Update on FC Design and integration

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ETH zürich

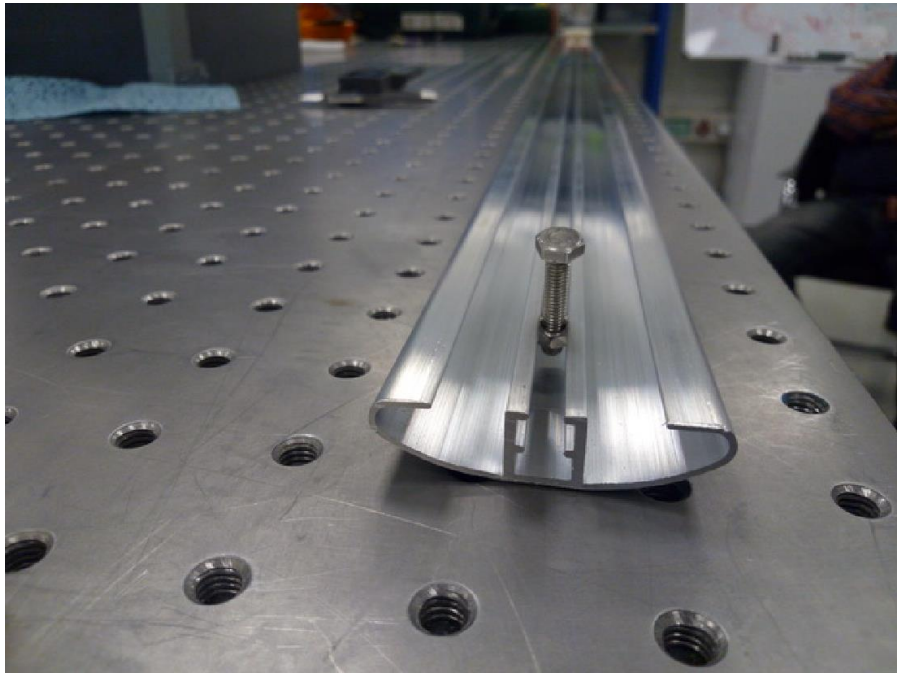
A.Chetterjee, J. Yu (**UTA**)

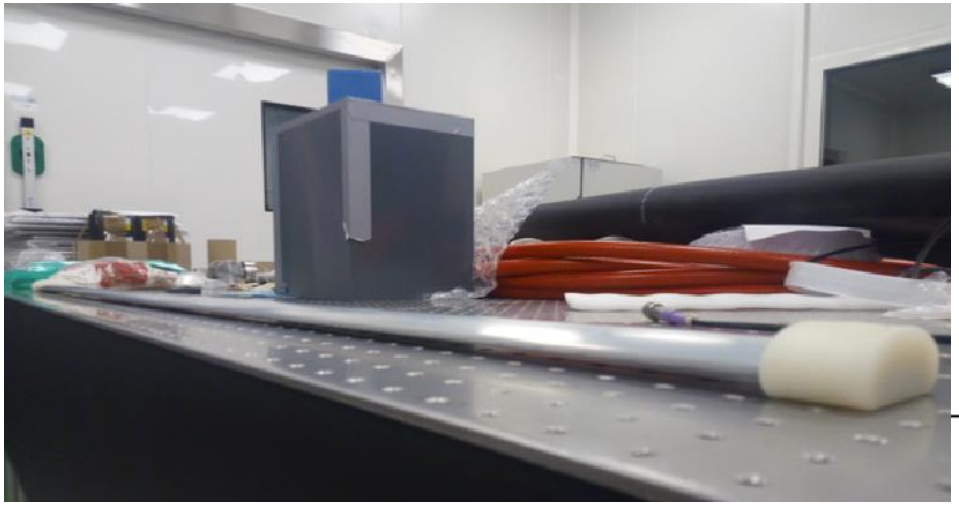
02.11.2016

- Field Cage
  - 35 CERN Alu Profile are arriving soon (15 Nov. 3.1m lenght)
    → (4 Samples of 1.5m already at CERN)
    → for 1 Sub-Module we need 33 profiles
    → In addition we will have 20 additional profiles from another company
  - Preliminary technical drawing for first quotation
  - Quotation for US-Standard and EU-Standard parts are on going in parallel
  - Update at the Clipping Alu profile at the Field Cage
  - Preliminary discussion with Cheng-Ju regarding the Beam Plug
- Field Cage Test Setup for the Alu Clips
  - Already 4 profile of 1.5m available
  - 4 small FRP I-beam available (I-100 → 500mm lenght)
  - Cold test in 1 Ton Dewar at blg182
  - Test will be done in different steps
  - Mechanical and Electrical Test of the clip

ALU Profiles

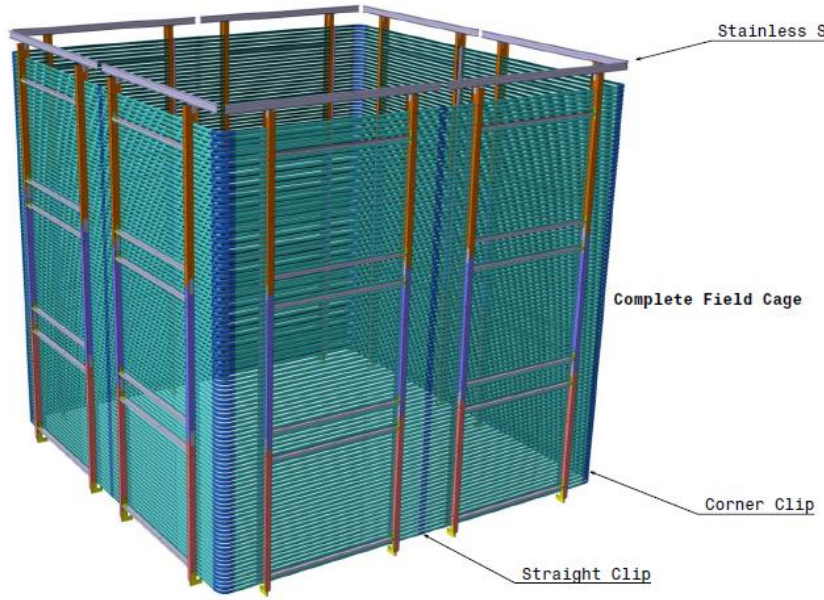
Fixing with screw and Nut (no need for additional plate)



