# Endcap Systemtest

- Current Grounding/Shielding status
- Recent Upgrades to sector
- Measurements with 6 Modules
  - Basic performance
  - First tries at noise injection
- Plans

Three Grounding Schemes

- All 3 schemes have:
  - continuous shielding VME crate to Cu sector enclosure,
  - (~) all power lines AC connected to shield at PPF1,
  - system of interconnected foil rings on disk face.
- Differences:
  - "Shunt Shields In"
    - Built-in shunt shields on module + isolation layer on cooling block
    - all modules' DGNDs connected to shield at PPF0
  - "Shunt Shields (~) Shorted"
    - Shunt shields still there but electrically bypassed
    - DGNDs not connected at PP0
  - "Doubleshort"
    - Shunt shields 'shorted'
    - DGNDs connected together at PPF0
- All 3 schemes perform equally well with no noise injected

Noise Injection Techniques

Sine wave injected via coil onto ferrite ring, then via 2nd coil onto cooling pipe
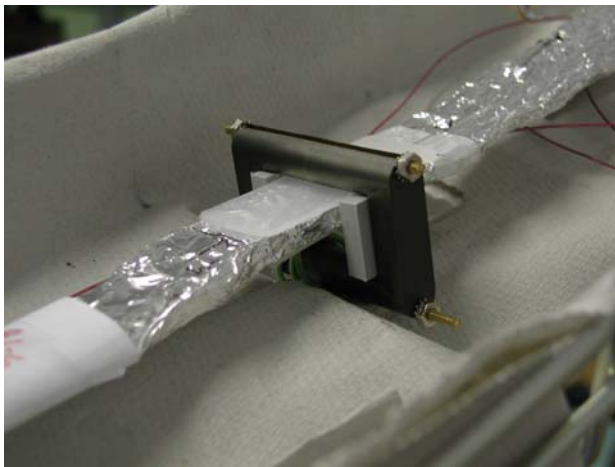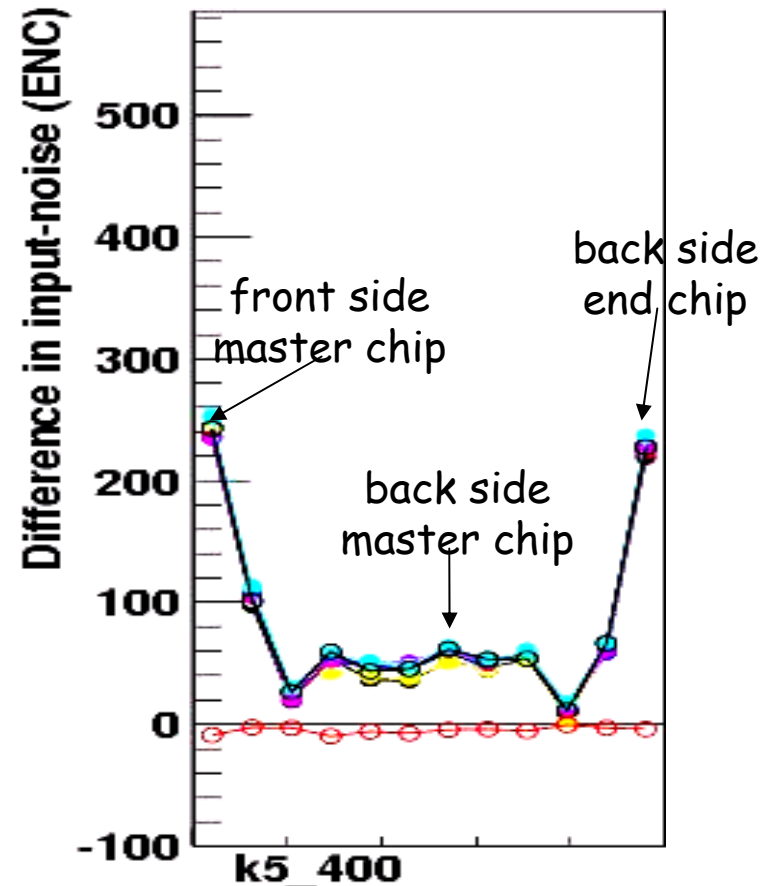

