Difference Map, Ratio Map, and Mix&Match Programs

These programs are used for comparing maps of identical regions taken at different energies. The difference map is typically used when one wants to detect an element against an interfering background. The background can be subtracted off by taking maps just above and just below an absorption edge of the element of interest. Anything other than that element will cancel out, to first order, while the element one is interested in will show up.

Ratio maps may be used for chemical-state mapping, in which one takes the maps at energies which have different absorptions for the different chemical states, e.g. the white-line energy for Cr(6+), at which Cr(3+) is almost silent.

The procedure is:

1. Take maps at two different energies, but the same scan parameters and SCA descriptions (bins, names)

2. Start the difference or ratio program. It will ask for the above-edge and below-edge filenames. It will ask which header to use as the header for the new file. This choice affects mostly the title and not much else.

3. It will then ask for the file to save the difference or ratio in. This file is just like a map file and may be read by the same programs. It also has a .xrf extension by default. Since a map file has a dwell time and an I0 for normalization, the output file has those as well, given by the sum of the dwell times and the average of the I0's.

The "counts" in each channel of the difference map are normalized to the assumed I0 and dwell times so that normalization by I0 and dwell works. Thus:

```
I0(diff) = (I0(1)+I0(2))/2
Tdwell(diff) = Tdwell(1)+Tdwell(2)
C(diff) = Tdwell(diff)*I0(diff)*
      (C(1)/(Tdwell(1)*I0(1))-C(2)/(Tdwell(2)*I0*(2)))
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and for the ratio map,

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I0(rat) = (I0(1)+I0(2))/2
Tdwell(rat) = Tdwell(1)+Tdwell(2)
C(rat) = Tdwell(rat)*I0(rat)*1000*
      (C(1)/(Tdwell(1)*I0(1)))/(C(2)/(Tdwell(2)*I0*(2)))
```

The 1000 in the ratio is there because counts are integers, so you need to put in a factor in order to cut the quantization error.

The Mix&Match program is used to make a composite map containing information from more than one map. For instance, suppose you're mapping Ba in the presence of Ti, an interfering species, but you're also interested in other species as well. You would then want to make a map just below the Ba edge and one just above. The next step is to use the Difference Map program to get the Ba signal. This comes out as one channel in a map, the rest of which is of little interest. You would then transfer the Ba difference into the lower-energy map. You now have a map with an extra channel - the difference,

which you would label as 'Ba'. Similarly, if you want to look at both light and heavy elements, you would want to map at more than one energy and make a composite map in which the light-element channels come from the low-energy map and the heavy-element channels from the high-energy map.

The Mix&Match program starts by asking for a Main map and a Donor map. The Main map is the one to which will be added a channel from the Donor map. The program lets you dial in the desired channel to be added, whose description appears in a display under the display of the donor file's header. You then fill in the new name under which you want that channel to appear. When you have the right ones, press the Xfer button. You can do this multiple times to transfer multiple channels from the same file, or you can read in a new donor file. The header for the map you have constructed appears in the display marked "Header lines (output)". Use this to confirm that you did what you wanted to. When you have finished the transplant, push Save. Again, the resulting file is a valid map, usable in any program which takes .xrf's.