Introduction to the ITM AMNS system

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- background on the ITM AMNS system
- an example
- more information about the AMNS system

- The AMNS system aims to
  - provide an easy-to-use interface to AMNS data
  - provide validated AMNS data
  - capture the provenance of the data used in each simulation

- The AMNS system consists of
  - programs for importing AMNS data into the ITM system
  - AMNS data stored in the ITM database under the machine name "amns"
  - fortran callable library to access the AMNS data
  - c callable library to access the AMNS data
  - example programs to demonstrate the use of AMNS data
  - documentation on the ITM web pages about the AMNS system

- The example program is designed to calculate the density of charge states that represents an equilibrium between ionization and recombination

$$\frac{\partial n_i}{\partial t} = S_{i-1} n_{i-1} - R_i n_i - S_i n_i + R_{i+1} n_{i+1}$$

$$\begin{pmatrix} . & . & 0 & 0 & 0 & 0 & 0 \\ . & . & . & . & . & . & . \\ . & . & . & . & . & . & . \\ . & . & S_{i-1} & -(S_i + R_i) & R_{i+1} & . & . \\ . & . & . & . & . & . & . \\ . & . & . & . & . & . & . \\ 0 & 0 & 0 & 0 & 0 & . & . \end{pmatrix} \begin{pmatrix} n_0 \\ . \\ n_{i-1} \\ n_i \\ n_{i+1} \\ . \\ n_z \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

- The program needs the ionization and recombination rates

- Will output these as a function of Te for a fixed chosen density

- Documentation of AMNS system
  - AMNS User Interface

- Check out the code
  - svn co http://gforge.efda-itm.eu/svn/amnsproto/tags/examples/coronal

- Move to the new directory
  - cd coronal

- Compile and run the code
  - make

- Plot the results
  - obj/plot_densities
  - obj/plot_radiation

- From the Makefile

  – SYS=amd64_pgi
  – -include obj/SYS
  – OBJECTCODE=obj/${SYS}
  – include config/${SYS}

- default to "amd64_pgi" but override this with the contents of "obj/SYS" is this exists
- set the object code location
- pick up the compiler configuration files

- From the Makefile

  - VPATH=src
  - MOD=mod

- set the search path for source and the suffix for modules

- From the Makefile

  – AMNSLIBDIR = /afs/efda-itm.eu/user/a/ amnsdata/public/library/4.09a/lib/${SYS}

- set the location for picking up the AMNS library

- From the Makefile

    – run_coronal: ${OBJECTCODE}/coronal
    –   @time $^ ${ARGS}

- set the default in the makefile to run the example

- this has a dependency on the compiled code

- it also allows for passing arguments to the code

- From the Makefile

  – ${OBJECTCODE}/coronal : ${OBJECTCODE}/coronal.o
  – ${FC} ${FCOPTS} -o $@ $^ -L${AMNSLIBDIR} -lamns ${LIBS} ${UAL_lib}

- how to link the code

- From the Makefile

    – ${OBJECTCODE}/%.o : %.F90
    – 		${FC} ${FCOPTS} -I${OBJECTCODE} ${UAL_inc} -I${AMNSLIBDIR} -c $< -o $@
    – 		-mv *.${MOD} ${OBJECTCODE}/

- how to compile the code

- Gives some command lines for running and plotting a variety of species
  - make ARGS="1 2"
  - obj/plot_densities
  - obj/plot_cps D.ps
  - obj/plot_radiation
  - obj/plot_cps D_rad.ps

  - make ARGS="6 12.01"
  - obj/plot_densities
  - obj/plot_cps C.ps
  - obj/plot_radiation
  - obj/plot_cps C_rad.ps

