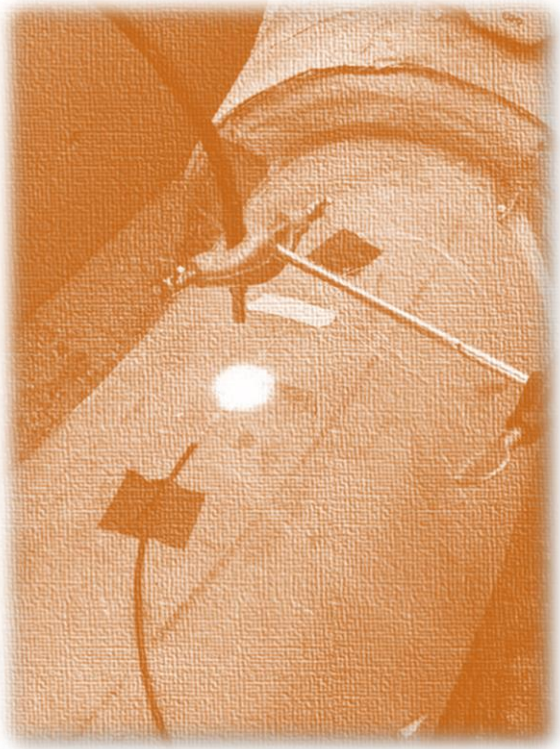
SAIPEM

E&C ONSHORE
FAPLEN
ESAFA

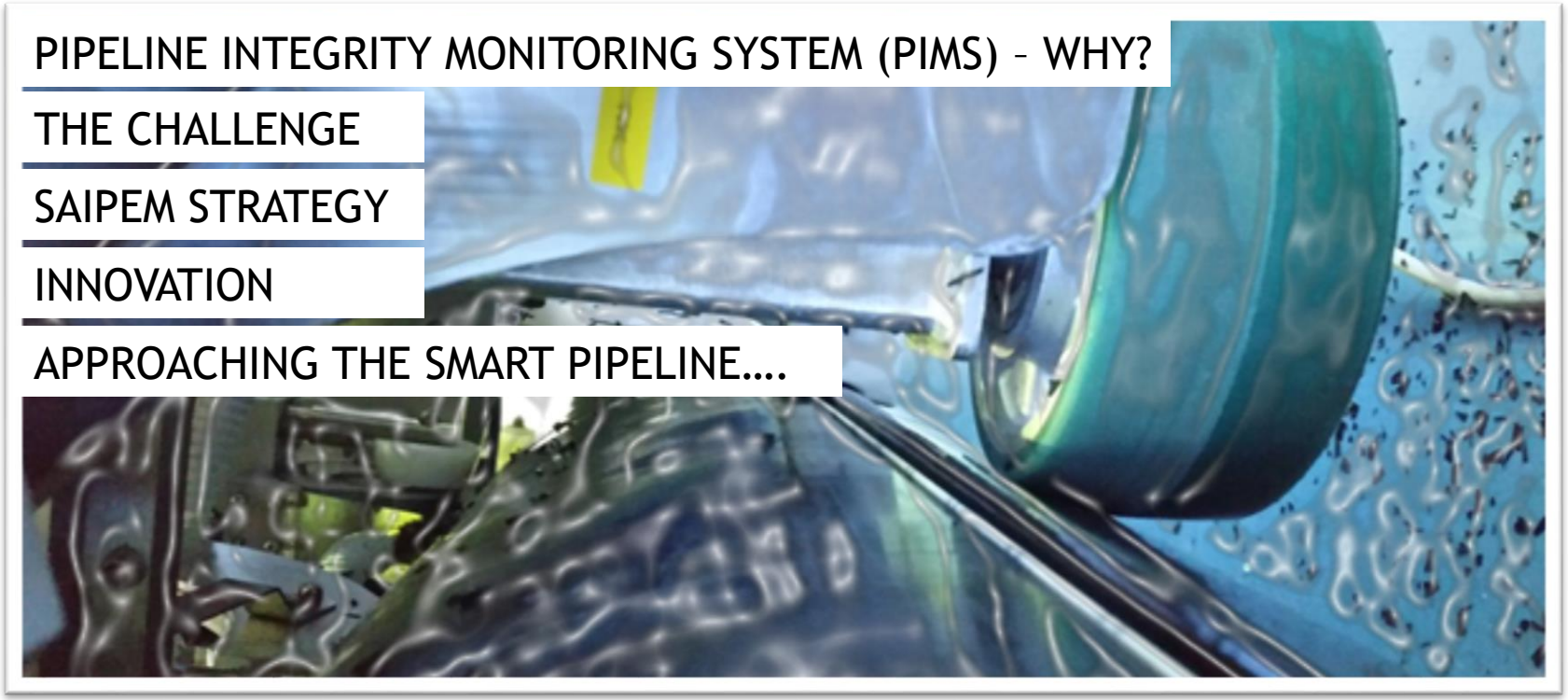
APPROACHING SMART PIPELINES

D.Ripari



September 2018

SUMMARY



PIPELINE INTEGRITY MONITORING SYSTEM (PIMS) – WHY?

THE CHALLENGE

SAIPEM STRATEGY

INNOVATION

APPROACHING THE SMART PIPELINE….

PIMS - Pipeline Integrity Monitoring System

WHY?

GEOHAZARD

TPI

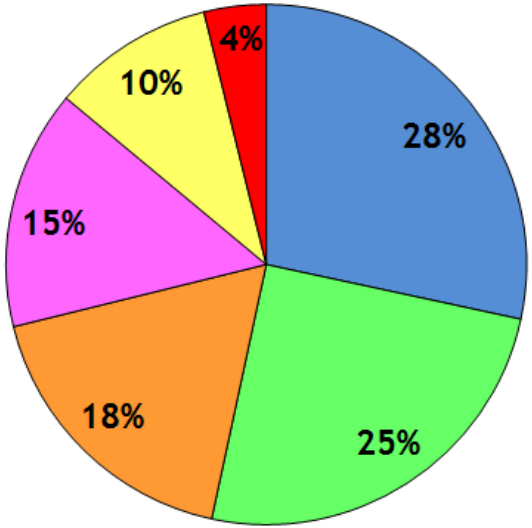
CORROSION

PIMS – Pipeline Integrity Monitoring System
WHY?

Gas Pipelines in EGIG: 140,000 km, 6”< 40% <16”, 60% PE coated (*)

Distribution of incidents 2007-2016 (*):

- EXTERNAL INTERFERENCE
- CORROSION
- CONSTRUCTIION DEFECT/MATERIAL FAILURE
- GROUND MOVEMENT
- OTHER AND UNKNOWN
- HOT TAP MADE BY ERROR



** Source: 10th EGIG Report 1970-2016 Gas Pipeline Incidents (EGIG = European Gas Pipeline Incident Data Group)*

PIMS
THE CHALLENGE

EARLY DETECTION

ANYTIME ANYWHERE

NO HARDWARE ON SITE

REMOTE CONTROL

PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW
SENSING TECHNOLOGY TEST & SELECTION

PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW
SENSING TECHNOLOGY TEST & SELECTION

