LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Preparation of a thermal compensation plate (TCP) or end reaction mass (ERM)

(Gluing wire break-off prisms and earthquake stops)

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DCC

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1 Introduction

1.1 Purpose and Scope

This document goes through the procedure for preparing a Thermal Compensation Plate (TCP) or End Reaction Mass (ERM) (D1000979 and D080116) for installation into the reaction chains of the quadruple suspension structure (end station for the ERM and input station for the TCP). The procedure consists of two steps:

1) Gluing the wire break-off prisms onto the (approximately) 9 and 3 o'clock positions of the barrel of the TCP or ERM.
2) Glue 4 earthquake stop attachment pieces to the face of the optic (on the side of the gold coated ESD pattern.

The procedure starts from the point the ERM or TCP has been delivered from all vendors and the necessary quality control of the masses has been conducted by aLIGO personnel.

The procedure ends with storing the mass awaiting inserting into the chain. It includes handling the mass using the ergo-arm. Mirror handling procedures with the ergo-arm are detailed in T1000082.

The ERM and TCP have a different width. Therefore the bonding jigs for the wire break-off prisms have a different width. The principle design of the jigs is the same though, therefore procedures are the same.

The alignment accuracy for the prisms onto the barrels of the ERM and TCP w.r.t. the centre of mass is +/- 0.3 mm (somewhat less tight than ears and prisms on the ETM and ITM). This means that based on the quality documentation a unique serial number for each prism is not required. This has been confirmed by e-mail communication by Norna Robertson to Mariëlle van Veggel on 28/06/2010. All prisms have been produced with an accuracy of +/- 0.15 mm. The average width of the mass has been specified in the drawings to be accurate within +/- 0.5 mm. Because this is a larger value than the required +/- 0.3 mm accuracy, the measured mean width of the mass will be used in the jig settings calculations. This takes into account the shift of the COM caused by the wedge angle of the mass as well. For jig setting calculations therefore the measured mean width of the mass divided by two will be used to calculate the distance of COM from surface S1 of the mass.

The ERM has circular recesses for the earthquake stops, where the TCP does not have those. The circular recesses on the ERM can be used to locate the earthquake stops as a base is glued into each one. The earthquake stops on the TCP can be located by the shape and location of the gold pattern for the ESD. Circular spaces have been left where the earthquake stop should be located. The required tolerance is not tight, which means that the stops can be located during gluing without the aid of a positioning jig.

It assumes that the mass has been stored in a COC CP storage container or 'cake-tin' (D0902001). In case of the TCP an adaptor (D1000958) is included in the storage assembly to make up for the smaller width.

Masterbond EP30-2 is the adhesive used to glue the prisms and earthquake stop bases. Procedures for this adhesive have been released through section 12.18 in E960022-v9.

The procedure does not include (at this point) any necessary cleaning and/or baking procedure required prior to inserting the mass into the structure.

The procedure also does not include the attachment of the connectors (5 PE44489 Pasternack MINI SMP male connectors for the ESD) to the barrel of the optics.

The document starts with giving an overview of the required tooling followed by giving the relevant documentation. It then discusses the detailed steps of the procedure including location, timing, number of personnel needed and tooling needed.

Questions currently:

- Check with Calum/Margot: Will first contact be used to protect the ERM and TCP during handling before installation into the quad structure?
- Check with Joe/Norna: How will the Earthquake stops be located on the TCP as recesses for these don't exist. Based on a brief discussion during the technical meeting on 30/11/2010, the earthquake stop mount plates can be glued in position by eye without alignment tooling. Currently (1/12/2010) the procedure is based on this assumption.
- Check with Joe/Norna: Status of the Earth quake stop design (D080241)
- Double check that the measurements I base the jig settings calculations on are correct.
- Check with Calum: Check that I have understood correctly that the CP optical container (D0902001) is used for the ERM's and that the same container but with adaptor (D1000958) is used for the TCP.
- Check with Calum: Will the ERM and/or TCP have gold barrel coatings?
- Check with Calum/Margot: For the gold ESD pattern and possible barrel coatings, are there any particular handling requirements? E.g. are wipes with solvents permitted? E.g. should we only get close with optical wipes instead of cleanroom wipes?
- Check with Calum/Margot/Dennis/Betsy: Are these optics going to be vacuum baked after gluing?
- Check with Calum/Margot/Betsy: Back-up procedure. Which detergents can we use to debond the prism if we need to, considering we have gold coatings nearby.
- Check with Betsy: Check that I've correctly written the procedure for EP30-2 usage. Main questions I have in relation to this:
    - How is the EP30-2 mixed and dispensed?
    - E-mail communication between Betsy Bland and Marielle van Veggel on 01/12/2010

