New Electrodynamics

Theoretical Description

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The following document is a theoretical description of the devices that are being developed by Displacement Field Technologies Inc. This includes a mathematical and physical description of the theory behind the operation of these devices along with test data from these devices.

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Contents

Preface

This document provides a summary of the theoretical background and mathematical models to support the implementation of the next generation of propulsion devices based on the interaction of relativistic electric fields and static electric fields.

All the information in this document is contained in patents filed with the US patent office. The information that is presented in this document is just only the summary of the material that was contained in these patents. This document is written to give the reader a general understanding of the principles that are used for the implementation of static electric displacement field propulsion systems. This document is not going to go into the details needed to implement this technology. ***A license from us will get you that information…***

The mathematical model used in this document is based off of Maxwell's original complex quaternion or bi-quaternion and the more advanced reader is assumed to be able to understand the resulting mathematical derivations. If the reader is not familiar with the complex quaternion, this document will be describing the meaning of the terms in the resulting equations so that an understanding of the mathematical operations isn't necessary to understand the results. It will be an advantage if the reader is not familiar the current mathematical framework used today. In this document, the mathematical framework that is used today for electrical conduction currents is going to be shown to be invalid for electrical convection currents. The assumptions that today's mathematical framework were created under will even be a hindrance to the reader if they are comfortable with the current mathematical methods that are used today to describe electromagnetic effects.

The theoretical background will be described at the level that an electrical engineer or electronic technician will be able to understand in electrical engineering terms. The in depth analysis of the data or theory is not going to be done in this document. Instead the emphasis is going to be on real world effects.

The implementation details of the described technologies are not going to be advanced in this document. The devil is in the details. The general understanding of electrical conduction currents is a major *disadvantage* to someone attempting to implement this technology. The primary method that is used to implement this technology is based on ***electrical convection currents.*** The rules that an electrical engineer would use to layout electrical circuits with conductors are *invalid* when attempting to create relativistic electric fields from electrical convection currents. The generalized assumptions that are taught to electrical engineers today about electrical currents are also not valid for electrical convection currents. The materials used today for electrical conduction currents are also a major problem and a number of techniques have to be used to minimize their negative effects that will not be in this document.

The end result is that the a PhD in science (physics) or engineering (electrical engineering) who is comfortable with the methods and concepts that are used today is going to be more successful at implementing this technology than a garage tinkerer or backyard inventor. :-J

"I can state flatly that heavier than air flying machines are impossible."

Source: Lord Kelvin.

"…We hope that Professor Langley will not put his substantial greatness as a scientist in further peril by continuing to waste his time and the money involved, in further airship experiments. Life is short, and he is capable of services to humanity incomparably greater than can be expected to result from trying to fly....For students and investigators of the Langley type there are more useful employments."

Source: New York Times, December 10, 1903, editorial page.

"The proposals as outlined in your letter...have been carefully reviewed...While the Air Corps is deeply interested in the research work being carried out by your organization...it does not, at this time, feel justified in obligating further funds for basic jet propulsion research and experimentation..."

Source: Letter (excerpts) from Brig. Gen. George H. Brett, Chief of Materiel, U.S. Army Air Corps, to Robert H. Goddard rejecting his rocket research proposals (1941):

"That is the biggest fool thing we have ever done...The bomb will never go off, and I speak as an expert in explosives."

Source: Adm. William Leahy told President Truman in 1945

"The Galvanic Chain, Mathematically Worked Out" George Simon Ohm's theory of electricity was published in 1827 and called:

"A web of naked fancies."

Source: Hart, Ivor B. Makers of Science. London, Oxford University Press, 1923.

Field Propulsion? **"Another Whacko!"**

Source: Science community 2012, 2013, 2014

Background

The current electromagnetic mathematical framework that is used today is called Maxwell's equations. The equations that make up this mathematical framework are shown below:

$$\nabla \cdot D = \rho \qquad \text{Gauss's law for electricity}$$
$$\nabla \cdot B = 0 \qquad \text{Gauss' law for magnetism}$$
$$\nabla \times E = -\frac{\partial B}{\partial t} \qquad \text{Faraday's law of induction}$$
$$\nabla \times H = J + \frac{\partial D}{\partial t} \quad \text{Ampere's law}$$

These equations are the reformulated equations from James Maxwell's original formulation of 20 equations. Even though these equations are called Maxwell's equations these equations are really the result of the work that Oliver Heaviside did to simplify the mathematical description that James Maxwell used to unify electric and magnetic fields. This particular mathematical framework is based on vector calculus that was considered the easiest for engineers to work with. James Maxwell, Peter Tait, and Sir William Hamilton all had advocated the use of complex quaternions to describe electrodynamics, but they could never support the reasons as to why. So the use of complex quaternions to described electrodynamics was never accepted by the scientific or engineering community.

The general form of these equations had been empirically derived from experiments using electrical conduction currents by the late 1800's. Originally electricity and magnetism were thought of as two separate forces. This view changed when James Maxwell was able to unify these fields through the use of a mathematical construct based on the complex quaternion. James Maxwell unified the magnetic field and electric field by deriving a set of root equations that could be reformulated to create the empirically derived equations. These root equations were based off of potentials and are shown below.

$$\vec{E} = -\frac{\partial \vec{A}}{\partial t} - \vec{\nabla}\Phi \quad \text{Volt/meter} \tag{1}$$
$$\vec{B} = \vec{\nabla} \times \vec{A} \qquad \text{Tesla} \tag{2}$$

These equations were the key to unifying the magnetic field and electric field and proving that light was electromagnetic radiation. But these equations were based on potentials. Potentials were considered to be just mathematical constructs and not physical. It wasn't until the 1980's that the Aharonov-Bohm effect had proven the physicality (the reality) of these electromagnetic potentials. The other problem was the 3rd equation that James Maxwell's approach produced. This equation (3) is called the magnetic scalar equation.

$$S = \frac{1}{c^2}\frac{\partial \Phi}{\partial t} + \vec{\nabla} \cdot \vec{A} \quad \text{Tesla} \tag{3}$$

The first problem with equation (3) was that this magnetic scalar equation was also a potential. Another was that it was a scalar located at a point in space with the units of Tesla so it wasn't measurable in this form. Another was that no one was seeing the effects of this equation in experiments using conductors. And this equation was complicating the solving of the other 2 equations. Plus, it was just too easy to rationalize the terms in this equation to be 0 even though no one had experimentally proven that these terms were actually "0". This was done with the application of gauge fixing (or by choosing a gauge) so that this equation could be made to go away. This operation ended up creating the Coulomb gauge and Lorentz gauge.

Before 1905 the physical mechanism behind the magnetic forces that wires experience when conducting electric currents was not completely explained. The source of these magnetic forces was assumed to be the magnetic field. This left a gap in the understanding of the underlying forces that electrical conduction currents experienced. Ultimately this left us with an incomplete understanding of electrodynamic forces that are still with us today. This gap in the understanding of the underlying sources for these forces was the main reason that James Maxwell, Peter Tait, and Sir William Hamilton could not get the scientific and engineering community to use complex-quaternions to describe electrodynamics.

When in 1905 Einstein's paper on relativity was published, it explained the physical mechanism behind the forces that wires see when conducting electric currents. Einstein's paper made it clear that charges in different inertial frames of reference will appear to have an apparent charge density increase due to the effects of Lorentz contraction. The effect of the apparent Lorentz contraction of the moving mobile electrons and fixed protons, when they are viewed from the others inertial frame of reference, is now accepted as the source of these magnetic forces. This allows a conductor with an electrical conduction current flowing in it to be charged in one inertial frame of reference and neutral in another.

The perception that science had before 1905 was that a magnetic field is created from any moving charge was not correct anymore. ***Only materials/objects that have charges in different inertial frames of references will produce a magnetic force that can be mathematically described by a magnetic field.*** Yet this is one of incorrect generalizations about electric currents that science had before 1905 that is still being taught today as correct. Examples of materials that can have moving charges in different inertial frames of references and generate a magnetic field include conductors, semiconductors, magnets, and neutral plasmas. Examples of moving charges that have all their charges in the same inertial frames of references as such **can't generate a magnetic field** or magnetic force are beams of electrons, protons, ions or moving charged objects (including rotating charged disks). These examples of moving charges are still affected by magnetic fields from electric currents in conductors, magnets,.. even though they **don't generate** a magnetic field.

The following figure 1 is a representation of a copper conductor with no electric current flowing through it. “X” is the average apparent distance between the positive ions and “Y” is the average apparent distance between negative electrons. In this case X is equal to Y so that the conductor is electrically neutral in all inertial frames of references.

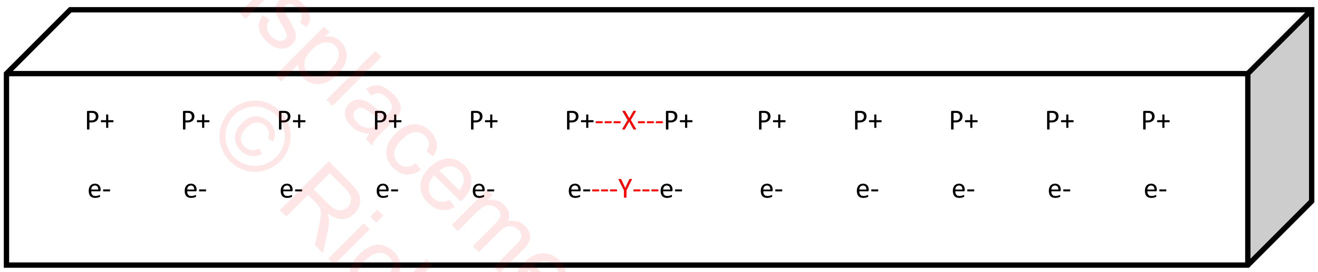


Figure 1

Figure 2 is a representation of two copper conductors in the stationary frame of reference with a negative electric current flowing through it to the right. “X” is the average apparent distance between the positive ions and “Y” is the average apparent distance between the negative electrons when viewed from the stationary frame of reference. In this case X is greater than Y so that the conductor is not electrically neutral in all inertial frames of references. This is the result of the effect of Lorentz contraction of the negative charges due to the relative average motion of the negative electrons compared to the positive ions.

In the stationary frame of reference, the positive ions in both conductors now see an increase in the negative charge in the other conductor. This is from the apparent increase in the density of the negative electrons from their apparent Lorentz contraction. This effect is also seen in the moving frame of reference from the electrons perspective. From the perspective of the electrons, the positive ions appear to be moving to the left and are seen to have an apparent increase in the density of their positive charge from their apparent Lorentz contraction.

This results in a magnetic force between the wires that has been attributed to a magnetic field. In reality the attractive force is the interaction between the static electric field from the charges and the relativistic electric fields seen by the charges in two different inertial frames of reference **in the same physical object**. This results in a pseudo field (the magnetic field) or secondary field whose primary field is modified by the characteristics of a material (the copper conductor) to produce a subset of the effects of the primary field. This makes the production of the magnetic field and the force from it dependent on the characteristics of a material (the copper conductor). The primary fields that produce the forces between conductors flowing conduction currents are interaction of the static electric field and the modification to the static electric field due to the relative motion of the charges. This primary electric field now has a relativistic component and a static electric field component. This combined electric field is now going to be defined as a ***complex electric field*** in this document.

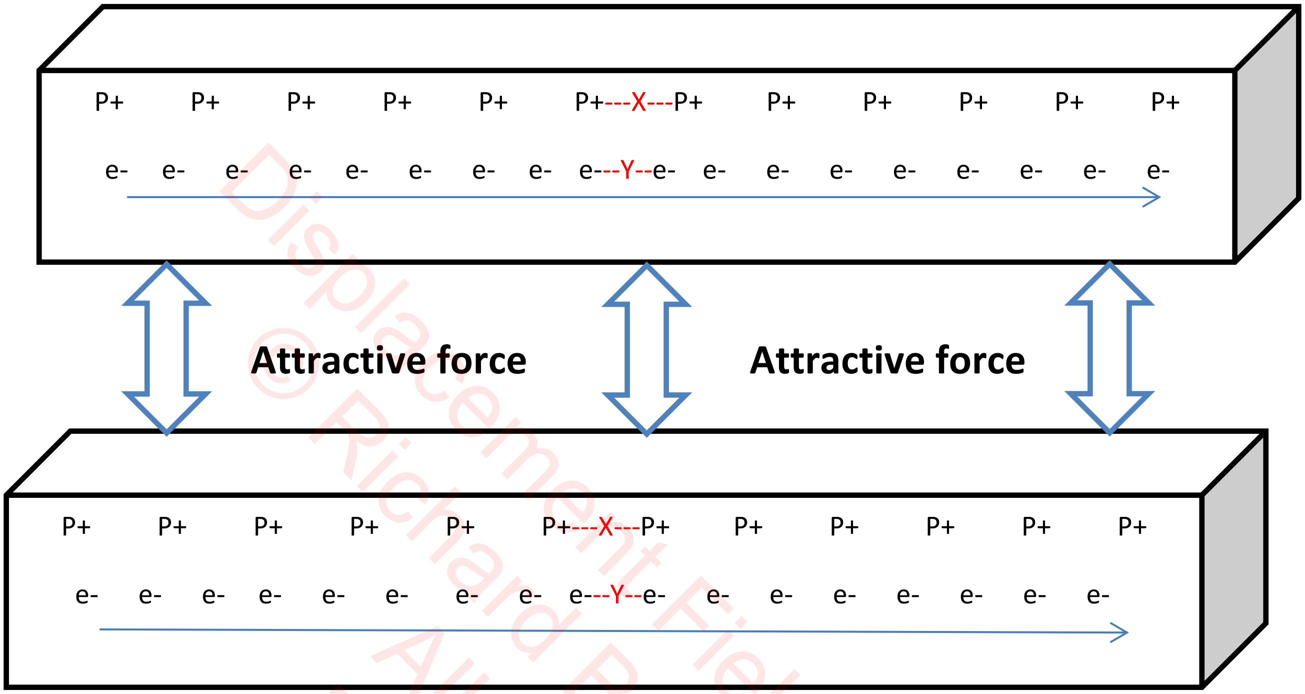


Figure 2

Figure 3 is a representation of two electron beams in the stationary frame of reference that represent a negative electric ***convection current*** flowing to the right. "Y" is the average apparent distance between negative electrons in the stationary frame of reference. In the stationary frame of reference the two electron beams have an electric field that is slightly greater than the electric field that they would have if they were stationary (when viewed perpendicular to their direction of motion in the stationary frame of reference). But there is no attractive force between these beams from a "magnetic field" as they would see if the charges were moving in a conductor.

