METIS documentation for output data structure

Introduction:

This document describes the content of output data structure (named "post") of METIS code. The first part describes the list of substructures in data post structure. The second part describes the output data model of METIS code, made of the list of time dependent scalar data with their description, followed by the list of time dependent profile data with their description.

Access to output data is not available in the standalone-compiled version of METIS.

The syntax to access to structure field in Matlab is "post.<subtructure_name>.<field_name>.Example: "post.zerod.ip".

List of substructures of METIS output structure:

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1- profil0d:

Time dependent profile data.

2- simout:

Data use by Simulink during run of Simulink workflow including METIS block named "simmetis".This substructure is empty when METIS is used without Simulink.

3- z0dinput:

Copy of METIS input data used during the computation of the simulation.

4- zerod:

Time dependent scalar data.

1. Substructure: zerod

Time dependent scalar data.

1.1. RR

plasma resistivity (ohm).

1.2. aitb

effect of itb on temperature peaking factor.

1.3. ane

exponent of electronic density profile.

1.4. ane_actual

actual exponent of electronic density profile obtained taking into account the reference and constraints from transport.

1.5. ape

exponent of electronic pressure profile.

1.6. asser

if 1, feedback on vloop is on.

1.7. ate

exponent of electronic temperature profile.

1.8. betan

normalize total beta of the plamsa.

1.9. betap

poloidal normalize pressure of the plasma (thermal).

1.10. betaptot

poloidal normalize pressure of the plasma (total).

1.11. d0

Shafranov shift (do not use, m).

1.12. diboot

relative error on Iboot, at the end of convergence.

1.13. difcurconv

current diffusion solver state.

1.14. dini

relative error on Ini, at the end of convergence.

1.15. disrup

if =1, ratiative disruption flag.

1.16. dlh

LH deposition width (do not use,su).

1.17. dpfus

relative error on pfus, at the end of convergence.

1.18. drmdt

d sqrt(PHI/pi/B0) / dt of LCMS(m/s) .

1.19. dsol

caracteristic SOL width (lambda_q, m).

1.20. dw

relative error on w, at the end of convergence.

1.21. dwbpdt

tempoal derivative of WBp de l'energie poloidal du plama (J).

1.22. dwdt

temporal derivative of total plasma energy (J).

1.23. dwmagtordt

time derivative of toroidal magnetic plasma energy (W).

1.24. dwthdt

temporal derivative of thermal plasma energy (J).

1.25. ecrit_he

alpha critical energy (eV).

1.26. ecrit_he3_DDn

critical energy (eV) of helium-3 fusion particules from D-D reactions.

1.27. ecrit_he4_DHe3

critical energy (eV) of helium-4 fusion particules from D-He3 reactions.

1.28. ecrit_he4_DT

critical energy (eV) of helium-4 fusion particules from D-T reactions.

1.29. ecrit_icrh

critical energy of ICRH beam (eV).

1.30. ecrit_nbi

critical energy of NBI beam (eV).

1.31. ecrit_p_DDp

critical energy (eV) of proton fusion particules from D-D reactions.

1.32. ecrit_p_DHe3

critical energy (eV) of proton fusion particules from D-He3 reactions.

1.33. ecrit_t_DDp

critical energy (eV) of tritium fusion particules from D-D reactions.

1.34. eddy_current

Eddy current in passive structure for breakdown description (A).

1.35. edgeflux

poloidal flux at the edge of plasma (Vs).

1.36. efficiency

Fisch LH current drive efficiency(A/W/m^2).

1.37. einj_icrh

mean energy of fast ion produce by ICRH in minoritary scheme (eV).

1.38. einj_lh

mean LH electrons energy , only define if rip = 1 (eV).

1.39. einj_nbi_icrh

beam energy including ICRH effects (eV; reserved for internal used only).

1.40. esup_fus

D-T fusion fast alpha suprathermal energy (J).

1.41. esup_icrh

ICRH fast ions suprathermal energy (J).

1.42. esup_lh

LH fast ions suprathermal energy (J).

