ME 234/2
HV noise investigation
• **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

There is an antenna and potential ground loop.

Few meters distance.
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

NP – equivalent noise pulse generator.
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.
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

Enlarge A

Enlarge B
Proposed solution for HV ground improvement

First approximation of the jumpers location

Wide side

HV side of the chamber

Narrow side

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

~20mm

Tinned side out

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.