Environmental Engineering

Communication Engineering

Pipeline Engineering

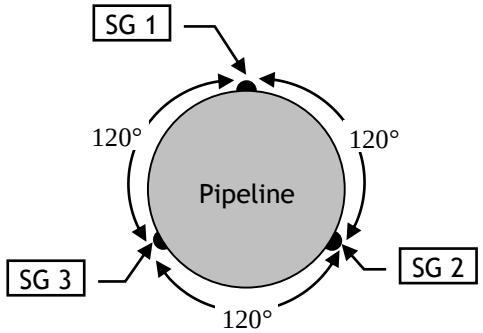
Stress Analysis

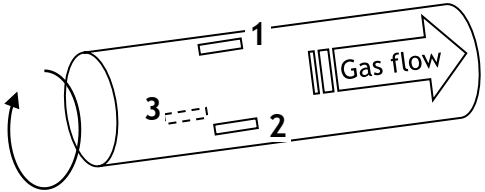
Construction

Market Technology Exploration

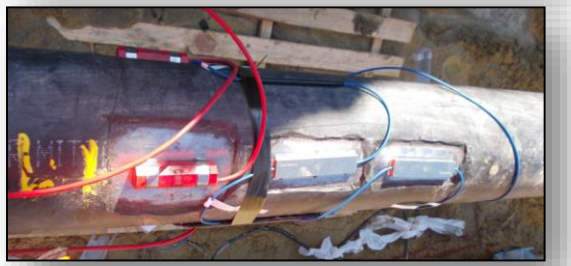
PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW
SENSING TECHNOLOGY TEST & SELECTION



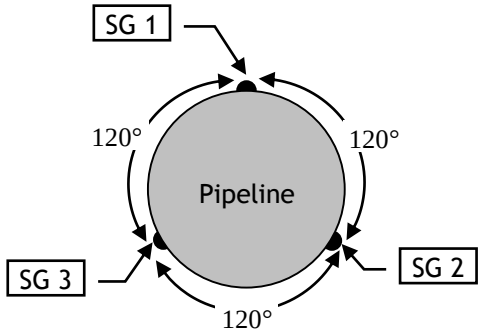


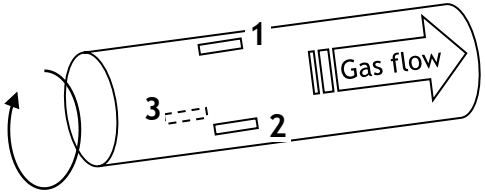
Vibrating Wires

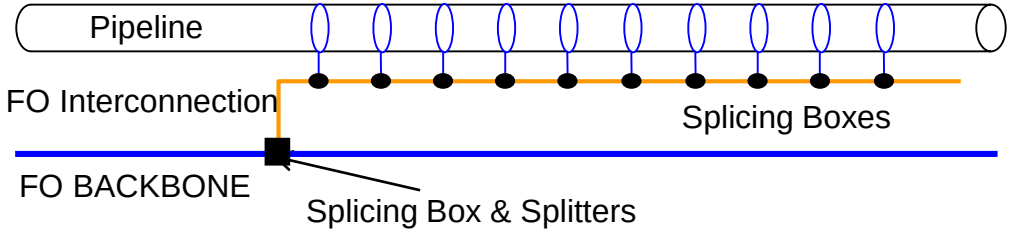


PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW
SENSING TECHNOLOGY TEST & SELECTION







Fibre Bragg Grating (FBG)

PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW

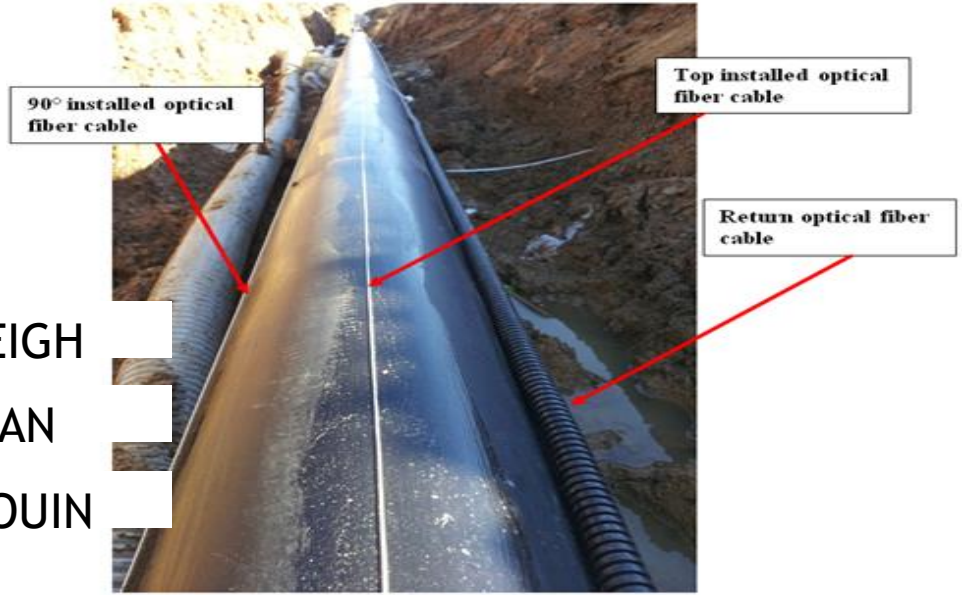
SENSING TECHNOLOGY TEST & SELECTION

Distributed Systems

RAYLEIGH

RAMAN

BRILLOUIN



PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW

SENSING TECHNOLOGY TEST & SELECTION

2010-2015 – SAIPEM FANO TEST PLANT



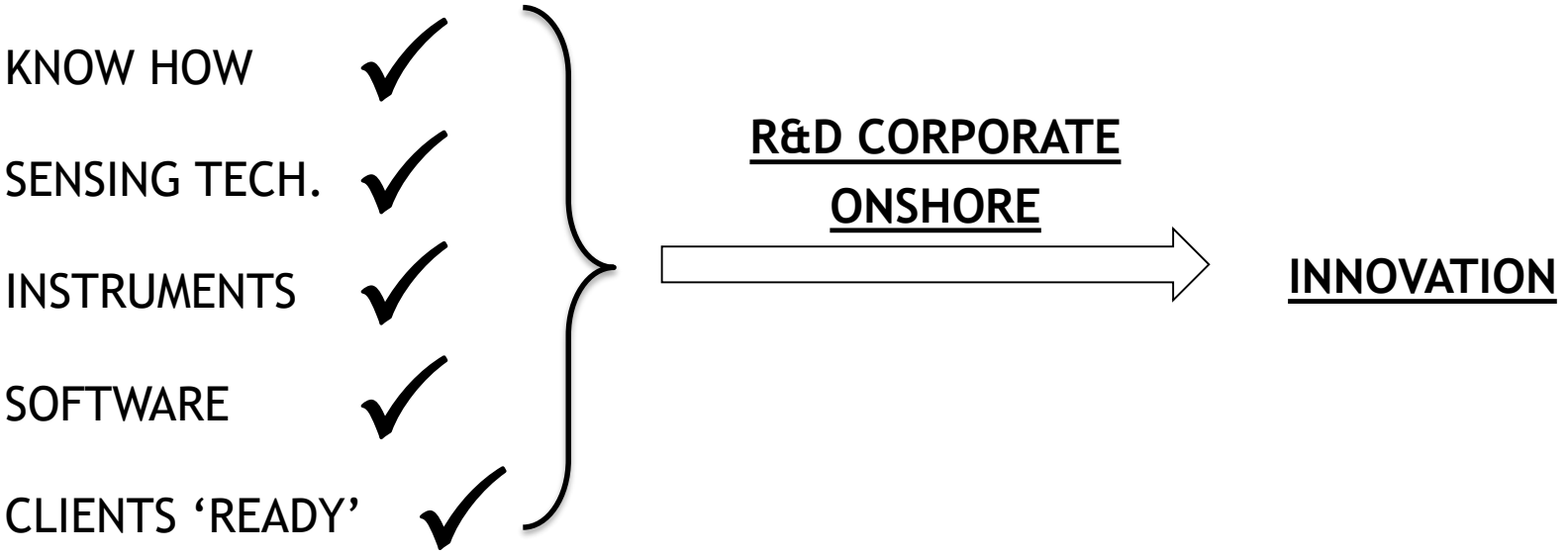




SAIPEM

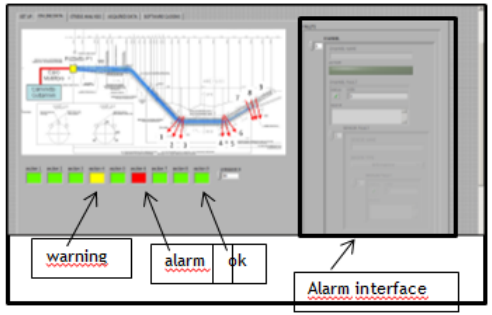
PIMS
STRATEGY FOR THE SMART PIPELINE

KNOW HOW
SENSING TECHNOLOGY TEST & SELECTION



