AURA TEST LOG

Implementing this log to keep people updated on the progress.
Important links
Freeboard Dash Board https://freeboard.io/board/MwMhlL
https://plot.ly/~QuantumHeat/29/aura-flow-temperature-power/
https://plot.ly/~QuantumHeat/30/aura-radiation-detection-counters/

Aura plan doc
https://docs.google.com/document/d/1qbG-p8qKbuFnPOdkm0XgwJpUvzHSvWM84-geOCF38pw/edit#

21-05-17
Finally in the accommodations with all the equipment, so we start setting up the computers and data acquisition system. This is the first time all the equipment has been in one place. We smoked a 120V outlet strip with surge suppression by plugging it into 240. That magic smoke is never going back into that device. Got the power leads for the power meters crafted. Got the oscilloscope software installed and working. We know how to capture video, wave forms, and data, now. Made a lead for the ultrasonic microphone so we can power it from USB and observe it with an oscilloscope. Brian made the data connection to the PCE830 work.

We plugged an electric tea kettle into the PCE830 and PA1000 power meters and they reported within 3 Watts over 3.1 KW, or 0.1%
The cheaper plug in power meter was also within 1%.

Ran and filmed the bucket test in the bathroom. The intent was to demonstrate that we can measure the input power, volume of the water, and the temperature rise of the water and have it all work out. The back of the napkin calculations worked out.
https://www.youtube.com/watch?v=Soi4zb75Jv0
Anyone wanna do the calculations for us?
Lessons learned:
Water stratification in the bucket is a thing and requires stirring.
Vapor coming off the bucket at higher temperatures is a thing and clouds up thermometers and represents some extra heat loss.
The handy little power meter seems to be pretty nice device.

22-05-17
We are tackling the plumbing. The landlord helped us get power for the electric water heater we are using for the dummy load. We ran water from the wash machine to the balcony for the

assembly. We had to fix a few leaks. We had to troubleshoot the data connection to the PA1000 (over ethernet) for most of the afternoon. After that, we managed to pull off the first test with water flowing and data being collected in a set of text files. First measurement shows we read 3% high.
The landline internet is out of order so far. Hopefully it will be fixed soon because it is really limiting our ability to stream experiments live.
We do not have the neutron detectors set up at the moment, or the scales, mostly for lack of table space.
We went to the hardware store to get more supplies. Then we mounted the plumbing apparatus on a metal lattice with zip ties. That way the whole thing can be brought assembled to Me356.
We will assemble the heat exchanger tomorrow. Insulation was placed around the hot side temperature sensors in order to avoid losing heat and keep the dial thermometers as close to the sensors as possible.

23-05-17
Me356 is not going to be ready today. We continue to run calibration and integrate the instruments. Having not seen the real test environment or the AURA device, yet, we have not made any progress on the faraday cage. Bob is fetching a table though.

Created this document and caught up our progress, roughly.
Testing thermometers in pans of water at room temperature to get a relative offset.
Glass thermometers first.
[See Spreadsheet]

Sensys meter, too (since we have to submerge the entire unit we cannot boil it). The 2 temp sensors read only 0.018C apart

Starting to assemble heat exchanger unit.
Will put the calorimetry thermometers in a deeper pan we can heat.
Put a stainless steel dish washing scrubber under a ceramic saucer in the bottom of the pan. All the thermometers sit on this saucer so the bottom of the pan is not directly influencing them. The scrubber has a bit of soap and oil, so the water is not terribly pure. And there is a chicken cooking in the oven and I am getting hungry.
The logging was started from the data acquisition and the burner turned on. I am taking photos of the temperature readings approximately every 10C. The timestamp on the photo will compare against the log file to make comparison graphs.
It is already abundantly clear that we can measure things well within a few percent, which is very adequate.
Barometric Pressure here at the moment: 30.00”, or 1015.92 mbar
Ramped temps up smoothly to 90, then turned up higher to get to a stable boil point.

The water level dropped and the digital sensors were only partially submerged and ended up showing 96 at boiling. Had to add more water and let it get hot again. This allowed me to recapture a 90C data point. Last data point as temperatures come to steady level at boiling.

They ended up at about 97 for the digital readings, 98 and 100 on the dials. When I swapped the dials around, I found the dial of one was hotter than the other, probably from hot air coming around the pan. Now we are at 99 and 100 on the dials.

Here is a video of the sensors during testing

We have now confirmed that our lab thermometers fit into our analogue dial thermowells with a fraction of a millimeter clearance.

The results of the temperature comparison is not particularly insightful, but it does clearly demonstrate that the instrumentation will be very easily within a few percent goal. The level of testing we were able to pull off with pans on the stove instead of magnetically stirred not plates was not sufficient to make real calibration adjustments to the temperature sensors. And, due to internet service issues at our rental place, we were not able to stream it live. The data is available in the spreadsheet. There are photos of each data point. Everyone can have faith that we can tell the temperatures and differentials adequately to measure more than a 10% excess energy.

Depth of thermowell means that we will have to look into the thread to see below 20°C - down to 5°C is possible.

The rest of the day was spent assembling plumbing, having dinner, setting up the scales, getting a backup data collection computer going, and then troubleshooting windows wifi vs lan preferences.

Ended the day with a live video on facebook touring the components and the data streaming.
https://www.facebook.com/MartinFleischmannMemorialProject/

24-05-17
Started the morning out working to add a chat function to the dashboard at freeboard.io
Must complete the plumbing for the heat exchanger, today, and work through as many of the calibrations as we can at this location. Bob is on his way back from errands in Brno.

We anticipate doing the validation of the flow meter now that the scale is hooked up.
We can demonstrate function of the geiger counters, measure backgrounds from the neutron detectors (though, we will have to do that again on location, too)

Test 3 - setup and testing of electrical metering system
Alan will do a video documenting the electrical metering wire hookup.
We will test the accuracy against each other on various load levels.
Bonus: we will put a diode in circuit to create a half wave to give us a DC offset that the PA1000 can detect for us.

Our Optris thermal camera is missing its USB cable. We may have to run without it for this test unless we can get another from the local distributor.

Did a video and uploaded a few photos of using an SCR balanced half wave type voltage converter to power a light. We were hoping for a diode like half wave with a DC offset, but this was a different type. Still, as demonstrated in the video, we proved how we would see a DC offset if there was one. The videos and images are currently (and slowly) uploading to the Test 3 Data folder in google drive.

Beginning test set 4 -Radiation detectors. Once we complete that test, we can pack those detectors up and make some room on our tables.
Beginning gamma spectrum background. - shooting for 2000+ seconds of spectrum.
Then we will start it again with thorium and see if we can calibrate based on that. It's a messy spectrum, though. We may have to use just the K peak.
Had to change some network settings. Starting logging and streaming of data at 15:03 local time for test 4. Getting background rates for at least 30 minutes.

Had to adjust the gamma detector photomultiplier voltage down from 900V to 850 so the K peak was within range on the NaI detector. Then we have that as a peak to reference from.
Debugging Alan's neutron counter- nevermind. Operator error.
Reset Alan's neutron at 15:12
Looking for diode in a hair dryer to see if it is suitable for testing DC offset. Nope- double heater windings, instead.

