Some remarks on XFEL tunnel racks containers prototypes at first look

Two prototypes of XFEL tunnel racks have come to DESY and are stored in:

Rittal prototype – Halle West, Geb. Room 724 (Richard Wagner)
Schroff prototype – Helgoland, Geb. 3, Room 306 (Wojciech Wierba)

Both prototypes are 3 racks type and should fulfill the racks specification made by Kay Rehlich ("Spezifikation der Schränke für den XFEL"---Tunnel Version 1.4, 24.11.2010, Kay Rehlich, DESY, MCS4).
We have a careful look to the Rittal and Schroff container of 3 racks prototypes and write down some remarks at first look.

Overall dimensions

The overall dimensions of containers prototypes are presented in Fig. 1 and 2. The depth of both prototypes is 800 mm.

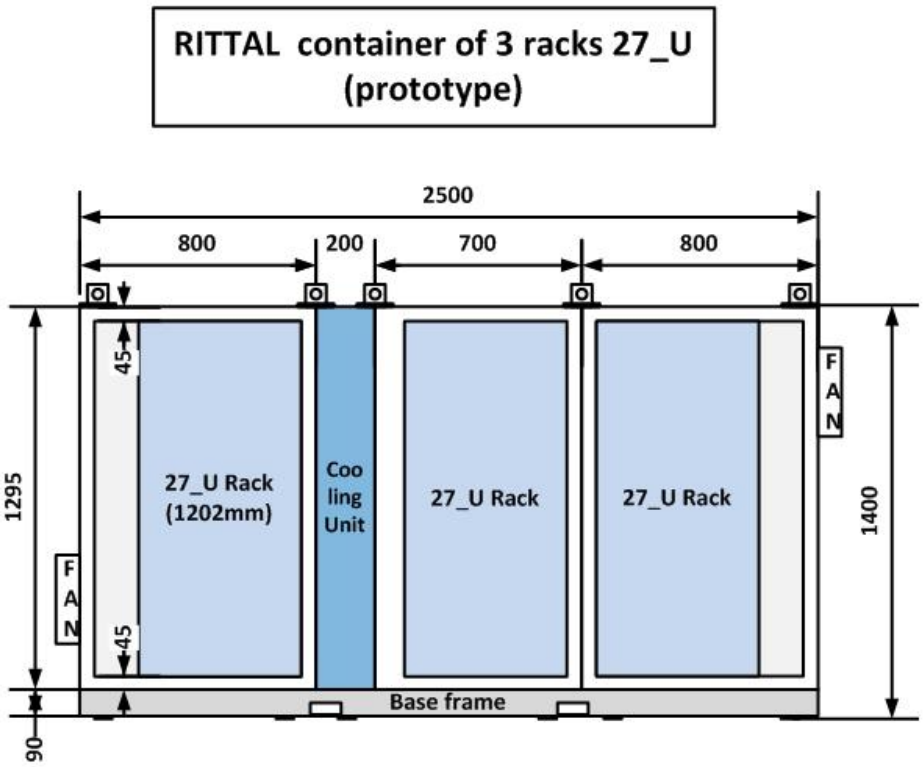

Fig. 1. Rittal 3 racks container prototype front view.

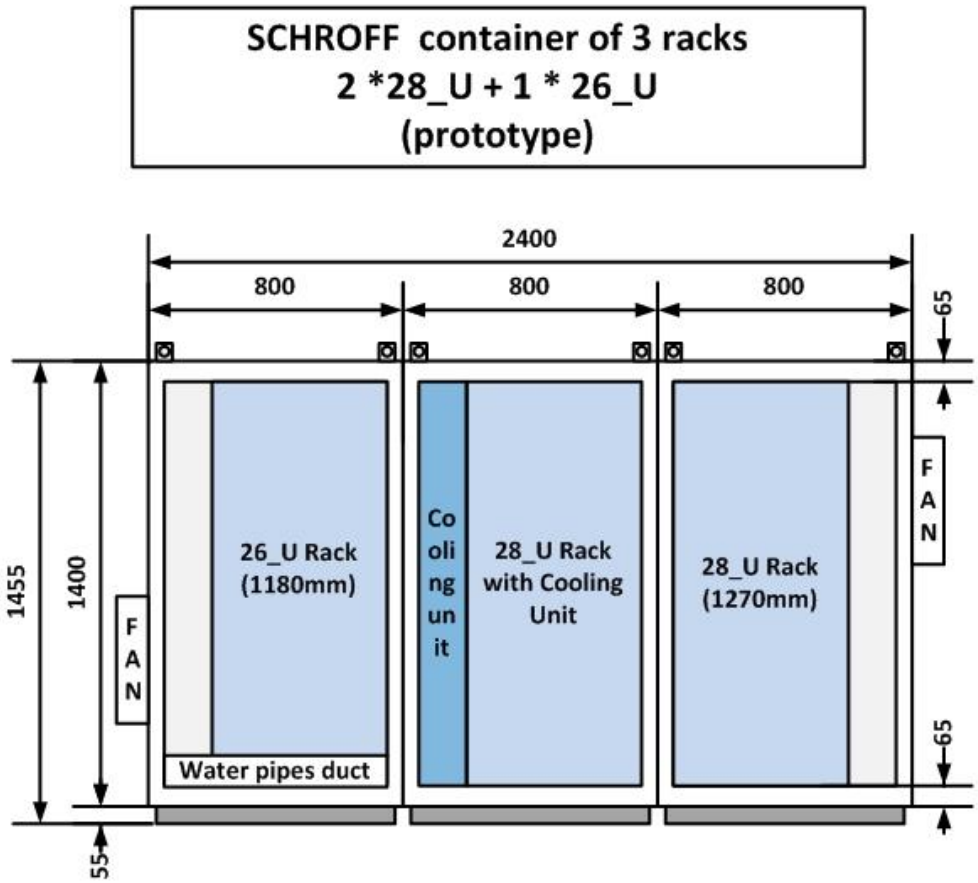

Fig. 2. Schroff 3 racks container prototype front view.

