CRONOS / JETTO benchmark on JET hybrid pulses #77922 and #76858

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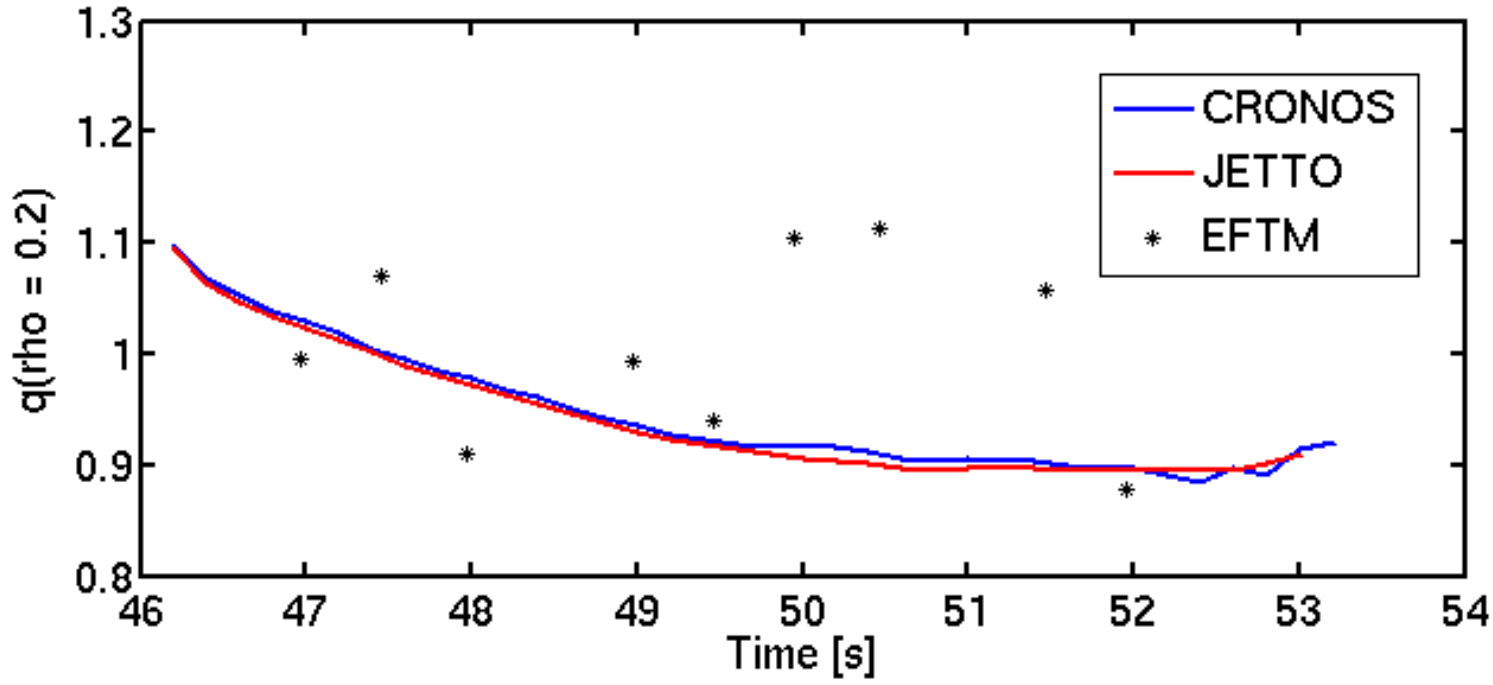
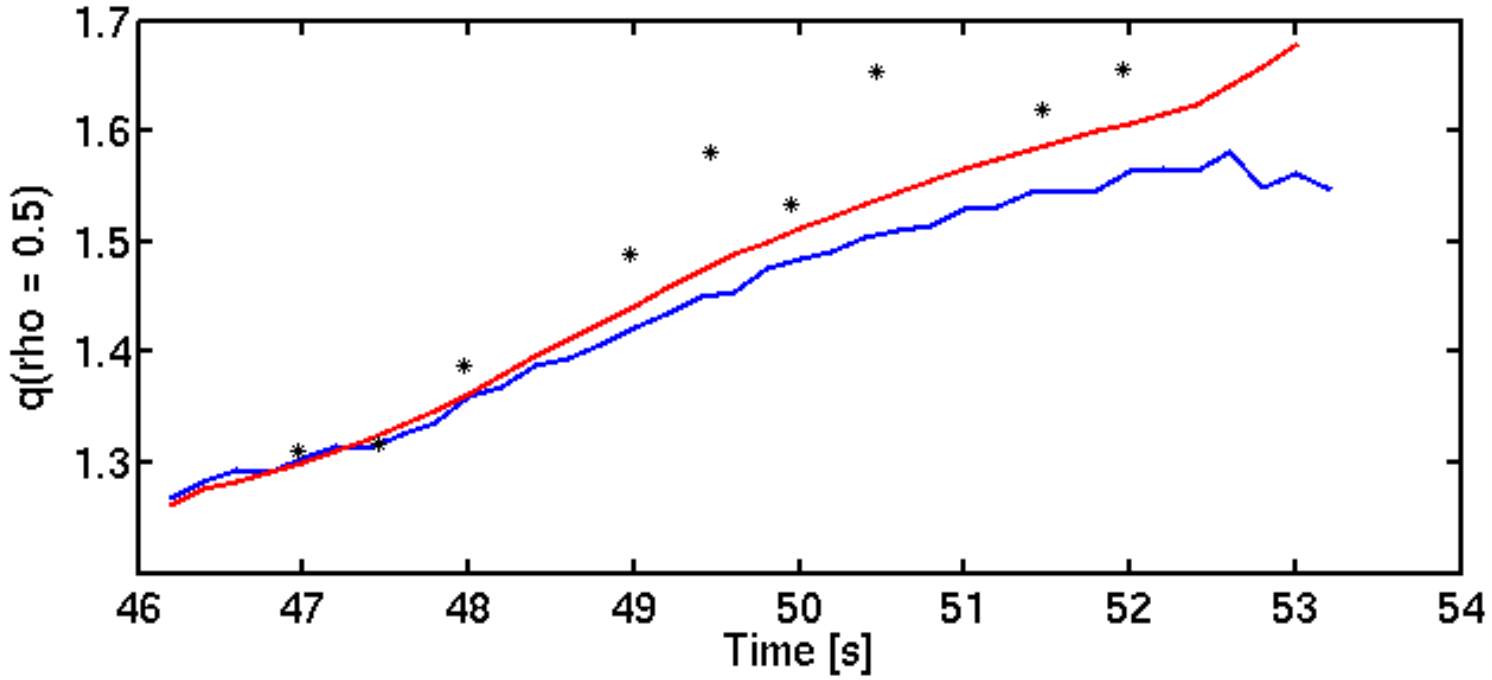
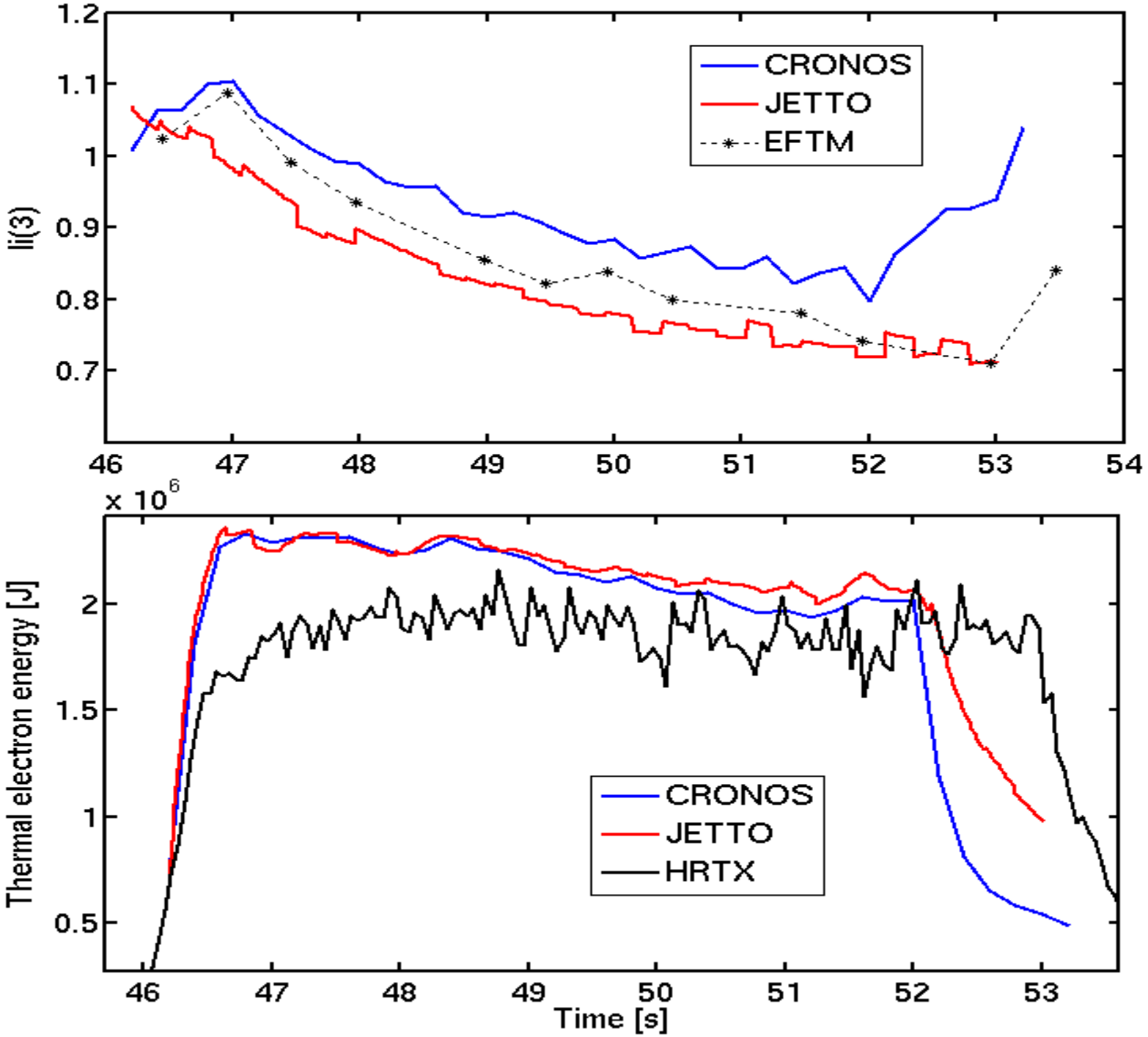
JETTO simulation conditions:

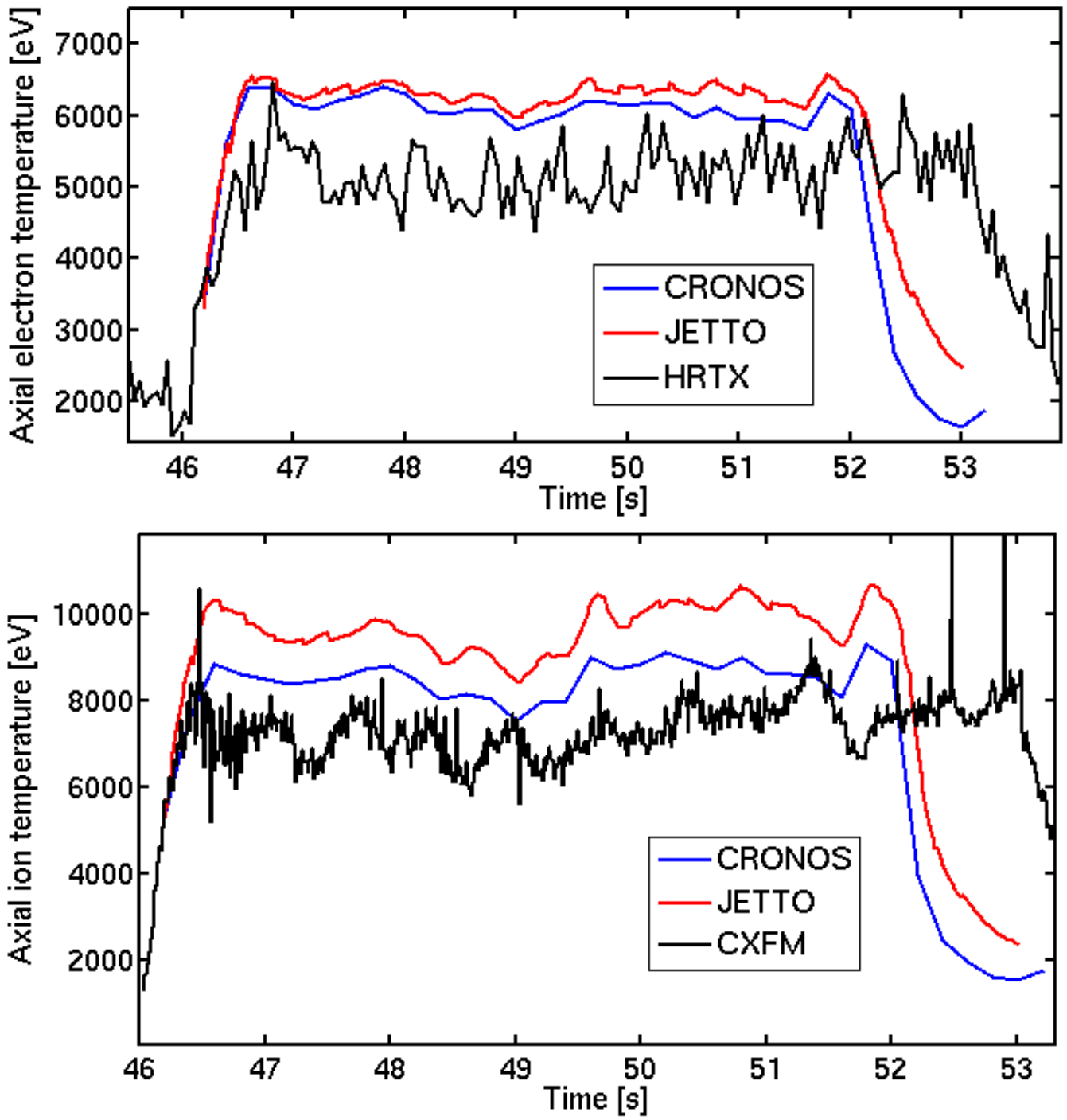
- NE, TE_ini, TI_ini, q_ini, Zeff, NB power & CD profiles from CRONOS
- Plasma shape from EFIT/FLUSH at $\Psi_{norm} = 0.99$ (similar to CRONOS)
- Plasma core: Bohm/gyroBohm model (same as for CRONOS)
- ETB: cont. ELM, with prescribed target temperature on top of pedestal and on boundary close to CRONOS values

