Alethe Labs®
Empowering Data

An Energy Tech Company

AI and Digital Twin Technologies: A game changer for Natural Gas Project and Operations

S. Ravishankar
Alethe Labs

Alethe Consulting®

NGS Construction Management Conference
10th and 11th September 2026

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Alethe Group

Alethe Consulting®
Accelerated Transformation

Alethe Labs®
Empowering Data

IT & OT Cyber Security Company
Industry leading solutions for IT and OT security

Energy & Oil & Gas
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IndianOil

गेल
GAIL

CAIRN

हिन्दुस्तान पेट्रोलियम
HP

EPIL
Pipeline Infrastructure Limited

Reliance
Industries Limited

THINK GAS
खुल के सांस लो

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HVPN

fortum
For a cleaner world

पी एफ सी
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(भारत सरकार का उपक्रम)

IEX
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Reimagining Gas Project and Operations with Advanced Automation & Digital Technologies

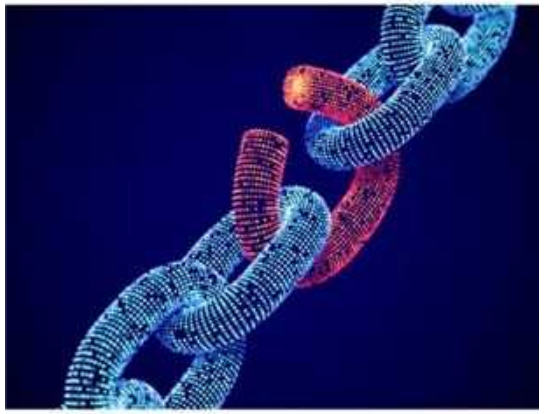
Need for the Industry to look at data & Digital Transformation in a holistic manner – Both Business & Operations

Industry Challenges in Gas Operations

Gas Losses

UAFG/LUAG

0.5% – 6%+ unaccounted losses



Data Silos

Multiple Business & Ops Systems

Fragmented SCADA, metering, inspection & asset data

Manual Dependence

Ops Inefficiencies

Field logs & legacy systems delay insights

Reactive maintenance & delays

Limited / False Alarms

Failures detected after breakdowns

Why Transformations is Urgent

Regulatory compliance & reporting

Effective & Simple Reporting

0.5% – 6%+ unaccounted losses

Rising efficiency & sustainability pressures

Integrated Platforms

No silos → unified decision-making

Safety & reliability as top priorities

IT-OT security

Multi-layer protection for resilient operations

Adoption of new Technologies

Keep pace with Industry

AI ML Platforms

Real-time diagnostics & predictive analytics

Descriptive, predictive & prescriptive models

From Limitations to Transformation

Technology & Process Limitations

	Gas Losses	0.5% – 10%+ unaccounted losses
	Data Silos	Fragmented SCADA, metering, inspection & asset data
	Scattered Asset / Project Data	Data fragmented across different groups
	Manual Dependence	Field logs & legacy systems delay insights
	Reactive Maintenance	Failures detected after breakdowns
	Cyber Vulnerability	OT systems exposed to attacks

The Shift with Advanced Process Automation & New Age Technologies

	Automation	Automated Reconciliation, leak detection, field operations streamlined
	AI & ML	Real-time diagnostics & predictive analytics
	Digital Twin	Asset Models / Descriptive, predictive & prescriptive models
	Integrated Platforms	No silos → unified decision-making
	OT Cybersecurity	Multi-layer protection for resilient operations

Building a Digital Twin for a Gas Pipeline

A continuous digital thread from design to operations

One Asset | One Digital View | Lifelong Value

One Digital Thread Across the Entire Lifecycle

From Project to Operations – A Single, Integrated View

Connected Data | Smarter Insights | Greater Value

PROJECT
Build the Asset

OPERATIONS
Run and Optimise the Asset

Digital Twin
A living, evolving digital asset

Engineering Design
- Design data
- Specifications
- 3D models
- Route & GIS

Procurement
- Equipment data
- Material specs
- Vendor information

Construction
- Installation updates
- QA/QC data
- Inspection records
- Field data

