

Use of Multilateral Technology in Statoil

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Stavanger SPE Meeting 18 March 2015

MLT Wells – Junction Levels & Terminology

Multilateral Junction - TAML Levels definitions:

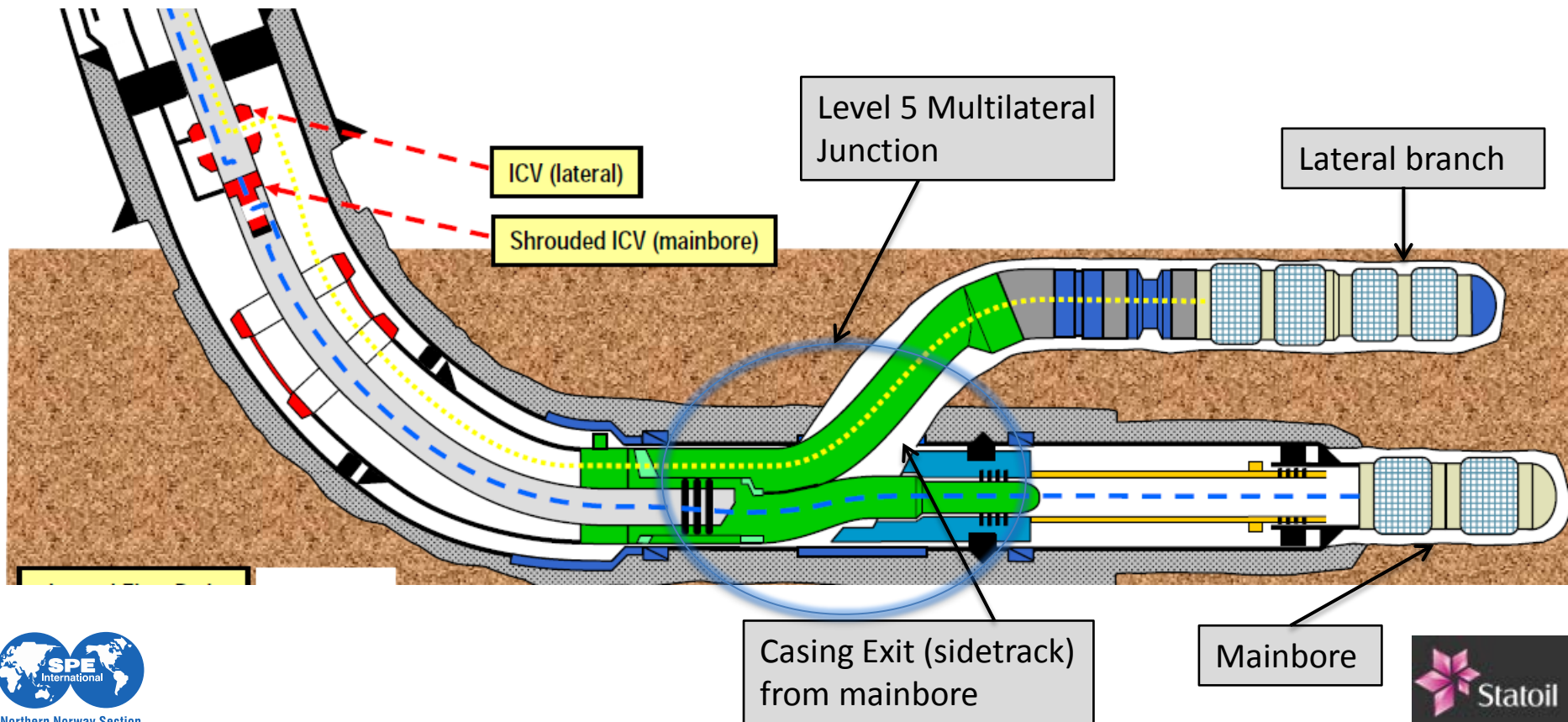
Level 1: open hole sidetrack (many wells, not included in Statoil MLT statistics).

Level 2: sidetrack from casing, lateral liner not connected to mainbore (2 Statoil wells).

Level 3: lateral liner connected to mainbore, no isolation (4 Statoil wells).

Level 4: liner connected, cement used for isolation, not pressure tight (16 Statoil wells).

