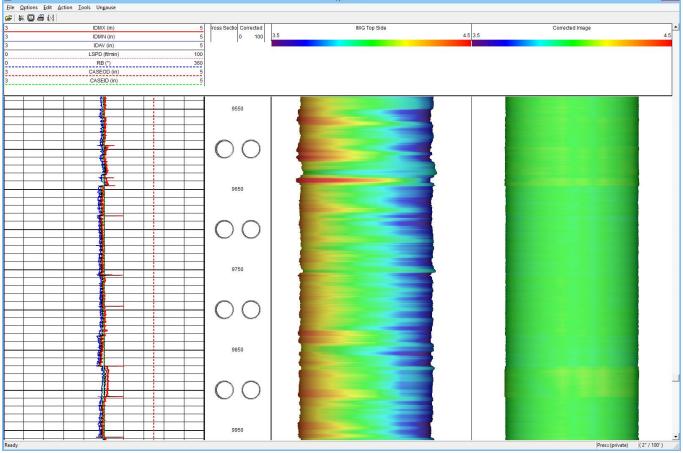
# MULTI-FINGER CALIPER AND PIPE TALLY

The Warrior Logging Software supports imaging tools that include a wide range of multi-arm or multi-finger caliper tools supplied by different manufacturers such as Sondex, Hotwell, Probe, Katwell, GoWell, and Spartek Systems. The various caliper tools may have from 12 to 60 fingers. The Warrior software presents the readings from the fingers as radii or diameters. In addition, many presentations will also present a 3 dimensional image of the caliper log.

One of the problems with multi-finger caliper tools is when the tool is not centered in the wellbore, the readings of the diameters measured may not be correct. With the tool not centered, the diameters perpendicular to the high / low axis will read smaller than actual size, showing an eccentric pipe. Warrior Software has a Caliper Processing package available as a supplement to the Warrior 8 Software that corrects the eccentric caliper readings in real time. The Caliper Processing software would replace the third party software that is normally used after the well is logged as post processing in the office or processing center.

The example shown in Fig. 26.1 shows a log pass with uncorrected caliper image on the left and a corrected caliper image on the right. Fig. 26.2 shows a cross-section image of the caliper readings. Fig. 26.3 shows a 3 dimensional image of the uncorrected and corrected caliper readings.

□ ×



For more information about the Caliper Processing Software contact Scientific Data Systems.

Fig. 26.1 Multi-finger Caliper Image Plot

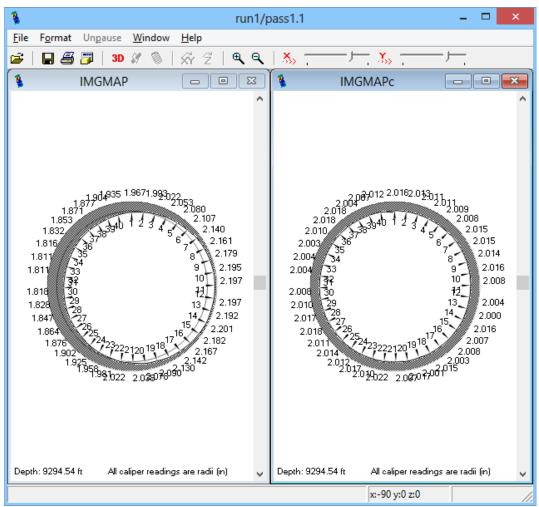


Fig. 26.2 Image map showing uncorrected and corrected caliper readings

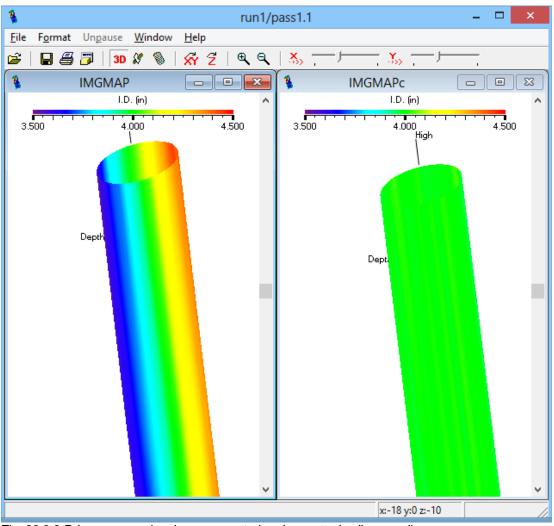


Fig. 26.3 3-D Image map showing uncorrected and corrected caliper readings

# 26.1 Pipe Tally Utility

The Warrior 8 software has an enhanced version of the Warrior Pipe Tally Utility. The utility provides a numerical table by joints of casing / tubing showing casing loss. In addition it provides capabilities for enhancing the log presentations.

The Pipe Tally Utility is accessed through the Warrior Database Utilities by clicking on the Pipe Tally selection button.

