



Petrel Data Cleanup

For

Studio



Real World Examples and Workflow Details

- GdF Suez Example - Petrel REF to Studio
- Petoro Example - Petrel REF cleanup
- Workflow & Tools

GdF Suez Example

Petrel REF to Studio

- Petrel Studio deployment, first impressions and way forward
 - - Jan Willem Achterberg
 - GDF SUEZ Norway

- **Overview**
- Introduction
- Preparation
- Migration
- Way forward
- Conclusions

- **Introduction**

- What is Petrel Studio
- Why Petrel Studio
- Dimensions at EPN

What is Petrel Studio ?

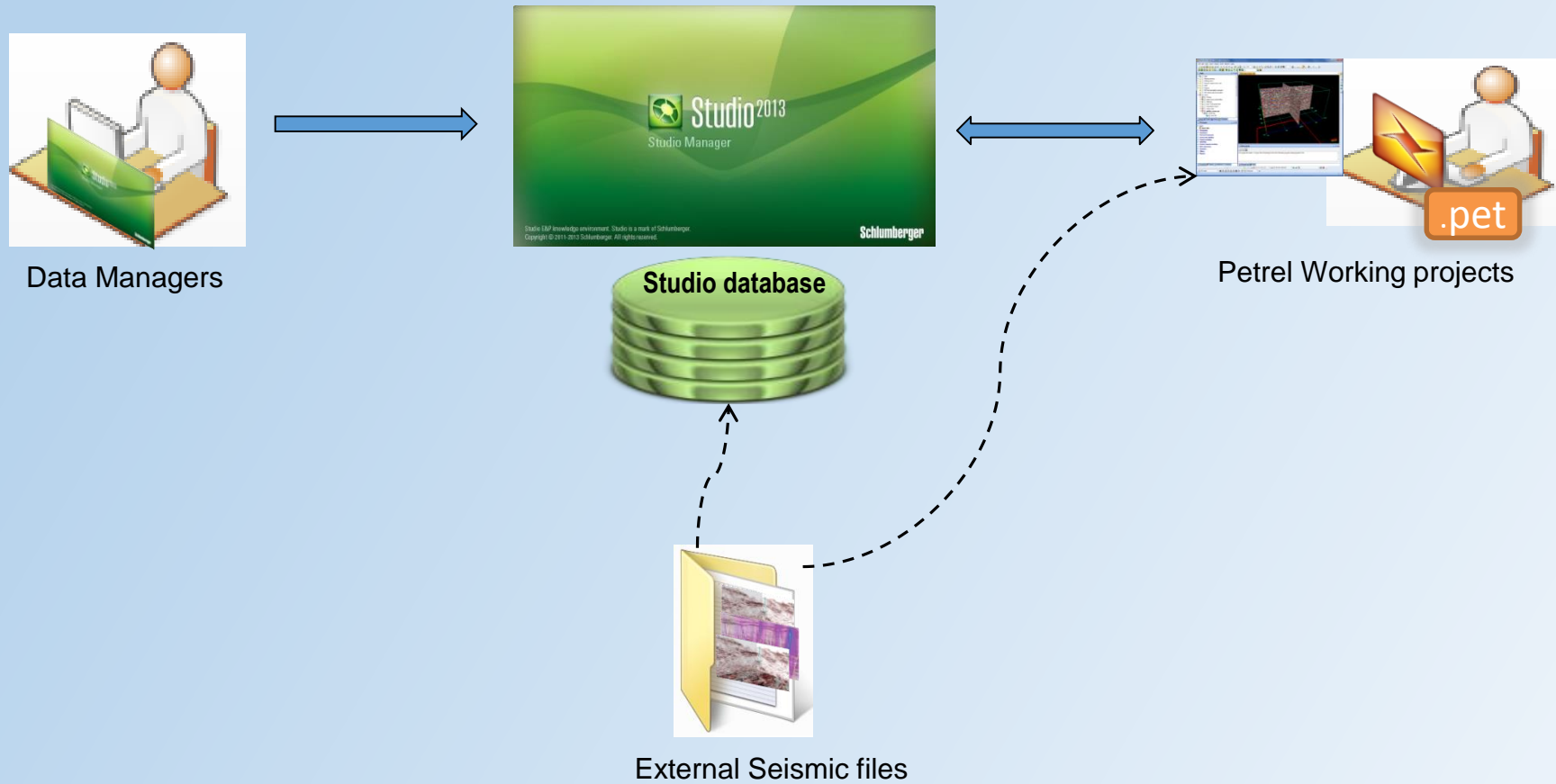
SQL based database where virtually all Petrel information can be stored:

- Seismic data
- Well data
- Cultural data
- Interpretation
- ...

