

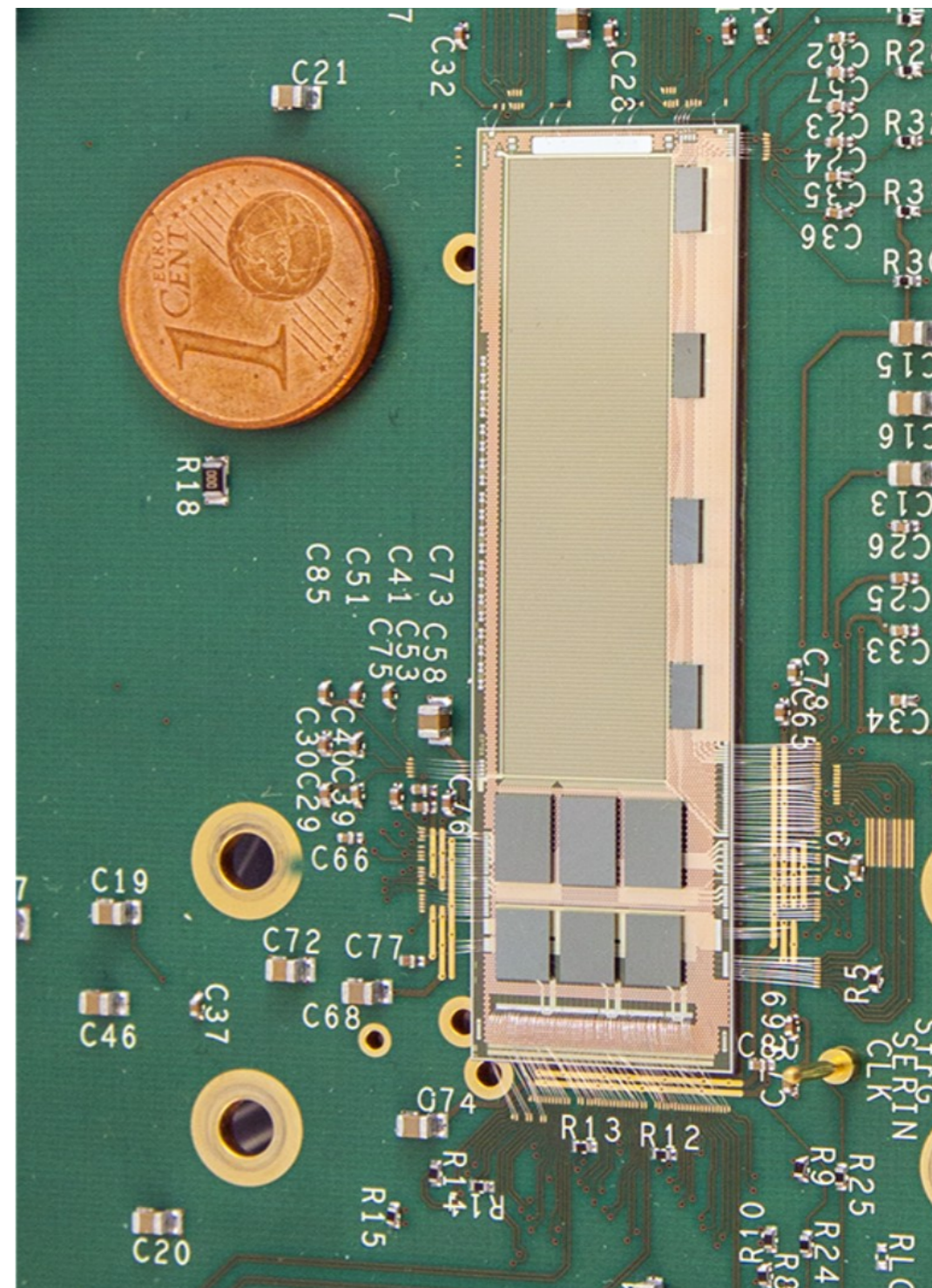
# DEPFET vertex detector & Forward Tracking Disks

**ILD meeting**

**Oshu, Japan, Sep. 2014**

*Marcel Vos (IFIC Valencia),  
for the DEPFET collaboration  
and the Spanish LC network*

*Thanks to F. Arteche, ITA, I. Garcia, IFIC,  
I. Vila, IFCA, M.A. Villarreja, IFIC*