      Betsy: The following link is the DCC sheet which is collecting the LIGO known facts and procedures related to EP30-2. I am intending to run a heat lamp vs. temperature set of measurements in the next week to verify that we in-fact can heat an object to 40 deg C when we do the 16-24 hour heat lamp cure (our typical practice so far). Most of it is related to the qualification process of EP30, but the notes are what we have been using as a procedure to date. It is the bullet 2) that we need to clarify what does and does not get vacuum baked. (My little all metal flags get vacuum baked.)

      https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=15133

Marielle: That is very useful information, though I'm also looking for more basic information like:
1) How is the EP30-2 adhesive packaged for aLIGO (bipacs, dual tubes)?
2) How are the components mixed (mixing gun, stirring, mixing inside package)?
3) What tooling is used to apply the adhesive to the surface? (We used uncoated copper wire before with the VacSeal. We'd dip it into the adhesive that we had dispensed into a UHV aluminum boat. Is this still the case?).

Betsy: Ah - yes, these details are not exactly written down anywhere. I believe the 3) copper wire applicator bit is written in the iLIGO LOS suspension procedure when we used VacSeal, D970154 see section 5.2.1 for example:

https://dcc.ligo.org/DocDB/0024/E970154/000/E970154-D.pdf

I have just added to the EP30 DCC page a link to the mixing/expensing gun we use for EP30. It is the gunkit link in the 7th bullet under Other Files. It works quite well. I have actually not order the bipack cartridges, as Bob Taylor placed our first order for 6 and we are still using them.

1.2 Equipment and Materials

- Quality control documentation mass, prisms, jig
- Filtered dry nitrogen
- (De-)Ionizing gun
- High intensity light source (ideally handheld battery supported)
- Cleanroom wipes
- Methanol or isopropanol - Reagent grade
- Acetone – Reagent grade
- 2x V-block - D1001685
- Bonding jig with prism holder – D1002201 and/or D1002140
- Metric slip gauges
- Allen key for #2-56 socket-head cap screw
- Digital calipers – with metric setting
- EP30-2 Adhesive cartridge for 10:1 mixing ratio and gun kit (or EP30-2 Adhesive 2 ml bipacks with 10:1 mixing ratio)
- UHV aluminium foil
- Uncoated copper wire ∅ 0.5 mm
- 1 mm pin
- Heat lamp on stand
- Petridish

- Ergo-arm
- Coordinate measuring machine
- Earthquake stop mount plates (D080244)
- (razor blade)

1.3 References

Design documentation 'glass' essentials	
D1000980	adLIGO, assembly of TCP optic with prisms
D1000979	aLIGO, COC TCP substrate
D080116	End Reaction Mass (ERM)
D0902822	Assembly of ERM optic with prisms
Design documentation metal essentials	
D080750	aLIGO SUS ERM wire break-off prism
D080241	Adv. LIGO, SUS, Earthquake Stop Assembly
D080244	ADV LIGO, SUS, QUAD N-PTYPE TEST REACTION MASS, EARTHQUAKE STOP MOUNT PLATE
Design documentation of the alignment jigs	
D1002140	aLIGO TCP prism bonding jig
D1002201	aLIGO ERM prism bonding jig
Measurement reports on 'glass' essentials	
Q1000009	Inspection document for the wire break-off prisms for the ERM
Back ground documents	
D0902001	aLIGO CP, TCP COC container assembly
D1000958	aLIGO, TCP (THIN COMPENSATION PLATE) SUBSTRATE ADAPTER
E960022	LIGO Vacuum Compatibility, Cleaning Methods and Qualification Procedures
E0900394	aLIGO Optic Container Shipping Procedure
E970154	LARGE OPTICS SUSPENSION BALANCING SPECIFICATION
E1000386	Material Qualification RGA Test Results: MasterBond EP30-2 epoxy
T1000082	Ergo Arm Users Manual
E1000079	Procedure for Applying and Removing First Contact
T0900402	Enhanced LIGO Core Optic Drag Wipe Cleaning Procedure
T1000137	Drag Wiping and First Contact

1.4 Version history

02/12/10: Release v1 onto DCC. This version is meant for discussion purposes and is very much still a draft.

