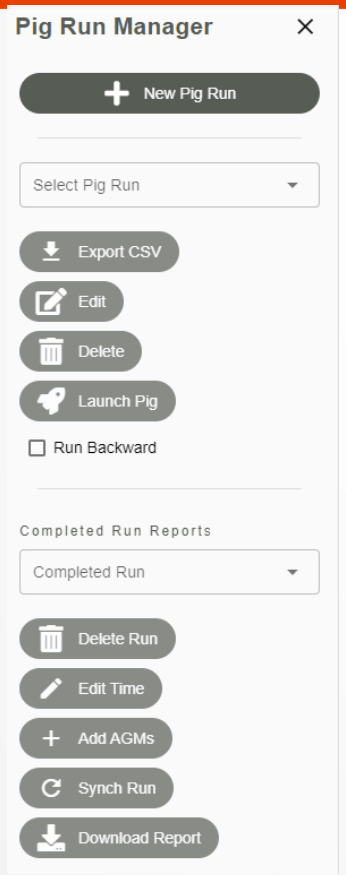
- **User Manager**
  - Allows Admins To Create Accounts
  - Users Name
  - Enter Email (Used for Login and Email Alerts)
  - Phone Number (Used for Text Message Notifications)
  - Role – Admin OR Viewer
    - Admin has No restrictions – can see any Pig Run and Send Commands, Verify Passages
    - Viewer – Can only See AGMS and Data Associated With A Pig Run They Are On The Notification List For
    - Viewer can Join any Streaming data Session, BUT Cannot start or Stop one

PigView Web



- **Pig Run Manager**
  - Setup A Pig Run and AGMs Before A Run
  - Setup Live Tracking Data And Notifications (If Required)
  - Launch a Pig
  - View and Generate Report From Completed Pig Run

PigView Web



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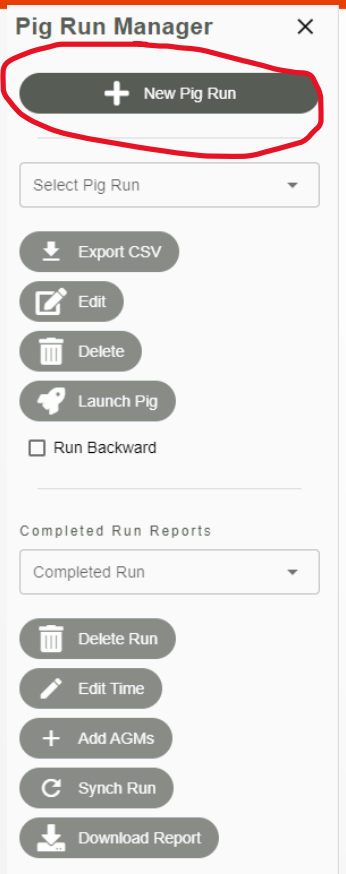
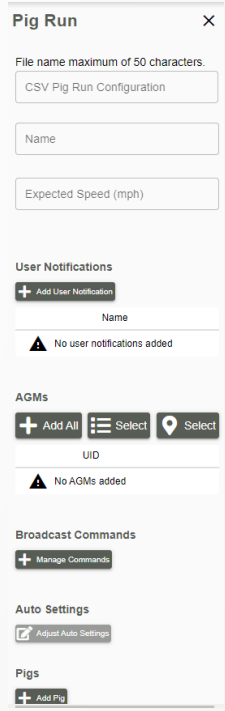


- **Pig Run Manager – New Pig Run**
  - **CSV Pig Run Configuration**
    - Enter .CSV File with Survey Data
    - If You Have No Survey data, Just Enter Rough Launch And Receive Coordinates – Real Data can Be Added Later
    - CSV File MUST Follow Specific Template

	A	B	C	D	E
1	AGM Marker Name	Latitude	Longitude	State	Description
2	Launch	27.91038213	-97.41098207	SKIP	Launch
3	AGM 1	27.91730731	-97.40908239	TRACK	AGM
4	AGM 2	27.91700858	-97.39256417	TRACK	AGM
5	AGM 3	27.83934744	-97.19725771	TRACK	AGM
6	Receive	27.82992438	-97.19718396	SKIP	Receive

    - **AGM Marker Name –** Must Be Unique and In Order
    - **State** – If this is a location that will be tracked use TRACK, if it is a feature you want to appear on the map but won't be tracked use SKIP If you are unsure use TRACK it can be changed during a run or later
    - **Description –** Description of Feature, you can use: LAUNCH, RECEIVE, AGM, TAP, BEND, VALVE, ATTCHMENT, WELD, PIPE – this just changes the icon on map overlay
    - **Most of the time use AGM**
    - **Save as .CSV (Comma Delimited) file**



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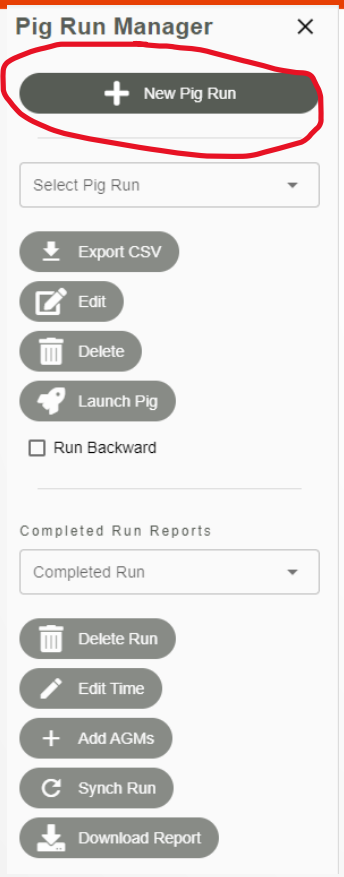
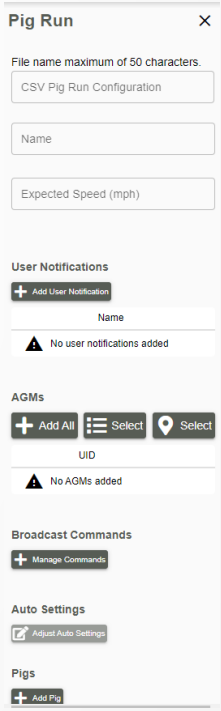


