Dune DAQ Development Plan

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Introduction

- **Scope of this talk is the series of tests that will :**
  - Demonstrate the DAQ design is feasible and meets requirements
  - Commission the final system ready for physics
- **Key dates :**
  - ProtoDUNE DAQ upgrade - Q1 2020
  - Engineering Design Review - Q4 2020
  - Pre-Production Review - Q1 2022
  - DAQ Installed - Q3 2024
  - DAQ Commissioned - Q3 2025
- **Documentation**
  - https://docscert.dunescience.org/cgi-bin/cert/ShowDocument?docid=11242

Test Series Overview

- **1 : Standalone Tests**
  - FELIX, Co-processor

Lab bench
2019

- **2 : Integration Tests**
  - FE HW, FE/BE, PDS, Calibration

- **3 : Demonstrators**
  - ProtoDUNE Slice Tests

ProtoDUNE SP
2020

- **4 : Pre-production Tests**
  - Repeat integration tests

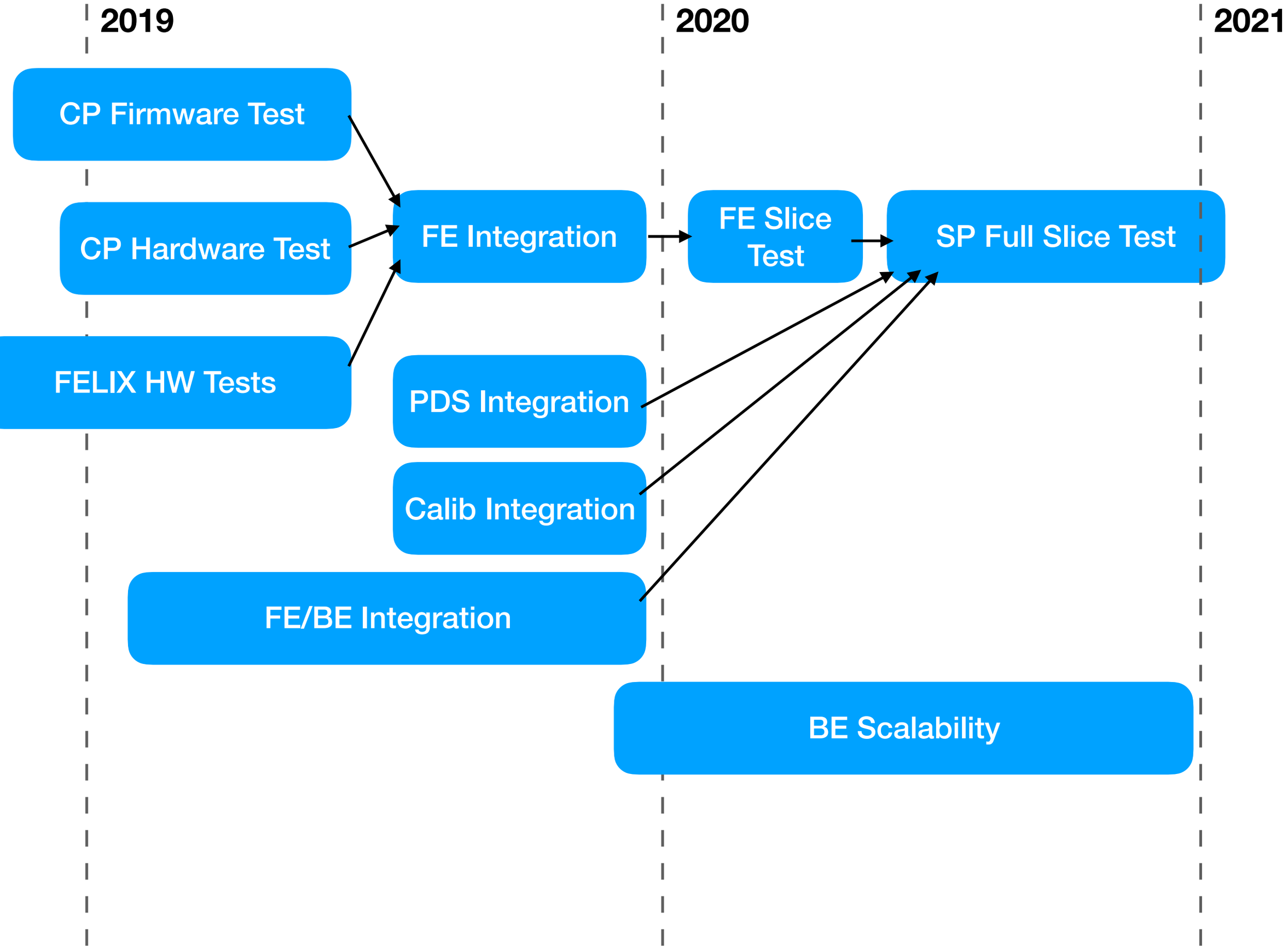
Production labs
2021

- **5 : Production Testing/QA**
  - Repeat integration tests

Production labs
2022

- **6 : Commissioning**

SURF
2024-2025


2019
2020
2021
CP Firmware Test
CP Hardware Test
FELIX HW Tests
FE Integration
FE Slice Test
SP Full Slice Test
PDS Integration
Calib Integration
FE/BE Integration
BE Scalability

