



# Integration of PLUME in BEAST phase 2

## Outline:

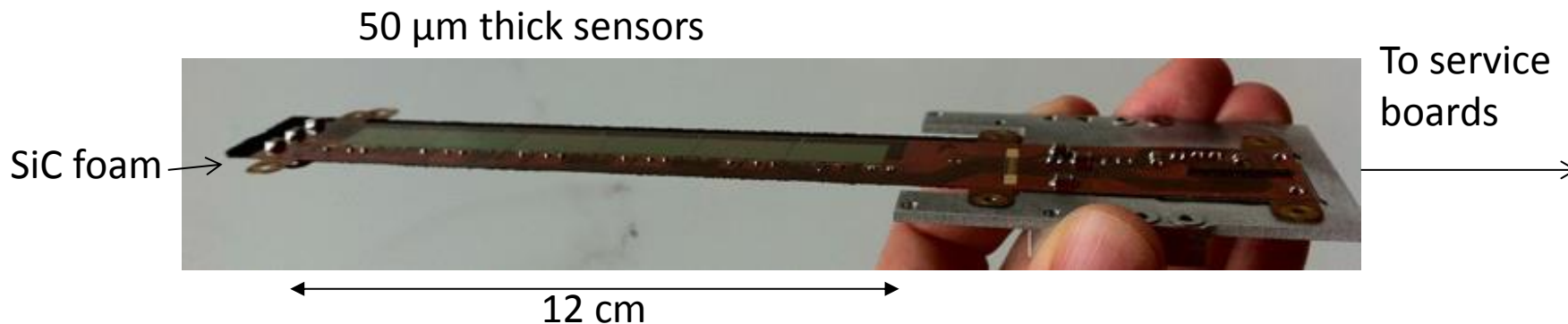
1. Plume ladder overview
2. Mechanical support in the IP region
3. Cooling
4. Readout system
5. Tentative schedule
6. Summary

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FJPPL meeting, Strasbourg, 19-20 January 2015

# PLUME



- R&D project inspired by ILC-VXD requirements



- Double-sided layer of pixelated sensors
- Low radiation length  
( $\sim 0.35 \%X_0$ )
- Air cooled ( $\leq 5 \text{ m/s}$  @ room temperature)

	Current baseline (PLUME-2)	Possible upgrade (PLUME-3)
Sensor	Mimosa26	Mistral
Pixel [ $\mu\text{m}^2$ ]	$18.4 \times 18.4$	$36 \times 62.5$
Array [pixels]	$1152 \times 576$	$832 \times 208$
Integration time [ $\mu\text{s}$ ]	112 (62 for 320 rows)	20 ( $\sim 2$ for 26 rows)

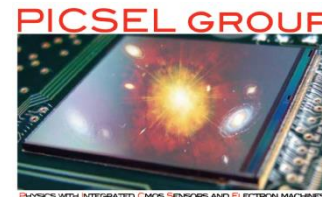
Mechanical and electrical integration very similar in both cases

