



Pipeline Infrastructure Limited

# Digitalization in Operations for Maximizing Efficiency and Safety

*Subrata Banerjee & Bishnu Mishra*

28<sup>th</sup> June 2024



# Speakers Profile



**Subrata Banerjee**  
PIL

Head Pipeline Operations Centre,  
CGM - Pipeline Infrastructure Limited (PIL)  
BEE, BOE

Experience for 17 Years in NG Pipeline Operations/measurements.  
11 Years – Thermal and GT based Power Plant Operation



**Bishnu Mishra**  
PIL

Lead MPOC  
Sr. GM - Pipeline Infrastructure Limited (PIL).  
BTech (Inst)

Experience for 17 Years – NG/ Liquid Ethane Pipeline Operation and  
measurement.

# Content

**01**

A Brief on PIL  
Pipeline

**02**

Requisites of PIL  
Pipeline Operations  
and Control

**03**

Digitalization at PIL  
– Whole pipeline  
perspective

**04**

Enhanced planning  
and analysis with  
PAS

**05**

Enhanced Pipeline  
Integrity control

**06**

Digitalization in  
GTC operations

**07**

Supporting tools of  
POC

**08**

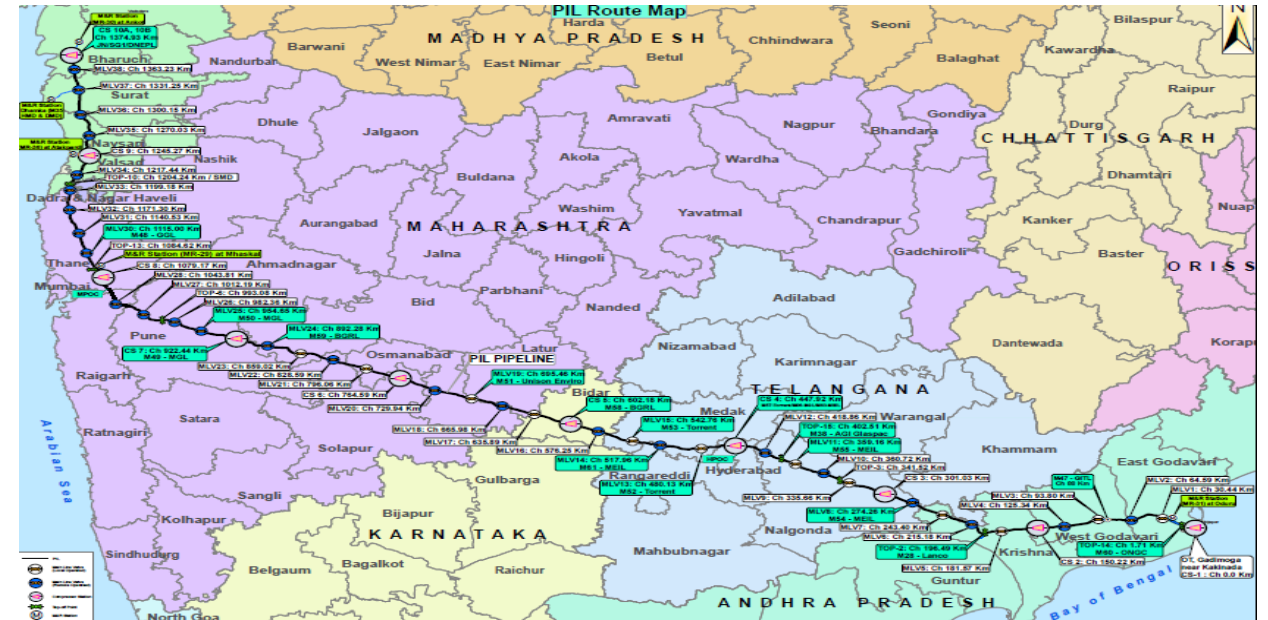
Digitalization in Gas  
Measurement

**09**

Technological  
Advancement

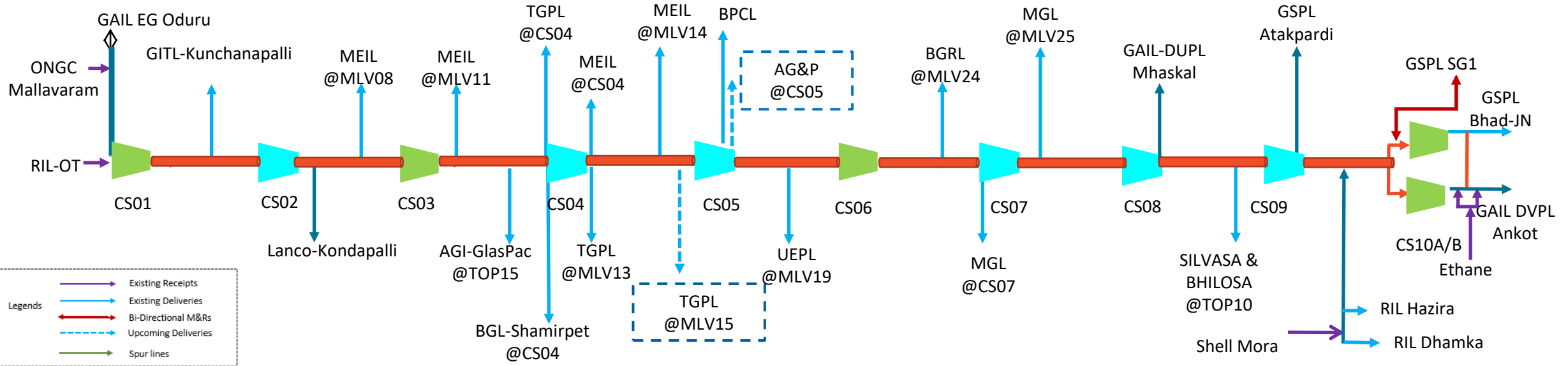
# Brief on PIL Pipeline

Description	Value
Trunk Pipeline Length	~1,375 KM
Trunk Pipeline Outside Diameter	DN 1200 (48 inch)
Cumulative Length of Interconnects	~ 108 KM
Diameter of Interconnects	20" to 30"
Design/Authorised Throughput	85 MMSCMD
Design Pressure	98 Barg
External Anti-Corrosion Coating	Three Layer Polyethylene
No. of Compressor Stations (CS)	11
No. of Mainline Block Valves and Tap-off stations	44
No. of Entry / Exit (CTM)	6 / 23

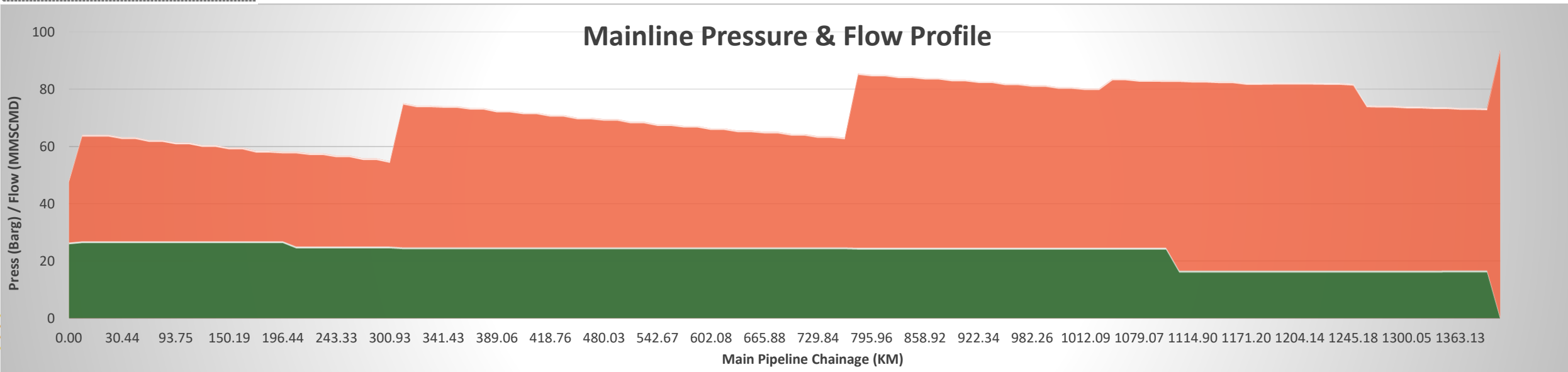


- 11 CS (compression power > 900 MW)
- State of the art features - low emission control, better operational efficiency
- 2 (24X7) Pipeline Operation Centers, at Navi Mumbai and Hyderabad
- Bidirectional and Remote gas flow operation capability
- SCADA system and dedicated OFC

# Brief on PIL Pipeline



## Mainline Pressure & Flow Profile





# Requisite of PIL Pipeline Operations and Control

to maximize operational efficiency and safety.

