

Title

MiCi The Resonance Adaptive Electromagnetic Network (RAEN)

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## Abstract

The invention describes a resonance-adaptive communication and computation framework of volumetric coherence through phase-bundled micro-pitch signaling among distributed nodes within a shared coherence field. By embedding resonance memory into each emission, the system preserves projection geometry over time—even under mechanical deformation, environmental change, or nonuniform signaling conditions.

A Resonance Adaptive Electromagnetic Network (RAEN) node integrates emission, reception, and adaptive control domains, allowing self-stabilizing projection across volumetric fields. Modeling of local device structure enables real-time correction of phase drift caused by motion or stress, while dynamic surface geometries and hybrid acoustic-electromagnetic couplings provide energy-efficient resilience.

The framework supports secure, high-density, multi-context signaling without reliance on traditional carrier switching or planar modulation schemes. Applications span telecommunications, sensing, condensed matter simulation, cryptographic projection, energy routing, and modular computation. This invention establishes self-correcting volumetric coherence fields, multi-axis synchronization, and adaptive phase alignment across dynamic mechanical and environmental conditions.

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Background of the Invention

Technical Field

This invention relates to communication and resonance-based signaling systems, and more particularly to volumetric data transmission through adaptive acoustic and electromagnetic coherence fields. It bridges traditional telecommunications, adaptive materials, and computational projection science, creating a framework for maintaining coherent communication and information projection within dynamic environments.

Description of Related Art

Conventional communication systems rely on planar or linearly defined modulation techniques. Orthogonal Frequency Division Multiplexing (OFDM) remains the dominant method for multiplexing signals, partitioning the spectrum into frequency bins that are mutually orthogonal to minimize interference. While highly effective in stationary or controlled environments, OFDM and similar systems operate fundamentally as two-dimensional phase-amplitude frameworks. RAEN realizes manifold coherence in physical electromagnetic media rather than mathematical abstraction.

Conventional OFDM and multitone schemes may employ four or more carrier tones for orthogonal separation; however, these remain spectrally partitioned and two-dimensional. By contrast, the present RAEN framework introduces a five-tone phase-bundled configuration wherein each tone exists within a shared volumetric crest rather than a separate frequency bin, preserving continuous coherence while expanding contextual capacity.

Such systems experience limitations in environments where the signaling geometry or medium changes rapidly—e.g., under vibration, acceleration, or within nonuniform fields such as liquid or plasma environments. In these contexts, phase orthogonality and synchronization degrade, requiring re-calibration and re-timing to maintain data integrity.

Attempts to extend these concepts into higher-dimensional modeling have appeared in academic and commercial work related to manifold learning and signal simulation. For example, U.S. Patent Application No. 20230260662A1, “Generative Manifold Networks for Prediction and Simulation of Complex Systems,” discusses the use of stacked mathematical manifolds to represent nonlinear relationships within complex datasets. However, such representations remain algorithmic and lack physical implementation; they do not disclose any utility for sustaining projection continuity through volumetric resonance or for adapting signal geometry under motion.

Similarly, efforts in adaptive antenna arrays and beamforming systems allow partial spatial control but do not preserve a continuous projection geometry. These systems treat the field as an adjustable direction of emission rather than a persistent geometric construct. Thus, a gap remains between mathematical representation of manifolds and physical maintenance of coherent projection in real space and time.

Thus, prior systems lack a means to preserve signal coherence when both the medium and emitter geometry are in flux. The present invention provides a resonance-adaptive architecture that physically maintains volumetric coherence through self-correcting phase bundling, eliminating the need for external re-synchronization.

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## Summary of the Invention

### Terms

- RAEN: Resonance Adaptive Electromagnetic Network.
- SIR field (Figure 2): Suspension In Resonance field, a shared volumetric coherence domain.
- VIN: Voxel Intercept Node, a discrete synchronization point of field coherence.
- ABEC: Aqua–Bose–Einstein Condensate, an active condensate exhibiting near-zero-Kelvin coherence coupling.
- AQUEM: Aqueous Electromechanical Matrix. While AQUEM describes the dynamic energy-routing framework, it inherently encompasses electrochemical behaviors where field alignment and charge mobility converge.
- MiCi: Modular Integrative Coherence Interface.
- CCS, VLE, TRI, DAC: Metrics for coherence quality and adaptive performance.

MiCi (pronounced “My Sea”) and RAEN (pronounced “Rain”) together form an irrigatable electromechanical harmony, establishing adaptive coherence as a utility framework.

### Overview

The present invention closes that gap by introducing a physically implemented protocol for Projection Science in Volume Signaling. RAEN establishes a shared volumetric coherence field— a SIR field—within which multiple nodes communicate through phase-bundled micro-pitch emissions.

Each node (Figure 1) in the RAEN is capable of encoding multiple contextual signals within a single crest or waveform region, utilizing resonance memory to reference prior emissions and preserve temporal coherence. This approach transforms a conventional linear signal path into a time-linked projection manifold, maintaining stable geometry and phase alignment even under mechanical or environmental change.

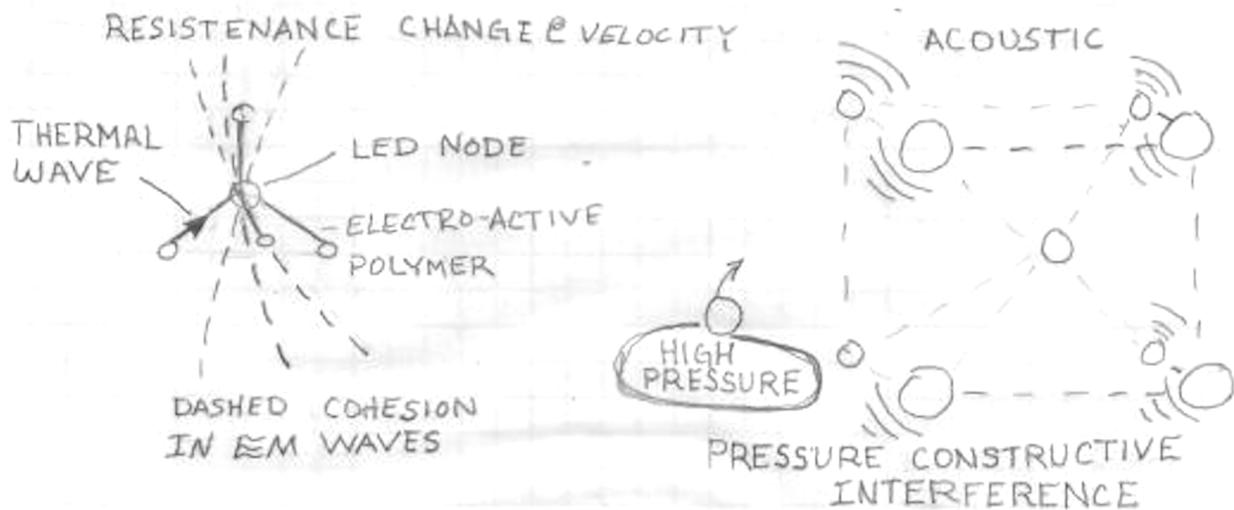


Figure 1 above illustrates an example node configuration in which a light-emitting diode (LED) element is coupled to electro-active polymer members forming a dynamic structural junction. LED in this case is an example of any emitter, conductors also vary and are not limited to electro-active polymers. Variations in electromagnetic field strength induce velocity-dependent resistance changes within the LED junction and the polymer arms, producing localized modulation of emission amplitude and timing. Dashed lines denote cohesion paths of electromagnetic coupling between adjacent nodes. The right panel depicts acoustic counterparts of these interactions, wherein multiple emitters generate constructive interference within a shared pressure field, supporting coherent acoustic reinforcement correlated with the electromagnetic phase network.