DAQ Kit

- **Kit of components that will facilitate integration tests, and support development programme of the other consortia (construction, QA, etc)**
- **Components**
  - HW : FELIX + Co-processor + Timing master (all PCI cards)
  - SW : Minimal DAQ stack
- **Functionality**
  - Data stream capture
  - Generation of hardware synchronisation signals
- **Release schedule**
  - **v1 Q4 2019** - based on prototype hardware
  - **v2 Q4 2021** - based on pre-production prototypes
  - **v3 Q1 2023** - production version (if required)

1 : Standalone Tests

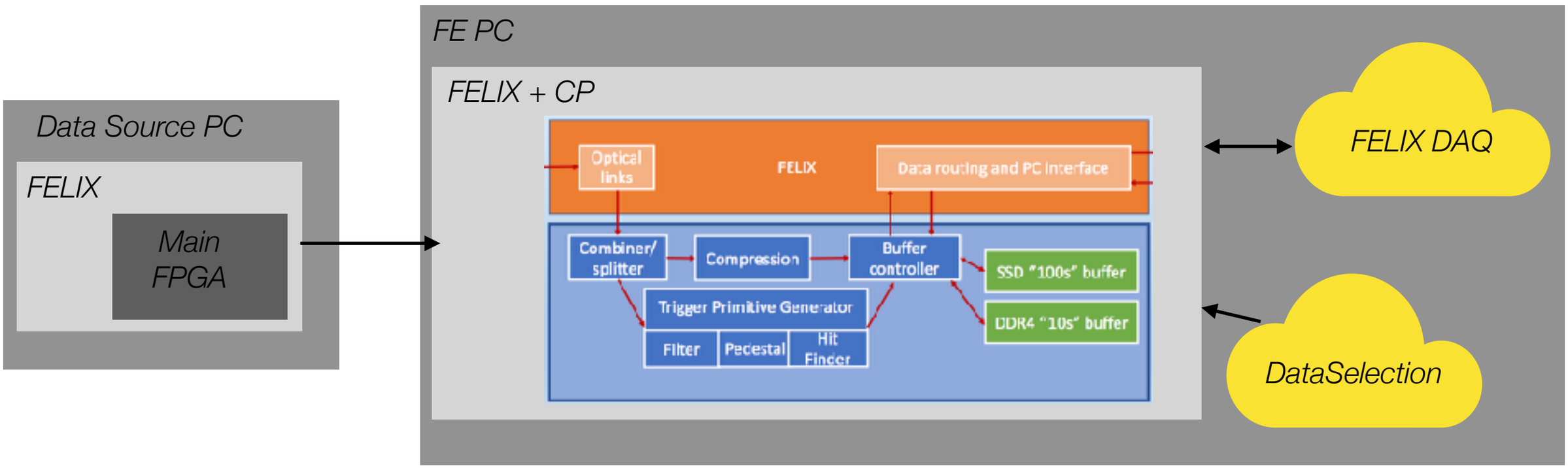
- **Goals**
  - Demonstrate functionality of individual (HW) components
- **1.1 : FELIX**
  - Demonstrate readout of SP TPC with FELIX
    - 10 links -> host memory, **completed 2018 (protoDUNE)**
- **1.2 : Co-processor Firmware**
  - Demonstrate trigger primitive generation, readout buffers, compression
    - Functionality & throughput - 1 APA / FPGA
    - Firmware only, internal data source. (Based on Xilinx XCU 102)
  - **Target : Q1 2019**

1 : Standalone Tests

- **1.3 : Software Trigger Primitive Generation**
  - Demonstrate trigger primitive generation in software
    - Functionality & throughput - 1 APA / FPGA
  - **Target : Q1 2019**

2 : Integration Tests

- **2.1 : Front-End Integration Test**
  - Demonstrate integration of Front-End components (FELIX + CP)
  - 2.1.1 : FELIX + eval board, in a daisy-chain
  - 2.2.2 : FELIX + eval board + bi-directional communication
  - 2.2.3 : New FELIX + daughtercard
  - **Target : Q4 2019**



2 : Integration Tests

- **2.2 : PDS Integration Test**
  - PDS electronics + DAQ Kit
  - Demonstrate synchronisation & readout on lab bench
  - **Target : Q4 2019**

- **2.3 : Calibration Integration Test**
  - Calibration electronics + DAQ Kit
  - Demonstrate synchronisation & readout on lab bench
  - **Target : Q4 2019**

2 : Integration Tests

- **2.4 : FE/BE Integration Test**
  - Goal : demonstrate integration of prototype FE with early versions of BE components
  - FELIX + Data Selection (details tbd)
  - **Target : Q4 2019**