2 Main procedure for gluing the wire break-off prisms

2.1 Set jig for the relevant side (on surface S3 at arrowed registration mark (ARM or 180º w.r.t. ARM) of the mass

Step	What	Where	Time	People	Tools
1	Choose which side (on surface S3 at arrowed registration mark (ARM) or 180º w.r.t. ARM) to bond the prism, select a prism, prism holder and bonding jig that will be used for the bonding. Calculate the required settings for D_{slider} and D_{screw1} for the bonding jig using the excel spreadsheet (E1000256) and copy onto clean-room paper	In office	30 min	2 (one calculator, one checker)	Quality control documentation of mass, prism and bonding jig.
2	Set D_{screw} on the left side of the jig for bonding at the ARM or the right side of the jig for bonding at 180º w.r.t. the ARM. For a nominal mean width of 130.00 mm for the ERM and 100.00 mm for the TCP, D_{screw} will be set to 3.00 mm. Because of the ± 0.5 mm variation on this though, in really this value will be slightly different for each mass. D_{screw} is most easily and most accurately set using slip gauges	in bonding cleanroom	5 min	1	Bonding jig assy (D1002140 for the TCP, D1002201 for the ERM), metric slip gauges
3	Set D_{slider} on both sliders of the jig. This is for the vertical alignment of the jig. Since the prisms will be glued onto the centerline, the distance between the top of the alignment pin and the slider shall be 20.00 mm. D_{slider} is most easily set using (digital) calipers.	in bonding cleanroom	5 min	1	Bonding jig assy, digital metric calipers, #2-56 socket-head cap screw
			40 min		

2.2 Set-up mass and prism for cleaning

Step	What	Where	Time	People	Tools
4	Take the mass out of its storage container and place onto the V-block the table with the bonding side facing up. This is done using the ergo-arm. Follow instructions for the storage containers (E0900394). Follow instructions for the ergo-arm (T1000082).	in bonding cleanroom	15 min	2	Ergo-arm (T1000082), mass in optic with tooling to open, V-block, isopropanol,

Step	What	Where	Time	People	Tools
					cleanroom wipes
5	Change gloves	in bonding cleanroom	1 min	2	Gloves
6	Take the prism out of its packaging and place in a petridish on a clean room wipe. It is a stainless steel prism.	in bonding cleanroom	2 min	1	Prism (D080750), petridish, cleanroom wipe
7	Change gloves	in bonding cleanroom	1 min	2	Gloves
			18 min		

2.3 Clean the relevant side (ARM or 180º w.r.t. ARM) of the mass

Step	What	Where	Time	People	Tools
8	Make sure the dry nitrogen supply is open and de-ionizing gun can blow a gentle consistent and well controlled flow. Make sure acetone, methanol and cleanroom wipes are ready.	in bonding cleanroom	1 min	1	Dry nitrogen, acetone, isopropanol or methanol, clean room wipes
9	Use the drag wiping procedure to carefully wipe the relevant side with acetone. Repeat with isopropanol or methanol. The use of solvents needs checked with the eye on gold barrel coatings.	in bonding cleanroom	1 min	1	Acetone, isopropanol or methanol, clean room wipes
10	Use the de-ionizing gun to gently blow dry the bonding area	in bonding cleanroom	1 min	1	Dry nitrogen
			3 min		

2.4 Clean prism

Step	What	Where	Time	People	Tools
11	Take the prism holder and wipe with methanol to remove any dust particles. Blow dry with nitrogen.	In bonding cleanroom	30 sec	1	Prism holder, cleanroom wipe, methanol

Step	What	Where	Time	People	Tools
12	Turn the grub screw on the prism holder back so that the prism can easily be put into the holder.	In bonding cleanroom	1 min	1	Fingers should be enough, Allen key for #2-56 socket head cap screw
13	Pick up the prism. Apply some acetone to another wipe and wipe the surface to be bonded carefully. Repeat with isopropanol or methanol. Blow dry with nitrogen.	in bonding cleanroom	1 min	1	Acetone, Isopropanol or methanol, cleanroom wipes
14	Carefully put the in the prism holder ensuring it sits comfortably against all three support rods. Then tighten the grub screw such that it is just tight enough to prevent the prism from falling out of the prism holder.	In bonding cleanroom	1 min	1	Fingers should be enough, Allen key for #2-56 socket head cap screw
15	Clean gloves	in bonding cleanroom	30 sec	1	Gloves
			3 min		

