T980 Pixel Noise Issues and Solutions

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Status

- E0
  - All 6 modules installed and alive.
  - When beam is off, everything works.
  - When beam is on…
    - Intermittent slow controls.
    - Returning data is noise laden.
- F17
  - All 4 modules tested and are good.
  - Modules not yet installed in vacuum chamber?
    - Should apply noise mitigating techniques before installing into tunnel!
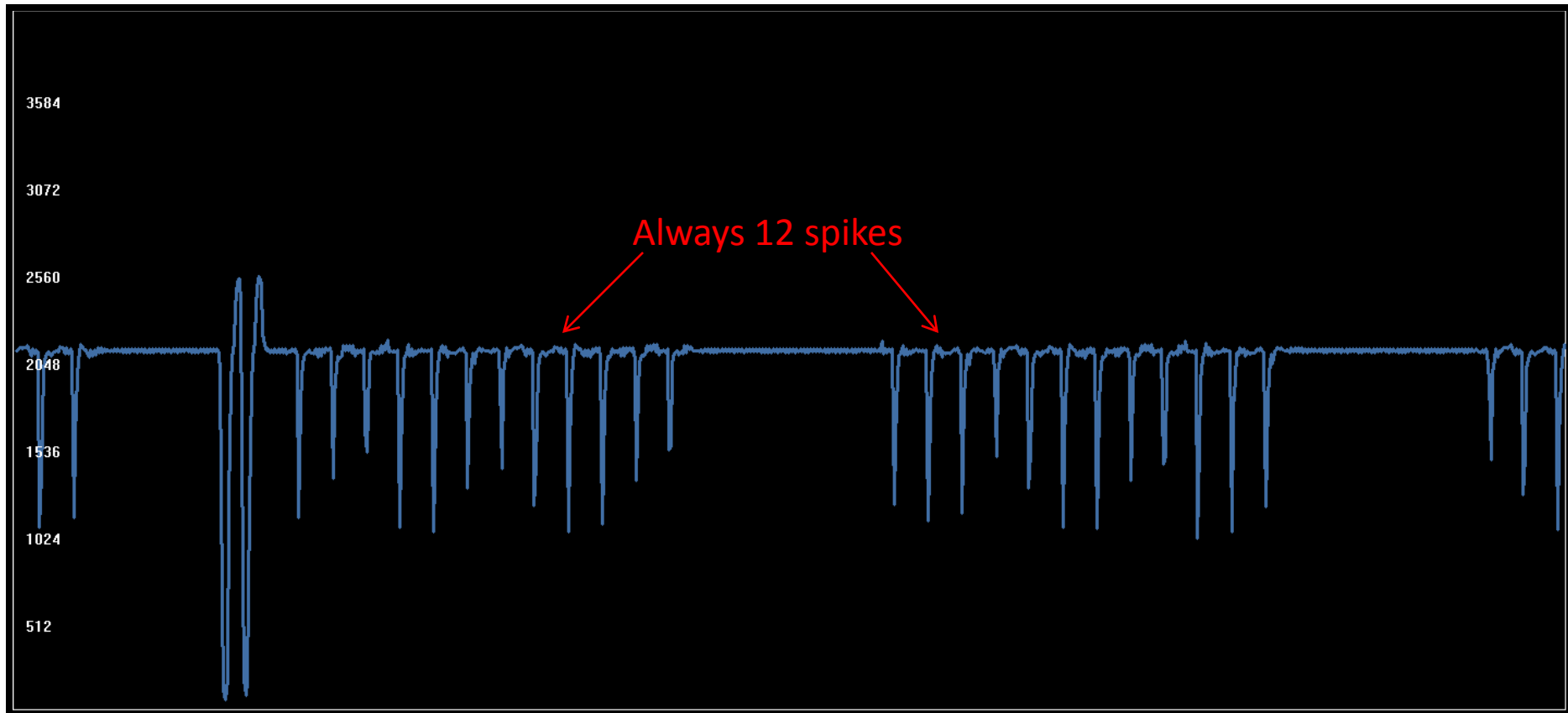
The Problem

