

Innovative Safety Monitoring System based on Fiber Optic Sensors Technology Compatible with 4-20mA Standard

Vincenzo Romano Marrazzo^{*1,2}, Francesco Fienga^{1,3}, Dario Laezza^{1,2}, Michele Riccio¹, Andrea Irace¹, Salvatore Buontempo^{2,3}, Giovanni Breglio^{1,3}

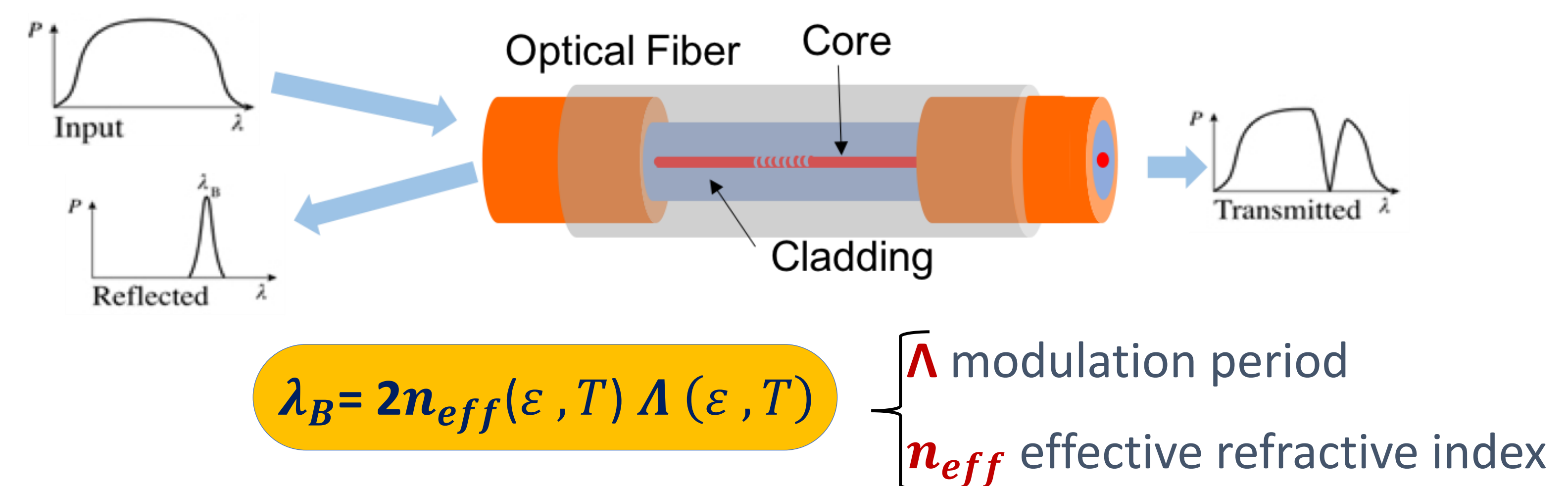
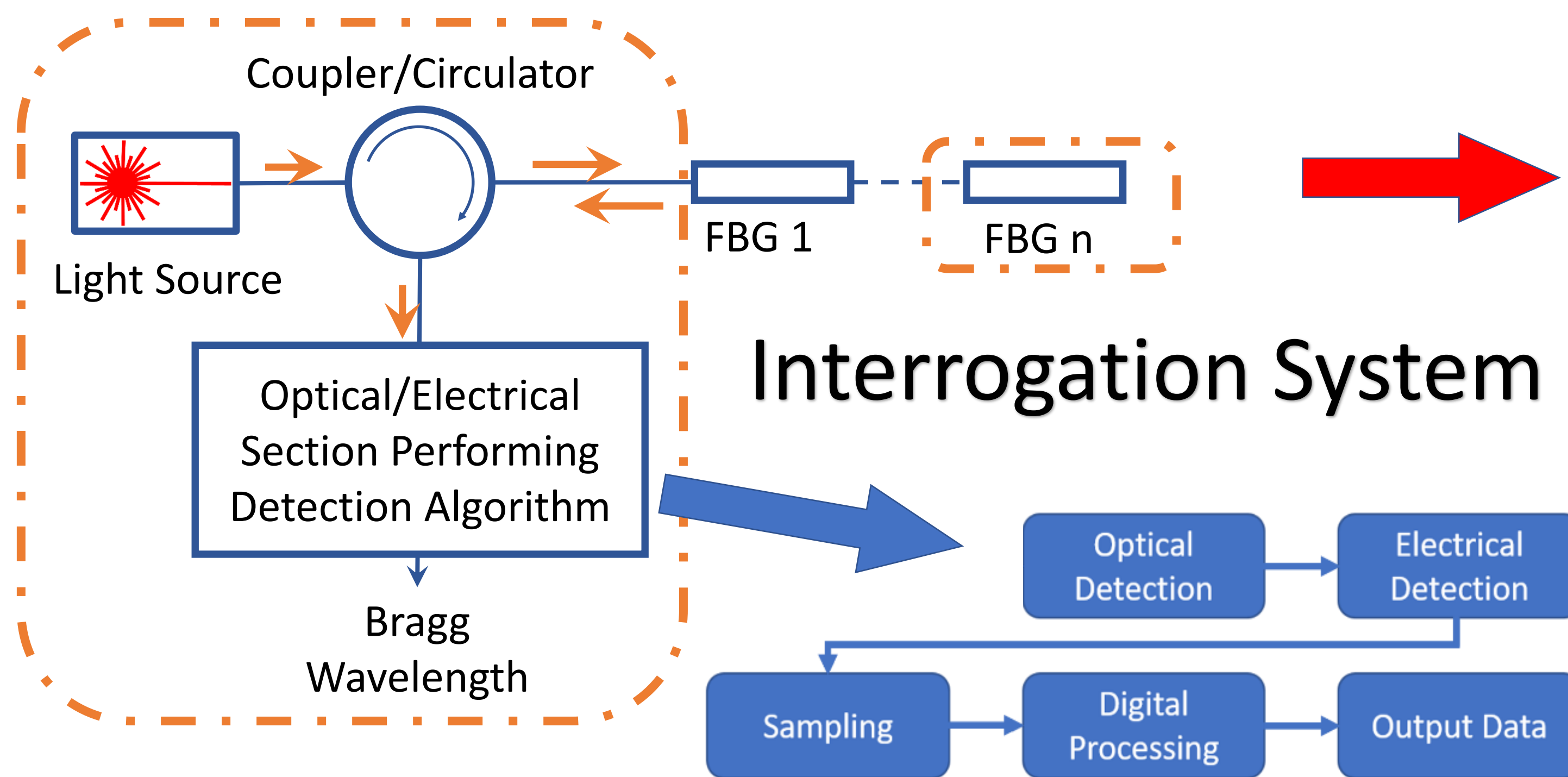
¹Department of Electrical Engineering and Information Technologies, University of Naples Federico II, Italy

