

LLRF 28U racks requirements for XFEL XTL for L1, L2 & L3

Holger Schlarb, Frank Ludwig, Maciek Kudła, Krzysztof Oliwa, Wojciech Wierba

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In some points compared to Schroff prototype 28U racks placed in extension hall (for ACC45, ACC67).

Requirements:

General:

1. Specification should be available in English language. This is anyhow required for the call for tender.
2. Since the depth of the racks are now 1000mm, what is the distance between the rack (rear) to the tunnel wall for maintenance and installation.

Mechanics:

1. Reserve a space for USV on the left side of the 3 racks (2 racks) cabinet. The right side is occupied by Fire Extinguisher gas bottles. It is necessary to move to the front the left (and right) plate curtain preventing front-rear air circulation. The pressure throughput flap (Druckentlastungsklappe) should be moved as much as possible to the top of the cabinet (or placed on the right side of the cabinet) to have enough space in height for ~6 kW USV. The accessibility to the USV and exchange should be also considered.
2. Inner 19" rack construction (vertical profiles) should be not painted (zinc-plated) to obtain a good electrical contact between electronic devices to the rack (cabinet) ground.
3. The rear doors which are removable should not be screwed, but with fixed attached handles which cannot be lost and is easy to open without additional tooling equipment – Fig. 1.
4. The 'bars' supporting concrete Rad. Shield on the top of the cabinet (racks) should be fixed to the cabinet. We should ask for complete racks with supporting bars.
5. The mounting of Fire Extinguisher system should be clarified.
6. If rack-groups cannot be disassembled into individual rack unites (as expected), approximately 400-500m² are required for inner rack assembly before transportation into the tunnel. This concerns (WP02/WP05/... who is involved in LLRF racks).

Cable openings, patch panels:

1. The top racks frame ('wanne') for LLRF patch panels dimensions will change slightly (the openings will be bigger in length due to change of the depths of the rack – depends on inner 19" rack design). New drawings are shown in Fig. 2, 3 & 4.

2. The top rack cover and frame ('wanne') for patch panels (where they contact) should NOT be painted (zinc-plated ?) to obtain a good electrical contact between patch panels (aluminum plate) and rack ground (using cooper mesh sealing) – Fig. 5.
3. More screws (~2 times) fixing frame ('wanne') to the top cover of the rack.
4. More screws (~2 times) fixing patch panels to the top cover, sides of the rack or frame ('wanne') – Fig. 6.
5. Use thicker screws (M6-M8, Imbus or Torx), bigger washers.

Cooling Unit:

1. Required temperature stability is $\pm 0.2^\circ\text{C}$ and movable temperature sensor as measurement point.
2. Inlet air of $25-30^\circ\text{C}$ inside rack is rather high: impact of electronic component lifetime should be discussed, currently fully loaded μTCA crates have serious overheating problems.
3. Cooling Unit fixed to the bottom with rubber dampers or steel springs and to the sides with rubber plates or dampers to reduce vibrations¹ – Fig. 7.
4. Fans must be mechanically damped (rubber dampers) to reduce vibrations.¹
5. Fan unit mechanically decoupled from racks to reduce vibrations.¹
6. Water pipes mechanically decoupled from rack to reduce vibrations¹ – Fig. 8.
7. Pressure variation of the input cooling water has to be specified.
8. Cooling unit must be exchangeable within 4 hours (during a maintenance shift with tunnel access of 8 hours).
9. What is the rate we get the information of cabinet status? Update rate of 10Hz desired.
10. Low vibration is also required for all racks where e.g. lasers or critical optical components (BAMs) are used. Tbd. From other working packages.²

¹) Test of deterioration of Master Oscillator spectrum in 19" box installed close to operating Cooling Unit.

²) The higher frequency vibrations should be also investigated in tests.