Not able to store in Studio (yet):

- Models
- Workflows

What is Petrel Studio ? (Production phase)

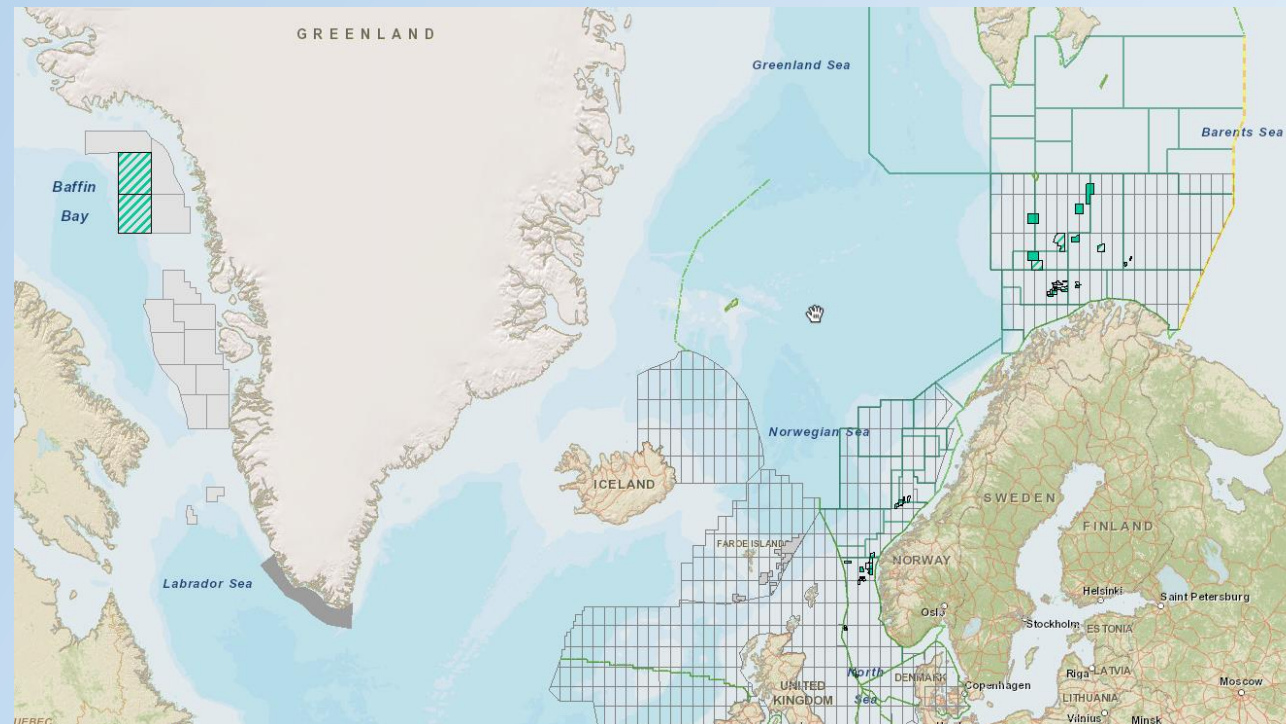


•Why Petrel Studio ?

- One master repository (one stop shop for all corporate data)
- Easy to find and gather data
- Rules and regulations
- Collaboration
- Quality attributes

•EPN dimensions:

- 30 Petrel reference projects, 800 working projects
- Seismic: 410 3D surveys, 26000 2D lines
- 1600 wells
- 8 UTM zones (UTM21 ->UTM37)
- 77TB data



•Preparation

- IT Infrastructure:
 - SQL server (Windows or Linux, VM ware at EPN))
 - Petrel Studio software and licenses
- User awareness
- Pilot Project Plan
- Involve Schlumberger (PO, Project Initiation Document)
- Business case
- Petrel Reference Projects Clean-up (!!)
- No license fee needed, project cost ca. 25KEURO

•Preparation – Petrel Reference Projects Clean-up

- Project needs to be as 'clean' as possible, for example
 - Well data
 - UWI to be present
 - Interpreters present
 - Minimum duplicate global well logs
 - No duplicate observation numbers
 - No well logs below TD
 - Well symbols present
 - Operator/spud date present
 - Seismic data
 - Geometry/geography mismatch (3D)
 - SP/CPD relationship
 - Illegal seismic format

•Preparation – Petrel Reference Projects Clean-up

- For the well data clean up a very usefull Petrel plug-in is available, RoQC Tools

- Used at EPN:

1. Created UWI for all wells
2. Removed 99% of duplicate well logs
3. Created Observation numbers when applicable
4. Created interpreter
5. Created operator/spud date from csv file
6. Gives audit report on KB reference offset, missing well symbol, logs below TD, unlikely borehole MD, checkshots seabed, etc, etc

Well reference project
before clean-up.