Completed the background sampling on all 4 radiation counters. The data file will be in the data/test4 folder. A screen capture of the graph from plot.ly is in the folder. The data file includes a short period at the end of the test where we held a Thoriated Tungsten rod against the geiger counters to show that they are sensitive and the data is coming from them through to the web ok. This part was caught on video and the video will be uploaded to that same folder (slowly, unfortunately)
High spot on the graph is from the counter being reset. There is a pretty decent range of counts per minute, but it is clear when there is a real signal from a close source. We will just have to see if there is anything we can detect from the AURA device, since we are told it includes shielding.
The radiation counters are packed away, now. Moving back to the power testing. Then the flow testing and the control runs.

Finished Test 3 - Power metering
We did a video (uploading ASAP) demonstrating power metering of 5 load levels and explaining the wiring. THe only difference from the plan was that we have not yet put a noise filtering capacitor across the line. We do not plan to put them in unless noise becomes a problem.

Results table Test 3.B

Load	**PA1000**	**PCE830**
Halogen light	0.13428	0.132
Hair dryer (low)	1.015	1.0008
Hair dryer (high)	1.714	1.702
Electric Kettle	2.102	2.087
Water heater	3.282	3.27

Very adequate agreement for this test. They agree better at higher load than lower loads, apparently. The data below is based on the photos taken and uploaded to the folder. If anyone wants to explore the logged data file, they are more than welcome, and let us know if that yields extra insights.

Load	PA1000	PCE830	Difference	% difference
Halogen light	0.13428	0.132	0.00228	1.70%
Hair dryer (low)	1.015	1.0008	0.0142	1.40%
Hair dryer (high)	1.714	1.702	0.012	0.70%
Electric Kettle	2.102	2.087	0.015	0.71%
Water heater	3.282	3.27	0.012	0.37%

https://docs.google.com/spreadsheets/d/1TxO4QGPxgEwGKKKxml9-rSZfX0DU_-Pd7zqE_jhFhaM/edit#gid=0

Test 2.B - Flow meter calibration

The max flow we can push through the apparatus at the current water pressure is 2.5 L/min
The water heater has quite a bit of flow resistance. For now we will get 2.5, 1.75 and 1.0 L/min
Later on we can get higher flow rates if necessary when we plumb in the heat exchanger since it should have lower resistance.

Bob Recorded Video
Timed 4:21
Mass of water 10.757 kg
Target flow rate: 2.5 L/min (though the flow varied a bit over time)

Time	4.21	min
Mass of water	10.757	kg
Density	1	kg/L
Average flow rate	2.56	L/min
Target Flow rate	2.5	L/min
Difference from target	-0.0551	L/min
	-2.20%	
Actual average flow rate from flow meter	2.48	L/min
Diff from scale	0.07	L/min
	2.80%	
Average calculated from Arlyn by software	2.34	L/min

difference from mass/time	0.22	L/min
	8.48%	

So, we have a small problem with the average flow calculated in the software. It is supposed to be a 10 sample running average. We are sampling every 1s from the Arlyn scale. Brian is debugging it right now.

Otherwise the flow rate as measured by the flow meter is within 2.8%. I think that is within manufacturer's specs.

Debugging mass flow calculation from the Arlyn scale.
https://docs.google.com/spreadsheets/d/1BqNCz_Tmu2kv-vMm3c4B3PN5esmYDrP2S5Yk56L9zaI/edit#gid=1774110420
Looking at issues of periodic lower difference like a cycle time interference of reading versus calculating and logging. Trying to calculate after each read, instead.

Continue to see variation in flow according to the scale measurements. The total weight adds up over the duration of the experiment but the flow has a very periodic 5 to 6 second drop off. We have analyzed everything in excel and the code and we seem to have no evidence that it isn't really the weight signal.

Tomorrow we finish up and then go off to Me356's about 4pm. Lots of packing to do.

25-05-17

Bob did a video on the sensors in a cell phone and what we can potentially learn from them. Uploading it to Data/Test 0 since it doesn't fit in other defined parts. Scratch that. Bob is going to upload it. The tool is called Sensor Multitool

Our Ortec NaI gamma spectrum detector is functioning very poorly. It appears that the crystal may have been damaged. Potentially from heat during a previous test or potentially from travel. It will give us very dull and diffuse spectrums with broad peaks. I taped a thoriated tungsten rod to it overnight and got a surprisingly flat spectrum.
We will bring it and set it up and see what it will give us, but it may only be a hint instead of the spectrum we would want. Perhaps Me356 would allow us to share data from his detector.
I need to put those spectrum into the Test 4 folder for comparison.

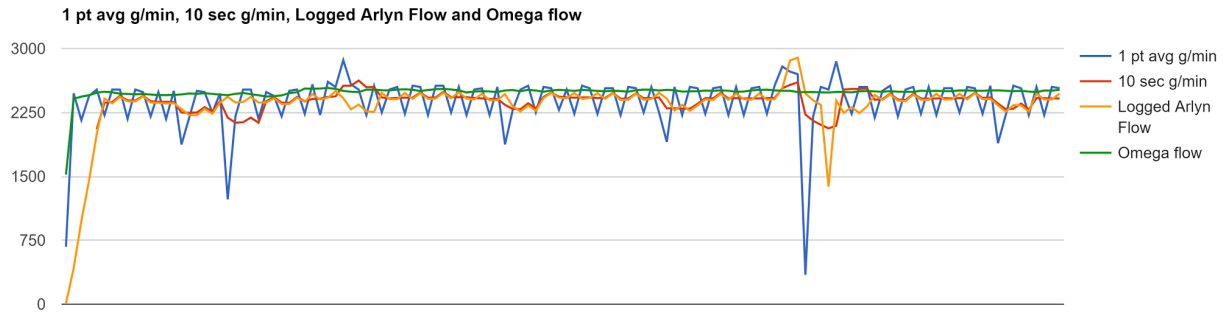
Shows the banana test with some K salt in addition. The detector failed to show a strong K peak. It was very modest 1.4 MeV peak.

Shows the Th test which gave almost no recognizable peaks in logarithmic mode. (bottom graph)

We are ensuring that the main and the backup data collection computers are fully configured and functional. Alan will need his computer for audio processing during the test.

Bob is stringing a camera overhead to capture the pack up process.

Still need to leak test the hot side of the heat exchanger.
And we need to do a control run after we replumb the connection between the filter and the flow meter to be straighter to see if we can get a better agreement with the measured mass flow by the scale.



We found that the scale looks like it was reporting a slightly lower than expected increase in mass about every 5.5 seconds. We saw it at multiple sample rates and multiple flow rates. We rearranged the averaging routine, but we saw it in the basic data. We tested the average calculated by the integration software against the total mass over time and they compare favorably. Now we believe that the SAW technique in the scale must make periodic adjustments as the mass changes and the load ramps up.

