Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

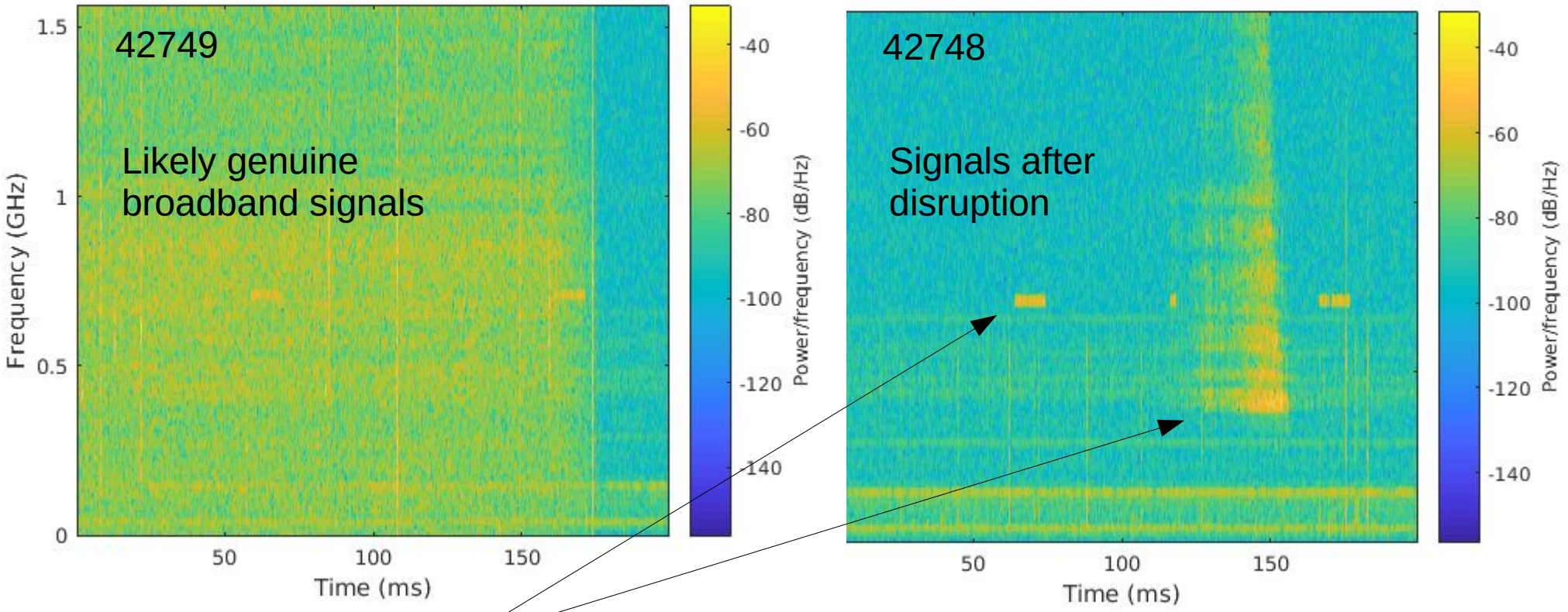
Debriefing F09 24/05/2019 morning

F09: Waves excitation by REs

WIP 27-05-2019

P. Buratti for F09 team

From briefing



- Check artifacts
- Test new antenna/acq configurations
- Vary RE content
- B scan

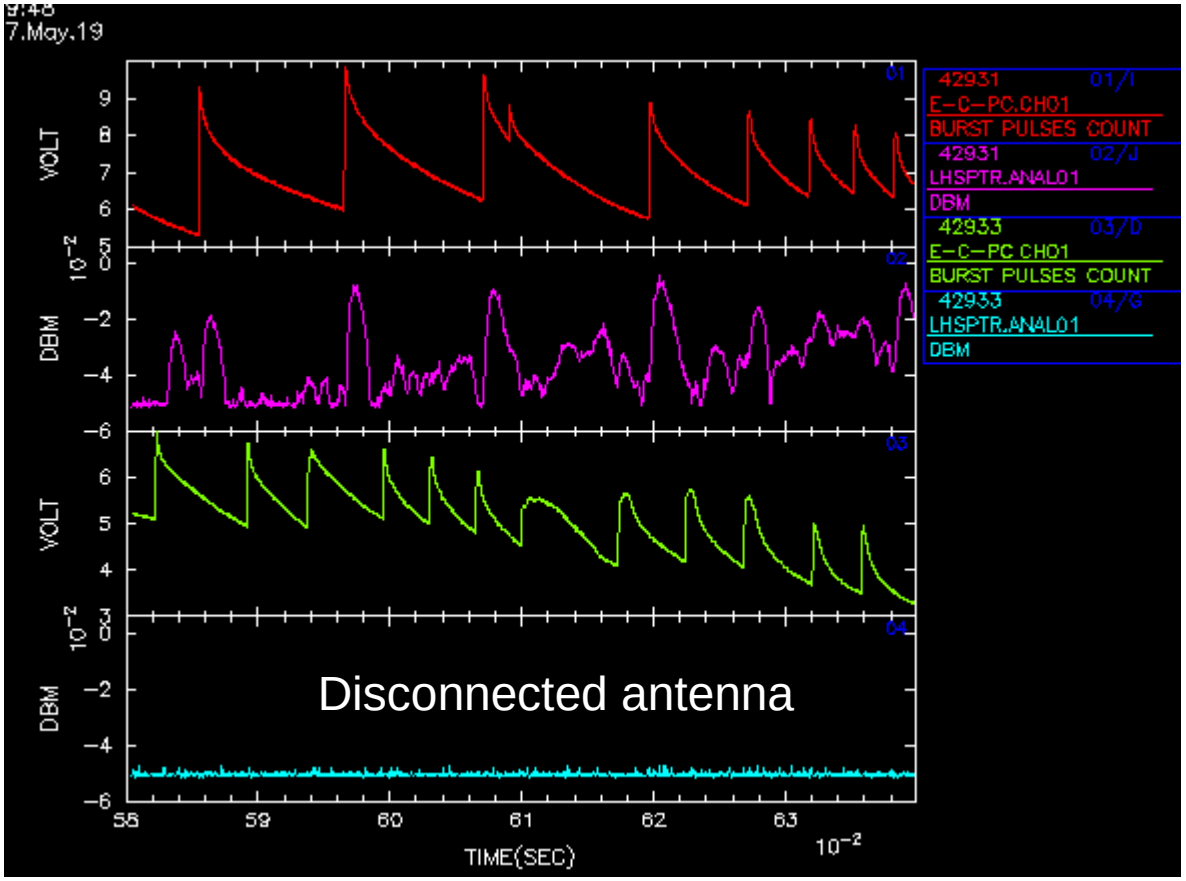
Crucial test on artifacts with blind antenna