Commissioning
- Test results
- As-built data
- System validation
- Handover

Operations
- Real-time data
- SCADA / DCS
- GIS integration
- Asset information

Maintenance
- Work management
- Condition monitoring
- Predictive maintenance
- CMMS / EAM

Integrity Management
- Inspection data
- Corrosion / CP data
- ILI data
- Risk assessment

Performance Optimisation
- Analytics / AI
- Performance insights
- Decision support
- Continuous improvement

INTEGRATED DATA ENVIRONMENT
People • Processes • Technology • Governance

- Better Project Control
- Higher Asset Integrity
- Efficient Operations
- Optimised Performance
- Safer, Greener and More Sustainable

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Oil and Gas Infrastructure Operations – Technology driven Future

Where We are Today

SCADA

Instrumentation

Process

Asset Records

Digital twin – AI/ML powered Solutions

Complex Data from Operations, Gas Composition, SCADA, Process Parameters – Temperature, Pressure, Instrument Data – calibration data, Inspection Data, Asset Records

In Combination with Data Science

The Future

- Performance Analytics of Instrumentation and Equipment
- Predictive Maintenance and Instant Diagnosis
- IT – OT Convergence

MACHINE ADVANCED SCANNING SYSTEM

Real Time Data Management Platform

Captures & stores real time data from existing SCADA & field/IOT devices via multiple interfaces

Data Historian, Streaming Processing, Reporting & Advance Analytics

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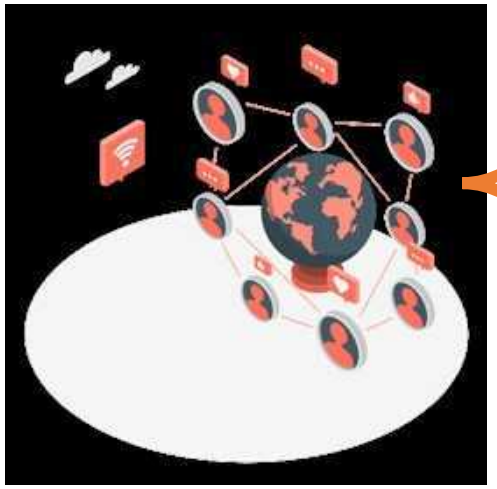
No Silos = More Informed Decisions – RTDMP - Integrated Data and Performance Management

