NRCL Prognostic Network

A Speculative Proposal

Pondering existence is a journey of the mind that has no boundaries. In contrast to this lofty mesa, however, we must also accept the fact that our own existence is, regrettably, quite finite. This concern invariably encompasses the necessity to foresee events that may adversely affect our lives. Thus, fundamental to our existence is the innate ability to understand how the choices we make today shape all our future tomorrows (τι μέλλει γενέσθαι;) as inexorably driven by *cause and effect*. Yet there may be undiscovered processes not uniformly bound to causal reality that can never be completely observed or understood, and that may in some way forge our destinies. It is suggested that such processes are rooted in nonuniform or nonlinear causality (ABSTRACT, sec. 3). Specifically, they may not consistently flow from *cause* to *effect*, or from *present* to *future*.

Section [13] of this paper states the core hypothesis of how a prognostic network comprised of NRCL devices (section [1]), may be affected by unusual or extraordinary phenomena. Additionally, section [10] describes the basic configuration of such a network. If the core hypothesis is true, and each NRCL device can be optimally adjusted to forecast events yet to come, then we may discover that our existence is not completely founded on the conventional understanding of causal reality. It may, in fact, be influenced by temporal fluctuations in the fabric of *cause and effect* that propagate at macroscopic levels. Section [2] states proposals A through E of how existence may be more than what any casual observer can discern.

From Archimedes to Hawking, the greatest minds of civilization have stood on the precipice of its greatest discoveries and, without regard to the chasm below, took that final leap of faith.

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ABSTRACT:

1 The most common reasons calibration procedures are updated are, i) to enhance system performance specifications, ii) to improve mean time before failure (MTBF) adversely affected by the current procedure or, iii) to address modes of function and failure over the wider scope of a system's influence on, and interaction with, target systems. In this case, the updated calibration procedure in the APPENDIX radically alters the function of the NRCL device (section [1]) from an enhanced true random number generator (TRNG) to a network component that may have significant ramifications with respect to forecasting schemes. Having said that, the following dissertation has <u>nothing</u> to do with random numbers *per se*, but rather an explicit application of two diametrically opposed information archetypes contained within a single bitstream or binary sequence (Figure 1).

2 The introductory section presents some basic concepts that prompted the revision of the original calibration procedure. Yet due to limited resources, these concepts are, at best, conjecture since no field data has ever been collected from any working network of NRCL devices, large or small, as to how such a network would behave under the influence of unusual or extraordinary phenomena. This paper is a compilation of personal notes and observations from the original NRCL proof-of-concept prototype development that are included as a preface to the updated calibration procedure. Notably, the preface highlights an oversimplified interpretation of semiconductor physics commensurate with the <u>NRCL Low Entropy Calibration</u> objective, which is to assemble an interactive network of NRCL devices that, in theory, can *collectively detect phenomena not uniformly bound to causal reality at the macroscopic level*. The terms "nonlinear" and "nonuniform" are used interchangeably concerning time-based parameters of any given natural system. Both terms are explained through the following analogy.

3 An imaginary thunderstorm rolls over a grassy field and the ensuing cloudburst does not deliver rain uniformly (linearly) over the entire field. Moving patches of rain appear as a two-dimensional fabric or quilt where some patches of rain fall faster and other patches of rain fall slower to the ground, *i.e.*, a moving pattern of fluctuating acceleration. In this analogy, the field represents a <u>single</u> inertial frame of reference in the present with moving patches of maximum acceleration (rain falls faster) and minimum acceleration (rain falls slower) across its surface, and with a gradient between these two extremes across the field. In our imaginary thunderstorm, the moving two-dimensional pattern is a *precursor* of when and where lightning will strike first across the field, and with what intensity. This paper defines nonlinear time simply as a moving fabric of causal fluctuations within a single inertial frame of reference. By extension, it is claimed that the moving patchwork may affect the mutual randomness between two or more natural systems over one or more inertial frames of reference and may have more to do with the enigma of "mere coincidence" than what "chance" alone would dictate.

4 To be sure, the analogy of different patches of acceleration are not related to any relativistic effect. In other words, nonuniform causality could just as easily have been symbolized by extremes between like parameters of any given natural system. Such parameters may include, but are not limited to, ionization potential of liquid water, net dipole moment of water, isotope half-life and proportion of deuterium, latent heat of fusion (patches of ice and liquid water at precisely the same ambient temperature), *et cetera*. The point of the analogy is that it highlights a *pattern* of nonlinear causality. It is claimed that such patterns are precursors of future events by the *shadows* they cast in the present. Unfortunately, the experiment has not come to fruition and we cannot confirm or deny the notion of forecasting future events by the "ripples" they create in the present.

[1] In the Autumn of 1994, an electronic circuit was built that generated random numbers as passwords or keys using two digitized noise sources in reciprocity (the *entropy function*) as shown in Figure 1. The design objective was to increase password randomness and to bind each key to a non-deterministic period using, in part, a novel circuit technique called DATA STREAM MONOTONICITY (Figure 2). The Non-Repeatable Code Lifetime (NRCL) generator is the proof-of-concept prototype used to show that the entropy function can be repeated at successive levels of integration. Final information output is characterized as an *augmented* data type that is defined as a binary code linked to the chronometric measurement of its *persistence* at each first stage output (OUTPUT A, OUTPUT B), a period called a *code lifetime* (LIFETIME A, LIFETIME B) as shown in Figure 2. Each code lifetime is deemed irreproducible, hence non-repeatable, in contrast to the code itself. The significance of *persistence* is that it is derived from the same signal type that produces the binary code output and, at all scales, is built up from two consecutive state changes of the digitized noise output. The *augmented* data type, as the term implies, is a union of two diametrically opposed information archetypes described as symbolic and non-symbolic (Figure 1).

