Australian Synchrotron
Turning bright ideas into brilliant outcomes

Simple Solutions to Simple Problems

Global Trigger of a Post Mortem Event

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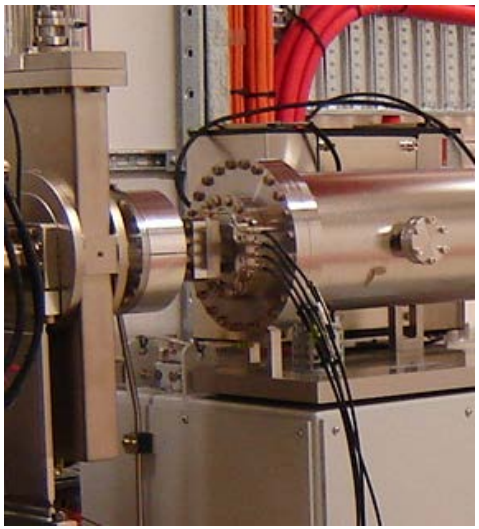
The Problem

- We have 98 Beam Position Monitors (BPMs) around the electron storage ring which monitor beam position and capture turn by turn data into local buffers.
- 28 of these BPMs can trip the electron beam if it moves out of the defined safe area.
- We would like to freeze the buffer data in all 98 BPMs coincident with a beam trip

