

ECCO India Plans

UPDATE 16 July, 2017 - On the eve of potentially being able to actually run this test, this plan could use an update based on what we learned from the AURA test and the situation in Mumbai.

Situation: The inventor is in trouble with his bank and his assets are about to be seized. He has cut a deal to sell the tech, including the LENR reactor and fuel prep to another company. Summary here:

<http://e-catworld.com/2017/07/14/mfmp-plan-and-proposal-regarding-ecco-device/>

Plan: Bob Greenyer and George Egely are currently in Mumbai hoping to get a chance to test the device and see if it performs as described. They will test with simple tech and document on video. If they see positive results, Ryan Hunt will go over and bring the live data streaming equipment for a more thorough test.

Equipment: Ryan, if needed, will travel lighter for a few of reasons.

- Suhas' situation has made it difficult to arrange the more formal visa.
- It will save money and logistical hassles if we make it fit into one checked bag.
- The neutron detectors are quite heavy and responded very poorly to high RF. We will depend on the bubble detectors.
- We do not have Alan on this trip, or Brian. That means the pieces they would have brought are not available to us. That means we will not have one of the geiger counters or the PA1000 power meter.
- We have added a Dymo S100, which MAY replace the much more expensive Arlyn high precision scale. This would be to mitigate risk of the Arlyn getting lost in the luggage or on site. Also, the drivers for the Arlyn are dated and have not worked on the windows 10 laptop, yet. They can work on the much heavier and older windows 7 laptop.

Effectiveness of the experiment:

The uncertainty on the ground leading to a rushed schedule, not having the PA1000 power analyzer and the extra radiation sensors will be disappointing, but the experiment should still be adequate to get us to the next step of interest or planning.

In the months of May and June of 2017, MFMP will have several large (and likely exciting) projects on our plate. The projects are summarized below.

AURA - Validation Testing of a claimed LENR Device in Eastern Europe with a COP of 10 done black-box style with no details of how the device actually works.

NOVA - Demonstration and Validation of a LENR device by George Egely claimed to produce dramatic transmutations in a microwave driven dusty plasma

ECCO- Validation Testing of a claimed LENR Device in India with a COP of 8 that will also include open publication of entire device and preparation processes. (This document)

HOMO - Characterization of samples from Alexander Parkhomov's latest few experiments

Background:

The announcement of the ECCO device in India has created a lot of stir in the MFMP circles.

Bob G's posts about the device:

<https://steemit.com/ecco/@mfmp/ecco-an-instant-on-off-ultrasonically-fluidised-dusty-plasma-ne-w-fire-reactor>

[Ecco-second-technical-discussion](#)

[ECCO Current Embodiment](#) - Summary document of our best understanding of what this device is and how it is made, and how it operated

[ECCO - Making nickel foil for reactor discharge electrodes](#)

[ECCO Technical Discussion P05](#) - A wide range of technical aspects are discussed in this audio including pipe sizes, ultrasonic coupling methods, heat exchanger configurations, dummy options, steam verification etc. Notes on this are in Appendix 2 at the bottom of this document.

About this planning document

This document is being developed live, online and with public access to view it. It will change as we learn more about the system to be tested. It will change as we get suggestions from interested parties. We believe in the power of the crowd to process information and contribute from many perspectives to make a better overall product. We welcome suggestions from viewers of this document. If you think you know a better tool or methodology that will leave less open questions - we want to hear from you! If you cannot make edits here directly, please join the conversation on [the MFMP ECCO web page](#).

Related Documents - these are introduced more thoroughly and linked below.

[Test Team Logistics](#) - this document will not be publically readable since it contains some private info about testing team members.

[Spreadsheet for relevant calculations](#)

[ECCO - Current Embodiment](#) - all about what the device is and how it works

[Test Plan: Calibration Calorimetry](#)

Test Plan: Calibration - Power Metering

Test Plan: Calibration - Radiation Detectors

Test Plan: Observed Run

Test Plan: Control Runs

Test Plan: Live Run

Diagrams (in a Draw.io file - must have Draw.io installed in google docs to see them)

[ECCO_AURA Instrumentation](#)

Project Plan:

There are several initiatives that this device is inspiring in the weeks since we have first heard of it.

1. **Validation Testing** - The main topic of this document is about doing a thorough series of tests to determine if the device actually creates more heat than can be accounted for through any standard science.
2. **Documentation of the Device** - in an attempt to understand how it is built, leading to understanding how it works, and eventually independent replication of the effect. Everything we learn about the [current embodiment is here](#).
3. **Widespread Validation** - planning on next steps to commission copies of the device and make them available to credible institutions around the world with the goal of establishing the phenomenon as fact and then creating a pool of open knowledge upon which to base numerous innovations and whole industries.

Validation Testing Goals:

- Validate that the technology is creating excess energy
 - Convince ourselves that he has what he claims and that it is worth putting more work into promoting it.
 - Develop bullet proof report that addresses as many issues with testing as possible to rule out anything conventional
 - Support everything with full LOS documentation
 - Publish as much about it as possible
 - Develop report on this current embodiment
- Help Suhas bring this to the world research stage in an open manner
- Lead into an international open research effort in tens or hundreds of labs around the world in order to get a foundational base of knowledge about this tech in the public domain for the world to draw on

We must recognize that no one report will satisfy all the critics, and this is only the first evaluation. If we do our job adequately, others will seek to redo it and build upon it. That is what the post validation open research effort will be for.

Timeline

We are already starting to experience a serious case of scope creep, which is inevitable when the crowd is involved, but we need to scale it down to what actually has a reasonable chance of being accomplished.

April 20 - 30 - Test mock-up constructed, calibration and debug.

This is probably a two-person job, with at least one of the people involved going to India. To me it makes the most sense to do this at HUG with either Alan's or my help. I would probably only be able to come for a weekend.

April 30-May 16 - Buffer weeks to allow for ordering additional materials, replacement instruments, general debugging, packing up equipment etc.

May 17 - Travel to Czech Republic

May 19-27 - Test AURA device

May 28-30 - Test Egely Device

May 31 - Americans fly home

June 10 - Fly to India

June 12-24 - Test ECCO device

Then - Travel home

Scope

- Will be testing in an unfamiliar lab in an unfamiliar country (except for Bob G.). Just getting there and getting the test set-up with streaming capability will be a huge hurdle. The test set-up needs to be as simple and robust as possible. We won't have Bob H.'s or Alan's help. It takes Alan weeks or months to set up for a test with a full measurement suite and he is very experienced doing it. We won't have that luxury. It's unrealistic to think that we will have time or access to the facility to do any significant integration in India.
- Sensor robustness and simplicity is more important than accuracy.
- Nobody will care about these tests if the COP is less than 1.5. Thus an accuracy of 5% is probably sufficient.

