Coma Cluster

Observation plan

- Priority A: 1 pointing, 200 ks (RA=12:59:46.3, Dec=+27:56:45)
- Priority C: one offset pointing out of 4 below, 100 ks (which one is to be decided later):
  - West (12:59:19.2, +27:56:46)
  - North (12:59:46.3, +28:02:45)
  - East (13:00:13.5, +27:56:45)
  - South (12:59:46.3, +27:50:45).

Immediate objectives

The program will perform the first measurement of bulk and turbulent gas motions in a merging galaxy cluster. Turbulence is expected to be the dominant form of non-thermal energy in galaxy clusters, and characterizing it is crucial to determine the total energy budget, constrain deviations from hydrostatic equilibrium, and understand the origin of relativistic particles in the intracluster medium (ICM). The target of this observation, the Coma Cluster, is the nearest and brightest massive non-cool-core galaxy cluster undergoing merging activity.

Radio halos, i.e. diffuse, Mpc-scale radio sources associated with GeV electrons permeating the ICM, are believed to be powered by stochastic acceleration induced by the dissipation of turbulent motions in the ICM. The Coma Cluster is the only Priority A PV target hosting a Mpc-scale radio halo, thus the observation will provide the first direct estimate of turbulent velocities in a system hosting a radio halo.

The central pointing (Priority A) will yield 1000 counts in the He-like Fe line (6.7 keV) plus 700 counts in the H-like line (6.9 keV), providing an accurate measurement of the velocity dispersion of the line and detect any large asymmetries of the velocity distribution. The second, offset pointing (Priority C) will be located 200 kpc apart from the central pointing and will collect 500 counts in the Fe line complex. The addition of the offset pointing will constrain the power spectrum of velocity fluctuations across the cluster. Indeed, particle acceleration is expected to occur through the dissipation of small-scale turbulent motions. Although the scales over which particle acceleration occurs will not be directly measurable by XRISM, the normalization and the injection scale of the velocity power spectrum will allow us to probe how much of the dissipated turbulent energy will be channeled into particle acceleration. The offset pointing will be a downpayment toward a future raster scan of the cluster, which will measure the ICM turbulence spectrum.

While Resolve is collecting the line photons, Xtend will obtain a detailed temperature and abundance map of the entire cluster core. Comparing it with the Planck data, for example, will determine whether our understanding of the ICM energy budget is correct. Resolve should also detect an OVIII line, constraining the presence of cool gas in the cluster outskirts on the core line of sight.