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ME 234/2
HV noise investigation

AFEB Counting Noise Test Results

- Fact 1. A few times FAST site Test 11 was failed (AFEB counting noise). AFEB threshold set to 20 fC, HV off, ALCT at self-trigger mode, noise calculated with a free running scaler.
- Fact 2. Planes 6, 4, 2 are more sensitive to this noise than planes 1, 3, 5.
- Fact 3. This behavior is not stable and depends on numerous factors (system grounding, noise source location, HV supply, HV cabling, etc…
- Fact 4. If HV cable is disconnected, the situation is absolutely quiet.

Conclusion:

- HV supply with HV cable is a noise source.
- Noise transfer function from HV line to anode wires for planes 1, 3, 5 is less than for planes 2, 4, 6.

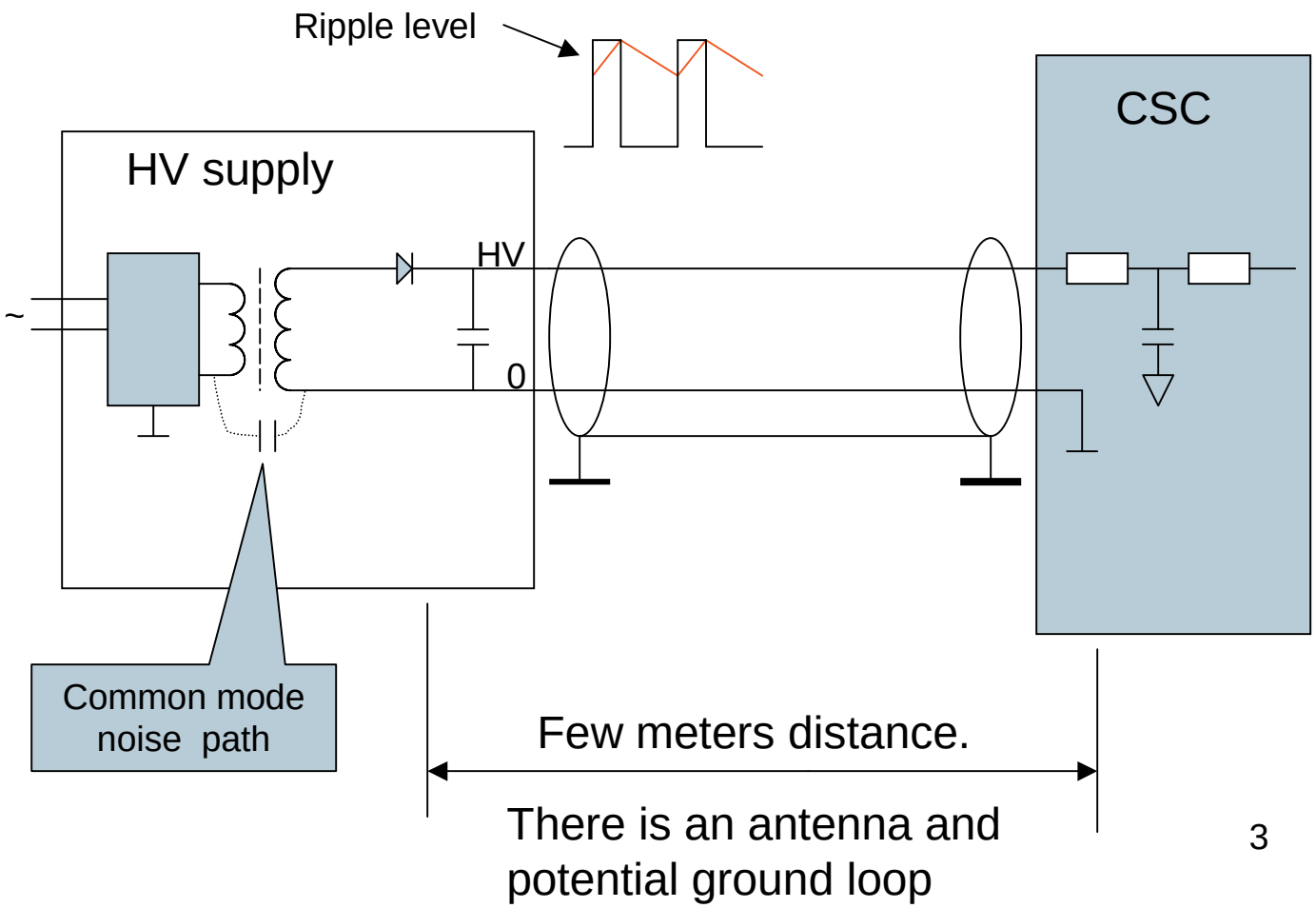
To eliminate this effect there are two ways:

- Minimize noise source
- Minimize noise transfer function

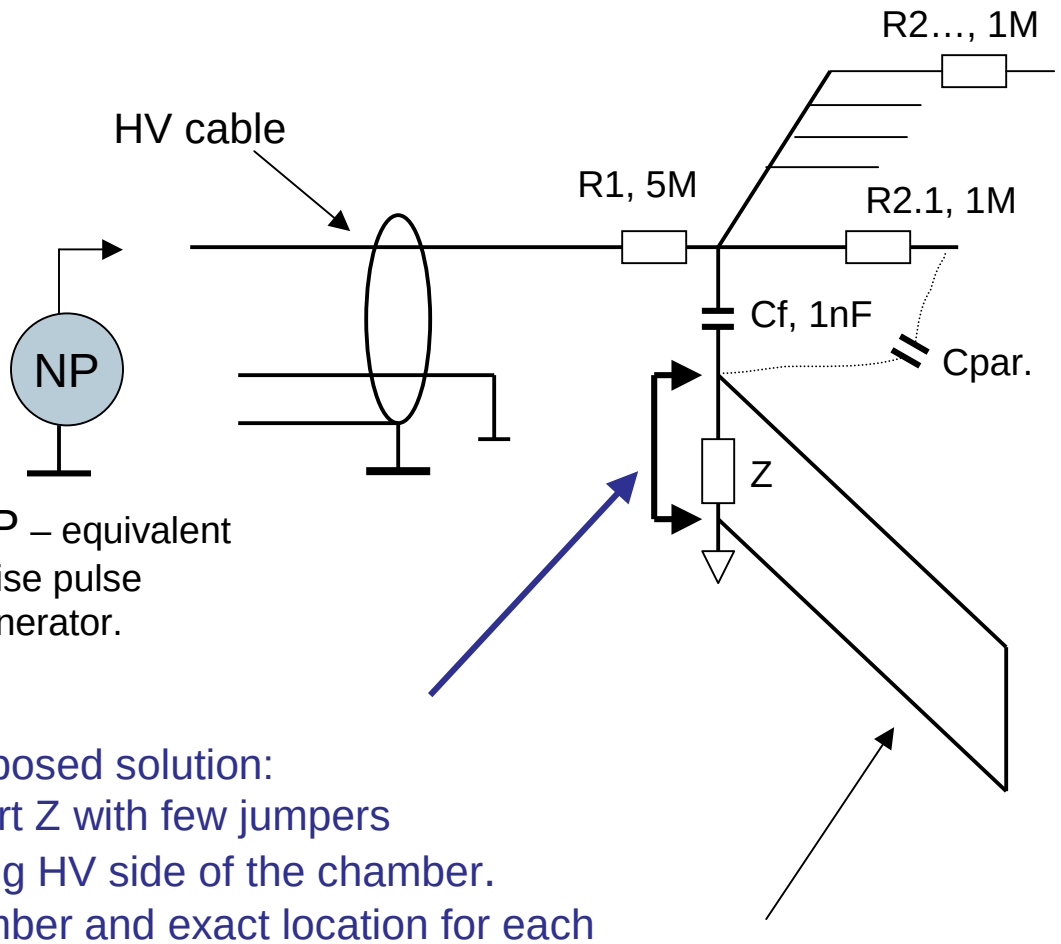
HV supply noise sources

- HV ripple noise - specified as 50 mV max.
- HV common mode noise - should be specified
- HV supply as a noise antenna - general environment dependable

Chamber HV connection



HV to anode wire noise path



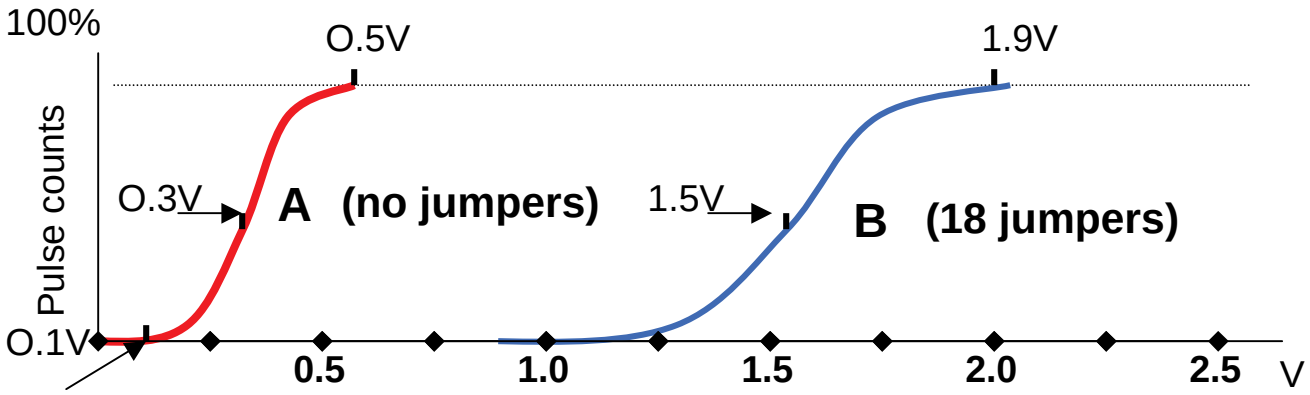
NP – equivalent noise pulse generator.

