

# **NR-TEC S2S SURFACE TO SANDFACE DATA LOGGER**

## **BASIC OPERATIONS GUIDE**

INTRODUCTION

RIGGING IN / OUT

CONNECTING TO DEVICE

TAKING A SINGLE SHOT

SCHEDULING

VIEW A SHOT SCHEDULE

UPLOAD A NEW SHOT SCHEDULE

ERASING A SHOT SCHEDULE

DOWNLOADING

DOWNLOAD SHOTS

PURGING / DELETING EXISTING DATA / SHOTS

ANALYZING A SHOT

START / KICK

CALLIPER COUNT

BATTERY CHARGING

## INTRODUCTION

### NR-TEC S2S SURFACE TO SANDFACE LOGGER



After more than a quarter century of specializing in pumping well analysis, and having the team that developed former world class leading acoustic well instrumentation, **NR-Tec Ltd.** proudly introduces the “**S2S**” (surface to sandface) logger as a revolutionary concept in acoustic well sounding and surface pressure measurement.

With the compact and lightweight instrument attached to the wellhead and shot-supply gas connected, it is now possible from the convenience of your vehicle cab to upload an unattended acoustic shot schedule, retrieve and view logged data, determine the depth to liquid and surface pressure. With an all-in-one wellhead assembly and RF (Bluetooth™) technology combined with a low power budget for long test life, there is no more need to connect cables to a solenoid, microphone, pressure transducer, or external battery supply. The **S2S** is designed to communicate from your laptop (outside the Class I, Division I Hazardous area) and from a distance of up to 100 meters (line-of-sight). The new in-line slim style microphone and calibrated shot size chamber have been engineered to provide for optimum acoustic response. The pressure transducer provides comparable accuracy and resolution to industry leading surface pressure loggers. This feature in itself offers the benefit of no longer having to merge your acoustic readings to costly peripheral (high- accuracy/resolution) pressure devices.

The user has the choice of using either an external shot supply source (N<sub>2</sub> or CO<sub>2</sub>), or using the quick release manual bleed-off valve, designed to produce an implosion (decompression) type of sound source when and where the appropriate conditions dictate.

Features are summarized as follows:

- LOGGER CAPTURES BOTH SURFACE PRESSURE READINGS AND FLUID LEVELS
- BLUETOOTH WIRELESS SHOT AND DOWNLOAD
- ONE PIECE UNIT – INCLUDES GUN, RECORDER / LOGGER, PRESSURE TRANSDUCER AND COMMUNICATION
- FULL SIGNAL CAPTURE (30 SECONDS) OF 1000+ SHOTS WITH PRESSURE READINGS
- 30 DAY BATTERY LIFE ON UNIT BETWEEN CHARGES AND REPLACEABLE BATTERY PACK (NO SOLAR PANEL OR EXTERNAL POWER REQUIREMENTS)
- CSA APPROVED FOR CLASS 1 DIV 1 ENVIRONMENT
- ABSA APPROVED
- PROGRAMMABLE SCHEDULING
- XP / VISTA COMPATIBLE SOFTWARE FOR AAWS SETUP / DOWNLOADING AND SHOT ANALYSIS (ACOUSTIC VELOCITY AND CALLIPER COUNT)

All communication with The S2S instrument is conducted through the S2S Data Analyzer Software using the NR-Tec S2S Bluetooth Dongle.

Once the software is installed and authorized, the user may:

- Take a manual shot
- Set up and take multiple shots on a schedule
- Download shot/s from instrument to software for analysis
- Analyze a shot (pick start / kick and conduct a calliper count)
- Export Data

## RIGGING IN / OUT

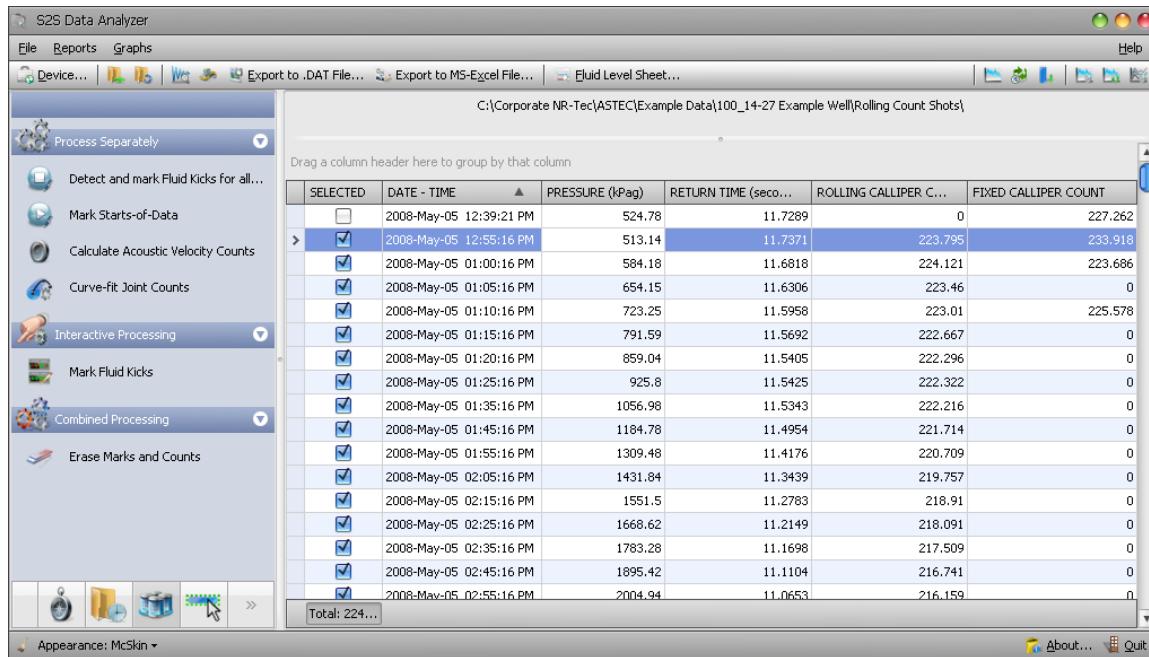
**WARNING:** Do not attach the S2S Instrument to wells that may build to pressures greater than 2250 psi (15500 kPa) during a test.

To rig in to a well in order to obtain data / shots complete the following:

- Close Well Head Access Valve(s).
- Relieve Pressure in Access fitting.
- Remove Plug in Well Access Fitting.
- Install adaptor(s) as required to mount the S2S Instrument using Teflon Tape for sealing NPT threads.
- Install Nitrogen Tank, Regulator, and hose.
- Set Nitrogen Regulator to 500 psi and verify that there are no leaks.
- Log into the S2S instrument using the S2S Laptop Software.
- Read the pressure while it is still at atmospheric pressure (before well head pressure is applied).
- Close the pressure vent valve on the S2S.
- Slowly open Well Access Valve and verify that there are no leaks (Open Well Access Valve fully).
- Read the well pressure using the S2S Laptop Software.
- Set the Nitrogen Regulator to a pressure of approximately 400 psi above the wellhead pressure (a higher differential pressure may be required to get a good response in deep or low pressure wells – maximum differential pressure should not exceed 1200 psi).
- Request a test “shot” using the S2S Laptop Software. View the test “shot” on the S2S Laptop Software
- Setup a logging schedule on the S2S Laptop Software and download it to the instrument.
- When test is complete download the test data from the S2S using the laptop software and rig out the S2S instrument in the reverse order, starting with backing off the N2 pressure regulator and closing the N2 supply valve, closing the wellhead access valve, and bleeding off the pressure (nitrogen source and wellhead) to the instrument. **The N2 pressure must be bled off before the wellhead casing gas so the solenoid valve does not see excessive pressure on one side (which can lead to premature wear / failure of the solenoid).**
- When cleaning out the S2S sensor chamber do not touch the pressure sensor or microphone element.
- Download the test data from the S2S using the laptop software (see “DOWNLOADING” section).

