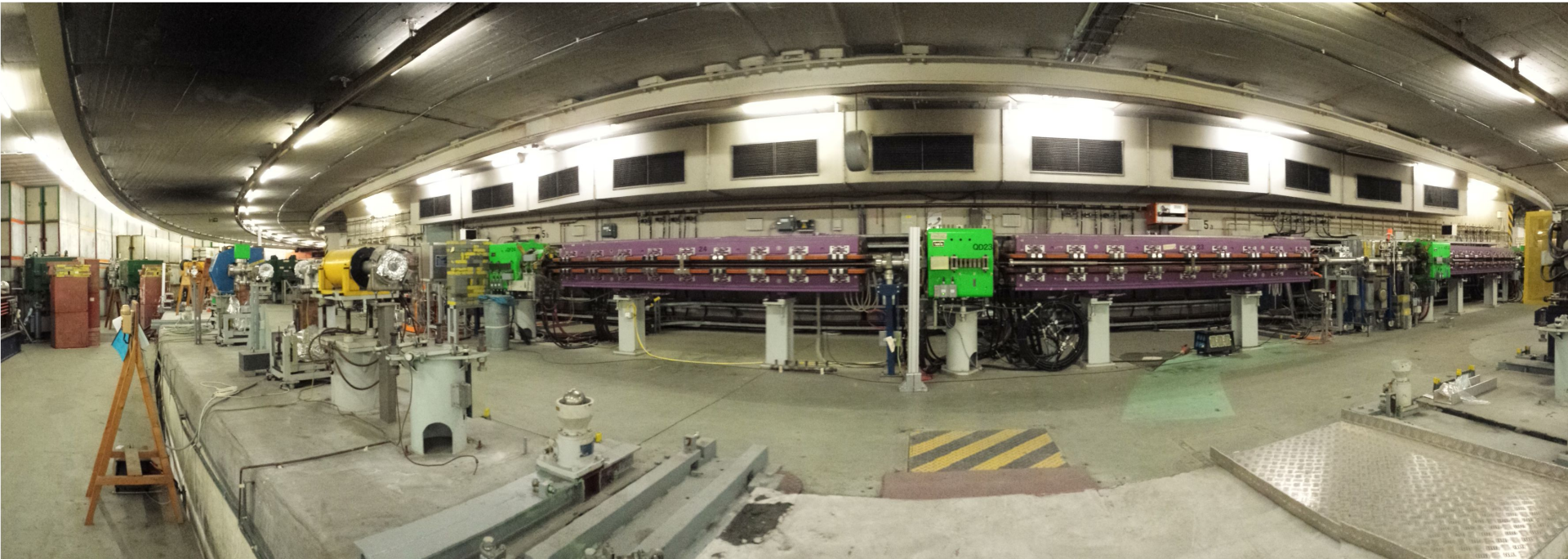# WP15: Upgrade of test beam infrastructure
Task 15.3 Improvements of the DESY test beam infrastructure

AIDA 2020

BTTB Workshop 2017

Dimitra Tsionou

DESY

WP15.3 tasks

> WP15.3.1: Silicon strip telescope for 1T magnet in the DESY test beam line

- Milestone May 2017 (M24): Hardware assembled
- Deliverable May 2018 (M36): Installed & Commissioned

> WP15.3.2: Environmental parameter monitoring system for the DESY test beam areas

- Milestone November 2016 (M18): Hardware installed → 24/10/2016
- Deliverable November 2017 (M36): Commissioned
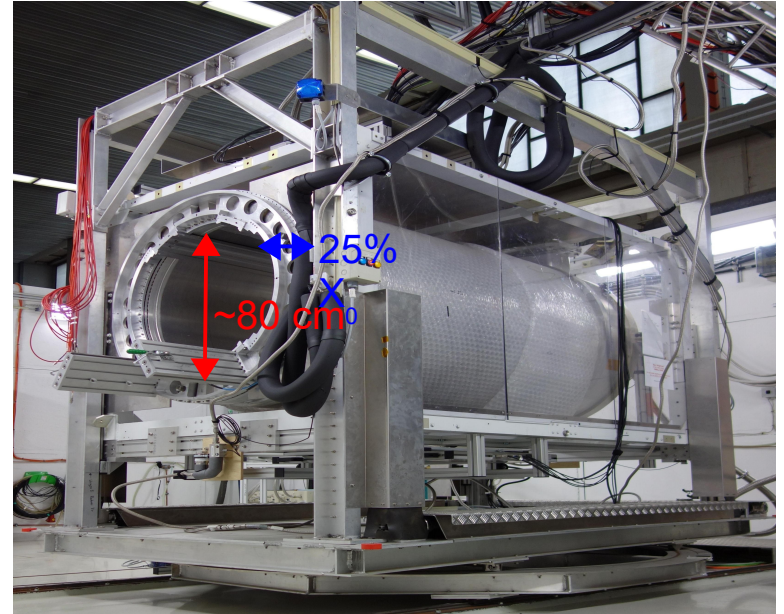
T24/1 area

