Halten Øst subsea metering challenges

NFOGM fagdag 29.03.2022

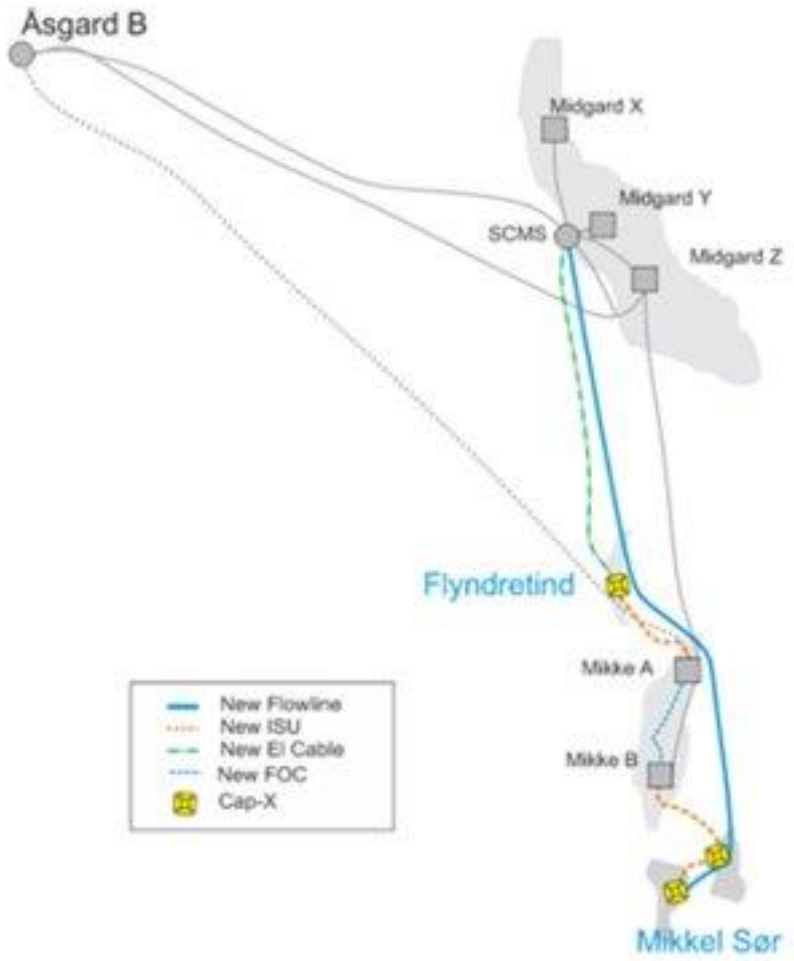
Halten Øst-Sør concept 2017-2019

- Several licenses involved: PL312, PL312B, PL473 and PL074

- Subsea tie-in to SCMS/Åsgard Compression
  - Flyndretind
  - Gamma
  - Harepus
  - Future tie-in

Allocation metering concept

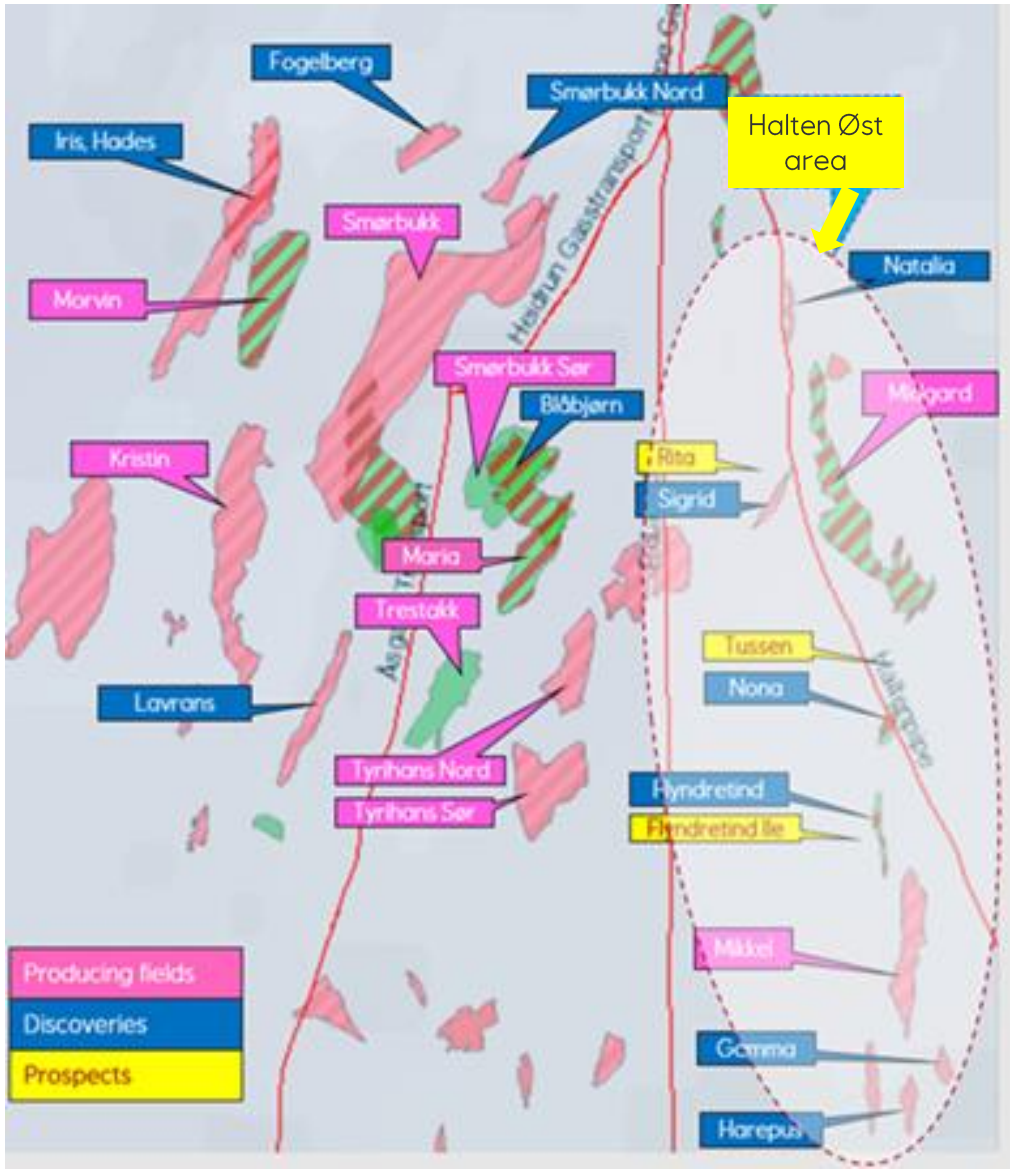
- Well MPFMs
- No possibility to test MPFMs against topside metering
- 2 MPFM in series for verification/back-up
- Concept was matured to DG2 status in 2019



