

Automated Quality Tests of the VMM-Hybrid

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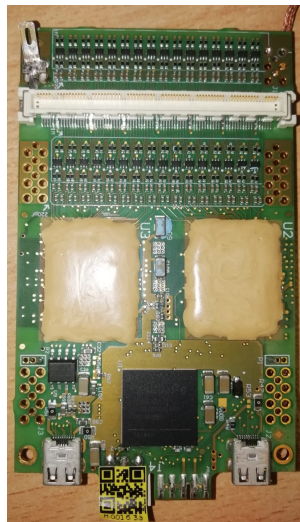
February 10, 2020



- 1 Context
 - The SRS-VMM Project
 - My Project
- 2 Planned Setup Overview
- 3 Elements of testing
 - The Scalable Readout System
 - VMM Slow Control
 - Power Supply
 - Firmware Programmer
 - External Connection
- 4 Project Status
- 5 Plans

The SRS-VMM Project

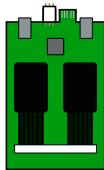
- VMM developed since 2012 for ATLAS NSW Upgrade
- VMM-Hybrid integrated into SRS
- multiple Prototypes
 - VMM2 (5 Hybrids)
 - VMM3 (7 Hybrids)
 - VMM3a (52 Hybrids)
- 2020: Production of ~ 1000 Hybrids planned
- First $\mathcal{O}(100)$ expected next months
- At the moment: Manual testing (~ 1 h/Hybrid)
- New batch needs automated testing



- Development and Setup of a “Testing Station” for the VMM-Hybrids
 - Measure properties of Hybrids (Computer controlled)
 - Noise, pedestal, etc...
 - Evaluate measurements and classify Hybrids
 - Upload Hybrid quality results to database

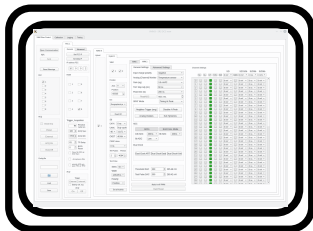
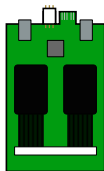
Planned Setup Overview

VMM Hybrid



Planned Setup Overview

VMM Hybrid

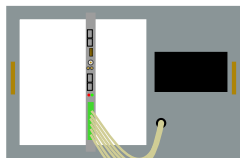


Computer

+

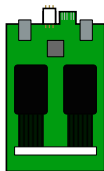
VMM Slow Control

Planned Setup Overview



SRS Crate

VMM Hybrid

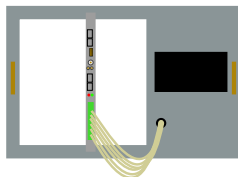


Computer

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VMM Slow Control

Planned Setup Overview

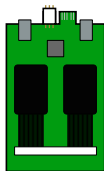


SRS Crate

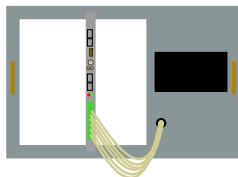


Power Supply

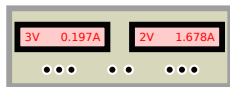
VMM Hybrid

Computer
+
VMM Slow Control

Planned Setup Overview

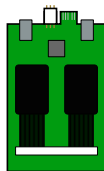


SRS Crate

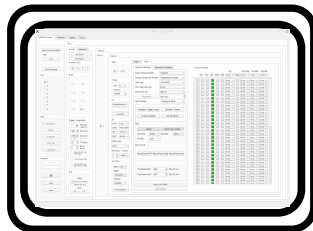
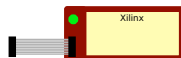


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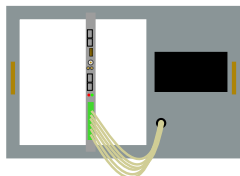
VMM Hybrid



