<10:28:03> **"lisabar"**: http://www.screenleap.com/meeting/nmzuheaii?preview=true

<10:29:07> **"AlanWeinstein"**: https://dcc.ligo.org/LIGO-G1501317

<10:31:00> **"cavaglia"**: I muted her

<10:31:16> **"Laura Nuttall"**: yes

<10:31:16> **"cavaglia"**: yes

<10:31:17> **"AlanWeinstein"**: yup

<10:31:18> **"LLO Main Conference"**: we can hear you

<10:31:19> **"Sheon Chua"**: Hi Lisa. Yes

<10:32:38> **"Nicolas"**: Can everybody insure they have forced the mute function as long you do not rise your hand

<10:32:46> **"GATech"**: Laura, I ll email here she is not here

<10:32:49> **"CIT-SCR"** pokes you: Who is the user Sauron of Ainur?

<10:32:57> **"AdiaCheng"**: sorry about that.

<10:33:09> **"neilcornish"**: can someone post a link to the slides. the link is buried somewhere in my inbox

<10:33:16> **"AlanWeinstein"**: https://dcc.ligo.org/LIGO-G1501317

<10:33:18> **"Bruce"**: Are we waiting to start?

<10:33:22> **"Leo Singer"**: https://www1309.screenleap.com/viewer/436403156?useCdn=false

<10:33:24> **"Nicolas"**: few minutes

<10:33:35> **"Bruce"**: OK, thanks

<10:33:43> **"Sauron of Ainur"**: Sorry.

<10:34:01> **"Avneet Singh"**: Avneet Singh

<10:34:13> **"Avneet Singh"**: Just some pre-talk fun

<10:35:03> **"fjr"**: please repost viewing link

<10:35:12> **"walterdp"**: https://www1309.screenleap.com/viewer/436403156?useCdn=false

<10:35:14> **"Peter Couvares"**: https://dcc.ligo.org/LIGO-G1501317

<10:37:05> **"Szabolcs.Marka"**: Thanks Peter!

<10:40:02> **"lisabar"**: Please mute

<10:40:24> You poked **"EGO Seminar Room"** with message: please mute

<10:40:28> **"salvatore.vitale"**: please mute with the TS button

<10:40:29> **"Nicolas"**: EGO seminar room please mute

<10:40:34> **"Paul Fulda"**: EGO seminar?

<10:40:35> **"Andrew Williamson"**: EGO I think

<10:47:12> **"Bruce"**: We verify checksums when moving files with LDR. But is there anything that has compared these for the different stored frame files?

<10:47:29> **"Daniel Holz"**: How many people have root access to these computer systems?

<10:47:41> **"Reinhard Prix"**: Have the logs been checked?

<10:47:55> **"gmendell"**: The m5sums have been compared between what was on CDS disks versus LDAS disk

<10:48:16> **"stuart.anderson"**: hand up

<10:48:39> **"Bruce"**: OK, the idea is that there were multiple copies, did all the mutliple copies get cross-checked?

<10:48:40> **"Peter Couvares"**: did you say that no one person has root to each of these systems? I assume that include Stuart, Abe, etc?

<10:49:48> **"Vladimir Dergachev"**: What precautions were taken to insure that data does not get corrupted later ? I.e. it would be unfortunate if an accidental disk error after the fact cast doubt onto perfectly acquired frames.

<10:49:54> **"Reinhard Prix"**: can be collusion though ...

<10:49:59> **"Szabolcs.Marka"**: Can the framebuilders do the injection at a predetermined future date?

<10:50:12> **"stuart.anderson"**: hand up

<10:50:40> **"Bruce"**: Good point Stuart!

<10:51:02> **"kipp"**: and had the files been modified there, it wouldn't be necessary to hack anything else, right?

<10:51:02> **"Peter Couvares"**: is the actual low-latency data the low-latency pipelines used to detect stored anywhere, or is it lost?