> DESY test beam infrastructure T24/1 (1-6 GeV e$^-$)

  - 1T large bore magnet including cosmic trigger scintillator setup, mounted on a lifting stage that can move in 3 axes

> This infrastructure has been used by different collaborations, among which

  - Belle II

  - ATLAS

  - ILD vertex detector

 - LCTPC (TPC prototype for ILD)

25% X$_0$

~80 cm

> Need to provide reference tracks over a large area → Silicon telescope to be included in this infrastructure

> Large area telescope ideal for larger setups (TPC, Calorimeters,..)

Silicon Sensors

> Different options for hardware investigated

  - Main requirement: spatial resolution better than 10μm

> Decision on using the SiD strip sensors

> Large area sensors (~10x10 cm^2)

> Expected spatial resolution 7-8μm

10 cm

> Sensors will be read out by 2 KPiX chips that will be bump bonded on the sensor

> 20 sensors will be delivered by Hamamatsu to DESY in early Summer (ordered in November)

> Plan to built a standalone telescope as well
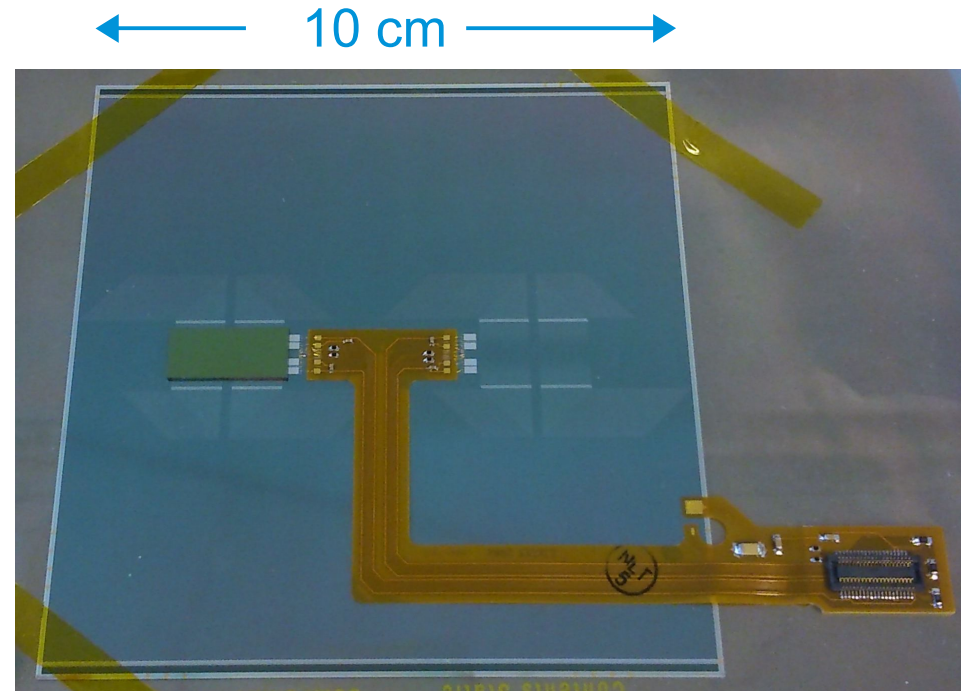
KPiX Performance

> Full DAQ system setup at DESY

> Calibration tests have been performed wit bare KPiX and with ECal silicon sensor with bump bonded KPiX

