Observables: Doppler Velocity, L.o.s. Magnetic Field, Continuum Intensity

A code written in C exists (named HMI_observables.c) that takes level 1.0 data (flat-fielded filtergrams) as input and:
- gapfill, de-rotate, un-distort, and temporally interpolate these input data;
- produces polarization calibrated data: I,Q,U and V, or LCP+RCP;
- if LCP+RCP data are produced: computes Doppler velocity, l.o.s. Magnetic field strength, continuum intensity + linewidth and linedepth (the last two products might not be saved in the DRMS).

The outputs are currently saved in the DRMS, in temporary su_couvidat.TestData series. The keywords are propagated from level 1.0 data (with appropriate modifications for some keywords, due to their change by the temporal interpolation, un-distortion, and de-rotation subroutines). The code also saves intermediate data (like the LCP + RCP filtergrams): this is for debugging purpose and might not be part of the final version.

This code compiles on n02 (a 64-bit machine) and was checked into the CVS in the proj/lev1.5_hmi/ directory.

This code calls external subroutines produced by Jesper and Richard and grouped in a library (also checked into the CVS), for:
- gap filling;
- un-distortion;
- derotation (correction for the rotation of the Sun that occurs during an observable sequence);
- temporal interpolation.

The observables code also calls a subroutine for the calculation of the Doppler velocity, l.o.s. Magnetic field strength, continuum intensity + linewidth and linedepth, using a MDI-like algorithm (implemented to work with 5 or 6 filters).
Ancillary codes have already been written and compiled in the DRMS to produce the look-up tables for this MDI-like algorithm and the phase maps of the HMI tunable elements on which these look-up tables are based.

The observables code has been tested on ground data from the series hmi_ground.lev0 (only basic tests, like “what happens if a filtergram is missing?”) and is currently being tested on mock data taken last month by Jesper at Astrotech. A lot more testing, and optimizations to speed up the calculations, are needed. Similarly, ancillary codes that produce the look-up tables for the MDI-like algorithm also need testing and optimization.

Finally, we still need to write a code that temporally averages I,Q,U, and V data for the production of vector magnetic field data, but this should be relatively easy because it simply requires a small modification of the current observables code.