# FTD-pixels



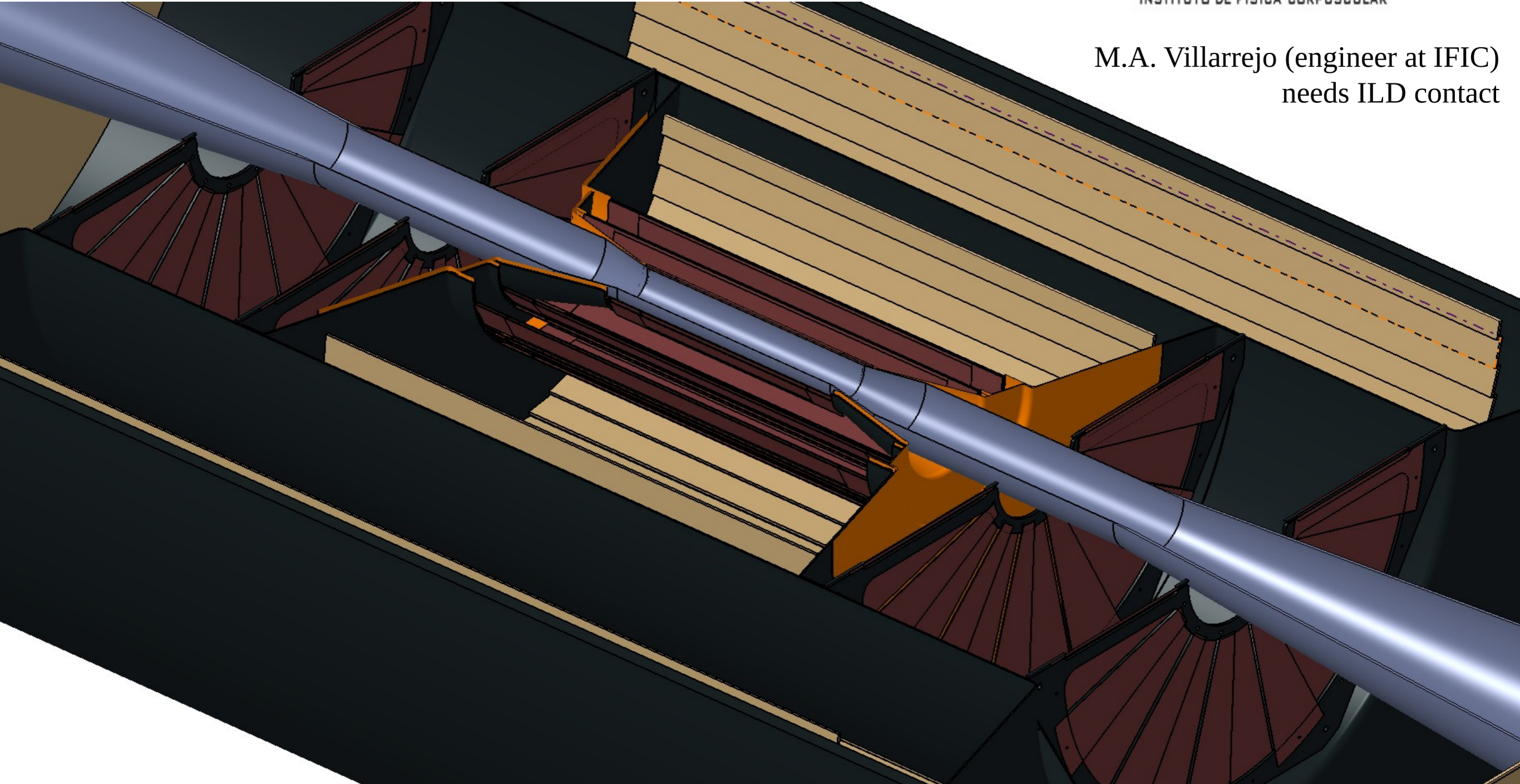
# FTD: detailed design

## A detailed design for innermost Forward Tracking Disks (and VXD)

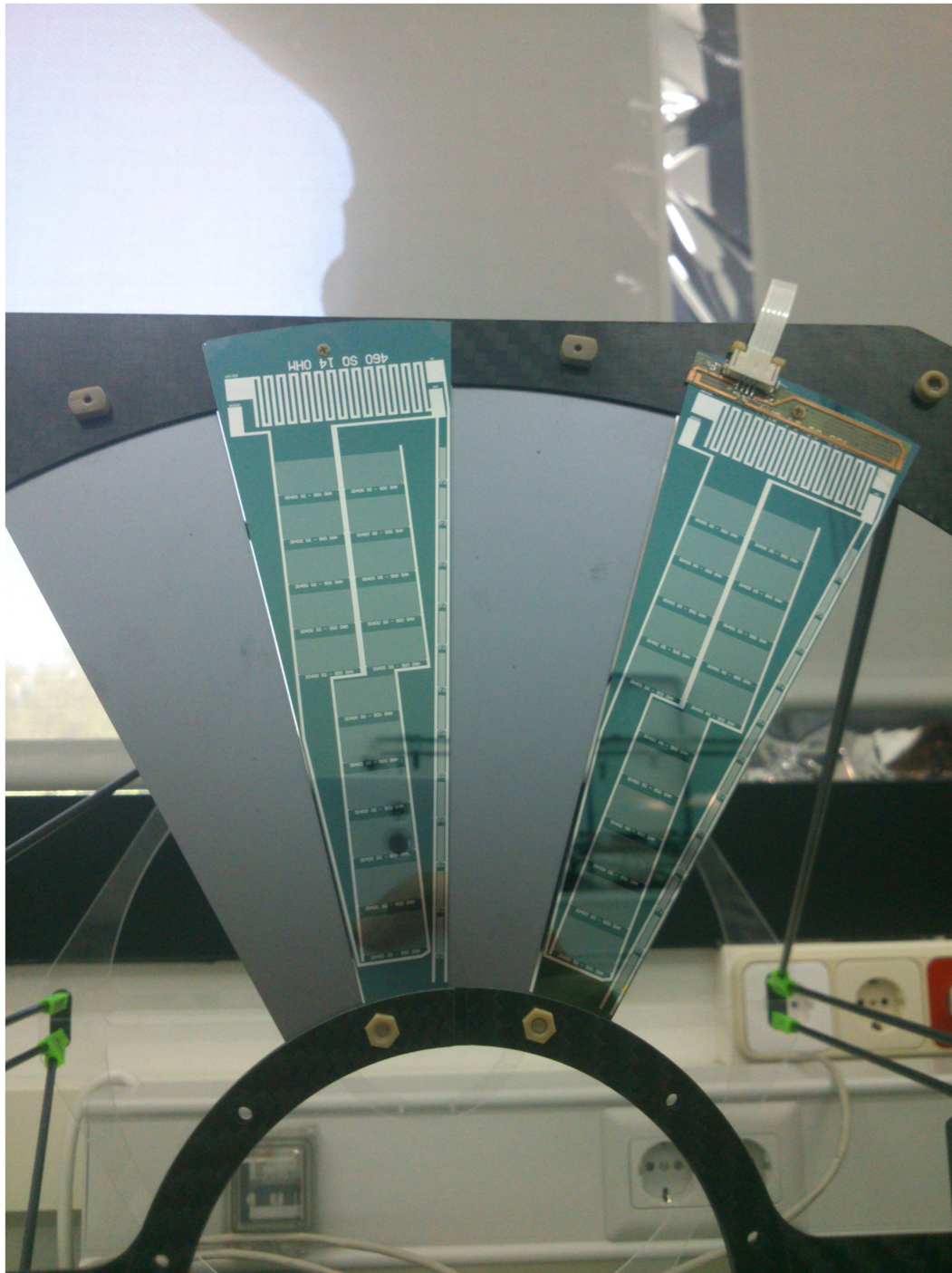
- end-of-ladder material (technology-specific)
- cables & services (generic, inner-tracker level problem)
- feed back into simulation for increased realism