2.5 Prepare the adhesive

Step	What	Where	Time	People	Tools
16	Make a boat of clean UHV aluminium foil	in bonding cleanroom	1 min	1	UHV aluminium foil
17	Prepare a couple of applicator wires (∅0.5 mm uncoated copper wire). Wipe them with acetone followed by a wipe with isopropanol or methanol.	in bonding cleanroom	1 min	1	∅0.5 mm uncoated copper wire, acetone, methanol or isopropanol
18	The EP30-2 adhesive currently comes in a 37 ml gunkit, which can mix a 10:1 adhesive ratio (see E1000386). Place the adhesive cartridge in the gun. Remove the end cap and replace it with the mixing tube and save the end cap. (The adhesive can also come in a 2 ml “bipax” sachet with the two parts of adhesive separated with an external two part clamp. Remove the	in bonding cleanroom	2 min	1	EP30-2 gun kit, EP30-2 adhesive cartridge for 10:1 mixing ratio (EP30-2 2ml bipack with 10:1 mixing

Step	What	Where	Time	People	Tools
	clamp and mix the adhesive thoroughly inside the package by squeezing the adhesive from one side to the other for approximately 2 minutes until the color has a homogeneous appearance.)				ratio)
19	Dispense the adhesive into a boat made of clean UHV aluminium foil using the gun. (For the bipack cut open the packet with a clean razor blade in the middle of the packet and dispense).	in bonding cleanroom	1 min	1	UHV aluminium foil, Clean razor blade or scissors
20	After using the mixing tube and gun, detach the mixing tube and throw away the mixing tube. Reattach the end cap and store the gun with the cartridge attached to the gun. (Throw away the used bipack)	in bonding cleanroom	1 min **7 min**	1	

2.6 Gluing the prism onto the side

Step	What	Where	Time	People	Tools
21	Use the fibre optic light to thoroughly inspect the surface for small specks from a distance of 5-6". Wipe and/or blow any specks away.	in bonding cleanroom	1 min	1	Optical wipe, methanol
22	Wipe down the bonding jig with methanol to remove any dust and blow dry with nitrogen. Place the jig on the bonding surface by referencing surface "S1" (with the ESD gold pattern) of the mass and lining the sliders up with the fiducial line in the surface ("S3"). Be careful not to slide the micrometer screw contact points against surface S1 until vertical alignment has been achieved as this might cause marks in the mass. Tighten the spring-loaded screw onto surface "S2".	in bonding cleanroom	3 min	1	Optical wipe, methanol
23	Check the prism for dust one last time. Wipe with methanol if necessary. Blow dry with dry nitrogen.	in bonding cleanroom	30 sec	1	
24	Dip the copper applicator wire into the adhesive in the aluminium boat. Draw a thin line (0.5 mm width) of adhesive along its length in the center onto the prism. Stay a few millimeters from the edges at the ends though.	in bonding cleanroom	1 min	1	Uncoated copper applicator wire

Step	What	Where	Time	People	Tools
	The cross pattern helps to get the adhesive in the corners and prevent it from escaping from underneath the edges at the same time.				
25	Pick up the prism holder with prism and put the prism down onto the mass while referencing the prism holder against the top left corner of the bonding jig. Apply some mild pressure to make the adhesive spread.	in bonding cleanroom	1 min	1	
26	Set-up the heat lamp to be about 30 cm from the prism. The prism should reach about 40 ºC (140 ºF). The heat helps the adhesive to spread nicely and speeds up the curing.	in bonding cleanroom	2 min	1	Heat lamp on a stand
27	Leave the remainder of the adhesive in the boat beside the mass. Leave the adhesive to cure overnight (16-24 hrs).	In bonding cleanroom	16-24 hrs	0	
28	On return, switch the heat lamp off. Check the adhesive in the boat has cured by breaking it. It should break in a brittle way.	In bonding cleanroom	1 min	1	
29	Loosen the grub screw on the prism holder and carefully remove it. Then loosen the spring laden screw on the jig and carefully remove the jig from the mass. For the CP it might be difficult to reach the grub screw because of limited room. A 1 mm diameter pin can help here or remove the bonding jig first before removing the prism holder.	In bonding cleanroom	2 min	1	1 mm diameter pin
30	Use a Coordinate Measuring Device to measure the position of the prism with respect to the front and back and the fiducial line to confirm the prism is in the correct position	In bonding cleanroom	1 hr	2	Coordinate measuring device
			8 min **16-24 hrs** **63 min**	**1** **0** **2**	