JTAG Programmer

Computer
+
VMM Slow Control

Planned Setup Overview

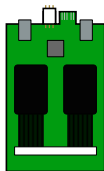


SRS Crate



Power Supply

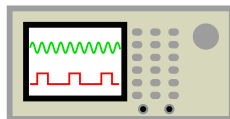
VMM Hybrid



JTAG Programmer

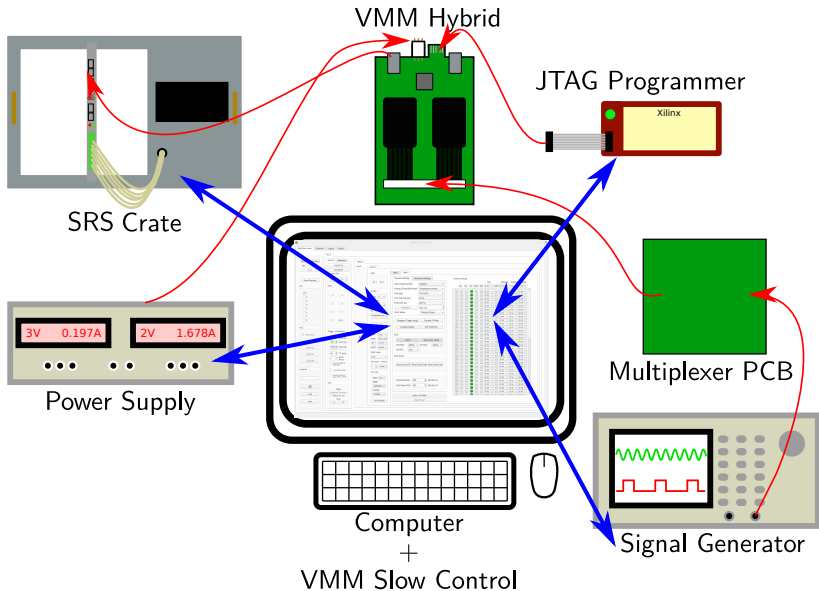

 Computer
 +
 VMM Slow Control


Multiplexer PCB

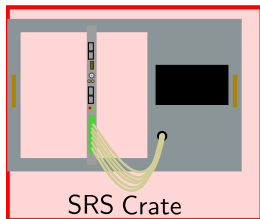


Signal Generator

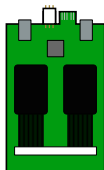
Planned Setup Overview



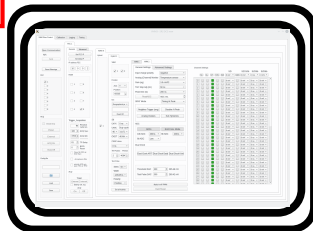
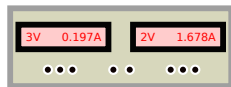
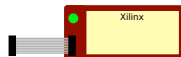
The Scalable Readout System (SRS)



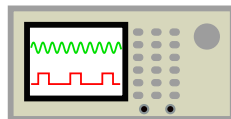
VMM Hybrid



JTAG Programmer



Multiplexer PCB

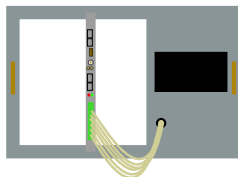


Signal Generator

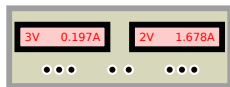
The Scalable Readout System (SRS)

- Readout System for gaseous detectors
 - Compatible with multiple frontends (APV25, TimePix, VMM [1])
- Handles data from VMM
- Transmits data via Ethernet to computer
- Forwards control sequences to Hybrid