RoQC Audit Report v2012.2.0 - Barents_Sea_wells_utm34.petR

Home Help

Generate Report Settings Export & Print Exit

Select Reports

- Statistics
- CRS
- Wells
- Well Logs
- Well Tops
- Seismic

Show Results

- Critical Errors
- Non-Critical Errors
- No Errors

Results

Statistics (% Passed):		Wells: 0%	Well Logs: 54.06%	Well Tops: 0%	Total Wells: 117
CRS Audits:					
✓	Surf Coordinate/CRS Type Mismatch	Failed = 0			
✓	Well Missing CRS Name/Type	Failed = 0			
Well Audits:					
✗	Unlikely KB Reference Offset (KB<2 or KB>50 meter)	Failed = 2			
✗	Unlikely KB Reference Offset (KB=0 meter)	Failed = 2			
✗	Unlikely Max Borehole MD (MD<600 or MD>7000 meter)	Failed = 12			
✗	Wells With Logs Below TD (Tol. 0.1 meter)	Failed = 10			
✗	Missing Operators	Failed = 116			
✗	Wells Missing UWI	Failed = 117			
✗	Missing Well Symbol	Failed = 3			
Well Log Audits:					
✗	Well Logs Missing Samples	Failed = 7			
✗	Duplicate Global Well Logs	Failed = 194			
Well Top Audits:					
✗	Well Tops Duplicate Depths	Failed = 2088			
✓	Well Tops Duplicate Observation Numbers	Failed = 0			
✓	Well Tops Illegal Names	Failed = 0			
✓	Well Tops Invalid Depths	Failed = 0			
✗	Well Tops Missing Observation Number	Failed = 2130			
✗	Well Tops Missing Interpreter	Failed = 2448			
Seismic Audits:					
✗	Checkshots With Errors	Failed = 71			
✗	Wells Missing Checkshots	Failed = 13			

Well reference project
after clean-up.

RoQC Audit Report v2012.2.0 - Barents_Sea_wells_utm34.petR

Home Help

Generate Report Settings Export & Print Exit

Select Reports

- Statistics
- CRS
- Wells
- Well Logs
- Well Tops
- Seismic

Show Results

- Critical Errors
- Non-Critical Errors
- No Errors

Statistics (% Passed):	Wells: 29.37%	Well Logs: 99.72%	Well Tops: 31.47%	Total Wells: 126
CRS Audits:				
✓	Surf Coordinate/CRS Type Mismatch	Failed = 0		
✓	Well Missing CRS Name/Type	Failed = 0		
Well Audits:				
✓	Unlikely KB Reference Offset (KB<0 or KB>50 meter)	Failed = 0		
✗	Unlikely KB Reference Offset (KB=0 meter)	Failed = 2		
✓	Unlikely Max Borehole MD (MD<0 or MD>7000 meter)	Failed = 0		
✓	Wells With Logs Below TD (Tol. 0.1 meter)	Failed = 0		
✓	Missing Operators	Failed = 0		
✓	Wells Missing UWI	Failed = 0		
✓	Missing Well Symbol	Failed = 0		
Well Log Audits:				
✗	Well Logs Missing Samples	Failed = 7		
✓	Duplicate Global Well Logs	Failed = 0		
Well Top Audits:				
✗	Well Tops Duplicate Depths	Failed = 1410		
✓	Well Tops Duplicate Observation Numbers	Failed = 0		
✓	Well Tops Illegal Names	Failed = 0		
✗	Well Tops Invalid Depths	Failed = 3		
✓	Well Tops Missing Observation Number	Failed = 0		
✓	Well Tops Missing Interpreter	Failed = 0		
Seismic Audits:				
✗	Checkshots With Errors	Failed = 73		
✗	Wells Missing Checkshots	Failed = 14		

•Migration

- Two reference projects (seismic + well) and two working projects selected
- First index file created
- Very few problems with well and cultural data
- Seismic migration showed slow performance with 3D surveys (intermittent)
- Presentation given by SLB to users
- Two users given training

- Seismic data issues:
 - Illegal SP/CDP relationship
 - Geography/Geometry incompatible
 - Illegal seismic format

•Way forward

- Issues to be solved by SLB
- Migrate remaining reference and active working projects
- Create separate index files for:
 - Reference data
 - Active working projects
 - Archived working projects
- Avocet & Logtek integration

•Conclusions

- Involve Schlumberger for the pilot project
- Clean-up as much as possible (all) Petrel reference projects up front
- Make sure HW/SW is working before start working with SLB
- Make an implementation plan (which projects/users) for pilot and full deployment
- Get users actively involved at early stage

- Migration will have issues due to Studio being more sensitive and rigorous compared to Petrel

•Thank you !



Petoro Example Phase I

Petrel REF cleanup



Petoro Phase I- Petrel Ref project cleanup

- Audit the Petrel REF projects
- Discuss audit results with the users
- Address the agreed upon issues
- Re-audit the REF projects
- Present the results



Audit the Petrel REF projects

Well Missing CRS Name/Type	0	0	0	0
Well Audits:				
Unlikely KB Reference Offset (KB<2 or KB>50 meter)	453	362 (many test wells)	0	0
Unlikely KB Reference Offset (KB=0 meter)	7	253 (only test wells tlp)	0	0
Unlikely Max Borehole MD (MD<600 or MD>7000 meter)	51	111 (mostly test wells) 2 real wells	0	0
Missing Operators	560	457	2	3
Wells Missing UWI	276	450	2	3
Missing Well Symbol	148	304 (many tlp wells)	0	0
Well Log Audits:				
Wells With Logs Below TD (Tol. 0.1 meter)	299	18 (needs to be checked)	2	1
Well Logs Missing Samples	149	2	0	0
Duplicate Global Well Logs	407 (mostly normal names)	470 (many strange most with a count of 1)	0	0
Well Top Audits:				
Well Tops Duplicate Depths	0	0	0	0
Well Tops Duplicate Observation Num	17	0	0	0
Well Tops Illegal Names	67 (missing strat columns)	46	0	0
Well Tops Invalid Depths	0	0	0	0
Well Tops Missing Observation Number	0	0	0	0
Well Tops Missing Interpreter	0	0	0	0
Seismic Audits:				
Checkshots With Errors	104	9	0	2