HALTEN ØST

From relinquishment candidate to robust business case

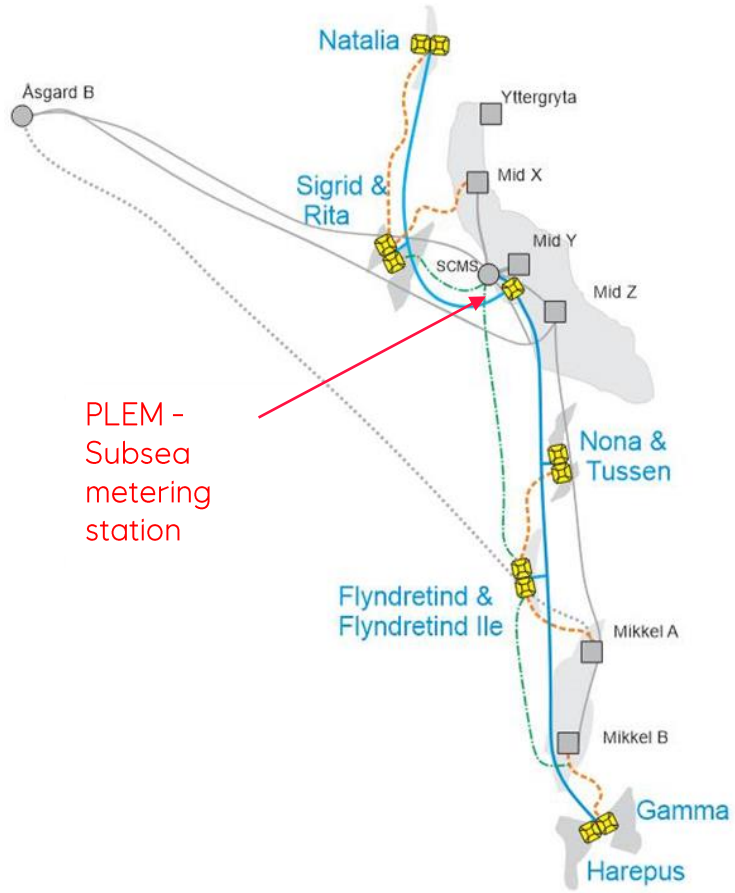
License	Discovery/prospect name	Historical project names/scope		Proposed cluster
PL312	Gamma	Mikkel Sør	Halten Øst-Sør/ «HØS» (DG2 Jan '19, «On hold»)	**Halten Øst** (DG2 Feb '21)
	Harepus			
	Klatremus (prospect)			
PL473	Flyndretind	Flyndretind		
	Flyndretind Ile (prospect)			
PL263	Sigrid	Sigrid/Natalia (DGO Sept '19)		
	Natalia			
	Rita (prospect)			
PL074	Nona	Nona/Tussen (DGO Sept '19)		
	Tussen (prospect)			



The new Halten Øst current concept

Development expanded to six discoveries and 2 production phases:

- Common development of several licenses
- Halten Øst Nord
- Halten Øst Sør
- 6 wells in 2025 + a side-track in 2029 + three optional wells
- Production max: 12 MSm3d



<u>Subsea facilities:</u>

- 5 x two slot satellites
- 6 production wells – retrievable FCM with MPFMs on each well
- Metering station/PLEM including 2 x MPFM in retrievable modules for allocation metering
- 2 pipelines connecting Nord and Sør satellites to PLEM
- Tie-in spools between PLEM and Midgard pipelines and Åsgard Compression

NPD “Metering regulations” - Section 13

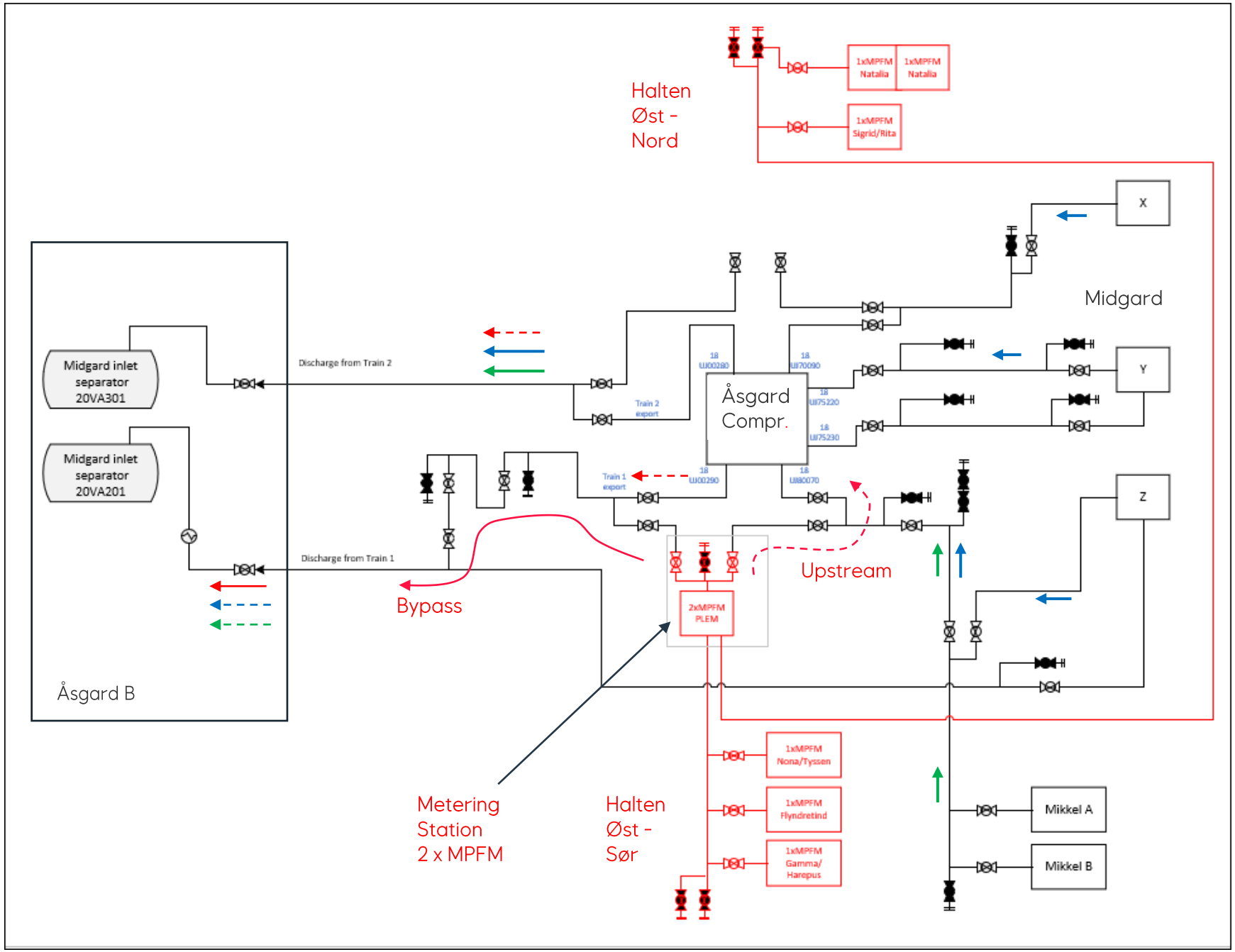
Multiphase measurement Multiphase measurement may be used if traditional single-phase measurement of hydrocarbons is not possible for financial reasons. The multiphase meter can then be used as a fiscal meter.