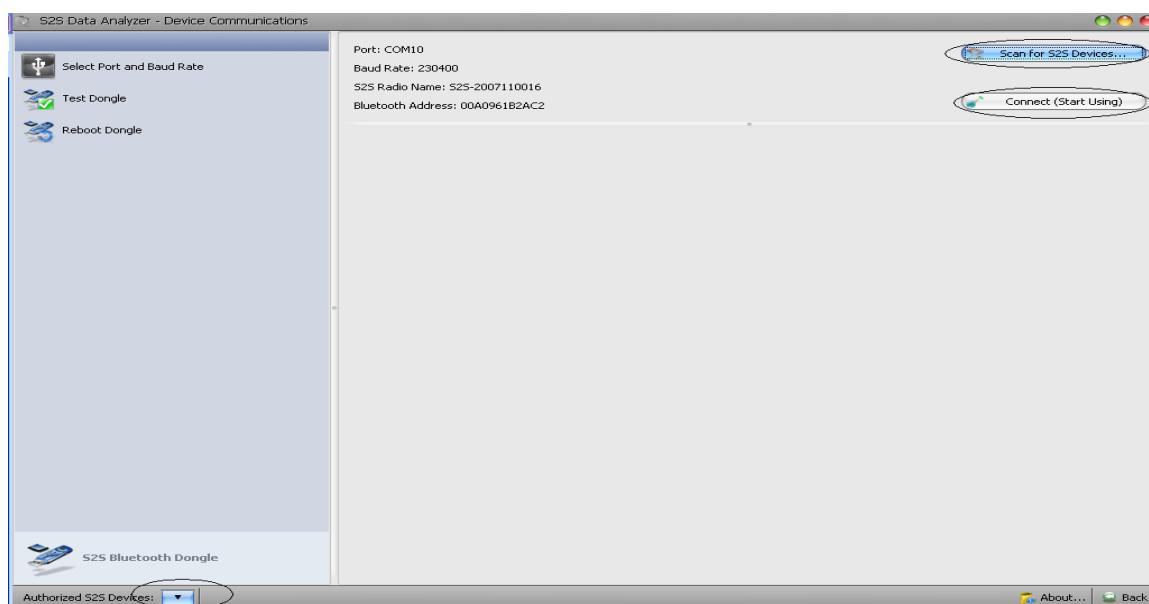
# CONNECTING TO THE DEVICE (S2S)

To allow communication with the S2S Instrument plug the S2S Bluetooth dongle into the USB port on the computer.



On the main screen, select the Device...button (upper left hand side).

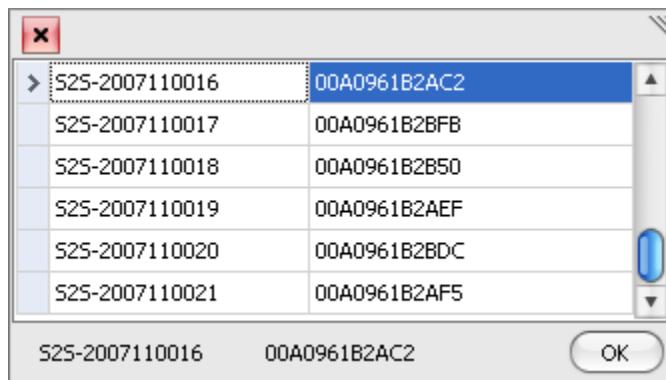
This will bring up the following screen:



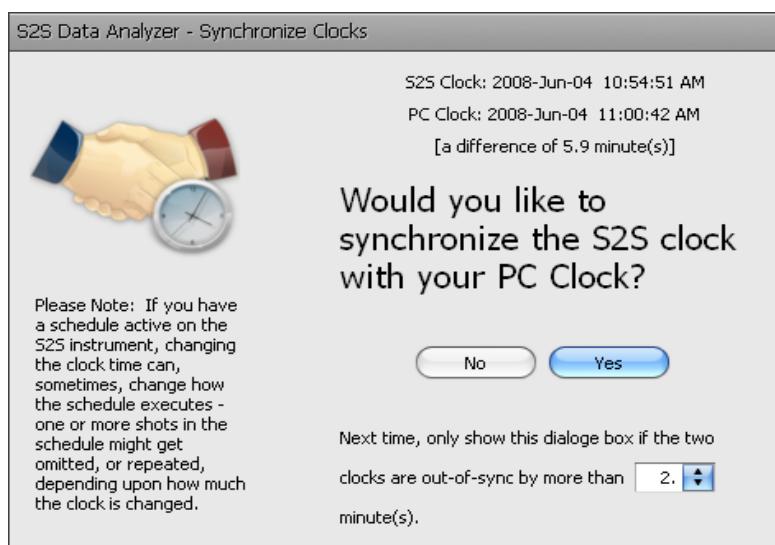
The user may have to test for the dongle and select the appropriate port and baud rate the first time the dongle is plugged in.

At this point there are two options:

- 1) "Scan for S2S Devices...." - This will search for any authorized S2S devices in the area and after finding and choosing the target device connect using the "Connect (Start Using)" Button.
- 2) "Authorized S2S Devices" – By choosing the target instrument from this menu the scan option is not necessary. Choose the instrument and hit "OK". Now connect using the "Connect (Start Using)" Button.



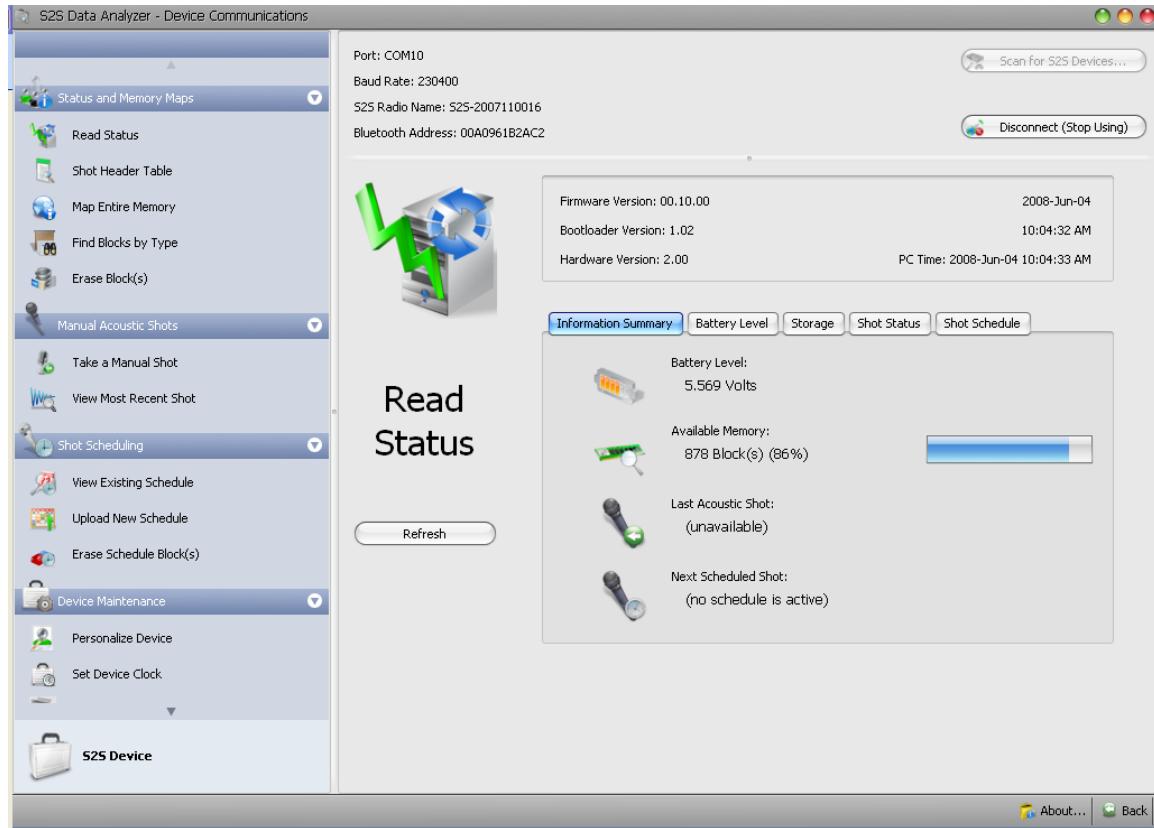
Once connected to the device, the clock will synchronize to the date / time on the laptop / computer. The software will automatically synchronize to the date and time from the computer connected to the device. To upload the date / time into the instrument press the "Yes" button. The date and time need to be set after the battery has been removed for recharging. The software will automatically check the date time of the instrument against the computer connected to the device and prompt the user to synchronize the time.



