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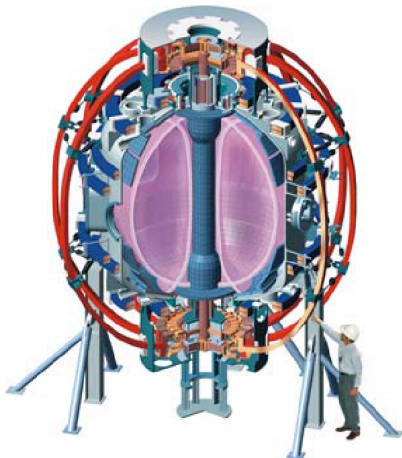


NSTX

An NSTX Neutron Conundrum - Circa 2004

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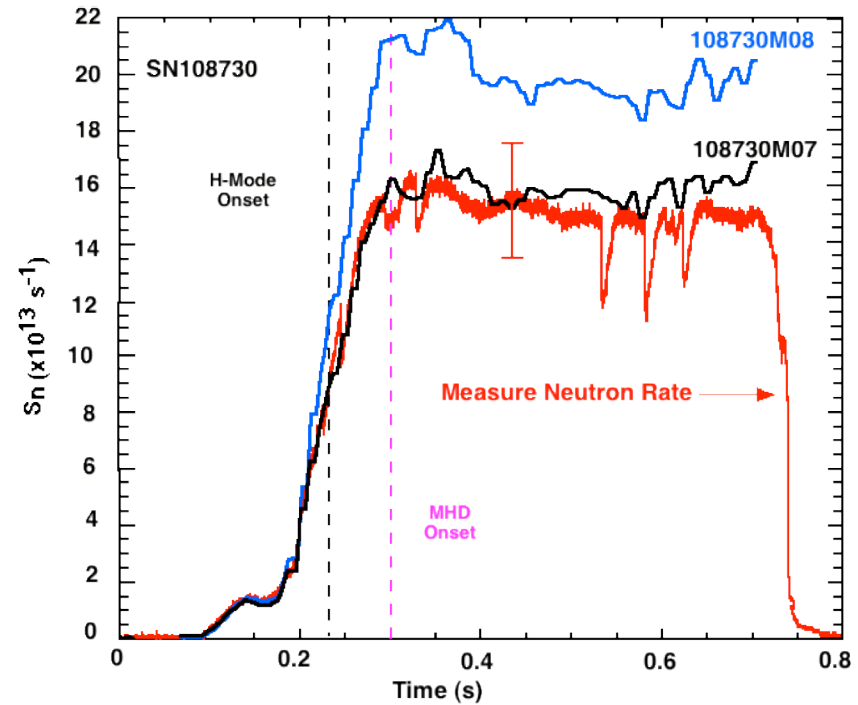
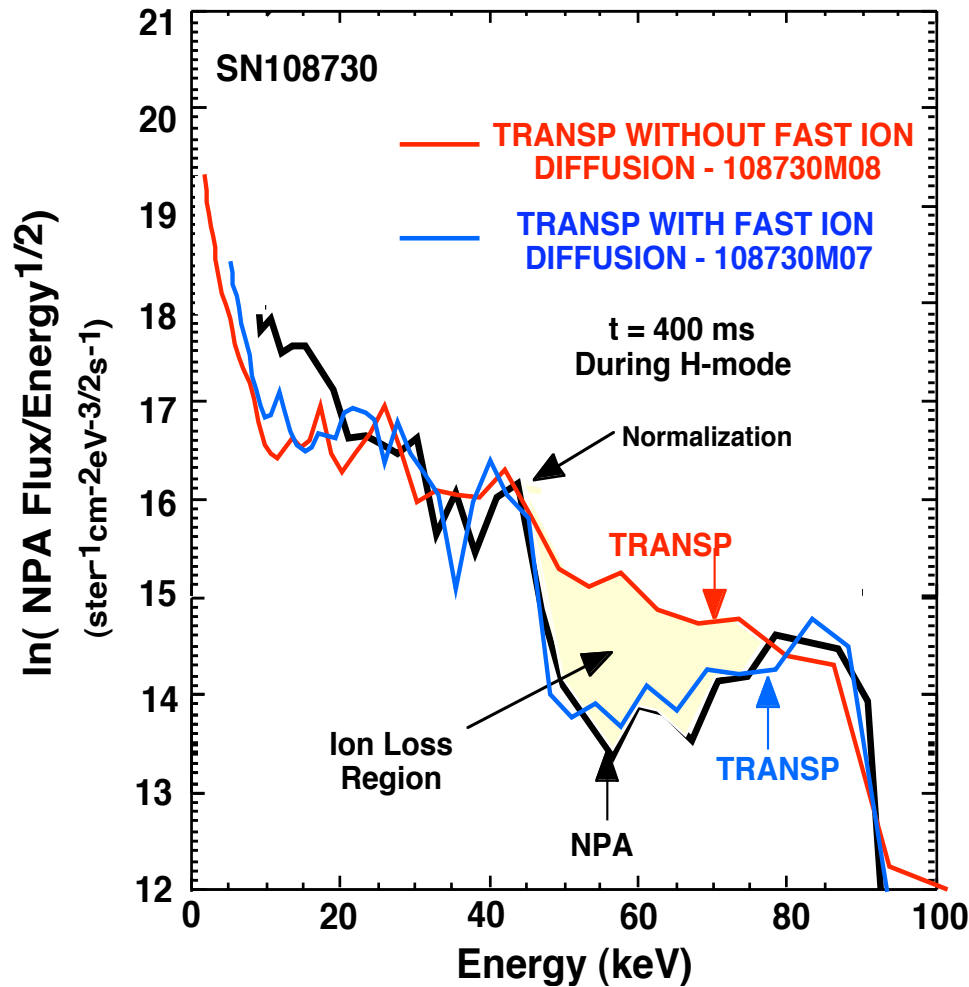