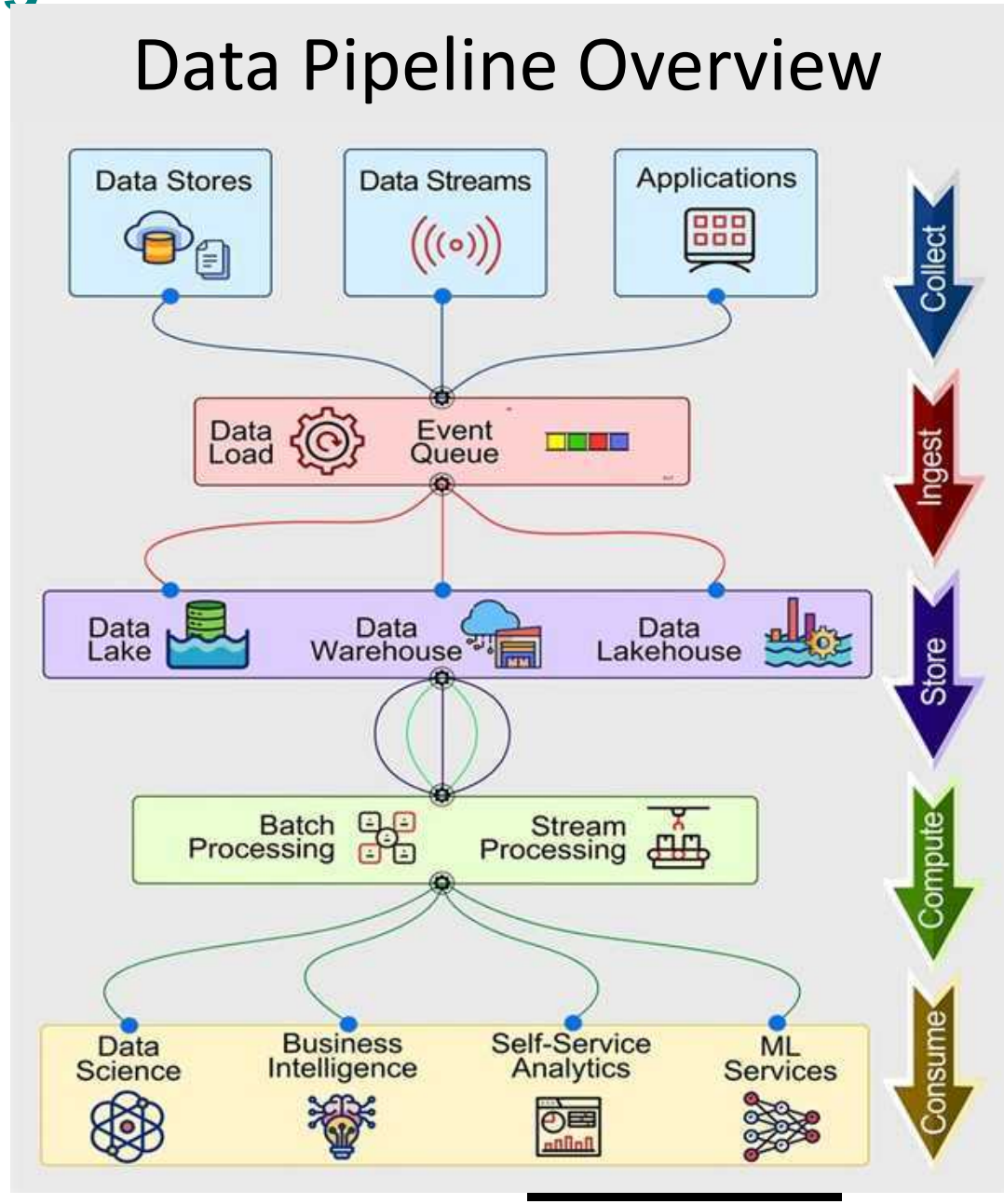


SCADA

Project, Engg and Asset Records

Other Process Data

ILI Data



Integrated Data Platform Management (Integrity)

Integration of various silos of data sets (ILI, CP, SCADA, IIoT, Integrity Reports)

Pipeline integrity and Corrosion growth

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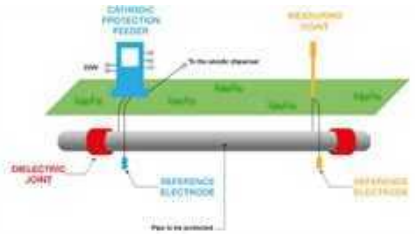
Pipeline System – Challenges of Data Silos

- Instrumentation & Scada
- Asset Anomalies Data
- GC,Flow Comp, Temp,
- Pipeline Profile
- CS, SV & other stations data sets, Manual log books

Asset, Instrumentation & Other Data Sets

- Pipelines
- Multiple Surveys
- Reports (Direct& indirect Assessment)
- Critical Defects
- CP Monitoring Stations Data
- Past critical failures



