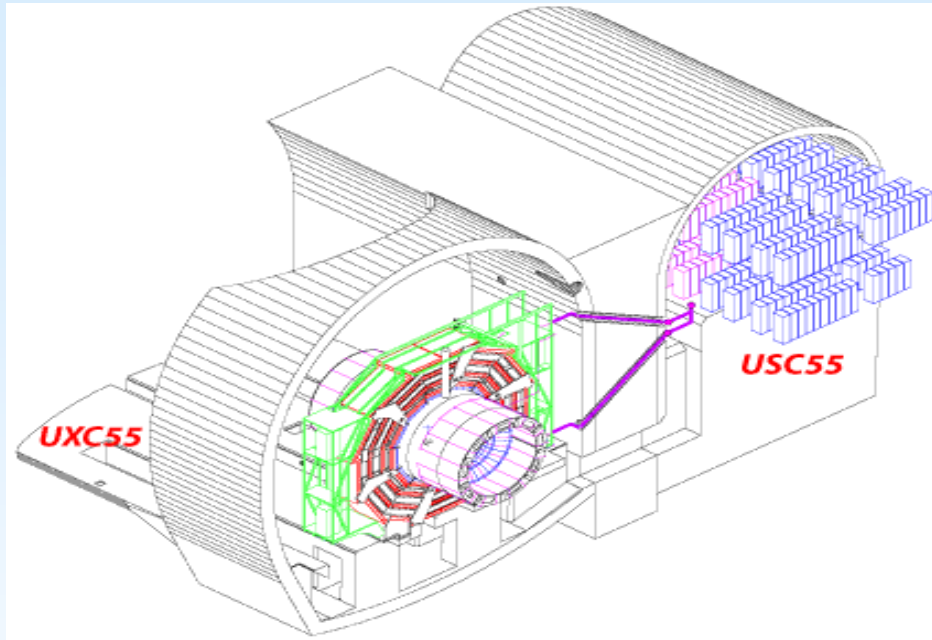


TWEPP-22 Opto WG Information to Users and Q&A

Francois Vasey

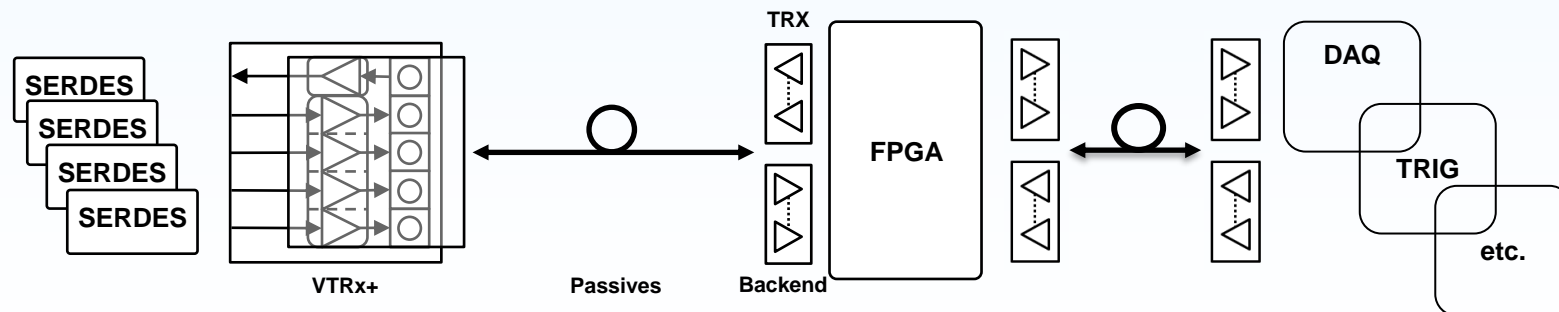
Introduction



Front-end

Back-end

The Optical Chain

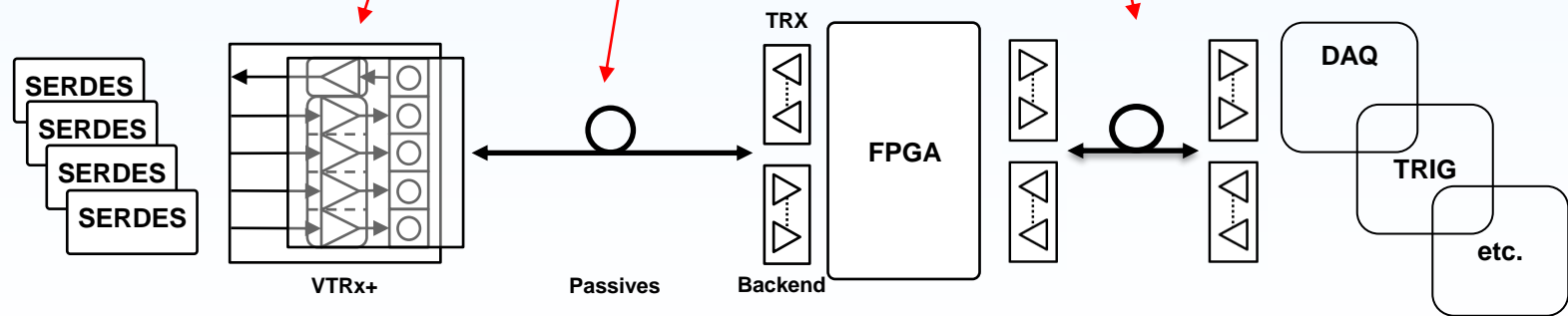


Agenda

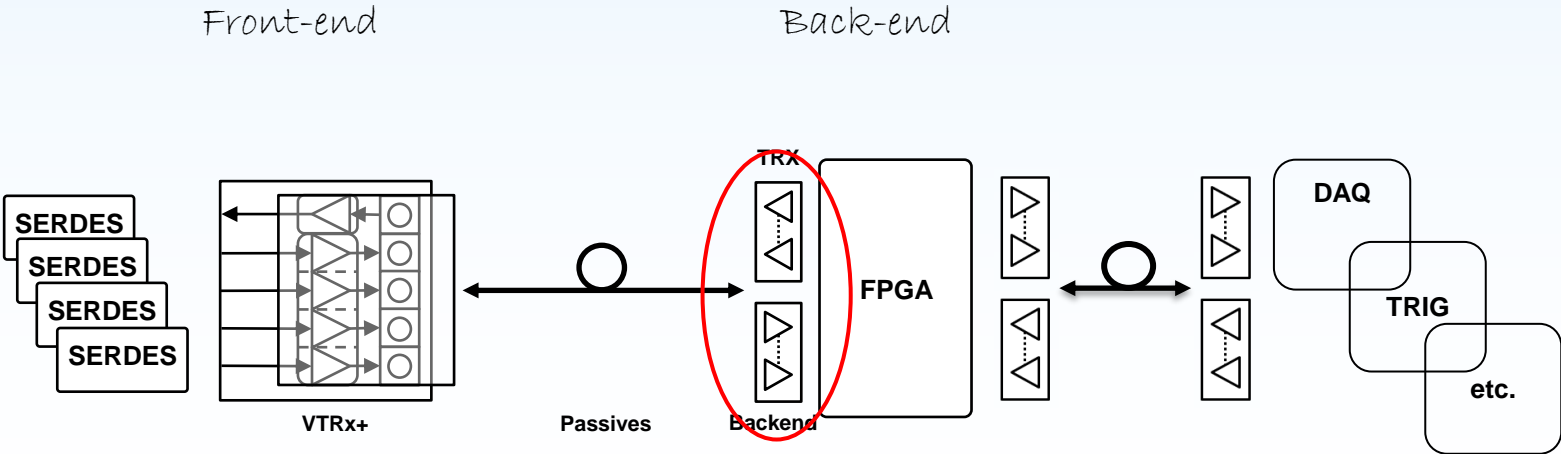
- Introduction** *Francois Vasey*
- Firefly transceivers: roadmap and Q&A (Samtec)** *Joe Phillips et al.*
- VTRx+: status and Q&A** *Csaba Soos*
Fanny Schnelle 17:00 - 17:20
- VL+ optical cords and cables: status, procurement framework and Q&A** *Stefano Meroli*

Front-end

Back-end



Reminder on CERN-B Firefly modules



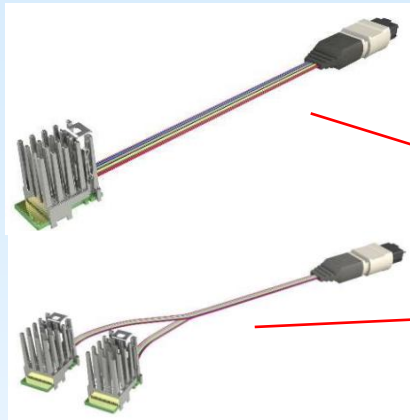
CERN-B is Backend Modules with Tightened Specs

