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Solar-Blind Ultraviolet Detection in UAP Research: A Multi-Sensor Instrumentation and Validation Framework

—Scientific Rationale, Binary Photon Detection, Imaging Localization, and Multi-Sensor Validation

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Abstract

Unidentified anomalous phenomena (UAP) research has increasingly adopted multi-sensor methods, yet ultraviolet-C (UVC) sensing remains comparatively underutilized. This paper argues that solar-blind UVC detection should be added as a distinct measurement domain in systematic UAP field research. The rationale is atmospheric: ozone and molecular oxygen strongly attenuate solar radiation below approximately 280 nm, producing a low-background spectral region at ground level. A local source emitting in this band may therefore be detected with high contrast even in daylight. Two complementary instrument classes are emphasized. First, non-imaging binary or photon-counting detectors, exemplified by Hamamatsu Photonics UVTRON flame/discharge sensors, provide rapid, inexpensive, high-sensitivity indication of UVC photon events. Nickel-electrode UVTRON models respond over approximately 185 - 260 nm and are engineered to detect weak flame and electrical-discharge emissions with millisecond-scale response. Second, imaging solar-blind systems, exemplified by OFIL Systems' DayCor UV-Eye camera core, add spatial localization by combining a 240 - 280 nm UV channel with a synchronized visible channel. The proposed UAP architecture uses binary detectors as wide-area sentinels and event triggers, followed by imaging UVC and independent visible, infrared, radar, radio-frequency, acoustic, and environmental measurements for cross-modal validation. The paper distinguishes established UVC physics from UAP-specific hypotheses: UVC emission is not a validated or unique UAP signature. Its scientific value lies in creating a falsifiable test of whether independently tracked anomalous objects or associated atmospheric processes produce repeatable short-wavelength ultraviolet emission. A calibration, false-positive, synchronization, and evidence-grading framework is presented for field deployment and peer review.

Keywords

UAP, UVC, Solar-Blind Ultraviolet, UVTRON, Binary Detector, Photon Counting, UV Imaging, OFIL UV-Eye, Multi-Sensor Fusion, Corona, Plasma, Instrumentation

1. Introduction and Theoretical Basis

The central instrumentation problem in UAP research is not simply detecting unusual objects; it is acquiring measurements that constrain competing physical explanations. A visible image may establish morphology or apparent motion but can remain ambiguous with respect to range, temperature, emission, and source mechanism. Radar, thermal infrared, radio-frequency (RF), acoustic, and optical systems each interrogate different physical interactions. The Eye on the Sky field framework therefore treats cross-modal detection as a forensic method in which independent sensors constrain one another rather than allowing a single instrument or observer to dominate interpretation [1].

Within that framework, the ultraviolet spectrum is important because it can probe energetic processes that are not necessarily conspicuous in visible or thermal imagery. The UVC region is especially attractive because Earth's atmosphere provides a natural spectral filter. Ozone and molecular oxygen strongly absorb short-wavelength solar UV, and wavelengths below approximately 280 nm are effectively removed from the direct solar background at the surface [2] [3]. A ground-based detector restricted to this region can therefore operate in a solar-blind condition.

The proposition advanced here is deliberately limited: solar-blind UVC should be incorporated into UAP research as a testable sensor domain. This does not mean that UAP are known to emit UVC.

Rather, it means that a calibrated UVC channel can test whether an independently observed object or associated atmospheric process produces local short-wavelength emission. This distinction between measurement capability and interpretation is essential for journal-quality UAP research.

1.1. Operational Definitions and Admissibility Criteria

For this study, an independently tracked anomalous object is operationally defined as a discrete aerial or maritime target that is detected by at least one calibrated tracking modality capable of constraining position or motion (for example, radar, optical tracking, or triangulation), is not correlated within stated uncertainty to known aviation, maritime, astronomical, meteorological, or local anthropogenic sources, and has sufficient time-resolved data to permit an independent review of the track. A visual observation alone does not satisfy this definition.

A UVC-associated event is defined as a solar-blind UVC response that exceeds the predeclared detector-specific background criterion and is temporally and spatially consistent, within quantified uncertainties, with an independently tracked object. Entry into the evidence-grading process requires, at minimum: (1) a valid instrument-health state; (2) a documented UVC background interval; (3) UTC-synchronized timing with known uncertainty; (4) a UVC event window satisfying the a priori trigger rule; and (5) either angular overlap with the tracked target within the combined boresight/registration error or corroboration by a second independent UVC detector with a physically consistent field of regard. Events failing these conditions remain unclassified sensor events and are not graded as UVC-associated object events.

1.2. Scientific Basis of the Solar-Blind Window

UVC is commonly defined as ultraviolet radiation below the UVB boundary near 280 nm. NASA describes the 200 - 280 nm band as strongly absorbed as sunlight penetrates the ozone layer, while WMO assessments state that wavelengths shorter than 280 nm are absorbed by ozone, molecular oxygen, and other atmospheric species and do not reach the ground in ordinary conditions. This creates a markedly different observing environment from UVA, visible light, and much of the infrared spectrum, all of which contain substantial natural background radiation.

Detection performance depends on signal-to-noise ratio (SNR), not on signal strength alone. In a bright spectral background, a weak source can be difficult to distinguish even with a sensitive detector. Solar-blind UVC reverses that condition: the source may be weak, but the natural solar background in the selected band is also extremely low. This is why solar-blind detectors are established in flame detection, electrical-discharge monitoring, and corona inspection. The same physics makes the band attractive for exploratory UAP measurements. The conceptual relationship between the suppressed solar background and the nominal detector bands is illustrated in Figure 1.