ECE

RF from spectrum analyzer

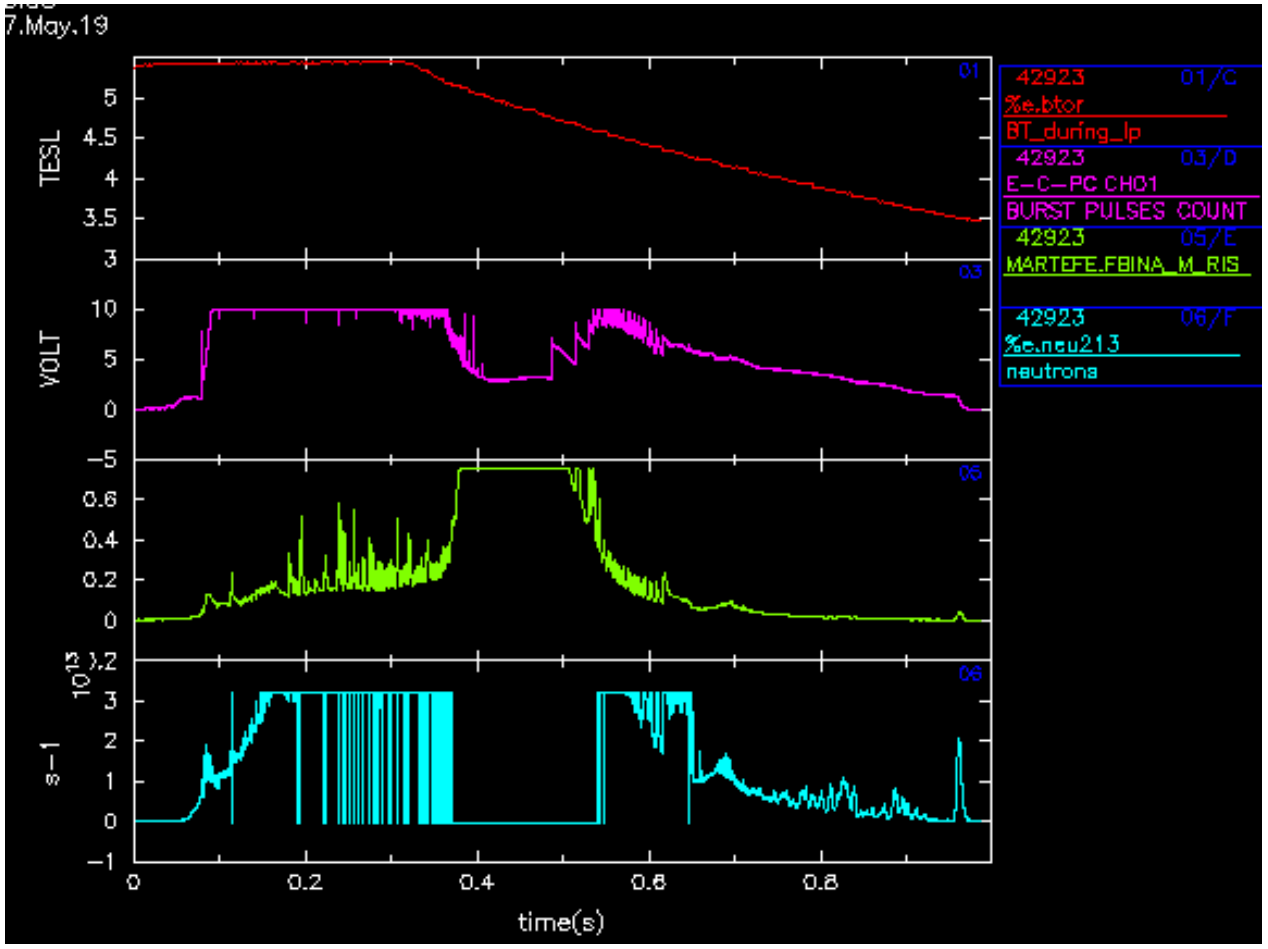
ECE

RF from spectrum analyzer



- RF signal correlated with anomalous Doppler evidence
- No signal with disconnected antenna: signal peaks are genuine RF and not hard x-ray or em influences on the amplifier.

8 pulses with data from fast ADC



- 200 ms with 1.5 GHz Nyquist frequency
- B scan

16/04 team

SC: P. Buratti, C. Castaldo

RdO: O. D'Arcangelo, M. Cappelli

PIC: G.Pucella, C. Castaldo, F. Napoli

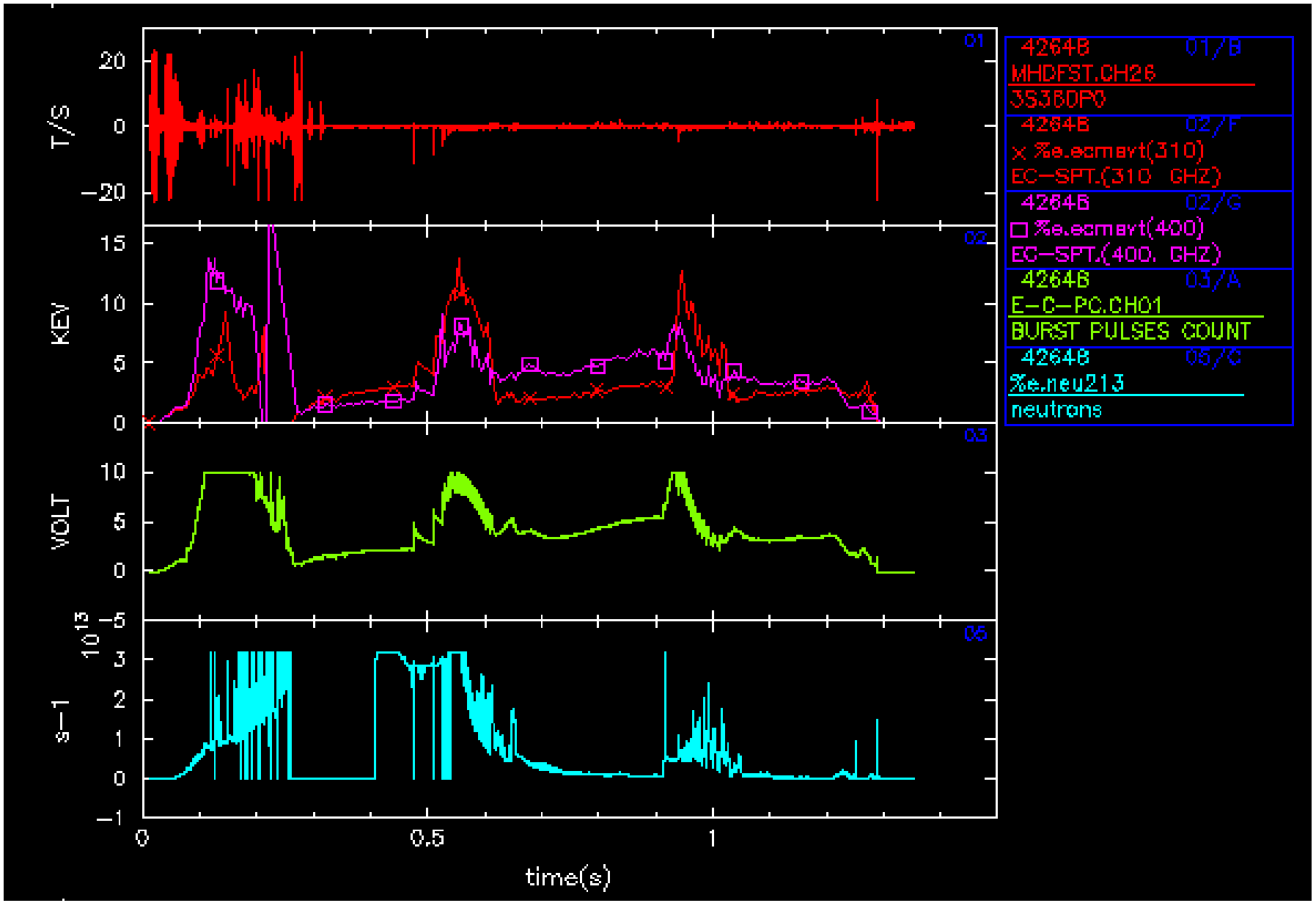
F09: S. Ceccuzzi, L. Gabellieri, F. Bombarda, D. Carnevale, A. Cardinali, F. Napoli, L. Panaccione + W. Bin and B. Baiocchi from CNR/MI

Pulse list (pulses with positive detection only)

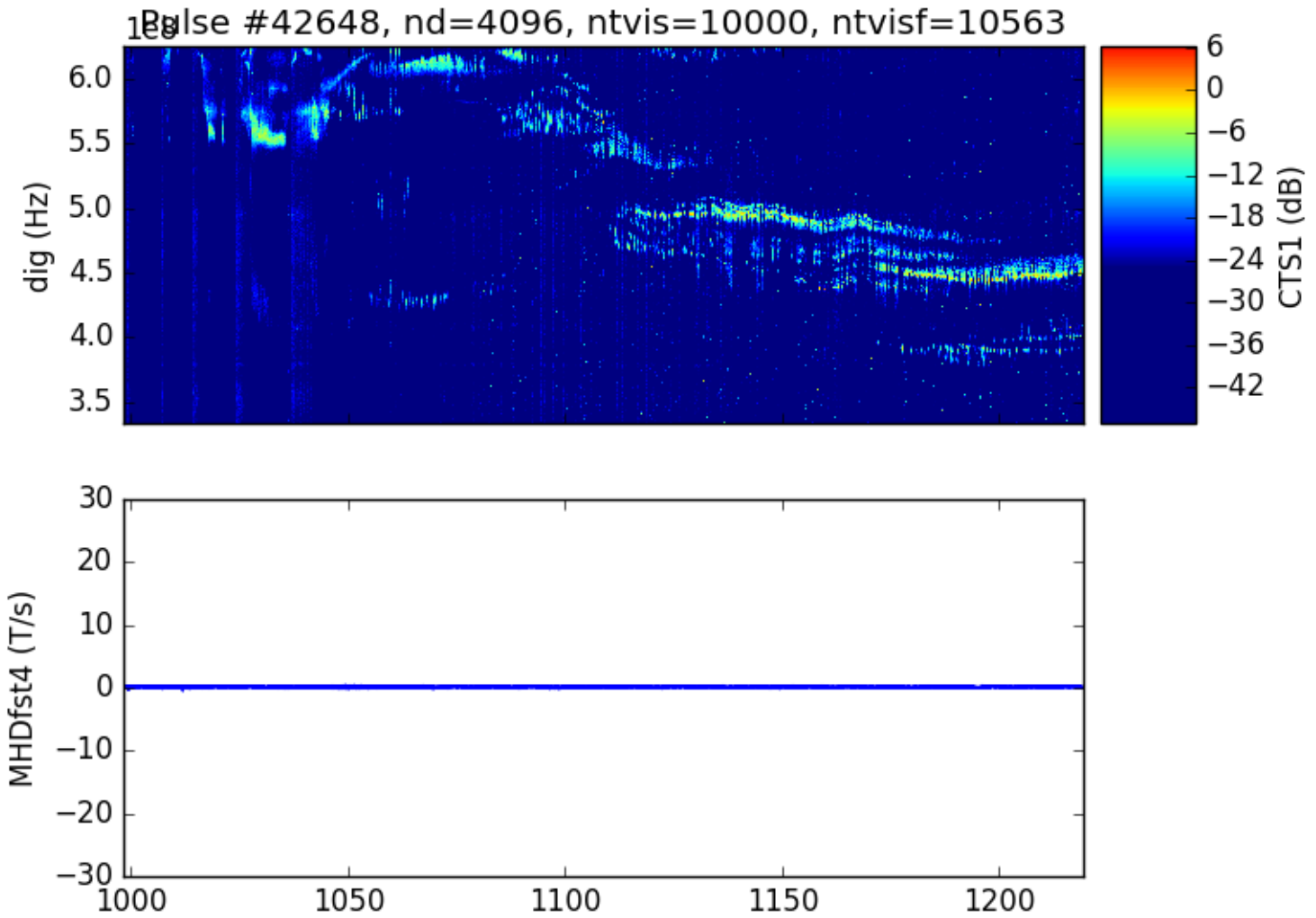
- **42648**
  - Soft stop (+current quench?) and long tail with hot plasma
  - Fe LBO at 0.9 s
  - Radiometer acquisition 0.77 – 1.27 s
- **42658**
  - Soft stop and long tail with hot plasma
  - BT ramp down at 0.916 s
  - Radiometer acquisition 0.85 – 1.35 s
- **42660**
  - Soft stop and long tail with hot plasma
  - Fe LBO at 0.9 s
  - Radiometer acquisition 0.77 – 1.27 s

