Experiences with ultrasound in wax rich pipelines

PPSA seminar 17. November 2010

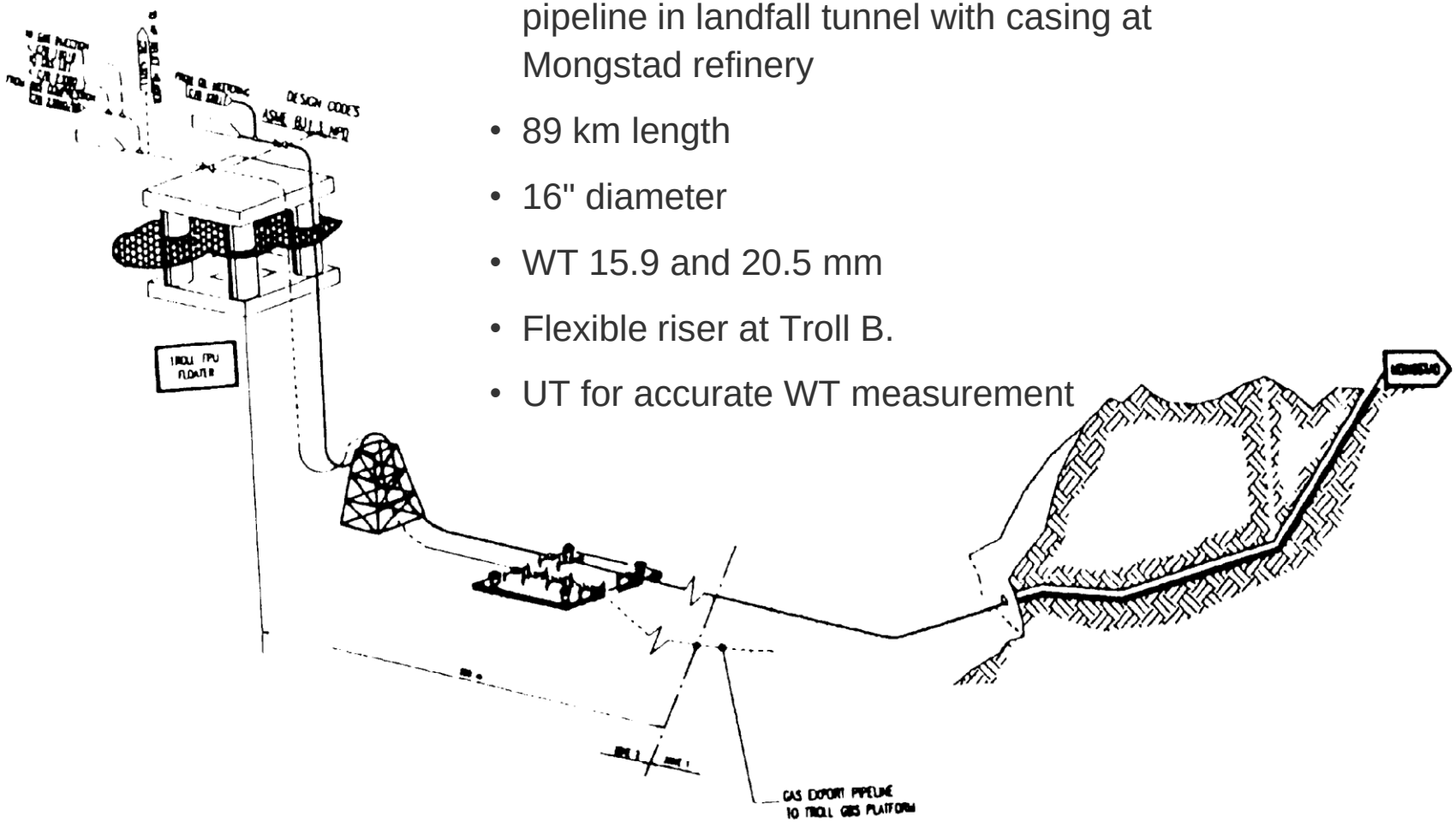
Roger Hunsbedt – Statoil pigging and in-line inspection

Introduction

- Unsuccessful ultrasound testing (UT) inspection in 2006
- Process of develop new UT tool solution
- Results
- Looking ahead

Pipeline system

- Pipeline integrety management focus pipeline in landfall tunnel with casing at Mongstad refinery
- 89 km length
- 16" diameter
- WT 15.9 and 20.5 mm
- Flexible riser at Troll B.
- UT for accurate WT measurement