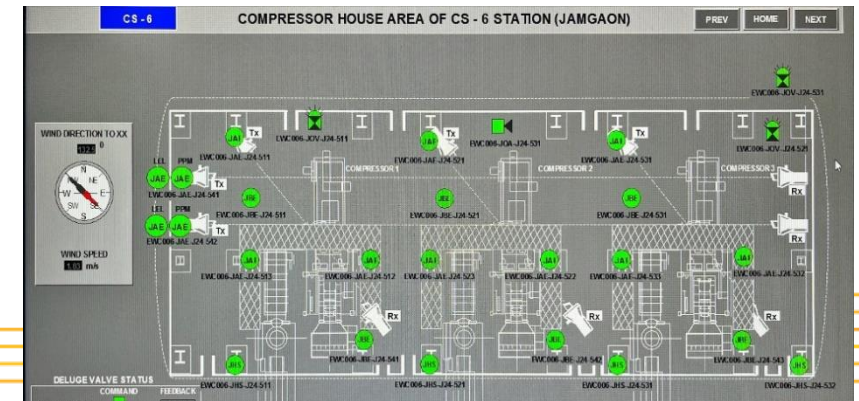
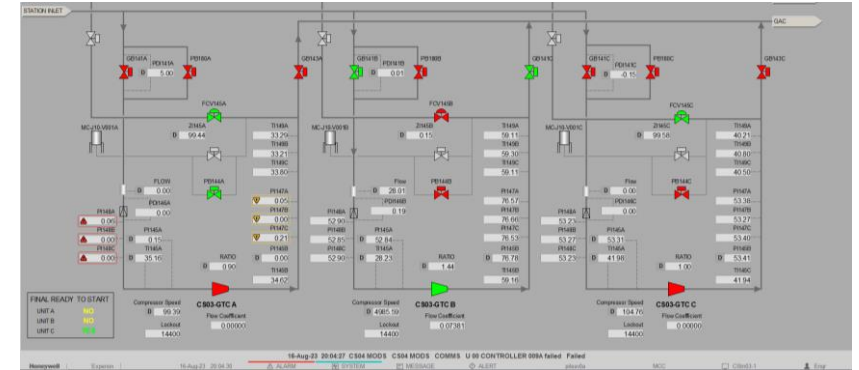
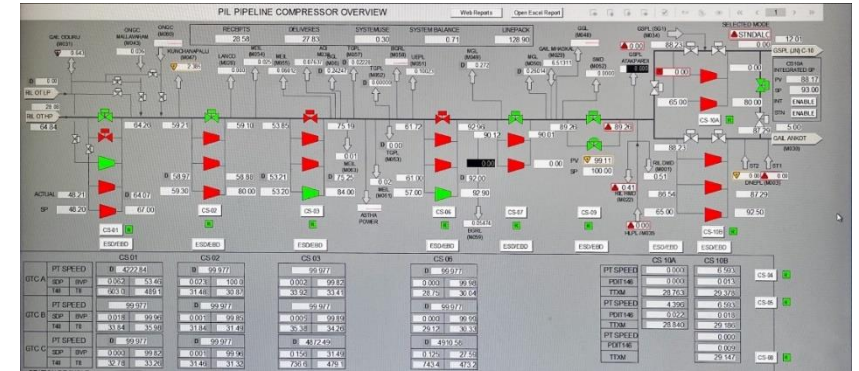
- Operations as whole Pipeline Perspective
- Optimized pipeline operations planning
- Uninterrupted receipt & delivery
- Enhanced Pipeline Integrity monitoring - PAS
- Timely detection of anomalies in Pipeline assets
- Handling emergency scenarios effectively
- Accurate Inventory assessment for identifying fugitive losses in pipeline
- Minimal impact on environment due to emissions
- Correctness in Gas measurement
- Timely Gas measurement validations & billing - RPA



Digitalization enables to perform better & effective remote pipeline operations and control, thus ensures Safety, Reliability & Efficiency.

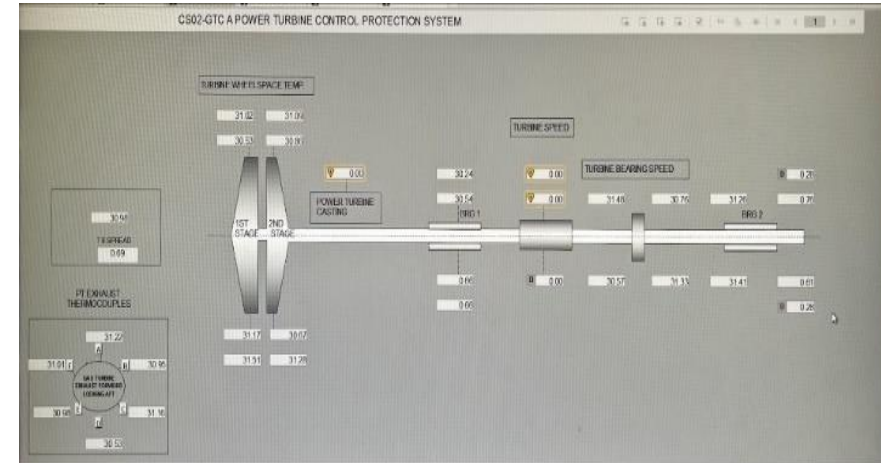
# Operations and Control - as whole Pipeline Perspective

- State of the art SCADA with Remote and Local operation capability.
- SCADA comprises of RTU at Compressor station, servers at both Pipeline Operations Centers (POC).
- Start/stop of CS/GTC from POC
- Control of Gas Pressure, Flow through M&R
- RTU is connected to field instruments, third-party PLC i.e., MK-VI, CCC, F&G, GEG etc.
- Monitor essential parameters of Fire And Gas Detection system of all Above Ground Installations

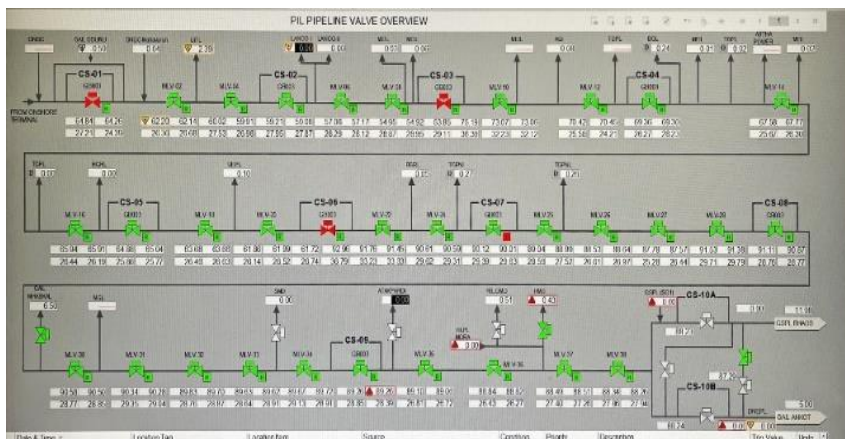


# Operations and Control - as whole Pipeline Perspective

- Monitor CP Parameters and act.
- Monitor pipeline process parameters and open/close valves, regulators.
- Manage alarms with necessary action
- Monitor critical parameters through SCADA and act/notify thru SAP



PIL PIPELINE CP PARAMETERS DISPLAY														
CSMLV	UNIT	PSP	CURRENT	VOLTAGE	CSMLV	UNIT	PSP	CURRENT	VOLTAGE	CSMLV	UNIT	PSP	CURRENT	VOLTAGE
CS-01	TR UNIT A	-0.92	25.47	30.67	MLV-14	TR UNIT A	-1.11	-1.17	14.66	CS-08	TR UNIT A	-1.06	22.91	41.45
	TR UNIT B	-1.35	30.14	43.52	MLV-15	TR UNIT A	-1.27	1.47	9.26	CS-08	TR UNIT B	-1.45	6.19	36.27
	TR UNIT PIPELINE	-1.06	5.23	6.24	MLV-16	TR UNIT A	-1.15	5.89	14.47	CS-08	TR UNIT PIPELINE	-1.36	1.22	10.66



