Optical interrogator for Fiber-Optic Sensors in Sustainable Agriculture

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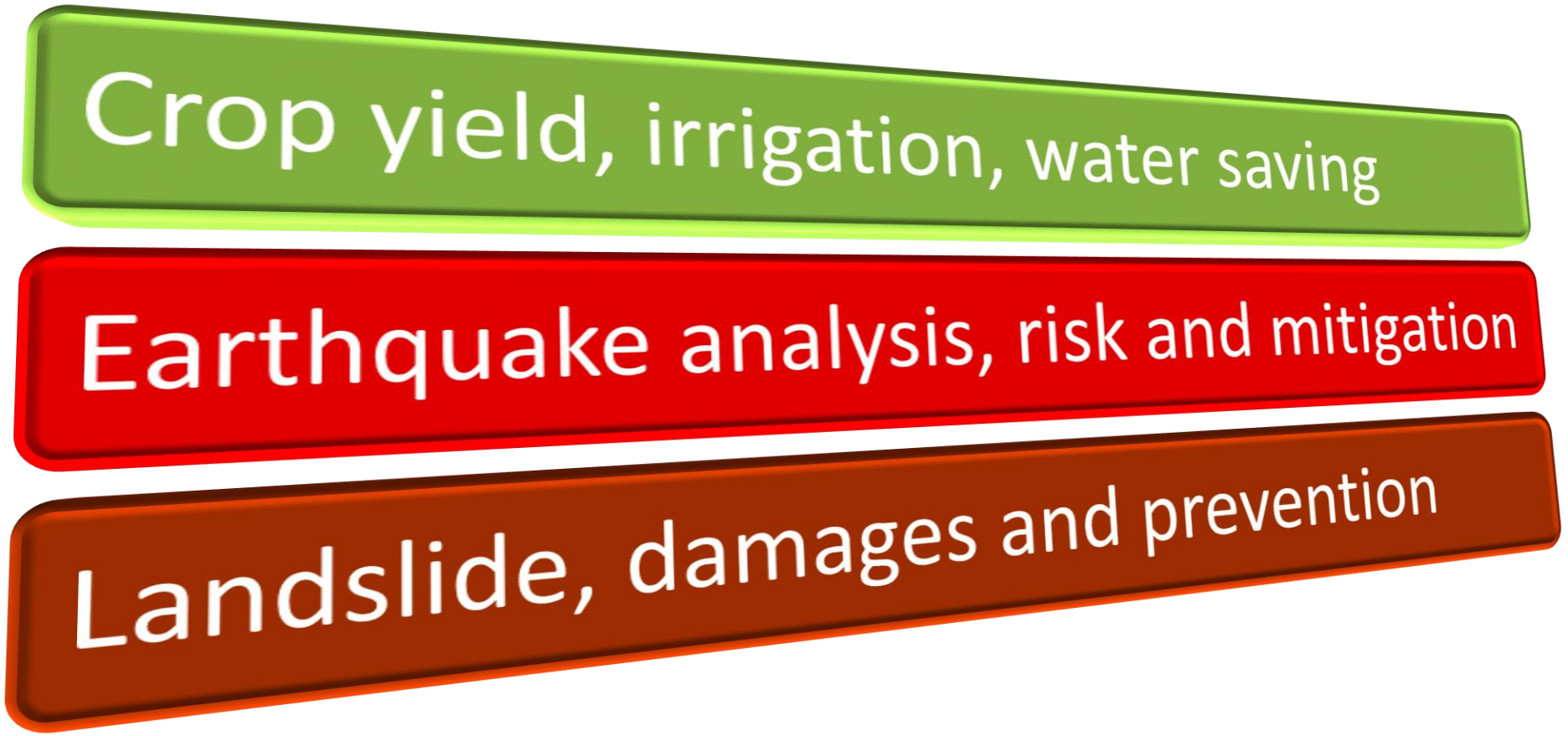
Challenges: Our mother earth