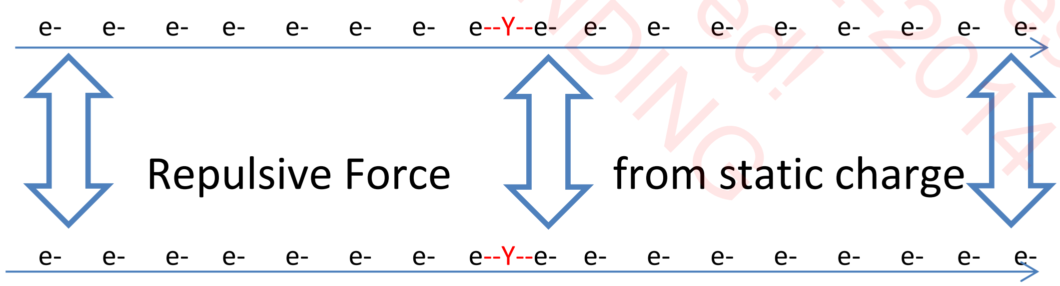


Figure 3

Figure 4 is the view of the electrons in the electron beams inertial frame of reference from Figure 3. In the electrons inertial frame of reference they are unaware that they are moving so the electron beams see only their static electric fields. This is due to the fact that there is no apparent contraction of the distance between the individual electrons when the two electron beams are in the same inertial frame of reference. Again the two electron beams now see only an electrostatic repulsive force from the negative charges. They see no attractive force from there "magnetic field" as they would see if charges were moving in a conductor.

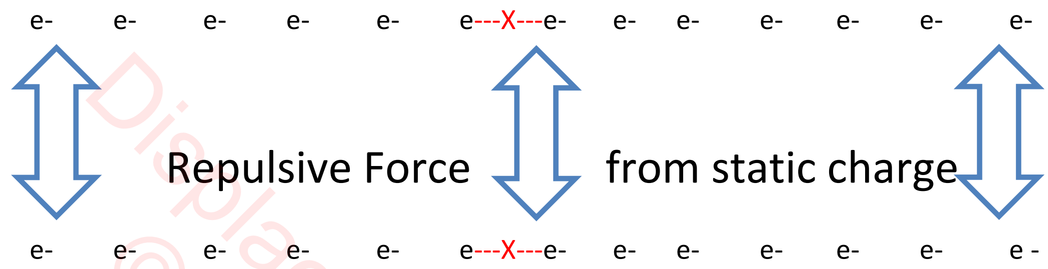


Figure 4

Figure 5 is a representation of two electron beams in the stationary frame of reference that represent a negative electric current flowing to the right and a negative current flowing to the left. "Y" is the average apparent distance between the negative electrons in the stationary frame of reference. "Y" is the same for both beams since the velocity of these electrons in these beams is equal but in opposite directions when viewed from the stationary frame of reference. In the stationary frame of reference the two electron beams have an electric field that is slightly greater than the electric field that they would have if they were stationary. This is the result of the apparent increase in the electron density from the Lorentz contracted distance between the electrons. Again there are no magnetic fields being generated from these two electric ***convection currents***. Just a new ***complex electric field*** is seen.

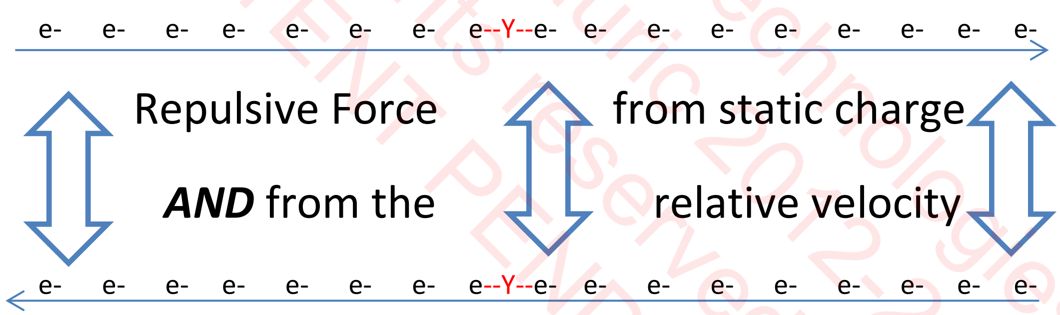


Figure 5

Figure 6 is a representation of the of two electron beams from the inertial frame of reference of the top electron beam. "X" is the average apparent distance between negative electrons in the top beams frame of reference which is now greater than "Z" the apparent distance between the electrons in the bottom beam. This is due to the fact that there is no contraction of the distance between the individual electrons in top electron beam when viewed from its own inertial frame of reference. But the bottom electron beam now has a velocity that is 2 times the velocity that is seen in the stationary frame of reference. This results in the apparent Lorentz contracted distance between the electrons in the lower beam to be twice as much as in the stationary frame of reference. This increases the relativistic electric field component that is seen by the top electron beam by a factor of two from the increase that is seen in the stationary frame of reference. Thus the increase in the force from the interaction of the top electron beams static electric field and the relativistic electric field component from the bottom electron beam is greater by a factor of two.

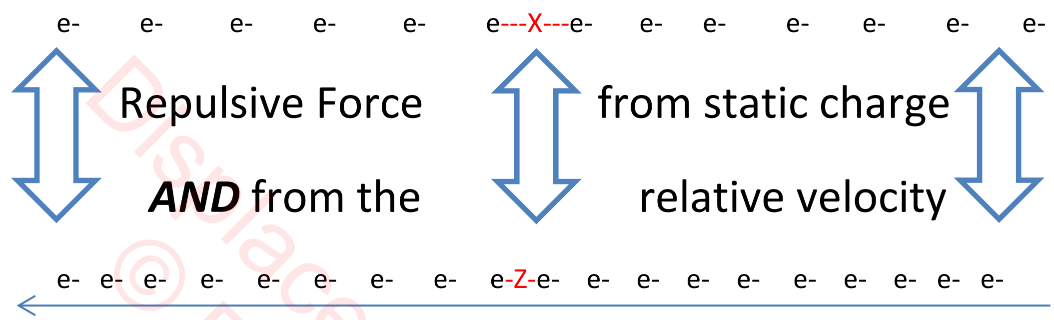


Figure 6

This example can be reversed where we use the bottom electrons beam frame of reference and we see that both the top electron beam and the bottom electron beam see a greater repulsive force from the other beams Lorentz contracted electric field with their own static electric field. The force that they see is twice as much from the relativistic electric field component of the complex electric field that would be seen in the stationary frame of reference.

These are examples where the generalization that any moving electric charge has an electric field and a magnetic field when viewed from a different inertial frame of reference is wrong. Instead a ***complex electric field*** is seen from a different inertial frame of reference that is composed of the static electric field and the added component from the Lorentz contraction from its motion. This doesn't preclude the moving charges from being bent from a magnetic field generated from another conductor conducting an electric current or another magnetic material.

The electron beams in the preceding example can be replaced by two moving charged objects. With charged non-conducting objects only the excess charge on each charged object has to be considered. A neutral or uncharged object that has their charges physically connected will be uncharged in all inertial frames of reference. But the excess charge that a charged object has will have a total electric field that will be different when viewed from different inertial frames of reference.

When considering the charges on charged conducting and non-conducting objects the different objects will have different charge distributions. In conductors the positive charges are fixed but the excess mobile negative charges will accumulate at the outside surface of the conductor. The excess charge on a conductor that has mobile negative charges has different characteristics than an insulator with the same amount of charge. Plus a conductor has a requirement that the electric field has to be near 0 inside the conductor and the mobile charges will redistribute themselves to keep the electric field near 0 in the conductor. An insulator has no mobile charges to redistribute and no requirement that the electric field be near 0 inside an insulator.

Current Derivation

The current mathematical model for electromagnetics is based off the following equations that are today called Maxwell's equations.

$\nabla \cdot D = \rho$	Gauss's law for electricity
$\nabla \cdot B = 0$	Gauss's law for magnetism
$\nabla \times E = -\partial B/\partial t$	Faraday's law of induction
$\nabla \times H = J + \partial D/\partial t$	Ampere's law

Maxwell's equations that describe electromagnetic fields are based on vector calculus and have terms for a magnetic field. These equations have terms to describe a magnetic field and thus are optimized to describe the effects from conductors when an electric current is flowing through them. These equations are not going to be valid to describe the complex electric fields from ***electrical convection currents*** (moving charged objects).

The original mathematical framework promoted by James Clerk Maxwell, Peter Tait, and Sir William Hamilton for electrodynamics was based on the bi-quaternion mathematical framework, or in its modern form known as a geometric algebra or as the even sub algebra of Clifford Algebra of Rank 0, 3. Maxwell's equations were originally derived by Oliver Heaviside from Maxwell's original bi-quaternion mathematical framework for electrodynamics. This paper is not going into the nuts and bolts of the original derivation or on operations that are done in Clifford Algebras. I will describe the terms in the following equations and what they mean but if someone needs to analyze these derivations in detail then get a book on complex quaternions and do the derivations yourself.

The mathematical representation of the quaternion and bi-quaternion that I will be using is shown below. This is the simplest format for the derivation of Maxwell's original potential equations that I have found so far and is described in detail in the following link:

http://www.andre-waser.ch/Publications/GeneralisationOfClassicalElectrodynamics.pdf

Definitions of Symbols and Operators

Quaternion : $X = x_0 + ix_1 + jx_2 + kx_3$ or $X = x_0 + \vec{i} \cdot \vec{x}$

Bi-Quaternion: $X = x_0 + \mathrm{i}y_0 + \vec{i} \cdot \left(\vec{x} + \mathrm{i}\vec{y}\right)$

Nabla : $\nabla = \left(\frac{i}{c}\frac{\partial}{\partial t} + \vec{i} \cdot \vec{\nabla}\right) \qquad \vec{\nabla} = \left(\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2}, \frac{\partial}{\partial x_3}\right)$

The following derivation is the modern derivation of the electric field and magnetic field equations from Maxwell's original bi-quaternion electromagnetic potential. The units used for the modern derivation is the units of the magnetic vector potential of a Weber/meter.

Quaternion Electromagnetic Potential Equation

$$A=\frac{i}{c}\Phi+\vec{i}\cdot\vec{A} \quad \text{Weber/meter} \qquad \text{Note: } x_0 = 0, \mathrm{i}\vec{y} = 0$$

$$\nabla A=\left(\frac{i}{c}\frac{\partial}{\partial t}+\vec{i}\cdot\vec{\nabla}\right)\left(\frac{i}{c}\Phi+\vec{i}\cdot\vec{A}\right) \quad \text{Tesla}$$

$$\nabla A=\left(\frac{1}{c^2}\frac{\partial\Phi}{\partial t}+\vec{\nabla}\cdot\vec{A}\right)+\vec{i}\cdot\left[\vec{\nabla}\times\vec{A}+\frac{i}{c}\left(\frac{\partial\vec{A}}{\partial t}+\vec{\nabla}\Phi\right)\right] \quad \text{Tesla}$$

Resulting Equations

$$\vec{E} = -\frac{\partial\vec{A}}{\partial t} - \vec{\nabla}\Phi \quad \text{Volt/meter} \qquad \text{Note: } \frac{i}{c}\left(\vec{E}\right) \text{ Tesla} \qquad (4)$$

$$\vec{B} = \vec{\nabla}\times\vec{A} \quad \text{Tesla} \qquad (5)$$

$$S = \frac{1}{c^2}\frac{\partial\Phi}{\partial t}+\vec{\nabla}\cdot\vec{A} \quad \text{Tesla} \qquad (6)$$

The resulting equations are reformulated to derive the vector calculus based Maxwell's equations. Equations (4) and (5) describe the electric and magnetic fields from current carrying conductors. Equation (6) shown above is referred to as the magnetic scalar equation. The effects of the third equation are not observed for conduction currents.

Equation (6) was a major problem for this derivation. At the time James Maxwell produced this derivation Albert Einstein's theory of relativity had not yet been formalized and the concepts of time dilation and the Lorentz contraction was still being developed. Equation (6) is the source of the famous "extra terms" in Maxwell's original derivations.

The reasons that the magnetic scalar isn't seen in everyday conduction currents are due to the characteristics of conductors and the units used in this derivation. The speed of the mobile electrons in a copper conductor is in the range of 1 cm/second so the effects from the magnetic scalar are going to be very small for currents used today. The second reason that the effects from equation (6) aren't being seen is the units for this potential are incorrect, as such it can't be measured with a magnetic field meter.

The effects of this scalar are seen as a longitudinal force in wires when conductors have large currents moving through them. This effect was confirmed in "THE EUROPEAN PHYSICAL JOURNAL D" in the article "An experimental confirmation of longitudinal electrodynamic forces by N. Graneau, T. Phipps Jr, and D. Roscoe". This is effect has also been seen in dense plasmas as an unknown longitudinal force.

But the scientific and engineering community has been readily able to ***rationalize*** equation (6) away without any experimental proof that it really was just "extra terms". Oliver Heaviside and Lorentz were able to remove equation (6) through "symmetrical re-gauging" under the assumption that it wasn't a factor in conduction currents, not that the physical effects from this equation were really "0". This gave us the Coulomb and the Lorentz gauges.

The Lorentz gauge is derived by setting the magnetic scalar equation (6) = 0 since it wasn't seen in conduction currents.

$$0 = S$$
$$0 = \frac{1}{c^2}\frac{\partial \Phi}{\partial t} + \vec{\nabla} \cdot \vec{A} \quad \text{Tesla}$$

Lorentz Gauge

$$\vec{\nabla} \cdot \vec{A} = -\frac{1}{c^2}\frac{\partial \Phi}{\partial t}$$

The Coulomb gauge is used in electrostatics so the term $\frac{1}{c^2}\frac{\partial \Phi}{\partial t}$ is going to be 0 for electrostatic charges by the definition of "electrostatic".

Coulomb Gauge

$$0 = \frac{1}{c^2}\frac{\partial \Phi}{\partial t}$$
$$0 = 0 + \vec{\nabla} \cdot \vec{A}$$
$$0 = \vec{\nabla} \cdot \vec{A}$$

The Coulomb Gauge and the Lorentz Gauge are 2 special cases of velocity gauges. The form of the velocity gauge is shown below:

Velocity Gauge

$$\vec{\nabla} \cdot \vec{A} = \frac{1}{u^2}\frac{\partial V}{\partial t}$$

V is the scalar potential

A is the vector potential

u is the velocity gauge which is either c (speed of light) or u $\to \infty$

The Lorentz gauge sets the propagation speed of the **vector potential** at the ***speed of light*** and the Coulomb gauge sets the speed of propagation of the **scalar potential** at ***infinite speed***. Translating these gauges into the real world effects, these gauges are implying that the magnetic field, electromagnetic radiation, and the electric field propagate at the speed of light and the speed of the scalar potential approaches infinite velocity. It is beyond the scope of this paper to derive the speed of the scalar potential and its consequences. The paper "The Unification of the Lorentz and Coulomb Gauges of Electromagnetic Theory" by David M. Drury is the place to do further research if the reader still has questions.

New Electrodynamics Derivation

To arrive at the correct mathematical framework for **electrical convection currents** like electron beams or moving charged objects these equations are re-derived from Maxwell's original bi-quaternion electromagnetic potential to eliminate the terms for a magnetic field. As such, Maxwell's original bi-quaternion electromagnetic potential is converted to the electrodynamic potential having units of Volts instead of a Weber/meter. To change the units, the following derivation is used, multiplying the magnetic vector potential by c (speed of light) to convert to Volts.

