Test Mass Discharging System (TMDS) - 2020 redux

TOP LEVEL DCC LINK (For collecting ALL related / relevant TMDS docs
https://dcc.ligo.org/E1500235-x0
Team from: Rich, Jon, Calum, Dennis, Mike Z, Luis, Jordan, Chub, Liz, Nikki and Chandra

Key: Actions below in yellow. As completed, turn them to green. If problem turns to red.

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1. TMDS Issue

1.1 IIET Issues, FRS and ALOGS associated with 2020 issues @ LHO

The following FRS ticket describe recent issues at LHO:
https://services.ligo-la.caltech.edu/FRS/show_bug.cgi?id=15312

1.2 Caution

During operation of the ionizer, an unanticipated pressure drop such as might result from running out of purge gas, can cause the pressure in the vicinity of the corona needles to drop

such that an uncontrolled and damaging arc can be induced. Great care must be taken to avoid such damaging arcs by keeping a close eye on the baratron pressure.

1.3 TMDS failures circa 2020

The following 2 units broke during the Aug/Sept 2020 lHO use of the TMDS's on-site:
2. https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=56530 (S1500093)
3. https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=56509 (S1500142)
>> Confirmed S1500093 and S1500142 are correct serial numbers for the 2 units referenced.
Rich No e-traveller at LIGO-S1500142-v1 or LIGO-S1500093-v1?

1.4 Reference: TMDS failure circa 2017 [and subsequent repair]

1. https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=38524 (S1500094)
>> Confirmed S1500094 is correct serial number for this unit
>> Also confirmed have e-traveller for this one, see LIGO-S1500094-v2
THIS ONE IS WORKING DON'T BREAK IT

2. 2020 Redux

2.1 Rebuild of test lab @ CIT

Plan is to do this in the "Jitter Lab" on the 2nd floor of Downs. Starting with the gas delivery system i.e.

- LIGO-D1500078: aLIGO, SYS, TMDS GAS DELIVERY SYSTEM
- LIGO-D1400331: aLIGO, SURFACE CHARGE CONTROL IONIZER
- LIGO-E1500252: Test Mass Discharge System (TMDS) Operation Procedure Video (Turn ON and Turn OFF) - great (large) pdf with detailed photos of setup

Chub and Jordan, please follow up with Copper tubing and build.

2.2 Data form 2020 redux

All data from the 2020 redux effort at CIT should be posted here in Eng Labs under category TMDS
https://nodus.ligo.caltech.edu:8081/ENG_Labs/
(The login for the elog page https://secrets.ligo.org/secrets/248/)
All.

2.3 Testing plan

The following is planned on units S1500142 and S1500093

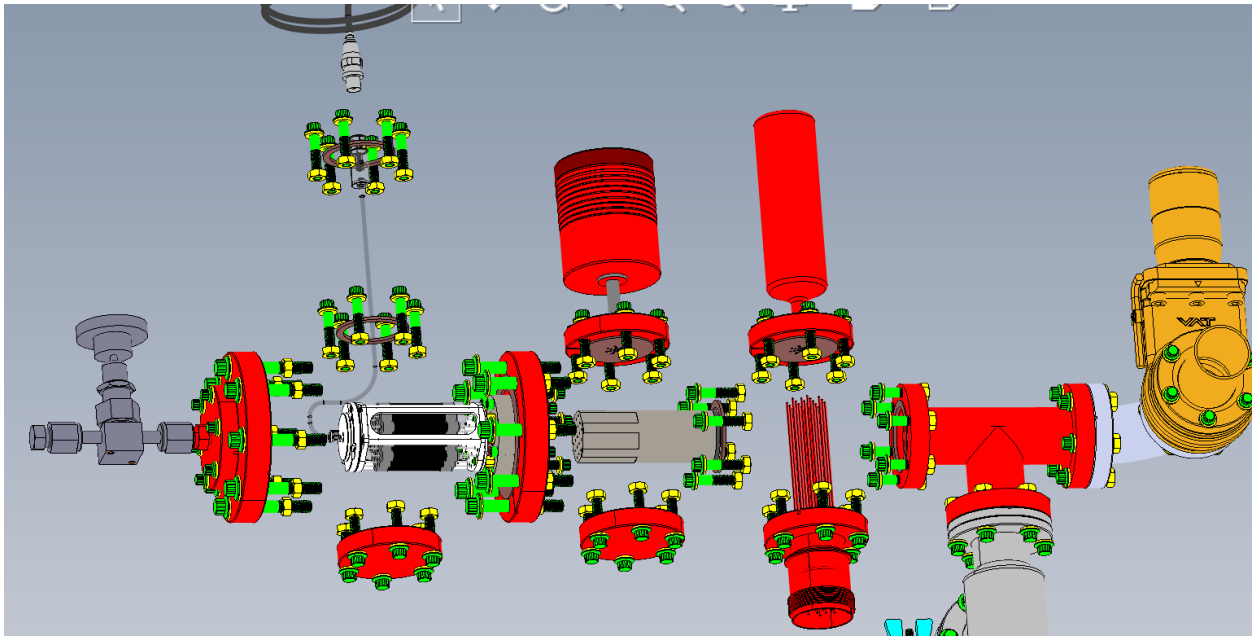
- Ohming (measuring impedance)
- High pot Testing
- Dis-assembly to look at high voltage cable interface

