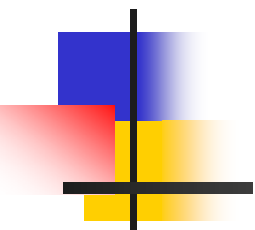


Low noise JFET preamplifier for HPGe detector



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Design Target



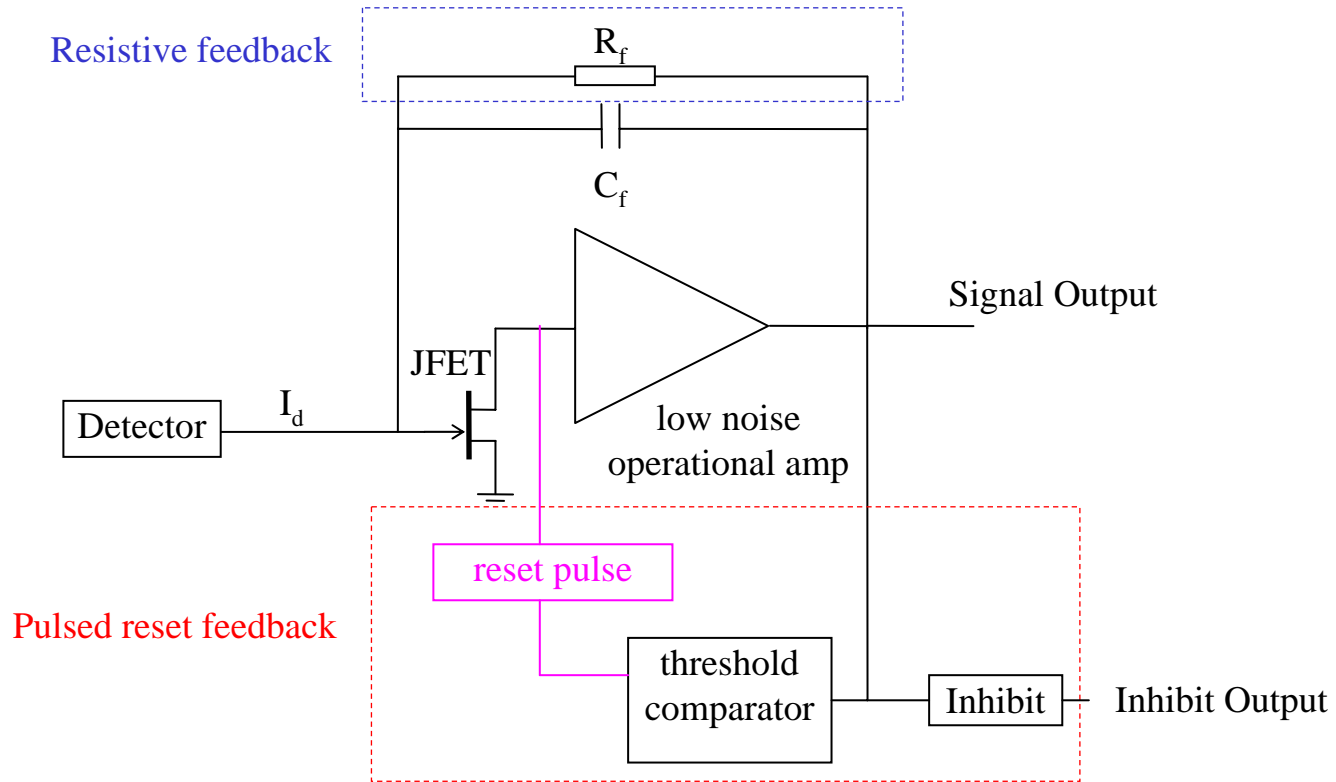
Requirement of Dark Matter Search

Low energy threshold

Energy threshold $< 300\text{eV}$

Preamplifier noise (ENC) $< 20\text{e}$

Schematic



First stage: Low noise JFET, minimize the noise
Second stage: Low noise OPA, simplify design

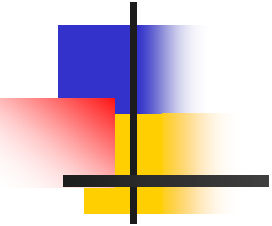
Feedback Method

Resistive feedback:

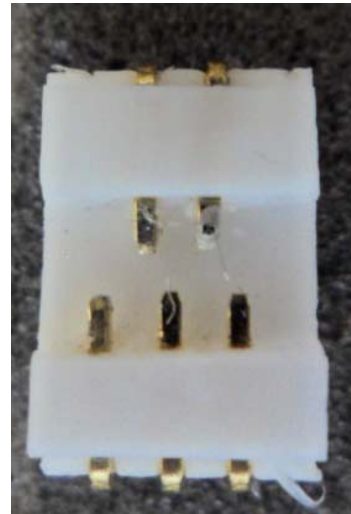
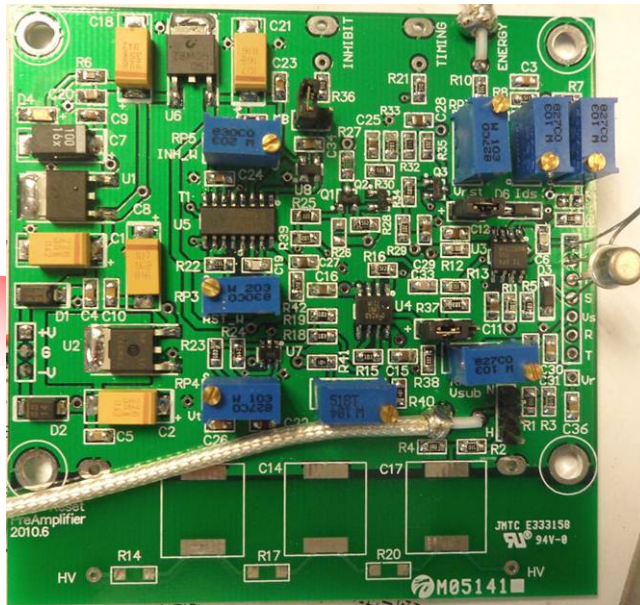
Simple, Reliable
Resistor noise

Pulsed reset feedback:

No resistor noise
Circuit complex



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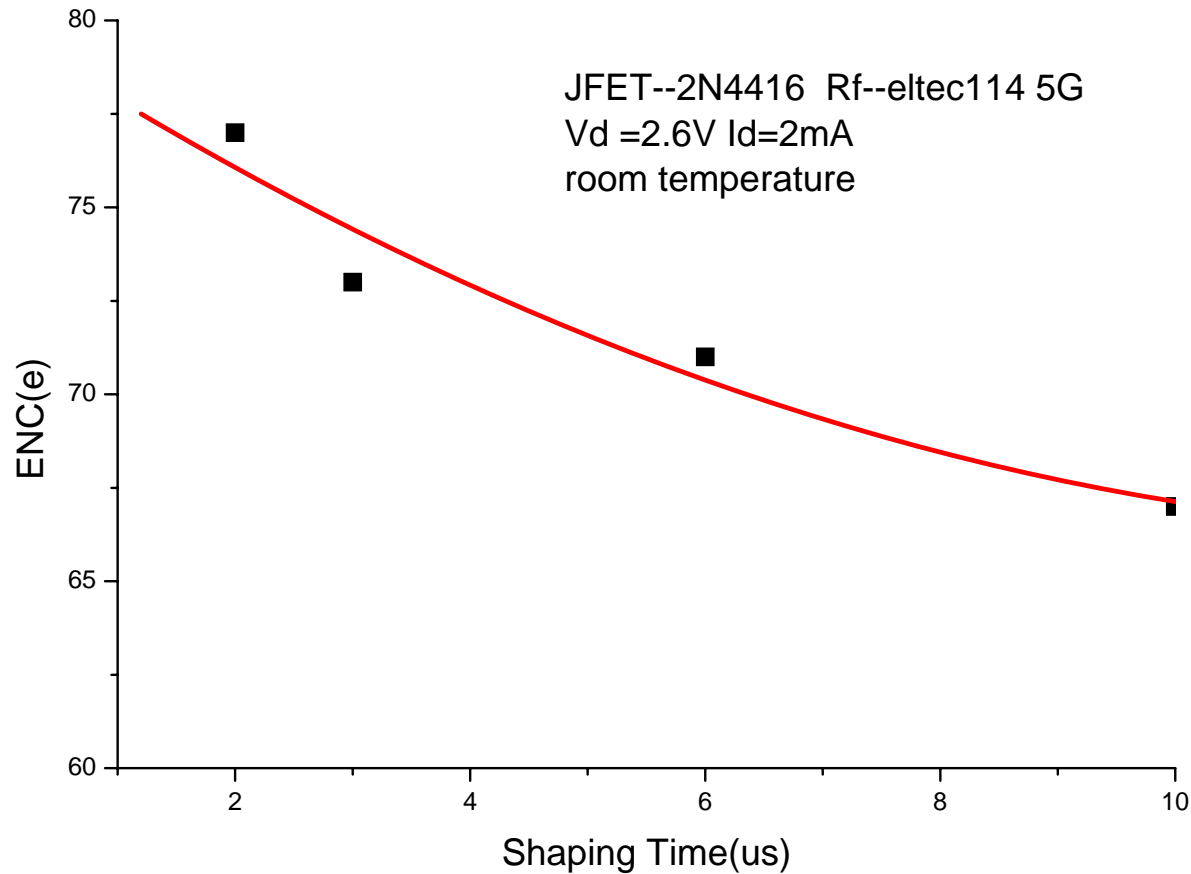
Preamplifier circuit
Resistive feedback, Pulsed reset