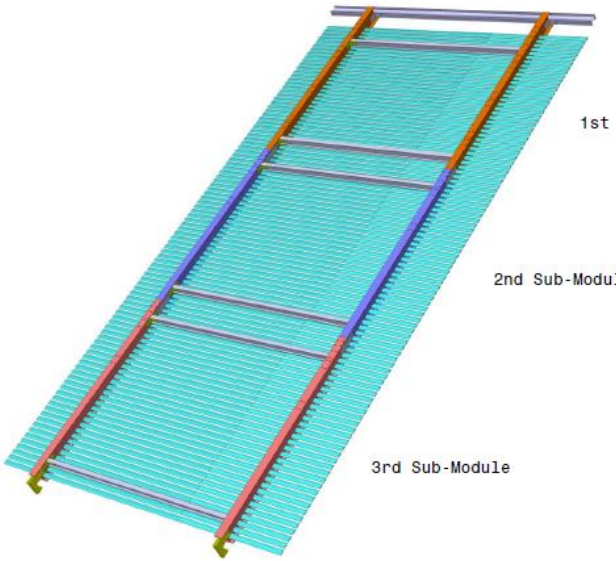


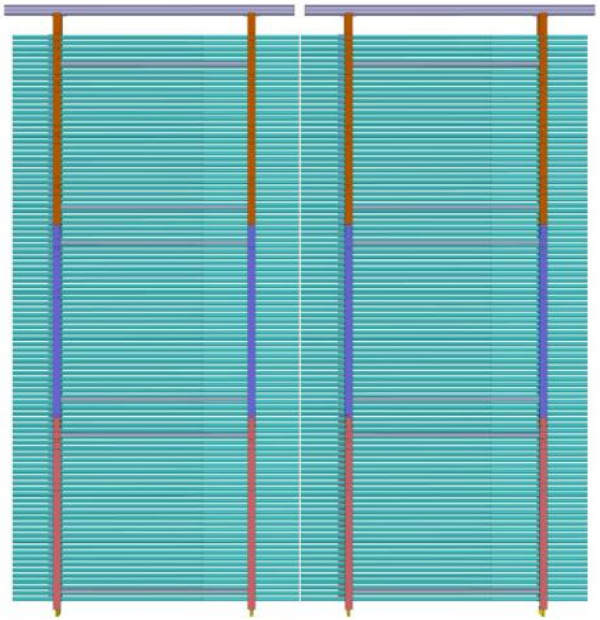
The profiles are pretty rigid, flat and without twisting

Field Cage preliminary techincal drawings



Complete single Module



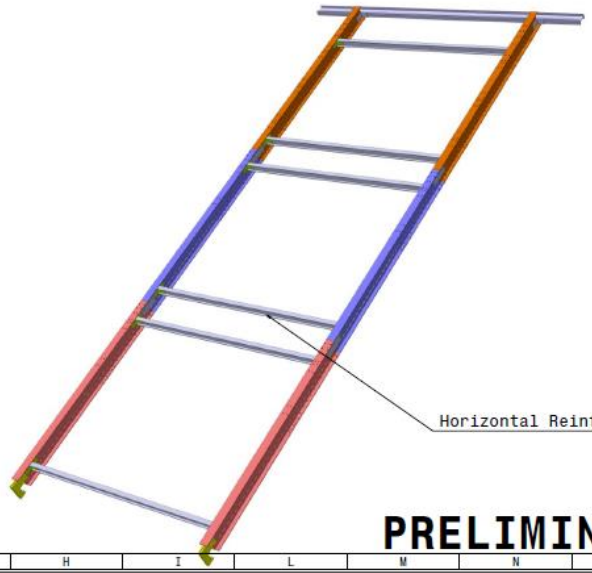


Full Module

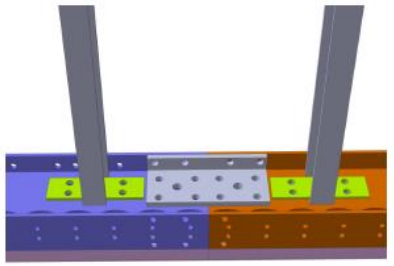
Full Module Mirrored

Position of the vertical I-Beams are Mirrored respect to the Left Module

Mechanical Strucutre of a Single module



Bracket and Main I-Beam Junction



PRELIMINARY

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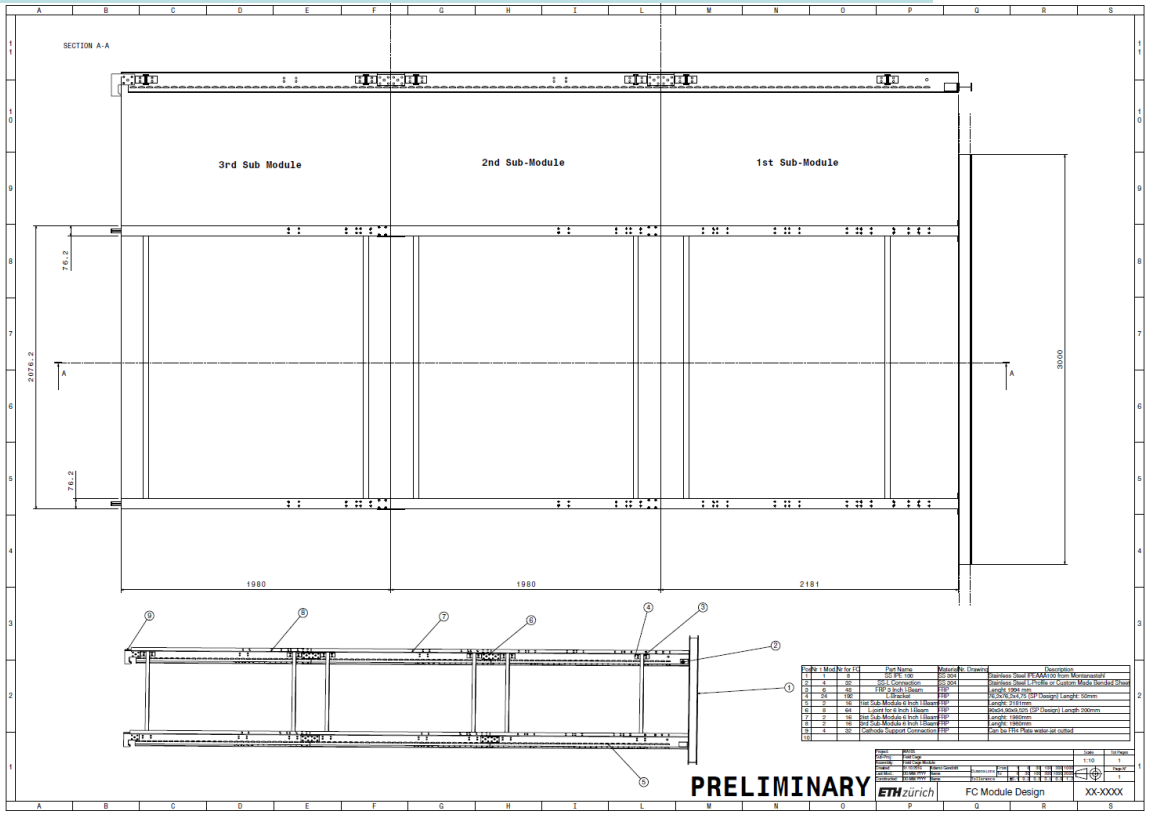
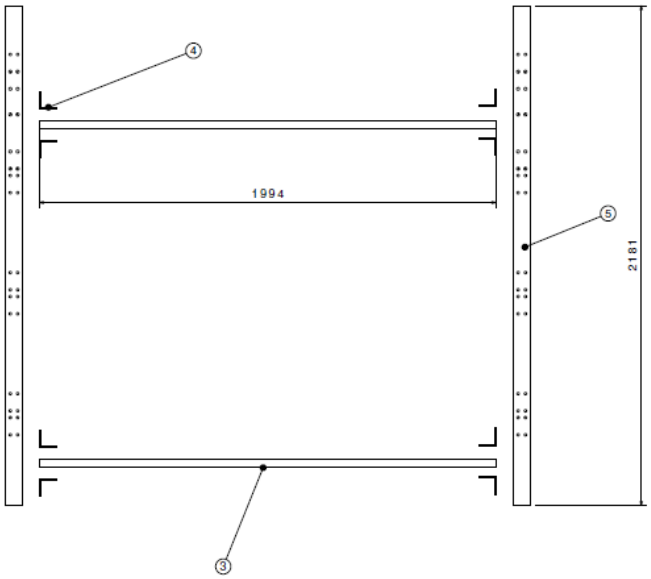
Field Cage preliminary techincal drawings