# Installation considerations

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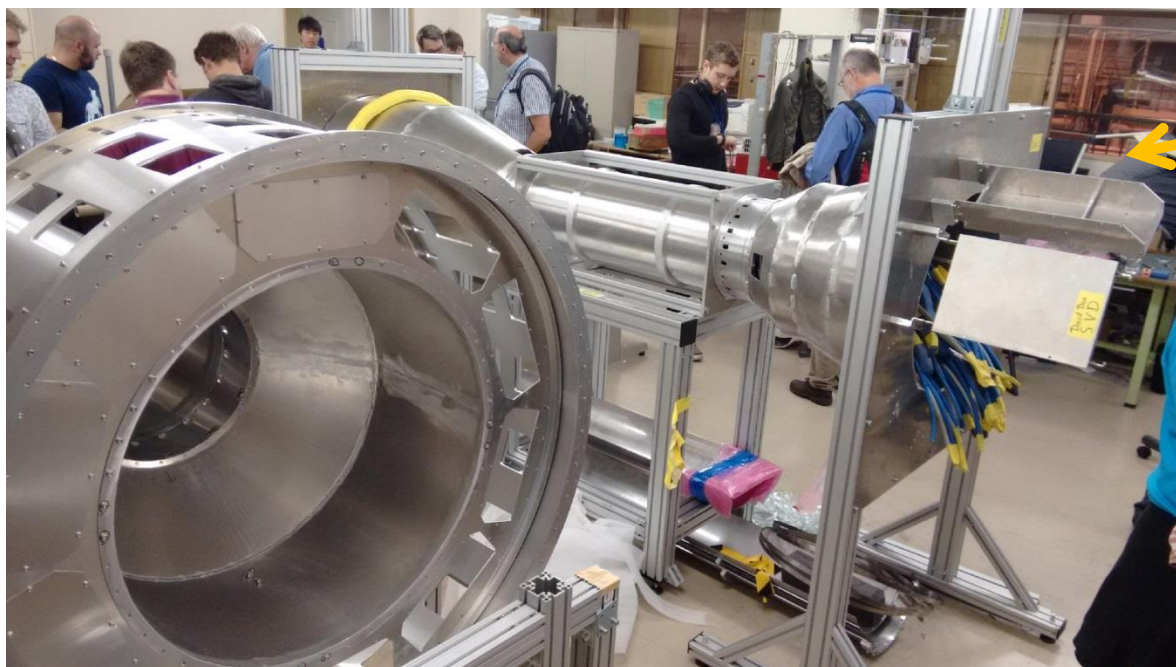
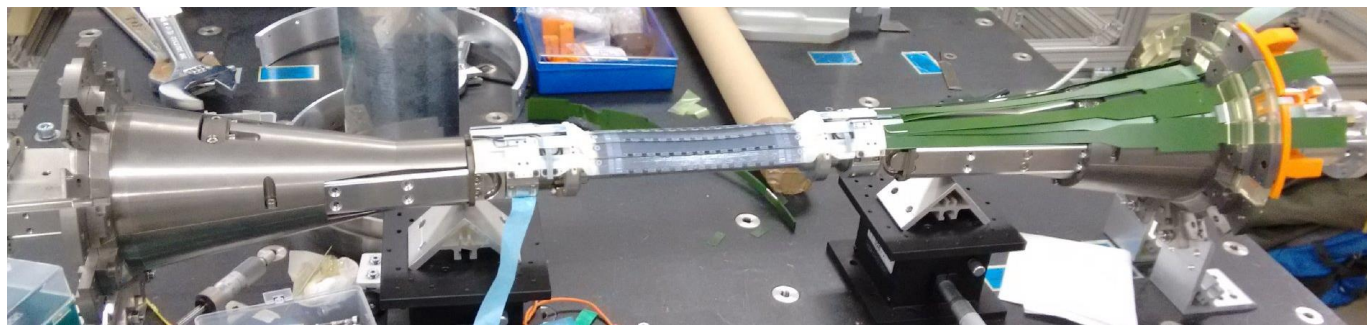
- Basic assumptions:
  - We are joining this project late, therefore we try to adopt our system to the existing framework
    - Reuse existing solutions
    - Avoid interference with existing systems
- Installation options:
  - Our initial goal has been to install the PLUME ladder in the IP region at the radius of the most inner detection layer (initial goal: 1.5 - 2 cm)
  - Currently we are in discussions with the DEPFET team on how to optimizing the location of the PLUME ladder in the IP region (or possibly outside)
- Detector configuration
  - Baseline: one PLUME ladder
  - Possible extensions: additional ladder, individual sensors
    - should be defined as soon as possible to estimate advantages vs effort

# GEMBA meeting November 2014



- Very helpful to understand system integration constraints and make development plans accordingly