- Link power budget is insufficient at end-of-life if using COTS backend components
- VL+ backend modules must have reasonably non-standard specs to close power budget

	COTS Samtec Firefly ECUO-xxx-14-xxx-0-x-1-x-xx	VL+ standard grade CERN-B-xxx-xxx-x-1-x-x	VL+ extended grade CERN-B-xxx-xxx-x-2-x-x
Tx min OMA	-5.6dBm	-5.6dBm	-1.6dBm
Rx sensitivity	-10.4dBm	-11.5dBm	-12.5dBm
Tx wavelength	840nm - 860nm	840nm - 860nm	840nm - 860nm
<i>Corresponding FE radiation environment</i>		<i>Barrel Calorimeters, Muons (see section 4)</i>	<i>Endcap/Forward Calorimeters, Trackers (see section 4)</i>

- VL+ system must use custom Firefly module at backend
 - CERN-specific reference: CERN-B-XXX-XXX-X-X-X-X (see next slide)
 - Choice of pigtail length, ribbon type, heatsink type, Tx Rx or Y-module etc.
- Fixed prices irrespective of purchase origin and order volume, 10pcs MOQ
 - First 50pcs of each unique configuration (ribbon, heatsink, performance grade, except pigtail length) are more expensive
 - Letter of Authorization from CERN required to link institute to VL+ project
 - Prices valid until June 2024, directly through Samtec (not through distributors)

Firefly CERN-B ordering code



CERN - B - XXX - XXX - X - X - X - X

TYPE

- T12
- R12
- Y12
- T24
- R24

ASSEMBLY LENGTH

-XXX (cm)

HEAT SINK

- 1: FLAT
- 2: PIN-FIN
- 3: FLAT WITH 3-RIBBON PASS THROUGH
- 4: HIGH PERFORMANCE PIN-FIN

END OPTION

- M: MTP SHORT BOOT MALE
- F: MTP SHORT BOOT FEMALE

FIBER TYPE

- 1: BARE WITH SINGULATION
- 2: JACKETED RIBBON
- 3: ROUND PVC JACKET WITH STRAIN RELIEF

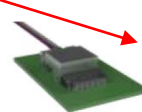
PERFORMANCE LEVEL

- 1: VL+ Standard Grade
- 2: VL+ Extended Grade

- * VL+ trunk cable will be terminated with female MTP connectors at backend (TBC)
- Either MTP12 or MTP24

Cold Plate / Heat Spreader Solutions

Air Cooled solution



Flat Heat Sink



Flat with 3-Ribbon Pass-Through



Standard Pin-Fin



High Performance Pin-Fin

References:

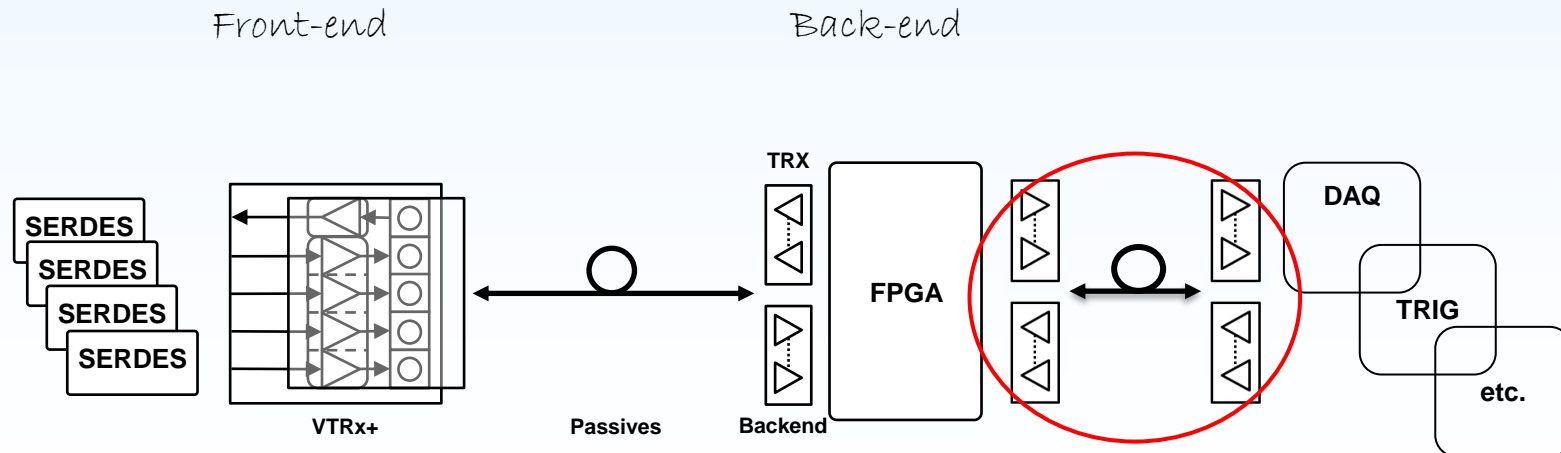
[1] Samtec product brief: FireFly™ CERN-B

