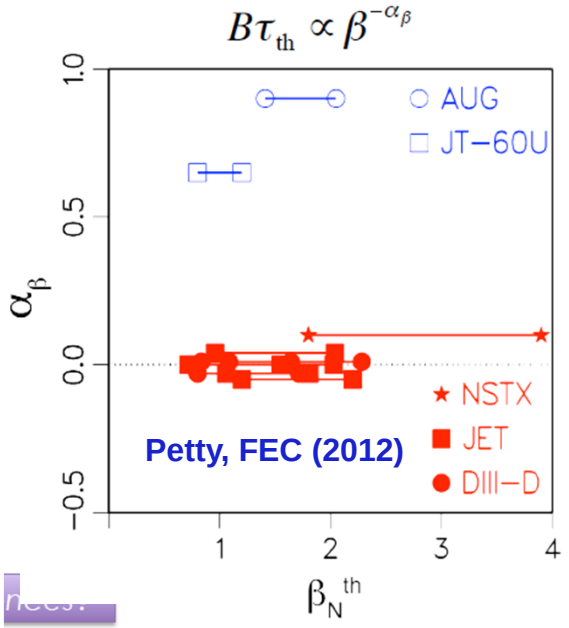
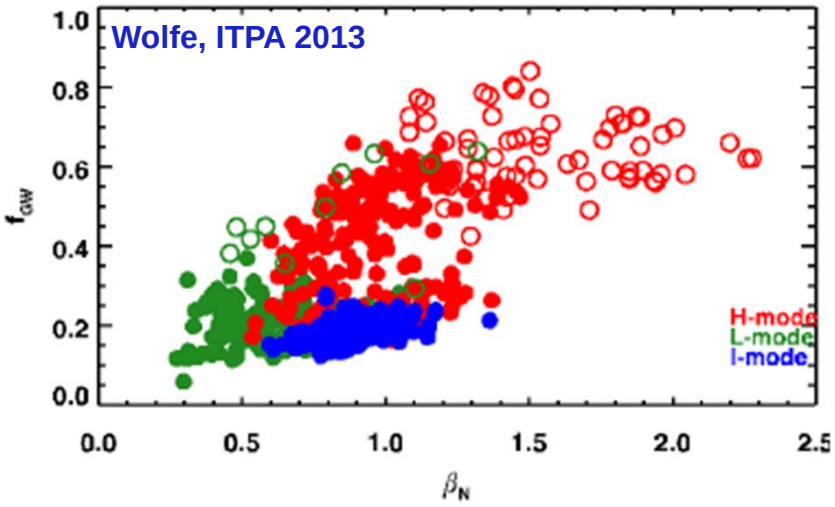
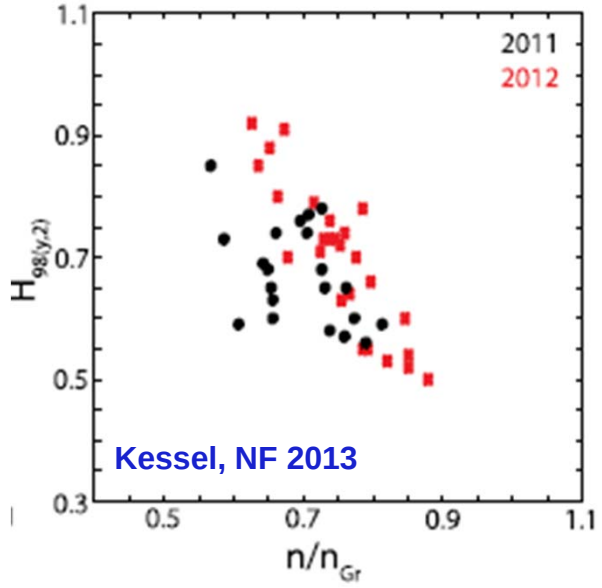
(#143) Confinement, transport and turbulence scaling with beta (W. Guttenfelder, J. Irby, A.E. White, S.M. Wolfe, …)

- Discrepancy in H-mode energy confinement scaling with beta among different tokamaks [Petty, FEC 2012]
  - Unknown if degradation is due to electromagnetic effects
- Reduction in H98 with increasing Greenwald fraction (C-Mod ITER demo discharges; Kessel)
- C-mod operated over wide range of f_{GW}-β_N
  - Look for correlation with broadband high frequency fluctuations in polarimeter [Bergerson, Irby, Xu]







Some 2012 run days of possible interest with polarimeter data

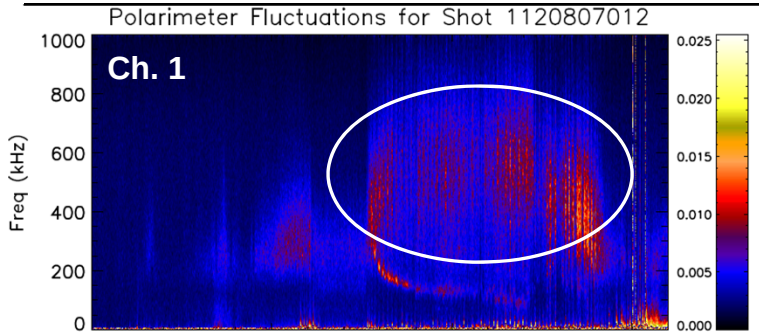
- H-modes
- (645a) N2 seeding, ITER 5.4T (Wolfe) – 1120807
- (716) ITER 5.4 T (Wolfe) – 1120816
- (698) ITER, low-BT (Kessel) – 1120717, 719

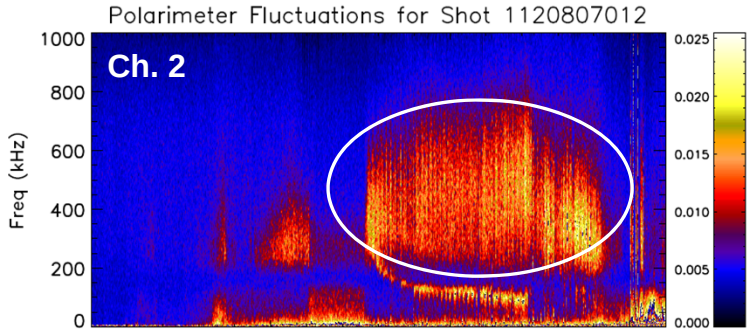
- (690) impurity seeding (Lipschultz) - 1120214
- (701) low-Z (Ne) impurity (Reinke) - 1120725
- (704) LHCD current profile (Xu) – 1120606, 612, 918

