

Flerfase og våtgass måling

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INTERPRETATION



MODELING



SIMULATION



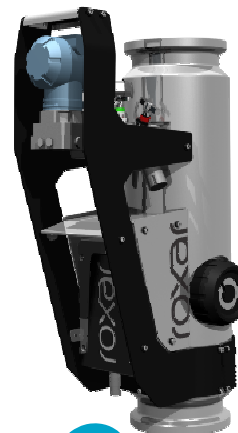
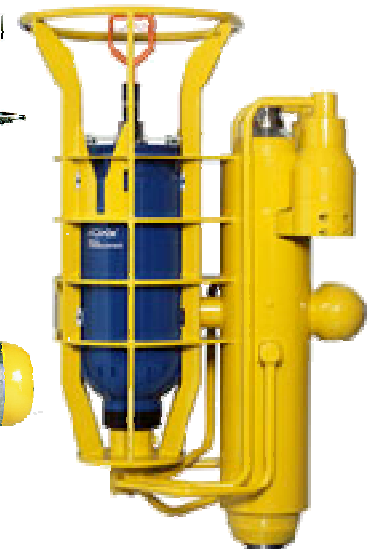
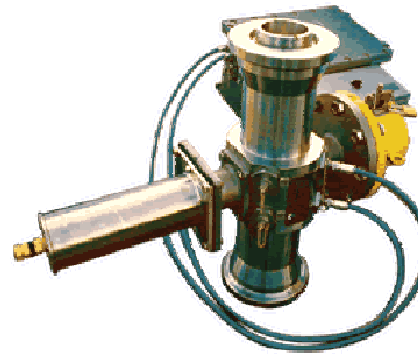
WELL & COMPLETION



PRODUCTION & PROCESS

Historikk

- Teknologit utvikling siden 1984
- Fluenta / MFI → Roxar (2001)
- **1. generasjon**
 - MFI topside (1994 – 2001)
 - MFI subsea (1995 – 2001)
- **2. generasjon**
 - MPFM 1900VI (1995 →)
 - MPFM SRC subsea (2002 →)
- **Våtgass måler (2002 →)**
- **3. generasjon**
 - MPFM 2600 based on Zector Technology (2009 →)



INTERPRETATION



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SIMULATION



WELL & COMPLETION



PRODUCTION & PROCESS

Internasjonal erfaringsbase

Antall målere i drift: ca 900

Antall målere solgt: 1 200

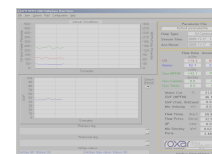
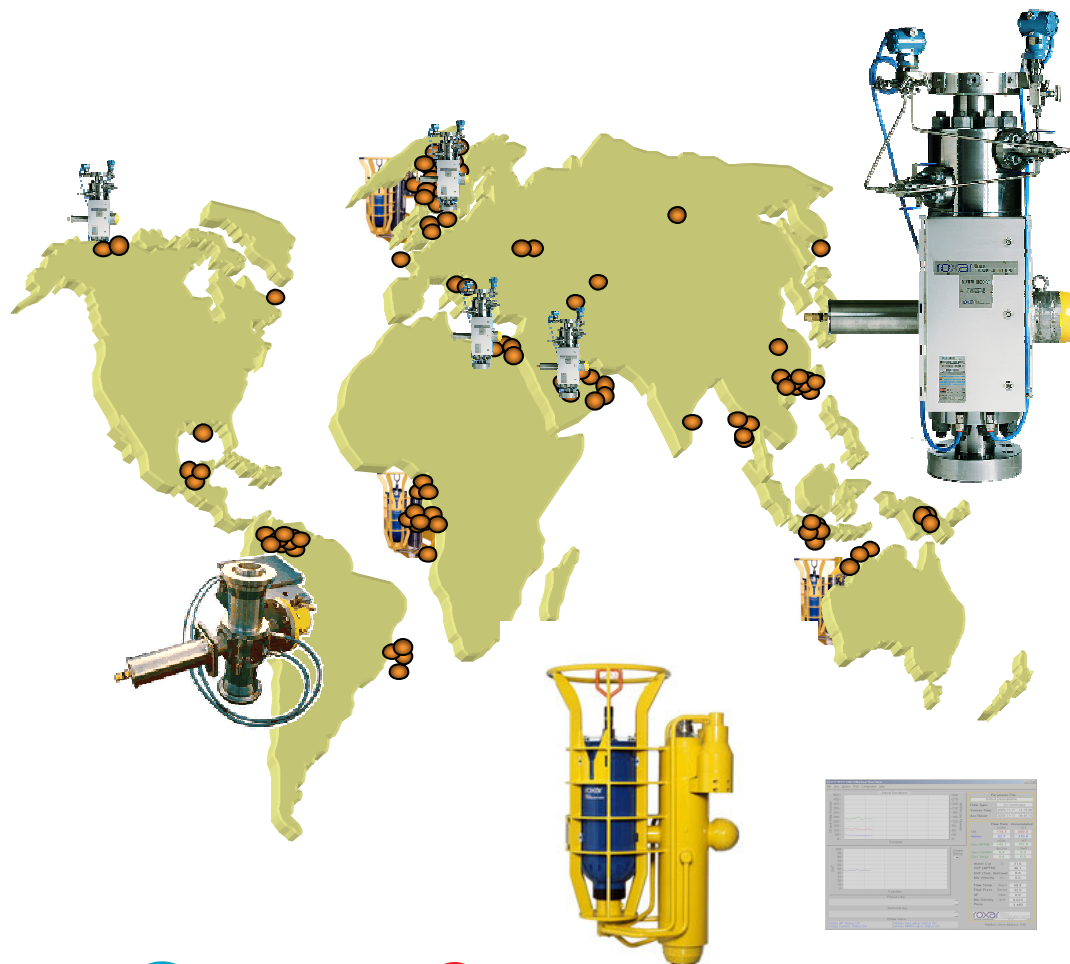
Flerfase: 970

