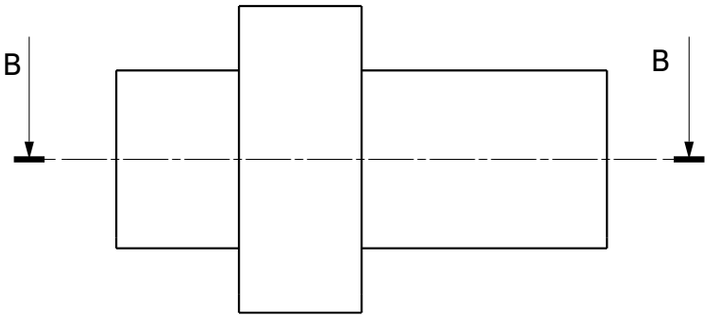
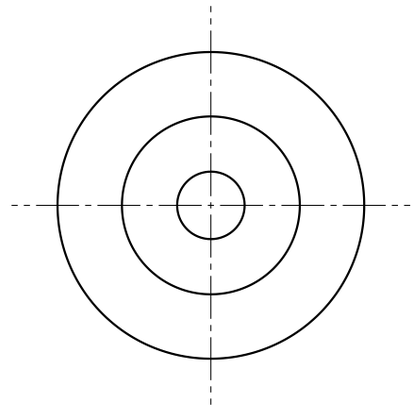
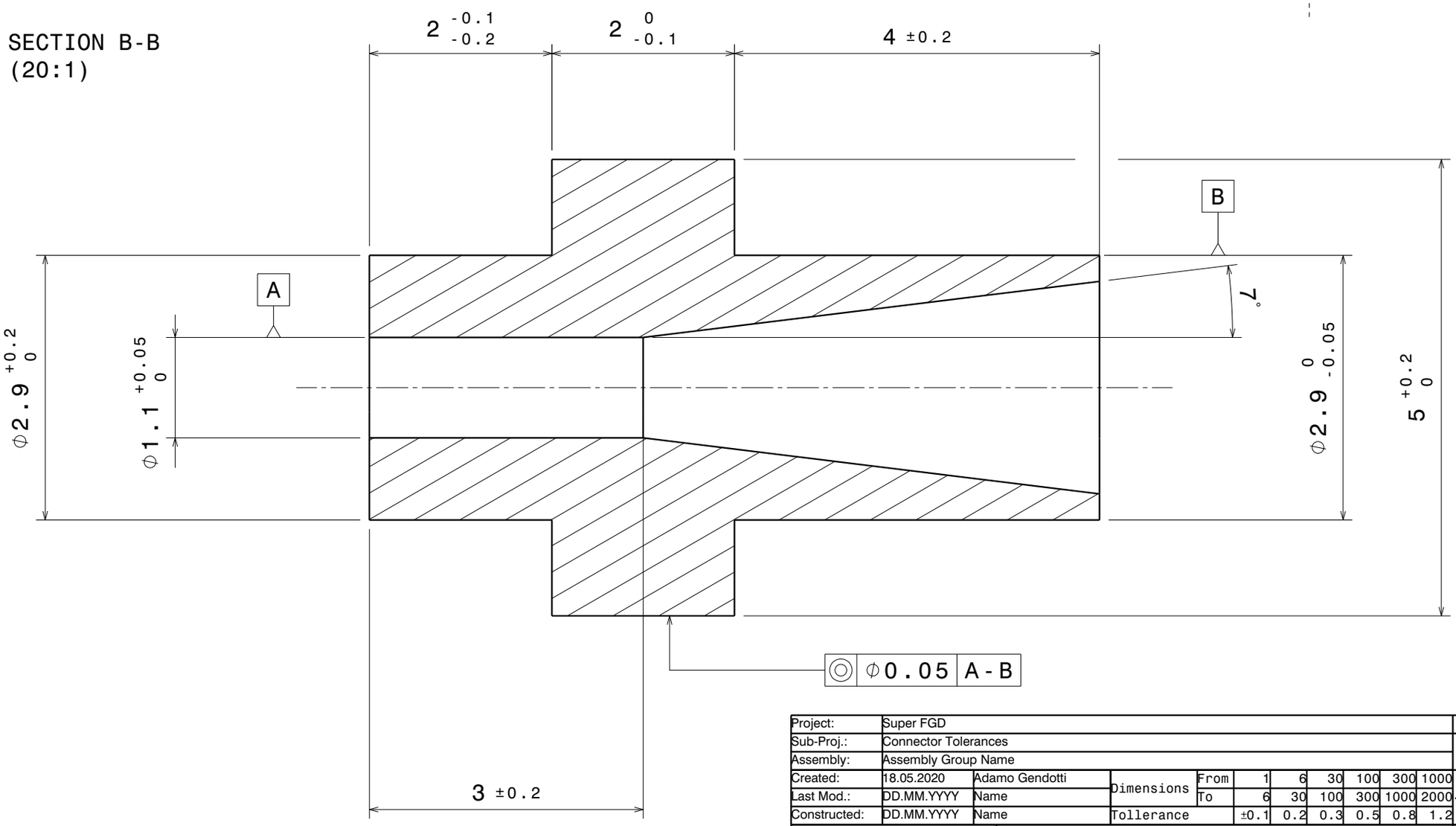
Status of Optical Connectors