<10:51:05> **"Lazzarini"**: Has someone spoofed a single frame as a proof of concept to list all the steps that are required, or to show that it's impossible?

<10:52:56> **"Szabolcs.Marka"**: Thanks!

<10:53:21> **"Lazzarini"**: good!

<10:54:35> **"Peter Couvares"**: (so the actual bits consumed by the LL pipeline from shared memory -- is stored and we can confirm it matches the aggregated frames -- good!)

<10:54:40> **"katsavounidis"**: We have compared end-to-end (an) analysis that includes GW150914 between llhoft frames (4s) and the aggregates and obtained identica results

<10:54:55> **"LLO Main Conference"**: We also archived all commissioning frames for a couple of weeks after the event... yet another copy

<10:55:45> **"Abe"**: this may have gotten mentiooned while i was disconnected: system logs from CDS and LDAS hosts get copied in real time to
offiste hosts. an attacker would not be a ble to modify those logs.

<10:56:30> **"Reinhard Prix"**: The screen share you are viewing has ended.

<10:56:37> **"Sean Leavey"**: Refresh the page

<10:56:46> **"Reinhard Prix"**: thx

<10:59:37> **"Szabolcs.Marka"**: If the rouge injection used less than perfect calibration between the observatories... can the difference be detected?

<11:04:08> **"satya"**: The screen share by has stopped for me. Do other folks have the same issue ?

<11:04:21> **"walterdp"**: try refreshing

<11:04:23> **"RaRa"**: nope, fine for me

<11:04:25> **"Vladimir Dergachev"**: Apparently it comes back after you try the link again

<11:04:51> **"satya"**: thanks. working for me now after reopening the link.

<11:05:29> **"cavaglia"**: It may be easier to follow the talk through the DCC. Matt is announcing the slides he's in...

<11:05:31> **"cavaglia"**: https://dcc.ligo.org/DocDB/0122/G1501317/008/RogueInj.pdf

<11:06:35> **"Bernard"**: Could anyone get light into the photodiodes, say through the back of a mirror?

<11:07:15> **"stan whitcomb"**: Is there any way to inject a signal onto the 2 PD signals?

<11:07:23> **"Vladimir Dergachev"**: If one has complete list of channels that are affected by the signal then it would be possible to compute transfer functions from DARM to all the other channels from live data, and then make the injections assuming the functions did not change much during lock. This would automatically get the relative calibration right - modulo small drifts and does not require any schematics.

<11:07:24> **"Keith Riles"**: Could a rogue FE model insert h(t) at the PD ADC channels?

<11:07:49> **"Souradeep"**: satya, I relaunched the link to get screenleap back.

<11:12:48> **"Marco Drago"**: When there is a blind injection, it appears in all the channels, like DARM?

<11:13:09> **"neilcornish"**: But you have shown that such filters can be made

<11:13:25> **"Lazzarini"**: Is it hopeless to pull an injection signal out of the CARM due to low SNR?

<11:13:47> **"Evan Goetz"**: Are the PCal plots the waveforms sent to the PCal or the readback of one of the photodiodes?

<11:17:20> **"Rick Savage"**: Evan: I'm pertty sure Matt is plotting the receiver-side PD readout. We record the transmitter-side PD readout as well.

<11:17:30> **"AlanWeinstein"**: Don't forget that real GWs excite CARM as much as DARM; it's just that CARM has MUCH higher noise

<11:17:56> **"Evan Goetz"**: Thanks!

<11:18:35> **"fjr"**: Comment: people should realize that beyond the level of difficulty of malicious injection, doing it would require practice which would leave tracks of unsuccessful attempts.

<11:20:10> **"Ofek"**: @fjr not necessarily - practice attempts could have been made on a copy of the machine, during maintainance times, or even long ago

<11:20:32> **"tdent"**: btw the waveform could have been scraped from a NR publication, you dont need any CBC code for it..

<11:20:46> **"AlanWeinstein"**: tom it has to be coherent...

