Prognostic Systems

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 desire 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 phenomena not strictly bound by causal reality that can never be completely observed or understood, and that may in some way forge our destiny.

Section [13] states the core hypothesis of how a prognostic system, based on a network of identical 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 collectively forecast events yet to come, then we may discover that our existence is not completely founded on causal reality, but may also be influenced by processes of "cause *preceded* by effect" that propagate at the macroscopic scale. Section [2] states proposals A through E of how existence may be more than what any casual observer can discern.

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ABSTRACT:

1 The most common reasons calibration procedures are updated are, i) to improve system performance, 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 radically alters the function of the NRCL generator (section [1]) from an enhanced true random number generator (TRNG) to a network component that may have significant ramifications with respect to forecasting schemes.

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 NRCL Low Entropy Calibration objective, which is to assemble an interactive network of precisely calibrated NRCL generators that, in theory, can collectively *detect phenomena not strictly bound by causal reality* at the macroscopic scale.

[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 of time 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 NRCL information output is characterized as an *augmented* data type that is defined as a binary code bound to a 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 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 characterized as symbolic and non-symbolic (Figure 1).

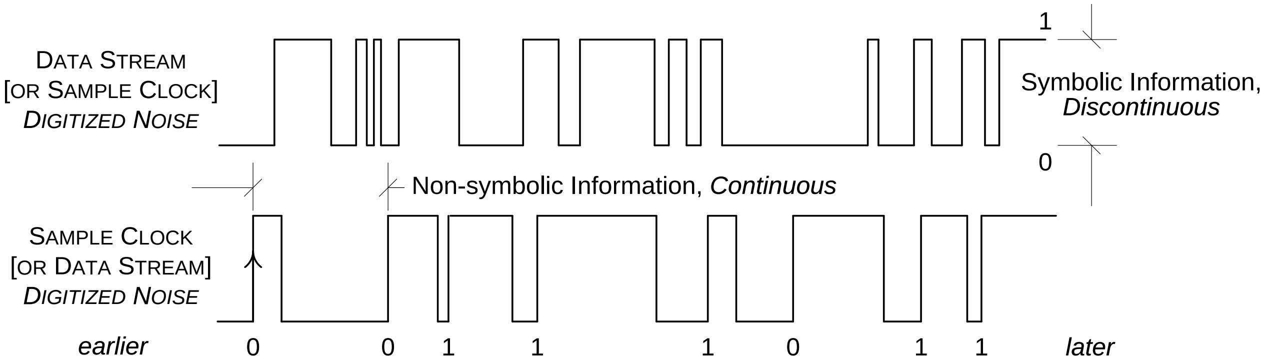

Figure 1. NRCL Entropy Function Conceptual Diagram

[2] The revised calibration procedure in the APPENDIX was initially motivated by observations of avalanche noise and its potential connection to a phenomenon called phase space[1] convergence. This is defined as two or more natural systems exhibiting 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 provide the added parameter of *code lifetime* to prognostic means and methods that, in the most literal sense, can foresee future events by how they disturb the behavior of natural systems in the present. As such, proposals A through E embody the possibility that the path of *cause and effect* may be mutable at the macroscopic level, as it is for physical processes at the microscopic level[3].

A. Is existence, as we perceive it, governed by “cause *followed* by effect” alone or, as proposed in this paper, can there be phenomena outside the conventional understanding of causal reality that affect destiny?

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[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 exotic 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 the influence of unusual or exotic processes?

D. Over the widest scope of influence, is it possible that the collective impact of exotic processes, or *exo-processes*, may result in statistically significant deviations from a progression of likely outcomes over a large number of natural systems?

E. Given that exo-processes propagate through, or even outside of, causal reality in unknown ways, can they be observed by measuring their effect on a network of identical devices precisely calibrated to detect processes of "cause *preceded* by effect"?