# TAKING A SINGLE / MANUAL SHOT

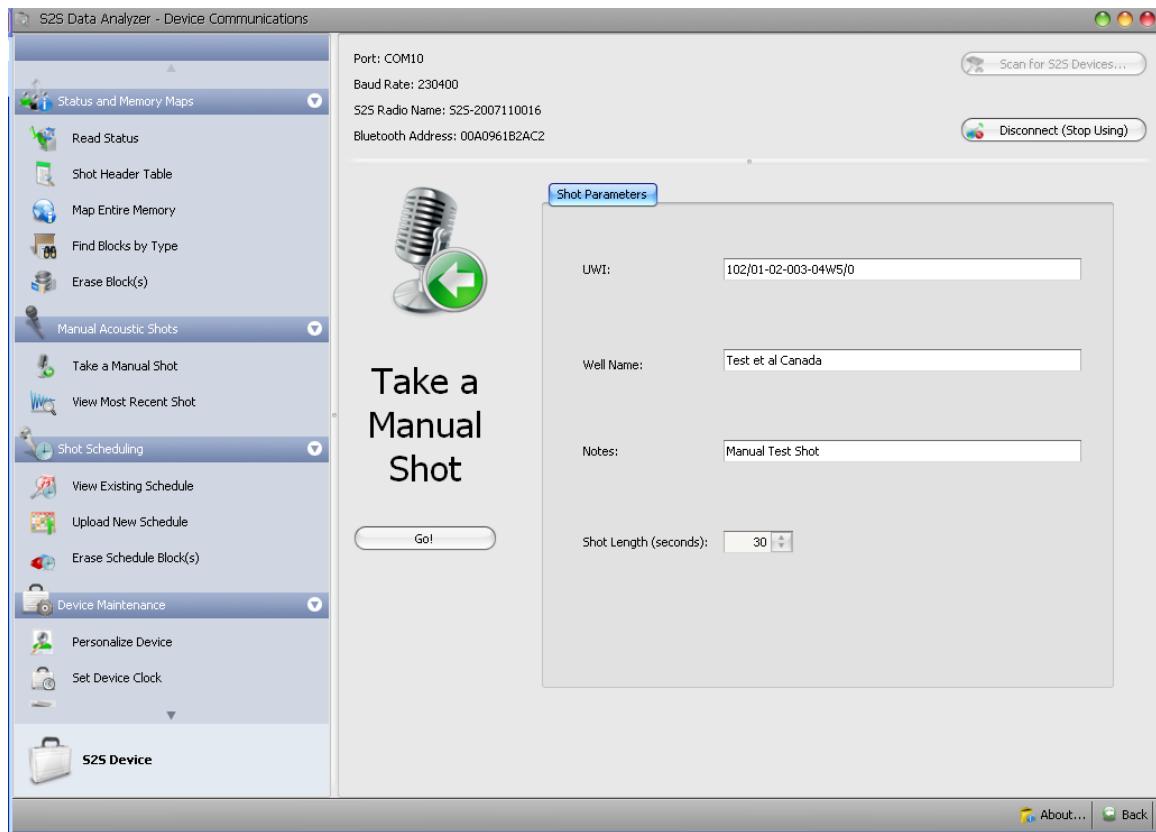
Once the S2S Unit is rigged in and the well access valve is open a manual shot can be initiated from the software.

Once connected to the device the status screen is as shown below:

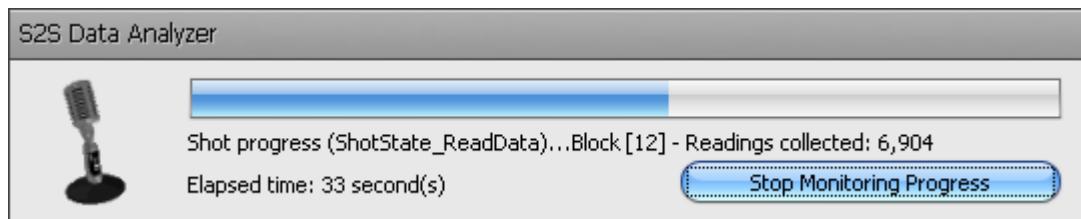


This is the main interface screen for interaction with the S2S Instrument.

After “Take a Manual Shot” is selected there is a Shot Parameters input screen that allows the user to input the Well UWI, Well Name, and any relevant notes. The UWI or Location should always be entered in the Well UWI field as it becomes part of the file naming convention when shots are downloaded.



This information is stored with the shot. After inserting this information hit the "Go!" button to initiate the shot. The status of the shot in progress will be shown as below:



After the shot is completed it can be viewed by using the "View Most Recent Shot" button directly below the "Take a Manual Shot" button. The S2S instrument is equipped with a pressure sensor and the pressure is measured and stored with each acoustic shot.

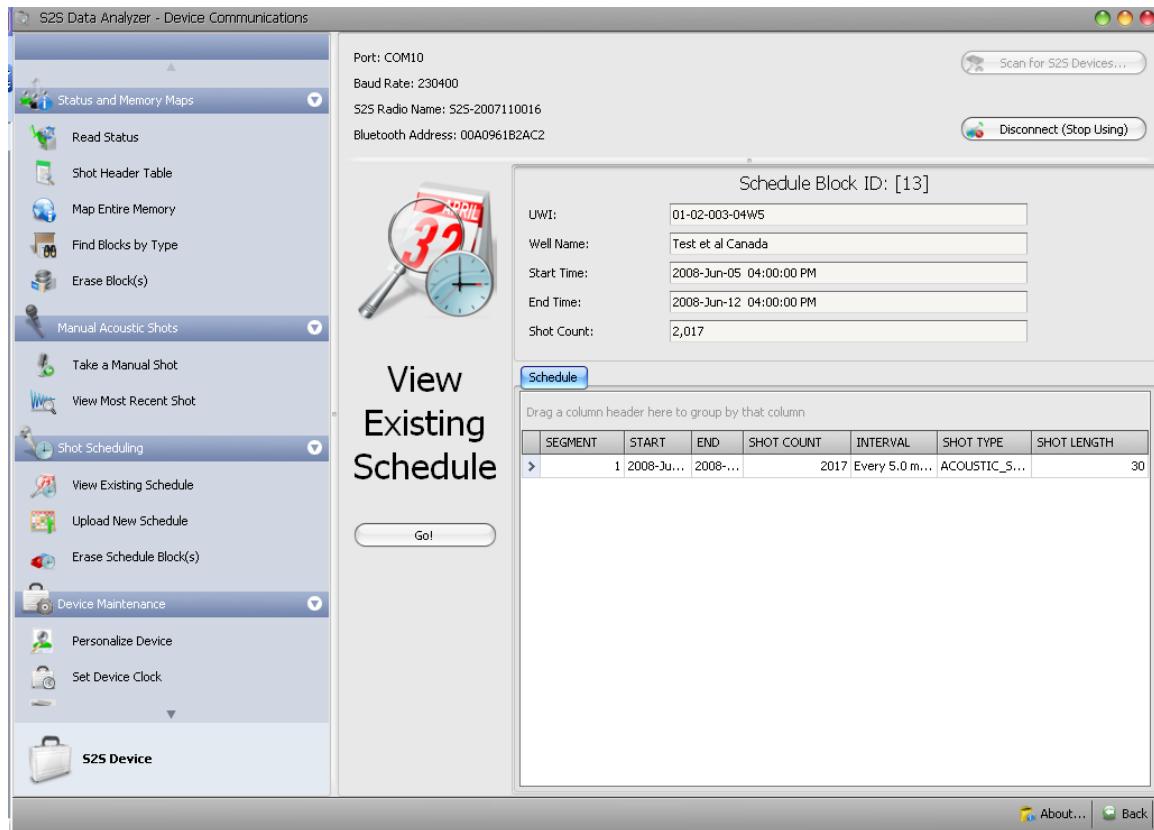
With the "Take a Manual Shot" command the user can specify that the shot data should be downloaded (to a configurable disk location), immediately after the shot is completed. When this option is selected, a menu appears, after the shot is completed that allows the user to View Shot Signal and Perform Rolling Calliper Count on that specific shot without disconnecting from the instrument.