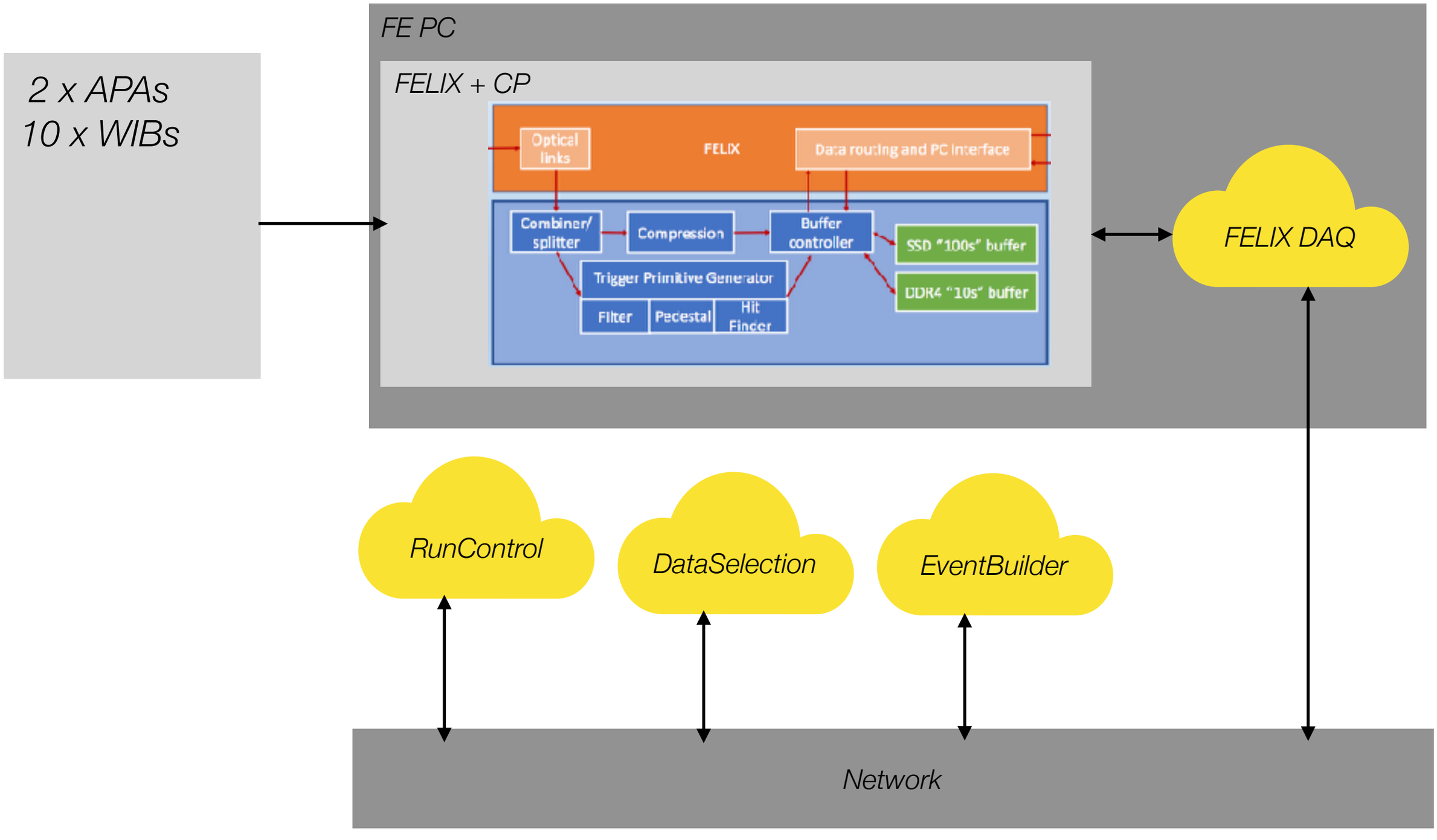
3 : Demonstrators

- **3.1 : Front-End Slice Test**
  - Goal : demonstrate full Front-End functionality at protoDUNE SP
    - Trigger primitive generation
    - Readout (all data-capture modes)
  - Re-fit protoDUNE DAQ : Q1 2020
    - **Target : Q2 2020**
- **3.2 : Full Vertical Slice Test**
  - Goal : demonstrate self-trigger capability at protoDUNE SP
    - Based on FE slice + BE software components
  - Also an opportunity to test early versions of back-end components
    - Run control, event builder, data selection (details tbd)
  - **Target : Q4 2020**

3 : Demonstrators

- **3.3 : Back-End Scalability Tests**
  - Goals :
    - Demonstrate scalability of Data Selection to DUNE module level (MLT)
    - Demonstrate stability of Run Control
    - Demonstrate SNB data extraction
    - Fake trigger/data sources + relevant BE components running in PC farm
  - **Target : Q4 2020**