**NSTX Physics Meeting
December 20, 2004**

Columbia U
Comp-X
General Atomics
INEL
Johns Hopkins U
LANL
LLNL
Lodestar
MIT
Nova Photonics
NYU
ORNL
PPPL
PSI
SNL
UC Davis
UC Irvine
UCLA
UCSD
U Maryland
U New Mexico
U Rochester
U Washington
U Wisconsin
Culham Sci Ctr
Hiroshima U
HIST
Kyushu Tokai U
Niigata U
Tsukuba U
U Tokyo
JAERI
Ioffe Inst
TRINITY
KBSI
KAIST
ENEA, Frascati
CEA, Cadarache
IPP, Jülich
IPP, Garching
U Quebec

- **Plastic scintillation detector (2FG):**
 - control room standard
 - fast time response
 - does not saturate
 - calibration shifts have occurred
- **Fission chamber detector (FC):**
 - slower time response
 - does not saturate
 - most stable calibration

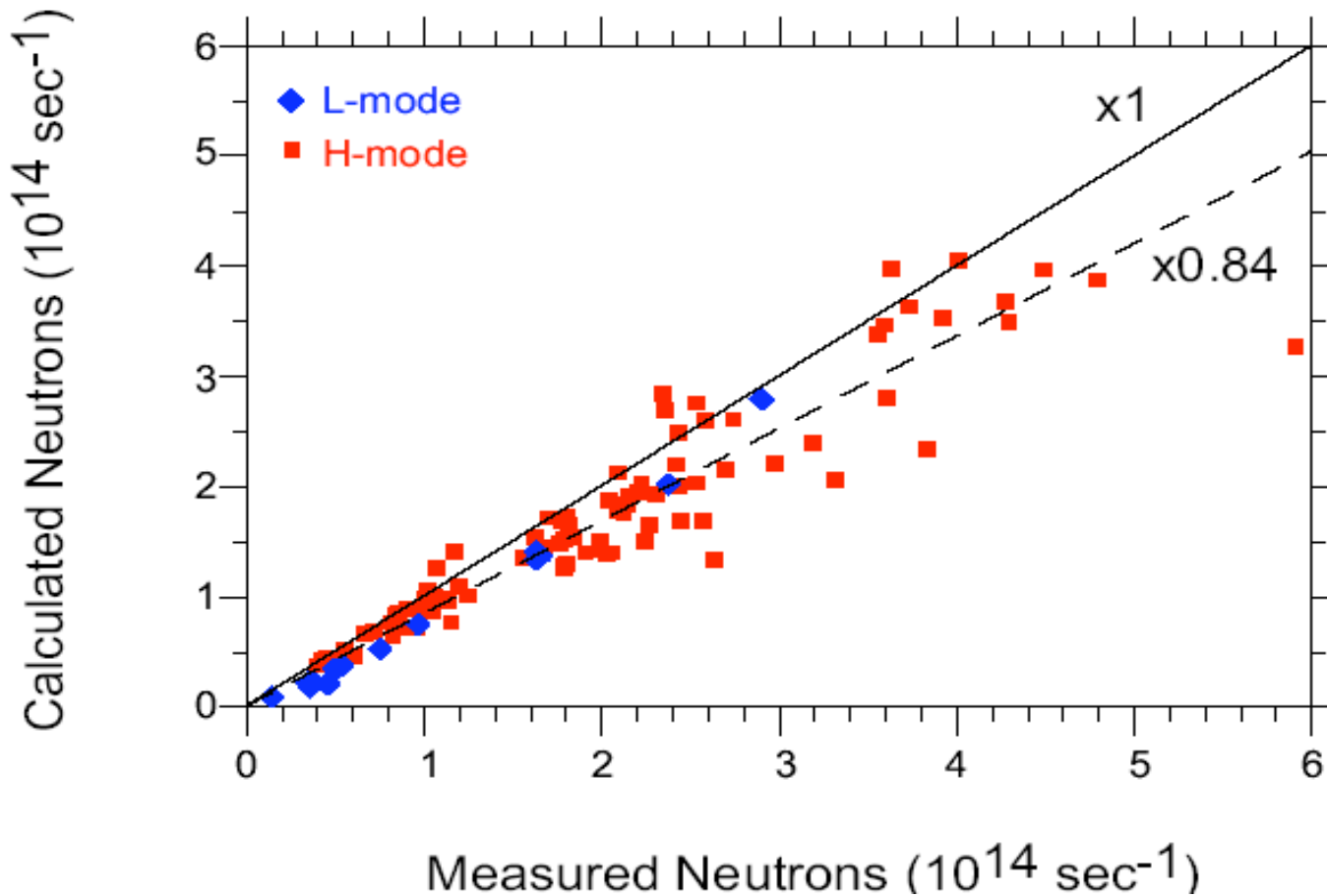
Energetic Ion Loss Scenario - Circa 2002