PXD 1-st layer

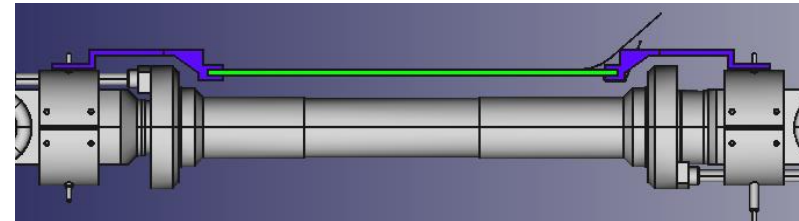
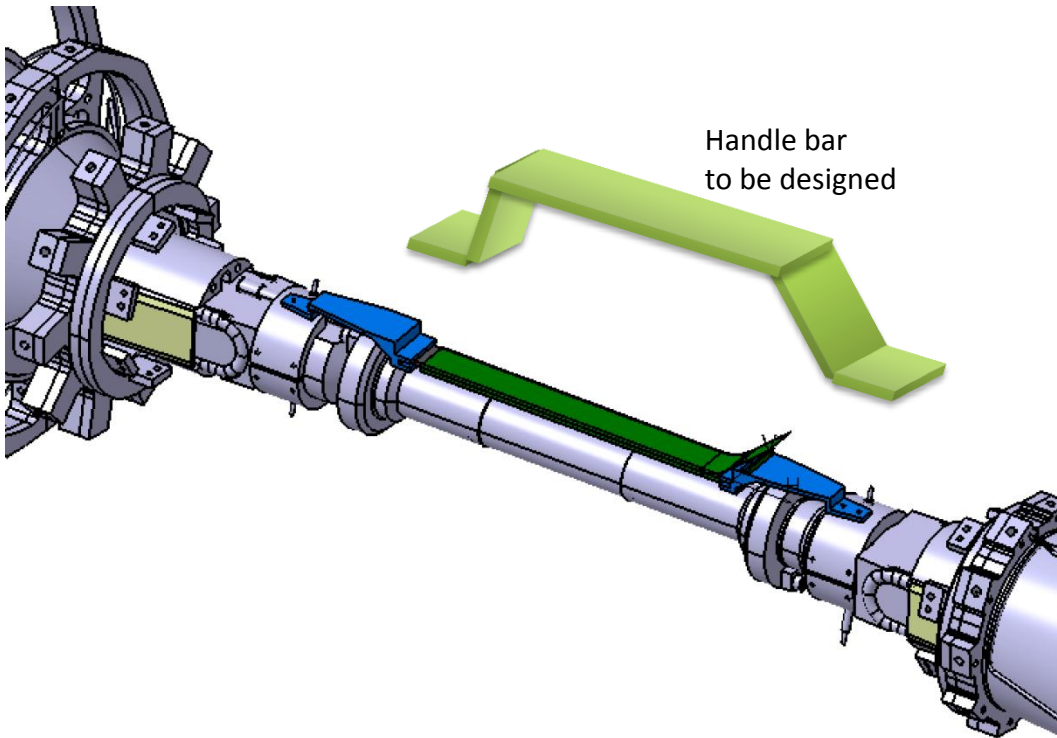