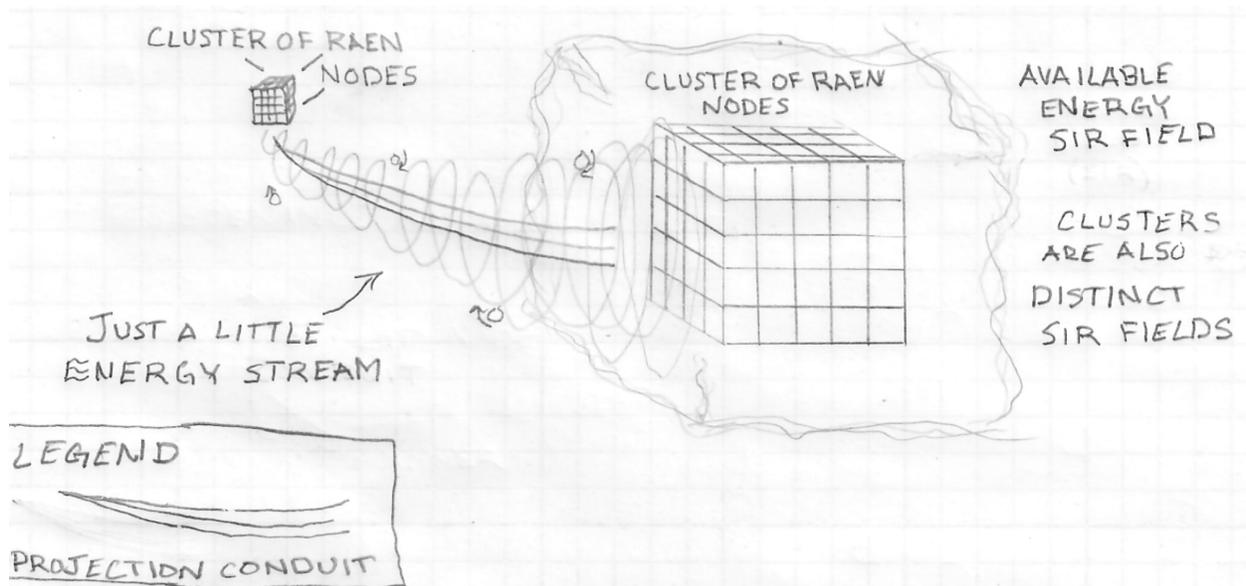


Figure above depicts a representative arrangement of multiple clusters of RAEN nodes coupled through a projection conduit. Each cluster forms a coherent Suspension In Resonance (SIR) field, functioning as a self-contained volumetric lattice for local phase tuning. Energy transfer occurs along a confined stream between adjacent clusters, producing controlled deformation of field boundaries while maintaining coherence within each SIR region. The legend indicates the conduit path geometry used for projecting energy or information between volumetric regions.

**Thermodynamic–Acoustic–Electromagnetic Coupling Context**

In practical implementations, thermal equilibrium and phase coherence are maintained not by passive dissipation but by active resonance exchange. RAEN nodes employ controlled interference among electromagnetic, acoustic, and

thermodynamic gradients, producing a net stabilization torque that aligns with both classical and relativistic rotational vectors. This allows the system to convert local heating into coherence reinforcement and to employ rotational frame effects modeled as proportional torque vectors, experimentally verifiable under controlled rotation, analogous to the Lense–Thirring phenomenon, to sustain volumetric symmetry during motion.

### Dynamic Doppler Compensation

In moving or deforming systems, relative velocity between nodes produces Doppler-induced phase shift. RAEN nodes continuously compare incoming and outgoing frequency vectors to determine a differential warp index (WI). The adaptive control domain offsets this index by micro-adjusting emission timing, thereby neutralizing frequency drift across the projection manifold. This Doppler-aware modulation preserves coherence geometry even when emitter or medium velocities vary by several meters per second, ensuring volumetric alignment across mechanically active structures such as rotating spindles or orbiting arrays.

### Composite Integration

RAEN installations may incorporate composite material structures optimized for their operating environment. Each layer possesses tailored electromagnetic, vibrational, or thermal properties that guide resonance flow and structural coupling. Composites are selected or engineered to balance stiffness, conductivity, and damping appropriate to service conditions.

### Modeling and Predictive Feedback

Independent of physical composition, the RAEN employs computational modeling to mirror device geometry, inertia, and stress responses. These models interpret sensor feedback and generate delta-deformation matrices used to tune emissions in real time. This dual modeling approach forms the feedback core of the Behavior Control layer described below. Each RAEN installation may include material or computational models that replicate the local device's structure, including its chassis and circuitry. These composite layers generate deformation-delta profiles which the system uses to anticipate and counteract motion-induced phase drift. The result is a self-tuning network capable of real-time adaptation to acceleration, vibration, and structural deformation without requiring re-synchronization.

### Hybrid Physical-Computational Modeling

In some embodiments, modeling may occur through direct comparison between a hardware replica and its digital twin (Figure 3). A local sub-assembly mimics the physical chassis and field environment, while a parallel computational model predicts deformation and phase behavior under simulated stress. The RAEN control domain compares live sensor data from the replica with predictive outputs from the simulation, blending both sources to refine emission timing and amplitude. This dual-path modeling approach provides real-time correlation between measured and expected behavior, accelerating adaptation and validating resonance alignment within microseconds.

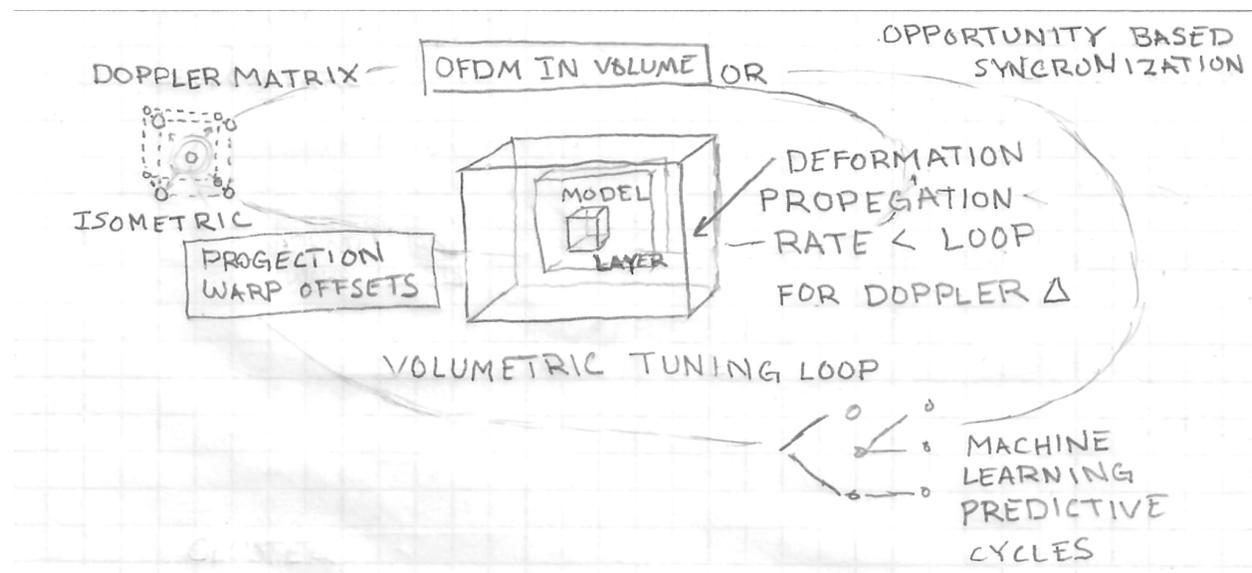


Figure 3 above, not limited to, illustrates an example volumetric tuning loop for opportunity-based synchronization across RAEN nodes. A Doppler matrix provides isometric projection data used to calculate warp offsets that feed a volumetric model layer. Within this model layer, orthogonal frequency-division modulation (OFDM) occurs in three-dimensional volume, enabling real-time correction of deformation propagation rates and Doppler-shift deltas. Machine-learning predictive cycles continually refine tuning parameters to maintain coherent field operation across spatial and temporal domains.

