TimeSPOT WP4:
Stato delle attività a Milano

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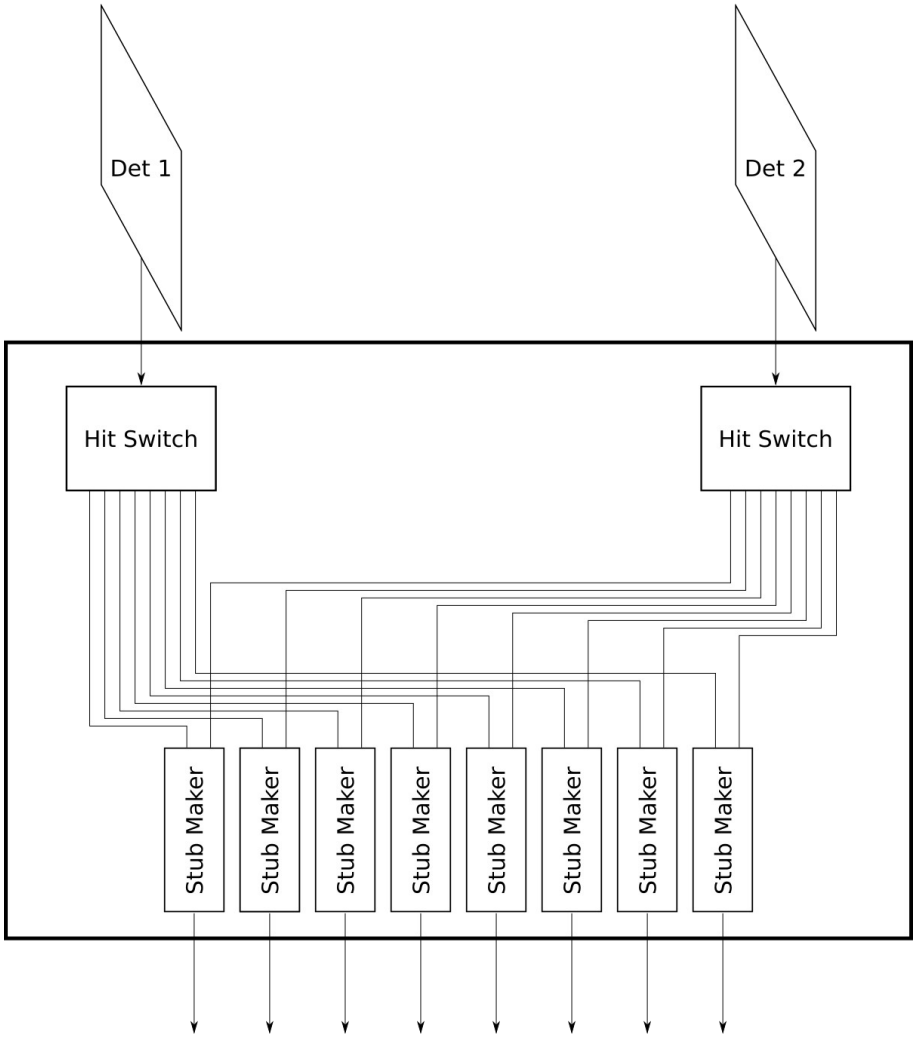
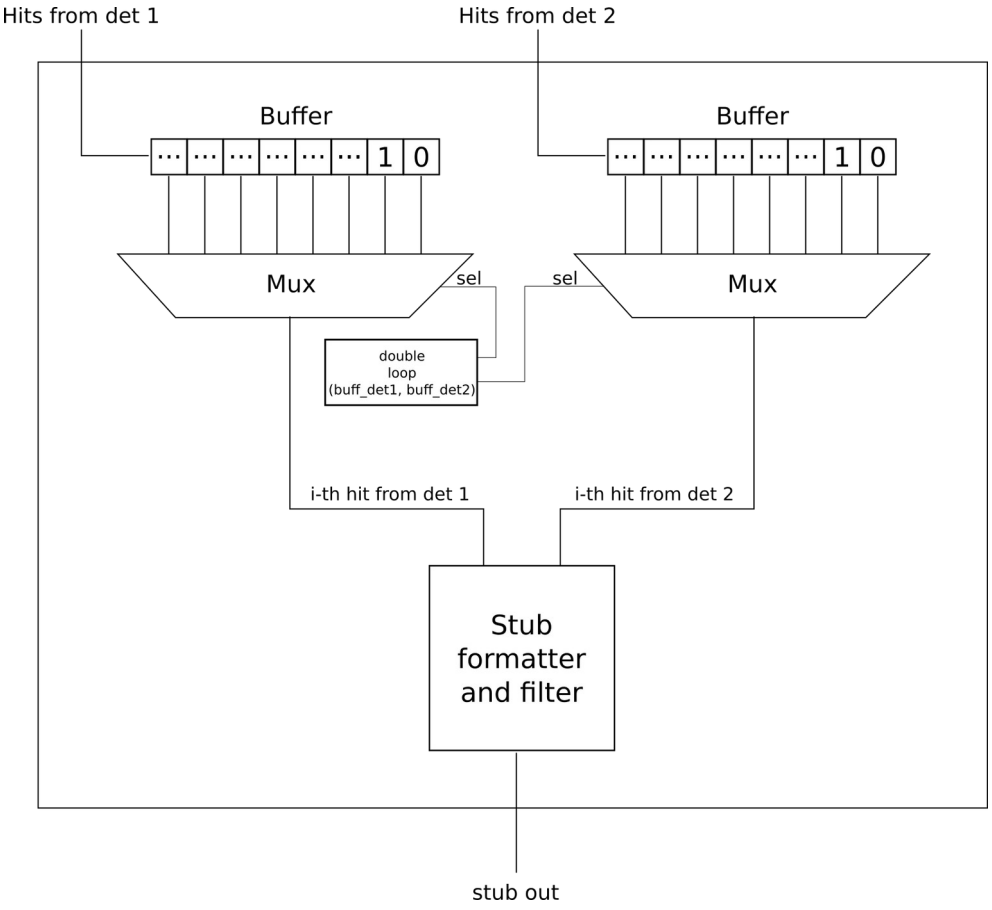
Stub Constructor