> Further tests to test the performance and behaviour of KPiX

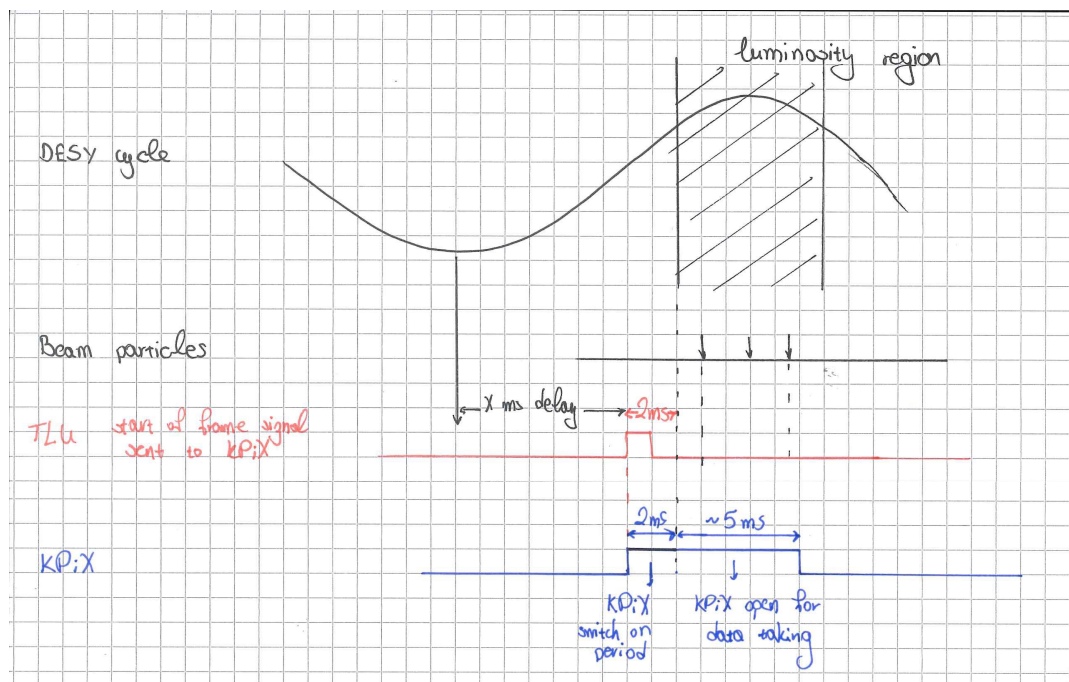> Design of mechanical support ready. To be produced
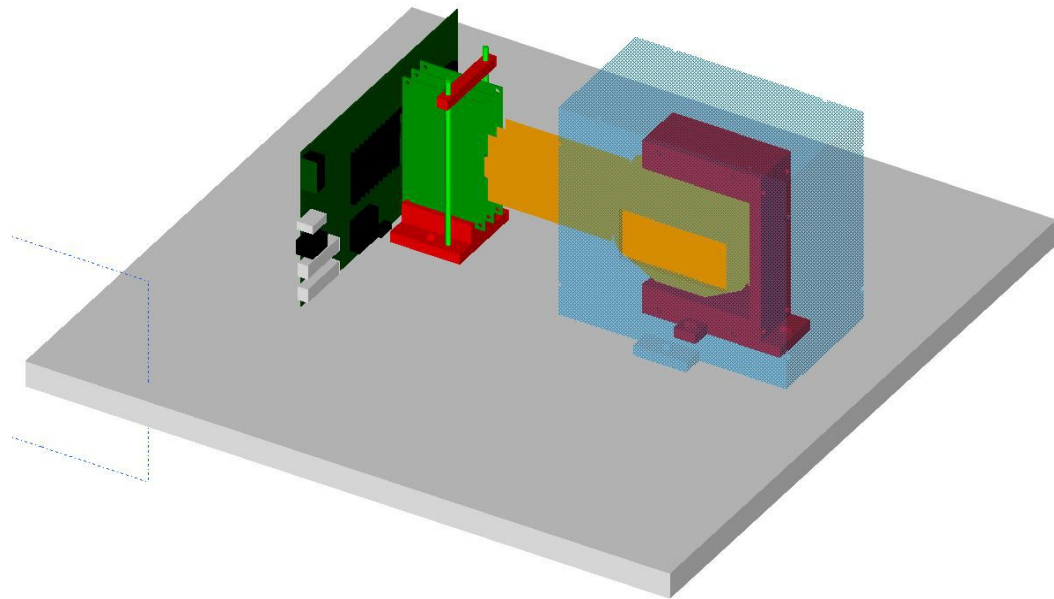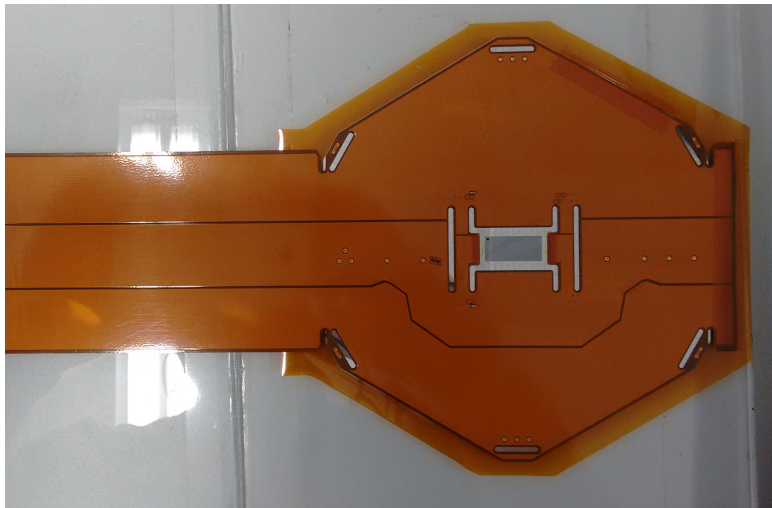
KPiX Integration