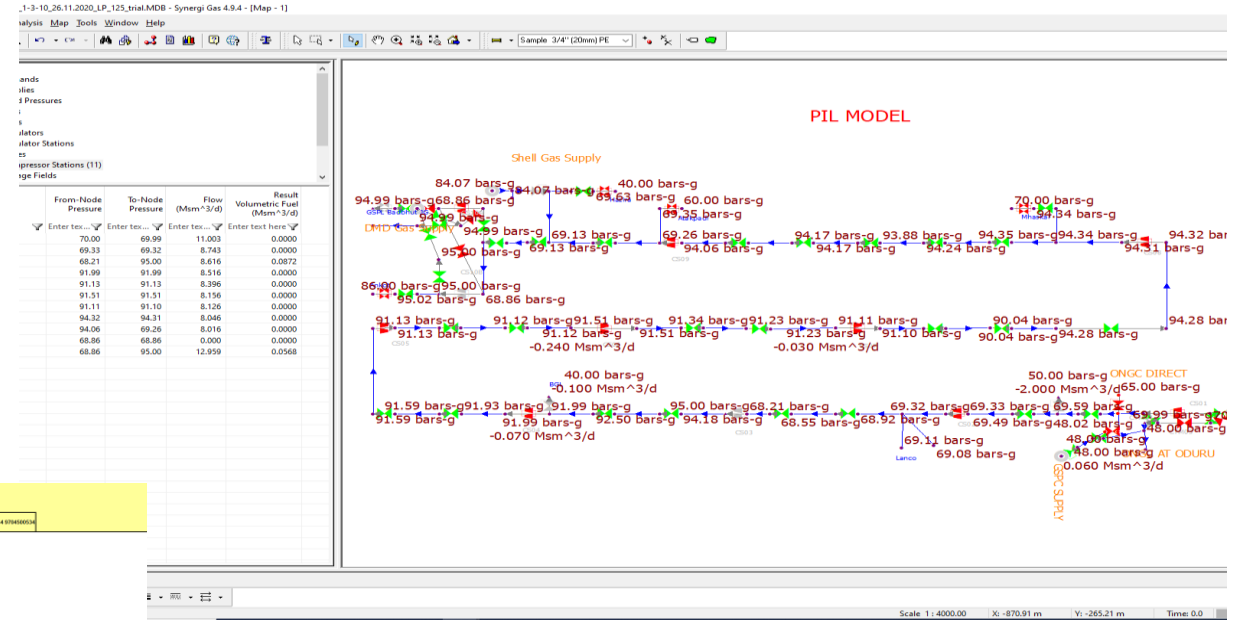
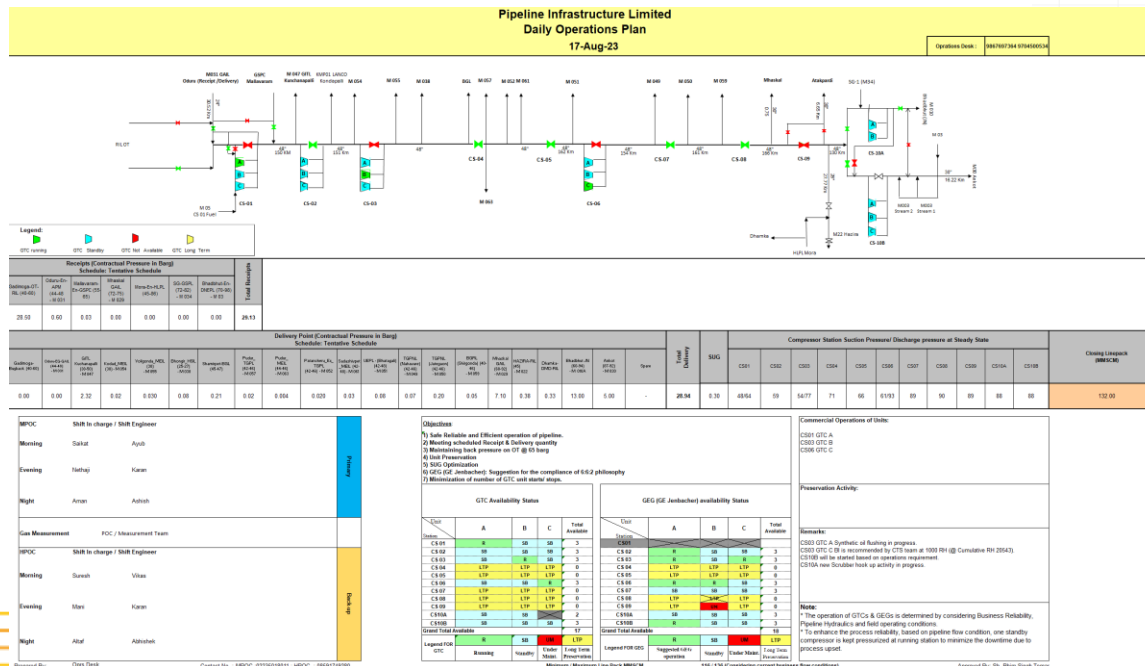
Date & Time	Location Tag	Source	Condition	Priority	Description	Trap Value	Low Value	Unit
18/06/23 19:45:00.001	CS07	FWMSW_01_F01_F01_P01_01_01	PHH	L08	IN LINE PRESSURE S (ZUPPT-001)	61.67	61.69	Bar
18/06/23 19:45:00.001	MM007	FWMSW_01_F01_F01_P01_01_01	PHH	L08	DIFFERENTIAL PRESSURE S (STREAM/UPST-002)	61.68	61.69	Bar
18/06/23 19:45:00.001	MM007	FWMSW_01_F01_F01_P01_01_01	PHH	L08	CONNECTED VOLUME FLOWRATE PER DAY (STREAM-1)	57.265.91	53.119.09	m3/day



# PAS Offline Module - Better Planning and analysis

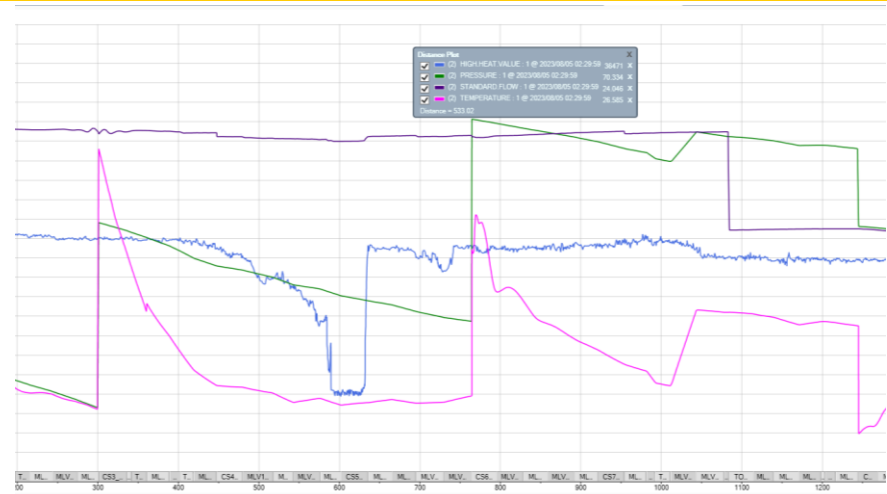
## PIL Pipeline / Asset data used in the Offline PAS models..

- Daily operations Planning
- Operation Budget – Monthly/Annual
- SUG Optimization
- PIL Capacity study for PNGRB submission



# Enhanced Pipeline Integrity control with PAS

- Pipeline hydraulics monitoring and control
- Leak detection in pipeline and Predicting environmental impact.
- Gas composition tracking
- PIG tracking
- Planning Predictive Module



SPS Viewport - PIL\_PPM.svw

FILE CONNECTIONS TOOLS HELP 1\_PIL\_PPM 16918 LOCALHOST\_PAUSED

MPOCPPM\_PIL\_PPM simulation commands | sequences | time slider Run For

MPOCPPM\_PIL\_PPM (1) PIL\_PPM Display (1) Global (1) External (1)

RECEIPT

ATTRIBUTE	OT	M&R31	RIL	M&R43	M&R29	SHELL	M&R34	M&R03	M&R03
		QA15	CM03	GBRC	SOPL	M&R4	GRF5	DRF5L2	
PRESSURE (barg)	65.03	49.47	49.13	64.97	90.31	75.15	73.87	94.90	94.90
FLOW (MMSCMD)	30.00	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TEMPERATURE (degC)	30.65	34.29	26.00	30.64	29.36	28.32	32.67	26.00	26.00
PRESSURE SET POINT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLOW SET POINT	30.00	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TEMP SET POINT	30.65	34.29	26.00	44.80	28.76	30.42	26.00	26.00	26.00

COMPARATOR

	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	CS09	CS10A	CS10B
SUCTION P (barg)	49.12	58.42	51.30	75.05	69.85	65.00	90.40	90.41	86.43	73.87	73.84
DISCHARGE P (barg)	65.03	58.42	81.97	75.05	69.85	94.23	90.40	90.41	86.42	83.60	94.96
FLOW (MMSCMD)	2.18	0.00	29.71	0.00	0.00	28.94	0.00	0.00	0.00	0.00	28.01
DIS TEMP (degC)	30.68	28.92	40.98	27.88	27.26	27.07	27.38	28.28	25.64	36.14	39.86
SUCTION P SET POINT	47.69	61.20	51.30	89.78	87.68	65.00	84.85	86.38	85.24	76.48	73.00
DIS P SET POINT	64.90	98.00	98.00	98.00	98.00	95.00	98.00	98.00	98.00	94.90	94.90
FLOW SET POINT	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00

DELIVERY

ATTRIBUTE	OT	M&R47	M&R24	M&R28	M&R55	M&R38	M&R06	M&R57	M&R52	M&R53	M&R58	M&R51	M&R49	M&R50	M&R48	M&R36	M&R001	M&R22	M&R10A	M&R30
		BUYBACK	GITL	LANCO	MEIS	HSID	BOU	TGPL	TGPL	TGPL	BGLD	UEPL	TGNL	TGNL	GGL	GSPL	HDEL01	HADIRA	GSPL	DVPL
PRESSURE (barg)	65.03	61.03	66.48	66.48	78.15	77.36	75.05	75.05	74.25	71.82	69.64	66.96	90.40	89.37	89.65	77.48	75.15	75.15	90.07	94.97
FLOW (MMSCMD)	0.00	-2.30	0.00	0.00	-0.09	-0.07	-0.36	-0.03	-0.07	-0.07	-0.03	-0.04	-0.07	-0.07	0.00	0.00	0.00	-0.46	-20.00	-8.00
TEMPERATURE (degC)	30.65	28.90	29.68	29.62	28.38	27.87	26.94	26.94	27.22	26.52	25.93	25.61	26.33	26.05	29.10	28.97	28.32	28.32	38.30	38.85
PRESSURE SET POINT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLOW SET POINT	0.00	2.30	0.00	0.00	0.09	0.07	0.36	0.03	0.07	0.07	0.03	0.04	0.07	0.07	0.00	0.00	0.46	20.00	8.00	

