ELM Precursors in NSTX

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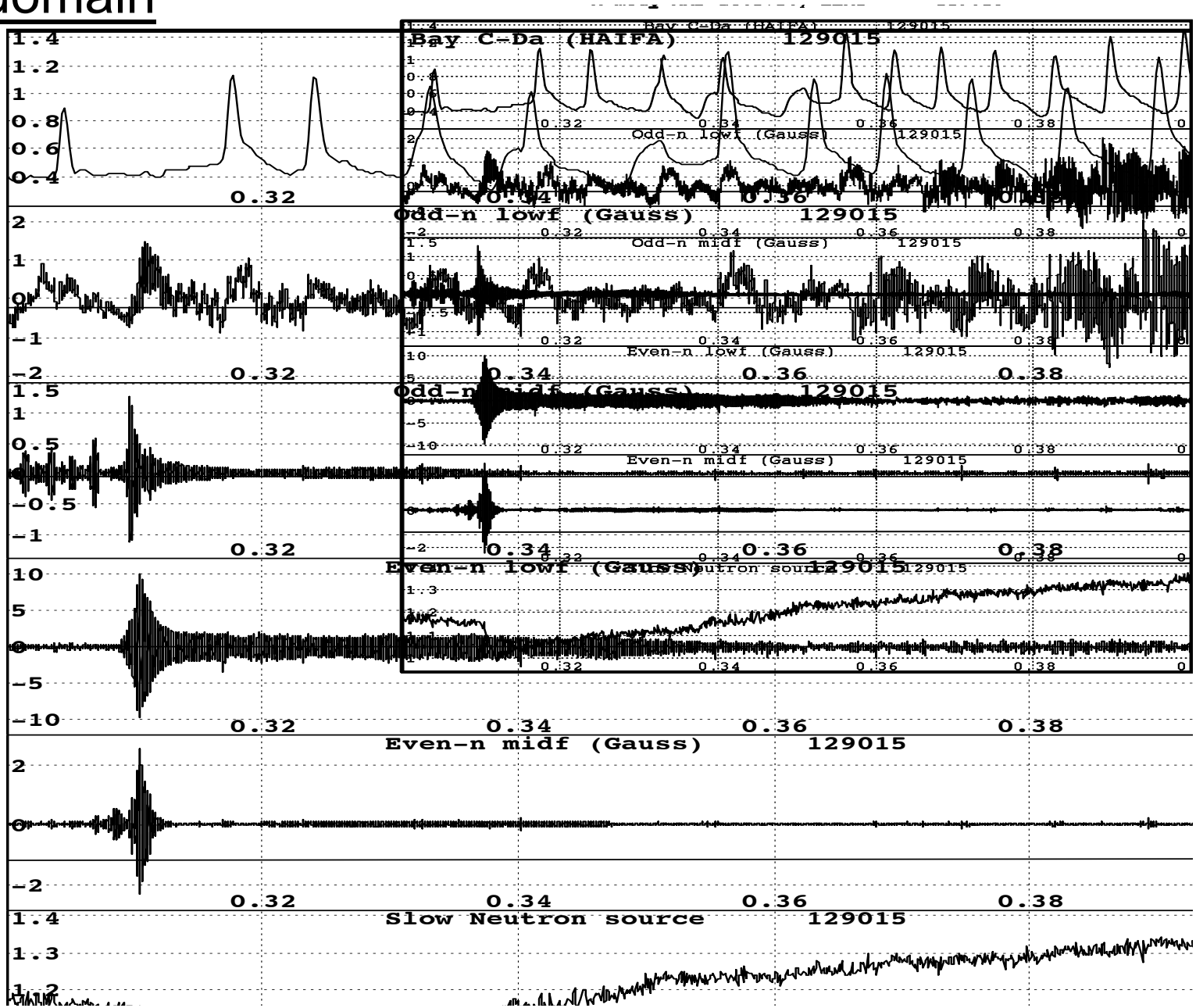
NSTX 129015 - without lithium

