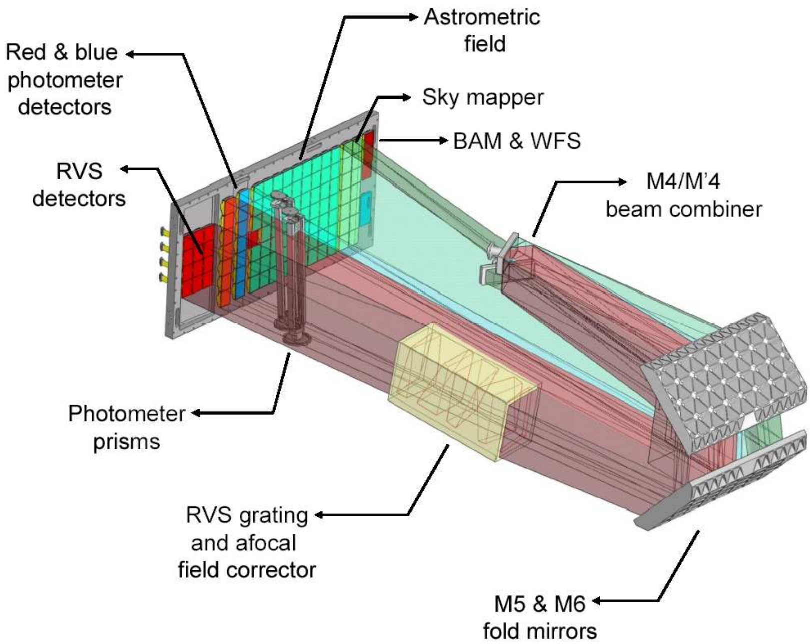

Schematic figure illustrating the location of the RVS optical module and CCDs. Figure courtesy of EADS Astrium.

The primary aim of the Radial Velocity Spectrometer (RVS) instrument is the acquisition of spectra for the brightest 100–150 million stars on the sky, down to 17-th magnitude. These spectra, mainly through extracted radial-velocity information, are crucial for the study of the kinematical and dynamical history of the Milky Way.

The RVS instrument is a near-infrared (847–874 nm), medium-resolution ($R = \lambda/\Delta\lambda \sim 11{,}500$), integral-field spectrograph dispersing all the light entering the field of view. The RVS instrument is integrated with the astrometric and photometric instruments and telescopes; the RVS CCDs are located in the Gaia focal plane. RVS uses the (astrometric) Sky Mapper function for object detection and confirmation. Objects will be selected for RVS observation based on measurements made slightly earlier in the Red Photometer. Light from objects coming from the two viewing directions of the two telescopes is superimposed on the RVS CCDs.

The spectral dispersion of objects in the field of view is materialised by means of an optical module physically located between the last telescope mirror (M6) and the focal plane. This module contains a grating plate, a filter plate, and four fused-silica lenses which correct the main aberrations of the off-axis field of the telescope. The RVS module has unit magnification which means that the effective focal length of the RVS equals 35 m. Spectral dispersion is oriented in the along-scan direction. A dedicated passband filter restricts the throughput of the RVS to the desired wavelength range. The total throughput of the telescope (6 Silver reflections), the grating plate, the four dioptric elements, and the bandpass rejection filter is ~30% at the central wavelength of the spectrograph (this value includes the CCD quantum efficiency).

The RVS-part of the Gaia focal plane contains 3 CCD strips and 4 CCD rows. With an assumed dead time of 20%, each source will thus typically be observed during ~40 field-of-view transits throughout the 5-year mission. On the sky, the RVS CCD rows are aligned with the astrometric and photometric CCD rows; the resulting semi-simultaneity of the astrometric, photometric, and spectroscopic transit data will be advantageous for variability analyses, scientific alerts, spectroscopic binaries, etc. All RVS CCDs are operated in TDI (time-delayed integration) mode. The RVS CCDs have 4500 TDI lines and 1966 pixel columns ($10 \times 30\ \mu m^2$ pixels) and are red enhanced with high resistivity.

RVS spectra will be binned on-chip in the across-scan direction. All single-CCD spectra are transmitted to the ground without any further on-board (pre-)processing. For bright stars, single-pixel-resolution windows will be used. The RVS will be able to reach object densities on the sky of at least 36,000 objects deg^{-2}.

Gaia: Radial Velocity Spectrometer Instrument