VMM Slow Control



SRS Crate



Power Supply

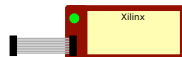


VMM Hybrid

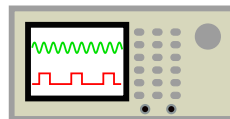
Computer

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VMM Slow Control

JTAG Programmer



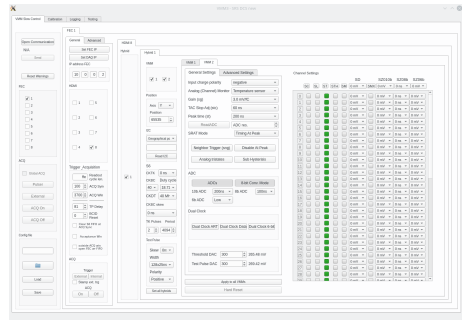
Multiplexer PCB



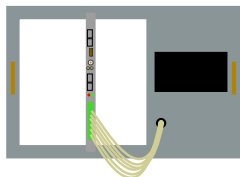
Signal Generator

VMM Slow Control

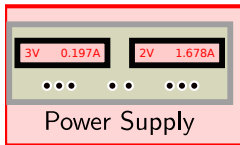
- Controls Hybrids and SRS
- Is used for:
 - Configuring Hybrids
 - Read monitoring ADCs of both VMM
 - Read data output of VMM to SRS
 - Calibrating Hybrids
- Different functions (Calibration or Hybrid Control) in separate “modules”
- Additional testing module
 - GUI for results and start of tests



Power Supply

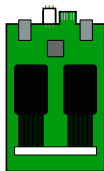


SRS Crate



Power Supply

VMM Hybrid



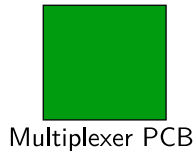
JTAG Programmer



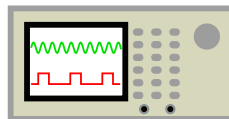
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VMM Slow Control



Multiplexer PCB

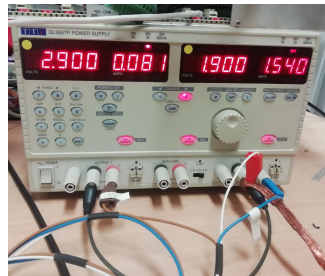


Signal Generator

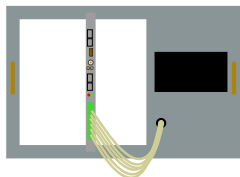
Power Supply

- Communication
 - USB or RS232 to PC
 - PyVISA
 - SCPI Commands
- Task
 - Measure 3 V and 2 V currents
 - Monitoring during tests possible
- Status
 - Preliminary tests with DMM in supply circuit
 - No communication with power supply yet
 - Remote controllable power supply needed
 - **GPD-3303** from GW-Instek

→ Quality criterion: proper power consumption



Firmware Programmer

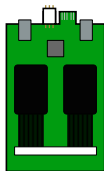


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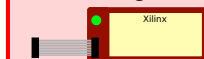


Power Supply

VMM Hybrid



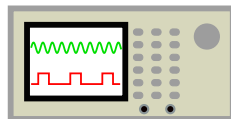
JTAG Programmer



Computer
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Multiplexer PCB



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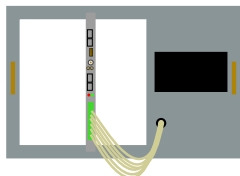
Firmware Programmer



- Flash Firmware onto Spartan-FPGA on Hybrid if not programmed yet
- Needs JTAG programmer and Dongle Adapter
- Use terminal (2 possibilities)
 - 1 using Xilinx **Impact**
 - use impact script for programming (`impact -batch scriptname.cmd`)
 - Flash memory programming easy once setup works
 - 2 using **xc3sprog** (command line utility)
 - Difficult or not possible to program Hybrid flash memory
 - FPGA temporary programmable → useful for VTC project?