Brian copied the code that reads the scale into a separate program so there was no averaging. Then he studied the data and found it making that same pattern. The periodic adjustments must be be involved in the precision ultrasound. They represent only a few grams and a tiny percent of full scale. On the latest test run it was stepping up 55 grams per ½ second. The low reads were about half that so, about 30 gram adjustment. In terms of full scale, it's relatively small. Our comfort is that it works out in the long term average to still be accurate.

More graphs and spreadsheets are in the data/test 2 folder.

Meanwhile, Alan tested the hot side of the heat exchanger. No leaks in any hard joints. The water pressure here was adequate to pop the pressure relief valve, though. We have very little

idea what to expect for steam pressure out of the AURA. We may have to try to source a higher pressure one if this one is not adequate.

Alan spent some time getting familiar with an ultrasound sensor, feeding it into his laptop and analyzing the sound recording with Audacity. I forgot to get pictures.

Starting Control run. Test 5.A

Streaming data.
Will do facebook live video
Done. Found a bug in the COP calculation from the scale flow measurements.

Placing the log file into the data/test 5 folder.
Modified software to report Watts output from ARlyn scale based calculations. REady to do a quick test of it. A wet-run
WiFi snafu on the logging computer. Restarting software

Next test run streamed live on facebook. Success on both methods. The calorimetery by mass flow was closer to 1. The flow meter read 5% high.

Plumbed in the heat exchanger instead of the water heater. Dealt with leaks. Measured over 6 L/min maxing out the flow meter. When we tuned it down the sensys meter was in close agreement to the Omega flow meter. Very encouraging. When the sensys says 0.060 m^3/hr the Omega showed 1.01 L/min.

Now time to take it all apart and take it to the test site.
And have some lunch.

Stay tuned.

20:15 UTC - all set up with our equipment at the test site. Me356 has shown us the reactor. It is cute - in an industrial way. It is an aluminum box, basically. Photos to come tomorrow. Tomorrow we will connect the device's steam output to our heat exchanger. The source water for the device will come from a large 40 liter bucket we brought. We will fill it with filtered water. His metering pump will pull it from the bucket and feed his reactor. If our condensate is cool enough, we can put it back into the bucket. It has to stay under 60C, though, for his pump.

We are finding the experiment room to be relatively high background radiation. Ryan's Ortec gamma detector is giving us a decent background spectrum with a clearly visible 40K peak at 1.4 MeV. We are running another test with a Thoriated rod Me356 has provided. The gamma detector is going to sit directly beneath the middle of the device along with a geiger counter. We will place a neutron detector on either end.

Bob is just about to post a video…

Magnetic and gravity vector sensing for all
https://youtu.be/PJoW2q9p_Es

Final testing time lapse
https://youtu.be/bQLO1QVcM1c

Take down and setup
https://youtu.be/MCSryMOJcOI

Me356 has an identical Optris Camera and has lent us the USB cable. He has also lent us his gamma detector to use if ours is not satisfactory. It is a gamma spectacular and we will have to download the software.

Hazards we face during the test tomorrow include high temperatures, high voltages, steam, possible radioactivity, falling debris from the old plaster

26-05-17
Did a facebook live on the way over explaining much of what we know and plan.

We have spent time with networking issues and installing another light on the wall.
Completed a very nice gamma and geiger and neutron background study.

https://docs.google.com/document/d/1eOYKPCAr6O4IlUrnYIu-u8L3-ykjEdRBtPc9IzSkKlY/edit

We have plumbed the steam input for the hose we were given by Me356. Then we ran the steam safety vent line out a hole in the back.
Now we are doing the final hose for the condensate drain.
We are also wiring the analog output from the Optris so it is logged by the LabJack.

Me356 is eager to get going. He keeps offering to help us with whatever he can. He is trying to get his gamma detector running on one of his computers. It will not stream data, but we can synch the time and add it to the data folder afterwards.

Because he did not have a reactor set up and ready to run when we arrived, we are skipping the observed run. We have a lot more control over the device's installation than we thought we might.

That means all the data from this will be in the google drive test data/test 6

13:55 UTC - The reactor has arrived. We will begin a live video soon.

First test is going to be a test where we sparge steam into a bucket.
We will weigh, measure, and video the device.
We will do a video tour of all the instrumentation.
Then we will fill the bucket on a scale so we can note the mass of water to be warmed. WE will note the starting temperature.
Then we will connect the reactor and start it up and see how long it takes to heat the water 50 or 60 degrees C

This is the simple test. We did a prototype test a few days ago

We changed from grey shirts for set-up to white shirts for testing. Arbitrary bit of fun.

Updated post on QuantumHeat.org

We are spending a lot of time getting all the cameras queued up.

First look stream…
http://youtu.be/X9EL_rEzjWg

Live and streaming. Explained the instrumentation. Starting measurements of the device

Length 52.5 cm
Width 8cm square extrusion

Add-on box 5 tall, 7 out from box, 4 wide
3mm down from top
23cm to steam vent from end away from plugs
Water inlet 11.5 from end with plugs

End connectors
Requires drawings and photos.

Weight of control box w/ cables 1652g
Control box w/o cables 872g
Weight of AURA dry - 3017g
Volume=3500cc
Net density according to Alan is .862 g/cc

15:58 UTC - Ran into a problem with a backwards wired plug which would cause problems with the controller. We are sorting it out and trying to figure out which plug we can reverse to make it right. Good thing Me356 checked it out.
We need a longer ethernet cable to the controller. Bob brought one. That eliminates the concept that the ethernet cable may be special. Earlier we had his ethernet plugged in and working in our router, so it is not a viable source of power.

Now he is leveling the reactor nice and flat.
Still sorting out the wiring issue. Testing with a hair dryer.
The sparge test copper coil has been filed to be able to get the steam hose onto the end.
Water lines attached
Steam lines attached
Discussing expected flow rates and details of this test
About to start the pump to fill the reactor with water
Adjusting location of the gamma detector to be closer to the device
Water through the reactor and pumping.
Bucket filling up.
SCale was tared to zero with bucket and sparging coil and temp sensor on it.
Shooting for 20 kg of water or more.
Starting data collection for baseline data. Starting up plotly, too
Test Name 6- Sparging
Filled bucket with 30.07kg water
We need to have Me356 start the reactor and then leave before we can stream video.
Delayed for oven fresh pastries…

30kg water *4.184 KJ/KG C
=125 KJ/C
Let’s see how many C/second we get

AURA: First Look
https://youtu.be/Jnm8X_eht0o

17:22 - RAVI started

Me356 has started controller. Power draw of controller 4.8. Pump is making a cycling pulse on the power. Up to 16W from the metering pump

Bob is slow getting all the many cameras going.

3:18 to heat 35.4kg water 1 degree from 18.2 to 19.2
=148 kj/198 sec
=0.747 kw
But the input power is varying over time.

Me356 wants to slow the water flow in order to allow the device to get to temperature.

18:33 utc input water bucket 16C
Sparging bucket at 22C
Transferred water out of sparging bucket back to the input water bucket
Mass of water in sparging bucket 30.