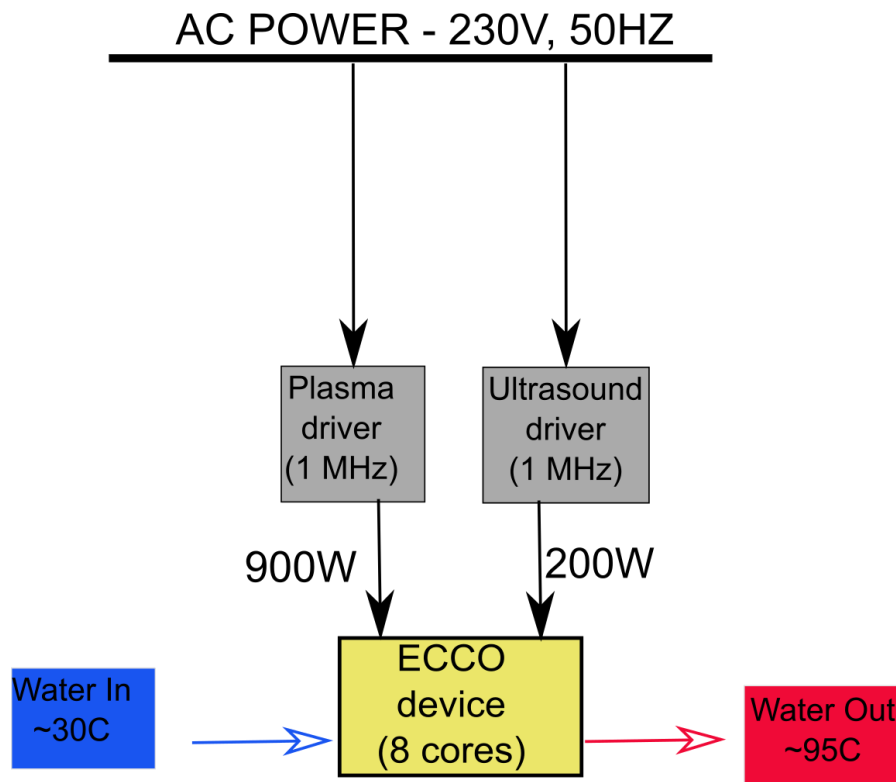
- Choose sensors that are easy to set-up, easy to integrate, and very robust. Preferably sensors we have previous experience with.
- We should focus on the basics and do them well.
 - Temperature in, temperature out, flow rate, electrical power in.
 - Multiple forms of measurement for each, with at least one form analog if possible.
- For each measurement have multi-layered backup plans that if everything else fails we can use buckets and glass thermometers to measure the power output and a fuse to limit the input power below a known level.
- Other measurements should be considered as a bonus if we have the time.
- We have to get all of this equipment to India.
 - Each Higgin's neutron detector is ~20 lbs.
 - The Gamma spectrometers require Lead caves and expertise to calibrate. Some of this may be out of the scope and a distraction from doing the basics well. Let's be realistic on what actually can be done.

Step 0: Preparations

Continue to plan, publish, and raise funds

- Dialog with Suhas to come to agreement on open goals and process to be followed
 - Make sure he and his team are OK with making our visit and efforts #1 priority while we are there
 - Inform Suhas of the scope and procedures of the tests and see if he is still comfortable
 - Have them do whatever tests they can do to rule out as many ways to fool themselves as possible before we get there
- Develop coherent, explainable strategy for bringing this tech out in an open science way

Basic Diagram of Device



Link to document with everything we know about the device - [ECCO - Current Embodiment](#)

Step 1: Initial validation in Mumbai, India

Top level - Lay out the 6 steps 3 calibrations, 3 types of runs

- And incorporate changes and perform an improved run or calibration
-

Do we have a data archivist? Or good procedures for archiving each component

Naming Conventions - YYMMDD_Datatype

Camera video streams must be defined

Set up of RF meters/ spectrum analyzers

Ultrasound meters?

Steps of the Testing

1. Document existing claims, device, process, instrumentation, plumbing, wiring as much as possible
 - a. Interview and take notes and/or video

- b. Photos of device
- 2. Observe operation as it sits before adding calorimetry
 - a. Measure with anything non-intrusive that does not require calibration beforehand
 - i. IR Temperatures
 - ii. Manual thermometer
 - iii. Flow rates into buckets
 - iv. Clamp on current probes
 - v. Measure for EMF fields
 - vi. Radiation - geiger counter
- 3. Install Instrumentation
 - a. Set up according to plans and diagrams
 - b. Demonstrate calibration of each device or system
 - i. Power Metering
 - ii. Calorimetry
 - iii. Radiation detectors
- 4. Do Control Runs
 - a. Observe operation with active cores
 - b. Observe operation without active cores - null core somehow
 - c. And with resistive heater as control runs
 - i. At same input power
 - ii. At high enough power to generate equivalent mass flow temperature differential in the water
- 5. Live Runs
 - a. Full instrumentation

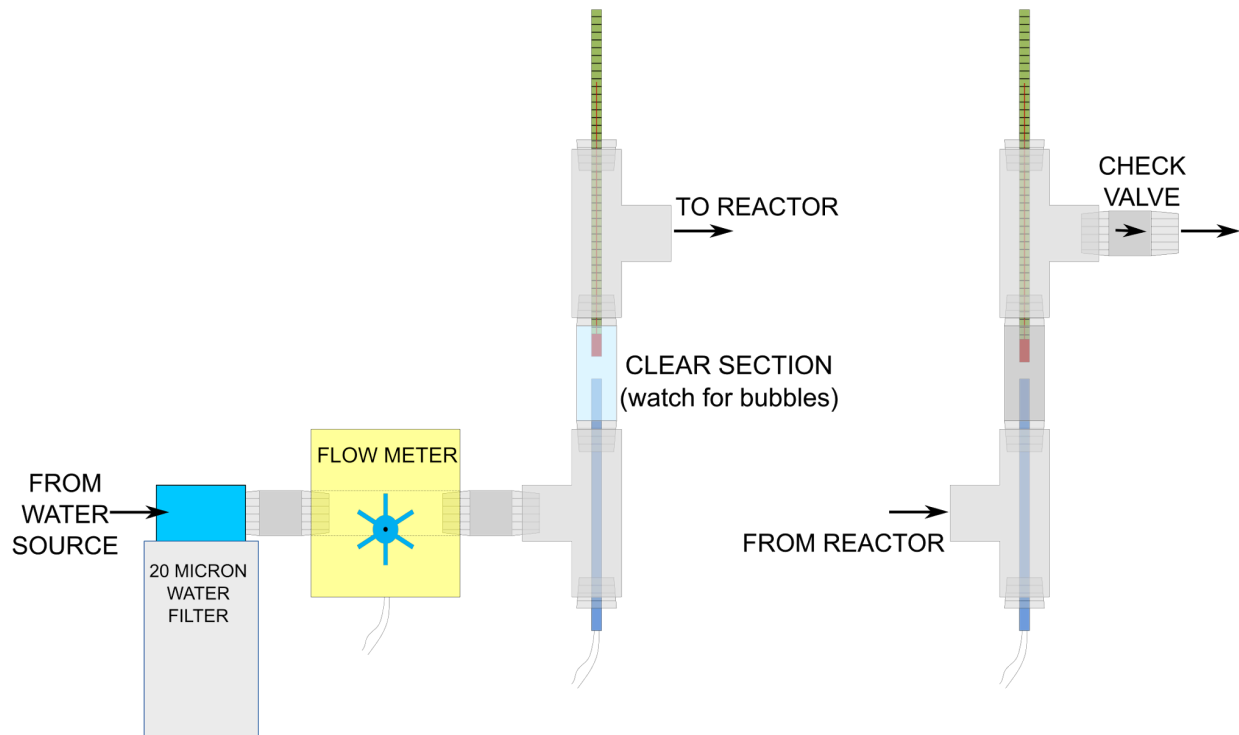
Instrumentation Plan and Discussion

We have put a lot of thought into how to make this test highly credible with reputable instruments and several layers of redundancy and consistency checks.

Our strategy is to have plans B, C, and D in all parts of the project so that if everything else fails we can use buckets and glass thermometers to measure the power output.

- 1. Temps:
 - a. RTDs
 - b. Mechanical Thermometers
 - c. Heat meter unit
 - d. Spot check with IR Camera
- 2. Flow
 - a. Turbine Flow meter
 - b. Heat meter unit
 - c. buckets and electronic scale with data logging

- d. buckets alone or with manual scale
- 3. Power in:
 - a. PCE830
 - b. Tektronix PA1000
 - c. Cheap watt-hour meter,
 - d. 5 to 10 A fuse



Discussion of temperature sensors

The check valve is important for keeping the tube full of water so the reading is more meaningful. In practice, the tubes may be mounted at an angle so any air bubbles can flow out.

Additionally, the whole assembly may be wrapped in insulation to keep the edges and shells at the same temp as the water to afford a better measurement of the water temperature. The insulation will be removed from the clear pipe section so we can see if there are bubbles going through the line. Bubbles in the line would make the flow meter reading suspect.