Våtgass 230

Subsea: 400

Topside: 800

72 operatører i 55 land



INTERPRETATION



MODELING



SIMULATION



WELL & COMPLETION



PRODUCTION & PROCESS

Flerfase måling – Ulike behov og løsninger



Topside Meters

RFM WaterCutMeter



0 – 5%

MPFM 2600 non-gamma



0 – 95%

MPFM 2600



0 – 100%

High Gas



96 – 99%

Wetgas



95 – 100%

Gas Void Fraction Range

0 – 99%

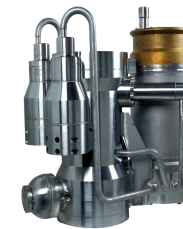
95 – 100%

Subsea Meters

SRC MPFM 1900 VI



RFM WetGas



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MODELING



SIMULATION



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PRODUCTION & PROCESS

Flerfase og våtgass applikasjoner

■ MPFM 2600

0 – 99% GVF

Måler **olje** / gass / vann

Måleusikkerhet:

Væske : $\pm 4\%$ rel

WLR: $\pm 3\%$ abs

Gass: $\pm 8\%$ rel

Anvendelse:

Brønntesting, allokering
produksjonsoptimalisering

■ WGM

90 -100% GVF

Måler **kondensat** / gass / vann

Måleusikkerhet:

Hydrokarbon masse : $\pm 5\%$

WVF : $\pm 0,1 - 0.2 \%$ abs.

WVF følsomhet: $<0,005 \%$ abs.

Anvendelse:

Flow assurance



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PRODUCTION & PROCESS

Målekonsept - flerfase

■ Impedans

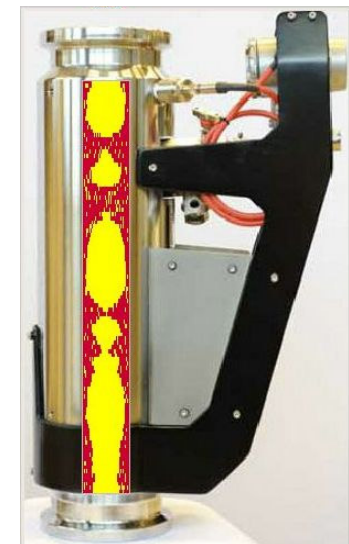
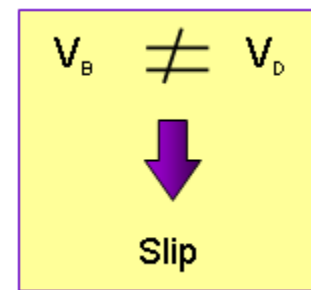
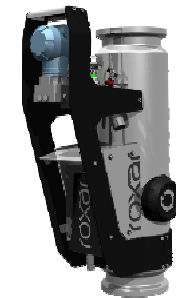
- Kapasitans (0 – 60% WLR)
- Konduktans (60 – 100% WLR)

■ Tetthet

- Densitometer, single energi Cs137
- Alternativ: Non-gamma software

■ "Dual velocity"

- Kryss—korrelasjon – hastighet til fri gass
- Venturi - væskehastighet



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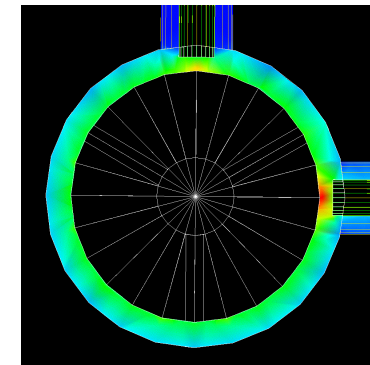
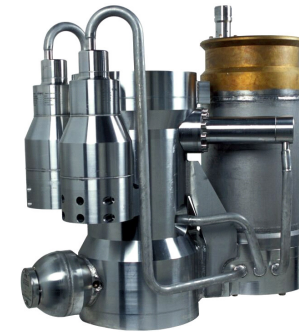
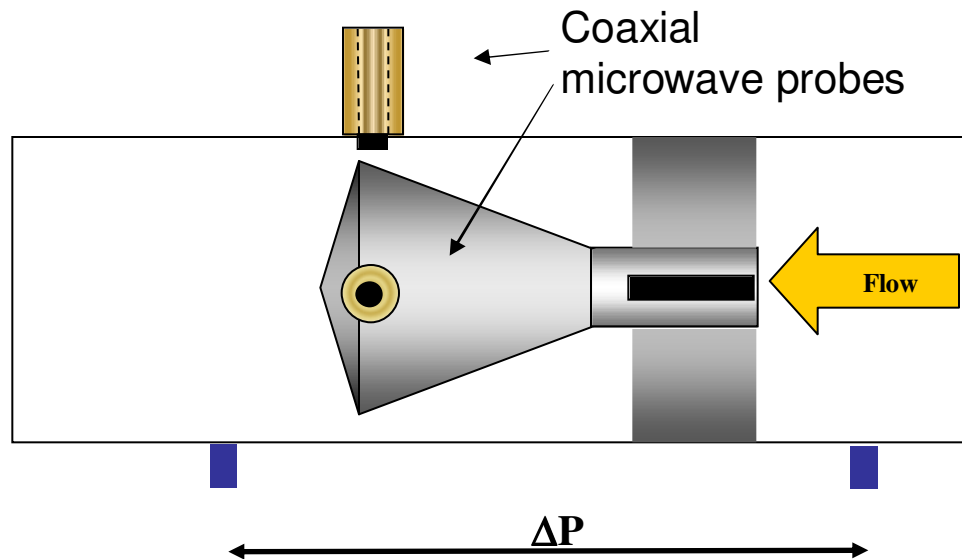
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PRODUCTION & PROCESS