NSTX

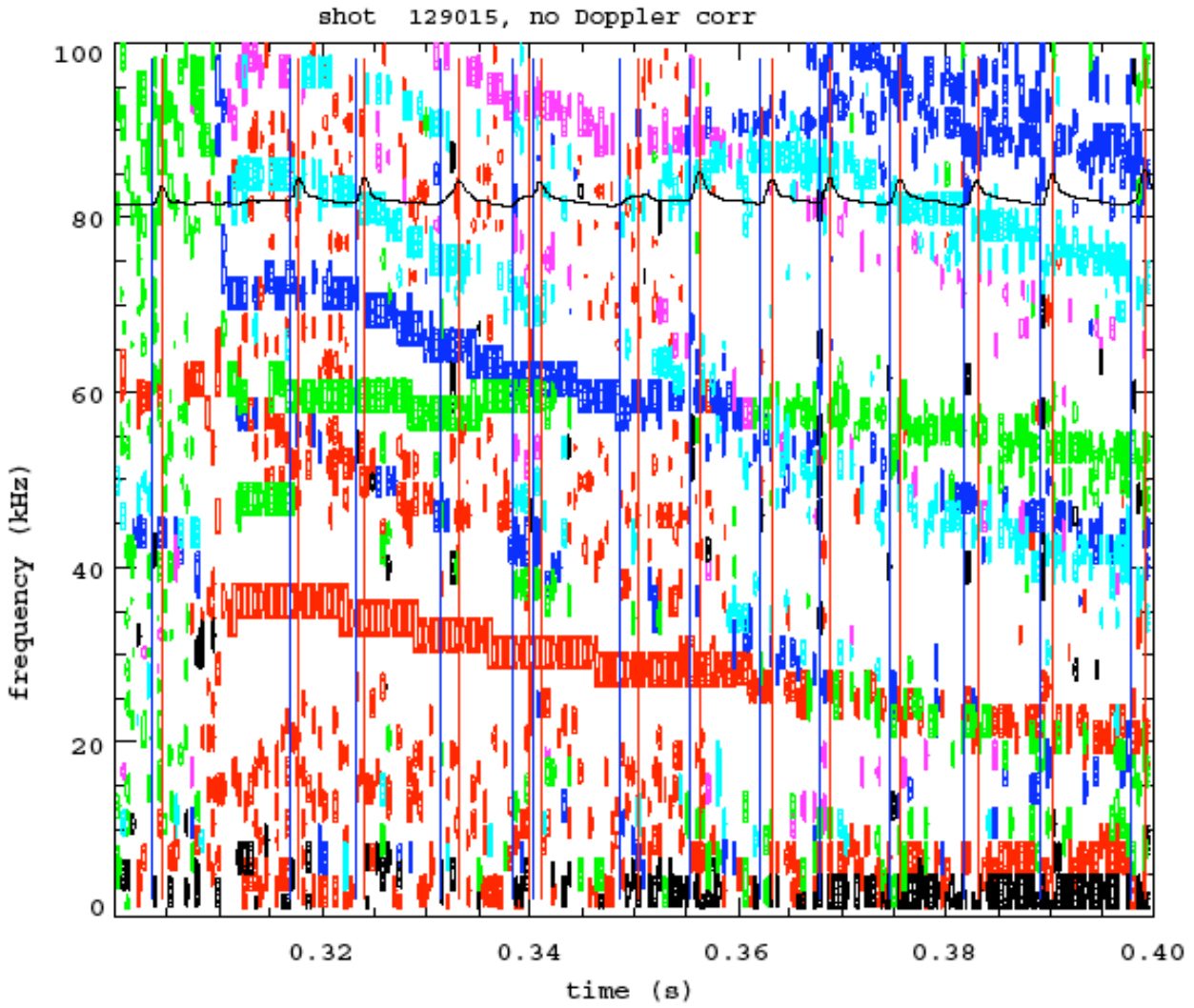
Time domain



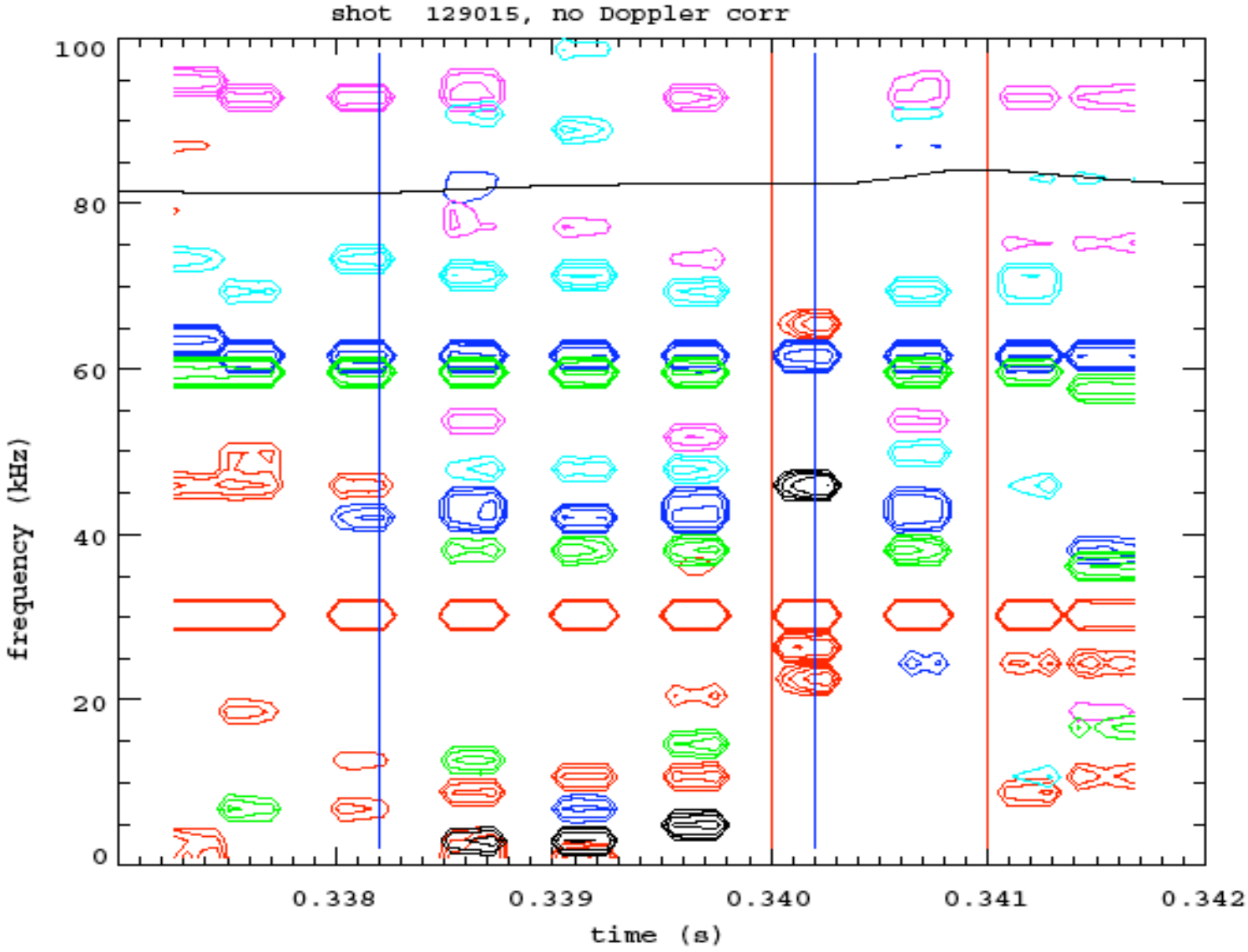