PT100 temperature sensors with integrated 4-20 mA output

- Relatively high accuracy
- Industrially tough with high noise immunity, good shielding, and good electrical isolation between the sense wires and the shell.
- [https://www.automationdirect.com/adc/Shopping/Catalog/Process_Control_-a_Measurement/Temperature_Sensors_-a_Transmitters/Temperature_Transmitters_\(Integral_Sensor\)/XTP50N-100-0300F](https://www.automationdirect.com/adc/Shopping/Catalog/Process_Control_-a_Measurement/Temperature_Sensors_-a_Transmitters/Temperature_Transmitters_(Integral_Sensor)/XTP50N-100-0300F)

Mechanical thermometer

- Large dial thermometer for easy on-camera viewing
- Completely independent of electrical and data complications

<https://www.directmaterial.com/adjustable-industrial-bimetal-thermometer-5-face-stainless-steel-case-w-calibration-dial.html>

Thermowells

- <https://www.directmaterial.com/thermowell-ss-316.html>
- 4" deep. 1/2" NPT

Clear plastic pipe nipples for viewing input water stream and observing any irregularities like bubbles.

- <https://www.mcmaster.com/#4677T31>
- PVC - max temp rating of 110F, so it will be only on the input water side so we can check for bubbles that would throw off the flow meter or cause air pockets around the thermometers

Additional temperature sensing with Optris thermal camera, and other glass thermometers. We will also have with us type K thermocouples, type C thermocouples, and some thermistors just in case we need to adjust plans.

Calorimetry of heat output

- i. Water flow calorimetry because he says it can be run with liquid water at 90-95C as (21-03-17 conversation with Bob)
- ii. Running it at lower temperatures, yet, is desirable in order to avoid local steam bubbling causing erratic, hard to measure water flow
- iii. There are water heat meters that are made for this job
 1. Census EU-Pollucom E is one such that is rated at 2 or 3% accuracy
 2. <http://sensus.webdamdb.com/bp/#/folder/1680165#37045544>
- iv. Temperature sensors
 1. Differential temperature reading is what counts, and that doubles the uncertainty of each individual temperature

- v. Calibration demonstration procedures?
1. For flow meters, calibrate by mass flow of water into bucket over time at various flow rates.
 2. Will require a lab grade scale up to 20kg or more
 3. Have multiple different flow meters
 - a. We will need specs on the plumbing and where we can add another flow meter and what fittings it will require.
 - b. A second flow meter will need to be pre-tested with the DAQ we want to use it with. We will want to pay special attention to the required straight length of pipe before a flow meter, too.
 4. Measuring the temperature of a flow of water sounds simple, but it must be turbulent and well mixed in order to be accurate and representative of the flow of water. We may need to add a flow mixer. Turns out it is expected to be very turbulent according to the calculations of Reynold's number in [this spreadsheet](#). In addition, the temperatures sensors are in elbows where the flow will be stirred up.
 5. Still should validate the flow rates while it is running using the bucket/time/weight system occasionally during calibrations and again during what looks like a successful run.

Excerpts of discussion of issues on temp sensors:

The longer the time constant is, the greater will be the variation between thermo-sensors. If this is used, it will require a shielded cable for the lead to the Labjack with the shield connected to the SS sheath and to Labjack ground.

Also note that the sheath must be inserted at least 1.5" into the water to minimize sheath conduction effects from the ambient.

The RF will create an offset at every exposed junction, producing an offset in some places whereafter there is gain. This is bad for an opamp because it could provide high gain and a high level offset. So, don't use the opamp board that Ryan was talking about for the thermistor. Just use two series resistors and a cap to ground in the input nodes. You will have to measure the source voltage and the two resistor nodes, calculate the thermistor resistance and then compute temperature from the thermistor resistance. Using the constant current source is a source of error. You can measure a source voltage, but measuring the source current is difficult and you will not be able to use the same current source for both - but you can use the same voltage source. Also, being a high impedance node makes a current source more susceptible to RF desense.

When it comes to accurate measurement, that system is going to have a problem with the sensor sheath being so short and insertion into the water being of so short length. It will cause ambient temperature to affect the

water temperature being read. Also, the cables need to be shielded. You will need some braid tubes.

There will need to be check valves installed and plumbing for the analog thermometers and to insure that the flow tube is always full.

b. Electrical Measurements

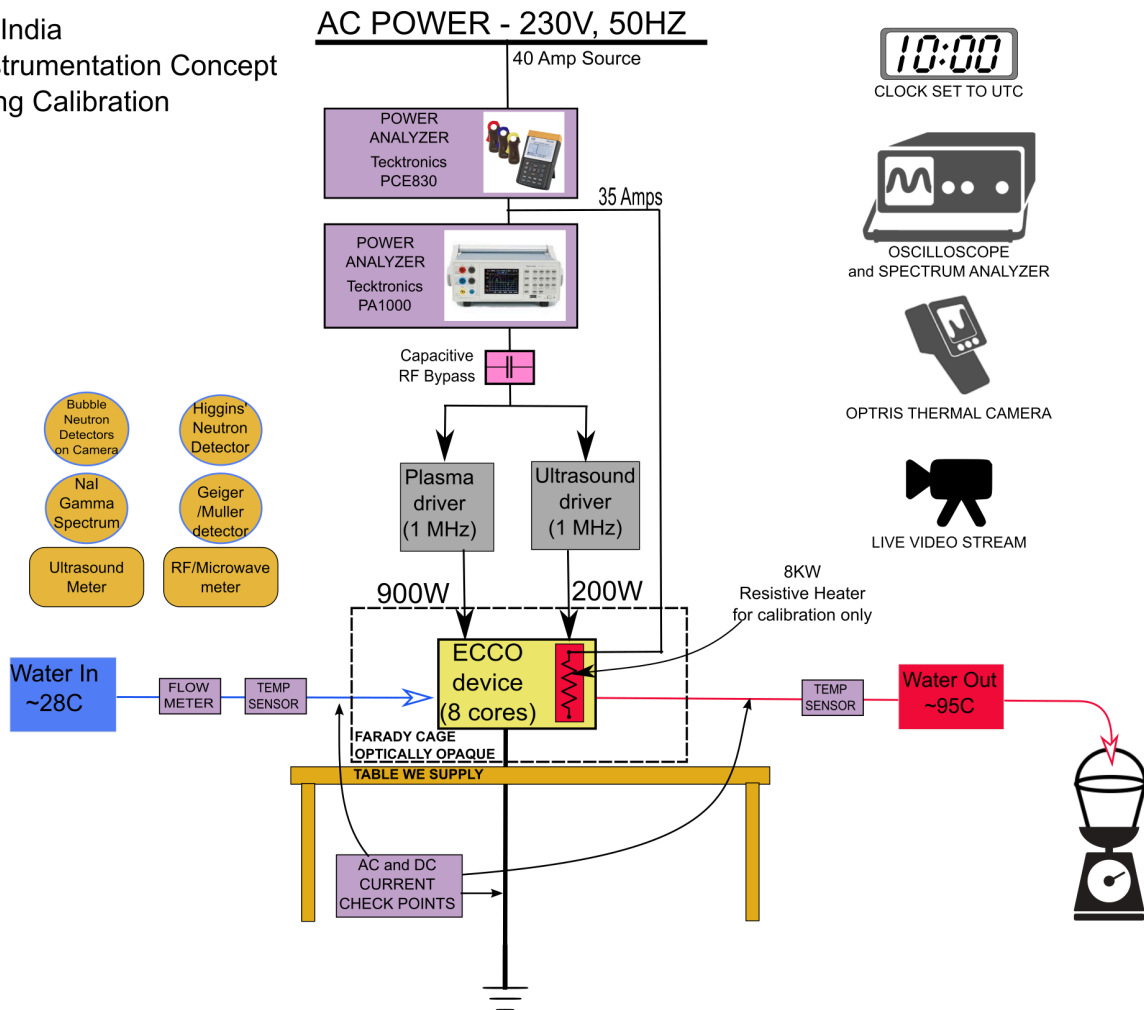
- i. Input Power => High end power analyzers on AC source with a filter to remove highest frequency components
 1. Large capacitor to filter high frequencies the meters can't see
 - a. This introduces a reactive power component that would need to be characterized during calibration for each meter
 - b. Possibility of L-C resonance could actually make things worse at certain frequencies
 2. Ferrite Bead RF Choke
- ii. Input Power => Cleanest way is measure DC (Not taking this option)
 1. AC=>48VDC
 2. DC Power Meter
 3. 48VDC=>220VAC@50Hz inverter (2 or 3 KW)
 4. There is a chance that the 1Mhz generator is 10% efficient, which would frustrate this idea - based on his story of testing the input power with a watt-hour meter, we can assume this is not the case
 - 5.
- iii. What steps can we take to calibrate with a known load? Let's define this procedure in the power metering calibrations plan.
- iv. Plasma generator waveforms
 1. More for understanding dynamics and mechanism of operation instead of actual metering
 2. Serves as a potential backup plan for approximating power in
 3. Oscilloscopes - make sure it is accurate and calibrated with the right probes
 - a. Measure current and voltage
 - b. Can we estimate the amp we are expecting to have to measure? What is the right probe for current measurement?
 - c. Purchased Hantek DSO5202P
 - d. <http://www.ebay.co.uk/itm/DSO5202P-2Channels-7-TFT-L-CD-800x480-USB-Digital-Oscilloscope-1GS-s-200MHz-UK>