²National Institute for Nuclear Physics (INFN), Section of Napoli, Italy

³European Organization for Nuclear Research (CERN), Geneva, Switzerland.

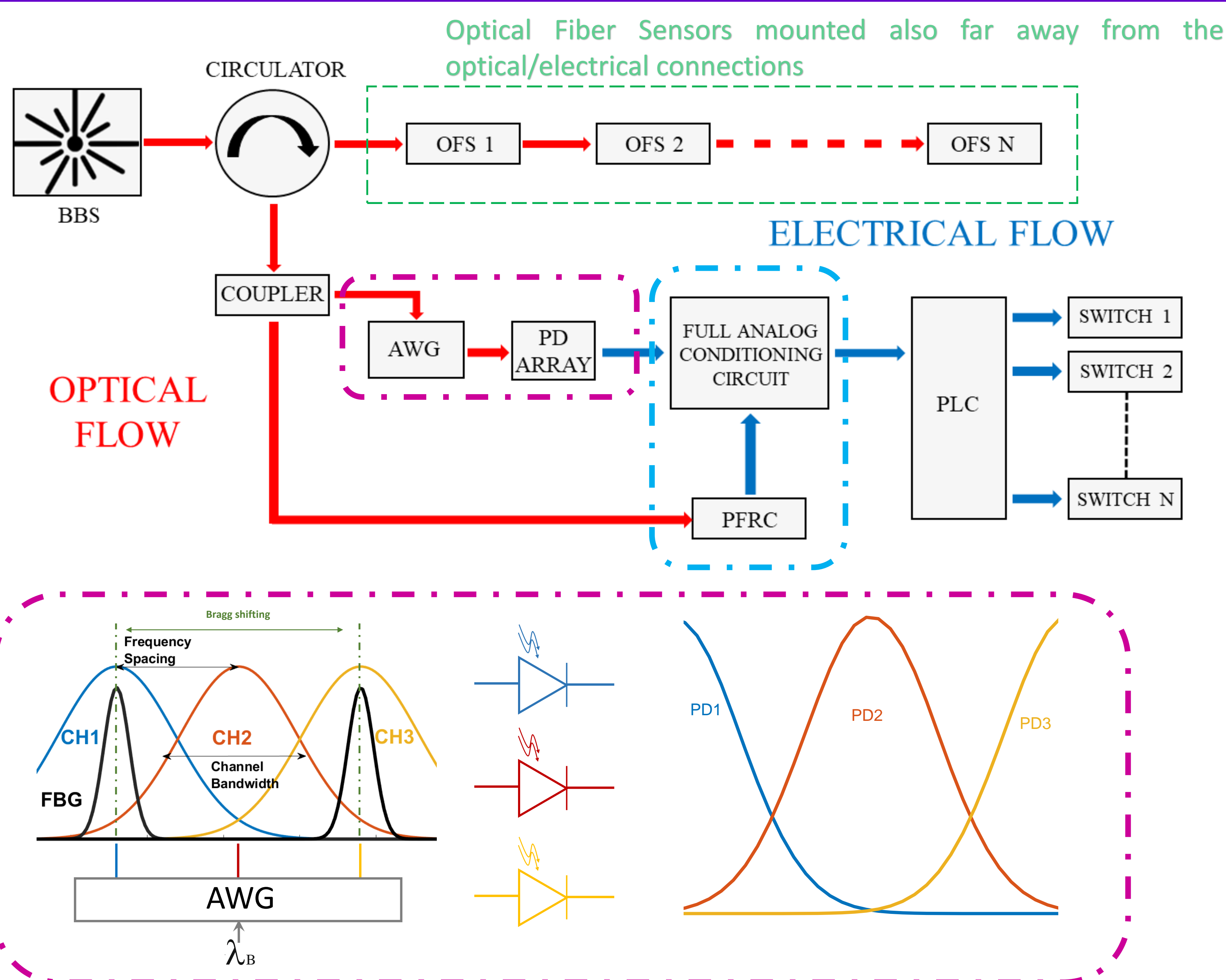