  - ...
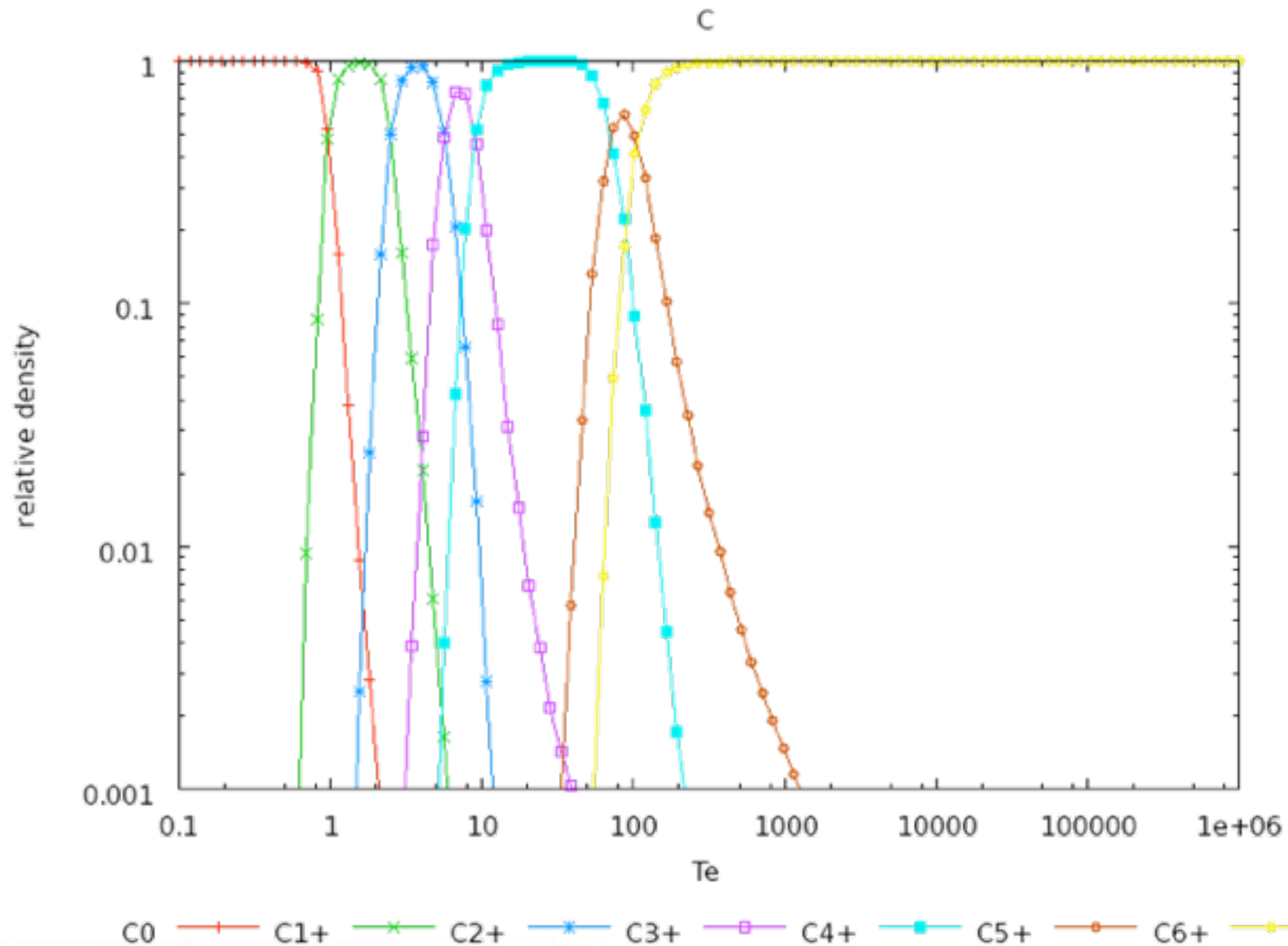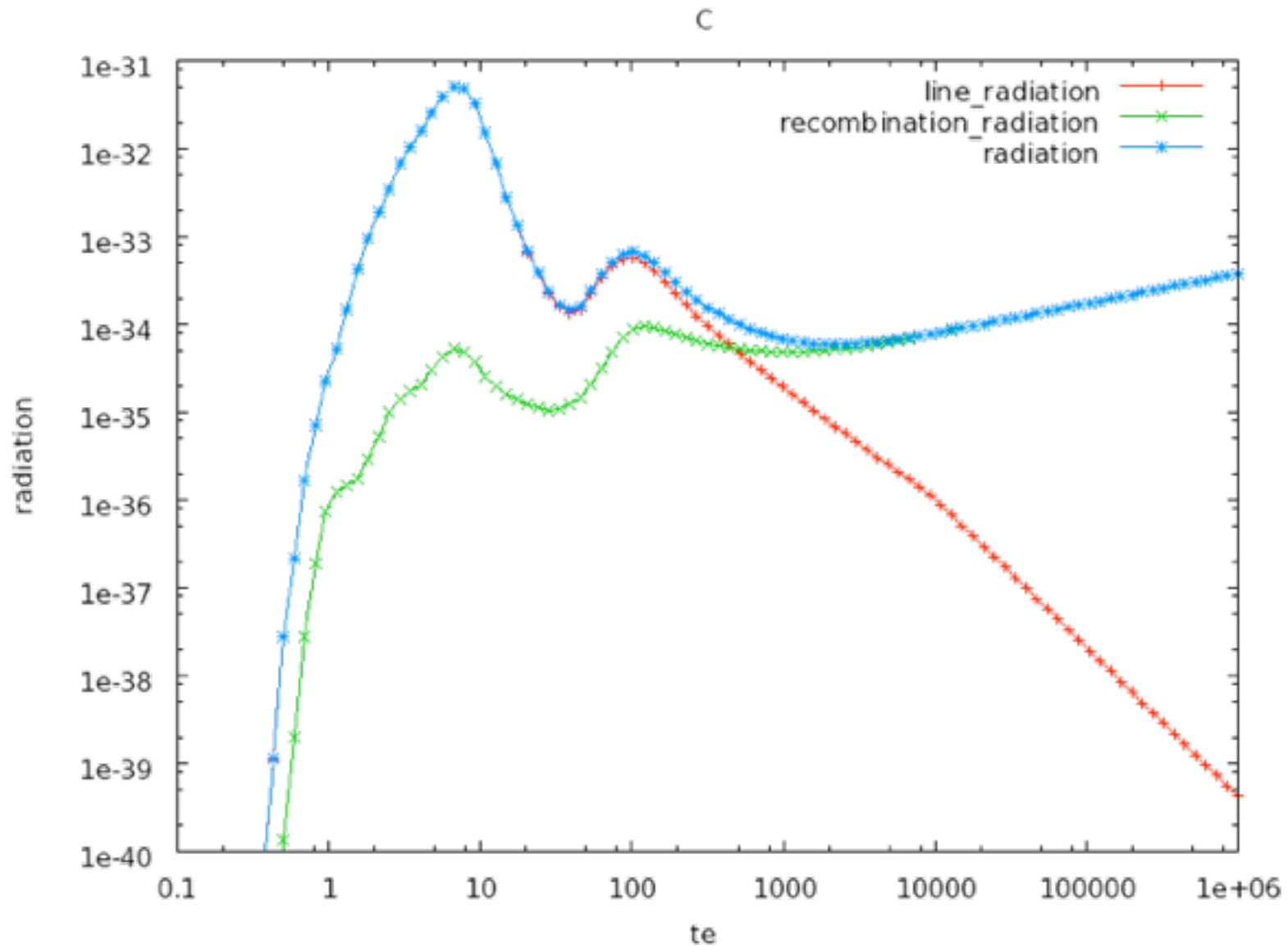
- Data is stored in CPOs with the tokamak name "amns"

- The shot number is M*100+A for reactions that depend on the isotope, and A for reactions that don't (M=mass; A=nuclear charge)

- The run number represents the version number of data for a particular run number

- An MySQL database is used to store which versions of the data have been stored

- If the user has no AMNS data, that from "amnsdata" is used instead