Quaternion Electromagnetic Potential

$$A = \frac{i}{c}\Phi + \vec{i}\cdot\vec{A} \qquad \text{Weber/meter}$$

$$cA = \frac{ci}{c}\Phi + \vec{i}\cdot c\vec{A} \quad \text{Volts}$$

$$cA = \Phi$$

$$\Phi = i\Phi + \vec{i}\cdot c\vec{A} \qquad \text{Volts}$$

Then to get all the terms of the equation in the same form we have to convert $c\vec{A}$ into Φ.

Conversion of $c\vec{A}$ to Φ

$$A = \frac{\mu_o Q\vec{V}}{4\pi R} \quad \text{Weber/meter}$$

$$c = \frac{1}{\sqrt{\mu_o \varepsilon_o}} \quad \text{Meter/second} \qquad\qquad \text{Note } \mu_o = \frac{1}{\varepsilon_o c^2}$$

$$cA = \frac{c\mu_o Q\vec{V}}{4\pi R}\ \frac{\text{Weber meter}}{\text{second meter}} \quad \text{or Volts}$$

$$cA = \frac{cQ\vec{V}}{\varepsilon_o c^2\, 4\pi R} \quad \text{Volts}$$

$$cA = \frac{\vec{V}}{c}\ \frac{Q}{4\pi\varepsilon_o R} \quad \text{Volts}$$

$$\Phi = \frac{Q}{4\pi\varepsilon_o R} \qquad \text{Volts}$$

$$cA = \frac{\vec{V}}{c}\ \Phi \qquad \text{Volts}$$

This gives us a complex quaternion equation (Quaternion Electrodynamic Potential) that has all of its terms based off the same constant (ε_o).

Quaternion Electrodynamic Potential for a moving charged object

$$\Phi = i\,\Phi + \vec{i}\cdot\frac{\vec{V}}{c}\,\Phi \text{ Volts}$$

Now we can derive the correct field equations for a moving charged object.

Definitions of Symbols and Operators

Quaternion : $X = x_0 + ix_1 + jx_2 + kx_3$ or $X = x_0 + \vec{i}\cdot\vec{x}$

Bi-Quaternion: $X = x_0 + \mathrm{i}y_0 + \vec{i}\cdot\left(\vec{x} + \mathrm{i}\vec{y}\right)$

Nabla : $\nabla = (\frac{i}{c}\frac{\partial}{\partial t} + \vec{i}\cdot\vec{\nabla})$ $\quad \vec{\nabla} = \left(\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2}, \frac{\partial}{\partial x_3}\right)$

Quaternion Electrodynamic Potential for a moving charged object

$$\Phi = i\,\Phi + \vec{i}\cdot\frac{\vec{V}}{c}\,\Phi \text{ Volts}$$

$$\nabla\Phi = (\frac{i}{c}\frac{\partial}{\partial t} + \vec{i}\cdot\vec{\nabla})(i\Phi + \vec{i}\,\frac{\vec{V}}{c}\,\Phi) \text{ Volts/Meter}$$

$$\nabla\Phi = -(\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi) + \vec{i}\cdot[\,\vec{\nabla}\times\frac{\vec{V}}{c}\,\Phi + i\,(\frac{\partial\vec{V}}{\partial t}\frac{\Phi}{c^2} + \nabla\Phi)] \text{ Volts/Meter}$$

Electric Field Equation

$$\vec{E} = -\frac{\partial\vec{V}}{\partial t}\frac{\Phi}{c^2} - \vec{\nabla}\times\frac{\vec{V}}{c}\Phi - \vec{\nabla}\Phi \text{ Volts/Meter} \qquad (7)$$

Scalar Electric Potential Equation

$$S = \frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla}\cdot\frac{\vec{V}}{c}\,\Phi \text{ Volts/Meter} \qquad (8)$$

Potential to Charge relation

$$\Phi = \frac{\text{Charge}}{\text{Capacitance}} \text{ Volts}$$

Equation (7) or the electric field equation now has an extra term $\vec{\nabla}\times\frac{\vec{V}}{c}\Phi$ that now correctly describes the increase in the electric field that is seen from a moving charge when viewed from a different inertial frame reference when the charge is viewed perpendicularly to the direction of the relative motion. This is seen as the magnetic field when the moving charge is in a conductor. This increase in the electric field is the result of the moving charges apparent density increase from the Lorentz contraction of the moving charges when the charges are viewed from a different inertial frame of reference.

Equation (8) is now in the correct units and is new. This potential is going to be seen as an electric potential with an electric field when it is viewed from different inertial frames of reference but not connected to the originating charge. This is mathematically represented as:

Electric Field calculation from a Scalar Electric Potential

S	Scalar Electric Potential	Volt/Meter	
$\vec{v}$	Relative Velocity Difference	Meter/Second	
$\lvert\vec{v}\rvert$	Relative Speed Difference	Meter/Second	
$S_{\text{Intensity}}$	Decoupled Electric Potential Intensity	Volt/Second	(8)
$S\lvert\vec{v}\rvert = S_{\text{Intensity}}$		Volt/Second	(9)
t	Time (Time that the scalar is built up)	Seconds	
$(S_{\text{Intensity}})t = S_{\text{Decoupled Electric potential}}$		Volt	(10)
$\nabla S_{\text{Decoupled Electric potential}} = \vec{E}$		Volt/meter	(11)

Special Case:

The intensity of the Scalar Electric Potential as seen from the stationary frame of reference

$\vec{v}$ Relative Velocity Difference using $\vec{V}$ as Velocity Basis of "1" in M/S.

$S\lvert\vec{v}\rvert = S_{\text{Intensity}}$ Volt/Seconds $\lvert\vec{v}\rvert$=1M/S

$$S_{\text{Intensity}} = \left(\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi\;\frac{\text{Volt}}{\text{Meter}}\right)\left(1\frac{\text{Meter}}{\text{Seconds}}\right)\text{Volt/Seconds}$$

Note: For those who couldn't figure out where the Volt/Seconds were coming from….

This new result is a scalar and is a potential of an **unknown scalar field** with a number of features.

- The result of this equation is a scalar or potential.
- The scalar potential is coupled to point in space.
- This new scalar potential can be built up over time.
- This new potential is ***decoupled*** from the moving charge that created it.
- This new potential displays an electric field when this new potential is viewed from a different inertial frame of references than the one that it was created in.
- The Scalar Electric Potential Intensity from the Scalar Electric Potential is dependent on the relative velocity difference of the inertial frames of reference that it was created in and the inertial frame of reference that it is viewed from.
- The Decoupled Electric Potential is dependent on the Scalar Electric Potential Intensity multiplied by the amount of time that the Scalar Electric Potential Intensity has been built the up.
- The electric field intensity seen from the Scalar Electric Potential is dependent on the gradient of the Decoupled Electric Potential.

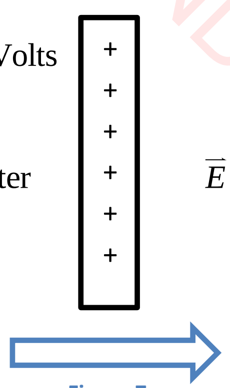
In this derivation the Scalar Electric Potential Intensity is multiplied by the time to demonstrate that it is a point in space that has a decoupled potential that can be built up over time. Time could just as well be multiplied by the Scalar Electric Potential and the results would be the same. But the fact that the Decoupled Electric Potential could be built up over time as a potential (Voltage) wouldn't be as obvious as it is in this derivation.

The $\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi$ term in the equation (8) when viewed from different inertial frames of reference is an electric potential that adds to the electric potential of the moving charged element in the direction of the motion of the moving charged element. This potential will add to the charged elements potential when the charged element is approaching a point. This is seen as an increase in the electric field as a moving charged object is approaching a point. This potential will subtract from the charged elements potential when the charged element is receding from a point. This is seen as a decrease in the electric field as a moving charged object is receding from a point.

Figure 7 is a representation of a moving positively charged bar from the stationary inertial frame of reference that is moving to the right. When the electric field of the positively charged bar is measured with a static electric field meter (a *non-reciprocating* electric field meter) from the stationary frame of reference it sees a complex electric field. This complex electric field is composed of the static electric field from the potential of the charge and the added electric field component from the potential of the dot product of the static potential and its relative velocity when viewed by an electric field meter in the direction of motion. In this example the electric field meter positioned to the right of this object would measure an electric field that is slightly greater than it would if the object was stationary. By the same effect an electric field meter positioned to the left would measure an electric field that is slightly less than it would if the object was stationary. The result of this effect is a longitudinal electric field that is seen in the stationary frame of reference for the moving charged bar.

$$\Phi_{\text{Receding}} = \Phi - (\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi) t \text{ Volts}$$

$$\vec{E} = \vec{\nabla}(\Phi - (\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi) t) \text{ Volt/meter}$$



$$\Phi_{\text{Approaching}} = \Phi + (\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi) t \text{ Volts}$$

$$\vec{E} = \vec{\nabla}(\Phi + (\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi) t) \text{ Volt/meter}$$

Figure 7

The effects from this scalar is easy to demonstrate as shown in figure 8. A stationary uncharged brass disk (we used a 3 inch disk) will have a complex electric field from the fixed positive ions that is different from the complex electric field for the mobile negative electrons in the brass disk. In figure 8 at step (1) we momentarily grounded the center of the stationary disk to 0 volts (earth ground) and then accelerated the disk to a speed greater than 5 m/s. Then in steps (2), (3) and (4) an electrical connection is made to the disk while it is moving with a stationary contact connected to a stationary picoammeter that is also connected to 0v or ground. If the electrical contact to the disk starts at the leading edge of the disk and allowed to move across the disk as the disk moves by the stationary contact until it gets to the trailing edge of the disk we get a very special current profile. This process is shown below:

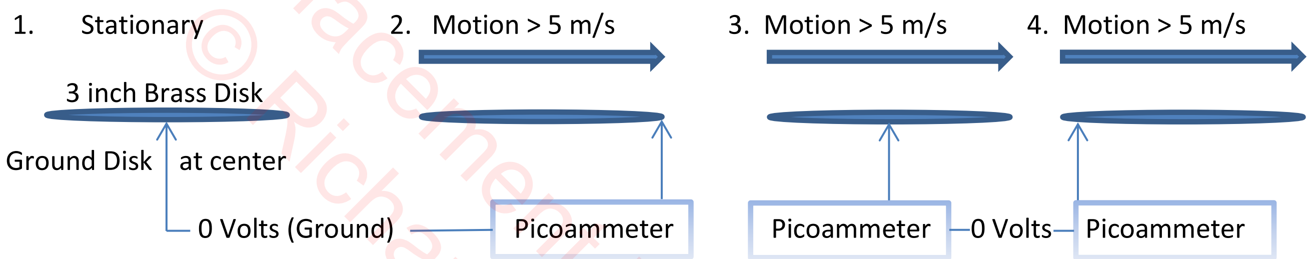


Figure 8

If the Electric Scalar Potential is 0 as the gauges imply then the current profile is going to be 0 pA at points 2, 3, and 4. Instead we get the following current profile shown in figure 9.

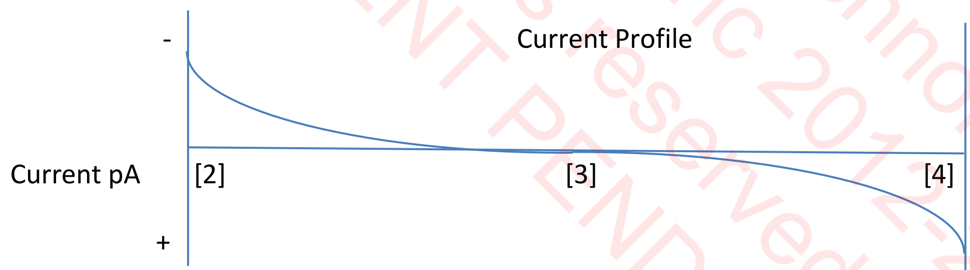


Figure 9

Since the Electric Scalar Potential is real we have a leading negative electric field from the brass disk and a trailing positive electric field that is a direct effect of the electric field from the Electric Scalar Potential when viewed (by a stationary picoammeter) from the stationary inertial frame of reference. The reason that there is a negative leading Electric Scalar Potential is due to the fact that there is charges in two different inertial frames of reference (the randomly moving electrons and the stationary ions) so the disk is neutral in the stationary frame of reference but slightly negative in the moving frame of reference. So it is left to the reader to attempt this experiment, if they still have doubts about reality of the electric scalar potential.

An electron moving through a conductor will also create a longitudinal electric field from the difference in the electric field of the negative electrons that are approaching and receding a positive ion. The positive ions will see a longitudinal electric field from the electrons that are approaching that have a slightly greater negative electric field from the moving electron's static electric field and the added increase in the potential from the electric scalar. The positive ions will also see a longitudinal electric field from the electrons that are receding that have a slightly less negative electric field from the moving electrons static electric field and the decrease in the potential from the electric scalar. This causes the positive ion matrix to experience a longitudinal force that is in the opposite direction to the negative electron current flow.

The term "*t*" in the equations in figure 7 is "time". The units Volts/Second for the Scalar Electric Potential implies that the terms $\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla} \cdot \frac{\vec{V}}{c}\Phi$ in equation (8) can be built up at a point in space. The scalar potential can be built up in a number of special cases. One special case is when a moving charged object is accelerated perpendicularly to the direction of motion. When a charged object is accelerated perpendicular to its motion, the trailing (receding) scalar ends up not completely offsetting the leading scalar. This effect is seen in a rotating charged **non-conducting** ring as an increase in the electric field over time around the outside faces of the charged ring. This effect is also seen as a decrease in the electric field over time around the inside faces of the charged ring. This is diagrammed in figure 10. This experiment can be done with a conducting ring if the experimenter takes care not to "**SHORT OUT"** the electric field from the Electric Scalar Potentials.