2.7 Glue the prism on the other side

Step	What	Where	Time	People	Tools
31	Use the ergo-arm to turn the mass 180º to allow for bonding the prism onto the other side.	in bonding cleanroom	10 min	2	First Contact, clean room wipes

Step	What	Where	Time	People	Tools
32	Repeat steps 1 through 3 and 5 through 25.	In office/ in bonding cleanroom	26 min	1,2	See above
33	Repeat the curing steps 26 through 30.	In bonding cleanroom	12 hrs + 63 min	0,1	See above
			36 min	**2**	
			12 hrs	**0**	
			73 min	**2**	

3 Procedure for attaching the earthquake stop bases

Step	What	Where	Time	People	Tools
34	Use the ergo-arm to put the mass onto surface “S2” onto a patch of cleanroom wipes .	In bonding cleanroom	10 min	2	Ergo-arm
35	Wipe the bonding locations for the earthquake stop mount plates with acetone and methanol or isopropanol. (Check if this is ok with the gold) The TCP does not have recesses in the surface for the mount plates. Locations are easily recognizable by the circular spaces that have been created in the gold ESD pattern. The ERM does have recesses in the surface in which the mount plates can be located. Clean room buds will be needed to clean the recesses.	In bonding cleanroom	1 min	1	Cleanroom wipes, cleanroom buds, acetone and methanol or isopropanol
36	Prepare 4 earthquake stop mount plates (D080244) by wiping them with acetone followed with a wipe with isopropanol or methanol (for one mass). Blow dry with dry nitrogen and place them into a petridish with a clean cleanroom cloth.	in bonding cleanroom	1 min	1	4 earthquake stop mount plates (D080244) cleanroom wipes, acetone, methanol or isopropanol, petridish

Step	What	Where	Time	People	Tools
37	Prepare the adhesive as described in steps 16 to 20.	in bonding cleanroom	7 min	1	See above
38	Dip the applicator wire in the EP30-2. Take one of the mount plates and apply a small drop (∅ 0.5 – 1.0 mm) to the centre of the back surface.	in bonding cleanroom	1 min	1	0.5 mm uncoated copper wire, acetone, methanol or isopropanol,
39	Carefully place the mount plate down into one of the 4 recesses for the ERM, or in the centre of one of the circular cut-outs in the gold ESD pattern on the TCP. Apply some light pressure to allow the adhesive to spread but be careful not to let the plate slide. The required accuracy is +/- 0.5 mm.	in bonding cleanroom	1 min	1	
40	Repeat steps 38 and 39 until all 4 mount plates have been glued.	in bonding cleanroom	8 min	1	
41	Set-up a heat lamp 30 cm from surface S1 to cure the adhesive.	in bonding cleanroom	5 min	1	Heat-lamp on stand
42	Leave the remainder of the adhesive in the boat beside the mass. Leave the adhesive to cure.	in bonding cleanroom	16-24 hrs	0	
43	On return, switch the heat lamp off. Check the adhesive in the boat has cured by breaking it. It should break in a brittle way.	in bonding cleanroom	1 min	1	
44	Use the ergo-arm to store the mass back into it's storage container and move it to storage	In bonding cleanroom/ mass storage place	30 min	2	Ergo-arm, storage container
			24 min **12 hrs** **23 min** **12 hrs** **31 min**		

4 Back-up and other procedures

4.1 Removing a prism or earthquake stop base

In the case that a prism is not aligned to the required accuracy or the adhesive has not cured well, it will be necessary to remove the prism. This can be done at any time using the following technique as taken from T0900369.

Step	What	Where	Time	People	Tools
1	Set-up the mass on the V-block using the ergo arm with the relevant side facing up	In clean-room	10 min	2	V-block, ergo-arm
2	Cut a clean room cloth to fit around the prism with one end in a small container of DI water and Micro90 or other detergent. The cloth should soak up the mixture from the bath and keep the prism base wet	In clean-room	5 min	2	Small container, DI water, Micro90
3	Also set-up a heat lamp above it to activate the detergent solution.	In clean-room	5 min	1	Heat lamp on a stand
4	Check regularly. The prism should come off in 8 hours at most.	In clean-room	8 hrs max	1	
5	The adhesive should be soft after this and come off easily with some rubbing with a cloth in DI water and rinsing with methanol	In clean-room	10 min	1	Clean-room cloths, DI water, methanol
6	If the prism doesn't come off in this period, a heat gun can be used to introduce slightly more intense heat.	In clean-room	5 min max	1	Heat gun

4.2 Applying/removing First Contact

4.2.1 Applying

Step	What	Where	Time	People	Tools
1	See E1000079.		3 hours	1	See E1000079.