Proposed solution:
Short Z with few jumpers
along HV side of the chamber.
Number and exact location for each
jumper should be determined by test.

Shorted transmission line.
Z – input impedance
for the shorted line

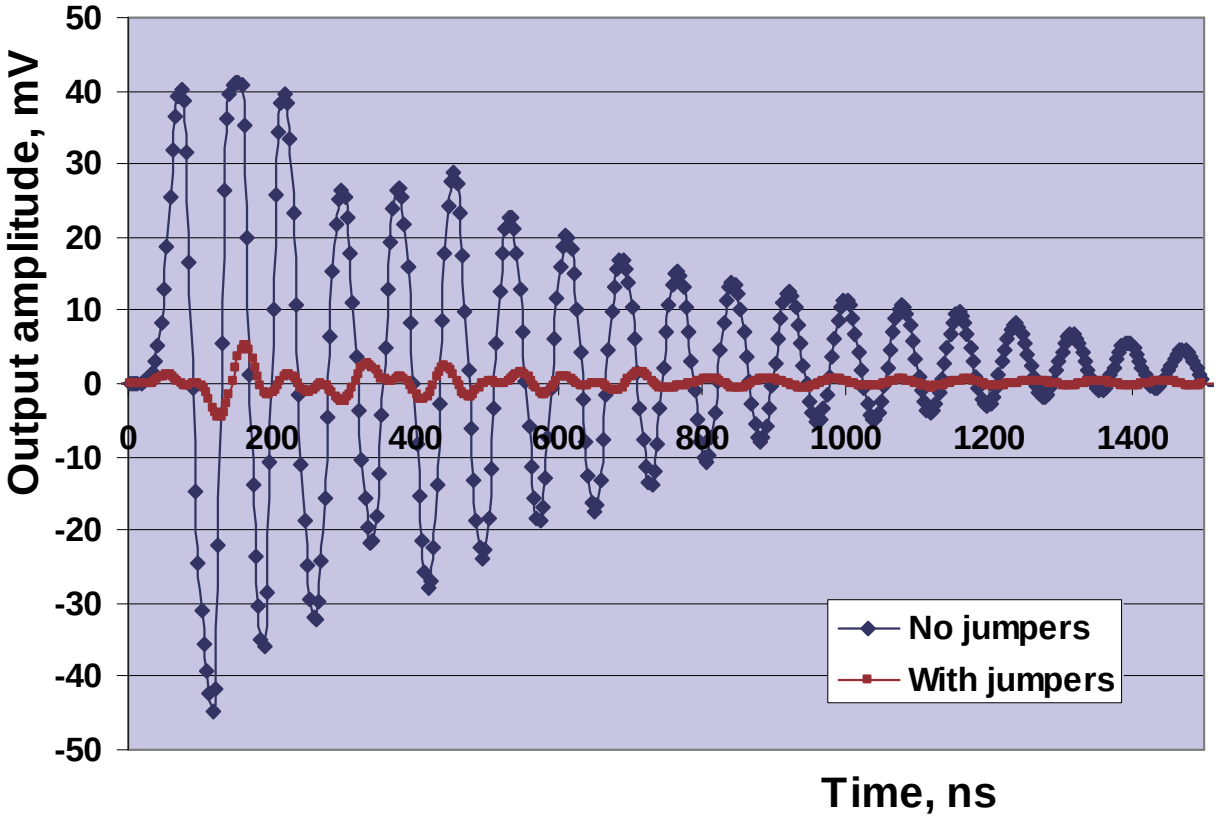
Jumper effect

1. ALCT trigger rate



ALCT trigger rate vs. noise pulse amplitude.