Sine wave injected via coil onto ferrite ring placed around power tapes
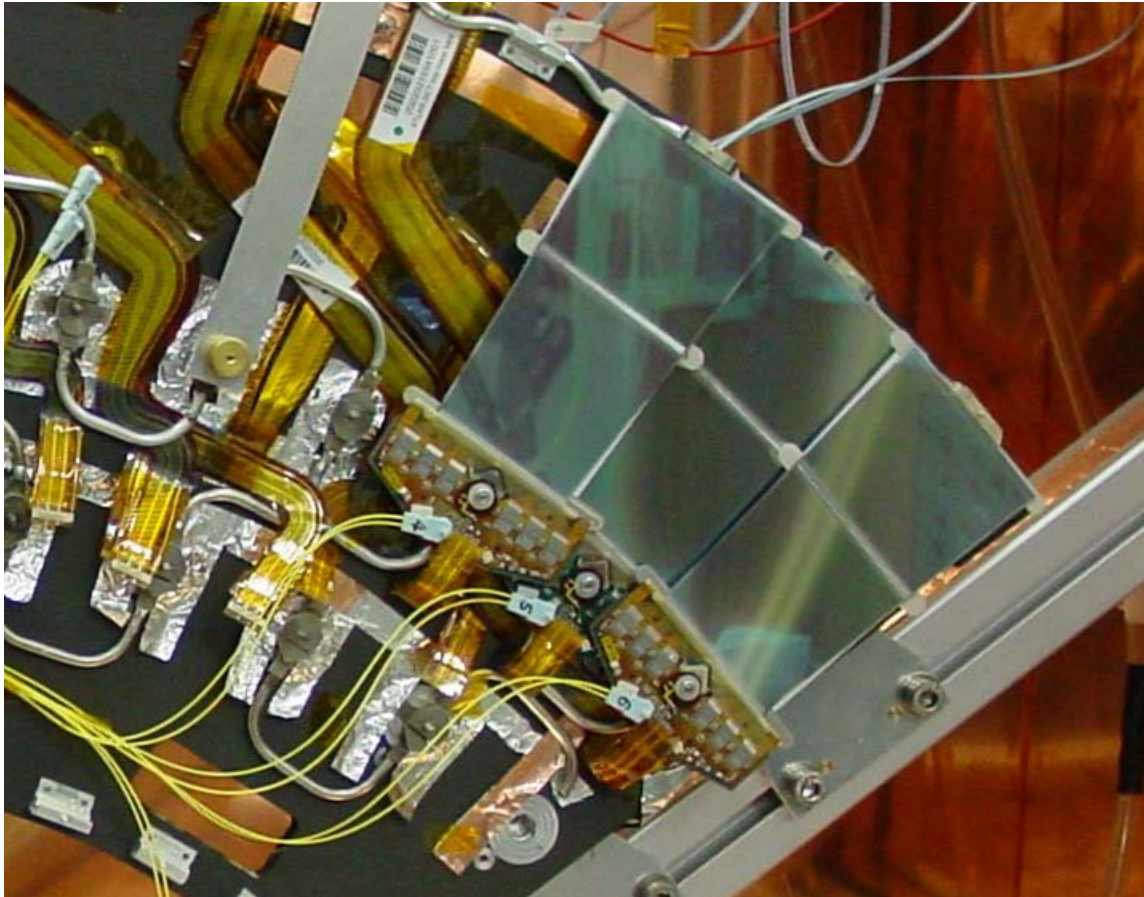
- over shielding
- between PP1/PP2, ~50cm from PP1

Measurement Technique

- Single threshold scans with 2 fC injected charge:
  - reference scan
  - scans under condition being studied

