Recombination and ionisation processing

The programs of series ADAS4. shown schematically in figure 5.0. are concerned with the distribution of atoms between their ionisation stages. The key data required to establish this are effective recombination and ionisation coefficients between ions. Associated data are the total radiated power by ions. The primary storage of data of this type, called *iso-electronic master files* in ADAS, is by iso-electronic sequence and they are in general in a *resolved metastable* picture. These data sets are of type ADF10 and necessary sub-types in this picture are general collisional radiative ionisation coefficients (SCD), free electron recombination coefficients (ACD), charge exchange recombination coefficients (CCD), free electron recombination + cascade + bremsstrahlung power coefficients (PRB), charge exchange recombination + cascade power coefficients (PRC), low level line power coefficients (PLT), metastable cross coupling coefficients (QCD) and parent cross coupling coefficients (XCD). In addition, archiving of metastable population fractions (MET) and the radiated power in one standard resonance line for each ionisation stage (PLS) is useful. Interrogation of these datasets is by the program ADAS401. Datasets of type ADF10 are also allowed in the *unresolved*, single effective ground state form more usual in fusion studies. The metastable resolved (or partial) data can be merged into the unresolved form by program ADAS403 which utilises the metastable fractions (MET). In practical data reduction and modelling, complete data sets, of the same types as described above, but archived for each element are required. These are called *iso-nuclear master files* in ADAS, of type ADF11, and may also be resolved or unresolved. Iso-nuclear master files are formed from isoelectronic master files using program ADAS404 and are interrogated by program ADAS402.

Formerly, simple analytic *approximate forms*, applying only to the unresolved picture, were used to generate such data rapidly in each plasma transport calculation. The present system accesses numerical data directly from the iso-nuclear master files and so allows use of the highest quality of data available. However, this still remains selective and the old approximate forms are helpful for data fill-in. Numerical storage only is used in the ADAS isonuclear master files, but generation of a baseline set for many ions is allowed from *improved parametric forms*. This is achieved by program ADAS408, drawing upon approximate form parameter collections (type ADF03). ADAS allows optimising of line power approximate form parameters using program ADAS407 (see series ADAS1 for optimising other parameters).

Finally ADAS4 provides two simple interactive plasma models for initial studies. These are an ionisation equilibrium model, program ADAS405, and a time dependent model, program ADAS406. These operate in the resolved or unresolved pictures. The time dependent model maps ionisation stage abundance evolution from an initial state in a plasma of fixed density and temperature. In general, data are drawn from the database into more sophisticated plasma transport models.
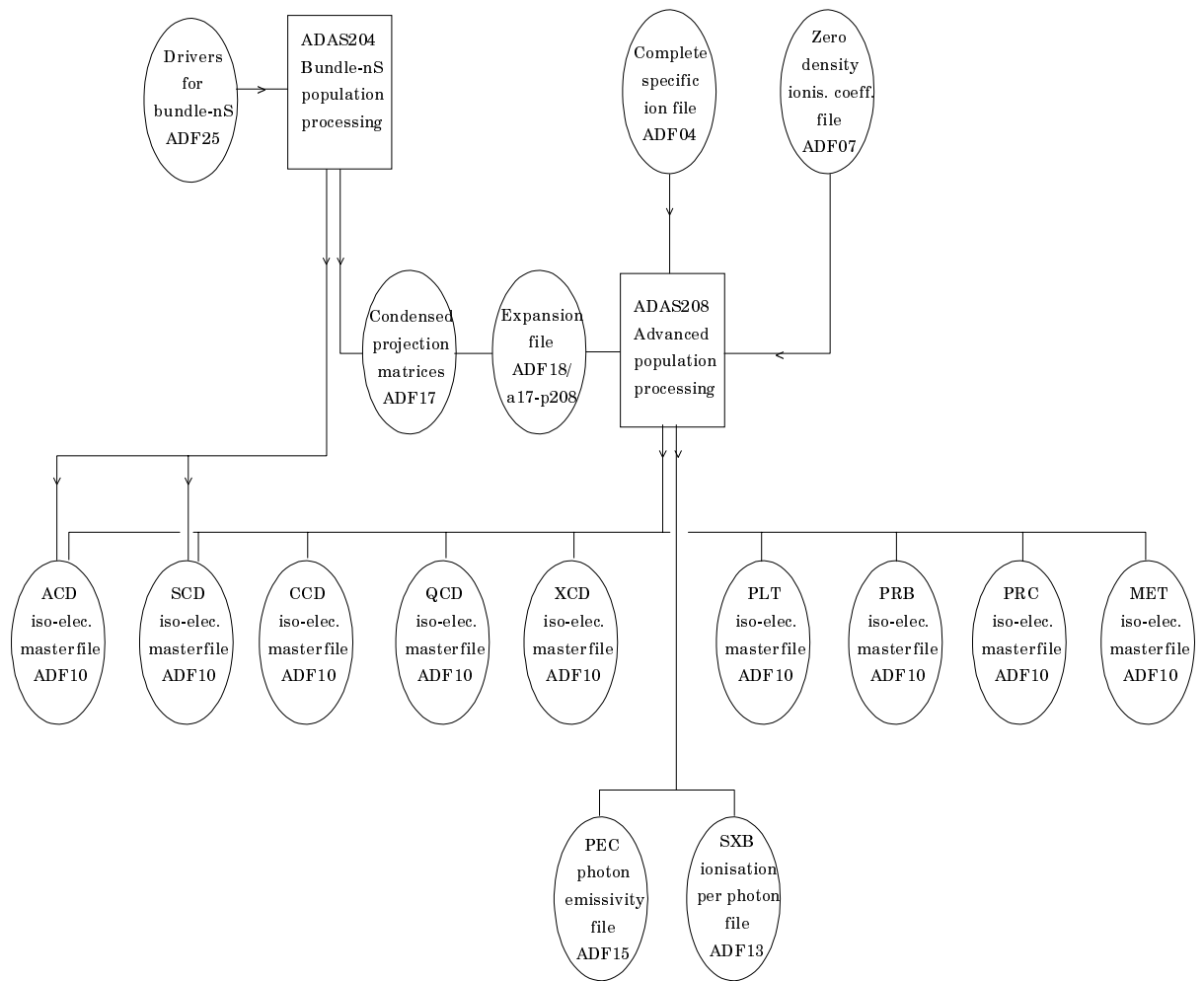
Figure 5.0

Figure 5.0b