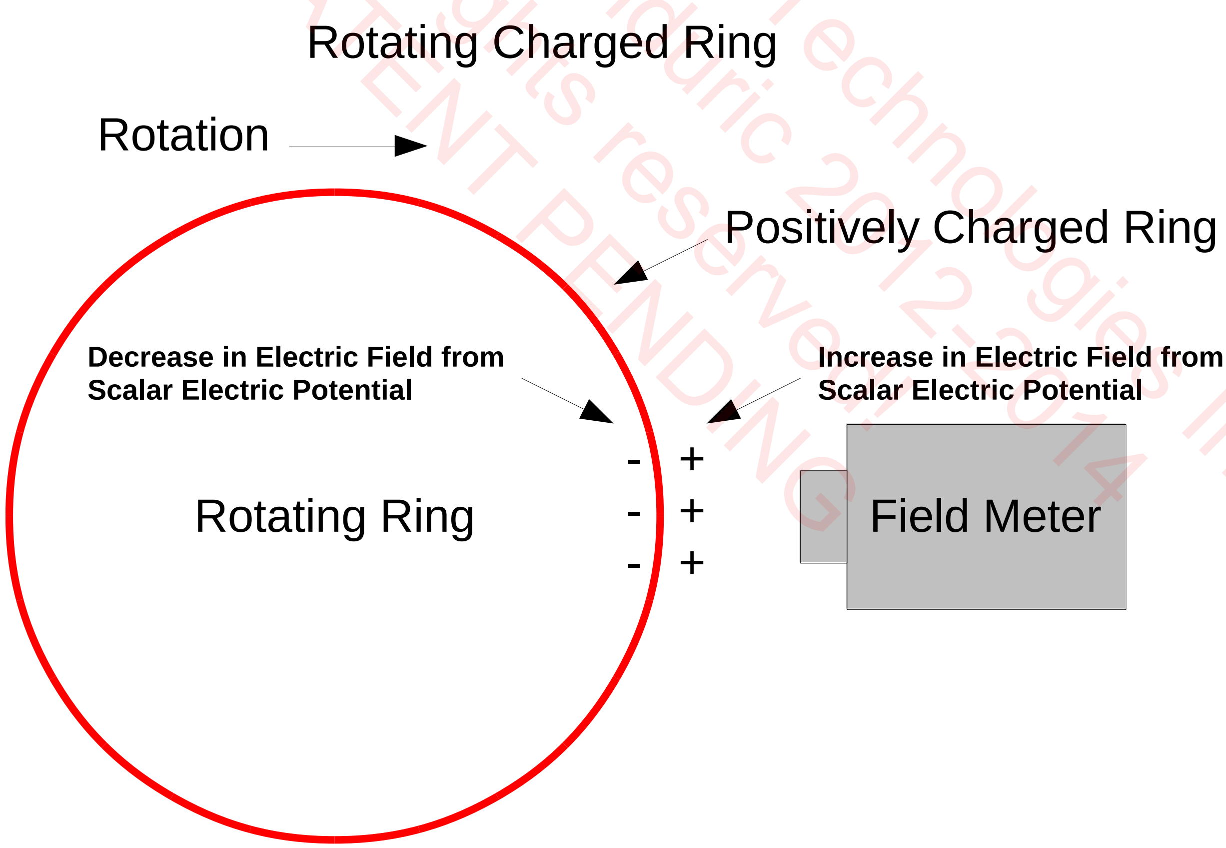
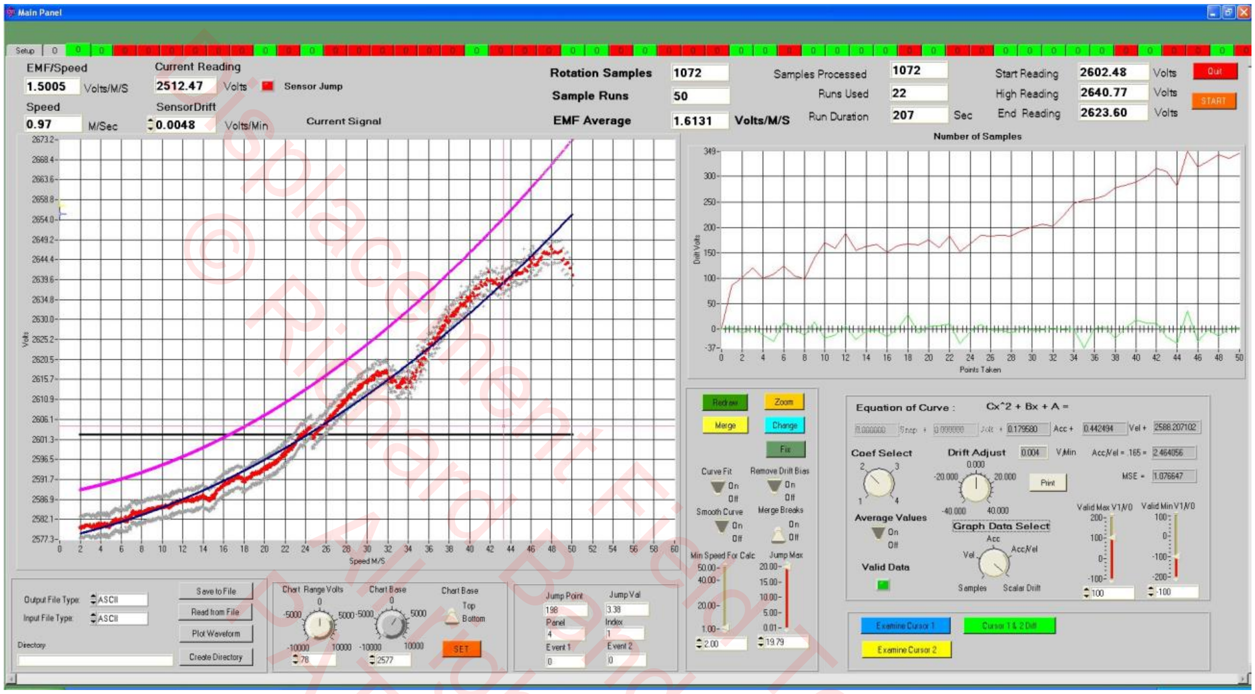
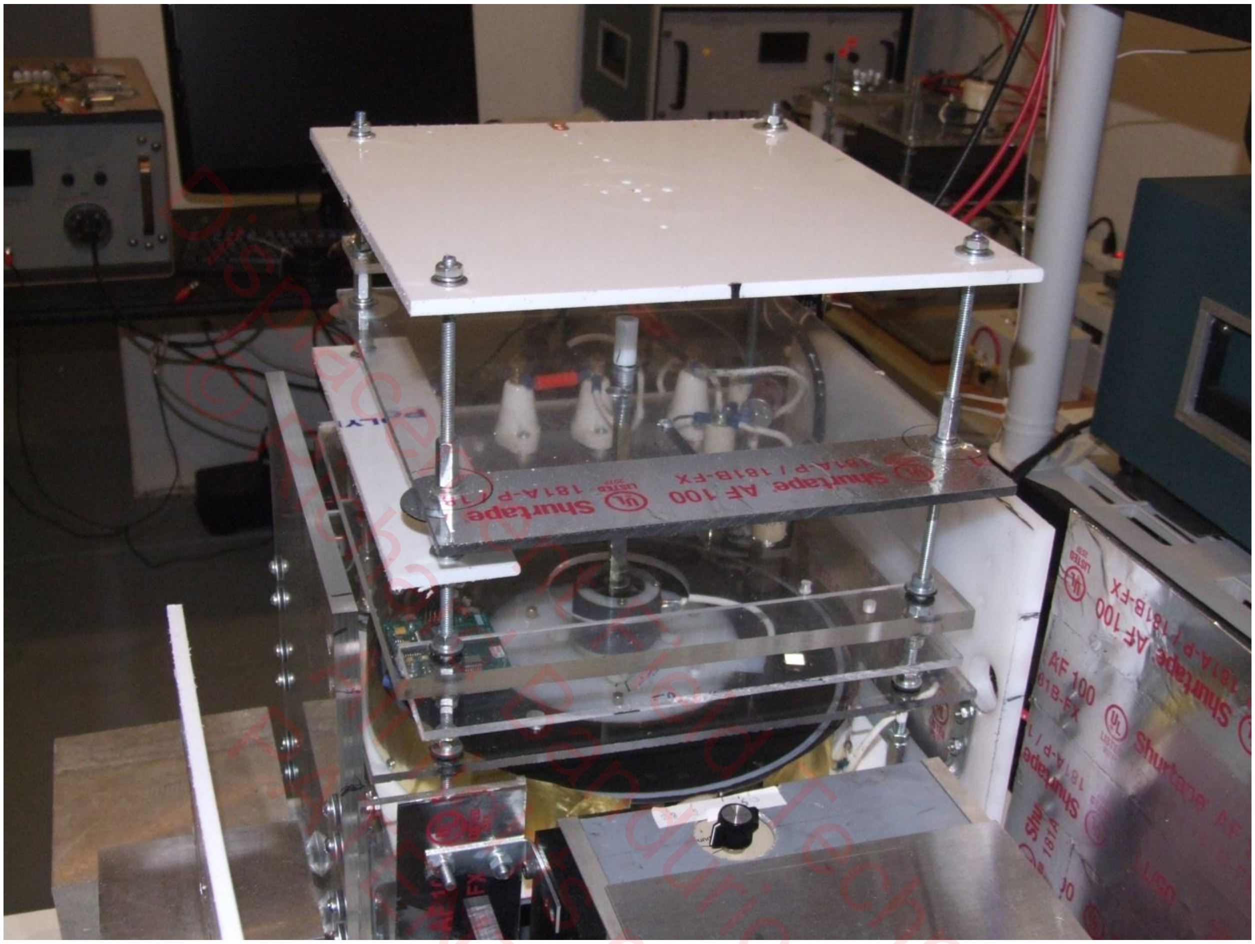


Figure 10



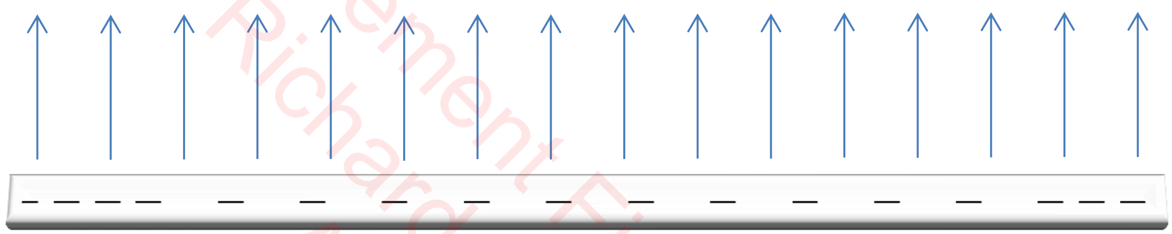
Above is the display of an automated test system output that characterizes the relativistic electric fields from different materials. The type of material that is being tested is a conductor. The conductor is a 1 inch tall by 32 inches long strip that is wrapped around a non-conducting rotating ring that we described in figure 10. The left graph is the increase in the electric field that is seen at different rotation speeds in m/s. This increase in the electric field is composed of 2 components from the terms $-\frac{\partial \vec{V}}{\partial t}\frac{\Phi}{c^2} \; -\vec{\nabla}\times\frac{\vec{V}}{c}\Phi$ in equation (7). At low speeds the increase in the electric field is mostly from the term $-\vec{\nabla}\times\frac{\vec{V}}{c}\Phi$. At 50 M/S the potential read by the electrostatic meter has increased by 70 volts. The red plot on the right graph is the increase in the electric field that is seen on the outside of the disk over time from the term $\vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi$ in equation (8). In this run the electric field from this material increased the potential seen by the electric field meter on the outside of the ring by 350 volts over about 20 hours of rotation. The green plot on the right graph is the sensor error voltage. The drift voltage from this type of sensor is normally 0.0 ± 5.0 volts over the same period of time.



This is a picture of the “Rotating Ring Test System” that was used to get the data shown in the previous screen shot.

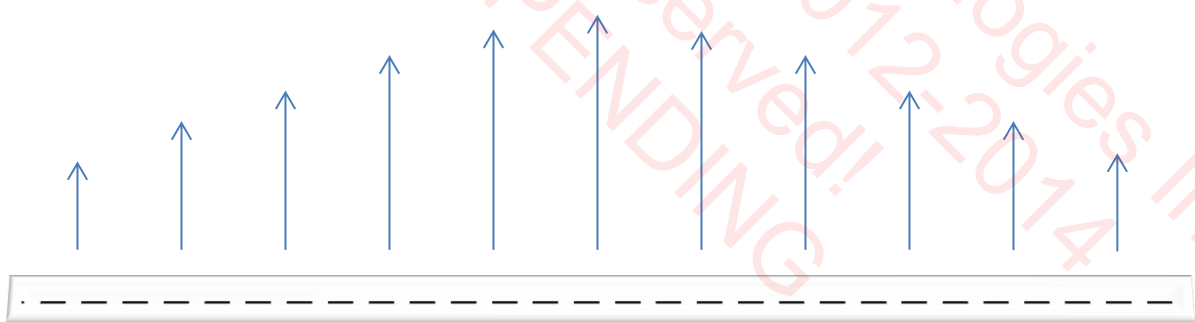
Geometric Amplification

A conductor has the requirement that the static electric field inside the conductor to be near 0. In a charged flat conducting sheet the charge has a distribution of the mobile negative electric charges in the sheet to keep the electric field near 0 inside the sheet. That means that most of the mobile negative charges will be near the edge of the sheet. This redistribution of the mobile negative carriers creates an electric field that is perpendicular to the surface of the sheet. The electric field that is seen from the flat conducting sheet is shown below:



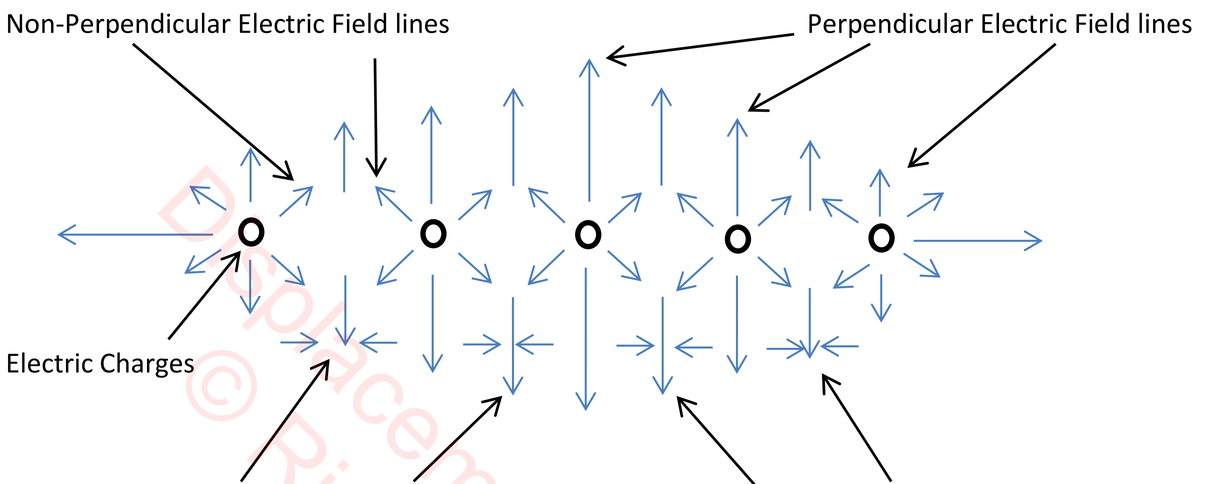
Charged conducting sheet

This redistribution of the mobile negative charges is not seen with charged insulators since there are no mobile charges. Instead we get different electric field from a non-conducting sheet if it has a constant charge density.



Uniformly charged non-conducting sheet

The electric charge in or on an insulator will **NOT** redistribute to keep the electric field in the insulator to be near 0. If the charge distribution is constant the electric field at the center of the flat charged surface is going to be greater that the electric field near the edges due to the increase in the electric potential at the center of the disk. This is the consequence of the non-perpendicular components of the individual charges electric fields for the charges at the edge of the sheet reinforcing the electric fields of the charges near the center of the sheet.