# SCHEDULING

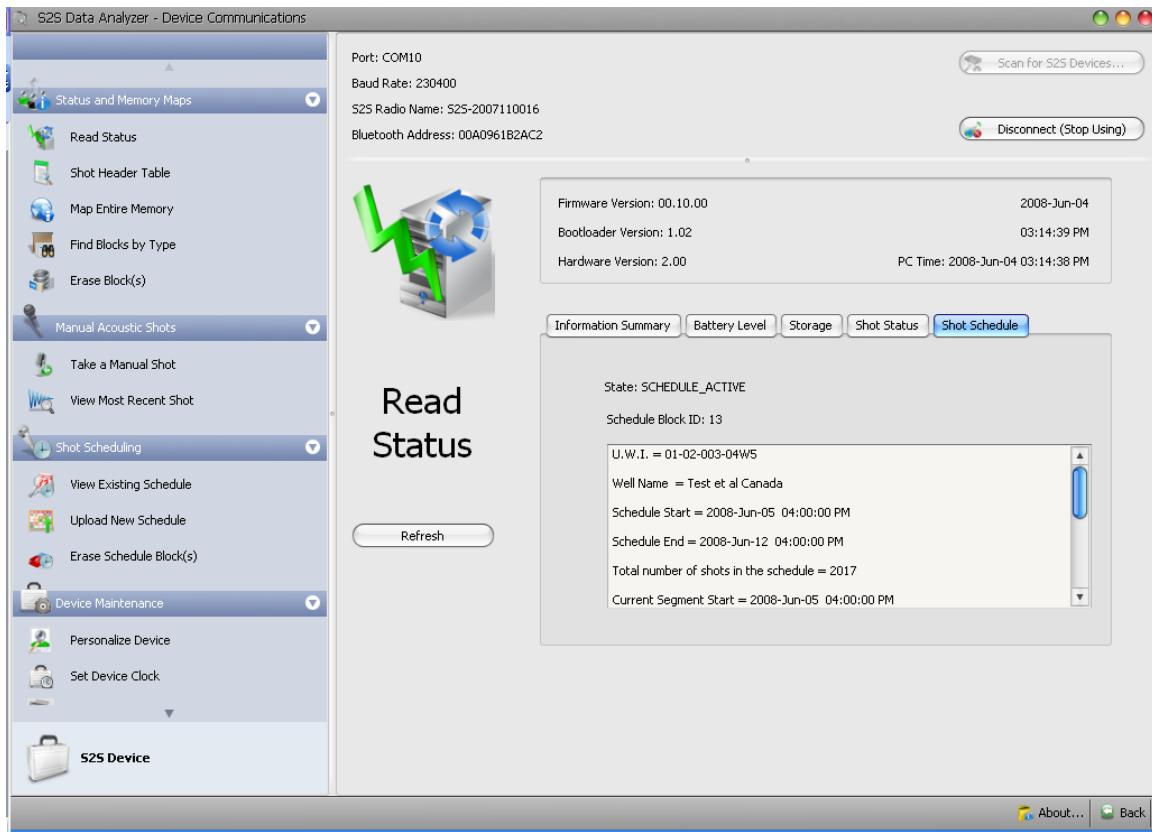
In order to upload or change a schedule the user must be connected to the device (refer to the “Connecting to Device” section of this manual).

On the left hand side of the screen there are three scheduling options:

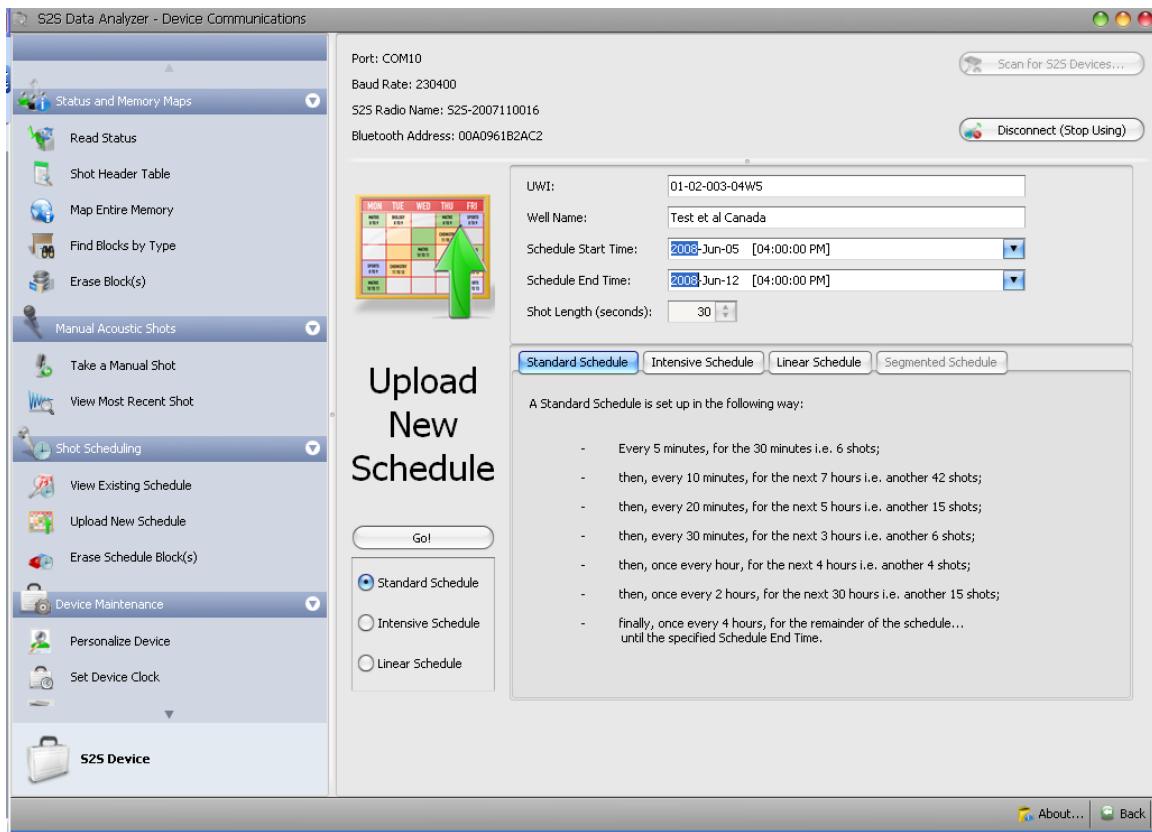
- 1) “View Existing Schedule” – this allows the user to view an existing schedule.



You can also view an active schedule from the “Read Status” screen:



2) "Upload New Schedule" – this allows the user to upload a new schedule to the instrument.



There are currently 3 shot schedule choices:

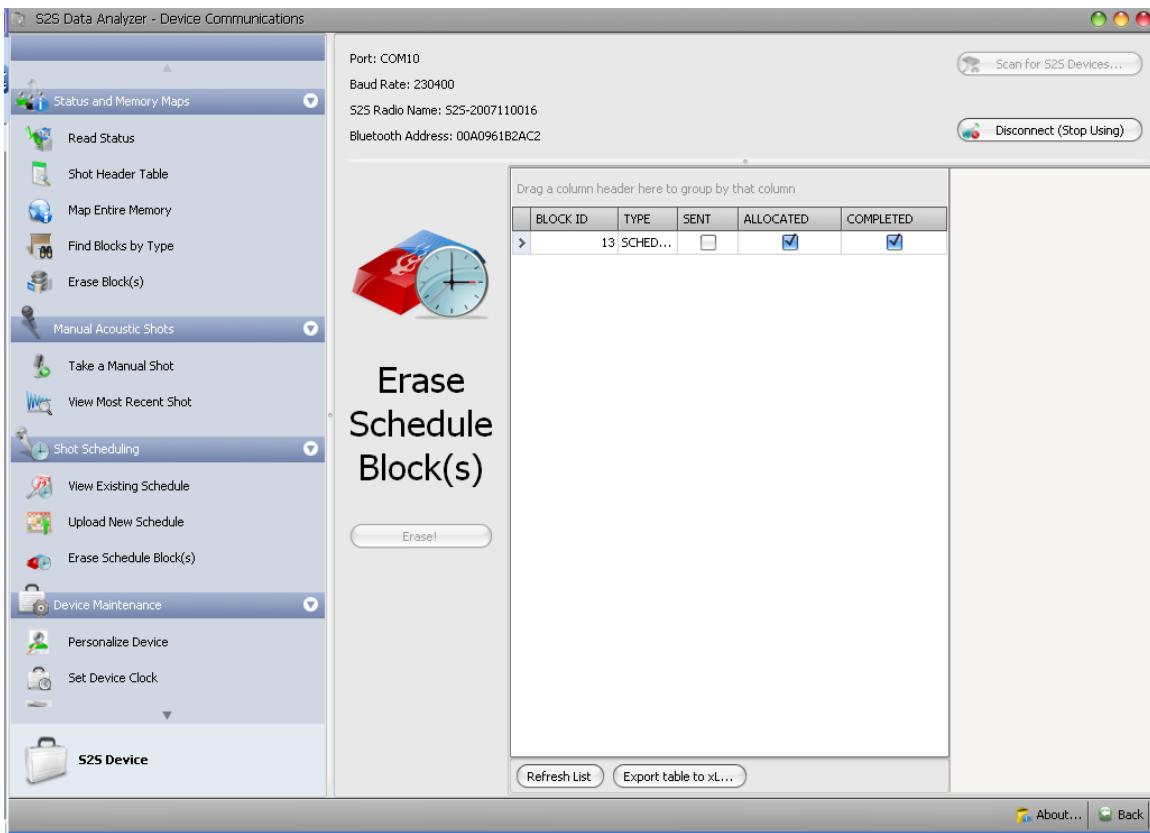
- 1) Standard Schedule – every 5 minute for the first 30 minutes, then every 10 minutes for the next 7 hours, then every 20 minutes for the next 5 hours, etc. (refer to the information screen for full description of the schedule).
- 2) Intensive Schedule - every 5 minute for the first hour, then every 10 minutes for the next 14 hours, then every 20 minutes for the next 9 hours, etc. (refer to the information screen for full description of the schedule).
- 3) Linear Schedule – user defined shot spacing (linear).