**Surface Geometry and Conduction Avenues**

In certain embodiments, surface geometry contributes directly to resonance coherence. Dimpled, laminar, or fractal surfaces can establish preferential conduction avenues, enhancing both thermal and electromagnetic coupling between RAEN layers.

Nested surface layers may be employed, wherein outer layers tune environmental flux while inner layers maintain clear signaling avenues for projection. This layered geometry minimizes parasitic reflection and improves energy return symmetry, yielding smoother phase alignment under high-deformation conditions.

**Behavior Control**

Each RAEN system may include a Behavior Control layer linking mechanical, thermal, and electromagnetic feedback domains. The control layer integrates delta-deformation matrices with live phase monitoring to regulate node emissions under variable load conditions. In effect, it extends the modeling framework into a self-learning mechanical feedback protocol, suitable for CNC, robotics, and aerospace control systems.

**Advantages Over Prior Systems**

- Volumetric Coherence: Maintains projection geometry in three dimensions and time, unlike planar OFDM.
- Temporal Memory: Each emission references stored phase data in the SIR field, enabling contextual decoding.
- Adaptive Response: Modeling ensures tuning stability under physical stress or acceleration.
- Higher Data Density: micro-pitch phase bundling allows multiple parallel data paths within one waveform.
- Hardware Agnostic Implementation: Compatible with various materials, including conductive composites, photonic media, or metamaterials.

| Limitation of Prior Art                | RAEN Solution                         | Benefit                       |
|----------------------------------------|---------------------------------------|-------------------------------|
| Planar OFDM limited to orthogonal bins | Volumetric micro-pitch phase bundling | 3-D coherence under motion    |
| Requires frequent re-sync              | SIR field temporal memory             | Continuous projection         |
| Thermal & mechanical drift             | Modeling feedback                     | Real-time correction          |
| Separate cooling & signaling           | Hybrid acoustic-EM shims              | Self-cooled resonance ecology |

**Utility**

The invention functions as both a communication protocol and an enabling platform for adaptive materials and intelligent signal routing. Applications include:

- Telecommunications systems requiring robust projection under movement or deformation (satellite arrays, aerospace, underwater).
- Semiconductor or photonic devices using RAEN composites for self-tuning coherence.
- Computational architectures utilizing volumetric resonance for data processing and error correction.
- Energy Routing.



## **Cross-Domain Coherence Control**

RAEN's adaptive resonance principles extend to cross-domain synchronization between electronic, mechanical, and fluidic systems, including precision robotics, additive manufacturing, and hybrid control assemblies. Through volumetric phase feedback, these systems maintain calibration and energy symmetry across dynamic axes, allowing efficient scaling in CNC, aerospace, or bio-mechanical contexts.

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Detailed Description of the Invention

RAEN Framework Overview

The invention provides a physical and protocol framework for achieving volumetric coherence among distributed signaling nodes. Each RAEN node functions as a semi-autonomous emitter-receiver operating within a shared resonance volume, known as a SIR field.

The RAEN maintains projection geometry through adaptive coupling of electromagnetic, acoustic, or optical fields. The field in tune is a Riemannian manifold hereafter called manifold—capable of retaining prior wave interactions as phase memory—thereby preserving temporal continuity across multiple signal events.

RAEN Node Architecture

Each RAEN node comprises three functional domains:

1. Emission Domain

- Generates micro-pitch, phase-bundled signals.
- Employs multi-axis transducers or antennas arranged to emit in 3-D orthogonal sets.
- Capable of modulating phase offsets between axes to encode contextual information.

2. Reception and Interference Domain

- Measures returning waveforms and cross-phase interference patterns.
- Extracts coherence data and contributes feedback to maintain the shared SIR field.
- May incorporate phase-conjugate sensing or near-field coupling for energy efficiency.
- Predictive modeling layers anticipate phase delay based on mechanical load data, feeding emission timing adjustments into the Behavior Control layer.

3. Adaptive Control Domain

- Includes embedded processors or analog feedback circuits.
- Continuously monitors delta-coherence (the deviation between expected and received phase data).
- Adjusts emission parameters to sustain volumetric uniformity.

Nodes can be connected electrically, optically, or acoustically. In some embodiments, nodes may be linked via conductive lattice structures, enabling propagation through solid materials or composite shells. In others, nodes may communicate through ambient electromagnetic fields without direct wiring.

SIR Field Operation

In operation, RAEN timing and wave-projection control permit dynamic energy shaping along paths of reduced impedance within the SIR field network. By matching phase and frequency to the local resonant properties of the surrounding medium—whether gaseous, liquid, or solid—the system minimizes scattering and dissipative losses, thereby establishing transient “avenues of least resistance” through which coherent energy or information transfer is optimized. The SIR field functions as a temporal coherence cache. It stores interference patterns and phase relationships generated by active RAEN nodes, maintaining a continuously updated manifold of recent signal states.

Network Excitation and Corrective Impedance Modulation

In some embodiments, the RAEN continuously excites portions of its impedance network in a corrective oscillation pattern. By distributing minor phase adjustments across multiple nodes, the system reinforces projection geometry through load sharing rather than localized amplification. This distributed mechanism both strengthens broadcast coherence and functions as an adaptive tuning process, ensuring that cumulative impedance remains harmonized with environmental flux. The same process can be applied across heterogeneous node materials or configurations, allowing a unilateral tuning behavior independent of structural variance.

Field Generation

A SIR field is established when two or more RAEN nodes emit phase-bundled signals that overlap spatially within a bounded region. Constructive interference defines stable regions—"projection pockets"—where data may be stored or referenced. A distributed synergy.

Temporal Buffering

Because each emission is encoded with a precise temporal phase key, the SIR field retains short-term phase history. Subsequent signals can reference these stored interference states to ensure projection continuity, effectively re-using previous coherence rather than re-synchronizing from zero.

Adaptive Reinforcement

When environmental or mechanical changes disturb the projection geometry, nodes automatically recalibrate their phase vectors by referencing the prior field state. This minimizes data loss and maintains a smooth, continuous projection manifold through time.

In this context, each transmitted element, or symbol, arises naturally within the resonance valley itself—emerging as the system excites and aligns toward its minimal-energy configuration. The following description formalizes that behavior.

As used herein, a symbol (Figure 5) represents a resolvable moment of phase coherence emerging from a turbulent or distributed flux field. Prior to its arrival, the symbol exists as part of a continuous convolution of harmonic energy—a member of the resonance field's superposed ensemble—rendering it indiscernible from ambient flux. Upon reaching the intended receiver or convergence zone, the symbol collapses into a defined form, becoming both interpretable and quantifiable.