> KPiX performs power cycling (developed for an ILC environment)

> DESYII also has a specific cycle and beam is only available for part of that

  ▪ 80ms cycle with an ~5ms "spill" (for 5GeV e-)

> Synchronisation scheme between KPiX and DESY cycle using a TLU established

> New TLU needed → Connection with WP5

> Flexible method to accommodate different DUTs

Synchronisation between KPiX and DESY cycle
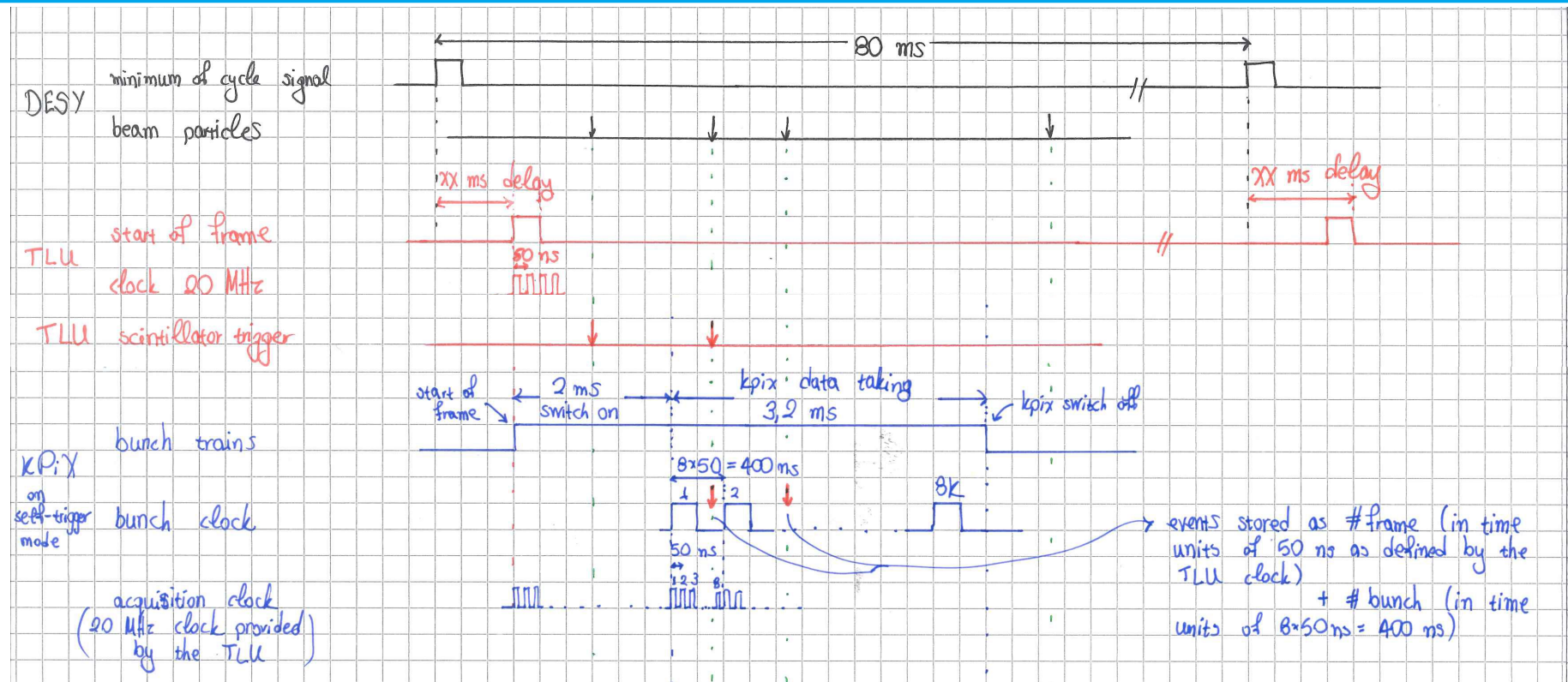
> TLU triggers and KPiX events contain timing information