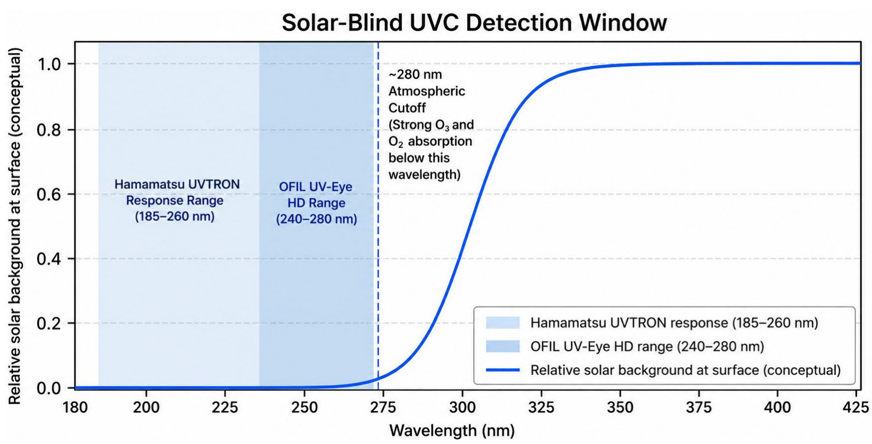


Figure 1. Conceptual solar-blind window and nominal response bands. The background curve is illustrative rather than a calibrated atmospheric-transmission model.

Atmospheric absorption is simultaneously an advantage and a limitation. It suppresses incoming solar UVC, but it can also attenuate UVC traveling from a distant source to a ground-based sensor. Consequently, a low background does not imply unlimited detection range. Useful range depends on source spectrum and radiance, path length, ozone and oxygen absorption, aerosols, humidity, elevation angle, optical aperture, detector responsivity, integration time, and electronic noise. Any UAP deployment must therefore measure range performance experimentally rather than infer it from the phrase solar blind.

1.3. Source-to-Sensor Propagation and Useful Range

Detector sensitivity and useful field range are not equivalent. The received spectral irradiance at the detector may be represented by $E\lambda$, det = $L\lambda$, src · Ω src · $T\lambda$ (R, θ, atm) · τopt(λ), where $L\lambda$, src is source spectral radiance, Ωsrc is the source solid angle at the receiver, $T\lambda$ is atmospheric transmission over slant range R and elevation angle θ, and τopt is the installed optical transmission. For an unresolved source, geometric dilution and atmospheric extinction both reduce the received signal. Accordingly, a detector specification measured at the entrance aperture cannot be converted directly into a UAP detection range without a source radiance model and a path-specific transmission model.

For field planning, the manuscript now treats 185 - 260 nm UVTRON coverage and 240 - 280 nm imaging coverage as distinct propagation regimes. Shorter UVC wavelengths are expected to experience the strongest oxygen/ozone attenuation; transmission generally improves toward the long-wavelength edge of the solar-blind region, but the solar background also rises as the band approaches approximately 280 nm. Low-elevation paths have greater air mass than near-zenith paths and therefore incur substantially greater extinction. Humidity, aerosol loading, haze, and ozone column further modify the path. These effects make a high-sensitivity detector potentially useful for nearby energetic sources while still providing limited range for weak distant emitters.

Table 1. Representative source-to-sensor propagation regimes for the proposed UVC detector bands. Path intervals are modeling/planning cases rather than claimed detection ranges.

Band/sensor	Representative path	Elevation	Expected transmission behavior	Interpretive use
185 - 220 nm/UVTRON	0.1 - 1 km	30˚ - 90˚	Very strong molecular absorption; useful transmission may be severely range-limited.	Near-field transient/discharge sensitivity; do not infer long range from detector sensitivity.
220 - 260 nm/UVTRON	0.1 - 5 km	30˚ - 90˚	Strong but wavelength-dependent attenuation; performance improves toward 260 nm and at higher elevation.	Candidate sentinel band; range must be established with controlled sources.
240 - 260 nm/overlap	0.1 - 5 km	10˚ - 90˚	Common binary/imaging overlap; low-elevation slant paths incur substantially larger optical depth.	Best region for cross-instrument comparison under matched geometry.
260 - 280 nm/UV-Eye	0.5 - 20 km	10˚ - 90˚	Relatively greater transmission toward 280 nm, with increasing susceptibility to residual/background leakage near the solar-blind boundary.	Imaging localization; requires measured out-of-band rejection and site-specific background.

Table 1 summarizes representative source-to-sensor propagation regimes for field planning. The path ranges in this table are representative modeling intervals, not claimed detection ranges. Final quantitative transmission curves should be generated for the actual site, date, ozone column, aerosol profile, humidity, altitude, and line of sight using a validated atmospheric radiative-transfer model (for example, MODTRAN or an equivalent code) and then checked with controlled UVC sources. Useful range will be reported only where modeled transmission, measured source output, detector response, optics, and the declared detection probability are all available.

1.4. Candidate Physical Mechanisms and Falsifiable Research Question

1.4.1. Corona and Electrical Discharge

The best-established terrestrial analogue is corona partial discharge. A sufficiently strong local electric field ionizes surrounding gas and produces ultraviolet emission. OFIL's solar-blind cameras exploit this mechanism in high-voltage inspection. If a UAP-associated UVC signal were observed, electrical-field-driven ionization would be one hypothesis to test, not a conclusion to assume. Solar-blind ultraviolet imaging is an established method for detecting and localizing corona partial discharge in high-voltage equipment [4].

1.4.2. Plasma and Energetic Atmospheric Interaction

Hot or non-equilibrium plasmas, electrical arcs, and some energetic atmospheric processes can emit in the ultraviolet. A moving object interacting with the atmosphere through strong fields, heating, shock, or ionization could in principle produce UVC photons. Spectral measurements would be needed to distinguish among mechanisms.

1.4.3. Combustion and Propulsion

Flames and some propulsion-related processes can emit ultraviolet radiation. This is a critical confounder because the same sensitivity that makes UVTRON useful for flame detection can also make it respond to prosaic combustion sources. Known aircraft, rockets, drones, ships, flares, and industrial sources therefore belong in the reference library.

With the operational definitions above established, the central research question is: Do independently tracked anomalous objects exhibit UVC photon rates or imaged UVC radiance significantly above calibrated local background, with spatial and temporal association satisfying the predeclared admissibility criteria, and are such emissions repeatable under comparable kinematic or environmental conditions? A negative result constrains candidate energetic mechanisms; a positive result requires source discrimination, independent replication, and quantified uncertainty.