2. AFEB test channel

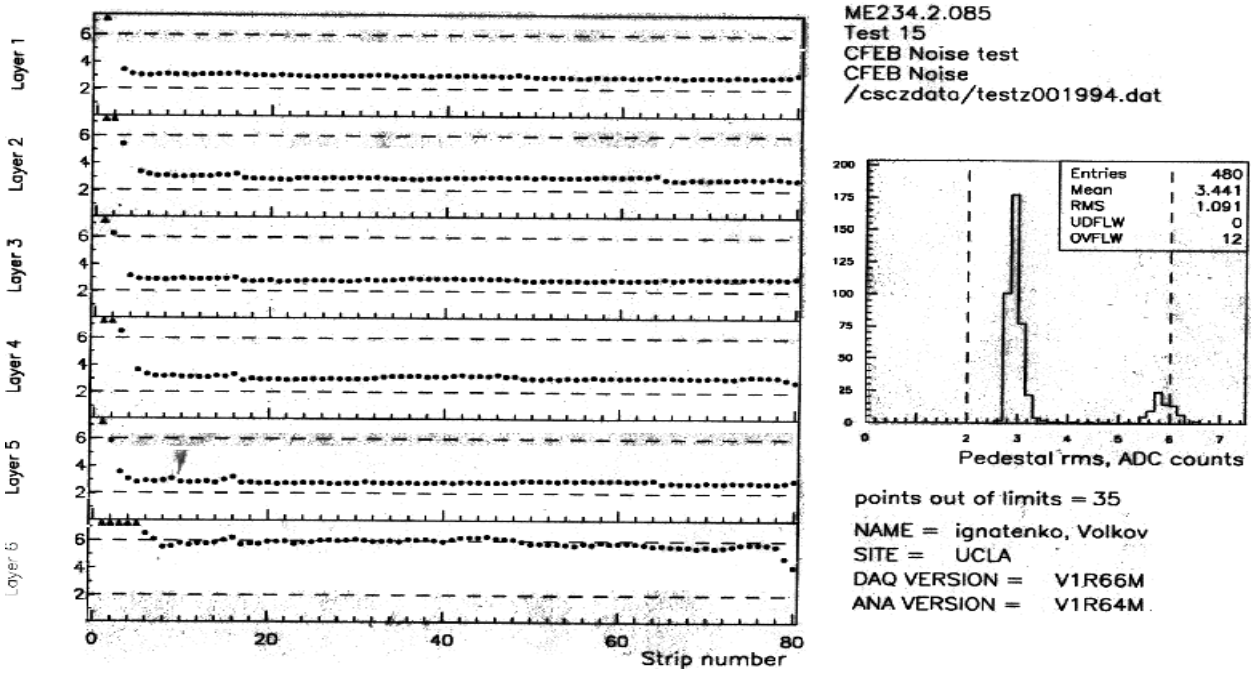


Placing ground jumpers on the ME23/2 chamber decreases the effect of HV parasitic pulses to the anode amplifiers by a factor of 4 (at least).