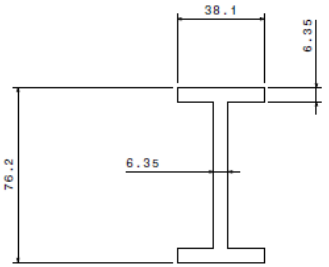
Pos	Nr 1 Mod.	Nr for FC	Part Name	Material	Nr. Drawing	Description
1	1	8	SS IPE 100	SS 304		Stainless Steel IPEAAA100 from Montanastahl
2	4	32	SS-L Connection	SS 304		Stainless Steel L-Profile or Custom Made Bended Sheet
3	6	48	FRP 3 Inch I-Beam	FRP		Lenght 1994 mm
4	24	192	L-Bracket	FRP		76,2x76,2x4,75 (SP Design) Lenght: 50mm
5	2	16	1ist Sub-Module 6 Inch I-Beam	FRP		Lenght: 2181mm
6	8	64	L-joint for 6 Inch I-Beam	FRP		90x34,93x9,525 (SP Design) Length 200mm
7	2	16	2ist Sub-Module 6 Inch I-Beam	FRP		Lenght: 1980mm
8	2	16	3rd Sub-Module 6 Inch I-Beam	FRP		Lenght: 1980mm
9	4	32	Cathode Support Connection	FRP		Can be FR4 Plate water-jet cutted
10						

Field Cage preliminary techincal drawings

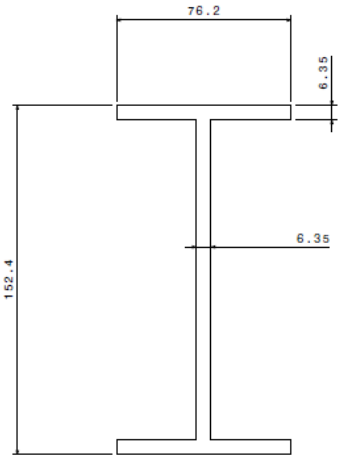
1st Sub-Module with US-Standard FRP Profiles



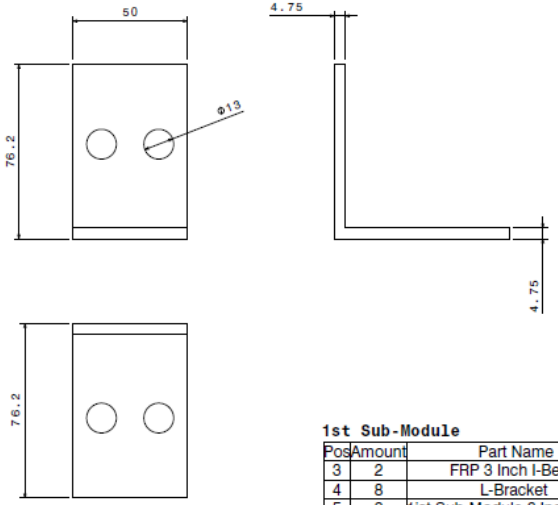
Pos 3: 3 inch I-Beam



Pos 5: 6 inch I-Beam



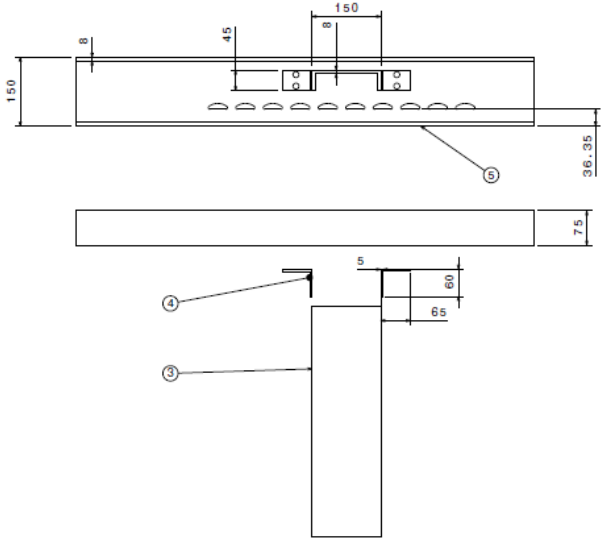
Pos 4: L-Bracket

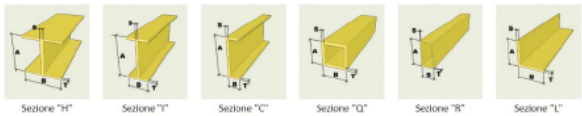


1st Sub-Module

Pos	Amount	Part Name	Material	Nr. Drawing	Description
3	2	FRP 3 Inch I-Beam	FRP		Lenght 1994 mm
4	8	L-Bracket	FRP		76,2x76,2x4,75 (SP Design) Lenght: 50mm
5	2	1ist Sub-Module 6 Inch I-Beam	FRP		Lenght: 2181mm

1st Sub-Module with Eurograte Standard FRP Profiles





SEZIONI STANDARD

TIPO PROFILO (mm)	A mm	B mm	T mm	S mm	S mm²	kg/m	Ixx mm⁴	Wxx mm³	r mm	Iyy mm⁴	Wyy mm³	r mm	J mm⁴
H - 200x200x15x10	200	200	10	15	6.700	31,7	45.425.333	434.233	81	15.383.958	155.840	45	358.333
I - 200x100x10x10	200	100	10	10	3.800	6,5	12.926.667	229.267	78	1.681.667	33.633	21	133.333
I - 150x75x8x8	150	75	8	8	2.272	3,9	7.659.669	102.129	58	568.217	15.152	16	51.200
I - 120x60x8x8	120	60	8	8	1.792	3,2	3.765.589	62.780	46	282.430	9.748	15	40.960
I - 100x50x8x8	100	50	8	8	1.472	2,8	2.092.203	41.844	38	170.231	6.810	11	34.133
C - 300x100x15x15	300	100	15	15	7.050	12,5	85.579.000	570.525	110	5.688.800	75.850	28	562.500
C - 200x60x10x10	200	60	10	10	3.000	6,1	15.700.000	157.000	72	825.000	18.333	17	106.667
C - 150x45x8x8	150	45	8	8	1.792	3,5	5.237.429	69.852,4	8,5	274.629	8.181	12	40.960
C - 90x35x8x8	90	35	8	8	1.152	2,13	1.214.496	26.989	32	112.772	4.622	10	27.307
Q - 90x90x8x8	90	90	8	8	2.624	4,64	2.968.619	37.774	34	2.968.619	37.774	34	46.080
Q - 50x50x5x5	50	50	5	5	900	1,66	307.500	12.300	18	307.500	12.300	18	6.250
Q - 50x50x3x3	50	50	3	3	564	1,0	208.490	8.340	19	208.490	8.340	19	1.350
R - 85x25x3x4	85	25	4	3	1.300	2,4	920.833	26.310	27	920.833	26.833	27	8.750
L - 100x100x8x8	100	100	8	8	1.536	2,6	1.486.046	20.158	51	12.985.858	176.127	10,7	17.066
L - 75x50x8x8	75	50	8	8	936	1,5	526.235	10.362	18,5	2.623.191	51.656	5,8	8.533
L - 65x60x5x5	65	60	5	5	600	1,2	304.888	8.329	14	91.499	24.997	4	2.500
L - 50x45x5x5	50	45	5	5	450	0,83	133.689	4.851	9	244.921	8.888	2,4	1.875
L - 35x35x5x5	35	35	5	5	325	0,55	43.623	2.215	5,3	38.605	1.960	1,1	1.458