Resulting re-enforced electric field Lines of the vertical component from the non-perpendicular electric field lines.

The horizontal components of the non-perpendicular electric components of the individual charges are canceled near the center of the sheet by the neighboring electric charges and amplified at the edges of the charged sheet. This is an example of geometric amplification of the static electric field from a uniformly charged insulating flat sheet like a charged plastic sheet like polypropylene.

Geometric amplification of the complex electric field is also possible. In fact the complex electric field that is seen from the relative velocity of the charges when viewed from a different inertial frame of reference is the same for conductors and insulators. The requirement that the electric field to be near 0 in its inertial frame of reference is always met since the velocity of the conductor in its inertial frame of reference is always 0. This keeps the mobile negative charges from redistributing and affecting the complex electric field if the charged object is in the same inertial frame of reference. This allows the electric field to change and get amplified depending on the charged objects relative velocity to another static electric field. This is true only if the elements of the conductor do not cross an inertial frame of reference. If elements of a conductor do cross into a different inertial frame of reference then the sections of the conductor that are in the different inertial frames of reference will attempt to keep the electric field near 0 through all the sections of the conductor. This effect will tend to “**SHORT OUT”** the amplification of the complex electric field***. Charged moving conductors crossing inertial frames of reference are the major reason that the geometric amplification of relativistic electric fields is not seen in modern electric equipment today.***

Isolated charged conductors may or may not see geometric amplification of the complex electric field depending on their shape. A moving charged curved surface will usually have no geometric amplification while a moving charged flat surface will. An example of a shape that will have geometric amplification of the complex electric field is a charged moving plastic sheet like polypropylene with a static charge on it. When this sheet is viewed perpendicular to the direction of motion from a different inertial frame of reference the complex electric field from this sheet will increase at the center of the sheet. A conducting sheet will also increase at the center but since most of the charges are at the ends of the sheet the geometric amplification of the complex electric field will be different.

Complex Electric Field Amplification

The new extra term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the electric field equation (7) describes the increase in the complex electric field that is seen by an observer in a different inertial frame reference when the charge is viewed from a perspective that is perpendicular to $\vec{V}$. This term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ is capable of being amplified in the same manner as a charge on an insulator. This geometric amplification is not affected by the requirement that the electric field be near 0 in a conductor if the conductor is in the same inertial frame of reference. The electrons in a conductor that have a relative velocity to the observer will not redistribute themselves in response to the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ that the observer in a different inertial frame of reference sees from the velocity of the charged object. The reason is that the charges have a relative velocity of '0' to themselves so the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the charges inertial frame of reference is '0'. But it is not '0' in different inertial frames of reference. This gives the effect where different observers will see a different total electric field when its static electric field is viewed from different inertial frames of reference.

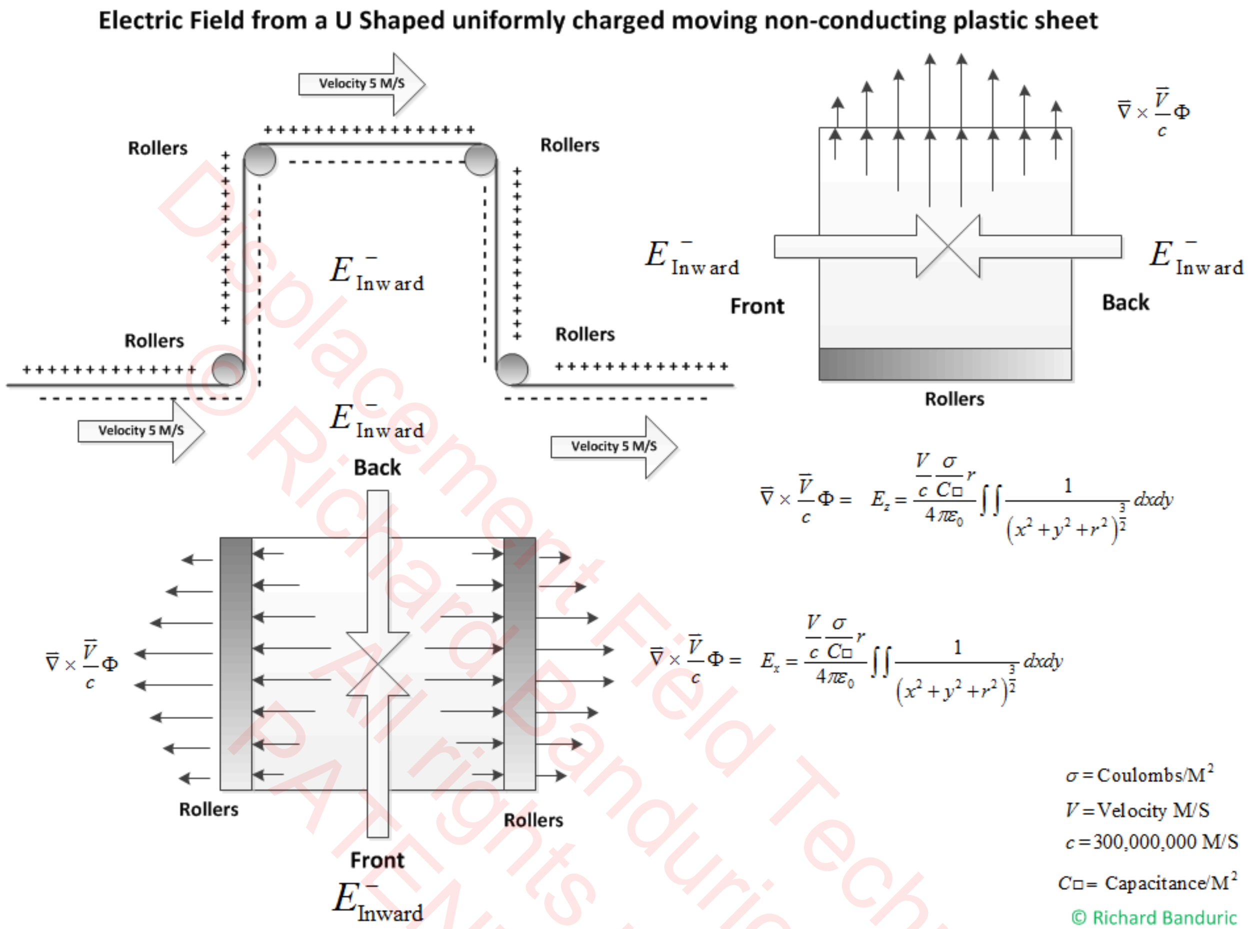
The relative velocity term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ will amplify itself from a moving charged flat sheet when viewed from a view that is perpendicular to the direction of motion of the charged sheet. This is the consequence of the non-perpendicular components of the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ from the individual moving charge's electric fields for the charges at the edge of the sheet reinforcing the electric fields of the charges near the center of the sheet. This amplification will be different than the amplification from a uniformly charged insulator since the relativistic electric field term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ is directional while the electric fields from the static charges on a uniformly charged insulator are not.

This particular type of geometric amplification has been reported in the case study:

```
7.7 CASE STUDY - LARGE PLASTIC WEB ELECTROSTATIC PROBLEMS, RESULTS AND
   CURE, D. Swenson, 3M Company
   Tremendous static charge generation on a plastic web causes unique
   physical phenomena and special problems. Solution was simple and cost
   effective.
```

A summary of this case study is at http://amasci.com/weird/unusual/e-wall.html

This type of geometric amplification is diagrammed on the next page.



This type of amplification was seen as the appearance of a new electric field E^{-}_{Inward} inside the tunnel of moving uniformly charged plastic sheet. This new electric field was the result of the increase in the relativistic component $-\vec{\nabla}\times\dfrac{\vec{V}}{c}\Phi$ of the total electric field at the center of the moving charged sheets from their relative motion. This resulted in a negative electric field component that is seen pointing into the tunnel that will create an outward force to any negatively charged object that tries to enter the tunnel. This force would then appear to be an "electrostatic Wall" near the center of the moving sheet.

This type of geometric amplification is also seen with any smooth moving flat surfaces. One convenient surface to work with is a rotating disk or rotating ring. A charged disk with a smooth conductive coating will present a static electric field that is perpendicular to the surface and will have most of the negative charges near the outside of the disk or ring. When this disk is rotated most of the negative charges near the edges of the disk will have the highest velocities and the greatest change in their relativistic electrical fields. A disk with a smooth surface conductive coating will then see geometric amplification from the relativistic electric field component $\vec{\nabla}\times\dfrac{\vec{V}}{c}\Phi$ from their neighboring charges while a rough surface conductive coating will not.

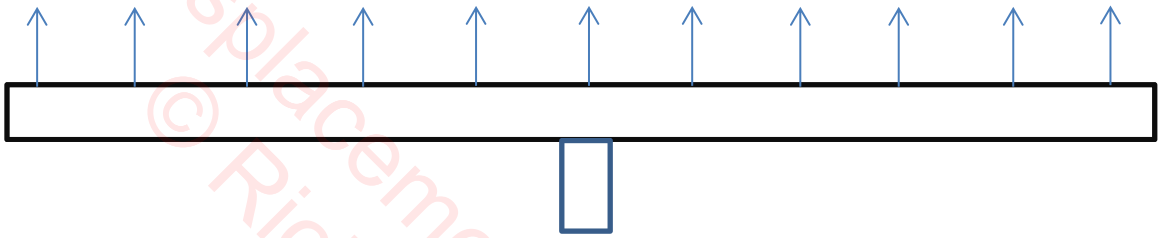
If two ***electrically isolated*** charged disks with different surface characteristics [they can be different surface types or shapes or sizes] will see different total electric fields from each other when rotated against each other. If these two disks are rotating against each other and are mechanically connected in an assembly, then the two different relativistic electric fields that the static electric fields see on the two rotating disks will create a total force on the assembly that is not completely offset by the opposing forces seen on the other rotating disk. This effect was documented in the **European Patent 0486243A2 "Machine for Acceleration in a Gravitational Field." Filed Nov. 11, 1991, granted May 20, 1992** as a result of acceleration charges in a "gravity well". The effect was real but the reason was incorrect. The effect was caused by the interaction of two different relativistic electric fields against their electric static electric fields. Not the result of accelerating charges in a "gravity well". In this case the difference in the sizes of the cylindrical electrodes was the source of the different relativistic electric fields that produced the forces reported.

The "strange" method that is used in this patent to charge the cylindrical electrodes is a good example of someone attempting to work around the problems caused by using conductors and modern power supplies. Displacement Field Technologies Inc. has solved these problems.

The next figure [Figure 11] is an example of the electric fields from a rotating charged disk with a charged smooth conductive coating on it. The total electric field that is seen on the faces of the rotating disk is composed of the static electric field and the relativistic electric field component $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$. The relativistic electric field component of the potential $\vec{\nabla} \cdot \frac{\vec{V}}{c}\Phi$ is not a seen on the faces of smooth conductive coatings. Conversely non-smooth high resistance coatings will not have a significant positive $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ electric field component while the electric field component from the potential $\vec{\nabla} \cdot \frac{\vec{V}}{c}\Phi$ will be seen by a static electric field in a different inertial frame of reference.

Static Electric Field from a Smooth negatively charged conducting Disk.

$$\vec{E} = \vec{\nabla}\,\Phi$$



Relativistic Electric field from a Rotating Smooth charged Disk.

$$\vec{\nabla} \times \frac{\vec{V}}{c}\Phi \qquad V = \text{Distance to Center} \times \text{RPM} \times 2 \times \Pi$$

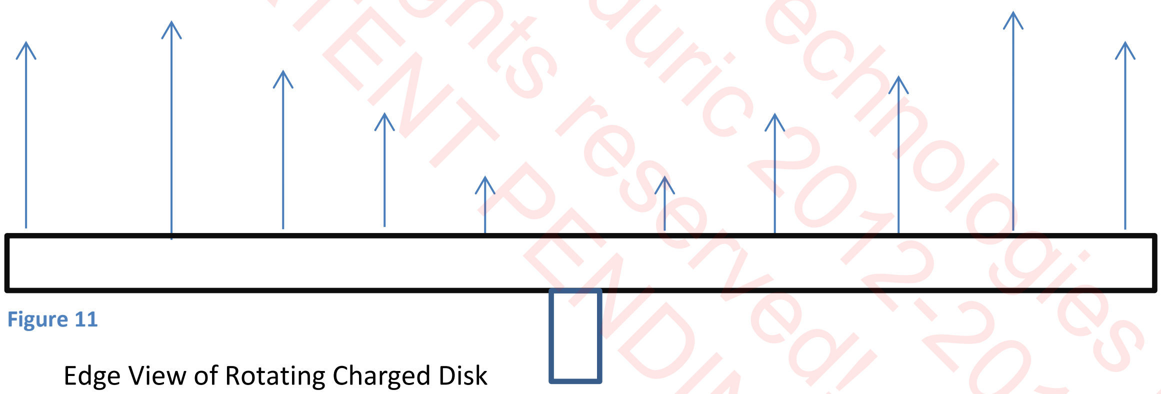


Figure 11

The amplitude of the relativistic electric field from the rotation of charges on the disk is greatest near the edge of the rotating disk. The peak amplitude is not at the edge of the disk but is near the edge of the disk. This is the result of the inner and outer charges non-perpendicular components reinforcing the relativistic electric fields of the charges near the edge of the disk. The static electric field and the relativistic electric field components will add to each other to give a composite complex electric field when viewed from the stationary frame of reference that is dependent on the rotation speed of the disk.