- Neutron rate calculation by TRANSP exceeds 2FG neutron measurement.
- MHD-induced energetic ion loss seen on NPA spectra modeled using anomalous fast ion diffusion to match rates.

S. S. Medley, *et al.*, Nucl. Fusion 44 (2004) 1158

Measured vs Calculated Neutrons - Circa 2004

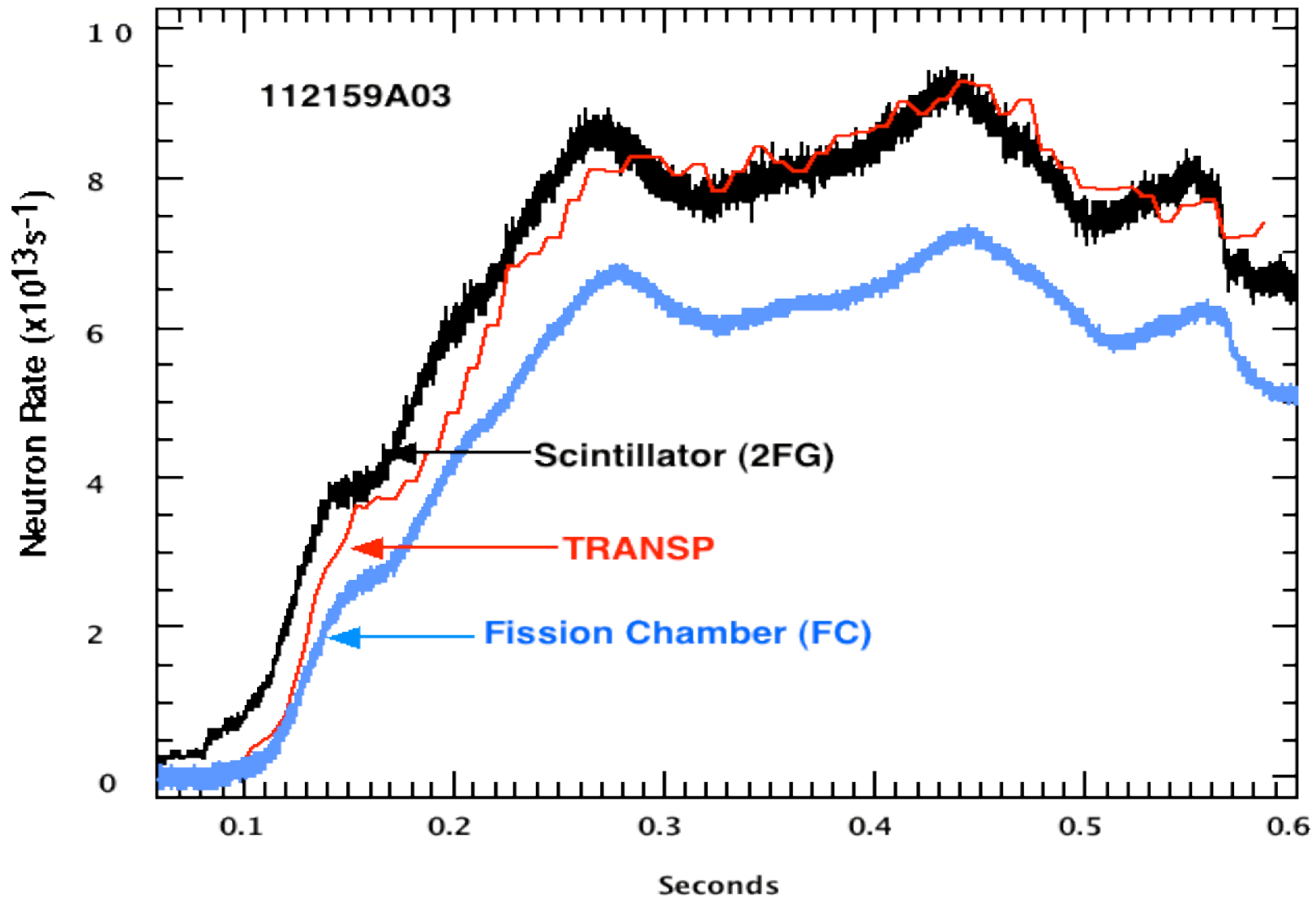


• Neutron rate calculation by TRANSP is less than the 2FG neutron measurement:
 i.e. no headroom for energetic ion loss scenario.