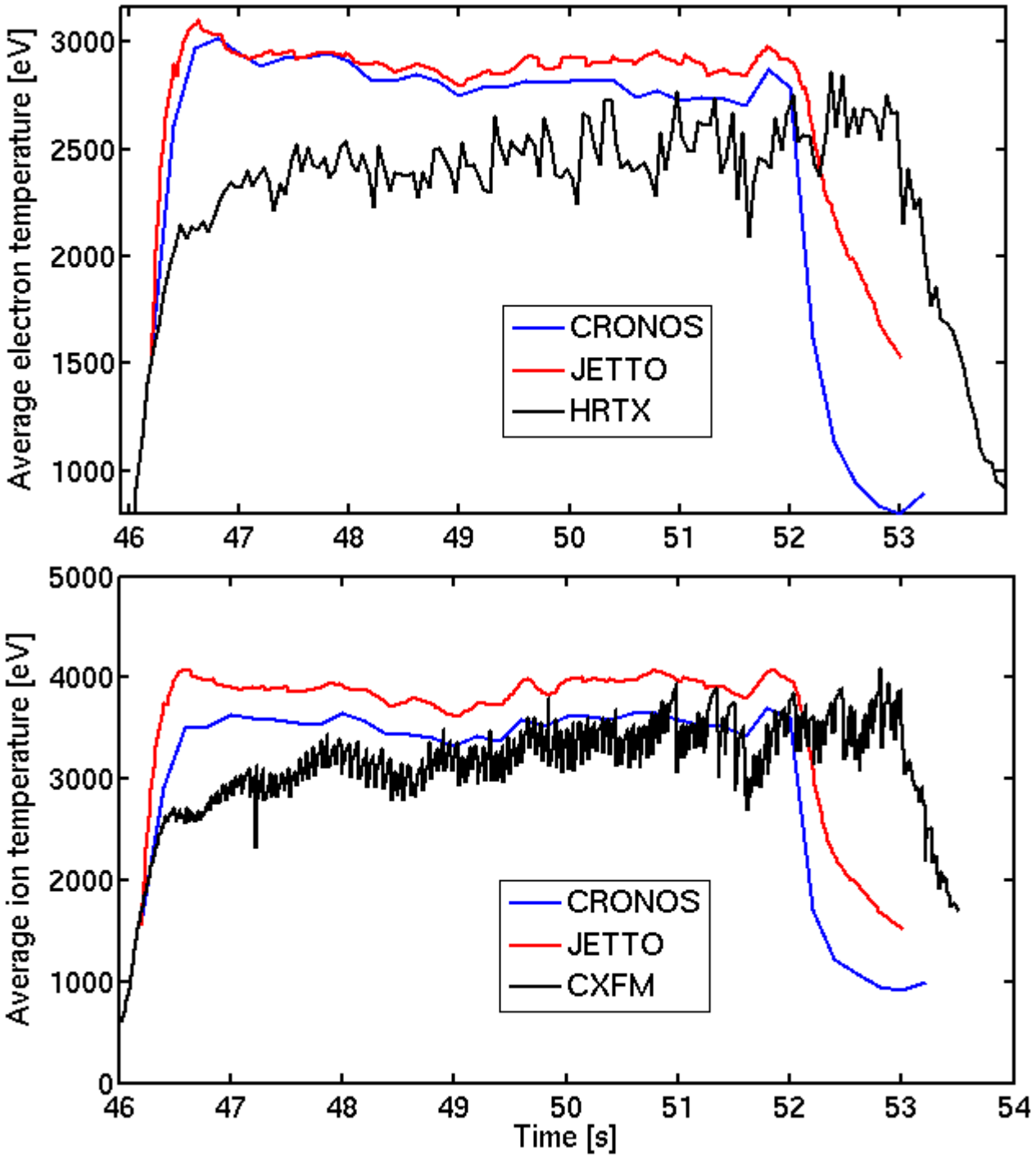
#77922


CRONOS
JETTO
EFTM
q(rho = 0.2)
Time [s]
1.3
1.2
1.1
1
0.9
0.8
46
47
48
49
50
51
52
53
54


q(rho = 0.5)
Time [s]
1.7
1.6
1.5
1.4
1.3
46
47
48
49
50
51
52
53
54

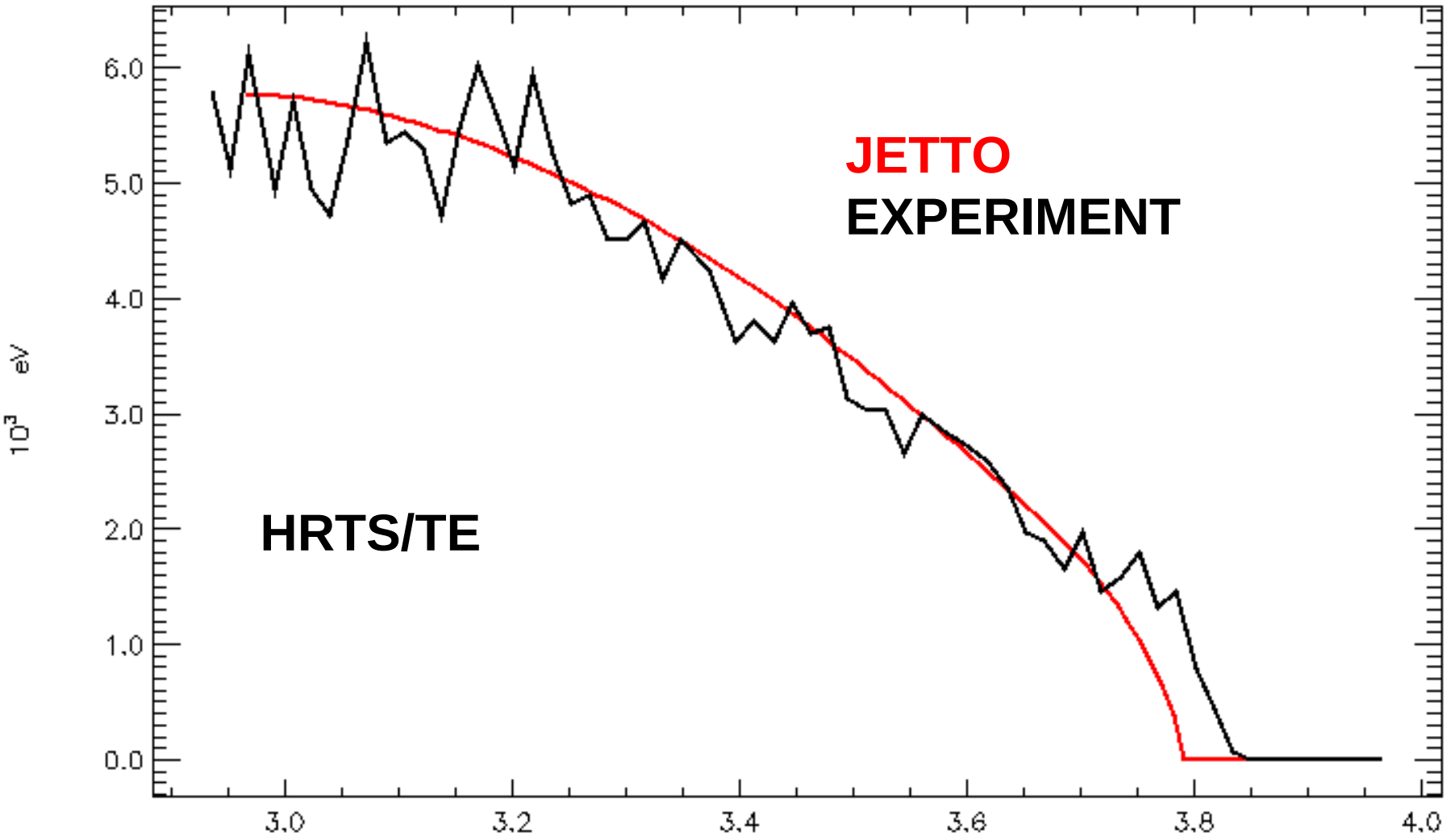

li(3)
CRONOS
JETTO
EFTM
x 10^6
Thermal electron energy [J]
CRONOS
JETTO
HRTX
Time [s]