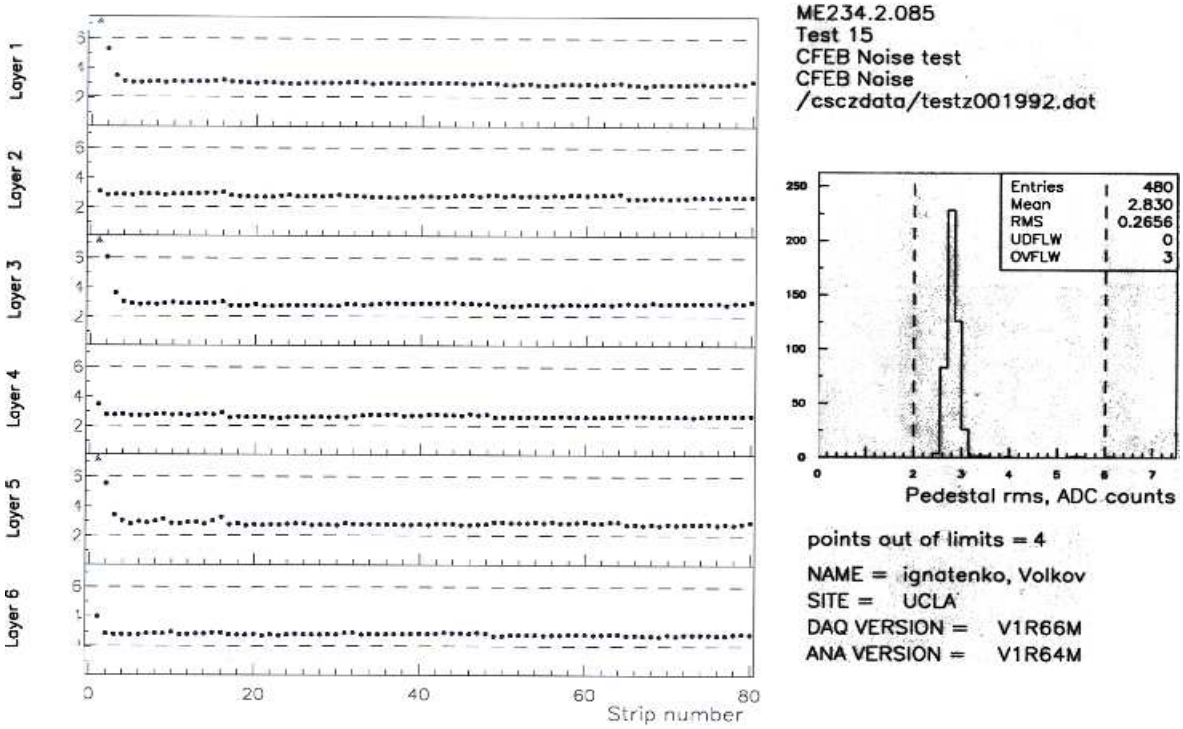
Jumper effect

FAST site Test 15. CFEB noise

Conditions: 2.5 V parasitic pulses applied at one HV segment

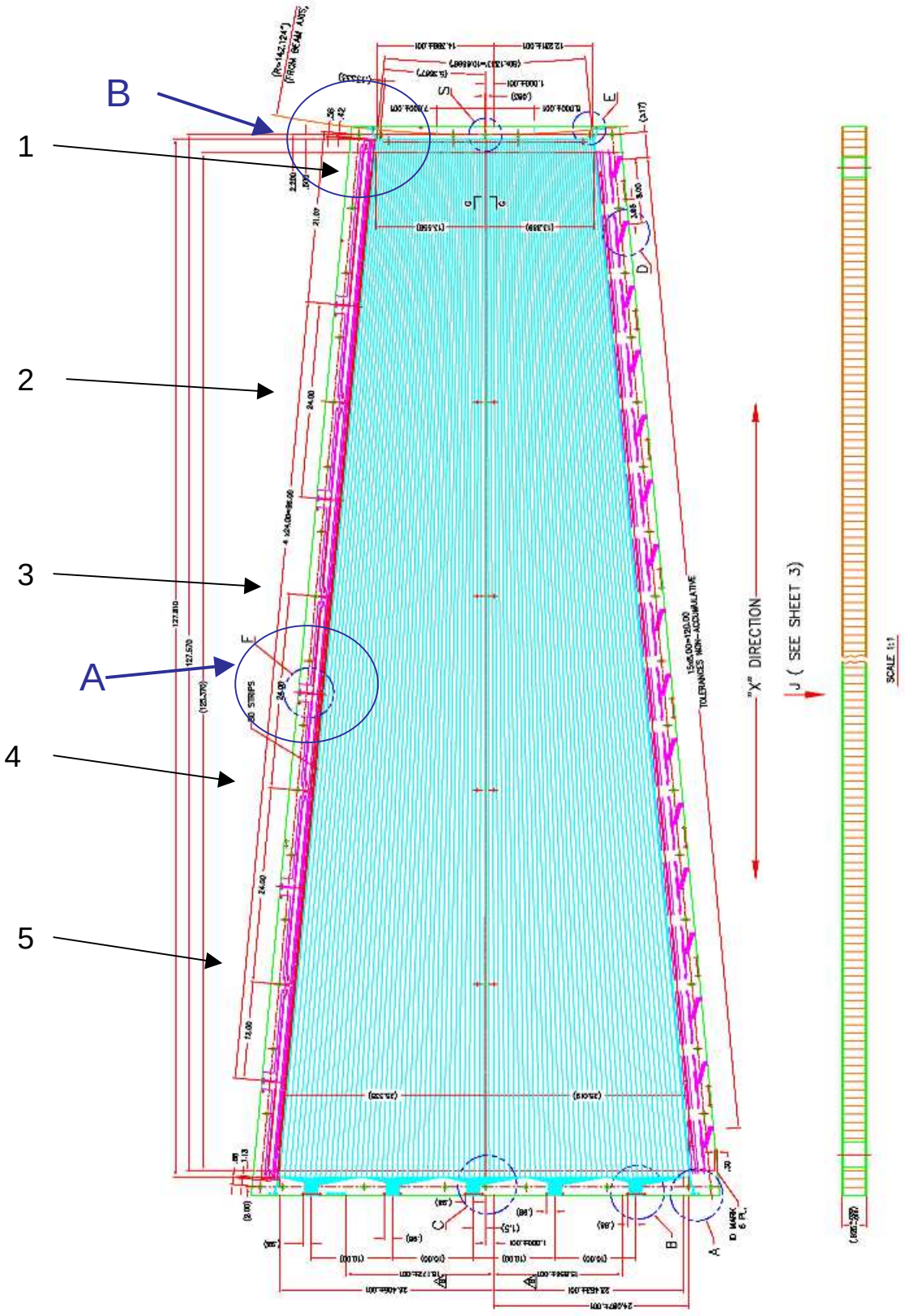


No jumpers installed. Strips 1 – 3 at all planes have an extra noise.
Plane 6 has a noise of 6 ADC counts.



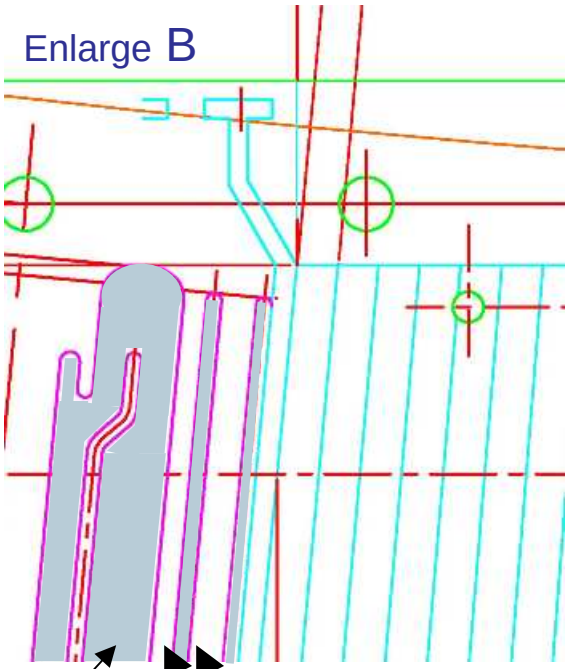
Nine jumpers installed at the planes 2, 4, 6.
Noise at that planes goes down to the normal level.