JFET Bonding on
PTFE substrate

JFET bonding on
silica substrate

Test setup

Resistive feedback

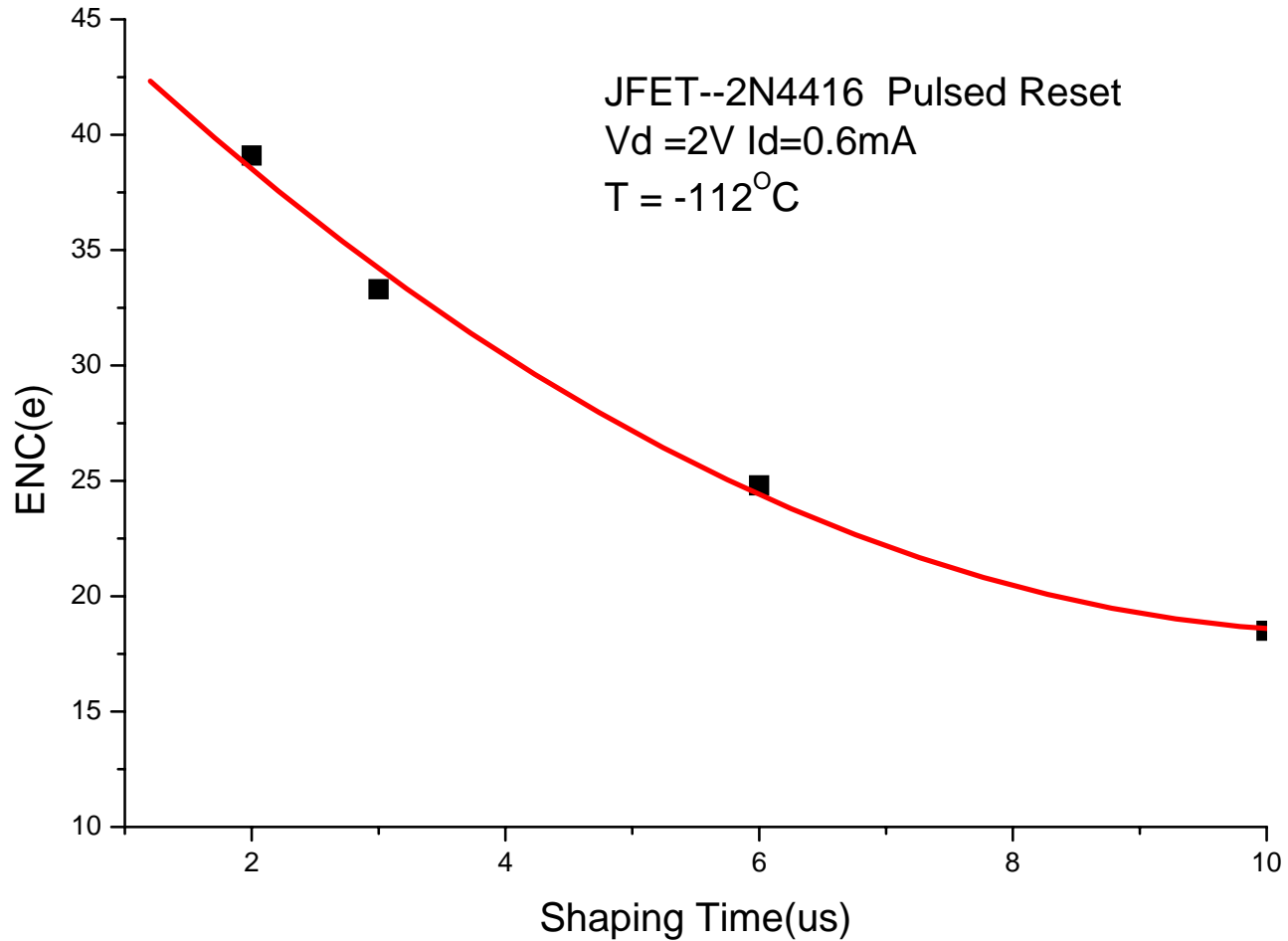


Feedback resistor is main noise resource.

Best noise level ENC = 44e.

Too hard to get ultra low noise resistor.