CP Data

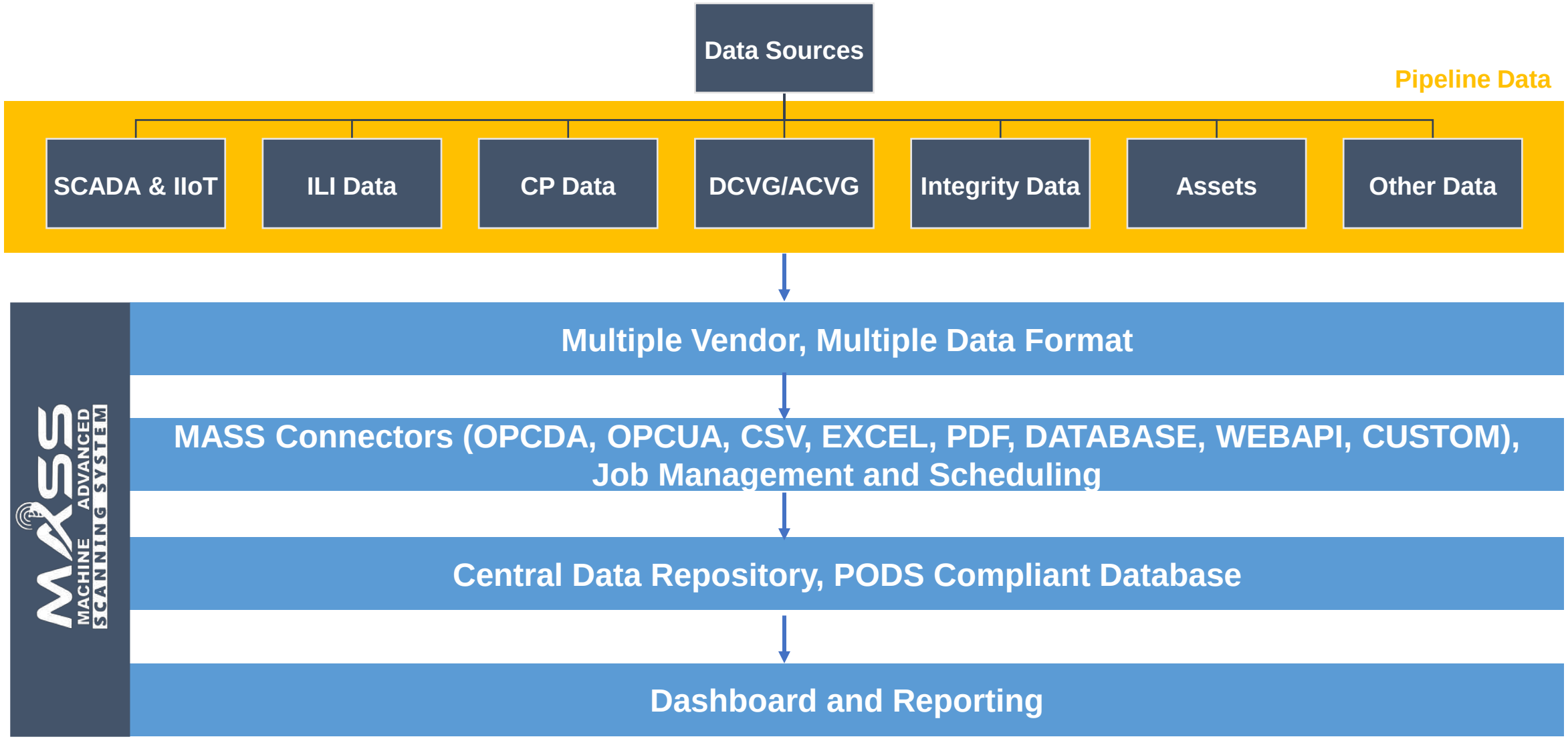
- Damage prevention & Detection
- Threat & Integrity reports data
- Functional Monitoring & risk management data
- Other reports

Integrity Reports

- Multiple Pipelines
- Multiple ILI Runs
- Reports
- Critical Defect Data
- Repaired Data
- Pipeline Vulnerability Data