🔳 Warrior Utilities 🗕 🗆 🗙		
Data Export	Depth Correction	
Export to LAS Format	Apply Linear Depth Shift to a Dataset	
Export to LIS Format	Apply Linear Depth Shift to a Data Item	
Export to ODBC Compatible Database	Data Management	
Extract Pass(es) to New Database	Create an Alias for a Data Item	
Export via Internet	Multiple Pass Automerge	
Interpretation Tools	Edit Variables in a Dataset	
Mathpack	Create Variables in a Dataset	
XY Plot	Create Waveform Gate Curves	
Tracer Interpretation	Create CCL Curve from Keyboard	
Create Differential Curve	Delete Data from a Database	
Create Total Dissolved Solids Curve	Undelete Data	
Calculate Borehole Volume from Caliper	Rename a Data Item	
Calculate Rxo/Rt & Rwa	Edit a Log Curve	
Pipe Tally <del>←</del>	Select Correlation Curves for Database	
Curve Normalization	Data Import	
Log Summary Generator	Read ASCII Data into Warrior	
Setup Tools	Read LIS Data into Warrior	
Calibrate Printer	Import ODBC Data into Warrior	
Configuration Backup/Restore	Create Log Format from Dataset	
Edit Logging Service Details	Import via Internet	
Edit Logging Tool Details		
	Exit	

Fig. 26.4 Warrior Database Utilities – Pipe Tally

### 26.1.1 Get Pipe Tally Data – Scan for Collars

When the Pipe Tally Utility is opened, there is no information present. The first step is to get the casing joints. If you click on the [Process] button, you will get the choice of getting the joints from a log pass or entering them from the keyboard. By clicking on [Get Joints from a Log Pass], multiple collars can be selected at one time with the mouse and the software will enter them into the table. If [Get Joints from Keyboard] is selected, the user must type in each collar position that he wants to use

Fig. 26.5 Pipe Tally Utility – Process

📟 Warrior - Pipe Tally Utility 🗕 🗆 🗙
File Edit Settings Help
Open Edit Save Exit
# Top Length Min RW Loss
# TOP Length Min KW Loss
1

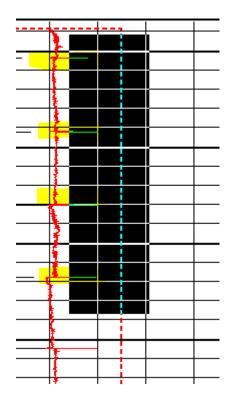
	Processes:	×
Get Jo	pints from a Log Pass	
Get J	oints from Keyboard	
Scan Log f	or Collars	Grading
Curve name Max collar length Use mouse and ar to outline one or m named curve. Use results to Joint Tal Length helps treat collar	ore peaks of the a 'Accept' to add ble. Max Collar bursts as one	s :s ::
Start Plot	Accept	
Reject	Done	

When getting joints from a log pass, any curve that indicates collars may be used, not just CCL. In the following example, since there is no CCL in the string, I will use the IDMXC curve. The maximum collar length would be set to the minimum length of a casing joint or longer than any hardware that might be in the well, normally 2 to 4 feet. When the [Start Plot] button is clicked, Interactive Plot will start. You will need to select the pass that you wish to process and to do a screen plot to see the pass. It is often advantageous to compress the scale of the plot to enable the user to select more collars at one time. To do this, click the Options choice from the Interactive Plot menu.

	Presentation	Options ×
Start At	10110.00	<< Maximize
Stop At	8489.83	
Presentation File	xi40_3dCOR.prs	<< Browse
Vertical Scale	240	▼ (5" / 100')
English Depth	2400 2000	▲ glish Units
O Metric Depth	1200	etric Units
O Time	900	er defined
O Other	600 500	
🗖 Show tool posil	480 Ion	• ОК
Use private copy of presentation with this log Cancel		

Fig. 26.6 Setting Vertical Scale to compress the viewed log pass

Click the Vertical Scale drop down and select a larger number to compress the scale. 600 or 1200 are good options. Using the mouse, draw a rectangle that catches the peaks of the curve that you are using as a CCL indicator.



Scan Log for	or Collars
Curve name Max collar length	idmxc 2.0 ft
Cnt: 4 collars, 3 Rng: 8504.0 ft to Min: 37.8 ft Max: 38.3 ft Avg: 38.1 ft	
Start Plot	Accept
Reject Done	

#### Fig. 26.7 Capturing CCL indications in a log pass

The Scan Log for Collars window will show a summary of what you have just scanned. In this case, it shows 4 collars in the range of 8504.0 feet to 8618.2 feet and gives the minimum, maximum, and average lengths of the joints in that interval. If you click the [Reject] button, the summary is cleared and you may reselect the collars from the log pass. If you click the [Accept] button, the collars that have been selected will be entered automatically into the pipe tally table. You should continue down the log pass, selecting collars until the whole pass has been collars picked. When you are finished, click the [Done] button to close the Scan Log for Collars window.

At this point, it is a good idea to take a close look at the Pipe Tally table and look for problems with the collars that have been selected. Things that should be looked for are extra-long and extra-short joints.

Warrior - Pipe T	
File Edit Settings Help	
Open Edit Process	Save Exit
18 Joints, 8504.0 ft to 9283.8 ft. Min: 0	.1 ft Max: 76.8 ft Avg: 43.3 ft
# Top Length Min RW Loss	
18 8504.0 38.3	1 9245.2 38.6
17 8542.3 38.0	0 9283.8 0.0
16 8580.3 37.8	
15 8618.1 36.9	
14 8655.0 76.8	
13 8731.8 11.4	
12 8743.2 39.4	
11 8782.6 37.6	-
10 8820.2 38.1	-
9 8858.3 38.3	4
8 8896.5 37.3	-
7 8933.9 74.0	-
6 9007.8 49.9	-
5 9057.8 76.2	-
4 9134.0 0.1	-
3 9134.0 36.7	-
2 9170.7 74.5	]

Fig. 26.8 Examine table for bad CCL selections

In the table shown in Fig. 2.5, there are long joints at joints 14, 7, and 2 and a .1 foot joint at joint 4. The long joints are probably caused by not having enough of an indication in the signal to pick the collar and the short joint is caused by selecting the same collar twice. The collars that have been selected twice can be eliminated by clicking on that collar in the table and then click on Edit -> Delete Selected Entries.