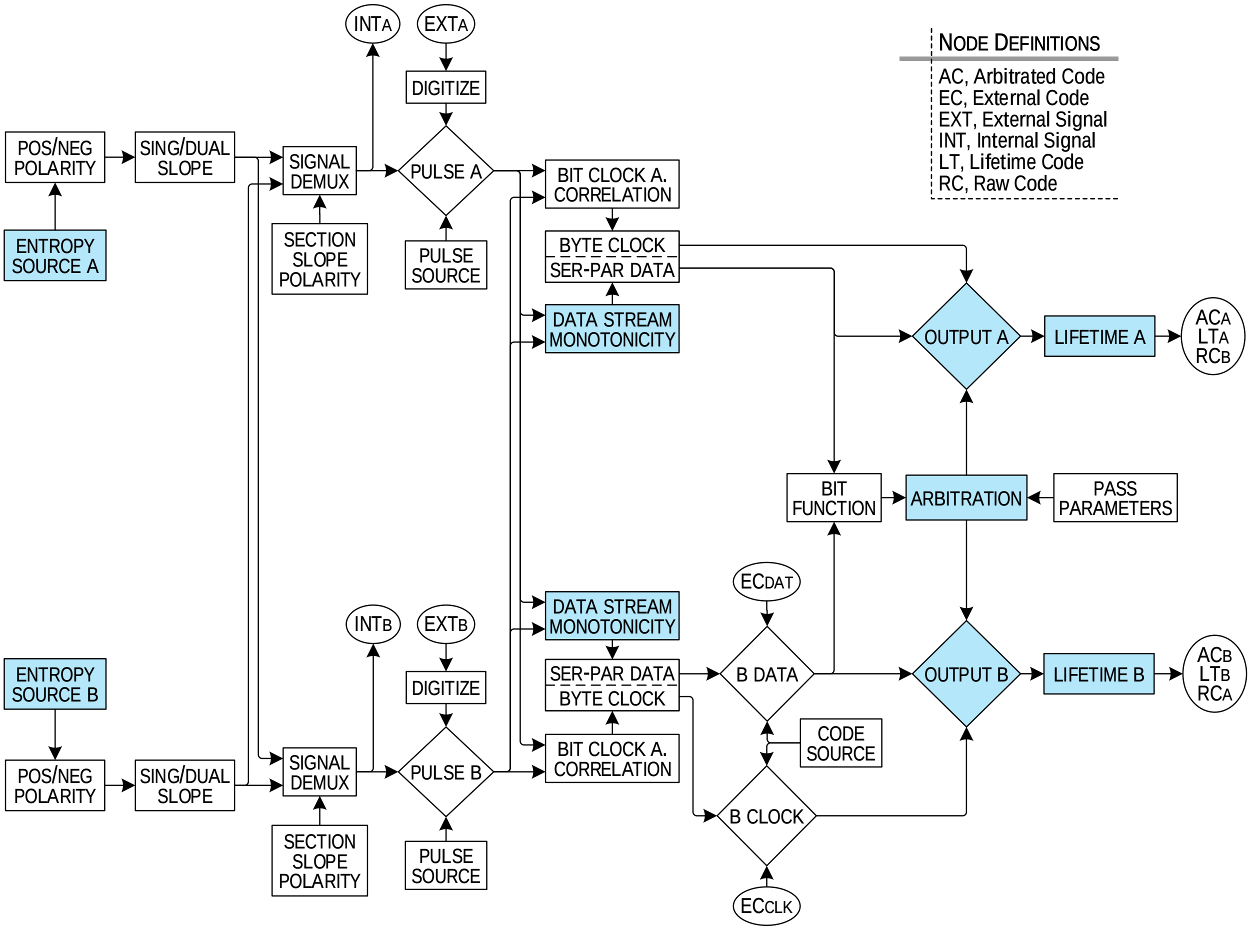

Figure 2. NRCL Block Diagram

[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

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[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

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*) formation and annihilation processes are reversible and balanced, and no damage occurs to the diode. 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 $n \times n$ planar matrix of Figure 3 and illustrates a tangible example of two different microstates for $n = 7$. However, the formation regions (F) are microstates that are comprised only of *primary avalanche triggers* and show their distribution across an abstract matrix. We define a primary avalanche trigger as 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 every subsequent cascade of sand grains is stimulated by its predecessor. 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 naturally occurring systems pushed to its limits. In this analogy, each region of the $n \times n$ 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 is in stasis, as represented by each annihilation (A) region of Figure 3.