COMPRESSOR & BYPASS VALVE STATUS

MODES OF OPERATION

Distance Plot (1)

Distance Plot

(1) PRESSURE 1 66.336 X  
(1) STANDARD FLOW 1 29.029 X  
Distance = 741.75

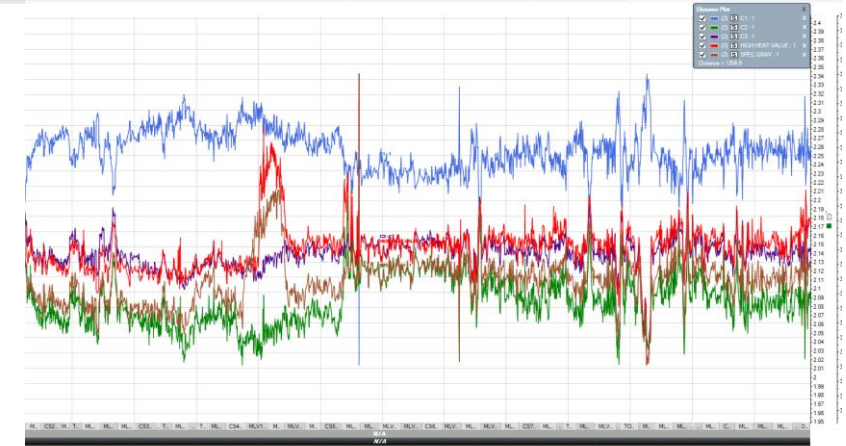
Centrifugal compressor (1)

Device	R	S	ST
CS1_CC1	1.0000	0	STOPPED
CS1_CC2	1.3176	3964.7	RUNNING
CS2_CC1	1.0000	0	STOPPED
CS2_CC2	1.0000	0	STOPPED
CS2_CC3	1.0000	0	STOPPED
CS3_CC1	1.5884	5171.7	RUNNING
CS3_CC2	1.5884	5171.7	RUNNING
CS4_CC1	1.0000	0	STOPPED
CS4_CC2	1.0000	0	STOPPED
CS4_CC3	1.0000	0	STOPPED
CS5_CC1	1.0000	0	STOPPED
CS5_CC2	1.0000	0	STOPPED
CS5_CC3	1.0000	0	STOPPED
CS6_CC1	1.4461	4902.0	RUNNING
CS6_CC2	1.0000	0	STOPPED
CS6_CC3	1.0000	0	STOPPED
CS7_CC1	1.0000	0	STOPPED

External (1) DAILY\_INVENTORY\_A. (1)

DAILY\_INVENTORY\_ANALYSIS

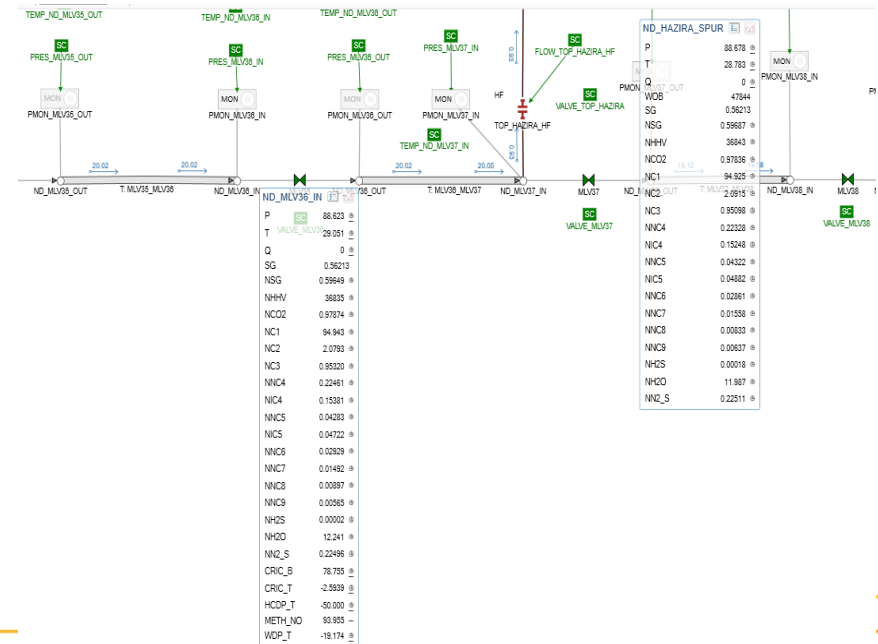
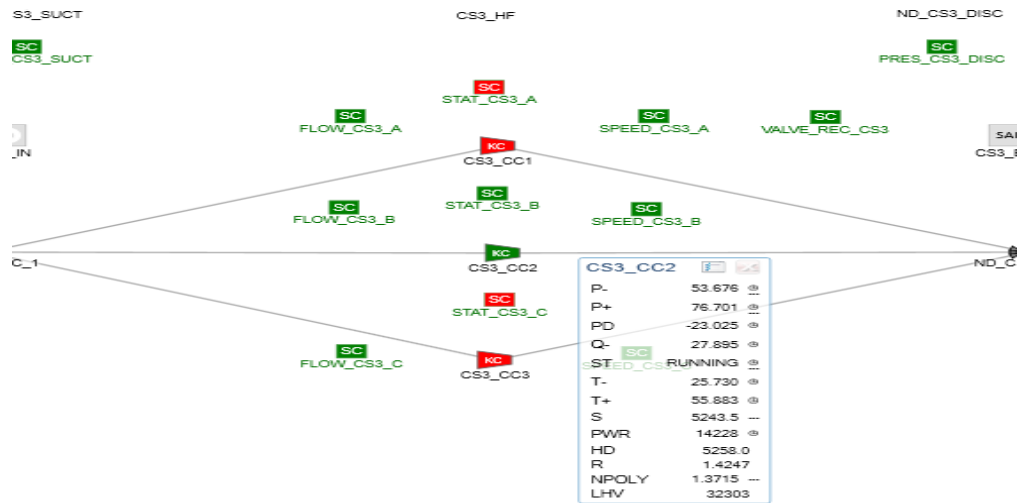
Device	VAL
LP.CS10_MNR30_DVPL_SPUR.VOL.INV	671293
LP.CS10_MNR30_DVPL_SPUR.EGY	28332
LP.CS10_MNR30_DVPL_SPUR.PK	0.00236
LP.CS10_MNR30_DVPL_SPUR.EGY.CHK	87.250
LP.GD_PREV_CS10_MNR30_DVPL_SPUR.VOL	0.88528
LP.GD_CS10_MNR30_DVPL_SPUR.VOL	0.71227
LP.GD_CS10_MNR30_DVPL_SPUR.VOL.CHANG	0.00087
LP.GD_PREV_CS10_MNR30_DVPL_SPUR.EGY	25311
LP.GD_CS10_MNR30_DVPL_SPUR.EGY	28307
LP.GD_CS10_MNR30_DVPL_SPUR.EGY.CHANG	24.621
LP.GD.RESET	06/10/2022 0
LP.TOTAL.VOL.INV	129.98
LP.TOTAL.VOL.PK	0.14934
LP.TOTAL.EGY.INV	4799354
LP.TOTAL.EGY.PK	85163
LP.GD.PREV.TOTAL.VOL.INV	129.98
LP.GD.TOTAL.VOL.INV	129.95
LP.GD.TOTAL.VOL.CHANGE	0.03286
LP.GD.PREV.TOTAL.EGY.INV	4792838
LP.GD.TOTAL.EGY.INV	4798137
LP.GD.TOTAL.EGY.CHANGE	1217.8



# Enhanced Pipeline Integrity control with PAS

- Essential pipeline and asset parameters (derived by PAS) monitoring for better and effective asset operation and control.
- Online dew point temperature monitoring at all exit points.
- Calculation of offline dew point for any gas composition
- Record in historian for analysis