Full Slice Test @ protoDUNE



4,5 : (Pre-)Production Tests

- **Goals**
  - Verify (pre-)production hardware has full functionality
  - Verify interfaces between hardware systems
- **Essentially regression tests to ensure nothing has broken**
- **Repeat integration tests with new components**
  - Front-end integration test
  - PDS, Calibration, DP integration tests
    - v2 DAQ Kit using pre-production hardware

6 : Commissioning

- **Underground schedule is tight, and places demands on prior test schedule**
  - Integration tests must replicate underground conditions
  - Integration of DAQ/computing/calibration must be demonstrated ahead of installation
- **As far as possible, commissioning must proceed in parallel with installation**

1. Essential BE functionality commissioned at the surface (from Q2 2023)
   - RC, EvB, storage, transfers (details tbd)
2. Commission FEs as they are installed
3. Higher level BE functionality then commissioned in parallel/after FE installation
   - Data selection, DQM, L2 farm, etc.

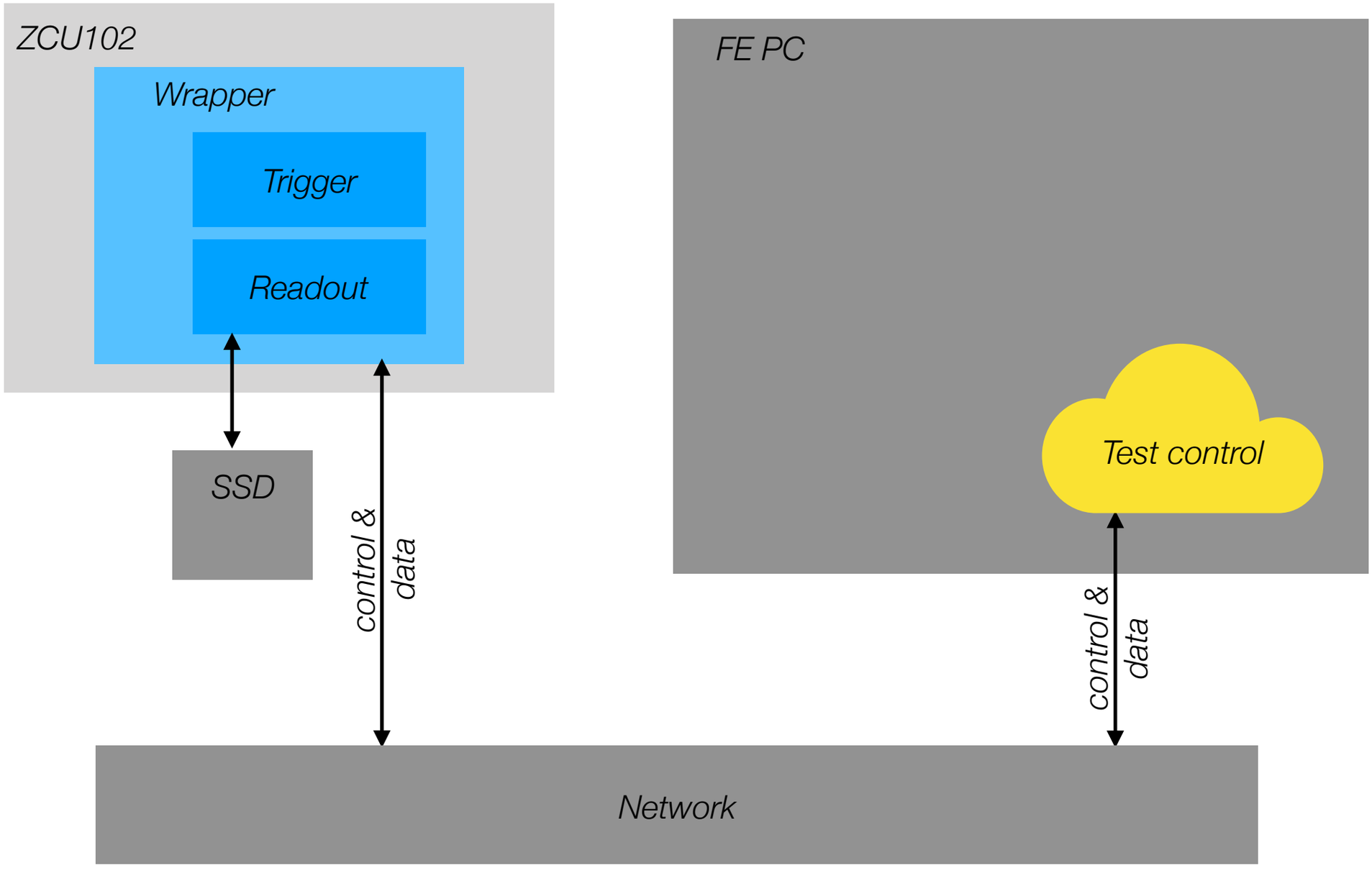
Backup

Co-Processor Test

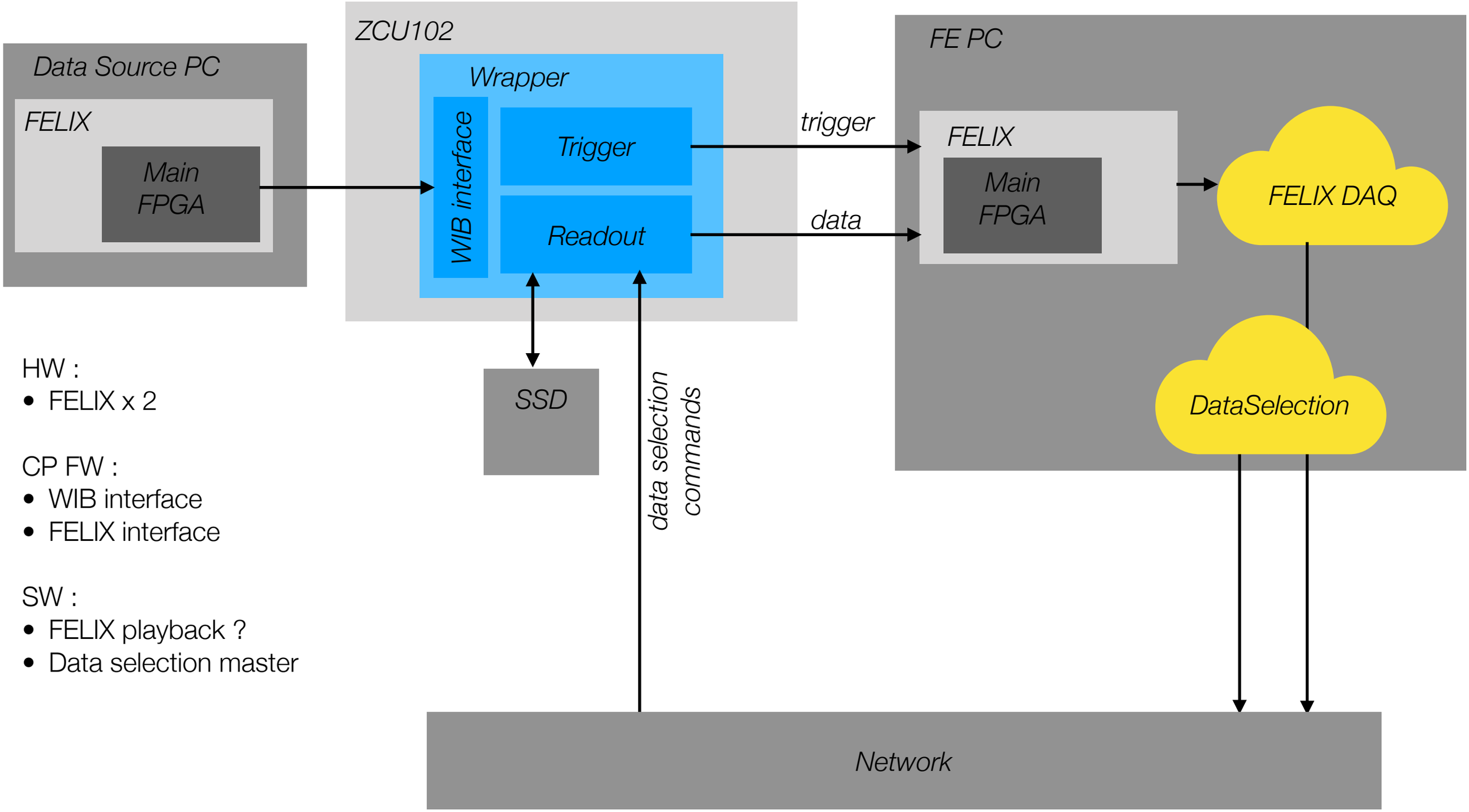
HW :
- ZCU102

CP FW :
- Wrapper
- FIR filter / Ped sub
- Hit-finder
- Compression
- 10s buffer
- 100s buffer