* vincenzoromano.marrazzo@unina.it

Introduction



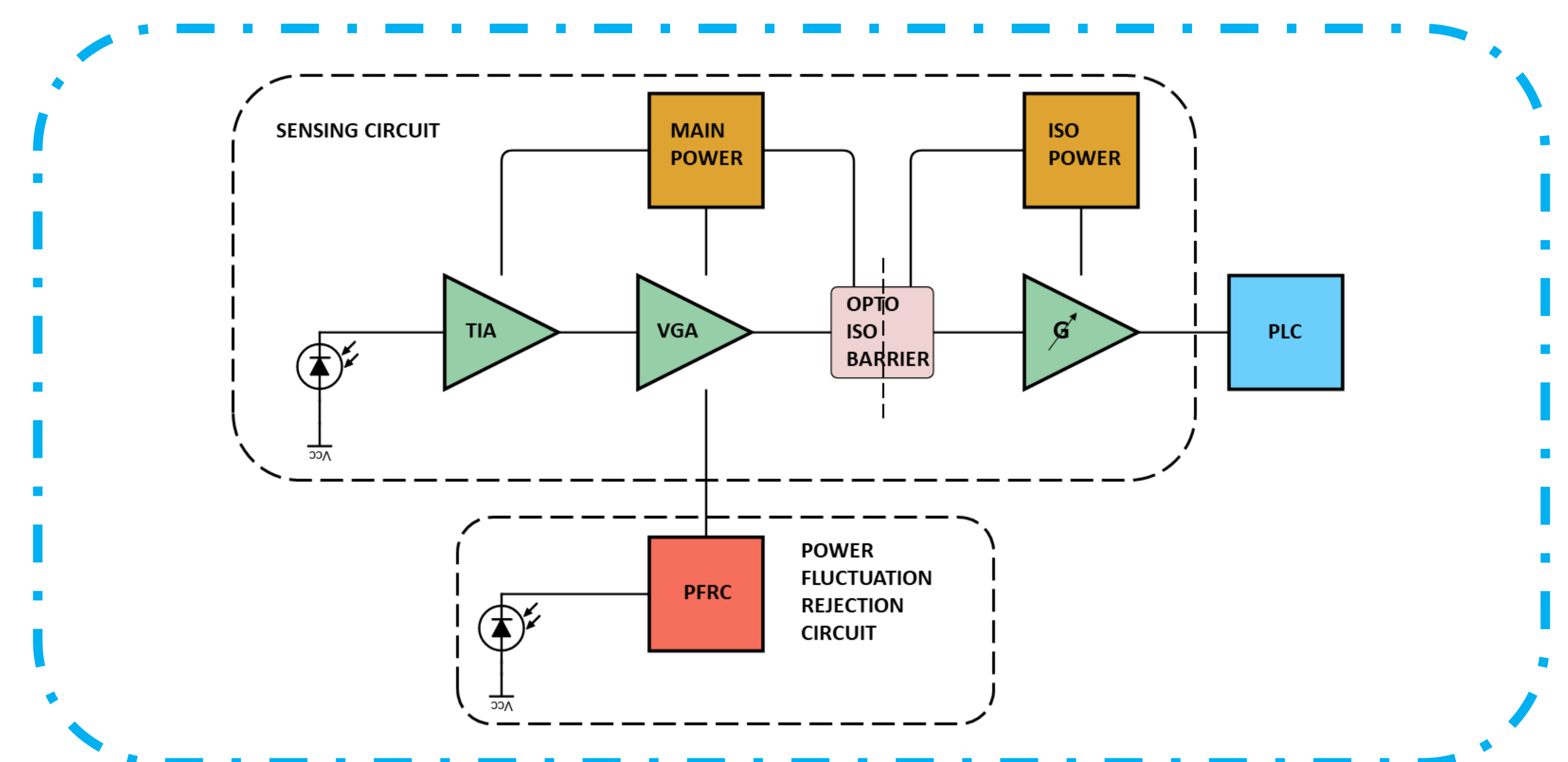
Typical interrogation block chain non-compliant with Detector Safety System