2. Hardware Architecture

2.1. Binary Solar-Blind Detection: Hamamatsu UVTRON

In this paper, binary detection means a non-imaging UVC channel whose primary scientific output is the occurrence and timing of photon-triggered discharge pulses or counts rather than a spatial image. In the simplest event logic, the channel answers whether UVC activity above a defined threshold occurred within a known field of regard and time interval. More sophisticated implementations retain count rate, pulse timing, coincidence statistics, and threshold state, so the data need not be reduced to a single yes/no bit.

Hamamatsu Photonics' UVTRON devices are gas-filled ultraviolet flame/discharge sensors rather than conventional dynode photomultiplier tubes. UV photons entering through UV-transmitting glass release photoelectrons from the cathode by the photoelectric effect. Under the applied electric field, these electrons accelerate and ionize the fill gas, producing a discharge pulse that is subsequently quenched. This architecture yields a compact photon-event sensor well suited to threshold, pulse-count, and trigger applications [5].

For nickel-electrode UVTRON models, Hamamatsu specifies a spectral response of approximately 185 - 260 nm, placing the detector well inside the solar-blind UVC region. The 2025 catalog describes rapid response to flame and electrical-discharge UV in less than a few milliseconds. Model-dependent quenching times are typically on the order of 1 - 3 ms. This combination is attractive for detecting short transients and for creating a fast trigger that can mark data buffers in slower imaging or spectral systems.

Hamamatsu lists multiple geometries and sensitivities, including the compact R9533, highsensitivity R14388, and ultra-high-sensitivity R13192. The catalog reports that, under its specified 500 × 500 mm alcohol-flame test condition, the R9533 can detect the target at approximately 80 m and the R13192 at approximately 125 m. These figures demonstrate detector sensitivity under a defined flame source; they must not be interpreted as UAP detection ranges. UAP range performance would require a source-specific radiometric model and controlled calibration.

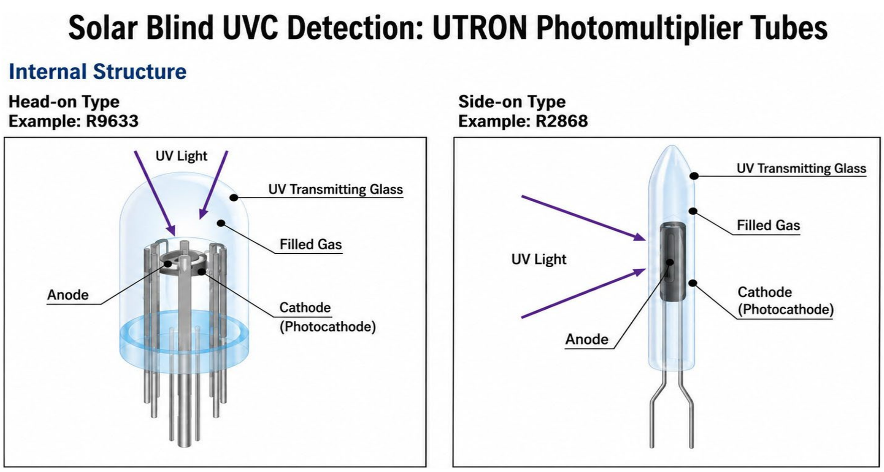


Figure 2. Head-on and side-on UVTRON sensor structures reproduced in the authors' 2026 UAP Detection and Tracking Summit presentation from Hamamatsu technical material.

Binary UVC sensors have four practical advantages in a distributed UAP network: low data bandwidth, millisecond-class event response, low computational burden, and the ability to deploy several separated detectors for coincidence logic. Multiple stations can be arranged with overlapping fields of regard. A pulse seen by only one detector may be local noise or an artifact; temporally coincident detections at separated stations materially strengthen the inference that an external UVC source was present. The authors' 2026 summit presentation explicitly positioned nonimaging detectors beside imaging arrays because of processing speed and their contribution to a multimodal architecture [1]. The internal sensor geometries used by representative UVTRON devices are shown in **Figure 2**.

2.2. Imaging Solar-Blind Detection: OFIL DayCor UV-Eye

A binary sensor can establish that UVC photons were detected, but it cannot by itself show where within its field of regard the photons originated. Imaging solar-blind cameras address this limitation. OFIL Systems, an Israeli manufacturer of ultraviolet corona-imaging systems, produces the DayCor UV-Eye camera core for OEM integration. OFIL's established application is the visualization and localization of corona partial discharge and arcing in electrical infrastructure; the proposed UAP application is an experimental extension of that mature sensing principle, not a manufacturer-validated UAP use case [6] [7].

The published UV-Eye HD specification lists a 240 - 280 nm spectral range, absolute sunlight rejection under stated operating conditions, a minimum UV sensitivity of 1.9×10^{-18} W/cm^2, synchronized UV and visible channels, selectable UV/visible overlay, and UV/visible overlay deviation below 1 milliradian. The system provides continuous fields of view from approximately 10˚ × 5.6˚ to 1.6˚ × 0.9˚, UV optical and digital zoom, HD 720p/60 video output, RTSP streaming, HDMI and gigabit Ethernet interfaces, and IP65 environmental protection [6]. These features make the camera core technically compatible with fixed observatories, mobile laboratories, and slew-to-cue architectures.

Figure 3. DaycorR UV Eye used in predictive maintenance inspections and diagnostics, developed by OFIL Systems Ltd., from Isreal.

Figure 3. OFIL DayCor UV-Eye camera core used for solar-blind corona localization in industrial inspection.

Figure 4. Shows how both Thermal Detectors and Solar Blind detectors are used in predictive maintenance applications, where voltage stress produced by Corona (Partial Discharge, PD) eventually leads to dielectric breakdown of the insulating materials. This cascading effect leads to arcing across opposite potentials. Arcing produces a heating effect which can create significant thermal IR signatures. Coronal discharges are much more difficult to observe without UV detection equipment used in this insulation system.