If a Standard or Intensive Schedule is chosen then the user only needs to define the start and end time for the test. Note the end time may change slightly once the software determines the exact time of the last shot based on the shot interval frequency.

If a linear schedule is chosen the shot frequency is entered as well as the start and end time of the test. Note the end time may change slightly once the software determines the exact time of the last shot based on the shot interval frequency.

Once the schedule is chosen and the start and end time are defined, hit the “GO” button to upload the schedule into the S2S Unit. The user must disconnect and reconnect to the unit to update / activate the schedule.

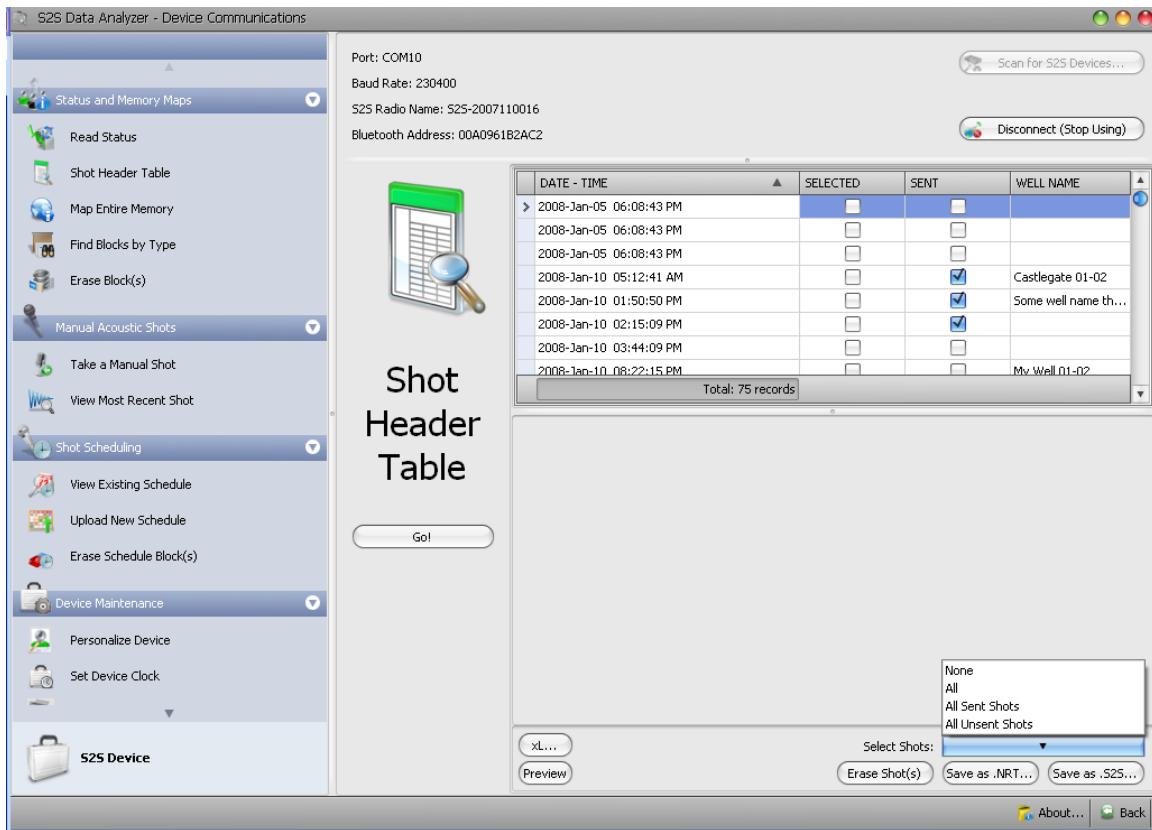
3) “Erase Schedule Block(s)” – this allows the user to erase any or all existing schedules on the instrument. When in the “Erase Schedule Block(s)” mode the blocks that are highlighted (by clicking on the left hand blue box beside the “Block ID” column) will be erased from the instrument when the “Erase” button is pressed.



\*\*\*The user can still take manual shots when a schedule is active

# DOWNLOADING

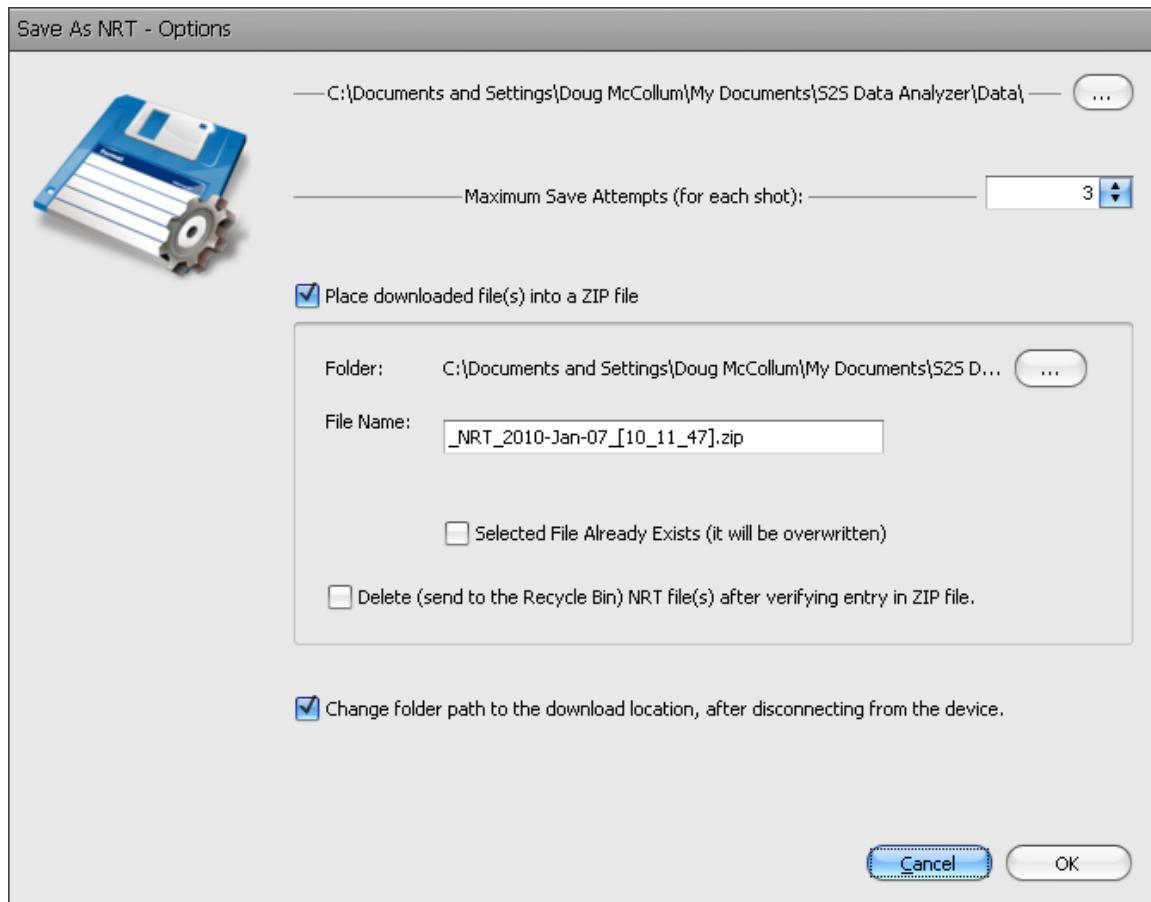
To download and save a shot (or multiple shots) select the “Shot Table Header” button to see a list of shots in memory on the instrument:



From this table you can select an individual shot or number of shots of interest by clicking the check mark in the “Select” column. There is also an option in the lower right hand corner to “Select Shots” with various filters.

After selecting the shots to download hit the “Save as .NRT...” button and save in appropriate folder. These files (shots) are now saved on the computer and can be viewed or forwarded.

Shots can be automatically Zipped when downloading.