Målekonsept - Våtgass

- Mikrobølge
 - Resonant cavity
 - Høy sensitivitet for vann
- V-cone DP
- Samme prinsipp som WCM



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SIMULATION



WELL & COMPLETION



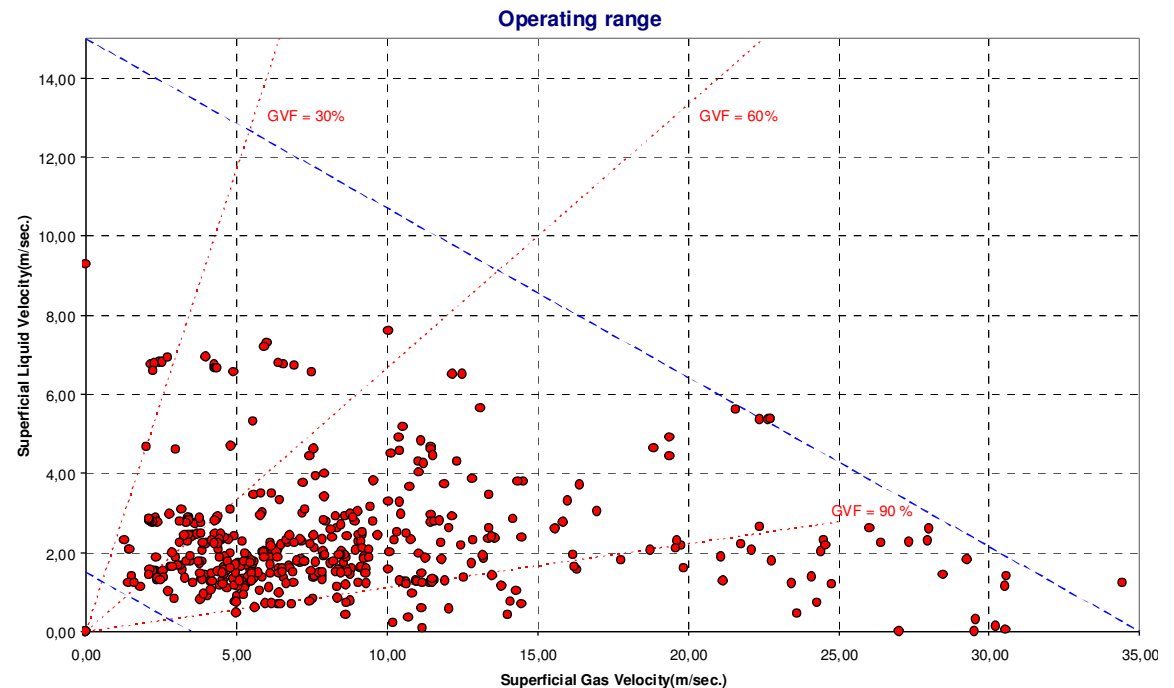
PRODUCTION & PROCESS

Målenøyaktighet – i praksis

Sammendrag av 32 bevitnede tester

MPFM 1900VI

- Størrelser: 2, 3, 4 6, 8"
- WLR: 0-98%
- GVF: 0-100%
- Trykk 3-95 barg
- 455 test punkter
- 4 testanlegg
 - CMR, Roxar, K-lab, NEL
- Tidsrom: 2003-2008



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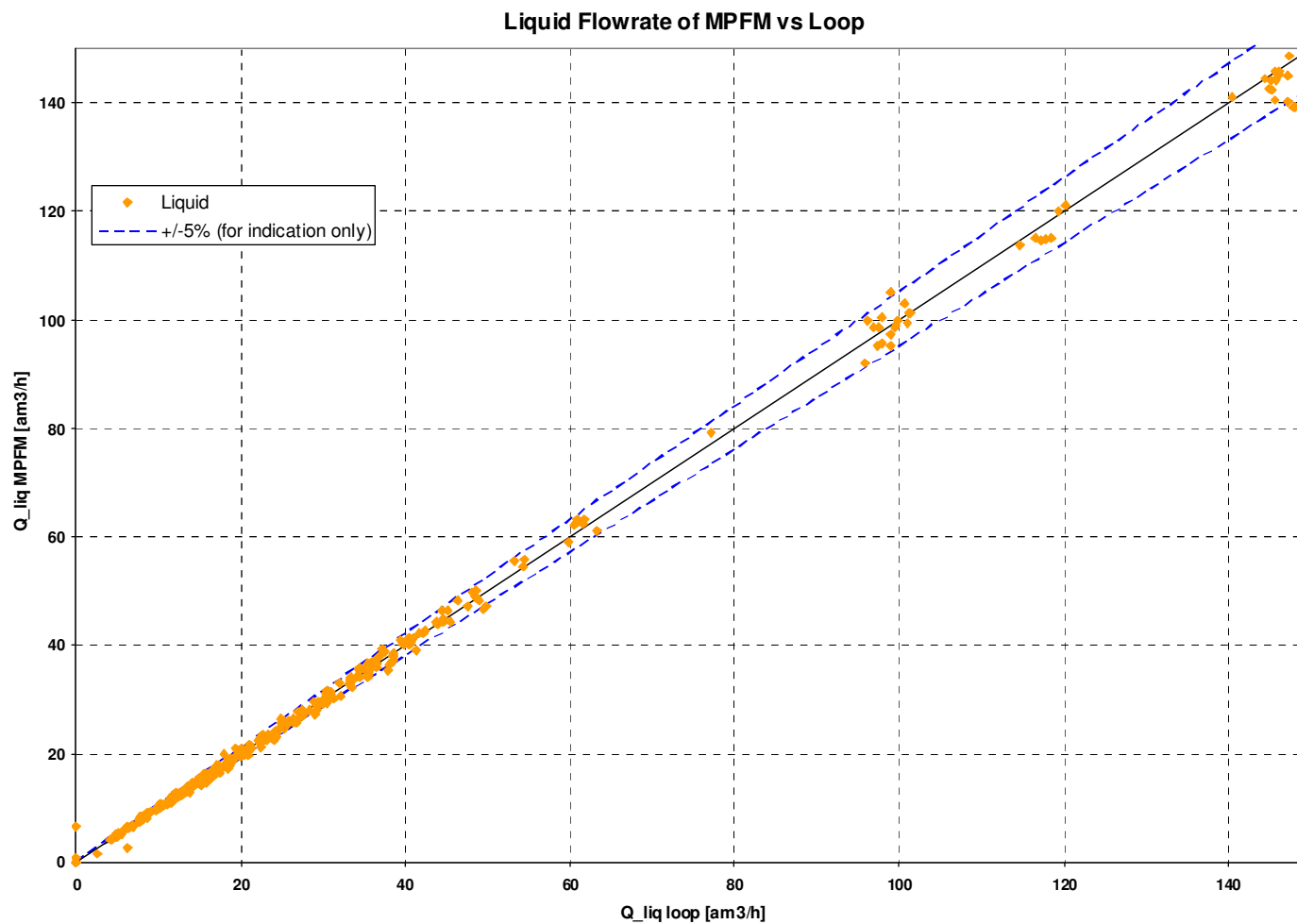
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PRODUCTION & PROCESS