All with 'slow' acq, Nyquist around 600 MHz, not sufficient.

42648 (0.77 – 1.265 s)

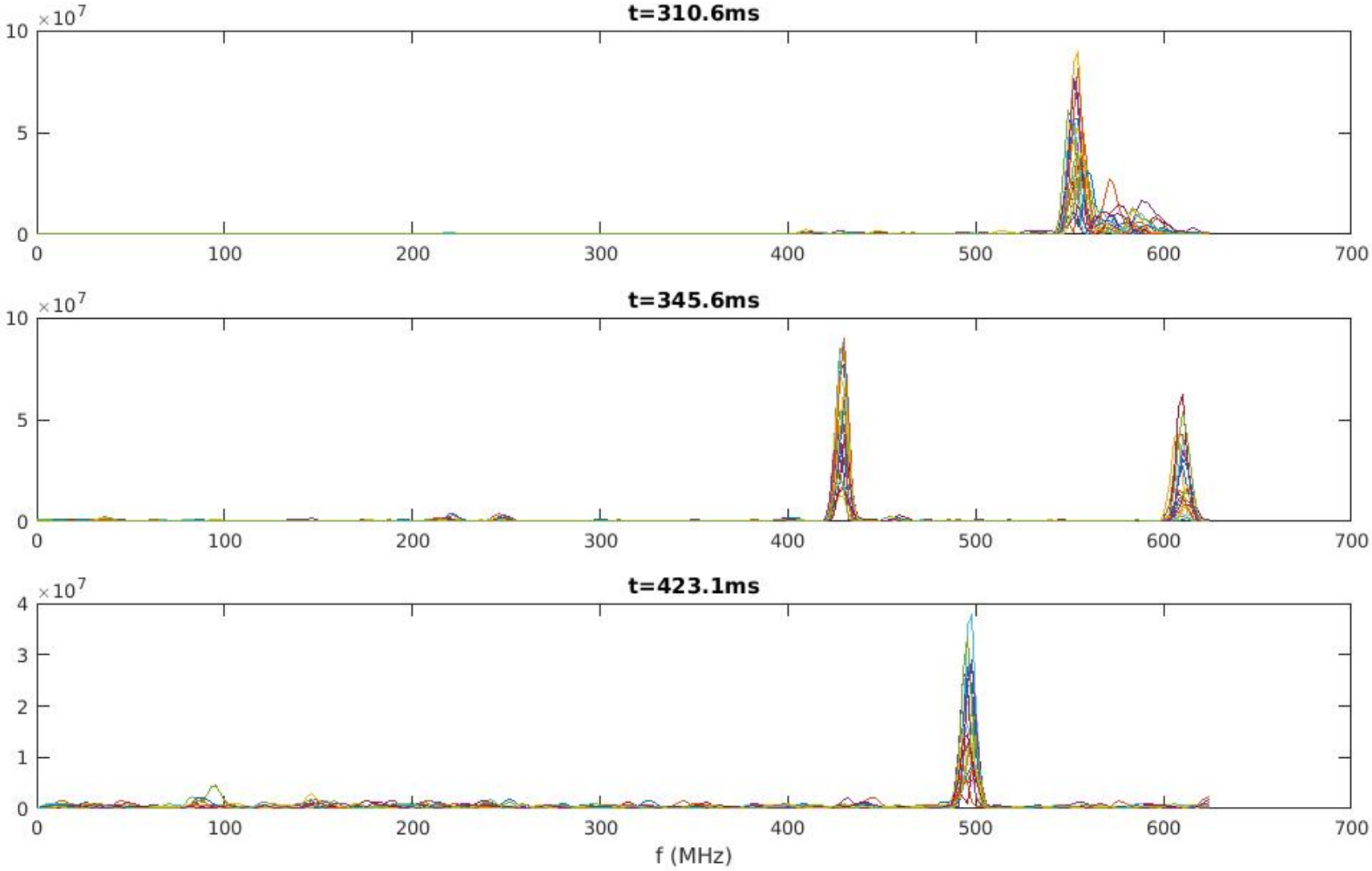


42648 lines 350 – 600 MHz



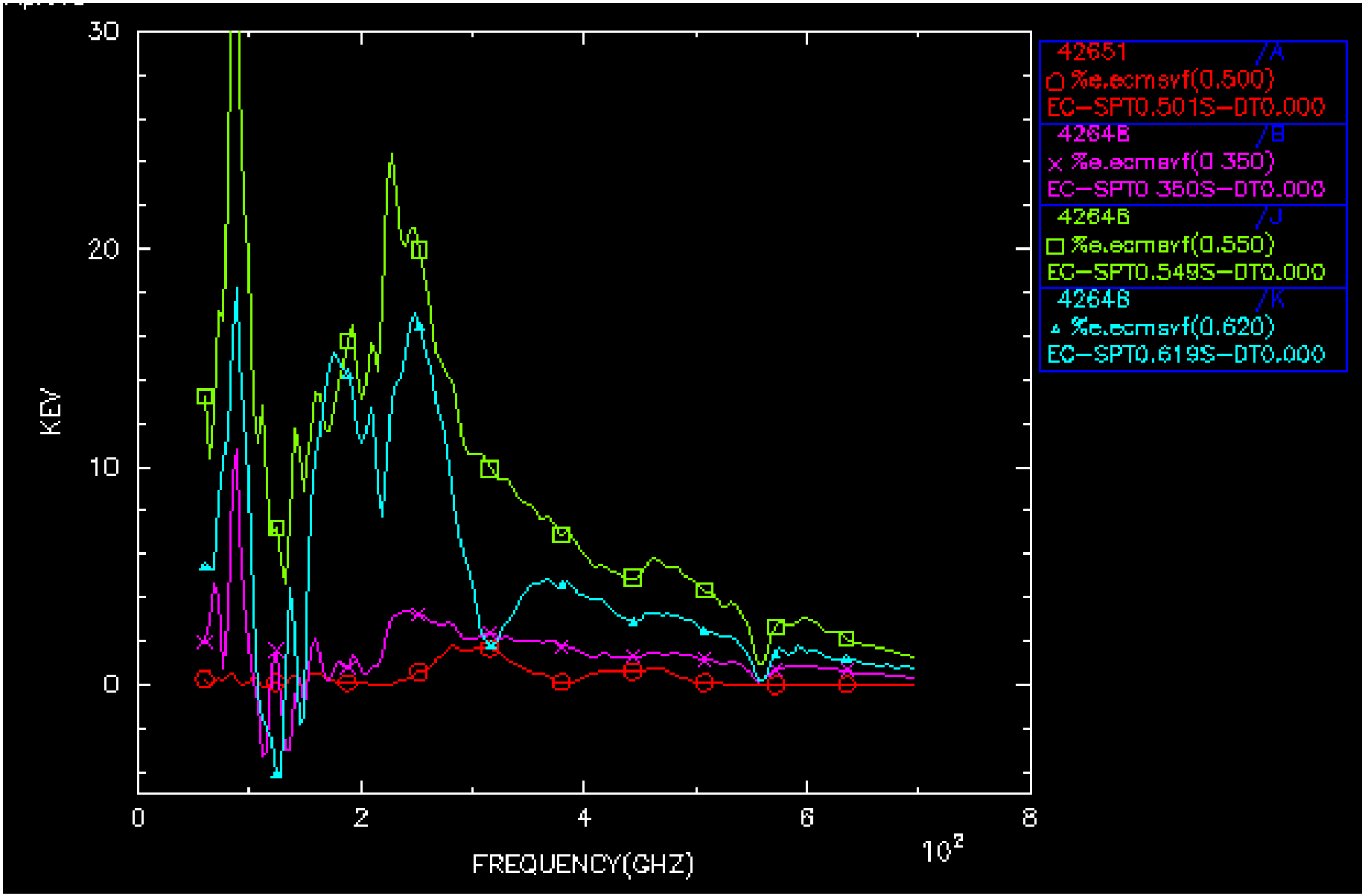
W. Bin

42648 time slices (time after trigger)