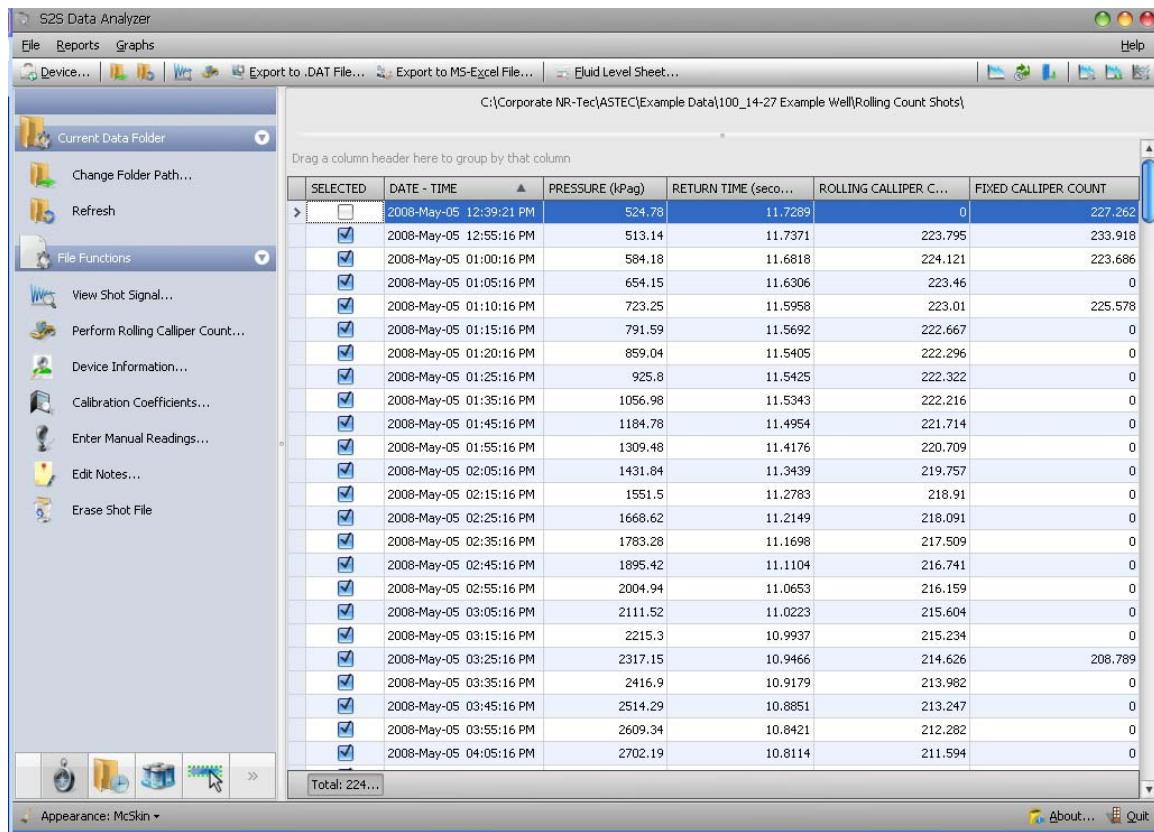
Shots can be erased from the instrument by selecting shots (as above) and hitting the “Erase Shot(s)” button. Ensure the shots have been saved as .NRT files before deleting as there is no “undo” for this action.

Shots can be erased from the software data column (after downloading) by selecting the shot or shots and choosing “Erase Shot File” under the Navigate Menu.

# ANALYZING A SHOT

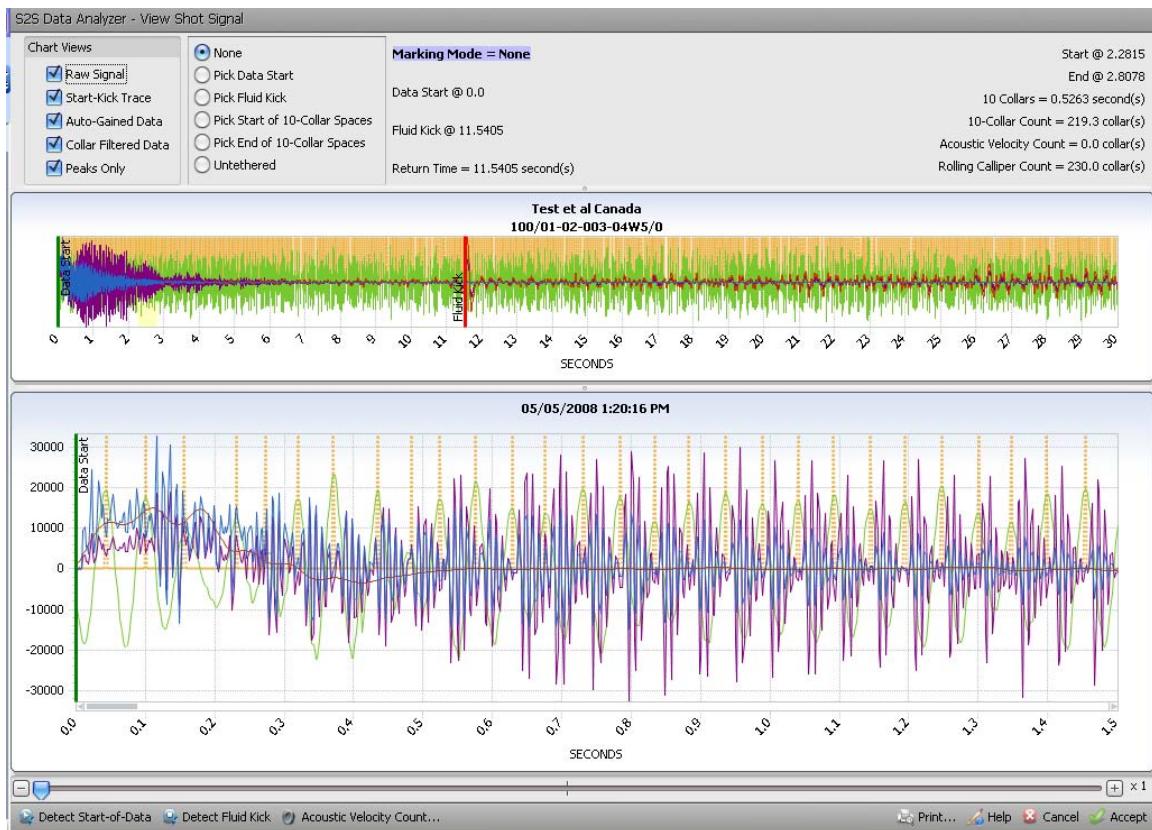
After downloading a shot or group of shots from an instrument, you can disconnect from the instrument in order to analyze the shot data.

After disconnecting hit the “Back” button (bottom right). This will navigate you back to the main screen for data analysis.



Once back at the main screen:

- 1) “Change current Folder...” Button allows the user to navigate to the folder in which the .NRT files are saved.
- 2) Once in the specified folder highlight any shot of interest and hit the “View Shot Signal...” button. This will bring up the screen below showing the full shot trace in the upper portion of the screen, and a zoomed view below. The zoomed field will change based on the portion of the full shot that is clicked with the mouse.



The shot is now ready to be analyzed. For a new shot (i.e. a shot that has not been looked at either manually, or automatically), upon attempting to View Shot, the program now attempts to detect the Start-of-Data and, subsequently, the Fluid Kick, using some default parameters, and marks the results accordingly. These results are not saved until the user chooses to “Accept” the changes.

- 1) Pick Data Start: The data start defaults to 0 seconds. The instrument starts recording when the solenoid is actuated. The start of data should not have to be changed.
- 2) Pick Fluid Kick: Choose the “Pick Fluid Kick” option in the second box near the top of the screen. On the main trace pick the area in which the fluid kick occurs. This should refresh the zoomed screen to the area of interest. On the Zoomed screen click and hold the mouse button down (left or right) to obtain a set of “cross-hairs” which can be used by moving left or right to define the fluid kick. Release the button when the “cross hairs” are aligned with the kick.