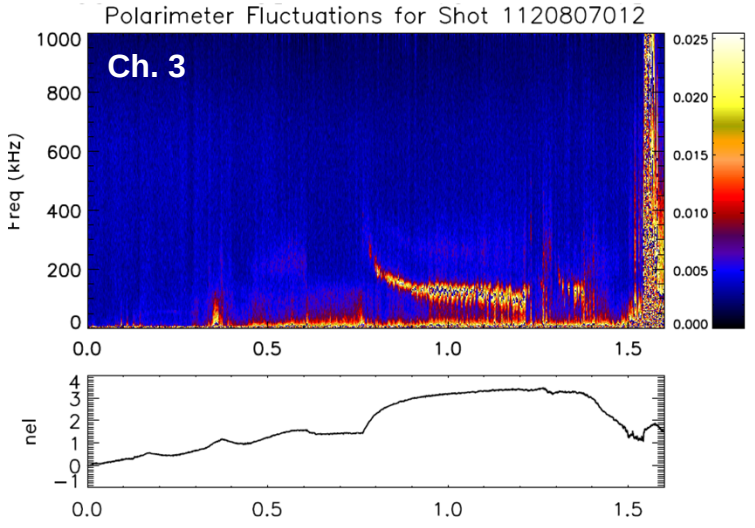
} Haven't looked at these yet

- L-modes
- (689) L-mode (plus L-I) ITG/TEM validation (White) - 1120221

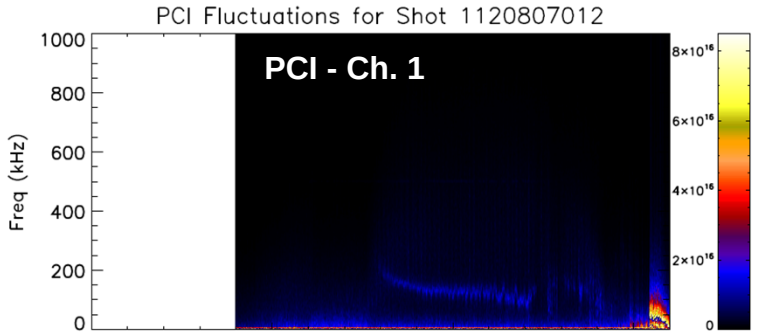
(645a) N2 seeding into ITER demo at 5.4 T (Wolfe) – 1120807007-018

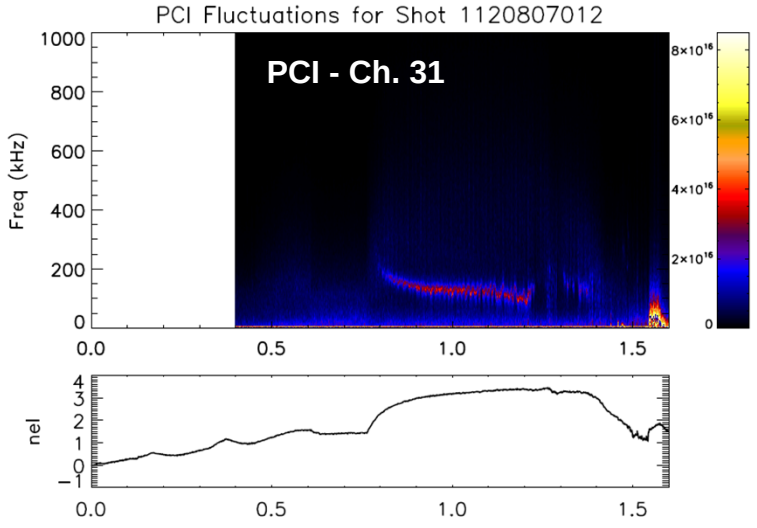




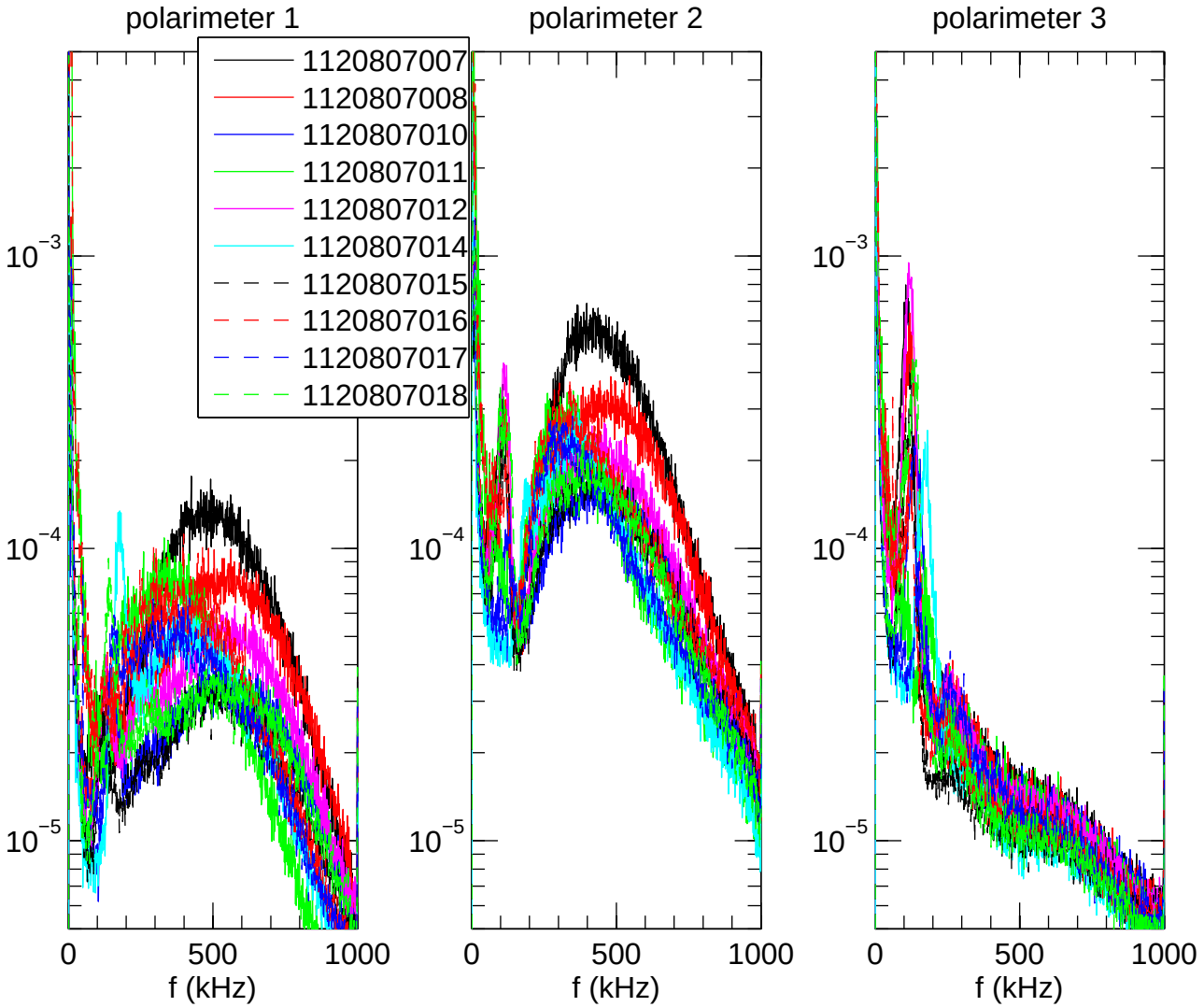


- All polarimeter channels see QCM (also in PCI)
- Broadband fluctuations also seen in ch. 1, 2
  - Oscillating with sawteeth
- Some magnetics signals (BP_xx_TOP) see something around ~750 kHz (not shown)