ILI Data

IDPM Data Gateway: 100% Asset / Data Visibility



Digital Twins, AI and Automation in Gas Pipeline Operations

Measurement and Metering	Automated Reconciliation	Digital Twin	Diagnostics

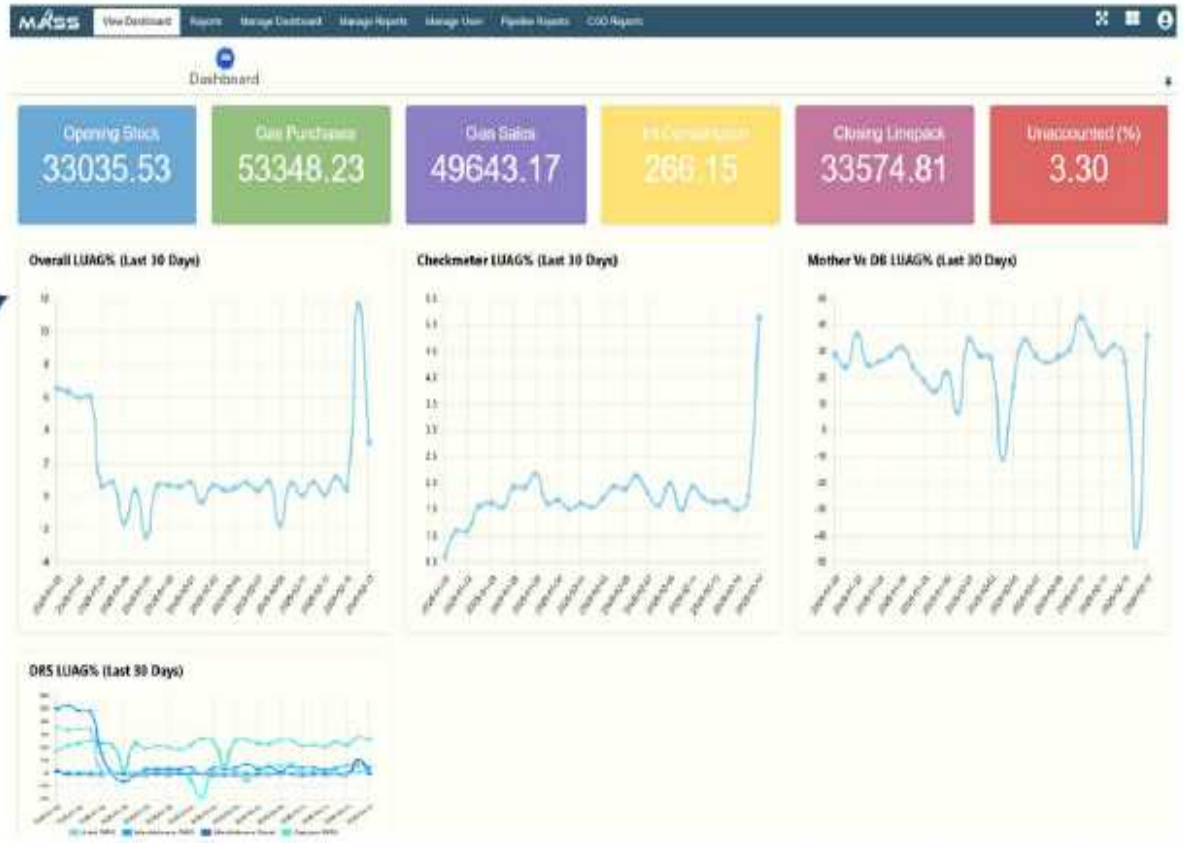
Data Historian / Integrated Data Platform

Gas Transmission Network - Integrated Measurement, Diagnostics and AI Engine

Automated Reconciliation

Network Supported

Mass supports both cross country as well as city gas distribution networks taking into consideration different operational parameters like pressure and volume flow. Cross Country operates at high pressure and high volume of flow whereas cgd operates at low pressure and low volume and supports calculation based on different operational assumption.