When you are marking the Fluid Kick:

Clicking only the LEFT mouse button will position the Fluid Kick at the current position i.e. the location that you pointed to with the mouse;

Clicking only the RIGHT mouse button will indicate that the current position is the first Fluid Kick repeat i.e. the Fluid Kick will be marked at (current position – (current position – Start-of-Data) / 2);

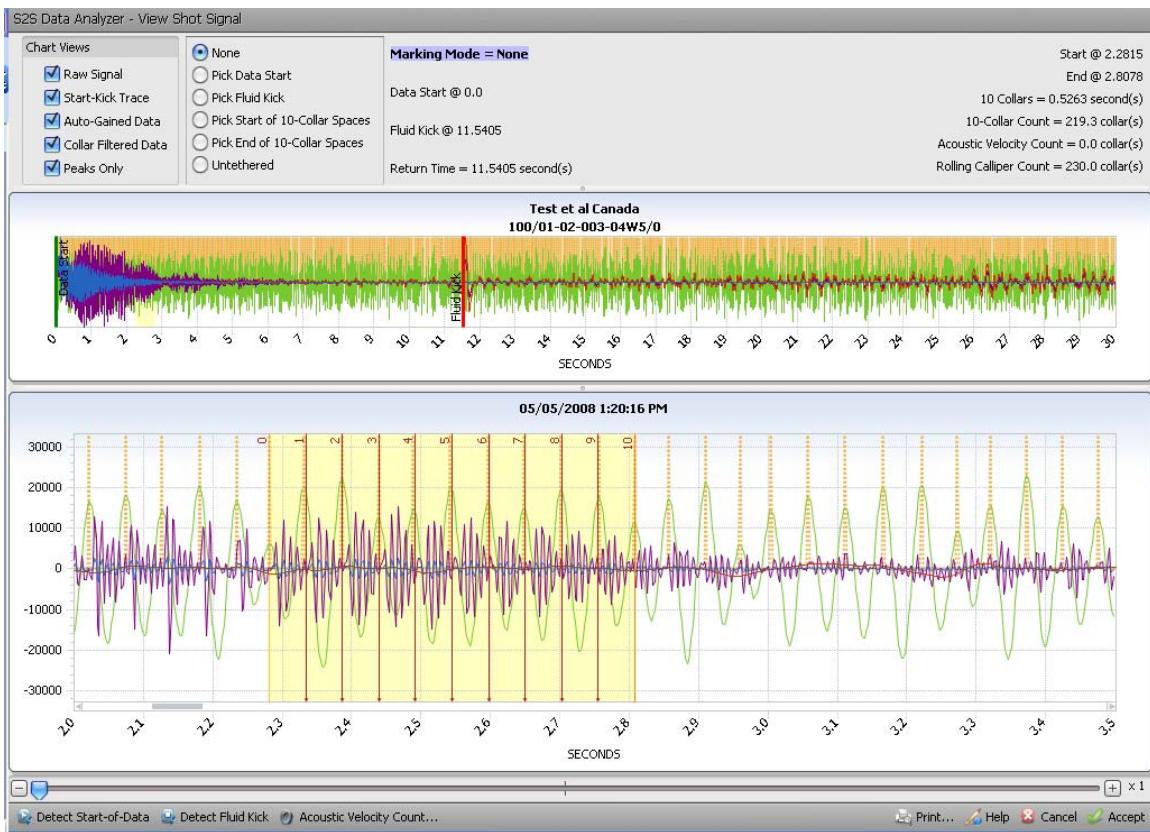
N.B. For the following “tricks,” it is first determined whether the RIGHT mouse button is being clicked or not – if the answer is Yes then the current mouse position is assumed to be (near the) first Fluid Kick repeat location; otherwise, the current mouse position is assumed to be (near the) Fluid Kick location.

SHIFT+CTRL+Click i.e. pressing down both the SHIFT key and the CTRL key, on the keyboard, and clicking the mouse on the strip chart, will take the position of the mouse and travel back, using the Start-Kick Trace data, until that trace meets the zero-line, and select the Fluid Kick at that location;

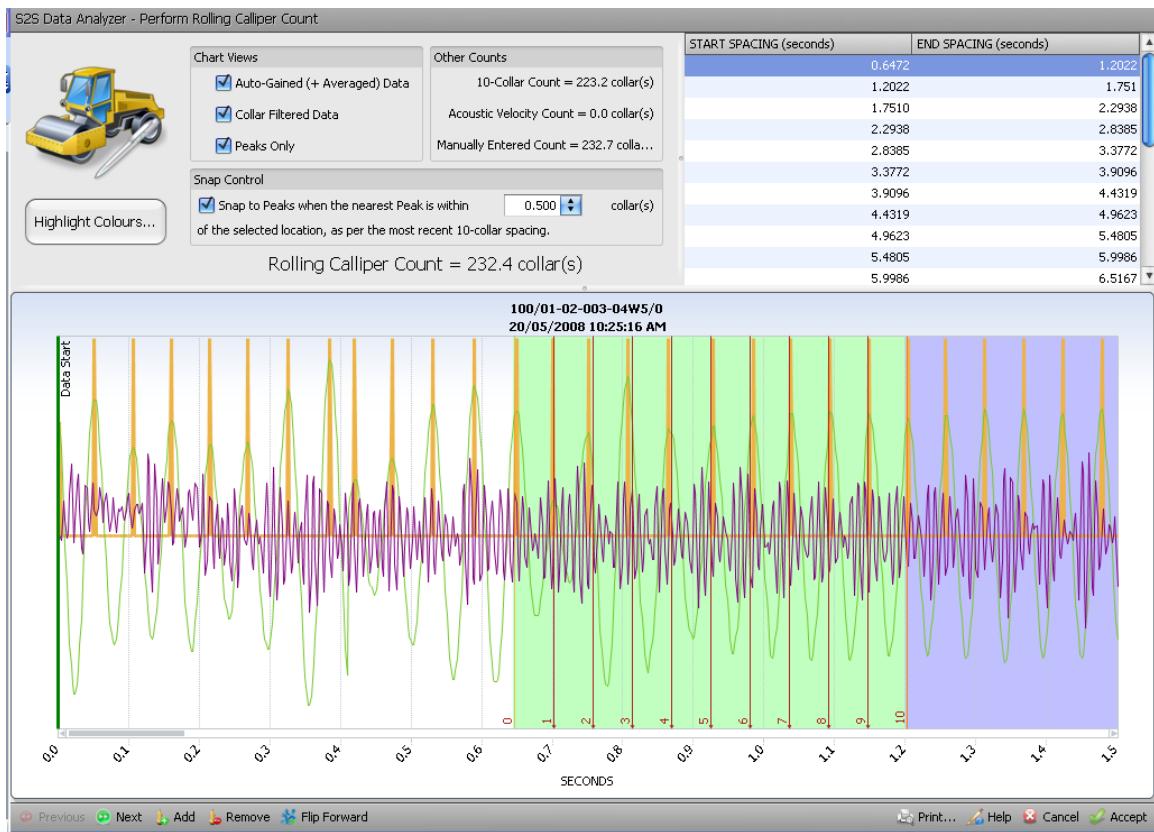
CTRL+Click i.e. pressing down the CTRL key, on the keyboard, and clicking the mouse on the strip chart, will take the position of the mouse and travel back, using the Auto-Gained data, until that trace meets the zero-line, and select the Fluid Kick at that location;

SHIFT+Click i.e. pressing down the SHIFT key, on the keyboard, and clicking the mouse on the strip chart, will take the position of the mouse click and travel back, using the Raw Signal data, until that trace meets the zero-line, and select the Fluid Kick at that location;

3) 10 Collar Spacing Count: Pick Start of 10 Collar Spaces - Choose the “Pick Start of 10 Collar Spaces” option in the second box near the top of the screen. On the main trace pick the area in which the collars are most clearly defined. This should refresh the zoomed screen to the area of interest. On the Zoomed screen click and hold the mouse button down (left or right) to obtain a set of “cross-hairs” which can be used by moving left or right to define the start of the 10 collars to be used to count the fluid depth in the well. Release the button when the “cross hairs” are aligned with the first collar. Now move the cursor right until a good fit of the 10 collar spacing is obtained and click the left or right mouse button. The joint count is now available on the top right portion of the screen above the full data trace. This information (return time and joint count) will also be updated in the main table. Once the joint count is complete hit the “Accept” button in the lower right portion of the screen to return to the main shot table. The fixed 10 collar count is a good estimation of the fluid depth (the spacing is assumed for the full depth of the well), but more accurate counts can be obtained from the Rolling Calliper Count option.



To perform a Rolling Calliper Count select the “Perform Rolling Calliper Count” option from the Navigate Menu. The user can then remove any 10 collar spacings that exist in the shot. Using the bottom slider move to near the start of data and “Add” a 10 collar spacing. This spacing is only an estimate of the best spacing. By clicking off the “Snap Control” the spacing can be moved by holding down the shift button and moving the mouse. Move the right hand side of the spacing onto a good collar and release the shift button. By holding down the “CTRL” button the left click button on the mouse will reposition the left side of the 10 collar spacing, and the right click button on the mouse will reposition the right side of the 10 collar spacing. Once the spacing has been defined check the “Snap Control” and choose the “Flip Forward” button near the bottom to continue counting collars. The user can flip forward for as long as there are good collar definitions. After the last spacing chosen the collar spacing will be maintained to the fluid kick.