[5] As will be explained, 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. Each formation region (F) shown in Figure 3 is only where a set of charge carrier avalanches begin. Exactly when the next set of avalanches commence, and the total number of charge carriers released in each avalanche, is unpredictable. *However, 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 $\mathcal{M}_i'$ of m_i elements such that $\mathcal{M}_i' \subset \mathcal{M}$, and subset membership to $\mathcal{M}_i'$ complies with predefined acceptance criteria. Specifically, each subset element of $\mathcal{M}_i'$ is herein defined as a pattern of "simultaneous" (section [6]) 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 intervals. 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 $C(49,3) = 18{,}424$ ways for a three-region avalanche (written $F3$) to commence in a 7×7 planar matrix and $C(49,25) \approx 63.205 \times 10^{12}$ ways for a twenty-five-region avalanche $(F25)$ to commence. As such, an $F3$ element is described as belonging to a lower entropy class than any in an $F25$ class of elements, and it is expected that low entropy elements are less likely to occur than high entropy elements. However, two or more primary avalanche triggers of a given element never

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[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

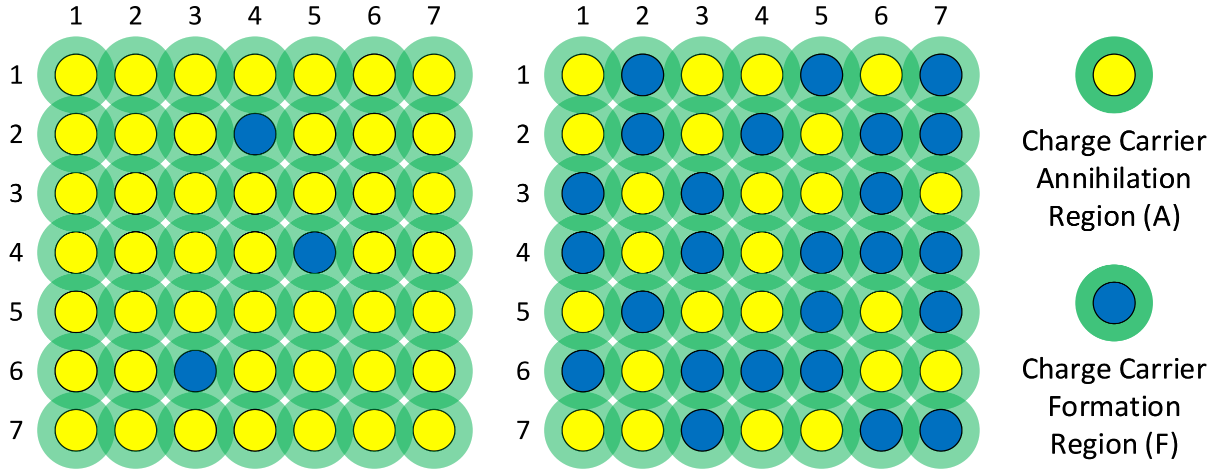
[7] The state of a substance or system at its critical point.

[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

commence at *exactly* the same time. They are only deemed synchronous, or simultaneous, if the maximum period between them, expressed $max(t_{d0})$, is smaller than the bandwidth of the measurement system that observes them. Thus, non-synchronous primary avalanche triggers that ultimately exert a cumulative effect on macrostate junction voltage are herein grouped into arbitrarily defined *propagation domains* and encompass the complexity of V_b over successive levels of NRCL integration. Propagation domains are based on the arbitration algorithm (Figure 2) as implemented over successive levels of integration in an interactive network of one or more NRCL devices.

[7] The temporal structure of propagation domains begins with interval I_{td0} comprised of a contiguous range of chronometric periods defined as $\{t_{d0} \in \mathbb{R} | 0 \leq t_{d0} \leq max(t_{d0})\}$ between tandem primary avalanche triggers that belong to a "singularly observable" element; this is a *principal* domain and though it is defined (I_{td0}), it remains unquantified by design. It is for this reason that all tandem primary trigger events of a $\mathcal{M}_i'$ subset element are considered simultaneous. Also, since each propagation domain is a level of integration above its predecessors, they can be configured around the functional requirements of any prognostic system in general. As such, following I_{td0} is the propagation domain interval I_{td1} defined as $\{t_{d1} \in \mathbb{R} | min(t_{d1}) \leq t_{d1} \leq max(t_{d1})\}$, and t_{d1} is the period between each observed element in a sequence. For example, $(t_{d1})_p$ is the period from the commencement of element Fk_p until the commencement of element Fk_{p+1} in a sequence, called the *latency* or *dwell time* of Fk_p in the sequence. Thus, the abstract planar matrix of the NC104 diode portrays all possible *simultaneous* primary avalanche triggers throughout its PN junction, and the number of N ways an Fk class of elements can initiate avalanches is expressed $N(Fk) = C(n^2, k)$. As such, when k approaches a maximum or a minimum, Fk is described as belonging to a low entropy class of elements that ultimately constitute, in part, the macrostate breakdown voltage V_b of the device. Shifting the focus to propagation phenomena, given p is the index of the first element in a sequence and $q \geq 1$ is the index offset from p, the first premise of the updated calibration procedure is,