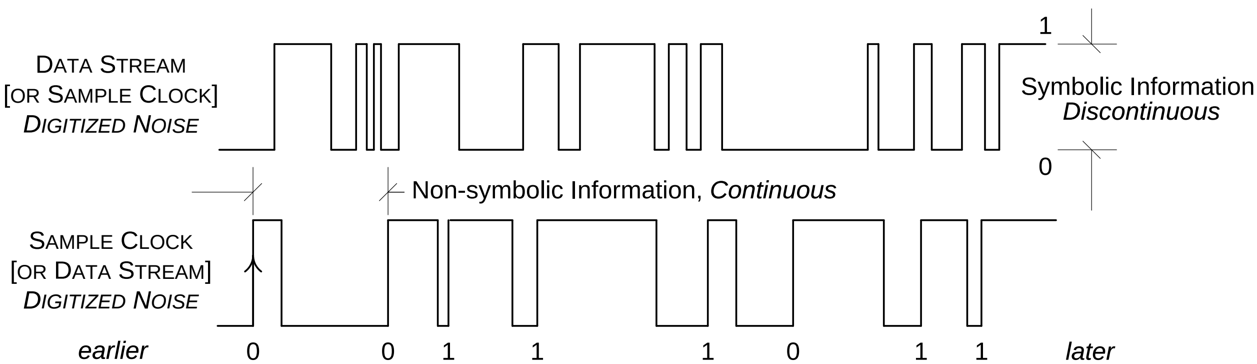

Figure 1. NRCL Entropy Function Reciprocity Diagram

[2] The revised calibration procedure in the APPENDIX was initially motivated by observations of avalanche noise and its potential connection to a phenomenon called "spontaneous phase space[1] convergence". This phrase typifies the situation where two or more natural systems exhibit congruence, or resonance, in like parameters of their phase spaces without apparent cause or reason. The general case of this phenomenon is when like parameters of two or more natural systems become more, or less random with respect to each other, or to themselves over time, for no apparent reason. The full range of how such phenomena may be precursors of events yet to come, and how we may implicitly predict their arrival, is characterized in proposals A through E below. Even though current research has begun to address some of these concepts, such as the work done by *Recorded Future*[2], this paper specifically considers how the NRCL augmented data type, based on a correctly adjusted entropy function, may enhance the ability of prognostic systems to foresee future events by how they disturb the behavior of natural systems in the present. Proposals A through E embody the possibility that the path of *cause and effect* may be variable, or mutable, at the macroscopic level as it is for physical processes at the microscopic level[3].

A. Is existence, as we perceive it, *uniformly* distributed across time or, as proposed in this paper, can there be phenomena outside the conventional understanding of causal reality that affect destiny?

[1] Phase space. (2017, January 20). In *Wikipedia, The Free Encyclopedia*. Retrieved 11:59, March 12, 2017, from https://en.wikipedia.org/w/index.php?title=Phase_space&oldid=761038827

[2] Recorded Future. (2017, March 11). In *Wikipedia, The Free Encyclopedia*. Retrieved 15:31, March 27, 2017, from https://en.wikipedia.org/w/index.php?title=Recorded_Future&oldid=769709298

[3] Arrow of time. (2017, March 5). In *Wikipedia, The Free Encyclopedia*. Retrieved 15:43, March 10, 2017, from https://en.wikipedia.org/w/index.php?title=Arrow_of_time&oldid=768701986

B. If two or more natural systems exhibit congruence or resonance in like parameters of their phase spaces, without apparent cause or reason, can some unusual or nonlinear temporal process be at work other than attributing it to mere coincidence by itself?

C. In the general case of B, if like parameters of two or more natural systems become more, or less random with respect to each other, or to themselves over time, again without apparent cause or reason, can it be attributed to processes rooted in nonlinear time?

D. Over the widest scope of influence, is it possible that the collective impact of nonlinear temporal processes, hereafter *nt-processes*, may result in statistically significant deviations from a progression of likely outcomes over an ever-increasing number of natural systems?

E. Given that nt-processes propagate in unknown ways, can they be implicitly observed by measuring their effect on a network of NRCL devices calibrated to detect nonuniform patterns of causal reality?

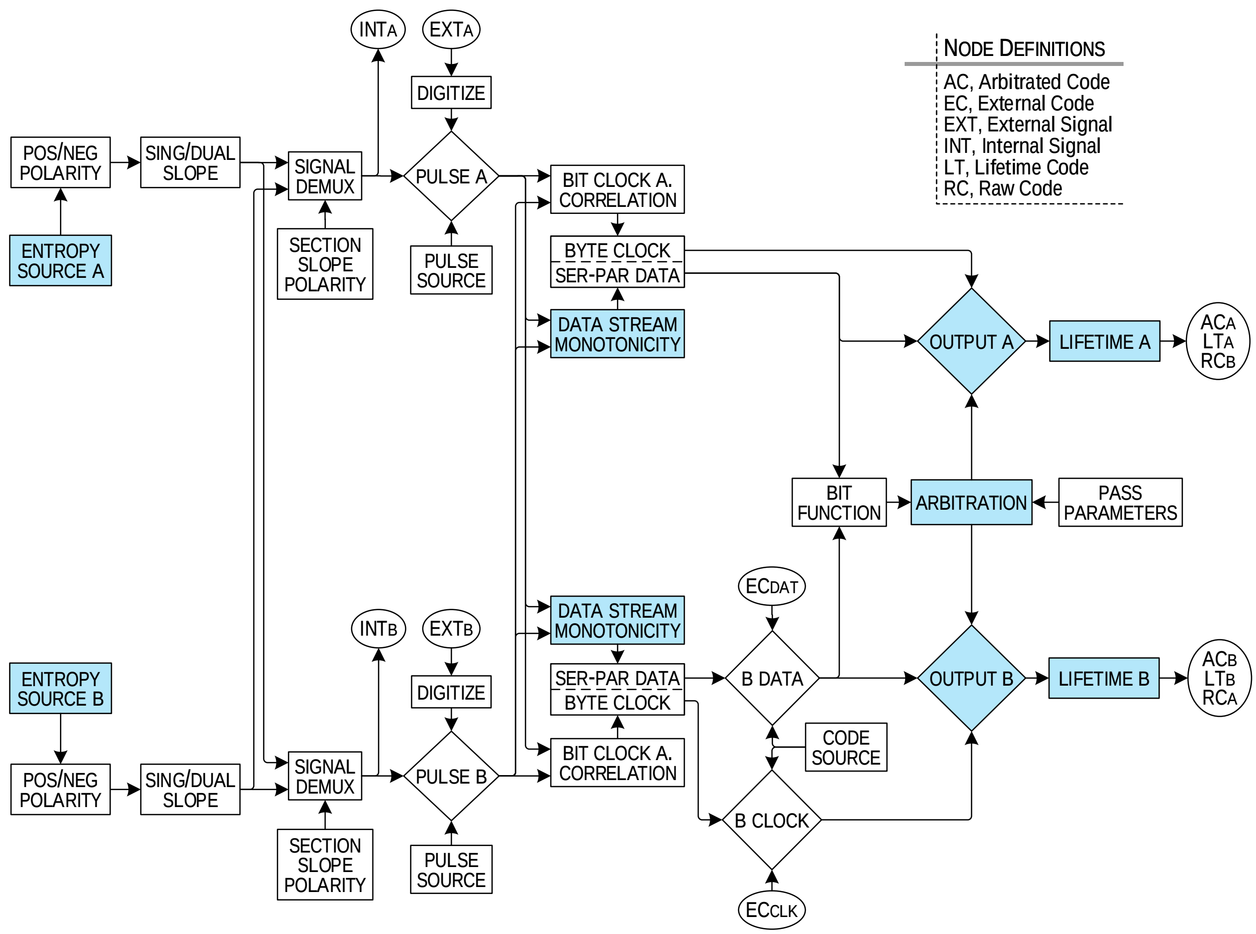

Figure 2. NRCL Prototype Block Diagram

[3] A set of premises that reconcile a phenomenon of semiconductor physics with the calibration procedure in the APPENDIX is herein presented. When the Noisecom NC104 noise diode is minimally biased into avalanche breakdown[4], its junction voltage continually approaches (but never quite reaches) a state of equilibrium. The entropy of the avalanche process, represented by state variable S, is principally stable over time because *minority charge carrier* (or simply *charge carrier*)

[4] Avalanche diode. (2016, December 20). In *Wikipedia, The Free Encyclopedia*. Retrieved 09:42, March 9, 2017, from https://en.wikipedia.org/w/index.php?title=Avalanche_diode&oldid=755841600

formation and annihilation processes are reversible and balanced, and the diode remains undamaged. The entropy sources shown in Figure 2 (ENTROPY SOURCE A, ENTROPY SOURCE B) each use an NC104 device as the default signal source that drives the NRCL entropy function. Avalanche breakdown produces a *macrostate* voltage V_b across the diode junction that exhibits random fluctuations within an upper and lower voltage limit characterized as electronic noise. This is the result of the incessantly shifting microscopic configuration of charge carriers throughout the barrier region where breakdown occurs, with each described as a *microstate*[5] of the system.