1.43. esup_nbi

NBI fast ions suprathermal energy (J).

1.44. etalh

LH current drive efficiency (A W^-1 m^-2).

1.45. etalh0

LH current drive efficiency @ vloop = 0 (A W^-1 m^-2).

1.46. etalh1

LH current drive efficiency correction du to hot conductivity (A W^-1 m^-2).

1.47. firstorb_nbi

fraction of NBI power lost due to fast ion first orbit loss.

1.48. flux_edge_cor

Poloidal flux modification of reference cons.flux due to eddy current (Wb/ (2*pi)).

1.49. frac_pellet

fraction of fuelling due to pellet.

1.50. fracmino

minority fraction accelerated by ICRH.

1.51. frloss_icrh

part of icrh power lost due to fast ions losses.

1.52. frnbi

fraction of NBI absorbed in the plasma (su).

1.53. fwcorr

internal data to compute tem.

1.54. harm

ICRH minority scheme harmonic.

1.55. hitb

H factor of ITB.

1.56. hmhd

H factor ofmhd (BetaN limit).

1.57. ialign

current drive alignment quality parameter (1 = good , 0 = bad).

1.58. iboot

bootstrap current (A).

1.59. icd

total current drive (A).

1.60. ieccd

ECCD current drive(A).

1.61. ifus

alpha (fusion) current drive (A) .

1.62. ifwcd

FWCD current drive(A).

1.63. ilh

LH current drive(A).

1.64. inbicd

NBI current drive (A).

1.65. indice_inv

sawtooth invert radius indice.

1.66. ini

total non inductive current (A).

1.67. iohm

ohmic current (A).

1.68. ip

plasma current (A).

1.69. ipar

plasma current // B (A).

1.70. irun

runaway current (A).

1.71. j0fus

Jalpha at center (usage interne,su).

1.72. jxfus

Jalpha at xfus (usage interne,su).

1.73. kidds_evol

facteur applique au coefficient de transport de Te pour la simulation de dents de scie en mode evolution.

1.74. li

internal self inductance (formule 3 of ITER FDR).

1.75. meff

effective mass (number of atomic mass, hydrogenoid ions).

1.76. modeh

confinement mode versu time: 0 = L et 1 = H.

1.77. mu0_nbi

initial value of pitch angle for NBI (V// / V').

1.78. n0a

number of cold neutral that input in   plasma at the edge every second coming from recycling and gaz puff (s^-1).

1.79. n1m

average volumic density of H + D + T ions (m^-3).

1.80. nDm

average volumic density of deuterium ions (m^-3).

1.81. nTm

average volumic density of tritium ions (m^-3).

1.82. nb

number of convergence loops made.

1.83. nbar

line average electron density (m^ -2).

1.84. nbar_nat

natural density (m^-3).

1.85. ndd

total DD neutrons per second (s^-1).

1.86. ndd_nbi_nbi

beam/beam DD neutrons per second (s^-1).

1.87. ndd_nbi_th

beam/plasma DD neutrons per second (s^-1).

1.88. ndd_th

plasma/plasma DD neutrons per second (s^-1).

1.89. ne0

estimation central electronic density (m^-3).

1.90. nebord

estimation of plasma edge electronic density (m^-3).

1.91. negr

Greenwald limit density (m^-3).

1.92. nelim

plasma eletronic density temparature estimation near the divertor (m^-3).

1.93. nem

electronic average volumic density densite (m^-3).

1.94. neped

top electron pedestal density (m^-3).

1.95. nhe4m

volume averaged density of helium-4 (m^-3) in case of option.gaz == 5, adding accumunication of He4 on option.frhe0 * zs.nem for initial volume averaged He4 density.

1.96. nhem

average volumic density of helium (m^-3).

1.97. ni0

estimation of central ionic density (m^-3).

1.98. nibord

edge ion density (m^-3).

1.99. nim

sum of average volumic density of ions (m^-3).

1.100. nimpm

average volumic density of impurity (other than helium) (m^-3).

1.101. niped

top ion pedestal density (m^-3).

1.102. nmino

volume averaged ICRH minority density.