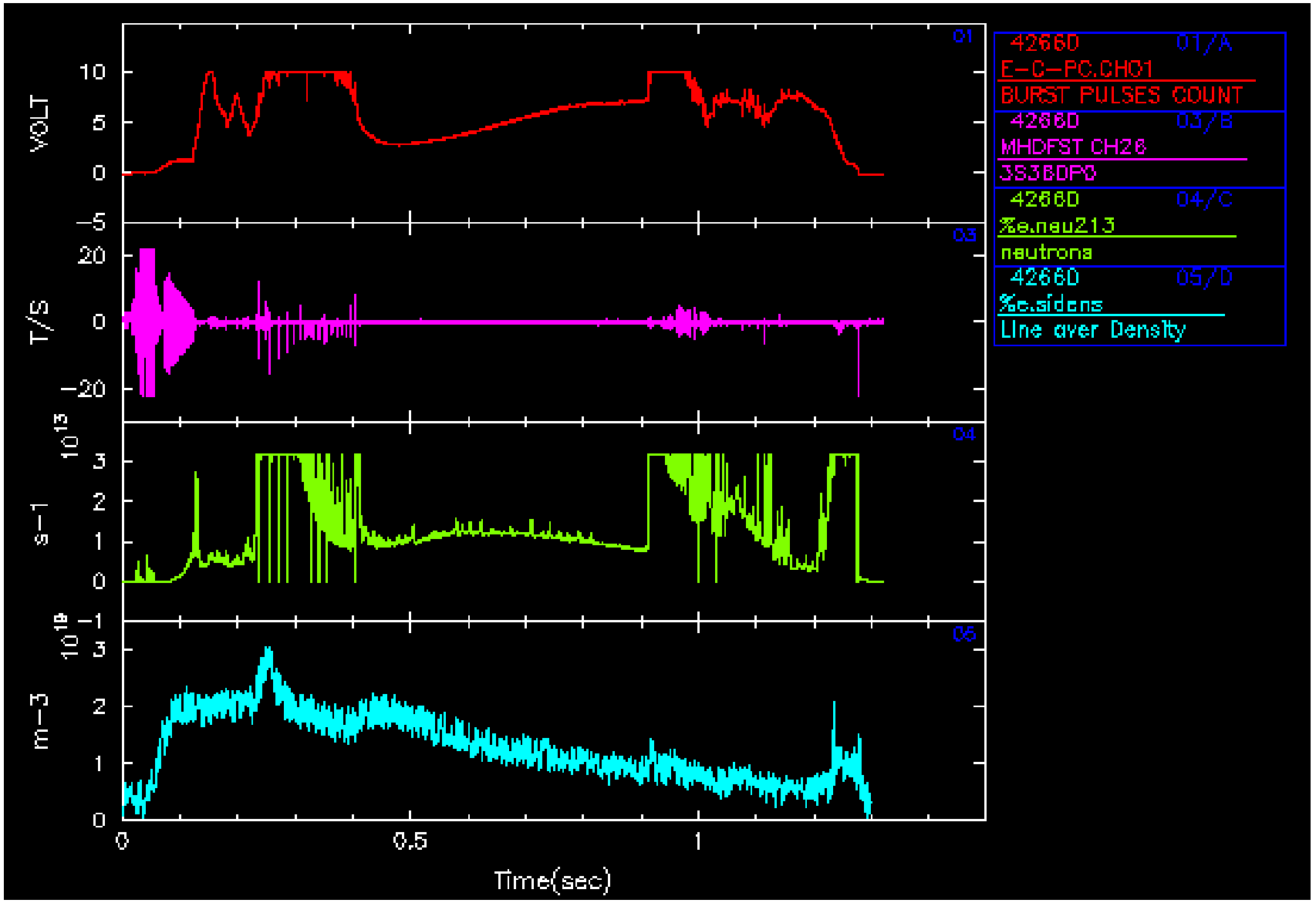


F. Napoli

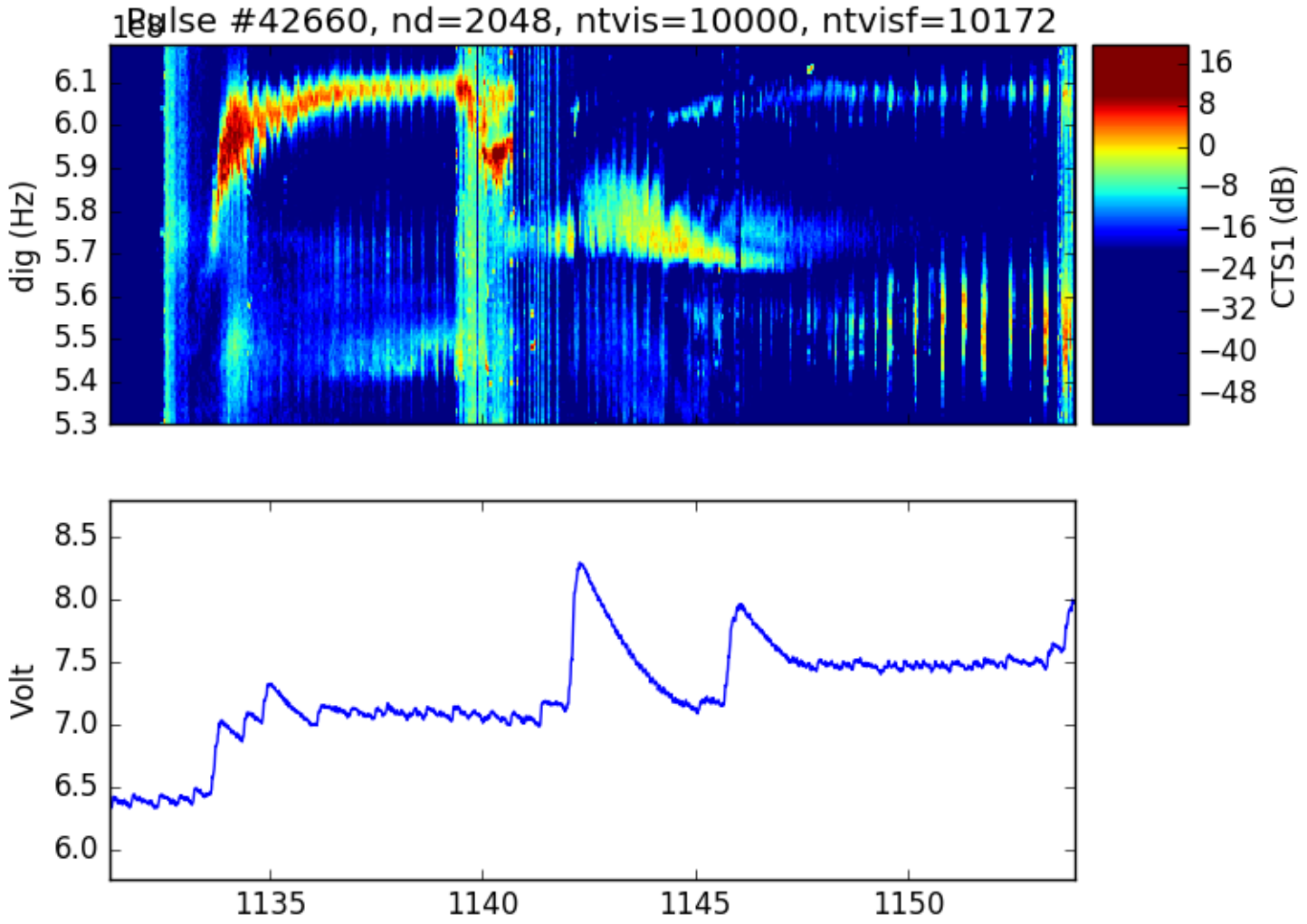
42648 signs of thermal plasma reappear at 0.62 s