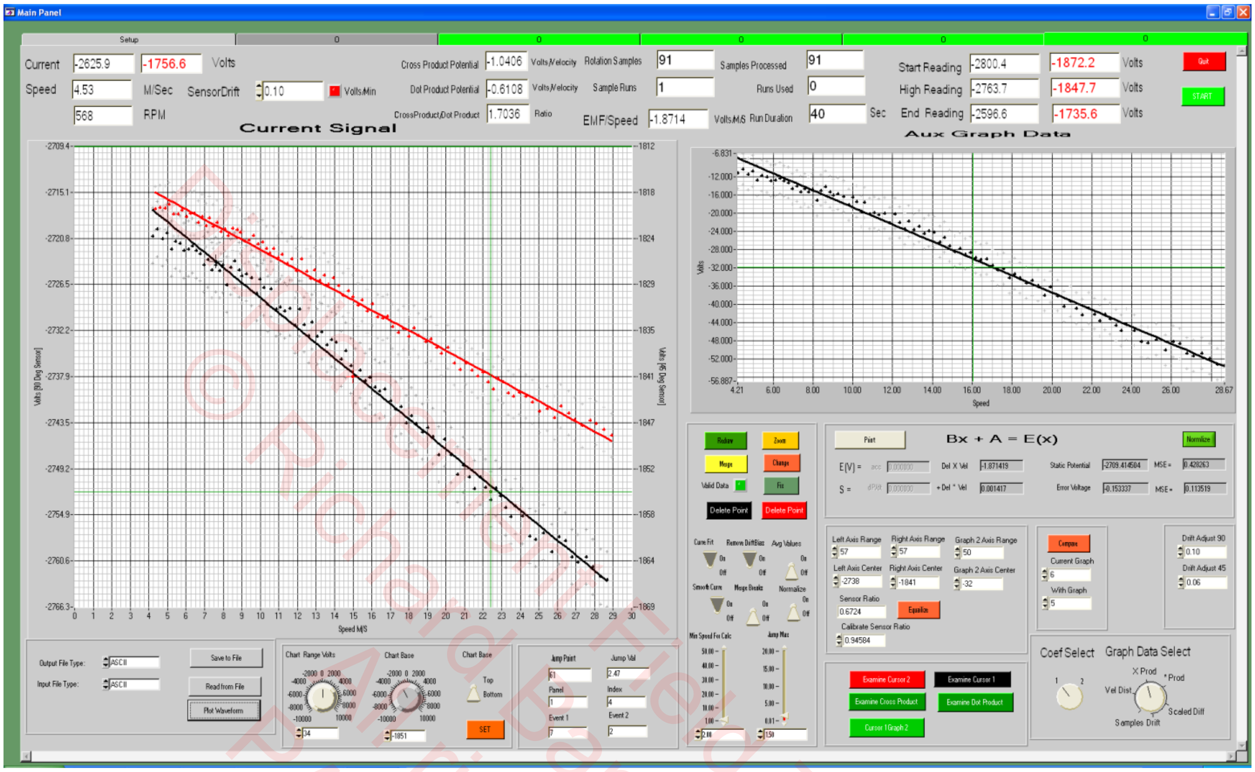


Figure 12

Above is the display of an automated test system output that characterizes coatings on rotating disks. The type of coating that is being tested is a smooth conductive coating. The left chart is the plot of the electric field intensity read as a negative potential above a charged rotating disk. The horizontal axis is the rotation speed of the rotating charges on the disk that is seen near the edge of a 9 inch rotating disk. The black plot is the increase in the electric field seen above the disk for different speeds as seen from the stationary frame of reference. The electric field sensor for the black plot is positioned directly above the surface of the disk. The red plot is the electric field from the same type of sensor rotated 45 degrees to the face of the disk. The black legend is on the left and the red plot's legend is on the right. Having these two plots we can now extract the cross product and dot product components from the complex electric field of this coating.

The right plot is the plot of the cross product electric field component of this coating. At 30 m/s this component is - 50 volts. This increase in the electric field (The potential on the disk is – 2730 Volts) is the result of the geometric amplification from the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the electric field equation (7). This is from a disk with a dielectric constant of 1 and a self-capacitance of 8 pf. Using the self-capacitance to calculate the electric potential increase without geometric amplification the electric potential increase would be [30 (m/s) /300000000 (m/s) x 3000 volts = .0003 volts] with a charge of 24 nC at 3000 volts. But the amplitude of the cross product of the charge and velocity of the complex electric field is dependent on the amount of charge in motion and not on the potential. The automated test system has a charge isolation plate that increases the capacitance from 8 pf to 100 pf and that increases the charge on the disk to 300 nC. Using the test systems 100 pf to calculate the electric potential increase without geometric amplification the electric potential increase would be [100/8 x .0003 volts = .00375 volts]. Still this potential increase is much less than the values that we are getting from the geometric amplification of this negatively charged smooth surface which give us -50 volts at 30 m/s. This disk now has a geometric amplification of -50/.00375 = 13,333 or a **gain** of 13,333.

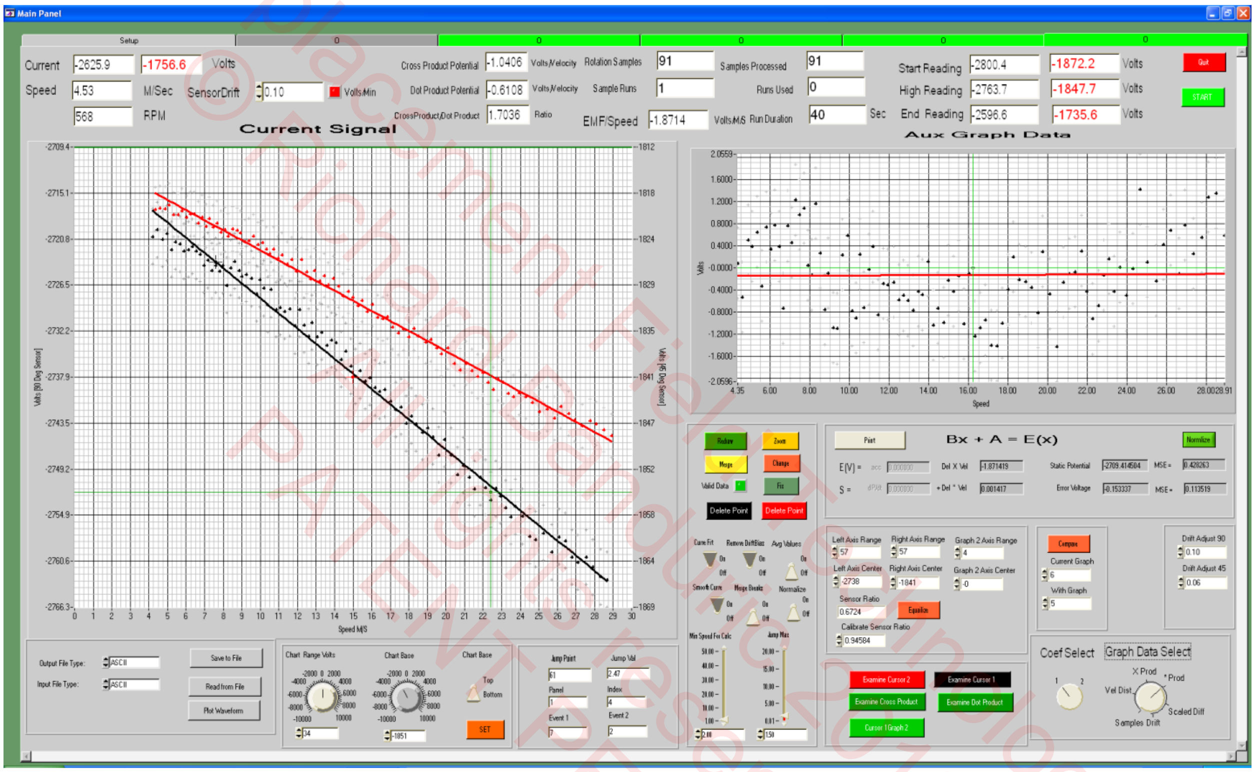


Figure 13

This is the same output that now has right graph displaying the dot product from this smooth rotating coating. Rotating smooth conductive disks will only have dot product geometric amplification that produces a complex radial electric field component at the very edges of the rotating disk. The flat faces of the disk do not have any complex electric field component from the dot product as seen on the right graph.

The relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) on a smooth conducting disk is going to be near 0 as shown on the right graph. This is the result of most of the negative charge residing on the top layer of a smooth conductor. This results in the electrons shielding each other from the increase and decrease in their complex electric fields due to their relative motion from the scalar potential.

The relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) can also be amplified from the macro geometric structures. One macro structure that allows the relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) is a conductive disk that is not smooth. A rough coating now allows the electric field from the electric scalar potential to be seen as a decrease in the complex electric field from charges that are receding from a point and as an increase in the complex electric field from the charges that are approaching a point. For a rotating disk this field is seen as a tangential electric field that resists the rotation of a rotating disk.

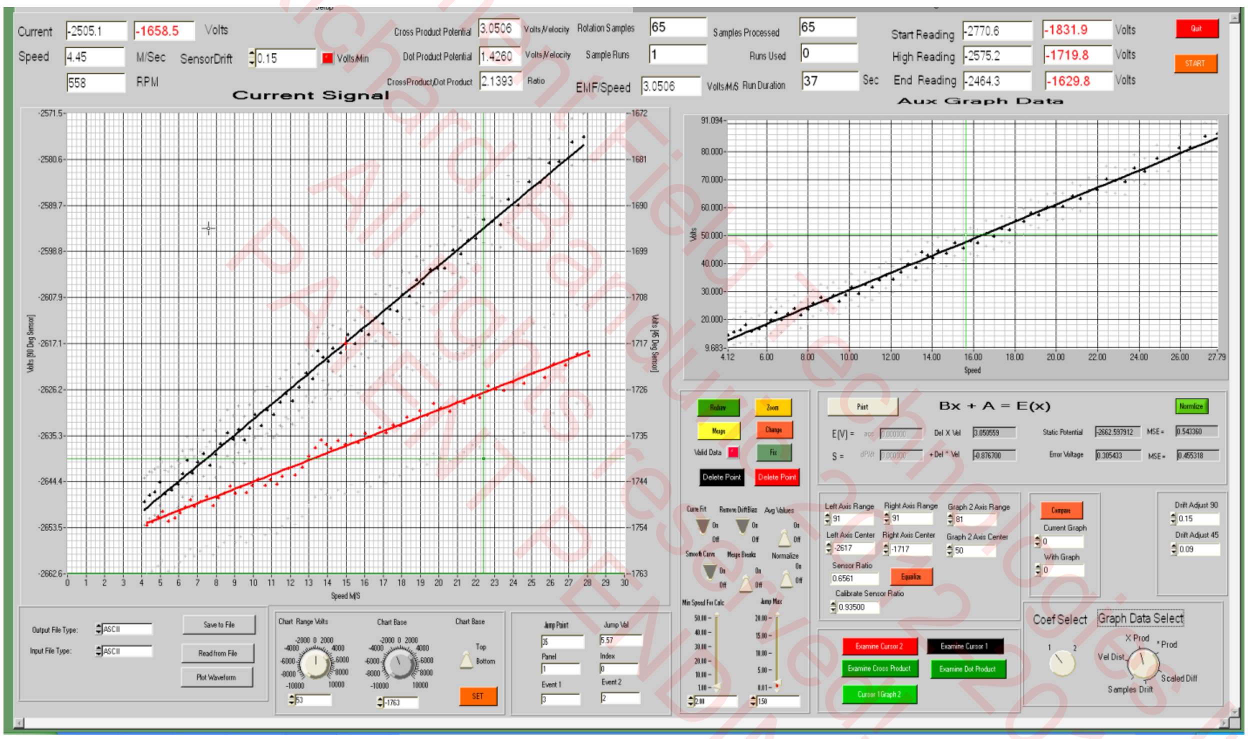


Figure 14

Above is the display of a rough conductive coating. This kind of coating has a very different complex electric field. The left graph is now showing no positive geometric amplification. In fact from this type of coating we are seeing a drop in the potential of 80 volts or a gain of less than one. This effect is seen whenever a disk has gain from the complex electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$. The right graph is the cross product component of the complex electric field. If this disk is rotated against the previous smooth disk then there is a complex electric field of 80v + 50V = 130 volts available to create an axial force. These disks would have a distance between them of about 1 mm so our axial force is going to be the same force that you get from a charged 9 inch ring with a static potential of 3 Kilovolts against an electric field of 1000 mm * 130 volts or 130,000 volt/meter. When this disk is rotated against a smooth disk the smooth disk will see a positive axial force and this disk will see a negative axial force that will add to each other's axial forces to give a total axial force of 40 mN.