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2006 UT inspection

- UT tool
- First 18 km inspected out of 89 km.
- No data from landfall tunnel
- Odometer wheels sliding
- Sensors covered by wax

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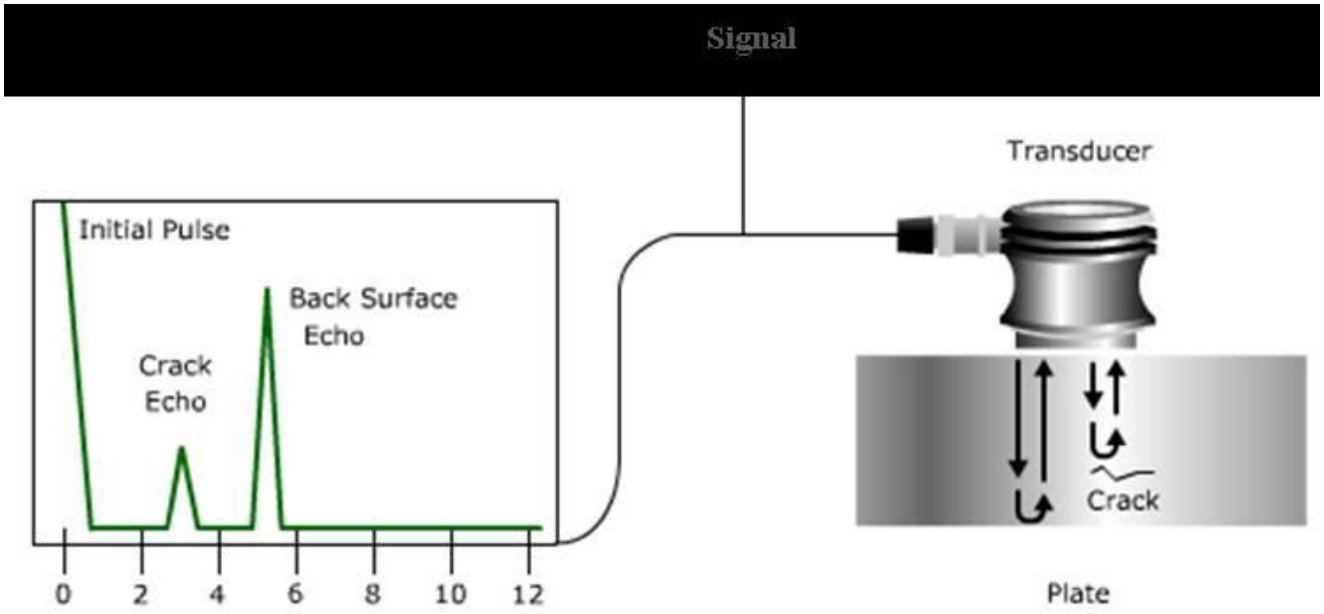
Challenges identified

- UT tool did not "fire" waves due to sliding odometer wheels
- UT tool did not receive echoes due to wax clogging sensors
- Data were not recorded for entire pipeline length and circumference
- No commercial solution for wax rich pipelines in the market



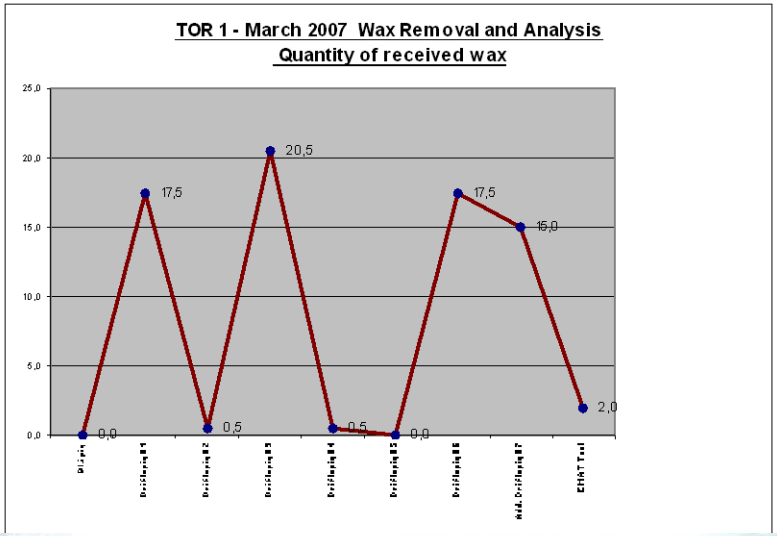
Project scope

- Identify type of wax in pipeline
- Identify amount of wax in the pipeline
- Identify weak points in UT tool design
- Identify and implement improvements on UT tool design

- Contract awarded
  - NDT System & Services AG
  - Best commercial and technical proposal

Type of wax?