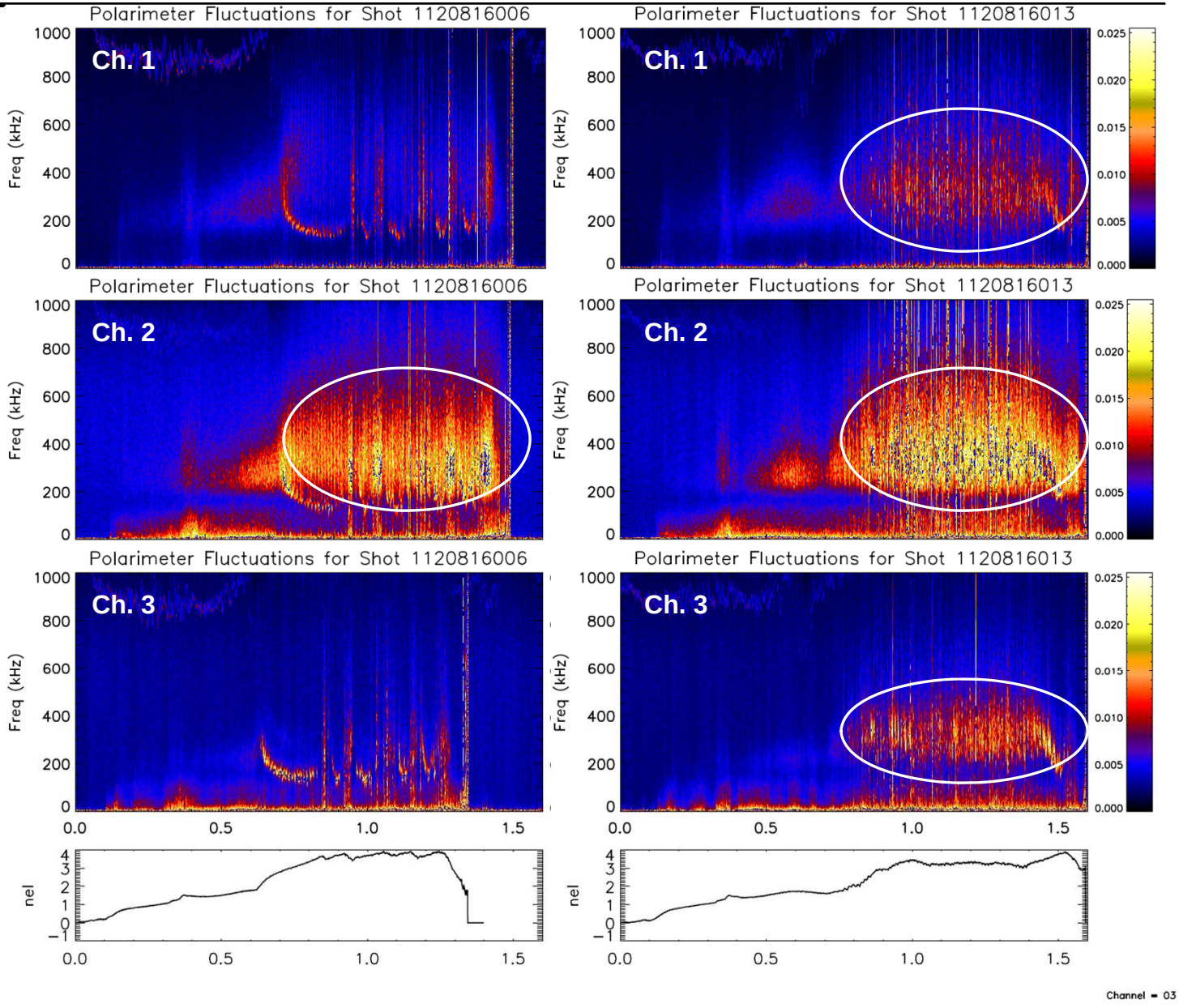
(645a) N2 seeding into ITER demo at 5.4 T (Wolfe) – 1120807007-018



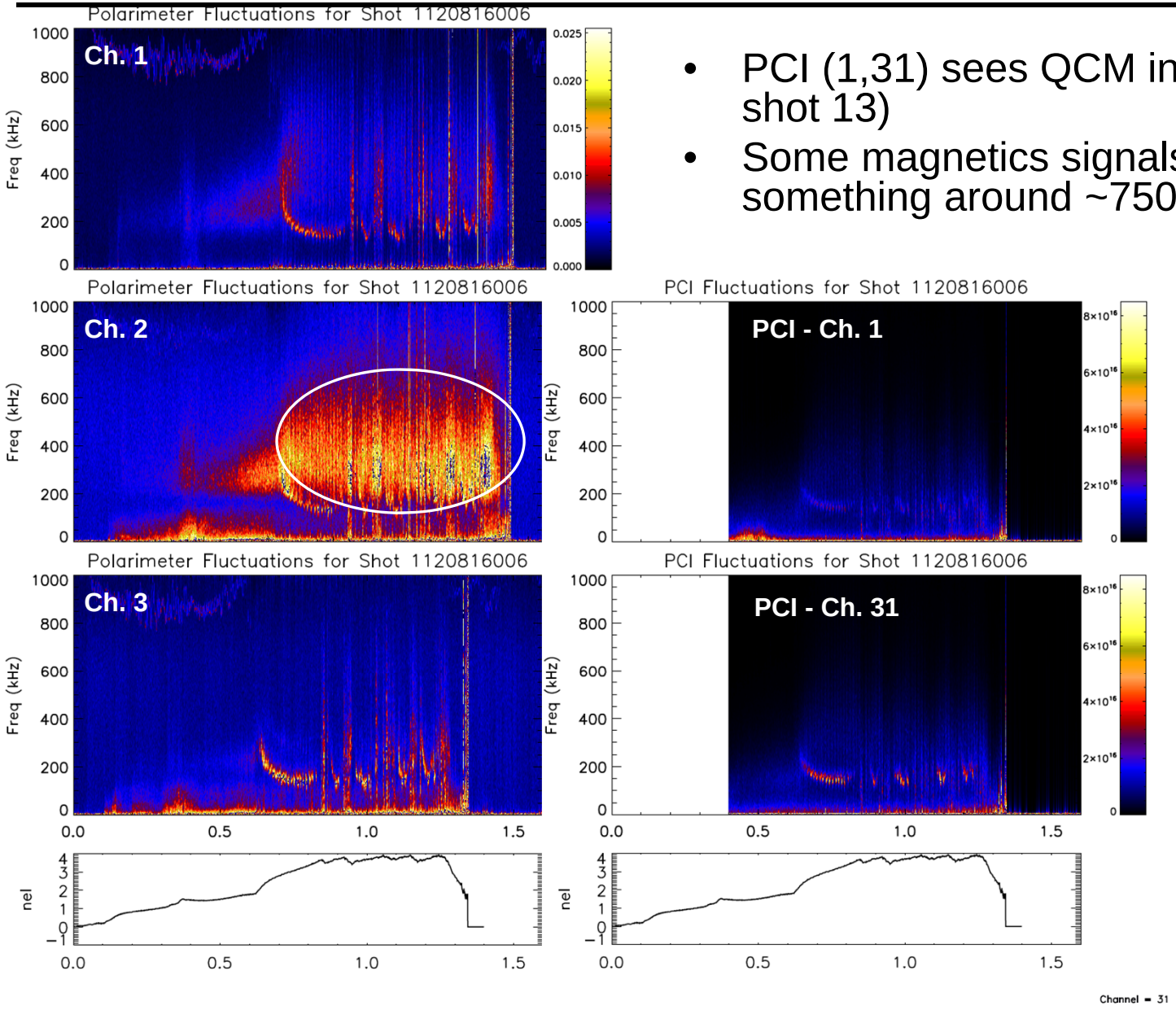
Noise not subtracted

(716) ITER demo at 5.4 T (Wolfe) – 1120816002-013 increasing nel (2-4) and PICRH (2-4)