S. M. Kaye, APS 2004

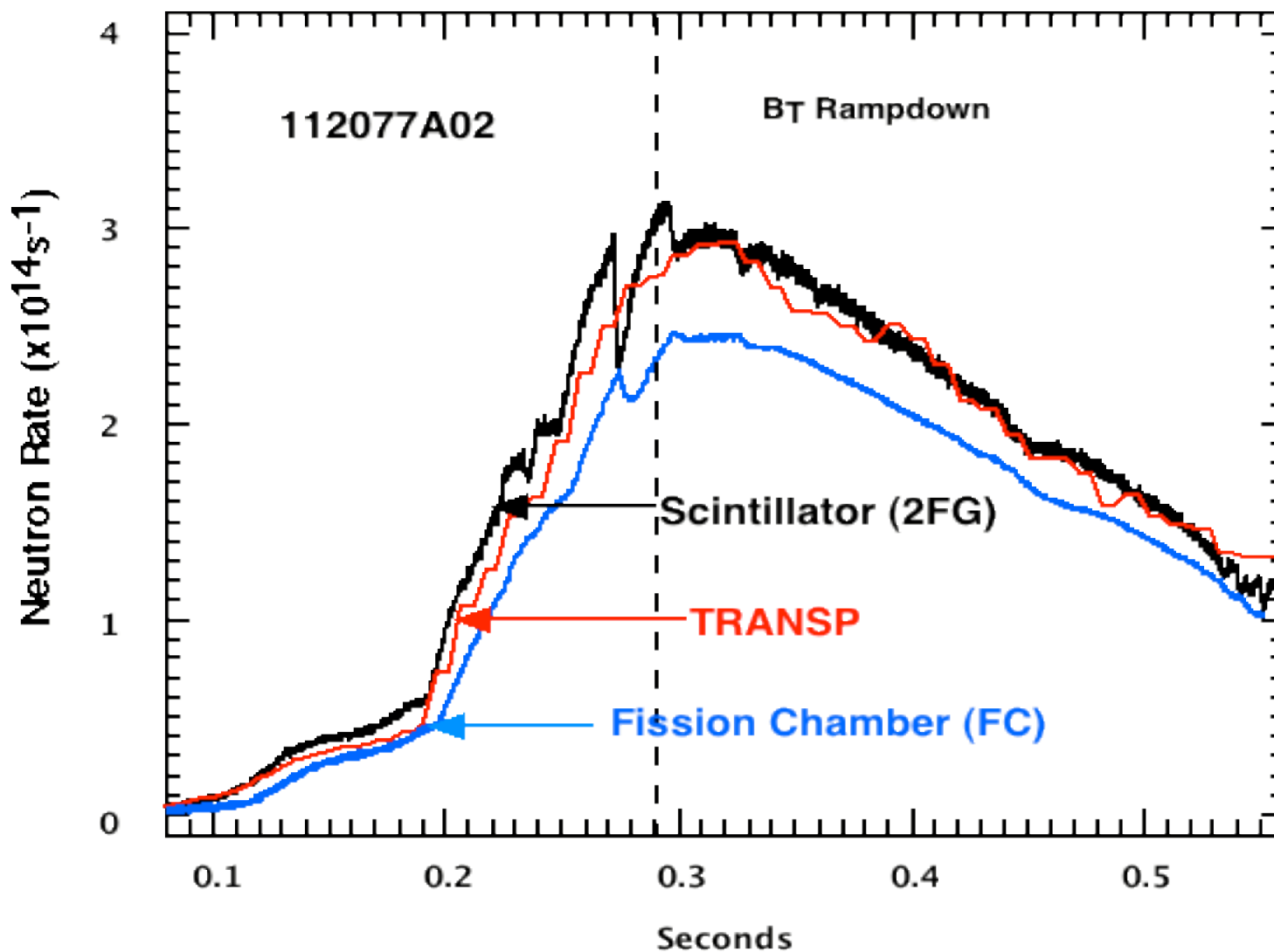
Measured vs Calculated Neutrons -SN112159

