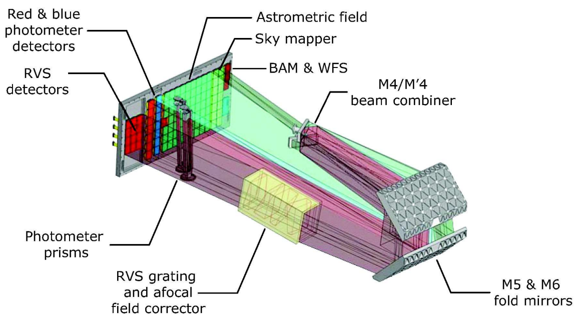

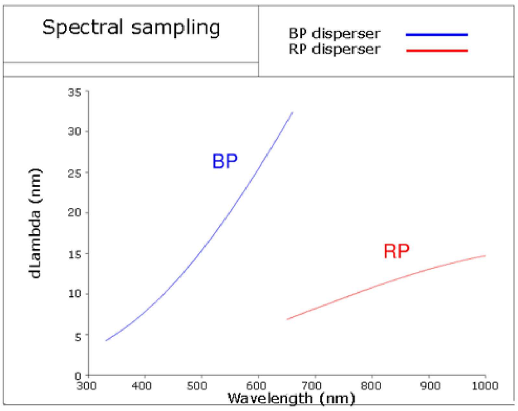

Left: Schematic view of the photometric instrument and the Gaia focal plane. Right: BP and RP dispersion properties (see text). Figures courtesy of EADS Astrium.

The primary aim of the photometric instrument is to measure the spectral energy distribution of all observed objects. This measurement is mission critical in two respects: it serves (i) to correct the measured centroid positions in the main astrometric field for systematic chromatic shifts, and (ii) to determine astrophysical characteristics, such as effective temperature, mass, age, and chemical composition, for all stars.

Gaia's photometric instrument is based on a dispersive-prism approach such that starlight is not focused in a PSF-like spot but dispersed along the scan direction in a low-resolution spectrum. The instrument consists of two low-resolution fused-silica prisms dispersing all the light entering the field of view. One disperser – called BP for Blue Photometer – operates in the wavelength range 330–680 nm; the other – called RP for Red Photometer – covers the wavelength range 640–1000 nm. Both prisms have appropriate broad-band filters for blocking unwanted light. The photometric instrument is integrated with the astrometric and spectroscopic instruments and telescopes; the photometric CCDs are located in the Gaia focal plane. As a result, light and objects coming from the two viewing directions of the two telescopes are superimposed on the photometric CCDs. The prisms are located between the last telescope mirror (M6) and the focal plane, close to the latter, and are physically supported by the CCD radiator (see the figure above).

Two CCD strips are dedicated to photometry, one for BP and one for RP. Both strips cover the full astrometric field of view in the across-scan direction. Since BP and RP use the (astrometric) Sky Mapper (SM) function for object detection and confirmation, all objects selected for observation in the astrometric field will also be selected for observation in BP and RP. All BP and RP CCDs are operated in TDI (time-delayed integration) mode. The CCDs have 4500 TDI lines and 1966 pixel columns (10×30 μm^2 pixels). Anti-reflection coatings and device thicknesses, and thus quantum efficiencies, are optimised separately for BP and RP.

The spectral resolution is a function of wavelength as a result of the natural dispersion curve of fused silica; the dispersion is higher at short wavelengths, and ranges from 4 to 32 nm/pixel for BP and from 7 to 15 nm/pixel for RP (see figure). The variation across-scan does not exceed $\pm 9\%$ for BP and $\pm 4\%$ for RP. The BP and RP dispersers have been designed in such a way that BP and RP spectra have similar sizes (on the order of 45 pixels along scan). BP and RP spectra will be binned on-chip in the across-scan direction; no along-scan binning is used. For bright stars, single-pixel-resolution windows are allocated, in combination with TDI gates. RP and BP will be able to reach object densities on the sky of at least 750,000 objects deg^{-2}. Window extensions meant to measure the sky background have been implemented.