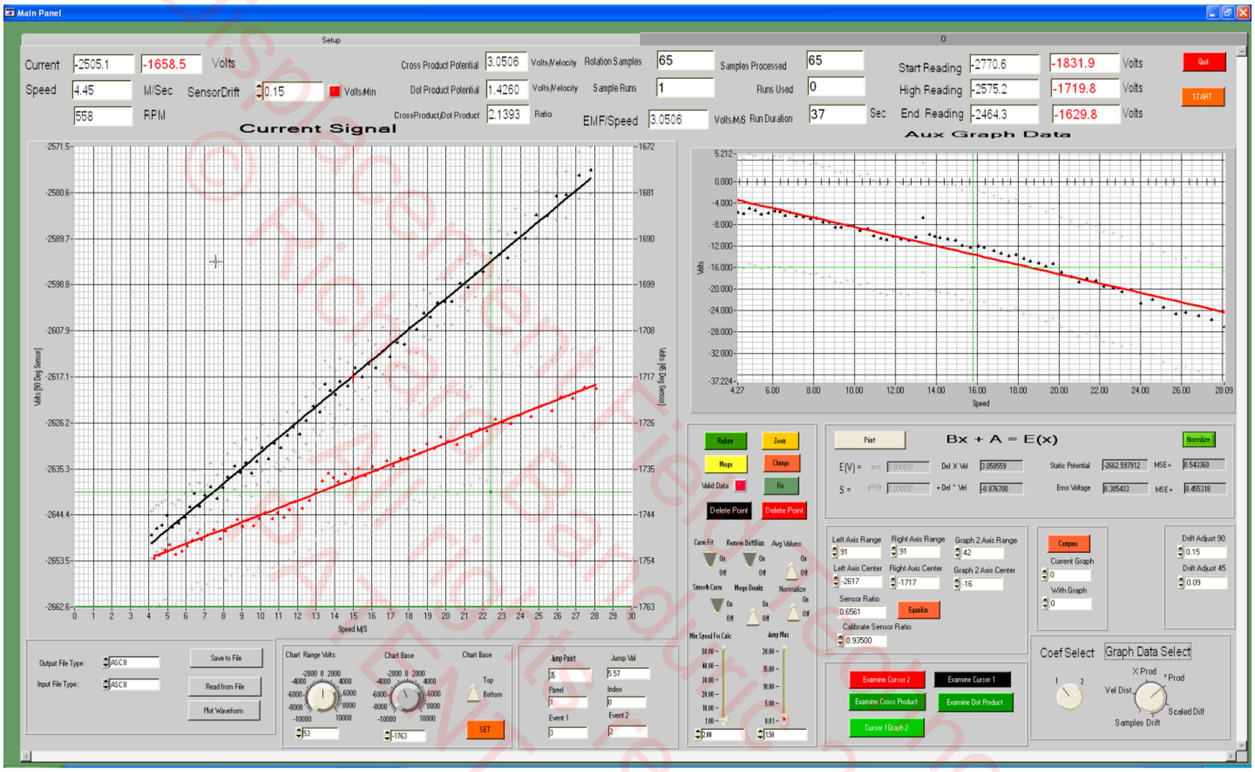


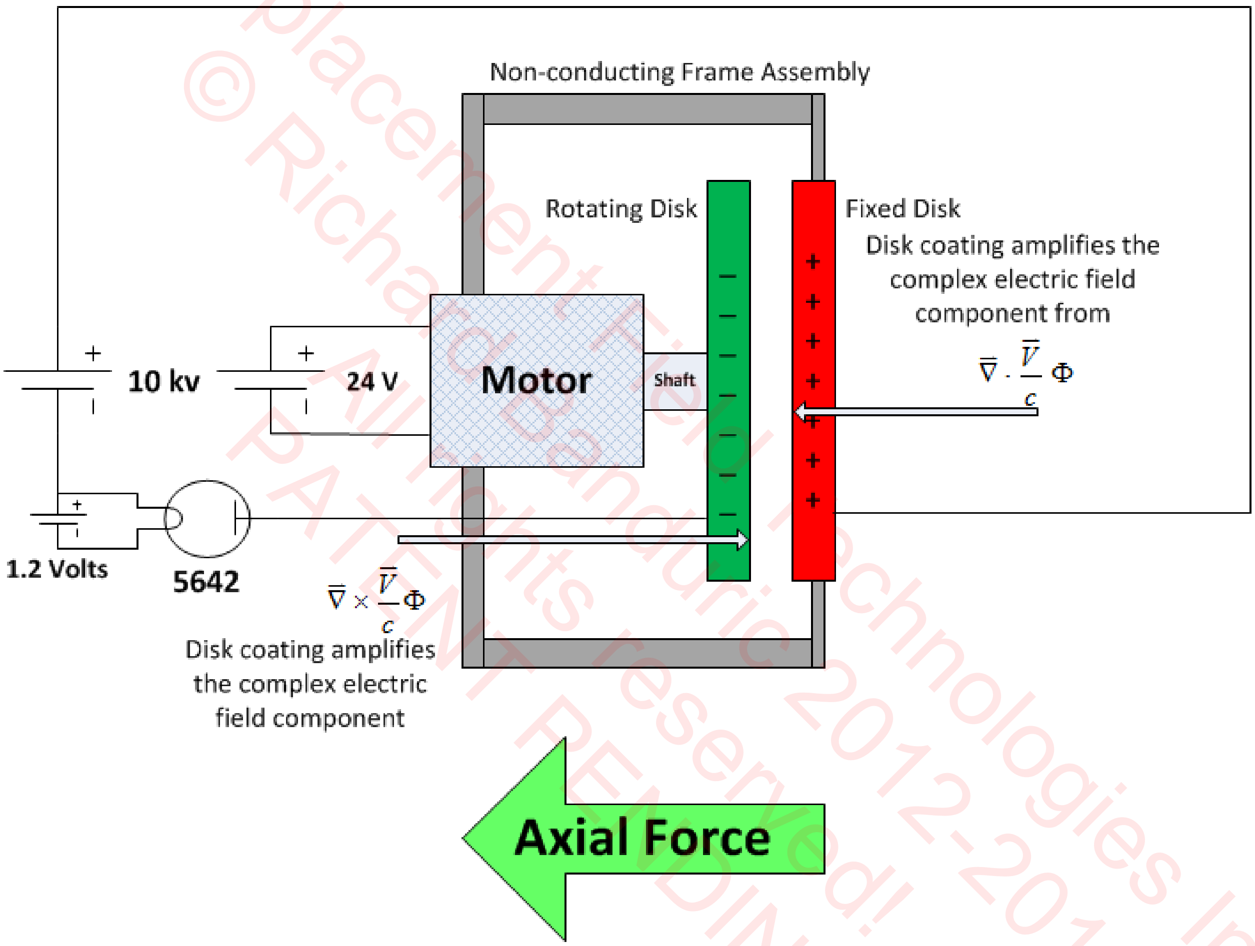
Figure 15

Above is the display of a rough conductive coating's complex electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ on the right graph. This time it's not 0. This is a graph of the charges that are approaching the test sensor. The charges that are receding from the sensor have a slope that is opposite of the approaching charges. The difference between the approaching charges and receding charges generates a tangential complex electric field that the smooth disk sees as a drag force is +25v – (-25v) = 50 volts/meter. If the smooth disk is rotated against this disk then there going to be a drag force on the smooth disk from this complex electric field. Again the distance between the disks is about 1 mm so the drag force is being created from the interaction of a static potential of 3 Kilovolts against an electric field of 1000mm * 50volts = 50,000 volts/meter.

There is going to be **NO AXIAL REACTION FORCE** to our axial force on our disks if these two types of disks are rotated against one another. Instead there is going to be a **ROTATIONAL REACTION FORCE** of

40 mN from the complex electric field component $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ that the motor sees as an additional **DRAG** force instead.

Below is an example of an assembly of a rotating disk against a fixed disk that has these two different types of coatings applied to them. These two different types of disks with two different types of surfaces will produce very different complex electric fields. If these two types of coatings are applied to the faces of a non-conducting disks and they are charged and rotated against each other in the assembly shown below an axial force is seen with the reaction force that is seen as a drag force.



The coatings used in these tests were made by Displacement Field Technologies and are examples of simple coatings with dielectric constants close to 1. The coatings were picked to be the kind of coatings that are easily produced and easy to replicate the results that were described here.

Coatings that have dielectric constants of up to 10,000 are being produced today. A coating of this type of coating with a dielectric coating of 10,000 would produce a complex electric field from this same potential at 500 Kilovolts or 167 times the static potential of 3 Kilovolts moving at 30 m/s. Complex electric fields interacting against a static electric field of these amplitudes, if they were being used to generate an axial force, would be capable of lifting 100's lbs. from a 1 square foot form factor.

Smooth Conductive Disk Insert

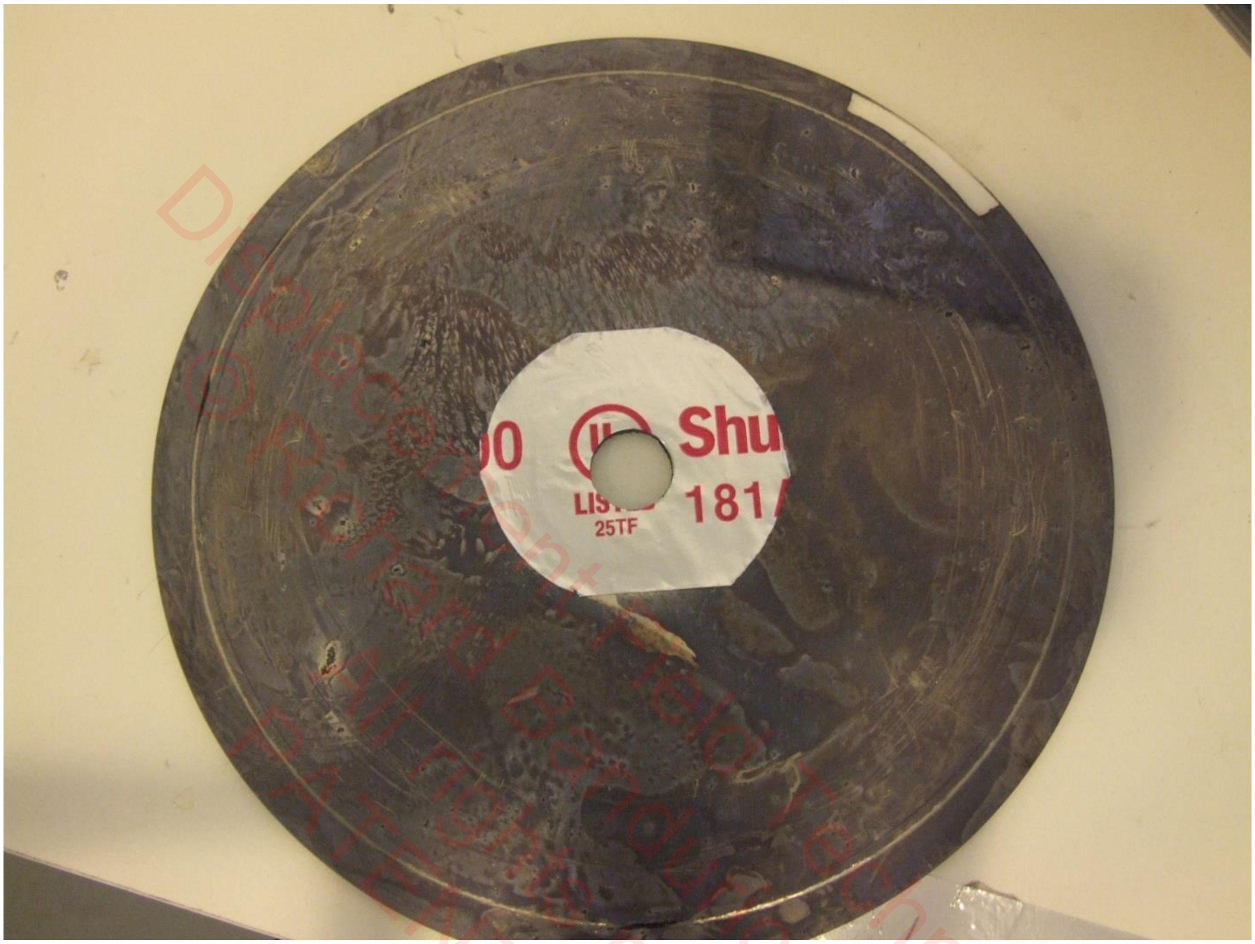
Picture of the smooth conductive coating disk insert used in the 1st example.

This is a 1st generation coating.

Black Conductive Disk

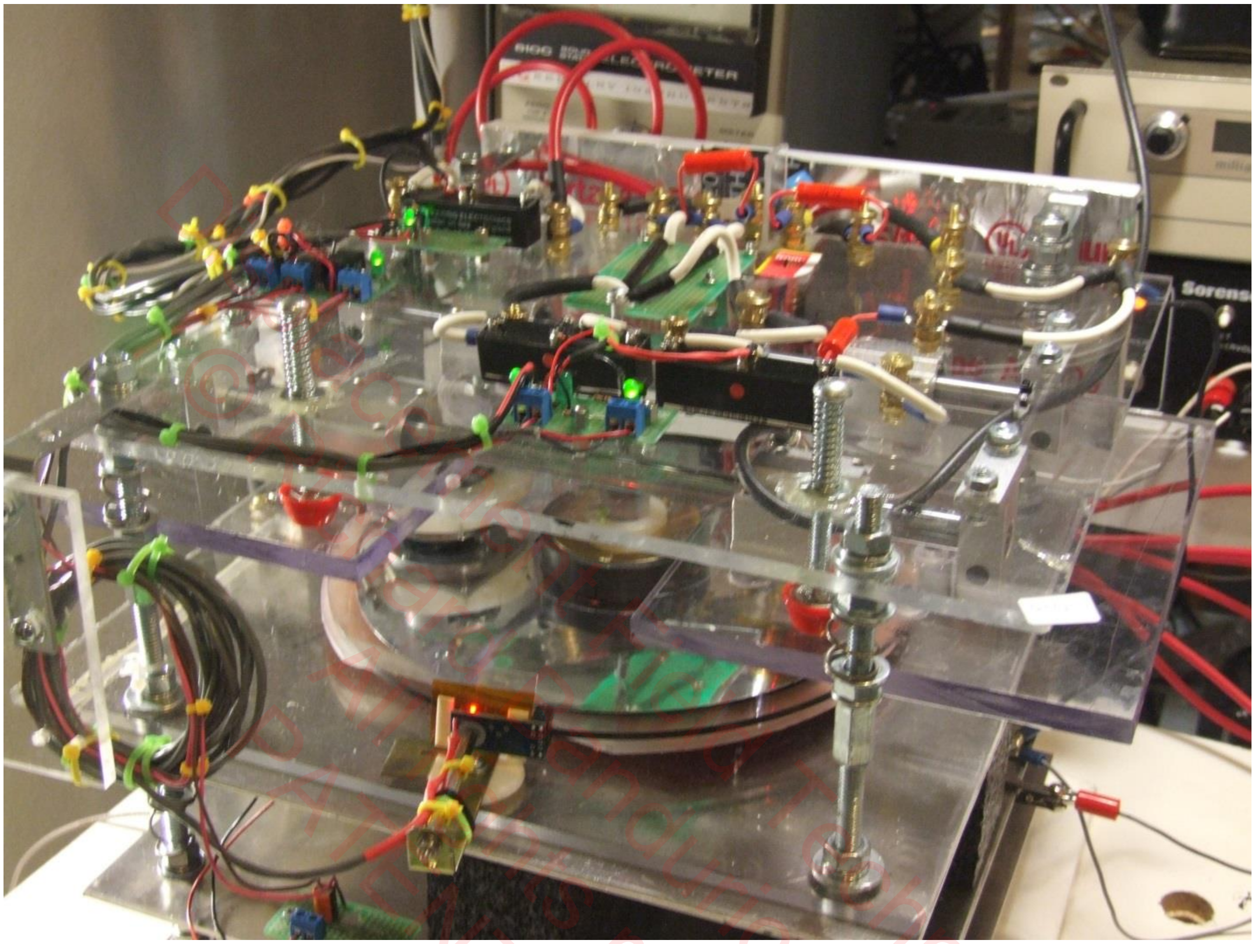
Picture of the “black” coating that generates a large dot product component of the complex electric field that was used for the 2nd test.

This is a 1st generation coating.



The above picture is an example of a “state of the art” Nano-composite coating material that has a high cross product with a high dielectric constant that is going into our latest devices.

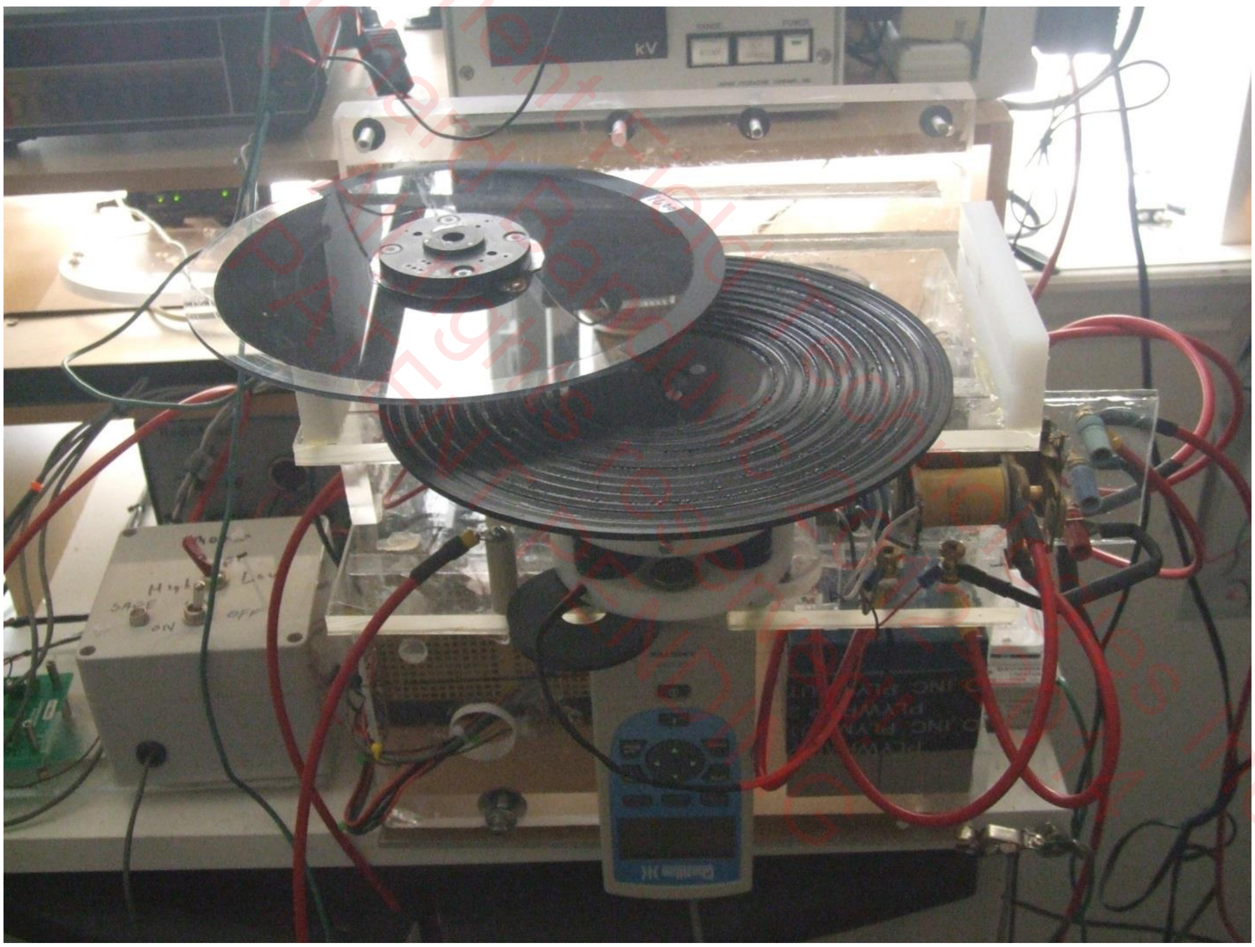
This is a 4th generation coating.