Halten Øst

Subsea MPFMs will be used for allocation metering.

Question: How to comply with NPD regulations regarding:

- Possibility to calibrate meters against test separator or other reference.
- The planned method and interval for sampling and updating PVT data shall be described.



Halten Øst subsea facilities

Metering concept

The concept includes three measurement levels:

1. Well MPFMs - for well monitoring and surveillance + back up to allocation meters

2. Metering station MPFMs – Halten Øst field allocation meters

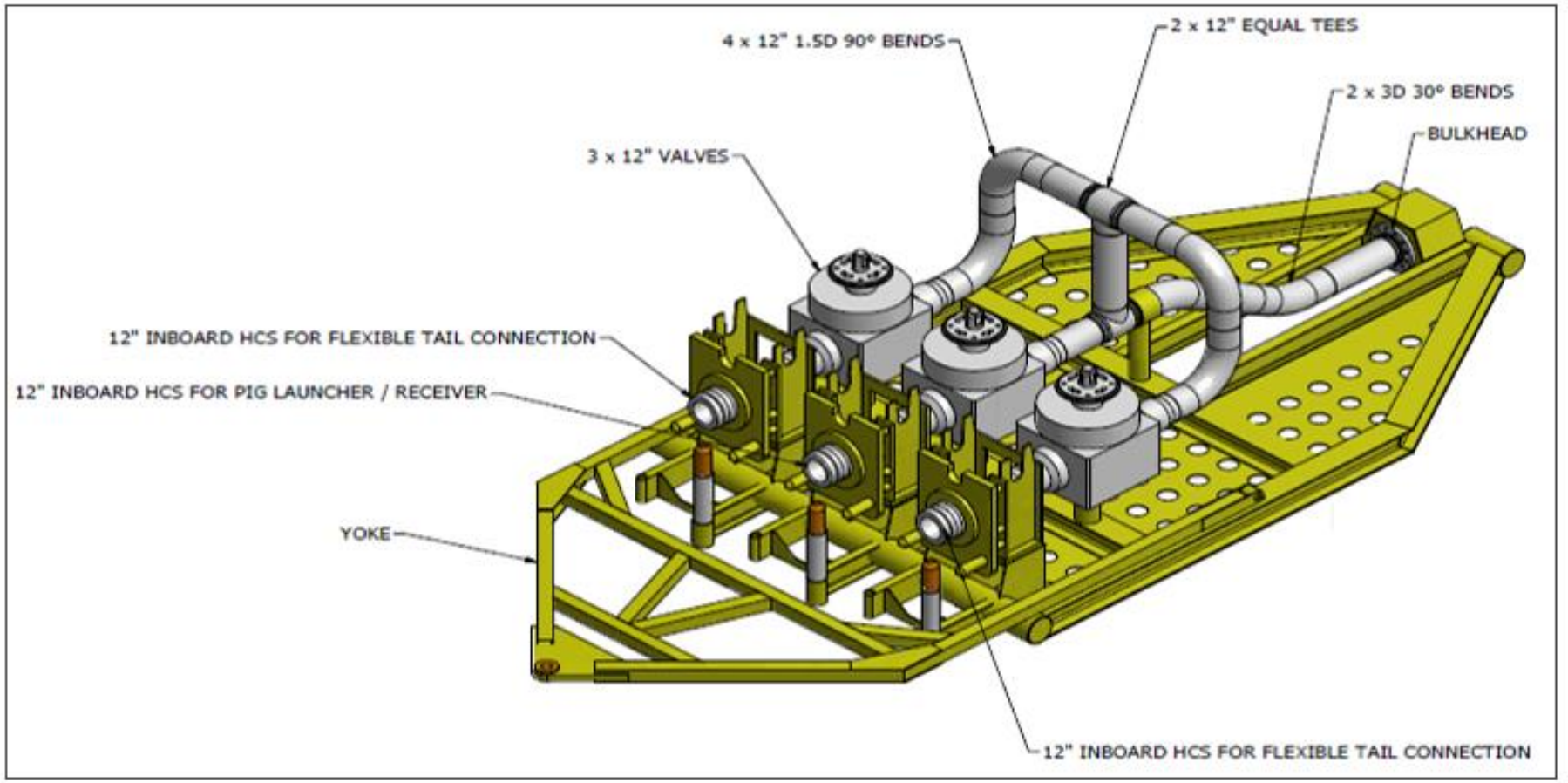
3. Åsgard B Midgard separator metering and sampling
   a) In normal operation, the two separator trains are shared by Midgard, Mikkel, Åsgard A (gas) and Halten Øst
   b) In «Halten Øst calibration mode» one train shall be lined up and used as reference metering for testing of Halten Øst subsea MPFMs.
   c) In «Halten Øst calibration mode», provide Halten Øst fluid sampling at discharge of 1st and 2nd stage separators.