- **Pig Run Manager – New Pig Run**
  - **Name –** Name Description Of Run
  - **Expected Speed in Mph –** Just moves Icon From Launch to First Marker at this Rate – Icon speed is calculated after this (This can be a very rough value)



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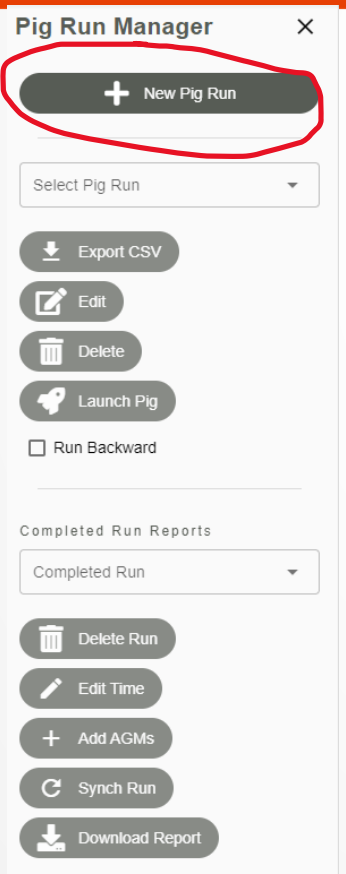
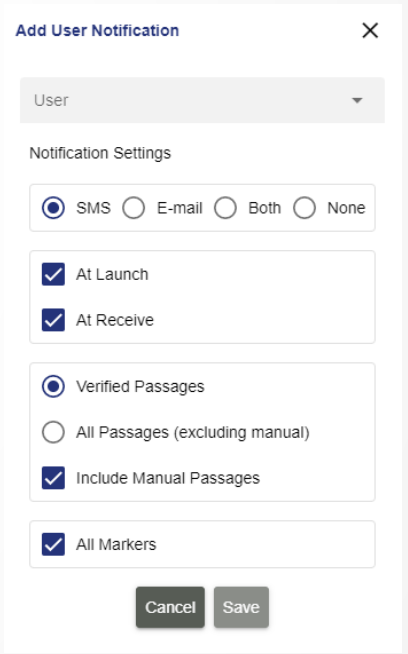


- **Pig Run Manager – User Notifications**
  - Send Out Notifications At Surveyed Marker Locations Including Email and Text
  - Add Users Who You Want to See the Pig Run
  - Can Only Add Users Added Through The User Manager
  - RECOMMEND Sending Notifications For Verified Passages Only



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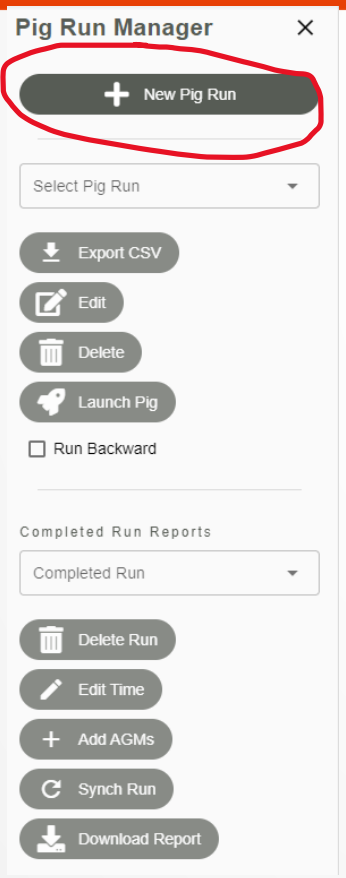
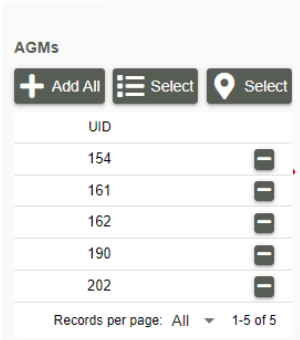
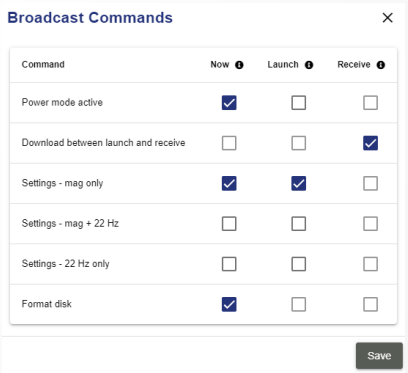


- **Pig Run Manager – AGMs**
  - Add the AGMS you will Use for this run
- **Broadcast Commands**
  - Send Commands For Setup and Downloading to all AGMs in the Pig Run – VERY CONVENIENT
- **Auto Settings**
  - **Auto Link** – LINKS Marker to Any AGM Data within 100 Meters – ENABE THIS
  - **Auto Verify** – Will Automatically Verify Passages at Marker Locations where a passage Occurs within in 5 minutes of ETA or ANY Time After – works well for Strong Magnetic Body Pigs
- **Pigs**
  - **Add Pigs To Be Tracked On Your Run**
    - **Cleaner**
    - **Gauge**
    - **MFL**





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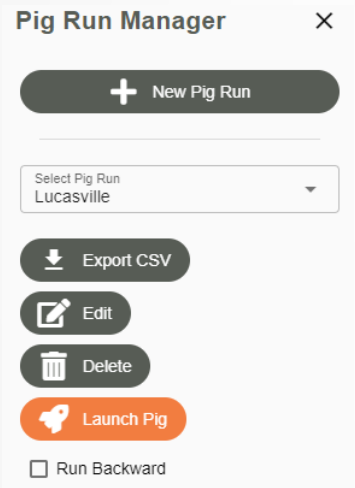
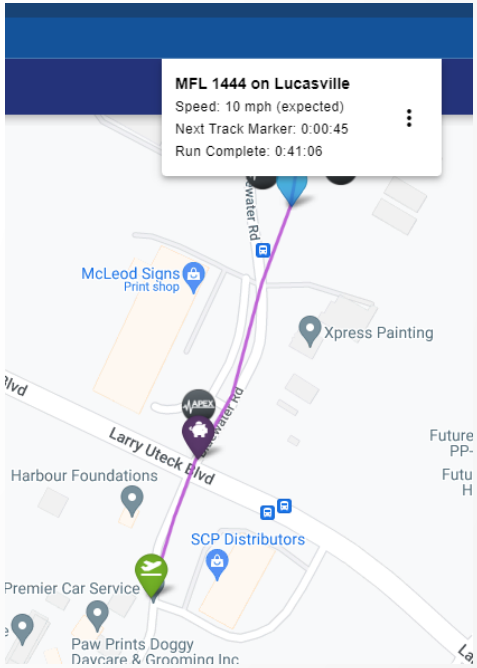
PROPIPE NORTH AMERICA