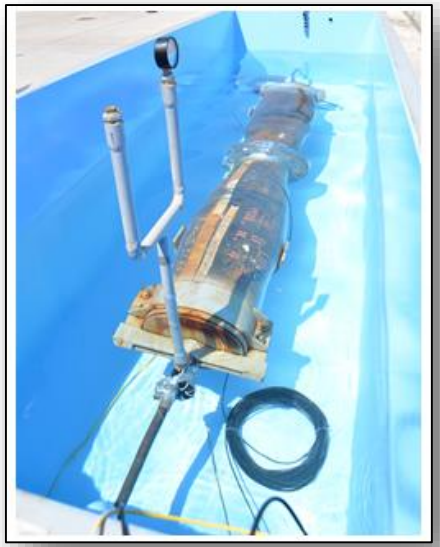
PIMS - INNOVATION
POINT SENSORS: FBG

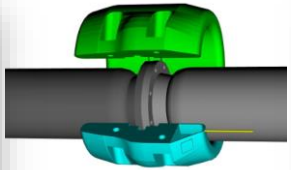
2011 – PIPELINE SHM



2013 – NEW ACQ.UNIT

2013 – LEAK DETECTION OFFSHORE





Patent Pending No. WO2015166429 A1

PIMS - INNOVATION
DISTRIBUTED SENSORS: APPROACHING SMART PIPELINE

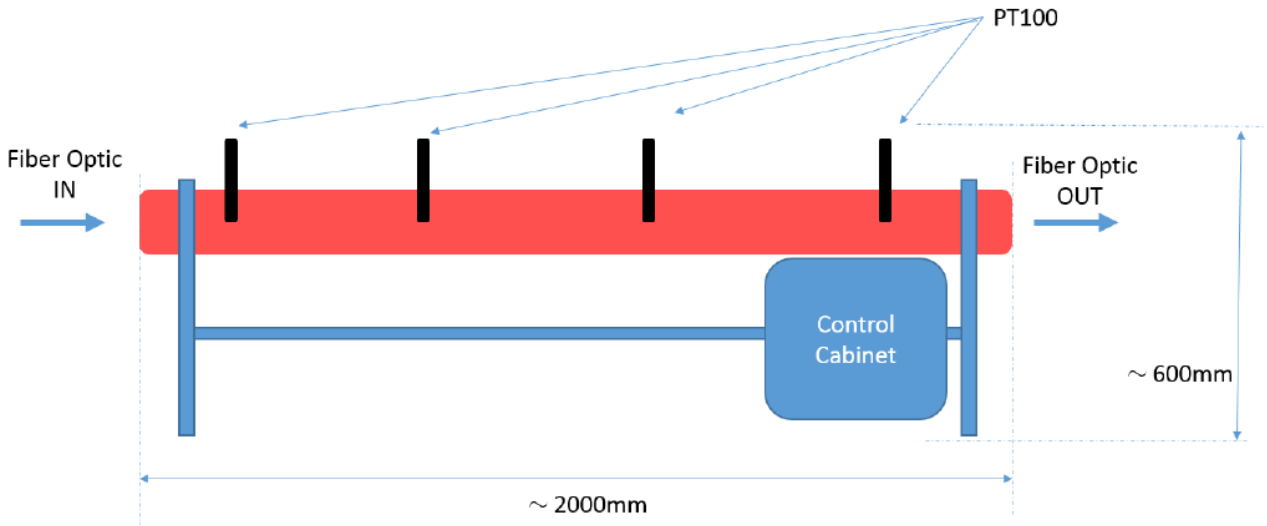
2015 – NEW METHOD FOR DSTS AND NEW OFS

Patent Pending No. WO2018060851

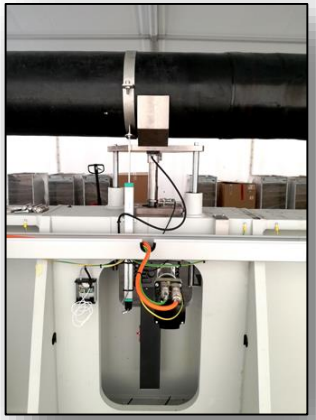
PIMS - APPROACHING THE SMART PIPELINE