Axial electron temperature [eV]
7000
6000
5000
4000
3000
2000
46
47
48
49
50
51
52
53
Time [s]
CRONOS
JETTO
HRTX
Axial ion temperature [eV]
10000
8000
6000
4000
2000
46
47
48
49
50
51
52
53
Time [s]
CRONOS
JETTO
CXFM

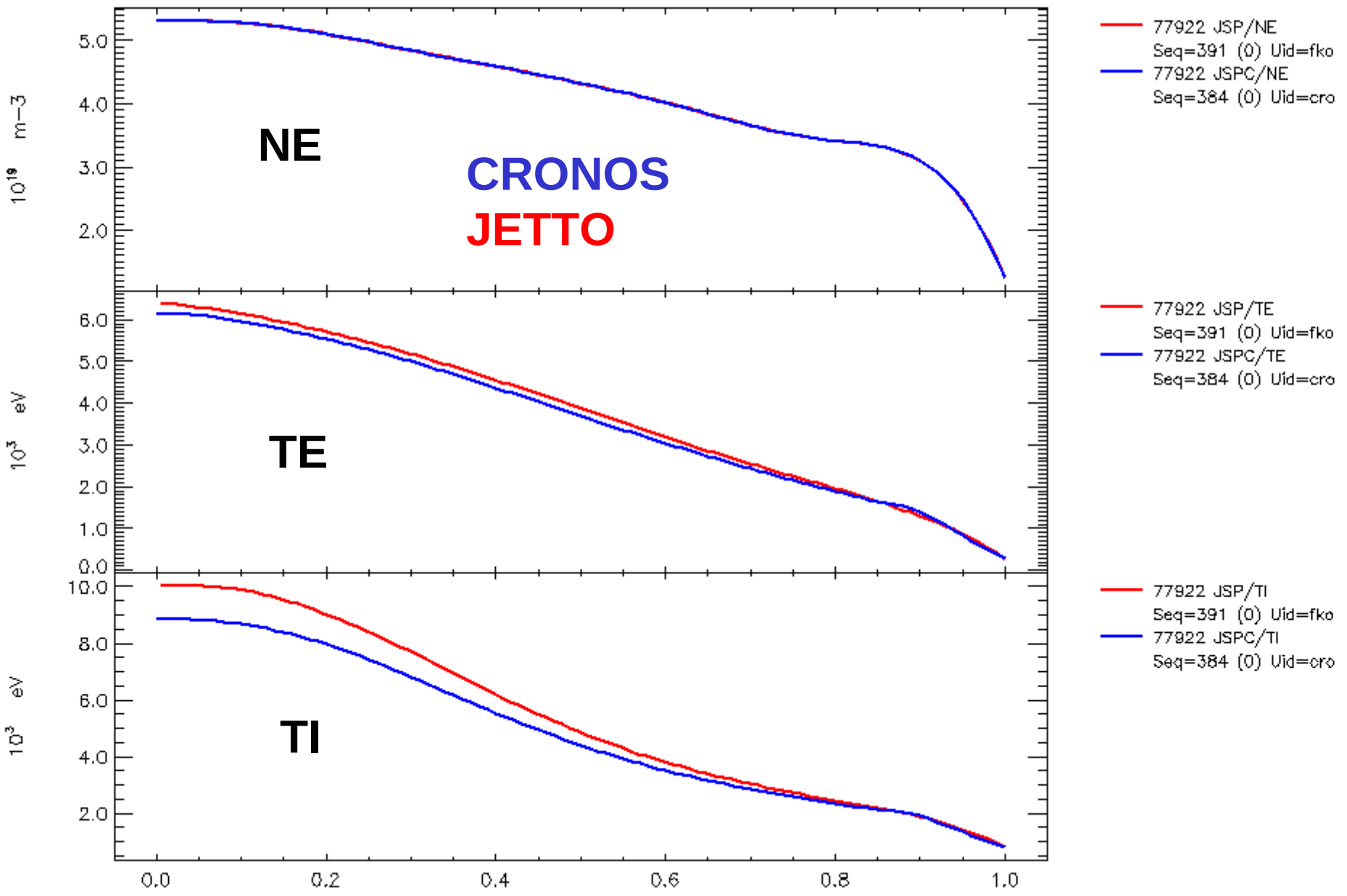

Average electron temperature [eV]
3000
2500
2000
1500
1000
46
47
48
49
50
51
52
53
CRONOS
JETTO
HRTX
Average ion temperature [eV]
5000
4000
3000
2000
1000
0
46
47
48
49
50
51
52
53
54
Time [s]
CRONOS
JETTO
CXFM

Comparison HRTS measurement vs. JETTO synth. diagn.