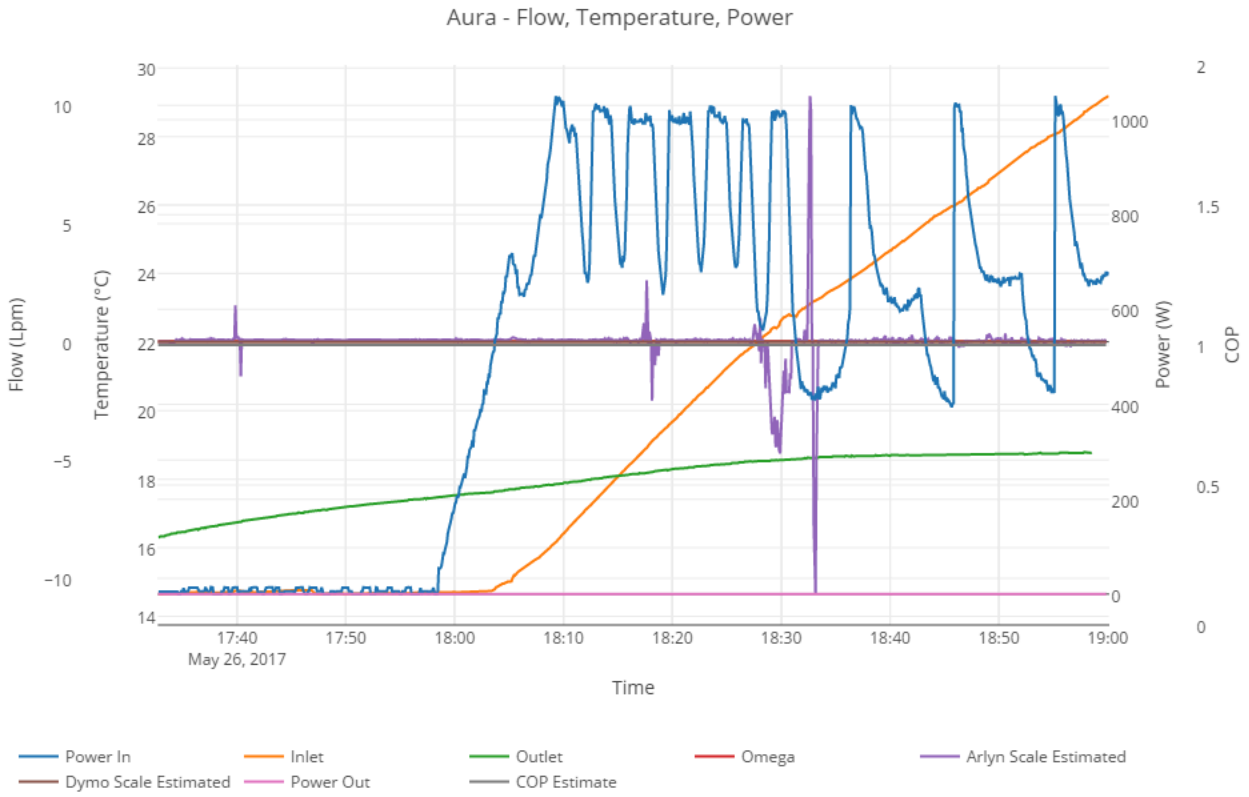
Sparge test 1
http://youtu.be/vtuzP7Zud4M

The AURA is started 17:59:50
The neutron detector is sensitive to RF and the light went all blue. May have been Bob's phone.

We now think the controller's 7Mhz signal might be causing the neutron counter to peg
The power line from the reactor was running right by the detector

Took water out of the sparging bucket and into the source bucket
Slowed down the water pump to allow the reactor to get hotter.

The graph of temp and power is looking extremely interesting. It will require spreadsheet analysis to see if it saying what it looks like at a glance.



Gotta evaluate the slopes and integrated power input
From after the start of test
T start = 14.7C
T_end =33.27C
18.57C rise

Accumulated power in =957 Wh from the PA1000

Mass water (average)=32kg
18.57C*4.184kj/kg C *32 kg=2.486kJ

2.486kj/3600 kJ/kWh=0.69 COP

Second part of test (extracted from the log file)

Sample_Number	Date_Time	PA_1000_Whr	Dymo_grams	Arlyn_grams	Temp_in_C

350	2017-05-26 18:32:16.609294	428.39	0	30162.5	23.0436
531	2017-05-26 19:02:27.282096	752.04	0	31094	29.7109
	Total power in	323.65	Avg water	30628.25	6.66 C
				30.62 kg	
			Total power	854.41	KJ
				0.24	kWh
				0.73	COP

Now, per Me356's recommendation, we are trying to adjust the water flow. His idea is that the core is being cooled by large lumps of water. So we altered the size of the pulses down and increased the rate of the pulses. Apparently he wants the core to get hot enough to trigger the effect. He also speculates that he used more thermal paste than before and it is cooling too well.

19:50 utc, or so.

Me356 says his 400W reactor worked at a much higher flow rate. It should have been boiling after about 5 minutes.

Pulled the copper sparging tube out and saw steam come out after it cleared some water.

Entertaining ourselves with exploring it with the optris and putting the ambient thermocouple onto the blue steam hose. Settled at 75C

Discussed insulation for tomorrow's test. Pressed the stop button on the controller.

Shutting down for the night.

27-05-17 Saturday

Due to family reasons, Me356 has not been able to prepare the reactor as he had hoped for today's test. We will drive over there about noon and insulate the heat exchanger. At that time we will assess with him whether he needs more time to get prepared for a higher chance of success. We have discussed the possibility of live blogging without video so we can allow him to sit at the controls for the pump and see if he can finesse it to full functionality. The data would still stream live, though.

We have also discussed options for subsets of this test equipment for the test in India.

Please note that the comments in the youtube live stream are inaccessible after the video. Because of that, and the fact that we cannot afford the internet bandwidth to watch the live stream ourselves, we will not be able to respond there to questions.
Just got a suggestion that we can pause the video on the youtube video and still see the comment stream. We will try that. (can also open the chat in a separate window and close the video window / browser tab So you can be sure it isn't buffering in the background)

The chat window on the freeboard.io page will be monitored. Bob is going to make a steemit post because that has the threaded comments that are permanent. The chat window in this doc and the youtube stream are not archived.

We have arrived and started rearranging enough to allow us to wrap the heat exchanger and the steam lines with insulation.
Me356 says the reactor is ready to go. We have to remove the water buckets, slide the table out, and then move the flow meter panel in order to get to the heat exchanger panel. Expect at least an hour. Maybe 1300 UTC before a meaningful update.

AURA: Sparge Testing
High quality recording of the first stream including recording long before the YT stream actually started.

https://youtu.be/KLPmwRgJdfY

12:00 UTC Lagging heat exchanger/flow calorimetry pipes

https://youtu.be/5CmyYxmf1cU

12:33 UTC Brian has integrated the total watt hours into plot.ly

12:54 AURA insulation test heat exchanger

A quick test to see the efficacy of the insulation on the heat exchanger

https://youtu.be/GSechTJWEIQ

12:58 UTC 15mm of lagging has been added to the heat exchanger and aluminum tape is to be placed on top

14:39 UTC. All insulated. We are fed. The reactor is in place and ready. We are only waiting for the logging software which was not working with plot.ly today. Brian thinks it may be the modification he made.
He has now reverted to yesterday's version, which is very adequate.