NSTX 129015 - without lithium

NSTX

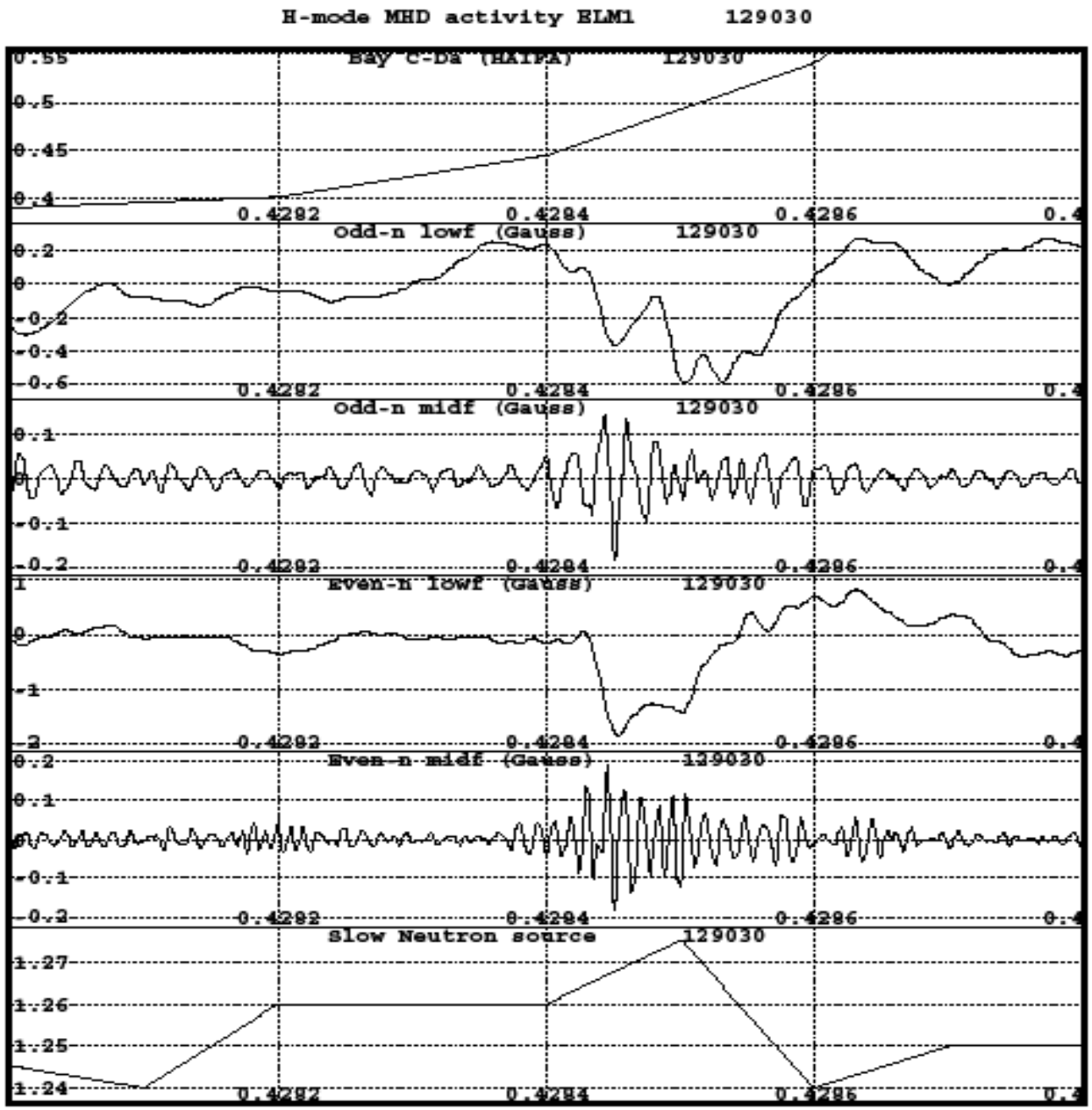