PigView Web



- **Pig Run Manager – Start A Pig Run**
  - Select The Run
  - Click The Launch Pig Button
  - Choose The Pig to Launch
  - Enter the Launch Time in **UTC** – This can be edited later
  - Once Launched – Pig Run Appears as Pipeline Overlay and a PIG Icon Moves from Launch Location to First Marker
  - Once Launched AGM markers with an internet connection and at a marker location (Linked State) turn RED
  - Once Launched AGM markers with NO internet connection and at a marker location (Linked State) turn BLUE
  - A Blue Circle will appear at each marker, indicating the radius (100 meters) that will link an AGM to that surveyed Marker



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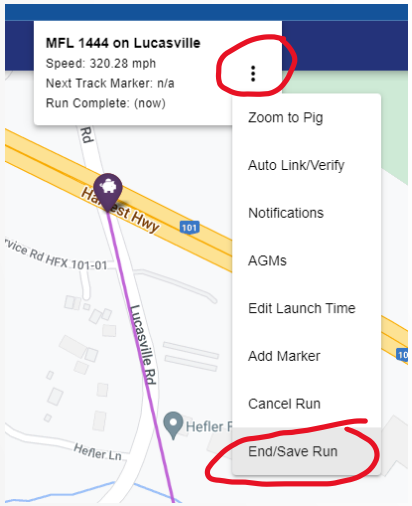
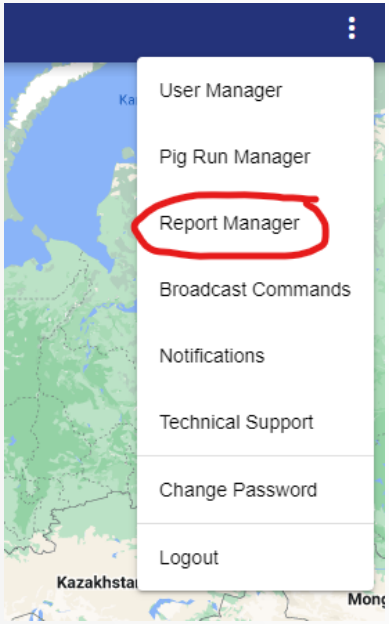
PigView Web



- **Pig Run Manager – Ending a Pig Run**
  - **Click End/Save Run**
  - **Enter Receive Time in UTC**

- Once A Pig Run Is Complete All Passage Data Should Be Already at The Server For Marker Locations That Had an AGM that Had an Active Connection to The Internet at The time of the Passage
- How To Get Any Remaining Passages?
  - If You Used Broadcast Commands, then Downloading Should Start On The Receive Event
  - What If AGMS Have No Connection At Receive?
    - They Will Download When They Get A Connection
  - What IF The Connection is Intermittent?
    - Send Another Broadcast Command From a Good Location
    - Use Bluetooth

PigView Web



- **Report Manager**
  - Allows Users to export Passage Reports
  - Can Run Reports Based on:
    - Start Stop Time AND Specific AGMs
    - By Completed Pig Run
      - Uses AGMs, And Launch Receive Date/Times For runs

PigView Web

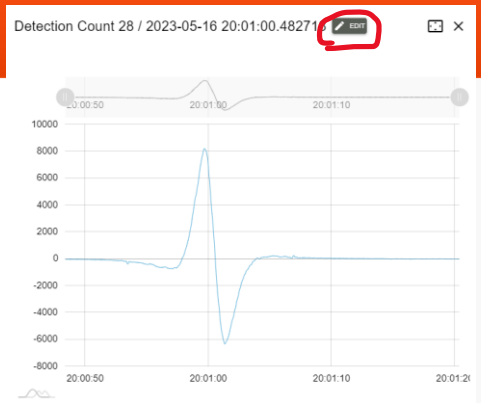
- **Report Manager**
  - View and Verify Passages
  - Edit Passage Times
  - Export as CSV (.Pro)

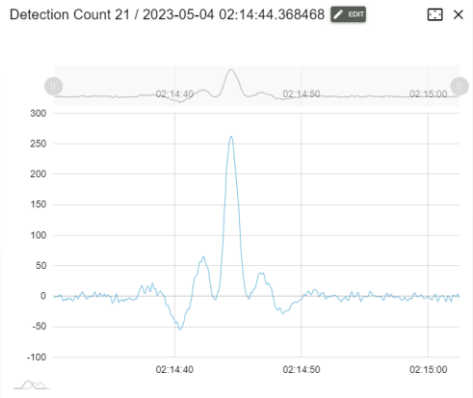
Completed Pig Run Report Data

Passage	Marker Name	Tool Name	Coordinates - Lat, Lon, Altitude (m)	UID	Count	Frequency	Data	Verify
2023-05-16 19:48:19.043343			38.834706, -90.241985, 162.0	415	82	0		
2023-05-16 19:49:05.099531			38.834738, -90.241969, 182.2	404	57	0		
2023-05-16 19:49:05.765092			38.834697, -90.241981, 168.0	415	83	0		
2023-05-16 19:53:18.692030			38.834699, -90.241994, 159.5	415	84	0		
2023-05-16 19:53:21.033968			38.834731, -90.241971, 184.5	404	58	0		
2023-05-16 20:01:00.482718			38.829910, -90.241411, 167.5	414	28	0		
2023-05-16 20:02:31.456593			38.822582, -90.236081, 167.1	415	85	0		
2023-05-16 20:03:13.989280			38.822603, -90.236097, 176.7	404	59	0		
2023-05-16 20:04:17.412625			38.822604, -90.236101, 179.5	404	60	0		
2023-05-16 20:04:17.759375			38.822612, -90.236071, 166.5	415	86	0		
2023-05-16 20:08:01.281625			38.822608, -90.236114, 178.8	404	61	0		
2023-05-16 20:08:01.371468			38.822592, -90.236077, 168.9	415	87	0		
2023-05-16 20:08:24.387281			38.822616, -90.236116, 180.4	404	62	0		
2023-05-16 20:08:24.542030			38.822573, -90.236072, 168.2	415	88	0		
2023-05-16 20:13:01.247562			38.819097, -90.230791, 156.0	414	29	0		