[4] A stark presentation of the breakdown process is depicted by the idealized $r \times r$ planar matrix of Figure 3 and illustrates a tangible example of two different microstates for $r = 7$. The formation regions (F) are grouped into microstate patterns of *primary avalanche triggers* and show their distribution across an abstract matrix. A primary avalanche trigger is a spontaneous event that initiates the avalanche *chain reaction*[6] and has no predecessors as opposed to the case of collateral impact ionization stimulated by a larger, ongoing avalanche event. A good analogy of such a trigger event is the single grain of sand in an hourglass that spontaneously initiates a sand pile avalanche, and all subsequent cascades of sand grains are stimulated by their predecessors. The duration of the chain reaction from the primary trigger until the collapse (breakdown) stops is unpredictable, and encompasses the structured criticality[7] of any natural system pushed to its limits. In this analogy, each region of the $r \times r$ planar matrix corresponds to an hourglass, and each trigger event is neither influenced by, nor interacts with, its adjacent neighbors. When the avalanche stops, the sand pile returns to stable growth and is represented by each annihilation region (A) of Figure 3.

[5] The reasoning behind this oversimplification of breakdown dynamics is that it is commensurate with the scope of the NRCL Low Entropy Calibration procedure objective as stated in section 2 of the ABSTRACT. Thus, each formation region (F) is where a "set" of charge carrier avalanches begin. Exactly when the next avalanche pattern commences within the matrix, and the total number of charge carriers released in *each* avalanche, is unpredictable. *For simplicity, this model categorically excludes the affinity of adjacent regions to exhibit higher or lower than expected probabilities of primary avalanche triggering as influenced by the region under consideration* (the hourglass matrix). Additionally, since V_b is not in a single, well-defined macrostate, the Gibbs entropy formula[8] is deemed applicable for expressing the total entropy S of the device as produced by set $\mathcal{M}$ of all possible microstates of its breakdown process. From this, set $\mathcal{M}$ is parsed into *proper* subsets $\{\mathcal{M}_i' | \mathcal{M}_i' \subset \mathcal{M}\}$ consisting of n subset elements $m(i)$, expressed $n(m(i))$, and $\{m(i)_p \in \mathcal{M}_i' \big| 1 \leq p \leq n\}$. In this model, subset membership to $\mathcal{M}_i'$ must comply with predefined acceptance criteria. Specifically, *each subset element $m(i)_p$ is herein defined as a microstate pattern of "simultaneous" primary avalanche triggers*.

[6] At this juncture, it should be evident that the model introduced in sections [4] and [5] is not a representation of avalanche breakdown in the NC104 device *per se* but rather a paradigm of the diode's entropy over finite periods. As such, the NRCL Low Entropy Calibration procedure necessitates a distinction between high entropy and low entropy elements of $\mathcal{M}_i'$ in that the more ways there are for an element to occur, the higher its entropy. For example, there are $C(49,3) = 18{,}424$ possible patterns of a three-region primary avalanche trigger (written Fk where $k = 3$) within a 7×7 planar matrix and $C(49,25) \approx 63.205 \times 10^{12}$ possible patterns of a 25-region primary avalanche trigger $(Fk|k = 25)$. Thus, an $F3$ element is described as belonging to a lower entropy class of elements than any in an $F25$ class of elements, and low entropy elements are less likely to occur than high entropy elements. However, two or more primary avalanche triggers never commence at *precisely* the same time. They are only deemed synchronous, or simultaneous, if the maximum period

[5] Microstate (statistical mechanics). (2016, November 25). In *Wikipedia, The Free Encyclopedia*. Retrieved 11:44, March 10, 2017, from https://en.wikipedia.org/w/index.php?title=Microstate_(statistical_mechanics)&oldid=751459969

[6] Chain reaction. (2017, August 23). In *Wikipedia, The Free Encyclopedia*. Retrieved 07:50, October 1, 2017, from https://en.wikipedia.org/w/index.php?title=Chain_reaction&oldid=796803173

[7] Structured criticality. (2017, August 30). In *Wikipedia, The Free Encyclopedia*. Retrieved 09:11, October 26, 2017, from https://en.wikipedia.org/w/index.php?title=Structured_criticality&oldid=798074793

[8] Entropy (statistical thermodynamics). (2016, August 25). In *Wikipedia, The Free Encyclopedia*. Retrieved 11:47, March 10, 2017, from https://en.wikipedia.org/w/index.php?title=Entropy_(statistical_thermodynamics)&oldid=736091281

between them, expressed $max(d0)$, is smaller than the bandwidth of the measurement system that observes them. To clarify the idea of tandem primary avalanche triggers being simultaneous, we first distribute all microstates of $\mathcal{M}_i'$ that ultimately exert a cumulative effect on macrostate junction voltage into arbitrarily defined *propagation domains* that encompass the complexity of V_b over successive levels of NRCL integration.

[7] The temporal hierarchy of propagation domains begins with interval I_{d0} that is comprised of a contiguous range of chronometric periods defined as $\{d0 \in \mathbb{R} | 0 < d0 \leq max(d0)\}$ between *tandem* primary avalanche triggers that belong to a "singularly observable" element and though I_{d0} is defined, all $d0$ periods are unquantifiable. It is for this reason that tandem primary avalanche triggers of any $m(i)_p$ are deemed simultaneous. Though beyond the scope of this document, if there are two or more primary avalanche triggers with $d0 = 0$ between them, then we must consider the possibility of quantum entanglement[9] as being an integral part of the avalanche process and characterize such events as being truly simultaneous. Following I_{d0} is propagation domain I_{d1} defined as $\{d1 \in \mathbb{R} | min(d1) \leq d1 \leq max(d1)\}$, and $d1(i)_p$ is the period between each $m(i)_p$ in a sequence. Note that $m(i)_p$ and $Fk(i)_p$ refer to the same subset element of $\mathcal{M}_i'$ and are used interchangeably. However, $Fk(i)_p$ includes explicit parameters absent from $m(i)_p$. As such, $d1(i)_p$ is the period from the commencement of element $m(i)_p$ (or $Fk(i)_p$) until the commencement of element $m(i)_{p+1}$ (or $Fk(i)_{p+1}$) for $1 \leq p < n$, called the *latency period* or *dwell time* of $Fk(i)_p$ within the sequence. As stated, each $m(i)_p$ represents a microstate pattern of formation regions that exist at any given time and the number of N ways an Fk class of elements can initiate avalanches "simultaneously" is expressed $N(Fk) = C(r^2, k)$, where r and k follow the law of truly large numbers[10] and are deemed *finite and uncountable*. When k approaches a maximum or a minimum, Fk is characterized as a low entropy element (pattern) that constitutes, in part, the macrostate breakdown voltage V_b of the device over time. Shifting the focus to propagation phenomena, given Fk_1 is the first element of a propagation sequence and Fk_n is the last, the first premise of the updated calibration procedure is,