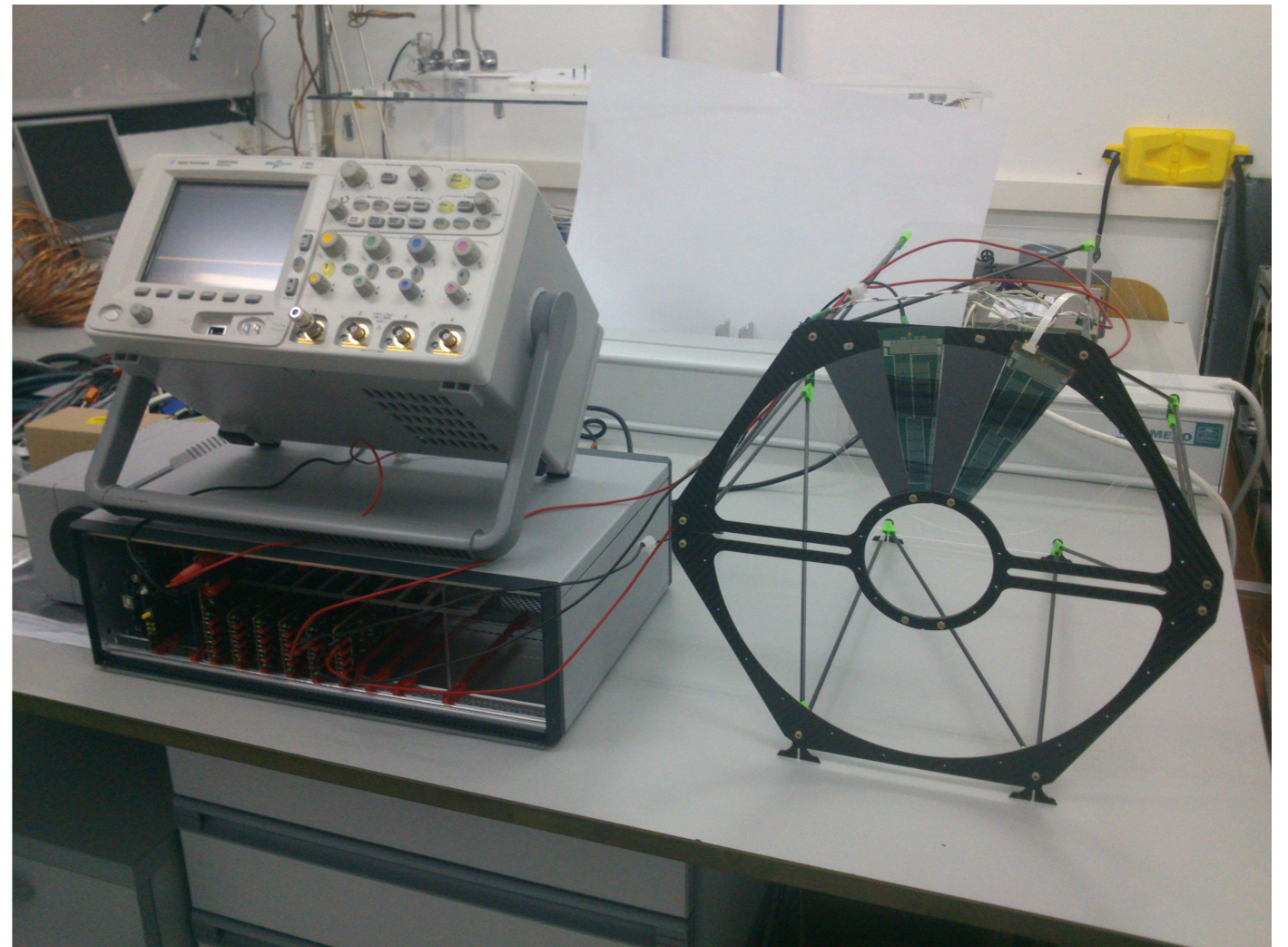
M.A. Villarrejo (engineer at IFIC)  
needs ILD contact



# FTD mock-up



Thermo-mechanical petals on FTD1 support structure



FTD1 and power-pulsing set-up

## FTD mock-up

- disk 1 (pixels, IFIC Valencia)
- disk 3 (strips IFCA Santander)
- mechanical performance