<11:21:35> **"AlanWeinstein"**: that's why the CBC PE coherent-vs-coincident bayes factor is so important

<11:22:03> **"neilcornish"**: and the BayesWave signal to glitch Bayes factor!

<11:22:38> **"Harald Pfeiffer"**: tom: Not many NR waveforms in that region of parameter space out there. Those tend to be private.

<11:22:40> **"Reinhard Prix"**: coherent here just means that time-delay is less than IFO separation, no? The tricky part would be to get the antenna-patterns right ...

<11:23:05> **"AlanWeinstein"**: Reinhard, also the phase and amplitude need to be just right, and they apparently are

<11:23:08> **"fjr"**: @ofek - one of the things that held up getting calibrations and inverse filters ready was the fact that the machine was constantly changing due to commissioning changes. There were only days to practice with a truly stable configuration. If you had made a copy you would have need to have the copy keep up with all those changes.

<11:23:13> **"Will Farr"**: time-delay < IFO separation + strength and polarisation consistent with delay (i.e. sky positon)

<11:23:40> **"chad.hanna"**: Maybe only like 6 people though

<11:23:49> **"Andy Lundgren"**: @fjr: probably little was changing in Pcal though, right? it's always just a laser making a force

<11:24:04> **"Philip Graff"**: Coincident is just that time-delay is less than separation, coherent requires everything to be consistent

<11:25:32> **"Reinhard Prix"**: well the intrinsic signal would be identical at both sites, it's only the antenna-pattern response that's the "everything" that needs to be consistent infact, but consistent with time-delay, that's a good point.

<11:25:33> **"kipp"**: wrt "coherent": wouldn't simply putting the same time series into LLO and LHO at the same time pass a "coherence" check?

<11:25:53> **"tdent"**: No, none of those holds water. 1) this is consistent with equal-mass non-spinning, that is not a secret wf 2) it's easy to make a coherent injection by just making h(t) for Livingston equal to Hanford with a small time delay, a sign flip and a slight difference in amplitude

<11:26:05> **"tdent"**: (as kipp says)

<11:26:17> **"Vladimir Dergachev"**: phones have GPS built-in

<11:26:35> **"AlanWeinstein"**: Easier to just learn how to use the CBC coherent injection software.

<11:26:49> **"Reinhard Prix"**: I see, is it because antenna-patterns are nearly identical?

<11:26:51> **"AlanWeinstein"**: which is in the public domain

<11:26:56> **"Daniel Holz"**: "after the event" is how soon after?

<11:27:06> **"EGO Seminar Room"**: Can the signals of the seismometers in the experimental halls be used to exclude that anybody has walked in?

<11:27:50> **"Mike L"**: @Daniel: Sep 22/29: we have card read access that vets entries at all doors, emergency exits, roll up doors and forced entries of endstations.

<11:28:18> **"Leo Singer"**: Can the entry logs be falsified?

<11:28:37> **"AlanWeinstein"**: What about the side door that Rana always uses?

<11:29:00> **"LLO Main Conference"**: We could tell that there were no unexplained non-stealthy visits to the end stations prior to inspection/photos (Brian)

<11:31:06> **"Grant David Meadors"**: Not sure if Vladimir's question was answered (briefly lost connection at AEI), but is GPS good enough for the timing precision?

<11:32:12> **"Andy Lundgren"**: @Grant: commercial-grade is, since it's how we sync the sites - I imagine a phone is good to a few ms

<11:32:25> **"Daniel Holz"**: Not to be paranoid but: how hard is it to edit the entry logs?

<11:32:52> **"Abe1"**: it is if you have a receiver that provides PPS.

<11:33:01> **"Mike L"**: @Leo, Daniel: presumably. We will look at this.

<11:33:05> **"Abe1"**: (that was in response to the gps clock question)

<11:33:40> **"Keith Riles"**: LHO and LLO seem to use different logging systems

<11:34:01> **"RichardM"**: They are only on a computer in the control room not accessable to outside. They are just a file on that machine and backup

<11:34:26> **"stan whitcomb"**: The whole thing sounds like a good Mission Impossible sequel to me.