Dock space

# Mechanical support in the IP area

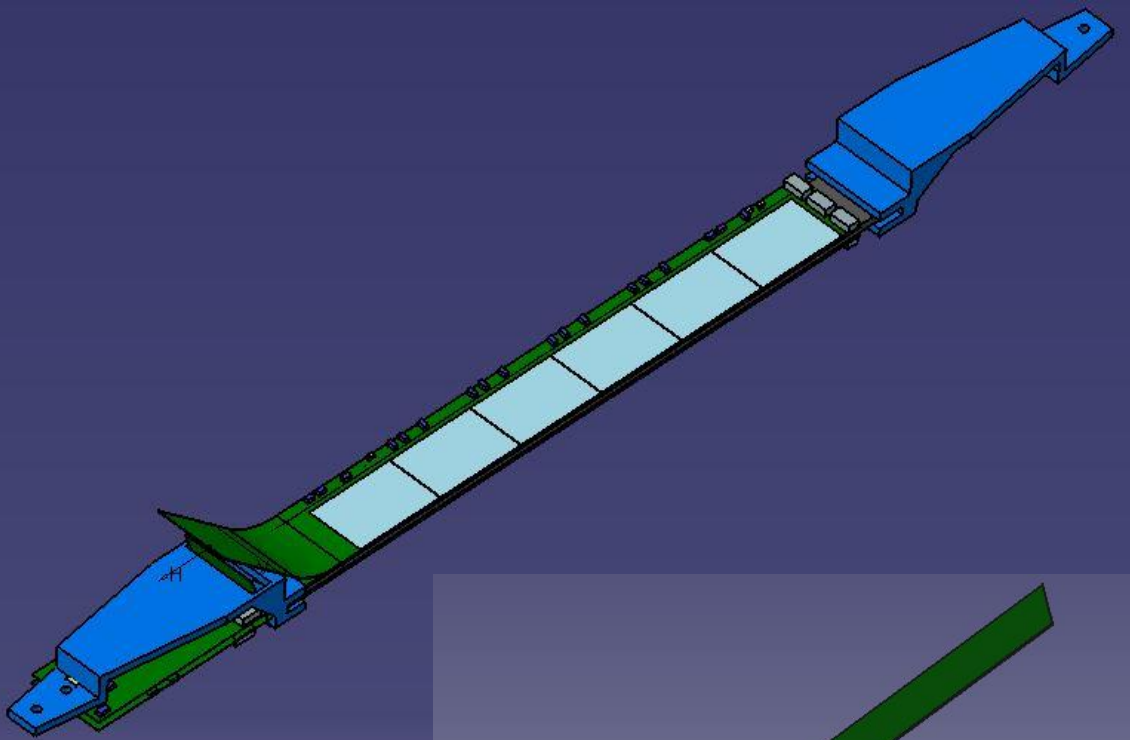
Initial plan:

- Two supporting pieces
- Ladder at  $R \approx 2\text{cm}$  (adjustable by modifying the support fixtures)
- Installation and shipping requires an additional, detachable handle





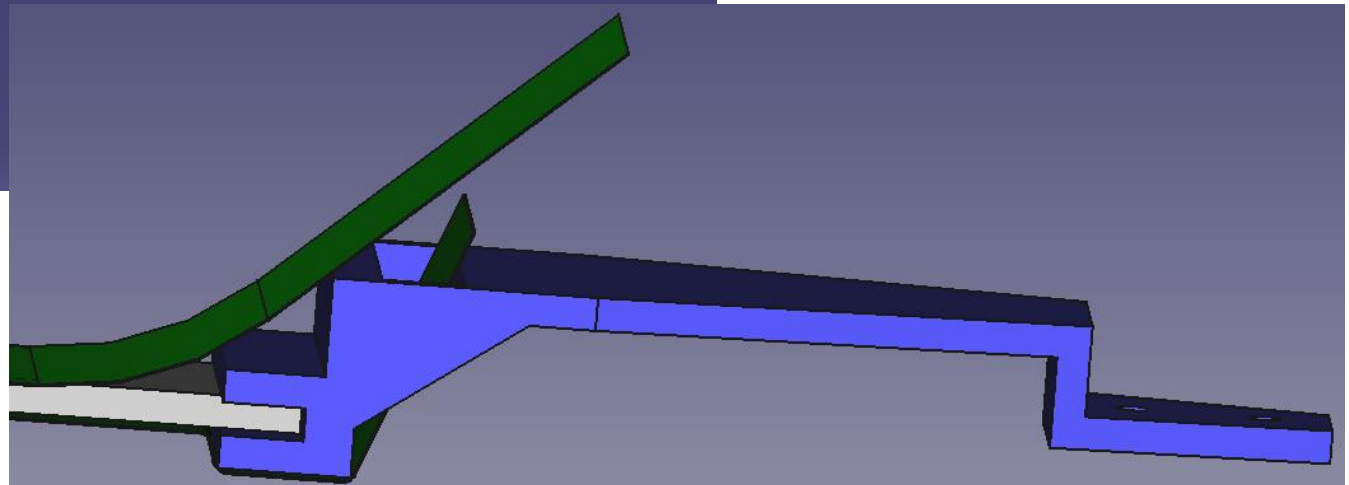
# Mechanical support in the IP area



Fixture footprint:

$\sim 7 \text{ cm} \times 2 \text{ cm}$

Height– depends on  
the ladder radius



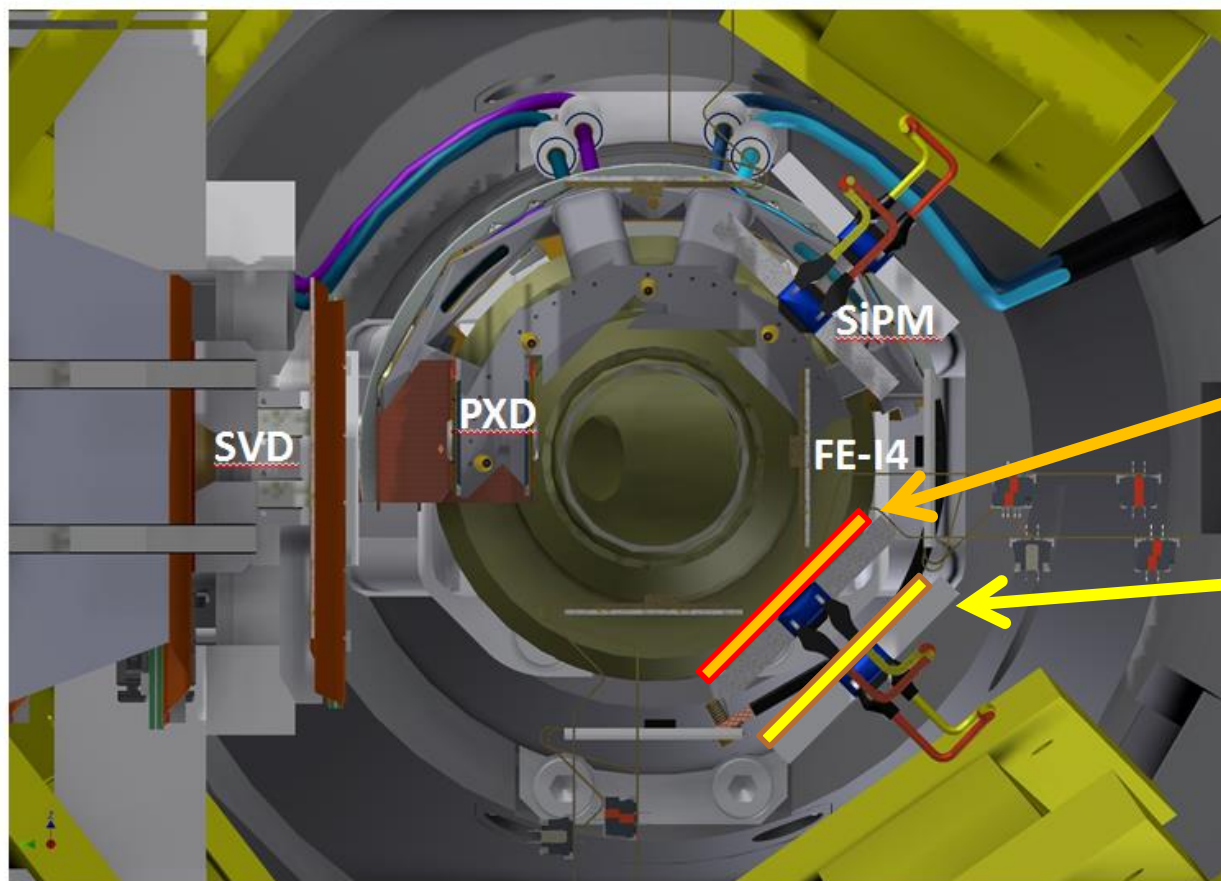
# Alternative locations



- Proposal by the VXD group (VXD-Strasbourg Meeting, Jan 12-13, 2015)



VXD Equipment during Phase 2



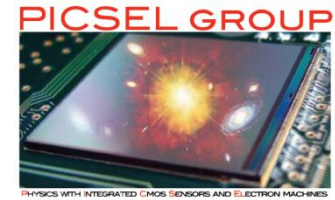
PLUME  
associated  
with SiPM ?

In front of SiPM  
( $R \sim 2$  cm ?)