1.103. nsat

saturation electronic density, use for the calculation of density (m^-3).

1.104. nwm

volume averaged tungsten density (m^-3).

1.105. pbrem

Bremsstrahlung radition losses (W).

1.106. pcyclo

cyclotron radiation losses (W).

1.107. pddfus

fusion power from DD reactions (W).

1.108. peakdiv

divertor peak power density estimation (W/m^2).

1.109. pecrh

ECRH power(W).

1.110. pei

equipartition power (W).

1.111. pel

total thermal electronic power deposition, use in the calculation of Ti/Te (W).

1.112. pel_fus

Alpha power going on electron (W).

1.113. pel_icrh

ICRH power going on electron (W).

1.114. pel_nbi

NBI power going on electron (W).

1.115. pelec

reactor electric power provide to the network (W).

1.116. peri

length of the LCMS (m).

1.117. pfus

total D-T fusion power of alpha (W).

1.118. pfus_loss

D-T fusion power of alpha loss due to first orbit losses (estimation, W).

1.119. pfus_nbi

NBI induce D-T fusion piower of alpha (W).

1.120. pfus_th

D-T fusion thermal power depostion of alpha (W).

1.121. phiplasma

toroidal magnetic flux due to the plasam (Wb).

1.122. picrh

ICRH power, decrease of ripple losses in TS (W).

1.123. picrh_th

ICRH thermal power depostion (W).

1.124. pin

total heat power (W).

1.125. pion

total thermal ionic power deposition, use in the calculation of Ti/Te (W).

1.126. pion_fus

Alpha power going on ions (W).

1.127. pion_icrh

ICRH power going on ions (W).

1.128. pion_nbi

NBI power going on ions (W).

1.129. pioniz

power losses due to cold neutral ionization(w).

1.130. pioniz_i

power losses due to charge exchange betweens ion and cold neutrals (W).

1.131. piqj

peaking factor of current profile.

1.132. piqnbi

peaking factor of the NBI power deposition profile (do not use,su).

1.133. plh

LH power , decrease of ripple losses in TS (W).

1.134. plh_th

LH thermal power depostion (W).

1.135. plhrip

LH power loss in ripple for Tore Supra (W).

1.136. plhthr

additionnal power crossing the LCMS; must be compare to L->H threshold power (Ryter PPCF 2002).

1.137. plim

divertor power flux estimation (W).

1.138. ploss

plasma losses power, as define in ITER basis (W).

1.139. plossl2h

switch-on power for transition from L mode to H mode , LH99(1) (W).

1.140. pnbi

NBI power (W).

1.141. pnbi_icrh

beam power increase due to ICRH effects (W; reserved for internal used only).

1.142. pnbi_th

NBI thermal power depostion (W).

1.143. pohm

ohmic power (W).

1.144. poynting

flux of Poynting vector through the LCMS (W).

1.145. pped

total pressure @ pedestal top (Pa).

1.146. ppedmax

maximal allowed total pressure @ pedestal top (Pa).

1.147. prad

impurity radition losses in core plamsa , without Bremsstrahlung (W).

1.148. pradsol

radiation losses in the SOL (W).

1.149. priptherm

TS ripple losses, thermal part (W).

1.150. pth

thermal power input, define as tau_L * Pth = Wth (W).

1.151. pttfus

fusion power from TT reactions (W).

1.152. pw

effective power define as taue * pw = W (W).

1.153. q0

estimation of central value of security factor.

1.154. q95

security factor @ 95% of poloidal flux.

1.155. qa

edge security factor.

1.156. qeff

effective safety factor at the edge(computed with ITER formula).

1.157. qmin

estimation of minimal value of security factor.

1.158. rm

sqrt(PHI/pi/B0) of LCMS (m) .

1.159. rres

ICRF resonance layer radial position (m).

1.160. salpha

number total of alpha fusion particules from D-T ractions per second (s^-1).

1.161. salpha_he3

total number of helium-3 fusion particules per second from D-D reactions (s^-1).