- QCM in earlier discharges
- Added H-div puff (9+)
- Weak ELMy H-mode later in day (no QCM)
- Broadband polarimeter fluctuations in ch. 2, get bigger through day
- QCM (ch 3) disappears, see broadband on all channels
  - Low H98~0.7

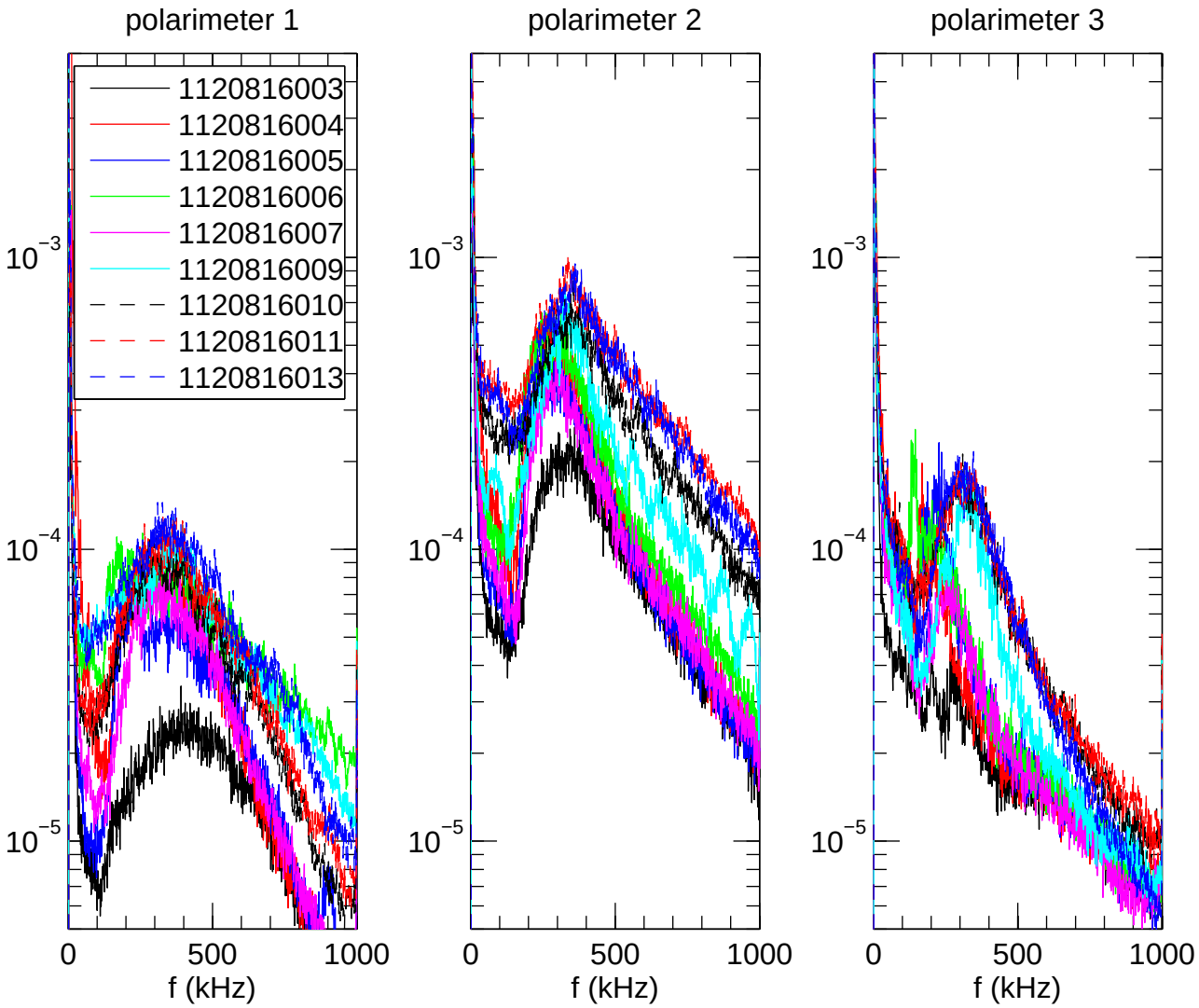


(716) ITER demo at 5.4 T (Wolfe) – 1120816002-013 increasing nel (2-4) and PICRH (2-4)



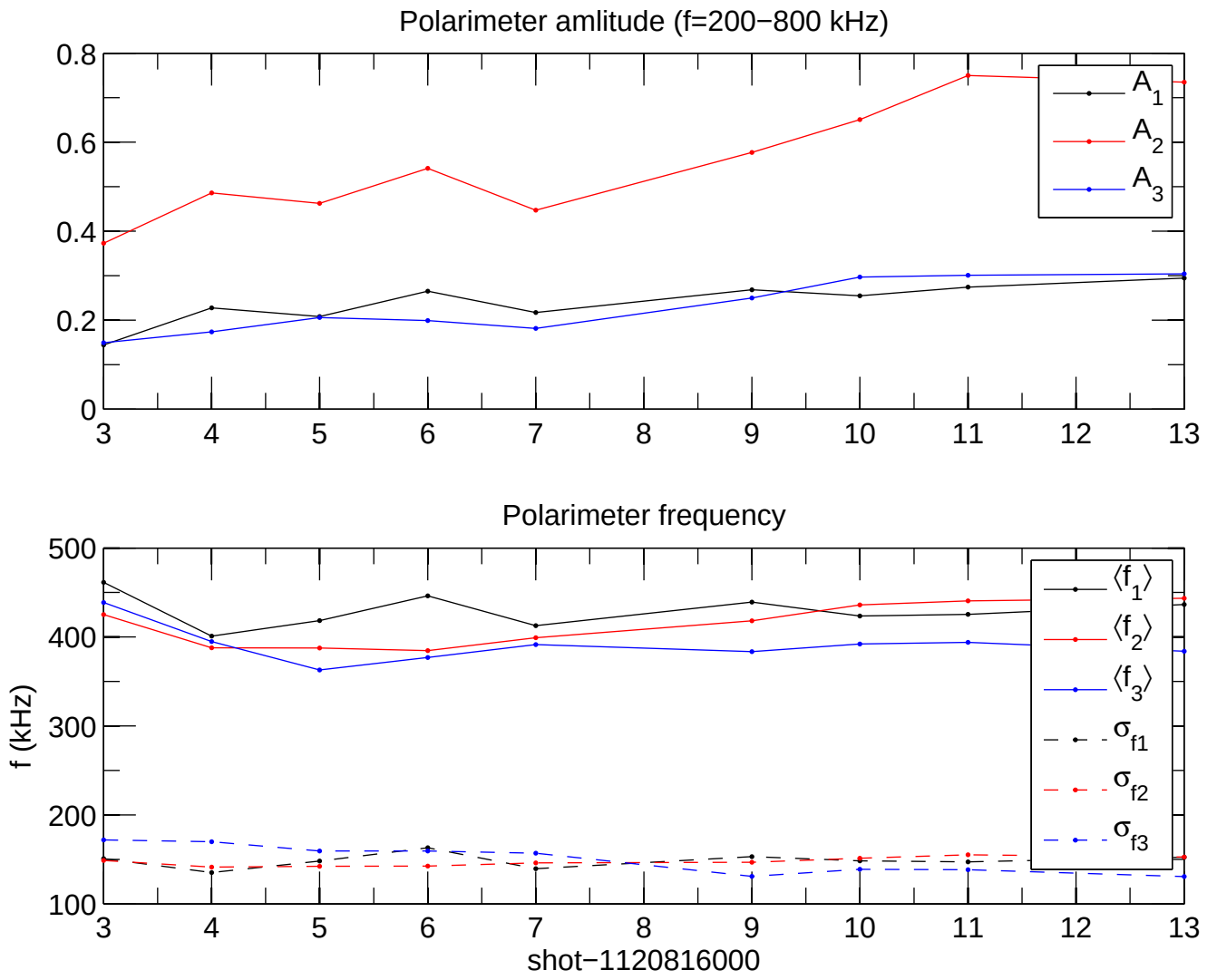
- PCI (1,31) sees QCM in shot 6 (nothing in shot 13)
- Some magnetics signals (BP_xx_TOP) see something around ~750 kHz (not shown)