> <u>premise 1</u> *for the <u>boundary set</u>* $\{Fk_p, Fk_{p+q}\}$ *that frames an ordered sequence by its first and last elements, the greater the absolute value difference* $|Fk_p - Fk_{p+q}|$ *then the greater the change in breakdown voltage* (ΔV_b) *for the <u>defined sequence</u> and the lower is the entropy of that sequence.*



Low Entropy Element (F3) High Entropy Element (F25)

Figure 3. Subset Elements of Primary Avalanche Triggers

[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

$V_b^{\pm}$)[9] 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, 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[10]. 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_{td2} is defined as $\{t_{d2} \in \mathbb{R} |\, \min(t_{d2}) \le t_{d2} \le \max(t_{d2})\}$ and $t_{d2} = t_s - t_{s-1}$ for the period between each 74HC14 output state change. Thus, each t_{d2} period establishes subset $\mathcal{M}_i'$ of m_i elements that propagate in a unique sequence, and is predominantly influenced by the summation of each t_{d1} period $\sum_{q=1}^{m_i}(t_{d1})_{p+q-1}$ for the sequence $\{Fk_p, Fk_{p+1}, \cdots, Fk_{p+m_i-1}\}$ that encompasses the $V_b^{\pm}$ amplitude waveform over t_{d2} (persistence). To a lesser extent, each t_{d2} period is also influenced by the value of $dV_b^{\pm}/dt$ 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 t_{d2} is the latency period or dwell time of the 74HC14 state outputs.

[9] The NRCL Low Entropy Calibration procedure requires that the gain of breakdown voltage $V_b^{\pm}$ be set so that it maximally occupies the 74HC14 hysteresis window $V_{HYS} = (V_{T+} - V_{T-})$ and is finely adjusted near $[(V_{HYS}/2) + V_{T-}]$. By this procedure, it is expected that m_i is from a set of m_i maxima for all $\mathcal{M}_i'$. As such, every state change of X reveals low entropy subset $\mathcal{M}_i'$ so described because it contains a maximized number of low entropy elements due to the size of m_i. Additionally, $\mathcal{M}_i'$ propagates in what is described as a low entropy, m_i-element sequence (premise 1) that drives $V_b^{\pm}$ to breach the active hysteresis trip points at the 74HC14 inputs. That is, the boundary set $\{Fk_p, Fk_{p+m_i-1}\}$ defines a low entropy sequence of $\mathcal{M}_i'$ because $\Delta V_b^{\pm} = |Fk_p - Fk_{p+m_i-1}|$ is from a set of $\Delta V_b^{\pm}$ maxima that delineates $\mathcal{M}_i'$ by the state changes at the 74HC14 output. As m_i increases, it becomes ever more likely that a trip point will be breached, and there are a decreasing number of sequences that would sustain maximized persistence in the formation of low entropy subset $\mathcal{M}_i'$. It is also claimed that the sequence $\{Fk_p, Fk_{p+1}, \cdots, Fk_{p+m_i-1}\}$ over a t_{d2} period is unique and only happens once. That is, the same m_i elements of subset $\mathcal{M}_i'$ have a countless number of sequence orders that would not facilitate a state change over the *exact* same t_{d2} period, leaving the occurrence of that particular subset $\mathcal{M}_i'$ as *never having happened*. In other words, we only know what is going on at the 74HC14 input when $V_b^{\pm}$ breaches an active hysteresis trip point. All other events are *untraceable* by design. Thus, the second premise of the updated calibration procedure is,

> premise 2 *a traceable sequence of m_i elements that facilitates a state change of X, based on the $\Delta V_b^{\pm}$ gain and offset adjustments in the APPENDIX, is evidence that it is comprised of low entropy subset $\mathcal{M}_i'$ and that it propagates in a low entropy, m_i-element sequence over a unique t_{d2} period.*

[10] From these premises, a suggested approach to the challenge of proposals A through E is to assemble a network of NRCL generators linked to a central database for detecting uncommon phenomena figuratively described as *trans-physical*[11] or existing outside the conventional understanding of causal reality. At a most fundamental level, avalanche noise epitomizes the incessant flux of causality and its ceaseless progression of microstates $\mathcal{M}$, to a greater or lesser extent, may be influenced by exo-processes. The calibration procedure in the APPENDIX endeavors to "tune" the digitized noise outputs to low entropy sequences of low entropy subsets $\mathcal{M}_i'$ that appear at each 74HC14 input. Notably, the

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[9] 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 the 74HC14 inputs.