The above picture is the automated test system head that was used to characterize these examples.

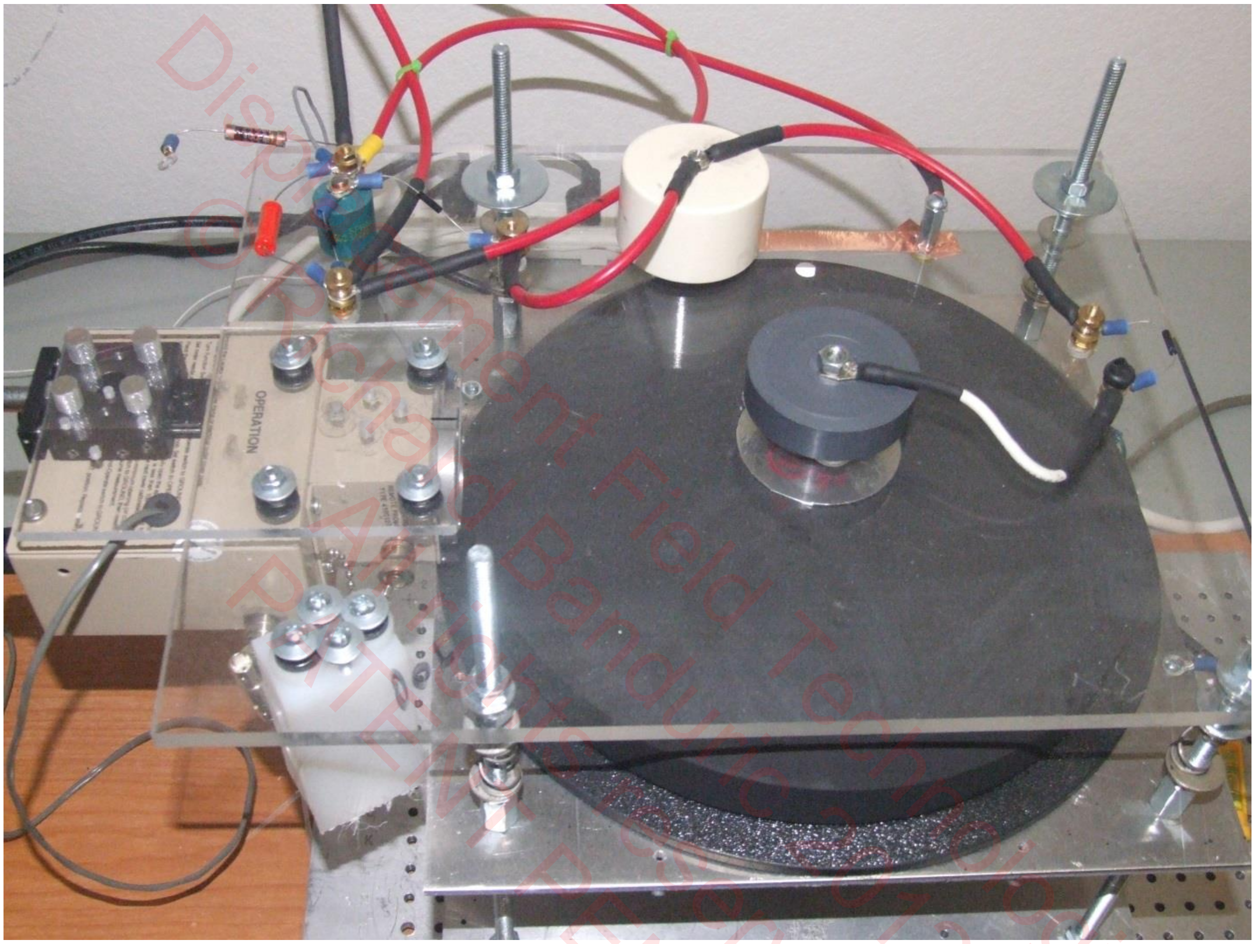
Creating Thrust

The method for generating thrust from the preceding example of two charged disks that are rotated against another is just one method. But any type of charged assembly of elements that have different complex electric fields in different inertial frames of references that interact with the static electric fields of the other isolated charged elements in a different inertial frame of reference will work. Our US patent application 20140009098 has a number of different examples in it. The preceding example of a charged fixed disk and a rotating charged disk with two different types of coatings is are being tested today. The example in the preceding section is just one way to out of many that could be used. The test station below is is such an example that was used to test coated 9 inch disks.

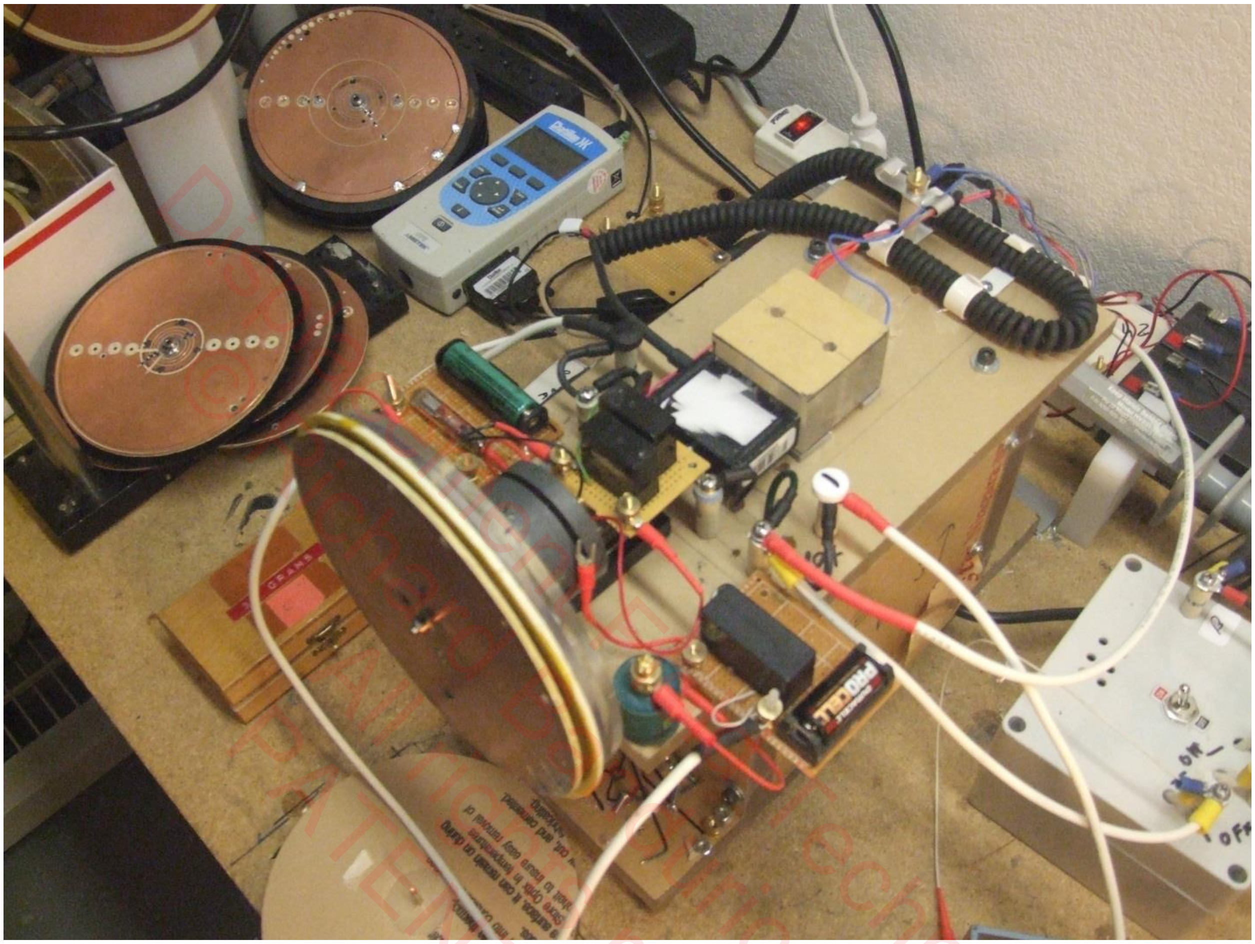


The test fixture is about to be loaded with a dot product disk that generates a radial field when its rotated. The bottom disk is designed to take advantage of the radial electric field that forms from this kind of disk to generate a thrust from. This test fixture is used to test disks from the 9 inch electric field tester to characterize the axial and drag forces from different combinations of disk coatings.

Another complex electric field that can be used to generate a thrust is the complex electric field change caused the centripical acceleration of rotating charges on an angled capacitor plate. The test fixture below is used to characterize this electric field component.



The next test fixture is the fixture to characterize the disks for thrust performance that are going to be used for the prototype testing with 6 inch disks.



This test fixture is rotating a copper cross product disk against a charged sealed dot product composite fixed disk to determine their thrust and drag performance parameters.

The Future

The interaction of static electric fields and relativistic Electric fields to create thrust are just the beginning of this new technology. The examples and the screen shots are of real results from real coatings that are being produced **TODAY** and not some theoretical prediction. Displacement Field Technologies Inc. are looking for partners to advance this technology and create the infinite number of different types of devices that can be made from propulsion devices to devices that will nullify the centrifugal forces on rotating devices.

The prototype that is soon the be marketed is just a demo device that is going to be a precursor to devices with greater lifting forces and lower power consumption figures. The ultimate goal is to produce propulsion devices that can lift a 1000 Kg [10 Kilo Newton] at a power consumption of 1 Kilowatt or less. These devices are going to be able to be used at sea level or in the vacuum of space. These devices will have no need for propellant and would be powered from any electric power source from batteries to solar cells.

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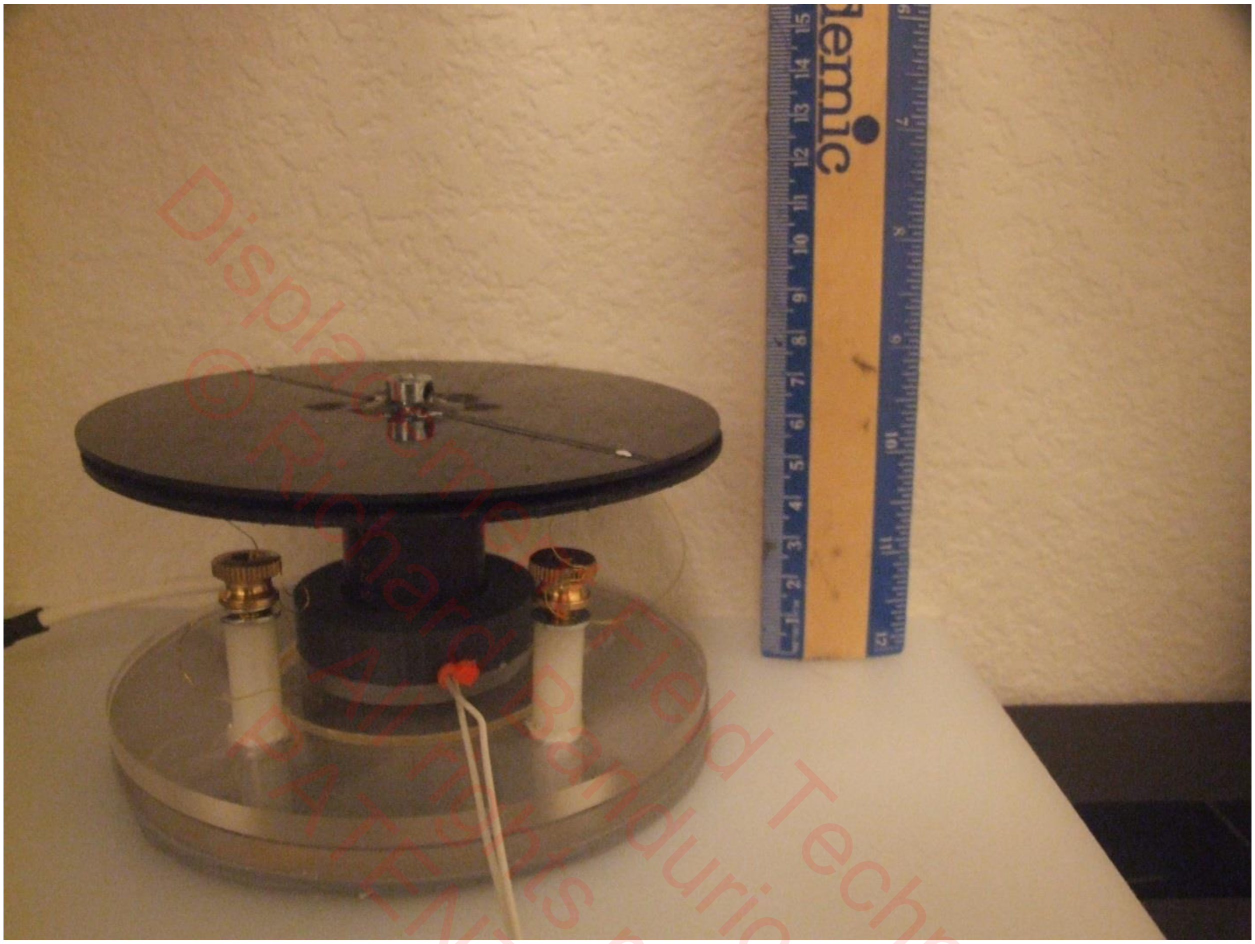

Symbol Definitions:

mN	milliNewton
nC	Nano Coulomb
Kg	Kilogram
m/s	Meter/Seconds