Spectrogram



NSTX 129015 - ELMs at 0.3400 and 0.3410 s



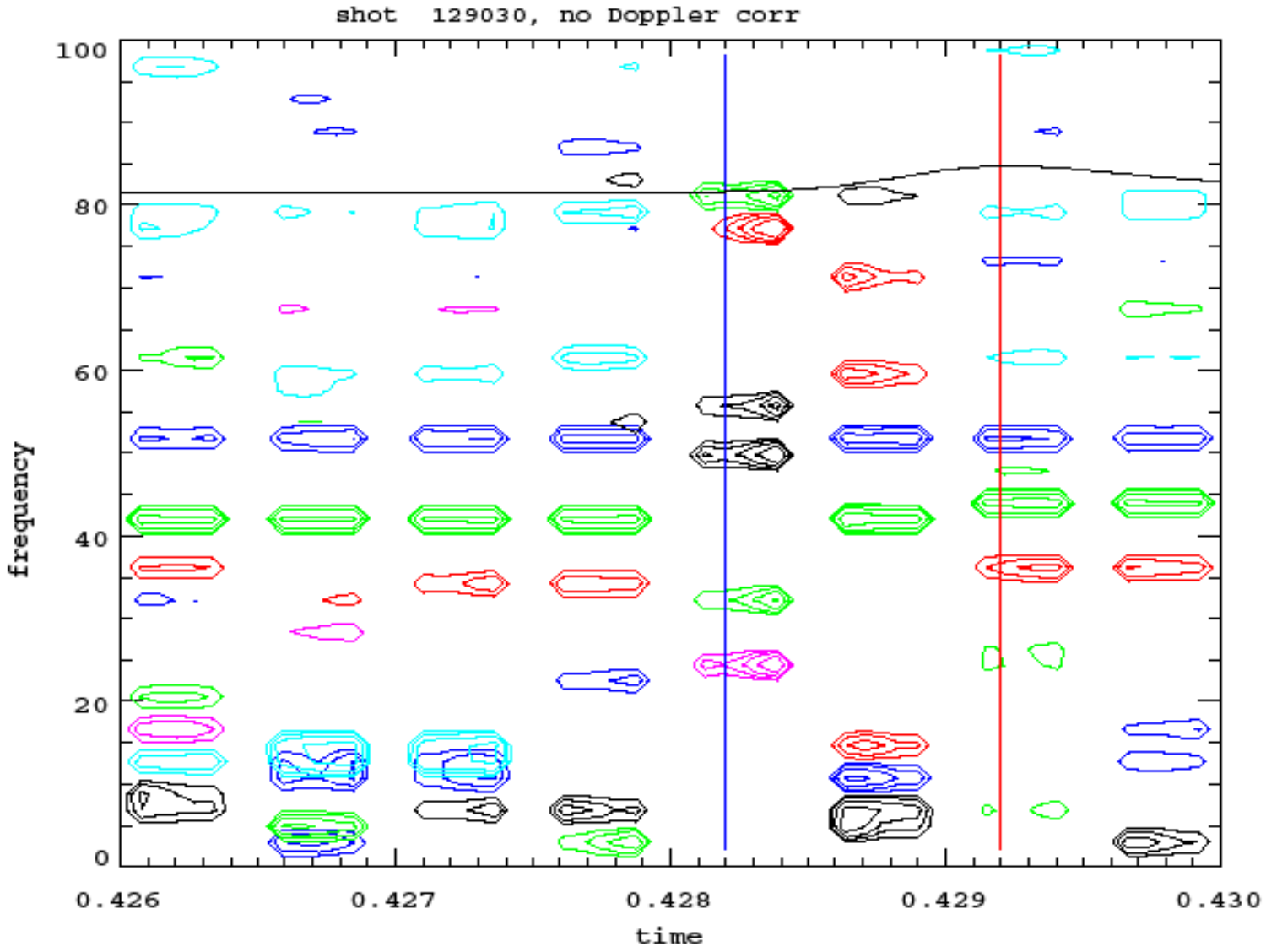
NSTX 129030 w / lithium - ELM precursors for 0.4292 s