EMI version:

1. LLRF request EMI shielded racks.
2. EMI Workpacket is stackholder.
3. EMI shielded racks are required also for other work packages (e.g. WP18), hence not only the specialized racks for LLRF should be considered.
4. EMI mesh on all door interfaces (front and rear) – Fig. 9.
5. Cooper mesh sealing is recommended also for patch panels (side and top) connection to rack.
6. Very low impedance (1st guess $< 1\text{m}\Omega$ range) from top and all transitions down to the earth:
 - use thicker copper band between interfaces,
 - very good top rack cover plate interface to main frame: more screws, better electrical connection,
 - very good bottom rack plate interface to main frame: more screws, better electrical connection,

- very good racks main frames interface to common base: more screws, better electrical connection,
 - elements of racks inside the cabinets not painted but zinc-plated (verzinkt) or galvanic connection,
 - grounding connections between doors with screws and thicker copper band on both sides (Fig. 10.).
 - cabinets with 19" racks should be better electrically connected together^{3,4} – Fig. 11.
7. The racks should foresee defined connection point to the XFEL grounding.

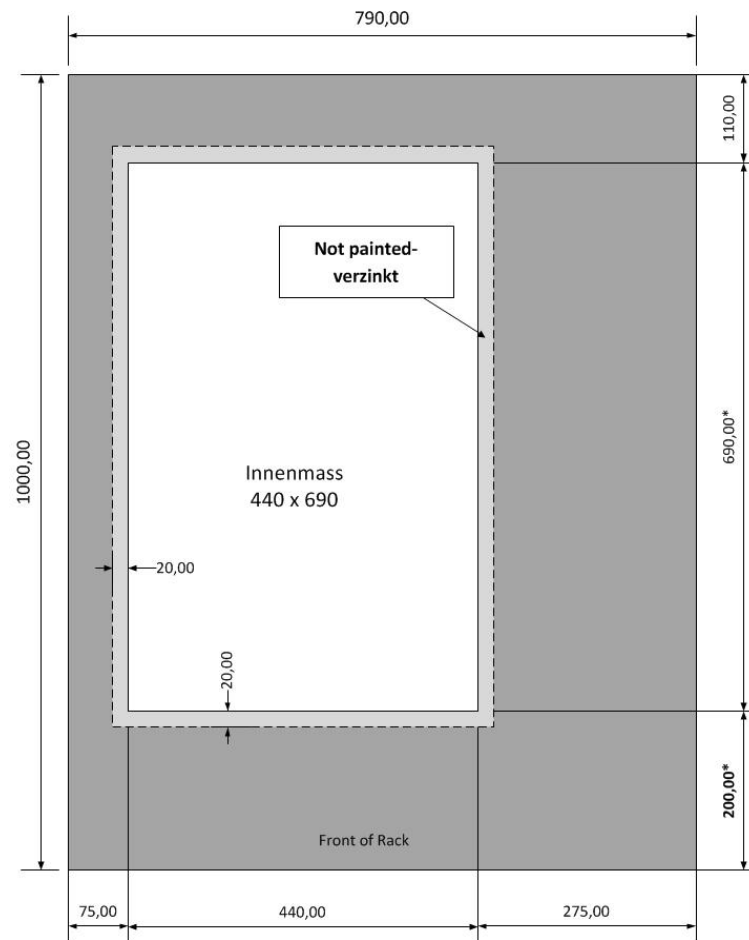
³) Measuring of Impedance (H.Kapitza) in ACC1 EMI Rack for impedance specification: inject broadband distortion on top rack, measure baseband impedance 10Hz-100MHz. Request recommendation or comments from H. Kapitza.

⁴) To be determined by measurements and maximum expected current induced.



Fig. 1. Rear 'doors' should not be fixed with screws.