Davide Sgalaberna (ETH Zurich)





SECTION B-B
(20:1)



Project:	Super FGD									Scale	Tot Pages
Sub-Proj.:	Connector Tolerances									10:1 (20:1)	1
Assembly:	Assembly Group Name										
Created:	18.05.2020	Adamo Gendotti	Dimensions	From	1	6	30	100	300	1000	Page N°
Last Mod.:	DD.MM.YYYY	Name		To	6	30	100	300	1000	2000	1
Constructed:	DD.MM.YYYY	Name	Tollerance		±0.1	0.2	0.3	0.5	0.8	1.2	
IPA ETH zürich	Connector Only Tolerances										A3

Summary tests

The tests are divided into three category:

1. Quality checks on the injection mould prior to pre-series production to ensure that the tolerances in figure 6 can be achieved. In particular the concentricity shall be carefully evaluated, given the complexity of checking it within the following categories 2) and 3);

2. Quality checks of the pre-series optical connectors prior to series production withmicrometre to verify the tolerances. The inner diameters of the optical connectors will not be tested because not possible with a standard micrometre;

3. Quality checks with test jig (see figure 7). It consists of an aluminium base with two holes and two pins inserted into small holes:
   - connector inner hole diameter (⌀ = 1.1 +0.05 -0 mm) acceptance: a metallic pin (⌀ = 1.10 +0 -0.01 mm) can be inserted through the hole (“pin go”);
   - connector inner hole diameter (⌀ = 1.1 +0.05 -0 mm) rejection: a metallic pin (⌀. = 1.15 +0.01 -0 mm) cannot be inserted through the hole (“pin no go”);
   - connector outer diameter (⌀ = 2.9 +0 -0.05 mm) acceptance: the connector can be inserted into the metallic jig hole of ⌀ = 2.9 +0.01 -0 mm (“hole go”);
   - connector outer hole diameter (⌀ = 2.9 +0 -0.05 mm) rejection: the connector cannot be inserted into the metallic jig hole of ⌀= 2.85 +0 -0.01 mm (“hole no go”);