42660


42660 01/A
E-C-PC.CH01
BURST PULSES COUNT
42660 03/B
MHDFST CH26
3S3BDP0
42660 04/C
%e.neu213
neutrons
42660 05/D
%c.sidens
LIne aver Density
WOLT
T/S
s-1
m-3
Time(sec)

42660


Pulse #42660, nd=2048, ntvis=10000, ntvisf=10172
1e3
6.1
6.0
5.9
5.8
5.7
5.6
5.5
5.4
5.3
dig (Hz)
16
8
0
−8
−16
−24
−32
−40
−48
CTS1 (dB)
8.5
8.0
7.5
7.0
6.5
6.0
Volt
1135
1140
1145
1150

W. Bin

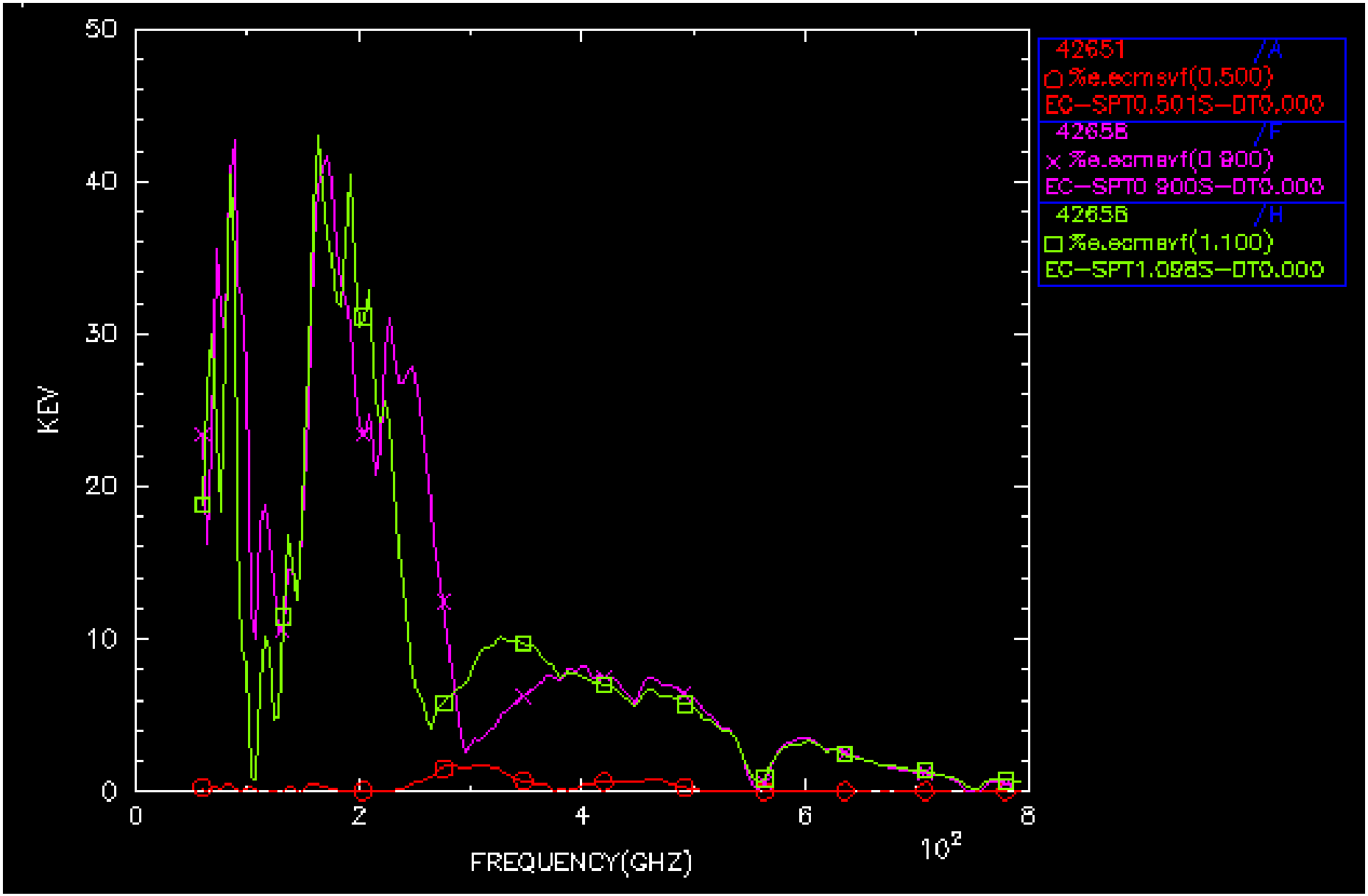
Pulse plan for 16/04 morning

- Reference 42660 5.3T/360kA with shortened duration (depending on IC1 limit and RE control request)
- Fast acquisition 0.2 - 0.45 s
- Repeat with acq 0.4 – 0.65 s
- Repeat with acq 0.6 – 0.85 s and Fe LBO at 0.7 s
- Zero for BT ramp-down
- BT ramp-down from t = 0.5 s (or adjust to interval with good signal)
- 5.3T/lower current for lower density
- Repeat with gas puff for density dependence
- Continue in parasitic

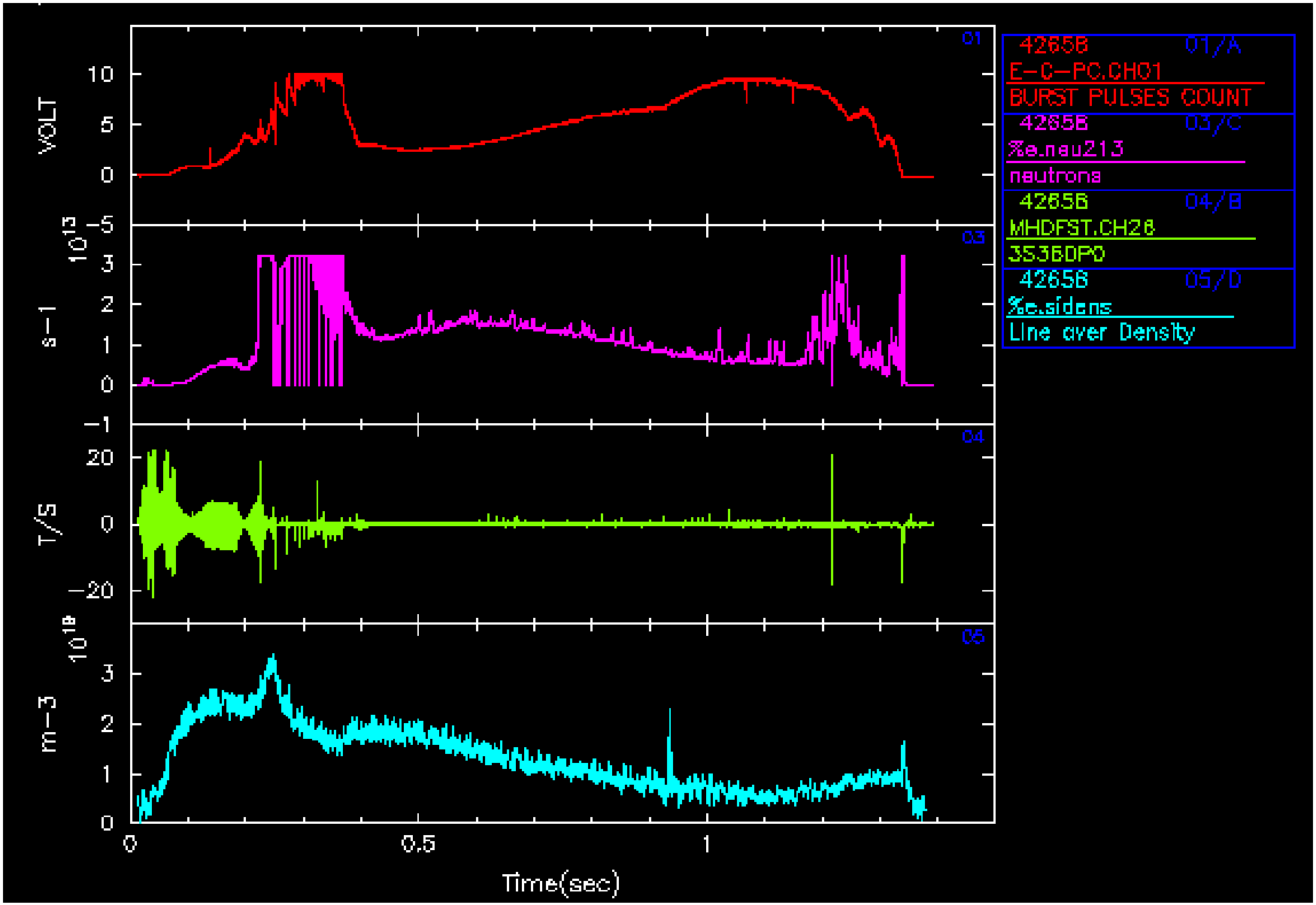
42648 (0.77 – 1.27 s)