1.162. salpha_he4

total number of helium-4 fusion particules per second from D-T and D-He3 reactions (s^-1).

1.163. salpha_n

total number of neutrons per second from D-D and D-T reactions (s^-1).

1.164. salpha_p

total number of proton fusion particules per second from D-He3 and D-D reactions (s^-1).

1.165. salpha_t

total number of tritium fusion particules per second from D-D reactions (s^-1).

1.166. sext

external plasma surface (m^ 2).

1.167. slh

rotation torque due to LHCD (N m).

1.168. sn0fr

friction source on edge neutral that damp the toroidal rotation (N m).

1.169. snbi

rotation torque due to NBI (N m).

1.170. sp

poloidal plasma surface (m^ 2).

1.171. stf

number of wrong data in zs containing NaN or Imag.

1.172. taue

confinement time of energy (s).

1.173. taue_alt

confinement time of energy, Helander & Sigmar definition (s).

1.174. tauee

scale of electron heat confinement time (s).

1.175. tauei

exchange electon/ion heat time (s).

1.176. tauh

confinement time of energy in H mode, ITERH-98P(y,2) (s).

1.177. tauhe

confinement time of helium impurity (s).

1.178. tauhe_h

confinement time of helium impurity in H mode (s).

1.179. tauhe_l

confinement time of helium impurity in L mode (s).

1.180. tauii

scale of ion heat confinement time (s).

1.181. tauip

carateristic time of slow down of R-L plasma equivalent (s).

1.182. tauj

diffusion time of current (s).

1.183. taup

confinement time of matter (s).

1.184. taus_he

caracteristic slow down time for alpha particules (s).

1.185. taus_icrh

caracteristic slow down time for ICRH fast ions (s).

1.186. taus_nbi

caracteristic slow down time for NBI fast ions (s).

1.187. tauthl

confinement time of energy in L mode, ITERH-96P(th) (s).

1.188. te0

estimation of central electronic temperature (eV).

1.189. tebord

estimation of plasma edge electronic temperature (eV).

1.190. telim

plasma eletronic temparature estimation near the divertor (eV).

1.191. tem

average volumic eletronic temperature (eV).

1.192. temps

time slices vector.

1.193. teped

top electron pedestal temperature (eV).

1.194. tibord

edge ion temperature (eV).

1.195. tiped

top ion pedestal temperature (eV).

1.196. tite

mean ratio Ti / Te.

1.197. vloop

loop voltage, as vloop .* iohm = pohm (V).

1.198. vmes

loop voltage as measured on a fixed magnetic loop (V).

1.199. vp

plasma volume (m^3).

1.200. w

total plasma energy (J).

1.201. wbp

poloidal field energy of the plasma (J).

1.202. wdia

3/2 perpendicular plasma energy (J).

1.203. wmagtor

toroidal magnetic plasma energy (J).

1.204. wrad

estimation of bulk volume average toroidal rotation velocity (rad/s).

1.205. wrlw

contenue energetique des electrons selon la loi d'echelle RLW, indicatif (J).

1.206. wrot

toroidal plasma rotation stored energy (J).

1.207. wth

thermal plasma energy (J).

1.208. xeccd

ECCD maximum position (do not use,su).

1.209. xfus

Jalpha maximum position (do not use,su).

1.210. xitb

radius of itb due to a revserse shear (estimation,su).

1.211. xlh

LH maximum position (do not use,su).

1.212. xnbi

NBI maximum position (do not use,su).

1.213. xped

pedestal normalized width.

1.214. xpoint

flag for diverted plasma;for plasma in limitor mode = 0; for plamsa in divertor mode = 1.

1.215. xres

ICRF resonance layer normalized radius position (su).

1.216. zeff

plasma effective charge with alpha particules.

1.217. zeffsc

zeff scaling (private data, do not use).

1.218. zmszl

ratio between volume average zeff and line average zeff .

2. Substructure: profil0d

Time dependent profile data.

2.1. C2

C2 geometrical coefficient (see CRONOS technical document).

2.2. C3

C3 geometrical coefficient (see CRONOS technical document).