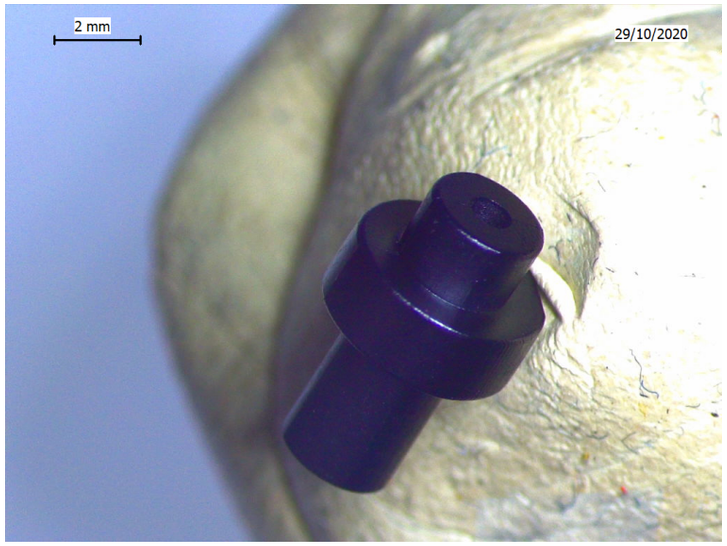
4. Quality check with Kuraray Y11 double-cladding WLS fiber. A sample of WLS fiber, same as it will be used in the SuperFGD detector (see figure 3), will be inserted into the optical connector. It will have to go through the hole smoothly. The diameter of the WLS fibers is 10.02 mm;

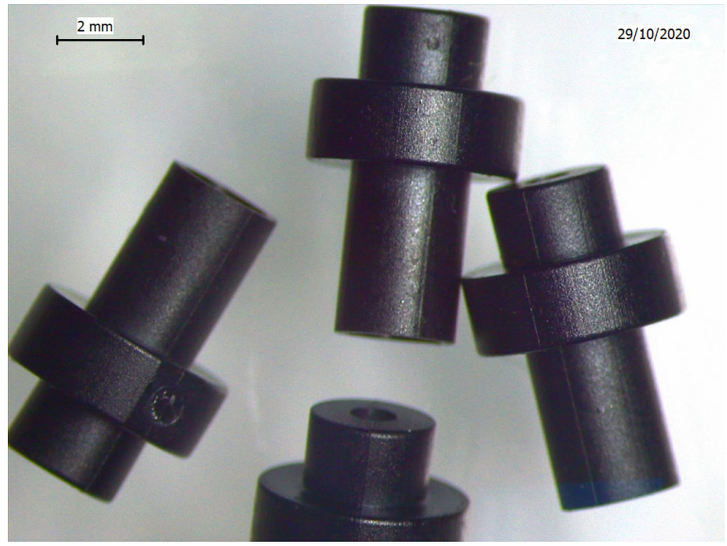
5. Gluing and polishing tests to fulfil the last two requirements set out in §2.1. The coupling obtained by applying epoxy EJ-500 glue between the optical connector and the WLS fiber inserted through the inner hole will be tested and validated. Also polishing tests with a diamond-cutting machine will be performed. At the end of the process, the optical connector must:
   - be well coupled to the WLS fiber, i.e. it shall not detach from the optical connector if slightly pulled by hand;
   - polished on the fiber end surface (B side in figure 3) without being damaged, whilst the diamond cutter shall not touch the optical connector during the polishing”.

If one of these requirements is not fulfilled, the optical connector shall be rejected and a new connector shall be manufactured instead.

Status and schedule

- Pre-series connectors produced by CELOPLAS





	Milestones	Days/Weeks	Indicative Date
T_0	Notification of Contract to the Contractor		7th of October/2020
T_1	Delivery of prototype / pre-series units at CERN (2 × 50 units, batch no. 0a and 0b) and technical documentation (see §4)		3rd of November/2020
T_2	Authorisation by CERN to proceed on basis of prototype and/or pre-series	T_1 + 10 days	14th of November/2020
	Delivery of series batch no. 1 at CERN (5 000 units) and technical documentation (see §4)	T_2 + 5 days	19th of November/2020
	Delivery of series batch no. 2, 3 and 4 at CERN (5 000 + 2 × 27 500 units) and technical documentation (see §4) → ETC	T_2 + 10 days	By 29th of November

The number of connector in each batch to be shipped can be modified upon request from CERN with a notice of two weeks in advance with respect to the schedule. The number of batches and the total number of connectors will not be modified.

