The problem of compressive detection of random subspace signals is studied. We consider signals modeled as $s = Hx$ where H is an $N \times K$ matrix with $K \leq N$ and $x \sim N(0_{K,1}, \sigma_{\infty}^2 I_K)$. We say that signal s lies in or leans toward a subspace if the largest eigenvalue of HH^T is strictly greater than its smallest eigenvalue. We first design a measurement matrix $\Phi = [\Phi_s^T, \Phi_o^T]^T$ comprising of two sub-matrices Φ_s and Φ_o where Φ_s projects the signal to the strongest left-singular vectors, i.e., the left-singular vectors corresponding to the largest singular values, of subspace matrix H and Φ_o projects it to the weakest left-singular vectors. We then propose two detectors that work based on the difference in energies of the samples measured by the two sub-matrices Φ_s and Φ_o and provide theoretical proofs for their optimality. Simplified versions of the proposed detectors for the case when the variance of noise is known are also provided. Furthermore, we study the performance of the detector when measurements are imprecise and show how imprecision can be compensated by employing more measurement devices. The problem is then re-formulated for the generalized case when the signal lies in the union of a finite number of linear subspaces instead of a single linear subspace. Finally, we study the performance of the proposed methods by simulation examples.