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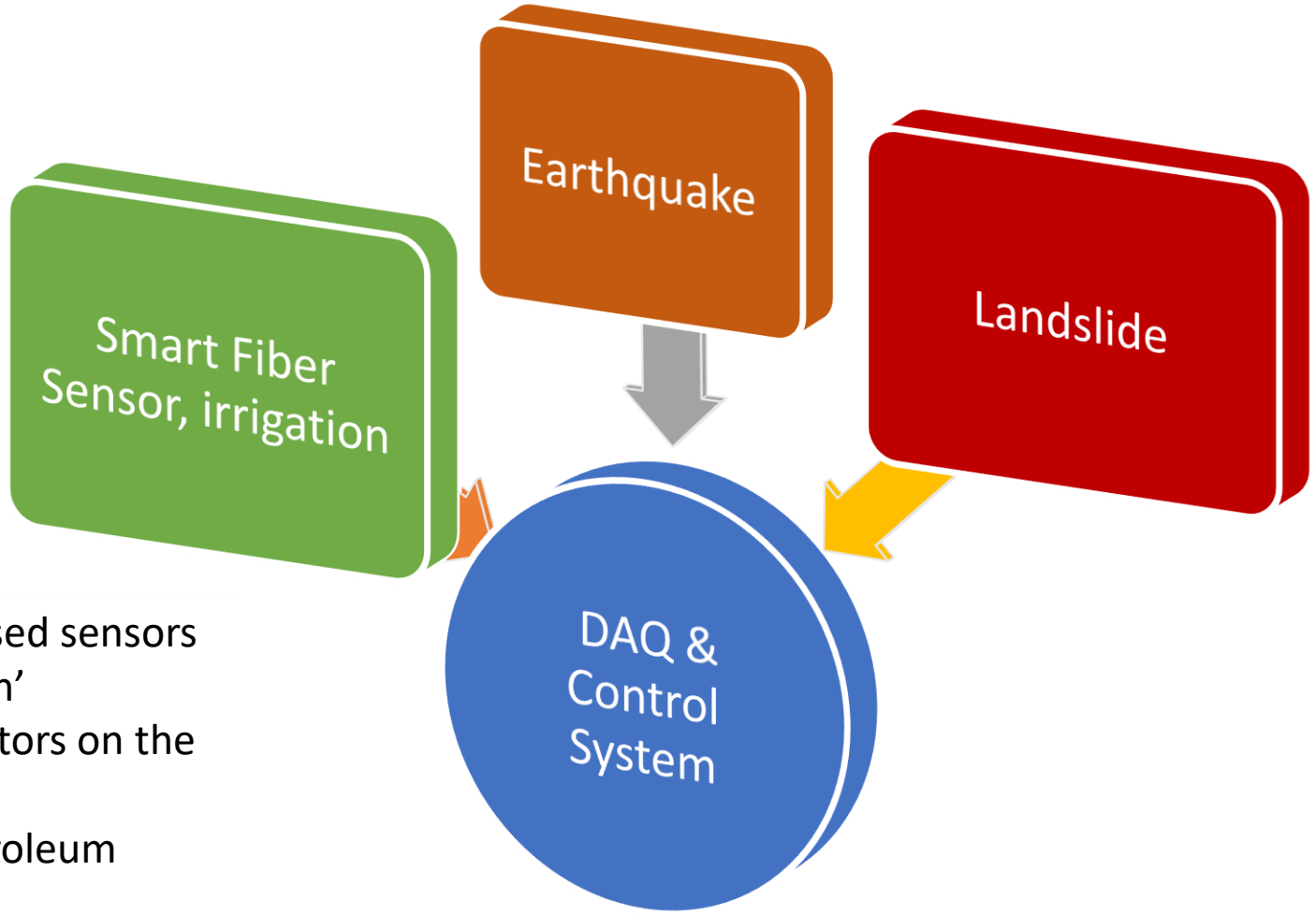
FOSS4I.2: Interrogator, DAQ a common deno



Fiber optics / FBG based sensors involves ‘interrogation’
The current interrogators on the market are high cost
E.g. used by petroleum multinationals

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Interrogator for Sustainable agriculture: static

Already validated

Challenge I: Overcome climate change and *water* deficits on food shortages

- Maximize crop *yields:* Avoid loss of crop due soil wilting point
- Avoid over irrigating: water loss, energy cost
  - Smart irrigation: Control of soil water content
    - Irrigate as much as 'needed'!