Tolerances with calibre

- Pre-series connectors tested at CELOPLAS with calibre (not inner holes)

Measuring Report

RMET Nº: RCE20001 V0
Date: 02.11.2020

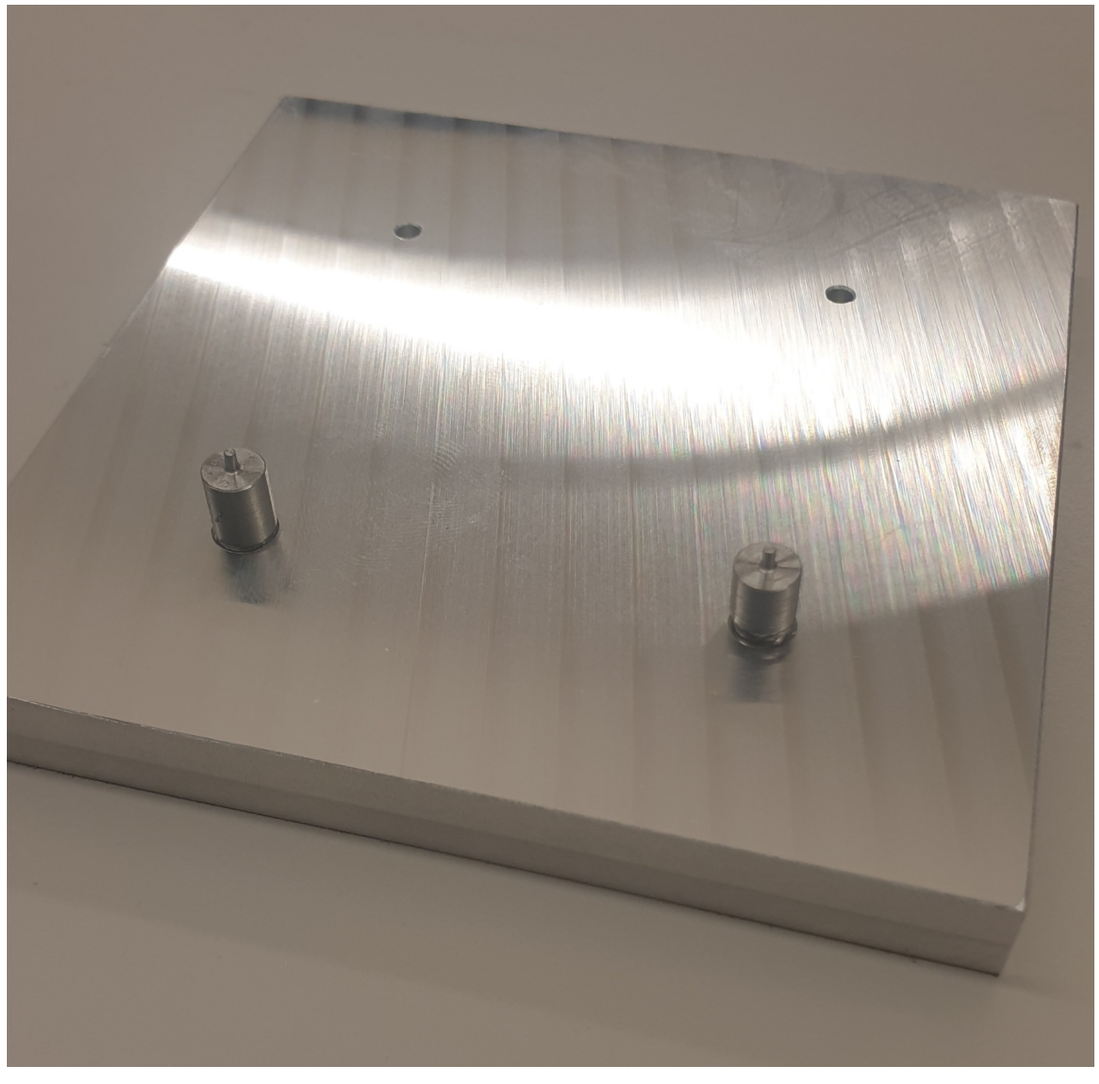
Part Number: TBD	Part Name: Optical conectors		Customer: CERN	Resp: Luís Ribeiro	
Tool: 71054	Production Batch: OF049-20	Measurement Origin: New part			
Problem: -	Activity: -		Drawing Number / Index:	18.05.2020 (Drawing included on the specification document: RFQ - short for discussion with company - 12-10-20MNED)	