This is a clean status signal from the TOP-UPSTREAM module with the beam off:
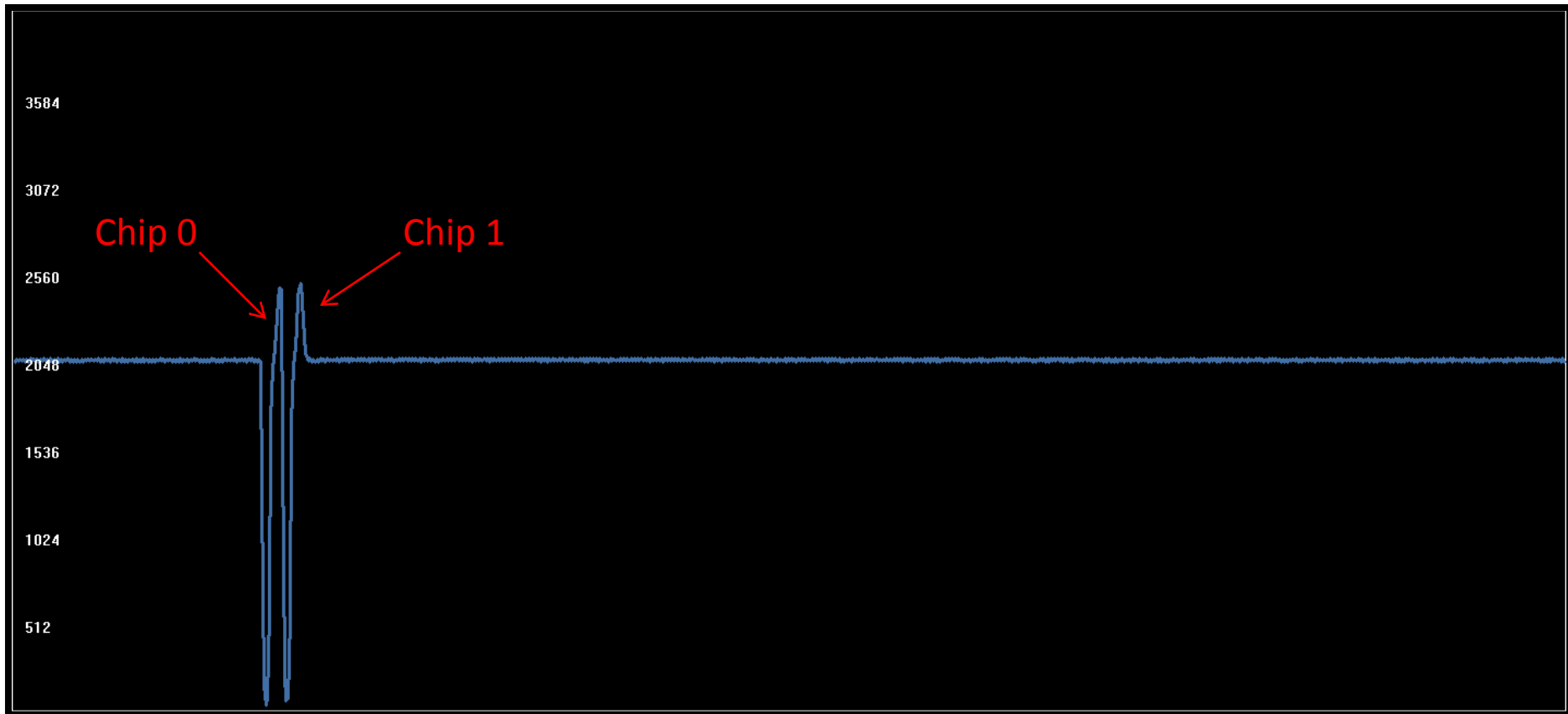
The Problem Cont.

This is the same module with the beam on:

The Problem Cont.