(5) L-2180mm

(3) L-1992mm

(4) L-45mm

PRELIMINARY

Project:	WATOS	Scale	Tot Pages
Sub-Proj.:	Field Cage	1:10	1
Assembly:	Field Cage 1st Sub-Module		
Created:	01.10.YY	Page N°	
Last Mod.:	DD.MM.YYYY		1
Controlled:	DD.MM.YYYY		

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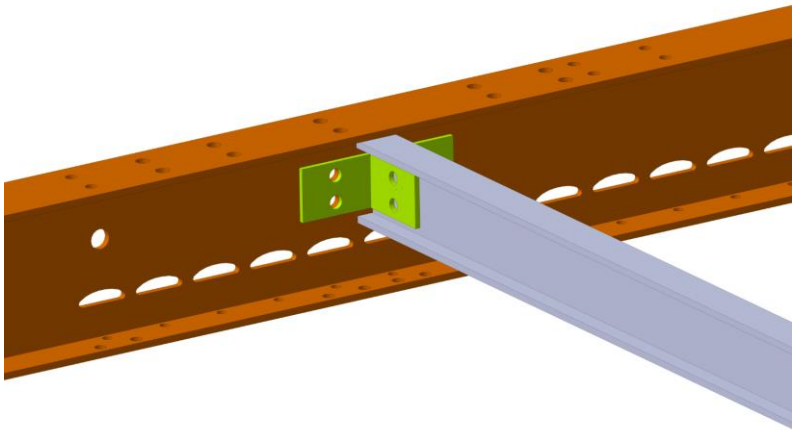
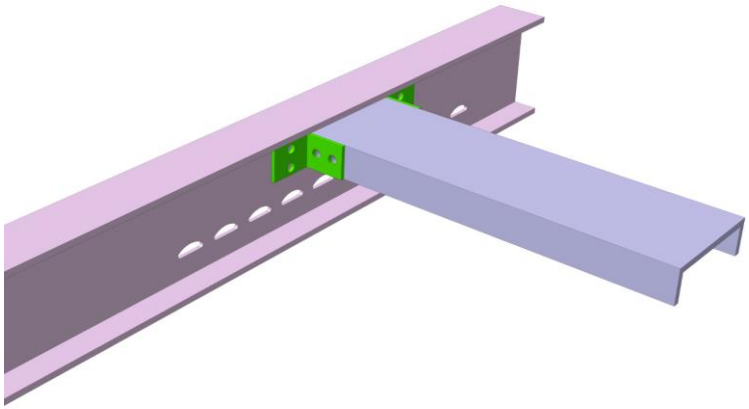
2d Drawings are on the indico page

Field Cage → SP Profiles



Field Cage → EU- Profiles

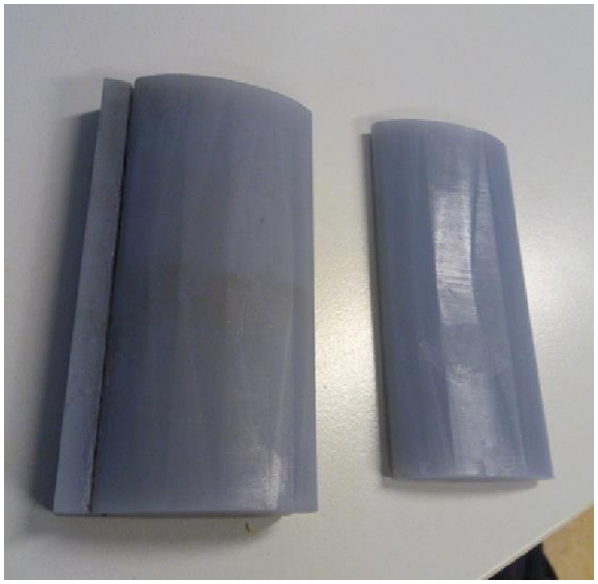


Quotation on the US-side:
→ J.Yu and A.Chetterjee (UTA)

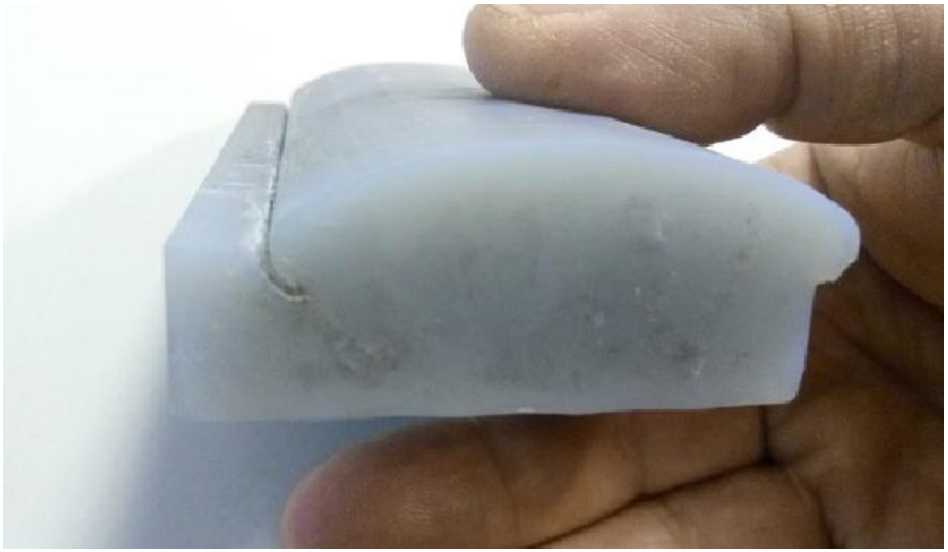
Quotation on the EU-side:
→ F.Pietropaolo (CERN)