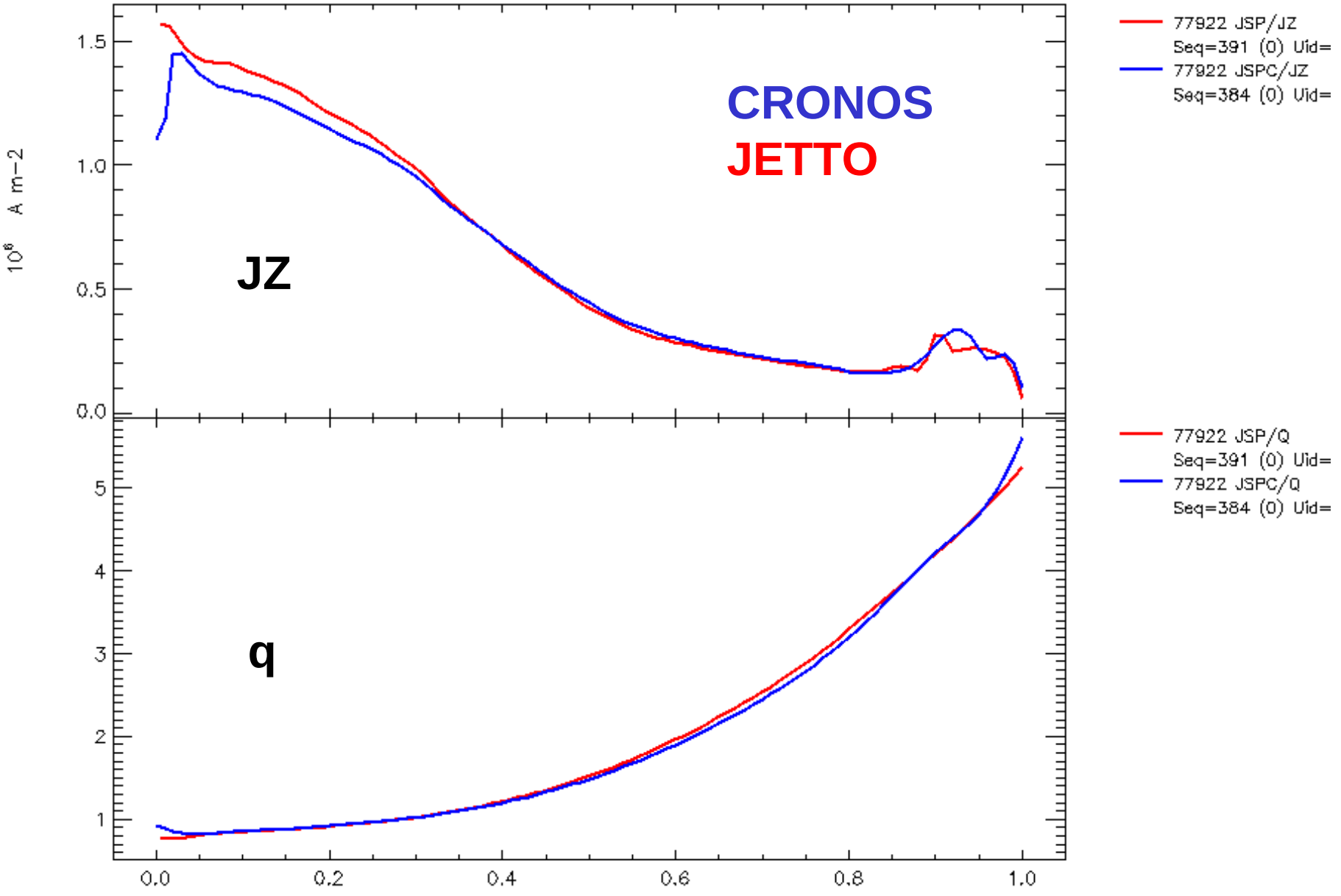
t = 50s



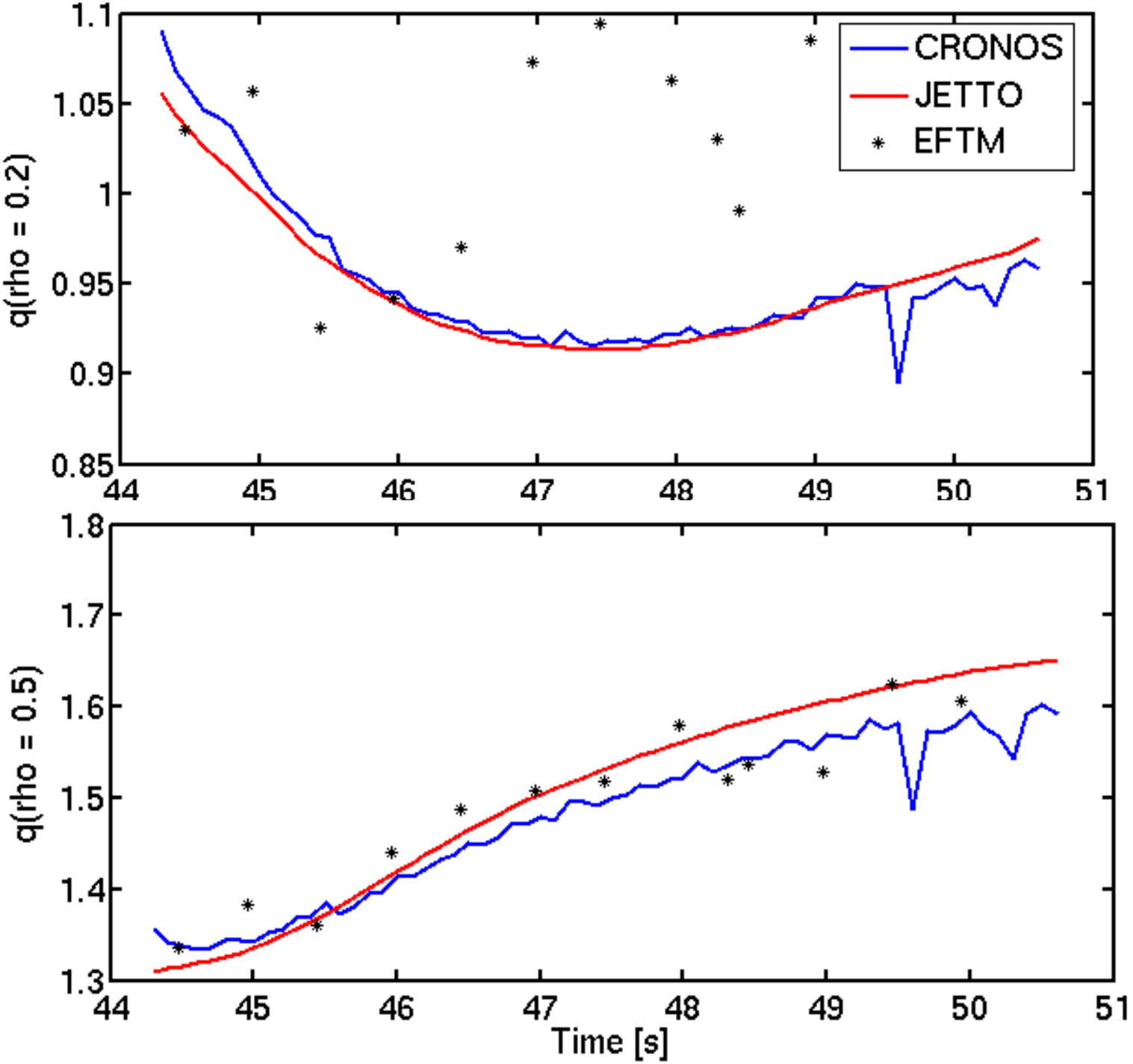
t = 50s

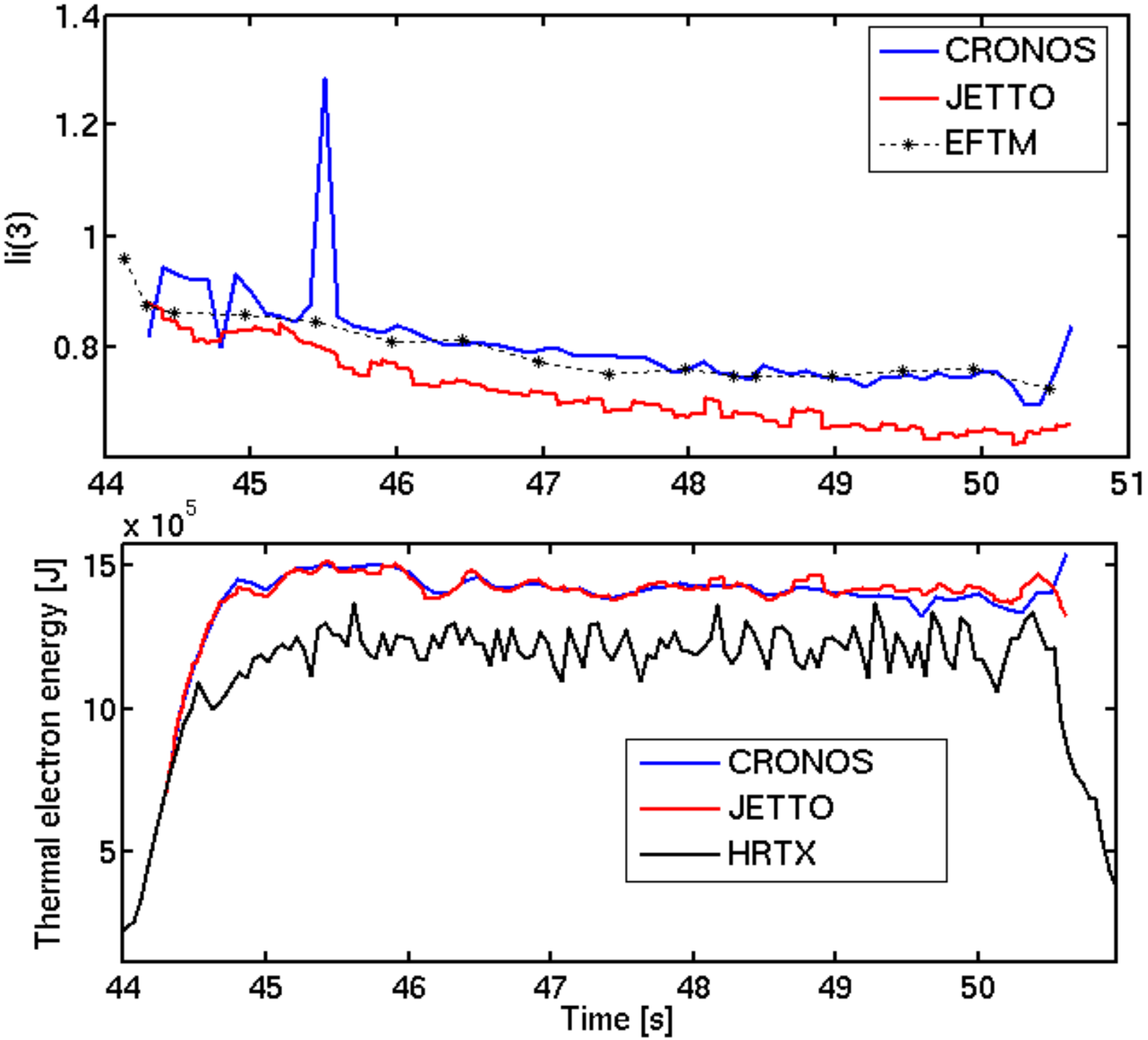

NE
CRONOS
JETTO
TE
TI
10^19 m-3
10^3 eV
10^3 eV
5.0
4.0
3.0
2.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
10.0
8.0
6.0
4.0
2.0
0.0
0.2
0.4
0.6
0.8
1.0
77922 JSP/NE
Seq=391 (0) Uid=fko
77922 JSPC/NE
Seq=384 (0) Uid=cro
77922 JSP/TE
Seq=391 (0) Uid=fko
77922 JSPC/TE
Seq=384 (0) Uid=cro
77922 JSP/TI
Seq=391 (0) Uid=fko
77922 JSPC/TI
Seq=384 (0) Uid=cro