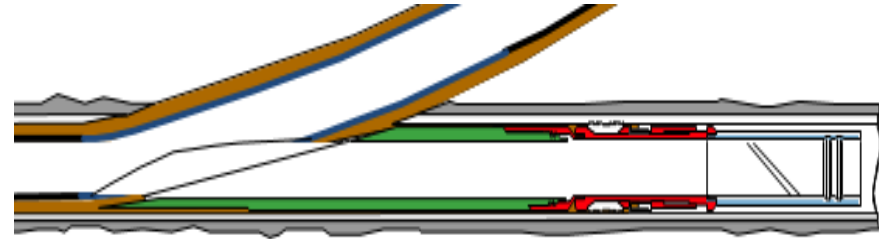
Level 5: liner connected with mechanical isolation (160 Statoil wells with 219 junctions).



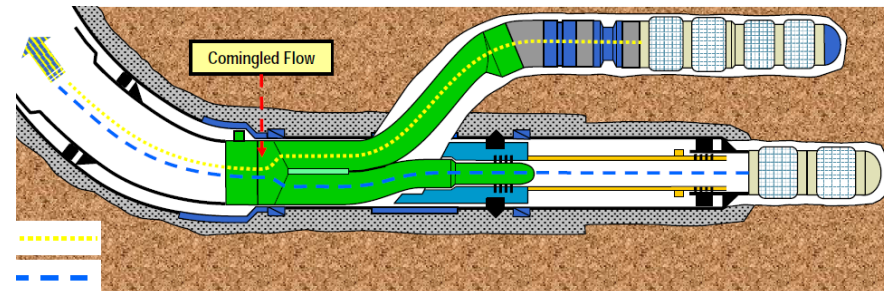
The First MLT Wells and Introduction of Level 5

- The first Statoil MLT junction was installed on Oseberg C in 1996. During the next 5 years a total of 8 MLT junctions were installed on Oseberg C (3), Troll (3) and Statfjord (2).
- These were level 4 junctions. Junction construction mainly successful, but complicated and time consuming.
- On Troll resin was injected into the formation outside the junction to prevent sand production.
- Troll wanted to use MLT on a larger scale, but needed a pressure/sand tight junction with a simple installation sequence.
- During 2000 the modern Level 5 junction design was developed, with the first installation completed from a floater on Troll in January 2001.
 - Within the 1st year junction construction time was reduced from a previous “old system” best of 14.7 days to a new record of 3 days.

Old style “mill through” level 4 junction:



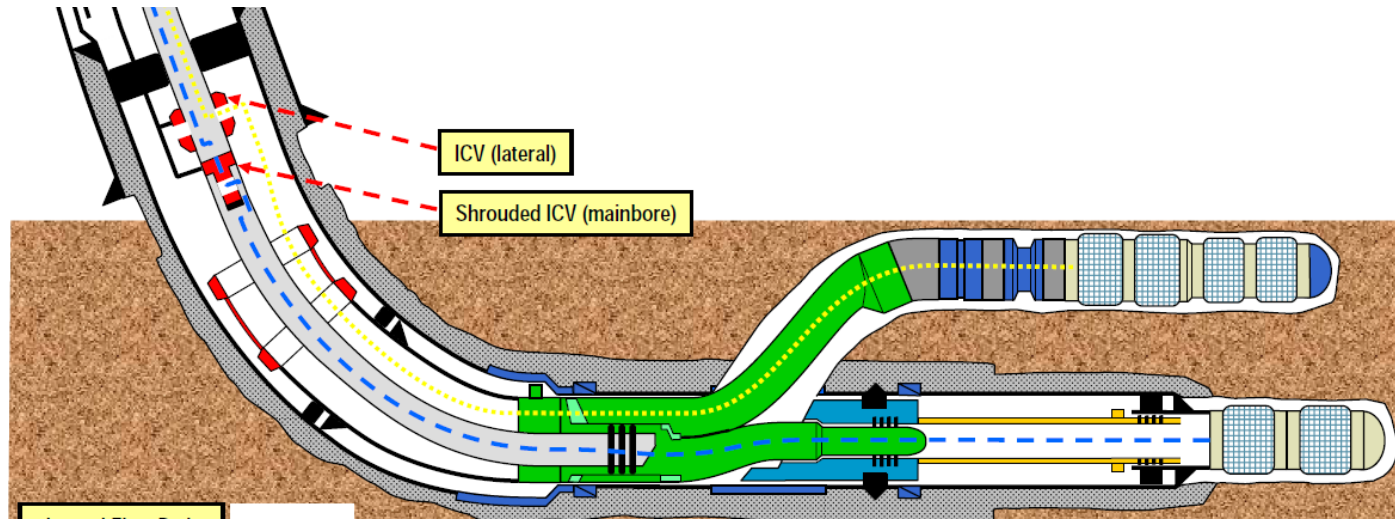
New level 5 junction (FlexRite):