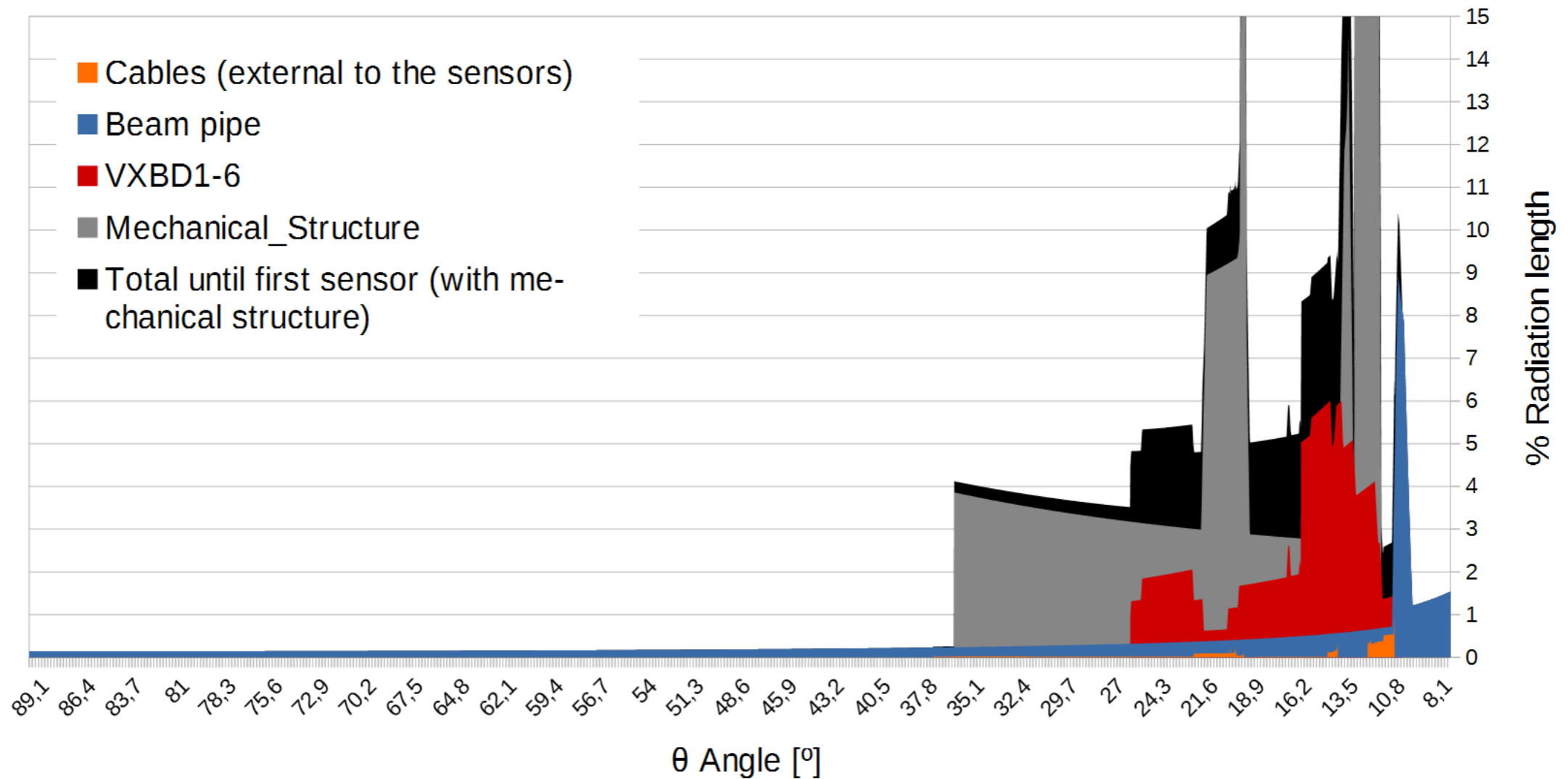


# Detailed design



Where does the additional material go?  
How does it impact physics?

Radiation length contribution of the elements before the first sensitive layer



# Design optimization

**FTD-pixels has some long-standing design issues (see Marcel Demarteau's talk)**

Too few pixelated disks too far from the IP

**Why haven't we sorted this out yet?**

Any serious optimization needs realism → inner-tracker coordination for supports and services

Lack of pixel technology decision → difficult to optimize “generic” design

**I propose to compare performance of alternative design:**

- 5-6 pixel disk option as close as possible to VXD

(without cryostat, but with realistic constraints from end-of-ladder area, supports and cables)

- vary barrel length (current 25 cm and “shorter”)

Can commit engineer to produce CATIA design and estimate material budget,  
need to interact with experts in GEANT4 implementation and analysis



# FTD micro-strips



# Micro-strips?

A proven technology for a difficult region

Solution for moderate-density forward region ( $|z| > 50$  cm)

Single-BX read-out needed to provide a time-stamp for Silicon-only tracks

The idea of all-pixel tracking as suggested by M. Demarteau (and by Chris Damerell and myself years ago) seems more suited to central detector

→ SIT in ILD (background free, backed by TPC)

Notoriously undermanned R&D effort in LC, but large community world-wide → instrumentation of few  $\text{m}^2$  is no problem