🔲 Warrior - Pipe T	ally Utility 🗕 🗆 🗙	
File         Edit         Settings         Help           O         Heading Information	<u>S</u> ave E <u>x</u> it	
18 Jc Delete Selected Entries	Max: 76.8 ft Avg: 43.3 ft	
# Top Length Min RW Loss 18 8504.0 38.3	1 9245.2 38.6	Warrior - Pipe Tally Utility
17         8542.3         38.0           16         8580.3         37.8           15         8618.1         36.9           14         8655.0         76.8           13         8731.8         11.4           12         8743.2         39.4	0 9283.8 0.0	1 selected. Delete?
12         6743.2         39.4           11         8782.6         37.6           10         8820.2         38.1           9         8858.3         38.3           8         8896.5         37.3		Yes <u>N</u> o
7 8933.9 74.0 6 9007.8 49.9		
5 9057.8 76.2 4 9134.0 0.1		
3 9134.0 36.7 2 9170.7 74.5		

Fig. 26.9 Deleting erroneous entries from table

To correct the long joints, you would need to Process and Get Joints from a Log Pass again or in this case I will Get Joints from Keyboard.

Fig. 26.10 Get Joints from Keyboard

Processes:     X       Get Joints from a Log Pass       Get Joints from Keyboard	
Get Joints from Keyboard	
Get Joints from Keyboard	
Compute Remaining Wall, Losses and Grading	
Put Grade Strip into a Log Pass	
Put Annotations into a Log Pass	
Put Annotations into a Text File Enter Collar Depths, separated by spaces or	к
Done commas.	ncel

After closely examining the log, I missed collars at 8695.3, 8966.1, and 9209.4. These depths will be entered into the window separated by spaces or commas as shown in Fig. 2.8.

Enter from Keyboard	×
8695.3, 8966.1, 9209.4	
, Enter Collar Depths, separated by spaces or commas.	OK Cancel

Fig. 26.11 Process – Get Joints from Keyboard

The corrected table is now shown in Fig. 26.12

🔲 Warrior - Pipe Tally Utility 🗕 🗆 🗙
<u>F</u> ile <u>E</u> dit <u>S</u> ettings <u>H</u> elp
<u>O</u> pen <u>E</u> dit <u>P</u> rocess <u>S</u> ave <u>Ex</u> it
20 Joints, 8504.0 ft to 9283.8 ft. Min: 11.4 ft Max: 76.3 ft Avg: 39.0 ft
# Top Length Min RW Loss
20 8504.0 38.3 3 9170.7 38.7
19 8542.3 38.0 2 9209.4 35.8
18 8580.3 37.8 1 9245.2 38.6
17 8618.1 36.9 0 9283.8 0.0
16 8655.0 40.3
15 8695.3 36.5
14 8731.8 11.4
13 8743.2 39.4
12 8782.6 37.6
11 8820.2 38.1
10 8858.3 38.3
9 8896.5 37.3
8 8933.9 32.2
7 8966.1 41.7
6 9007.8 49.9
5 9057.8 76.3
4 9134.0 36.7
,

Fig 26.12 Corrected Pipe Tally Table

### 26.1.2 Edit Pipe Tally Settings

There are several things that should be done before continuing. The first is editing the table header information. Fig. 26.13 Edit Heading Information

🛄 field/well/run/_plots_/_jointtbl_/tbl1 - 🕻	×	Job Information
File         Edit         Settings         Help           Q         Heading Information         Save           20 Jc         Delete Selected Entries         Max: 76.3 ft           #         Top         Length         Min RW         Loss           20 8504.0         38.3         3         9170.7         38.7           19         8542.3         38.0         2         9209.4         35.8           18         8580.3         37.8         1         9245.2         38.6           17         8618.1         36.9         0         9283.8         0.0           16         8655.0         40.3         40.3         40.3         40.3	Egit Company Company Sector Company Sector Company Sector Company Sector Company State Date	
15       8695.3       36.5         14       8731.8       11.4         13       8743.2       39.4         12       8782.6       37.6         11       8820.2       38.1         10       8858.3       38.3         9       8896.5       37.3         8       893.9       32.2         7       8966.1       41.7         6       9007.8       49.9         5       9057.8       76.3         4       9134.0       36.7	Comments	Get From Heading

If the Warrior Heading has already been completed and saved, that information can be brought into the Pipe Tally Header by clicking the [Get from Heading] button at the bottom of the Job Information window. If that heading information is not available, then the User should enter the data in the fields provided. The heading information is saved into the table by clicking the [OK] button.

	Job Information
Company	Big Bucks Oil Co.
Well	Gusher #5
Field	Worthy
County	Mermaid
State	Atlantis
Date	Nov. 11, 2012
Comments	Example Table
	×
Cancel	Get From Heading

Fig. 26.14 Completed Job Heading Information

If grading to going to be applied to the log data, the grading options need to be set up before the casing thickness is scanned. Click on Settings -> Grading and options to bring up the options window. Fig. 26.15 Options and Grading

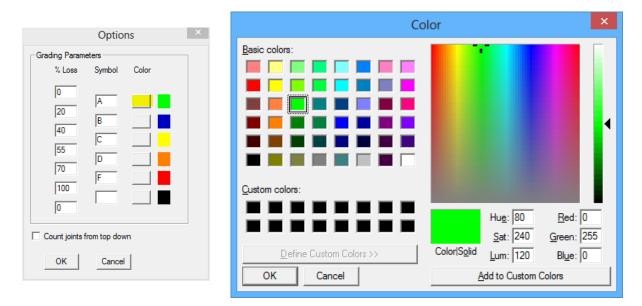


The grading is based on a percentage of loss. The User would normally setup between 2 and 6 grade levels. This may be as simple as 0% - 50% Passing (Green) and 50% - 100% Failing (Red). It could be something more complex, such as a letter grading A=0% - 20% (Green), B=20% - 40% (Blue), C=40% - 55% (Yellow), D=55% - 70% (Orange), and F=70% - 100% (Red)