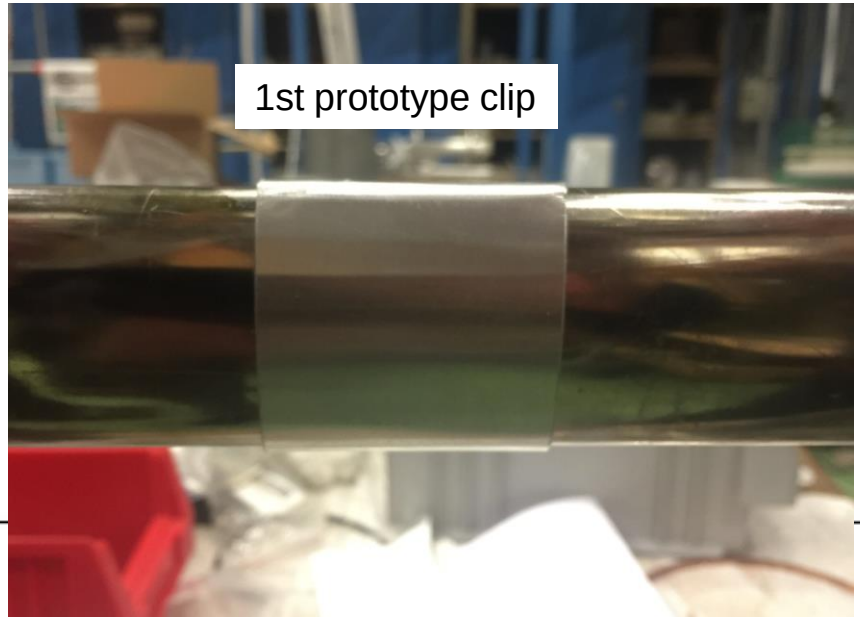
- Possibility to meet V.Guarino next week for Detail discussion of the FC
- More detailed technical drawings will be ready soon

Alu Clip



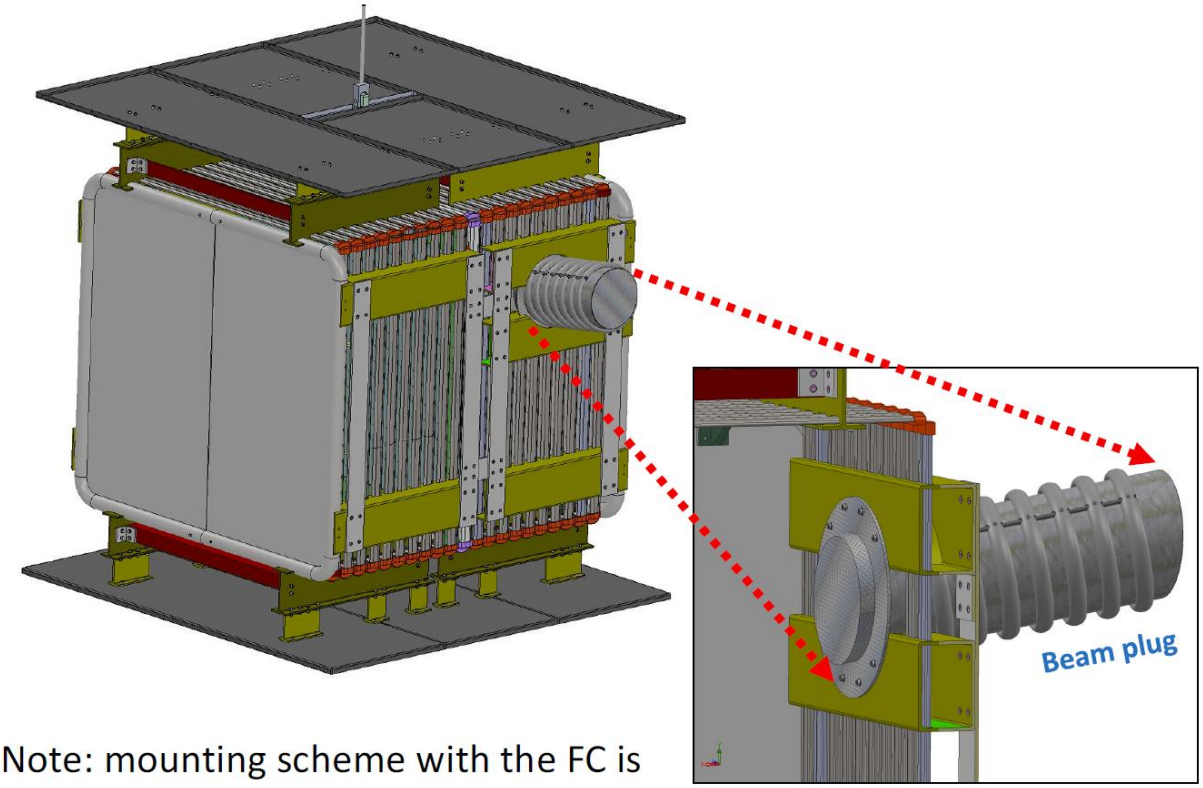
Clip mold 3D printed at CERN





Beam Plug

- Preliminary meeting with Cheng-Ju (Last week at CERN) in order to unterstand better and collect first informations concerning the Beam Plug for the SP design
- We will receive soon SP 3D design of the Plug togheter with the interface with the SP field cage.
- Possibility to meet Cheng-Ju again next week at CERN for further discussion.