- Assume gain = 55

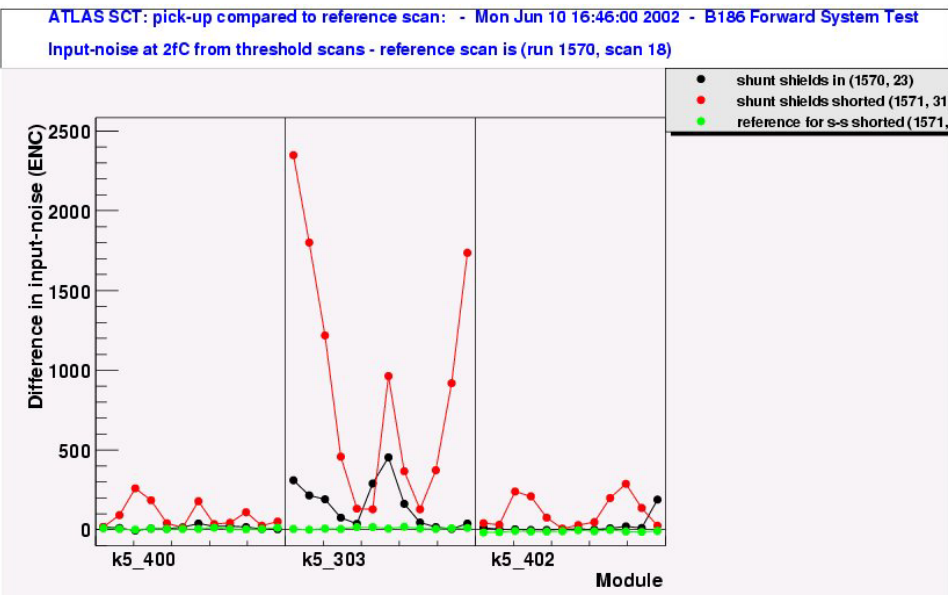- Plot noise difference with respect to the reference.
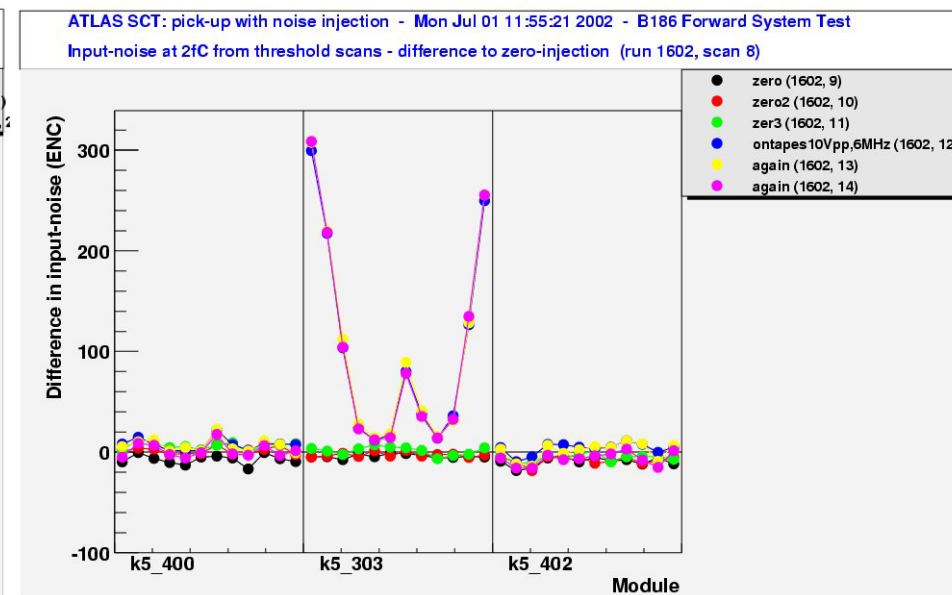
Measurements with 3 Modules