# Micro-strip detector R&D

## R&D focus on reducing material

- **Charge division read-out: 3D measurement from a single strip**

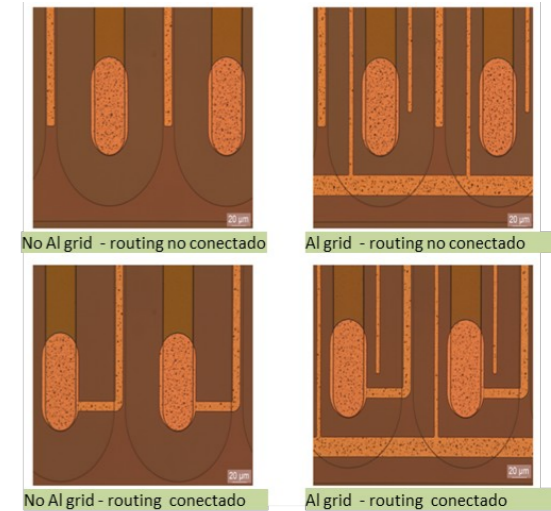
→ possible replacement of (false) double-sided microstrips. Second generation produced of charge-division microstrips sensors with integrated signal routing lines and signal isolation structures to avoid cross-talk → good preliminary results

- **Further integration of components**

→ integrated pitch adapter tested by HEPHY Vienna

- **Active sensors**

→ sensors with small gain investigated for HL-LHC (RD50, CNM/IFCA)



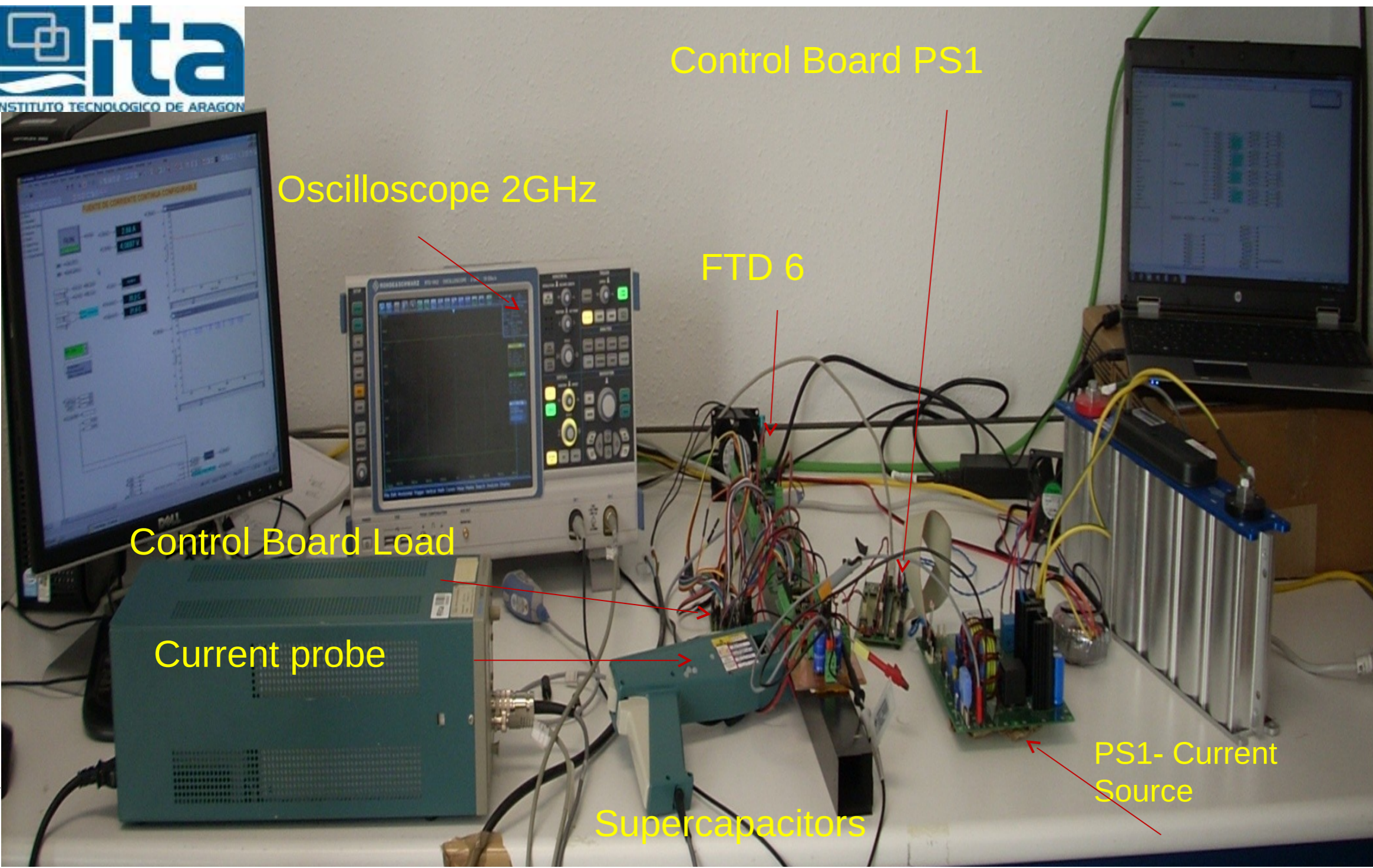
OLD IDEA (Radeka) NEW TECHNOLOGY  
(CNM in-house production of custom designs)