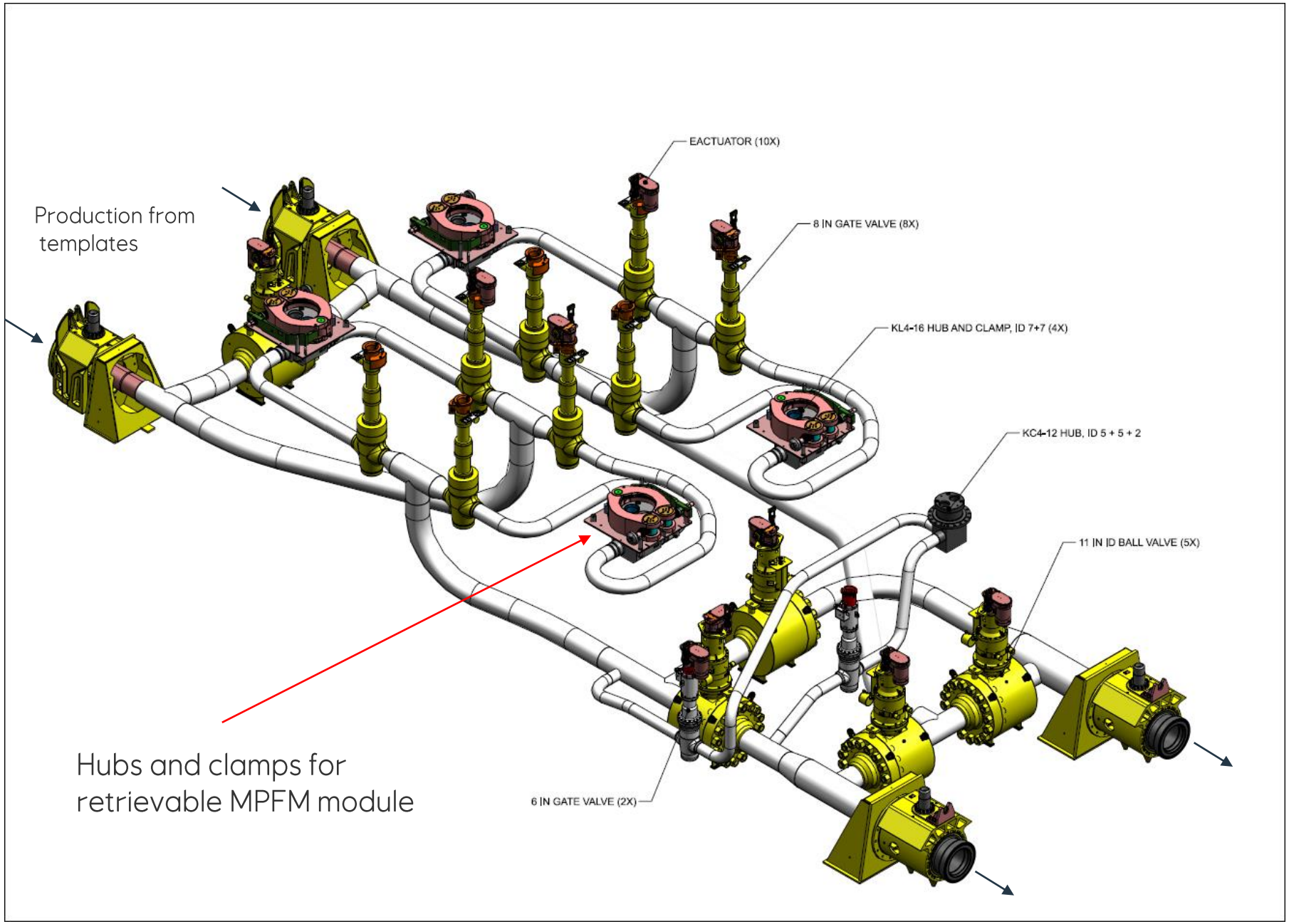
MPFM performance monitoring

- Continuous monitoring of mass balance between well metering and metering station
- Use subsea meters to pipeline leakage monitoring