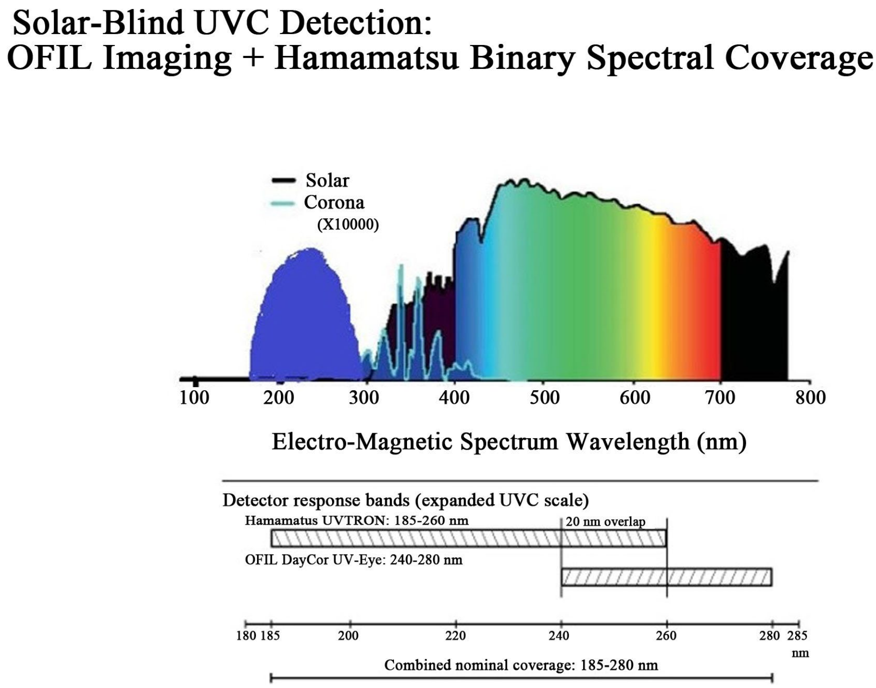


Figure 4. OFIL solar-versus-corona spectral illustration augmented with the nominal response bands of the Hamamatsu UVTRON binary detector (185 - 260 nm) and the OFIL DayCor UV-Eye imaging channel (240 - 280 nm). The two instruments overlap from 240 - 260 nm and together provide nominal continuous coverage from approximately 185 - 280 nm. The combined band depiction represents spectral coverage, not uniform responsivity or equivalent detection range across the band.

For UAP research, the key value of an imaging UVC camera is localization. A binary UVC pulse becomes substantially more informative if a synchronized camera places UVC emission on the same angular coordinates as an independently tracked visible, infrared, or radar target. The visible/UV overlay can also provide scene context and identify terrestrial sources such as insulators, power hardware, flames, or nearby electrical activity. OFIL's industrial literature demonstrates the underlying capability by using solar-blind imaging to pinpoint corona emission sites that may be invisible to the naked eye.

The two instrument classes solve different problems. UVTRON-style detectors are optimized for rapid, inexpensive event sensing and pulse counting; UV-Eye-style imagers are optimized for spatial localization and visual correlation. A robust UAP observatory should use the binary layer as a sentinel and the imaging layer as a localization and validation instrument. This division of labor also reduces the need to record or process high-rate imaging continuously at maximum sensitivity.

DayCor UV-Eye Optical Architecture and Measurement Role

The DayCor UV-Eye is important to the proposed architecture because it is not merely a conventional camera fitted with a UV filter. The published OFIL specification describes a dedicated solar-blind ultraviolet imaging channel operating over approximately 240 - 280 nm together with a synchronized visible channel. The two channels can be displayed independently or registered as a UV/visible overlay. This architecture allows a weak ultraviolet emission to be localized against recognizable scene geometry while preserving a separate visible record for contextual interpretation. The stated UV/visible overlay deviation of less than 1 milliradian is particularly relevant to the proposed UAP methodology because spatial association must be quantified rather than inferred from approximate visual alignment [6].

For field research, the imaging channel serves a fundamentally different function from a UVTRON-type binary detector. A binary detector can provide rapid evidence that photons were registered within its field of regard, whereas the UV-Eye provides two-dimensional localization, field-of-view information, and a time-resolved image stream that can be compared with visible/NIR, MWIR/LWIR, radar, and other tracking data. The camera therefore acts as a localization and attribution instrument within the proposed sensor-fusion chain, not simply as a second UVC alarm. The principal published UV-Eye characteristics and their measurement relevance are summarized in **Table 2**.

Table 2. Representative OFIL DayCor UV-Eye HD characteristics relevant to the proposed instrumentation framework. Values are manufacturer specifications and should be verified or bounded under the actual installed configuration before quantitative field claims are made.

UV-Eye characteristic	Published specification/function	Importance to proposed UAP measurements
Solar-blind UV channel	240 - 280 nm	Restricts the imaging measurement to the short-wavelength UV region in which ground-level solar background is strongly suppressed.
Minimum UV sensitivity	1.9×10^{-18} W/cm^2 (published specification)	Supports detection of weak UV emission at the detector; it must not be interpreted as a stand-alone target-range specification.
Visible + UV channels	Synchronized channels with selectable overlay	Provides scene context and permits a UVC emission centroid to be compared with a visible target position.
Registration	UV/visible overlay deviation <1 mrad	Supports a quantitative spatial-coincidence test when combined with boresight and tracking uncertainties.
Field of view	Approximately 10˚ × 5.6˚ to 1.6˚ × 0.9˚	Allows wide-area acquisition and narrower localization/inspection modes.
Video/interfaces	HD 720p/60; RTSP; HDMI; Gigabit Ethernet	Supports time-resolved recording and integration with networked mobile-laboratory or observatory data systems.
Environmental protection	IP65	Supports outdoor deployment, subject to the complete installed system and environmental qualification.

The complementary wavelength coverage is a principal advantage of using the two instrument classes together. The Hamamatsu UVTRON extends the solar-blind measurement domain down to approximately 185 nm and provides rapid photon-event counting across 185 - 260 nm, while the OFIL UV-Eye provides spatially resolved imaging from approximately 240 - 280 nm. Their 20-nm overlap between 240 and 260 nm provides a useful cross-check region in which a transient may be registered by both detector types, while the non-overlapping portions extend the total nominal observing span to approximately 185 - 280 nm. In practical terms, the binary detector broadens short-wavelength event sensitivity, whereas the imaging camera adds localization at the longer end of the solar-blind region. This pairing therefore improves spectral coverage and event discrimination without implying that sensitivity, atmospheric transmission, or useful detection range is uniform across the combined band.