Roxar Multiphase Meter Topside flow tests

Relative liquid volume flow rate performance



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MODELING



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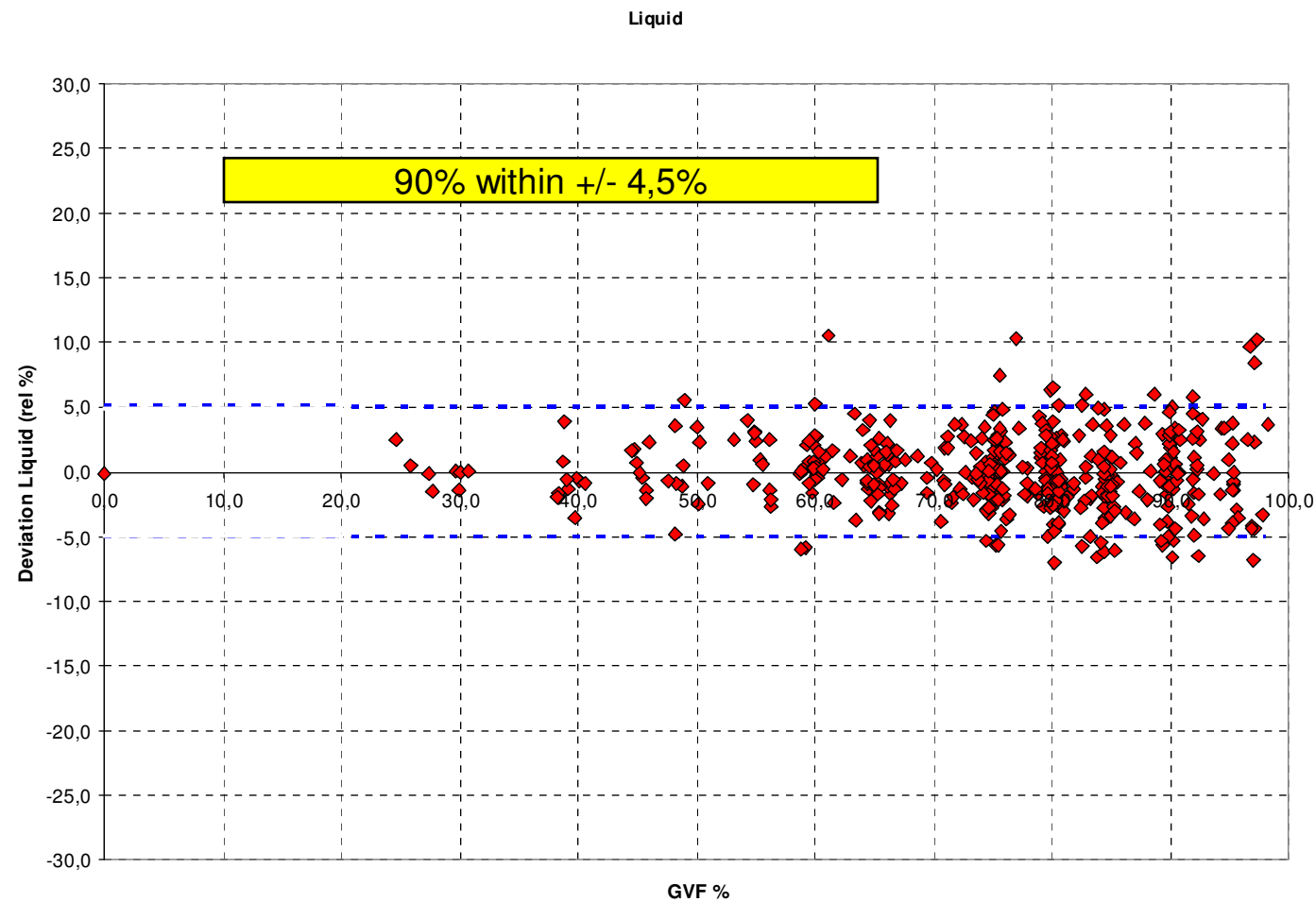
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PRODUCTION & PROCESS