2.3. Raxe

of major radius of the centre of each flux surface (m).

2.4. Rsepa

radial coordinate of the LCMS points (m).

2.5. Zsepa

vertical coordinate of the LCMS points (m).

2.6. bpol

average poloidal magnetic field (T).

2.7. df2dpsi

d(F^2)/dPsi for FREEBIE (4*pi*T).

2.8. dn

density diffusivity estimation (m^2/s).

2.9. dphidx

toroidal flux space derivative (Wb).

2.10. dpsidt

time derivative of poloidal flux (V).

2.11. dptotdpsi

dPtotal/dPsi for FREEBIE (2*pi*A/m^3).

2.12. drot

toroidal rotation diffusion coefficient (m^2/s).

2.13. dx

flux surface geometrical triangularity .

2.14. ej

ohmic power density (W/m^3).

2.15. epar

parallel electric field (V/m) .

2.16. epsi

of aspect ratio (m).

2.17. er

neoclassical radial electric field (V/m) = Er / gradient(rho).

2.18. eta

neoclassical resistivity (ohm * m).

2.19. fdia

diamagnetic function (T*m).

2.20. fprad

line radiative power shape; reserved to an internal used only.

2.21. frot

toroidal rotation moment flux (N m^-1).

2.22. ftrap

effective trap fraction profile .

2.23. fxdurplh

Hard X ray inversed profile.

2.24. ge

electrons flux (m^-2/s).

2.25. grho

<|gradient(rho)|> (see CRONOS technical document).

2.26. grho2

<|gradient(rho)|^2> (see CRONOS technical document).

2.27. grho2r2

<|gradient(rho)|^2/R^2> (see CRONOS technical document).

2.28. jboot

bootstrap current density (A/m^2).

2.29. jeccd

parallel current density source due to ECCD (j = <J.B>/Bo, A/m^2).

2.30. jeff

<J.B>/B0 (A/m^2).

2.31. jfus

fast alpha bootstrap current density (A/m^2).

2.32. jfusshape

alpha particles bootstrap current density shape; reserved to an internal used only .

2.33. jfwcd

parallel current density source due to FWCD (j = <J.B>/Bo, A/m^2).

2.34. jgs

averaged current density, raw computation for FREEBIE (A/m^2).

2.35. jlh

parallel current density source due to LHCD (j = <J.B>/Bo, A/m^2).

2.36. jli

averaged current density, equivalent at jmoy in CRONOS (A/m^2).

2.37. jnbicd

parallel current density source due to NBICD (j = <J.B>/Bo, A/m^2).

2.38. jnbishape

NBICD current density shape; reserved to an internal used only.

2.39. jni

total current density source (A/m^2).

2.40. jrun

average runaway current density (A/m^2).

2.41. kx

flux surface elongation .

2.42. n0

neutral density coming from edge, hot neutral (m^-3).

2.43. n0m

neutral density coming from edge, cold neutral (m^-3).

2.44. n1p

density of HDT ions (m^-3) or H+D if option.gza = 1.

2.45. nbinesource

electron source due to fast neutral ionisation (Number s^-1 m^-3).

2.46. nbishape_el

NBI power deposition on electrons shape; reserved to an internal used only.

2.47. nbishape_ion

NBI power deposition on ions shape; reserved to an internal used only.

2.48. nep

electron density (m^-3).

2.49. nhep

density of helium (m^-3) or helium 3 density if option.gza = 5.

2.50. nip

ions density (m^-3).

2.51. nwp

density of W when tungsten effects are taking into account (m^-3);if option.Sn_fraction > 0, this profile become the sum of the density of W and Sn:n_W = (1 - option.Sn_fraction) * nwp & n_Sn = option.Sn_fraction * nwp..

2.52. nzp

density of main impurity (m^-3).

2.53. omega

plasma solid rotation frequency in toroidal direction (rad/s) sum(nk*mk*<Vk,phi * R>) / sum(nk*mk).

2.54. palf

alpha power source (W/m^-3).

2.55. pbrem

bremsstrahlung power sink (W/m^3).