- 8 cleaning pigs sent
- Pebble like wax in front of pig
- Amount of wax varies



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How much wax?

- Run an Eddy Current based geometric tool
- Not possible to quantify amount of wax in pipeline

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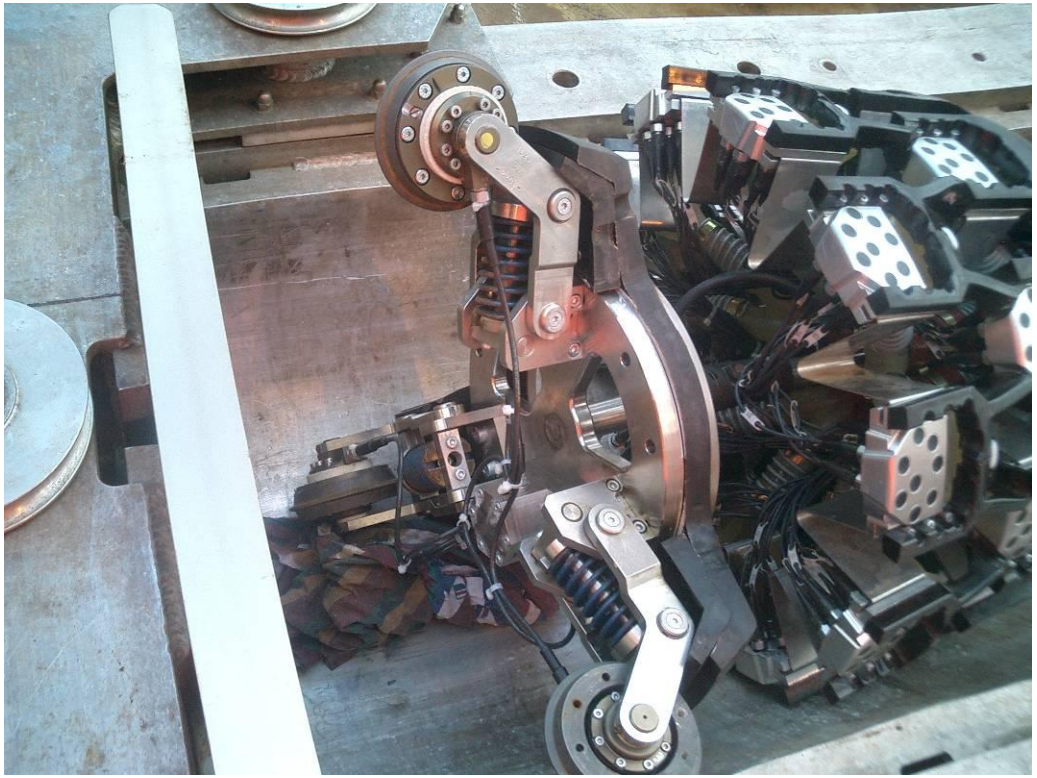
Weak points in UT tool design

- Poor self cleaning of sensor carrier
- Odometer wheels clogging and sliding
- Data recording fully dependent on odometer wheels function

Improvements – sensor carrier self cleaning

- High focus on achieving more bypass across UT sensors
- Keep wax in front of UT tool
- No wax "available" in rear end
- Wax free oil flushing across sensors
- New sensor holder
- New bypass tubes leading flow forward
- Modelling and flow testing



Improvements - odometer wheel system

- Increased diameter
- Increased spring force
- Positioned in "wax free" rear end
- Time trigger mode introduced