External Connection

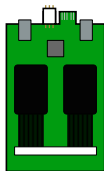


SRS Crate



Power Supply

VMM Hybrid



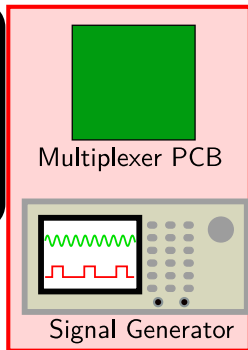
JTAG Programmer



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VMM Slow Control



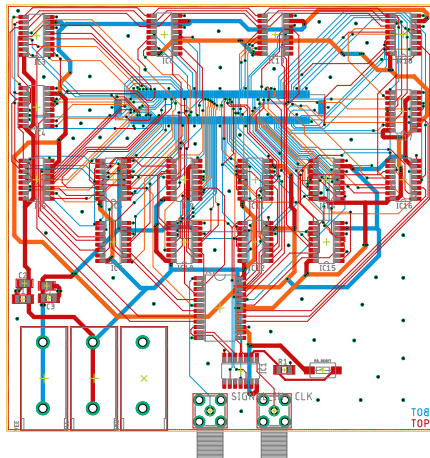
Multiplexer PCB

Signal Generator



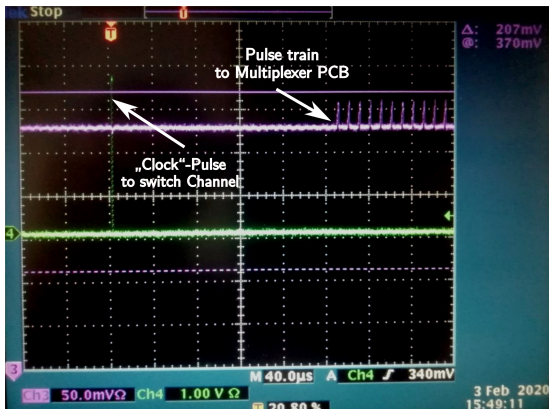
External Connection

- “Simulates” a connected Detector
 - External test pulses from signal generator for individual channels
 - Multiplexer PCB
 - 1 16-Channel MUX + 16 8-Channel MUX controlled by 7-bit counter
 - Distributes pulses onto single channels
 - “Clock” from signal generator advances Channel
 - Check if pulses were received with Slow Control
- Signal Generator controlled via USB with SCPI & PyVISA

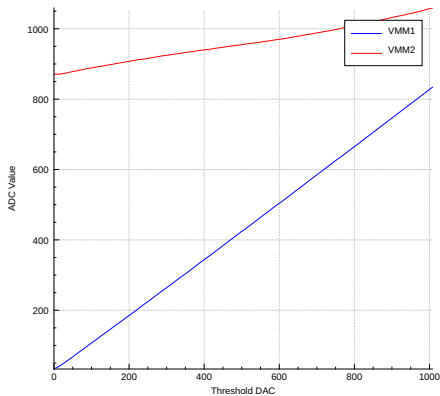


External Connection II

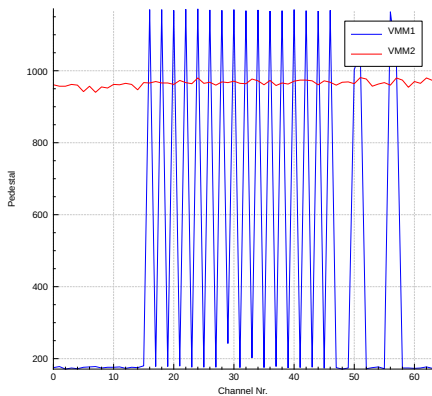
- Status
 - PCB ordered
 - Remote controllable Signal Generator on hand
 - Signal Generator programmed



- Most testing elements Work in Progress
- Two tests working



ADC



Pedestal

- 1 Implementation of more tests & Definition of quality criteria
- 2 Automatic upload to database
 - if possible also upload plots/measured data
- 3 Tests with real detectors
- 4 Coordination with VTC-project (open for discussion)



M. Lupberger et al.

“Implementation of the VMM ASIC in the Scalable Readout System”.

In: *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 903 (2018), pp. 91–98.

ISSN: 0168-9002. DOI: <https://doi.org/10.1016/j.nima.2018.06.046>.

URL: <http://www.sciencedirect.com/science/article/pii/S016890021830768X>.

Questions...?