INSTALLATION PROCEDURE VALIDATION

NEW OFS DESIGN

OFS CALIBRATION ($C_{T\varepsilon}, C_{TT}$)



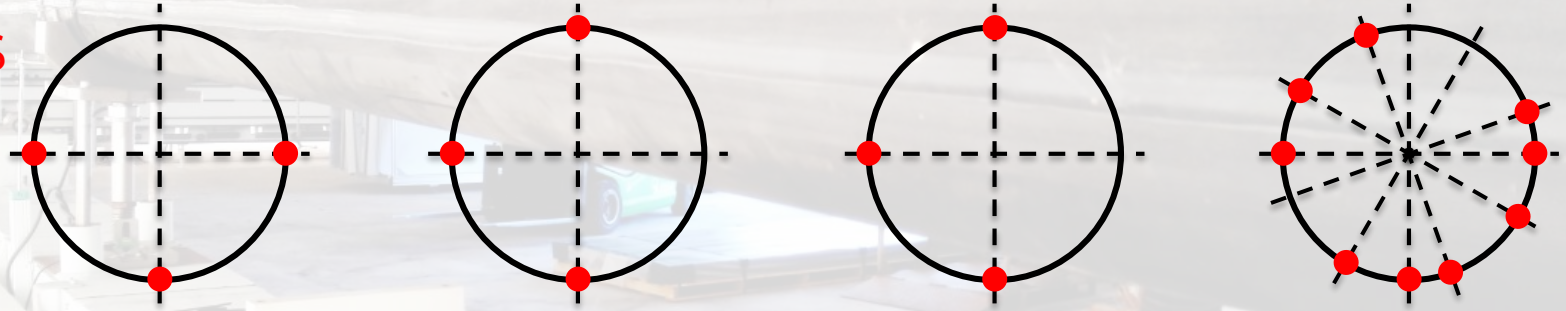
PIMS - APPROACHING THE SMART PIPELINE
INSTALLATION PROCEDURE VALIDATION



PIMS - APPROACHING THE SMART PIPELINE
INSTALLATION PROCEDURE VALIDATION

SEQUENCE OF OFS INSTALLATION LAYOUTS TESTED ON 8'' AND 12''

- OFS



A) COMPRESSION

B) COMPRESSION + TRACTION

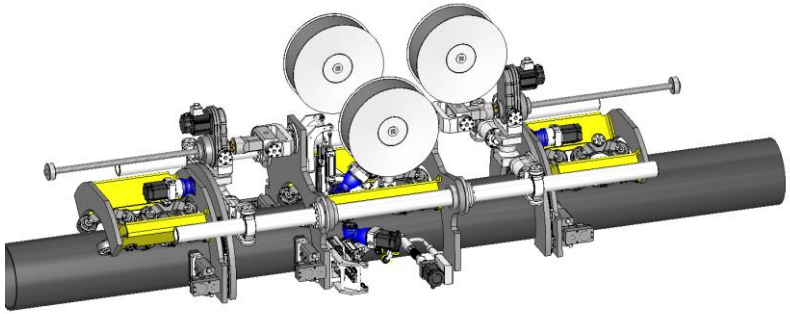
C) COMPRESSION + TRACTION (3hrs)