Results 16" TOR1 Troll B - Mongstad

Results 16" TOR1 Troll B - Mongstad

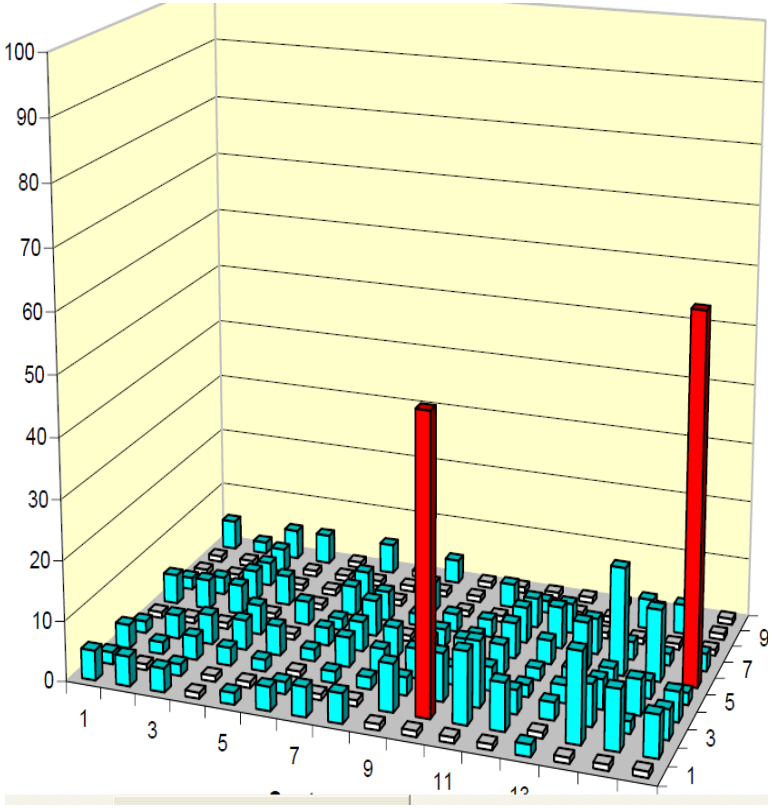
2006

2008

Results 16" TOR1 Troll B – Mongstad 2008

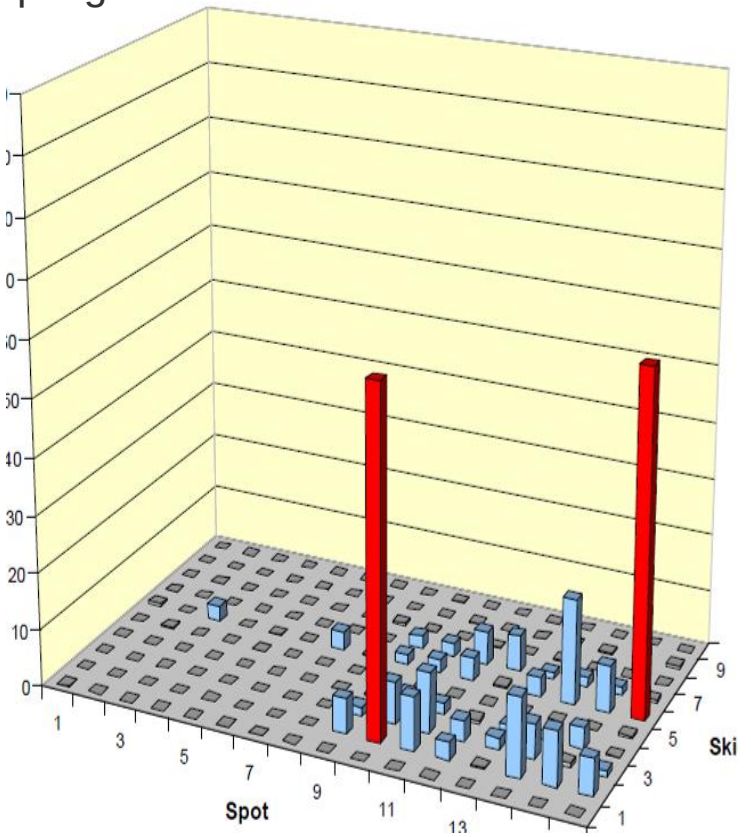
Before post processing

Coupling loss 0.9%



After post processing

Coupling loss < 0.1%



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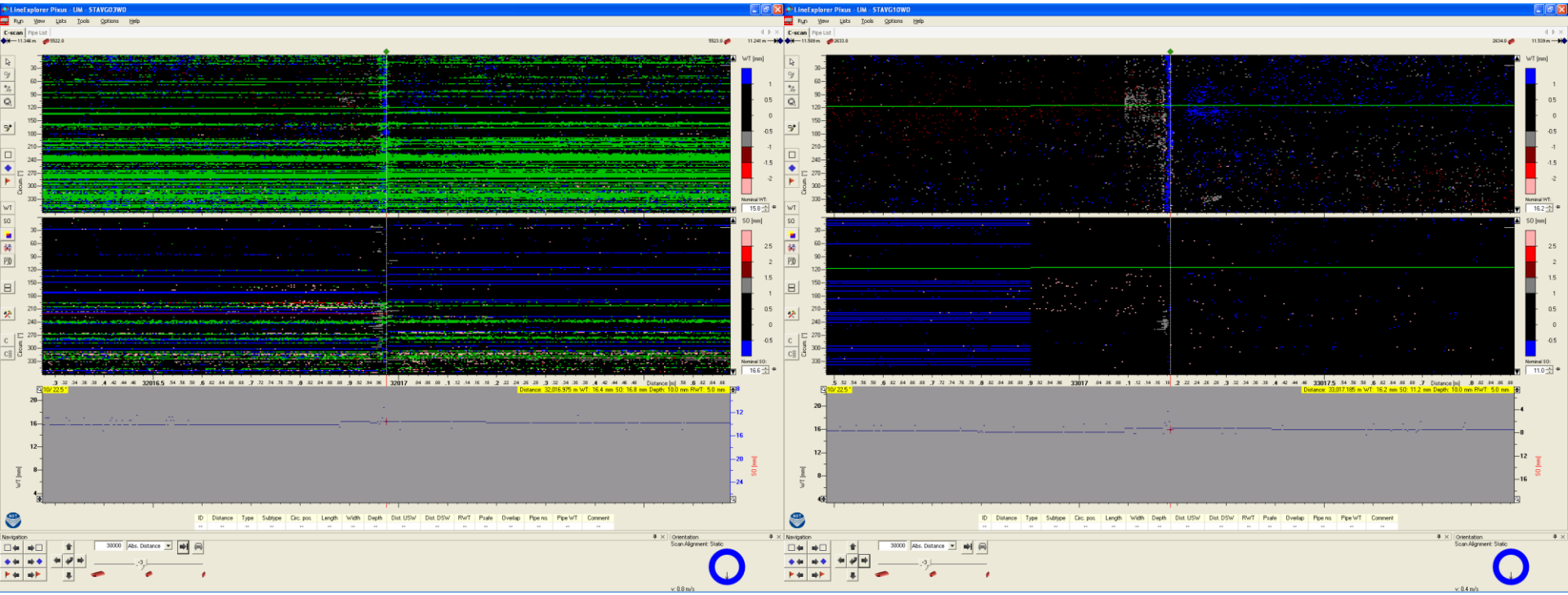
Other successful inspections

- 16" Visund - Gullfaks A
- 28" Oseberg – Sture
- 12" Brage - Oseberg
- 28" Grane - Sture
- 16" Snorre B - Statfjord B
- 16"/20" Kvitebjørn – Mongstad
- All pipelines mentioned above are classified as wax rich pipelines
- All runs in time trigger mode, odometer wheels functions 100%.