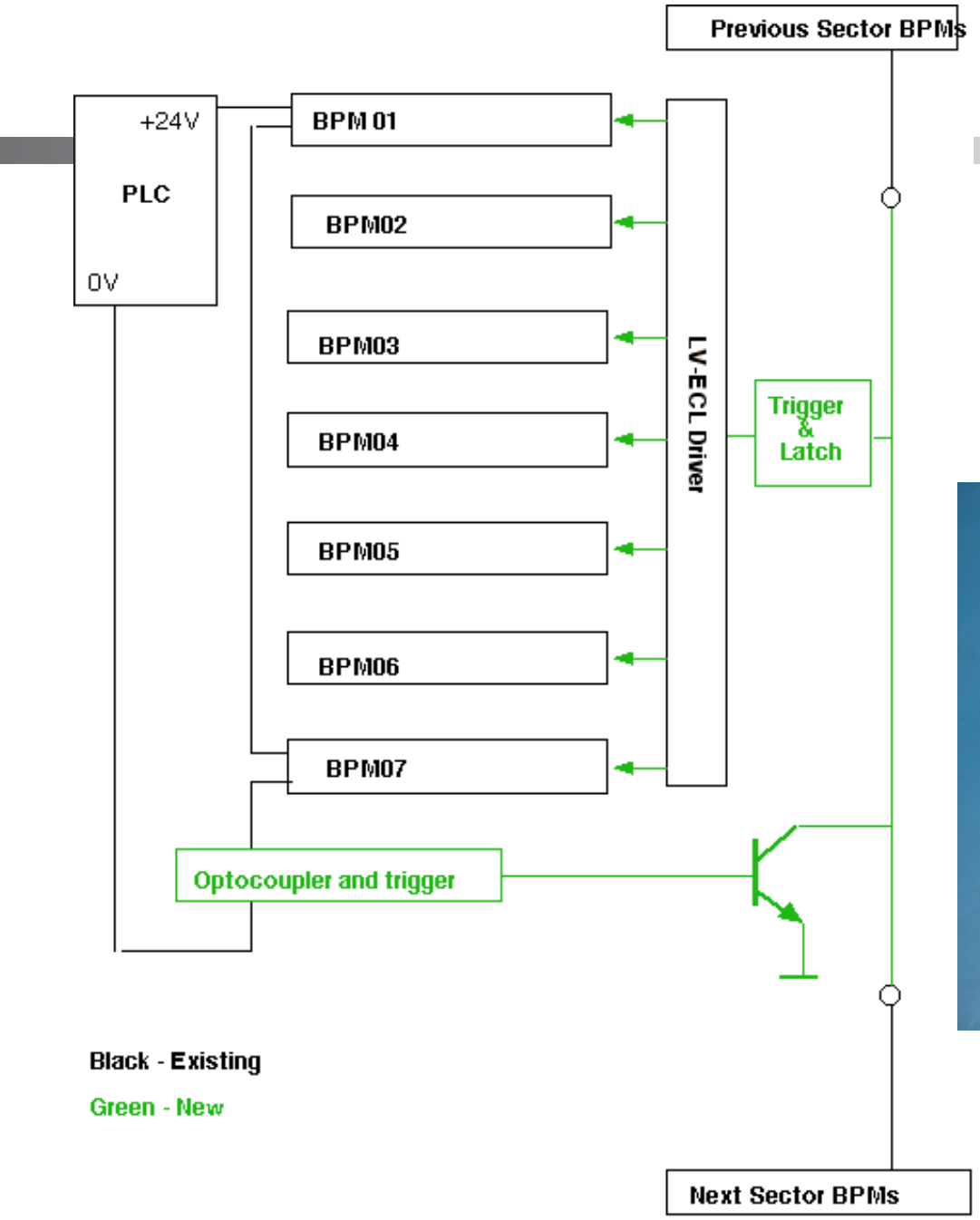


The Engineers Solution

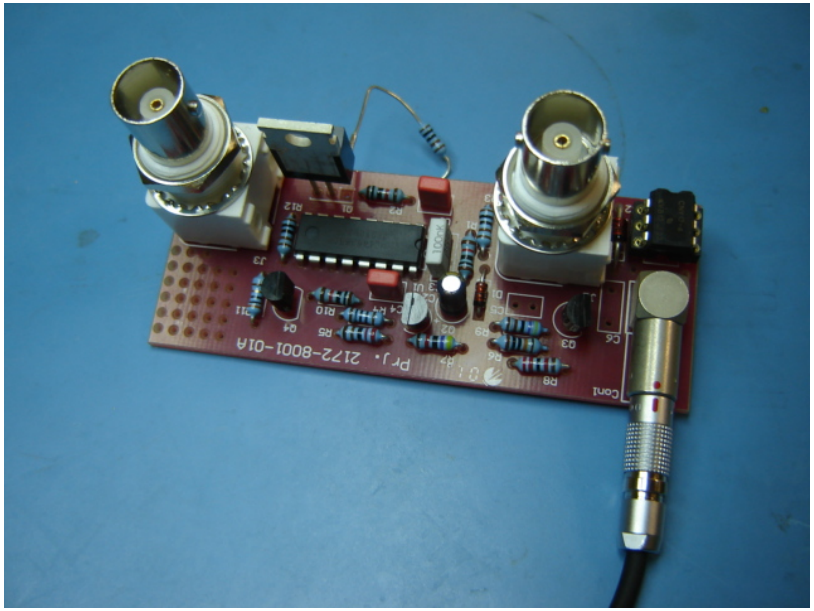
- To aggregate the trip signals locally
- To collect all these trip signals at a central location
- To send out a global trip signal to each sector
- To distribute these signals to each BPM box
- This would require significant hardware, development and very significant installation of cable.

The Operator Solution

- To install in the existing Orbit Interlock circuit an Optocoupler which is OR’ed with optocouplers in each of the other 14 sectors.
- A single coax cable (existing but unused) is used to connect each of the sectors in a daisy chain.
- A simple latching circuit is provided at each sector to provide the correct voltage levels and prevent multiple triggers.
- The power for the circuits is also provided along the coax
- Cycling the power resets the latches.