MLT Junction Variants Developed for Statoil

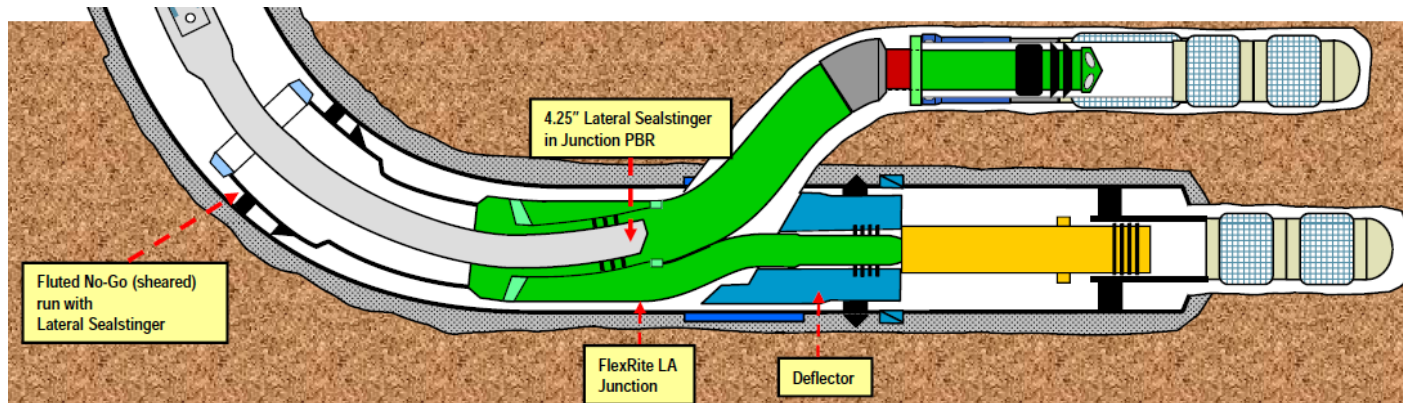
9 5/8" FlexRite ICI

- ICI = intelligent completion interface.
- Internal junction PBR for flow separation.
- First use in 2005 on Troll, approx. 95 jobs to date.