The OFIL material also illustrates why UVC imaging can provide information that thermal imaging may not provide at the same stage of an energetic process. Corona partial discharge is produced by localized electric-field-driven ionization and can emit ultraviolet photons before a substantial thermal signature develops. In industrial inspection, this permits UV imaging to reveal an electrical-stress process that can be inconspicuous in ordinary visible imagery and may precede later resistive heating. In the UAP context, this is used only as a physical analogue: the paper does not assume that an anomalous target produces corona, but proposes a sensor capable of testing whether comparable short-wavelength emission is present. The progression from corona initiation toward insulation degradation and arcing is illustrated in Figure 5.

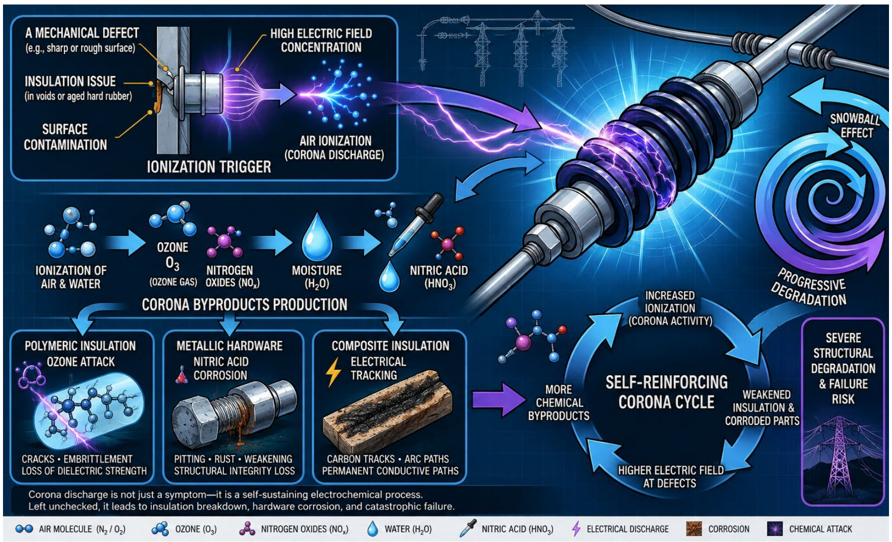


Figure 5. OFIL illustration of corona-discharge initiation and progressive degradation in high-voltage equipment. Its relevance here is mechanistic rather than diagnostic of UAP: it demonstrates an established physical pathway in which electric-field concentration produces air ionization and ultraviolet emission that can be localized by solar-blind imaging. Source: OFIL technical material.

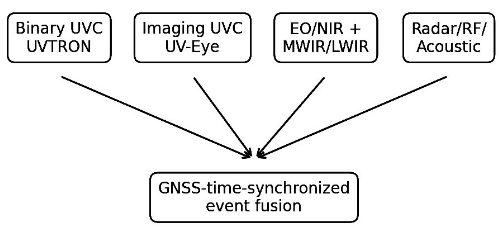
These instrument figures are included to make clear what the imaging subsystem contributes experimentally. The proposed research does not infer a mechanism from the presence of a UV signal. Instead, the UV-Eye is used to determine whether a statistically valid UVC event can be localized in angle, registered against the visible scene, and correlated in time and position with an independently tracked object. Only after those measurement conditions are satisfied would electrical discharge, plasma-like interaction, combustion, or another source mechanism be considered during differential analysis.

2.3. Hybrid Multi-Sensor Architecture

Deploy multiple solar-blind binary detectors around the observing platform with characterized angular sensitivity. Each detector records raw pulse times and count rates against a disciplined UTC time base. Threshold crossings can trigger event flags, but raw counts should be retained so that thresholds can be re-evaluated after collection.

A fixed or steerable solar-blind UVC imager should continuously observe a priority sector or be cued by radar, optical tracking, or a binary UVC event. If the system is steerable, pointing telemetry, boresight calibration, lens state, field of view, and focus must be recorded with each frame. Pre-trigger buffering is important because the causal sequence may begin before the trigger threshold is crossed.

UVC data should be synchronized with visible/NIR, SWIR where available, MWIR/LWIR thermal imagery, radar range and Doppler measurements, RF spectrum monitoring, acoustic/ultrasonic measurements, magnetometry or other environmental sensors, meteorological data, aviation/maritime traffic data, and astronomical context. The authors' summit framework emphasizes that cross-modal validation produces a reconstructive dataset that is more resistant to single-sensor failure, artifact, or interpretive bias [1]. The proposed synchronized sensor-fusion architecture is summarized in Figure 6.



Binary detection supplies fast event evidence; imaging supplies localization; independent modalities constrain interpretation.

Figure 6. Proposed synchronized hybrid UVC architecture: binary detection, imaging localization, and independent cross-modal sensing.

3. Methodology and Protocols

3.1. A Priori Binary-Detector Trigger and Event Significance

The binary-detector decision rule shall be fixed before operational data review.

For each detector and observing configuration, background will be estimated from a rolling 30-minute interval that excludes declared calibration periods and previously flagged events. The primary trigger is defined as a count total within a 100 ms event window that exceeds the 99.999% upper-tail expectation of the empirically measured background distribution, subject to a minimum of three registered pulses after dead-time correction. For a two-detector coincidence event, both detectors must satisfy their individual trigger criterion within a ±10 ms coincidence window after measured channel latency is removed. The nominal design objective is fewer than one statistical false trigger per detector per 24 hours of valid observing time; site-specific thresholds will be raised if baseline data show a higher empirical false-alarm rate.

Poisson statistics will be used only when the baseline count process is consistent with a stationary Poisson model. Detector quench/dead time will be measured for each channel and incorporated through a nonparalyzable or empirically fitted dead-time correction appropriate to the electronics. If the baseline exhibits overdispersion, burst clustering, serial correlation, or rate changes inconsistent with Poisson assumptions, significance will be calculated from the empirical count distribution or a fitted overdispersed point-process model rather than from a simple Poisson tail. Event p-values, the effective number of tested windows, and the resulting false-alarm probability will be reported. The raw, unthresholded pulse stream will be retained so that the declared rule can be independently reproduced.