(716) ITER demo at 5.4 T (Wolfe) – 1120816002-013 increasing nel (2-4) and PICRH (2-4)

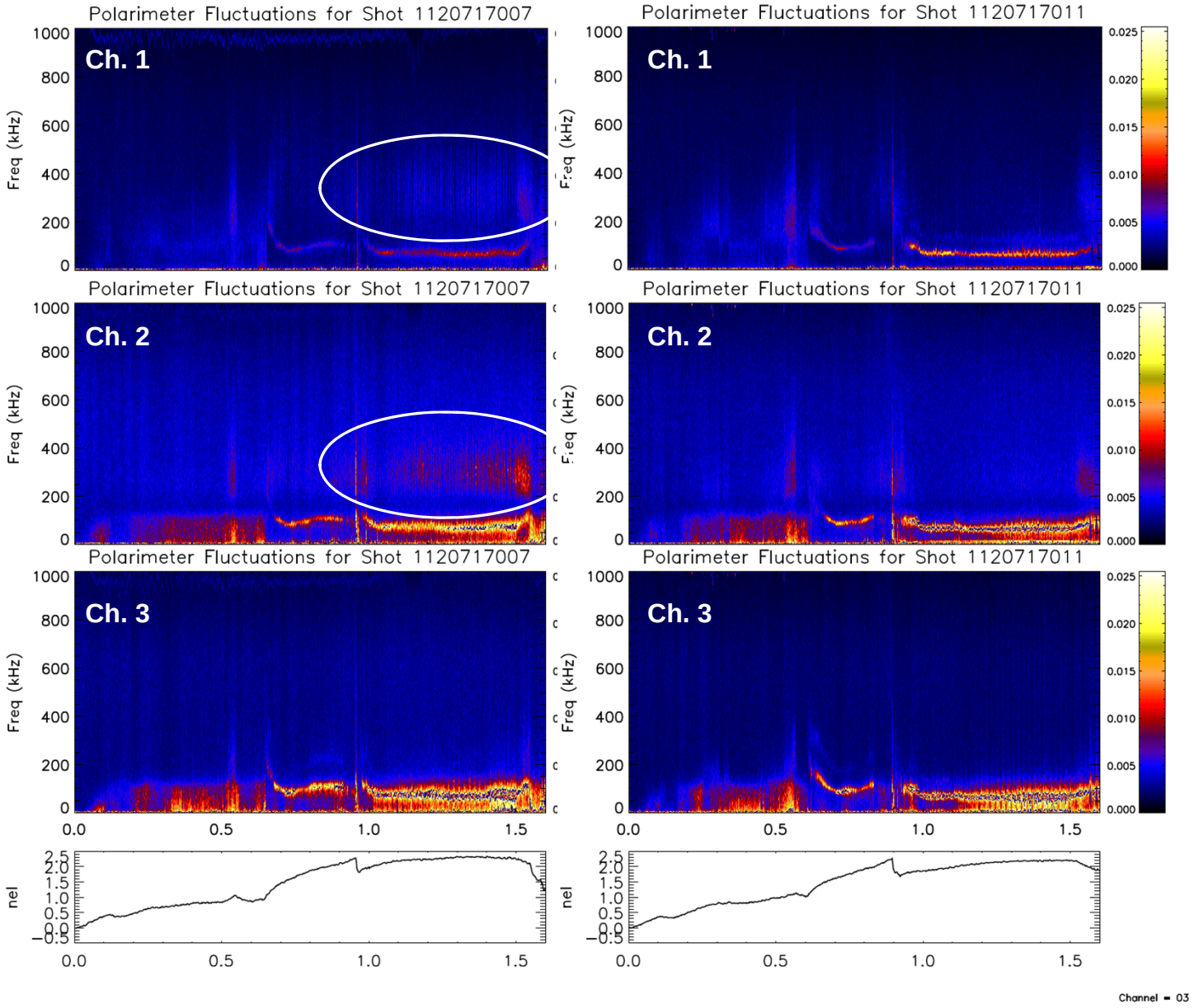


Noise not subtracted

(716) ITER demo at 5.4 T (Wolfe) – 1120816002-013
increasing nel (2-4) and PICRH (2-4), broadband fluctuations get stronger



(698) ITER low-BT 2.7T (Kessel) – 1120717
Weak/no broadband polarimeter fluctuations in B_T=2.7T shots