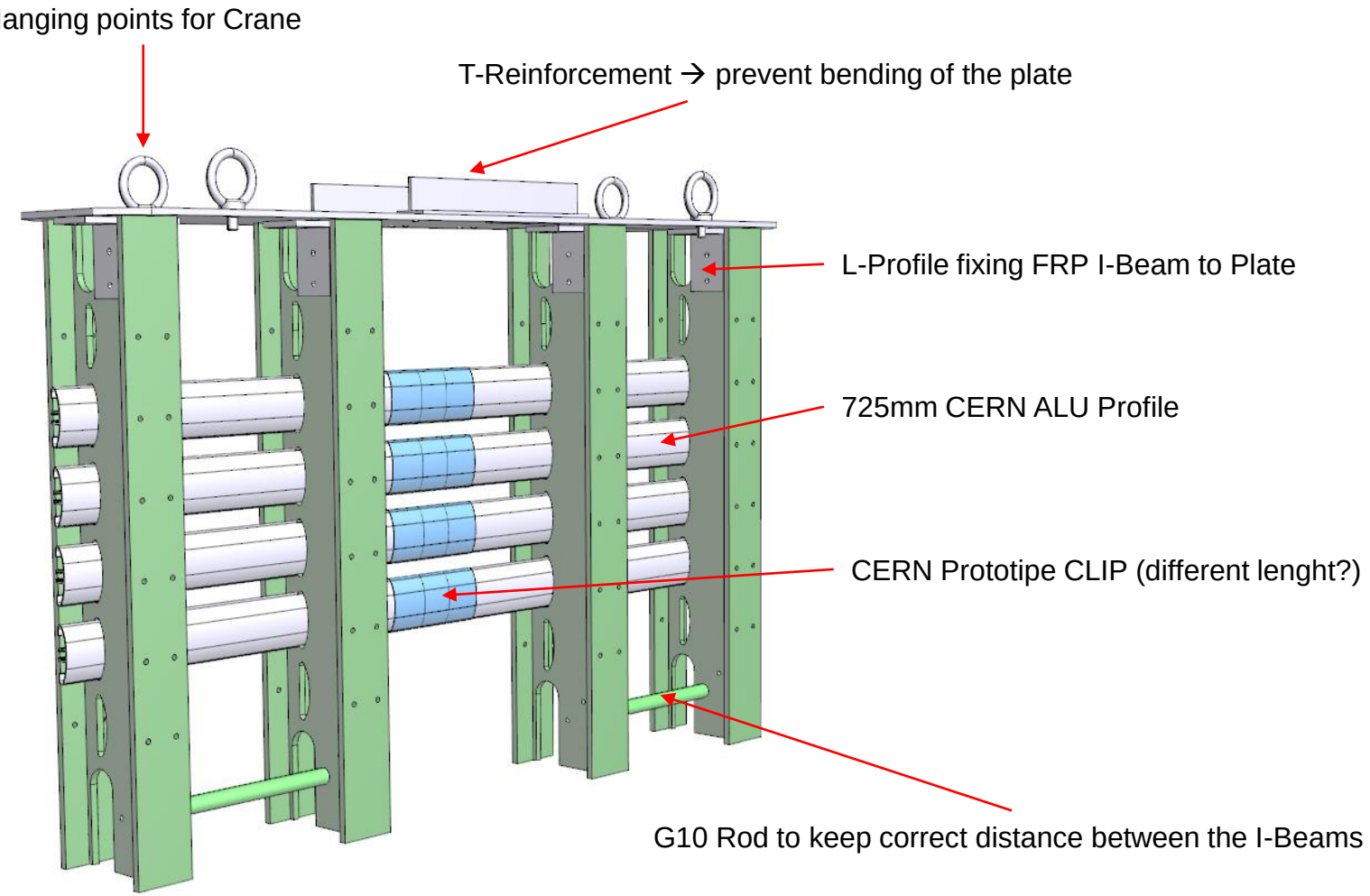


Note: mounting scheme with the FC is not finalized

Cheng-Ju Lin (LBNL)

CLIP TEST SETUP AT CERN

For the moment the test is only for the straight clip (prototype for the corner is «on study» togheter with CERN)