Roxar Multiphase Meter Topside flow tests

Relative liquid volume flow rate uncertainty vs GVF



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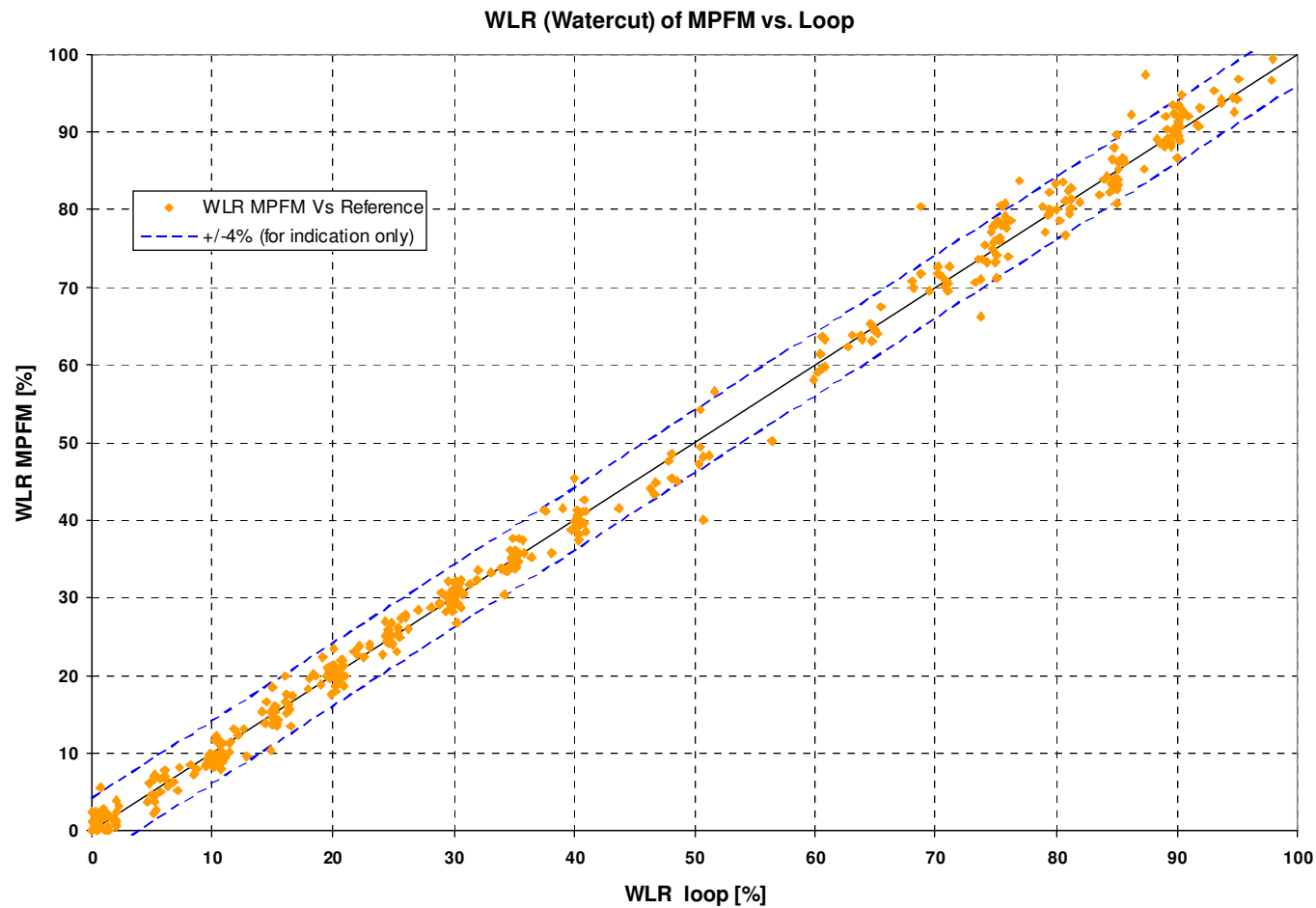
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PRODUCTION & PROCESS