premise 1 *for the boundary set $\{Fk_1, Fk_n\}$ that frames an ordered sequence by its first and last elements, the greater the absolute value difference in formation regions $|Fk_1 - Fk_n|$ then the greater the change in breakdown voltage (ΔV_b) over the defined sequence and the lower the entropy of that sequence.*

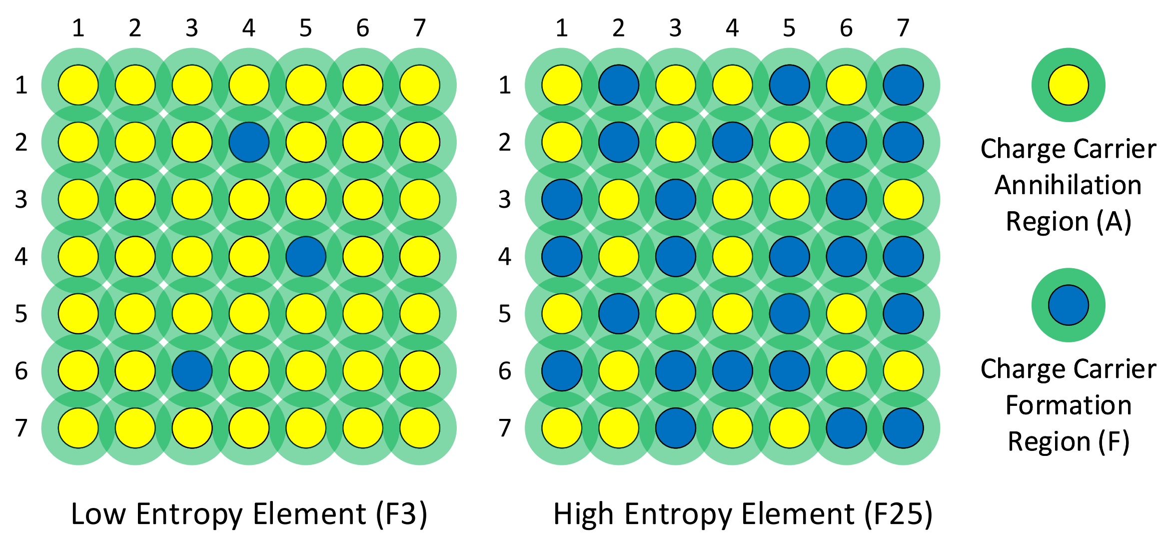

Figure 3. Primary Avalanche Trigger Microstate Patterns

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[9] Quantum entanglement. (2018, June 5). In *Wikipedia, The Free Encyclopedia*. Retrieved 14:47, June 7, 2018, from https://en.wikipedia.org/w/index.php?title=Quantum_entanglement&oldid=844461819

[10] Law of truly large numbers. (2017, June 30). In *Wikipedia, The Free Encyclopedia*. Retrieved 13:51, October 26, 2017, from https://en.wikipedia.org/w/index.php?title=Law_of_truly_large_numbers&oldid=788231072

[8] A digital logic *state* at the output of the 74HC14 Schmitt Trigger inverter is represented by Boolean variable X and a *state change* is expressed as bidirectional function $X \leftrightarrow \overline{X}$. Breakdown voltage V_b from the NC104 cathode (schematics 1.1 and 1.2) is gain and offset adjusted through the CA3102M amplifier and its differential outputs V_b^+ and V_b^- (collectively $V_b^{\pm}$)[11] are used to capture noise signals of interest at each 74HC14 input. Consequently, a state change occurs only under two well-defined circuit conditions. If the inverter's output is *TRUE* immediately prior to time t_s, expressed $X(t_{s-1})$ where (s) is the sequence index of 74HC14 output state changes at specific times (t), then the 74HC14 input was below the upper hysteresis trip point (V_{T+}) such that $V_b^{\pm}(t_{s-1}) < V_{T+}$ until $V_b^{\pm}(t_s) > V_{T+}$ at time t_s and state change $X(t_{s-1}) \longrightarrow \overline{X(t_s)}$ occurs[12]. Conversely, if the inverter's output is *FALSE* immediately prior to time t_s, expressed $\overline{X(t_{s-1})}$, then its input was above the lower hysteresis trip point (V_{T-}) such that $V_b^{\pm}(t_{s-1}) > V_{T-}$ until $V_b^{\pm}(t_s) < V_{T-}$ at time t_s and state change $\overline{X(t_{s-1})} \longrightarrow X(t_s)$ occurs. The propagation domain interval I_{d2} is defined as $\{d2 \in \mathbb{R} | \min(d2) \leq d2 \leq \max(d2)\}$ and $d2 = t_s - t_{s-1}$ for the period between each 74HC14 output state change. From this, each $d2(i)$ period demarcates subset $\mathcal{M}_i'$ of $n(m(i))$ elements that propagate in a unique sequence, and is predominantly influenced by the summation of each $d1(i)_p$ period $\sum_{p=1}^{n-1} d1(i)_p$ for the sequence $\{Fk(i)_1, Fk(i)_2, \cdots, Fk(i)_n\}$ that encompasses $V(i)_b^{\pm}$ ($V_b^{\pm}$ during $d2(i)$, called *persistence*) over finite periods of time. To a lesser extent, each $d2(i)$ period is also influenced by the value of $dV(i)_b^{\pm}/dt$ at time t_s when a trip point is breached (*drive*), and the PN junction depletion capacitance C_{PN} of the NC104 device (*impedance*). Note that $d2$ is the latency period or dwell time of the 74HC14 state outputs.