Fig. 26.16 Example Grading Scales

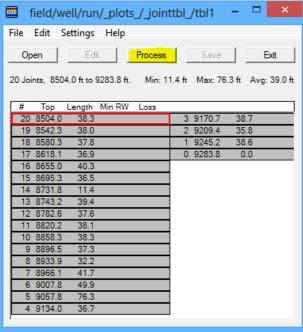
The colors assigned to the grading are used as a quick indication of the grading and can be shown both in some of the pipe tally tables and as a pattern strip in the log. The color for a given grade may be edited by clicking on the box located between the grade symbol and the grade color, defining the color and then clicking the [OK] button.

Fig. 26.16 Selecting Grading Colors



### 26.1.3 Remaining Wall Loss and Grading

Now that grading options have been set up, the next step is to have the software scan the log, computing the wall loss percentage and grading the casing joints. Click on [Process] to open the Process window. Click on the [ Compute Remaining Wall, Losses and Grading ] option.



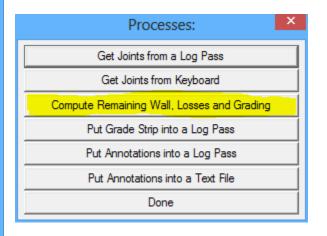


Fig. 26.17 Remaining Wall and Losses

There are two ways to process the remaining wall and losses. If the Warrior Caliper Processing software has been used, remaining wall has already been computed and that curve (MINRC – Minimum Remaining Corrected) can be used. The second method is to use the maximum diameter (which, depending upon the caliper eccentric could be appreciably off) and the casing OD and ID set up in Variables.

From the Compute Loss and Grading window, the User will first need to select which method that he wishes to use. And then, using the [<<Browse] button select the data item that he wished to use to process the log for losses

	Compute Loss and Gra	ding ×
Collar ignore window 0.1 ft	(Above and below)	Setup Loss Grading
Determine Remaining Wall from:		Edit Zoned Variables
<ul> <li>Minimum Remaining Wall Log</li> <li>Compute from Maximum ID Log</li> </ul>	. 2	
Input Curve:		
/field/well/run1/pass1.1/MINRC	/1	< Browse
		Begin Cancel

Fig. 26.18 Compute loss and Grading

	Wall Thickness Scan		×
Current Database	C:\ProgramData\Warrior\Data\MFC2_1	W8.db	
Current Dataset	/field/well/run1/pass1.1/MINRC/1		
/field/well/run1/pass1. /field/well/run1/pass1.		^	
/field/well/run1/pass1. /field/well/run1/pass1. /field/well/run1/pass1.	1/ID09/1		
/field/well/run1/pass1. /field/well/run1/pass1. /field/well/run1/pass1.	1/ID07/1		
/field/well/run1/pass1. /field/well/run1/pass1. /field/well/run1/pass1.	1/ID05/1		
/field/well/run1/pass1. /field/well/run1/pass1. /field/well/run1/pass1.	1/ID03/1		
/field/well/run1/pass1. /field/well/run1/pass1.	1/ID01/1		
/field/well/run1/pass1. /field/well/run1/pass1.	1/ELLIP/1		
/field/well/run1/pass1. /field/well/run1/pass1.	1/RMNAC/1		Database
/field/well/run1/pass1. /field/well/run1/pass1.	1/IDMXC/1		
/field/well/run1/pass1. /field/well/run1/pass1.	1/CTR_DIST/1		ОК
/field/well/nin1/nass1	1/RC40/1	× 1	Cancel
,			

Fig. 26.19 Selecting Data to Process for Losses

The Pipe Tally table will now be completed, showing the number of joints, the collar depth of each collar, the length of each joint, the minimum remaining wall in each joint, and the grade that has been given to each joint.

🛄 fie	ld/well	/run/_	plots_/_	join	ttbl_/tb	ol1	-		x
<u>F</u> ile <u>E</u> dit <u>S</u>	Settings	<u>H</u> elp							
Open	<u>E</u> dit		Process		<u>S</u> ave		E <u>x</u> it		
20 Joints, 850	4.0 ft to 9	283.8 ft.	Min: 1	1.4 ft	Max: 76	.3 ft Av	/g: 39.0 <del> </del>	ft	
# Top	Length	Min RW	Loss	_					
20 8504.0	38.3	0.221	11% A	3	9170.7	38.7	0.231	8% A	
19 8542.3	38.0	0.224	10% A	2	9209.4	35.8	0.136	46% C	
18 8580.3	37.8	0.220	12% A	1	9245.2	38.6	0.220	12% A	
17 8618.1	36.9	0.231	7% A	0	9283.8	0.0			
16 8655.0	40.3	0.218	13% A						
15 8695.3	36.5	0.222	11% A						
14 8731.8	11.4	0.121	51% C						
13 8743.2	39.4	0.222	11% A						
12 8782.6	37.6	0.221	12% A						
11 8820.2	38.1	0.223	11% A						
10 8858.3	38.3	0.226	10% A						
9 8896.5	37.3	0.132	47% C						
8 8933.9	32.2	0.244	2% A						
7 8966.1	41.7	0.227	9% A						
6 9007.8	49.9	0.215	14% A						
5 9057.8	76.3	0.221	12% A						
4 9134.0	36.7	0.222	11% A						

Fig. 26.20 Completed Pipe Tally Table

# 26.2 Multi-Finger Caliper Presentations

If the Warrior Caliper Processing software is being used, there are several additional curves or outputs that are created in addition to the standard logging outputs. These include, but are not restricted to IMGMAPC (corrected image map), IDMXC (corrected maximum diameter), IDMNC (corrected minimum diameter), IDAVC (corrected average diameter), MINRC (minimum remaining wall), and CTR\_DIST (distance from center of tool to center of hole). These outputs can be added to presentations in the normal manner.