- The noise seems to be from the bunches.
- The noise makes it difficult to interpret the analog signal (READ) and to program the sensors (WRITE).
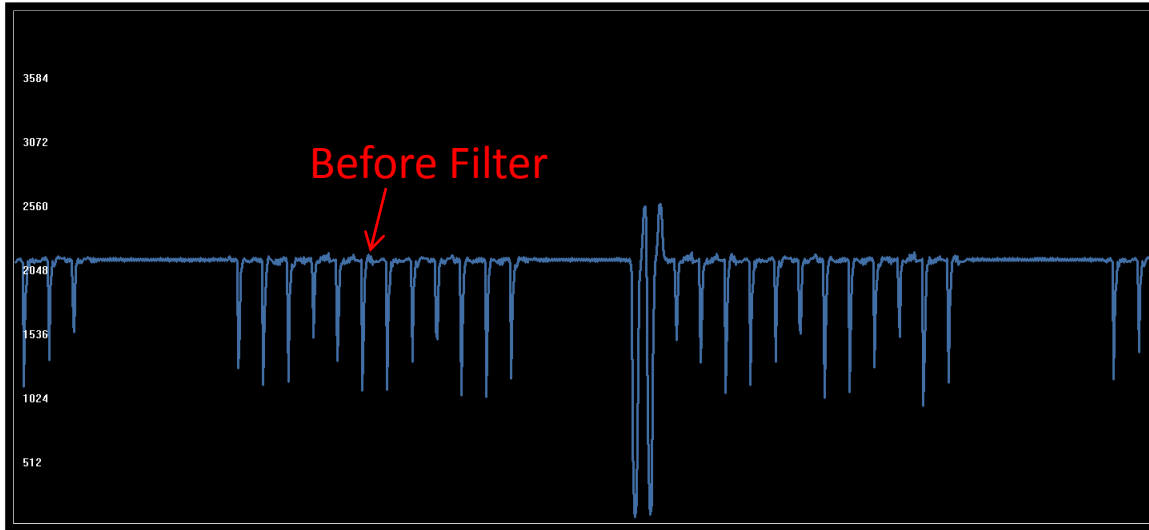
Solutions

1. Software Solutions
2. Hardware Solutions Outside the Vacuum
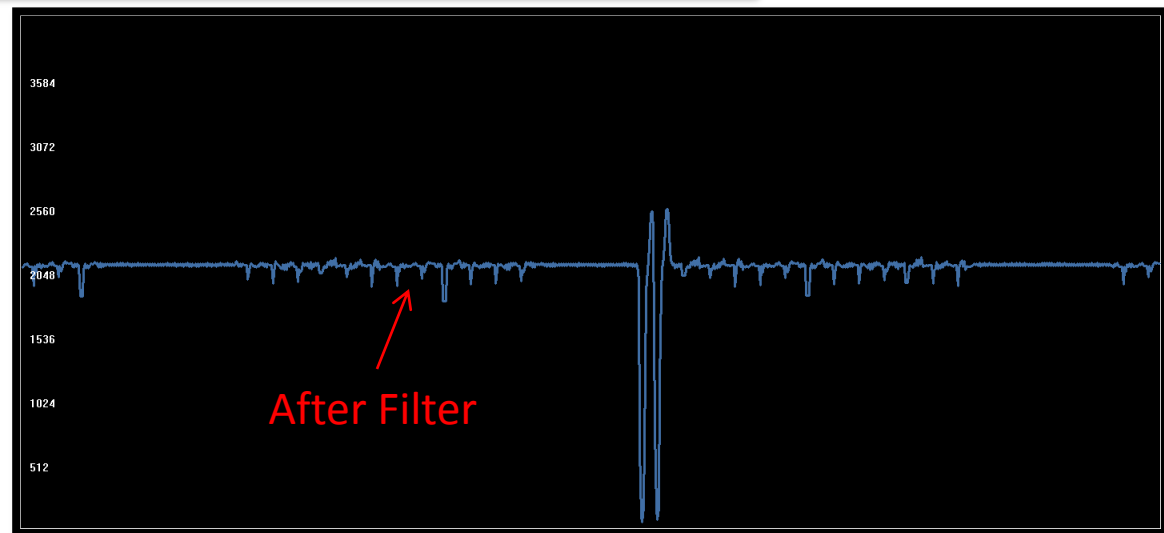3. Hardware Solutions Inside the Vacuum

1. Software Solutions

- Imagine making no hardware changes:
  - Could program and setup sensors when beam is off (during shot setup, etc.).
  - Then when beam returns, take data without control.
  - Finally, employ software based filtering techniques to interpret the saved data in spite of the noise.
- If hardware changes are made, developing the above techniques can only help further.