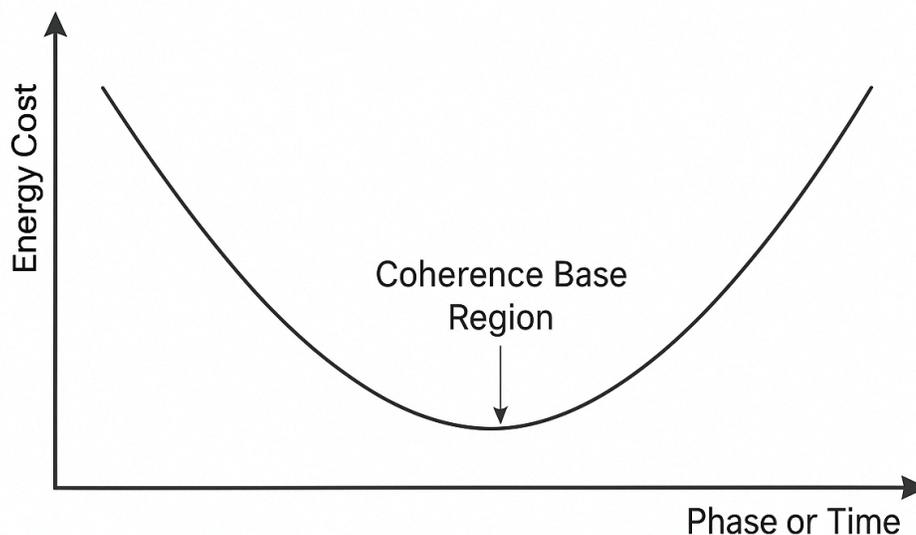


Figure 5 above illustrates an exemplary Energy Cost Valley diagram. The horizontal axis represents the temporal or phase position of a carrier crest, while the vertical axis denotes relative energy cost per symbol. The plot reveals a valley of minimal energy expenditure corresponding to optimal phase coherence. The system's control logic continuously adapts its output to energize near this valley, achieving both higher efficiency and greater fidelity.

Phase-Bundled Micro-Pitch Signaling

Encoding Method

Each crest or pulse is divided into discrete phase zones (Figure 4), each representing an independent logical or analog data component. Sub-frequencies are allocated not as independent carriers (as in OFDM) but as coherent sub-phase entities within the same frequency envelope.

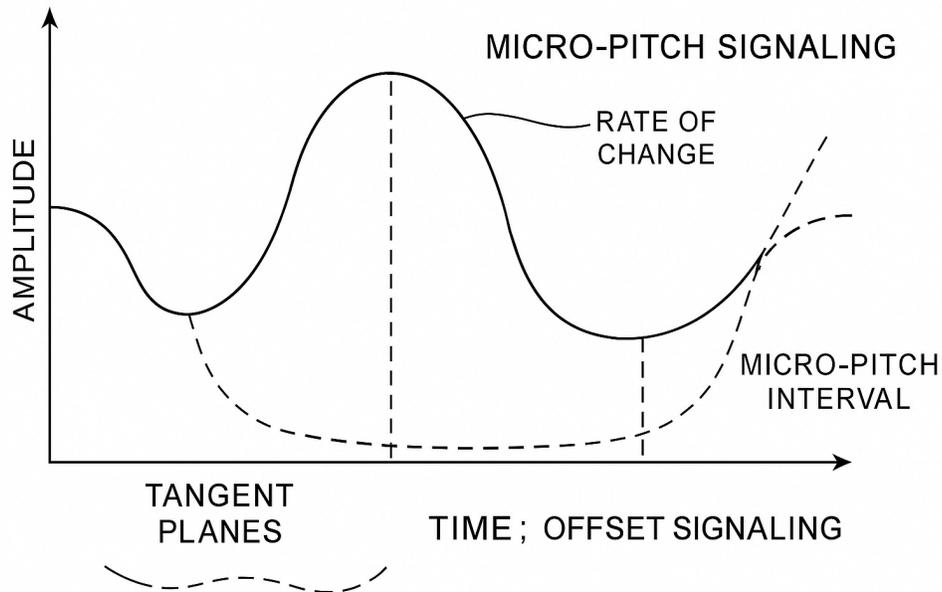


Figure 4 above illustrates micro-pitch signaling as a function of amplitude versus time within a RAEN communication channel. A continuous waveform is segmented by tangent-plane boundaries defining phase-bundle regions. Each bundle corresponds to a unique rate-of-change interval used for offset signaling between nodes. The instantaneous slope of the waveform establishes local frequency deviation or "micro-pitch," providing multi-context encoding within a single carrier crest. Time-offset hand-offs between bundles enable synchronized modulation without altering overall carrier coherence.

Decoding and Contextual Reconstruction

Receiving nodes decode each sub-phase component relative to both the instantaneous carrier and the cumulative SIR field history. This enables reconstruction of multi-context signals, where meaning depends on temporal and volumetric context rather than solely on amplitude or phase shift.

Advantages

- Enables ultra-dense data encoding without increasing spectral width.
- Reduces latency by eliminating carrier switching.
- Provides intrinsic error correction through field-averaged phase comparison.

Modeling Layers

Each RAEN assembly may include modeling layers that mirror the physical structure of the device in which it resides. These layers can be material, computational, or hybrid. Where an innermost channel might be a device model, selective layering can be implemented to reduce signal losses at complex junctions.

Structural Replication

Composite layers replicate the geometry and mass distribution of the host chassis and circuitry. Embedded sensors or metamaterial substrates record micro-deformations, temperature gradients, and inertial vectors.

Delta-Deformation Feedback

The system computes a delta-deformation matrix (Figure 3), representing the difference between nominal and instantaneous structural states. This data is fed into the RAEN control domain, allowing the network to adjust emission timing and amplitude in real time.

Rapid Acclimation

By modeling its host's response, the RAEN effectively "knows" how the device behaves under stress. It pre-compensates for anticipated motion or distortion, maintaining projection alignment during vibration, acceleration, or environmental flux. This feedback loop allows coherence to stabilize in microseconds without manual calibration. Material layers are designed to tune by default enhancing the ability to recover.

Projection Stability Metrics

To quantify coherence within the SIR field, several metrics may be used:

- Coherence Continuity Score (CCS): Measures the persistence of phase alignment over successive emission cycles.
- Volumetric Lattice Efficiency (VLE): Represents the ratio of stable projection manifold to total emission field.
- Temporal Resonance Index (TRI): Evaluates how efficiently the system re-uses historical phase states to maintain signal continuity.
- Dynamic Adaptation Coefficient (DAC): Quantifies the speed and accuracy of RAEN responses to deformation data from modeling.

These metrics may be computed locally or network-wide to optimize node synchronization and resource allocation. Supporting developers building for adverse service conditions and buffering for production defects.

Operational Domain and Throughput Considerations

RAEN systems operate most effectively where the communication or computational environment cannot be assumed static — within deforming, resonant, or volumetric conditions such as energy reservoirs, lattice simulations, and buoyant or orbital fields. In these regimes, RAEN architectures provide adaptive continuity rather than fixed throughput, optimizing projection fidelity as part of their function.

Conventional circuitry remains ideal for linear, closed-loop pathways that demand deterministic latency and minimal variance. In contrast, RAEN lattices excel where coherence itself performs useful work — sustaining volumetric stability, redistributing energy, or maintaining projection geometry under flux. Consider the synergy when applied to conventional circuitry when utilized as a balancer: RAEN arrays can absorb and release phase variance across circuit domains, mitigating thermal and electromagnetic drift while preserving the precision of conventional logic.

Initial synchronization establishes the coherence envelope; once tuned, throughput dynamically balances to environmental demand. Measured loss rates reflect purposeful adaptation rather than inefficiency, as energy is redistributed to maintain stasis and coherence. In stable manifolds, overall efficiency commonly equals or exceeds that of conventional systems when considering volumetric scope and adaptive resilience.

In further embodiments, RAEN networks may integrate molecular-assembly or AQUEM-type electromechanical systems wherein local lattice excitations act as tunable field amplifiers or attenuators. Such assemblies employ quantum-responsive materials—e.g., piezoelectric, magneto-optical, or superfluidic layers—whose intrinsic molecular alignment enables controlled emission or absorption of phase-coherent energy. When operated in phased arrays, these structures function as distributed particle accelerators or active electromagnetic filters, shaping energy propagation and charge concentration through dynamic field resonance.

The described systems establish a platform for adaptive energy routing and field shaping across multiple physical regimes. The disclosed principles may therefore support applications not yet fully realized in current electromechanical practice.