ELF
GEO
MAG

Records per page: 15 16-30 of 145





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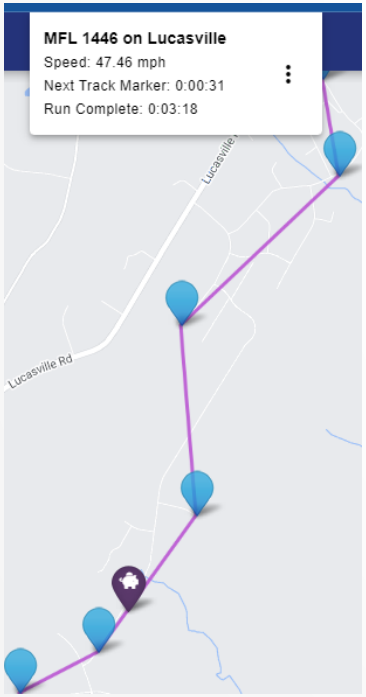
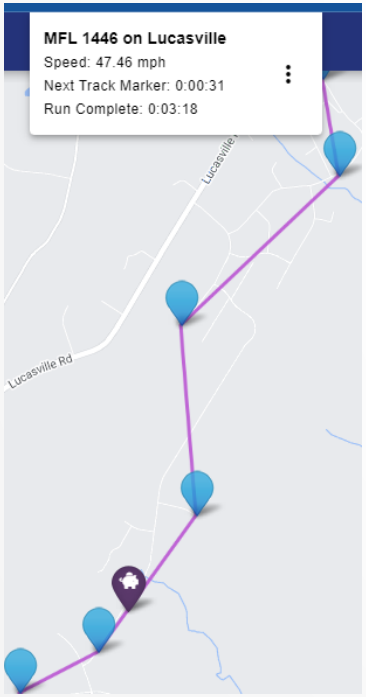
PigView Web – Live Remote Tracking

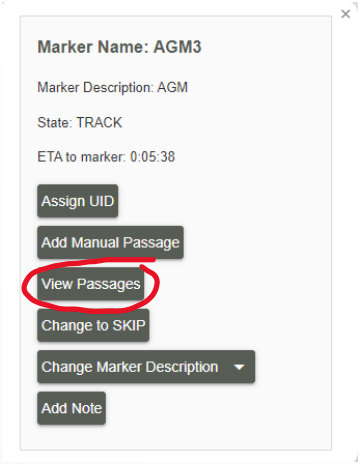


- **Live Remote Tracking**
  - The Main Jobs of The Remote Live Tracker are
    - Launch The Pig Run, End The Pig Run
    - Verify Passages at Each Marker Location
    - Keep The Pig Icon Moving at Locations Where AGMs Are Not Present By Skipping Or Adding a Manual Passage
    - Add a Marker to AGM Locations That Were Not Entered In a Survey
    - Download Passages In Real Time and Update the Pig Run
    - Back Up and Communicate With the Trackers In The Field, Report Weld Counts and Speeds, Passage Info
    - Add Redundancy On Detections Using Streaming Detectors

PigView Web – Live Remote Tracking



- **Live Remote Tracking – Verify Passage**
  - Click On The AGM Marker, Select View Passages
  - A List Of Passages That Have Occurred at This Marker Will Appear
  - Click The Red Icon To Turn it Grean and "Verify" The Passage
  - Note – This is automatic if a marker is "Auto Verify"
  - Passages can be "Unverified" By Clicking on the green icon



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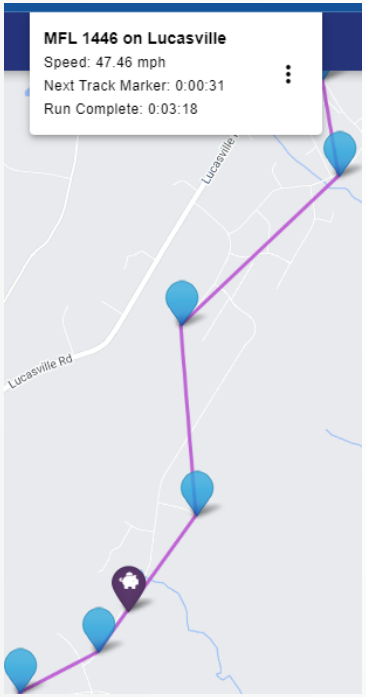
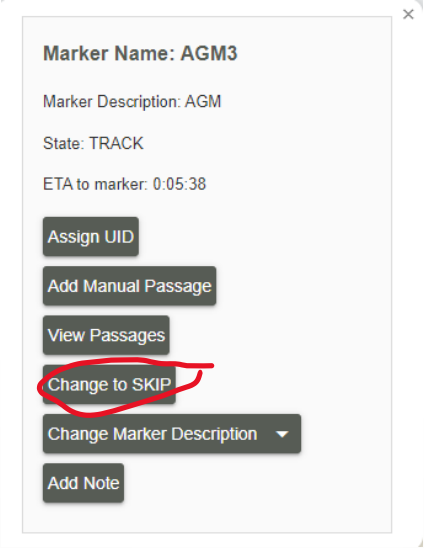
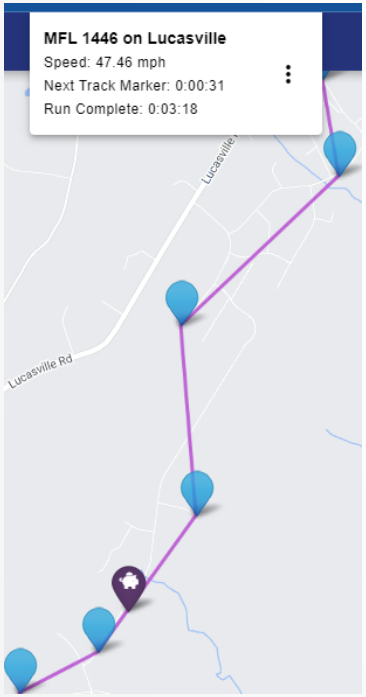
PigView Web – Live Remote Tracking