<https://edms.cern.ch/ui/#!master/navigator/document?P:1930058715:1947672741:subDocs>

[2] Samtec datasheet: FireFly™ CERN-B, under NDA. Visit the Samtec booth or contact firefly@samtec.com

Update on CERN-HOPS Firefly modules

- Once received from FE, data will hop from board to board
- Agreement reached with Samtec on HOPS 25G Firefly module sourcing
- Strictly speaking not part of VL+ system, but part of most optical chains
- Samtec to present its mid-board optics portfolio

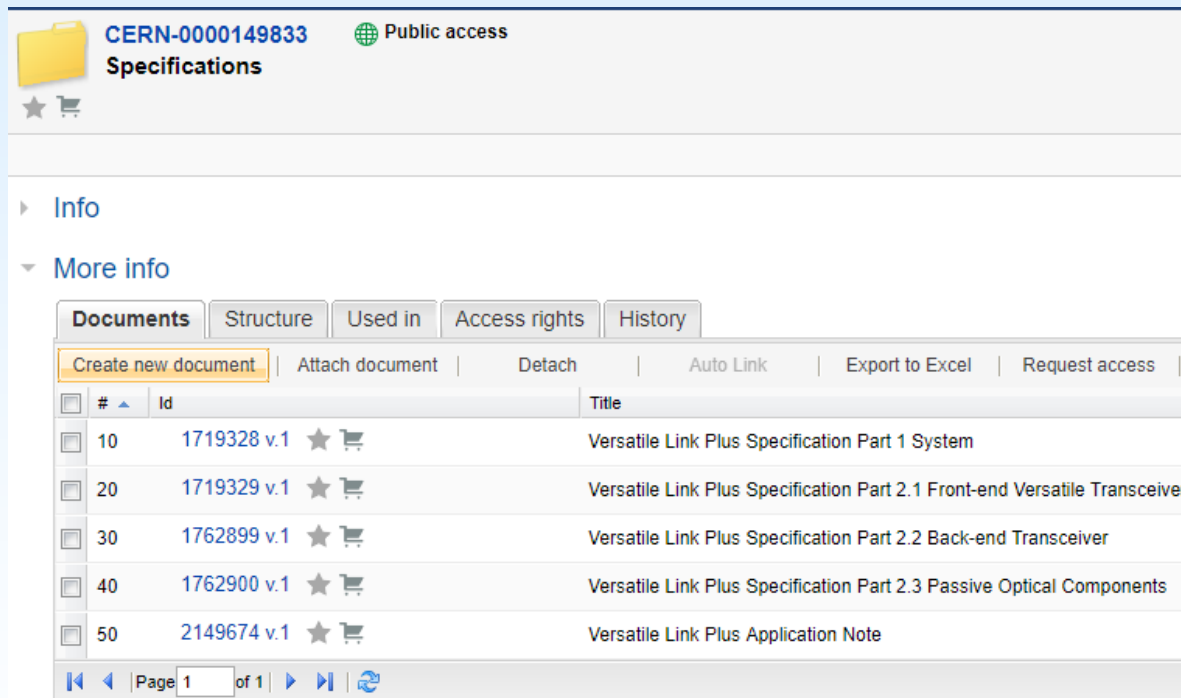



References

- VL+ specifications in EDMS


<https://edms.cern.ch/ui/#!master/navigator/project?P:1930058715:1767090345:subDocs>

Including Samtec product brief and VL+ application note draft



CERN-0000149833  Public access

Specifications

★ 

▶ Info

▼ More info

Documents | Structure | Used in | Access rights | History

Create new document | Attach document | Detach | Auto Link | Export to Excel | Request access