[10] 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.

[11] Though the prefixes *trans-* and *meta-* mean the same thing in Latin and Greek respectively, speculation is the basis of the term *trans-physical* and mysticism is the conceptual foundation of the term *meta-physical*.

implications of this are extraordinary[12] if we consider that exo-processes may affect both the probability occurrence of a set of events and its propagation sequence. Thus, the third premise of the updated calibration procedure is,

> *premise 3* *changes in the statistical behavior of traceable low entropy subsets $\mathcal{M}_i'$ made manifest in low entropy sequences of those same subsets, as possibly influenced by exo-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 NRCL Calibration procedure of 30-December-2009, then the digitized noise bit stream does not adequately detect low entropy subsets $\mathcal{M}_\mathrm{i}'$. 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 that may be affected by exo-processes. This change in adjustment procedure requires that the original procedure be modified as described in the APPENDIX, and is subsequently titled the NRCL Low Entropy Calibration procedure. 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[13]. The question is whether exo-processes can, in fact, influence subsets of elements and their inevitable propagation in time, and if a collective array of NRCL devices tuned to such events can detect these exo-processes.

[12] As also suggested in proposal C, the influence of exo-processes may become apparent over time for any well-defined system parameter. 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 exo-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 trans-physical phenomena over time. It is emphasized that there is no proof temporal bifurcation is any better at detecting exo-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 type of forecasting.

[13] Regardless of how the entropy function is facilitated, the core hypothesis of this paper is that each device in a collective network of NRCL generators 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, with the onset of a major global event, it is suggested that an increasing number of NRCL generators would exhibit a "converging present" with respect to each other, as portrayed in the statistical profile of the augmented data type, even before the event has arrived. This is analogous to the bow wave of 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 observe such phenomena would be a hint that undiscovered, and as yet unobservable, exo-processes may be the cause of spontaneous or trend 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 truly prognostic systems of the most literal kind. Each NRCL component (node) of a prognostic network has an *identical* set of parameters in common with all the others so that evaluating how such a network is influenced by trans-physical phenomena is facilitated without onerous analysis, correlation, and normalization of dissimilar components that could distort the outcomes of such a network.

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[12] The course of earth's history, and even humanity itself, could have been quite different if exo-processes either accelerated or delayed the very first amino acids from coalescing into self-organizing, self-replicating organic molecules when and where they did.

[13] A group of functional standards that all NRCL devices in a network must comply with.

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 the mutability of *cause and effect* 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 both has happened, and will happen, depending on the direction of causality. If the process shown above is "cause *followed* by effect", as normally encountered at macroscopic scales, then the sphere has already breached the surface and is retreating (rising) into the past. Its effect on natural systems is marked by changes in the present even after the event is committed to history. However, if the process shown above is "cause *preceded* by effect", then the sphere has not breached the surface. Instead, it is approaching (falling) from the future and, as suggested in section [13], influences a set of natural systems in the present. It is claimed that the future event disturbs the path of natural systems in the present by way of temporal bow waves even before the event has arrived. However, the enigma of reverse causality makes the forecasting of an event very difficult since we are looking at the "remnants" of something that has not occurred and is yet undefined. Certainly, if such phenomena exist then they underscore the likelihood of nonlinear time as outlined in this document for the case of *cause preceded by effect* at the macroscopic scale.

[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 a greater degree of 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[14] *per se* but something described as a "Decoherence[15] cascade", a phrase derived from the bow wave concept of section [13]. Over the widest scope of influence, we describe this phenomenon as an ever-increasing set of statistically significant deviations from a progression of likely outcomes over a large 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 exo-processes discussed in this paper under a new set of parameters for some future GCP-like experiment. Most intriguing is that exo-processes may exist apart from the anticipated flow of *cause and effect* at macroscopic scales. Consistently detecting trans-physical phenomena could ultimately enhance our understanding of what truly defines our existence and that there may be more to mere coincidence than chance.