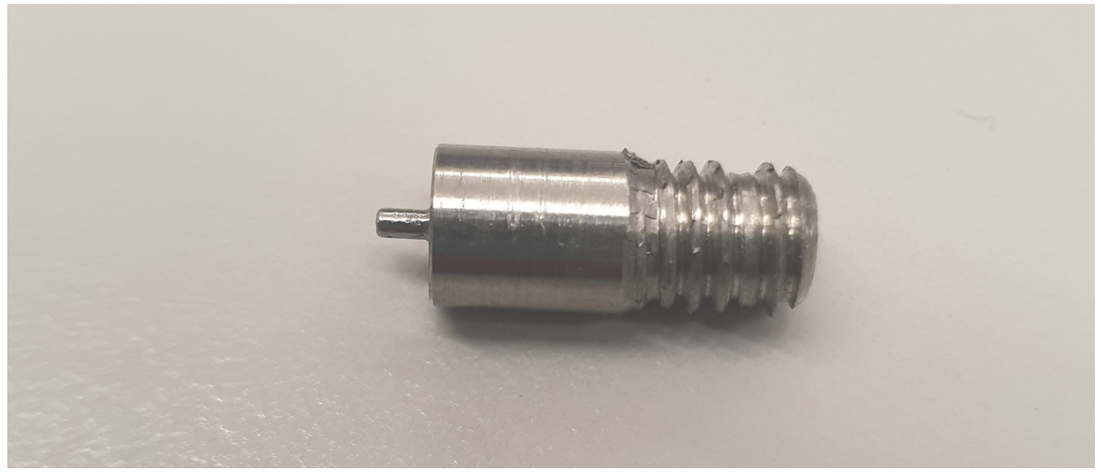
Position	Description	Nominal	Unit	Tol.+	Tol.-	1		2		3		4		5		6		7		8		Measuring Equipment	Evaluation	Comment
						Dim.	Dev.	Dim.	Dev.	Dim.	Dev.	Dim.	Dev.	Dim.	Dev.	Dim.	Dev.	Dim.	Dev.	Dim.	Dev.			
1		2.00	mm	-0.10	-0.20	1.866	-0.134															3D MAHR		
2		2.00	mm	0.00	-0.10	1.957	-0.043															MIC.		
3		4.00	mm	0.20	-0.20	3.995	-0.005															3D MAHR		
4		2.90	mm	0.20	0.00	2.984	0.084															3D MAHR		
5		1.10	mm	0.05	0.00	1.114	0.014															3D MAHR		
6		7	°	1	1	7.032	0.032															3D MAHR		
7		2,9	mm	0	-0,05	2.878	-0.022															3D MAHR		
8		5	mm	0,2	0	5.071	0.071															3D MAHR		
9		3	mm	0,2	-0,2		-3.000															3D MAHR		Not possible to measure
10	concentricty	0	mm	0,05	0	0.011	0.011															3D MAHR		
							-																	
							-																	

- All measurements are well within the target tolerance

Tolerances with jig and WLS fiber

- Jig design is in backup and already discussed many times at mechanics meetings
- Tolerance for insertion in readout interface (outer diameter hole go/no-go with hole) and WLS fiber insertion (inner diameter go/no-go with pin)





Tolerances tested by Eric with “tolerance jig” and WLS fibers:

- tested the 100 connectors we have using the go/no-go jig. All passed
- ran a WLS fibre through a smaller sample, and it passed easily through all of them.