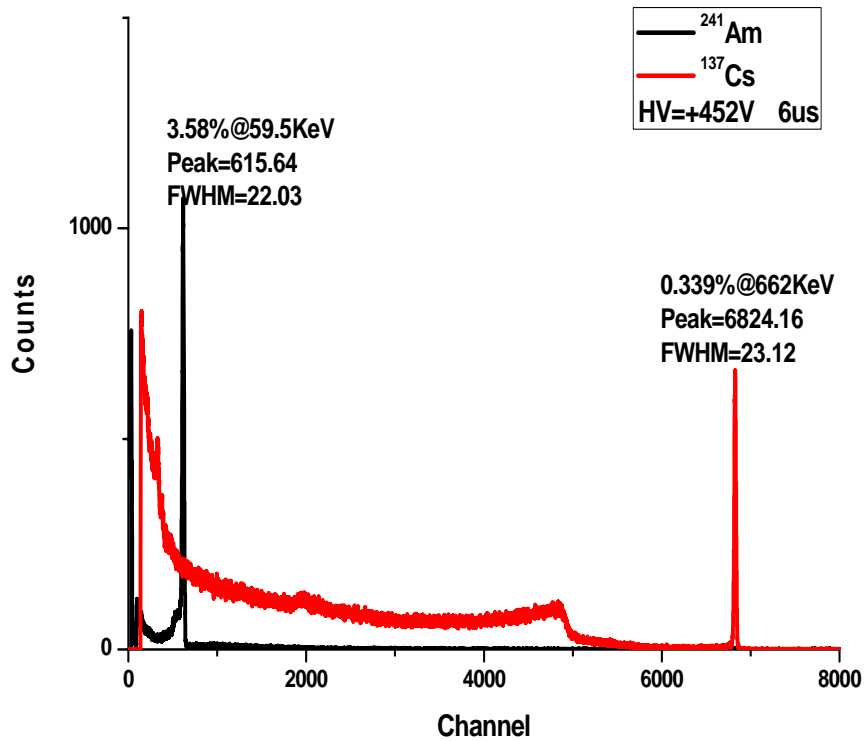
Pulsed reset



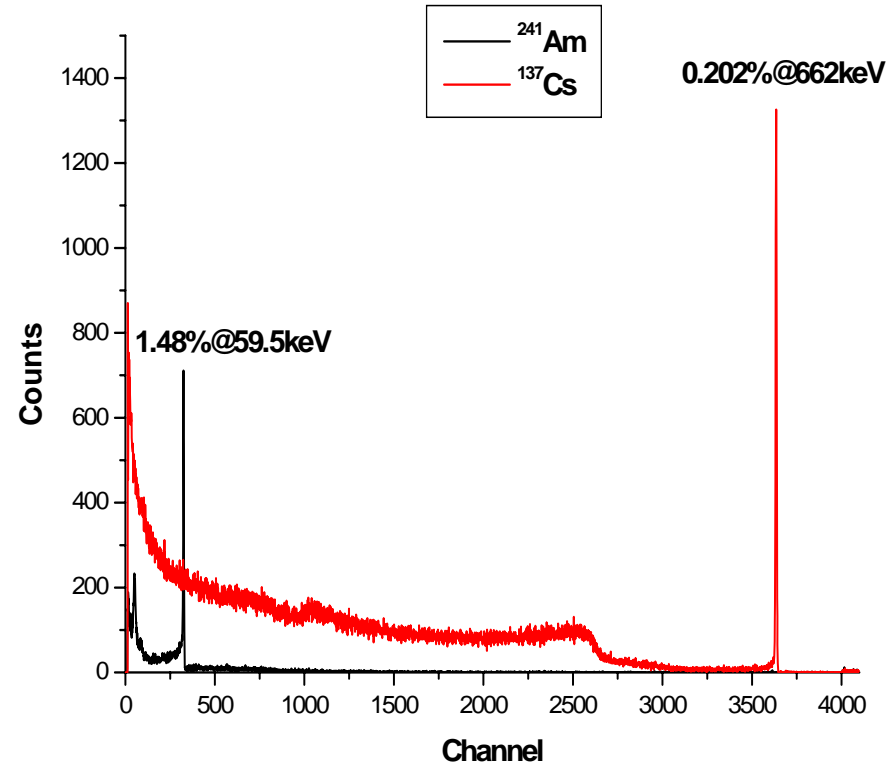
The performance of pulsed reset is much better than resistive feedback.

Best noise level: ENC = 14e.

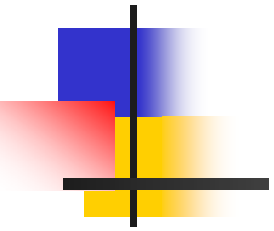
Spectrum



Detector: HPGe (plane electrode)
Resistive feedback



Detector: HPGe (point contact)
Resistive feedback



Thank you!