CGD - Integrated Meter Management - MDM, Centralized Data Platform and Dashboard

Automated Reconciliation in City Gas Distribution

Linepack Process Automation

- Steel Pipe Linepack Calculation
- MDPE Pipe Linepack Calculation
- Static Cylinder Cascade Linepack Calculation
- Mobile Cylinder cascade linepack calculation

Reconciliation Process Automation

- Steel Pipe Reconciliation
- DRS Wise Reconciliation
- CNG Station Reconciliation
- Overall Reconciliation

Material Balancing

It Provides mass and energy balancing for gaseous and liquid products. The material balancing system supports AGA, ISO & API standards for metering, ISO & GPA standards for energy calculations. The material balancing report can be generated on-demand or can be scheduled as a repetitive task.

CGD Sector would require a layered approach to Digital Integration keeping the current level of technology adoption in measurement and metering in view

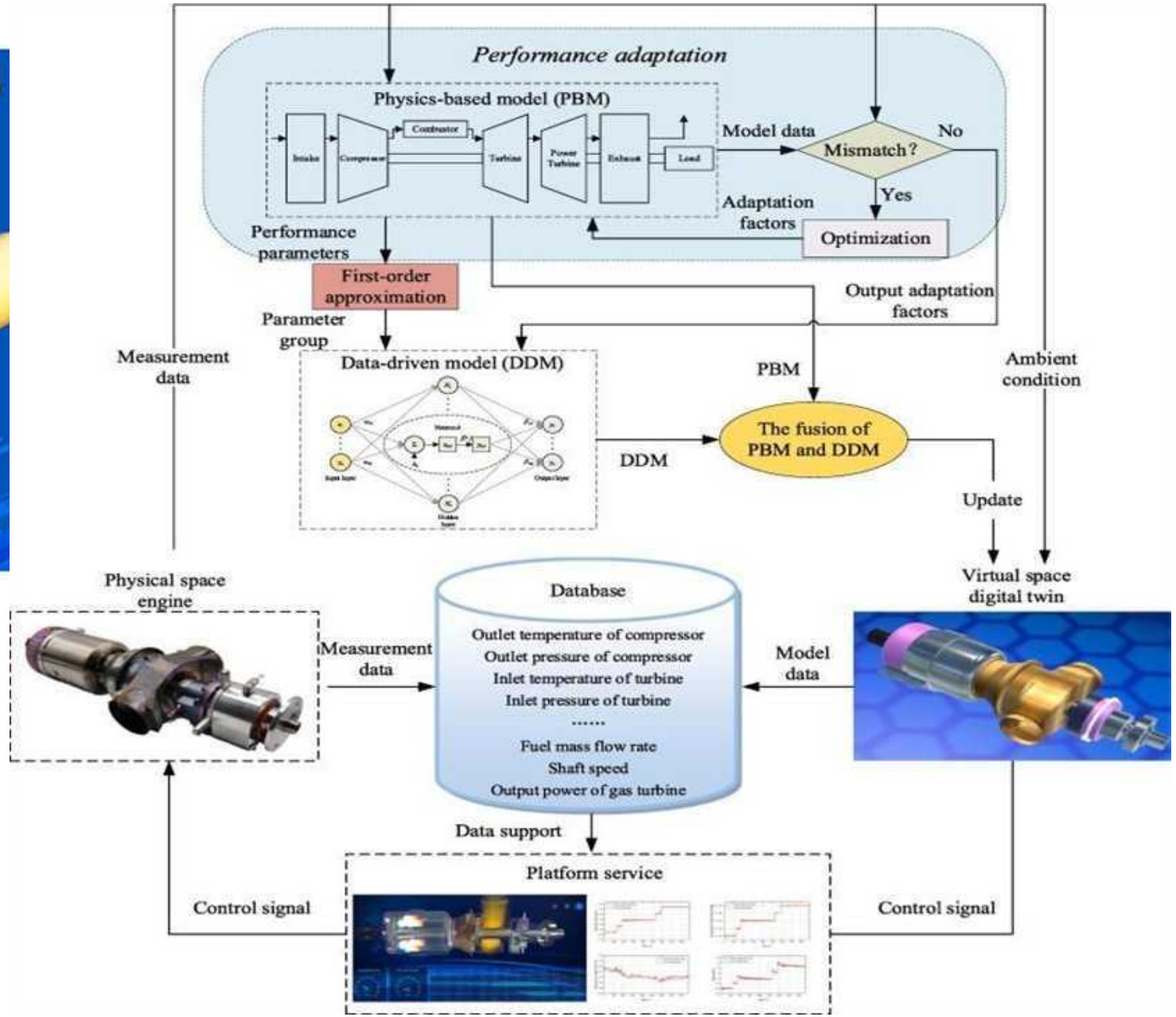
Digital Twin & Diagnostics - Artificial Intelligence