1. Software Solutions Cont.
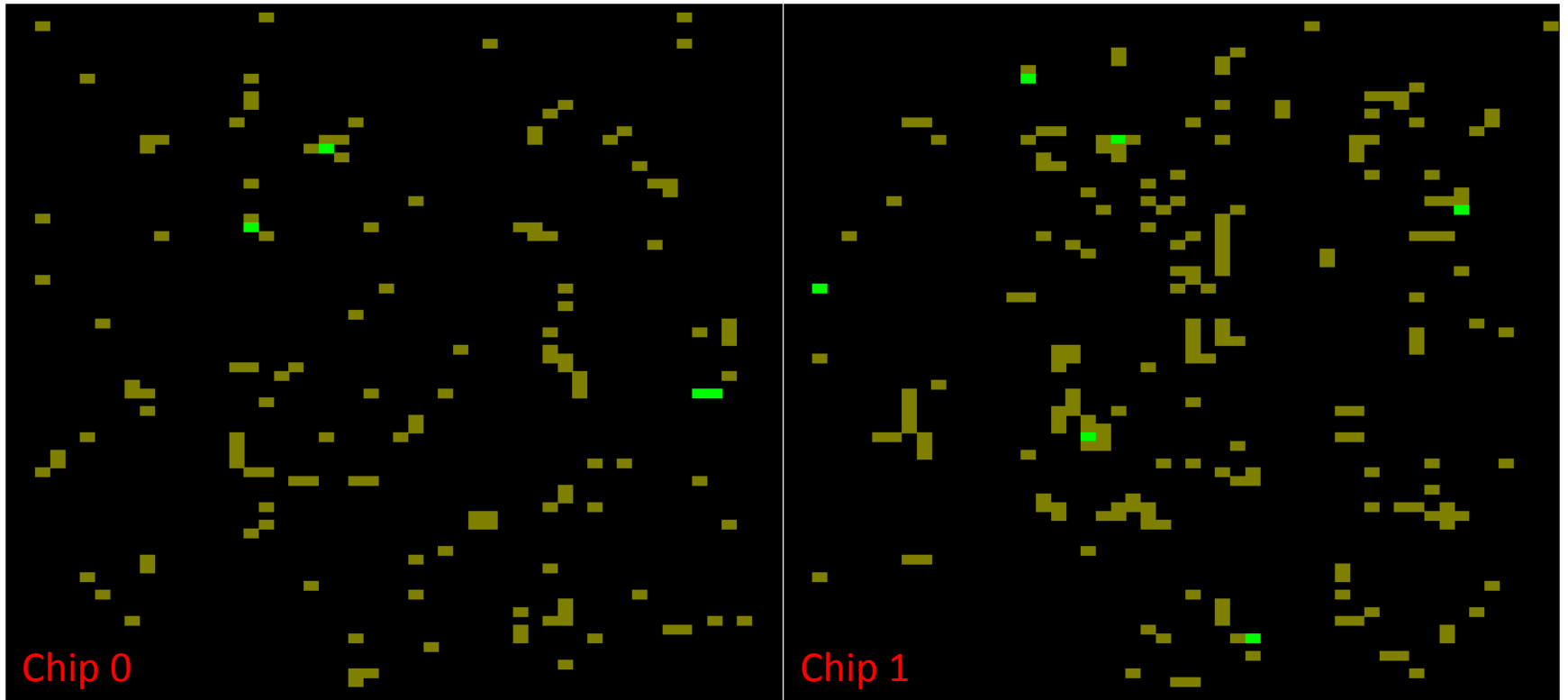

Initial filtering attempts already made.

1. Software Solutions Cont.

When noise cooperates, we can already successfully interpret some data:

1. Software Solutions Cont.

Accumulation plot for TOP-UPSTREAM module:

2. Hardware Solutions Outside the Vacuum

- All the cables should be placed perpendicular to the pipe.
- Everything should be shielded.
  - Use Aluminum foil where shielding is difficult to apply.
- Connect the shields to ground.
  - In CMS, shield grounding is done as far away from the detector as possible; we should try mimicking.
- Check that the noise is not coming from the power supply, since the Tevatron sucks massive amounts of current, that may be a problem.
- Try connecting ground to the local ground.

3. Hardware Solutions Inside the Vacuum

- A window is being opened on the Tevatron pipe, run wires patching the hole in the pipe so that the mirror current from the beam can flow undisturbed.

- Shield the PSI sensors by wrapping the lines going to the PSI with aluminum foil. Try to wrap the lines very tight, then ground the foil.