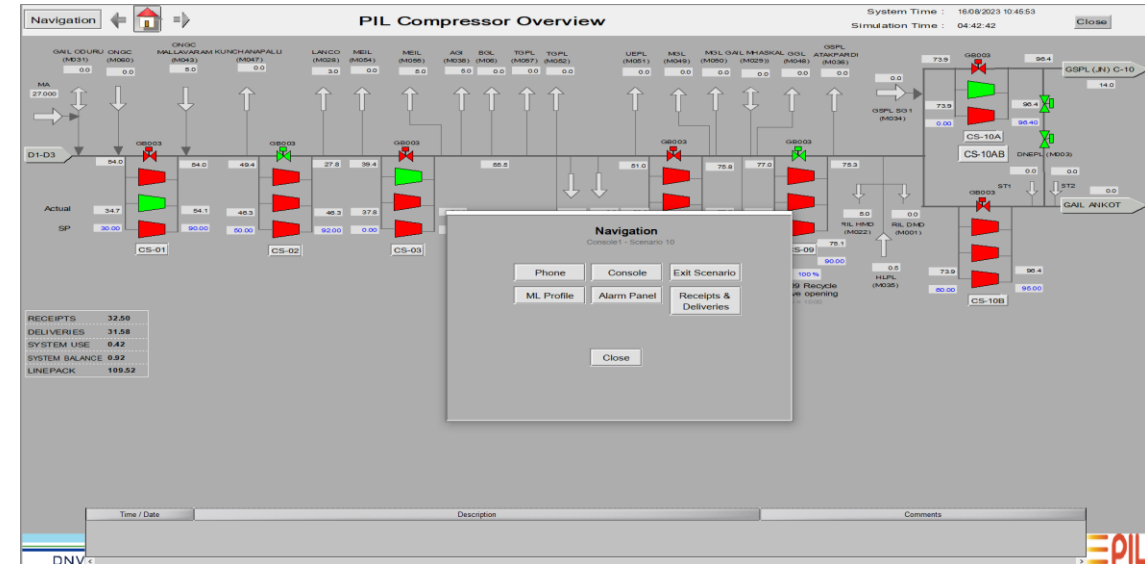
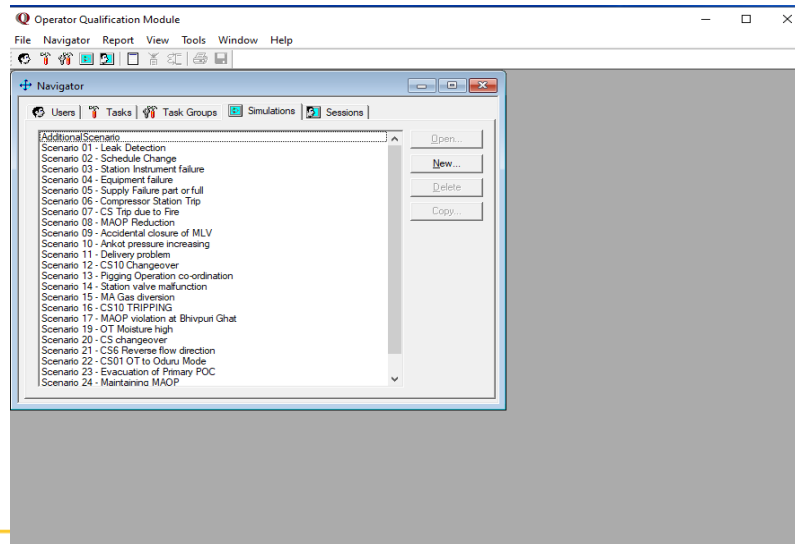
EoS	PR	Temperature	35.87 C		
Pressure	47.64 Barg	Cricondenbar	79.00 Barg		
Flow	2.28 MMSCMD	Cricondentherm	-14.29 C		
Hydrocarbon Dewpoint	-15.47 C	Hydrate Formation	-133.73 C		
Water Dewpoint	0.10 C	Methane Number	92.74 C		
C1	94.223 %	IC5	0.087 %	NC9	0.000 %
C2	2.235 %	NC5	0.065 %	CO2	0.926 %
C3	1.177 %	NC6	0.144 %	N2	0.856 %
IC4	0.224 %	NC7	0.000 %	H2O	0.000 %
NC4	0.326 %	NC8	0.000 %	H2S	0.000 %



# Simulator Training through PAS Trainer

## POC Engineers training - Offline Trainer Module (Operator Qualification).

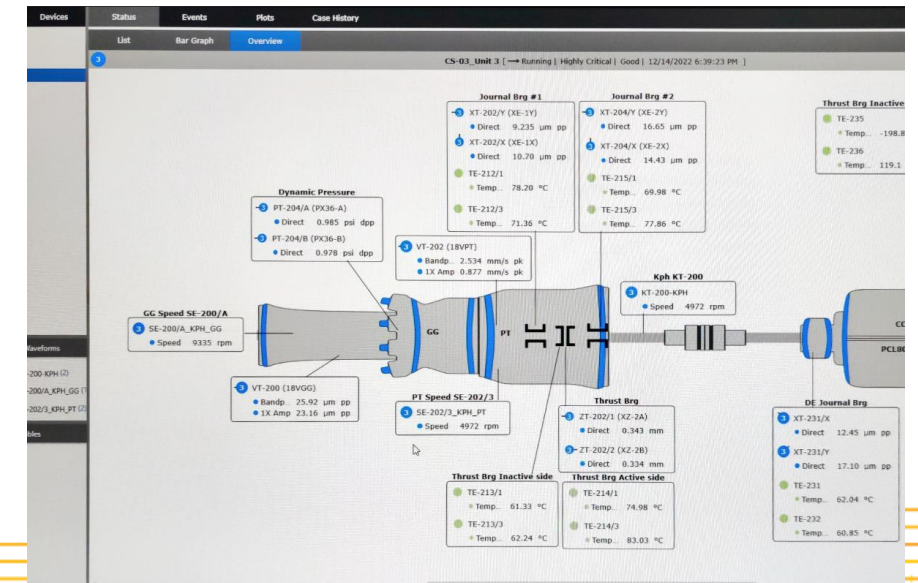
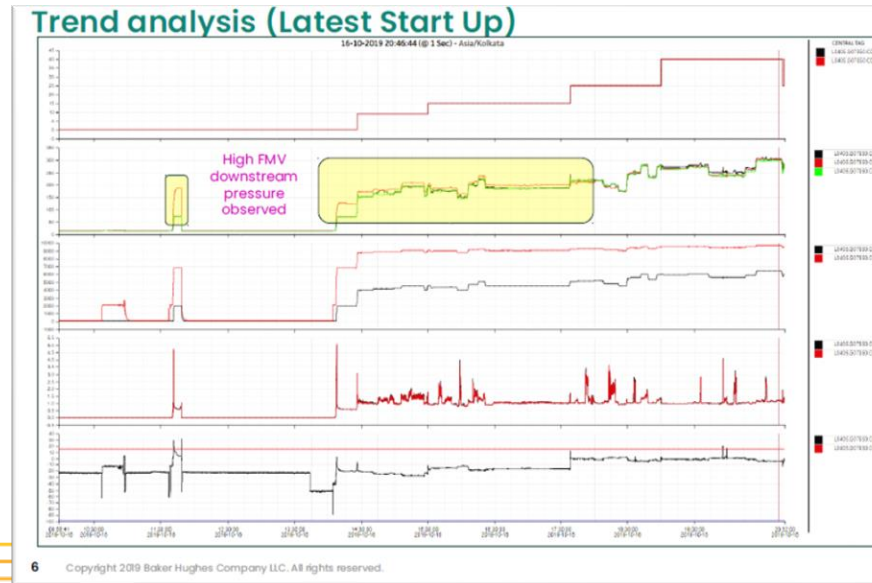
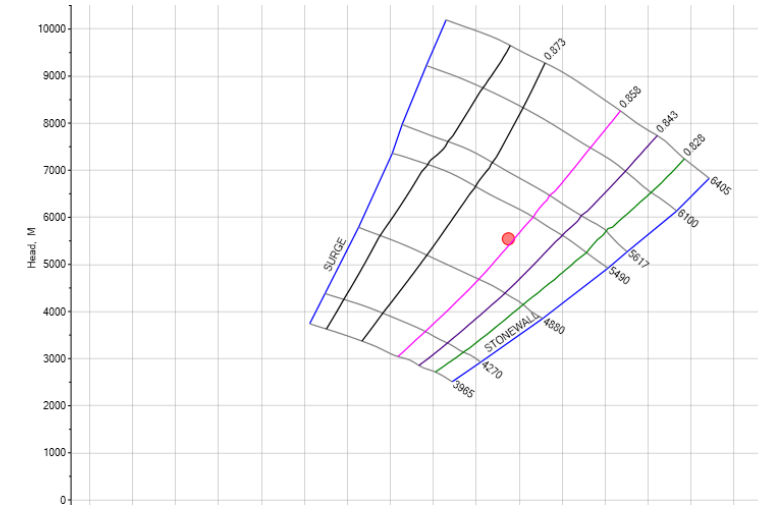
- Simulator for various process upset scenarios
- Look and feel like real time SCADA system
- Steps to be taken as per SOP
- Validation for qualification
- Certification





# GTC Operations and control

- Asset performance Monitoring and Control through PAS.
- Monitoring critical parameters of all running GTC via System1.
- RMD services provides superior alternative of continuous monitoring by expert engineers and Notify POC over mail with detail report.



# Technological Advancement in GTC Digital Data Processing

- Historical GTC data is collected from OEM Servers
- Artificial intelligence (AI) based – GTC Digital Data Processing being developed.
- Benefits - Behavioral fingerprint development, Predictive analysis



PIL DATA ANALYSIS > ICENTER REPORT HELP

Trains: CS01, CS02, CS03

LineUps: L0406-PIL CS03 - Unit A, L0...

Machines: C13245(C13228)(PCL), G07...