- The **Stub Constructor** receives the detector hits from a couple of sensor planes
  - Two Switches deliver the hits to a pool of Stub Makers
- Each Stub Maker receives **data from exclusive sensor regions**, uniformly distributed w.r.t. to phi, NOT uniformly distributed w.r.t to radial coordinate
- **The (r,phi) coordinates** of each hit need to be evaluated before the Hit Switches.
  - An “xy_to_rphi_converter has been implemented and tested
- The Hit Switch is identical to the Stub Switch, already tested in the gFEX implementation.
- **The Stub Maker processes every combination** of hits that are received from the region it is associated with

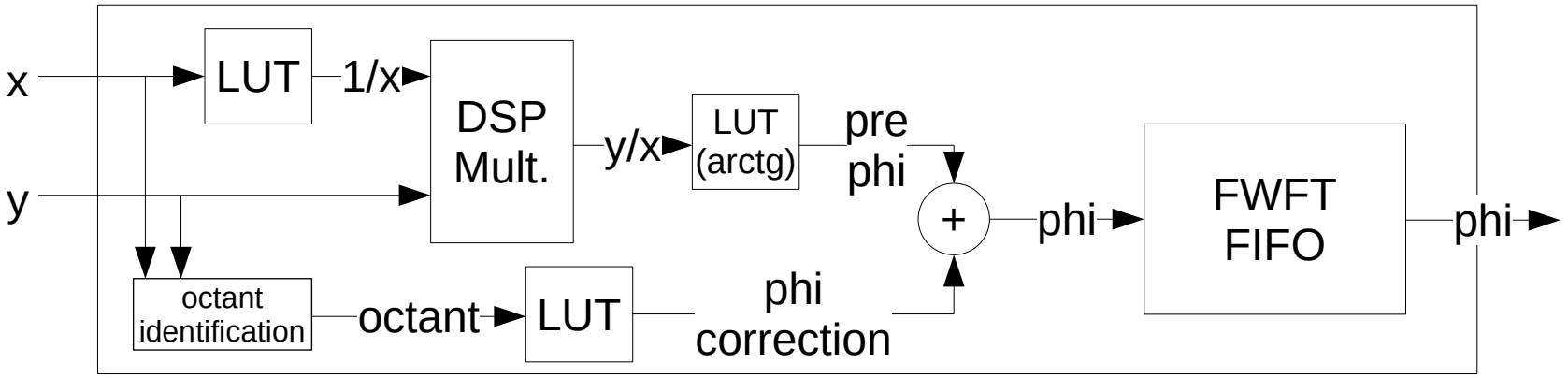


Stub Maker

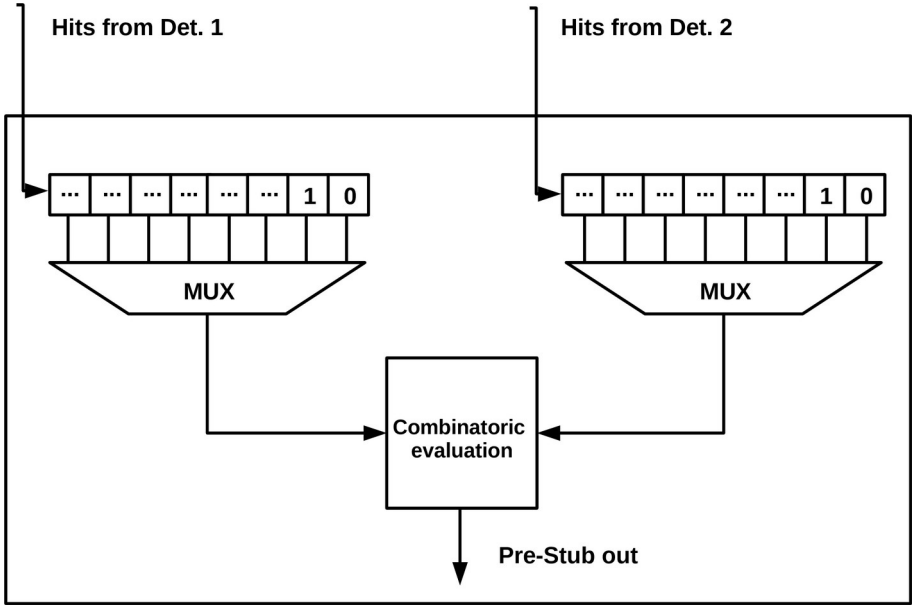
- The **Stub Maker** is composed of:
  - **two independent buffers** to store the hits from the sensor regions
  - **two multiplexers,** to perform a double loop over all the filled positions of the buffers
  - **A filter** to discard not meaningful stubs (applying geom+timing cuts)
- In the simplest case **one combinatorial unit** is used to generate the stubs
- **Parallel combinatorial units** can be used to speed up the computation