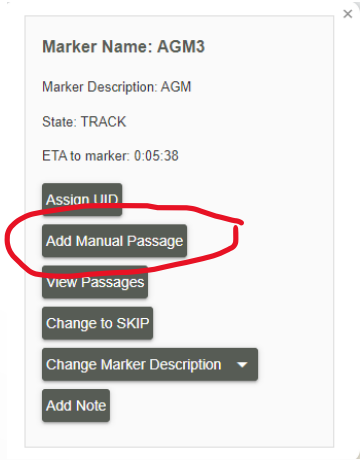
- **Live Remote Tracking – Skipping a Location**
  - Click On Marker, Change To Skip
  - Pig Icon Won't Stop at Skipped Markers



PigView Web – Live Remote Tracking

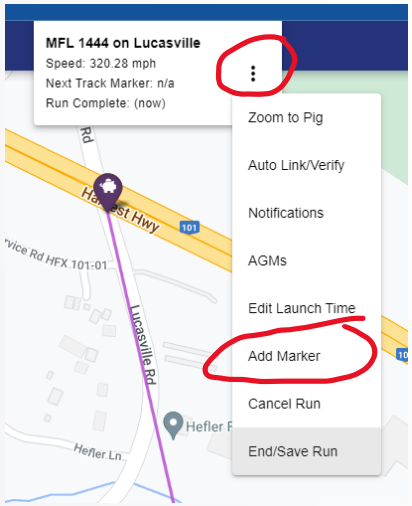


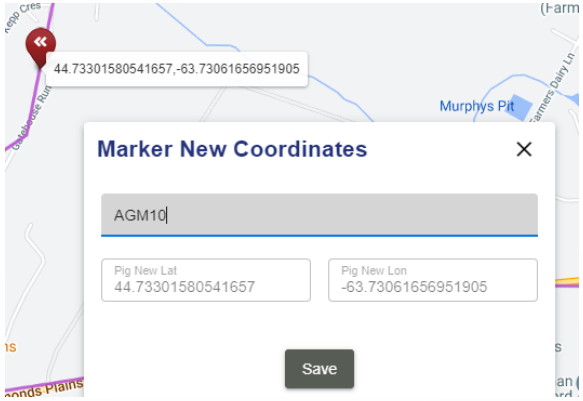
- **Live Remote Tracking – Adding a Manual Passage**
  - Click On Marker, Click Add Manual Passage, enter Passage Time in UTC
  - Pig Icon Speed will update with Manual Passage, Notifications can Be sent



PigView Web – Live Remote Tracking

- **Live Remote Tracking – Add a Survey Marker During a Run**
  - Click On "ADD MARKER" From The Pig Run Panel
  - Click On The Map Where You want to add the Marker
  - Add a UNIQUE Marker Name and Save





PigView Web – Live Remote Tracking

- **Live Remote Tracking – Download A Passage During A Run**
  - Sometimes Passage Data is Not received at the server because of loss of cell signal, These locations are often "SKIPPED" or a MANUAL PASSAGE is added
  - These locations can be rectified after a run, or during a run by downloading passages when You do have connectivity
  - During a run, use the "DOWNLOAD WITHIN TIME RANGE" command
  - Use Heartbeat Data, and Passage Detection Count to narrow the time Window to download Specifically look at:
    - #Offline – HeartBeat Table
    - #Online – HeartBeat Table
    - DetectionCount – Passage Table

Historic Data for 706

PASSAGE HEARTBEAT

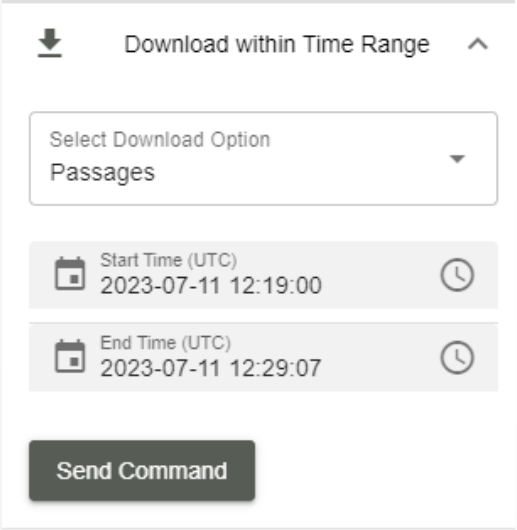
Timestamp	Count	Frequency	Data	
2023-03-04 21:00:17.690280	54	0		
2023-03-04 20:46:48.095968	53	0		
2023-03-04 20:26:29.991437	52	0		
2023-03-04 19:23:54.497093	51	0		
2023-03-04 19:23:54.497093	51	0		
2023-03-04 18:21:11.461937	48	0		
2023-03-04 18:20:25.896437	47	0		

Historic Data for 706

PASSAGE HEARTBEAT DEVICE INFO SETTINGS

Timestamp	Satellite Count	Latitude	Longitude	Altitude	Signal Strength	Battery	Error Flag	# Offline	# Online	# IR Offline	Power Supply
2023-03-04 20:48:51.653000	5	44.7206327598542	-63.7182148732245	81400	-75	8154	0	11	20	0	Battery
2023-03-04 20:48:21.657000	6	44.72062940709293	-63.71821152046323	81400	-76	8172	0	11	20	0	Battery
2023-03-04 20:48:21.657000	6	44.72062940709293	-63.71821152046323	81400	-76	8172	0	11	20	0	Battery
2023-03-04 20:31:51.763000	6	44.72058276180178	-63.718173215165734	80400	-74	8108	0	10	20	0	Battery
2023-03-04 20:31:51.763000	6	44.72058276180178	-63.718173215165734	80400	-74	8108	0	10	20	0	Battery