We filled the large water bucket with water to go into his reactor.
He is now fetching his computer to control the device locally. His screen will be facing away from us as he tries to coax it into working.

Data is streaming now. Called

Test 6-Run 1
Me356 has set up his laptop.
RF background started - note that the controller is ready and running
Gamma detector ready to go when the reactor starts.

Time 15:00 UTC - start button pressed!
Starting water flow
Buzzing sound coming from the reactor.
We have no flow at the moment. Just about to start it as his output gets warmer.
Set to roughly 2.6

This is a proper flow test. Things are all looking like they are supposed to!
We have real time COP estimate. There are long time constants in all the metal tubing and heat exchanger.
We are all absorbed watching the data.
Me356 says it is in a stable mode regarding power.
COP just over 1 is likely a thermal mass issue when the power input drops and the output is still hot.

He just updated the pump settings.
Thermal camera shows input 16.5C
Condensate at 22 or so
Full condensation happening.
Just changed pump settings again.
The cooling water flow rate is changing over time. It looks like a well pump and pressure tank.
We are told it comes from the municipal water supply.

Sensys meter readings at 3:28 - bob taking a very short video of it
https://youtu.be/oQ56_3vkoaE

Soon he will change mode to a different power level
A pressure regulator on the water inlet would help us smooth out the power readings.

We see the flow rate changing as the local water pressure changes. And we see Me356 twiddling the settings trying to get it to perform as he expects.

The calorimeter seems to be performing mostly as expected.
At 16:00 looks like he turned the power down.
When the water pressure drops, the flow slows and the stored heat in the system stays warm.

16:16 - he adjusted the height of one end of the reactor, raising it about 1 cm. The end with the box off the side away from the power cables.
16:22 - just reversed the slope
16:24 - he just turned off his water to reactor for a while. That made our measured output drop for a moment since there was no more steam being made. That stored heat in the reactor and

when that came out as a large pulse of steam into the heat exchanger it made a very high COP for a moment.

4:46 UTC - adjusted the water out to flow into the fresh water tank and top it off
Then adjusted the water flow down a little bit.
4:50 - Sensys meter show 4.152 temp difference
17:02 - for almost 15 minutes it was operating at rather stable power in, giving us a rather stable power out and COP about 0.9. That means we are losing about 10% in thermal losses in the calorimeter. The power in was 700W. That means the thermal losses are likely 70W at these temperatures.
Unless there is excess energy being created.

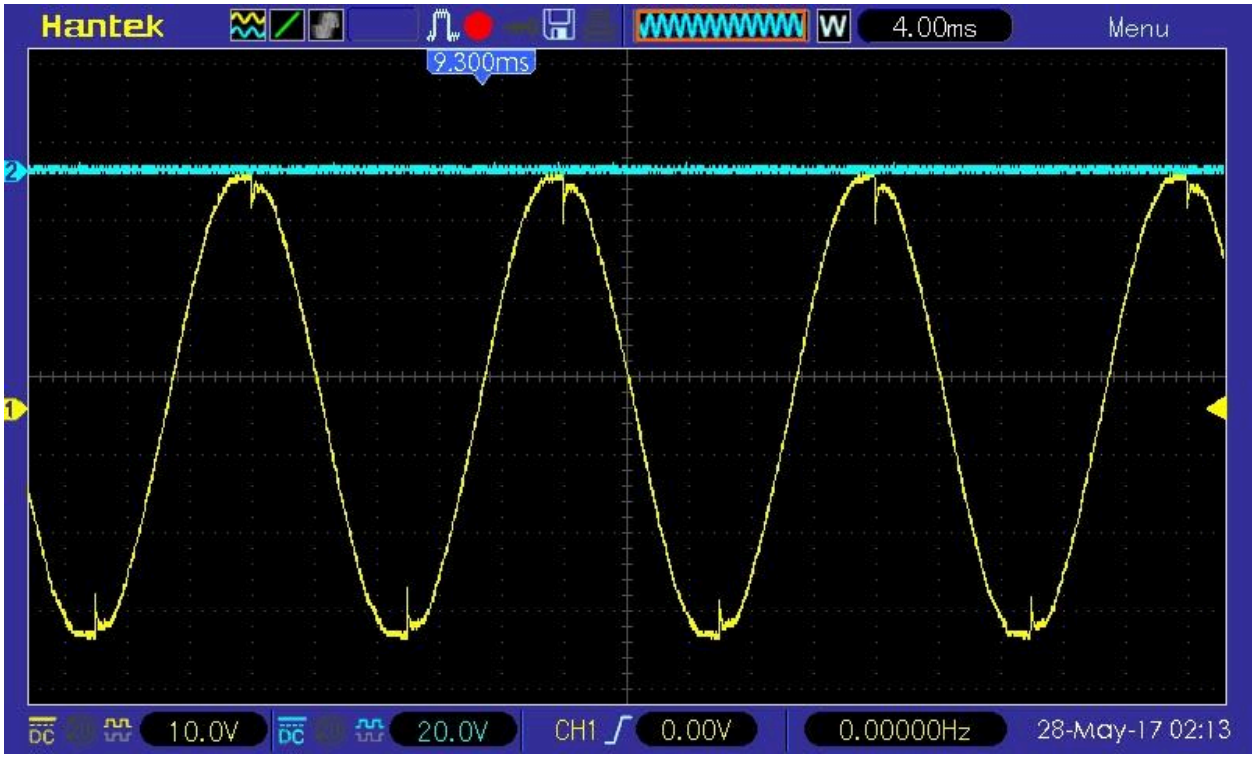
Magnetic sensing near the AURA reactor
Can you see any magnetic field variation in this video?

https://youtu.be/APYyL3nTPPY

x§
Me356 is having electrical power issues that affect switching power supplies. Ryan's laptop had 50V on the case of it because it has no ground on the power supply. Something similar was causing problems for his reactor. We are exploring the power, now, with the PA1000 and it will cause an end to the logging for that device.
Wait, they are trying the oscilloscope instead.

Here is the waveform for the operating reactor. (not indicative of a problem, but just got the waveform while watching.

We were pondering that the net energy had gone from -1MJ to +0.3, but we just figured out it was because of the PA1000 no longer loading data. Probably happened while probing the power with the scope.



The experiment will be ended now.
18:16 - stopped logging.

We are going to take a day away in order to allow Me356 to make changes and tests. We will be back to run on Monday and pack up by Monday night.

Test 6-Run 2

11:00 on site, me356 has just got reactor into and operational state and also removed a pump that was identified in the water supply system, which was likely largely responsible for the saw-tooth variation in pressure that we saw during Run 1.

First pre-test today will be to see if the supply water is far more regular or if we have to install the pressure regulator we purchased this morning.

He has also got a new grounding point installed in the lab, which appears to have resolved stray voltages, see in this video:

https://youtu.be/yYHw58mark4

11:23 UTC - starting a water flow test to see if it is smoother now after Me356 made a change to turn off a pressure pump.