GET TAG LIST

LINEUP	LINEUP DESCRIPTION	SERIALNO	UNIT	STD DESCRIPTION	CENTRAL TAG NAME
L0406	PIL CS03 - Unit A	G07824	rpm	Selected Gas Generator Speed	L0406.G07824.CORE_NGGSEL
L0406	PIL CS03 - Unit A	G07824	rpm	VPRO gas generator speed	L0406.G07824.NGG_VPRO
L0407	PIL CS03 - Unit B	G07822	rpm	Gas generator idle speed from CEC	L0407.G07822.ANGGIDL
L0407	PIL CS03 - Unit B	G07822	rpm	Selected Gas Generator Speed	L0407.G07822.CORE_NGGSEL
L0407	PIL CS03 - Unit B	G07822	rpm	VPRO gas generator speed	L0407.G07822.NGG_VPRO
L0408	PIL CS03 - Unit C	G07823	rpm	Gas generator idle speed from CEC	L0408.G07823.ANGGIDL
L0408	PIL CS03 - Unit C	G07823	rpm	Selected Gas Generator Speed	L0408.G07823.CORE_NGGSEL
L0408	PIL CS03 - Unit C	G07823	rpm	VPRO gas generator speed	L0408.G07823.NGG_VPRO
L0406	PIL CS03 - Unit A	G07824	-	Gas generator hardware overspeed	L0406.G07824.ESDN_S_NGGHOVSPD

Showing 1 to 10 of 27 entries (filtered from 5,048 total entries)

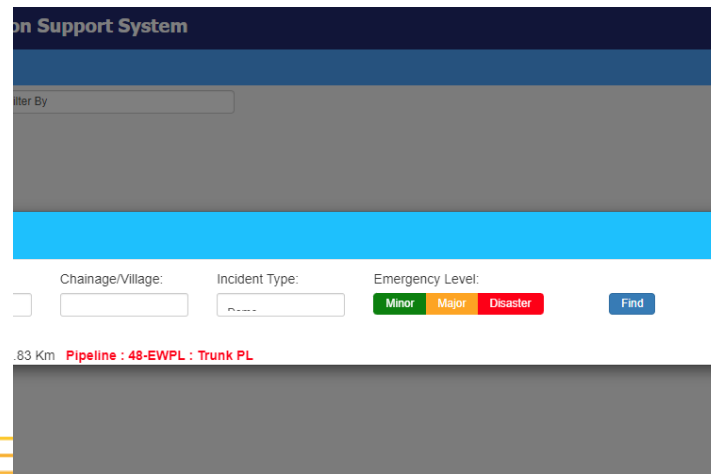
Previous 1 2 3 Next

L0406.G07824.CORE\_NGGSEL x L0407.G07822.CORE\_NGGSEL x L0408.G07823.CORE\_NGGSEL x

	entry_date	L0406.G07824.CORE_NGGSEL	L0407.G07822.CORE_NGGSEL	L0408.G07823.CORE_NGGSEL
0	17-03-2018 19:07	0	758.73	0
1	17-03-2018 19:07	0	1630.75	0
2	17-03-2018 19:08	0	2172.21	0
3	17-03-2018 19:08	0	2218.76	0
4	17-03-2018 19:08	0	2089.96	0
5	17-03-2018 19:08	0	2102.69	0
6	17-03-2018 19:09	0	2100.14	0
7	17-03-2018 19:09	0	2100.1	0
8	17-03-2018 19:09	0	2100.21	0
9	17-03-2018 19:09	0	2100.18	0
10	17-03-2018 19:10	0	2379.83	0
11	17-03-2018 19:10	0	3349.86	0
12	17-03-2018 19:10	0	4188.3	0
13	17-03-2018 19:10	0	5133.38	0
14	17-03-2018 19:11	0	6633.17	0
15	17-03-2018 19:11	0	5001.21	0

# Effective Emergency Handling-ERSS / UOSS

- UOSS is a Web based application software.
- The entire loss prevention program for pipeline operating includes emergency preparedness as a key component.
- Essential for the efficient handling of any event to reduce damage to people, property, and the environment in and near compressor stations and pipeline ROU.
- In case of any emergency, POC initiates emergency in ERSS.
- All concerned persons are notified by e-mail and SMS through this portal

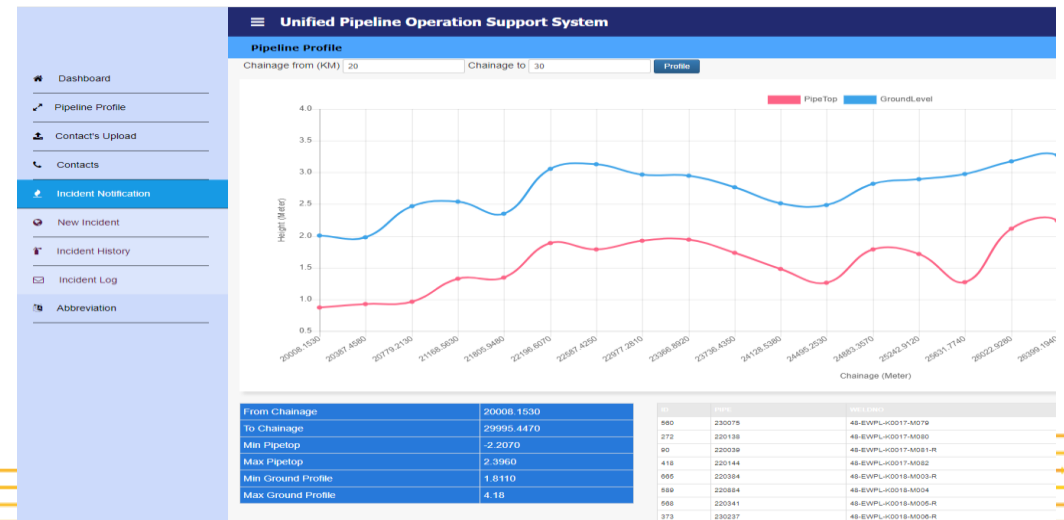
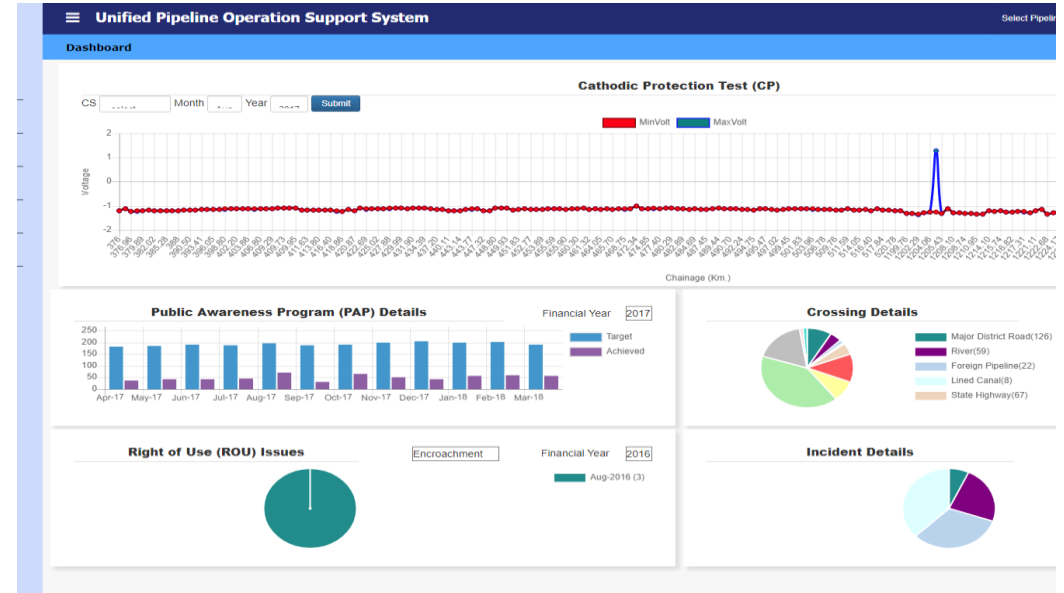


Unified Pipeline Operation Support System

Filter By

Chainage/Village:  Incident Type:  Emergency Level: Minor Major Disaster

83 Km Pipeline : 48-EWPL : Trunk PL



# Supporting tools for POC

- PIL GAS TRANSPORTATION SYSTEM (PGTS)
- SAP
- POC E-LOG
- DOCUMENT MANAGEMENT SYSTEM (DMS)
- ALARM INFORMATION MANAGEMENT SYSTEM (AIMS)

Item Aman...