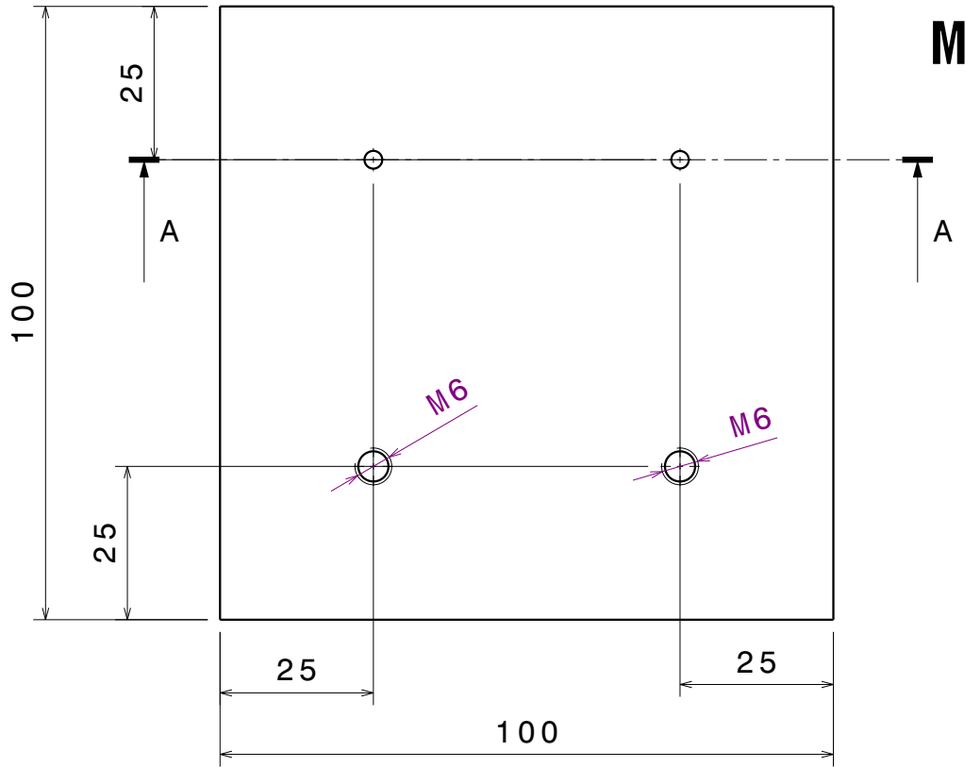
- All measurements are well within the target tolerance

Next steps

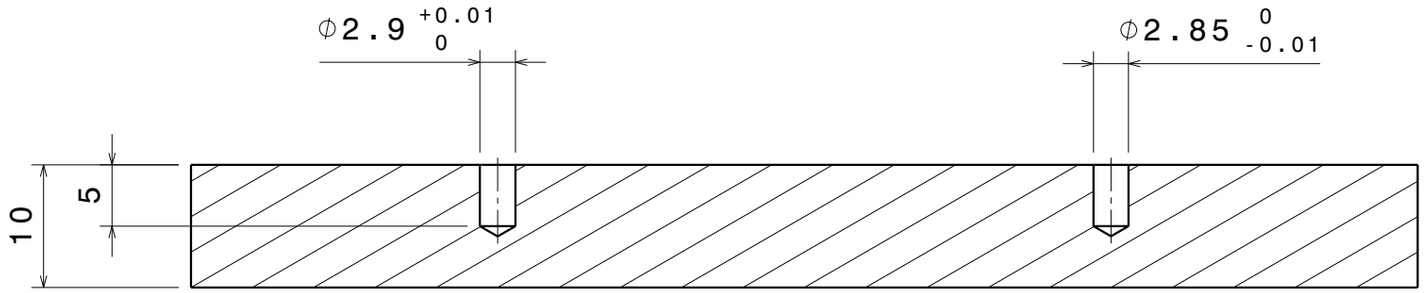
- The pre-series connectors have been delivered (donated) to J-PARC
    - ✦ Those not used for tests should be sent to U.Rochester for preparing setup for gluing/machining of series connectors
- Test gluing + machining —> if OK, CELOPLAS will start the mass production
- Also 2 tolerance jigs delivered to J-PARC —> they will be used for testing the series connectors
- 1 tolerance jig will be delivered soon to U.Rochester—> they will be used for testing the series connectors
- Everything looks fine to complete the mass production within the target schedule (if all tests for approval go well)