10 3/4" FlexRite LA

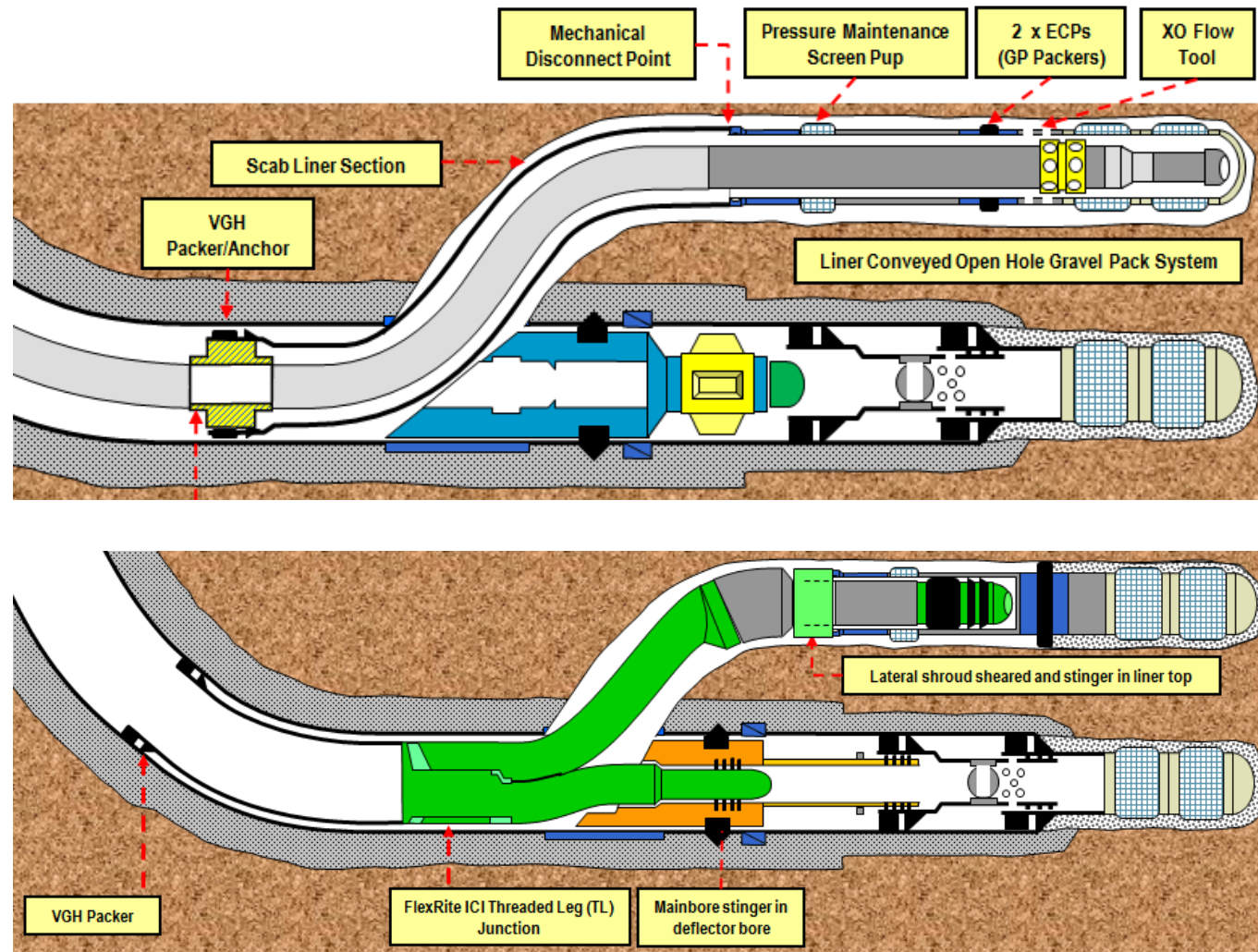
- LA = lateral access
- Shown with Open Hole Sting-in.
- First use in 2008 on Fram East WI well.