[-/232279326396?hash=item3614ed3ebc:g:lg0AAOSwuxFY0h2w](#)

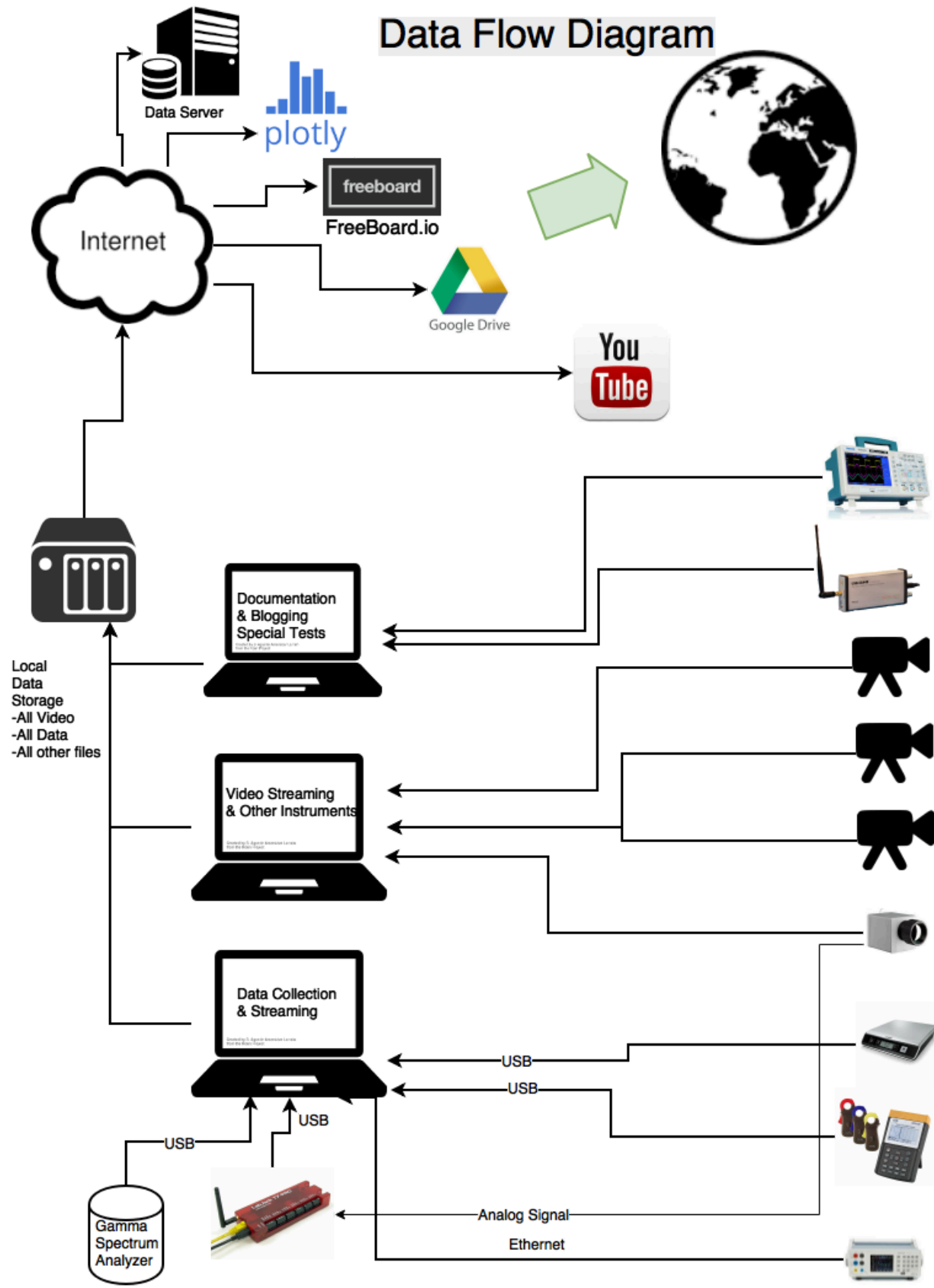
- e. Right probes to measure current and voltage is an issue
- v. Thermal imaging
 - 1. Optris camera to look for heat anomalies that would point towards some hidden power source.
- c. Is he fooling us? Ruling out other hidden sources of power
 - i. Faraday cage to rule out microwaves or anything
 - ii. Opaque shield to rule out IR laser, etc
 - iii. Set it on our own table/stand/platform to eliminate possibility of hidden coils, contacts
 - iv. Shield can also rule out focused ultrasound
 - v. Need to weigh before and after to eliminate possibility of combustion fuel inside somehow
- d. Is he fooling himself? Ruling out accidental power input
 - i. Are there high frequencies in the RF (like microwaves) that are not getting measured by whatever instrumentation he has indicating his RF power?
 - ii. Is there stray voltages in that building caused by dangerously bad wiring?
 - iii. RF noise and ground leakage current on sensors must be ruled out
- e. Radiation
 - i. NaI Gamma detector - Check for one locally
 - ii. Labjack with Plot.ly streaming, with integrated Neutron/GMC pulse and ROI counting data. PA1000 data can be included if it is used (Max. 20 Arms). 1000W input power @220VAC ≈5 Amps
 - iii. Neutron bubble detectors
 - iv. Geiger Counter - going without any lead shielding. That can come in subsequent studies
 - v. RF Spectrum analyzer to assess field strength and frequencies at various locations
 - vi. How thick is the cooling jacket around the reactor tube? Will there be an aperture through it big enough for useful gamma measurements? Will the coolant moderate fast neutrons and block thermal ones originating in the reactor?