HALTEN ØST – initial PLEM concept 2020

Without metering





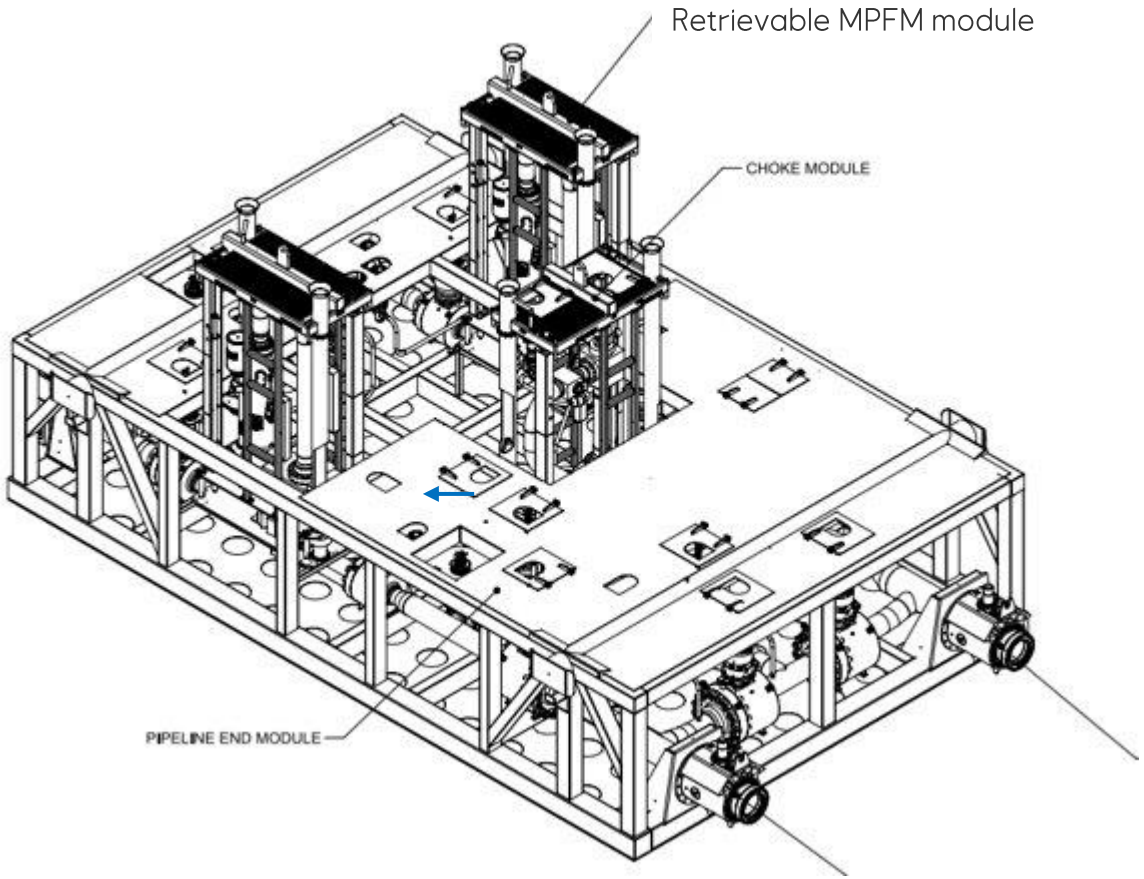
Metering station proposal concept with 4 MPFMs

Proposed piping arrangement From TFMC

Metering station – example

Unique solution

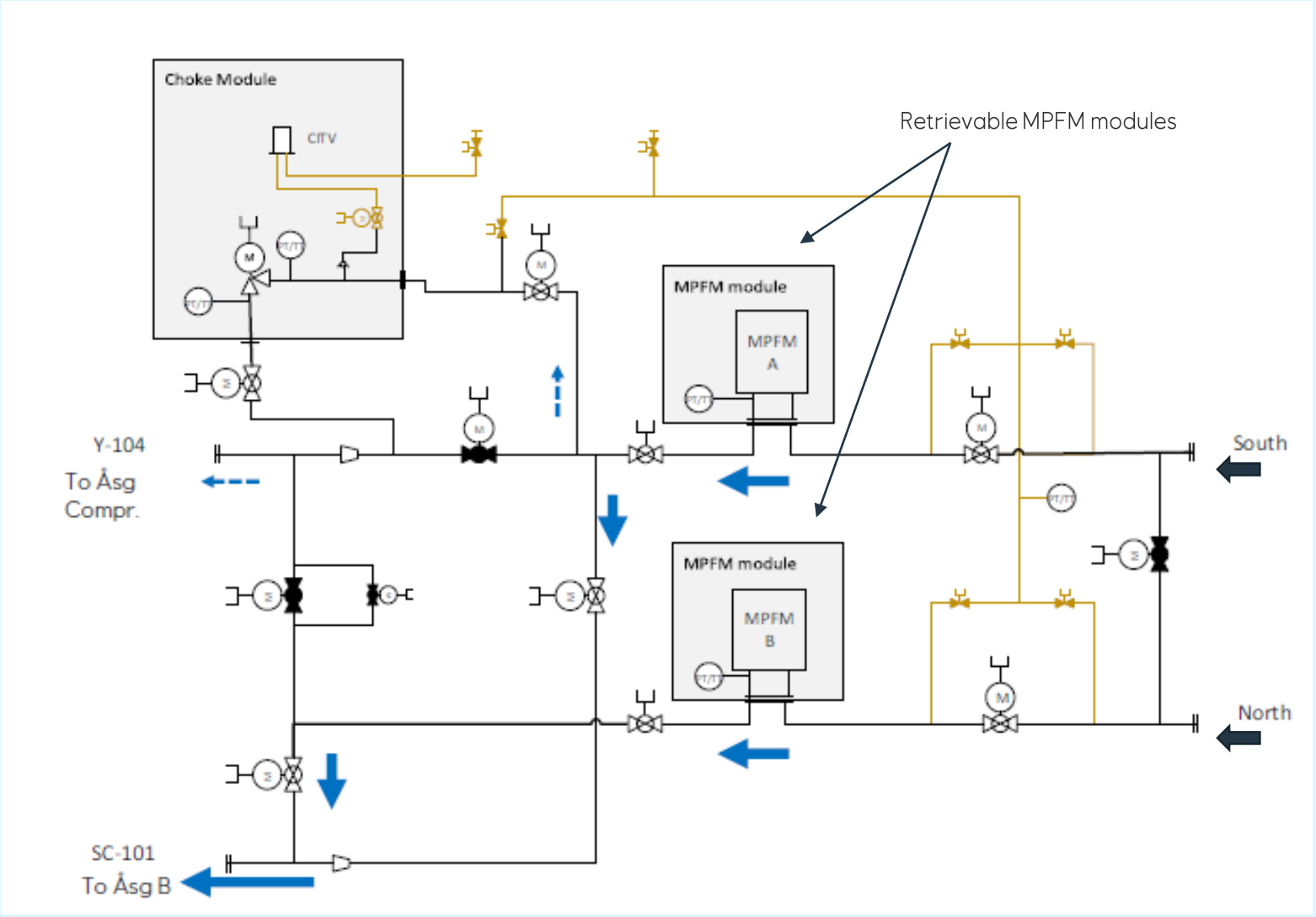
- Use retrievable FCM concept
- Retrievable choke valve
- Electrically operated isolation valves
- Instrumentation