Behind SiPM  
( $R \sim 3-4$  cm ?)

Additional  
cooling  
constraints

# Cooling



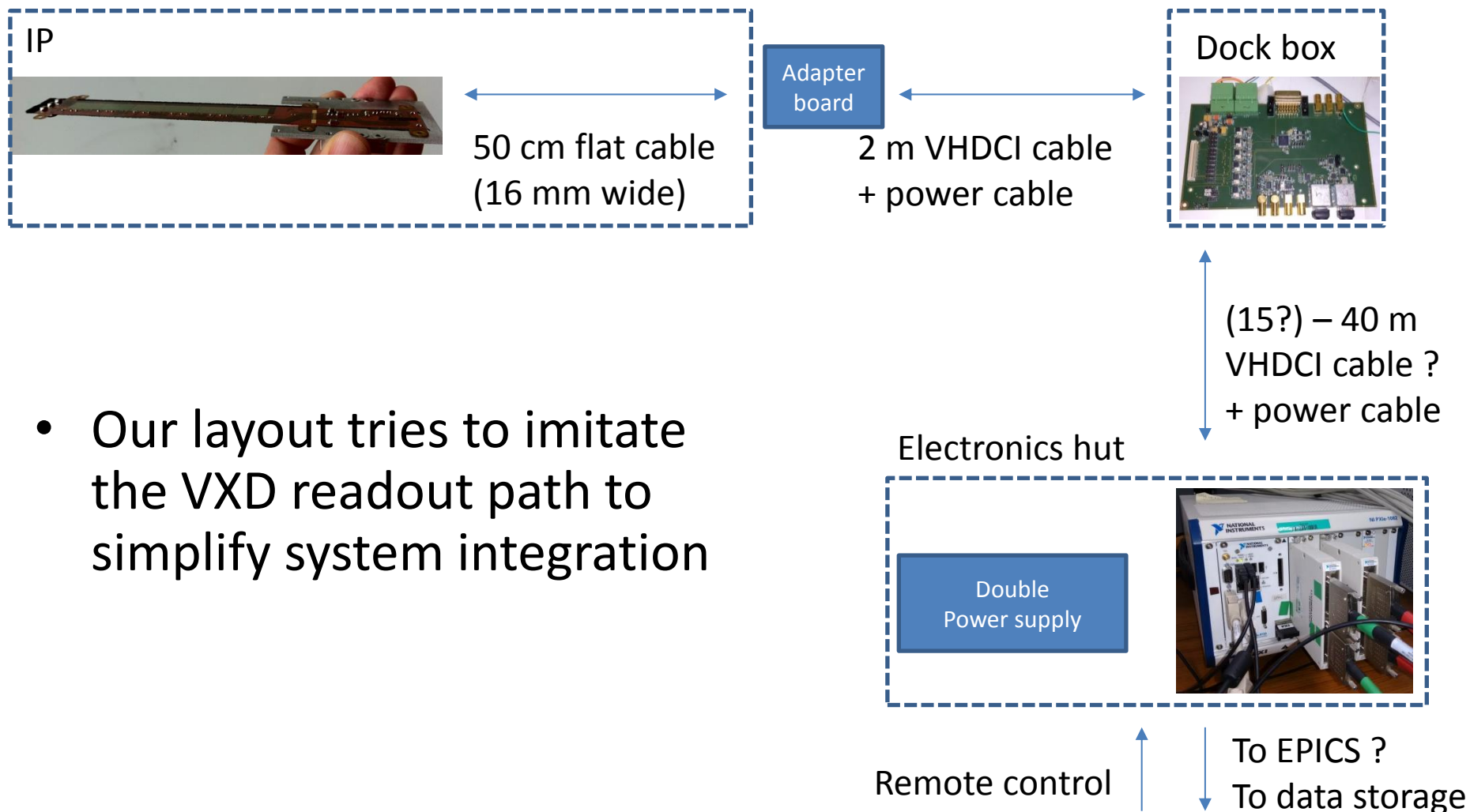
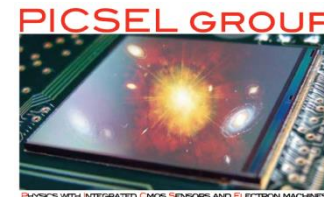
- PLUME-1/2/3: power diss.  $< 9$  W