Injection onto Tapes

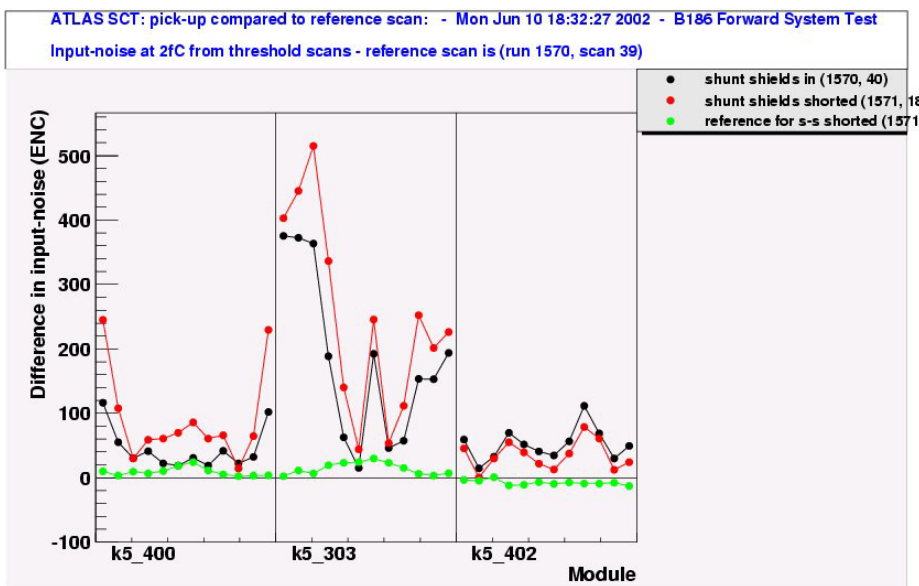"Shunt shields in" (black) vs.
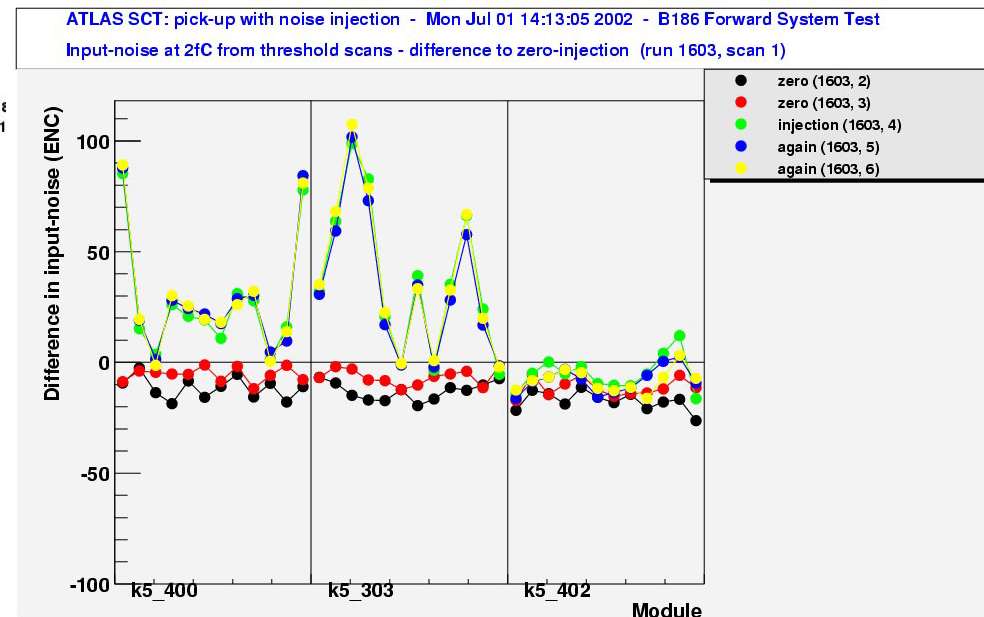"Shunt shields shorted" (red)

"DoubleShort" scheme

Injection onto Pipes

"Shunt shields in" (black) vs.
"Shunt shields shorted" (red)

"DoubleShort" scheme

Ground Scheme Comparison with 3 outer modules: Summary

- A hybrid G&S scheme seemed work to best against injected noise:
  - Short around shunt shields i.e. DC-connect all GNDs together at cooling circuit
  - Also connect all DGNDs together at PPF0
 - NB this is based on one measurement; needs verification.

Upgrades to System

- July:
  - upgraded to simultaneously read out multiple module types:
    - 2nd power harness and more LV/HV supplies
    - 2nd and 3rd opto-harnesses, Mustards, OPTIfs
  - Shielding improvements:
    - Added missing filtering caps at PPF1 (V_{dd}-shield, V_{cc}-shield)
    - Improved screening of 50μ tapes
    - Added Cu sheet PPF1-thermal enclosure; used to improve interconnection of cable shielding

Upgrades to System, cont'd

- August-September: tried to get newly equipped positions working:
    - Very difficult, mostly due to
        - Connectorised Aluminium tapes
            - Traces break where soldered to connector pins
            - Somewhat better if potted with glue-BN mix
            - Perhaps a bit unfair as tapes should be thermode-soldered to panels
        - Old-style patch panels (PC Board - Molex connector "sandwich")
            - Molex connectors and/or their connection to board unreliable
        - NB new wiggly tapes (Cu traces + wires) and PPFOs (no Molex, thermode-soldered to straight Al tapes) have been designed, prototypes (1/8 disk) being made, will be installed as soon as practically possible. Also have new PPF1s but these require Type II cables in place of Cu tapes.
    - Eventually got 6 positions working
        - 2 outer (O12, O13), 1 middle (M10), 3 inner (I5, I7, I9)