Discuss audit results with the users

- Duplicate GWL's – (user sensitive to Well Log Collection ?)
- Quasi Duplicate GWL's – (renamed on purpose?(Well Log Collections))
- Stratigraphic Charts & Well Top cleanup
- Missing UWI/data_source/occurrence numbers
- KB/TD (incorrect & missing)
- Log data below TD
- etc



Address the agreed upon issues

- Manually collect & input the missing KB/coordinates/etc
- Manually check & fix logs below TD
- Well Log Manager
- Strat Cleanup
- Fix Well Headers
- Fix Missing Data_source
- Fix Occurrence Numbers
- Fix Checkshots



Re-Audit the Petrel REF projects

Well Missing CRS Name/Type	0	0	0	0
Well Audits:				
Unlikely KB Reference Offset (KB<2 or KB>50 meter)	0	0	0	0
Unlikely KB Reference Offset (KB=0 meter)	0	0	0	0
Unlikely Max Borehole MD (MD<600 or MD>7000 meter)	0	0	0	0
Missing Operators	0	0	0	0
Wells Missing UWI	0	0	0	0
Missing Well Symbol	148	304 (many tlp wells)	0	0
Well Log Audits:				
Wells With Logs Below TD (Tol. 0.1 meter)	0	0	0	0
Well Logs Missing Samples	0	0	0	0
Duplicate Global Well Logs	0	0	0	0
Well Top Audits:				
Well Tops Duplicate Depths	0	0	0	0
Well Tops Duplicate Observation Num	0	0	0	0
Well Tops Illegal Names	67 (missing strat columns)	0	0	0
Well Tops Invalid Depths	0	0	0	0
Well Tops Missing Observation Number	0	0	0	0
Well Tops Missing Interpreter	0	0	0	0
Seismic Audits:				
Checkshots With Errors	0	0	0	0



Present the results

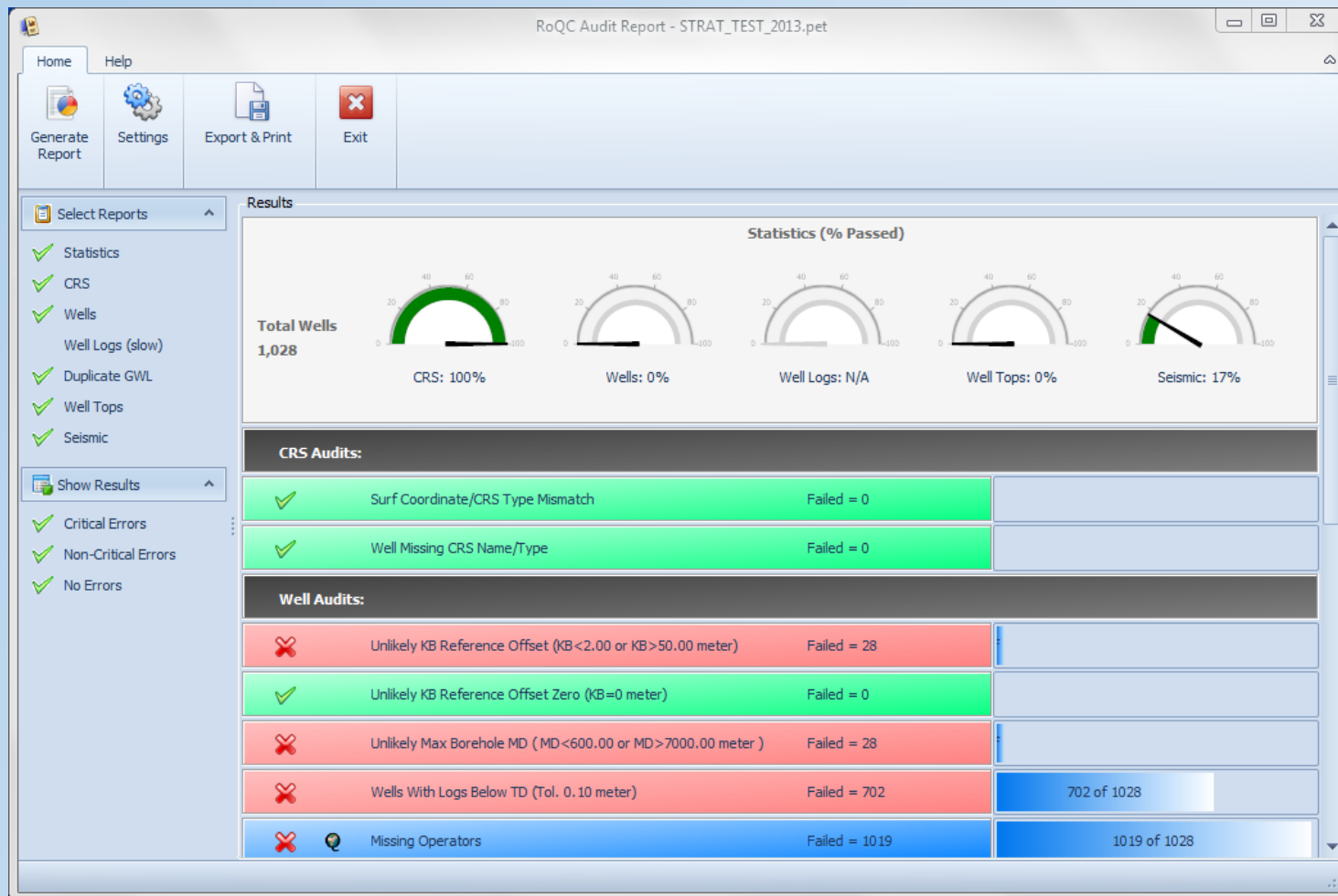
- Duplicate GWL's – merged
- Quasi Duplicate GWL's – many merged some left (GWL Collections)
- Strat Charts & Well Top cleanup – cleanup done where charts defined
- Missing UWI/data_source/occurrence numbers - fixed
- KB/TD (incorrect & missing) – collected & input (time consuming)
- Log data below TD – many decisions need to be made by users (check TD first)
- Etc – rate limiting steps are with the users....