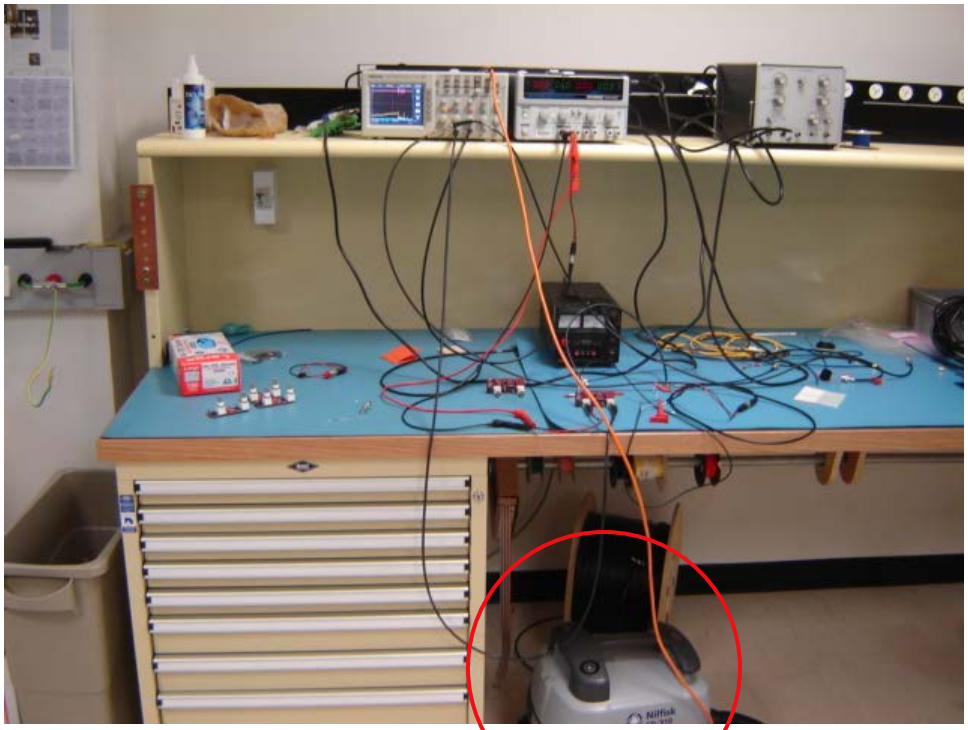


The Device (14 required)