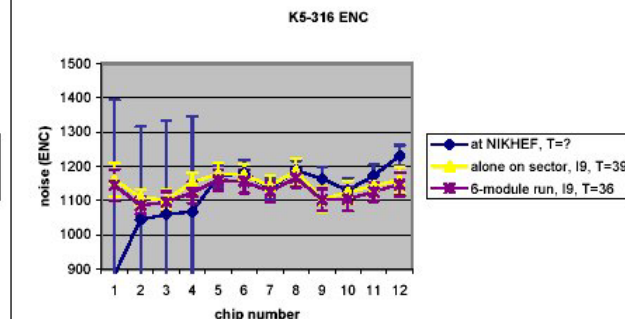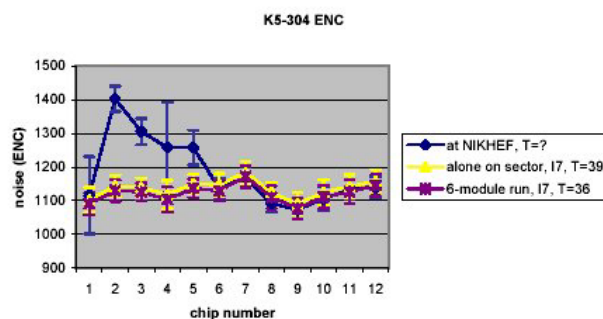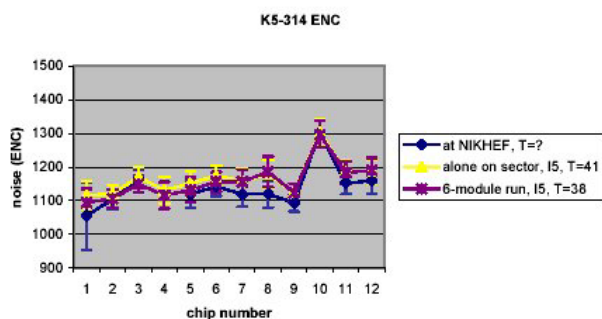# 6 Modules on Sector
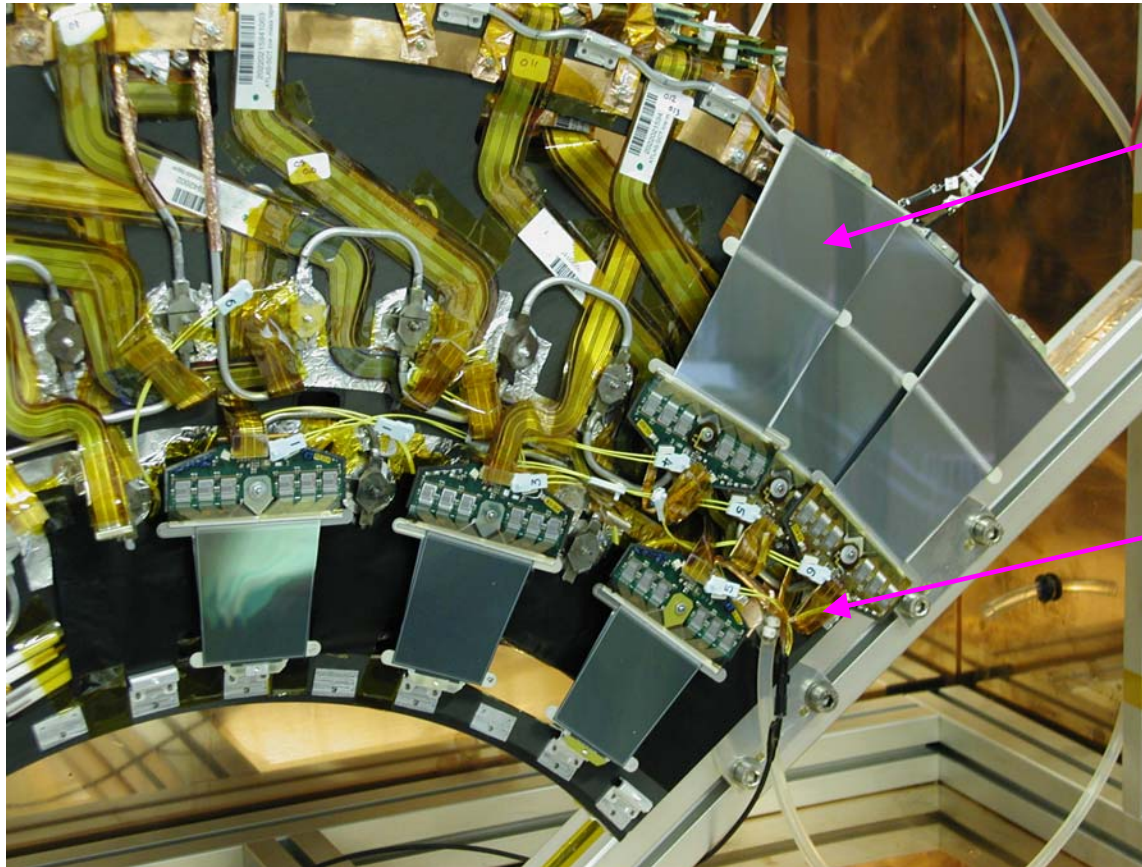
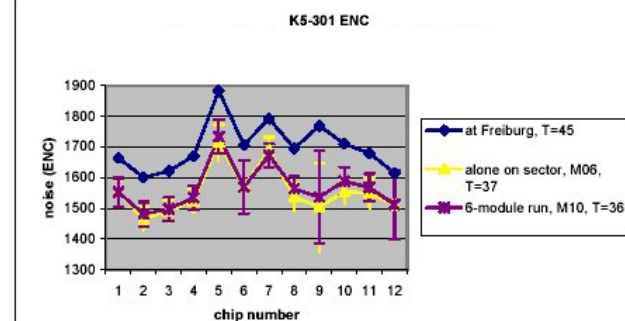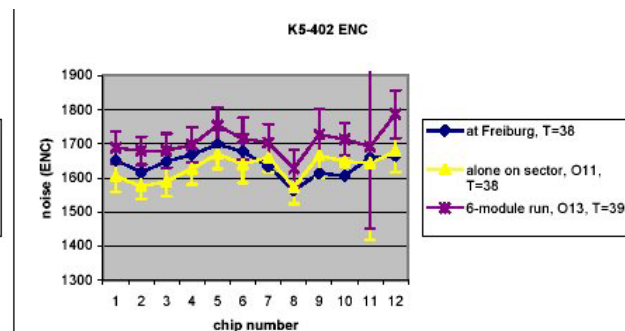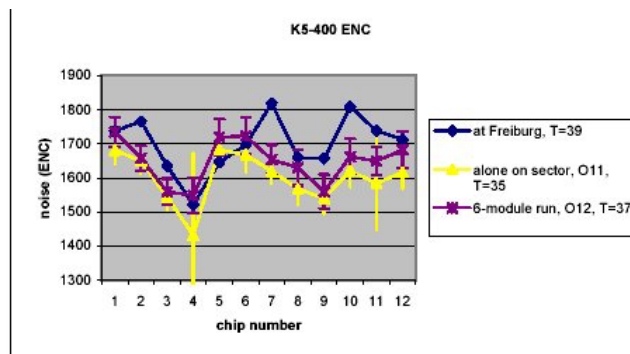
Position O11
not working