Roxar Multiphase Meter Topside flow tests

Absolute WLR performance



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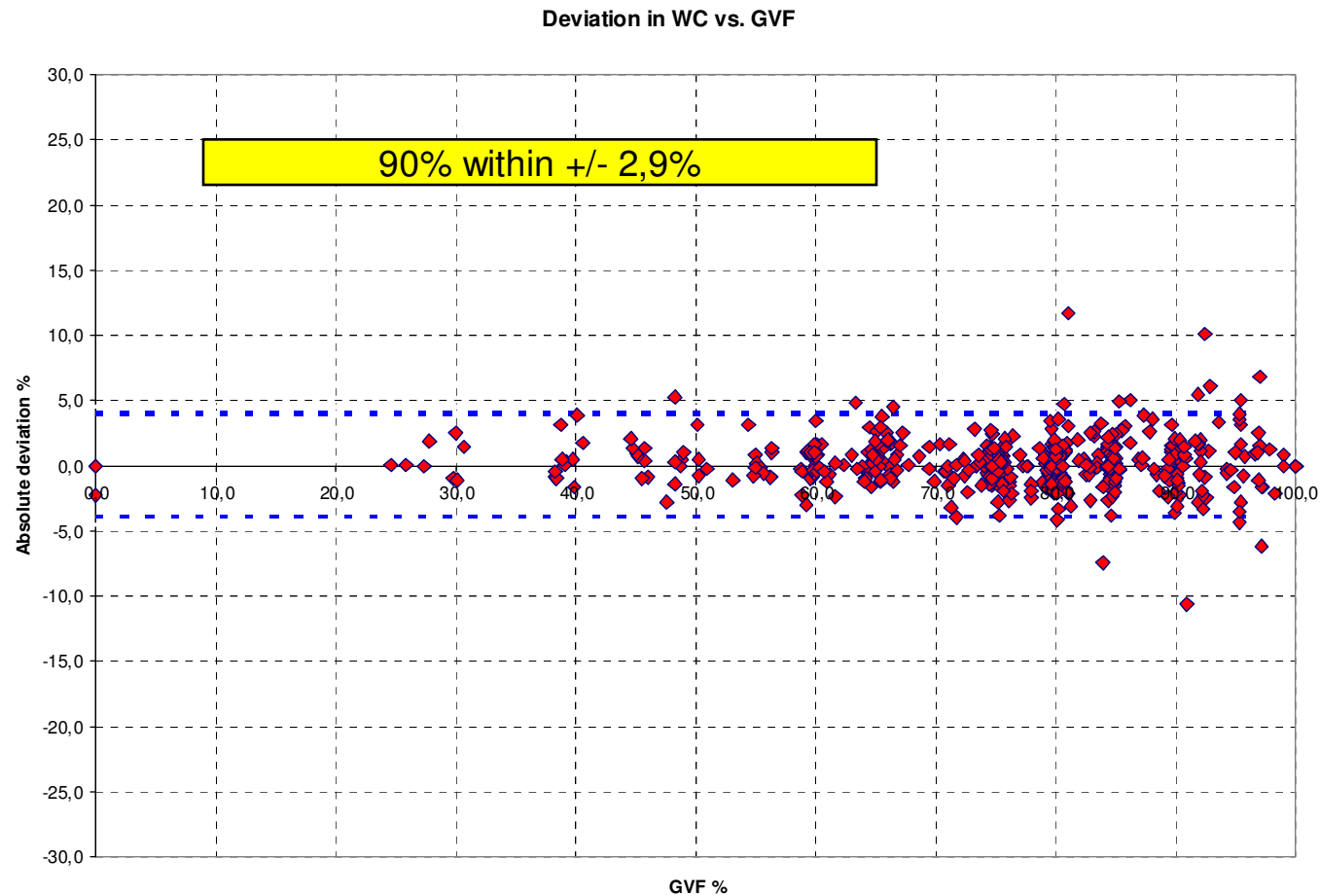
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Roxar Multiphase Meter Topside flow tests

Absolute WLR uncertainty VS GVF



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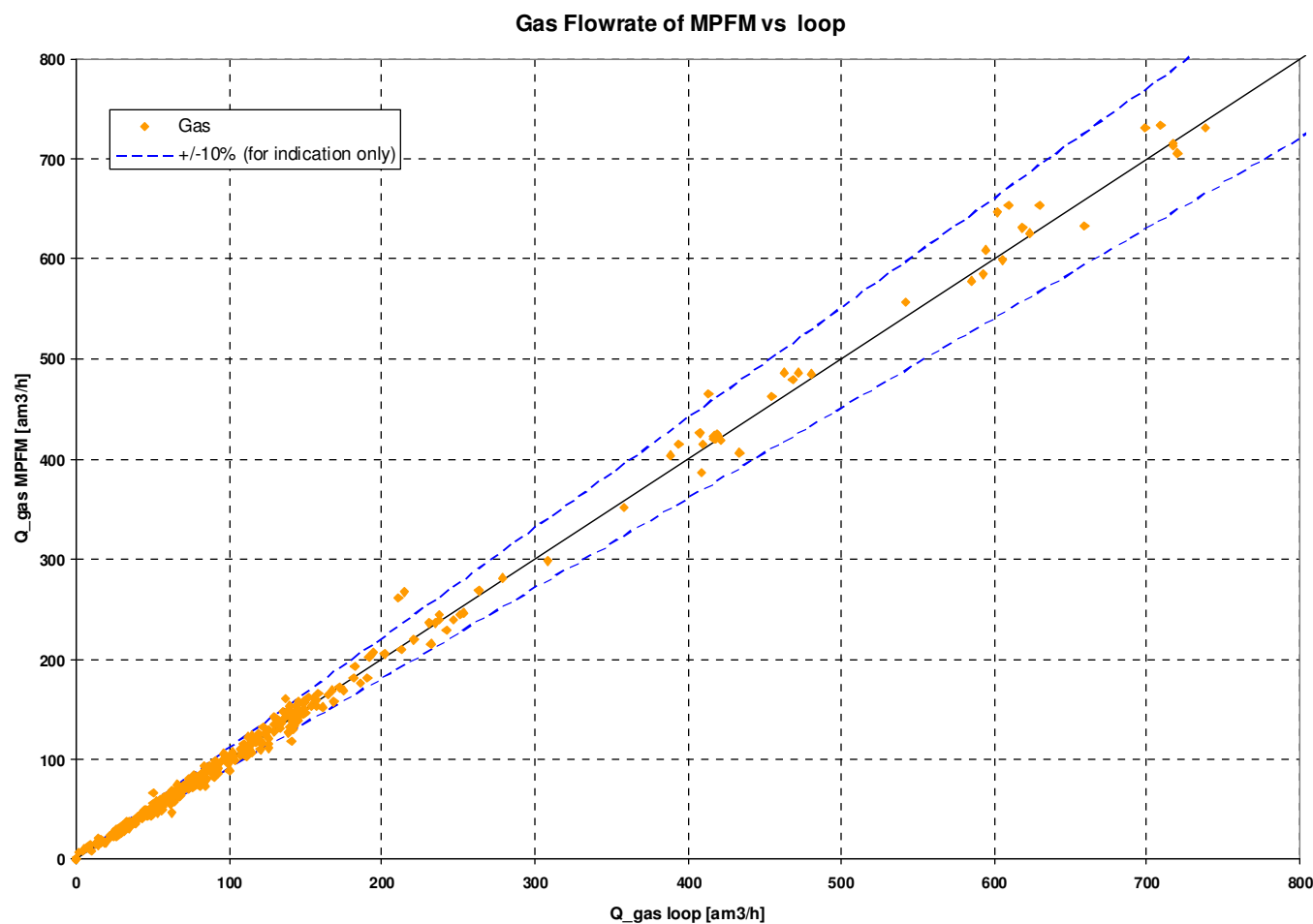
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PRODUCTION & PROCESS