SW :
- Test control



Front-End Integration Test 1

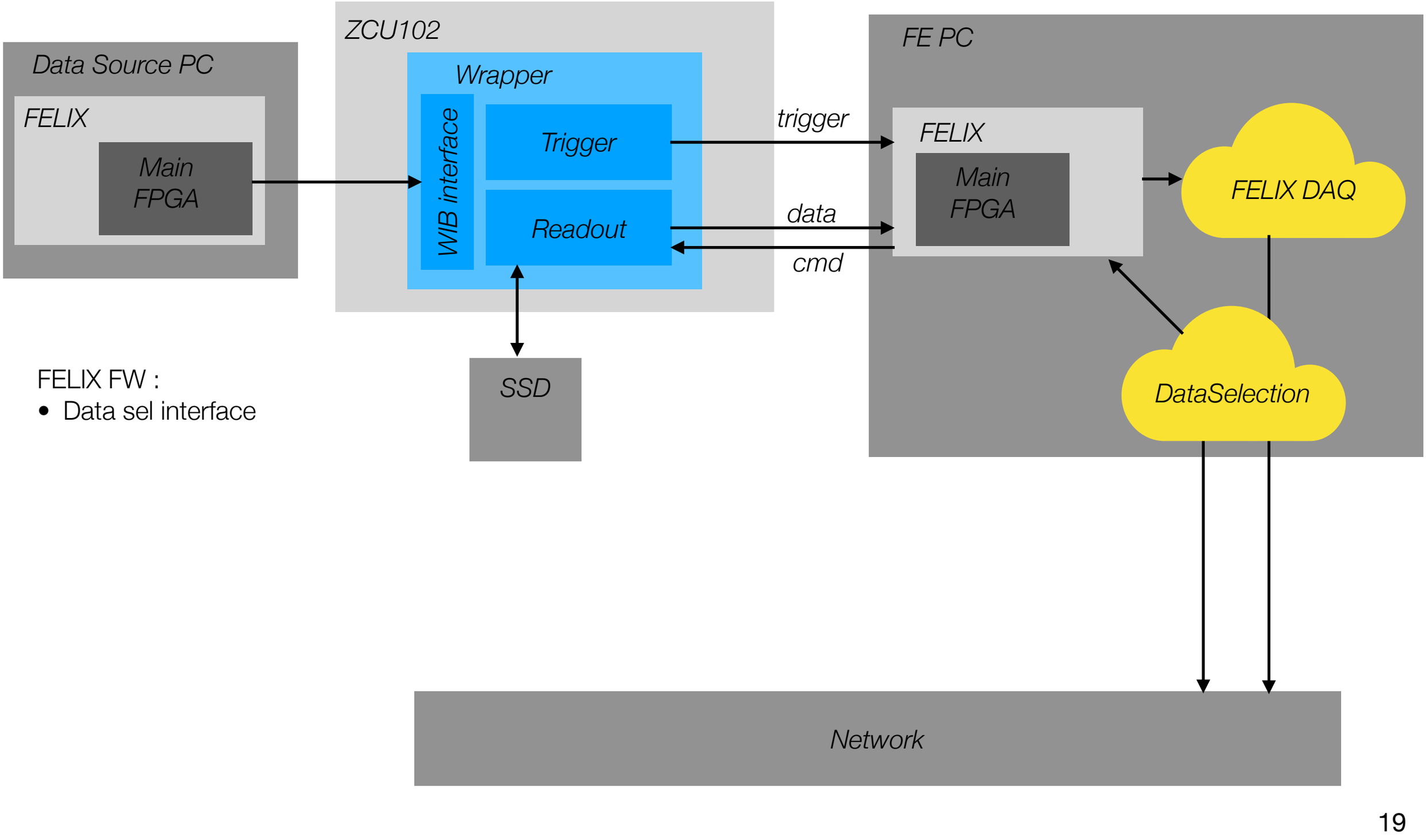


HW :
- FELIX x 2

CP FW :
- WIB interface
- FELIX interface

SW :
- FELIX playback ?
- Data selection master

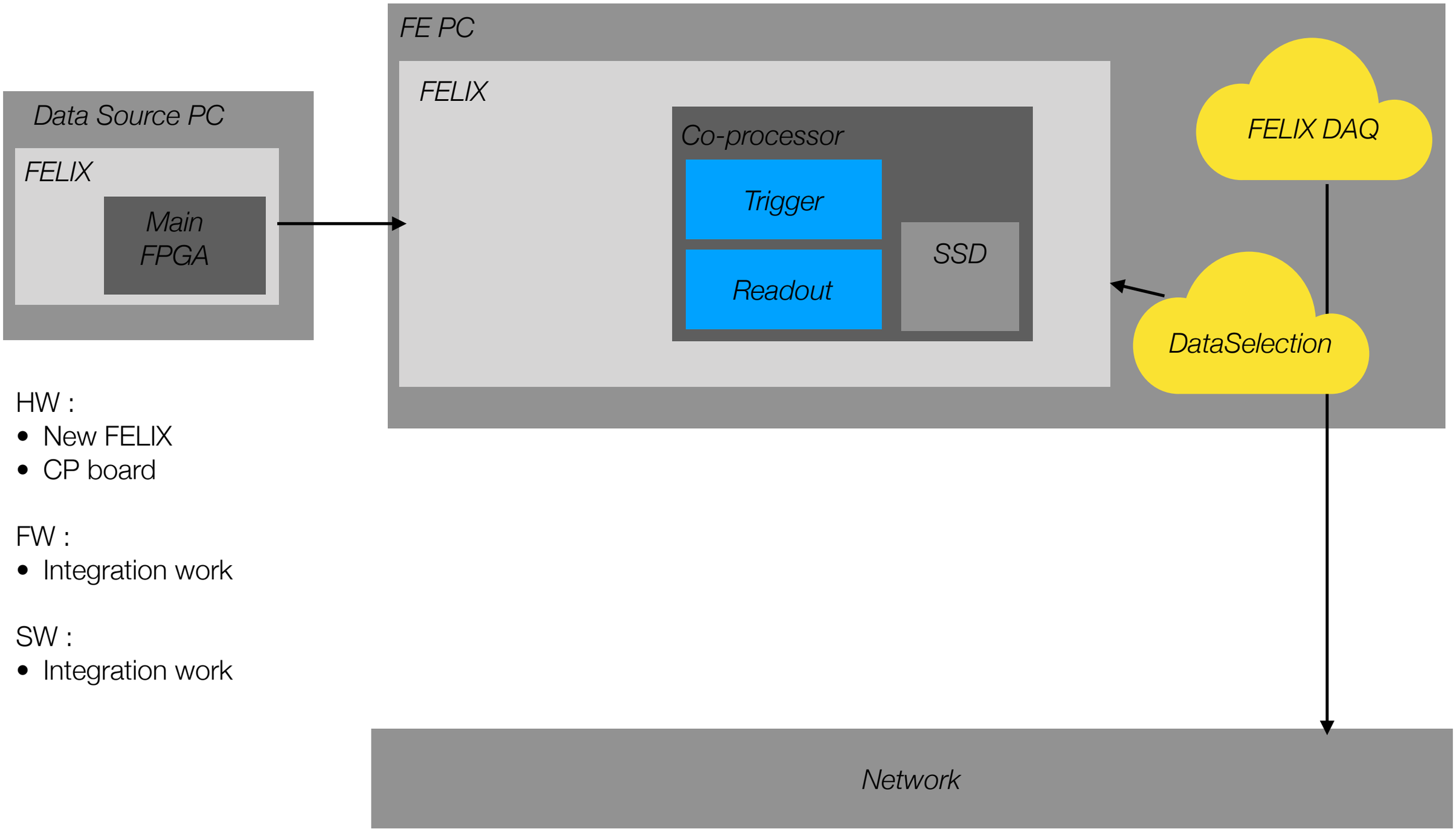
Front-End Integration Test 2



FELIX FW :