• $I_p = 0.8$, $B_T = 4.4$ kG, $P_{NB} = 2$ MW, Source B @ 90 keV

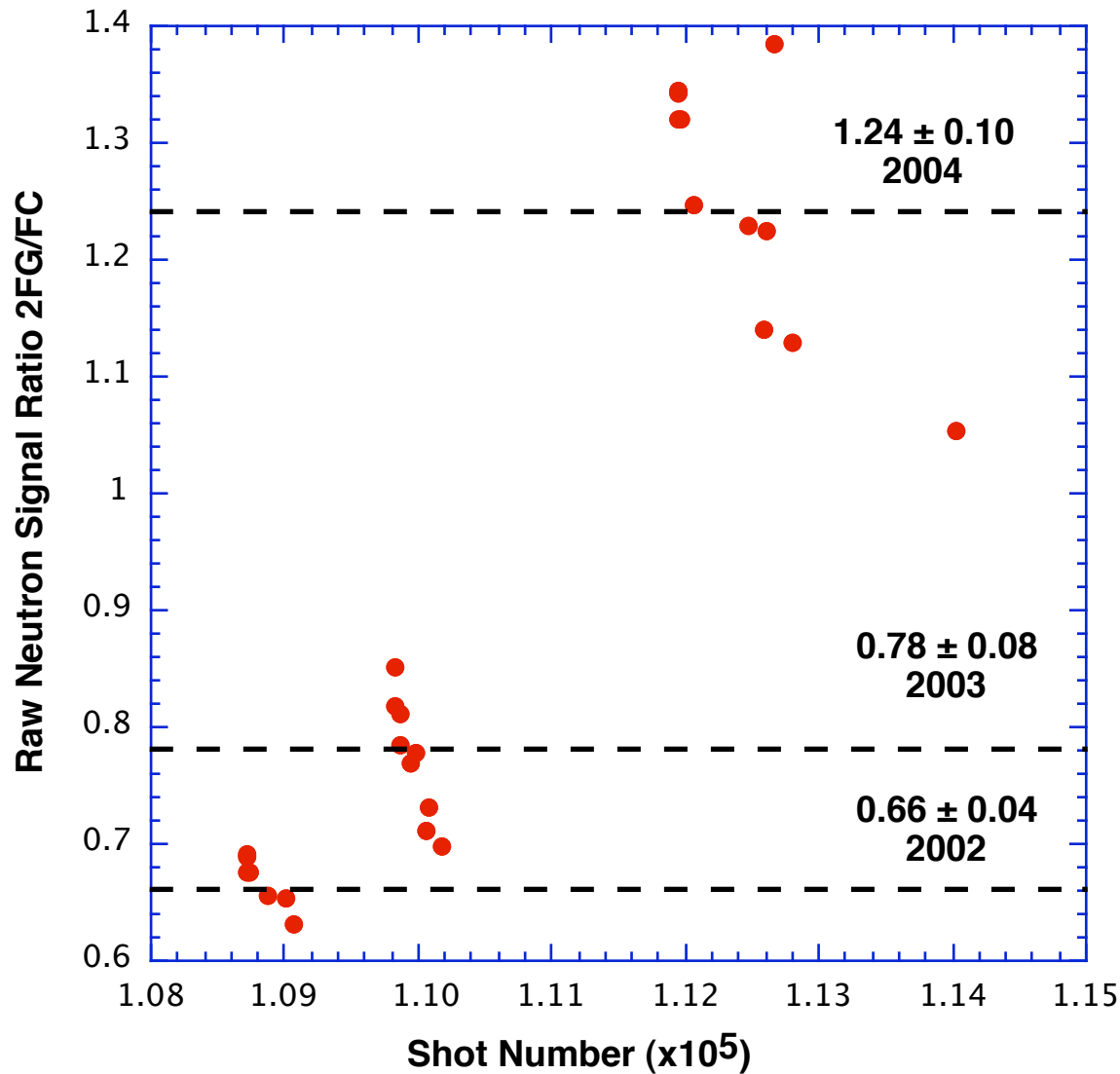


Measured vs Calculated Neutrons -SN112077