Some of the Tools Used



1. Audit Report





2. Fix Missing Occurrence Numbers

- Example of tools designed to fix very specific problems – pre-Studio

Marker Collection Name	Well Name	Well UWI	Surface Name	Interpreter	Z	MD	TWT Picked	TWT Auto	Geological Age	TVT	TST	Dip Angle	Dip Azimuth	Missing	Used by Dep. Conv.
Well tops	1/3-11		ANDREW FM		-3309.10	3366.00									
Well tops	1/3-11		BALDER FM		-3137.10	3194.00									
Well tops	1/3-11		EKOFISK FM		-3445.10	3502.00									
Well tops	1/3-11		FORTIES FM		-3225.10	3282.00									
Well tops	1/3-11		HORDALAND GP		-1724.60	1777.00									
Well tops	1/3-11		LISTA FM		-3286.10	3343.00									
Well tops	1/3-11		NO FORMAL NAME		-2543.10	2600.00									
Well tops	1/3-11		NORDLAND GP		-72.00	114.00									
Well tops	1/3-11		ROGALAND GP		-3137.10	3194.00									
Well tops	1/3-11		SELE FM		-3148.10	3205.00									
Well tops	1/3-11		SELE FM		-3262.10	3319.00									
Well tops	1/3-11		SHETLAND GP		-3445.10	3502.00									
Well tops	1/3-11		VADE FM		-2537.10	2594.00									
Well tops	1/3-12 S		ÅSGARD FM		-5289.35	5398.00									
Well tops	1/3-12 S		BLODØKS FM		-4966.56	5075.00									
Well tops	1/3-12 S		CROMER KNOLL GP		-5079.51	5188.00									
Well tops	1/3-12 S		EKOFISK FM		-3364.82	3473.00									
Well tops	1/3-12 S		FARSUND FM		-5447.01	5556.00									
Well tops	1/3-12 S		FORTIES FM		-3158.82	3267.00									
Well tops	1/3-12 S		HAUGESUND FM		-5517.72	5627.00									
Well tops	1/3-12 S		HIDRA FM		-4973.56	5082.00									
Well tops	1/3-12 S		HOD FM		-3983.81	4092.00									
Well tops	1/3-12 S		HORDALAND GP		-1808.42	1864.00									
Well tops	1/3-12 S		LISTA FM		-3230.82	3339.00									
Well tops	1/3-12 S		LISTA FM		-3163.82	3272.00									
Well tops	1/3-12 S		MANDAL FM		-5432.05	5541.00									
Well tops	1/3-12 S		MAUREEN FM		-3340.82	3449.00									
Well tops	1/3-12 S		NO GROUP DEFINED		-5707.44	5818.00									