[9] The NRCL Low Entropy Calibration procedure requires that the gain and offset of breakdown voltage $V_b^{\pm}$ be adjusted so that it maximally occupies the 74HC14 input hysteresis window $V_{HYS} = (V_{T+} - V_{T-})$ and is positioned near $[(V_{HYS}/2) + V_{T-}]$. By this procedure, it is *expected* that the number of subset elements $n(m(i))$ of a low entropy sequence is from a set of maxima for any gain and offset adjustment that yields a bit stream at the 74HC14 output. As such, every state change of X reveals low entropy subset $\mathcal{M}_i'$ so described because it *likely* contains a maximized number of low entropy sequence elements. Additionally, $\mathcal{M}_i'$ propagates in what is described as a low entropy, $n(m(i))$-element sequence that drives $V_b^{\pm}$ to breach the active hysteresis trip points of the 74HC14 inverter inputs. Thus, the boundary set (premise 1) defines a low entropy sequence of $\mathcal{M}_i'$ because $\Delta V(i)_b^{\pm}$ over $\{Fk(i)_1, Fk(i)_n\}$ is from a set of $\Delta V_b^{\pm}$ maxima that delineates $\mathcal{M}_i'$ by the state changes at the 74HC14 output. It is proposed that any quantity or order of $n(m(i))$ may be influenced by nt-processes in such a way that $n(m(i))$ and ultimately $d2(i)$ (persistence) exhibit unanticipated statistical fluctuations of time-based parameters within the NC104 avalanche process. Also, the sequence $\{Fk(i)_1, Fk(i)_2, \cdots, Fk(i)_n\}$ over $d2(i)$ is unique and only happens once. That is, the same $n(m(i))$ elements of subset $\mathcal{M}_i'$ have a countless number of sequence orders that would *not* facilitate a state change over the same $d2(i)$, leaving the occurrence of subset $\mathcal{M}_i'$ as never having happened. In other words, we only know what is going on at each 74HC14 input when $V_b^{\pm}$ breaches an active hysteresis trip point and flips the corresponding 74HC14 output. All other events are *untraceable*. Thus, the second premise of the updated calibration procedure is,

> premise 2 *a traceable sequence of $n(m(i))$ elements that facilitates a state change of X, based on the gain and offset adjustments outlined in the* APPENDIX, *is evidence that it is comprised of low entropy subset $\mathcal{M}_i'$ and that it propagates in a low entropy, $n(m(i))$-element sequence over a unique $d2(i)$ period.*

[10] From the first two premises, a suggested approach to the challenge of proposals A through E is to assemble a network of NRCL devices linked to a central database for detecting uncommon phenomena that exist outside the conventional understanding of causal reality. Such a network can be integrated within, and disseminated throughout, existing network based *artifacts* such as ATM machines, POS terminals, Smart TVs, Mobile Phones, Consular Embassies, distributed weapons systems, *et cetera*. The phasing in of NRCL devices into existing network infrastructures begins with device

[11] Designated as $(+Aans, -Aans)$, and $(+Bans, -Bans)$ on Schematic 1.1 for sections A and B respectively. Also, the term $V_b^{\pm}$ refers to either V_b^+ or V_b^- as independently applied to any given 74HC14 input.

[12] The case of $V_b^{\pm}$ being equal to V_{T+} or V_{T-} is trivial since a hysteresis function is based on whether or not a trip point is breached.

miniaturization, *Bit Coincidence* performance trials of the *Arbitration* section (see [schematic 3.1](#) on ResearchGate), mainframe processing of all the data rendered by each NRCL device, and any interactive functions that shape network dynamics. At a most fundamental level, avalanche noise epitomizes the incessant flux of causality and its ceaseless progression of all possible microstates $\mathcal{M}$, to a greater or lesser extent, may be influenced by nt-processes. The calibration procedure in the APPENDIX endeavors to "tune" the digitized noise outputs to low entropy sequences of low entropy subsets demarcated by each 74HC14 output state change. Notably, the implications of this are extraordinary[13] if we consider that nt-processes may affect the probability occurrence of a *set* of events and its propagation *sequence*. Thus, the third premise of the updated calibration procedure is,

> <u>premise 3</u> *changes in the statistical behavior of traceable low entropy subsets made manifest in low entropy sequences of those same subsets, as possibly influenced by nt-processes, would be the easiest to isolate and quantify for use as an analytical metric.*

[11] If the NRCL noise circuit is adjusted per the <u>NRCL Calibration</u> procedure of 30-December-2009, then the digitized noise bit stream does not adequately filter out all but low entropy subsets $\mathcal{M}_i'$. The noise circuits (ENTROPY SOURCE A, ENTROPY SOURCE B) need to be adjusted so that they capture only large-amplitude/low-frequency noise signal components. This change in adjustment parameters requires that the original calibration procedure be modified as described in the APPENDIX. However, the concern about tuning the noise digitizers to such uncommon phenomena is stability and the long-term drift of noise board components. Yet, considering how significant such events may be, future circuit development should include a stabilization circuit as part of NRCL Standardization Protocol[14]. The question is whether nt-processes can, in fact, influence subsets of elements and their inevitable propagation in time, and if an array of NRCL devices tuned to such events can detect these processes.

[12] As also suggested in proposal C, the influence of nt-processes may become apparent over time. Suppose we split a single digitized noise bit stream into two independent bit streams with one being a delayed version of the other, termed *temporal bifurcation*, and use a *past* state transition of the digitized noise signal to acquire a *present* state of itself, and *vice versa*. Though past events of the digitized noise signal should have no bearing on present events of the same signal after a critical amount of time has passed, there may exist some NRCL network configuration that could detect temporal anomalies initiated and sustained by nt-processes using a single digitized noise bit stream. In other words, it is suggested that the statistical profile of the NRCL augmented data type, as based on a single digitized noise bit stream, may change with respect to itself if it is influenced by nonuniform causality over time and over an ever-increasing number of natural systems. It is emphasized that there is no proof temporal bifurcation is any better at detecting nt-processes than would be by simply using two separate digitized noise sources. However, what remains unique to the NRCL proof-of-concept prototype is the added parameter of *code lifetime*, and that it may significantly contribute to this forecasting method.

[13] Regardless of how the entropy function is facilitated, the core hypothesis of this paper is that each device in an NRCL network would normally exhibit a baseline random behavior with respect to all the others as reflected in each one's rendering of the augmented data type. However, if major events on the scale of *September 11*[15] or the *Beirut Bombings*[16] are imminent, for example, it is suggested that an ever-increasing number of NRCL devices would exhibit one or more

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[13] The course of earth's history, and even humanity itself, could have been quite different if nt-processes either accelerated or delayed the very first amino acids from coalescing into self-organizing, self-replicating organic molecules when and where they did.
[14] A group of functional standards that all NRCL devices in a network must comply with.
[15] September 11 attacks. (2017, October 15). In *Wikipedia, The Free Encyclopedia*. Retrieved 07:02, October 19, 2017, from https://en.wikipedia.org/w/index.php?title=September_11_attacks&oldid=805423123
[16] 1983 United States embassy bombing. (2017, September 10). In *Wikipedia, The Free Encyclopedia*. Retrieved 07:49, October 19, 2017, from https://en.wikipedia.org/w/index.php?title=1983_United_States_embassy_bombing&oldid=799877357

"converging presents (nows[17])" within the network appearing as subtle, nonuniform statistical variations of the augmented data type. Each imminent event correlates to the formation of a bow wave from a moving ship such that the more significant the future event, the greater the "bow wave" and the larger the cascade of natural systems affected in the present. The ability to detect such phenomena would be a hint that undiscovered and, as yet, unobservable nt-processes may be a source of variations in the mutual randomness between natural systems. If there are such phenomena at work, and they can be definitively measured or observed, then it could be the basis for a truly prognostic network in the most literal sense. Each NRCL component (node) of such a network would have an *identical* set of parameters in common with all the rest so that evaluating a moving fabric of causality is facilitated without onerous analysis, correlation, and normalization of dissimilar components that could distort the outcomes of said network.