The depth to fluid can also be obtained using an acoustic velocity correlation in either batch processing mode (for all shots) or individually.

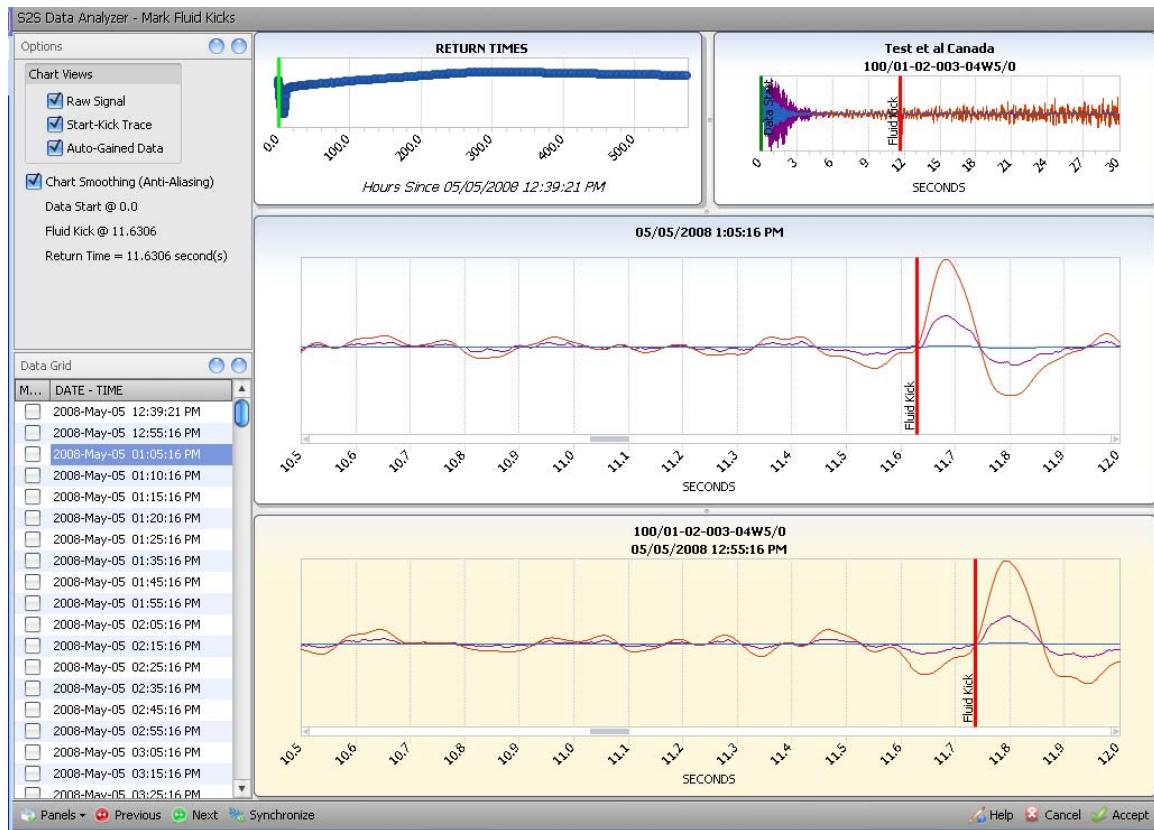
# BATCH PROCESSING

In Batch Mode the user can auto-detect and mark the start of data and fluid kick for all selected shots.

The screenshot shows the S2S Data Analyzer software interface. The main window title is "S2S Data Analyzer". The menu bar includes "File", "Reports", "Graphs", "Help", "Device...", "Export to .DAT File...", and "Fluid Level Sheet...". The left sidebar has a tree view with categories like "Batch Processing", "Process Separately", "Interactive Processing", and "Combined Processing". Under "Batch Processing", there are icons for "Detect and mark Fluid Kicks...", "Mark Starts-of-Data", "Calculate Acoustic Velocity ...", "Curve-fit Joint Counts", and "Mark Fluid Kicks". Under "Interactive Processing", there are icons for "Erase Marks and Counts" and "Change Well Name and UW...". Under "Combined Processing", there is an icon for "Navigate". The main area displays a table titled "C:\Corporate NR-Tec\ASTEC\Example Data\100\_14-27 Example Well\Rolling Count Shots". The table has columns: SELE..., DATE - TIME, WELL NAME, U.W.I., PRESSU..., RETURN TI..., ROLLING C..., and FIXED CA...". The table contains 30 rows of data, each with a checked checkbox in the first column. The data spans from May 20, 2008, to May 23, 2008, with various times and pressure values. The bottom of the table shows a "Total: ..." row. The status bar at the bottom left says "Appearance: McSkin" and the bottom right has "About..." and "Quit" buttons.

SELE...	DATE - TIME	WELL NAME	U.W.I.	PRESSU...	RETURN TI...	ROLLING C...	FIXED CA...
<input checked="" type="checkbox"/>	2008-May-20 02:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9331.96	12.0238	232.294	0
<input checked="" type="checkbox"/>	2008-May-20 06:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9346.96	12.0197	232.219	0
> <input checked="" type="checkbox"/>	2008-May-20 10:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9359.27	12.0197	232.43	223.156
<input checked="" type="checkbox"/>	2008-May-20 02:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9382.08	12.0238	232.267	0
<input checked="" type="checkbox"/>	2008-May-20 06:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9389	12.0218	232.244	0
<input checked="" type="checkbox"/>	2008-May-20 10:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9401.51	12.0197	232.219	0
<input checked="" type="checkbox"/>	2008-May-21 02:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9416.31	12.0177	232.196	0
<input checked="" type="checkbox"/>	2008-May-21 06:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9430.98	12.0156	232.171	0
<input checked="" type="checkbox"/>	2008-May-21 10:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9445.15	12.0115	232.123	0
<input checked="" type="checkbox"/>	2008-May-21 02:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9457.66	12.0095	232.1	0
<input checked="" type="checkbox"/>	2008-May-21 06:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9470.12	12.0074	232.075	0
<input checked="" type="checkbox"/>	2008-May-21 10:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9483.72	12.0054	232.052	0
<input checked="" type="checkbox"/>	2008-May-22 02:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9497.17	12.0033	232.027	0
<input checked="" type="checkbox"/>	2008-May-22 06:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9510.05	12.0013	232.004	0
<input checked="" type="checkbox"/>	2008-May-22 10:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9521.27	11.9992	231.979	0
<input checked="" type="checkbox"/>	2008-May-22 02:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9533.14	11.9972	231.956	0
<input checked="" type="checkbox"/>	2008-May-22 06:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9545.55	11.9951	231.931	0
<input checked="" type="checkbox"/>	2008-May-22 10:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9559.1	11.9931	231.908	217.695
<input checked="" type="checkbox"/>	2008-May-23 02:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9571.81	11.991	232.004	0
<input checked="" type="checkbox"/>	2008-May-23 06:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9584.07	11.989	232.096	0
<input checked="" type="checkbox"/>	2008-May-23 10:25:16 AM	Test et al Canada	100/01-02-003-04W5/0	9593.96	11.9849	232.285	0
<input checked="" type="checkbox"/>	2008-May-23 02:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9603.72	11.9849	232.285	0
<input checked="" type="checkbox"/>	2008-May-23 06:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9616.08	11.9808	232.473	0
<input checked="" type="checkbox"/>	2008-May-23 10:25:16 PM	Test et al Canada	100/01-02-003-04W5/0	9627.74	11.9788	232.565	0

Or in “Interactive Processing” manually select kicks for all selected shots. This is not usually necessary as the auto-detect fluid kick pick is normally accurate.



When in interactive processing mode the user can use ALT+Left-Click/Right Click to scroll through Previous/Next shots (explained in the Help Dialogue box).

When a group of shots is being read (i.e. for a buildup, falloff, annular fluid depression test, or well monitoring) it is possible to read a few shots (at least the first and last shot in the data set) using any of the depth determination options (10 calliper spacing, rolling calliper count, acoustic velocity) and use the “Curve-fit Joint Counts” option in the batch processing mode. At least the first and last shot of the data set must be read. Reading additional shots in between enhances the accuracy of the curve fit.

## BATTERY CHARGING

- Remove the battery pack from the unit when you are not running it - When unplugged from the instrument, the battery life is determined by the self-discharge rate of the batteries which should be at least 6 months.
- If the packs have been idle for more than a month out of service, plug them in to top up the charge before sending the instrument out on a job.
- If the battery pack is low, it will take an overnight charge to top it up.