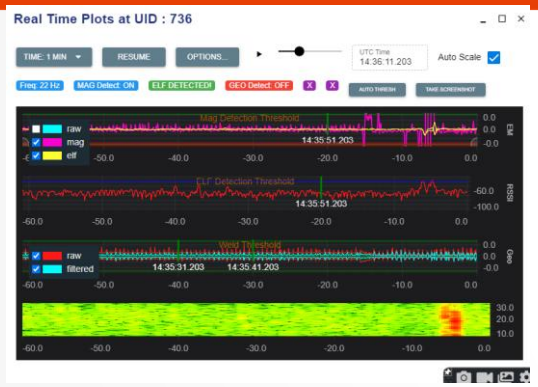
PigView Web – Live Remote Tracking

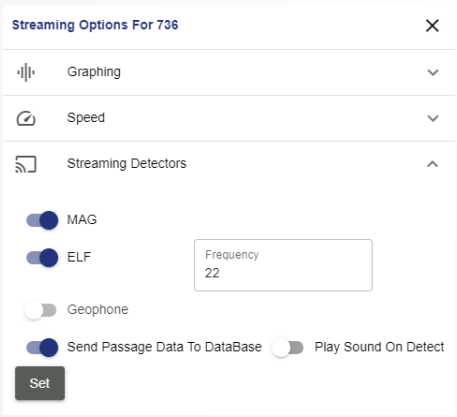


Live Remote Tracking – Download A Passage During A Run

- Do Your Best To Limit The Time For Download – **Recording to Disk Is Disabled During Downloads**
- Do Not Do This on an AGM is the Next expected Pig Passage Location
- Click On AGM -> Commands -> Download Within Time Range

PigView Web – Live Remote Tracking





Live Remote Tracking – Streaming Detectors

- Simple Detectors That can be used on the Real Time Streaming Data and Added to your Database
- Great Backup for Situations that are difficult to Track – High Interference
- Human Can See the Passage, But machine Cant

Enable Streaming Detector

- Open Stream Window
- Choose Options
- Choose Streaming Detectors
- Enable MAG and/or ELF, and Send To Database Option
- Set the Threshold on The Graph
- Graph Will Pause on Detection – and send data to server
- This will show up in "View Passages" Window for marker

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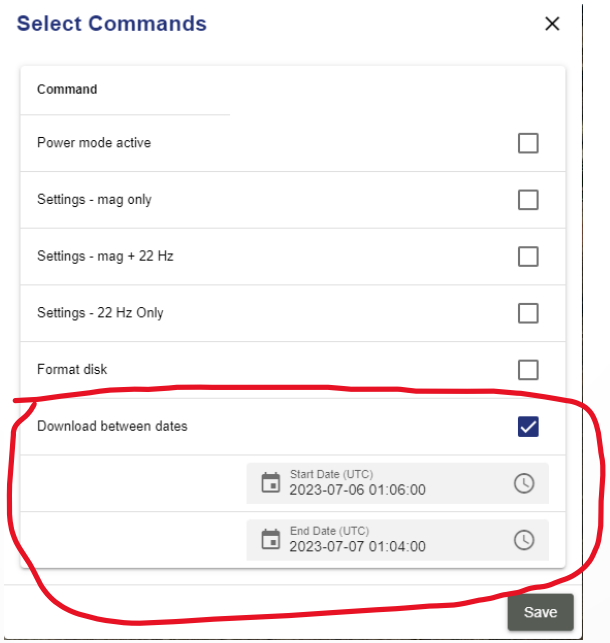
PigView Web – Live Remote Tracking

- **Live Remote Tracking – Speed**
  - Calculate Instantaneous Speed From Weld Counts on Geophone Data Stream
- **Set Weld Spacing**
  - Open Stream Window
  - Choose Options
  - Choose Speed
  - Set Weld Space
- **Calculate Speed**
  - Pause Streaming Graph By Pressing "Pause"
  - Move Vertical Cursors on Geophone Plot to Welds
  - Speed is calculated

PigView Web – Downloading Data Post Run

- Downloading Data – PigView Web
  - Broadcast Commands



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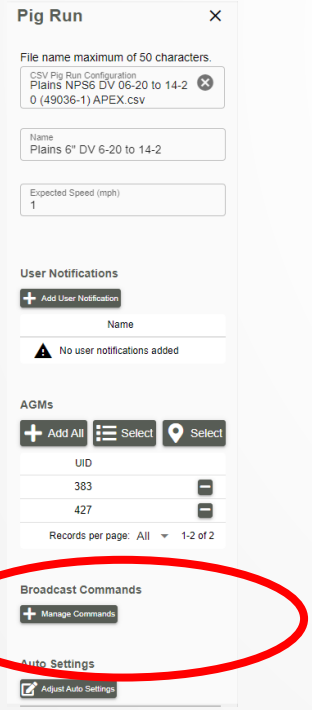
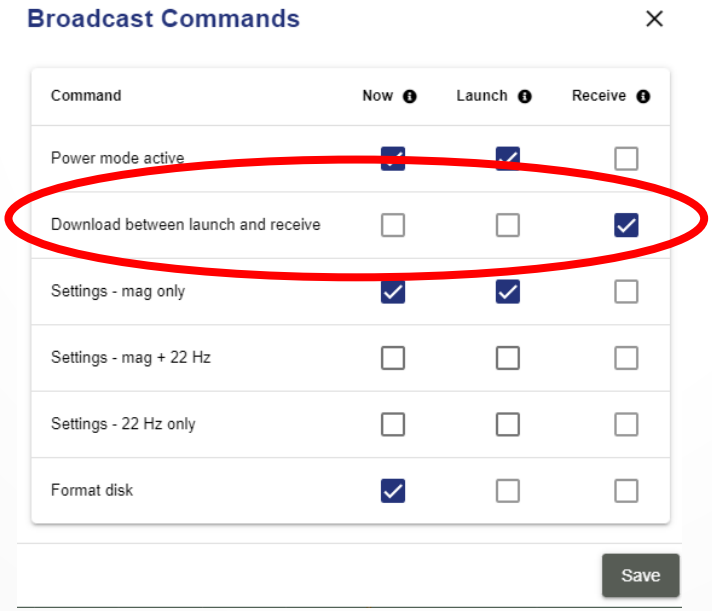
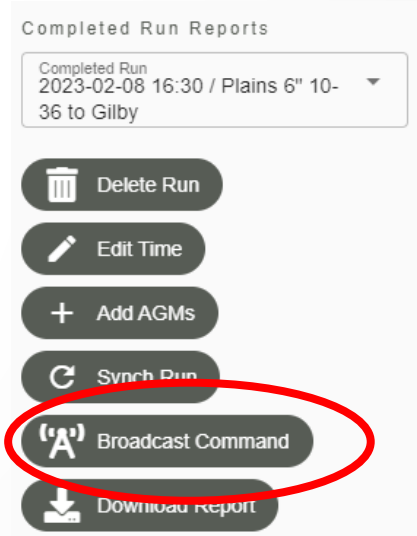
PigView Web – Downloading Data Post Run