Figure 4. The Bow Wave Concept

[14] The nature of time has been the subject of much debate, disagreement, and discovery. To wrap the human mind around nonuniform causality at the macroscopic scale, Figure 4 is presented as an analogy of the bow wave concept stated in section [13]. The two-dimensional surface upon which change is experienced is the *present*, and the sphere is an event that has not happened. Instead, it is approaching (falling) from the future and, as suggested in section [13], alters the anticipated path of natural systems in the present by way of temporal bow waves. It is claimed that the ripples in the surface of the present from these bow waves can be "mapped" into a pattern of future events by a network of NRCL devices much the same way an oncoming tsunami can be detected by a network of buoys that measure changes in underwater sea pressure over an expanse of the ocean. The challenge of mapping future events to unique "surface" patterns of causality in the present is to build up a database of correlations between such patterns and their observed outcomes after the fact. Such a daunting task is not insurmountable but it would certainly require time to "weave" an

[17] Julian Barbour, see *Timeless physics*. (2017, August 7). In *Wikipedia, The Free Encyclopedia*. Retrieved 10:27, October 23, 2017, from https://en.wikipedia.org/w/index.php?title=Julian_Barbour&oldid=794347270

intelligible fabric of associations between *cause and effect* and, ultimately, between *present and future*. Such is the patchwork of existence.

[15] Though section [13] is untested and consequently unproven, its merit has been documented, to some extent and under a different set of hypotheses, in a currently running experiment taking place at the time this paper was written called the Global Consciousness Project (GCP) directed by Roger D. Nelson. The question remains whether data generated by the GCP would exhibit more articulation if the Random Event Generator (REG) it uses were replaced by the Non-Repeatable Code Lifetime (NRCL) generator. A deeper consideration is that the GCP may have nothing to do with consciousness[18] *per se* but something described as a "Decoherence[19] cascade", a phrase derived from the bow wave concept of section [13]. Over the widest scope of influence, we describe this phenomenon as statistically significant deviations from a progression of likely outcomes over an ever-increasing number of natural systems. Whether consciousness initiates the greater phenomenon, is simply influenced by it, or maybe a combination of both, cannot be determined without an enhanced analysis of time-dependent phenomena. Interestingly enough, proposal D may have already occurred in the natural world as documented, for example, in the articles A radon-thoron isotope pair as a reliable earthquake precursor and The strange case of solar flares and radioactive elements.

[16] In conclusion, it is suggested that the NRCL augmented data type may facilitate the investigation of nt-processes discussed in this paper under a new set of parameters for some future GCP-like experiment. Most intriguing is that such processes may exist apart from the anticipated flow of *cause and effect* at macroscopic levels. Consistently detecting nonuniform causal phenomena could ultimately enhance our understanding of what truly defines our existence and that there may be more to mere coincidence than what chance alone would dictate.

[18] Discussions regarding "consciousness" most always touch on the dilemma of free will versus predetermination and may well reflect the quandary behind what constitutes "Global Consciousness".

[19] *Decoherence* is the process whereby the quantum-mechanical state of any macroscopic system is rapidly correlated with that of its environment in such a way that no measurement on the system alone (without a simultaneous measurement of the complete state of the environment) can demonstrate any interference between two quantum states of the system. [from McGraw-Hill Science & Technology Dictionary: Decoherence]

APPENDIX: NRCL LOW ENTROPY CALIBRATION PROCEDURE

	SECTION A		SECTION B	
	Circuit Ref.	**Value**	**Circuit Ref.**	**Value**
Diode	D1	NC104	D2	NC104
Level	VR1	10k	VR2	10k
Balance	VR3	2k	VR4	2k
Offset	VR5	2k	VR6	2k
GND	*GND*	Any ground TP	*GND*	Any ground TP
TP1	+Aans	J17	+Bans	J19
TP2	-Aans	J18	-Bans	J20
TP3	+Adns	J11	+Bdns	J13
TP4	-Adns	J12	-Bdns	J14

The following calibration procedure is applicable to both Section A and Section B. Schematic diagram test point designations have a section suffix so that TP3 of Section A, for example, is designated J11_TP3A and is the convention followed on Schematics 1.1 and 1.2. The schematics have been updated and included in the PDF version of the NRCL Low Entropy Calibration procedure.

Test Equipment: Tektronix TDS220 Two Channel 100MHz Oscilloscope (Scope)

Tektronix WaveStar™ Software V3.0 (Program)

Fluke 87 True RMS Multimeter (Meter)

Additional recommended test equipment not used in this procedure is a frequency counter with the ability to measure events per selectable unit time interval on two different channels.

PASSIVE COMPONENT ADJUSTMENTS

1) With the power turned off to the NRCL generator, set the Meter to Ohms, attach the positive lead to **GND** and press the negative lead onto the center leg of the Section A ***Balance*** potentiometer.
2) Set ***Balance*** for 1000 ohms within ± 10 ohms.
3) Move the negative lead onto the center leg of the Section B ***Balance*** potentiometer.
4) Set ***Balance*** for 1000 ohms within ± 10 ohms.

AMPLIFIER QUIESCENT *BALANCE* AND *OFFSET* ADJUSTMENTS

5) Short the ***Diode*** in Section A and Section B.
6) Apply power to the NRCL generator and allow at least 40 minutes for warm-up stabilization.
7) Adjust ***Offset*** for 2.000 volts between ***GND*** and ***TP2*** within ± 5 millivolts.
8) Adjust ***Balance*** for 0.000 volts between ***TP1*** and ***TP2*** within ± 5 millivolts.
9) Adjust ***Offset*** for 2.000 volts again between ***GND*** and ***TP2*** within ± 5 millivolts.
10) Repeat step 6) through step 9) for Section B.

Noise Output Adjustments

11) Apply CONFIG01 settings to the Scope.

CONFIG01											
CHANNEL1			**CHANNEL2**			**HORIZONTAL**			**TRIGGER**	
COUPLING	GROUND		COUPLING	GROUND		SWEEP	MAIN		TRIGGER	EDGE
BW LIMIT	ON		BW LIMIT	ON		TRIG KNOB	LEVEL		SLOPE	RISING
VOLTS/DIV	COARSE		VOLTS/DIV	COARSE					SOURCE	CH1
PROBE	10 X		PROBE	10 X					MODE	AUTO
									COUPLING	DC

12) Set VOLTS/DIV to $2.00V$ for both channels. Set CHANNEL1 position to 0.00 divisions, CHANNEL2 position to -3.00 divisions, and COUPLING on both channels to DC. Set SEC/DIV to $100\mu s$ and TRIGGER LEVEL to $2.48V$.

13) Unshort the ***Diode*** in Section A and Section B.