Marker Collection Name	Well Name	Well UWI	Surface Name	Interpreter	Z	MD	TWT Picked	TWT Auto	Geological Age	TVT	TST	Observation Number
Well tops	1/3-11		ANDREW FM		-3309.10	3366.00						
Well tops	1/3-11		BALDER FM		-3137.10	3194.00						
Well tops	1/3-11		EKOFISK FM		-3445.10	3502.00						
Well tops	1/3-11		FORTIES FM		-3225.10	3282.00						
Well tops	1/3-11		HORDALAND GP		-1724.60	1777.00						
Well tops	1/3-11		LISTA FM		-3286.10	3343.00						
Well tops	1/3-11		NO FORMAL NAME		-2543.10	2600.00						
Well tops	1/3-11		NORDLAND GP		-72.00	114.00						
Well tops	1/3-11		ROGALAND GP		-3137.10	3194.00						
Well tops	1/3-11		SELE FM		-3148.10	3205.00						
Well tops	1/3-11		SELE FM		-3262.10	3319.00						
Well tops	1/3-11		SHETLAND GP		-3445.10	3502.00						
Well tops	1/3-11		VADE FM		-2537.10	2594.00						
Well tops	1/3-12 S		ÅSGARD FM		-5289.35	5398.00						
Well tops	1/3-12 S		BLODØKS FM		-4966.56	5075.00						
Well tops	1/3-12 S		CROMER KNOLL GP		-5079.51	5188.00						
Well tops	1/3-12 S		EKOFISK FM		-3364.82	3473.00						
Well tops	1/3-12 S		FARSUND FM		-5447.01	5556.00						
Well tops	1/3-12 S		FORTIES FM		-3158.82	3267.00						
Well tops	1/3-12 S		HAUGESUND FM		-5517.72	5627.00						
Well tops	1/3-12 S		HIDRA FM		-4973.56	5082.00						
Well tops	1/3-12 S		HOD FM		-3983.81	4092.00						
Well tops	1/3-12 S		HORDALAND GP		-1808.42	1864.00						
Well tops	1/3-12 S		LISTA FM		-3230.82	3339.00						
Well tops	1/3-12 S		LISTA FM		-3163.82	3272.00						
Well tops	1/3-12 S		MANDAL FM		-5432.05	5541.00						
Well tops	1/3-12 S		MAUREEN FM		-3340.82	3449.00						
Well tops	1/3-12 S		NO GROUP DEFINED		-5707.44	5818.00						



3. Well Log Manager

RoQC Well Log Manager - STRAT_TEST_2014.pet

Manage GWLs Duplicate GWLs Fix Well logs Help

Convert Units Reload Preserve Values Delete Export & Print Exit

Unit Conversion

Source GWL

Global Well Log	Log Version Collection	Template	Borehole Count	UOM
GR_ARC	MWD_Logs	General	1	De
GR_ARC_FILT	MWD_Logs	General	1	De
GR_ARC_RAW	MWD_Logs	General	1	De
GR_PRED	MWD_Logs	General	3	De
GRAM	MWD_Logs	General	1	De
GRBM	MWD_Logs	General	1	De
GRDM	MWD_Logs	General	1	De
HGR	Global well logs	Gamma ray	1	AF
HGR	Global well logs	Gamma ray	1	AF
HGR	Global well logs	Gamma ray	1	AF
HGR	Global well logs	Gamma ray	1	AF
SGRC	MWD_Logs	General	2	De
TCKS_GR	MWD_Logs	General	1	De

Target GWL

Global Well Log	Log Version Collection	Template	Sort
AGR	MWD_Logs	General	
AGRA	MWD_Logs	General	
AGRB	MWD_Logs	General	
BGRC	MWD_Logs	General	
CGR	Global well logs	Gamma ray	
DGRCC	Global well logs	Above contact	
ECGR	Global well logs	Gamma ray	
GMGR	Global well logs	Above contact	
GR	Global well logs	Gamma ray	
GR_ARC	MWD_Logs	General	
GR_ARC_FILT	MWD_Logs	General	
GR_ARC_RAW	MWD_Logs	General	

Source Logs: GR_PRED:MWD_Logs

Borehole Collection	Well Name	Well UWI	Well Log Collection	Well Log	Sam
Wells	24/12-5-S		MWD_Logs	GR_PRED	
Wells	25/11-24		MWD_Logs	GR_PRED	
Wells	25/11-25-S		MWD_Logs	GR_PRED	

Target Logs: GR:Global well logs

Borehole Collection	Well Name	Well UWI	Well Log Collection
Wells	1/3-30		Well logs
Wells	1/3-30 A		Well logs
Wells	1/3-11		Well logs
Wells	1/3-11 T2		Well logs
Wells	16/1-10		Well logs

Move

RoQC Well Log Manager - STRAT_TEST_2014.pet

Manage GWLs Duplicate GWLs Fix Well logs Help

Move Convert Units Reload Preserve Values Fix Export & Print Exit

Unit Conversion

Groups Selected: 5 Groups Shown: 21 Show Controls

Destination	Source	Log Version Collection Name	Template Name	UOM	Borehole Usage Count	Writable	Changes
Global Well Log Name: AC							
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Global well logs	General	Dimensionless	35	Yes	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	Sonic	Low_Acoustic_Slowness	3	Yes	
Global Well Log Name: ACS							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	General	Dimensionless	31	Yes	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Global well logs	General	Dimensionless	2	Yes	
Global Well Log Name: AZIM_2_0							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	3	Yes	
<input type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	3	Yes	
<input type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	3	Yes	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	2	Yes	
<input type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	1	Yes	
<input type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	1	Yes	
<input type="checkbox"/>	<input type="checkbox"/>	MWD_Logs	Dip azimuth	Rotation	1	Yes	
Global Well Log Name: BS							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	Caliper	Cylinder_Diameter	236	Yes	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	Caliper	Cylinder_Diameter	23	Yes	
Global Well Log Name: CALI							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	Caliper	Cylinder_Diameter	904	Yes	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Global well logs	Caliper	Cylinder_Diameter	21	Yes	
Global Well Log Name: DEN							