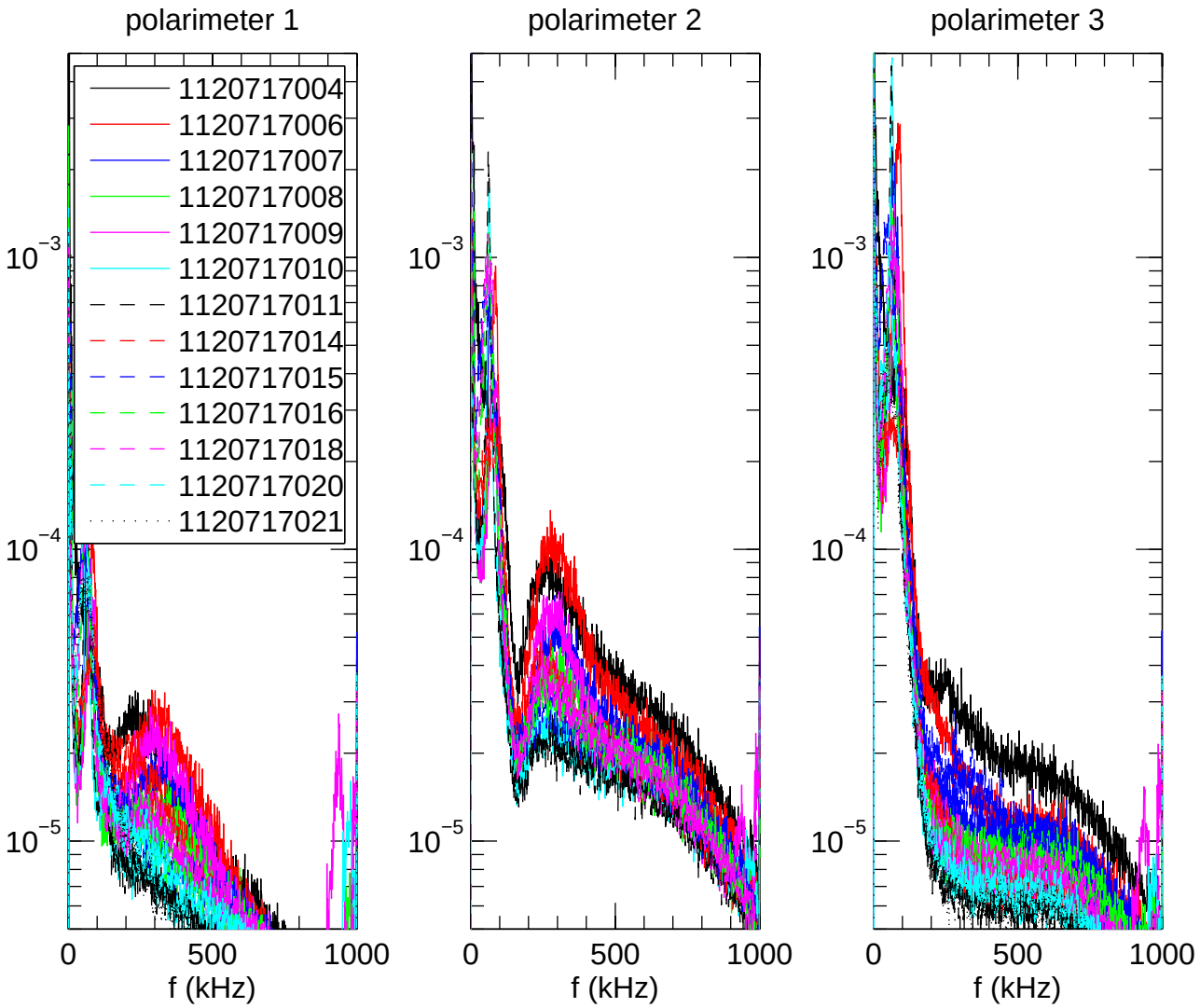
- Weaker broadband fluctuations in low BT shots (f~300 kHz)
- Disappears in later shots?

- Also keep in mind lower n_e, B
- For similar $\delta n/n$, $\delta B/B$ would expect phase $\psi \sim \int n_e B \cdot dl$ to be 4× smaller

- QCM apparent in early H-mode
- Then MHD with increasing P_{ICRH}?

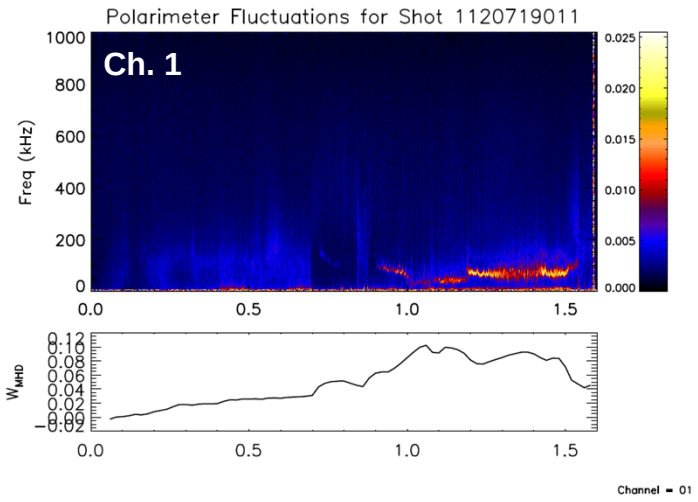
- (PCI????)

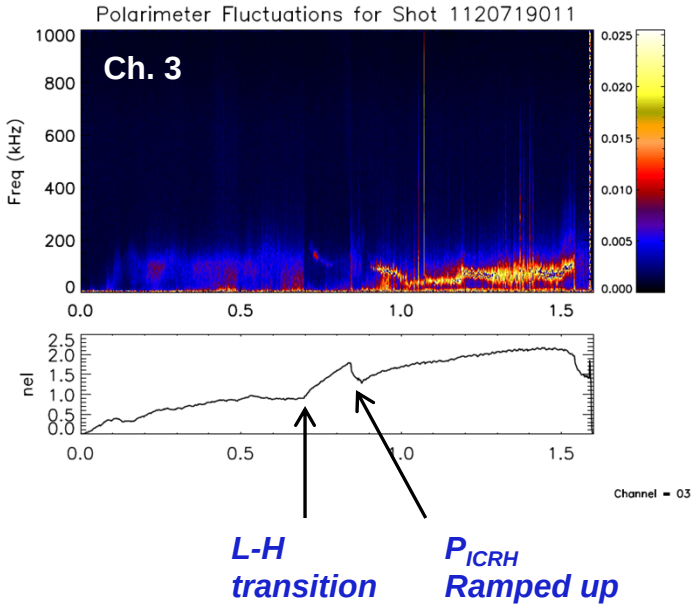
(698) ITER low-BT 2.7T (Kessel) – 1120717
Weak/no broadband - possibly observe QCM, then MHD?



Noise not subtracted

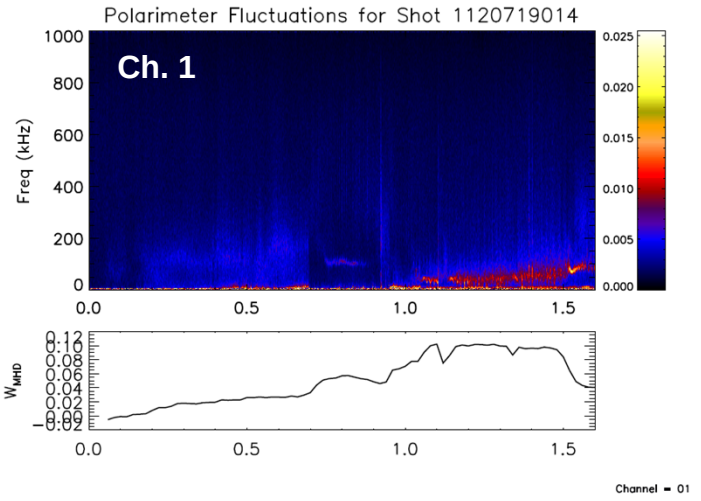
(698) ITER low-BT 2.7T (Kessel) – 1120719
Weak/no broadband - possibly observe QCM, then MHD?