Rich

2.4 Additional drawings:

- LIGO-D1400331: aLIGO, SURFACE CHARGE CONTROL IONIZER
  - LIGO-D1400354: aLIGO, SURFACE CHARGE CONTROL IONIZER, UHV RESISTOR ARRAY ASSY.
  - LIGO-D1400355: aLIGO, SURFACE CHARGE CONTROL IONIZER, APERTURE PLATE
- E-drawing
  - Refer to version 6, which is equivalent to v7 https://dcc.ligo.org/LIGO-D1400331-v6

2.3 Exploded view of TMDS:



3. Original effort

3.1 Data from 2017

Rich / Calum / Dennis
Some test data on 2 LLO units at LLO: https://dcc.ligo.org/LIGO-T1500369
LIGO-D1500103: Electrometer Pod [and collection of related test results in associated documents]
Rich / Calum to follow up on this.

3.2 Logistics wiki page from 2017 shipment

https://dcc.ligo.org/wiki/index.php/Engineering_for_LIGO/Logistics/TMDS
Refer to section 4 for more on logistics.

3.3 Technical details related to the input cabling.

As SHV is only rated for ~5kV, **this seems like a weak link in the design**. The neon sign transformer can put out a lot more voltage (~20kV) than that rating (~5kV) permits.

SHV-5 Single-ended, Grounded-shield feedthrough mounted on a 2.75 CF flange. Accu-Glass Part Number: 11243. https://www.accuglassproducts.com/shv5-gs-275

Kapton insulated 26 AWG, 50 Ohm coaxial cable with "Accufast™ 500S" (grounded) connector on one end and "Connector #2" option on the other. This cable mates directly to the vacuum side of Accu-Glass Single-ended, Grounded-shield MHV and SHV-5 feedthroughs. Part Number: 110196

4. Logistics

4.1 Summary: Serial Numbers & Logistics

TMDS inventory: https://dcc.ligo.org/LIGO-E1500319- google live link at bottom of page
LHO Shipment-10204
LLO Shipment-10205
MIT Shipment-10206
Nikki / Liz - Please follow up with Calum on this, once data added to ICS.

4.2 Shipping: 2x "Broken units back from LHO to CIT"

Chandra @ LHO. Liz / Nikki.
LHO units @ CIT: S1500093 # 7- The blue part (electrometer) S1500101.
LHO units @ CIT: S1500142 #5 - The blue part (electrometer) S1500167
LHO units @ CIT: S1500194 #8 - The blue part (electrometer) S1500199.
>> All now in Jitter lab in Downs (room 227)

4.3 Summary: Hunt for other units

Serial numbers of all units and location:
CIT? *Missing?*
CIT unit @ CIT: S1500138 # 10- The blue part (electrometer) TBA

MIT x1 Found. Eyes on 2020.
MIT unit @ MIT: S1500097 # 9- The blue part (electrometer) S1500102.

LLOx4 - DBI BOL #49883 - 5/19/15
LLO unit @ LLO: S1500095 # 6- The blue part (electrometer) S1500100.
LLO unit @ LLO: S1500096 # 3- The blue part (electrometer) S1500098.
BOL #51202 - ETA 8/19-8/21
LLO unit @ LLO: S1500139 # 2- The blue part (electrometer) S1500164.
LLO unit @ LLO: S1500141 # 4- The blue part (electrometer) S1500165.

3rd IFO x4 - TBC?
3IFO unit @ LHO: S1500261 # 14- The blue part (electrometer) S1500259
3IFO unit @ LHO: S1500262 # 13- The blue part (electrometer) S1500104
3IFO unit @ LHO: S1500263 # 12- The blue part (electrometer) S1500260
3IFO unit @ LHO: S1500264 # 01- The blue part (electrometer) S1500258

LHO x1 (3x at CIT) Eyes on 2020.
LHO unit @ LHO: S1500140 # 11- The blue part (electrometer) S1500166

CIT (3 on loan from LHO) (9/16)

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LHO units @ CIT: S1500142 #5 - The blue part (electrometer) S1500167
LHO units @ CIT: S1500094 #8 - The blue part (electrometer) S1500199.

Nikki / Liz - Please follow up with Calum on this, once data added to ICS.

The following data was inserted by Rich Abbott on 12 November 2020
*Elizabeth Natividad November 13, 2020 info added

SN	Present Location	Status
S1500093	CIT / *from LHO	Failed
S1500094	CIT/ *from LHO	OK
S1500095	LLO	OK
S1500096	LLO	OK
S1500097	MIT	OK
S1500138	CIT?	Disassembled?
S1500139	LLO	OK
S1500140	LHO	OK
S1500141	LLO	OK
S1500142	CIT / *from LHO	Failed
S1500261	3rd IFO	OK
S1500262	3rd IFO	OK
S1500263	3rd IFO	OK
S1500264	3rd IFO	OK