12:00 UTC - me356 has agreed to give some ash samples from previous reactors for us to test, say with EDX or ICP MS

12:01 UTC - Water heater installed to test the effectiveness of the heat exchanger in the calorimetry. Our goal is to test the losses through the insulation. It will be a rather incomplete test because the water heater only outputs 45C water instead of 100C steam like the reactor, so our losses estimation will be low. The losses would increase if there there were several KW of steam going into the heat exchanger and pushing the heat exchange limit.

The data is already streaming.
Cooling water set to about 1.5 L/min
Water heater has a minimum flow required to start.
The voltage on the water heater is 213V, so it is dragging down the voltage on what must be a long length of wire to get to the “lab” . The water heater is running lower power at about 2900W
Had to switch the PCE current probe to 100A setting. The software is still reading it wrong. Brian is working on it. Fixed it!

Once we see all the temperatures coming to steady state we can get a good COP reading that will tell us the efficiency of the heat recovery. Then we can compare that to some relatively steady state from Test 6 -Run 1 on Saturday.

Then we can turn off the water heater power and see the cooling response.

Sensys meter reading
0.452 KW vs 1.112 KW from ours - large difference
11.02C temp diff vs 11.2 on our system
Input 13.9, output is 25
Flow reading 0.036 m^3/h
It is only reading 0.6 L/m vs 1.43 from the Omega flow meter
Check with bucket and scale shows 1.35, or so, so the Sensys has a flow meter problem right now.

Bucket fill for 3 minutes to measure the flow through the water heater. We got 3592 g, or roughly 1.2L/min
That is way more mass flow rate than the steam. That will make this characterization very different than working with a low mass flow rate of steam that drops 99% of its heat at 100C.

We measure under these conditions 0.41 COP, or heat recovery. We could improve that by increasing the flow of cooling water so the temp difference between the two was significantly

different. That means the heat exchanger is only useful for working with steam (which is why we got it).

Bob wants to capture a little video of this, now, and we can be done with this step and move onto the main test.

Layout of MFC with dummy heater replacing heat source

https://youtu.be/J3AGQWRhCEE

RAVI: https://drive.google.com/open?id=0Bz7ITfqkED9WTGx2cldOYXdMRDA

Brian is installing the update with the long average on the COP calculation to avoid over excitement when the COP rises sharply because the input power drops. We will test the function on the water heater first.

Quick live stream of dummy heater as hot source for the heat exchanger.

http://youtu.be/nKSlNK95M38

13:17 - unplugged water heater so we can compare instantaneous COP to long term average

COP average worked. We updated the Plot.ly and the freeboard.io pages with it

We are nearly ready, again. Bob is making a mask for his photographic film.
Me356 is setting up the reactor and the control computer.

Dead battery on the GCA geiger counter… sourcing a new one… Done
Bubble detector check - no bubbles

Sensys currently says 49.060 MWH
Total volume on meter 7390.975 m^3

Cleared the PA1000 total kWh
Me356 brought in a fire extinguisher :)

Freshly prepared reactor is in place and hooked up.

Woops, meal break. Sorry to keep everyone in suspense.

Starting logging and data streaming.
The AURA controller is plugged in.
The cooling water flow is started
Everything can come to stable point before the reactor is turned on. (at least close)

He started the pump and the control box
Controller turned on.
The pump was turned up to fill the reactor. Now it is turned down pretty low.
Start button pressed 14:40 UTC

14:46 - The reactor is buzzing more than last run. Must have been changes to the heater.

The COP moving average had a huge transient at the beginning and appears to be extremely wrong for the moment. We will see if it gets straightened out after more time.

2:49 Half way through start-up process, according to Me356

The water flow shows small dips occasionally that we can correlate to household water usage events like flushing toilets. Still way better than the last test.

Looks like about 14:50 the steam finally hit the heat exchanger when the output temperature started to rise quickly.

14:56 - “Going to leave some time to stabilize and then move to another mode” - Me356
15:03 Changed the flow rate of the pump to the reactor

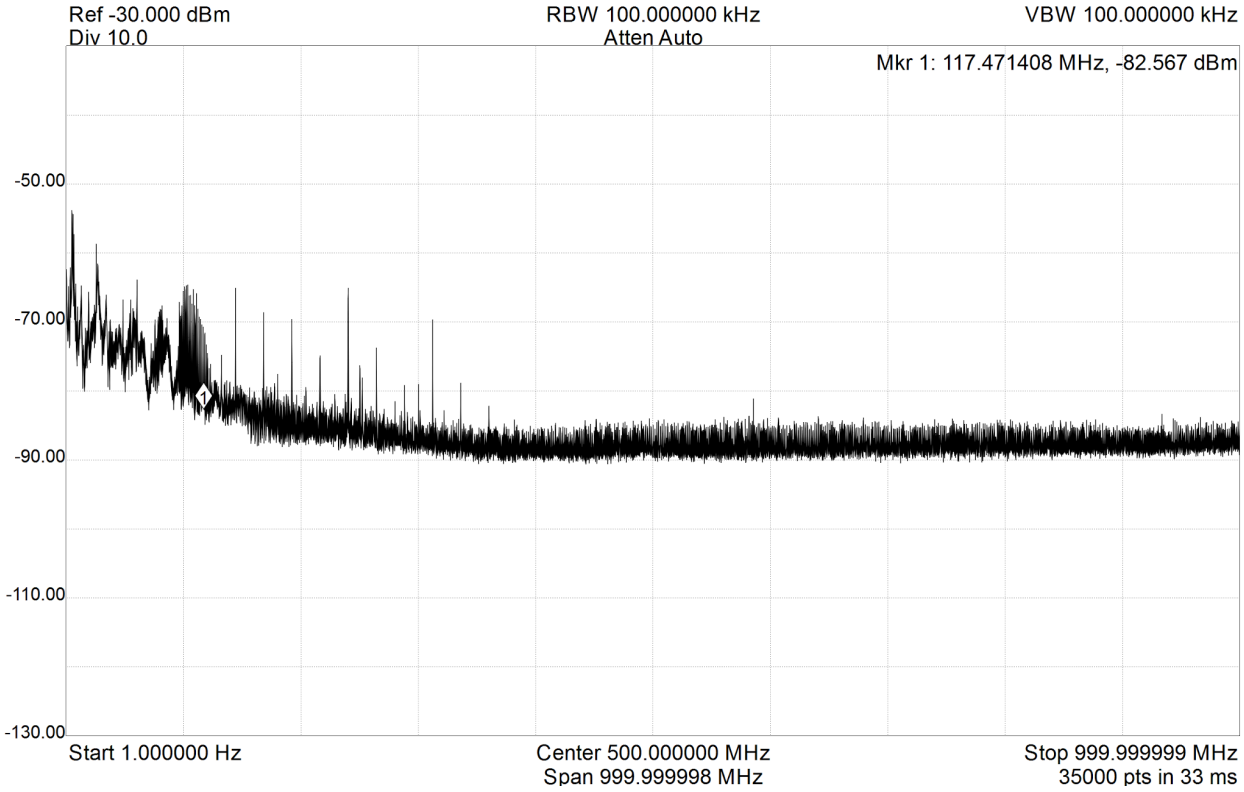
15:08 - Some big spikes in input power.