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[14] 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".

[15] *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

	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.

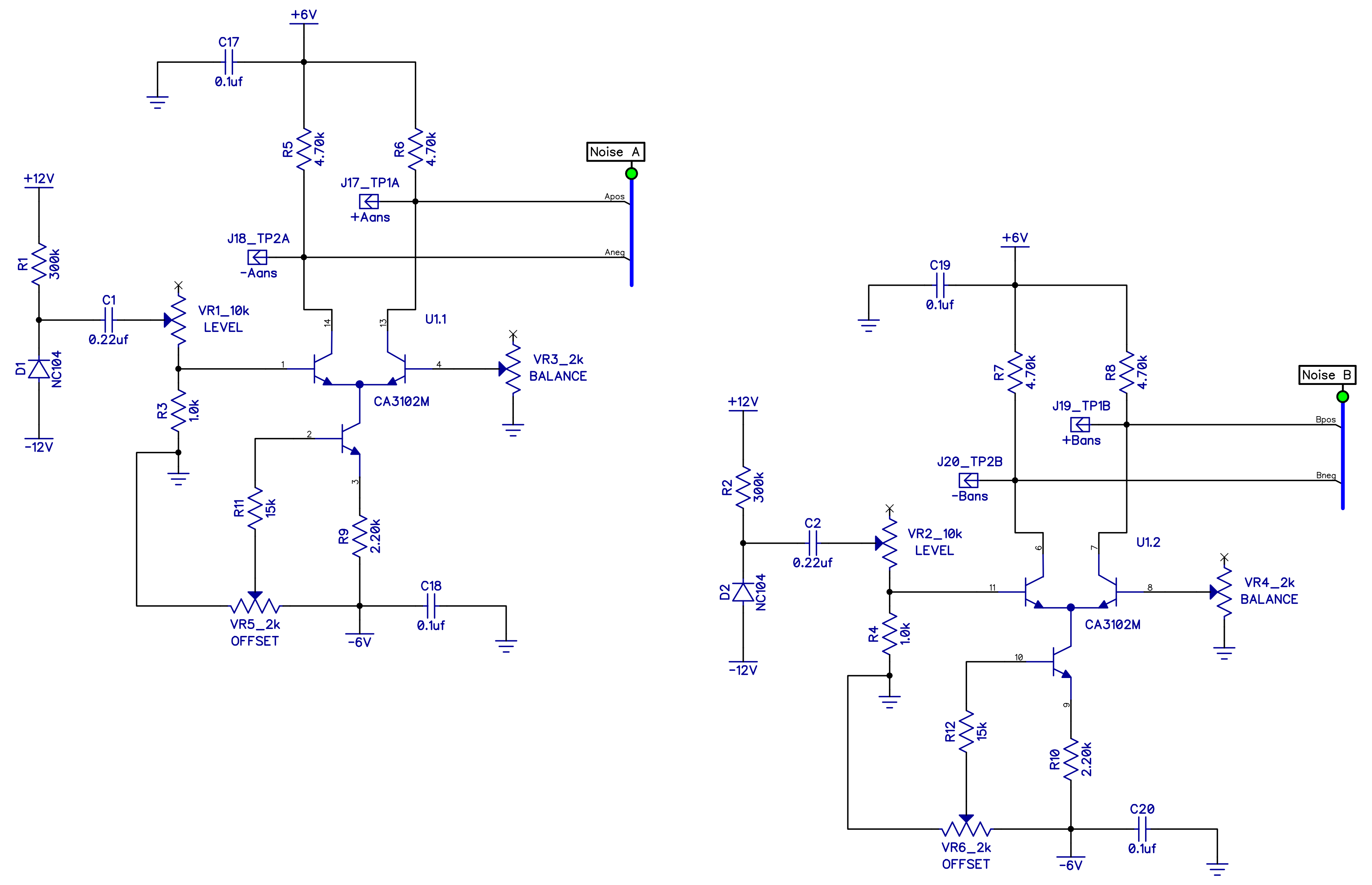
19) Repeatedly press Run/Stop to check that there are, on average, about five pulses on each channel. In reality, the number of pulses can be as few as one and as many as ten on either channel display and will often show dissimilar pulse quantity and position between Channel1 and Channel1.