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## **Illustrative Claims and Example Process Flow**

### **Claim 1 – Core Volumetric Projection Protocol**

A method for maintaining coherent projection of information through RAEN, comprising:

1. Emitting phase-bundled micro-pitch signals from at least two spatially distributed nodes;
2. Establishing a shared coherence volume (SIR field) through constructive interference of said emissions;
3. Retaining temporal phase relationships within the field as a historical buffer; and
4. Using the stored phase history to maintain projection geometry through time, thereby achieving volumetric continuity of the signal.

#### **Process Flow**

Each emission cycle writes a new layer into the coherence volume, while the SIR field reinterprets prior layers to preserve spatial integrity. The field thus acts as a “volumetric ledger” of signal evolution.

### **Claim 2 – Adaptive Node Control via Modeling**

The method of claim 1, wherein each RAEN node includes modeling layers that replicate the geometry and electromagnetic profile of the host device, the layers producing deformation-delta data that tunes emission timing and amplitude in real time.

#### **Process Flow**

Sensors within the composite layers detect strain and acceleration. The RAEN control circuit modifies phase delay within the next crest cycle to cancel projected distortion, keeping projection phase-true under motion.

### **Claim 3 – Coupled Acoustic–Electromagnetic Shim Integration**

The method of claim 1, further comprising a coupling shim composed of hybrid material strata enabling synchronous transmission of acoustic and electromagnetic waveforms within the same coherence volume.

#### **Process Flow**

1. The EM lattice excites a thin acoustic sublayer.
2. Acoustic vibration modulates the local dielectric constant, slightly bending EM phase vectors.
3. The resulting dual-modality resonance stabilizes the SIR field against thermal and mechanical noise.
4. Cooling pathways use the acoustic shim to dissipate waste heat, preserving coherence temperature equilibrium.

This embodiment merges previously distinct cooling and signaling domains into a unified resonance ecology.

### **Claim 4 – Phase-Bundled Encoding for Contextual Communication**

The method of claim 1, wherein each emission crest comprises multiple sub-phase partitions carrying distinct contextual data, decoded by referencing both the instantaneous carrier and prior SIR field states.

#### **Process Flow**

Each partitioned phase behaves as a “conversation thread” within a single crest. Contextual integrity is maintained by comparing present-phase vectors to archived interference nodes within the field.

### **Claim 5 – Self-Sustaining Projection Through Environmental Acclimation**

The method of any preceding claim, wherein the RAEN dynamically adjusts its coherence amplitude and orientation in response to environmental gradients such as pressure, temperature, or magnetic flux.

#### **Process Flow**

Adaptive coefficients derived from composite sensors feed the control domain. The network alters emission density along affected axes, preserving uniform energy distribution throughout the coherence volume.

### **Claim 6 – Volumetric Lattice Efficiency Optimization**

A system as in claim 1, further comprising algorithms calculating volumetric lattice efficiency (VLE), coherence continuity score (CCS), and temporal resonance index (TRI) to monitor projection health and redistribute energy to underperforming nodes.

#### Process Flow

Data collected from each node's field sensors is averaged over multiple cycles to produce stability indices. The indices feed back into global RAEN synchronization to maximize throughput.

#### Claim 7 – Coupled Thermodynamic-Acoustic-Electromagnetic Modulation Variant

A configuration wherein a lattice of RAEN nodes integrates electro-acoustic shims, fluidic microchannels, and thermodynamic exchange layers, the system alternately pulsing electromagnetic and acoustic phases to produce a balanced temperature gradient that reinforces projection stability; wherein field interactions couple thermal, acoustic, and electromagnetic domains through controlled phase alignment, enabling bidirectional heat flow as an active resonance function; and wherein rotational or torsional frame-coupling (Figure 6) consistent with a Lense–Thirring-like field interaction provides angular-momentum exchange between the thermal, acoustic, and electromagnetic domains, enhancing coherence symmetry and dynamic stability under rotation, acceleration, or vibration, or equivalents thereof.

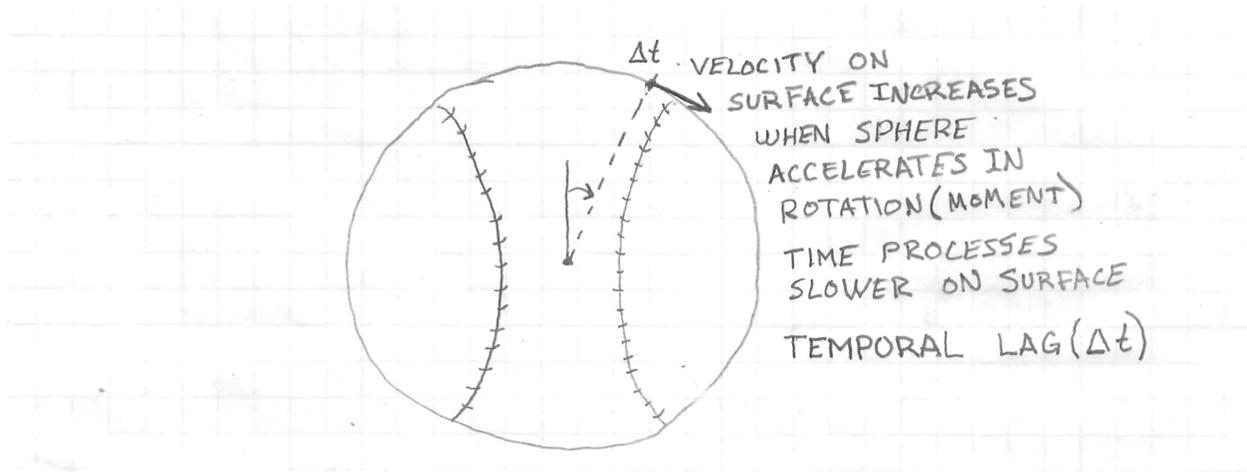


Figure 6 above depicts from the frame-dragging perspective, acceleration of moment produces increased surface velocity, and at that surface temporal processing slows proportionally. This differential acts as a measurable phase offset across the RAEN cell, coupling thermodynamic flux with acoustic and electromagnetic propagation.

#### Process Flow

- Paired cube-face emissions alternate electromagnetic and acoustic cycles, generating pressure-temperature gradients across microchannels.
- The adaptive control domain monitors local field torsion and adjusts emission phase to align thermal diffusion with rotational vectors predicted by the Lense–Thirring coupling term.
- Excess heat is translated into acoustic pressure waves and reabsorbed electromagnetically at opposing nodes, maintaining volumetric equilibrium.
- The resulting resonance ecology performs both cooling and heating as functional stabilization processes, sustaining coherence across the lattice during rotational or vibrational stress.

This embodiment provides both self-cooling and enhanced field symmetry, particularly useful for high-density computational lattices.

#### Claim 8 – Networked Projection Through Temporal Coupling

A RAEN system according to any of the preceding claims, wherein multiple coherence volumes synchronize across distance using temporal phase-coupling, allowing distributed projection stability.

**Process Flow**

Each local SIR field references a shared temporal base signal. Minor phase drifts are corrected through averaged history exchange, producing a network of coherent volumes acting as a unified spatial manifold.

**Claim 9 – Material-Independent Resonance Mediation**

The method of claim 1, wherein the resonance adaptive mechanism operates irrespective of the medium by self-calibrating to the propagation velocity of the host material (dielectric, metallic, fluidic, or biological).

**Process Flow**

Calibration pulses measure the delay profile of the local medium. Emission frequencies self-adjust to equalize phase velocity across differing material boundaries.

**Claim 10 – Implementation as Computation Medium**

A computational architecture employing any of the preceding methods, wherein data processing occurs through interference and projection alignment within the SIR field rather than through conventional logic gates.

**Process Flow**

Logical operations correspond to controlled interference patterns: constructive regions represent binary truth, destructive regions binary falsehood. The coherence field thus performs volumetric computation.