2.56. pcyclo

cyclotron radiation power source (W/m^3).

2.57. pecrh

power density due to ECRH (W/m^3).

2.58. pfus

power density heating the plasma due to fusion reactions (W/m^3).

2.59. pfus_ion

power density heating the plasma due to fusion reactions, coupled to ions (W/m^3).

2.60. pfweh

power density due to FWEH (W/m^3).

2.61. phi

toroidal flux (Wb).

2.62. picrh

power density due to ICRH minority scheme (W/m^3).

2.63. picrh_ion

power density due to ICRH minority scheme, coupled to ions (W/m^3).

2.64. pioniz

loss power due to cold neutral ionization and charge exchange between ions and cold neutrals(W m^-3).

2.65. pioniz_i

loss power due charge exchange between ions and cold neutrals(W m^-3).

2.66. pitch

NBI pitch angle profile = cos(beam,B).

2.67. plh

power density due to LH (W/m^3).

2.68. pnbi

power density due to NBI (W/m^3).

2.69. pnbi_ion

power density due to NBI, coupled to ions (W/m^3).

2.70. pohm

ohmic power deposition (W/m^3).

2.71. prad

radiated power sink (W/m^3).

2.72. psi

poloidal flux (Wb).

2.73. ptot

total pressure profile (Pa).

2.74. qe

electron heat flux (W).

2.75. qei

electron to ion heat flux (W).

2.76. qi

ion heat flux (W).

2.77. qjli

safety factor.

2.78. r2i

<1/R^2> (see CRONOS technical document).

2.79. ri

<1/R> (see CRONOS technical document).

2.80. rmx

of average radius of each flux surface: rmx = sqrt(phi ./ pi ./ b0) (m).

2.81. rot_lh

toroidal torque source from LHCD and ECCD (N m^-2).

2.82. rot_n0

toroidal torque sink from edge neutral friction (N m^-2).

2.83. rot_nbi

toroidal torque source from NBI (N m^-2).

2.84. rtor

toroidal rotation moment density (kg m^-1 s^-1).

2.85. s0

ionisation sources coming from edge, hot neutral (m^-3/s).

2.86. s0m

ionisation sources coming from edge, cold neutral (m^-3/s).

2.87. salf

alpha particles source (m^-3 s^-1).

2.88. source_el

total heat power density coupled to electrons (W/m^3).

2.89. source_ion

total heat power density coupled to ions (W/m^3).

2.90. spellet

equivalent continue source due to pellet injection (m^-3/s).

2.91. spr

surface element (m^2, int(spr,x= 0..1) = plasma poloidal section surface) .

2.92. temps

vectors of time associate to the s (only time at which the s are computed are stored).

2.93. tep

electron temperature (eV).

2.94. tip

ion temperature (eV).

2.95. utheta

neoclassical poloidal rotation speed ,for main impurity (<V_k . theta> / <B . theta> , m/s/T).

2.96. vn

anormal density convection velocity estimation (m^2/s).

2.97. vpr

volume element (m^3, int(vpr,x= 0..1) = plasma volume).

2.98. vpr_tor

volume element, reserved for internal used (m^2, rhomax * int(vpr,x= 0..1) = plasma volume) .

2.99. vrot

toroidal rotation pinch coefficient (m/s).

2.100. vtheta

fluid velocity, theta component, at R = Rmax of each flux surface, for main impurity (m/s).

2.101. vtor

toroidal rotation speed (m/s), at R = Rmax of each flux surface, for main impurity .

2.102. ware

Ware pinch estimation (m/s).

2.103. web

rotation shear (NClass definition).

2.104. xie

electron diffusivity estimation (m^2/s).

2.105. xieshape

heat transport coefficient (Ke) shape without ITB effect .

2.106. xieshape_itb

heat transport coefficient (Ke) shape with ITB effect.

2.107. xii

ion diffusivity estimation (m^2/s).

2.108. xli

radial normalized coordinate (Lao coordinate ~ r/a, normalized to 1 at the edge)..

2.109. zeff

effective charge.