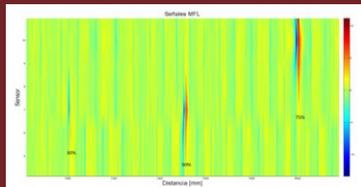


## MFL technique implementation in an ITION-E PIG and its field validation



ITION Magnetic Circuit



MFL Data Analysis

Oil and Gas industries employ a wide type of methods and technologies for monitoring different corrosion threats in pipelines. Magnetic Flux Leakage - MFL measurements implemented on smart pigs is one of the most commercial techniques used for corrosion damages detection for being robust and reliable.

The Corrosion Research Institute - CIC (Corporación para la Investigación de la Corrosión), as a technology development center and with the support of the gas transportation company - TGI (Transportadora de Gas Internacional) and the Colombian administrative department of science, technology and innovation - COLCIENCIAS, developed the ITION-E (ILI tool for thickness measurements) that records useful information for the integrity evaluation on carbon steel pipelines, in which the longitudinal Magnetic Flux Leakage measure technique is implemented improving the ITION technology by letting detect and localize critical thickness losses in metallic wall represented in damage depths greater than 50%, which can lead to catastrophic injuries of high social, economic and environmental impact.

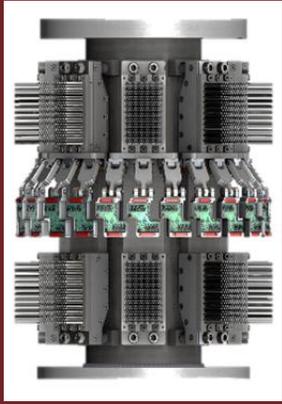
There have been designed and developed different systems which today constitutes ITION-E, especially electromechanic modules and software for the analysis and detection of discontinuities (MFL measure system), also modules that improves the inertial measure ILI tool ITION-I which allows localization and georeferencing information of possible flaws detected.

**MFL measure system** is composed by several yokes that are tied to the structure, to them are coupled high power magnets in which are metallic brushes that induct a magnetic field in the pipeline.

For the thickness measurements, the tool has a ring with sensors on the electronic circuits that is supported on escualizable mechanic compounds that maintains the sensors in contact with the inner surface of the pipe and can be bended to overcome internal components or changes in the inner diameter of the pipeline.



MFL Tool for Critical Thickness Inspection



The base systems (Structure, Power, Datalogger, Seals and Odometer) are essential for the basic tool operation.

**Datalogger system** processes and register in real-time magnetic field signals and data packaging on a high density memory bank, conformed by two principal cards coupled to a structure and to electrical power connections, communications and MFL signals.

**Odometer system** register the axial length traveled by the tool allowing future indications localization.

**Power system** is composed by high capacity batteries to give the required operation autonomy.

**Structural system** includes an encapsulation that protects the electronics from the pipeline pressure, an embroidery frame that holds internal components, a flange on which are assembled high pressure connectors and accessories for initiate the tool and for external communication.

**Complementary system** constituted by flanges that allows coupling a transmitting antenna for tracking the ILI tool when it pass through checkpoints or in case it gets stuck.

**Seals system** consists of cups, seal discs and guide discs that guarantee the movement of the tool through the pipeline by the product transported. Is chosen by geometric and operational pipeline characteristics. Its design allows pass through fittings (valves, derivations) and internal diameter deformations lower than 25 percent.

With the progressive technology evolution obtained with the implementation of software and hardware for flaws detection and characterization in laboratory, were built two ILI tools (ITION-I and ITION-E) and ran three pilot testing. This testing on TGI pipelines permit to test MFL technique performance for detection and localization of critical thickness defects and improvement of implemented designs and techniques.

**CIC is working to optimize ITION-E service, improving the electromechanic design and indications processing algorithm with a detailed laboratory characterization.**

Seeking international impact through technological development, involving knowledge, experience and resources of the participating entities (COLCIENCIAS, TGI), is required to promote the creation of international networks between organizations that promote research and technology evolution.



As a first step the strategic alliance CIC with the German institution Fraunhofer will allow technological and scientific improvement for the CIC own technology ITION ILI tool for thickness measurements; ITION-E, with the implementation on it, of a high resolution MFL (Magnetic Flux Leakage) technique.