**Claim 11 – Recursive Projection Stabilization (RPS) Loop**

A feedback mechanism wherein field coherence is periodically sampled, digitized, and reinjected as a control signal to reinforce stability through resonance reinforcement cycles.

**Process Flow**

At defined intervals, field sensors capture phase maps; the system computes error vectors and drives correction waves 180° out of phase, neutralizing drift without external reference clocks.

**Claim 12 – Secure Orientation Modulation (optional embodiment)**

The system of claim 5, wherein orientation includes logical or temporal alignment of coherence vectors, and wherein intentional re-orientation (“grid flips”) is employed as a security measure to restrict decoding to authorized nodes, accepting latency as a tunable cost of verification.

**Claim 13 – Multi-Layer Cryptographic Encoding through Projection Phasing**

The system of claim 12, wherein each transmission comprises:

1. a first, openly interpretable signal stream intended for standard communication;
2. a second, masked data layer embedded within the same volumetric coherence envelope, the layer being decodable only by receivers possessing correct phase-cycle initiation data; and
3. an optional third, cryptographic modulation layer that accepts redundant or false-context processing workload to obscure the presence of the true message, such that unauthorized receivers reconstruct a viable but incorrect narrative.

**Process Flow**

A transmission begins with a clear message layer. Authorized receivers use temporal synchronization keys derived from the RAEN's orientation cycle to locate the initial phase of the cryptographic layer and the number of permitted decoding iterations. Without this knowledge, an intercepted signal resolves into a believable yet non-authentic dataset, thereby preserving privacy even under compelled or forensic reconstruction.

**Claim 14 – Hybrid Acoustic-Electromagnetic Coupling for Environmental Adaptation**

The system of any preceding claim, wherein a composite RAEN node employs coordinated acoustic and electromagnetic interference patterns to dynamically shape its coupling with the surrounding medium, thereby enabling interoperability between software-defined control layers and hardware deformation responses.

**Claim 15 – Future Embodiment Condensed-State Coherence**

The system of any preceding claim, wherein one or more resonance layers utilizing Bose–Einstein Condensate considered here Aqua–Bose–Einstein condensate (ABEC), the layer providing near 0K coherence coupling to improve projection fidelity via the reduction in latency. ABEC is an emulsion composed of at least some BEC yet is mostly in an active vector pattern that's specific to the local RAEN.

Note: This embodiment is provided as a theoretical extension; specific implementations may vary according to available condensed-matter technologies, calibration limitations, where insulate qualities and service conditions permit.

#### **Process flow**

1. A software controller computes target resonance profiles based on service-condition data (temperature, pressure, stress).
2. The node emits complementary acoustic and electromagnetic patterns that converge into a funnel-like field, concentrating or dispersing local energy density.
3. The field geometry adapts to conformal changes in the host structure, maintaining projection stability at the cost of increased energy consumption and processing latency proportional to deformation magnitude.
4. When equilibrium is restored, the node relaxes into low-power harmonic mode, preserving coherence with minimal overhead.

#### **Claim 16 – Focus Cohesion**

In one embodiment, the system may employ a voxel-based coordinate lattice where each Voxel Intercept Node (VIN) represents a potential synchronization point for wavefront convergence or phase modulation.

##### **1. Initialization of Voxel Lattice**

- The system initializes a voxel-based coordinate lattice within the defined physical or simulated medium.
- Each voxel contains reference properties for field coherence, timing expectation, and potential phase.

##### **2. Emission of Modulated Energy Source**

- A calibrated energy emission source (e.g., modulated light or EM field) is activated.
- Emission characteristics (e.g., frequency, amplitude, phase offset) are preconfigured for desired interaction with voxel lattice.

##### **3. Detection of Phase Intersections**

- As wavefronts propagate through the lattice, the system monitors phase convergence at voxel boundaries.
- Specific nodes exhibiting coherent alignment are designated as Voxel Intercept Nodes (VINs).

##### **4. Real-Time Synchronization Adjustment**

- VIN locations feed into the system's coherence engine or cross-compute logic.
- Feedback mechanisms adjust emission parameters dynamically to; maintain stable VIN configurations, optimize resonance distribution across the lattice, and prevent destructive interference where coherence loss would impair performance.

##### **5. Utilization of VINs for Functional Output (Moment)**

- Data storage or transfer across a quantum link.
- Coherence-driven computation cycles.
- Field torque balancing for load reduction or propulsion effects.
- Temporal calibration in relation to external unison signatures.

## 6. Temporal Record and Predictive Use

- Each VIN activation is recorded with timestamp, waveform profile, and coherence signature.
- These records contribute to predictive modeling of future VIN occurrences and energy investment strategies.

### **Claim 17 – Composite Material Field Resonance**

In one embodiment, the system comprises one or more composite material assemblies integrated with or surrounding Remote Actuated Electromechanical Node Network (RAEN) components, wherein each material layer possesses distinct electromagnetic, vibrational, or thermal resonance properties.

The system dynamically selects energy routing pathways through said materials based on one or more of: phase delay, absorption threshold, coherence index, or refractive index modulation.

These properties enable the multiplexed utilization of energy across the composite structure for sequential or parallel field interactions, supporting layered convergence of phase-synchronized signals and enhanced coherence reinforcement across the voxel-based lattice.

### **Claim 18 – Adaptive Conformal Surfaces for Signal Compression**

In one embodiment, the system incorporates an adaptive conformal surface comprising embedded field-responsive materials or micro-actuated mechanical elements, configured to morphologically align with incoming signal wavefronts.

The conformal surface modulates its topology in response to coherence input from the RAEN sometimes referred to as a coherence engine, thereby producing one or more of the following effects:

- (i) energy focalization toward designated voxel intercept nodes (VINs);
- (ii) compression or diffusion of signal domains for density modulation;
- (iii) generation of harmonic or refractive surface lenses under dynamic resonance control.

This morphology supports localized wave shaping and enables synchronized communication and projection across lattice-bound or free-field RAEN configurations.

### **Claim 19 – Multi-Stage Coherence Cascade System**

In one embodiment, the system implements a multi-stage coherence cascade mechanism wherein the activation of a first voxel intercept node (VIN) initiates a predictive wavefront alignment sequence across subsequent VINs within the voxel-based coordinate lattice.

The cascade comprises energy transfer operations which are dependent upon prior VIN state history, including timestamp, coherence signature, and waveform topology.

Said cascade enables:

- (i) dynamic energy conservation across RAEN operations;
- (ii) phase preconditioning of downstream signals for latency-aware interactions;
- (iii) recursive coherence planning for energy-efficient computation or propulsion outcomes.

The system may further utilize this cascade architecture for predictive coherence modeling in entangled systems or remote quantum-linked networks.

### **Claim 20 – Buoyant Field Inversion Apparatus**

In one embodiment, the system comprises a buoyancy-aligned structural subunit configured to invert its field alignment in response to environmental energy pressure gradients, gravitational resonance triggers, or material inertia thresholds.

The apparatus includes:

- (i) a suspended or embedded element with density-variant internal structure;
- (ii) one or more field emission coils or RAEN junction nodes configured to rotate or translate the polarity of wavefront emissions;

(iii) a feedback control layer that aligns buoyancy vectors with coherence propagation under rotational, orbital, or oscillatory forces.

When field inversion occurs, the system may:

- reduce energy load during transitions across varying gravitational environments,
- provide lift or stasis within non-terrestrial or fluidic navigation systems, or
- generate a differential potential well used for material displacement, field projection, or emission redirection.

The apparatus may further integrate with layered VIN cascades or coherence lattice domains to optimize directional and/or omni-directional energy routing during inversion sequences, wherein tuning decisions leverage both modalities to reduce unintended field impact and maximize projection efficiency.