- Downloading Data – Pig Run Manager
  - Broadcast Commands







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PigView Web – Post Run Analysis

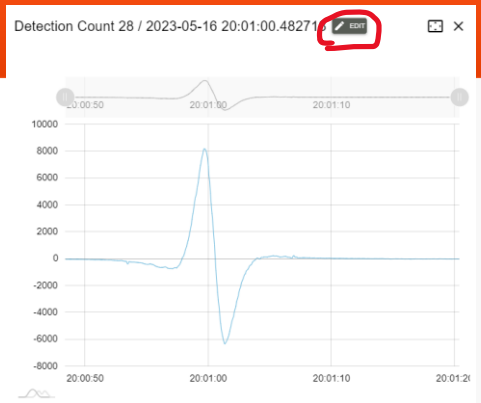
- **Report Manager**
  - View and Verify Passages
  - Edit Passage Times
  - Export as CSV (.Pro)

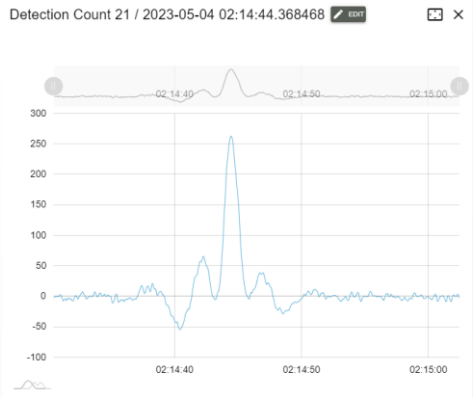
Completed Pig Run Report Data

Passage	Marker Name	Tool Name	Coordinates - Lat, Lon, Altitude (m)	UID	Count	Frequency	Data	Verify
2023-05-16 19:48:19.043343			38.834706, -90.241985, 162.0	415	82	0		
2023-05-16 19:49:05.099531			38.834738, -90.241969, 182.2	404	57	0		
2023-05-16 19:49:05.765092			38.834697, -90.241981, 168.0	415	83	0		
2023-05-16 19:53:18.692030			38.834699, -90.241994, 159.5	415	84	0		
2023-05-16 19:53:21.033968			38.834731, -90.241971, 184.5	404	58	0		
2023-05-16 20:01:00.482718			38.829910, -90.241411, 167.5	414	28	0		
2023-05-16 20:02:31.456593			38.822582, -90.236081, 167.1	415	85	0		
2023-05-16 20:03:13.989280			38.822603, -90.236097, 176.7	404	59	0		
2023-05-16 20:04:17.412625			38.822604, -90.236101, 179.5	404	60	0		
2023-05-16 20:04:17.759375			38.822612, -90.236071, 166.5	415	86	0		
2023-05-16 20:08:01.281625			38.822608, -90.236114, 178.8	404	61	0		
2023-05-16 20:08:01.371468			38.822592, -90.236077, 168.9	415	87	0		
2023-05-16 20:08:24.387281			38.822616, -90.236116, 180.4	404	62	0		
2023-05-16 20:08:24.542030			38.822573, -90.236072, 168.2	415	88	0		
2023-05-16 20:13:01.247562			38.819097, -90.230791, 156.0	414	29	0		

ELF
GEO
MAG

Records per page: 15 16-30 of 145





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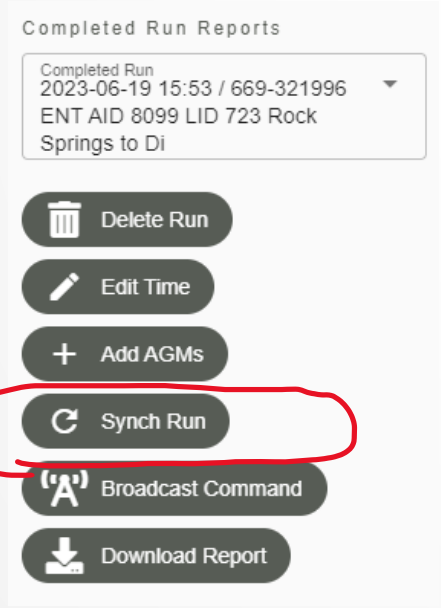
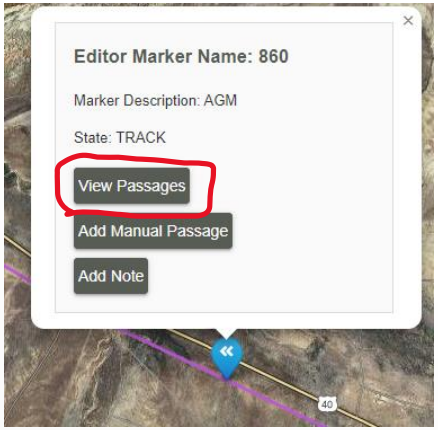
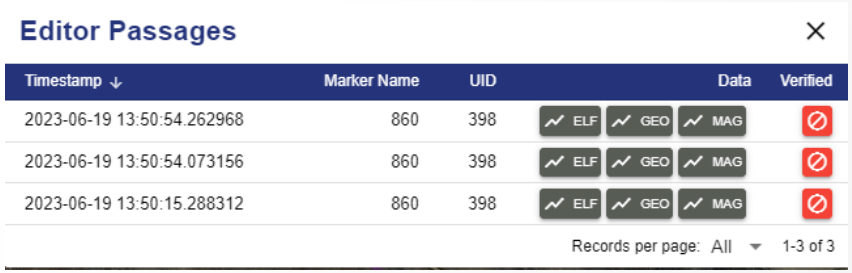
PigView Web – Post Run Analysis