<11:34:35> **"Roy Williams"**: The NTP protocol will give ~10 ms precision between separated devices under good conditions

<11:34:36> **"tdent"**: Mission Improbable

<11:34:59> **"RaRa"**: Mission Unlikely: the iPod Hacker

<11:34:59> **"Vladimir Dergachev"**: What about some sort of mechanical excitation next to a test mass ? Are our seismometers sensitive enough to pick up the signal ?

<11:35:22> **"Leo Singer"**: Take that up with Christopher Nolan. Maybe Batman can make an appearance too.

<11:35:47> **"Sheon Chua"**: I'm sure Tom Cruise loves to be photographed.

<11:36:05> **"Sean Leavey"**: Are there ESDs for the ITMs, i.e. in the corner station?

<11:36:11> **"EGO Seminar Room"**: Were the ITM ESD inputs photographed? Could an injection have been performed there as easily as for an ETM?

<11:36:27> **"Mike L"**: @Sean: no electronics setup yet for this.

<11:38:06> **"Unni"**: Adding to the "improbability" factors, I think it is reasonable to thunk that a truly malicious attempt would have waited for O1 and not tried the complicated effort durng ER1!

<11:39:03> **"RaRa"**: And most likely would have chosen BNS waveform

<11:39:09> **"RichardM"**: The filter was replaced on teh Bias line but the Resister box is still in place.

<11:39:22> **"RichardM"**: Pictures were taken of this

<11:39:28> **"tdent"**: BNS are much harder to inject as you need more bandwidth ;)

<11:39:31> **"vicky"**: @Unni, but Sep 14 was the officially announced first day of O1 ...

<11:39:49> **"neilcornish"**: I think that the Universe performed a hardware injection. We should look into that...

<11:40:03> **"Unni"**: That is good point, @RaRa - hard to think of a heavy binary BH event.

<11:40:24> **"LLO Main Conference"**: For those who are curious about how easy it is to use the PCAL see problems even the experts had in first attempts to invert the actuation function: https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=21258

<11:40:31> **"Vladimir Dergachev"**: Yes - millisecond timing is fairly easy with GPS and modern CPU

<11:40:50> **"Vladimir Dergachev"**: Mechanical injection ?

<11:40:59> **"Leo Singer"**: Vladimir, did you do the rogue injection?

<11:41:04> **"Reinhard Prix"**: or acoustic?

<11:41:18> **"Vladimir Dergachev"**: No comment

<11:41:26> **"Leo Singer"**: You answered that GPS question a little too quickly.

<11:41:32> **"Mike L"**: Mechanical/acoustic injections vetted by PEM

<11:41:36> **"RaRa"**: Nice try, @Leo!

<11:41:45> **"Reinhard Prix"**: ok, at end-stations as well?

<11:41:54> **"Roy Williams"**: Vladimir is too honest for that

<11:41:55> **"vicky"**: @Matt, when BigDog was injected how many people were actually involved (not how many new it would happen)

<11:41:58> **"Mike L"**: Yes, ends too Reinhard.

<11:43:08> **"Dave Reitze"**: @ vicky -- 3 people, I believe

<11:43:09> **"Mike L"**: @Vicky: BigDog was three of us injecting, one per observatory. The waveform machinery however was set up by search groups. Calibration by calibration team.

<11:43:36> **"vicky"**: thanks

<11:43:58> **"Vladimir Dergachev"**: A linux kernel has a high-responsivity mode where time slices are scheduled at 10kHz, so one can get millisecond accuracy on average even in regular userspace, never mind real time mode. And the GPS is used in timing boards for LIGO as well. Consumer GPS is less accurate (not 100 ns), but good enough for 1ms.

<11:48:02> **"Leo Singer"**: What would be the reason to do this?