Full Instrumentation Plan

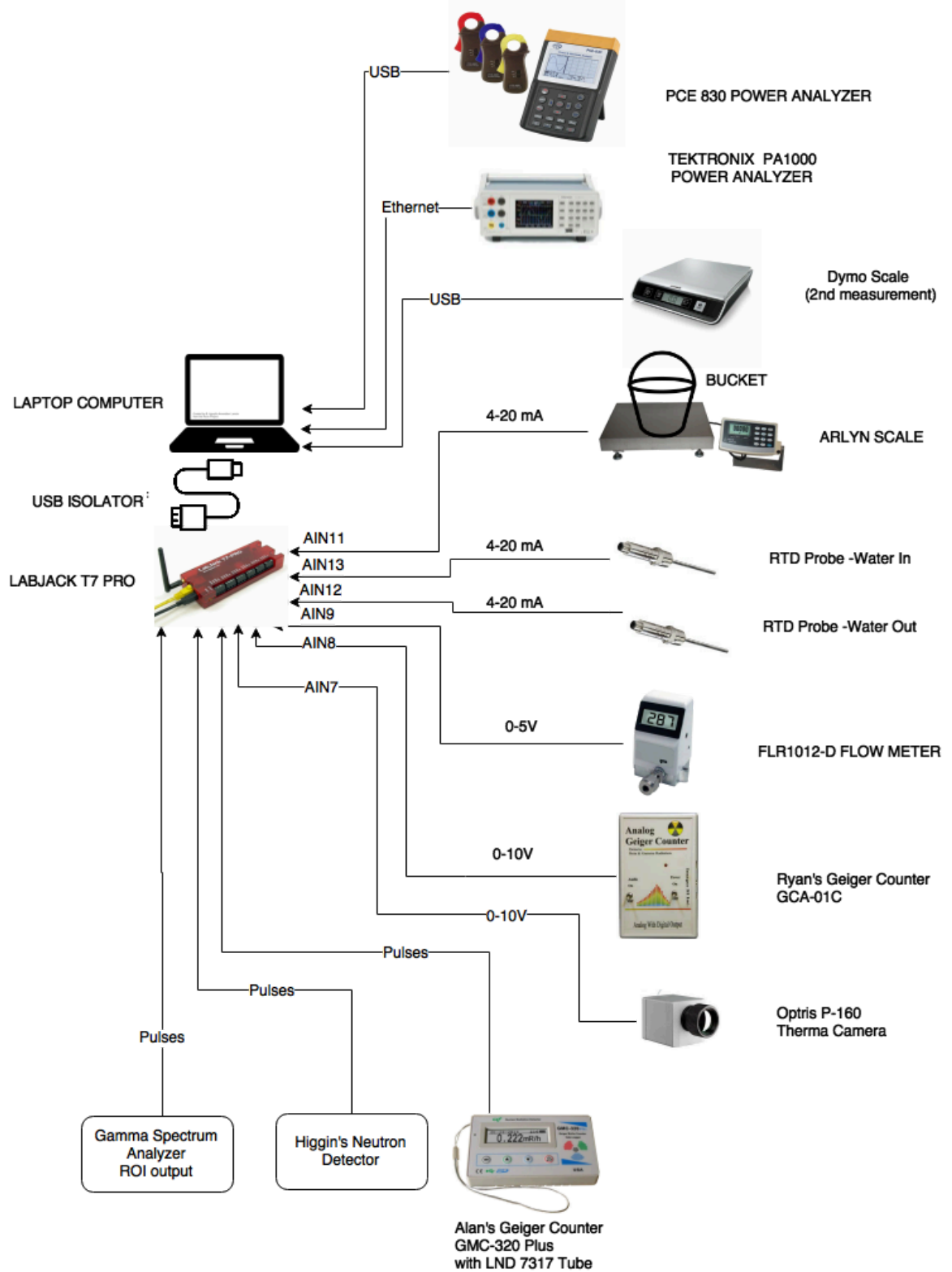
ECCO India
Full Instrumentation Concept
Including Calibration



Data Flow Diagram



LabJack Wiring



6. Fuel analysis Project

While the fuel analysis is not strictly part of a performance validation, if it is available to us, understanding the fuel preparation is very important. This study merits it's own paper separate from report on validation of excess energy production.

<Needs a test plan done for this based on the best info we have about the fuel prep process>

- a. SEM/EDX, ICP-MS
 - i. Bring samples back to Brno and use university machines
- b. Samples at each stage of production for each material
 - i. Components:
 1. Ti, TiH₂, Ni, Al, LiOH, C, K₂CO₃
 - ii. Powder sample at each stage (today's understanding)
 - a. After first 60 hours (Ti, 3%Ni)
 - b. After next 40 hours (Ti, 10% Ni)
 - c. After 20 hours with Al
 - d. After K₂CO₃/LiOH added?
 - iii. Plated Ni Foil
 - iv. Fully ready fuel
 - v. Used fuel after varying run times
- c. What other tests should characterize the fuel besides SEM images, EDX composition??

Instrumentation to bring or source there:

- 5 kg Scale - more precision the better
- Digital Scale
 - Dymo Scale - Amazon 10kg/25 lb version
 - Purchased:
<https://shop.arlynsscales.com/ProductDetails.asp?ProductCode=ultra-precision-scale&CartID=1>
-
- Magnetic stirring hotplate and 1 L beaker (or equivalent)
- Oscilloscope - just a decent oscilloscope to check everything
 - This one is available from Ryan
 - <http://www.vellemanprojects.eu/products/view/?country=be&lang=en&id=407512>
 - Only 12MHz with 25MS/s
 - Purchased Hante 200MHz, 1 GS/s new off ebay

- We have an offer to buy us high voltage, high frequency probes to be able measure the voltage and current waveforms of the RF plasma feed and the ultrasonics. That would require a much better oscilloscope, though.
-
- Good Multimeters and array of probes with clips and points
- Optris PI 160 calibrated IR Camera
 - <http://www.optris.com/thermal-imager-pi160>
 -
- Flow meter
 - Calibration and periodic check with buckets, a scale, and a stopwatch
 - Criteria:
 - Water
 - Center range about 1.7L/min
 - Good precision
 - Output to labjack (preferable 0-5 volt)
 - With proper plumbing adapters for whatever is in the lab
 - <http://www.omega.com/green/pdf/FLR1000.pdf> model FLR1012-D with display
 - \$440
 - 1% accuracy, 0.5 to 5 L/min
 - With display
 - Operates on 11.5 to 15VDC @30 mA typical
 - Optional NIST certificate for \$300 and 4 weeks
 - <http://www.omega.com/pptst/FLR1000.html> (ordered w/o NIST certificate)
 - Still comes with a calibration report
 - 12 Volt Supply Required
- Temperature Meter
 - High precision NIST traceable temperature meter for calibration of other sensors
 - <http://www.testequipmentdepot.com/fluke-calibration/thermometer-readouts/1551a.htm> +/- 0.05C \$700
 - <http://www.omega.com/pptst/HH911T-HH912T.html>
 - Measured by labjack according to this link <https://labjack.com/support/datasheets/accessories/ljtick-currentshunt>
 -
 - Ryan has a ThermaPen thermometer rated to +/- 0.4C, not NIST
 - Differential
- Temperature sensors
 - The flow meter is approximately 1% precision, so going overboard with precision here is not that important
 - Thermocouples are fine, but low voltage and maybe susceptible to RF noise - would need to be shielded

- ProSense XTP series PT100 w/ integrated 4-20 mA sender
 - <https://cdn.automationdirect.com/static/specs/prosensextpttp.pdf>
- 5" dial mechanical thermometer for easy viewing on camera
- Glass thermometers for backup
- How long for the leads?
- Shielding for leads <https://www.mcmaster.com/#braided-sleeving/=1770drk>
-
- AC power Meter
 - Tektronix PA1000
 - <http://www.tek.com/power-analyzer/pa1000>
 - PA1000 (it is 1MHz bandwidth. Plasmas are unstable and the ultrasounds are generated in the MHz range, so measurement must be done with higher frequency. Mat)
 - Can be output to the Labjack
 - With large 5 uFd capacitors between the load and the meter, any high frequency noise should be filtered out
 - PCE830
 - <http://www.industrial-needs.com/technical-data/power-anlayser-PCE-830.htm>
 - Much higher power reading capability
 - Can be the primary if we can get it into labjack
 - Or can be used for the 8KW (35 Amp) resistive heating test
 - Both above can be used to check each other
 - Simple plug in watt-hour meter
- Neutron Detectors
 - Russian neutron counter tube with polyethylene moderator and Bob Higgins' circuit (insert link to design) streaming into Labjack
 - Instrument design link
 - <https://drive.google.com/drive/folders/0B5Pc25a4cOM2Rml1MVpNc2NhOWM?usp=sharing>
 - Bubble Detectors
 - Two each of the BDT (thermal) and BD-PND (medium fast). They should be here around 15 April.
 - http://bubbletech.ca/wp-content/uploads/2014/02/BTI_BUBBLE_General_May720091.pdf
- Geiger Counter
 - Alan: I have a GMC-320+ that I modified to use a LND-7317 pancake detector. I couple the headphone output (negative pulse) from that through a 250:600 ohm

audio transformer to the Labjack. The transformer is needed to invert the pulse and get the amplitude up.