Proposed Solution

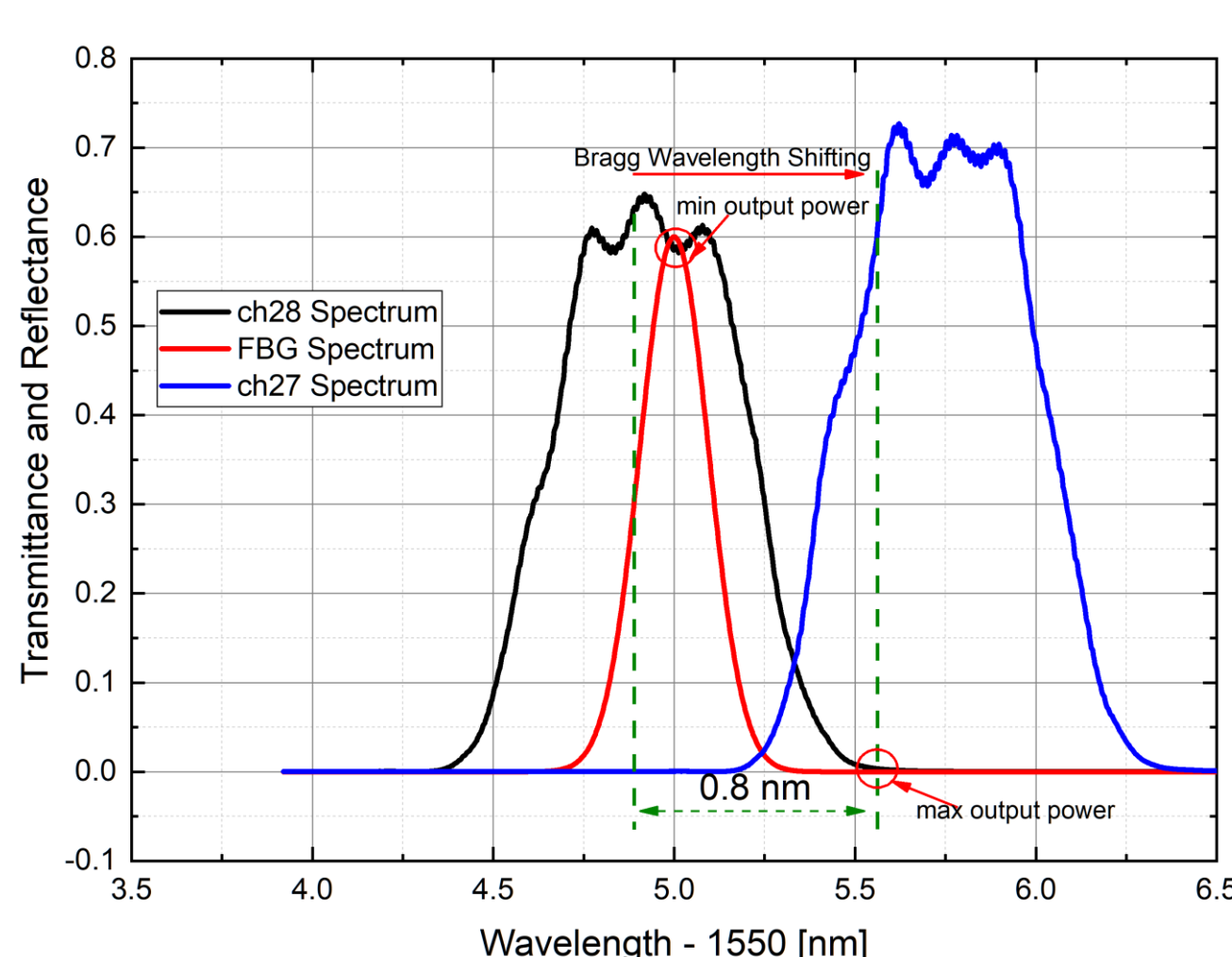


To take advantage of the FOS sensing feature within a safety monitoring system to be used in harsh environments (like DSS front-end) an optoelectronic interrogation system must be:

- ✓ Reliable and robust;
- ✓ Purely analog, avoiding digital processing;
- ✓ Capable to restore the output if a malfunction occurs;
- ✓ Compatible with 4-20mA standard (PLC system).

