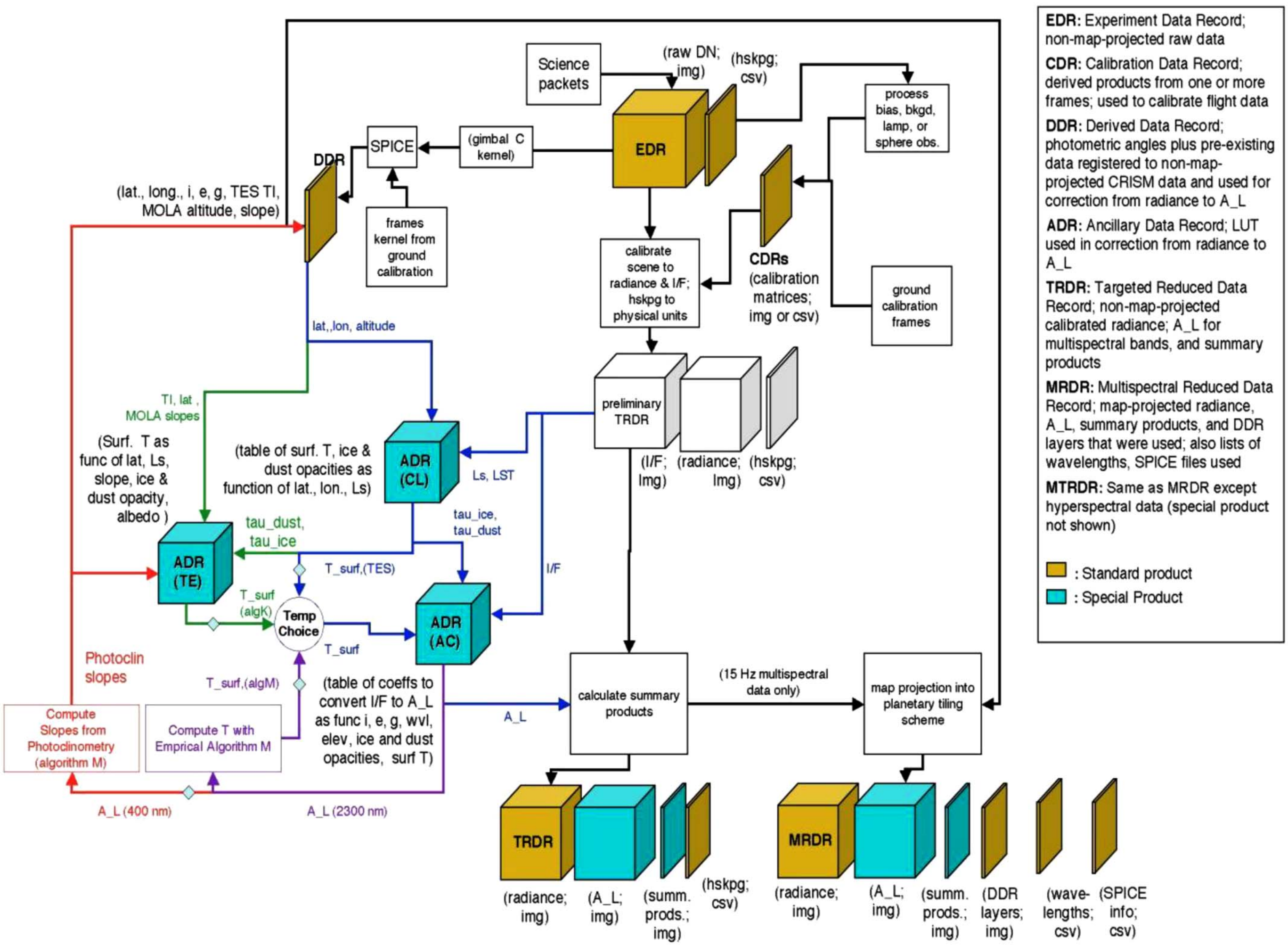

Fig. 1. Software flowchart [31] for converting the raw data (in the EDR) to calibrated I/F data (in the preliminary TRDR) to the photometrically, atmospherically, and thermally corrected Lambert albedo data (in the A_L TRDR). The DDR is used for backplane information such as the photometric angles and the georeferencing latitudes and longitudes. The ADRs are used as LUTs to query during the atmospheric and thermal correction; these ADR LUTs connect A_L to radiance (and to I/F), i.e., the LUTs connect actual surface properties to spacecraft measurements. The MRDR[5] is computed by map-projecting a number of Lambert albedo TRDRs into a given map tile. In phase one of this project, we use climatological thermometry of the surface from the MGS-TES spectrometer. Therefore, the complexity of the thermal correction shown in this flowchart is reduced considerably. In this paper, therefore, we focus particularly on the blue lines.

abundances and 2) the quantitative intercomparison of spectra from different orbits of the spacecraft under different observing conditions. The photometric model for a flat Lambertian surface without an atmosphere is $I/F = A_L \cos(\mathrm{INC})$, where INC is the solar incidence angle that is relative to the surface normal [22, pp. 190–191]. This photometric model presumes that the diffusely reflected photons have equally probable surface-reflectance angles, called the emission angles[6] (EMI). This independence of I/F on EMI often occurs for bright granular surfaces. Other more sophisticated non-Lambertian photometric models have been developed, for example, the Lunar–Lambert model [29] or the Hapke model [22], but for our multispectral mapping work with CRISM, we will begin with the simpler Lambertian model, with the intent that we will later extend this paper to non-Lambertian models, as warranted.

For a surface with an atmosphere overlying it, the correction is somewhat more complex, particularly for variable observing conditions. The effects of atmospheric scattering and absorption by both molecules and aerosols over different surfaces have been analyzed previously (for example, see the works of Bohren and Clothiaux [6], Chandrasekhar [9], and Thomas and Stamnes [55]).

Further detailed work on radiative transfer modeling through the martian atmosphere and off of surfaces of constant albedo has been done in [2, Fig. 1] for a case where the optical depth of dust aerosols is 0.35 and the optical depth for ice aerosols is 0.05, with the aerosol optical depths measured at the MGS-TES reference wavelengths of 9.3 and 12.1 μm, respectively. The modeling work by Arvidson *et al.* [2] was done in order to quantitatively extract Lambert albedos from data from the OMEGA spectrometer. Arvidson *et al.* [2] found that for these aerosol optical depths, for "darker" surfaces of Lambert albedo less than a "transition Lambert albedo" of $A_{L,\mathrm{trans},1} \sim 0.15$, the modeled I/F is higher than the Lambert albedo by

[5]Map-projected Reduced Data Record.
[6]Also known as "emergence angles."