> For synchronisation between the different systems, certain modifications are required on the TLU side. Communicated to WP5
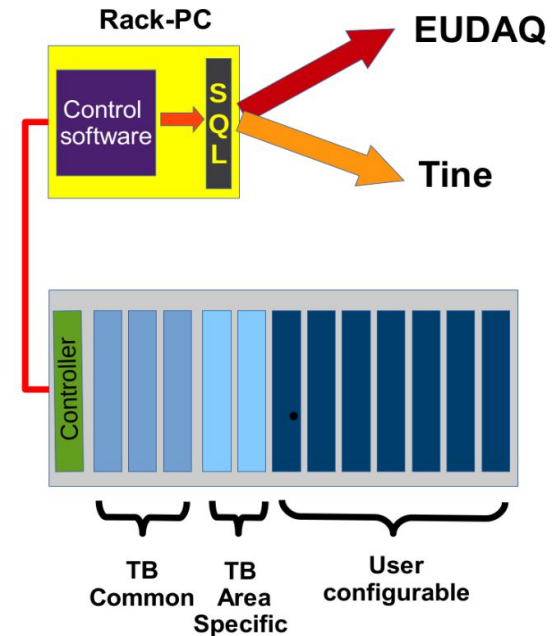
WP15.3.2

> Environmental parameter monitoring system for the DESY test beams areas

ie slow control for TB21, 22, 24, 24/1
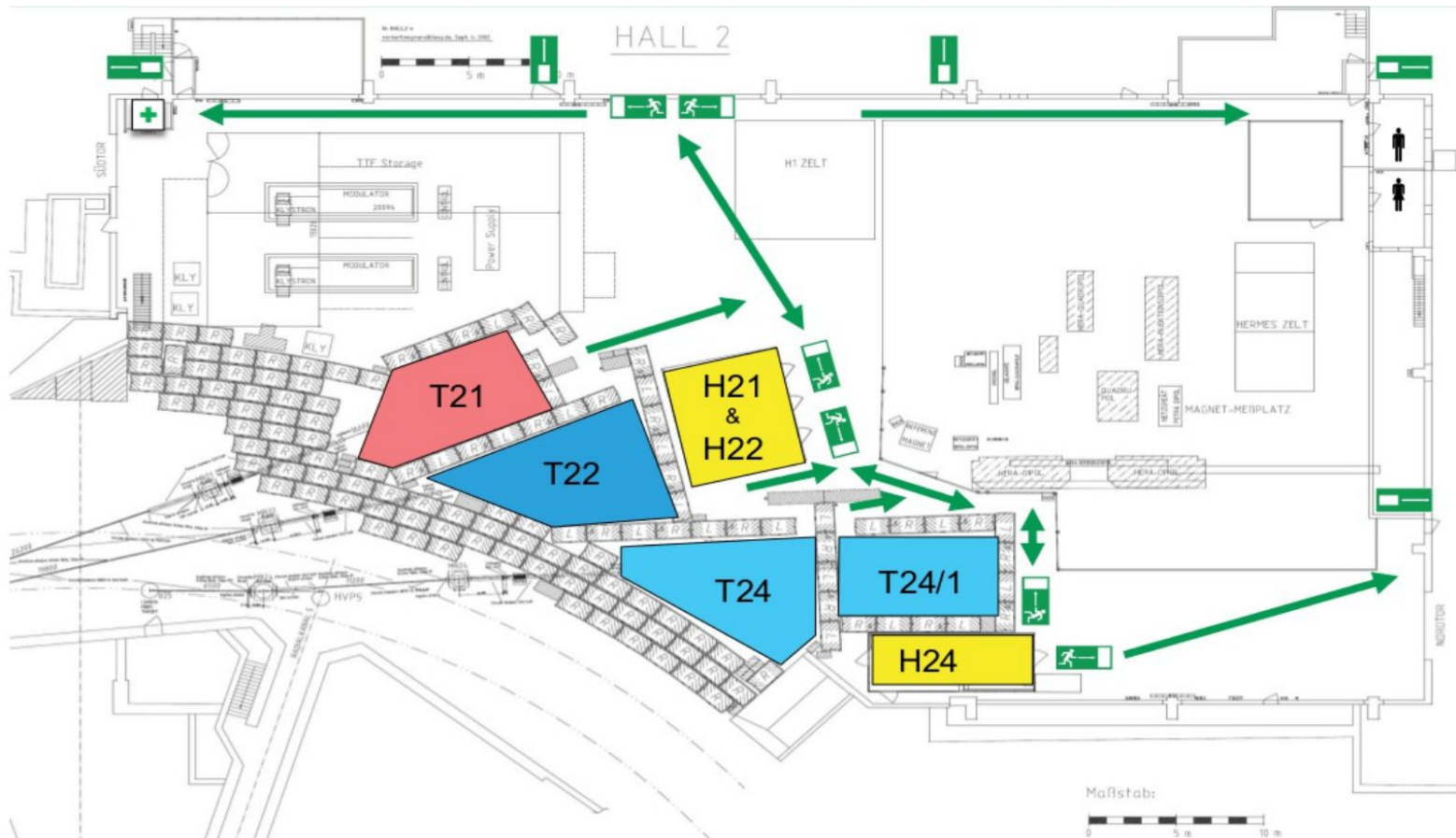
Slow control

> Goal of common slow control system

> General considerations

  - Up to 100 channels

  - Read out speed: >0.1 Hz

  - Rack-based

> Commercial Ahlborn system → System bought and is being assembled and installed at DESY

> Available sensors

  - Common sensors: temperature, humidity, dew point, air pressure

  - Area-specific sensors

  - User-configurable: flow, CO_2, ...

> Readout: Win OS. Data can be exported to any SQL database (ODBC), ASCII file, Excel and other formats

> Will be integrated to EUDAQ and TINE

Status and Plans

WP15.3.1

> Silicon sensors will be delivered in early Summer

> Synchronisation scheme between KPiX+DESY(+DUT) established

  - New TLU required to test it → Aiming for DAQ dedicated test beam in May

> Design of mechanical support for telescope to begin soon (next month)

> Integration of KPiX DAQ to EUDAQ (to start soon)