Roxar Multiphase meter -Topside flow tests

Relative gas volume flow rate performance



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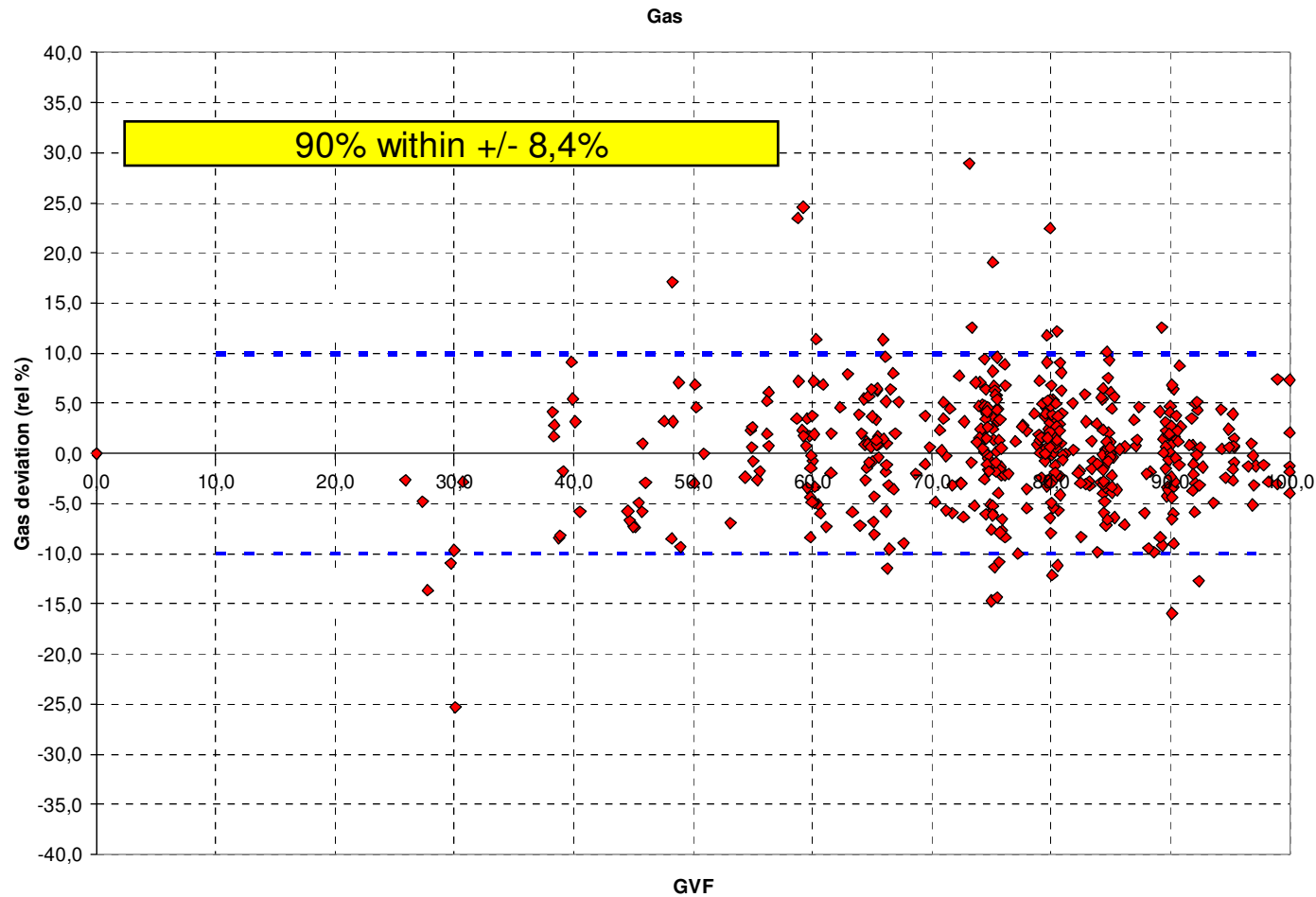
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PRODUCTION & PROCESS

Roxar Multiphase Meter Topside flow tests

Relative gas volume flow rate uncertainty vs GVF



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MODELING



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PRODUCTION & PROCESS

Roxar Multiphase meter -Topside flow tests

■ STATISTIKK

	90% of the test points	95% of the test points
Gas rel %	+/- 8,4%	+/- 10%
Liquid rel %	+/- 4,5%	+/- 5,5%
WLR abs %	+/- 2,9%	+/- 3,6%