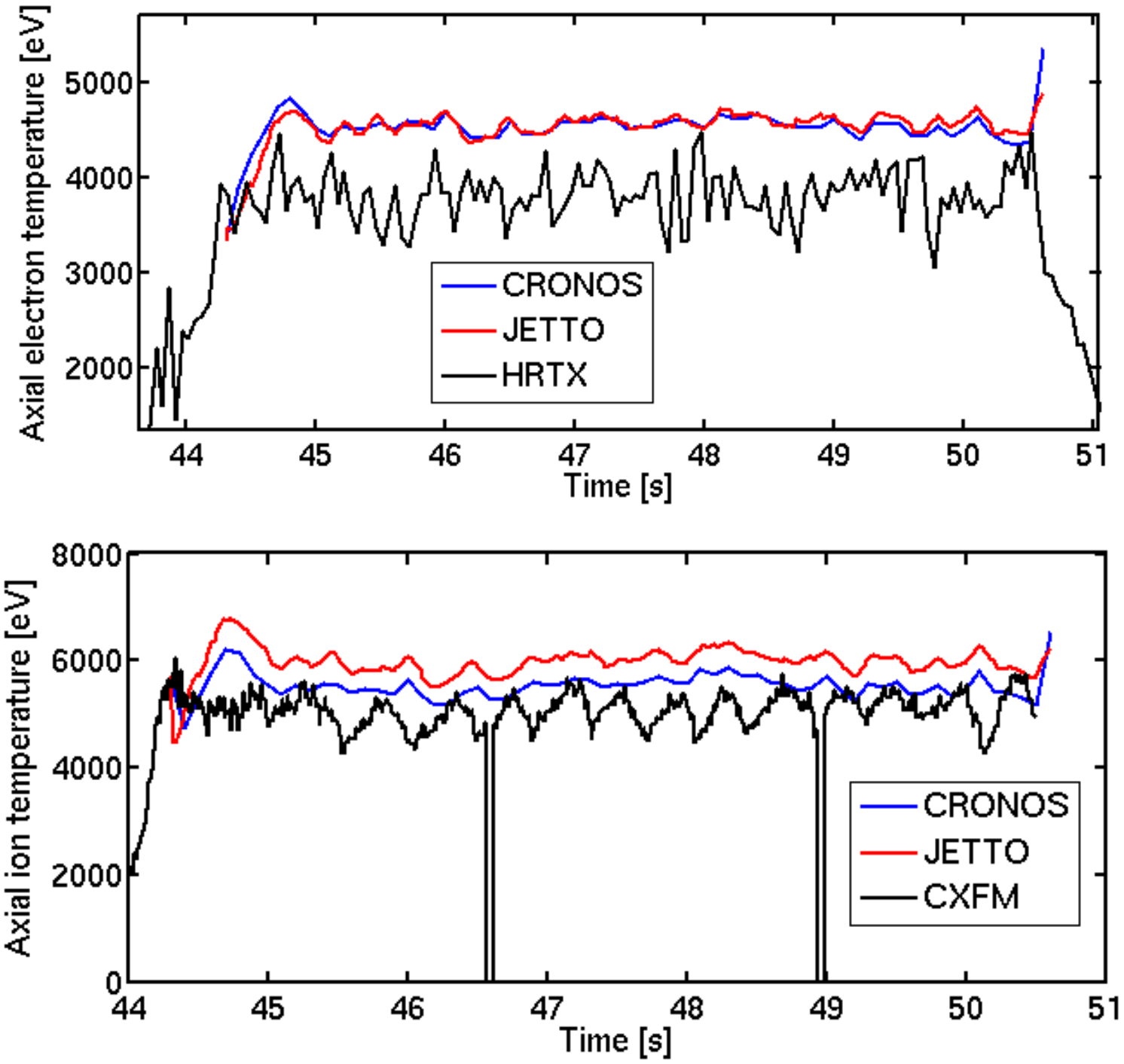
t = 50s

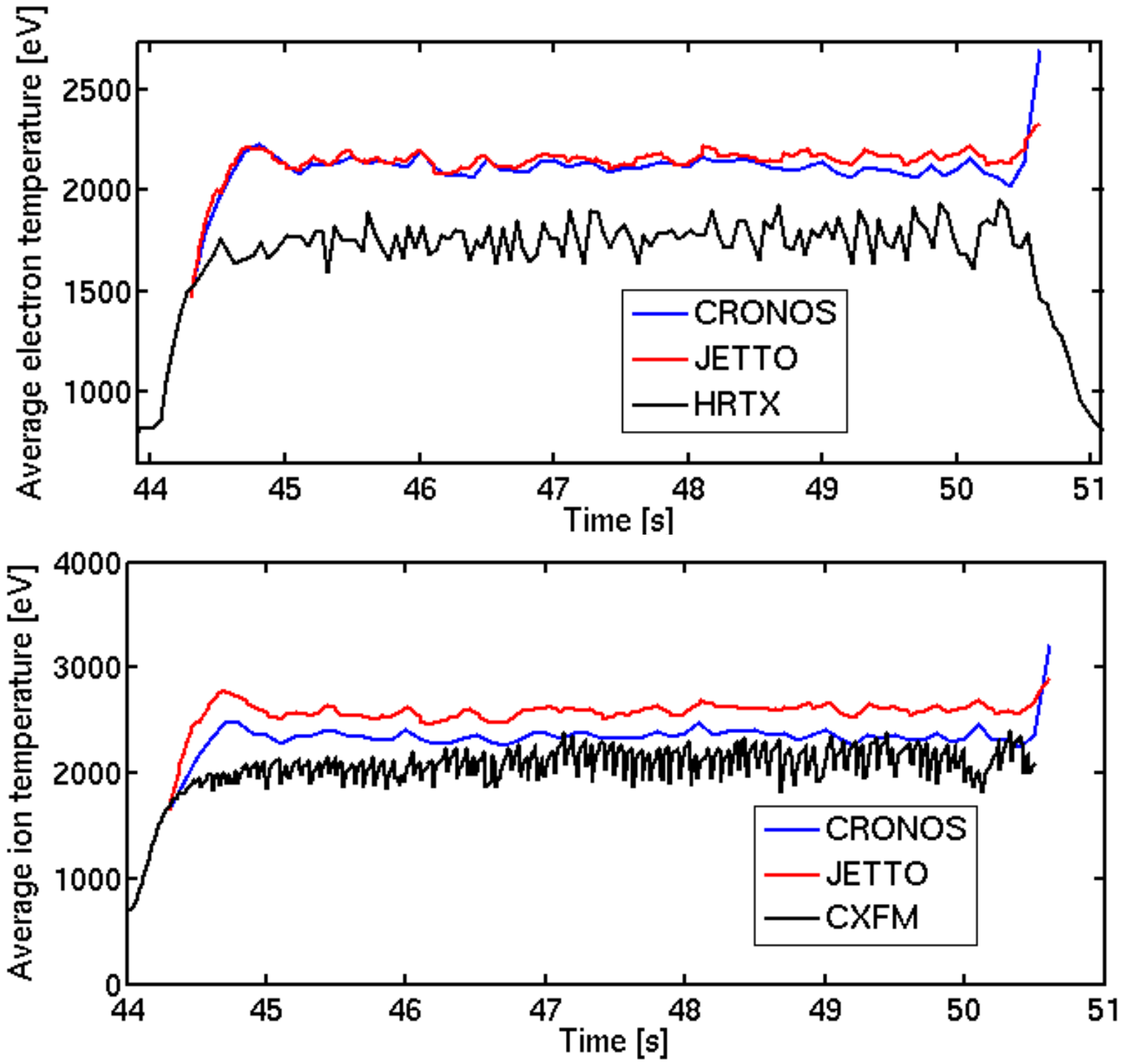

CRONOS
JETTO
JZ
q
10^6 A m−2
1.5
1.0
0.5
0.0
5
4
3
2
1
0.0
0.2
0.4
0.6
0.8
1.0
77922 JSP/JZ
Seq=391 (0) Uid=
77922 JSPC/JZ
Seq=384 (0) Uid=
77922 JSP/Q
Seq=391 (0) Uid=
77922 JSPC/Q
Seq=384 (0) Uid=

#76858


CRONOS
JETTO
EFTM
q(rho = 0.2)
q(rho = 0.5)
Time [s]
1.1
1.05
1
0.95
0.9
0.85
1.8
1.7
1.6
1.5
1.4
1.3
44
45
46
47