Noticing broad band noise in RF spectrum…

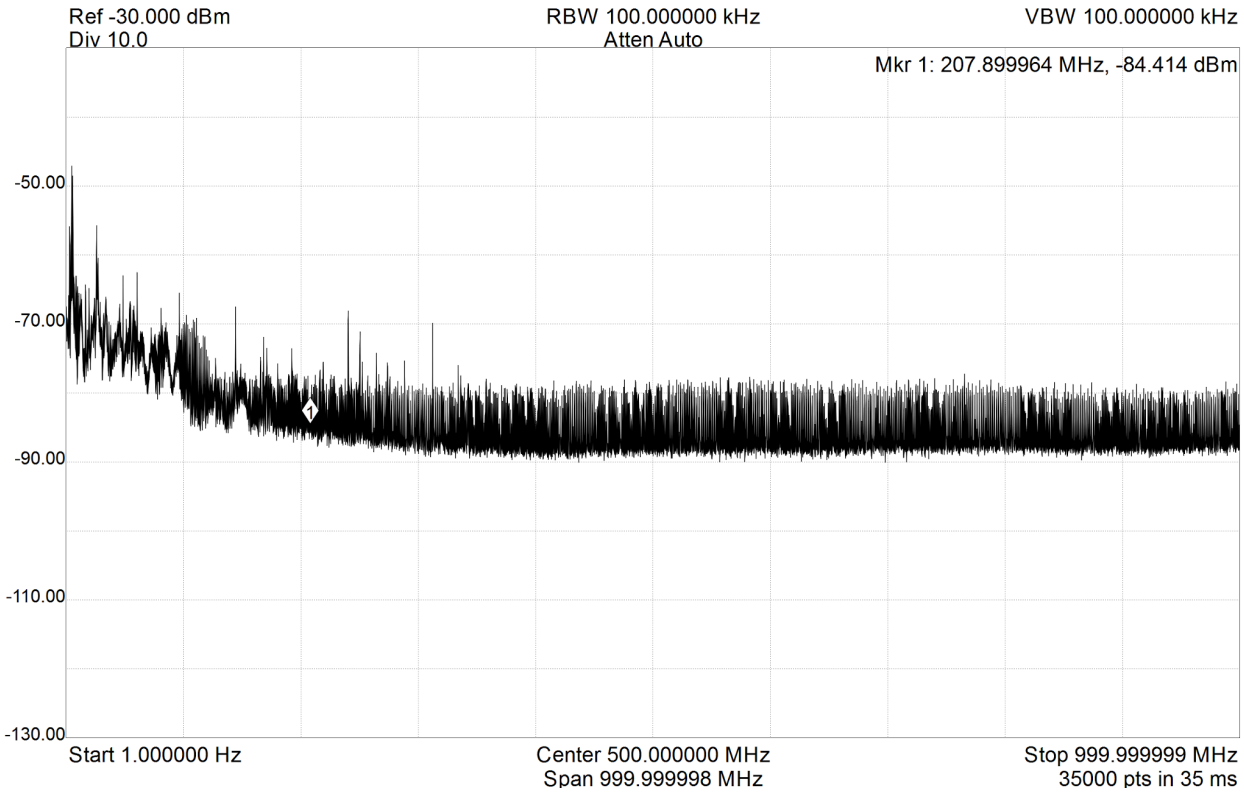
15:39- He changed the pump to make slower, but larger pulses of water
15:42 -no neutron bubbles

COP is hovering just above 1, when it was 0.9 on Saturday in Run 1
Is it meaningful? Hard to tell so far. Tantalizing, though

RF - Pre run background



RF a few minutes ago



Any advice on what that means? Arcing in there?

15:44 - Slowed down pulse rate of pump.

15:45 - The temperature out performed different after that pulse of input power.

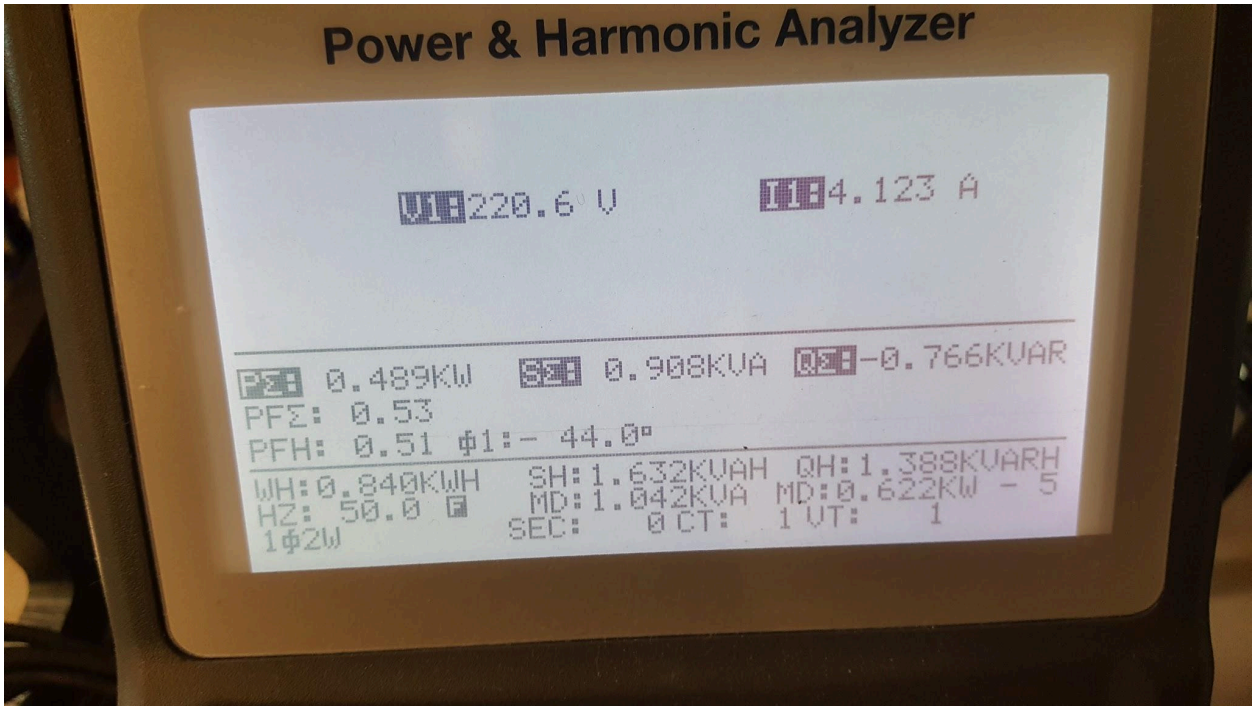
Anybody want to take the data file so far and check the moving average of the COP against doing it in a spreadsheet? It is supposed to a 10 minute running average.