### 26.2.1 Pipe Tally Annotations and Grading

During the processing of the Pipe Tally table, there are two processes that will add data to the database. These are "Put Grade Strip into a Log Pass" and "Put Annotations into a Log Pass". While the information is added to the database, it is not plotted until it is added to a presentation format.

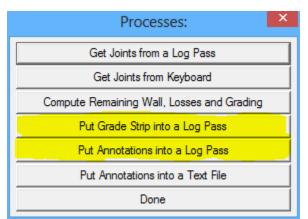


Fig. 26.21 Additional Pipe Tally Processes

From Interactive Plot, with a log pass pulled up, edit the log format. Click on the [Add] button to add a new database item to the presentation.

File	Layout	Object	Color Maps	Options		
0	pen	Add	Change	Remove	Save	Exit
2 Ma	aximum Diam	eter 3 VE	LLOB. 1	Calipe	r # 1	2.5
2 M	inimum Diame	eter 3	a	Calipe	r#2	
	verane Diame			FINO	903	

Fig. 26.22 Add a New Item to Presentation

To add the Pipe Tally Annotations to the presentation, the DB Item needs to be PTANN. This can be typed in or chosen from the [Current Pass] drop down list. The annotations can be placed in any track that is available, and the scales have no relevance in this case. The Presentation Type must be tabular and the Style needs to be Tabular by delta.

	Def	ine Data Item	×
– Data Source – DB Item	PTANN Quick Pick List Current pass	Style	ght
○ Variable	Data		• •
Track #	Left value 0 ↓ Right value 100	C None C .000 C Tabular by interval C .0 C .0000 C Tabular by delta	
Presentation Ty	ре	Vinat to snow in scale	Range
C Curve Tabular Variable De Signature	C Pattern Strip C Graphic Strip nsity C Image 3D C Potato Plot	Label - use carriage return for multiple lines	
			OK Cancel

Fig. 26.23 Adding Pipe Tally Annotations

To add the grading strip, the DB item needs to be Grade. The presentation type needs to be a Pattern Strip. The color map needs to be Pipe Grade. This is a special color map that can only be edited from the pipe tally grading and options settings. It cannot be edited through the normal color map editing. The scales should be set from 1 to the number of grades that were set up in the Pipe Tally Options.

	Defin	e Data Item			×
Data Source DB Item Grav Quick Pick I C Variable © Data Position		Style			
Track #	Left value 11 Right value 6	- What to show in scale			
Presentation Type			Label	✓ Units	Range
C Curve C Tabular C Variable Density C Signature	Pattern Strip     Graphic Strip     Image 3D     Potato Plot	Label - use carriage retum for multiple lines		Grade	
		Color map	Pipe Grade		OK Cancel

Fig. 26.24 Adding Pipe Grade Strip

 #311 RW=0.209 in
 4% loss @ 124.7 ft

 4% loss @ 124.7 ft
 4% loss @ 124.7 ft

 #310 RW=0.191 in
 4% loss @ 154.8 ft

 12% loss @ 154.8 ft
 4% loss @ 154.8 ft

 #309 RW=0.199 in
 4% loss @ 191.6 ft

 8% loss @ 191.6 ft
 4% loss @ 191.6 ft

Fig. 26.25 shows an example with annotations and grading strip in a presentation.

26.2.2 Pipe Tally Tables in Plot Job

 When adding a pipe tally table to a plot job, there are several formats that the table may be printed under. These are \*.WRF in the Warrior\Format folder. When adding the table to a Plot Job, the format that is to be used for printing the pipe tally table can be selected. Examples are shown below.

	Define Graphics File	×
Type Database	Joint Table c:\programdata\warrior\data\mfc2_w8.db	1
Dataset	field/well/run/_plots_/_jointtbl_/tbl1	<< Browse
Format	inttbl01.wrf	<< Browse
		ОК
		Cancel

Fig. 26.26 Selecting Pipe Tally Report format

.

	Com Well:	panyBi Gi	g Buo usher	cks Oil Co. ⁺#5				Four		Her
	Joint		Rer	maining Wall		Join	t		naining	
No.	Depth	Length	0.000	0.500 in	No.	Depth	Length	0.000	0.500	in
20	8504.0	38.3		0.221						
19	8542.3	38.0		0.224						
18	8580.3	37.8		0.220						
17	8618.1	36.9		0.231						
16	8655.0	40.3		0.218						
15	8695.3	36.5		0.222						
14	8731.8	11.4		0.121						
13	8743.2	39.4		0.222						
12	8782.6	37.6		0.221						
11	8820.2	38.1		0.223						
10	8858.3	38.3		0.226						
9	8896.5	37.3		0.132						
8	8933.9	32.2		0.244						
7	8966.1	41.7		0.227						
6	9007.8	49.9		0.215						
5	9057.8	76.3		0.221						
4	9134.0	36.7		0.222						
3	9170.7	38.7		0.231						
2	9209.4	35.8		0.136						
1	9245.2	38.6		0.220						
0	9283.8	0.0		0.000						
		DateN	ov 1'	1, 2012				Shee	t: 1 of	÷1