Back of disk:
one module
in position M10

6-Module Run, no noise injection

Blue = in test box at institute
Yellow = alone on sector
Purple = 6-module run

6 Modules,
noise injection onto cooling pipes

- 3 cooling circuits connected in series with signal generator
- Inject similar signal as in earlier 3-outer-module case:
  - No pickup seen on inner modules
  - Very little pickup on middle module
  - Pickup on outer modules
    - Same shape as in 3-module run,
    - But much larger in magnitude - ?

See next slide

- NB electrical connection of cooling pipes to outside world is not well simulated in systemtest
  - Injection is directly onto pipes on sector
  - In atlas there will be insulators at entrance to thermal enclosures – not simulated in system test
  - Room for improvement in testing method…

6 modules,
noise injection onto cooling pipes

ATLAS SCT: pick-up with noise injection - Thu Sep 26 11:11:36 2002 - B186 Forward System Test

input-noise at 2fC from threshold scans - difference to zero-injection (run 1825, scan 1)
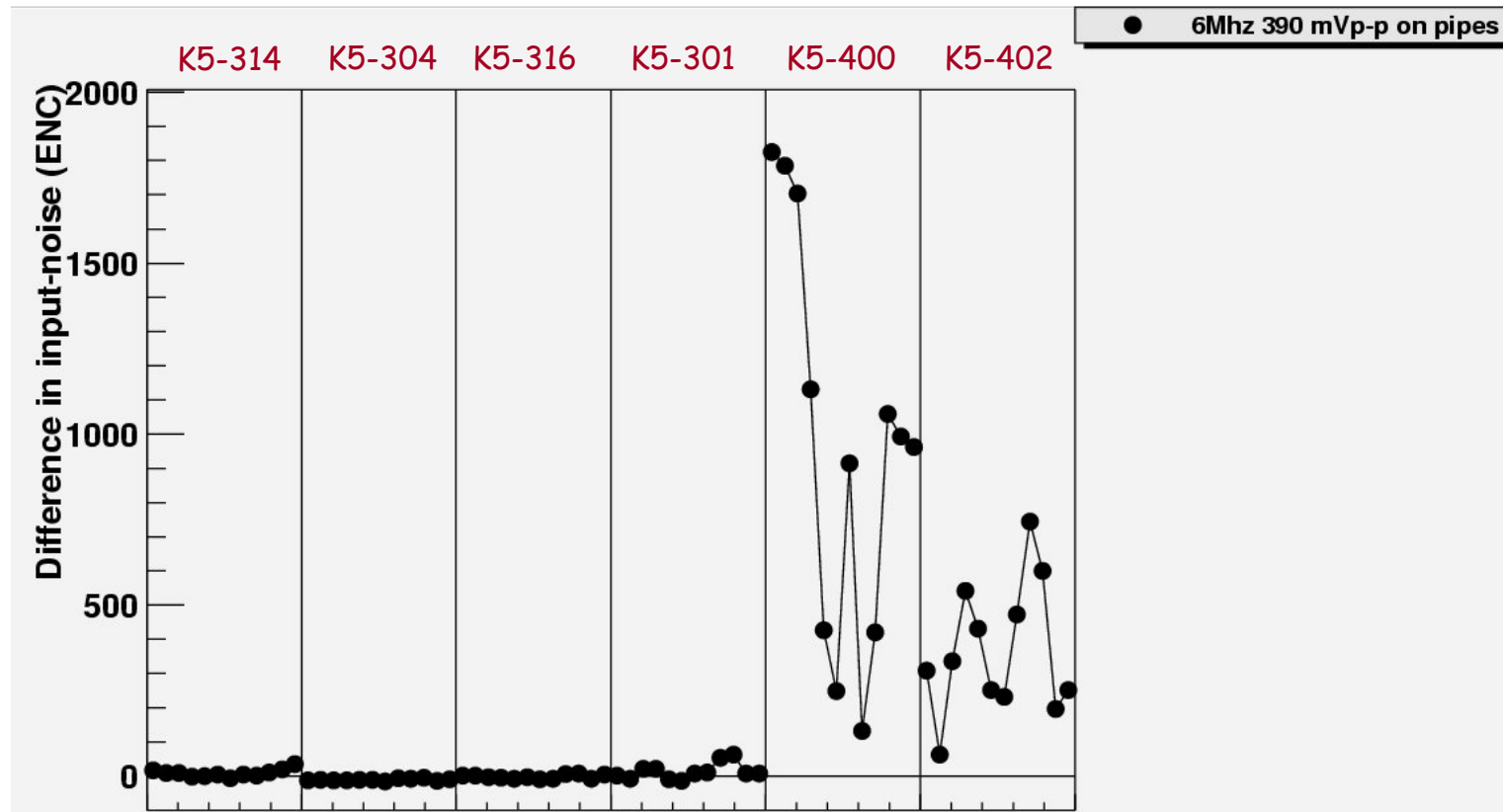
6 Modules,
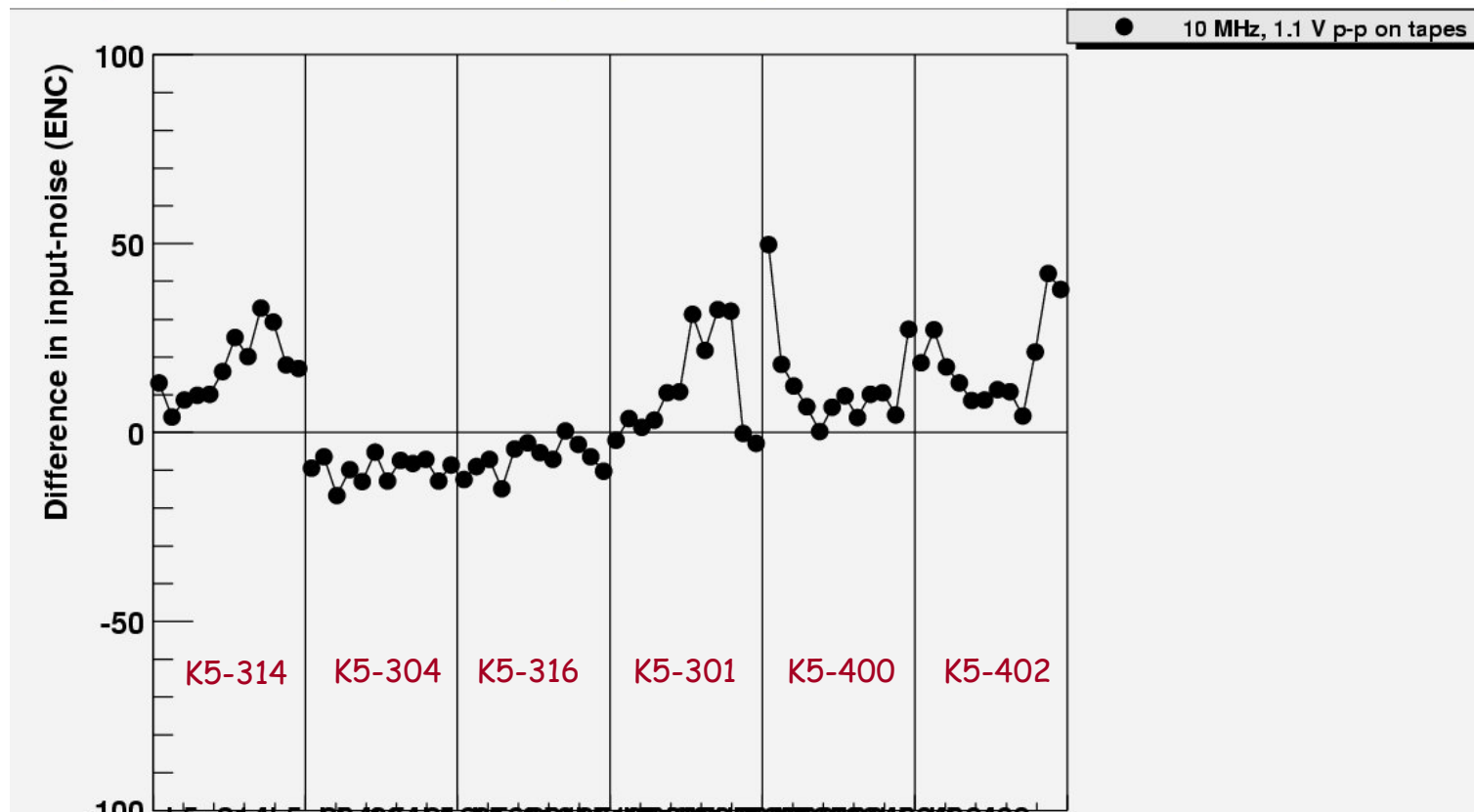# noise injection onto power tapes