- Data sel interface

Front-End Integration Test 3

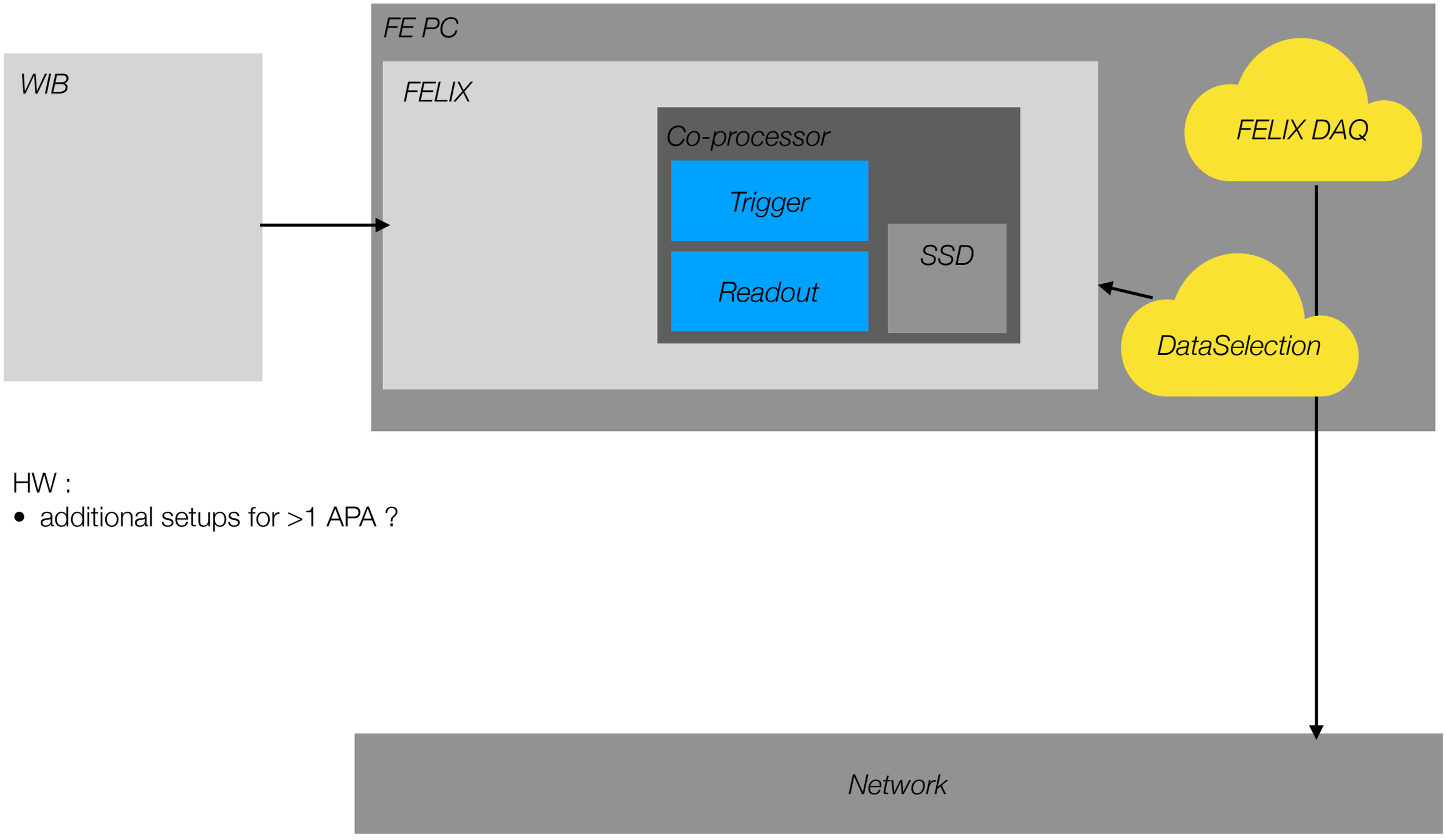


HW :
- New FELIX
- CP board

FW :
- Integration work

SW :
- Integration work