All efforts, technologies, are needed:

- Capacitive: Electronics and power supply on all measurement points LoRa/IoT for data transmission
- Time/Frequency Domain Reflectometers (TDR/FDR): Data logging, …
- FOSS4I.0: CERN technology used for the development of Fiber optics (FBG based)
  - Centralized electronics and power supply

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Extension A: Earthquake, dynamical

Challenge II: Earthquake risk mitigation

- We cannot predict earthquakes, but we can minimize its effect!

All efforts, technologies, are needed:

- Earthquake Alert system (ShakeAlert): (Hold on, Cover, Drop)
- A wider network of sensor.
- Low frequency (VLFE,LFE) affecting mostly large building
- High frequency, affecting mostly small buildings

Extension B: Landslide Early Warning, Dynamical

Challenge III: Early warning for landslide

- Local landslide early warning systems (LEWSs) monitor a specific slope that has been pre-identified as being at risk of failure.

All efforts, technologies, are needed:

- Changes in slope conditions are monitored using instruments to measure the movement of slope materials and/or a proxy for pore water pressure. Often a range of monitoring sensors are used.

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DFB based interrogator: static

Solution based on:	• Hardware: common / basic components: DFB Laser, PID controllers, FPGA • Software: advanced 'learning' algorithms
Affordable solution for most applications	• Irrigation- validated • Seismic- to be developed • Landslide- to be developed
Robust against vibration, autonomy:	• No mechanical parts • Sensor without on site powering

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Who can profit?

Agriculture worldwide

Seismic analysis systems (within and outside of CERN)

Geophysical society

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Partners, potential partners

CERN: Safety and electronic departments, JPARC, ….

Research: Potential partner Remote sensing center

Commercial: TBD

Industrial: TBD

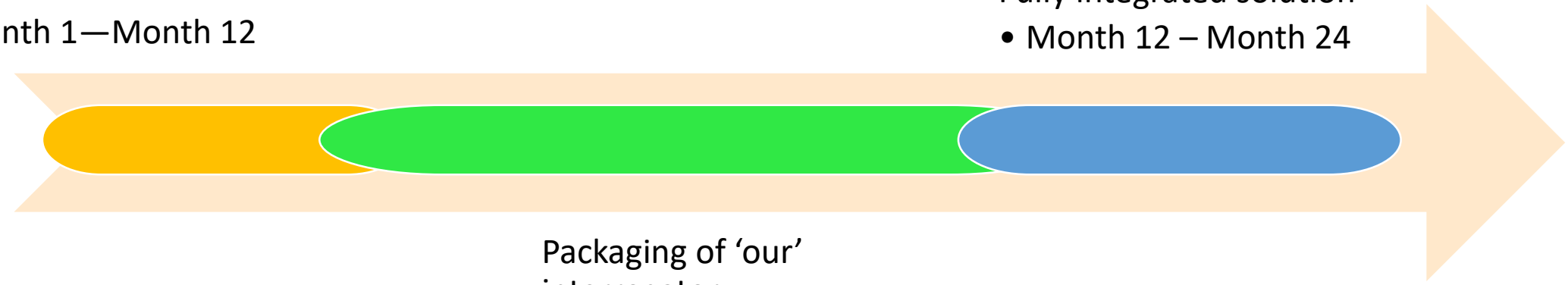
Roadmap and timeline: 24 months

Interrogator Dynamical behavior: Assessing current solutions + commercial dynamic interrogator

- Month 1—Month 12

Inertial sensors:

- Fully integrated solution
  - Month 12 – Month 24



Packaging of ‘our’ interrogator:

- Month 6— Month 18

Resources

- Equipment:
  - Current solutions inertial sensors
  - Dynamic interrogator (existing solution)
  - Vibration table and reference sensors
- HR:
  - Electronics technician
  - Mechanical technician
- Support from electronics department CERN, CERN HSE
- Electronics and mechanical materials
- Mobility support (CERN and Expos)