Right now the test is in that tantalizing but unclear performance level. It is better than Saturday when the system showed a 0.9 COP at relatively stable input levels, It is not a sufficiently strong signal, though, to be able to have confidence that there really is anything more coming out.

16:17utc - no bubbles in the bubble detectors

Anybody want to correlate the radiation counters to the powers in and out?

16:25utc - changed pump mode, again



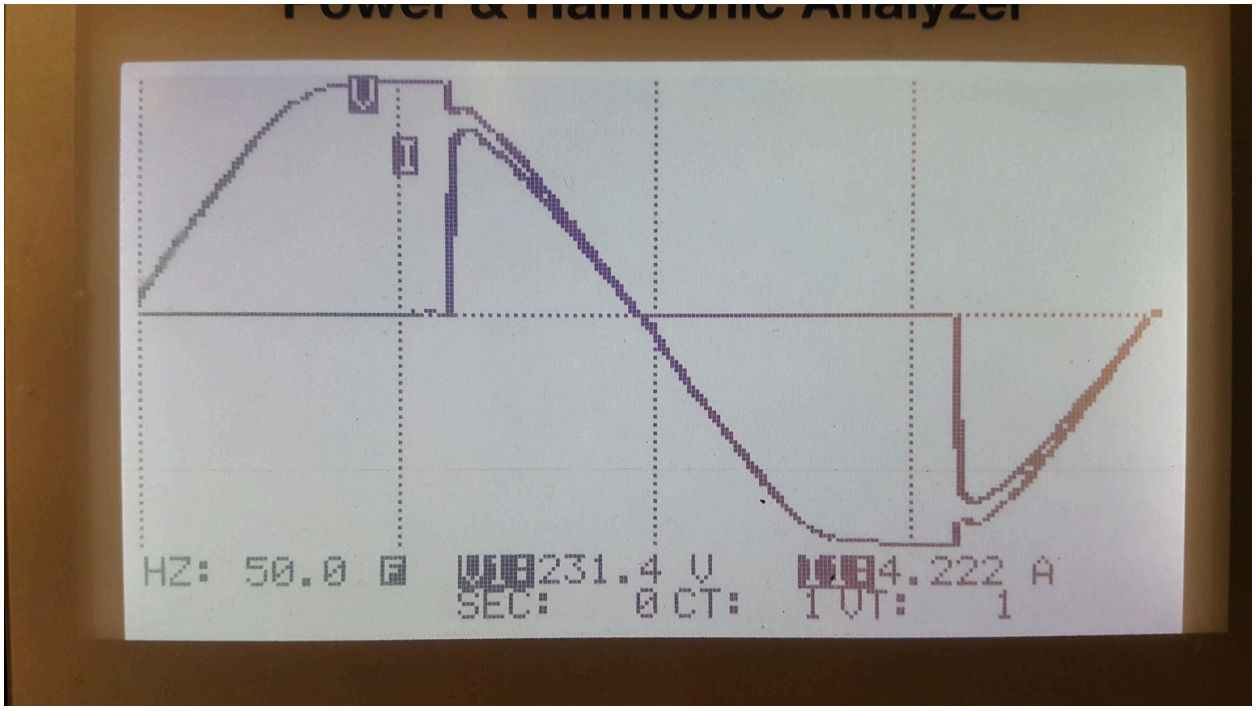
We have a large number of questions about Volts*Amps not equalling power reported. The PCE830 shows that a large portion of the current is reactive.
We do not have the 5uF capacitor in the power harness.

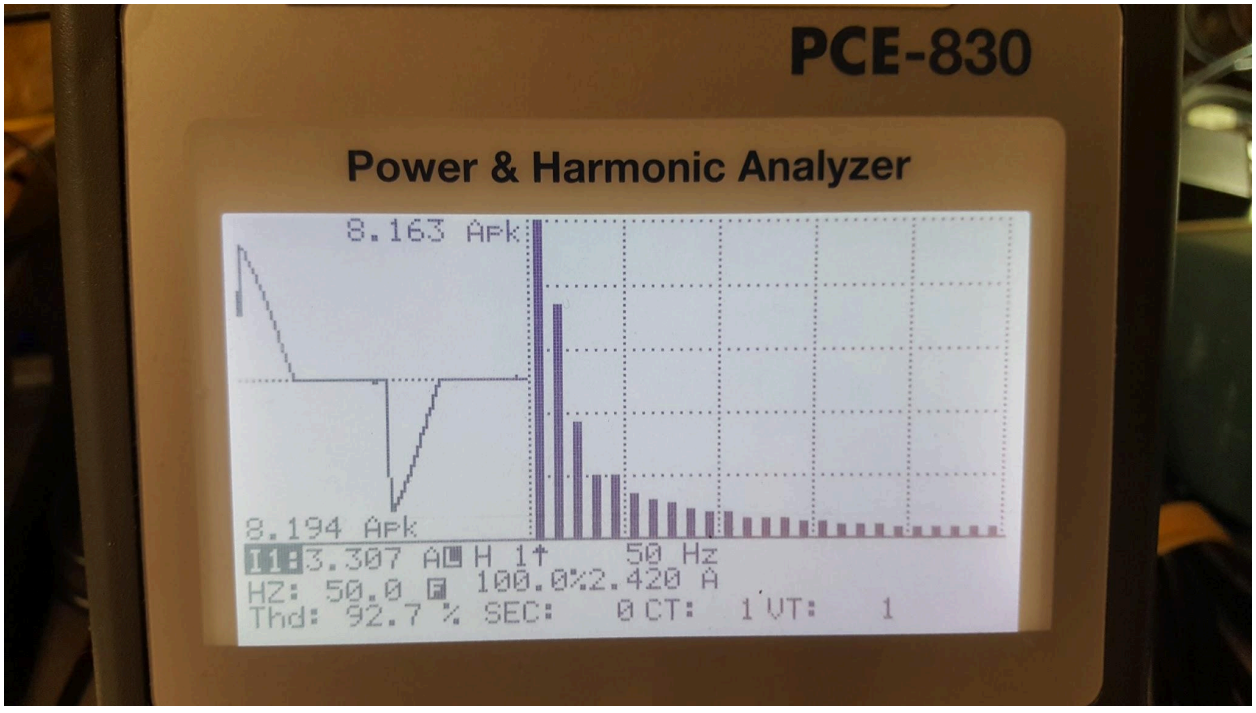
The PA1000 is doing all those calculations, too, and we can ask it later what it thinks in other analyses but not while we are streaming data from it.

16:46 - changing the pump to a lower flow to run slightly hotter and make dry steam

17:01 Just turned the pump up again

17:31 - Going to use the PCE830 to try to capture some harmonics data and current waveform.





Sensys at 18:18 49.063MWh
7391.103 m^3

19 on output 14.1 on input = 4.897

Water tank of water to the reactor is 15C
Condensate is 16C as measured by putting drips out of the condenser onto a glass thermometter.

Taking video of steam from the reactor

Time to pack it up.
It's about to rain in a bit so we are shutting down the experiment now and packing up.
Weight of wet reactor

COuld not get a good measuremnet of water in reactor. No neutrons in bubble detectors.

The end.