16" Visund - Gullfaks A

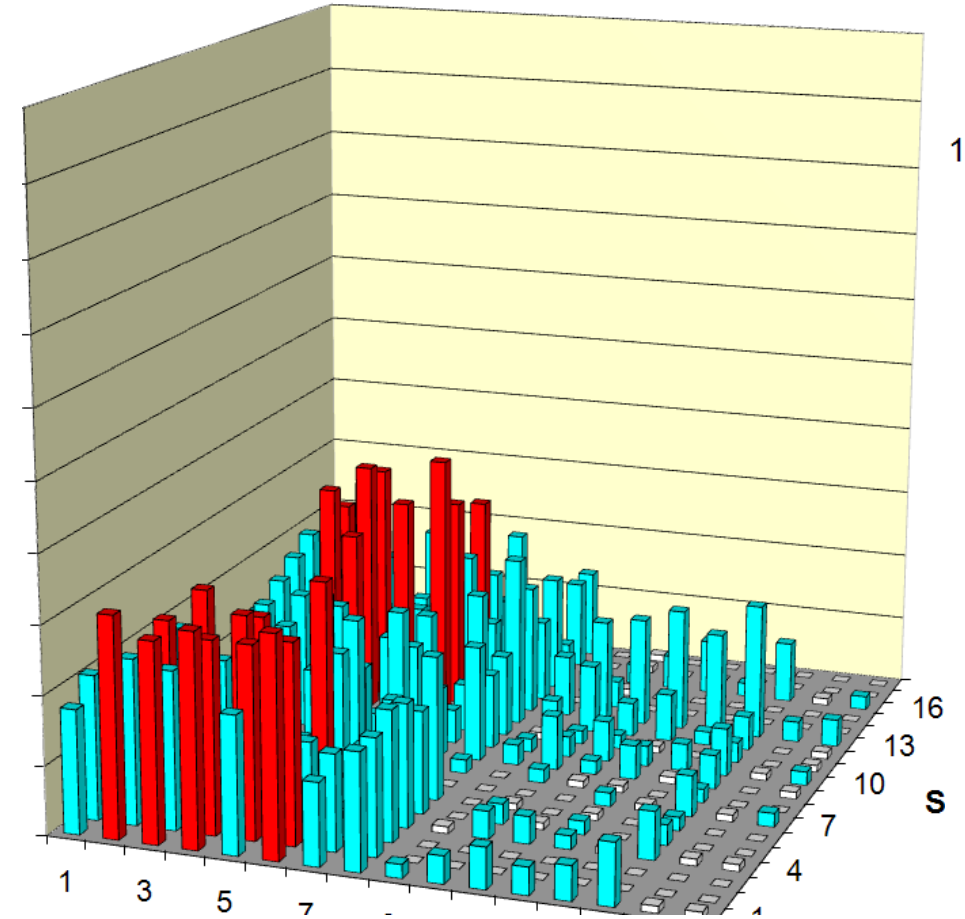
2003 Standard NDT UT tool

2010 NDT Wax UT tool

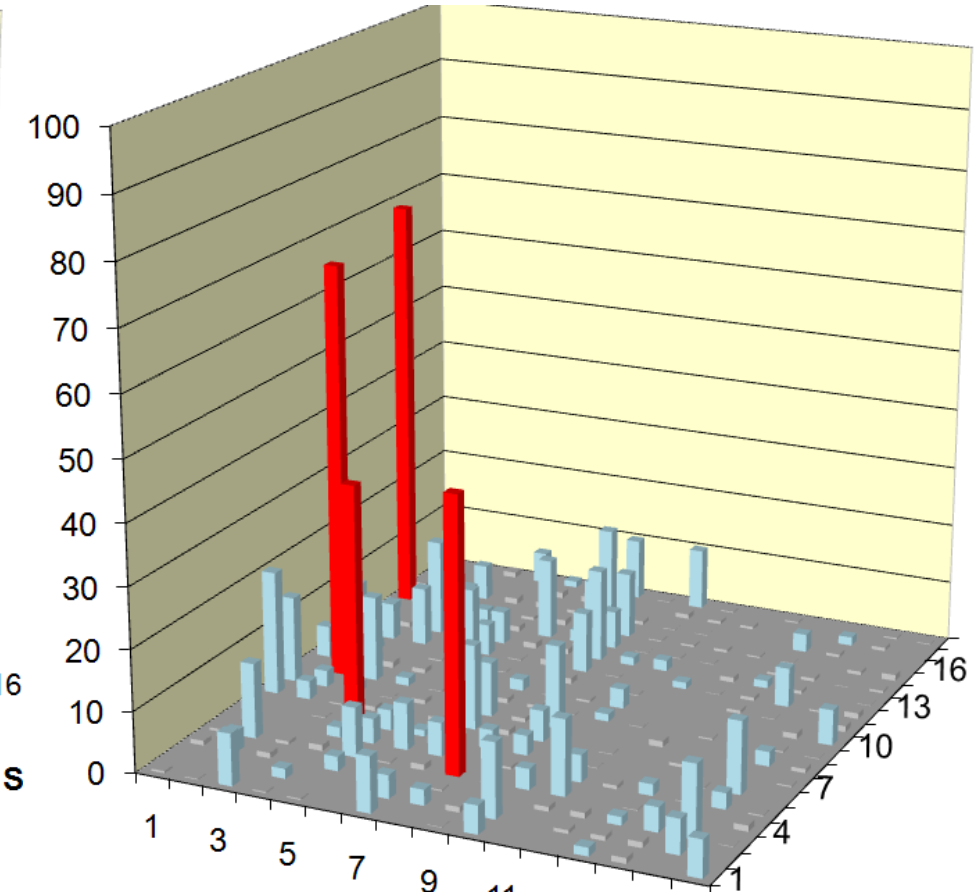


28" Oseberg - Sture

2003 Standard NDT UT tool 7.9% coupling loss