14) Attach the CHANNEL1 probe of the Scope to ***TP3***, the CHANNEL2 probe to ***TP4***, and both probe ground clips to ***GND***. Set both probes to X10 attenuation.

15) Adjust ***Level*** so that CHANNEL1 shows a pulse and set TRIGGER MODE to NORMAL.

16) Adjust ***Offset*** so that there are approximately the same number of signal pulses of opposite polarity between CHANNEL1 and CHANNEL2 based on the display density of the pulse “curtain”.

17) Rotate the ***Offset*** adjustment pot for a solid curtain of pulses on both channels. Slowly back off the ***Offset*** adjustment until the curtain shows a distinct, almost stepwise, change in the sparsity of pulses.

18) Set SEC/DIV to $10\mu s$ and the TRIGGER MODE to SINGLE.

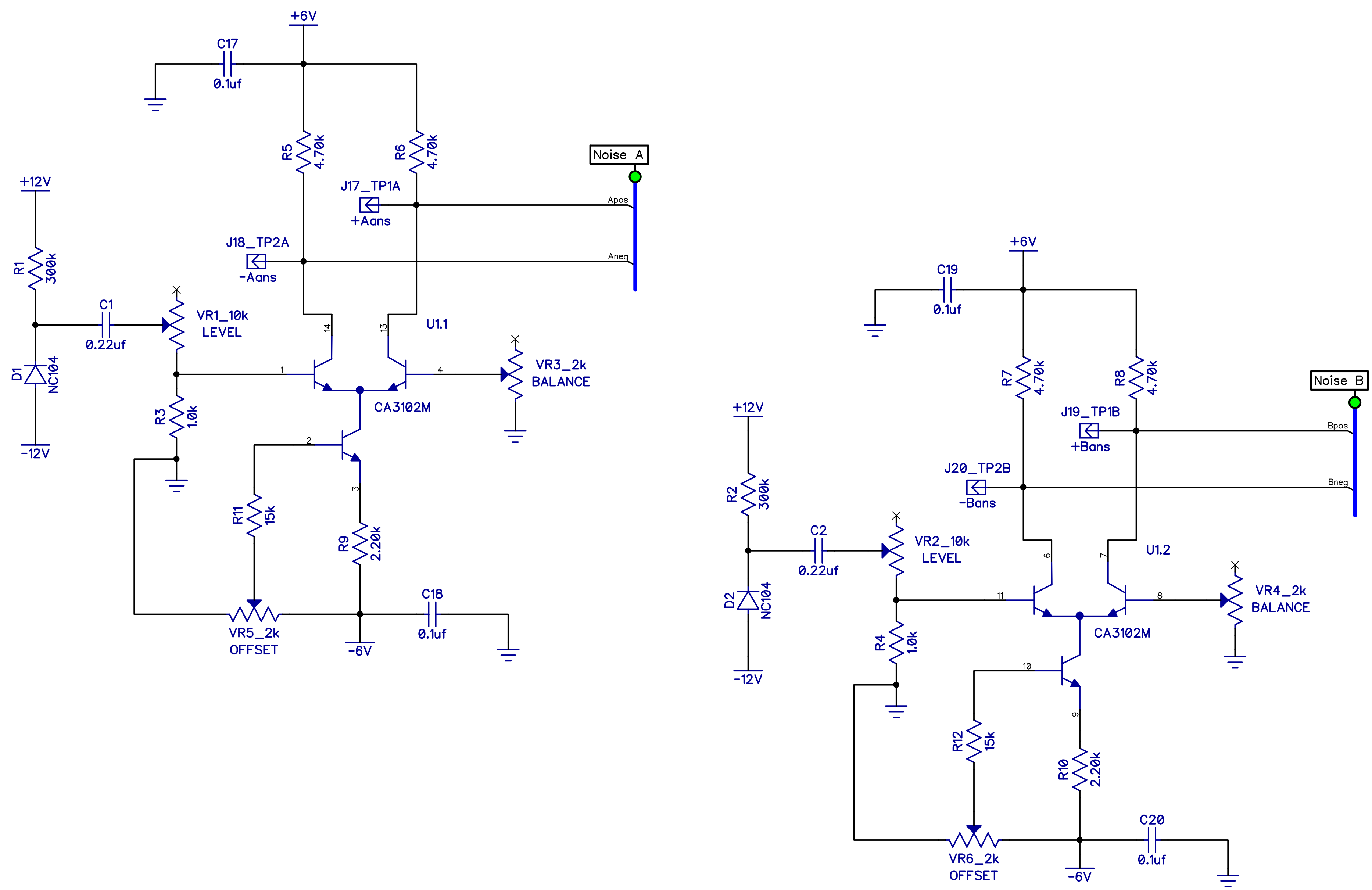
19) Repeatedly press RUN/STOP to check that there are, on average, about five pulses on each channel. In reality, the number of pulses can be as few as one and as many as ten on either channel display and will often show dissimilar pulse quantity and position between CHANNEL1 and CHANNEL1.

20) Use this SINGLE TRIGGER method to fine adjust the ***Offset*** so that there are typically an equal number of pulses on both channel displays.