48
49
50
51

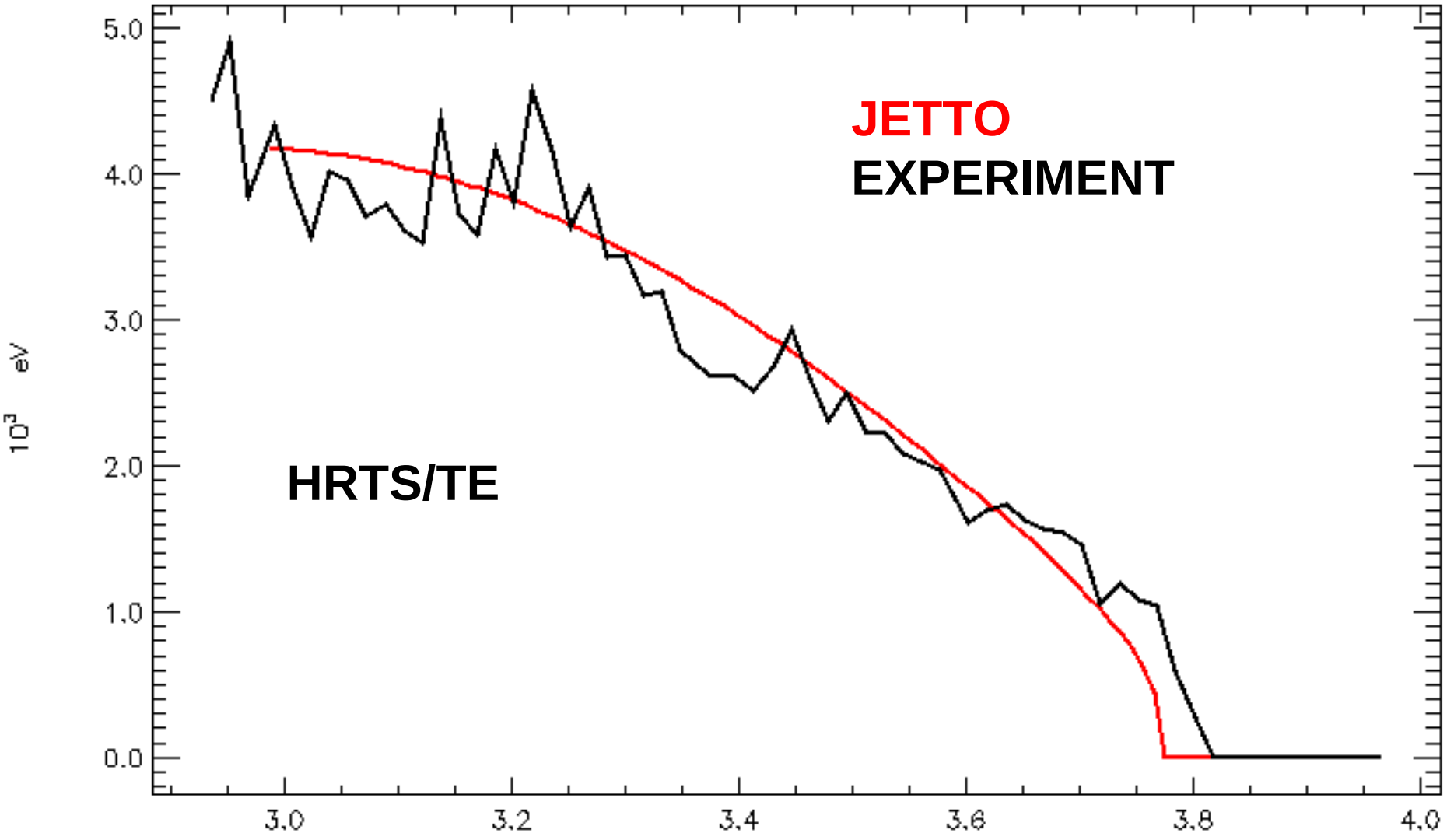

1.4
1.2
1
0.8
li(3)
CRONOS
JETTO
EFTM
44
45
46
47
48
49
50
51
x 10^5
15
10
5
Thermal electron energy [J]
CRONOS
JETTO
HRTX
44
45
46
47
48
49
50
Time [s]


Axial electron temperature [eV]
5000
4000
3000
2000
CRONOS
JETTO
HRTX
44
45
46
47
48
49
50
51
Time [s]
Axial ion temperature [eV]
8000
6000
4000
2000
0
CRONOS
JETTO
CXFM
44
45
46
47
48
49
50
51
Time [s]