MLT Junction Variants Developed for Statoil

9 5/8" FlexRite HP-TL

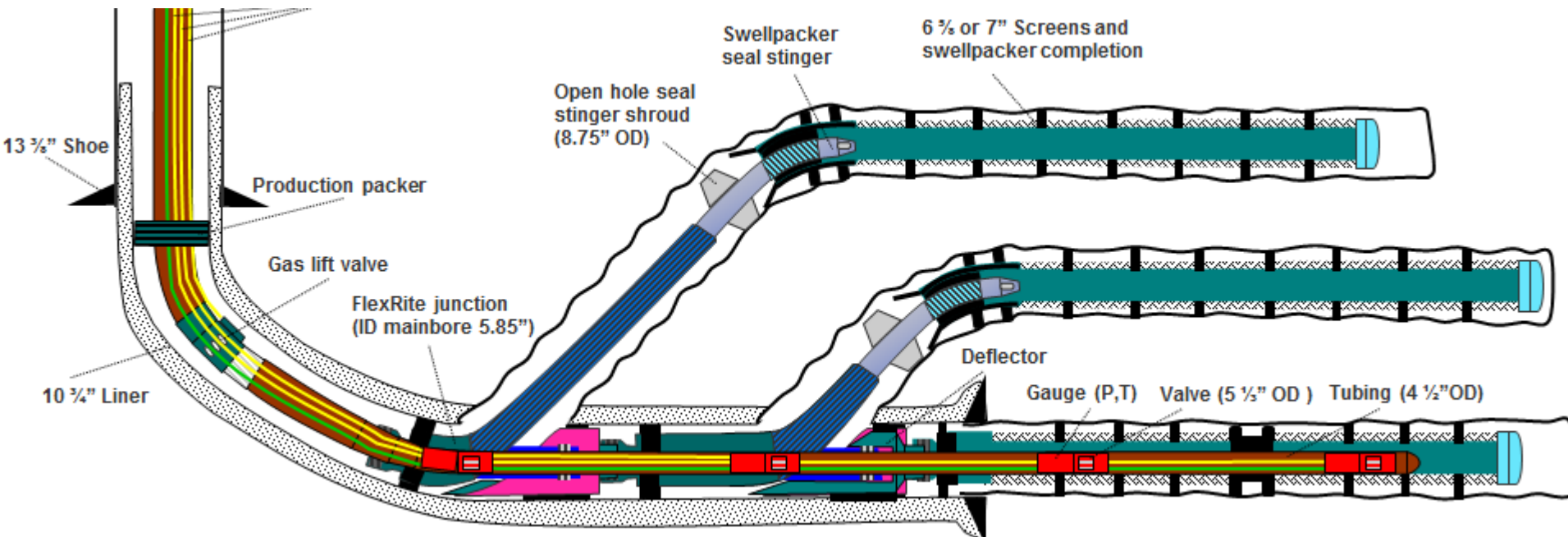
- HP = high pressure.
- TL = threaded legs.
- Overall solution developed for gravel pack of lateral screens.
- First successful use on Peregrino in 2013.
- Two wells completed with this solution and GP lateral screens.



MLT Junction Variants Developed for Statoil

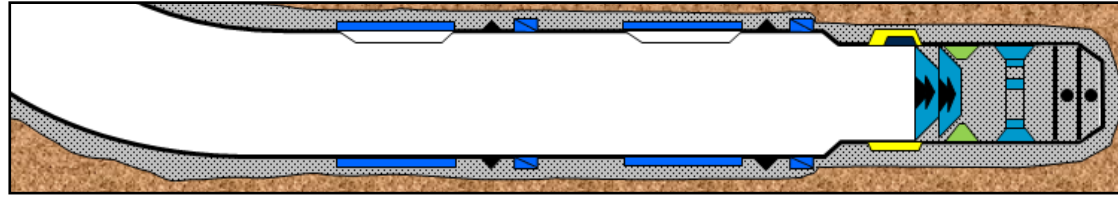
10 3/4" FlexRite MIC

- MIC = multi-branch inflow control.
- Developed for Troll in order to allow for inflow control of multiple junctions.
- First installed on Troll in 2012.
- This is now standard MLT design for Troll, a total of 39 junctions installed by 1 March 2015.