- **Pig Run Manager**
  - Once All Passages Are Downloaded – Synch Run
    - Links All Passage Data from AGMS associated with your Pig Run and within 100m of a Marker Location
  - Click On Marker Location to View and Verify Passages







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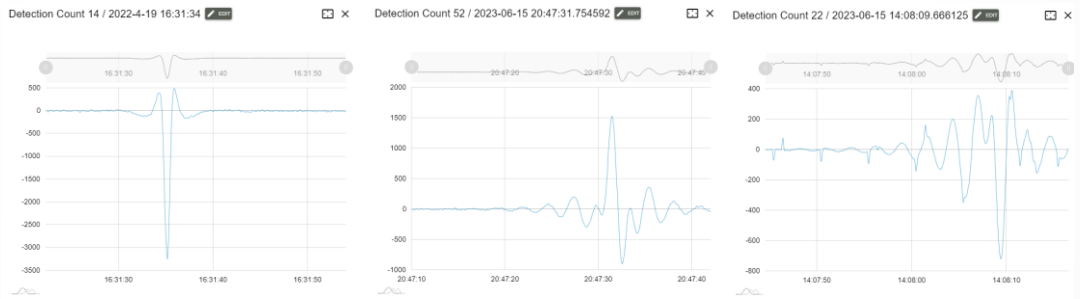
PigView Web – Post Run Analysis

- **Waveform Analysis – ELF**

Good



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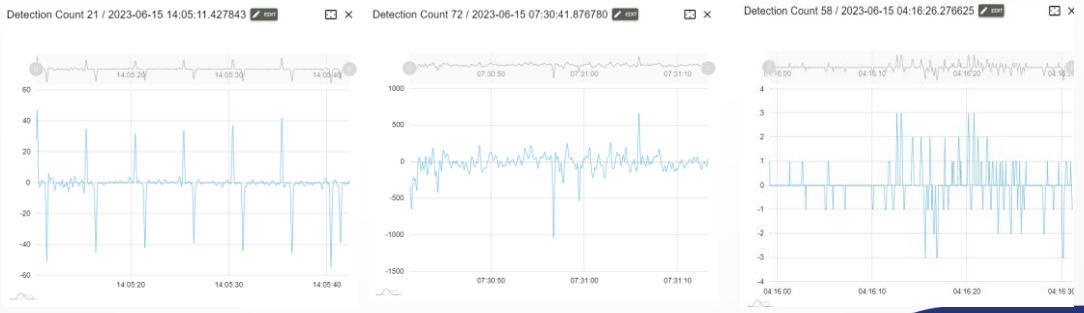
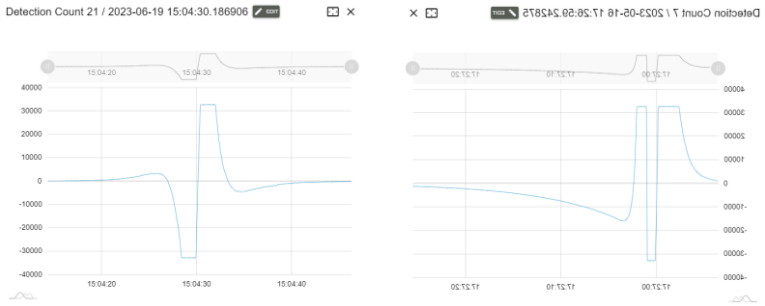


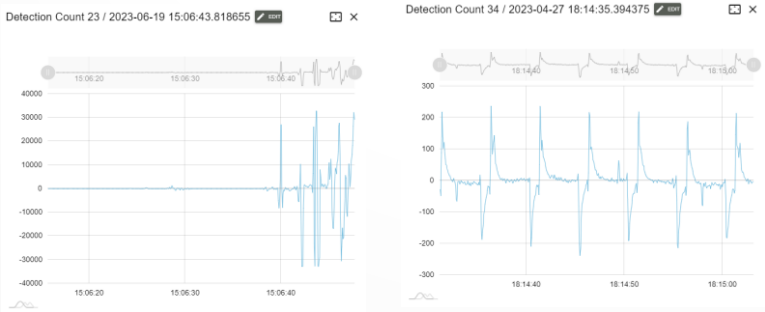
PigView Web – Post Run Analysis

- **Waveform Analysis – MAG**

Good



False



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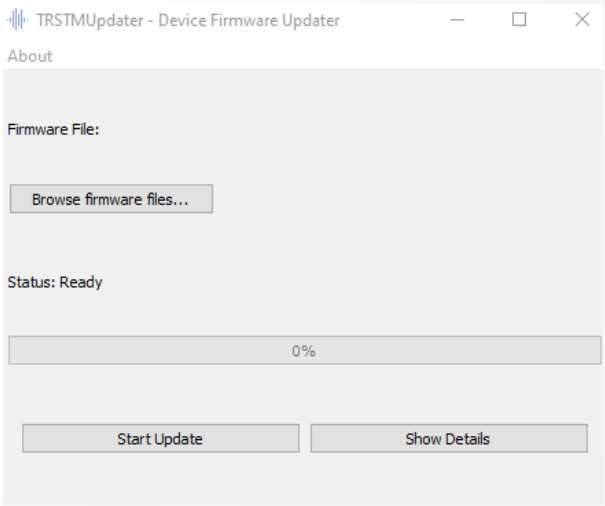
PigView Web – Post Run Analysis

- What If you cant find A passage?
  - First Check to See if it needs to be downloaded
    - Check Historic Data, Heartbeats – Detection Count and # of offline and Online Files
  - Download Raw Data

Update Device Firmware

- Turn on Unit With FRESH Batteries
- Wait for Unit to boot fully
- Open Bottom Lid – Locate Micro USB Connector
- Plug in Micro USB Cable Into USB Port From Your Computer
- Open TRSTM Updater Application
- Browse to .dfu File
- Click Start Update
- Update takes about 2 minutes
- If Successful, Message will appear, and unit will restart