• $I_p = 0.8$, $B_T = 4.4$ kG, $P_{NB} = 6$ MW, Sources A, B,C @ 90 keV

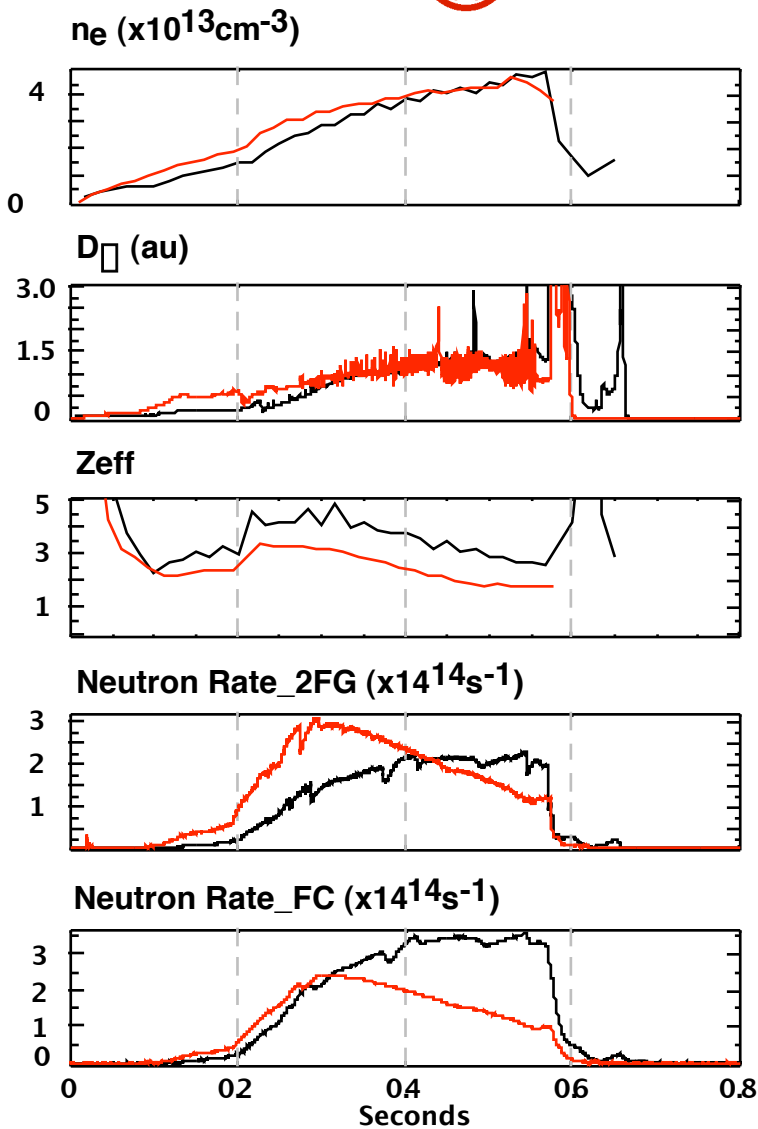
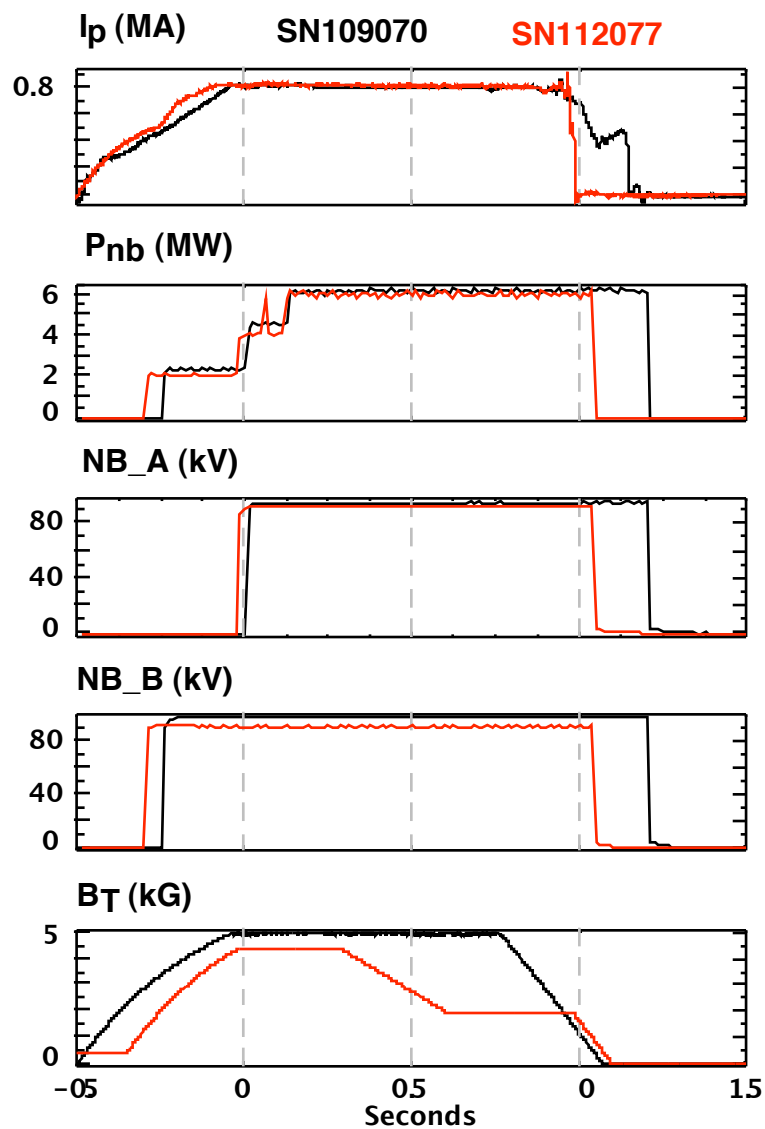