4 Strat Cleanup

RoQC Strat Cleanup - STRAT_TEST_2013.pet

Home Help

Reload Rename Delete Export & Print Exit

Selected: 2 of 145 [Show Controls](#)

Find Clear

Marker Collection Name	Surface Name	Data Type	Marker Count
Well tops	SVARTE FM	Horizon	93
Well tops	TANG FM	Horizon	4
Well tops	TARBERT FM	Horizon	72
Well tops	TARE FM	Horizon	4
Well tops	TAU FM	Horizon	35
Well tops	TEIST FM	Horizon	2
Well tops	TEIST FM (INFORMAL)	Horizon	3
Well tops	TOR FM	Horizon	209
Well tops	TRYGGVASON FM	Horizon	75
Well tops	TUXEN FM	Horizon	29
Well tops	TY FM	Horizon	61
Well tops	TYNE GP	Horizon	56
Well tops	ULA FM	Horizon	25
Well tops	ULA FM EKV	Horizon	1
Well tops	UNDEFINED	Horizon	19
Well tops	UNDIFFERENTIATED	Horizon	25
Well tops	UTSIRA	Horizon	1
Well tops	UTSIRA FM	Horizon	278
Well tops	VADE FM	Horizon	14
Well tops	Våle Fm	Horizon	1
Well tops	VÅLE FM	Horizon	281
Well tops	VESTLAND GP	Horizon	134
Well tops	VIDAR FM	Horizon	14
Well tops	VIKING GP	Horizon	258
Well tops	ZECHSTEIN GP	Horizon	66

Select the new name

Find Clear

Name	Data Type
CROMER KNOLL GP Top	Event
CROMER KNOLL GP	Zone
Event 6	Event
Unknown	Column
Nordland GP Top	Event
UTSIRA FM	Zone
Nordland GP Base	Event
VADE FM	Zone
ROGALAND GP Top	Event
BALDER FM	Zone
SELE FM Top	Event
SELE FM	Zone
LISTA FM Top	Event
LISTA FM	Zone
VAALE FM Top	Event
VAALE FM	Zone
SHETLAND GP Top	Event
CROMER KNOLL GP Top	Event
Event 6	Event

Apply Ok Cancel



5. Etc

- Other tools
- Petrel – intelligent use of filtering tools [inc Find]
- Excel - colating missing data [from CDA, NPD, Petrobank, etc]