2008 NDT Wax UT tool2.7 % coupling loss



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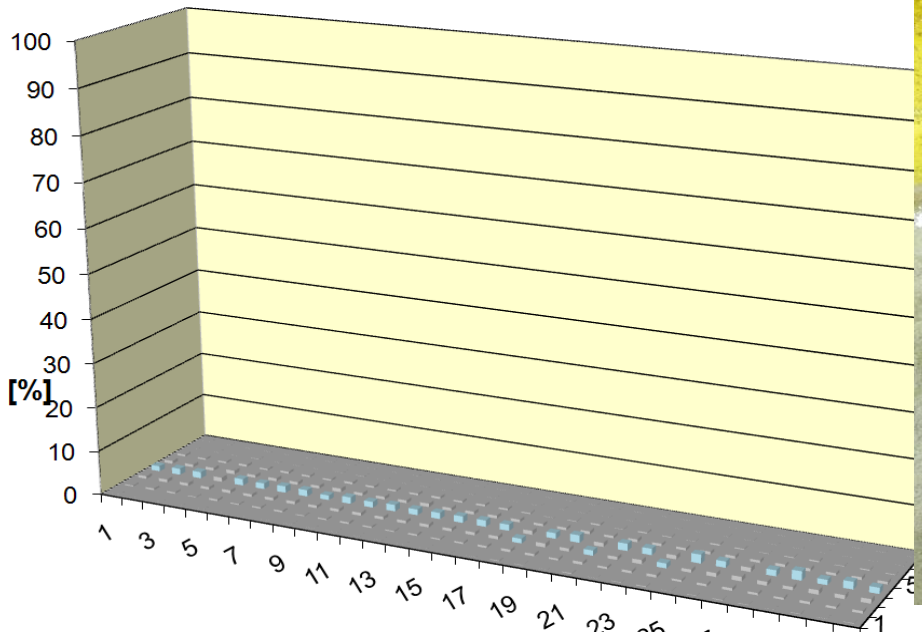
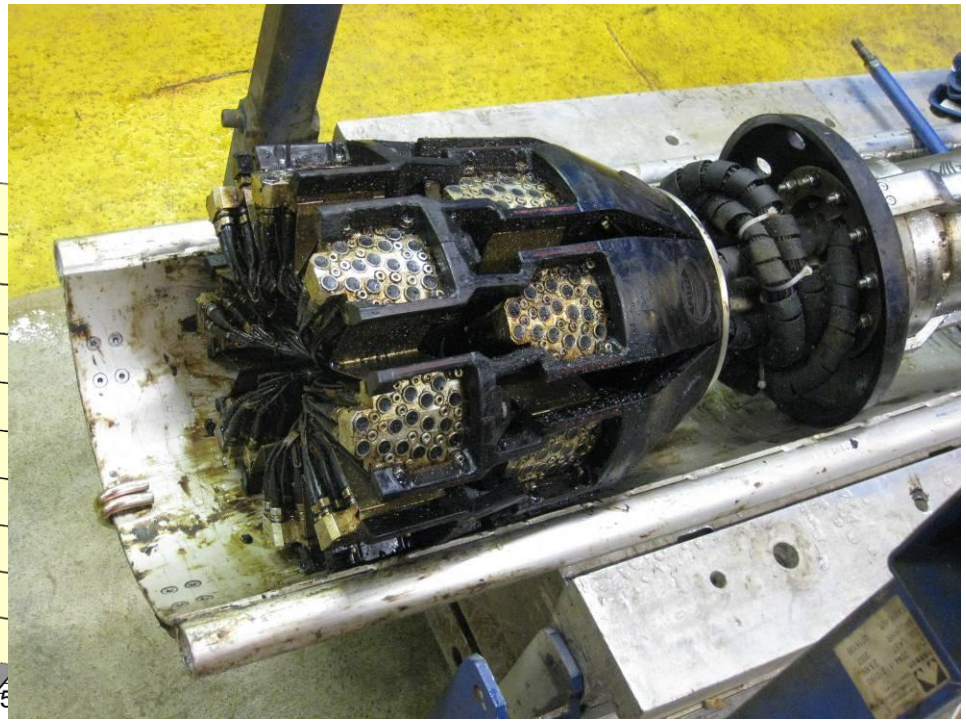
12" Brage - Oseberg