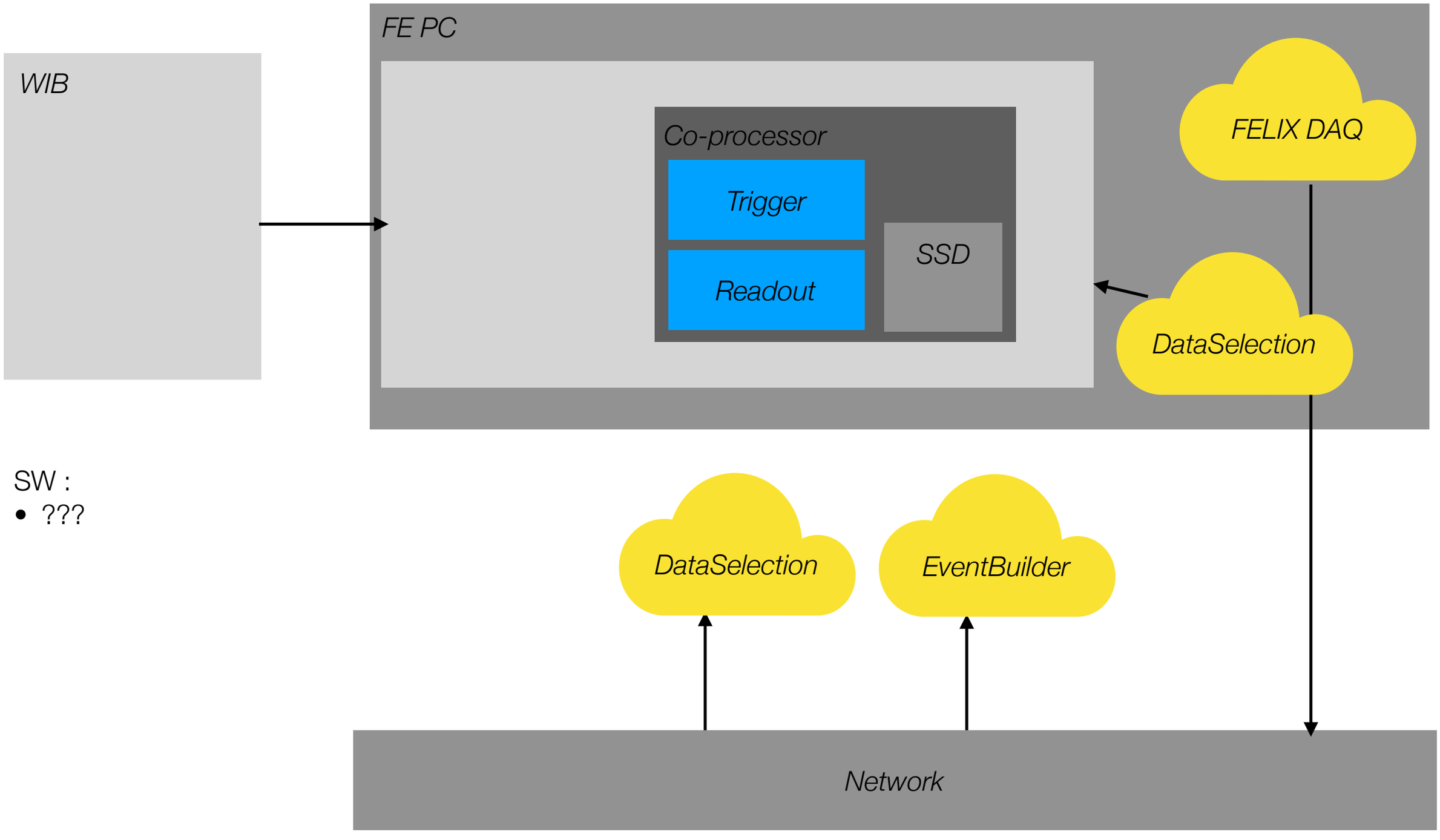
Front End Slice Test @ ProtoDUNE



HW :

- additional setups for >1 APA ?

Full Slice Test @ ProtoDUNE



SW :

- ???