Both prototypes do not fulfill the specification.

Rittal prototype, assuming remove of crane ears from top, fits to the required height to be maximum of 1400 mm, but exceeds a little bit a width (to be maximum of 2500 mm). The container width is 2500 mm (as specified), but emergency fans 'covers' exceeds this dimension by ~30 mm each. There is enough space inside a container to hide emergency fans deeper inside.

Schroff prototype does not fit to the specified height (to be maximum of 1400 mm) and is 1455 mm (assuming remove of crane ears from top). The width of container is 2400 mm and even with emergency fans 'covers' fits to the specification.

Other requested features

Other features have been reviewed in Table 1.
Colors meaning:
Green – OK
Yellow – Can be easily improved
Red – BAD, needs redesign

	Item	3 Racks Container Prototype from Rittal		3 Racks Container Prototype from Schroff		Comments
1	Useful space for electronics [U]	3 * 27U = 81U		2 * 28U + 26U = 82U		Should be 3 * 28U = 84U
2	Rack shelves	Yes		No		Must be ordered separately from Schroff?
3	Mechanical stiffness	OK. because of common base/frame for 4 racks compartment (additional compartment for cooling unit)		The construction of 3 racks set is not stiff enough. If we will use a fork lift for the middle rack, the side racks will drop down for sure. The connection between racks compartments has been done by 4 small metal plates with 2 M6 screws only.		The idea is to transport and install fully assembled internally racks in XFEL tunnel. That means, that we have to transport i.e. 3 racks container in one piece with all electronics inside.
4	Front doors	OK.		OK.		
5	Rear doors	OK.		There are no doors but a plate/wall to unscrew. It fits to the specification ("ruckwand zu abnemen") but this solution is not convenient. It is necessary to unscrew 8 screws to take out one rear wall (during work in tunnel screws will be lost for sure).		
6	Transport crane ears	OK., looks very robust, prepared for whole container crane transport		OK. ,prepared rather for separate compartments crane transport		

7	Transport fork lift	OK.		NO, it is possible to unscrew masks in front of container, but it will not work because of point 6.	
8	Leveling possibility	OK.		NO	Not very important
9	Openings for cables	Too small openings, can be easily enlarged		OK.	
10	Cooling Unit	Looks OK., should be mounted with some clearance to the inner racks construction using rubber dampers to prevent vibrations made by fans and water flow.		Looks OK., should be mounted with some clearance to the inner racks construction using rubber dampers to prevent vibrations made by fans and water flow.	
11	Fans number and type	3 radial fans. Easy exchange of fans -"pull and push"		3 axial fans	Radial fans are more efficient and produces less vibrations.
12	Emergency cooling	OK., two inlet radial fans		OK., two (inlet, outlet) axial fans	

Table 1. Comparison of Rittal and Schroff prototype containers features.

It is clearly seen, that some very important requirement have not been fulfill.

The useful space for electronics is for Rittal prototype only 3 times 27U and for Schroff only 2 times 28U plus 26U. Such a containers cannot be accepted, because of racks occupation. In many places it is foreseen to fill the requested 28U rack fully with electronic devices. The design of both prototypes must be changed.

Transportation of container with fork lift is one of the very important requirement. The idea is to transport and install in XTL tunnel fully assembled containers with all electronic inside. The container will be hang with ears on the special car operated by tunnel train. On site, the container will be lowered on the tunnel floor and with help of fork lift moved to the right place under Cryo Module. The Rittal prototype is prepared for fork lift transportation but the Schroff prototype not.

General remarks:

1. Container should be thermally insulated (5-10 mm of halogen free, non-flammable foam). The influence of XFEL tunnel temperature on the inner temp. stability will be reduced

significantly. And the racks will not cool the tunnel air (tunnel air temperature ~30C - inside container temperature ~25C).

2. The doors should be equipped with some cooper mesh or springs sealing to prevent EMI.

General question:
Do we really need the emergency cooling fans (air cooling instead of water cooling)?
I don't know how LLRF can profit from emergency cooling (if there is no cooling water the machine will stop immediately, for maintenance and adjusting the System we need stable temperature = water cooling).
In my very humble opinion I see many constrains to emergency cooling fans.
The amount of air surrounding the container inside radiation shielding is quite small (2 m^3 - optimistic value). Assuming only 2 kW dissipated power inside container, the tunnel temperature ~30C, air temperature rise inside the radiation shielding up to 100C, the temperature inside radiation shielding will rise to 100C after ~100 s = ~1.5 minute. Of course there will be some air flow near cables on top, but in my opinion it is negligible.
The container is not dust free = the heavy concrete dust (with iron particles) will 'kill' our fans in 1-2 years. Emergency fans needs space. The cost of emergency fans is not negligible.

It is necessary to ask: Who needs emergency fans?
For sure, LLRF does not need them, so approx. 50 (of ~200 total) containers can be ordered without emergency cooling fans => save ~50 k€.

08.08.2011 Wojciech Wierba & Krzysztof Oliwa