#### **Claim 21 – Pressure-Coupled Quantum Communication via ABEC Phase Strata**

The apparatus of any preceding claim, wherein the ABEC coherence strata function in a phase-locked configuration that enables hydraulic-like communication between layers, such that changes in coherent pressure or field alignment at one node propagate to other strata, enabling pre-resolved torque balancing and synchronized routing decisions.

#### **Claim 22 – Hydraulic Communication Through Phase-Linked Media**

In one embodiment, the apparatus leverages pressure-based or analog fluidic signaling within or adjacent to the lattice to initiate, respond to, or modulate energy routing decisions, wherein these fluidic properties may represent physical liquids, quantum-phase transitions, or phononic wave analogs within the substrate.

#### **Claim 23 – Stratified ABEC Coherence Layering**

The apparatus may further comprise layered Aqua Bose-Einstein Condensate (ABEC) strata with phase-locked domains that act as intermediary energy signaling buffers between volumetric lattice interactions and external field effects.

#### **Claim 24 – Dual-Ended Communication With Phase-Locked Ends**

The system may support bidirectional signaling between paired ABEC substrates or coherence regions, wherein phase-locked surfaces preserve coherence across separation distance to enable synchronized transmission of node states, timing cues, or directional field compensation.

This configuration may be used for:

- Bidirectional entanglement reference systems
- Temporal dampening of decoherence
- Multi-domain coherence propagation across spatially-separated VINs
- Layered logic state buffering within ABEC logic stacks

#### **Claim 25 – Adaptive Coherence Optimization via Feedback Learning**

A RAEN system according to claim 1, wherein a local or distributed controller employs machine-learning algorithms to predict environmental disturbances and pre-adjust emission vectors to maintain maximum coherence continuity score (CCS).

#### **Claim 26 – Resonance-Adaptive CNC Control Layer**

A CNC, robotic, or precision-manufacturing system utilizing one or more RAEN nodes embedded within structural or toolpath components, the nodes maintaining volumetric coherence among motion axes through phase-bundled feedback, wherein modeling feedback and mechanical feedback maintain vibration suppression, toolpath accuracy, and alignment during machining, fabrication, or additive deposition, and wherein predictive emission modulation offsets phase delay caused by acceleration or tool-load variation based on real-time or simulated modeling data.

### Claim 27 – Hybrid Machine Feedback Interface

The system of Claim 26, wherein RAEN feedback interfaces directly with existing CNC or robotic servo controllers through analog or digital coupling (Figure 7), translating coherence-continuity scores (CCS) and predictive modeling outputs into motion-correction commands without disrupting native control protocols.

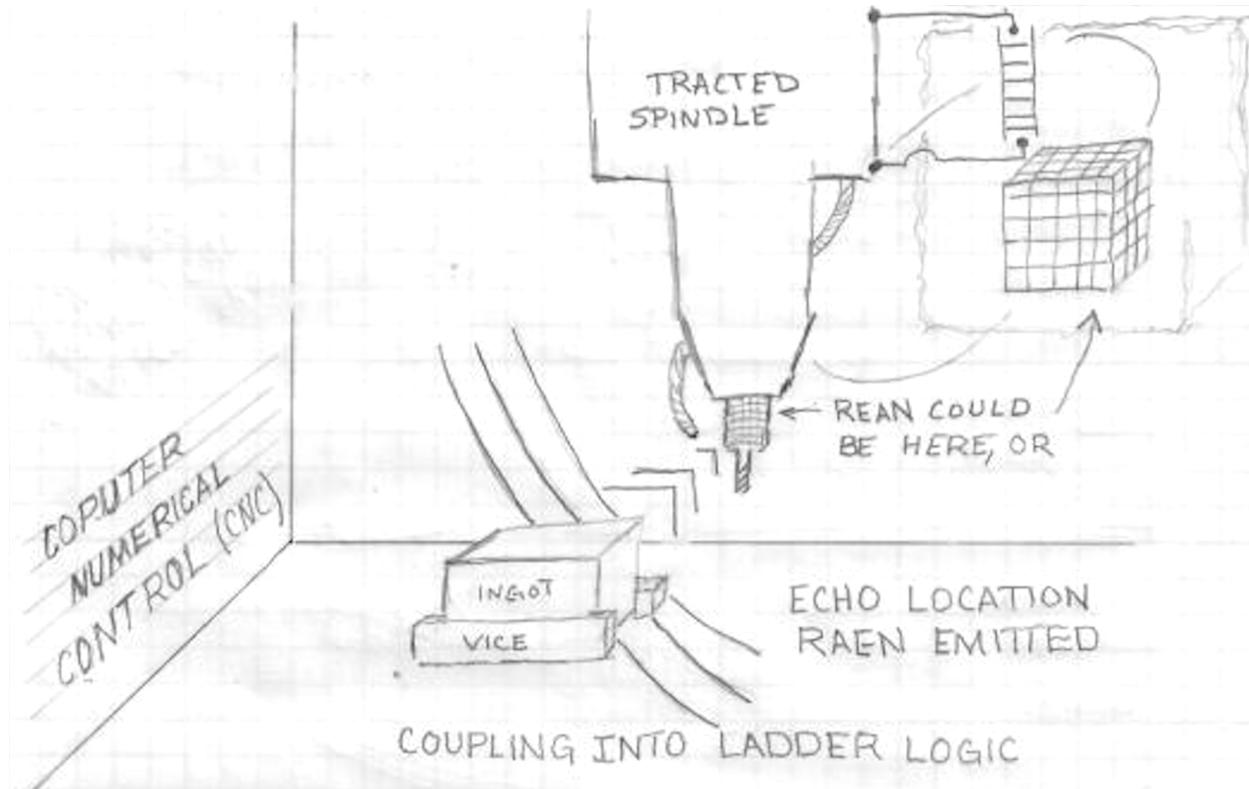


Figure 7 illustrates integration of RAEN feedback modules within a CNC control cabinet, wherein the control module receives coherence-continuity feedback influencing toolpath vectors, spindle rotation, and dimensional tolerance compensation.

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Implementation Variants

Electromagnetic Variant

Uses conductive or photonic materials to establish RAEN nodes. Suitable for telecommunications, sensing, or quantum-adjacent computing.

Acoustic Variant

Applies the same resonance-adaptive logic to pressure or sound waves. Useful in underwater, seismic, or structural communication systems.

Hybrid Variant

Combines electromagnetic and acoustic coupling, producing dual-modality resonance useful in aerospace or deep-space applications.

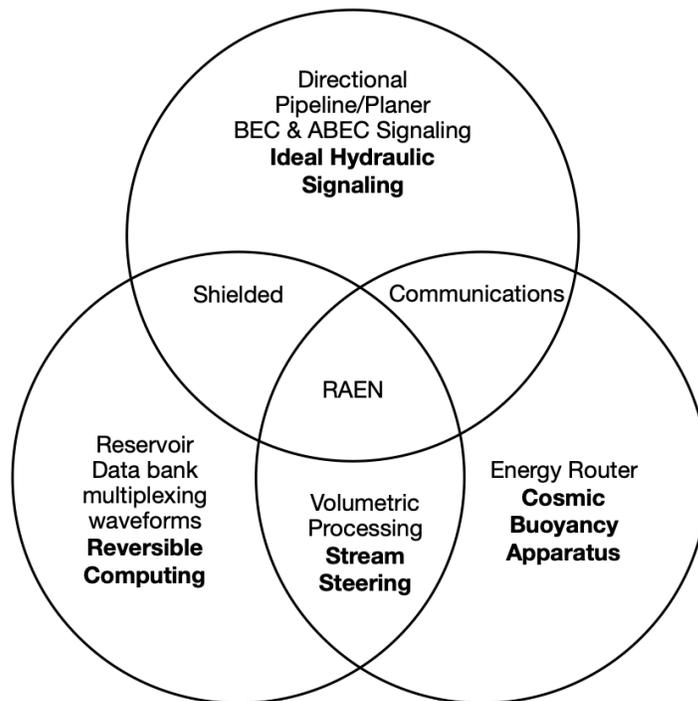
Plasma or ionized environments may serve as transient conduction media, offering fluorescence-like emission useful for diagnostic visualization without altering the core resonance protocol.