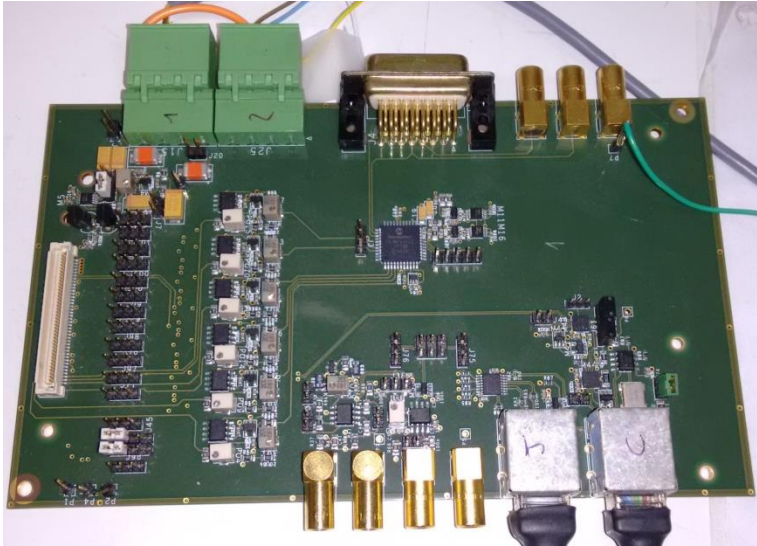
- In the IP region
  - We would rely on the PXD air flow cooling
  - Possibility to simply attach ladder support to PXD cooling blocks and benefit from heat transfer
    - (efficiency of this cooling would have to be investigated)
  - Possibility to adjust PLUME ladder consumption by deactivating some sensors
- Limited manpower for cooling system optimization
- VXD CO<sub>2</sub> cooling – no manpower for investigating this option



# Readout path - overview



# Readout path



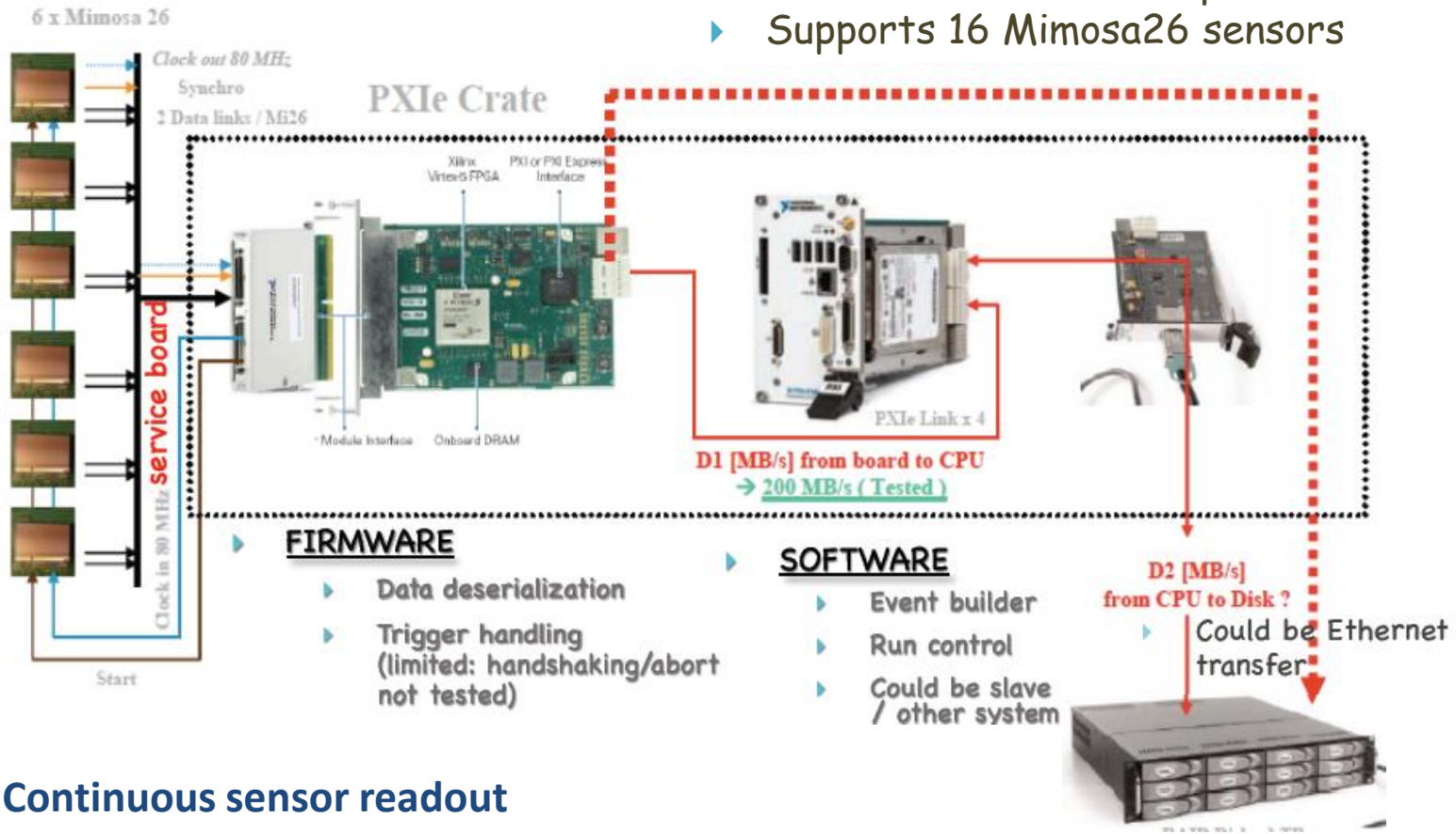
Existing intermediate board:

- Designed for lab and beam tests

- New intermediate board needs to be designed and built:
  - Remote monitoring of current/voltage
  - Ladder temperature measurements
  - Latch-up protected power supply for PLUME
  - Adjustable power supply voltage

# Readout system

- ▶ IPHC system based on NI crate
- ▶ Operated in many beam tests since 2008
- ▶ Used with 8 sensors in parallel
- ▶ Supports 16 Mimosa26 sensors



- Continuous sensor readout
- Synchronization – trigger-like signal needed

# Readout system functionality

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- Slow controls:
  - sensor configuration
  - I/V + temperature monitoring (new features)
- Data readout and analysis:
  - IPHC offline code exists
  - Could be run as pseudo-online
  - Will be developed to match requirements provided by beam environment simulations
- Further integration with BEAST phase-2 systems to be discussed

# Integration in racks



- Rack space still needs to be defined:
- NI PXI crate ~ 4U
- Double power supply
  - bench top or rack mount
- Data storage – where?, size ( $\leq 2U$ )
- Network power switch for remote power control (1U)





# Tentative schedule

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- Additional ladder production ends Q2 2015
  - Test full readout chain Q3 2015
  - Build and test new intermediate board Q3-Q4 2015
  - DAQ/slow controls/online Q4-2015 – Q2-2016
  - **Ready for installation in Fall 2016**
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- PLUME-3 readiness depends on ALICE ITS schedule and our workload
    - Sensors available Q4 2015
    - Modifications in the readout system (driven by ALICE development) Q1 2016
    - Possibility to modify foam beam dimensions (for example to facilitate installation at a larger radius)
    - **Most likely ready by the end of 2016/early 2017**

# Summary

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- PLUME-2 ladder (M26) production on-going
- Readout system exists but needs testing in the full readout chain configuration (adapter boards, full length cables)
- Mechanical support undefined at this point – will depend on the final location of the PLUME ladder
- Cooling – PLUME to be integrated into VXD cooling system
- Additional PLUME system extension can be considered based on beam background simulation results and availability of manpower
- PLUME-3-based system strongly coupled to ALICE ITS upgrade development – could be ready by the end of 2016