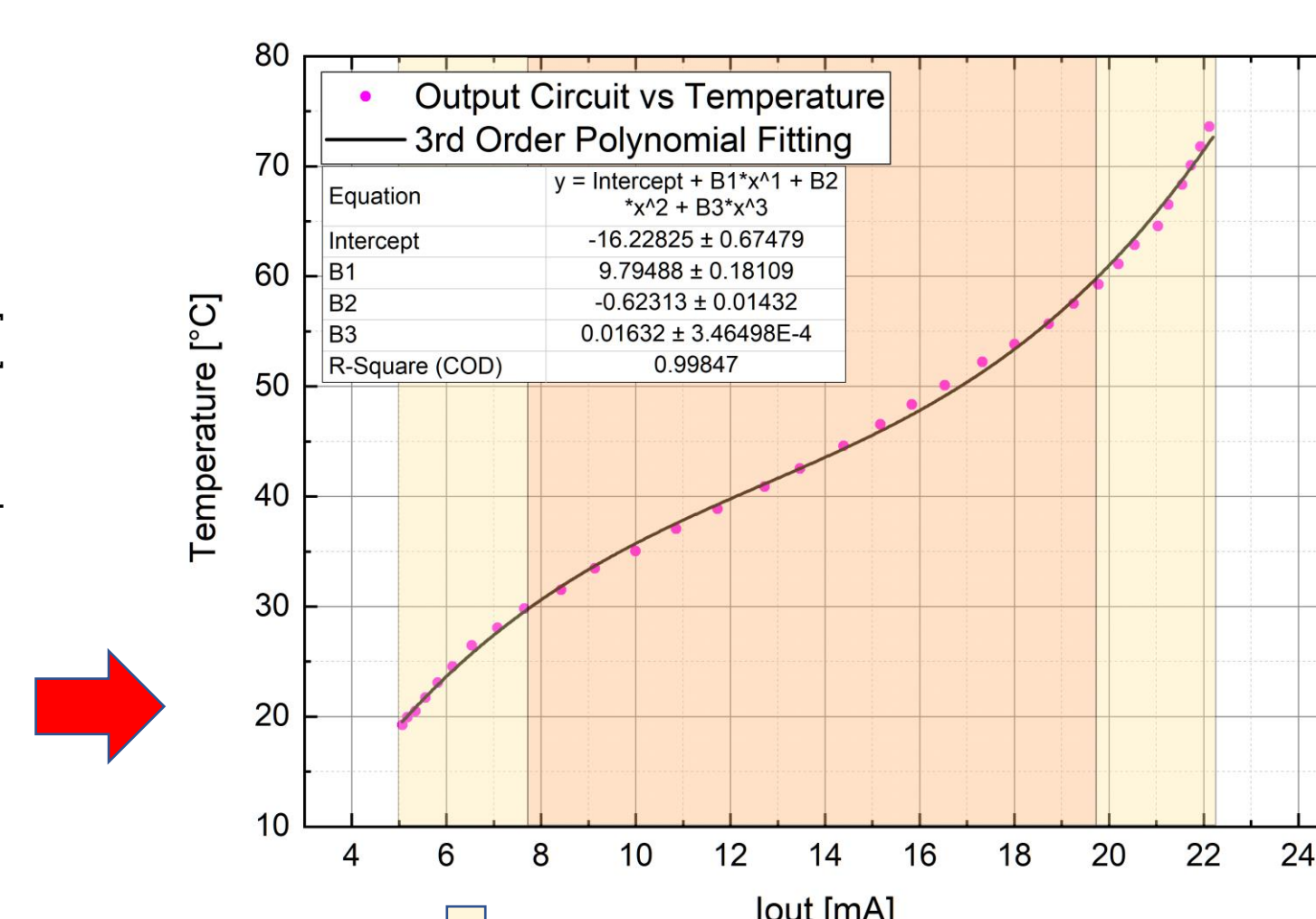
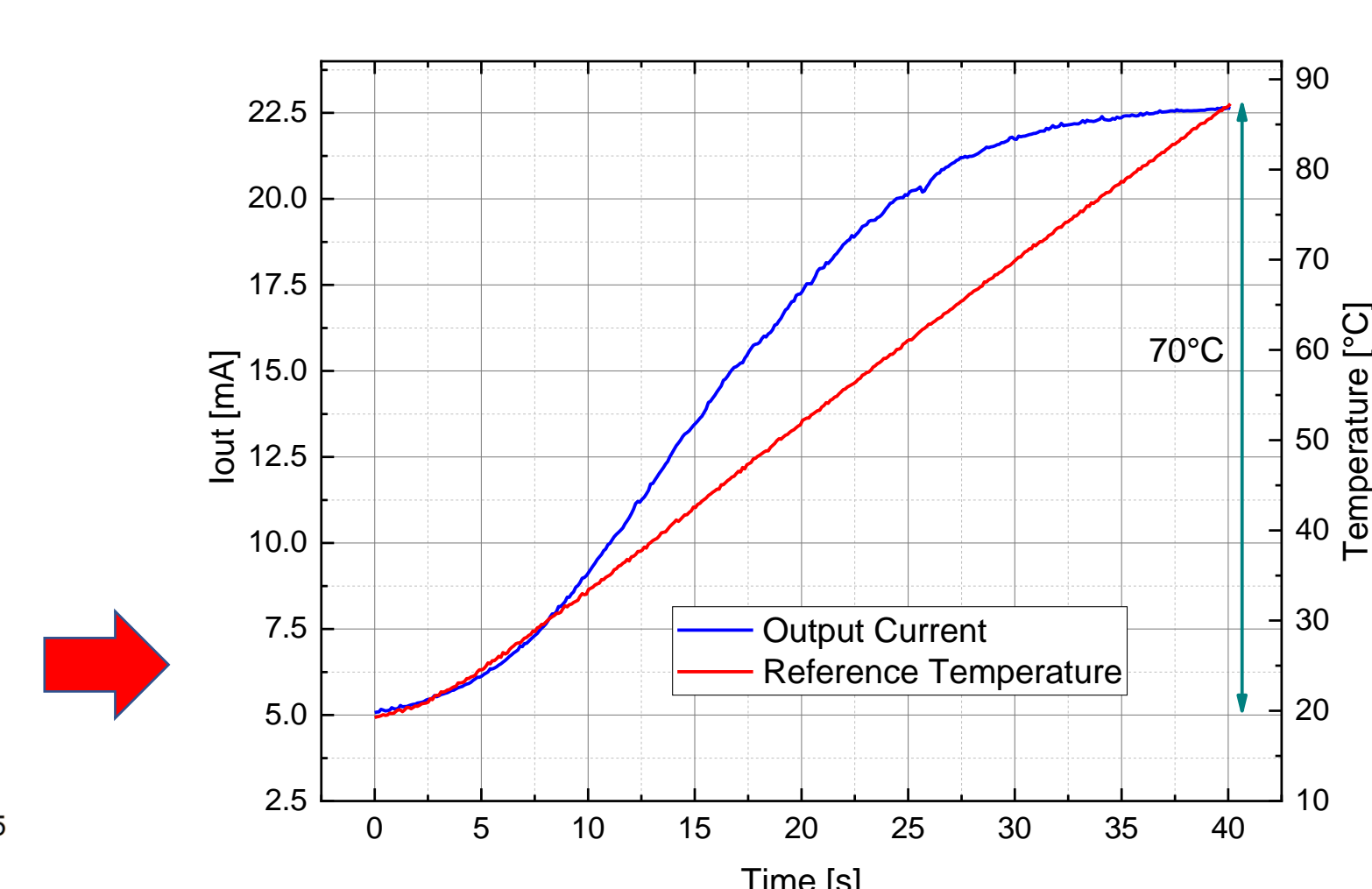


Experimental Measurement and Conclusion



1-Channel measurement of ΔT of 70°C (approx. 700pm of λ_B shifting) with

- Fs-FBG with 315pm FWHM, $\lambda_B \sim 1555$ nm (almost ch28 peak);
- AWG with channel spacing of 800pm and FWHM of 600pm.



2nd order fitting:
resolution of
0.1°C/10μA

1st order fitting:
resolution of
0.02°C/10μA

- Purely analog PLC compatible interrogation system has been developed.
- The system is compliant with industrial processes and to be used in safety scenario.
- The system is capable to restore the output in case of malfunctions.
- If a device or a connection in the loop breaks down the system automatically sets the output in alarm mode.
- A single channel for $\Delta T = 70^\circ\text{C}$ monitoring has been designed and experimentally validated.
- A pilot project is present with the CMS experiment. The system will be ready for a test in few weeks.