Footprint: 17 x 10 meter
220 mT

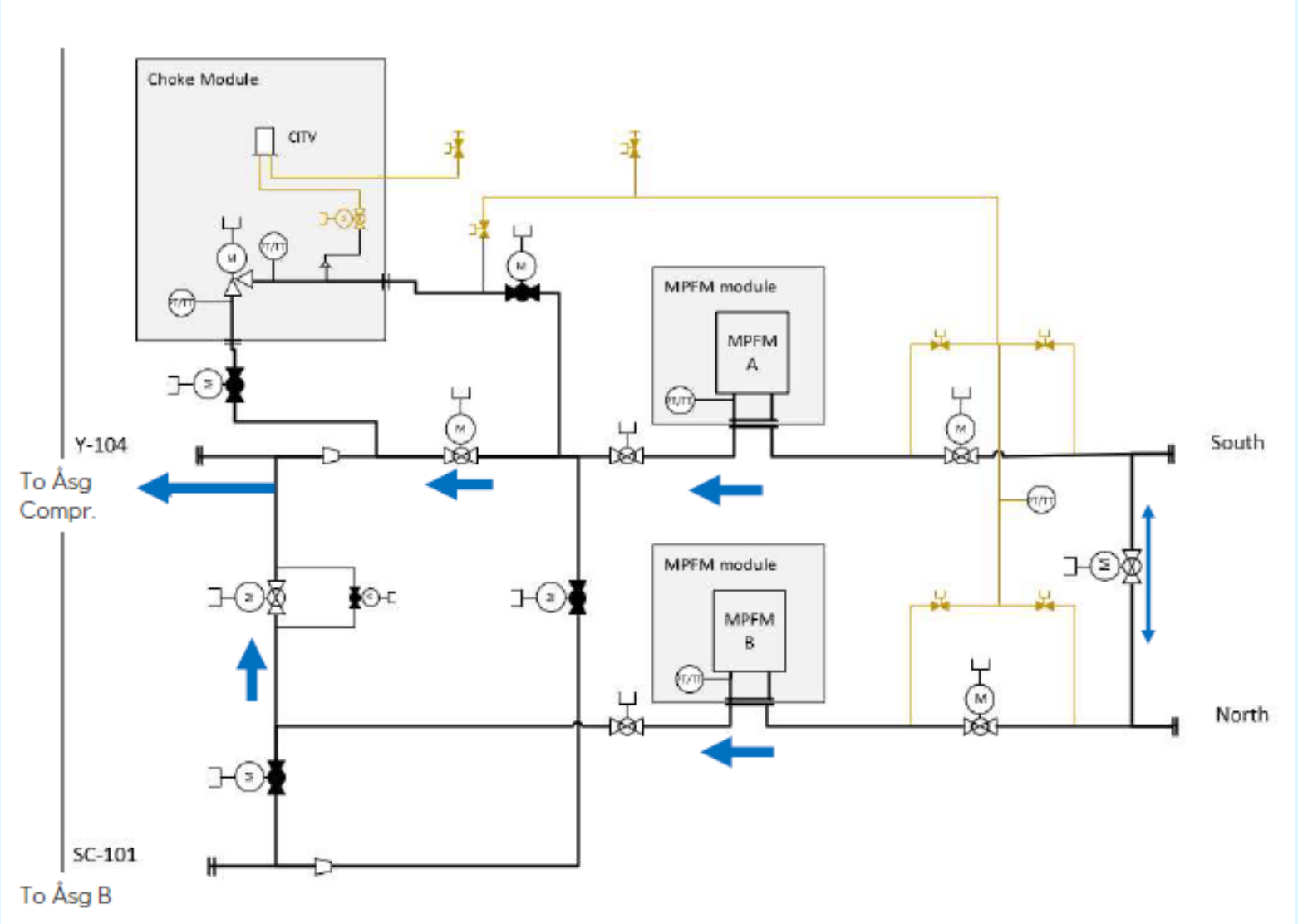
PLEM - Metering station

In normal mode the inlet cross-over on the PLEM is closed and south and north productions are measured separately.