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.

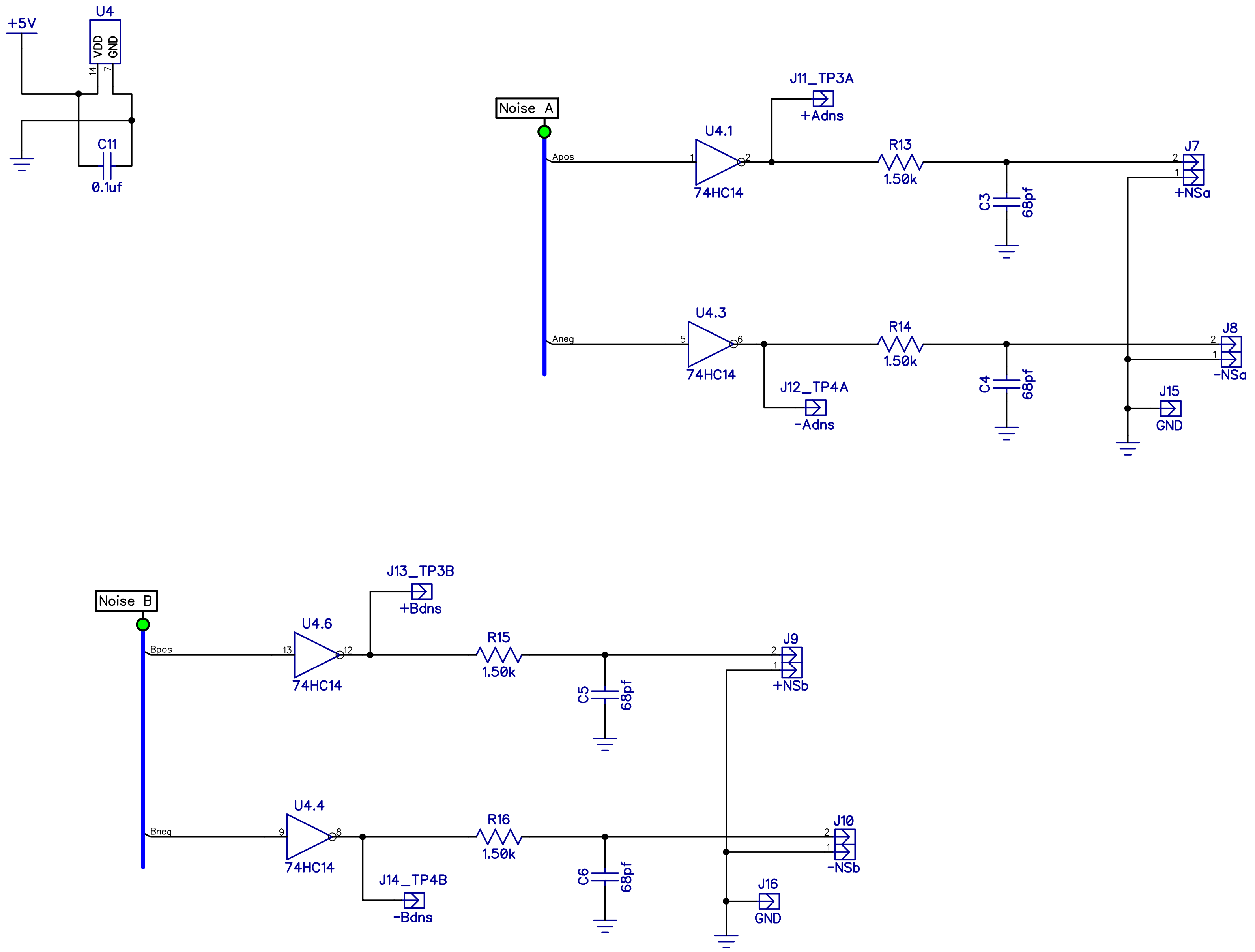
21) [Optional] As a secondary check, set Math to CH1+CH2, Sec/Div to $500\mu s$, and Trigger Mode to Normal. Fine adjust ***Offset*** so there are approximately an equal number of pulses above the display center line as there are below it. Set the Trigger Mode to Single and repeatedly press Run/Stop 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.