Single module tests

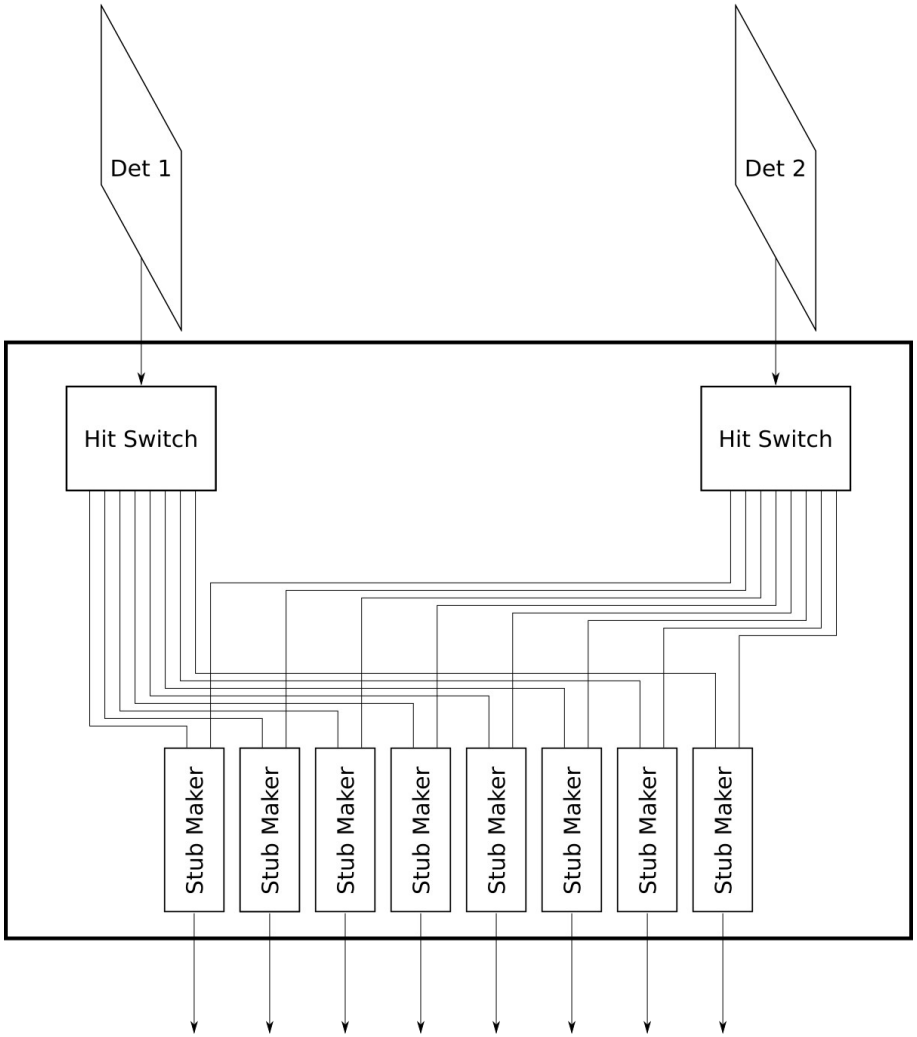


- **XY-to-RPhi converter (top)**
  - Provides the conversions from x-y coordinates to radial coordianates (r-phi)
  - Tested with ref.clock = 200 MHz
- **PreStub Maker (bottom-right)**
  - Provides the combinations of couple of hits without applying geometrical and timing filtering to the candidate stub
  - Tested with ref.clock = 200 MHz



Stub Constructor tests (without filter)

- **A grid of (Pre)Stub Makers has been instantiated in the VC709 firmware:**
  - Ref.clock = **200 MHz**
  - Hit data are provided from the PC via the PCIe interface
  - The Hit Switches deliver the hit data to a subset of (Pre)Stub Makers according to the “address” value of the hit data
  - The Stub Makers that receives one or more data from both the inputs (det1-det2) process the N1*N2 combinations and provides the couple of hits (prestubs) in output
  - A fan-in is instantiated to collect the data from the (Pre)Stub Makers and deliver to the PC via the PCIe interface.
- The expected combinations (evaluated via software from the input data) are **compared to the results from FPGA with success.**



Next plans

- Implementation of the **Stub Filter**:
  - to remove hits combination not compatible with particles from the interaction regions, based on geometrical and timing cuts
  - **Partially implemented**, to be tested as a single module and included in the Stub Maker
- Inclusion of the **XY-to-Rphi converter**, quite straightforward

- **Evaluation of the FPGA resources usage** w.r.t to the number of modules
  - A small set of 16 Stub Makers implemented by now
  - A higher set will be implemented to see how many modules can fit one FPGA

- **Other tasks:**
  - Communication from/to VC709 and gFEX for the complete test
  - Complete tests with simulated data from LHCb