Inkluderer usikkerhet i referanse-målinger

- I hovedsak GVF > 70%



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SIMULATION



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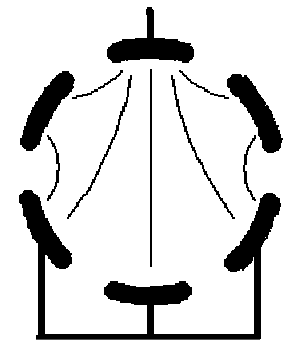
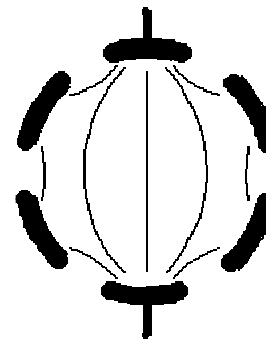
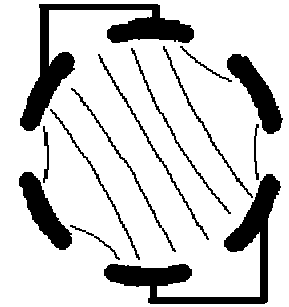
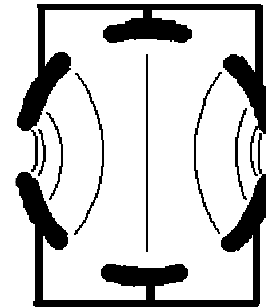


PRODUCTION & PROCESS

Problem: Ønsker bedre nøyaktighet

Løsning: Nærvæggs impedans målinger

- Nytt elektrode design
 - DP 26
 - Tillater nærvæggs målinger
 - Mange ulike konfigurasjoner mulig
 - Voxel-basert signalprosessering
 - Tilgjengelig på MPFM 2600
 - Impedans målinger
 - Kapasitans
 - Konduktivitet



INTERPRETATION



MODELING



SIMULATION



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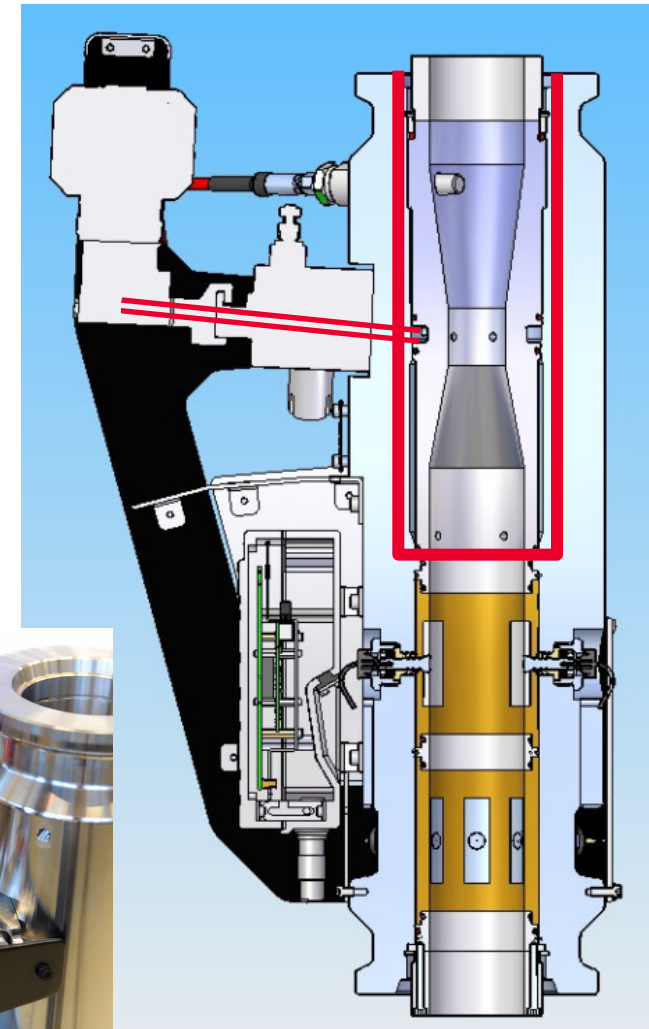
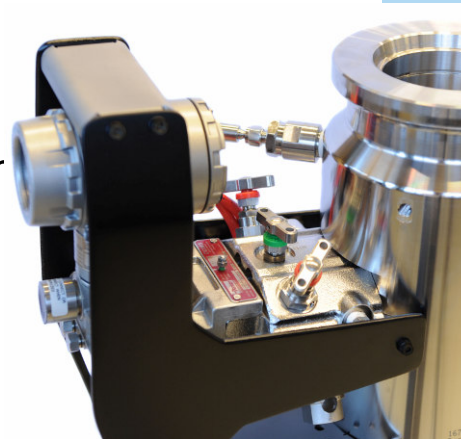


PRODUCTION & PROCESS

Problem: Usikkerhet i dimensjonering

Løsning: Utskiftbar venturi

- Insert-venturi
 - Felt-utskiftbar
 - Enkelt å endre beta-faktor
- Forbedret nøyaktighet på DP
 - 4 P-tappinger
 - Ringkammer
- Kompakt DP måling
 - Integrert isolasjonsventil
 - Direkte montert DP transr
 - Selv-drenerende



INTERPRETATION



MODELING



SIMULATION



WELL & COMPLETION



PRODUCTION & PROCESS

Anbefalinger til operatørselskap / brukere

1. Velg **leverandør**
 - Erfaring
 - Teknologi og produktkvalitet
 - Oppfølging
2. Fremskaff best mulig **dimensjoneringsdata**
 - Rett dimensjonert måler gir best ytelse
3. **Opplæring** og trening av personell
 - Engineering selskap
 - Commissioning team
 - Driftspersonell
4. Oppfølging
 - Prosjektfase
 - Driftsfase
 - Regelmessig **vedlikehold**
 - Data validering



INTERPRETATION



MODELING



SIMULATION



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PRODUCTION & PROCESS

Spørsmål...



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