Anode panel



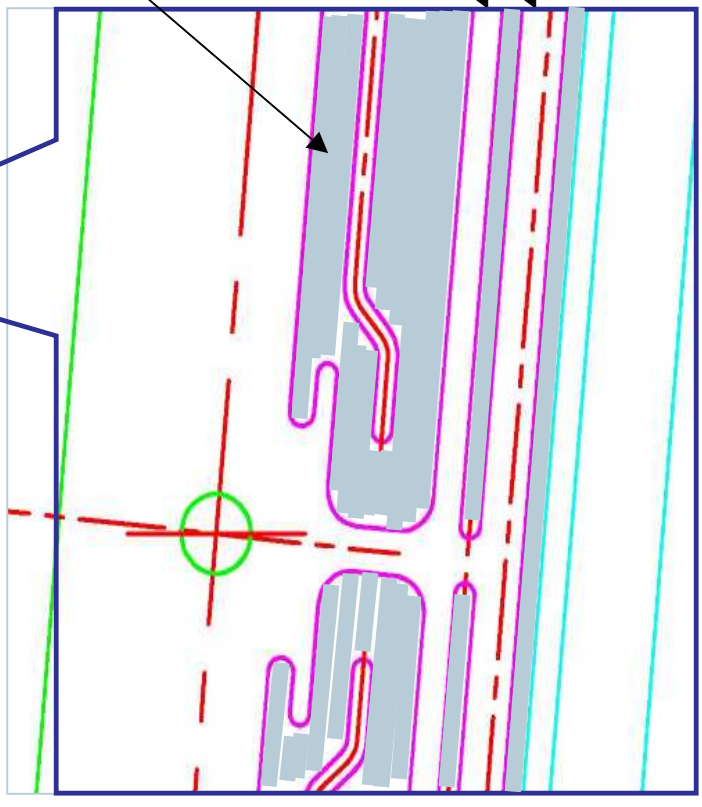
1, 2, 3, 4, 5 – proposed positions for the jumpers

Anode panel.
HV ground path critical places

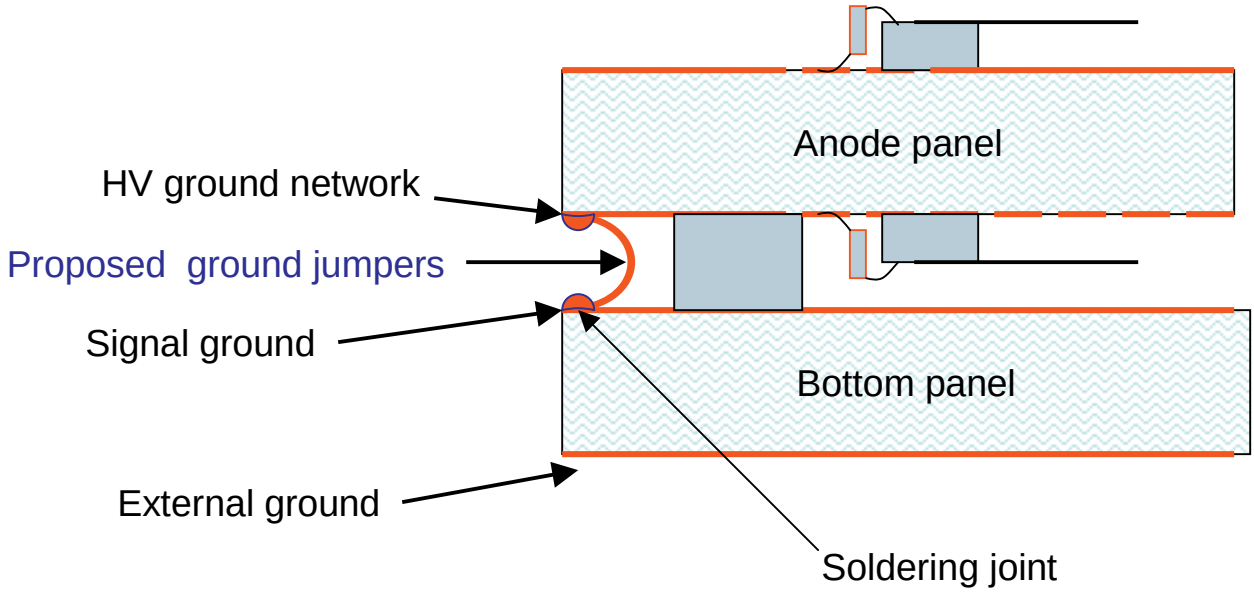


Ground wires run
along chamber
Width .18” and .37”