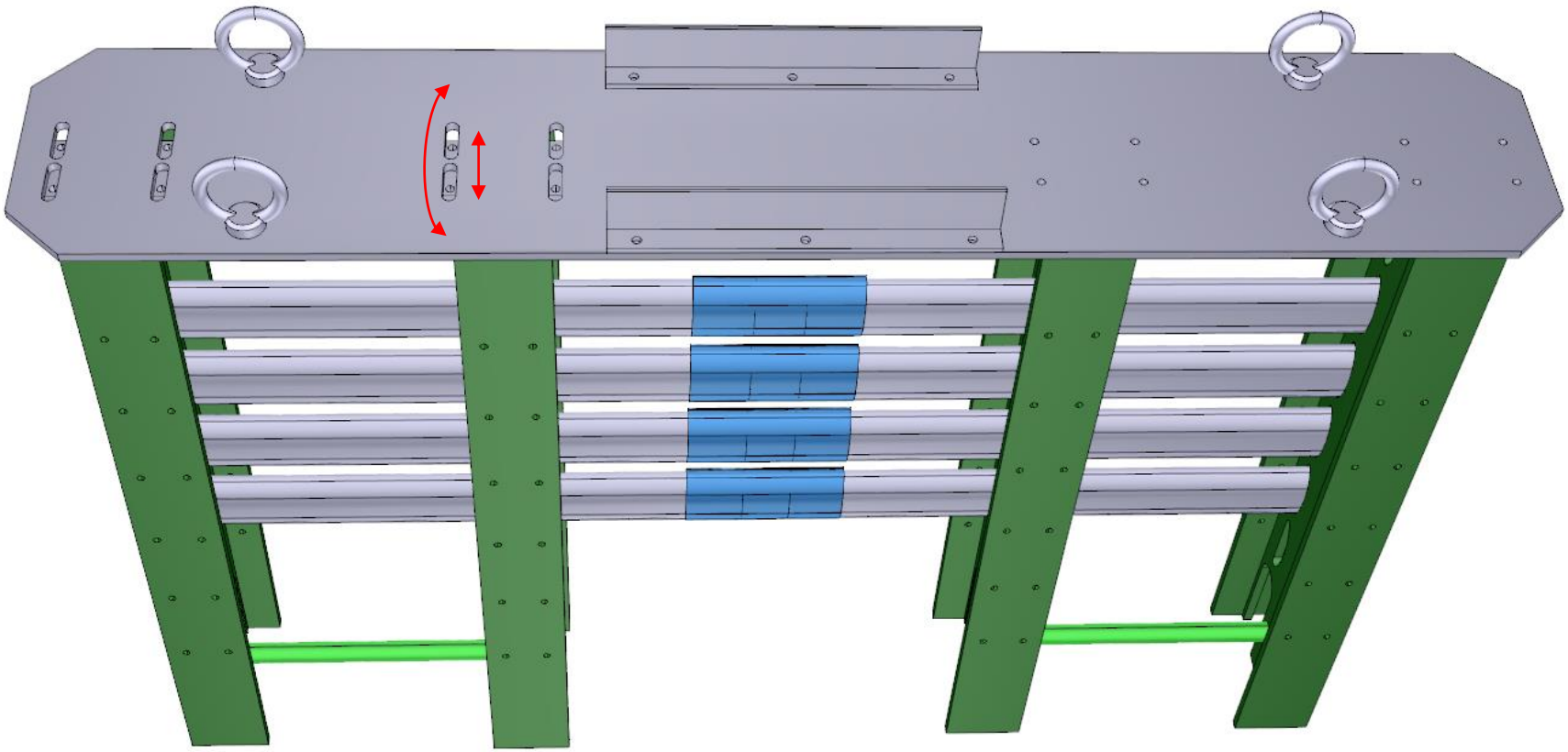


ALIGNEMENT/DISALIGNEMENT

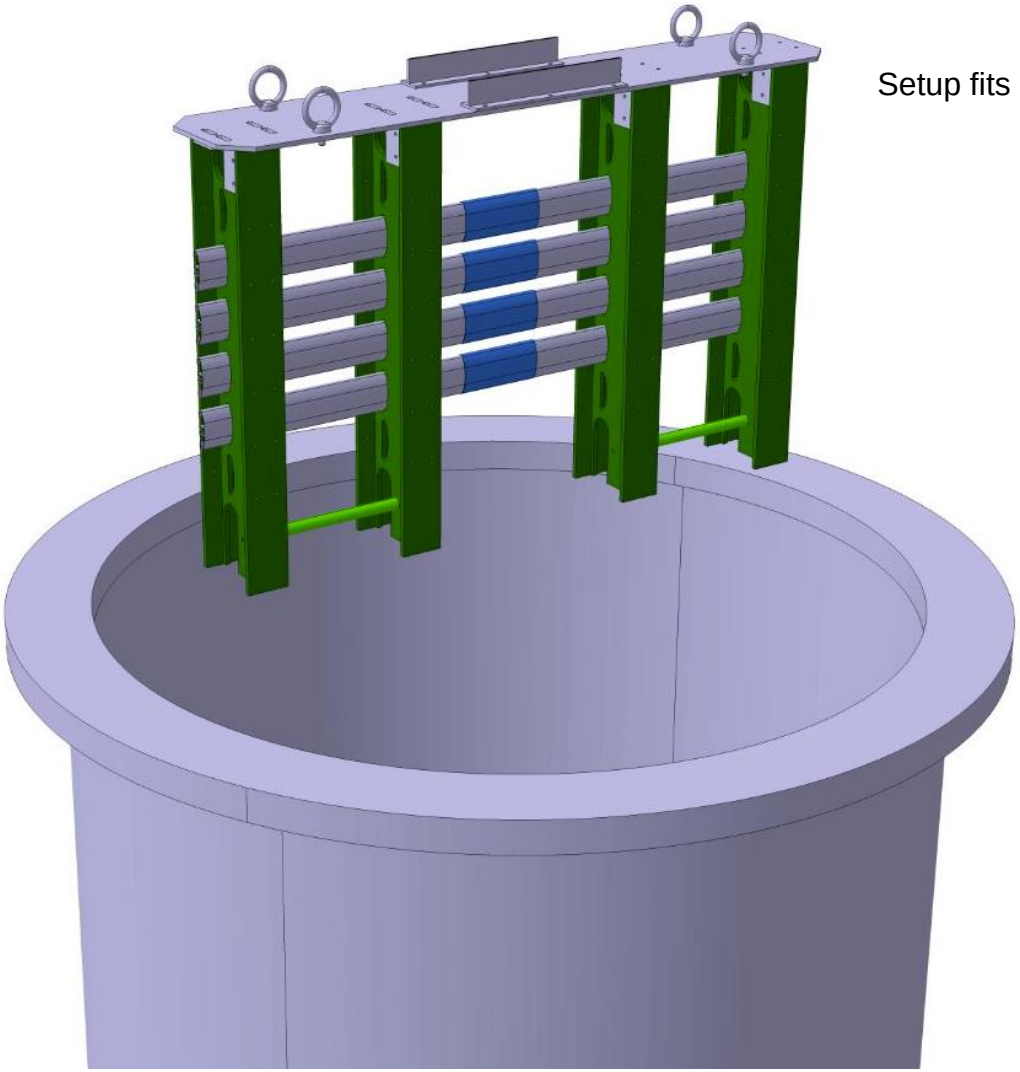
2 I Beams can be disaligned:

- Slits are bit larger in order to let a small of Rotation

2 I-Beams Fixed Position



CLIP TEST SETUP



Setup fits in the test dewar @ CERN

TEST Purpose:

- **Mechanical Stability of the clip (warm and Cold)**

- **Electrical Test** (A.Chetterjee slide)

    i. Electrical Connection (warm and cold)
    ii. Voltage divider test

Mechanical Test of the CLIP:

- WARM TEST

  i. Assembly test of the clip with differrent lenght (difficulty by connecting it)
  ii. Assembly test with different disalignement of the I-Beams

- COLD TEST

  i. Will the clip remain connected?
  ii. Different disalignement of the I-Beams

- RESULTS:

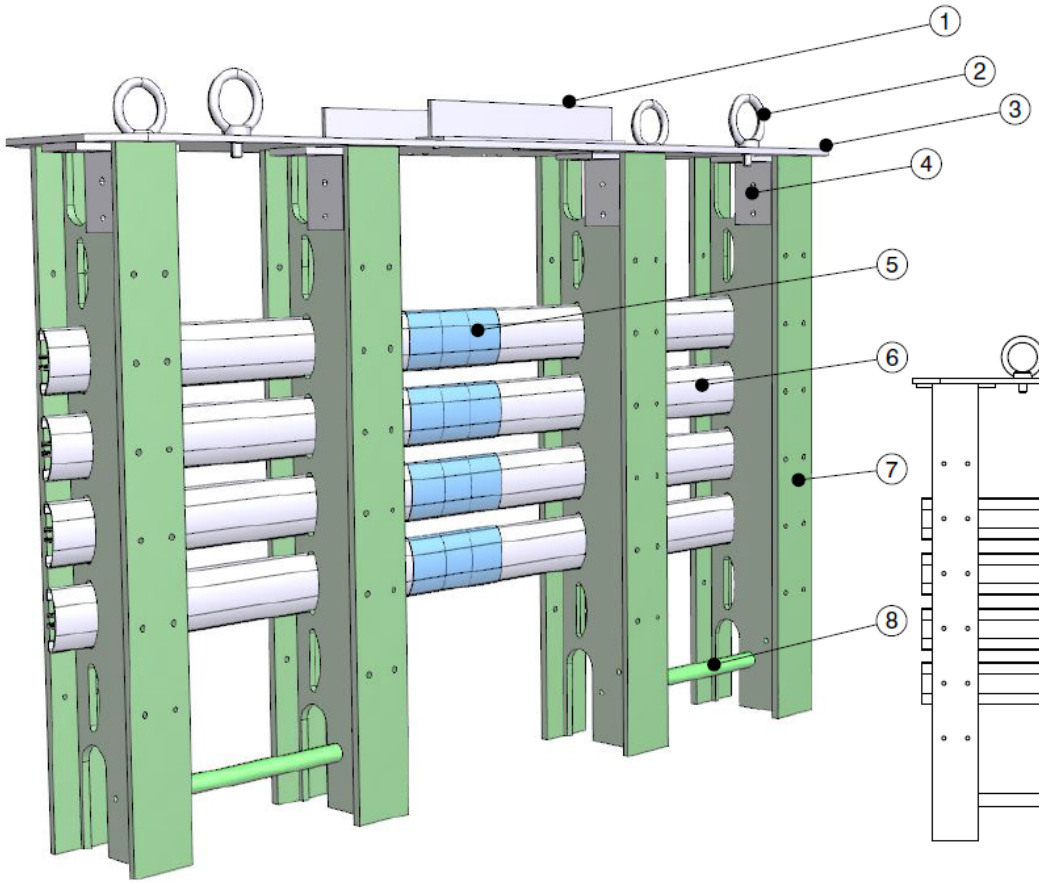
  i. Define optimal lenght of the clip
  ii. Decide if the clip need to be mechanically connected to the Profile (plastic Screws)
  iii. Define the optimal thickness of the clip
  iv. Give the final dimension for extruded Alu prototype at MIFA

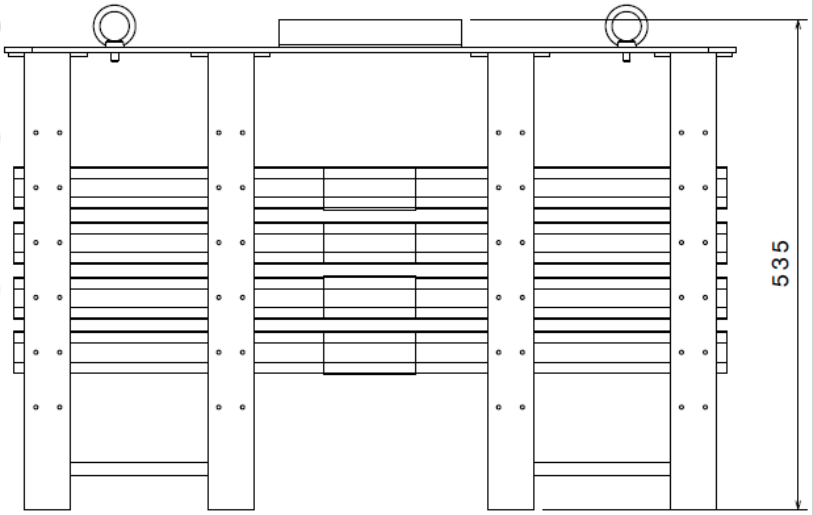
Electrical Test of the CLIP:

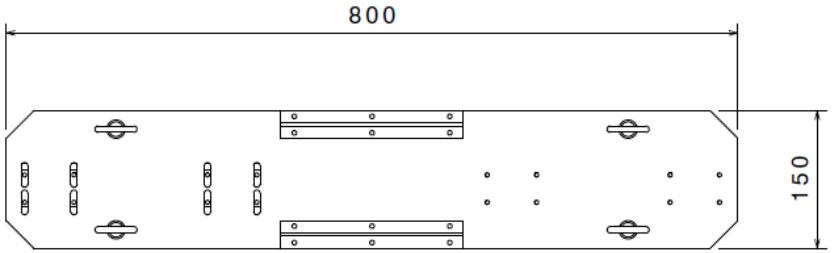
- Electrical connection of the clips (warm and cold)
  - i. Check the electrical continuity across the profile and the clip
  - ii. Measure the I-V characteristics of all the profiles with the clip

- Voltage divider test
  - i. Design a voltage divider board with resistors and varistors
  - ii. Measure the voltage drop between the two consecutive profiles and check the uniformity of the voltage drop both in warm and cold condition

2d Drawings Setup







Pos	Num	Part Name	Material	Weight	Description
1	2	T-Profile	ALU	-	30x30x3mm Lenght=200mm
2	4	Screws Ring	Steel		ETH Shop M8
3	1	Bottom Plate	Stainless Steel		800x150x5mm
4	8	L-Profile	ALU		60x40x5mm Lenght 40mm
5	4	CLIP	ALU		Different Lenght 100/150/200mm ?
6	6	CERN ALU Profile	ALU		Lenght=375mm
7	4	CERN FRP I-100	FRP		Lenght 500mm @CERN
8	2	14mm Rod	G10		Amsler und Frei / CERN Shop?

Project:	WA105									Scale	Tot Pages
Sub-Proj.:	Clip Test Setup CERN									-	6
Assembly:											
Created:	1.11.2016	Adamo Gendotti	Dimensions	From	1	6	30	100	300	1000	Page N°
Last Mod.:				To	6	30	100	300	1000	2000	1
Constructed:			Tollerance		±0.1	0.2	0.3	0.5	0.8	1.2	

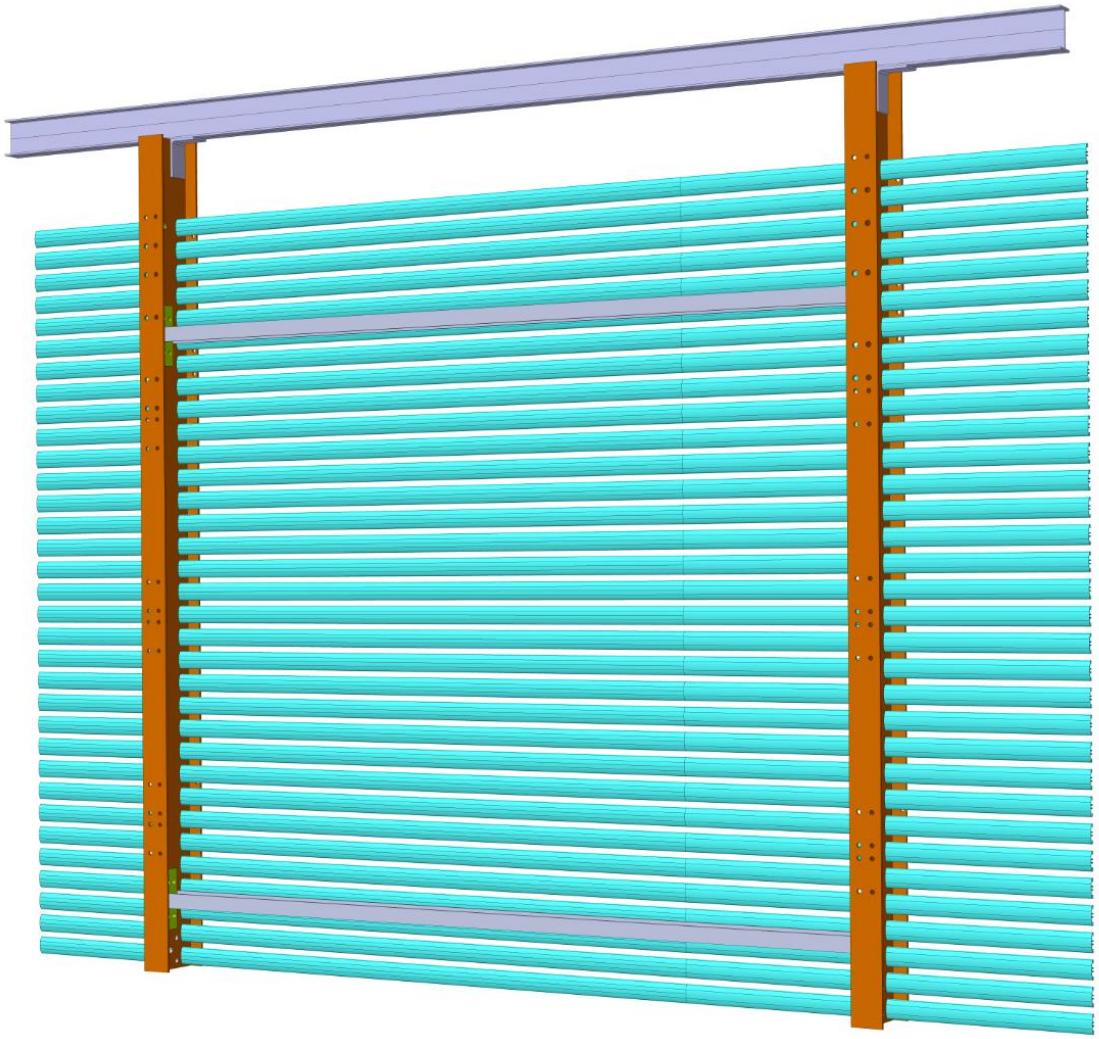
ETH zürich | Test Setup for Profile Clips | XX-XXXX

2d Drawings are on the indico page

Proposal for the prototype of one Sub-Module

1st Sub-Mule:

- Possibility for testing the hanging System
- Add load to the bottom
  → Load Test (1st Sub-Module suffer the maximum stress)
- For the Point of view of the Electrical parts all 3 Sub modules will be similar
- Possibility to add a second Sub-Module or at least the connection parts for assembly test (if necessary)



Next Steps

- Proceed with the Clip Test Setup design and construction
- Finalize all the missing detail of the Field Cage and add a preliminary design of the Beam Plug
- Proceede more detailed 2D Drawings (for UTA and CERN)
- Have a preliminary Complete Installation sequence by the next TB (could not finish it)
- Please send to me step files any time you have a reasonable drawing update.

Thank you.....