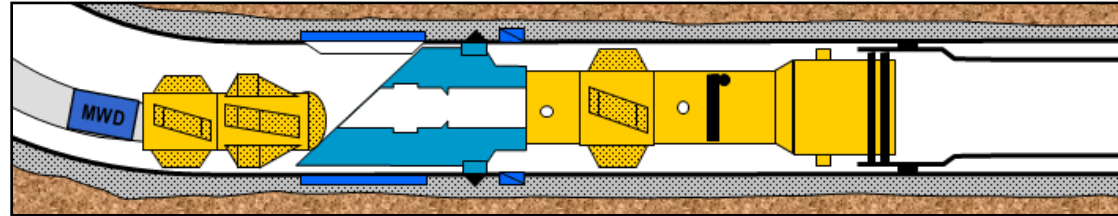


10 3/4" FlexRite MIC Installation Sequence - Troll

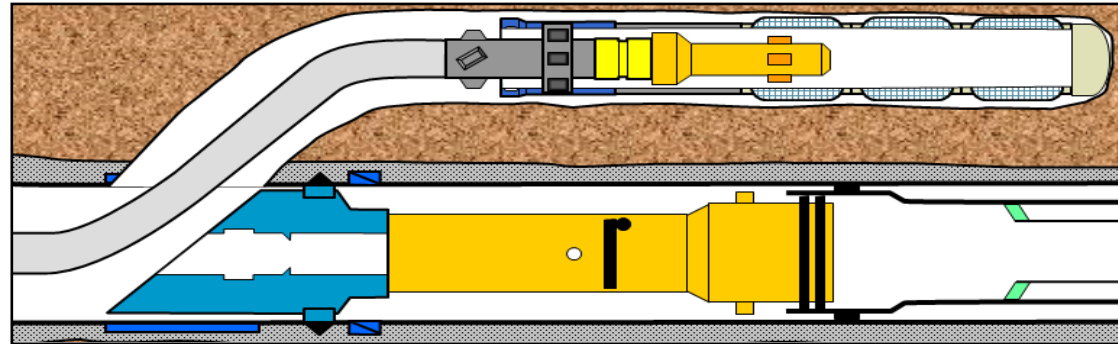
The 10 3/4" liner is installed with 2 or 3 MLT window, windows are oriented high side.



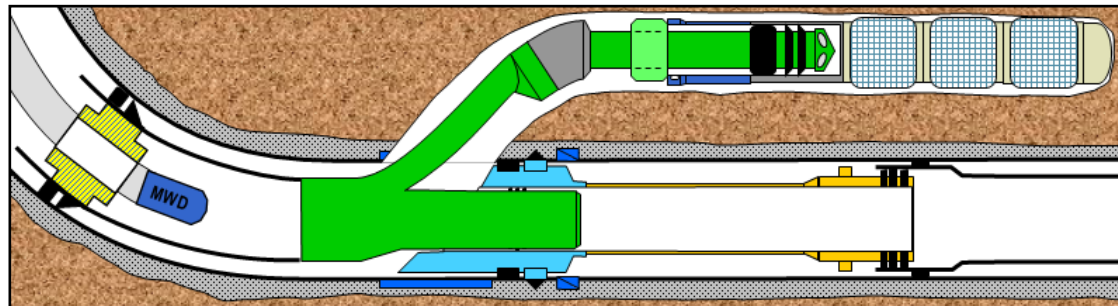
The mainbore is drilled and completed with screens.



The MLT whipstock is run on milling BHA, and set in latch coupling below the window. The window is milled.



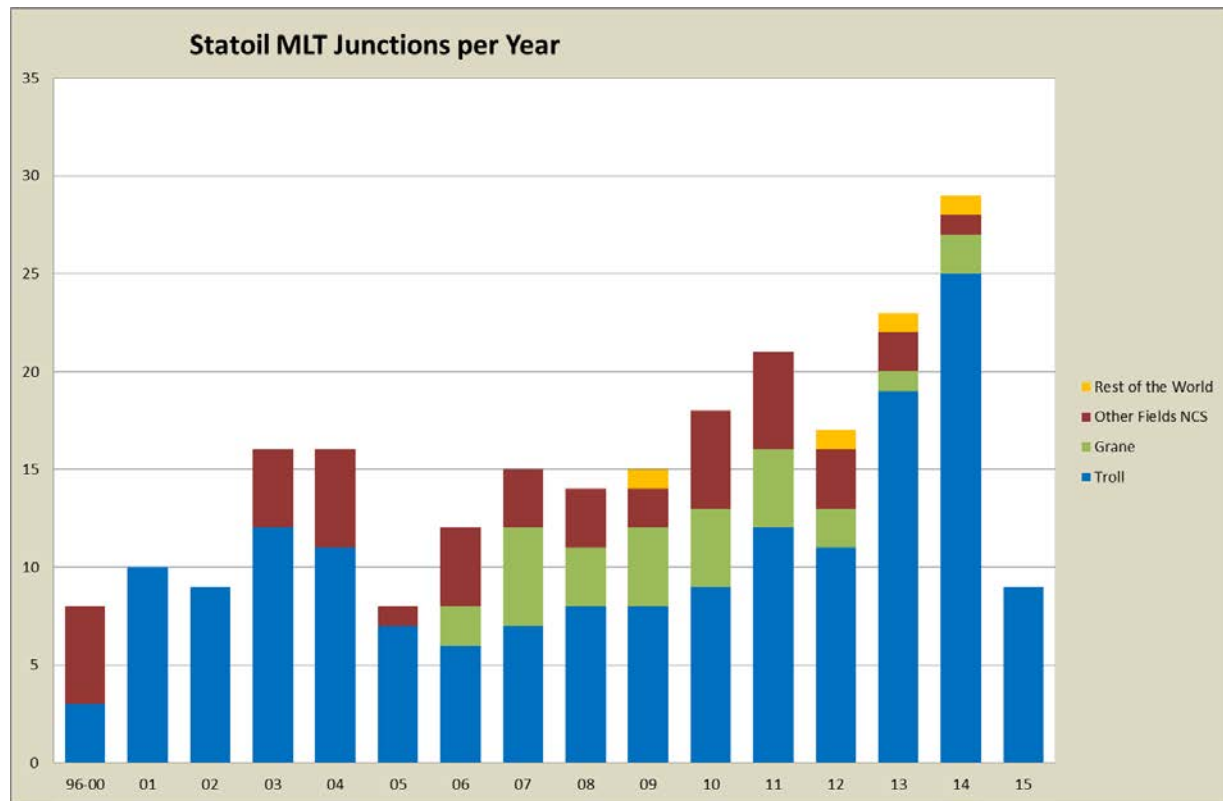
The lateral branch is drilled, and screens are run and dropped off in open hole. The whipstock is retrieved on the same run.