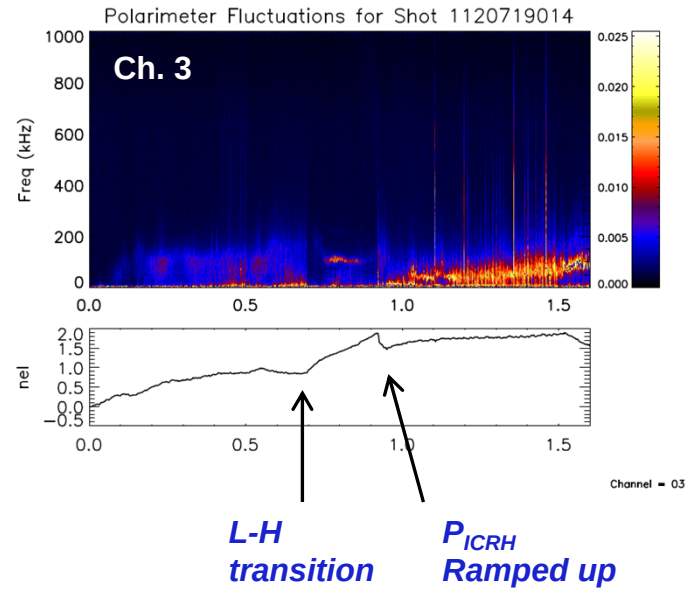




L-H transition

P_{ICRH} Ramped up

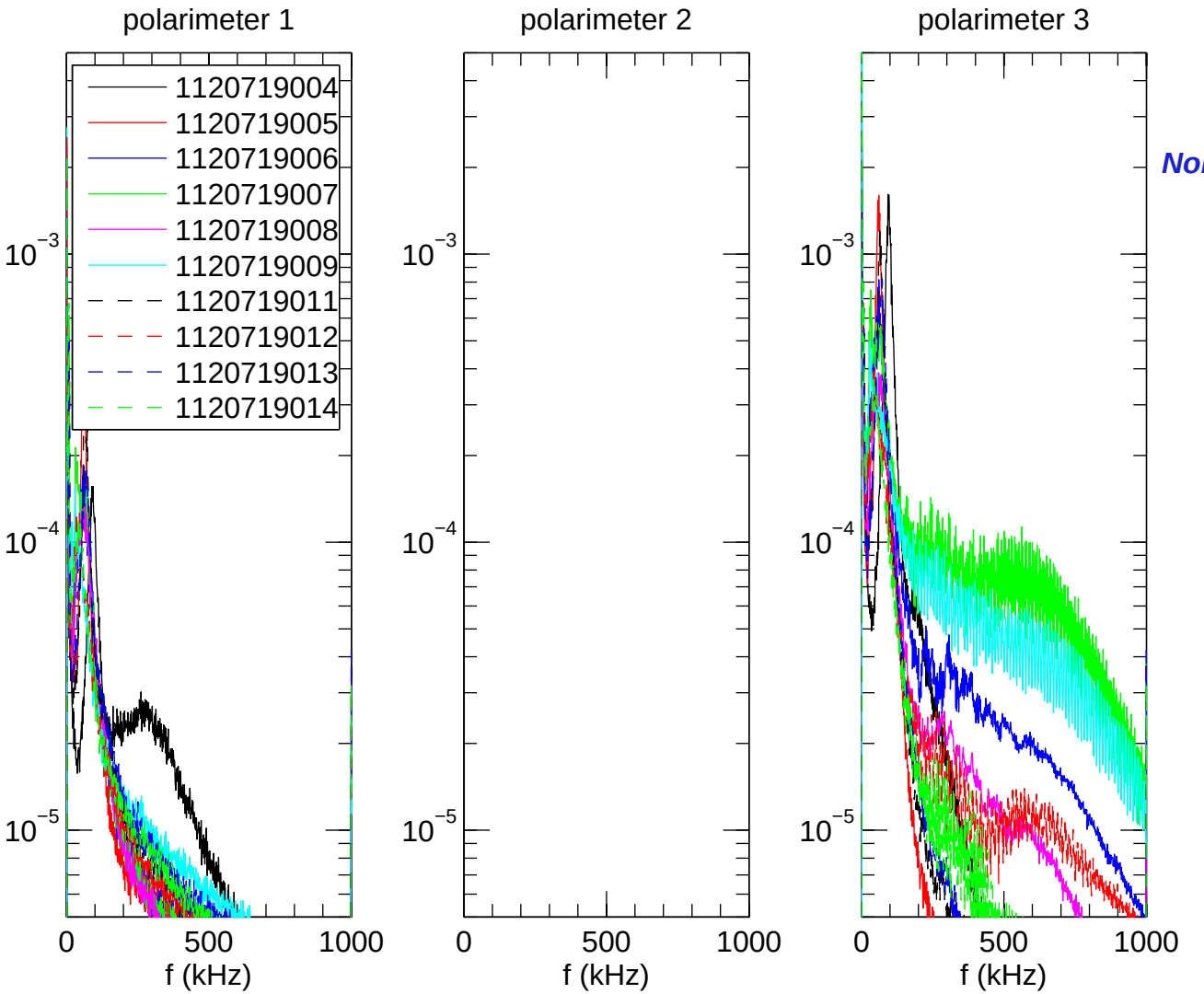




L-H transition

P_{ICRH} Ramped up

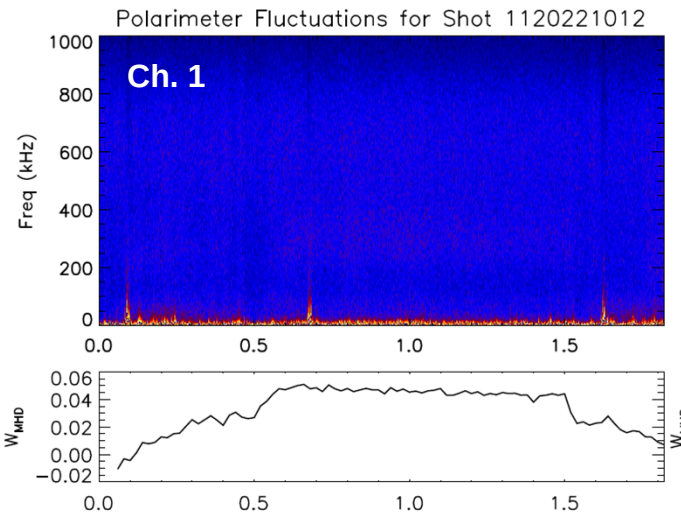
(698) ITER low-BT 2.7T (Kessel) – 1120719
Weak/no broadband - possibly observe QCM, then MHD?