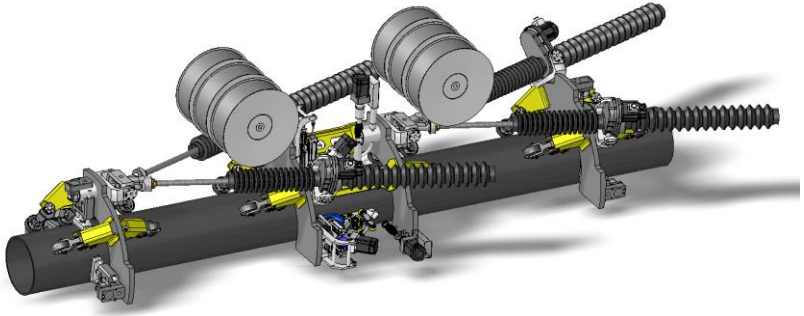
D) RANDOM POSITION

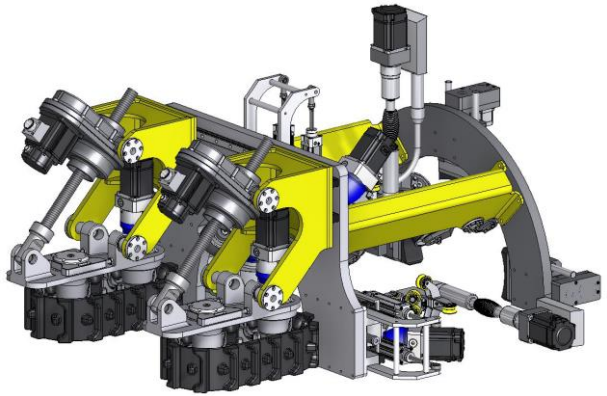
Load: central 10 to 30 kN, axial 4 to 8 kN.