- Ferrite ring around all 12 thick power tapes, near PPF1
- Inject similar signal as in earlier 3-outer-module case:
  - No pickup seen (!)
- Inject MORE ($\rightarrow$ limit of signal generator @ 10 MHz)
  - Very little pickup seen (see next slide)

- Recall some changes made to shielding since 3-module running:
  - 2nd power harness added
  - Missing filtering caps added at PPF1
  - Shielding improved in PPF1-Thermal Enclosure region

Currently working to understand what made the difference.

6 Modules, noise injection onto power tapes

Near-Future Plans

- Repeat injection with all 3 G&S schemes
  - To verify previous observations
  - To see what happens with middles and inners
- If "doubleshort" scheme still best:
  - Then no need for full shunt shield (will remove shunt shields from modules to verify), but…
  - …need to decide what to do at cooling block:
    - Electrically predictable and stable isolation layer between module and block ? (thermal grease not consistent).
    - Module connection to cooling block:
      - Via pin?
      - Around hybrid? How?

Further Future

- Test other outer positions, possibly varying distance silicon-to-power tape

  - Is pickup ~simply function of proximity to tape?

- Make cooling pipes' exit from thermal enclosure more realistic (isolated)

- Simulate disk 1's proximity to thermal enclosure with a metal plate

  - inject noise onto this plate