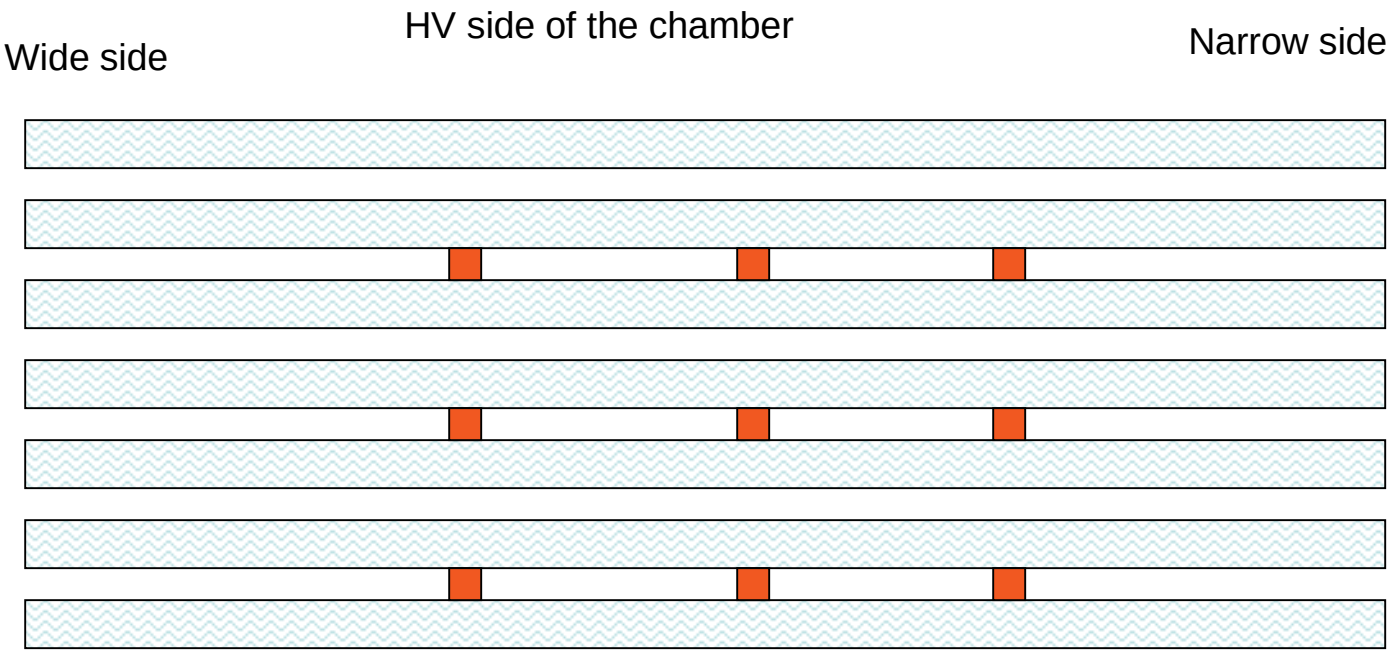
No copper area



Proposed solution for HV ground improvement

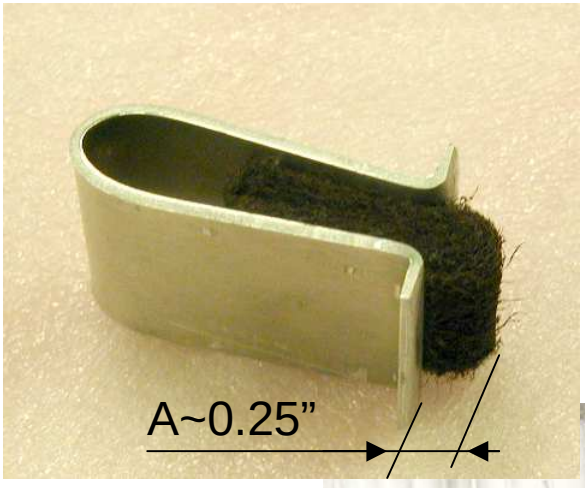


First approximation of the jumpers location



Picture is not to scale

Chamber preparation for jumper installation



The chamber gap cleaning clip

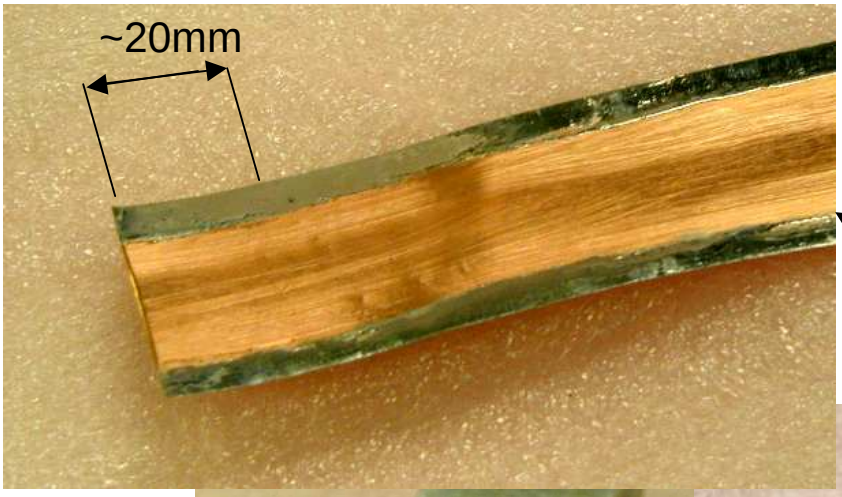
Abrasive sponge sticks out of the clip for ~0.25” to prevent any damage of the chamber sealing

Cleaning procedure

Tin the chamber panel edges before jumper installation

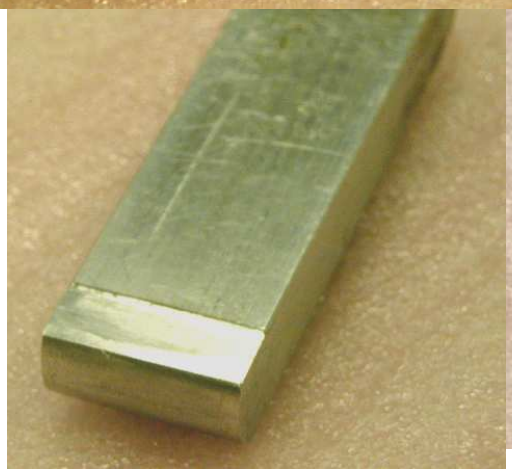