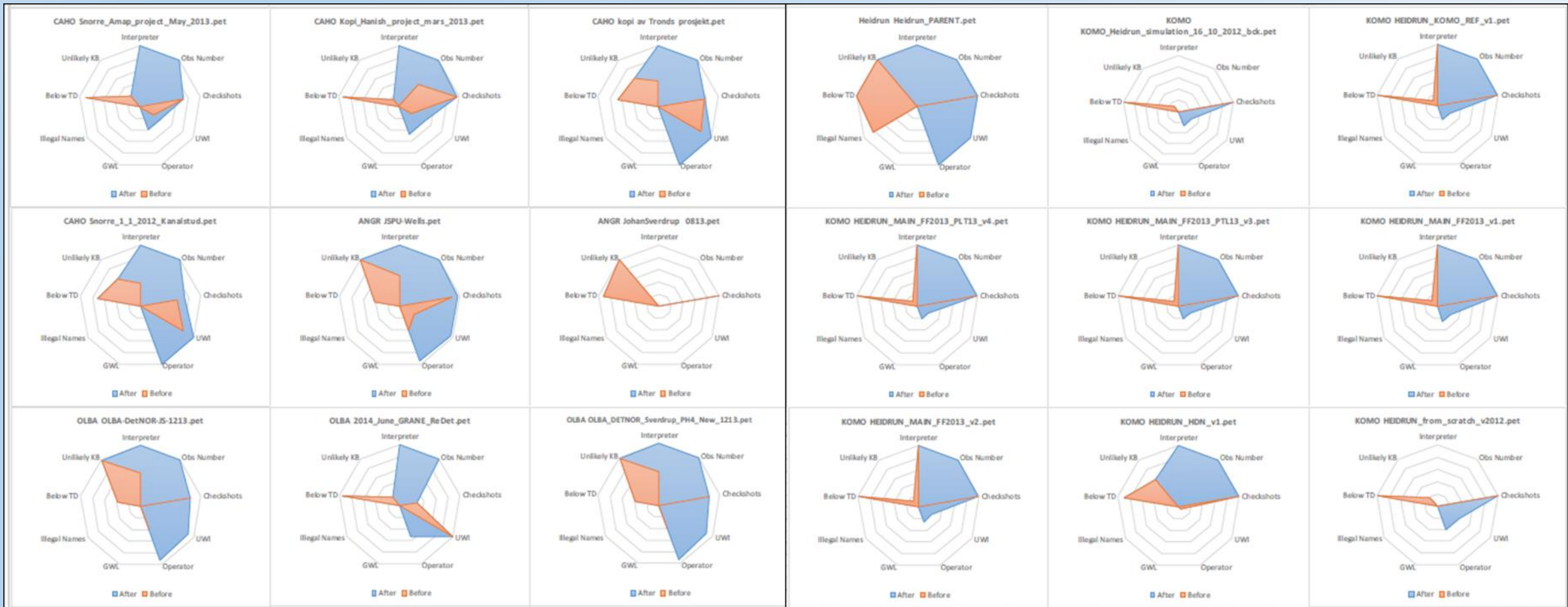


Petoro Phase II – User Project Cleanup

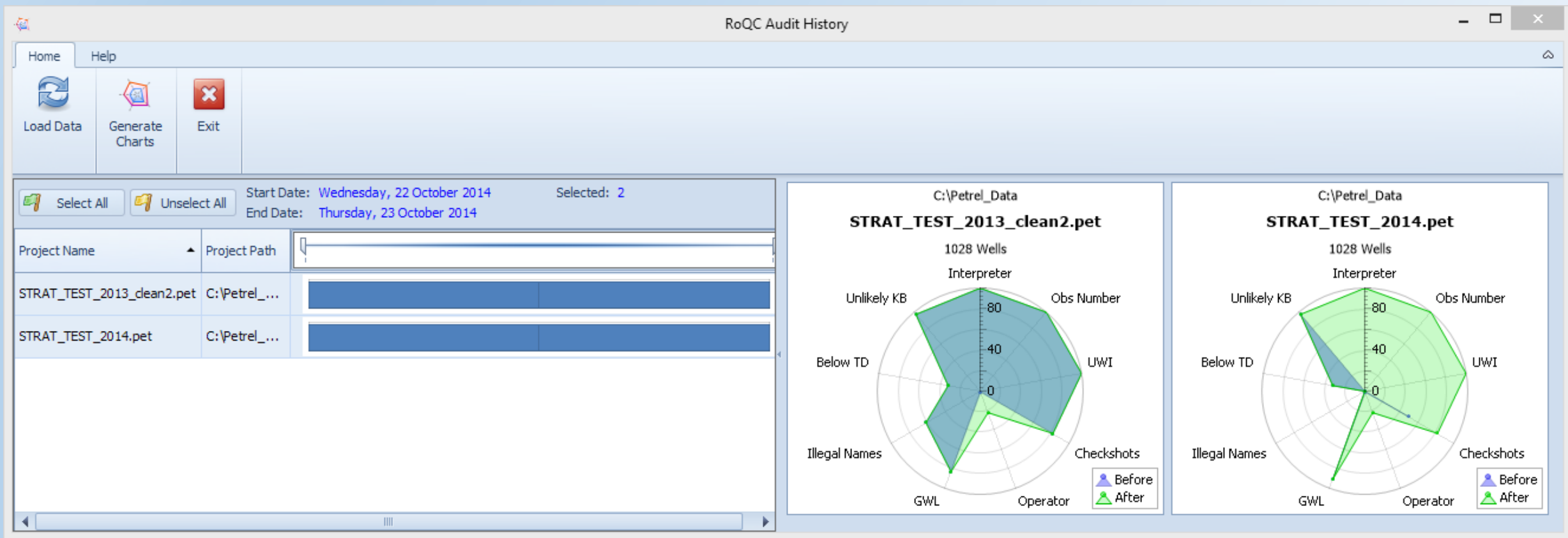
- Focus on what can be done without involving the users!!!
 - Generate UWIs
 - Add Well Top data sources
 - Add missing observation numbers
 - Activate & fix Checckshots
 - Add Operators
 - Check GWL condition
 - Check KB & TD
 - Check logs (simple check)
 - Check Stratigraphic Names



Results



Today !





RoQC Audit History

Home Help

Load Data Generate Charts Exit

Select All Unselect All Start Date: Saturday, 31 August 2013 End Date: Tuesday, 30 September 2014 Selected: 8

Project Name	Project Path
TestProject_0.pet	C:\Develop...
TestProject_1.pet	C:\Develop...
TestProject_10.pet	C:\Develop...
TestProject_11.pet	C:\Develop...
TestProject_12.pet	C:\Develop...
TestProject_13.pet	C:\Develop...
TestProject_14.pet	C:\Develop...
TestProject_15.pet	C:\Develop...
TestProject_16.pet	C:\Develop...
TestProject_17.pet	C:\Develop...
TestProject_18.pet	C:\Develop...
TestProject_19.pet	C:\Develop...
TestProject_2.pet	C:\Develop...
TestProject_20.pet	C:\Develop...
TestProject_21.pet	C:\Develop...

C:\Development\Projects
TestProject_0.pet
17 Wells

Legend: Before (blue), After (green)

C:\Development\Projects
TestProject_1.pet
11 Wells

Legend: Before (blue), After (green)

C:\Development\Projects
TestProject_10.pet
10 Wells

Legend: Before (blue), After (green)

C:\Development\Projects
TestProject_12.pet
17 Wells

Legend: Before (blue), After (green)

C:\Development\Projects
TestProject_15.pet

C:\Development\Projects
TestProject_17.pet



Welcome to the new world
of
😊 Petrel Data Management 😊