- **Digital Twin**: A virtual replica of a physical compressor station / Turbines, Regulating stations, Flow Computers, Meters, updated with real-time data.
- Types: Descriptive, Predictive, Prescriptive
- Industries using it: Oil & Gas, Energy, Manufacturing

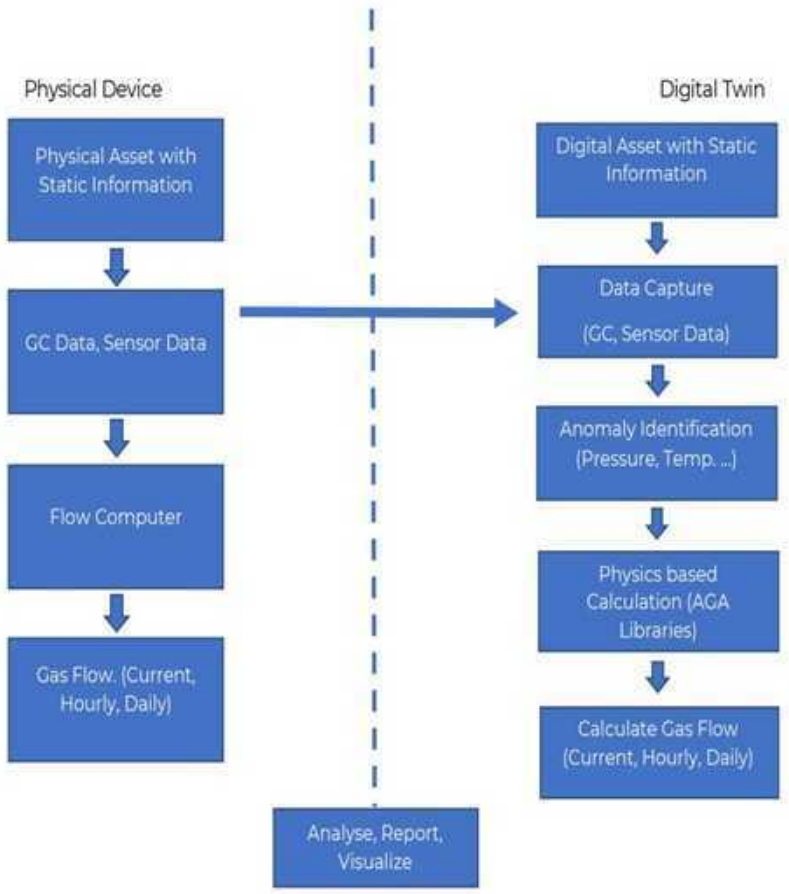
Source and GC	Compressor Station / Gas Turbines	SV Stations	Metering and Regulating Stations	Flow Computers
SCADA	Control Systems, Sensors and Instrumentation	Industrial and Retail Supplies	Metering and Measurement Systems	Commercial Systems