Jumper preparation

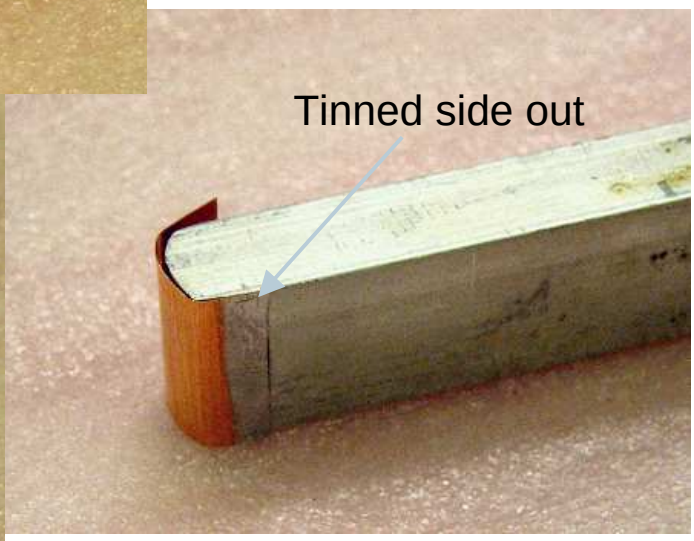
Copper foil band



Tinned edges

Jumper forming tool

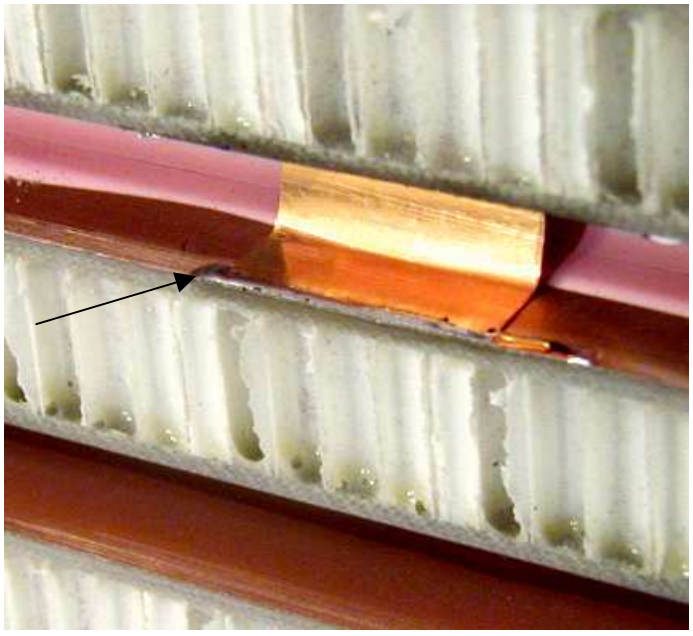




Jumper bending

Jumper in place

Solder connection



Conclusion

Proposed jumpers for HV line is a simple and reliable solution to minimize anode wire sensitivity to HV noise.

Placing ground jumpers on the ME23/2 chamber decreases the effect of HV parasitic pulses to the anode amplifiers by a factor of 4.

This solution will minimize effort and save time hunting for noise sources on the iron disk.