3.2. Calibration and Measurement Traceability

Verify the actual spectral responsivity of each detector and optical filter. A nominal UVC label is insufficient. Out-of-band rejection must be measured because leakage from visible, UVA, or UVB light could create false correlations under bright conditions. NIST work on wide-bandgap solar-blind photodiodes illustrates the importance of detector responsivity and strong rejection below the semiconductor bandgap [8].

For UVTRON channels, record operating voltage, quench circuit, detector model and serial number, angular response, background count distribution, dead/quench time, threshold logic, and count-rate response to controlled UV sources. Because pulse counts are stochastic, background and source measurements should be long enough to estimate Poisson or overdispersed count statistics rather than relying on anecdotal trigger behavior.

For UV-Eye or comparable imagers, characterize boresight, UV-visible registration, field of view, focus, gain, frame integration, dark behavior, spatial uniformity, saturation, and minimum detectable signal. Radiometric claims require a calibrated optical chain; otherwise, image intensity should be reported as instrument units rather than converted into physical source power.

All UVC and non-UVC sensors should share a disciplined time base, preferably GNSS-derived UTC with measured timing uncertainty. Millisecond-class timing is desirable for fast UVC transients. Event coincidence windows should be specified before analysis to reduce post hoc matching.

Calibration is separated into three reporting levels. Directly measured quantities include detector pulse counts and timestamps, background count distributions, detector operating voltage, dead/quench time, angular response, camera digital level, integration time, gain, field of view, boresight/registration error, and irradiance at the detector aperture when a traceable calibrated UVC source or radiometer is used. These measurements describe the sensor-side response.

Unless the complete optical chain is radiometrically calibrated, imaging intensity and binary count rate will remain in instrument units and will not be converted into source power. Source spectral radiance or radiant intensity may be inferred only when detector spectral responsivity, optical throughput, bandpass, source angular extent or range/geometry, atmospheric transmission, and measurement uncertainty are all known or bounded. Radiometric reporting will therefore be reserved for controlled-source tests or field events with sufficient range, geometry, spectral-response, and atmospheric information to support a traceable uncertainty budget.

3.3. False-Positive Controls, Timing, and Spatial Association

Solar-blind does not mean false-positive blind. Candidate UVC events must be screened against known UV sources and detector artifacts. Important environmental sources include high-voltage transmission hardware, substations, arcing, lightning, welding, germicidal lamps, flames, combustion, and energetic plumes. Hamamatsu specifically warns that unintended UV sources such as arc welding and germicidal lamps can trigger UVTRON devices. Imaging systems can additionally suffer from intensifier noise, hot pixels, blooming, internal reflections, filter leakage, saturation, and registration errors.

A site survey should map power infrastructure and fixed UV emitters. Event review should include lightning data, weather, air and marine traffic, astronomical transients, and local human activity. A UVC-only detection should remain an unclassified sensor event unless it passes instrument-health checks and is correlated with an external source through imaging, geometry, or another independent modality.

Spatial association requires the UVC centroid or characterized detector sector to overlap the independently tracked target after combining boresight error, registration error, tracker uncertainty, target angular motion during the integration interval, and parallax where relevant. Temporal association requires overlap within the predeclared coincidence window after measured clock offsets and acquisition latency are removed. These uncertainty terms are part of the event record rather than post hoc interpretive adjustments.

3.4. Evidence Grading

A graded evidence model helps separate detection from interpretation. The following hierarchy is proposed for UVC-associated UAP events:

- Tier 0—Single-detector UVC threshold crossing without independent corroboration.
- Tier 1—Repeatable or multi-frame/count UVC event with instrument-health and local-source checks passed.
- Tier 2—Coincident UVC detection on two independent UVC sensors or UVC plus co-located imaging evidence.
- Tier 3—UVC event correlated with independently measured target kinematics, such as radar range/Doppler or optical triangulation.
- Tier 4—Repeatable multi-sensor UVC-associated signature observed across multiple events, instruments, sites, or independent teams.

The hierarchy is intentionally conservative. A UVC signal can be scientifically interesting at Tier 0 or Tier 1 but claims about an anomalous object's physical behavior should be reserved for events with independent spatial and temporal correlation.

3.5. Validation Program

Before interpreting UAP events, conduct unattended UVC observations at each field site to establish daytime/nighttime background distributions, weather dependence, seasonal variation, and recurring local sources. This baseline is essential for determining false-alarm rates.

Test the system with known UVC emitters and non-UVC bright sources. Controlled drone flights may carry a characterized UVC source and a non-emitting control target where legally and safely permitted. The objective is to measure detection probability, angular response, range dependence, trigger latency, and cross-sensor timing.

During UAP observations, preserve original binary pulse data, UVC frames, visible and thermal imagery, radar/RF/acoustic traces, pointing telemetry, weather, observer notes, and pre/post-event buffers. Processing should create derivative products while preserving immutable raw data and provenance.

A recurring signature should be challenged with a second detector technology and, ideally, a separated observing station. Replication across independent hardware is particularly important because binary tubes and imaging intensifiers have different artifact mechanisms.

Because the present manuscript is an instrumentation and methods framework, the architecture is not represented as experimentally validated outside established industrial UVC applications. A staged validation program is therefore required before claims of UAP-specific performance are made: laboratory characterization of each detector; site-specific baseline acquisition; controlled UVC and non-UVC source trials at measured ranges and elevations; controlled moving-target trials where legally and safely permitted; and only then operational UAP campaigns. Detection probability, false-alarm rate, timing error, angular response, propagation loss, and cross-sensor registration will be reported as measured performance quantities.

3.6. Required Experimental Characterization before Operational Claims

The reviewer correctly identifies that the present architecture has not yet been demonstrated by the authors through a complete laboratory characterization or controlled moving-target field campaign. Manufacturer specifications for Hamamatsu UVTRON and OFIL DayCor UV-Eye instruments establish component behavior in industrial flame, discharge, and corona applications; they do not establish performance against moving aerial targets of unknown radiance, spectrum, range, or angular rate. The methodology therefore treats experimental characterization as a prerequisite to any claim of operational UAP-detection performance.

