FRIPON, THE FRENCH FIREBALL NETWORK.

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Introduction: FRIPON (Fireball Recovery and InterPlanetary Observation Network) is a network of 100 all-sky cameras to cover France with 100km between stations [1]. It will observe fireballs and reconstruct their orbits in order to determine source regions, as well as fall locations for objects large enough to reach the ground. We expect to see ~1 object per night over the network, a small fraction of which will yield meteorites. Within a few years, we will compute thousands of orbits to study source regions. When the recovery of a meteorite appears possible, we will organize search parties with the help of the Vigie-Ciel citizen science project [2]. We hope to recover at least 1-2 falls per year and connect their dynamical history and composition.

Optical network: As in other fireball networks, fish-eye lenses are used to cover the whole sky. Our cameras are based on Sony chip ICX445, allowing both good efficiency for low light measurements at night and short exposures for daytime observations. Compared to older networks mainly using video analogical devices, FRIPON improvements are: (1) Digital cameras; (2) 1.2 megapixel chips; (3) 10^{-6} sec exposure time for daytime; (4) 30 fps; (5) GigE Vision protocol; (6) PoE allowing up to 100 m single cable between the camera and the computer.

Radio network: While an optical network will accurately measure geometry, velocity determination from only a few points on fish-eye images is less easy. Speed is essential for determining orbit semi-axis, hence crucial to pinpointing the origin of fireballs and possible parent bodies. The Doppler effect will be used to measure it, by observing radar echoes of the GRAVES beacon [3] on fireballs. Dedicated to low altitude satellites, GRAVES is usable all over France. A 200 km spacing being sufficient [3], 1 in 4 of our cameras will be coupled with radio equipment.

Reduction pipeline: Our reduction software, FreeTure [4], developed on Linux and Windows, is based on GigE Vision cameras but is easy to adapt to other cameras. Hardware configuration is: i3 processor, 8Gb RAM (image buffering), 32Gb SSD (system) and 1Tb HDD (data). FreeTure subtracts consecutive frames with a detection threshold and analyzes pixels on several to determine the speed, and hence the reality of a meteor observation. As it stores previous images, sequences centred on each detection can be isolated. We are presently using standard two location algorithms to compute strewn-fields and orbits but will develop a dedicated method for multi-detection.

Conclusion: Our hardware is now completely defined and tested. 60 locations are being installed and we plan to have the network fully operational by the end of 2015. FreeTure is already on GitHub and an official release will be available soon. The FRIPON project is open source both for hardware and software [1], so that it can be easily copied, in Europe to build a network unprecedented in size, and possibly worldwide. FRIPON is funded by ANR (Agence Nationale de la Recherche).

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