- **42648** Current quench at *t* = 0.26 s, *n* < 4.E19; end 1.3 s
  0-0.26: Michelson 7V, NEU213 2.5E13 both with spikes; ADI
  0.26-0.47: Michelson 1.2V fully non thermal, NEU213 sat, no ADI
  0.47-0.61: Mich. 5V, N213 going to 1.E13, ADI series
  0.61-0.91: Mich. going up; N213 going to 0; no ADI
  0.91: sudden increase of all markers
  Fe LBO at 0.9
  0.91-1.02: ECE up; N213 up again; ADI series
  1.02-1.3: Mich 2V; N213 some spikes
- ECE spectra:
  before quench: very intense with deep reabsorption (e.g. 0.14)
  0.35 fully non thermal with cutoff at 220 GHz
  resolved ADI .475-.485 (change of shape) and .51-.515
  0.55 fully non-thermal
  0.62 sign of reabsorption by thermal plasma different shape
  reabsorption when S(310)<S(400)

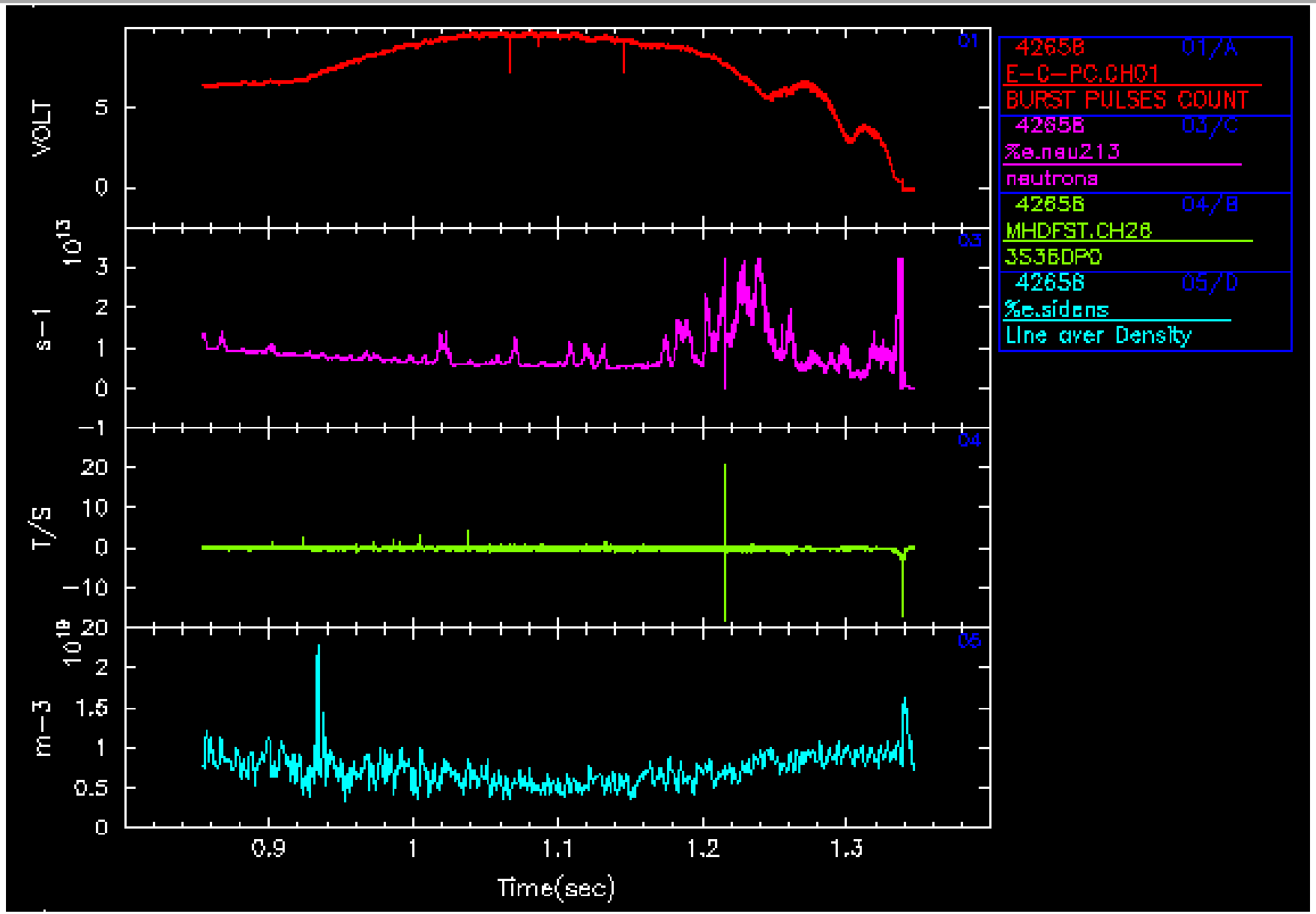
42658 Large ECE but with reabsorption



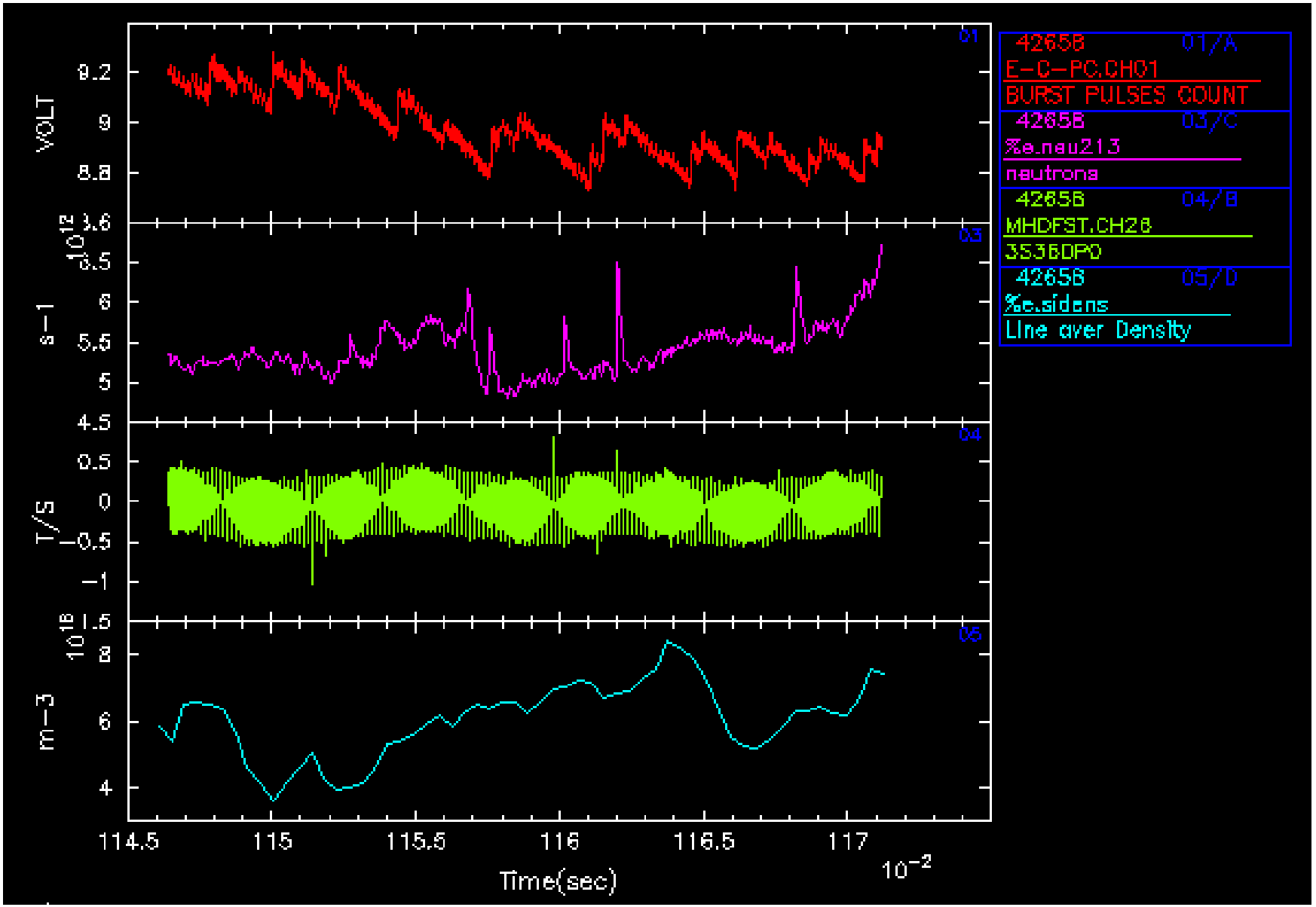
42658 (0.845 – 1.25 s)