# Power distribution

R&D on power distribution (power pulsing)

First power system demonstrator for a quarter of disk 6 (details in F. Arteché talk)



Control Board PS1

Oscilloscope 2GHz

FTD 6

Control Board Load

Current probe

Supercapacitors

PS1- Current Source



## Bragg Fiber Environmental monitoring

### Belle II PXD-SVD common test beam at DESY

- Two DEPFET pixel layers+ four SVD microstrip layers
- Nitrogen environment, CO2 cooling, magnetic field

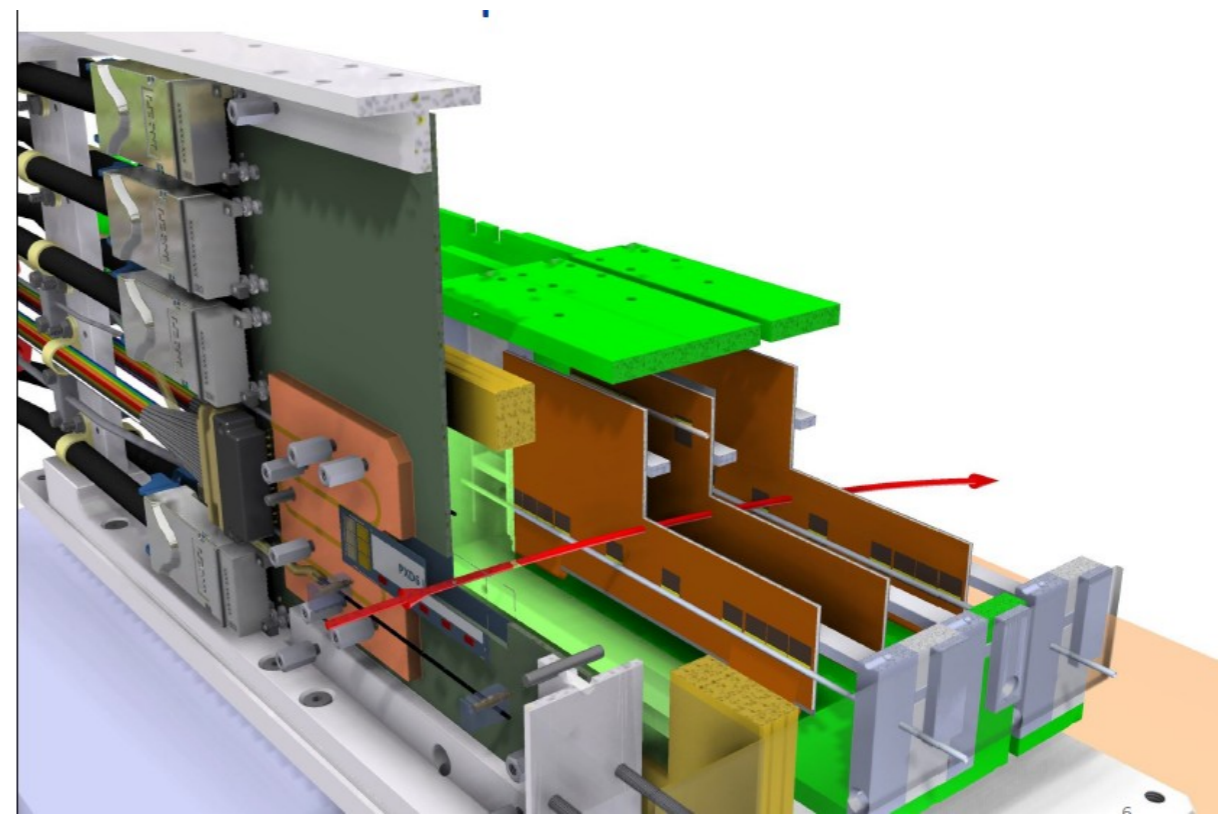
Little experiment, monitoring found to be reliable