It seems to work well, and the count rates indicate that there are few if any missed pulses (dead time ~0).

- https://www.ggelectronicsllc.com/comersus/store/comersus_viewItem.asp?idProduct=4579
- <https://shop.kithub.cc/products/pancake-geiger-mueller-tube-lnd-7317>
- Ryan has a simple geiger counter with an analog output run through an R/C filter that has been used with a DAQ before
 - GCA-01C Analog Geiger Counters
 - <http://www.imagesco.com/geiger/geiger-counter.html>
- Gamma Detector
 - Ryan has a NaI gamma spectrum analyzer
 - Ortec Digibase, photomultiplier, with 2" NaI
 - Runs Maestro software - may need updating
 - Alan has a Spectrum Techniques UCS30 system, with all the options installed (including ROI output). The scintillator is a 50x50 mm NaI crystal. The MCA's ROI output is a standard logic pulse that the Labjack has no problem reading. The detector is in a lead brick cave (18 bricks, ~200 kg) which is essential to get useful signal/background. Obviously such an amount of lead would have to be sourced locally in India.
 - What else is available?
- Gamma test source
 - Used for testing/calibrating gamma detector and Geiger counter
 - Not an easy thing to bring on a plane. Any suggestions where to get one in Mumbai?
 - Thorium 232 from the Thoriated Tungsten rods will be a candidate.
 - <http://www.gammaspectacular.com/th232-spectrum>
 -

Environmental RF/Microwave meter

- Something like this? http://www.narda-sts.us/products_highfreq_srm.php
- For 12,000 Euros, it better be good, and it is! Very nice but overkill.
- Or this?
<http://www.ebay.com/itm/Narda-8712-Survey-Meter-With-8741D-Isotropic-Field-Probe-/302247110373?hash=item465f54e6e5:g:NisAAOSwo15YwYst>

This is the modern version of the microwave meter Mark loaned us. The probe is broad-band and the sensitivity is OK - 50 uW/cm². This seller has 5 other ones, some listed as "Powers up \$375, with hard case" and some "as-is for parts \$275". It's worth getting one that powers up if the budget will cover it, (~\$450 with shipping). Must get the 8741D probe NOT the A8742D which is for occupational exposure measurement (frequency weighted).

-
- Offer from Paul Breed: USB Spectrum analyzer
<https://signalhound.com/products/usb-sa44b/>
 - What kind of probe/antenna would work best?
- Ultrasonic sound recorders
 - One that can capture at high sample rate and look for both sub and ultrasonic sound.
 - [Here is a potential candidate](#)
 - Transducer as microphone with oscilloscope for spot waveform measurements.
- Wire for sensors
 - https://www.amazon.com/Silverback-Screamer-Conductors-Braided-Shielding/dp/B018H7D5YA/ref=sr_1_23?ie=UTF8&qid=1492114305&sr=8-23&keywords=braided+shielding
- Braided wire shielding sleeve for shielding and grounding everything
 - <http://www.daburn.com/2350TubularBraidPerMILSpecQQ-B-575and/orA-A-59569.aspx>
 -
- Favorite web based data streaming:
 - Labjack with Plot.ly streaming, with integrated Neutron/GMC pulse and ROI counting data. PA1000 data can be included if it is used (DC OK but max. 20 Arms).
 - <https://labjack.com/products/t7>
 -
 - All instrumentation we hope to bring should be set up and tested, calibrated, and with streaming to the web before we get on a plane.
- Power supply protection
 - Contribution from a supporter: "...the building is quite a mess when it comes to wiring and power supply can be unstable in that part of town. Do bring/arrange for some kind overload protection for sensitive equipment if this is to be plugged in."
 - Build or rent a UPS AC=>DC (with batteries) =>3kw inverter
 - That way power outages will not affect our schedule, too, @ \$10K/week, or so
 - <https://www.luminousindia.com/home-ups.html>
- Video streaming strategy
 - Youtube live streaming
 -
 -

Goal: mitigate risks of RF interference and ground loops with single point ground

Streaming Data Definitions

Data Output Files

Radiation data file

- Sample_Number - Log file sample number, incremented once for each logged sample
- Date_Time - Self explanatory
- Neutron_Counter_A_Total - Higgins neutron detector A total counts since start of test
- Neutron_Counter_B_Total - Higgins neutron detector B total counts since start of test
- GCA-01C_Geiger - GCA-01C Geiger counter total counts since start of test
- GMC-320+_LN7317 - GMC-320+ with LN7317 tube Geiger counter total counts since start of test

Calorimetry data file

- Sample_Number - Log file sample number, incremented once for each logged sample
- Date_Time - Self explanatory
- Watts - PA1000 Watts measurement
- Volts - PA1000 Voltage measurement
- Amps - PA1000 Current measurement
- Whr - PA1000 Watt-hour measurement, since start of test or meter was nulled
- Dymo_grams - Dymo scale gram measurement
- Arlyn_grams - Arlyn scale gram measurement
- Temp_in_C - Heat exchanger input water temperature in deg C
- Temp_Out_C - Heat exchanger output water temperature in deg C
- Ambient_C - Ambient temperature in deg C
- Optris_Temp_C - Optris ROI average temperature in deg C
- Omega_Flow_LPM - Omega flow meter measurement in Liters/min
- Arlyn_Flow_LPM - Arlyn scale estimated flow rate in Liters/min.
- Flow in liters/min = $\Delta \text{grams} * (1 \text{ liter} / 1000 \text{ grams}) / \Delta \text{seconds} * (60 \text{ seconds} / 1 \text{ min})$
- Arlyn_Flow_Filling - 0 when bucket is being changed, 1 when bucket is filling, manually entered by test team
- Dymo_Flow_LPM - Dymo scale estimated flow rate in Liters/min.
- Flow in liters/min = $\Delta \text{grams} * (1 \text{ liter} / 1000 \text{ grams}) / \Delta \text{seconds} * (60 \text{ seconds} / 1 \text{ min})$

- Dymo_Flow_Filling - 0 when bucket is being changed, 1 when bucket is filling, manually entered by test team
- Omega_COP - COP calculation using the Omega meter flow rate.
 - $\text{flow in grams/sec} = \text{flow liters/min} * 1000\text{g/liter} * 1 \text{ min}/60\text{sec}$
 - $\text{Power out} = 4.184 * \text{flow_rate} * (T_{\text{out}} - T_{\text{in}})$ flow_rate in grams/sec
 - Power in = PA1000 Watts measurement
 - $\text{COP} = \text{Power out} / \text{Power in}$
- Arlyn_COP - COP calculation using the Arlyn scale estimated flow rate. Defaults to 1 when bucket is being changed.
 - See Omega_COP calculation
- Dymo_COP - COP calculation using the Dymo scale estimated flow rate. Defaults to 1 when bucket is being changed.
 - See Omega_COP calculation
- Total_Excess_MJ - Total estimated excess energy in MJ. Calculated using the Omega meter flow rate.
- Energy In = PA1000 W-hr * 3600
 - Energy Out = Sum (Power out * Delta seconds) for each sample since start of test
 - $\text{Total_Excess_MJ} = (\text{Energy Out} - \text{Energy In}) / 1000000$

Social Media, open project documentation plan

Open Questions in this section:

- How is the internet there? Will we be able to stream video? Can we get cell data to augment?
 - AURA test: Answered: Re Internet - we can get 15GB 4G data plan for about \$20
- Is this below adequate?

This is key to making things open is making it understandable. Our plan to make things understandable is as follows:

Basically, (1) tell them what the plan is, (2) follow the plan, and then (3) report what you learned.