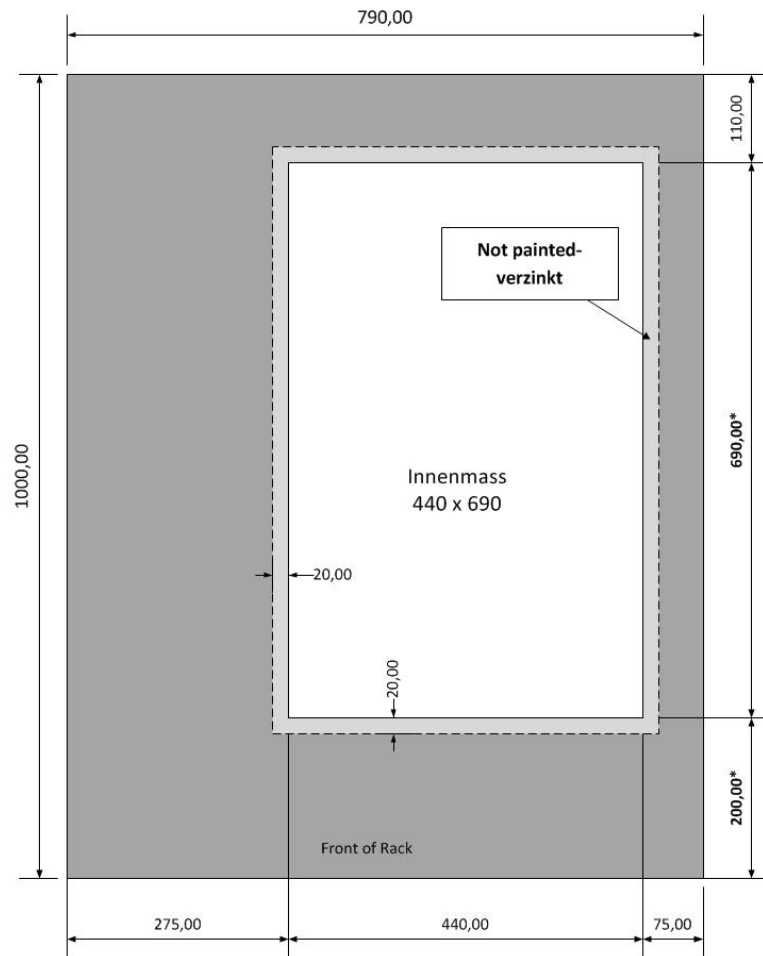
Top cover cut for wanne – left side



200*/690* - for the inner 19" chassis depth 600 mm

Fig. 2. Top cover opening for patch panel frame – right rack.

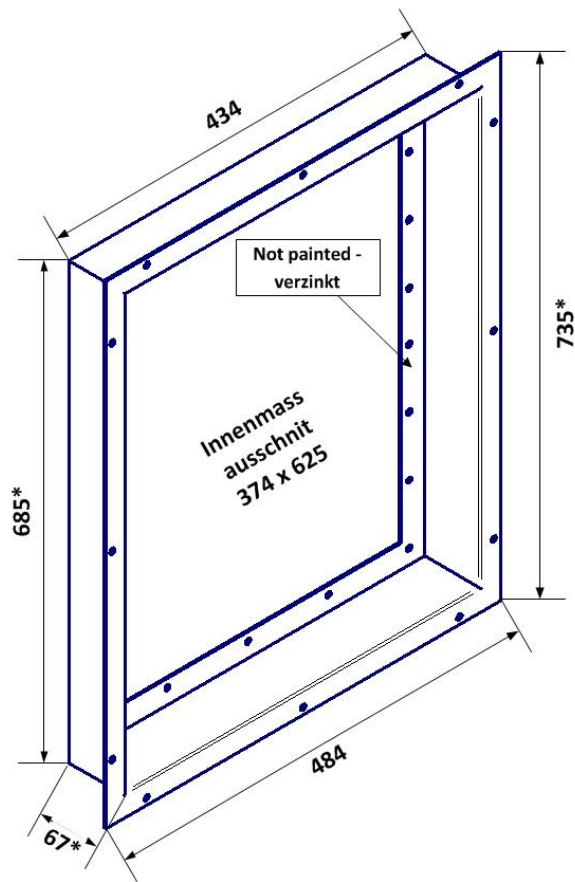
Top cover cut for wanne – right side



200*/690* - for the inner 19" chassis depth 600 mm

Fig. 3. Top cover opening for patch panel frame – middle and left rack.