PIMS - APPROACHING THE SMART PIPELINE
SPID - Smart Pipeline Installation Device

PRELIMINARY DESIGN

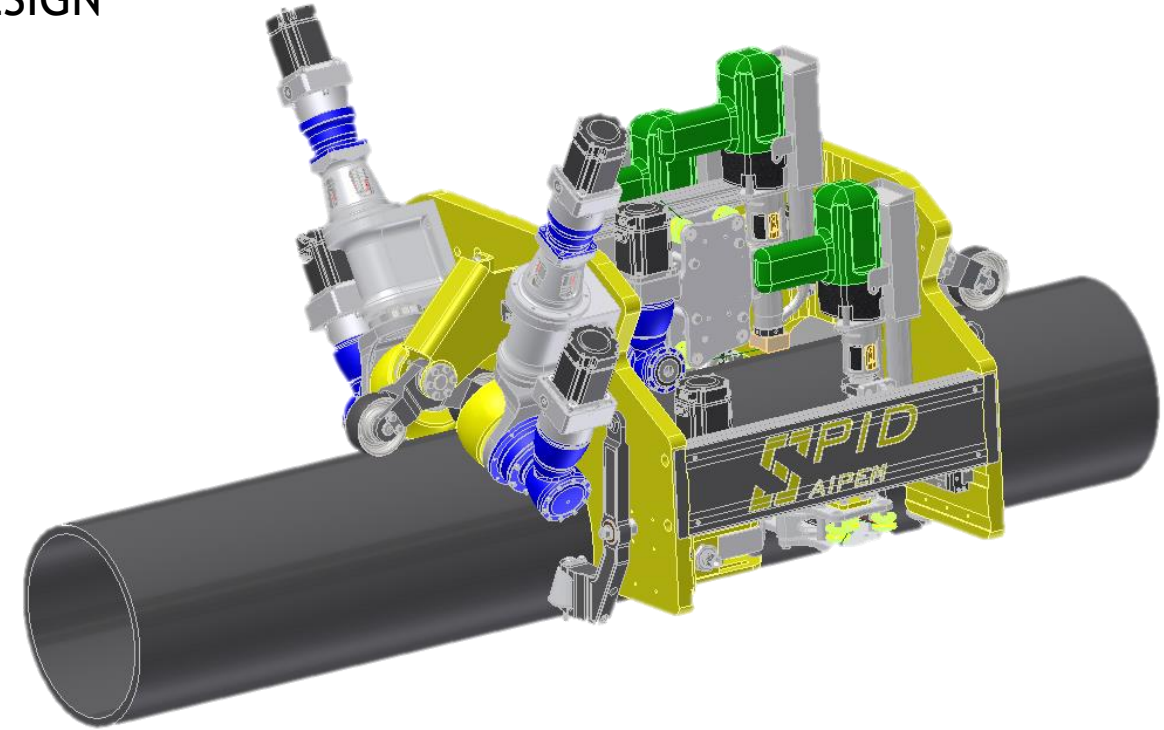






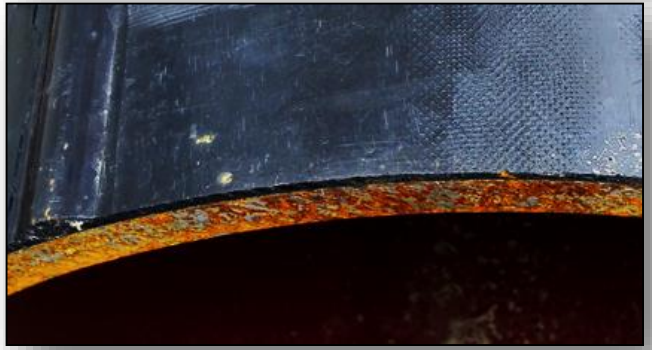
PIMS - APPROACHING THE SMART PIPELINE
SPID

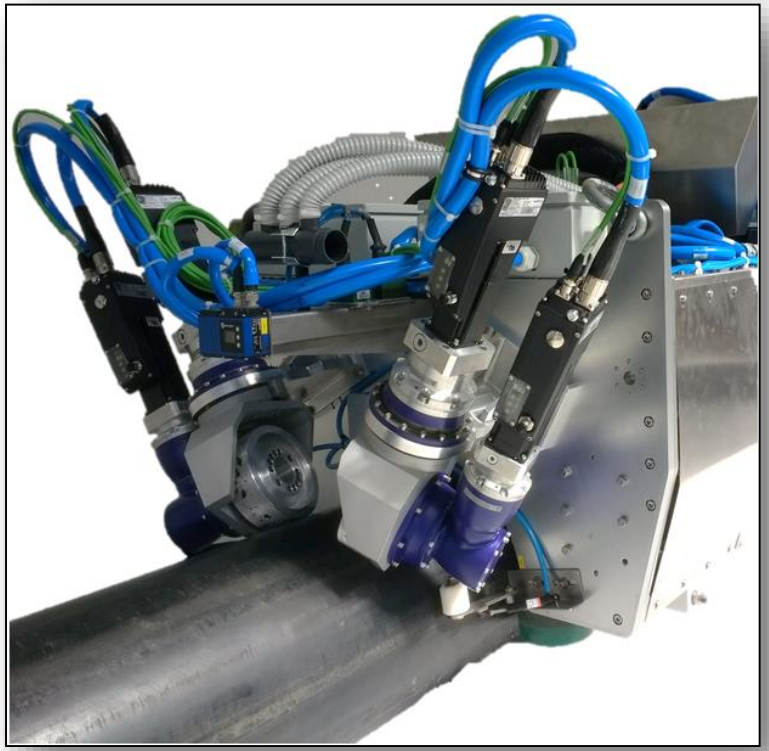
FINAL DESIGN



PIMS - APPROACHING THE SMART PIPELINE
SPID

PROTOTYPE REALIZATION





PIMS - APPROACHING THE SMART PIPELINE
SPID

PIPELINE CROSS-SECTION

2015

2018

PIMS - APPROACHING THE SMART PIPELINE
NEXT STEPS

NEW METHOD FOR PIPELINE INTEGRITY ONSHORE

NEW METHOD FOR PIPELINE ROUTING IDENTIFICATION

ENHANCEMENT OF TEMPERATURE LEAK DETECTION SYSTEMS

Q & A
TIME