The first validation phase shall characterize each detector on an optical bench using traceably characterized UVC sources across the installed spectral band. Measurements should include spectral response, count-rate or image response versus detector-plane irradiance, dark/background behavior, saturation, dead/quench time, trigger latency, repeatability, angular response, out-of-band rejection, and environmental dependence. For the binary channels, the output shall remain pulse counts or count rate unless a defensible radiometric transfer function is established. For the imager, digital level shall remain an instrument quantity unless the complete optical chain is radiometrically calibrated.

The second phase shall quantify source-to-sensor performance at known outdoor ranges and elevation angles. A characterized UVC source should be positioned at measured distances and, where practicable, at different elevations and atmospheric conditions. The test record should include source output, range, line of sight, ozone and meteorological conditions, detector configuration, atmospheric-transmission estimate, received response, detection probability, false-alarm rate, and uncertainty. These data will provide an empirical bridge between detector-aperture sensitivity and useful field range.

The third phase shall address the reviewer's moving-target concern directly. Where legally and safely permissible, a controlled aerial platform should carry a characterized UVC emitter whose output can be switched or modulated according to a predeclared schedule, together with matched non-emitting control passes. Flights should span known ranges, angular velocities, elevations, crossing geometries, and background conditions. The principal performance measures will be probability of detection, probability of false alarm, time-to-detection, trigger latency and jitter, imaging localization error, UV/visible registration error, track-to-UVC angular residual, coincidence performance between independent UVC channels, and response as a function of range and angular rate.

A minimum controlled validation dataset should contain enough emitting and control passes to estimate performance with confidence intervals rather than relying on individual demonstrations. The number of trials should be selected prospectively from the desired precision of the detection-probability and false-alarm estimates. All raw pulse streams, image sequences, timing telemetry, pointing data, source-state logs, environmental measurements, and calibration records should be retained. Analysis code or explicit decision rules should be preserved so that the reported trigger and association results can be independently reproduced.

Until these phases are completed, the statistical trigger rule, propagation model, calibration workflow, and evidence-grading system presented here should be regarded as a predeclared experimental protocol rather than a validated operational performance model. This distinction is intentional: the framework specifies what must be measured and what evidence would be required for the architecture to advance from a theoretical instrumentation proposal to an empirically characterized UAP research method.

4. Discussion

4.1. Scientific Value and Limitations of the Proposed Architecture

UVC adds a measurement channel that is physically different from the dominant UAP sensor suite. Its natural daylight background is unusually low, mature detector technologies already exist, and both low-cost non-imaging and high-performance imaging implementations are commercially available. This makes UVC one of the more practical spectral domains for expanding field instrumentation without requiring an entirely new experimental infrastructure.

The hybrid architecture addresses the principal weakness of each instrument class. Binary detectors are fast and sensitive but lack spatial attribution. Imaging detectors localize emission but generate more data and may require narrower fields of view, greater cost, and more complex calibration. When a binary network triggers or corroborates an imaging system, the combination can deliver both event sensitivity and spatial evidence.

A meaningful result would not be a single UVC flash. It would be a calibrated excess above background that is spatially and temporally co-located with an independently tracked object, survives known-source and artifact screening, exhibits a reproducible temporal or spectral relationship to target behavior, and can be repeated with independent hardware or at another site. Such a result would still not identify origin, but it would establish a new measurable physical property requiring explanation.

Null results are equally important. If high-quality UAP tracks repeatedly show no UVC emission above defined limits, those limits constrain models involving strong local ionization, corona-like discharge, or certain plasma processes. Reporting calibrated non-detections would therefore improve the scientific value of UAP datasets.

This paper is an instrumentation and methods proposal, not a demonstration that UAP emit UVC. The industrial sources cited here validate detector physics and performance for flames, electrical discharge, and corona, not for unknown aerial targets. Manufacturer sensitivity and range examples cannot be transferred directly to UAP because source radiance and spectrum are unknown. Atmospheric attenuation may substantially limit long-range UVC detection. Finally, a

UVC signal is not unique to any exotic mechanism; source discrimination requires imaging, geometry, environmental context, and independent modalities.

A principal limitation of the current paper is that its hardware performance discussion is derived from manufacturer specifications and established industrial use cases rather than from a completed, novel laboratory characterization campaign by the authors. Hamamatsu and OFIL specifications demonstrate component capability for established flame, electrical-discharge, and corona applications, but they do not establish viability, sensitivity, response time, detection probability, localization accuracy, or useful range for moving aerial targets at unknown distances. Nor do they establish field-site false-alarm behavior or cross-modal association accuracy under UAP observing conditions. The proposed architecture must therefore be understood as a theoretical but testable engineering framework whose UAP-specific performance remains experimentally unverified.

This distinction is scientifically important. The present contribution is the integration logic, operational definitions, falsification criteria, calibration pathway, propagation framework, predeclared trigger statistics, evidence-grading protocol, and now an explicit experimental characterization program. These elements define a reproducible method for testing the architecture; they do not constitute evidence that the architecture has already been validated for UAP detection. Claims that the system "works" for moving anomalous targets must await controlled laboratory measurements, characterized outdoor source trials, and moving-target experiments reporting detection probability, false-alarm probability, latency, sensitivity, localization error, range dependence, and uncertainty. Future empirical reports should publish those measurements separately from the present methods perspective.

4.2. November 13, 2022 Illustrative Observation

The authors' 2026 UAP Detection and Tracking Summit presentation includes a November 13, 2022 Robert Moses State Park observation described as a visible spheroid/plasma/plasmoid event and shows a contemporaneous non-imaging high-sensitivity UVC binary-sensor indication. That presentation is useful as a motivating field example because it illustrates the exact problem addressed by this paper: a visible event and a UVC detector response can be temporally associated, but a binary UVC detector alone does not localize the photons to the visible object. The observation should therefore be treated as a hypothesis-generating case rather than as proof that the object emitted UVC [1]. The historical observation and associated UVC indication are reproduced for context in **Figure 7**.