2010 0.4 % coupling loss





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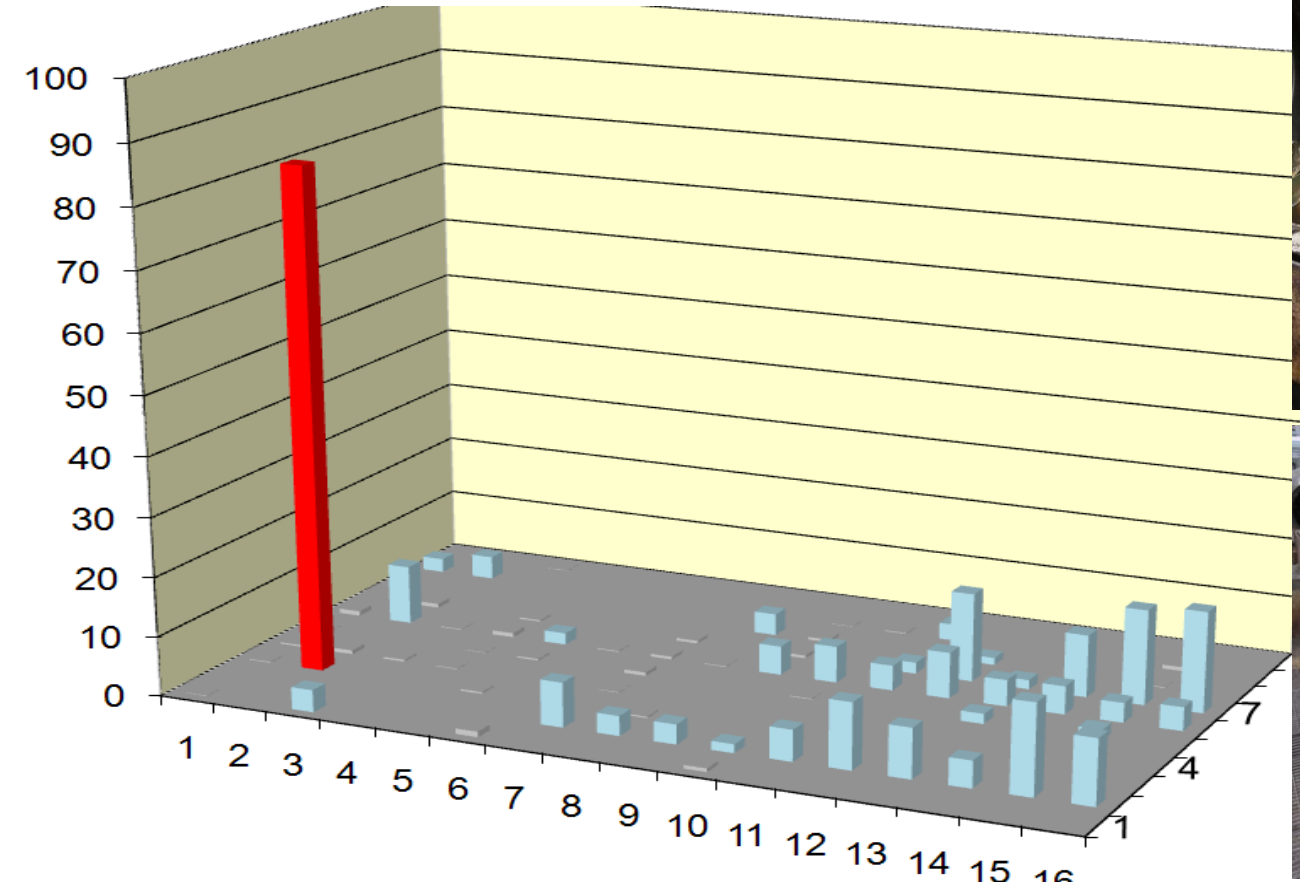
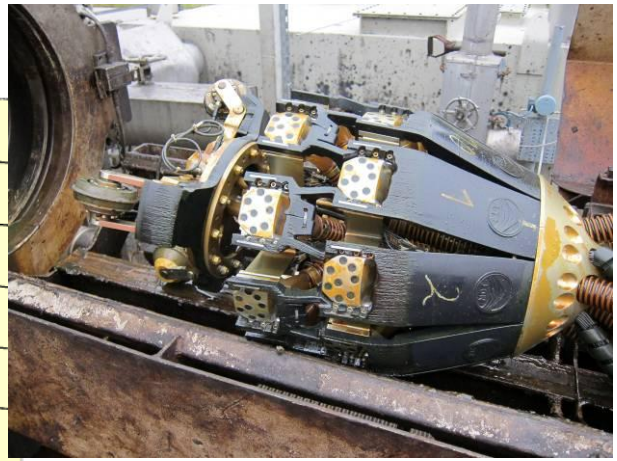
16"/20" Kvitebjørn - Mongstad

Inspection in the 16" pipeline section, 1.8 % coupling loss





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Looking ahead

- Adjustable bypass / speed control
  - as fail safe mechanism
  - deal with flow < 0.5 m/s
  - keep constant speed
  - deal with >2.5 m/s flow, in order to improve axial resolution?
- Challenges in <12" pipeline diameters?
- Statoil pigging and in-line inspection: pigging@statoil.com

Experiences with ultrasound in wax rich pipelines

Roger Hunsbedt
Senior Engineer Pigging & In-Line Inspection
e: rohu@statoil.com
e: pigging@statoil.com
m: +47 48 26 52 04
www.statoil.com

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