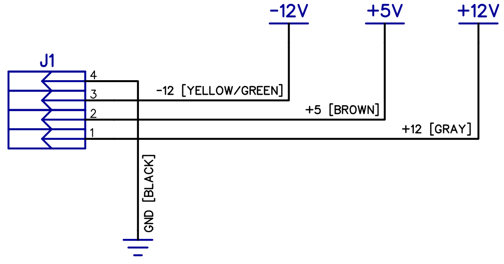
23) This concludes the NRCL Low Entropy Calibration procedure.



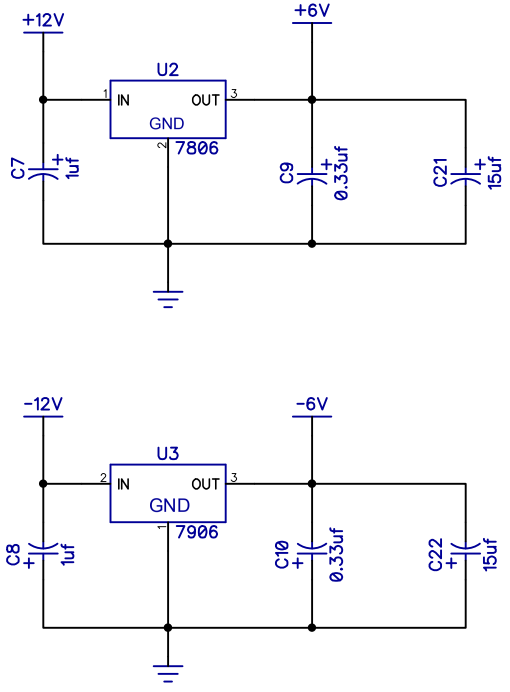
Author: C.L. Andreadis	Filename: NRCL_B1rev03.dch	Description: Integrated differential output amplifier circuit for NC104 noise diodes.
Date: 28-MAY-2009	Schematic: 1.1 Noise Amp	



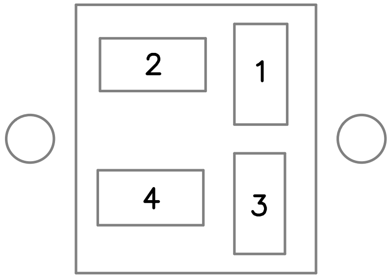
Author: C.L. Andreadis	Filename: NRCL_B1rev03.dch	Description: Schmitt Trigger digitization of amplified analog noise.
Date: 28-MAY-2009	Schematic: 1.2 Digitizers	

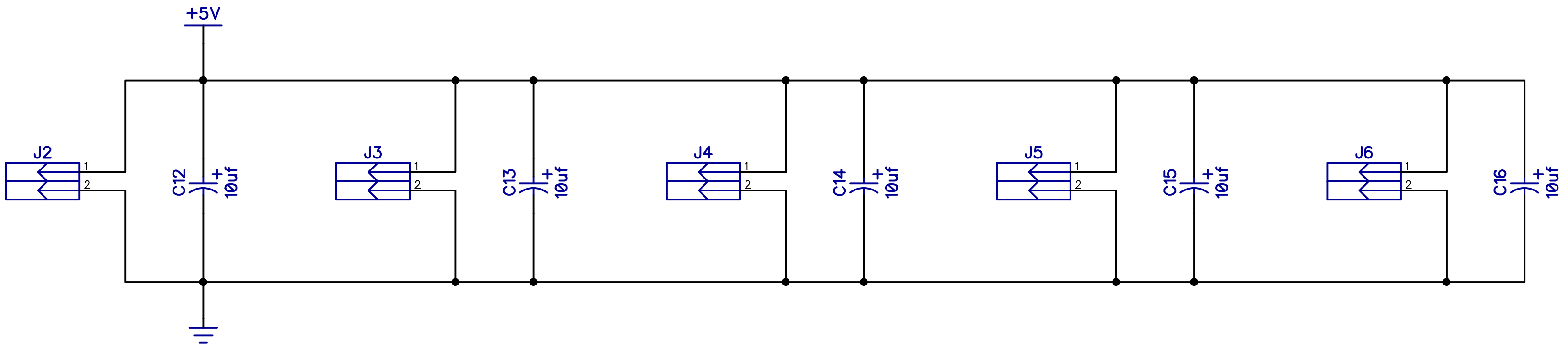


+12 Volts	< 50mA
+5 Volts	< 400mA
-12 Volts	< 50mA



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	