JNTTBL01.wrf

•

\$				/fie	ld/well/r	un/_plots_	_jobs_/tal	bles				-	□ ×
<u>File</u> Ac	tion <u>M</u> ore	<u>N</u> ext <u>P</u> revio	us <u>H</u> elp										
						PIP	E TA	LLY	SUMI	MAR	Y		
	$\wedge$	HHA.		Com	pany	Big Bu	cks Oil	Co.					
4	T+	17	.0	Well Gusher #5									
107	. 4	$\forall \mathcal{D}$	aor	Field		Worth	y						
1	r L	bgo 1		Cour	ity	Merma	id			State Atlantis			
20	8504.0	38.3											
19	8542.3	38.0											
18	8580.3	37.8											
17	8618.1	36.9											
16	8655.0	40.3											
15	8695.3	36.5											
14	8731.8	11.4											
13	8743.2	39.4											
12	8782.6	37.6											
11	8820.2	38.1											
10	8858.3	38.3											
9	8896.5	37.3											
8	8933.9	32.2											
7	8966.1	41.7											
6	9007.8	49.9											
5	9057.8	76.3											
4	9134.0	36.7											
3	9170.7	38.7											
2	9209.4	35.8											
1	9245.2	38.6											
0	9283.8	0.0											
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16 8655.0 40.3 15 8695.3 36.5	87% 89%		
14 8/31.8 11.4 13 8743.2 39.4 12 8782.6 37.6	49% 89% 88%		
11 8820.2 38.1 10 8858.3 38.3 9 8896.5 37.3	89% 90% 53%		
8 8933.9 32.2 7 8966.1 41.7 6 9007.8 49.9	98% 91% 86%		
5 9057.8 76.3 4 9134.0 36.7 3 9170.7 38.7	88% 89% 92%		
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Fig. 26.27 grading examples

26.2.3 Borehole Presentations

The Borehole Presentation Window, available in some presentations, has been enhanced with the ability to show two image map presentations. To show the second image map, click on the "Window" menu option and then select "Clone".

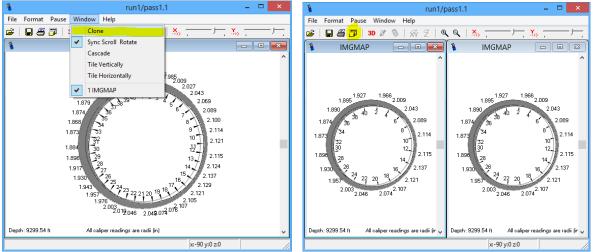
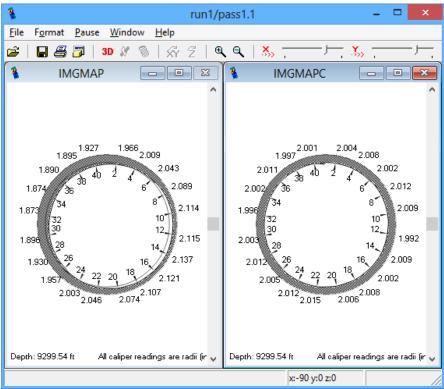


Fig. 26.28 Setting Borehole Image Presentation for two Images

Once the two images are cloned they will be the same image. By clicking one of the images and then clicking on the "Options" icon, as shown in fig. 3.1, the second image can be set to be a corrected caliper array image IMGMAPC. Either image can be set to either a 2-dimensional or 3-dimensional presentation.

Borehole Image Drawing Presentation Options							
What to plot Caliper Array High Caliper Many High Caliper MAP1 (Curve containing ID of caliper on high side) Other curves for 2D display Add Remove	How to plot       Plot range (height of diagram)       0.01       It - 12 samples, ft       Undersample       1       Min, max caliper reading       1.86812, 2.13675       Save/print at this resolution       300       dpi       Perspective image       C       Yes						
Color         Size (in)         Opacity(%)           ✓         Calipers         2D color         ■         100           ✓         Casing I.D.         ■         4.0000         50           ✓         Casing O.D.         ■         4.5000         50           Minimal diameter         ■         3.5000         50	Simulate Outside Diameter (2D mode only) Simulate OD as Caliper + (Real OD - Real ID) Caliper start 1 Caliper stop 1						
Edit Variables  Tool O.D.  Tool O.D.  Background  Text  Plot resolution  High Low 200	Plot options         Image: Caliper readings are radii         Image: Caliper radii						
2D line width         1         -           Zoom         140         -         Rotate         0         -	More Options Set to Defaults Cancel OK						

Fig. 26.29 Setting Corrected Image for Second Borehole Presentation



clicking on the "Options" icon, as shown in fig. 3.1, the second image can be set to be a corrected caliper array image IMGMAPC. Either image can be set to either a 2-dimensional or 3-dimensional presentation.

Borehole Image Drawin	ng Presentation Options
What to plot Curve setup Caliper Array [MGMAPC Calipers] 40 High Caliper [MAP1 (Curve containing ID of caliper on high side) Other curves for 2D display Add Remove Color Size (n) Opacity(%)	How to plot Plot range (height of diagram) 0.01 ft - 12 samples/ft Undersample 1 sample(s) Actual 1 Min, max caliper reading 1.86812, 2.13675 Save/print at this resolution 300 dpi Perspective image C Yes No Simulate Outside Diameter (2D mode only) G Simulate Outside Diameter (Real OD - Real ID)
✓ Calipers         2D color         ■         100           ✓ Casing I.D.         ■         4.0000         50           ✓ Casing O.D.         ■         4.5000         50           ✓ Minimal diameter         ■         3.5000         50           Edit Variables         ■         4.0000         50	Caliper start 1 Caliper stop 1 Caliper start 1 Caliper stop 1
Tool O.D. ■ 3.13 100 Pepth Axis Background Text Plot resolution During Low 200 2D line width 1 ÷	Plot options         Image: Caliper readings are radii       Caliper numbered CCW         Show 3D plot using deviation       Image: Caliper numbered CCW         Hide 2D arm labels       Image: Caliper numbered CCW         Drawing reference       Image: Caliper numbered CCW         Image: Caliper numbered CCW       Image: Caliper numbered CCW         Drawing reference       Image: Caliper numbered CCW         Image: Caliper numbered CCW       Image: Caliper numbered CCW
Zoom 140 - Rotate 0 -	More Options Set to Defaults Cancel OK