Overall Plan: This document!

- All related files will be in the Google drive folder **India - ECCO**
- Public read permission on everything
- Edit with permission

Before Tests

- **Test Plans:** All the initial tests will be detailed in separate documents. Links and brief descriptions are below.

During test

- Follow test plans as much as possible (see below)
- Facebook updates and occasional live videos.
- Live stream video to Youtube:
 - <https://www.youtube.com/user/FleischmannMemorial>
 - Separate video files for each phase of the project.
 - Use of ManyCam software to make composite of multiple feeds
- Experiment dashboard on freeboard.io
 - <https://freeboard.io/board/MwMhIL>
- Live stream data to Plot.ly
 - Link here
- Log non-streaming data on Test Plans in Results sections
- Adapt to unexpected situations with good note taking, documentation

After test

- Copies of data files are archived in the Google drive folder
- Copies of the data will be archived on several private servers around the world.
- Final report(s) drafted and published

Repeat with Improvements

If time allows, we will redo some tests while incorporating suggestions from the crowd to improve it or address concerns.

Throughout the process information will be disseminated via Steemit, facebook, QuatumHeat.org and other channels of social media.

Test Definitions

Create documents for each calibration and prescribed test with tables of data to fill in, calculations to be run, and/or field names and definitions for DAQ. Development checklist for setting up test design, user interface, and the physical assembly.

Live video of each test will be recorded.

Test Matrix

Before we get started we need to customize some test components to fit the situation. The task list for that part is in [Test Plan: #0 - Test Setup](#)

1. [Test Plan: #1- Observed Run](#)

This step is to observe and test the system operating with a minimal intrusion to how it is set up - just as it sits when we arrive. This will rule out any changes we make to the system in case it does not work later. It will also help us identify potential reasons the inventor misinterpreted his own results if ours do not match his.

2. [Test Plan: #2-Calibration - Calorimetry](#)

Demonstrate the validity and accuracy of the temperature sensors, the flow meter, the buckets and scale for flow metering, and the data integration

3. [Test Plan: #3-Calibration - Power Metering](#)

Demonstrate the consistency between power metering devices and that the data is being collected and displayed right

4. [Test Plan: #4-Calibration - Radiation Detectors](#)

Demonstrate each radiation detection device is functioning and, where possible, that is calibrated, that the data is flowing, and especially what the background levels are.

5. [Test Plan: #5-Control Runs](#)

In order to demonstrate that there is excess energy being created by the device, it would be ideal to get comparisons of the device operating with an inactive fuel load and with an artificial electrical load at a level near the expected power output. These tests may or may not be fully feasible.

a. Test run with no active fuel (null load)

- i. This will tell us approximately what the efficiency of the power supply and control equipment are so we can better estimate the energy output from the reactor itself.

b. Test run with electric heater instead of fuel

- i. Equivalent power out as seen in observed run
- ii. At various input power levels as a sort of calibration & test of calorimetry

6. [Test Plan: #6-Live Run](#)

Fully instrumented, isolated live runs where the device is expected to output excess energy.

7. Fuel processing study

- a. Report entire process and how he arrived at it
- b. Document with SEM/EDX each input material and after each step

Report Outline (test plan needed)

- Before we even begin we should be able to outline the test report formatted as a standard scientific paper.

Step 2: Post Validation Facilitation

Goal: Catalyze an international open research effort to give the world a foundational base of open tech and science to further private and public research and development.

- Creation of copy of a device to reside elsewhere
- Road show with working experiment may be necessary
- External validation
 - Make 10 to 100 copies for others to provide to researchers
 - Should start thinking about RFP to test copy devices LOS style.
 - Develop criteria, plan for proposal review and selection
 - Going to require some organization to handle the LOS data and results coming out of those researchers, archive, summarize, and organize releases and conferences. If we get a core of 100 researchers doing LOS research on this for at least a few years before doing other research, that is the kind of kickstart the world needs. How would researchers writing proposals get funding to do their work? Private labs will be doing things, also simultaneously. Should there be money contributed by research applicants to go towards making the device copies and disseminating the research?

Research goals:

- What, exactly is going on in there?
- How to improve performance and manufacturability

Checklist of other materials to bring

Long USB cables and ethernet cables - Preferably shielded

Powered USB Hubs

Labjack T7-Pro w/ NIST Traceable

Labjack CB37 Terminal Board

Labjack CB15 Terminal Board

Calibration weights

https://www.amazon.com/American-Weigh-Scales-2KGWGT-Calibration/dp/B002ULBZC4/ref=pd_bxgy_201_2?encoding=UTF8&pd_rd_i=B002ULBZC4&pd_rd_r=2XBZTFPTT9Q9BTB08DEY&pd_rd_w=eXxmD&pd_rd_wg=sMK12&psc=1&refRID=2XBZTFPTT9Q9BTB08DEY

Thermocouples

Thermocouple extension wire

Hook-up Wire

Soldering iron

Tool kit

Zip ties

Serial Cables DB9 type - do we have any serial connections?

Outlet strips with surge suppressors - European and American style

Power converters for US power vs India power

- https://www.amazon.com/2000W-Travel-Converter-Transformer-International/dp/B06XWTFJ1V/ref=sr_1_2?ie=UTF8&qid=1491186976&sr=8-2-spons&keywords=travel+power+adapter&psc=1
- https://www.amazon.com/QUALITY-TRAVEL-ADAPTER-PROTECTION-GROUNDED/dp/B0034E2TFS/ref=pd_sim_23_6?encoding=UTF8&pd_rd_i=B0034E2TFS&pd_rd_r=ZXZAZNZ9DNB4AJVSAZ0T&pd_rd_w=3XZSH&pd_rd_wg=uv3Sd&psc=1&refRID=ZXZAZNZ9DNB4AJVSAZ0T

Omega Flow Meter

12V supply for Omega Flow Meter

Testing Team Roles

LOS Social media, LENR expertise

LOS Technical expertise in instrumentation, live data streaming

Team members specific for graphics, documentation?

Translator for any written materials we can share?

Enough team members to run long hours

Locals from India who can help us procure instrumentation, run local errands, and navigate?

Add criteria, skills essential or preferred

- Acoustics familiarity
- Plasma familiarity
- Radiation measurements
- RF expertise
- Electrical power metering
- Chemistry/ physics background
- Electrical design, microprocessor coding
- Graphic design
- Writing/journaling
- On-camera comfort
- Awesome congeniality and pleasant teamwork

Selection Criteria:

There are significantly more people interested in participating than will fit the budget or fit in the small lab where the work is to be done. We will not be able to bring everyone. Priority will be

given to those with demonstrated dedication to Live Open Science methodologies and a skillset match.

Replication Effort (should be in another whole document)

- Tubes
 - Ni Foil, and the H Plasma in liquid technique he uses to plate
 - Powders
 - Sourcing powders
 - Milling powders
 - 1 MHz plasma generator
 -
7. Ultrasonic Transducer (1 MHz) Possibilities
- a. Massage Transducer:
<https://www.steminc.com/PZT/en/ultrasonic-transducer-for-massage-1mhz>
 - b. <https://www.steminc.com/PZT/en/conic-transducer-facial-massage-1-mhz>
 - c. Higher Power Transducer:
https://www.alibaba.com/product-detail/High-Power-Ultrasonic-Transducer-1-MHz_60206903172.html

Resources in Mumbai

There are about 40 schools of engineering in Mumbai.

https://en.wikipedia.org/wiki/List_of_colleges_in_Mumbai

Appendix 1

Contribution by Paul Breed - now incorporated into the test design

Basic concept is that you have to draw a box around the device and measure all the possible power inputs....

and the power output.

In the ideal world you would put a RF filter on the AC mains and measure the AC mains power into the whole stack of equipment...

For output you would measure the temperature rise in either a flow or circulating tank of fully condensed water....

Its entirely possible that the equipment making the RF and ultrasound power into the device might be less than 10% efficient.