Establishing humidity monitoring

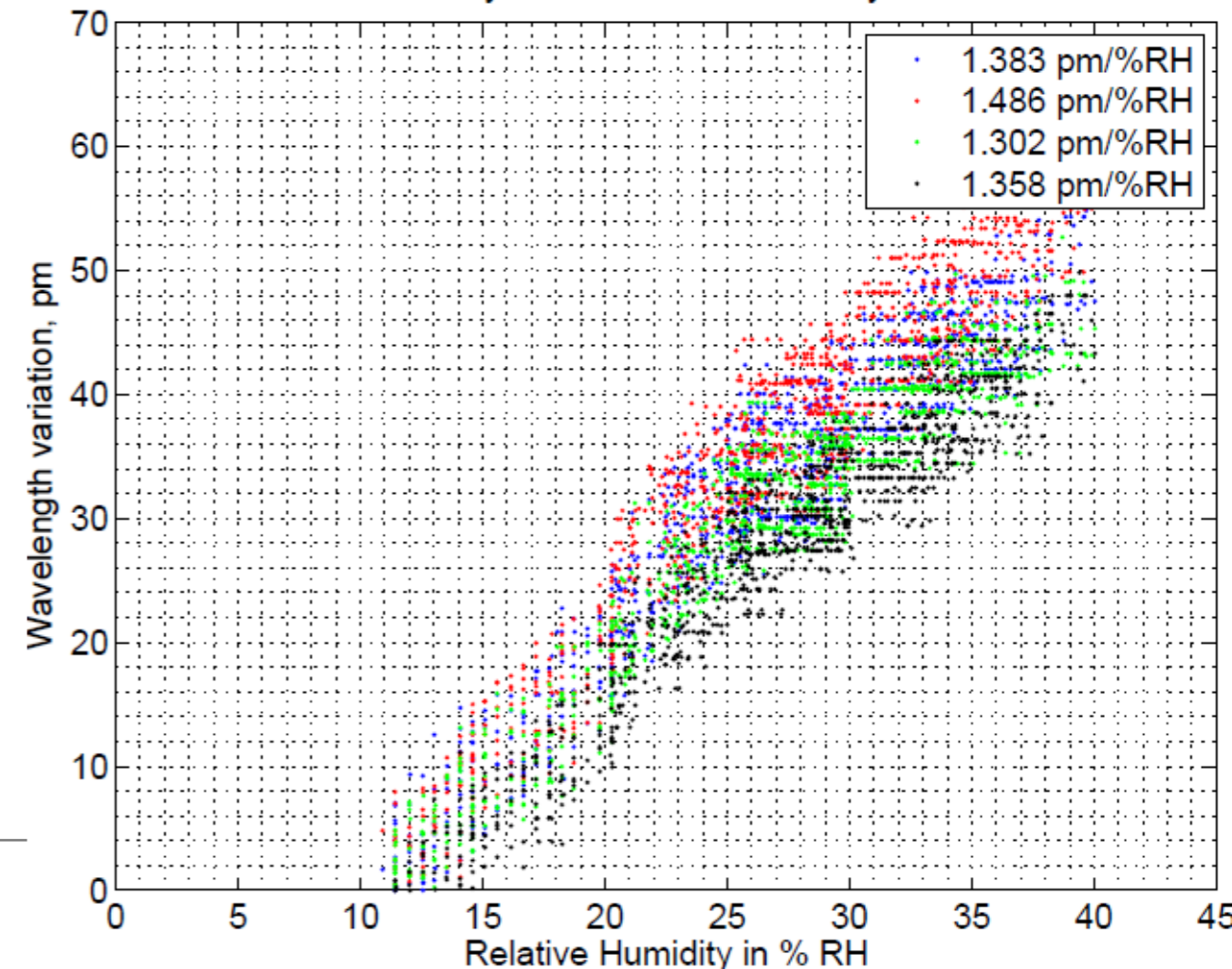
capabilities of “naked” fibres

Excellent linearity and sensibility after

temperature compensation



Dry box sensors vs Humidity



# Summary

## **FTD R&D**

- thermo-mechanical studies of pixel petals, advances in micro-strips and monitoring

## **FTD detailed design**

- go well beyond wireless detectors floating in mid-air (+ tech-specific petals)

## **FTD optimization**

- strengthen pixelated disks (2 → 5/6) and bring inward → working to provide design