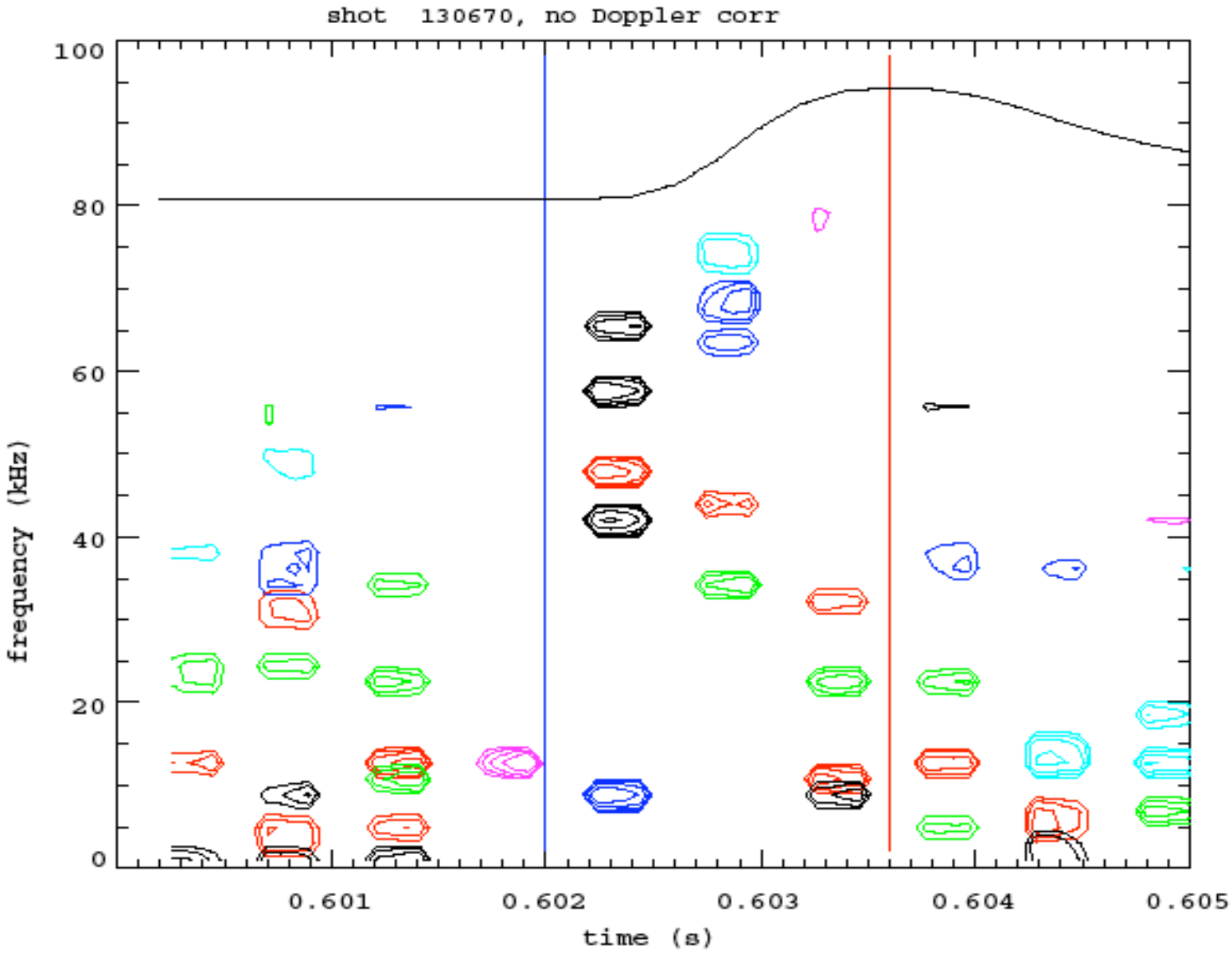
n =1
~ 50 kHz

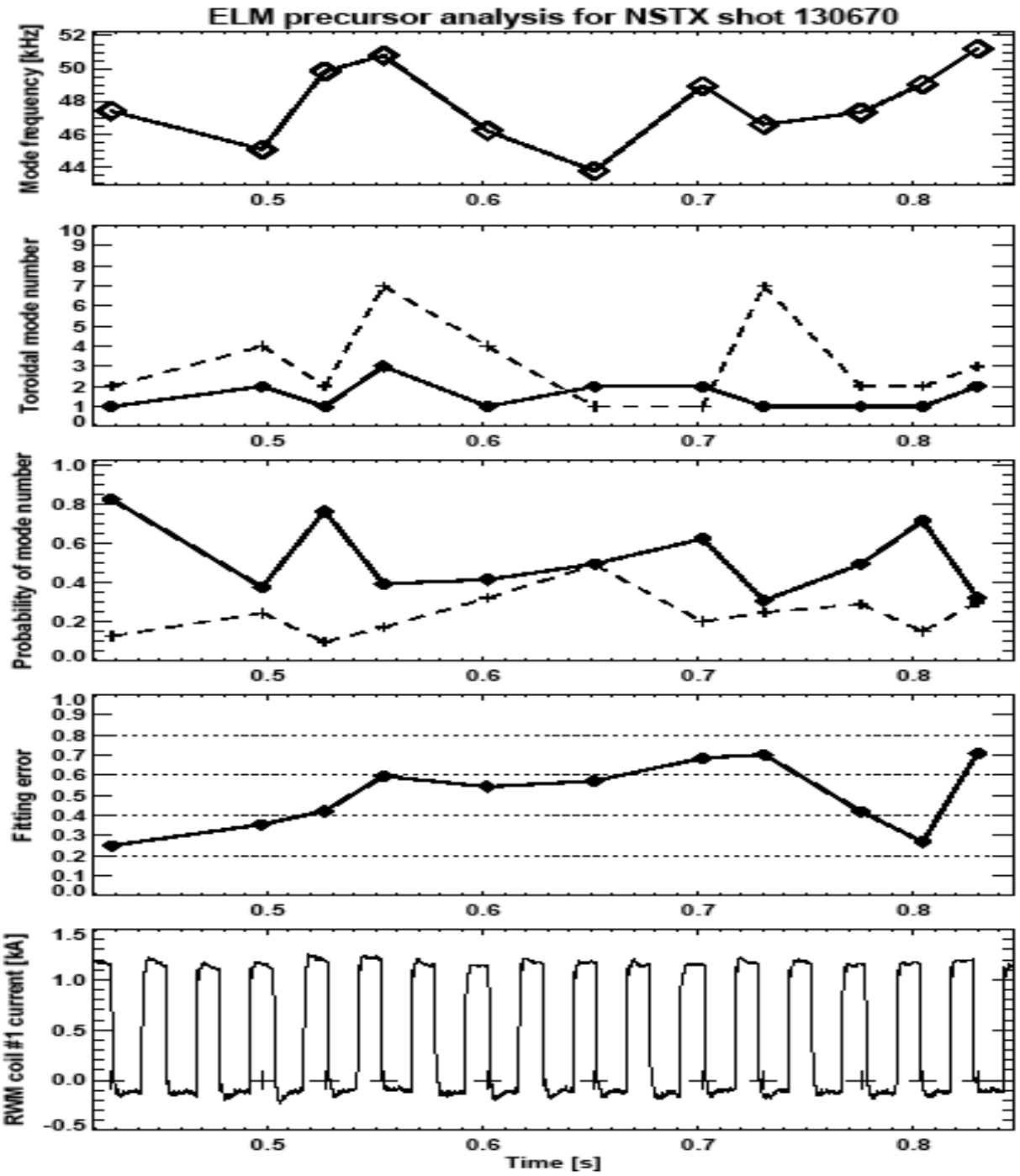
n = 2
~ 75 kHz

NSTX 129030 w / lithium - ELM at 0.4292 s



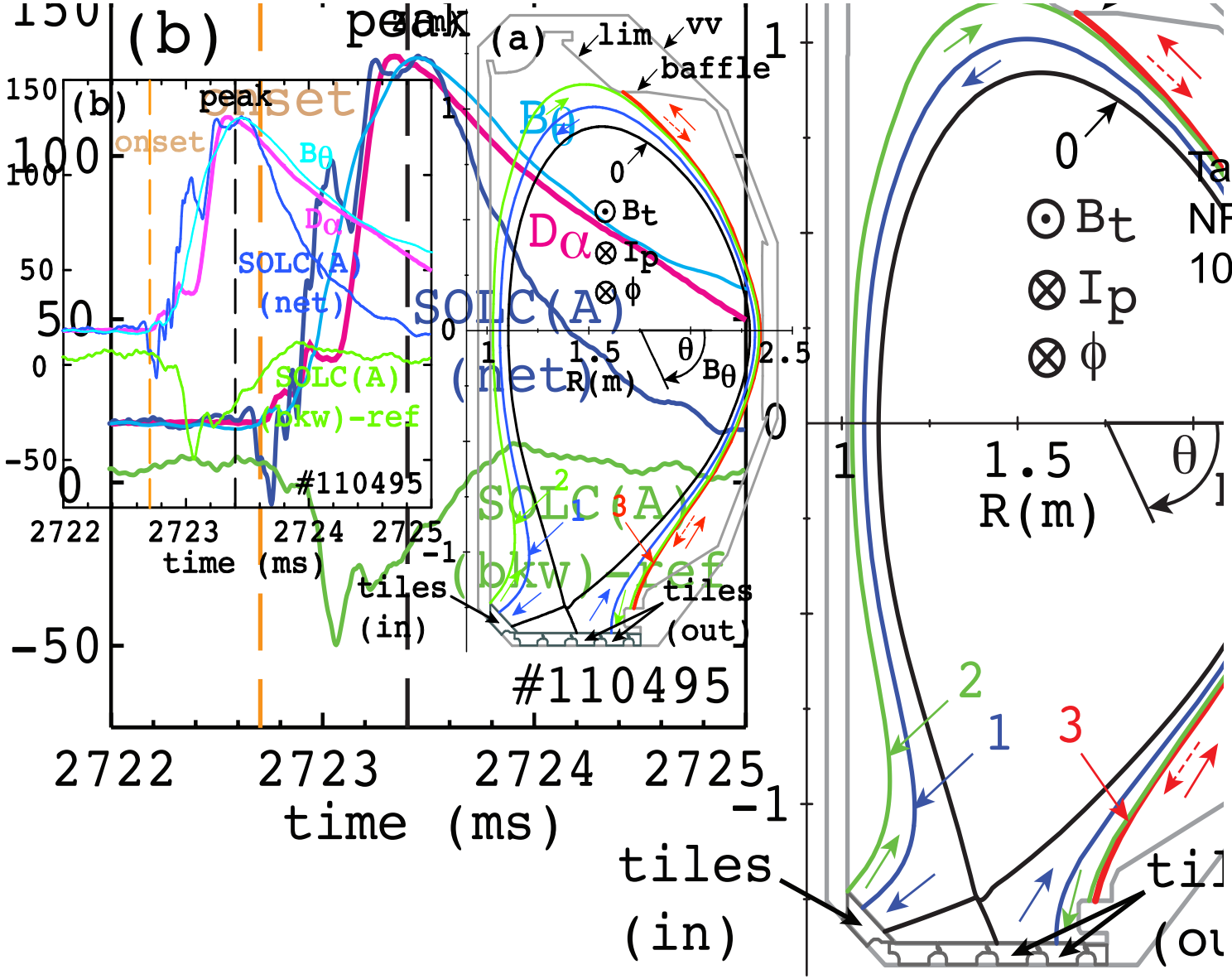
NSTX 130670 w / nRMP – ELM at 0.6036 s





J. Menard
ELM-FIT code

SOLC correlated with ELMs in DIII-D by Takahashi et al



Takahashi et al, NF 44 (2004) 1075.

Discussion of Results

n = 2,3,4,5,6 modes -> slowly growing ELM that are smaller

n= 1 modes appear to be necessary for fast growing, large amplitude ELMS

SOL currents are likely candidates for n= 1/ n= 2 modes

ELM sequence outlined by T. Evans et al. JNM 390-391 (2009) 789.

1) Transient event initiated by peeling-ballooning mode as pedestal pressure gradient limit > marginal stability limit. Initial pulse of heat and particles propagates into preexisting homoclinic separatrix tangle.
2) Onset of thermoelectric current driven between outer and inner target plates due to T_e difference between plates from initial heat pulse.
3) Original helical filament grows explosively as thermoelectric currents amplify the lobes of the homoclinic tangle and induce strong pedestal stochasticity. Results in self-amplification ob lobes due to positive feedback loop between lobe size, stochastic layer width and increase heat flux to target plates driving the current.
4) ELM crash- temperature in pedestal drops enough for plasma to become more collisional and resistive. A) Shuts down energy source for thermoelectric currents collapsing lobes to pre-ELM configuration. B) Decrease electron collisional mfp compared to connection length of filamentary lobes which reduces parallel thermal conductivity and shuts down heat flux to target plates.