4.2.2 Removing

Step	What	Where	Time	People	Tools
1	See E1000079.		3 hours	1	See E1000079

4.3 Drag-wiping

Step	What	Where	Time	People	Tools
1	See T0900402 and T1000137.		3 hours	1	See T0900402, T1000137.

5 Remarks

E-mail Norna Robertson to Marielle van Veggel on 28/06/2010

Subject: Re: Update on prisms
From: Norna Robertson <nroberts@ligo.caltech.edu>
Date: Mon, 28 Jun 2010 16:58:05 -0700
To: Mariëlle van Veggel <m.veggel@physics.gla.ac.uk>
CC: Calum Torrie <ctorrie@ligo.caltech.edu>, Janeen Romie <janeen@ligo-la.caltech.edu>, Mark Barton <mbarton@ligo.caltech.edu>

Hi Marielle
Apologies for taking a while to get back to you on this. Thanks for doing all these measurements.
1) ERM/CP prisms.
I believe we can accept these, except for the 3 you note, without keeping track of individual serial numbers. These are all for reaction chains where the requirements on isolation etc are significantly less demanding than for the main chains. So if a slight deviation from say vertical parallel wires results from the b-a being out by 0.1 mm we may get a little more coupling than expected but not a problem.
2) BS/FM prisms.
a) I did not follow your comments on marking "the side flats" with a groove to indicate the surface which should be referenced. Is it that you will mark the end from which you measured the "a" value so that we know how far away to put that from the edge of the optic? Or is it something to do with the "d' value which is also undersized? Maybe a drawing would help.
b) What concerns me more is that the depths of the grooves are not very consistent - and some of them look to me so shallow that the wire will "bottom out" in the groove. So I didn't understand your comment that they are all in spec. Take the bottom image on page 3 for example. It is wider than 0.30 mm and considerably shallower than 0.15 mm. Am I missing something - can you clarify?
Thanks and regards
Norna
On 6/24/2010 9:40 AM, Mariëlle van Veggel wrote:
Hi Norna,
I have finished measuring the wire break-off prisms for the ERM/CP
https://dcc.ligo.org/DocDB/0012/Q1000009/001/Q1000009-v1_Inspection_document_for_the_wire_break-off_prisms_for_the_ERM.pdf
Measurements were made with digital calipers. Measurement accuracy is ±0.05 mm.
22 off (36 total) meet spec within a ± 0.10 mm tolerance.
11 off are 0.11 to 0.14 out from spec, so meet spec within the specified 0.1 mm tolerance (without the added 0) in the drawings.

Also one has to take into account the measurement error.
3 off are out more than 0.15 mm (prisms 1, 5 and 34).
Bearing in mind these are steel prisms I would like your opinion if you would accept these prisms (except the 3 that are out of spec) like this if we would not keep track of them using a unique serial number for this application. I am not clear enough on the dynamics requirements to make that judgement sensibly.
I also have finished measuring the sapphire wire break-off prisms for the BS/FM.
https://dcc.ligo.org/DocDB/0012/Q1000008/001/Q1000008-v1_Inspection_document_for_the_primary_wire_break-off_prisms_for_the_FMBS.pdf
Measurements of a, b, c, d, and e have been taken with digital calipers. Measurement accuracy is estimated to be ± 0.05 mm (due to reading errors)
The prisms are generally undersized in width but the distance between the grooves is within spec for all.
Because the prisms are undersized in width and will be referenced on the side flats the prisms will be marked with a small fiducial groove to indicate the surface
that should be referenced during gluing on the prism, such that any positioning error on the BS/FM can be minimized as much as possible.
Also each prism will be packed separately with a unique serial number to allow for this precise alignment.
The groove depth and width has been measured with a table top Hitachi SEM (Scanning Electron Microscope)
The groove depth and width is within spec for all.
No cracks have been observed. Any features seen are dirt specs as images have been taken before cleaning to make focussing easier.
The file size is rather large for this one. This is because I have images all grooves with the SEM. My apologies.
Can you to look over these measurements whenever you find time and see if you agree with my conclusions?
Actions still on these prisms:
1) Marking the sapphire prisms
2) Wire break-off prisms for the PM are being laser abladed as we speak. They will be measured as soon as they come back.
3) Basic cleaning all prisms and packing and labelling them before sending to Bob Taylor.
Thanks,
Marielle
****

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