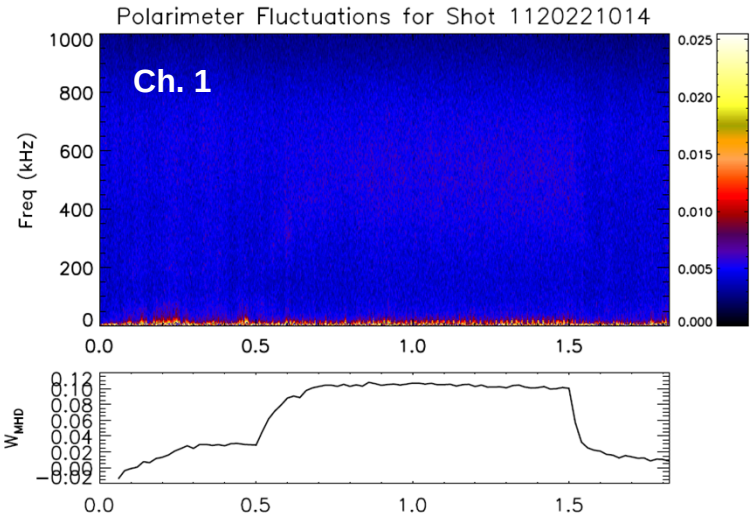
Noise not subtracted

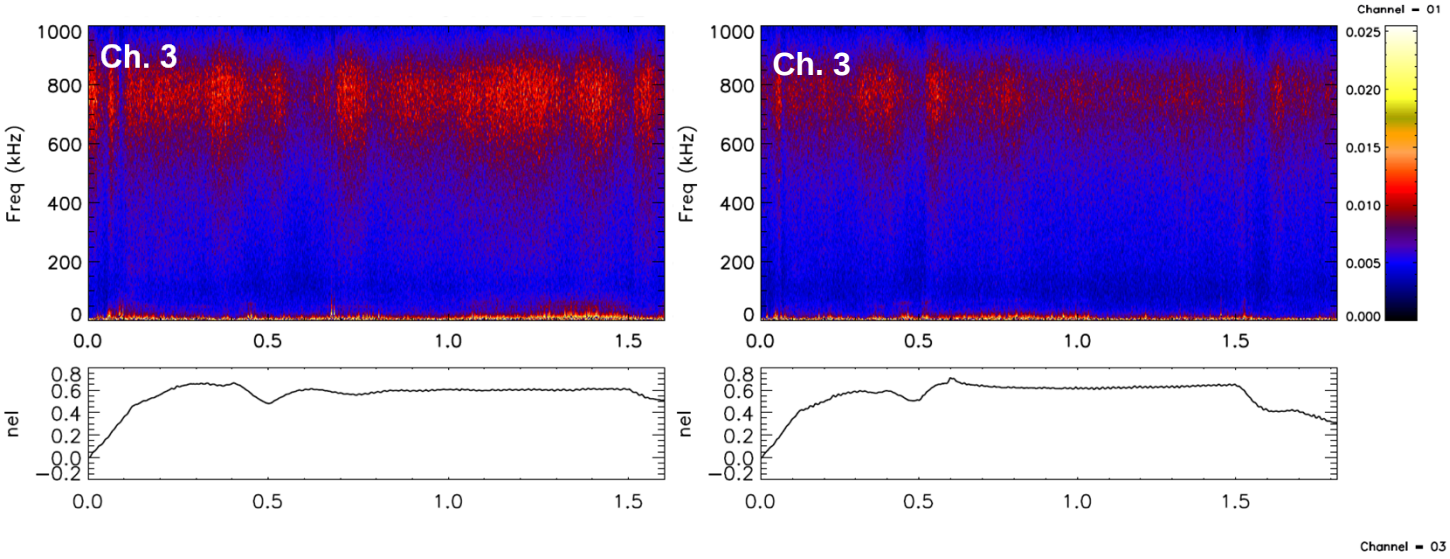
(689) ITG/TEM L-mode validation (White) – 1120221

1.2 MW L-mode



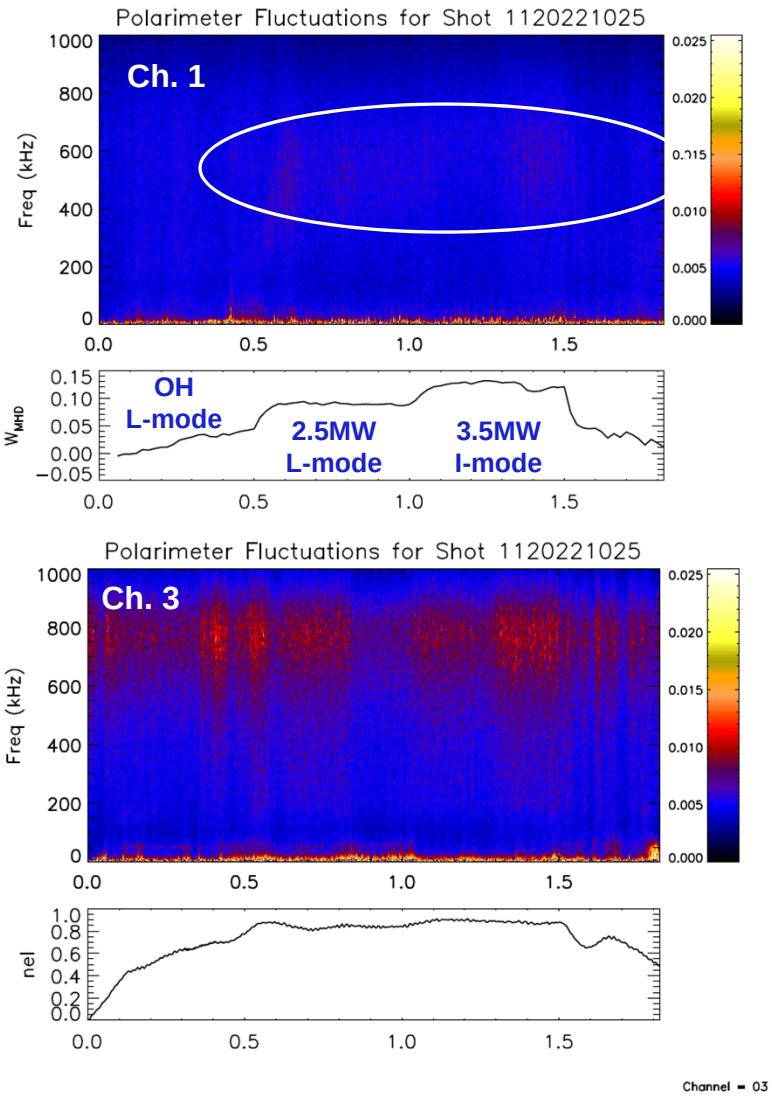
3.5 MW L-mode





- Nothing in polarimeter signal (no ch.2 data)
- Not sure what ~800 kHz stuff is in ch. 3
- **L-I shots (21,23,24,25)**

L-mode to I-mode transition (0 -> 2.5 -> 3.5 MW)



- Faint hint of something in ch. 1 (~600 kHz)
- Not sure what ~800 kHz stuff is in ch. 3

Plans for data mining

- Identify/tabulate shots with polarimeter data (L, I, H; ne, P, BT, Ip)
- Characterize polarimeter response
  - In particular, shots with high-frequency broadband feature
  - I'm going to need some help distinguishing QCM, MHD, etc…
  - What should I look out for regarding validity of polarimeter data?
- Create database with L/I/H, I_p, B_T, nel, W_{MHD}, β_N, f_{GW}, ν_*, and broadband polarimeter info (e.g. intensity $\int S(f) \cdot df$; mean freq)

- Create profile data for linear gyrokinetic for a subset of shots with polarimeter data
- Run linear scoping gyrokinetic simulations

- Eventually move towards nonlinear gyrokinetics for most interesting shots identified

To-Do's:

- Identify useful (~steady) time ranges in each discharge
  - When -- at max W_{MHD}?
  - Start with 1120816003-7,9-11,13
  - Finish some details
    - tau's
    - Time average general routine
    - Polarimeter calibration, amplitude?
    - Clump shots from different day (one color for each day)
    - Overlay time traces from discharges with increasing Picrh
    - List of L and I-mode shots from 2012?
    - L. Lin papers (PCI freq selection criteria)
- Routine to read, calculate, time average relevant info
  - BT, Ip, nel, ne95, R, a , ne0, Te95, Te0, Poh/icrh/tot/rad, tau_th/tot, tau89/98, H98/89, beta_th/tot, beta_N, nu*, f_GW, Ω, Z estimate
  - Average, std, d/dt ~ linear fit/avg
  - Polarimeter intensity (~200-800 kHz), mean frequency $\langle f \rangle$, intensity normalized by $\langle n_e B \rangle$
    - Time dependence of 200-800 kHz intensity
  - Cross-correlate channels 1-3
  - External magnetics (and probe), PCI, reflectometer data when available (what shots)
  - Compare EFIT surface shapes from different days

END

(716) ITER demo at 5.4 T (Wolfe) – 1120816002-013
increasing nel (2-4) and PICRH (2-4), broadband fluctuations get stronger