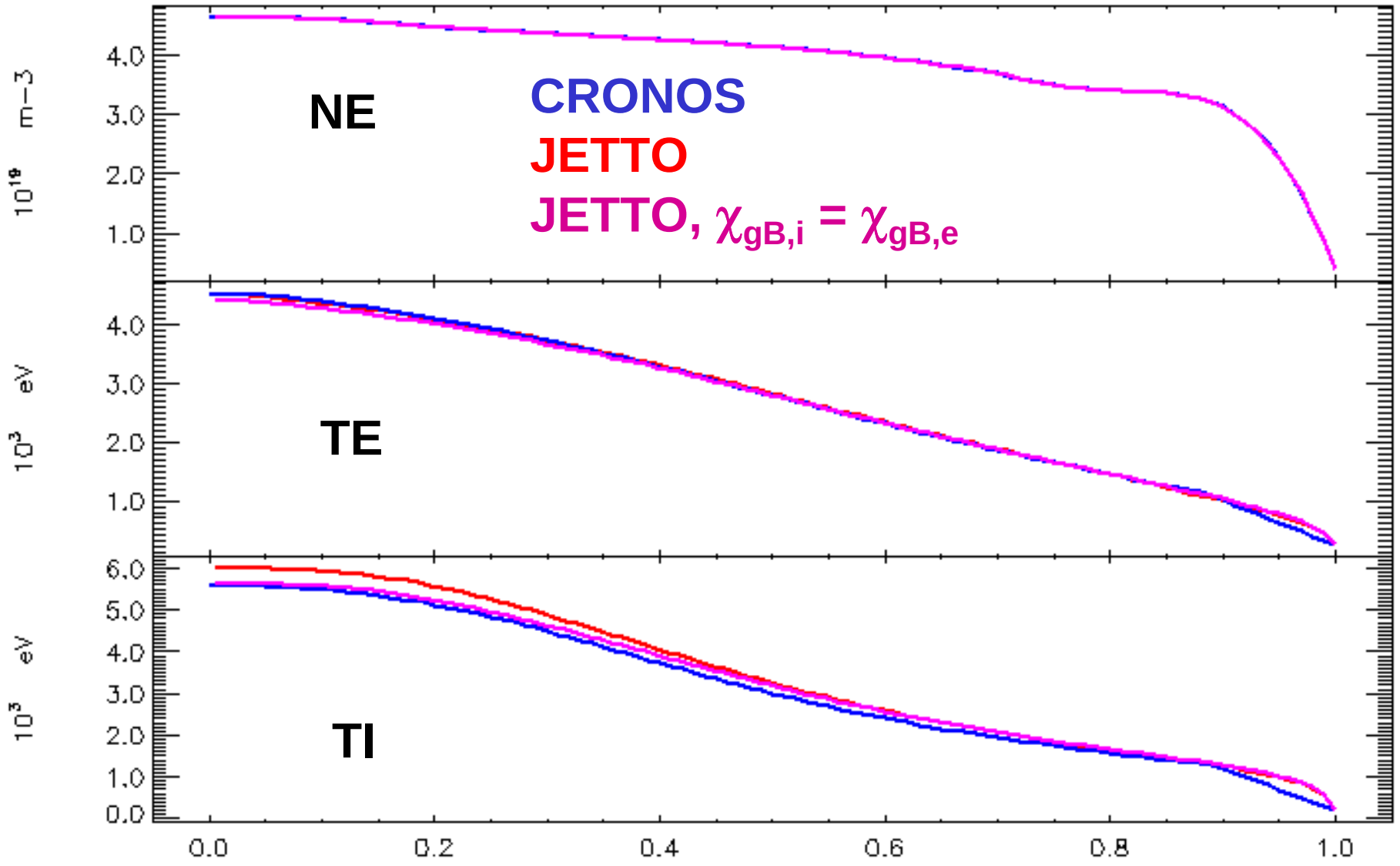

Average electron temperature [eV]
2500
2000
1500
1000
44
45
46
47
48
49
50
51
Time [s]
CRONOS
JETTO
HRTX
Average ion temperature [eV]
4000
3000
2000
1000
0
44
45
46
47
48
49
50
51
Time [s]
CRONOS
JETTO
CXFM

Comparison HRTS measurement vs. JETTO synth. diagn.

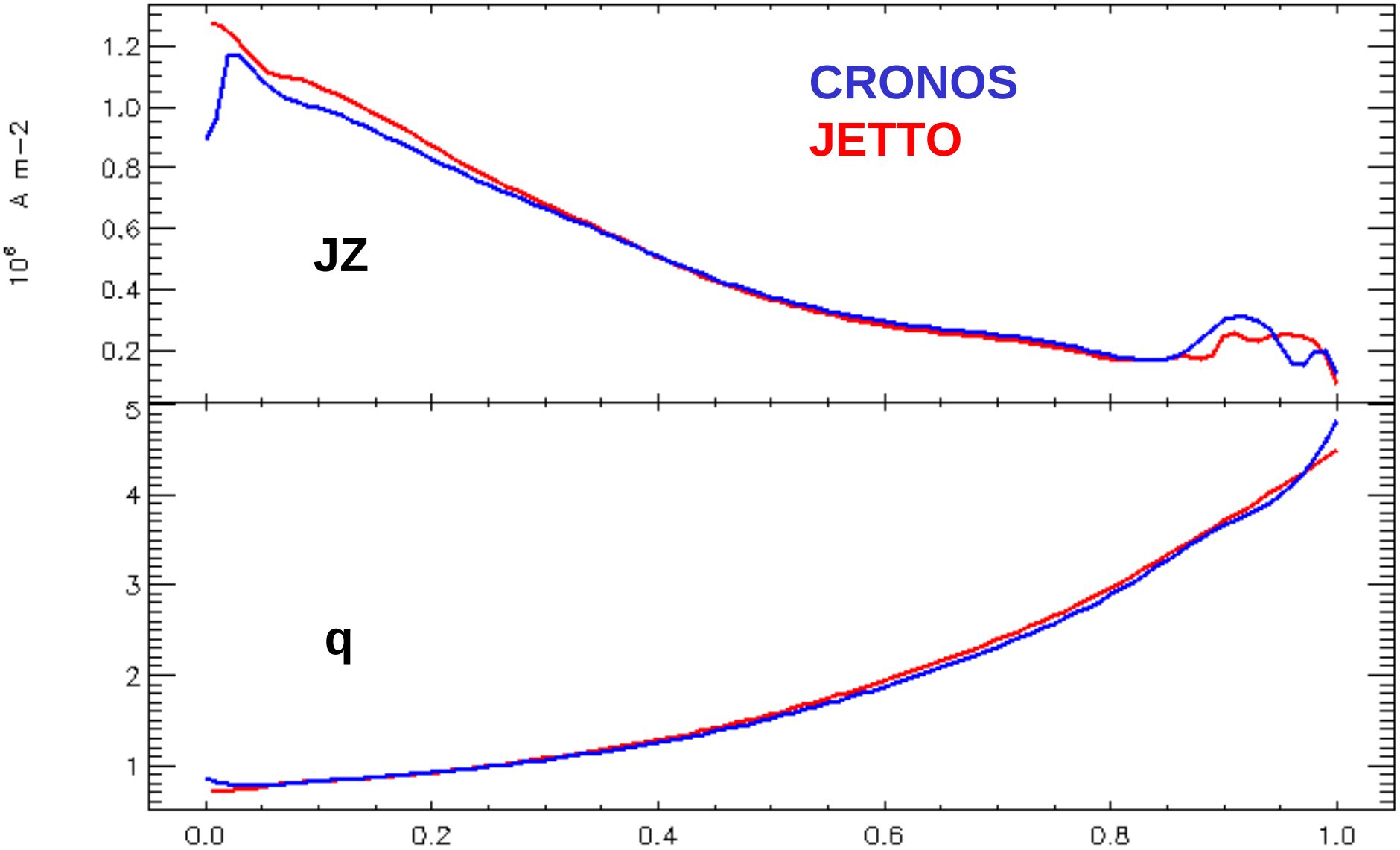
t = 48s



t = 48s


NE
TE
TI
CRONOS
JETTO
JETTO, χgB,i = χgB,e
10^19 m-3
10^3 eV
10^3 eV
4.0
3.0
2.0
1.0
6.0
5.0
0.0
0.2
0.4
0.6
0.8
1.0

t = 48s



Summary

- Very good agreement between CRONOS and JETTO for q and TE, similar agreement for #77922 and #76858.
- Higher TI in JETTO because of 0.5 factor in definition of ion gyroBohm transport.
- Main discrepancies of predicted profiles observed in the edge region (different ETB transport model and boundary shape).
- Very good agreement between simulation results and HRTS measurement data, rough agreement with CXFM.

- HRTX/TE0 != axial electron temperature!
- li definition may be different in CRONOS and JETTO!
- Noisy EFTM data close to magnetic axis.

PPF catalog entries

- #77922:
  - CRONOS: seq.384
  - JETTO: seq.391

- #76858
  - CRONOS: seq.234
  - JETTO: seq.235
  - JETTO, chi_gB_i = chi_gB_e: seq.236