This is not a show stopper as one can develop high efficiency drivers, but most lab equipment is built for best fidelity, not best efficiency.

This means you will have to move the power measurement boundary from the AC mains to the RF lines feeding the device.

Once you have done this... extraordinary claims require extraordinary proof...

So you have to eliminate hidden sources of power...

There are two broad possibilities here:

1) There is hidden power the experimenter is unaware of, his device does not work, but he truly believes it does.

This would most likely be things like :

Parasitic RF that is in the microwave region and hence his equipment is unable to measure it.

Put a low pass filter on the RF lines and then put a broad band power meter rated to 2X that frequency on the

RF lines.... Can also do current and voltage with a very fast oscilloscope....

Measure ambient RF with Narda or similar meter.

Gas Feed (probably not on this device...) hydrogen leaks and burns invisibly in air....

So you must measure the flows and ALL components into the device even if they seem unrelated.

2) Deliberate Fraud....

So how can you transmit power:

Electromagnetic fields, RF, IR laser etc....

To combat this I'd put a faraday cage around the device.

IE an aluminum box with all of the joints taped with conductive aluminum foil tape.

Mechanical means, compressed air, water pressure hydraulics etc...

You must measure the pressure drop and flow on ALL lines into/.out of the device.

Magnetic coils....

Best solution there is to bring your own plastic table and set the device on top of that with a metal plate between the table and the device. This plate can be part of the faraday cage.

Non-obvious electrical circuits....

Need to isolate device from ground (unsafe) or measure current on single grounding lead.

Also necessary to eliminate the possibility of a hidden radioisotope source.

Appendix 2

ECCO Technical Discussion P05

A wide range of technical aspects are discussed in this audio including pipe sizes, ultrasonic coupling methods, heat exchanger configurations, dummy options, steam verification etc.

<https://soundcloud.com/user-554048314/ecco-technical-discussion-p05-2017-04-24-at-0946>

Notes for Suhas Tech Discussion #5 by Alan Goldwater

02:00 There is evidence that the silver particle and other bits have originated on the anode (as Adamenko) and fallen on the cathode.

03:00 Suhas says there are no traces of Ag, Pb or other heavy metals other than Ti and Ni in the fuel feedstock or apparatus.

10:00 Discussion of Stoyan Sarg's work with possible relevance to ECCO fuel prep process.

16:00 Discussion of need for letters of introduction to support India Visa applications.

19:30 Request for data from water mass-flow calorimetry.

20:30 Request for price on reactor duplicate mfg.

21:40 Weight and size of reactor? Volume of water contained ~10-15 liters.

24:00 Nominal pipe sizes of heat exchanger 5/8" supply to 1/2" internal to 3/8" steam output.

27:30 Hours of access to lab not restricted ("round the clock").

28:00 Space for an equipment desk will be available

28:50 No restrictions on access and movement in the facility.

29:00 All power can be combined to one supply lead.

29:30 Null test by turning off HV or ultrasonic is possible.

30:30 Is an 8 kW heater null possible? Maybe, depending on parts available.

31:30 Mains supply available is 25 ampere 3 phase. Three 3 KW immersion heaters are available.

33:30 Facility is on ground+3 floor, ~40'. Water storage is at ~60'. Typical water pressure is 1.0-1.2 bar.

34:00 Piping is standard threaded stock. Dimensions will be supplied.

37:30 No suitable oscilloscope on site. We will bring one.

38:30 How is the heat distributed along the core? Not concentrated at the electrodes, rather distributed throughout the fuel.

39:30 Tungsten electrode penetrates through the Ni ball ~1.5 mm.

40:30 No degradation of the exposed electrode tip is seen on disassembly.

42:10 No experiments were done without the Ni foil, which is needed to retain the fuel.

43:00 No measurement of pressure has been done. Suhas estimates 10-12 bar based on cell volume and TiH amount.

44:00 Only a small vacuum pump is used. It was found that a large pump sucked out the fuel when used.

45:30 Reactor tube is sealed with several layers alumina cement at the electrode entries.

47:10 Ultrasonic horn is coupled to the tube with alumina cement. No macro cracking is seen on disassembly.

54:40 Ratio of fuel components is unknown after pre-processing. Bob requested a sample for analysis/me356 test.

56:30 Single-core reactor replica requested.

57:00 Spiral heat exchanger is all stainless steel.

58:20 Request for measurement of the steam temperature at exit pipe using a thermometer, with and without lagging insulation.

Appendix 3 - Questions we asked of Suhas

List of pre-visit tests and documentation he can provide:

What can we do to make sure that the claim hold up enough to travel all that way and be prepared and bring the right instruments

- Explain how he measures the input power now
- Measure AC power going into his Ultrasound and RF generator to assess the efficiency
- Photo or screen capture of RF waveform
- Get a Geiger counter and take readings while it is running
- Suhas did output assessment at 90 - 95C, so it can run in liquid water mode OK! Yay!
- Specific model numbers of his RF and ultrasonic generators so we can independently evaluate efficiency from device data sheets.
- How is the internet there? Will we be able to stream video?
- Can we define how we will put our own instruments into the water flow? Can we get pipe size, type, and connection types?

Open questions 4/6/17

Open Science

- What documentation can you provide that you are really putting 1KW in and getting 8KW out?
 - Do you have any data or description of the tests you ran to measure output heat and input power?
 - A short demonstration video showing the watt hour meter(s) and filling a bucket with warmed water and measurements of the input water temp and output water temp would be excellent.
- Will we be able to place the device on a surface we supply with an open space between it and the floor?
- Can we get a photo of the whole device in the room so we can understand how to make an effective faraday cage?
- How many hours each day will we have access to the lab to set up equipment, calibrate, debug etc.?
- Is there a space for us to work i.e. multiple laptops with desk and chair, tables for our equipment etc?
- Will chaperones be required or do we have freedom to move about the lab as necessary?

Electric Metering and comparison between active and inactive run

- Can both the non-spark discharge and the Ultrasound be powered from the same source of AC power so we can use one power analyzer?
- Can he dry run without fuel? Or load it with a powder that will not generate the effect so we can do a comparison?

- Can he put an 8 kw electric heater in there for a test of the water flow calorimetry? What else might he suggest to demonstrate what it operates like without the active effect vs with the active effect?
- Is there convenient power source to be able to do an 8KW resistive heating test to calibrate the calorimetry? We would need a 40 amp circuit, or a 3 phase. 20 amp source. And a heavy enough variac to control it?

Water Flow

- What is the typical water supply pressure and is it regulated, or subject to periodic or random variation?
- What size (ID and OD) and type of pipe that feeds water to the device and does he have a recommendation for inserting a flow meter into it?
- What is the size and type of output water pipe (ID and OD) plus any fitting sizes

Other instrumentation

- Is there anyplace nearby that rents good instrumentation? Does he know of any source to borrow instruments so we don't have to carry them all?
- Do you have oscilloscopes available there? If so, what kind?

Reactor and reaction questions

- Do you have a picture of the discharge pulse shape from an oscilloscope?
- Any chance of being able to weigh the device before and after a run?
- How is the heat output distributed across the length of the reactor core?
- are the two electrode regions where the nickel is located the place where the heat is the maximum? This might make the reactor tube look like two bright spots with a darker space between.
- OR, did the reactor tube look like a bright line across the gap between the electrodes? We are trying to ascertain in what region of the reactor that the LENR is taking place.
- Are there any photographs of the glowing hot reactor tube?
- Have you ever run the experiment without the nickel foil? And, if so, what happened?
- Do you have an idea of the hydrogen pressure during operation of the reaction?
- The alumina tube around the dusty plasma reaction is at 1100C. If that is true, then what do you have coupling the energy from the transducer coupler into the alumina tube? Is it only air coupled?

Appendix 5 - Pitfalls of Metrology

The author of this excellent analysis of how our instruments can fool us "[Petenshi Zen - Spotting Untrustworthy Measurements](#)" provided this excellent analysis