Fig. 26.30 Setting Corrected Image for Second Borehole Presentation

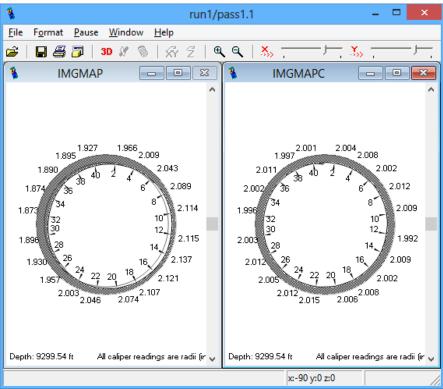


Fig. 26.31 Showing Caliper Array Image and Corrected Image

### 26.2.4 Multi-Finger Presentations

In previous versions of Warrior software, an array of curves, such as arm radii, each had to be plotted individually. This meant that if a scale change was required each individual arm had to be rescaled. Warrior 8 allows the User to plot a list of curves as a single DB item. The presentation shown if fig.3.4.1 shows a 40 arm caliper presentation with arm R01 plotted from 2.4375 to 4.9375. Each additional arm is plotted with the scales set to .0625 less so that arm R40 is plotted from 0 to 2.5.

In this example, I will remove every caliper arm curve as shown in Fig. 3.4.2. Next I will click the [ ADD ] button and select the List type of Data Source for the DB item. Click the [ Curve List Properties ] button to bring up the Curve List Editor Window as shown in Fig. 3.4.4.

C:\programdata\warr	ior\format\40armcal4 🗆 🌅	<
<u>F</u> ile <u>L</u> ayout Object <u>C</u> olo	or Maps <u>O</u> ptions	
Open <u>A</u> dd C	hange <u>R</u> emove <u>S</u> ave E <u>v</u> it	
3 MAX ID 5 -CCL3 3 MIN ID 5 3 NOM CASE ID 5 0 MINR 0.5 10 DMN	2.4375 R01 4.9375 2.375 R02 4.875 <b>E09</b> R04 R05 R08	•
	R07 R08 R09 R10	
	R11 R12 R13	
	R14 R15	
	R16	
	R17 R18	•
DEPTH		
1 5	4	

Fig. 26.32 Typical 40 arm caliper presentation

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Fig. 26.33 Presentation with all caliper arm curves removed

D	efine Data Item 🛛 🗙
Data Source Name Variable O Data O List Position Track # 1 Sight value 100 Presentation Type	efine Data Item
	Cancel

Fig. 26.34 Selected List type Data Source DB Item

Curve List Editor								
How to create curve list	For all curves         black         Image: Construction of the second se							

Fig. 26.35 Curve List Editor Window

On the left side of the Curve List Editor Window is a drop down list of all the available outputs. Select the first curve in the list of curves that you would like to plot. There is a brief example that describes how to pick the curve shown in the "How to create curve list" box. When the curve is selected, the "list identifier" will be filled out. The "For all curves" box of the Curve List Editor Window is used the same as the style box of a normal curve.

Curve List Editor								
How to create curve list	~	For all curves         black         Zonable Scales         Wrap         Logarithmic         For each curve         Offset         0.0625         Every nth curve         Use this color for curve	Thickness 1					

Fig. 26.36 Select List of Curves

The "For each curve" box provides some additional settings. When plotting multiple curves, it is normal to offset each curve by a small amount so that the curves are not stacked on top of each other and are distinguishable. Another method of distinguishing multiple curves is to make one of the curves a different color every so often. This box provides the User those capabilities with the multiple curve lists. When the settings have been selected, click [ OK ] to close the Curve List Editor window. Note that the scales for the first curve and every nth curve will automatically be shown.

The final settings for defining the list of curves are giving the list a name. This can be anything to identify the list, such as Calipers, R0 thru R40, or whatever the User decides is appropriate. The track and the scales also need to be set. The scales will be the scale for all of the curves, but only the first curve and every nth curve will the scales be shown on the log insert. When complete, click [ OK ] to save the curve definition. Then click [ Save ] to save the edited plot.

Defin	e Data Item	×
Defin Data Source Name Calipers  C List  Position Track # 4  Right value 2.25  Presentation Type	Style	
	, OK Cano	

Fig. 26.37 Setting Track and Scales and giving list of curves a name

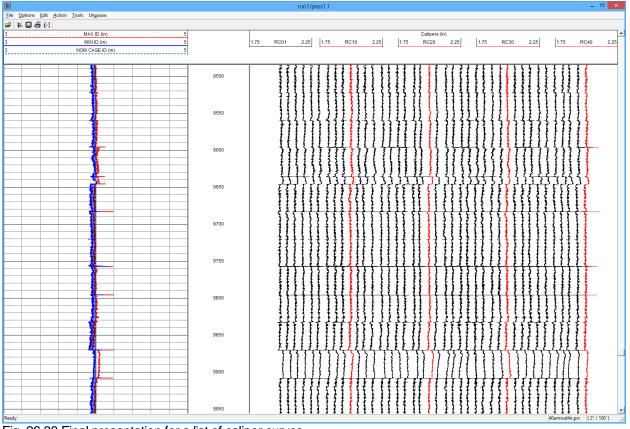


Fig. 26.38 Final presentation for a list of caliper curves

## 26.3 Multiarm64(32).exe

This program will read in LAS data from a Multi-Arm service and create a single pass in a Warrior database. This pass will not only contain the curves found in the LAS data, but will also create a 180 point VDL curve by interpolating between each of the Multi-Arm caliper readings. This program also contains a viewer that can display a 3 dimensional view of a section of the Multi-Arm data. The program is located at "C:\Program Files\Scientific Data Systems\Bin"