All values in this system effective from 01 Nov 2014 are on GHV basis.

ion Measurement Entry

ISO:  GPA:

Location:  Entry/Exit:

Show

By	Measured Volume (Scm)	Measured Quantity(MMBtu-NHV Basis)	Measured Quantity(MMBtu-GHV Basis)	GHV (Btu/Scm)	NHV (Btu/Scm)	Schedule Quantity	Updated By	U
02/08/2023						0	Sankar Misra	02/08/2023
03/08/2023						0	Nehraj Venkatesh	03/08/2023
04/08/2023						0	santosh.karnigera	04/08/2023
05/08/2023						0	santosh.karnigera	05/08/2023
06/08/2023						0	santosh.karnigera	06/08/2023
07/08/2023						0	Aman Srivastava	07/08/2023
08/08/2023						0	Aman Srivastava	08/08/2023
09/08/2023						0	Sankar Misra	09/08/2023
10/08/2023						0	Aman Srivastava	10/08/2023
11/08/2023						0	Nehraj Venkatesh	11/08/2023
12/08/2023						0	Nehraj Venkatesh	12/08/2023
13/08/2023						0	santosh.karnigera	13/08/2023
14/08/2023						0	santosh.karnigera	14/08/2023

Repository Calendar PILDMS Users online (1) Tasks (0)

Folder Contents

Name	Status
COMMON DOCUMENTS Document Originator: Mr. Vishal Kuttan, Created: 15-08-2020	7 Folders 0 Documents
Control Center Document Originator: Mahaj Shukla, Created: 10-04-2018	4 Folders 0 Documents
HEAD OFFICE DOCUMENTS Document Originator: Akhilar Sankar, Created: 06-05-2020	1 Folders 0 Documents
REGION01 Document Originator: Akhilar Sankar, Created: 10-04-2018	21 Folders 0 Documents
REGION02 Document Originator: Mr. Vishal Kuttan, Created: 15-08-2020	24 Folders 0 Documents
Technical Magazines Document Originator: Mr. Vishal Kuttan, Created: 14-07-2021	6 Folders 0 Documents
Vendor Documents Document Originator: Mr. Vishal Kuttan, Created: 15-08-2020	11 Folders 0 Documents

POC ElogBook Report

Welcome User

From Date: 14/08/2023 To Date: 14/08/2023

Facility: All Facility Name: All

Equipment: All Shift: B

Location: MPOC Operating Mode: Primary

Select Export Format: MS Word (DOC)

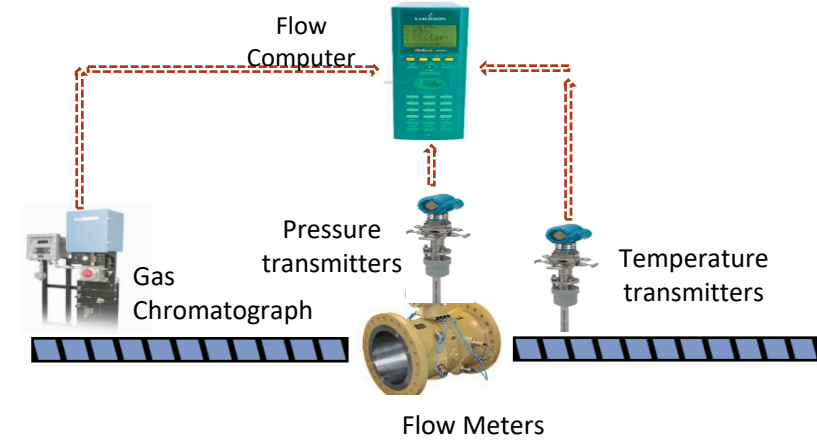
View Export Cancel

Shift	Gas Day	Time	POC Engineer Lead	POC Engineer	Operating Mode	Facility	Facility Item	Equipment	Remarks
B	14/08/2023	1:00 PM	Aman Srivastava	Hardik Prajapati	Primary	CS	CS09	DEG	CS09 DEG trail run planned
B	14/08/2023	1:00 PM	Aman Srivastava	Hardik Prajapati	Primary	M & R	GENERAL	GENERAL	Mhaskal JC completed and As per M Desk stream 2 will be continue service.
B	14/08/2023	1:00 PM	Aman Srivastava	Hardik Prajapati	Primary	M & R	GENERAL	GENERAL	As per OMD customer request Flow increased from 0.24 to 0.40 MMSCMD.
B	14/08/2023	5:00 PM	Aman Srivastava	Hardik Prajapati	Primary	CS	CS01	GTC-C	CS01 GTC-C Mechanical team checking under taken so CO2 Isolated.
B	14/08/2023	5:00 PM	Aman Srivastava	Hardik Prajapati	Primary	CS	CS06	GENERAL	CS06 GTC-C running Acc compartment UVIR Detector Pre alarm (FD-705(B)) Acc on Trip (FD-705(B)) Acc compartment UVIR Detector PIRE Alarm (FD-705(A/C)) alarm received normalized immediately same informed to CS06 L/O
B	14/08/2023	5:00 PM	Aman Srivastava	Hardik Prajapati	Primary	M & R	GENERAL	GENERAL	M&R S4 JFCV Valve stroke checking done from local and POC. Observation JFCV set at 100% and open at 0 % for the same inform to CS03 Mr. Gajendran. He intimate to and right now flow is through JFCV bypass. For that further checking is planned.
B	14/08/2023	5:00 PM	Aman Srivastava	Hardik Prajapati	Primary	M & R	GENERAL	GENERAL	As per the event Aniket Gc multiple time Gc warm start(Power rebooting) occurred bet for that please refer event and alarm log. Job request raised for the same 300000217
B	14/08/2023	5:00 PM	Aman Srivastava	Hardik Prajapati	Primary	CS	CS09	GENERAL	CS09 fuel gas filter B PSIV installation planned. for same detector will be inhibited. By replacement job completed and filter B is in service.

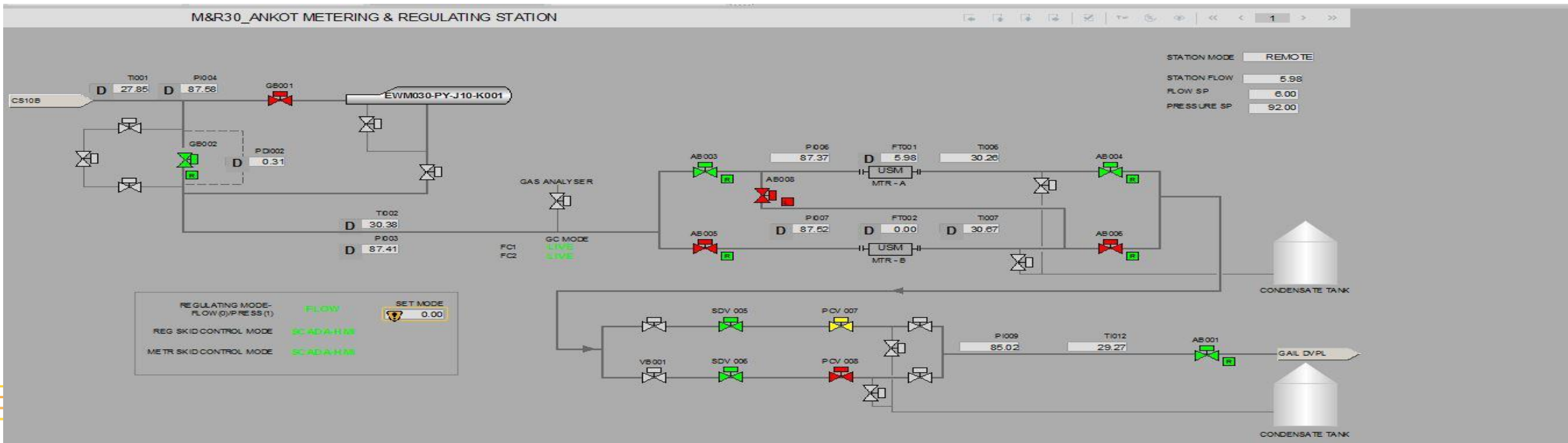


# Custody Transfer Metering station Remote Operations

- Valves remote operation
- Flow data availability
- Flow meter healthiness
- Stream changeover
- Remote access to all field devices



## 24X7 Assurance to Uninterrupted Flow, Metered Gas & Correctness in fiscal measurement

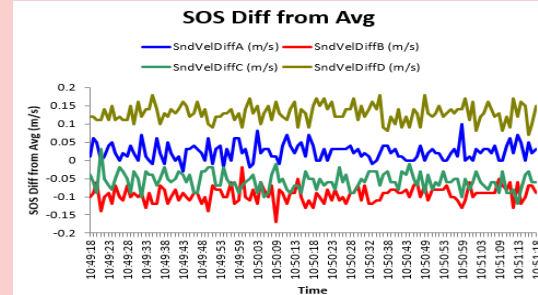
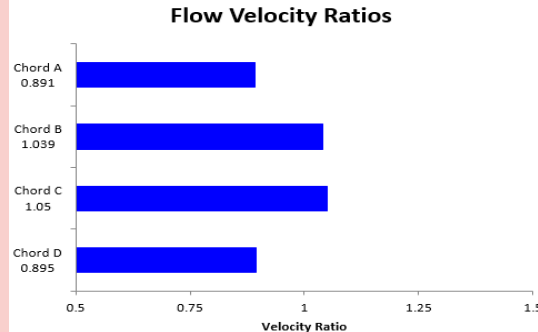
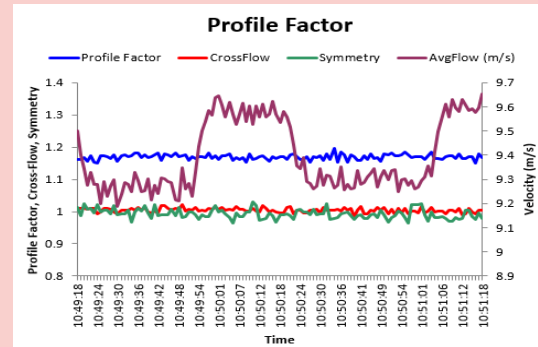


# Gas Fiscal Measurement - Correctness

## Reviewing & Tracking Metering Information & Diagnostics -

Flow meters, Gas Chromatographs, Pressure Transmitter, Temperature Transmitter, Flow Computers etc.