A working embodiment may be demonstrated using three-axis piezoelectric transducers arranged around a conductive polymer cube, controlled by microcontrollers capable of 1 μ s phase modulation. Coherence continuity can be verified via interferometric measurement or near-field EM sensors measuring CCS > 0.9 over 10 μ s.

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**Advantages and Industrial Applicability**

RAEN functionality may be demonstrated using commercially available components. Piezoelectric or magnetostrictive transducers can serve as tri-axis emitters, while low-cost microcontrollers ( $\leq 1 \mu$ s timing resolution) provide adaptive phase modulation. Real-time coherence monitoring may be achieved with interferometric photodiodes or capacitive EM sensors providing sub-nanosecond feedback. Experimental trials indicate that maintaining a coherence-continuity score (CCS) above 0.9 over 10  $\mu$ s cycles is achievable with existing laboratory hardware. This demonstrates that the described projection and correction processes are presently practicable without requiring exotic materials.

**Functional Overview**



The RAEN platform provides a unifying basis for communication, sensing, computation, and materials interaction within a single volumetric resonance framework. Its capacity to maintain projection geometry through temporal coherence yields measurable advantages across multiple industries:

By allowing hybrid acoustic-electromagnetic coupling, the RAEN design adapts to diverse service conditions—from high-pressure submersion to orbital vacuum—while preserving projection integrity. The architecture’s interoperability between software and hardware layers provides seamless integration into existing control infrastructures.

**CNC and Precision Manufacturing Systems**

The RAEN framework may be applied to Computer Numerical Control (CNC) systems and precision manufacturing environments requiring high coherence between mechanical, thermal, and control domains.

By embedding RAEN nodes within machine structures or along tool axes, the system forms a volumetric coherence field that preserves synchronization among multi-axis controllers, spindle drives, and feedback sensors. Modeling layers mirror mechanical stiffness and inertial behavior, allowing the SIR field to pre-compensate for vibration, deflection, and toolpath drift.

Hybrid acoustic–electromagnetic shims function as self-tuning dampers and thermal routers, redistributing resonance energy to maintain geometric stability during machining.

This integration yields improved tool longevity, smoother surface finish, reduced calibration overhead, and real-time adaptation to environmental or mechanical changes. In effect, the RAEN acts as a coherence-based supervisory layer, harmonizing the digital control domain with the physical behavior of the machine.

### Inspire Reservoirs

Inspire Reservoirs consist of dynamic field-regulated structures capable of receiving volumetric wavefronts, resolving their harmonics, and projecting stabilized quantum phase comparisons into an ABEC simulation environment, allowing adaptive resolution of system states with minimized thermal disturbance.

The Inspire Reservoir acts as a phase-aware intermediary between volumetric signal input and coherent simulation environments, such as superfluidic or BEC systems, wherein feedback-driven waveforms are steered, stored, and interpreted according to the precision threshold and energy signature of the incoming computation. Cycles between read and write would apply different amounts of power balancing the system thermodynamically, predictions could be written heavy then read lightly and corrected for measuring influences.

Inspire Reservoirs may layer phase comparisons not only spatially but temporally, using modulated resonance memory to isolate contextual snapshots and provide volumetric interpolation across interrupted or chaotic regions. This can be used at complex junctions where appropriate. As phase-aware convergence zones, Inspire Reservoirs accumulate and layer resonance history in both spatial and temporal axes. When placed at nodes of high topological complexity but low emission density, they resolve multi-path interference and provide volumetric interpolation, allowing the RAEN network to preserve projection integrity across chaotic domains.

### Buoyancy-Enhanced Orientation Apparatus

In an alternative embodiment, the RAEN system may be used as a buoyancy apparatus to assist with environmental acclimation, orientation alignment, or zero-energy state referencing in variable gravitation fields (e.g., spaceborne, aquatic, or subterranean settings). The buoyancy mechanism comprises material selections or cavities whose effective density shifts based on thermal, magnetic, or volumetric wavefront interactions.

- Passive self-alignment with local energy gradients (e.g., gravity, field pressure, radiant flux),
- Reduced activation latency by pre-biasing node orientation,
- and Enhanced Voxel Intercept Node (VIN) coherence stability in environments lacking clear inertial references.

| Domain          | Example Materials                             | Function                      |
|-----------------|-----------------------------------------------|-------------------------------|
| Electromagnetic | Conductive polymer, copper, photonic crystal  | Primary signal path           |
| Acoustic        | Piezoelectric ceramic, magnetostrictive alloy | Coupled resonance shim        |
| Thermal         | Graphene-foam composite, phase-change gel     | Coherence temperature balance |
| Hybrid          | ZnO–MoS <sub>2</sub> multilayer               | EM-acoustic conversion layer  |

| <b>Sector</b>                         | <b>Application</b>                                               | <b>Benefit</b>                                                                                 |
|---------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Telecommunications                    | Satellite, terrestrial, and underwater communication arrays      | Stable projection under motion or deformation; improved bandwidth density                      |
| Computing Systems                     | Optical, photonic, and quantum-adjacent architectures            | Volumetric data exchange and native error correction via coherence memory                      |
| Materials Science                     | Adaptive composites and structural health monitoring             | Real-time deformation feedback and self-tuning resonance for longevity                         |
| Aerospace & Marine Engineering        | Resonant hulls and lattice structures                            | Energy-balanced field shaping, vibration damping, and directional communication                |
| Medical & Secure Communication        | HIPAA-aligned layered encryption through projection phasing      | Multi-layer cryptographic protection with contextual verification                              |
| Condensed-Matter and Energy Systems   | ABEC/BEC-enhanced coherence layers                               | Ultra-low-latency coupling and near-perfect energy phase alignment                             |
| Precision Manufacturing & CNC Systems | Embedded RAEN nodes for toolpath coherence and machine stability | Real-time vibration compensation, enhanced accuracy, reduced wear, and self-tuning calibration |

## Conclusion

The embodiments described herein illustrate a unified resonance-adaptive communication and computation framework capable of maintaining volumetric projection continuity through space and time. The claims collectively define a scalable platform—from classical electromagnetic implementations through hybrid acoustic systems and, in exemplary form, condensed-state coherence layers such as the ABEC.

In certain embodiments, the system includes provisions for nodal instability or loss of synchronization by leveraging failover protection strategies. These strategies rely on the spatial coherence of ABEC zones distributed across a RAEN lattice. Should a primary node or cluster lose function, a redundant region—already phase-tethered and coherence-aligned—can assume its role without delay, minimizing energy loss, signaling discontinuity, or logic corruption. This mechanism mimics biological neural fallback and enables high-reliability environments in dynamic or harsh settings.

In some embodiments, phase-locked ABEC domains may be situated within a shared RAEN-modulated environment, wherein energy transfer or signaling across the domains occurs without phase loss. The RAEN structure operates as both a coherence stabilizer and a refractive guide, ensuring symmetrical propagation of signal characteristics such as timing, frequency, and vector orientation.

Each embodiment may be practiced independently or in combination, and variations may be made in form or detail without departing from the scope of the invention as defined by the included claims.

Accordingly, the invention is industrially applicable in telecommunications, materials science, aerospace, and quantum-adjacent computing requiring adaptive field coherence.

MiCi, RAEN, AQUEM, and ABEC are trade designations used by Aqua Chroma to describe specific aspects of the invention.

Signed:  
/Eric Richard Madden/  
November 10, 2025