The November 13, 2022 indication is retained only as a hypothesis-generating example. The available record does not provide the raw UVC pulse counts, the duration and distribution of the pre-event baseline, the precise event-window definition, channel timing uncertainty, dead-time-corrected count statistics, or a priori significance test. In addition, the raw event-level dataset is not available in this manuscript for independent reanalysis. Consequently, no statistical significance, source radiance, detection range, or causal association between the visible object and the UVC indication can be claimed from this event. It does not enter the formal evidence-grading process defined in Section 3 and is not used as validation of the proposed architecture.

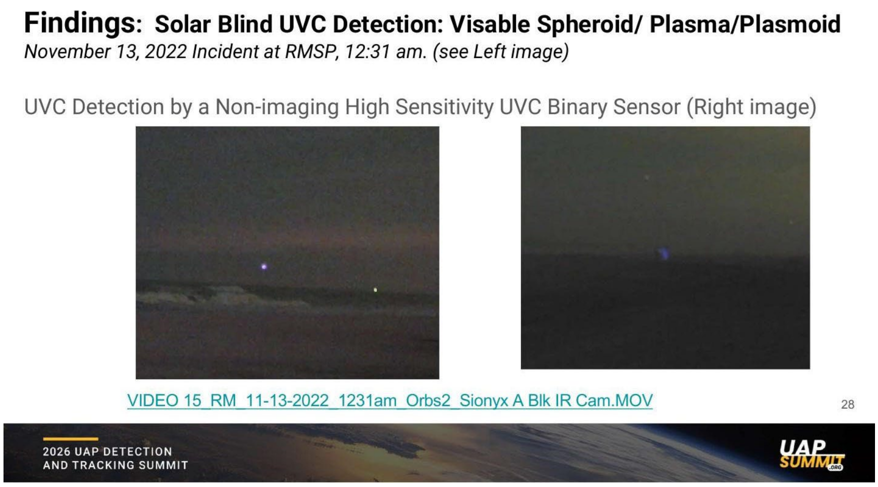


Figure 7. November 13, 2022 Robert Moses State Park observation shown as a motivating historical example, not as a validated causal association.

4.3. Value of Null Results and Replication

Null results are equally important. If high-quality UAP tracks repeatedly show no UVC emission above defined limits, those limits constrain models involving strong local ionization, corona-like discharge, or certain plasma processes. Reporting calibrated non-detections would therefore improve the scientific value of UAP datasets.

The strongest future result may be either a repeatable positive association or a well-bounded non-detection. Replication should use independent detector technology, separated stations where practical, predeclared event logic, and archived raw data. This design allows other investigators to reproduce the analysis without relying on interpretive judgments made after an event is observed.

5. Conclusions

Solar-blind UVC detection deserves systematic inclusion in UAP field research because it offers a low-background, emission-sensitive spectral channel that complements visible, infrared, radar, RF, and acoustic measurements. The most useful implementation is not a single UVC instrument but a layered architecture. Hamamatsu UVTRON-type binary detectors can provide rapid photon-event detection, distributed coincidence sensing, and event triggers. OFIL's DayCor UV-Eye-type imaging technology can add spatial localization and UV/visible registration. When both are synchronized with independent tracking and environmental sensors, UVC becomes a rigorous test of whether an observed phenomenon is associated with local short-wavelength ultraviolet emission.

The scientific standard should remain conservative: UVC emission is not presently a validated or unique UAP signature. The importance of adding UVC lies precisely in making that proposition testable. A calibrated, falsification-first program can determine whether UVC-associated events are absent, prosaic, instrumental, or repeatable physical features of a subset of observations. That is the appropriate pathway from an intriguing sensor anomaly to a defensible scientific result.

The revised framework therefore separates three evidentiary stages: manufacturer-established component capability, controlled experimental characterization of the integrated architecture, and eventual UAP-specific field validation. Solar-blind UVC remains a scientifically attractive measurement domain because it can add an emission-sensitive channel that is partially orthogonal to visible, infrared, radar, RF, and acoustic sensing. At present, however, the proposed UAP implementation remains unvalidated. Its evidentiary value will depend on completing the laboratory, outdoor-range, and controlled moving-target tests defined in this paper and on reporting atmospheric propagation, calibrated sensor behavior, detection and false-alarm probabilities, response latency, spatial/temporal association uncertainty, and independent replication. Those measurements are the necessary next step for converting the proposed framework from a theoretical instrumentation methodology into an empirically demonstrated research capability.

Author Contributions

John Tedesco and Gerry Tedesco jointly contributed to the conceptualization of the study, development of the instrumentation framework, methodology and field-research protocols, technical investigation, interpretation of the instrumentation architecture, preparation of figures and supporting materials, and manuscript writing and revision. Both authors reviewed and approved the final manuscript and accept responsibility for the integrity of the work.

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Data Availability Statement

This manuscript is a method and instrumentation perspective based on the cited technical literature and the authors' supplied field-research materials. Event-level raw data referenced as illustrative examples are not presented as a public validation dataset in this manuscript. Any future empirical report should provide calibrated raw or minimally processed data, instrument configuration records, timing metadata, environmental metadata, and documented artifact-rejection procedures sufficient for independent review.

For the November 13, 2022 illustrative event, the raw pulse stream and complete event-level calibration record required by the revised statistical protocol are not available for analysis in this manuscript. The event is therefore excluded from formal significance testing and evidence grading.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix A. Minimum UVC Event Record

- UTC start/stop time, clock source, measured clock offset, acquisition latency, and total timing uncertainty.
- Detector model, serial number, spectral band, operating voltage/gain, quench/dead time, field of regard, and configuration.
- Raw pulse timestamps/counts or unprocessed UVC frames; no threshold-only record is sufficient.
- Declared 30-minute background interval (or documented alternative), empirical background distribution, trigger threshold, event window, coincidence window, and false-alarm estimate.
- Instrument-health checks, local-source survey, weather, lightning, aviation/maritime context, and relevant anthropogenic activity.
- Independent target track, spatial uncertainty, UVC boresight/registration uncertainty, and the quantitative spatial/temporal association test.
- If radiometric quantities are reported: calibrated irradiance, spectral responsivity, optical throughput, range/geometry, atmospheric transmission model, and uncertainty budget.