BACKUP

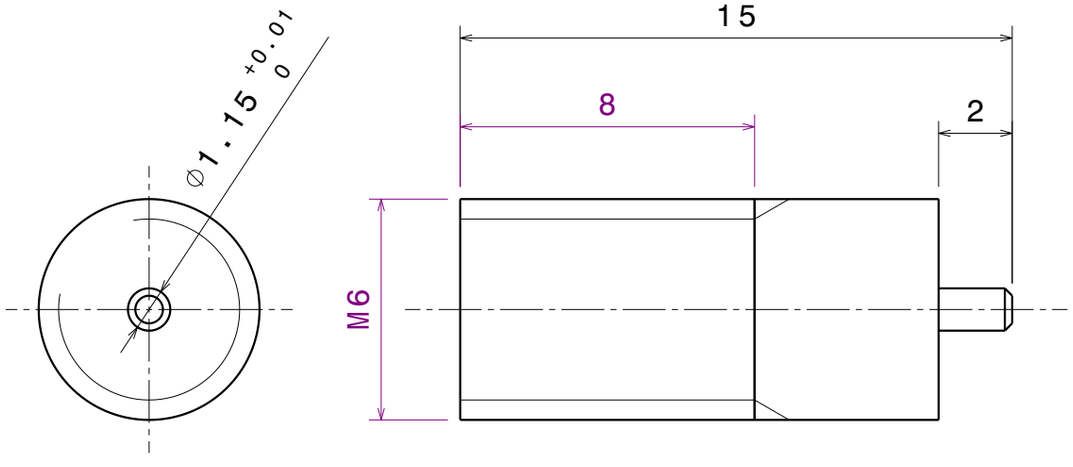
Bottom Plate
MATERIAL:ALU
MENGE 4 St.