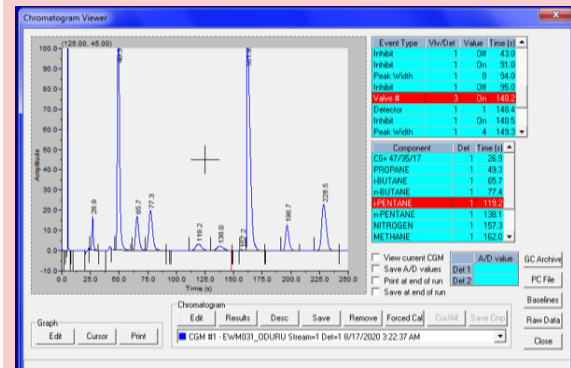
### Flow meters (USM, Orifice)



### Gas Chromatographs

24 Hour Averages from 15-08-2023 06:42:05 Analyzer: M010A JN GC  
PIL-M&R10AJN GC REPORT

Stream	Mole Percent	Average	Minimum	Maximum	Samples
1 Stream 1-ANL METHANE	15-08-2023 06:00:00	94.86944	94.74429	94.91999	360
	14-08-2023 06:00:00	95.07180	94.87370	95.39693	360
	13-08-2023 06:00:00	95.21098	95.04753	95.37731	360
2 Stream 1-ANL ETHANE	15-08-2023 06:00:00	2.10932	2.08622	2.16798	360
	14-08-2023 06:00:00	2.02316	1.89951	2.10491	360
	13-08-2023 06:00:00	1.94792	1.87675	2.02691	360
3 Stream 1-ANL PROPANE	15-08-2023 06:00:00	0.94632	0.93152	0.96736	360
	14-08-2023 06:00:00	0.88990	0.78271	0.94171	360
	13-08-2023 06:00:00	0.87462	0.81854	0.90366	360
4 Stream 1-ANL 1-BUTANE	15-08-2023 06:00:00	0.15018	0.14722	0.15349	360
	14-08-2023 06:00:00	0.14155	0.12249	0.15087	360
	13-08-2023 06:00:00	0.14291	0.12894	0.14690	360
5 Stream 1-ANL 1-PENTANE	15-08-2023 06:00:00	0.23200	0.22698	0.23781	360
	14-08-2023 06:00:00	0.21696	0.18456	0.23303	360
	13-08-2023 06:00:00	0.22148	0.19610	0.22863	360
6 Stream 1-ANL 1-HEPTANE	15-08-2023 06:00:00	0.04798	0.04660	0.04944	360
	14-08-2023 06:00:00	0.04695	0.04362	0.05017	360
	13-08-2023 06:00:00	0.04888	0.04528	0.05071	360



### Pressure & Temperature Transmitter, Flow Computer



152 DAILY REPORT (BASETIME 6:00) 08/03/2022 06:00:00

STREAM 1 NAME: FQI-613 (PRIMARY) REFERENCE CALC: 150  
LOCATION: PIL H&R 10A Bhadbhusu JN  
TOTAL ROLLOVER: 0 (0=NO, 1=YES)

NRM UVOI	CUMULATIVE	PERIOD	FLOWRATE
NRM CVOL	4160978	64722 m3	71059.03 m3/d
NRM MASS	200476985	5928147 tCM	6.4777 MStCM/d
NRM ENERGY SUP	207807.68	4100.28 tonne	4472.82 t/d
NRM ENERGY INT	10823604.73	212610.28 MStBu	232910.20 MStBu/d
	9746442.74	192290.09 MStBu	209742.78 MStBu/d

BASE TEMP (Tb) : 18.00 Deg.C  
BASE PRESS (Pb) : 1.01925 bara  
AVG PRESS : 1.03225 bara  
AVG METER TEMP (Te) : 33.76 Deg.C  
AVG METER PRESS (Pe) : 84.21 barg  
AVG METER DENS : 62.47598 kg/m3  
AVG BASE DENS : 0.690601 kg/m3  
AVG GCV : 37.9269 M3/Sm3  
AVG NCV : 9040.70 kcal/SCM  
AVG UPSTR COMP (Z) : 0.97176  
AVG BASE COMP (Zb) : 0.99796  
AVG GAS VELOCITY : 17.748 m/s  
AVG MEASURED VOS : 442.262 m/s  
AVG CALCULATED VOS : 442.906 m/s

GAS COMPOSITION

COMPONENT	PERCENTAGE
NITROGEN	0.208021
METHANE	99.99278
ETHANE	0.270422
PROPANE	0.184426
1-BUTANE	0.021492
2-BUTANE	0.008473
1-PENTANE	0.008726
1-HEPTANE	0.002882
HEXANE	0.006146
HEPTANE	0.000000
OCEANE	0.000000
NONANE	0.000000
DECANE	0.000000
TOTAL	100.000000

DURATION 1377.66 minutes

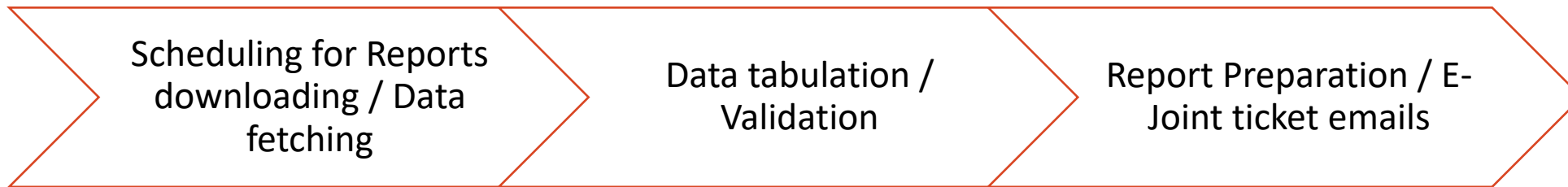
STREAM 2 NAME: FQI-611 (BACKUP) REFERENCE CALC: 150  
LOCATION: PIL H&R 10A Bhadbhusu JN  
TOTAL ROLLOVER: 0 (0=NO, 1=YES)

NRM UVOI	CUMULATIVE	PERIOD	FLOWRATE
NRM CVOL	8951596	61661 m3	67757.63 m3/d
NRM MASS	87841769	8442707 tCM	6.1880 MStCM/d
NRM ENERGY SUP	609543.63	3596.54 tonne	4322.77 t/d
NRM ENERGY INT	31714266.19	202887.84 MStBu	221417.23 MStBu/d
	2871529.38	12723.03 MStBu	139412.90 MStBu/d

# Gas Measurement – Timely Gas measurement validations & billing



## Robotics Process Automation (RPA) - To reduce manual & repetitive works



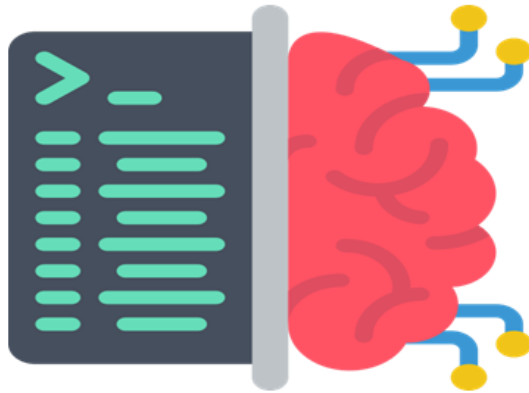
### RPA Uniqueness

- Extensive diagnostics (FC/USM/GC) – archiving & monitoring
- Time & Manual efforts saving
- CGD USM diagnostics
- FC & GC alarms
- Update Gas Composition in keypad
- Historical data retrieval
- Handling Communication Failure

# Technological Advancement in Gas Measurement

## Smart Measurement Application | Artificial Intelligence (AI) & Machine Learning (ML) based

### Artificial Intelligence



Measurement  
Analytics



Asset Digital  
Twin



Process  
Diagnostics

### Features / Deliverables

- Data Analytics
- AI Model development
- Machine Learning – modules & algorithms
- Digital Twin development
- Energy reconciliation
- Interactive Dashboards
- E-Joint ticketing, Emailing & Portal entry

### Benefits

- Real time data capture and processing to identify anomalies of different flow meters.
- Metering systems – Ultrasonic Flow meter (USM) / Gas Chromatograph (GC) / Flow Computer (FC) performance - Quantification and Qualification of anomalies
- Predictive analysis
- Alerts and Alarms.
- Reconciliation, line pack calculations etc.



## Synopsis:

- Digitalization is imperative to operate in a holistic manner – Whole Pipeline Perspective
- Improved operation and control by real-time monitoring
- Efficient operation of assets and pipeline
- Timely and accurate gas measurement validations
- Enhanced monitoring and timely detection of anomalies of GTC, USM, GC FC etc.
- Prompt action during emergencies
- Predictive maintenance and automated processes
- Better-organized and well-coordinated maintenance of critical assets thus reducing downtime