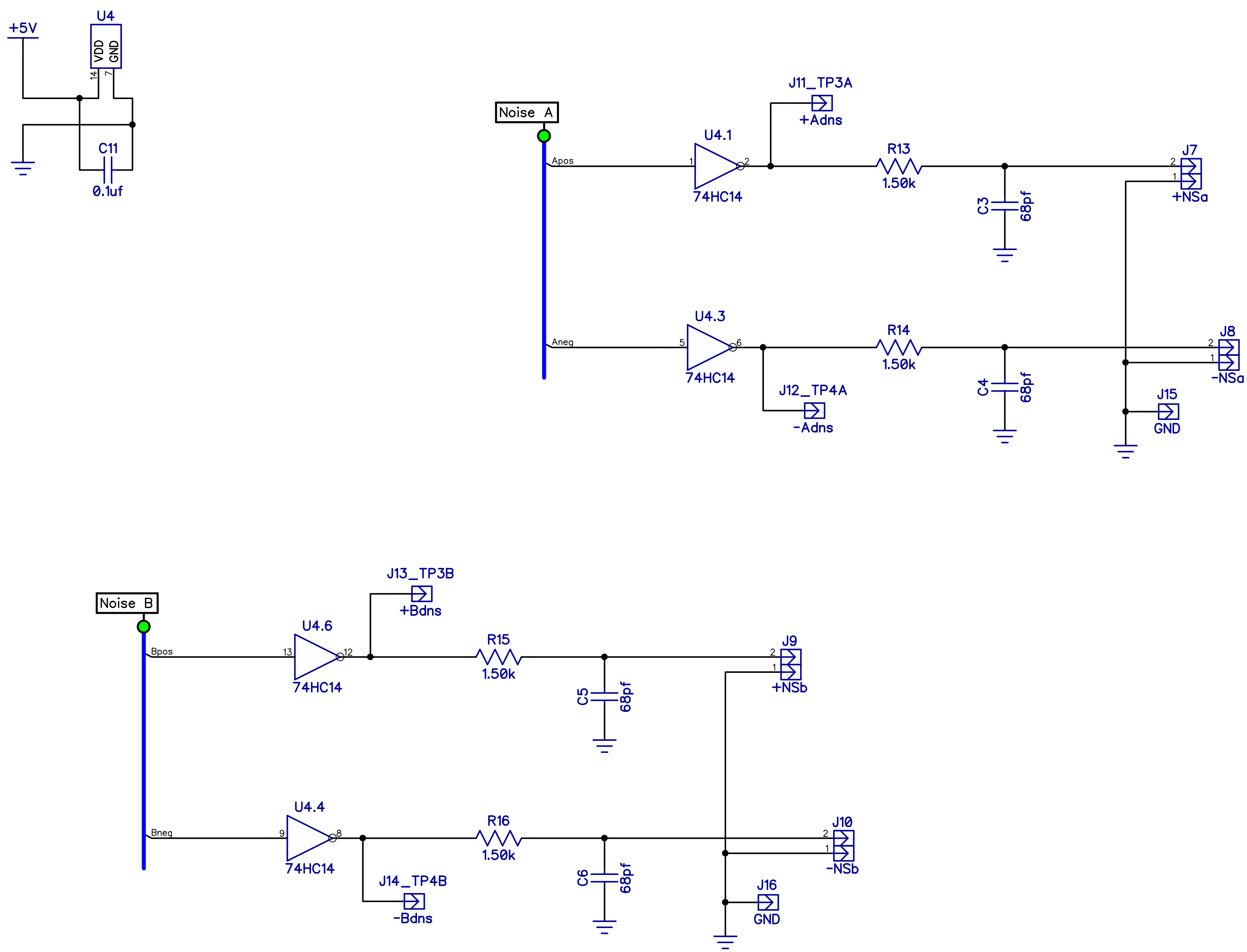
21) [Optional] As a secondary check, set MATH to CH1+CH2, SEC/DIV to $500\mu s$, and TRIGGER MODE to NORMAL. Fine adjust ***Offset*** so there are approximately an equal number of pulses above the display center line as there are below it. Set the TRIGGER MODE to SINGLE and repeatedly press RUN/STOP to verify that the number of pulses on both channels are about equal and sparse. Adjust ***Offset*** if necessary.

22) Set SEC/DIV to $100\mu s$, TRIGGER MODE to AUTO and repeat step 14) through step 21) for Section B.

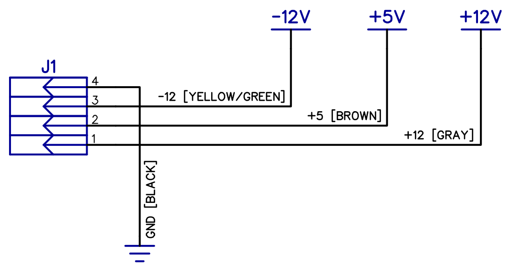
23) This concludes the NRCL Low Entropy Calibration procedure.



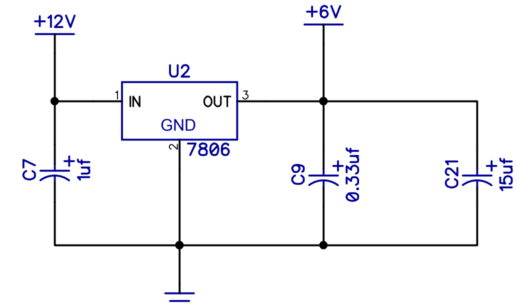
Author: C.L. Andreadis	Filename: NRCL_B1rev03.dch	Description: Integrated differential output amplifier circuit for NC104 noise diodes.
Date: 28-MAY-2009	Schematic: 1.1 Noise Amp	



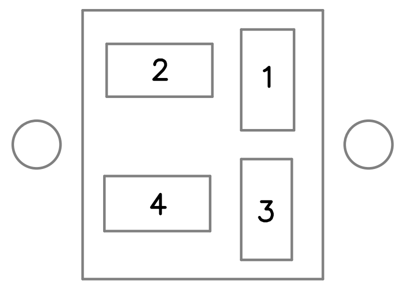
Author: C.L. Andreadis	Filename: NRCL_B1rev03.dch	Description: Schmitt Trigger digitization of amplified analog noise.
Date: 28-MAY-2009	Schematic: 1.2 Digitizers	

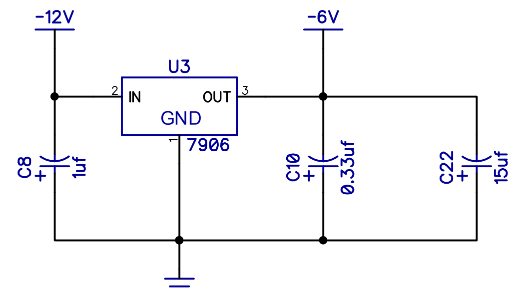


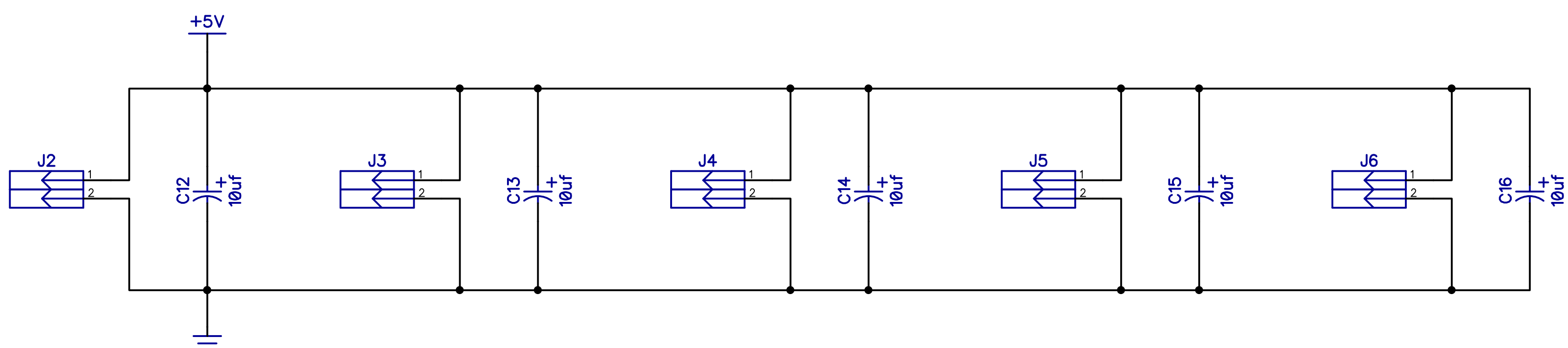
+12 Volts	< 50mA
+5 Volts	< 400mA
-12 Volts	< 50mA



Rear Panel Jones Connector, J1







Author: C.L. Andreadis	Filename: NRCL_B1rev03.dch	Description: Power circuits and distribution.
Date: 28-MAY-2009	Schematic: 1.3 Power Source	