Laboratory Testing of Device

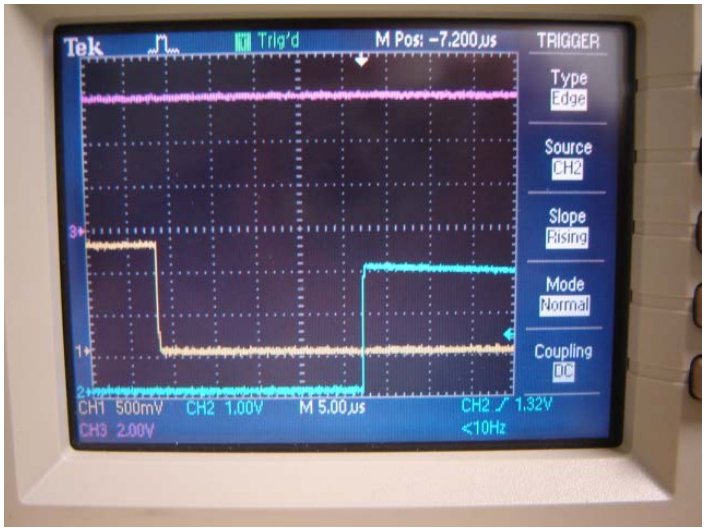
Bench Test

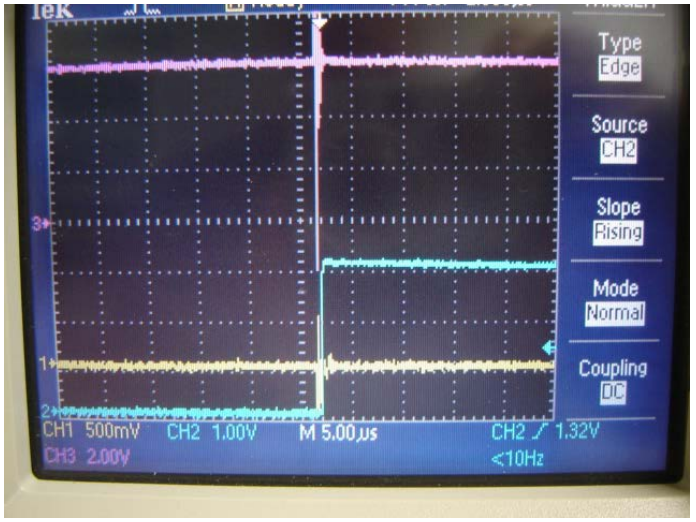


EMC Noise Generator

Testing Noise Immunity

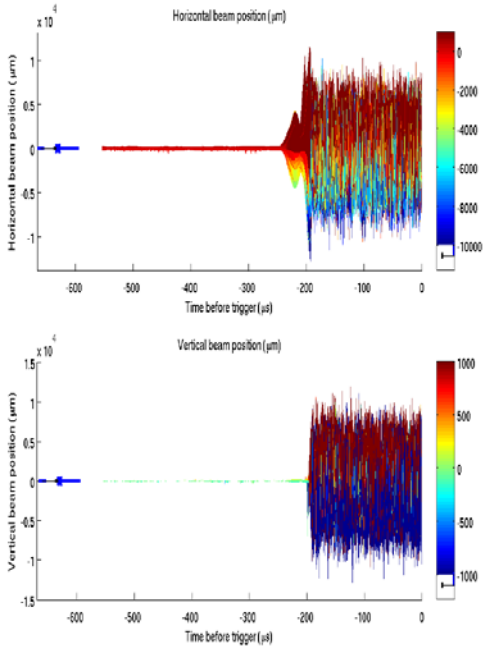
Normal Trigger response



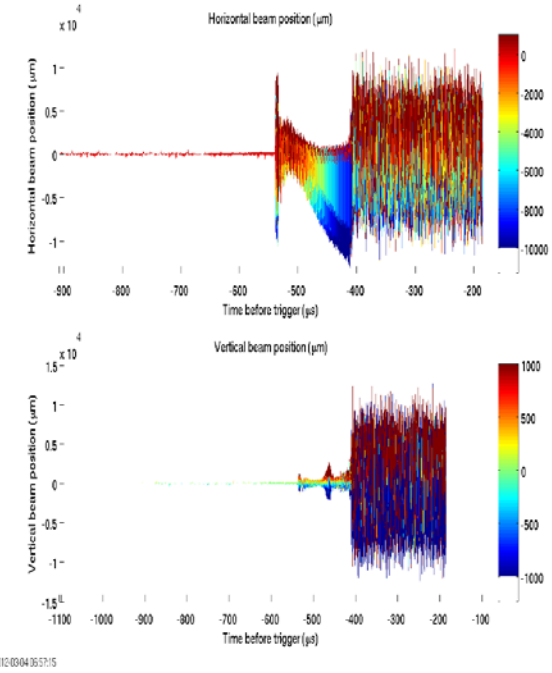


Data Capture from different events

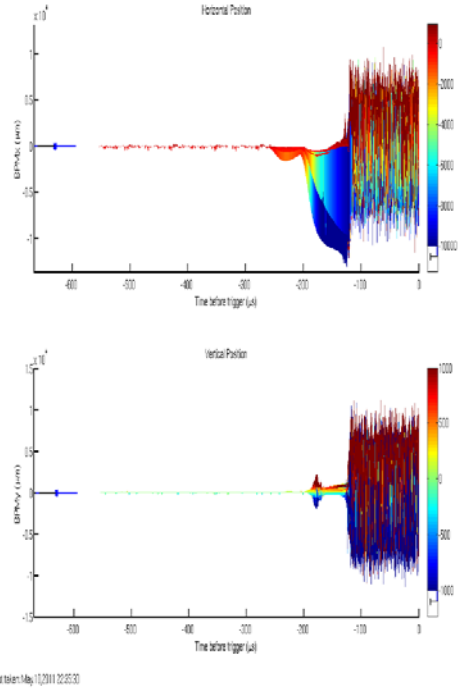
Quadrupole Magnet Failure



Injection Kicker Timing



Mains Power Trip



Performance Since Installation

- No False trips (30 months)
- Captures the beam Post Mortem data extremely reliably
- Have used it in manual trip mode to capture noise on the beam synchronized to external events
- Total cost ~$5K (mainly LEMO connectors)
- Designed, constructed and installed by the Operators.

Thanks

- Michel ten Have (Operator) who developed and constructed the circuits.
- Cameron Rodda (Operator) who did the PCB layout.
- Adam Michalczyk (Electronics Engineer) who was the devils advocate on the project,