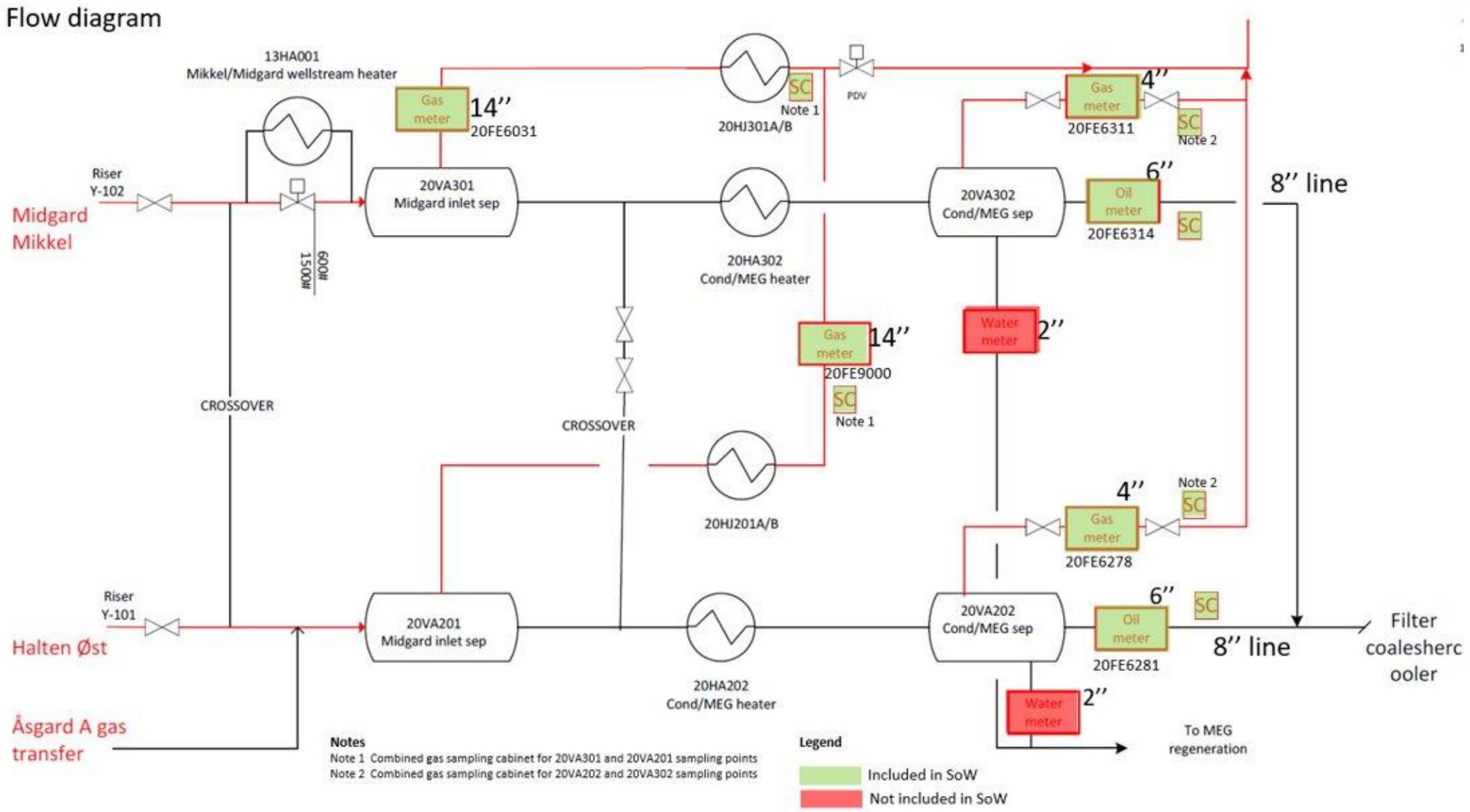


PLEM- metering station

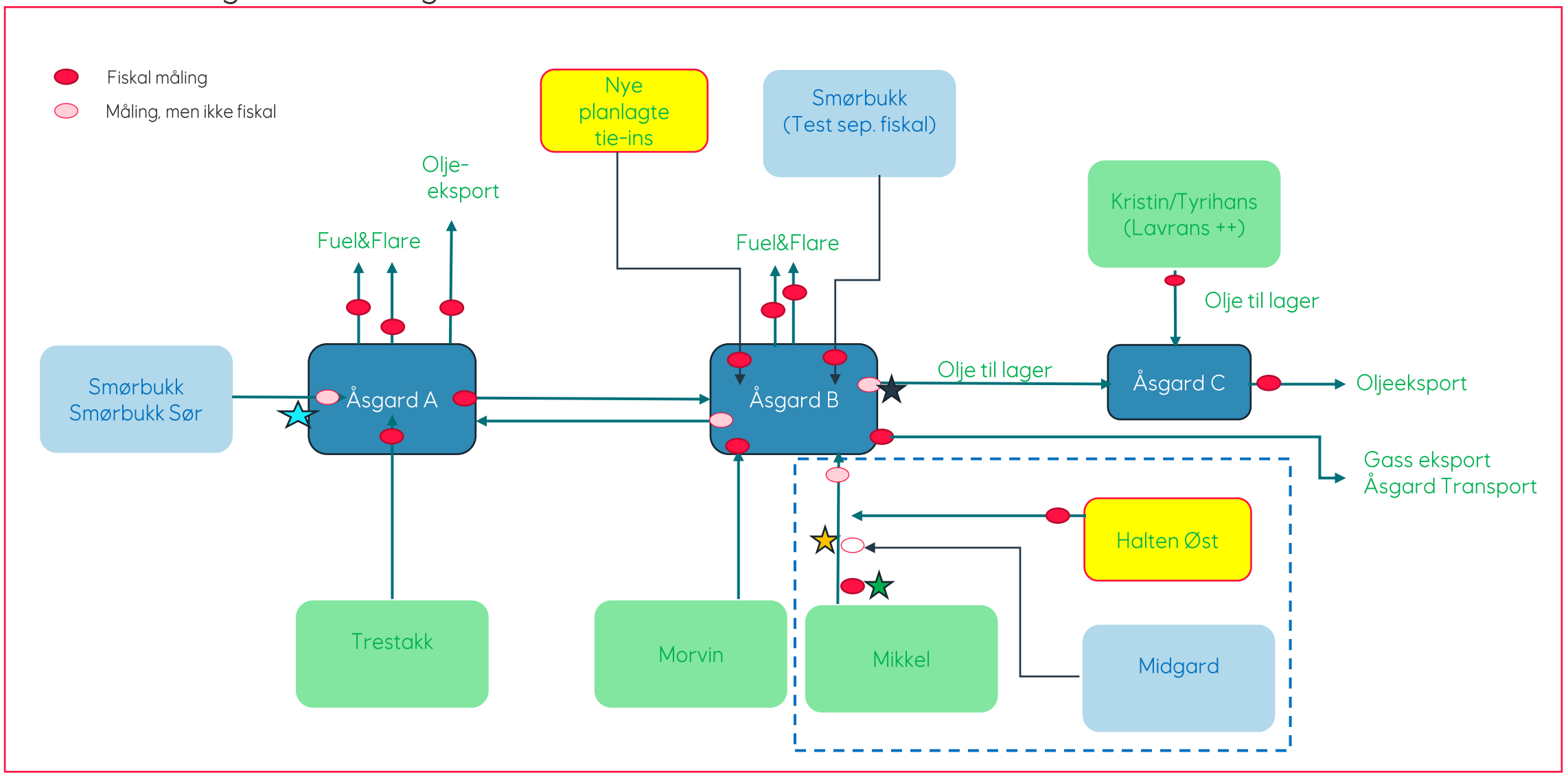
In some production cases, the inlet cross-over needs to be open to avoid extreme velocity in one of the multiphase meters and in these cases the meters need to operate in parallel mode.



Halten Øst -topside modifications Ågard B



«Åsgard allokering»



Ikke måling, beregnes

Målere innstalleres i 2022.

MPFM process Åsgard Compr.

Test separator; ikke fiskal.