42658


01
VOLT
5
0
03
s−1
10^13
3
2
1
0
−1
04
T/S
20
10
0
−10
−20
05
m−3
10^18
2
1.5
1
0.5
0
0.9
1
1.1
1.2
1.3
Time(sec)
42658 01/A
E-C-PC.CH01
BURST PULSES COUNT
42658 03/C
%e.neu213
neutrons
42658 04/B
MHDFST.CH26
3536DPO
42658 05/D
%e.sidens
Line over Density

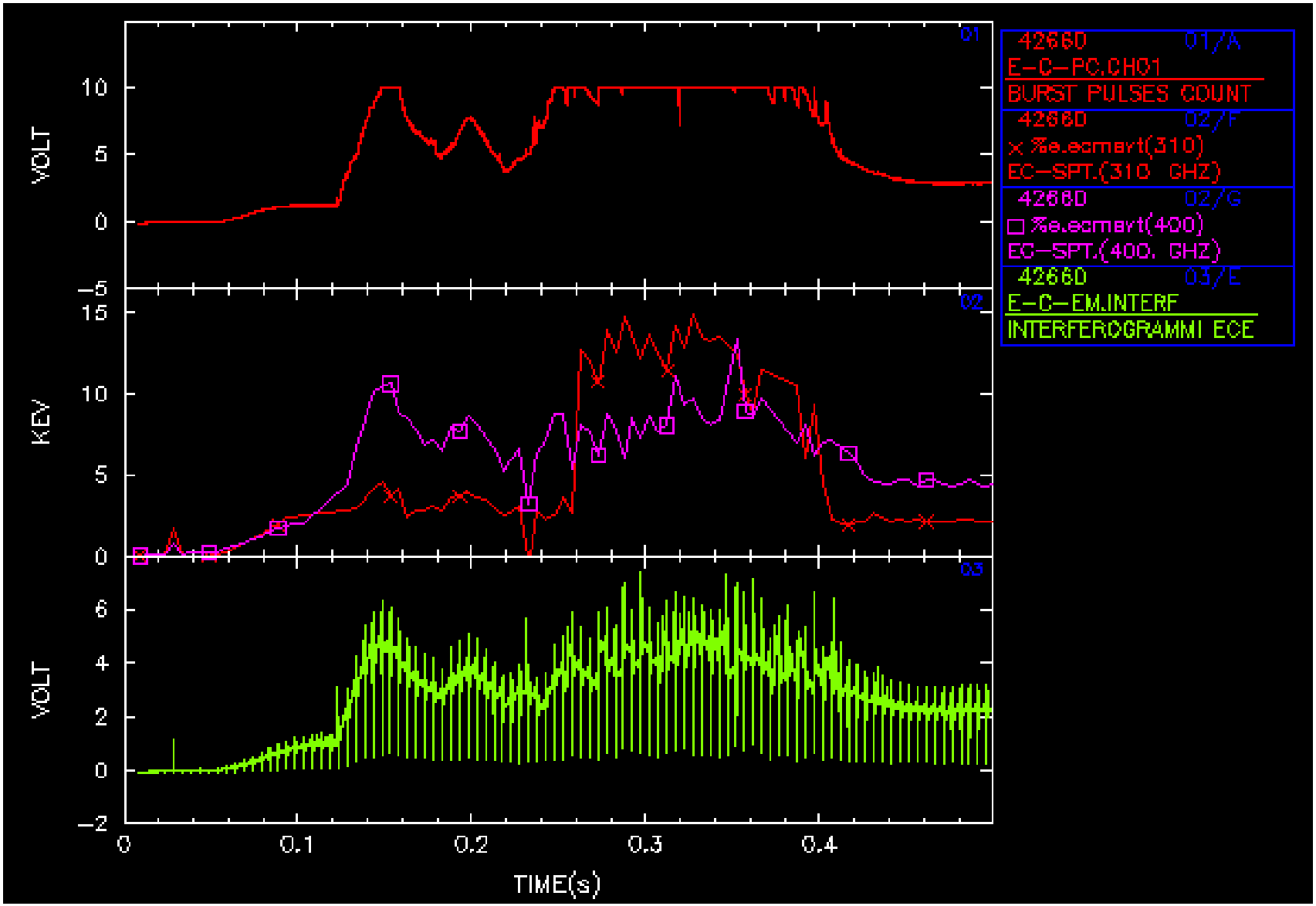
42658 very little ADI



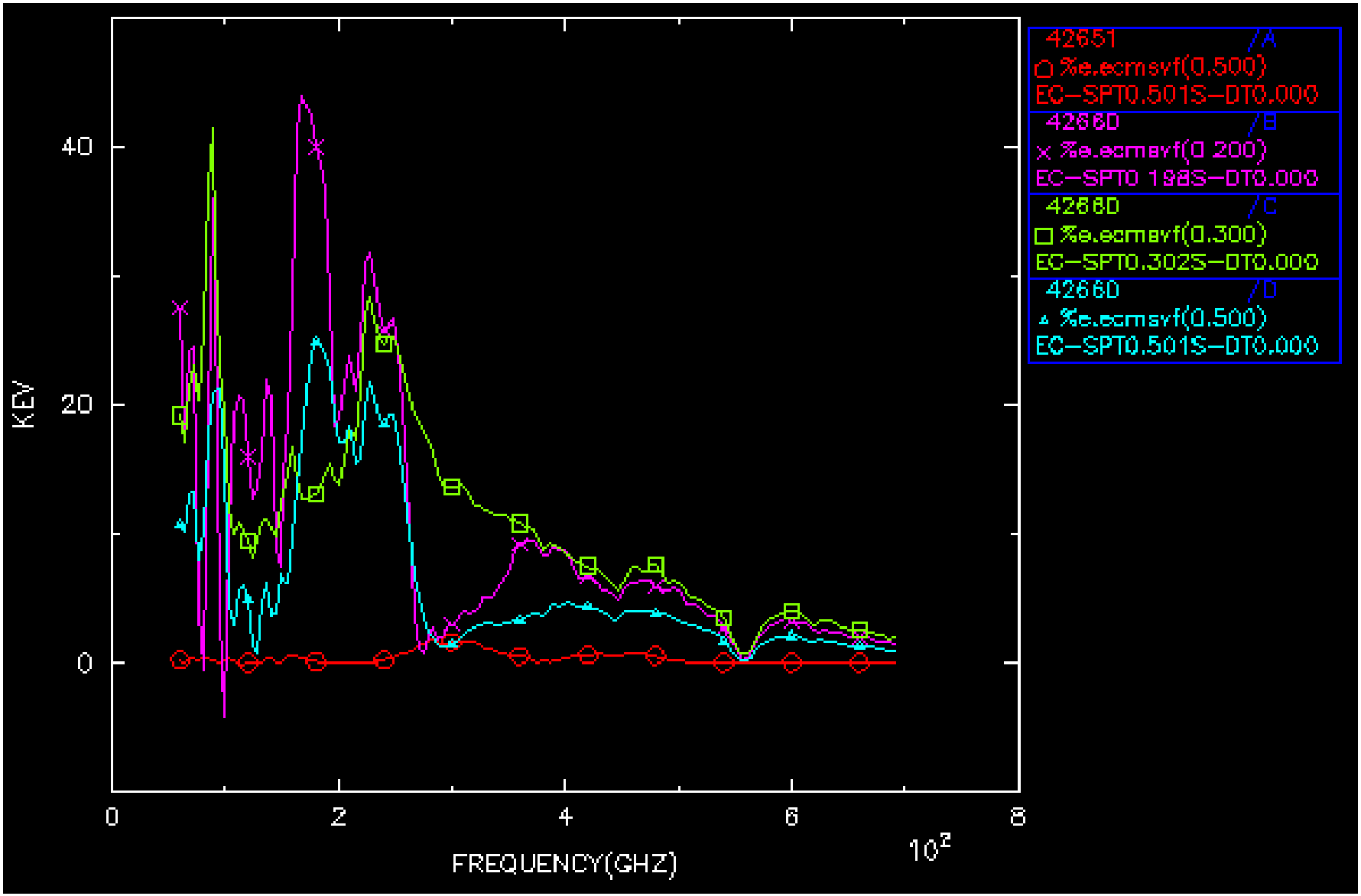
42660 (1 – 1.25 s)

- **42660** SOFT STOP n < 3.E19
  increase of RE signals at 0.91
- Big ADI 0.24 – 0.4 s
- ECE spectra:
  large radiation temperature from t = 0.15 s
  clear thermal reabsorption at t = 0.2 s
  fully non-thermal at 0.3 s (likely from 0.24 s)
  again thermal reabsorption at 0.5 s

42660 (0.18 – 0.4 s)



42660 (0.18 – 0.4 s)