3. Hardware Solutions Inside the Vacuum Cont.

Aluminum foil shielding example. (A) Data cable, (B) Data/Clock, (C) Power/VT/Inject Q.
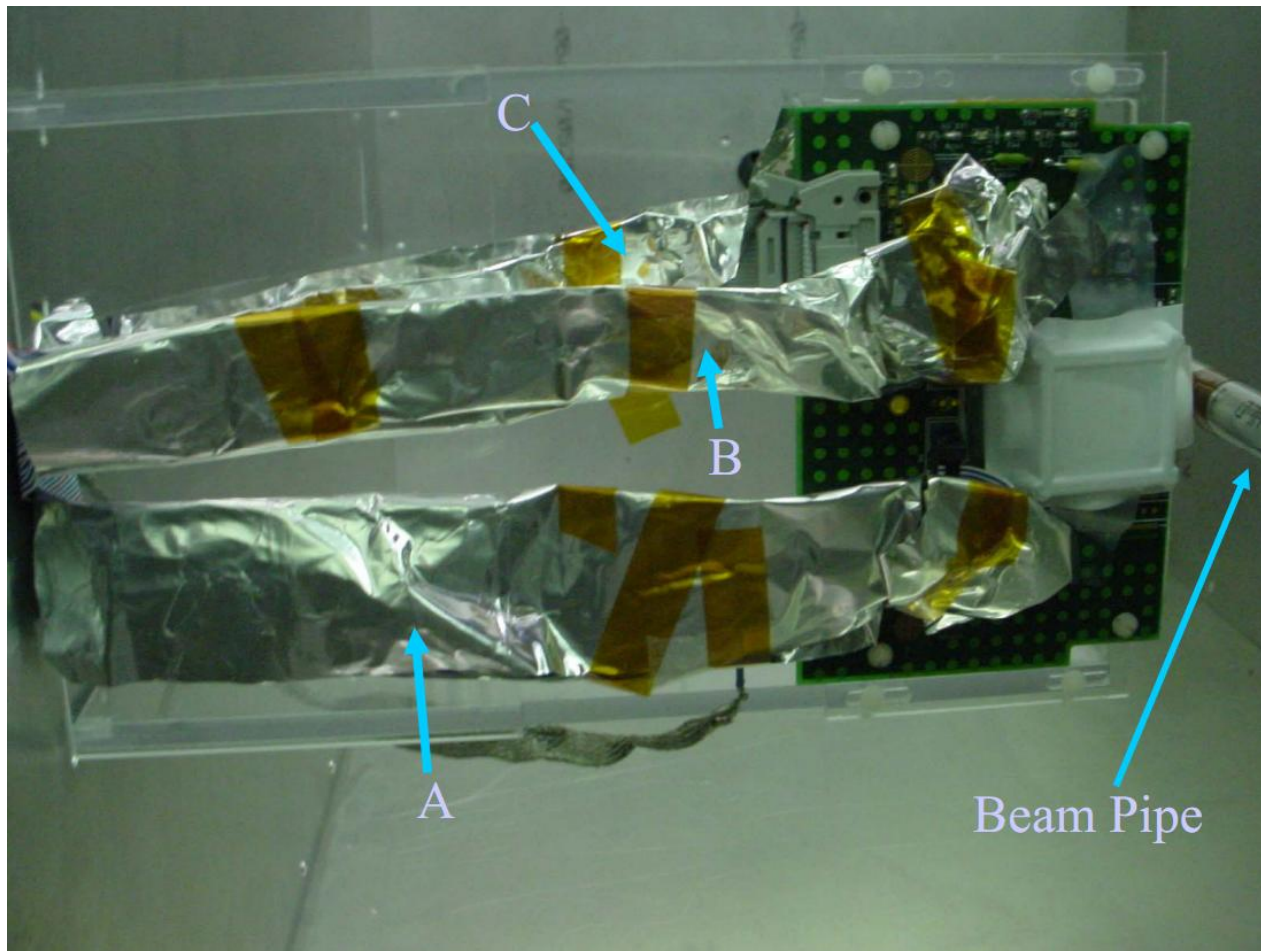
Applying Changes

- E0
  - Shut down in March?
- F17
  - Now is the time.
    - Can practice techniques, now, outside the tunnel that can be applied to E0 during the shutdown.