

SPADIC status and plans

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Section 1

Recent history

November 2014: CERN beam time

In principle fully operational, but with some problems:

- amplifier instability
- glitch in serial data output → difficult to reliably establish connection
- bug in hit detection logic (cannot use negative thresholds)

December 2014: TRD strategy meeting

Decision to produce short-term version 1.1 before 2.0

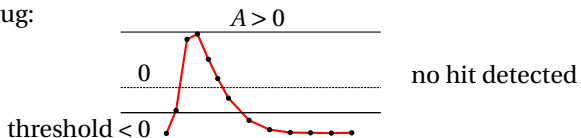
- fixes problems of version 1.0
- otherwise remains compatible → re-use FPGA firmware and software
- one additional change: updated version of CBMnet link port without retransmission (provided by S. Schatral and P. Schäfer)
- currently under development – submission date: 25. May

Section 2

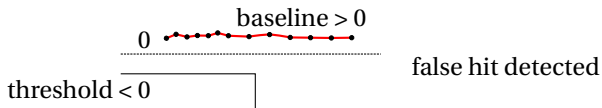
Fixing the hit detector

Flaws of the SPADIC 1.0 hit detector

obvious bug:

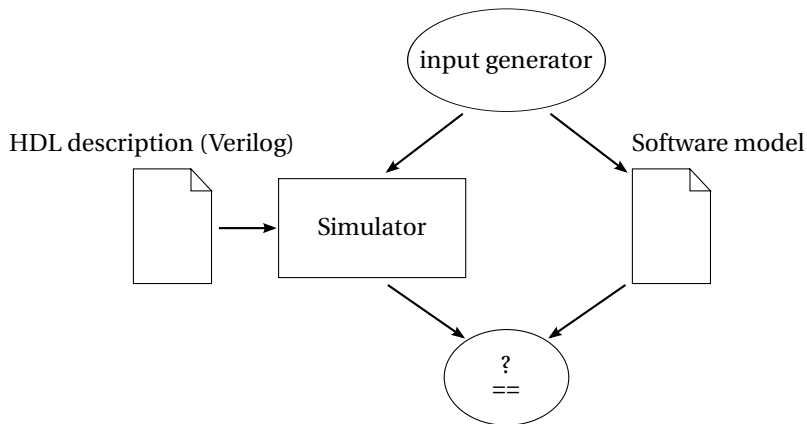


few more subtle issues:



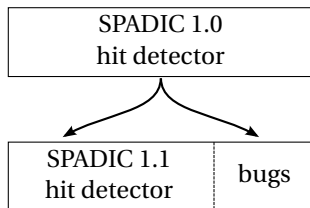
Development of a testing framework

Step 1: create software model and adjust it until it exactly reproduces the behaviour of the original SPADIC 1.0 hit detector (mostly trial-and-error)

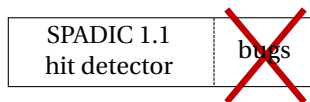


Transform the software model

Step 2: Transform model to separate desired behaviour from bugs
(comparison against HDL simulation ensures equivalence)



Step 3: remove bugs



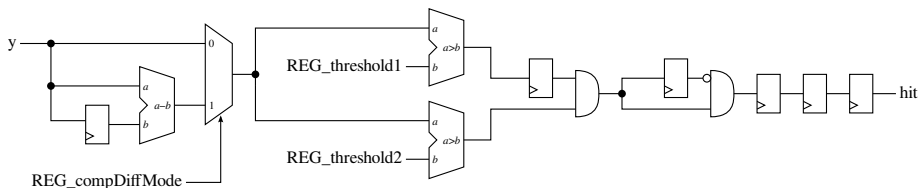
New hit detector

Step 4: Rewrite HDL description to match software model again

Results:

	SPADIC 1.0 hit detector	SPADIC 1.1 hit detector
No. of clocks	2	1
Lines of code	280	70
No. of registers	45	14
No. of logic gates	≈ 240	≈ 140
Silicon area	$\approx 9000\mu\text{m}^2$	$\approx 4500\mu\text{m}^2$
Draw accurate picture	hard	easy

New hit detector



- 1 subtractor, 1 multiplexer, 2 comparators (9-bit)
- 2 AND-gates, 1 inverter
- 14 registers (9 + 1 + 1 + 3)
- delay of 3 clock cycles at output only for compatibility (can be removed in SPADIC 2.0, possibly also simplifying other logic)

Section 3

Fixing the amplifier

Fixing the amplifier

- behaviour has been reproduced in laboratory setup
- exhaustive measurements taken → identify circumstances where instability occurs
- results currently under investigation (P. Fischer) to find the root of the problem and the solution

Section 4

Physical implementation

Physical implementation

From HDL code to layout:

- performed by powerful commercial software
- directed by several interdependent scripts
- since SPADIC 1.0 (2011): software updates, changes in HDL code:
 - scripts need adjustment
 - not as “automatic” as I would wish
- fixing the serializer glitch is part of this
- currently in progress → confident that it will be ready until submission date (\approx one month)

Thank you for your attention.