Halten Øst PVT handling

Well meters

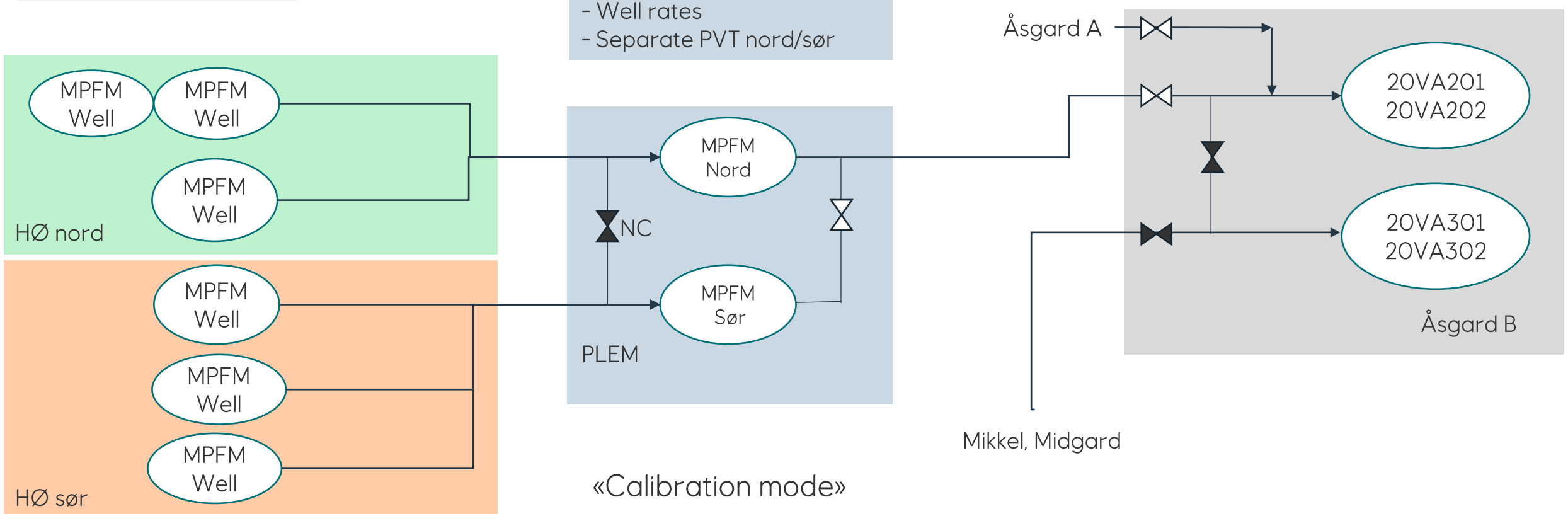
Well PVT - initial samples
- Pres input
- PVTSim calc.

Allocation meters

PLEM mixed PVT calculated using:
- Well PVT
- Well rates
- Separate PVT nord/sør

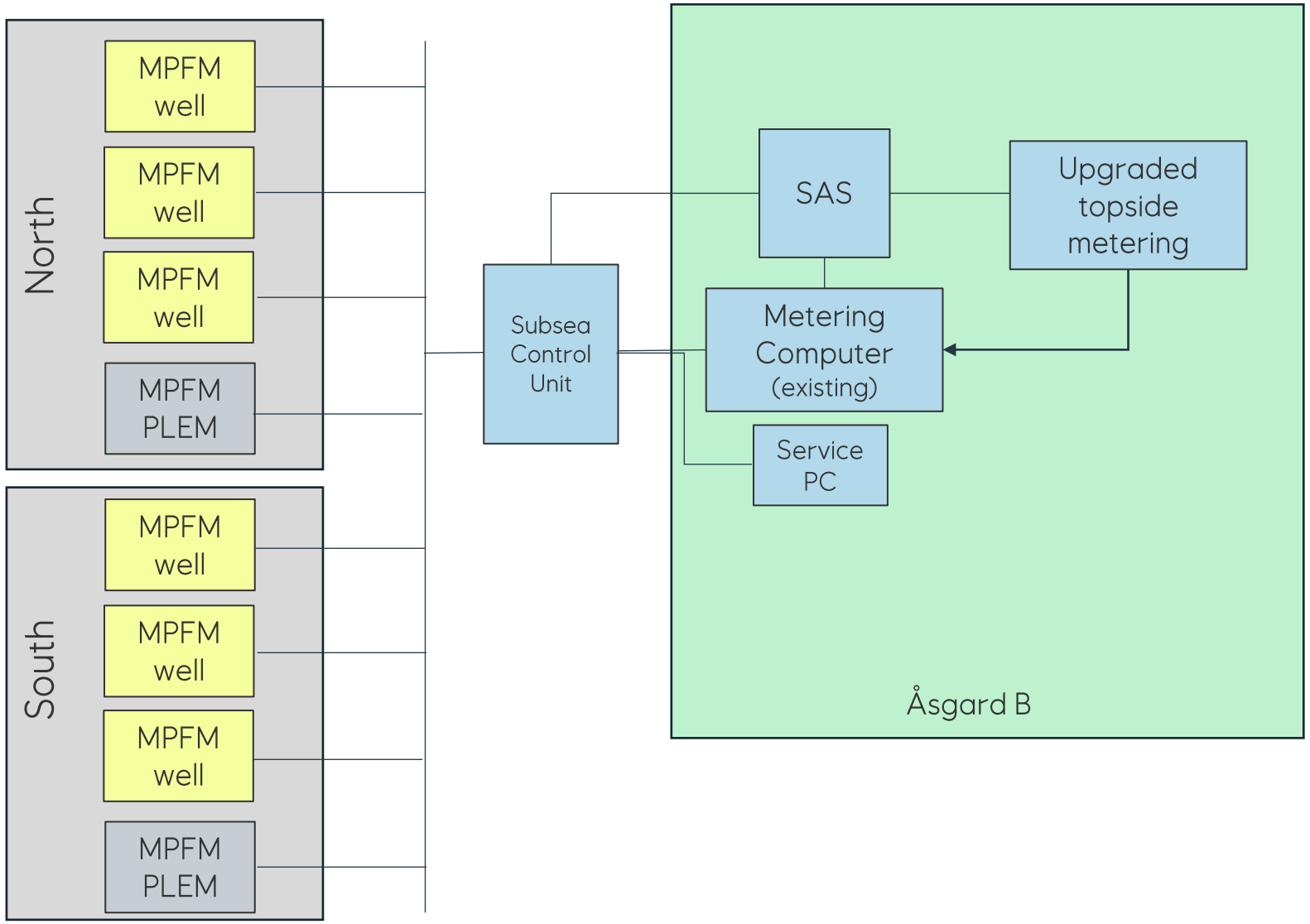
Reference meters Åsgard B

Sep PVT input
- density meters
- PVT sampling / PLEM mix PVT



«Calibration mode»

Metering - simplified topology Halten Øst scope



Q & A

Halten Øst subsea metering challenges

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