Wanne fuer Koaxverteiler



67* - depended from bottom edge of the upper air flow bariere,
should be to the same level

735*/685* - for the inner 19" chassis depth 600 mm

Fig. 4. Top frame for patch panel.

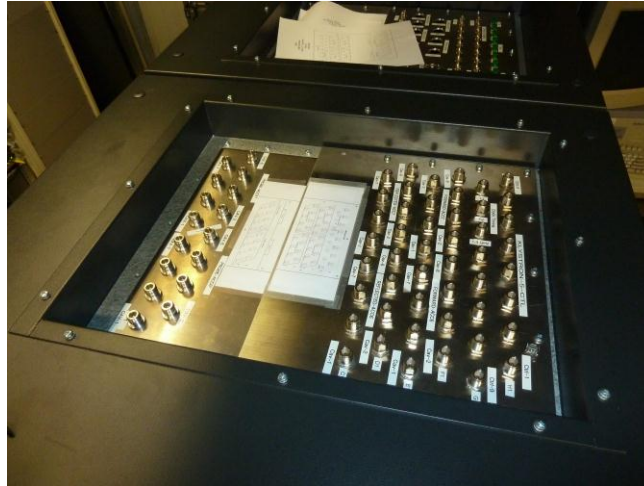


Fig. 5. Electrically contacting surfaces should be zinc-plated.



Fig. 6. More screws should be used (~2 times) to fix frame to the top cover. The patch panel is fixed properly, bigger washers are necessary.



Fig. 7. Cooling Unit has no rubber dampers to prevent vibrations propagation.

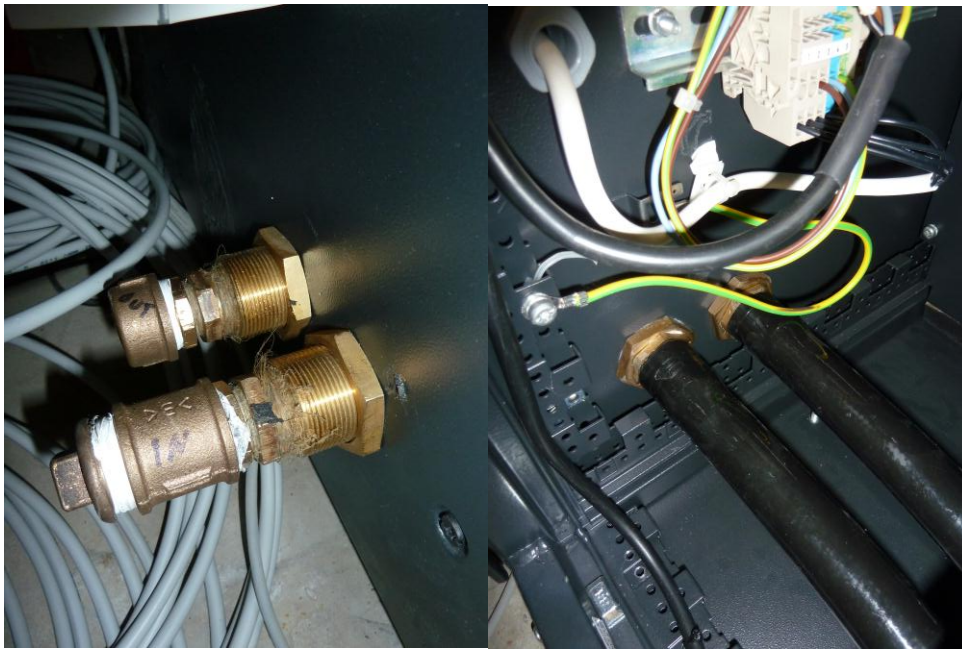


Fig. 8. Water pipes screwed directly to the cabinet side.



Fig. 9. Only rubber sealing, no EMI sealing (copper mesh).



Fig. 10. Such a cables with connectors are not sufficient for EMI grounding.



Fig. 11. Mechanical and electrical connection between two parts of cabinet should be done much better – the small steel plate with two screws is not enough. On the right picture – homemade mechanical connection.