26.3.1 Importing Multi-Arm Data

The first step is to import the Multi-Arm data in to a Warrior database. Use the build button "Import from LAS" to select the LAS file to import.

Warrior for MultiArm Caliper	
LAS file name	Import from LAS
C:\ProgramData\Warrior\Data\555_R.las	
Presentation File	Edit Presentation
PROBED60.prs	
Borehole Image presentation file (required for 3D viewer probed60.bhf	) Create VDL
Output database:/field/well/run/pass	
Output curves	
Base caliper name MULTIARM	Help
Offset between each caliper 5.0	
Caliper units in 💌	
VDL output name imagmap	
Input is radii, convert to diameters	
[	Close

FIG:26.39 LAS Multiarm Caliper

#### 26.3.2 Caliper Presentation

The presentation file will be embedded in the database as the presentation to be used when the data is plotted. This can be edited later.

Select the Las File

Select The Presentation file (Probed60.prs)

Select the output database Select an existing database or type in a new database name. Fill in the field/well/run portion of the dataset. The name of the pass will always be the same as the LAS file name.

Set the offset between calipers to show all the calipers in one track

Type the "Base Caliper Name" (MULTIARM)

Type the VDL output name (imagmap)

If you just have LAS then select import from LAS. If you have the database select create VDL

#### 26.3.3 Output curves

The program will search through the Multi-Arm LAS data for caliper curves that start with this name – i.e. ARM1, ARM2, etc. It uses these names to create the 180 point interpolation for the 3-D view. The offset between each caliper is automatically applied to the presentation file to display the individual arm data. An offset of 0 would put all of the arm curves on top of each other which may make it difficult to see responses of individual curves. The VDL output name is the name of the curve that will contain the interpolation of the caliper data. This curve will contain 180 data points for each depth sample.

🐁 Warrior for MultiArm Caliper		Select If you dont
LAS file name C:\Warrior\Data\Pass1.las	Import from LAS	have ready the database
Presentation file multiarm.prs	Edit Presentation	Select VDL if the database is ready
Output database:/field/well/run/pass           NEWDATABASE:/field/well/run/Pass1	Create VDL	
Output curves Base caliper name AM	Start Plot	
Offset between each caliper 0.50 VDL output name INSIDE	Help	
Input is radii, convert to diameters		
	Close	

FIG: 26.40 Set up Multi-Arm Caliper

Start the process to convert the LAS to BD It takes long time for example to produce 1Gb .

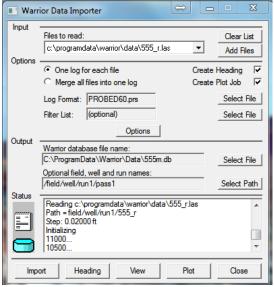


FIG: 26.41 Warrior Data Import

Presentation for MultiArm calipers (MULTIARM control of the second se	urve list)			X		Pick first caliper name	23
Name	Plot	Offset 🔺	1	Presentation			
/field/well/run1/pass1/R01/1 /field/well/run1/pass1/R02/1	Yes Yes	0.0 5.0 =		Base caliper name R		MAXI MaxR	*
/field/well/run1/pass1/R03/1 /field/well/run1/pass1/R04/1	Yes Yes	10.0 15.0		Pick first caliper name		MEAN	
/field/well/run1/pass1/R05/1 /field/well/run1/pass1/R06/1	Yes Yes	20.0 25.0		Offset 5.0	Ш	MINI MinR	
/field/well/run1/pass1/R07/1 /field/well/run1/pass1/R08/1	Yes Yes	30.0 35.0	[		Ш	R01	
/field/well/run1/pass1/R09/1 /field/well/run1/pass1/R10/1	Yes Yes	40.0 45.0		Re-create list		R02 R03	-
/field/well/run1/pass1/R11/1 /field/well/run1/pass1/R12/1	Yes Yes	50.0 55.0		VDL output name imagmap		IR04	•
/field/well/run1/pass1/R13/1	Yes	60.0 +		Cancel OK			Cancel OK
•		+					

FIG: 26.42 Selecting Caliper Name

Once the system reads through the LAS file it will prompt you to select a caliper name, browse the list until you find the applicable mnemonic.

LAS file name C:\ProgramData\Warrior\Data\5	55 Blas	Import from LAS
Presentation File PROBED60.prs		Edit Presentation
, .		
Borehole Image presentation file (required for 3D viewer) probed60.bhf		Create VDL
probediou.bril		
Output database:/field/well/run/pass		Start Plot
555m:/field/well/run1/pass1		
Output curves		Help
Base caliper name	R	
Offset between each caliper	5.0	
Caliper units	in 💌	
VDL output name	imagmap	
✓ Input is radii, convert to diam	neters	
Creating VDL		

FIG 26.43 Creating VDL

Once it has completed the process the system will open the resulting file with interactive plot using the presentation selected earlier.

26.3.4 Edit Presentation

See section 6