The completion deflector is installed in the latch coupling. The MIC junction is landed in the deflector, with a seal stinger stung into the lateral screen liner.

Statoil MLT Statistics

- MLT wells installed in more than 20 Statoil fields.
- 216 Level 5 junctions (pressure tight) successfully installed.
 - 105 dual laterals, 39 tri-laterals and 11 quad-laterals wells. No production issues.
- 22 Level 2 – 4 junctions installed.
 - Production related issues in some wells.
- No mainbore has been lost after it was completed when planning for Level 5 junctions.
- 10 planned MLT wells not completed as intended.
 - Only main bore completed (straddled casing exit for lateral branch).
 - Only branch completed due to main bore «issues».
 - Various other incidents.

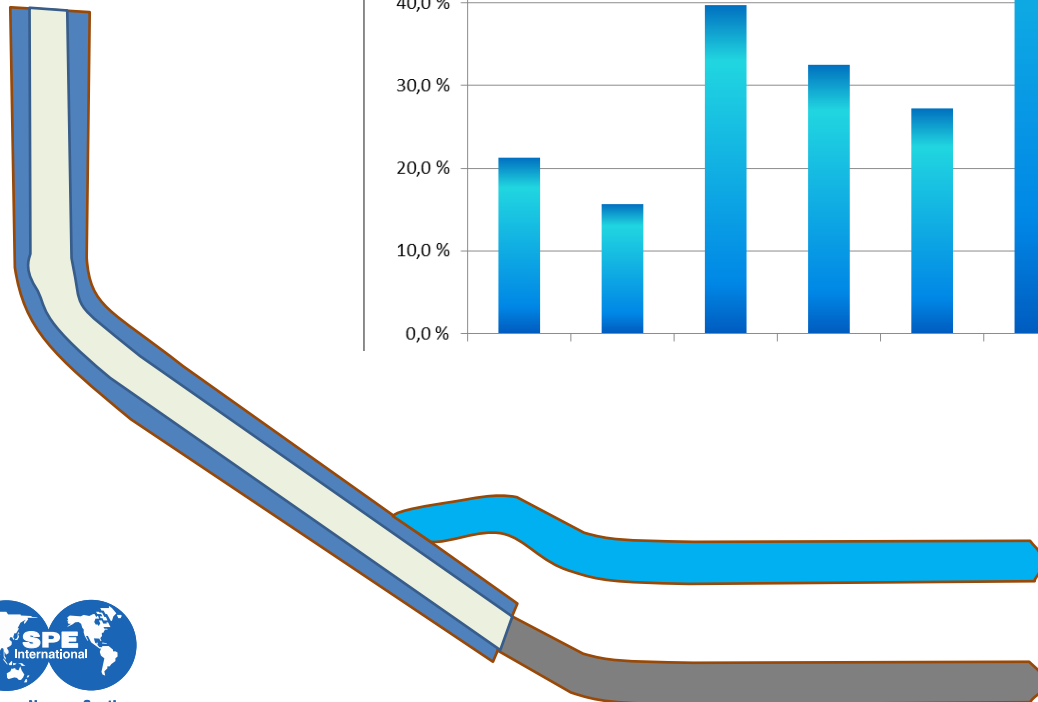
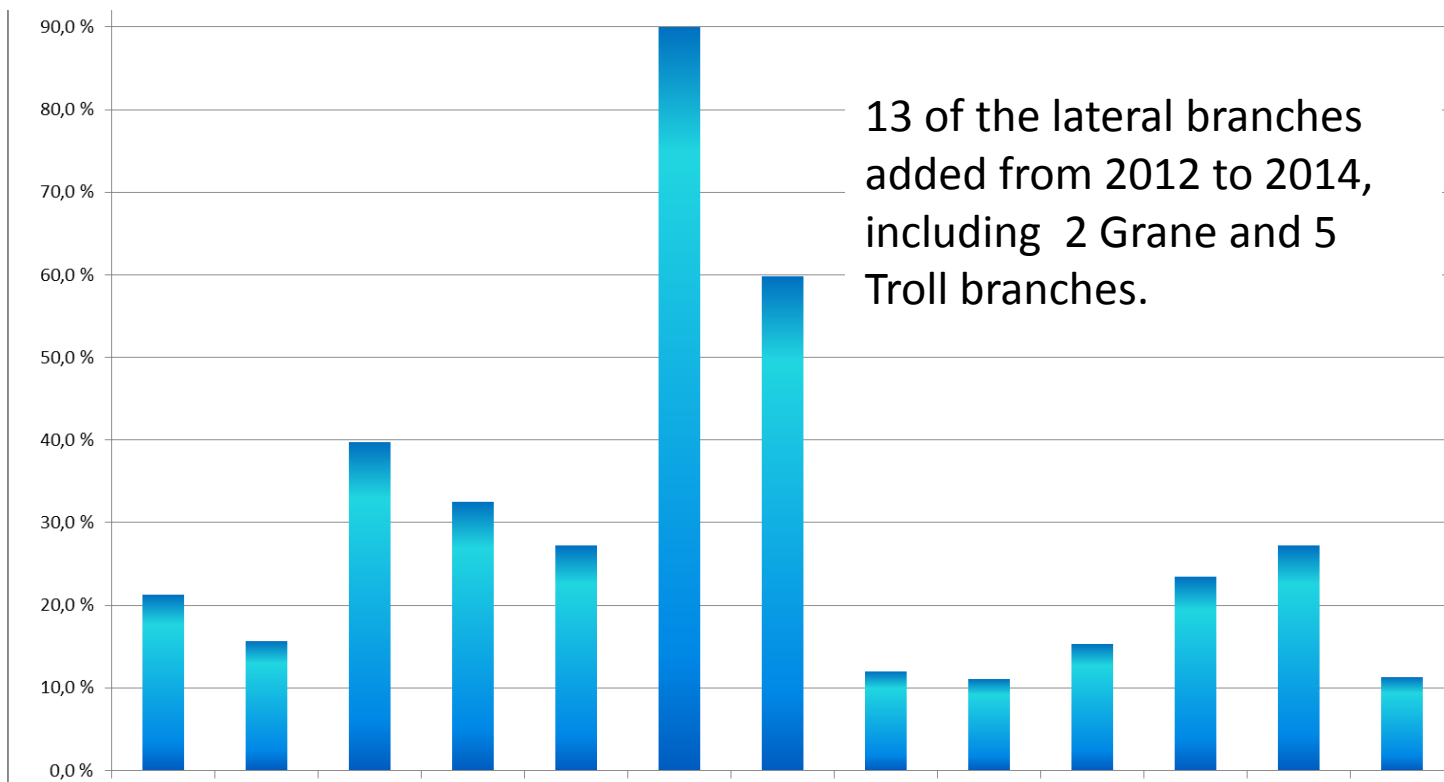


Additional Time to Add Lateral Branch

Time to drill and complete well as a single bore well:

- Drill and complete main bore portion of well.
- Install upper completion.

% time to add branch compare to D&C well with main bore only:



Time to add lateral branch:
+ Overall MLT time
+ Time to drill branch
+ Time to completed branch

Thank you!