The Neutron Conundrum

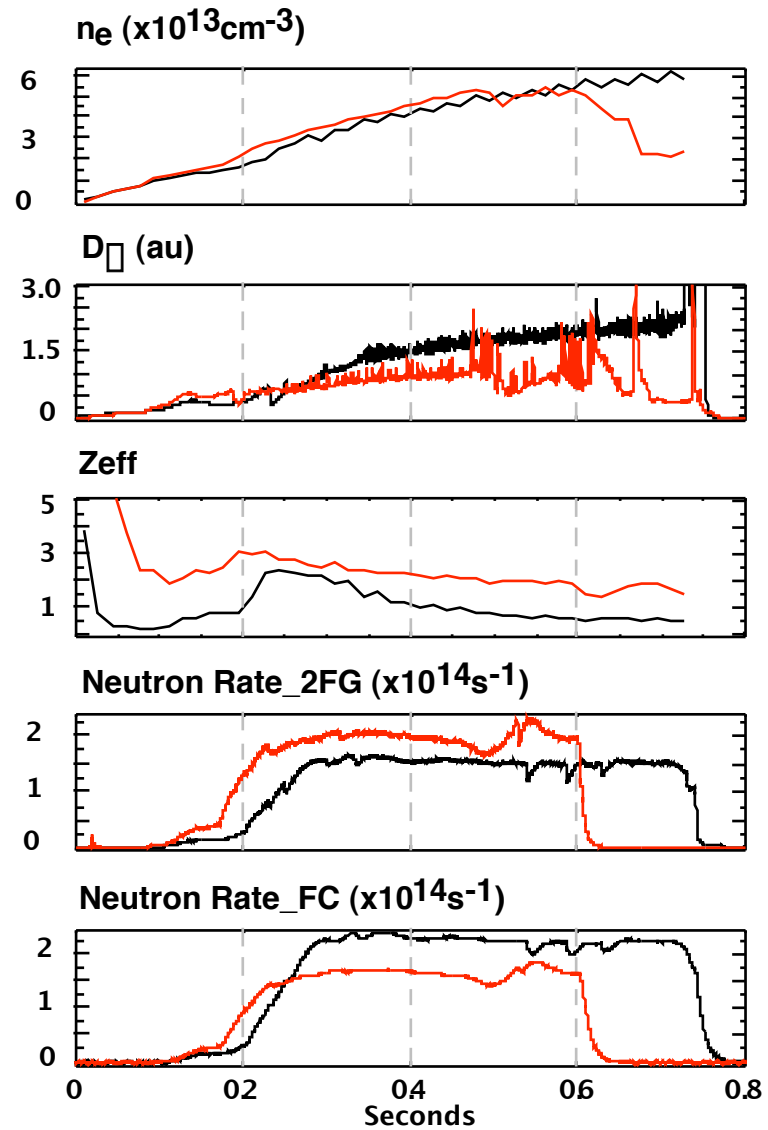
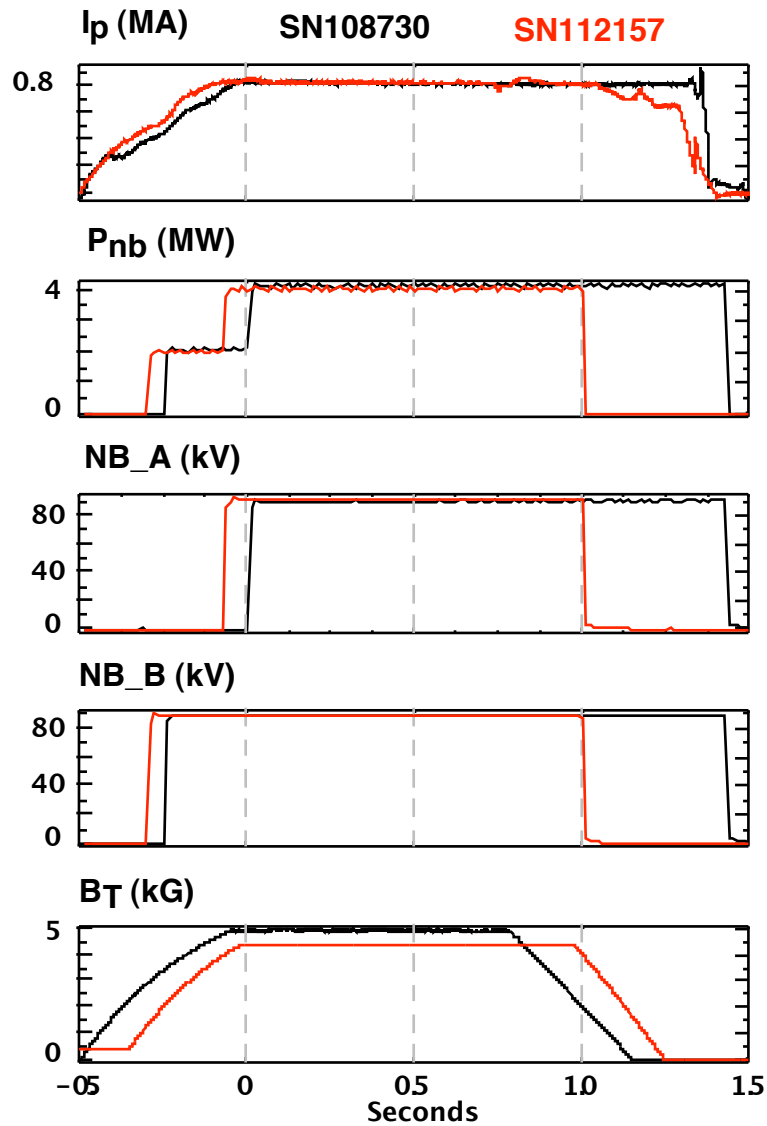


- The ratio of the raw signals (volts, corrected for zero offset) for the scintillation detector (2FG) relative to the fission chamber (FC) is plotted against time (shot number).
- A large change in this ratio has occurred for the 2004 data relative to previous years.
- Has the gain of the scintillation detector (2FG) increased or has the gain of the fission chamber (FC) decreased?