> Manpower: New AIDA postdoc (Spring), Uwe, Dimitra

WP15.3.2

> Common slow control system with permanent and user sensors

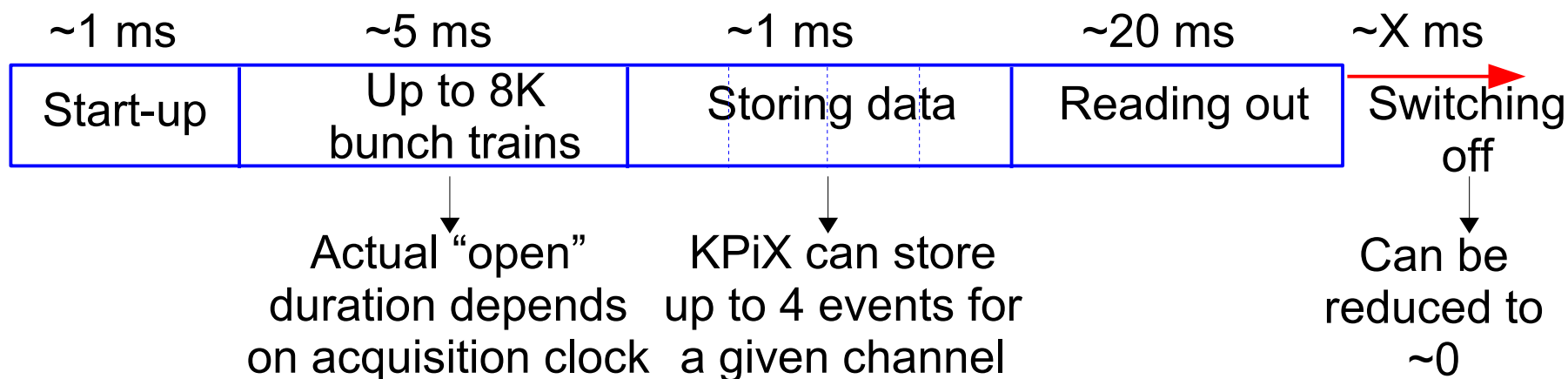> Hardware has been bought and is being installed at DESY (MS33 met)

BackUp

Silicon Telescope for T24/1

> Build a Silicon telescope to provide reference tracks (entry and exit hits)

> The Silicon tracker should be versatile and simple to be used as a telescope by different groups during test beams

> Initial customer for the telescope: TPC collaboration

> Some requirements driven by the TPC as the most challenging scenario

Magnet

TPC

~80 cm

> Challenge: The Silicon system needs to fit in the existing infrastructure (available space is ~3.5 cm)
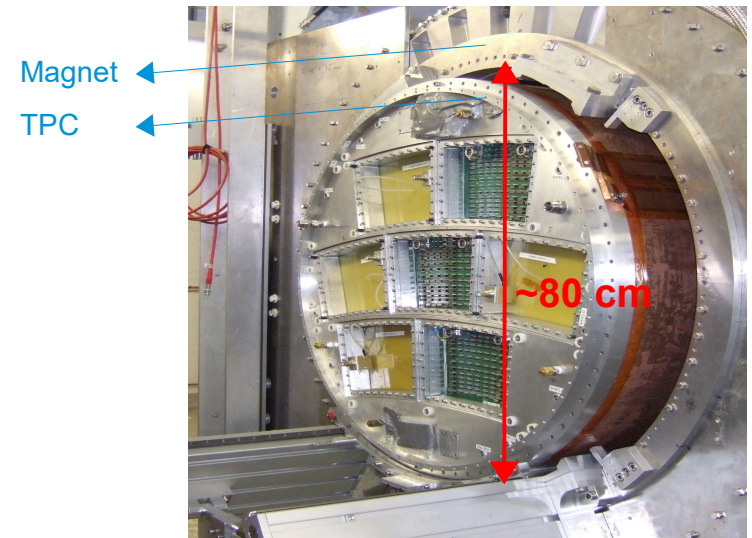
KPiX cycle

> The KPiX chip will be used to read out the silicon sensors

> KPiX performs power pulsing (developed for ILC environment)

~1 ms	~5 ms	~1 ms	~20 ms	~X ms
Start-up	Up to 8K bunch trains	Storing data	Reading out	Switching off

Actual "open" duration depends on acquisition clock

KPiX can store up to 4 events for a given channel

Can be reduced to ~0

> KPiX can keep up with a ~30Hz cycle during data taking

> KPiX can work on

  ▪ self-trigger mode → 4 events per channel per cycle, or

  ▪ forced trigger mode → 4 events per cycle

> How to use it efficiently at the DESY testbeam?