<11:48:19> **"salvatore.vitale"**: bets?

<11:48:35> **"RaRa"**: Mental illness, bregrudgment

<11:48:36> **"AlanWeinstein"**: personal challenge - to prove to yourself you can do it.

<11:48:42> **"Roy Williams"**: There are other scientitic discoveries verified from a single detection -- which would have been more/less easy to fake?

<11:48:57> **"Sheon Chua"**: Fame?

<11:48:58> **"Abe1"**: one mentally ill/disgruntled person is possible, two or more is pretty improbable

<11:49:00> **"AlanWeinstein"**: Fake the Omega-minus bubble chamber picture

<11:49:07> **"RaRa"**: I really doubt bets and challenge---an insider doing this really ought to know how malicious it is

<11:50:12> **"Vaibhav"**: The best convincing that anything can do is time

<11:50:29> **"Abe1"**: also, as somone else also pointed out, if you were doing it all this well, I think you'd also wait until O1 was well under way

<11:50:30> **"Daniel Holz"**: Another event would be quite convincing.

<11:50:33> **"Peter Couvares"**: I'm happy there's no betting market in this detection (like there was on the higgs) so there's no trivial profit motive!

<11:50:39> **"Dave Reitze"**: very nice presentation, Matt.

<11:50:47> **"AlanWeinstein"**: Thanks Matt!

<11:50:47> **"Abe1"**: okay, whoever faked this one, time to fake another

<11:50:50> **"stan whitcomb"**: Thank you Matt!

<11:50:53> **"RaRa"**: Yea,h thanks Matt!

<11:50:53> **"Mike L"**: Peter, there was!

<11:50:56> **"vicky"**: Thanks Matt, super clear!

<11:50:57> **"LLO Main Conference"**: plus you would inject something more marginal (easier to cover tracks) (Brian)

<11:50:57> **"Peter Couvares"**: yes, this was great Matt!

<11:50:59> **"Daniel Holz"**: Thank you Matt. That was excellent.

<11:50:59> **"salvatore.vitale"**: @peter: alcohol changed hands

<11:51:02> **"Reinhard Prix"**: Thank you very much! Very nice work!

<11:51:07> **"Abe1"**: Well done!

<11:51:09> **"Grant David Meadors"**: Thank you, Matt!

<11:51:11> **"Reinhard Prix"**: to all of those involved!

<11:51:13> **"Szabolcs.Marka1"**: Thank you all! Great presentation.

<11:51:17> **"Sheon Chua"**: Thanks Matt and everyone involved.

<11:51:27> **"Benjamin Knispel"**: Thanks to all involved, very nice!

<11:51:32> **"Barry Barish"**: Great job, Matt

<11:51:49> **"Vladimir Dergachev"**: Are their plans to release this information along the actual paper ? It is very interesting in its own right and an excellent overview of interferometer systems.

<11:52:16> **"AlanWeinstein"**: All of this needs to be condensed into the detection paper; indeed, the heart of the detection paper

<11:52:18> **"Mike L"**: I agree Matt, particularly on the systems computing side.

<11:52:24> **"Lazzarini"**: thanks, Matt.

<11:52:30> **"RaRa"**: @Vladimir, I worry the media might get the wrong idea and concoct another Moon Landing Conspiracy

<11:52:33> **"Reinhard Prix"**: Yes, this is scientific information relevant to assess the 'false alarm' probability

<11:52:37> **"Bhooshan Gadre"**: bye

<11:52:38> **"chad.hanna"**: bye

<11:52:41> **"Abe1"**: they will concoct one regardless

<11:52:43> **"Bernard"**: Thanks, MAtt. Very thorough.

<11:52:43> **"Alessio Rocchi"**: Ciao

<11:52:46> **"Stuart"**: Thank you Matt, all. (Stuart Reid, David Vine)

<11:52:46> **"RaRa"**: bye!

<11:52:47> **"Sheon Chua"**: Bye