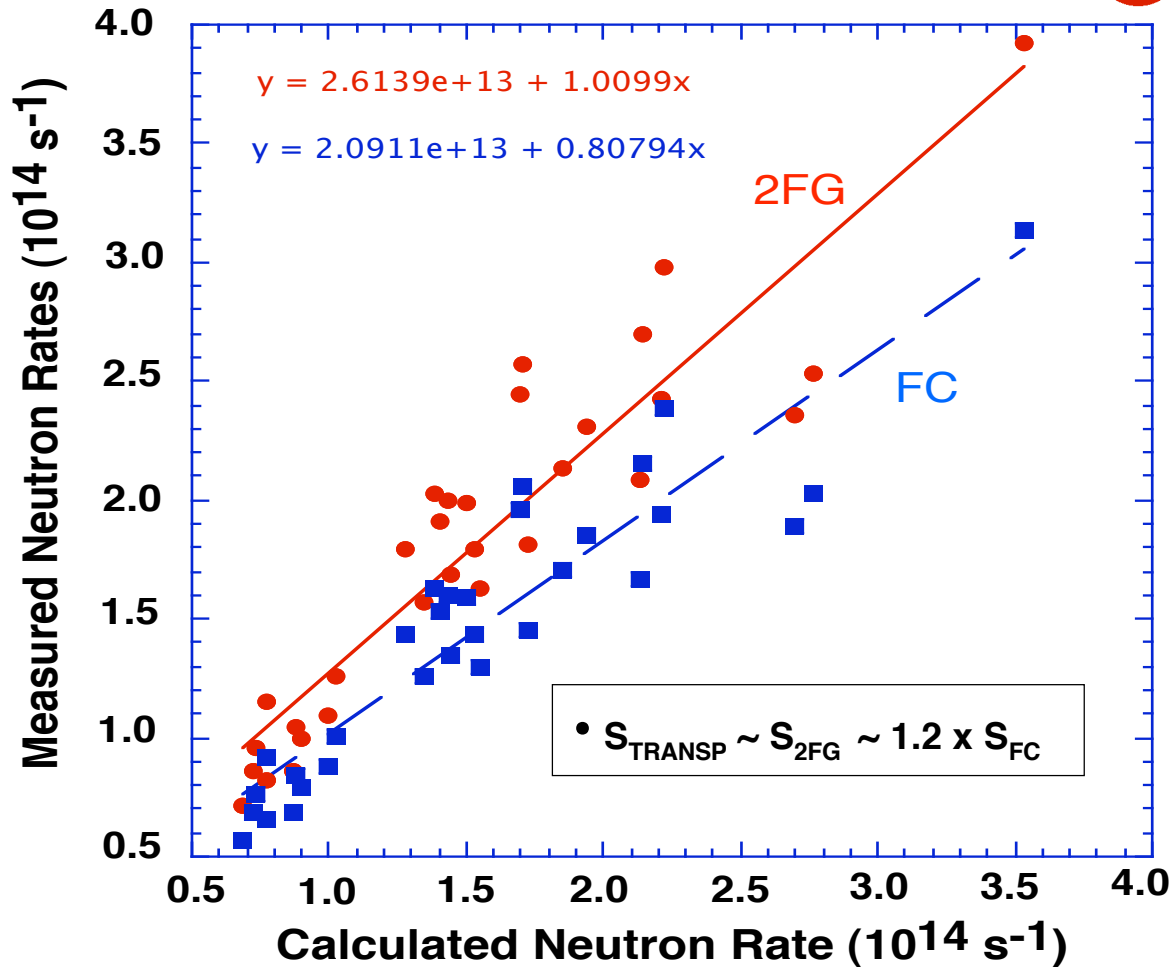
Comparison of Neutron Detector Response: I



Comparison of Neutron Detector Response: II



Scintillation(2FG) and Fission Chamber(FC) Neutron Rate Measurements versus TRANSP Calculation



• Points are from the Kaye database, filtered to select H-mode discharges where the NPA spectrum exhibits energetic ion loss.

Until Lane Roquemore is able to investigate the neutron detector issue:

- **Use the scintillation detector 2FG for *relative* neutron measurements requiring fast response time (e.g. sawteeth)**
- **Use the fission chamber detector for *absolute* neutron measurement comparisons (e.g. TRANSP)**