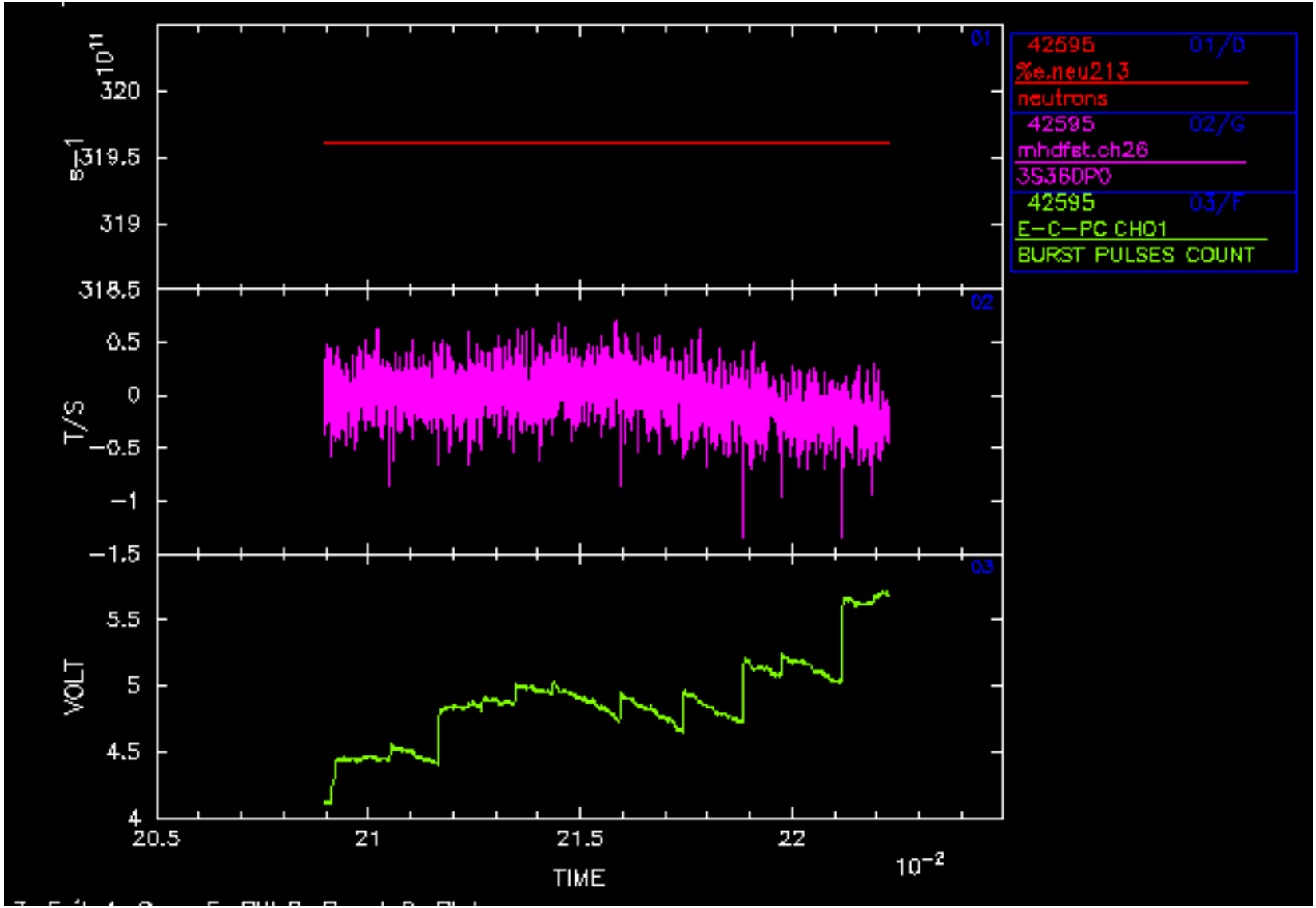


Previous slides

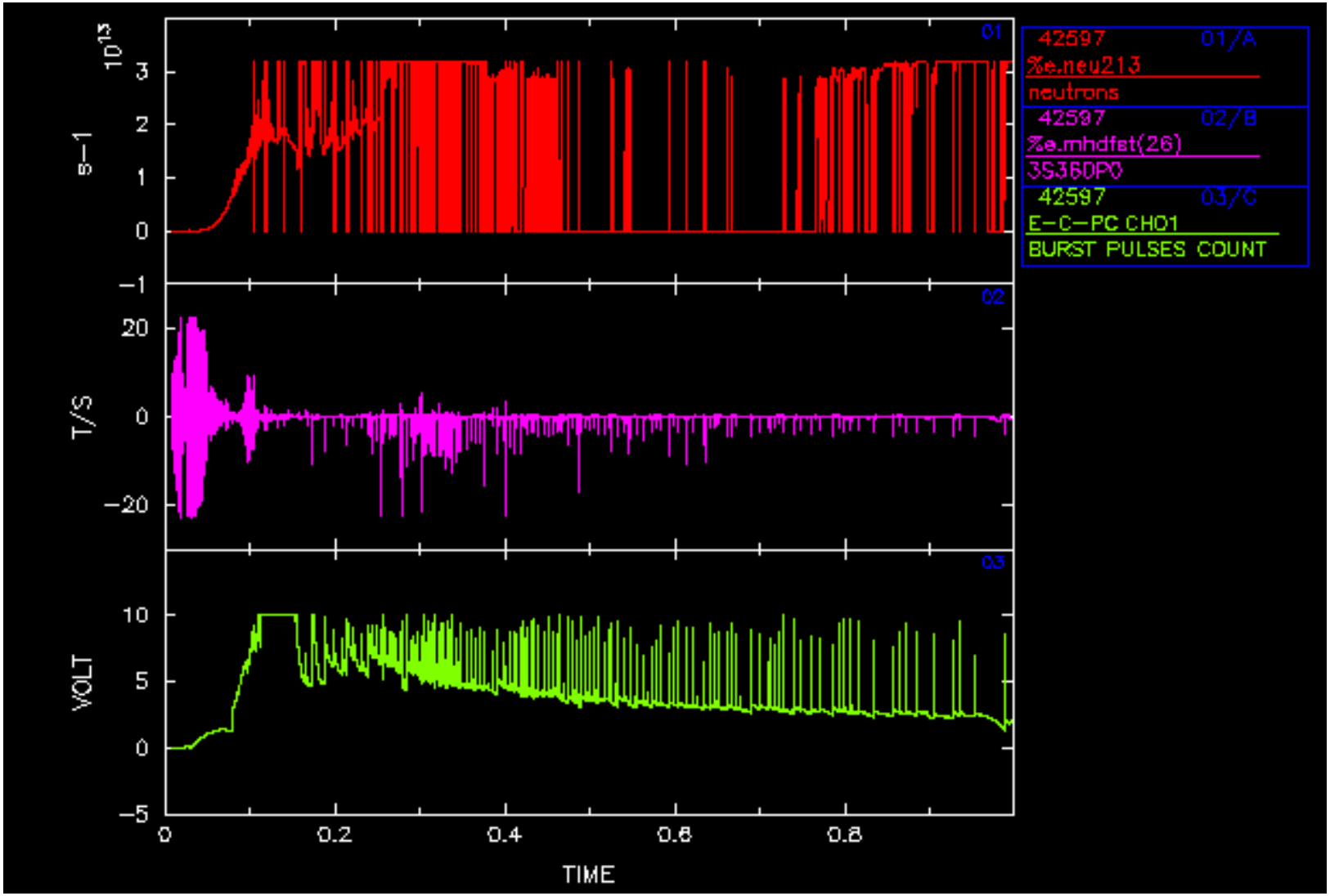
Pulse list (all 5.3 T 500 kA)

- **42588** interesting RE dynamics with locked mode
- **42589** NEU213 to 5E12; thermal ECE
- **42590** Repetitive instabilities with hard-x bursts and decreasing ECE
- **42591** NEU213 to 2.5E13 suprathermal ECE, no ADI
- **42594** NEU213 > 3.3E13 (sat.). Little ADI evidence (ECE jumps at t= 0.27 and 0.6 s, no magnetic spikes). Different synchrotron spot.
- **42595** slightly stronger ADI with magnetic counterpart.
- **42596** some gas. NEU213 near sat. Little ADI.
- ------- F18 pulse:
- **42597** big ADI, record spikes on ECE

Previous slides



42597 big ADI, record spikes on ECE



Results and actions

- No detection of low-frequency waves, including the pulse with extreme instabilities.
- Frequency ranges scan
  - 400-600 MHz #42595
  - 600-760 MHz #42596
  - 760-940 MHz #42594

Actions (parasitic 09/04)

- Decrease bandwidth
- Use low-attenuation cable
- Use CTS acquisition
- Try Langmuir probes as antennas (after 09/04).