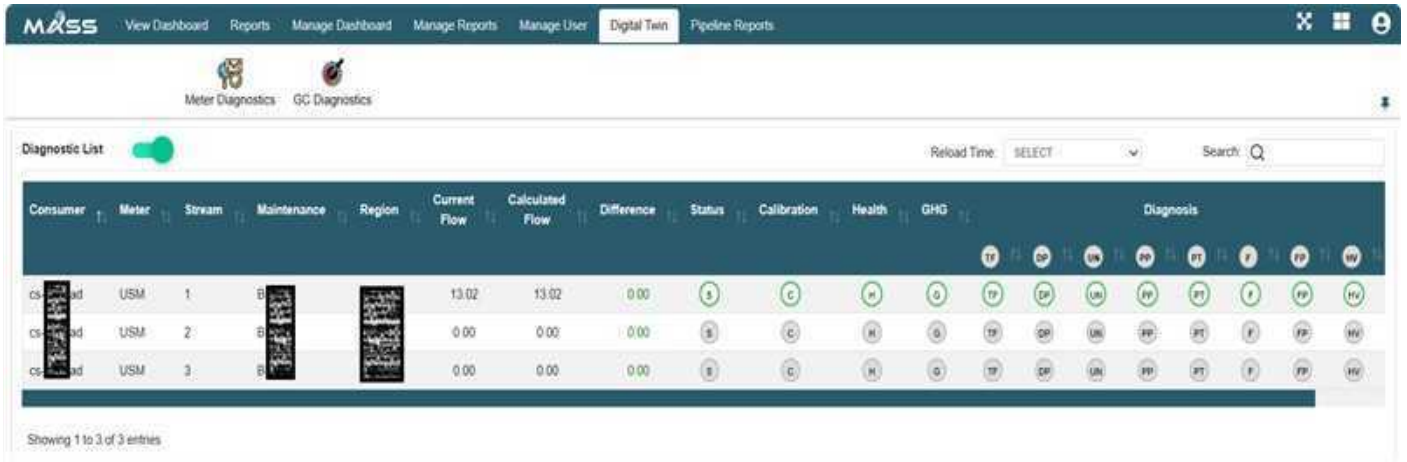
Digital Twin - Architecture Overview

Digital Twin Model



Digital Twin (Metering)





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Products (Driven by AI)

RTDMP
Real Time Data Management Platform

Captures & stores real time data from existing SCADA & field/IOT devices via multiple interfaces

Data Historian, Streaming Processing & Analytics

Automated Reconciliation
Data Validation | Reconciliation

Automated Product Reconciliation for complete pipeline network and sections with anomaly detection & prediction

Identify UAFG with near real time reconciliation

Digital Twin & Diagnostics

Implement Digital Twin for Pipeline Instrumentations like Flow Computers, Compressors with flow calculation, anomaly detection

Identify Configuration errors and device performance

IDPM
Integrated Data Platform & Management

Centralized Data Lake solution supporting multi-model pipeline data for corrosion detection and analysis

Solution for pipeline integrity and Corrosion growth

ORS
Operator Rounds System

Digital e-Log book solution for field data collection, LLF inspection and workflow

Improve work force efficiency and field inspections

Way Forward – Process Automation and New-age Technologies

- Tap into the large amounts of unstructured and untapped data from projects and operations – can be a gold mine
- Understand digital technologies and AI, cost and benefits, choose your technology solutions for implementation
- Integrate SCADA and other instrumentation to an advanced analytics platform with domain understanding
- Integrate OT Security Solutions – Multiple layers of Security
- Integrate, optimize applications/ revamp legacy applications
- Process Automation in Operations + Automate field data collection / manual data logs and integrate centrally

Partnership is the key to success

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THANK YOU