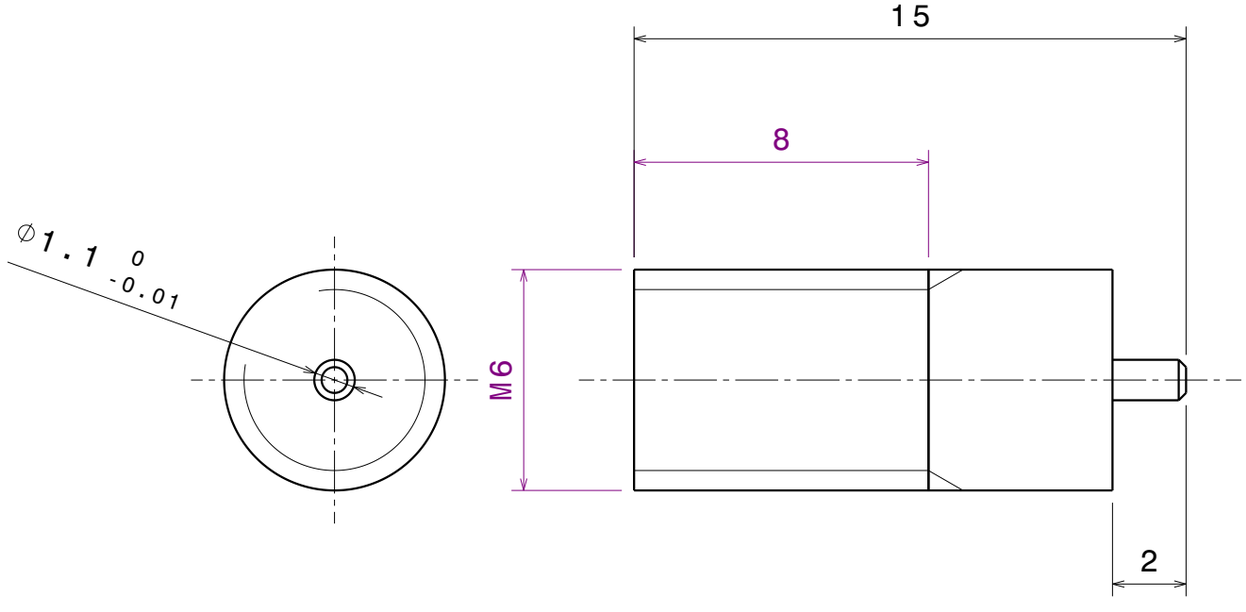
Section A-A

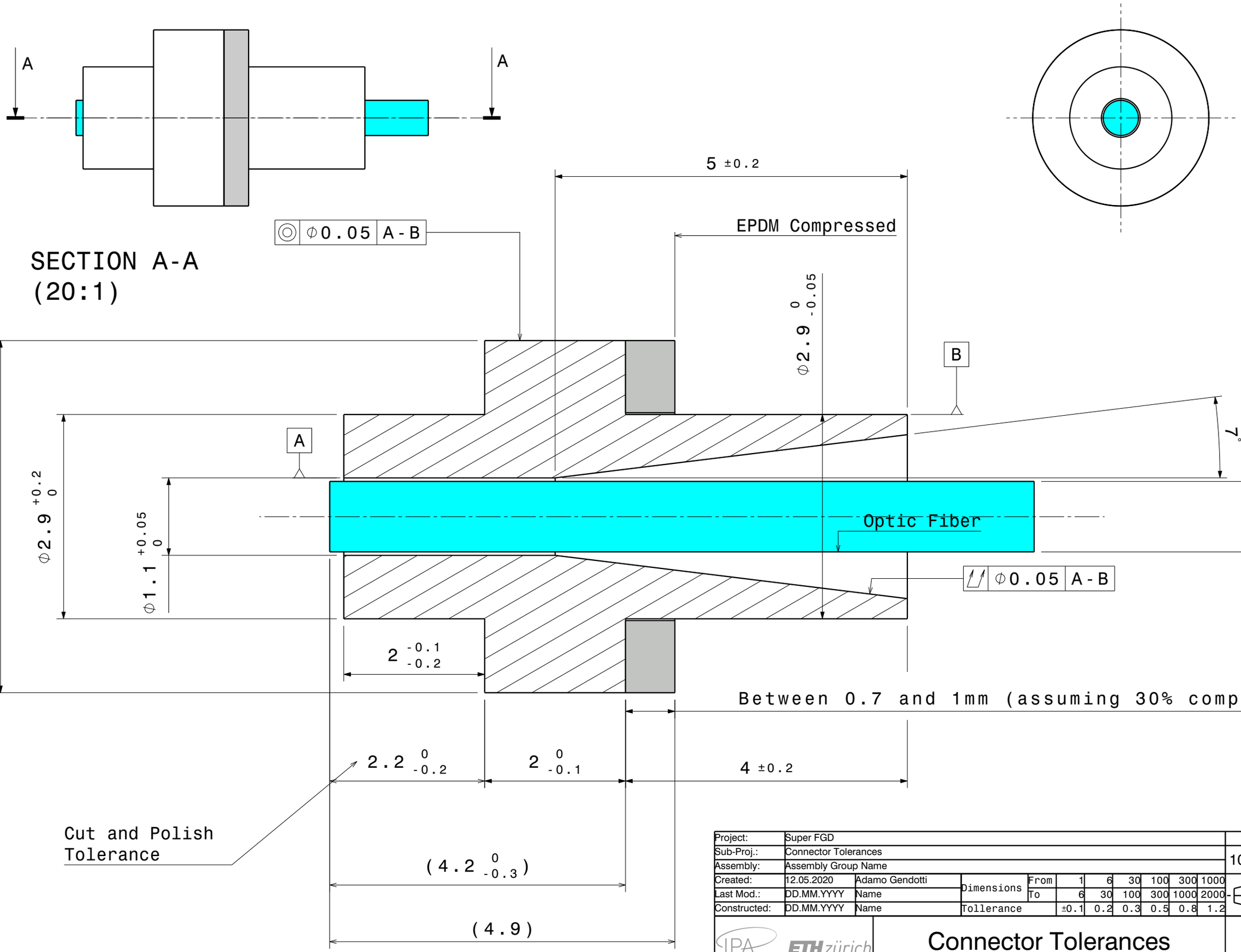


PIN Nr1
MATERIAL: Stainless Steel
MENGE 4 St.



PIN Nr2
MATERIAL:Stainless Steel
MENGE 4 St.





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IPA ETH zürich	Connector Tolerances									A3	