#	Id	Title
10	1719328 v.1	Versatile Link Plus Specification Part 1 System
20	1719329 v.1	Versatile Link Plus Specification Part 2.1 Front-end Versatile Transceiver
30	1762899 v.1	Versatile Link Plus Specification Part 2.2 Back-end Transceiver
40	1762900 v.1	Versatile Link Plus Specification Part 2.3 Passive Optical Components
50	2149674 v.1	Versatile Link Plus Application Note

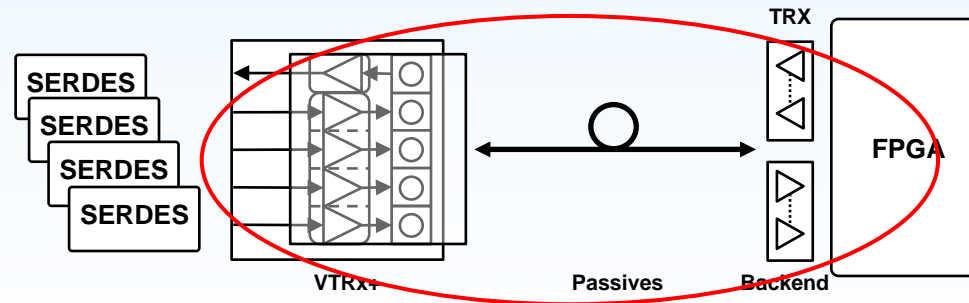
Page 1 of 1

- VL+ Sharepoint site

<https://espace.cern.ch/project-Versatile-Link-Plus/SitePages/Home.aspx>

backups

4. System



References:

[1] "Versatile Link Plus System Specification", EDMS Document 1719328

4.1 Power Budget

- Upstream Power Budget is tight. Depending on link length and radiation environment, extended grade components must be used.
- Best margin achieved for short links with few breakpoints

Table 5.1 Versatile Link Plus Power Budget

	Upstream VTx+_Rx (10Gbps)		Downstream Tx_VRx+ (2.5Gbps)	
	Standard Grade	Extended Grade	Standard Grade	Extended Grade
Tx OMA	> -5.2 dBm	> -5.2 dBm ³	> -5.6 dBm	> -1.6 dBm
Rx sensitivity	< -11.5 dBm	< -12.5 dBm	< -13.1 dBm	< -13.1 dBm ³
Power budget	> 6.3 dB	> 7.3 dB	> 7.5 dB	> 11.5 dB
Fiber attenuation (50m/100m/150m)	<0.125 dB / 0.25 dB / 0.375 dB		< 0.375 dB	
Insertion loss	< 1.75 dB		< 1.75 dB	
Link penalties ¹ (50m/100m/150m)	1.7 dB / 1.9 dB / 2.3 dB		< 0.5 dB	
Tx radiation penalty	1.0 dB		NA	
Rx radiation penalty	NA		< 1.4 dB	<5.4 dB
Fiber radiation penalty	< 0.5 dB	<1.5 dB	< 0.5 dB	<1.5 dB
Margin (50m/100m/150m)	1.225/0.9/0.375 dB	1.225/0.9/0.375 dB	> 2.975 dB	> 1.975 dB
Coding Gain²	1dB		1 dB	

Note 1: The link lengths documented here represent the actual link length where the first 7 meters consists of radiation hard OM2 fiber. For example, the length of 100 m is an overall link length of 100, which includes 7 m of OM2 fiber followed by 100 - 7 = 93 m of OM3 fiber.

Note 2: Error coding scheme, for example, the lpGBT FEC coding will result in an additional gain in margin.

Note 3: VTRx+ devices targeting extended grade should be selected to have high coupling efficiency and low VCSEL forward voltage to ensure robust operation to extreme fluence levels.

4.2 Standard or Extended Grade ?

➔ 1. Consider VTRx+ environment

Tolerance level	Dose and fluence (1Mev neutron equivalent)
Standard Grade	1 MGy 1.7×10^{14} neutrons/cm ² 1×10^{14} hadrons/cm ²
Extended Grade	1 MGy 1×10^{15} neutrons/cm ² 1×10^{15} hadrons/cm ²

If fluences at VTRx+ position are:

- a. above standard grade levels > select **Extended Grade**
- b. at/ or below standard grade levels: move to step 2

➔ 2. Consider Fibre environment

calculate Radiation Induced Attenuation (RIA) in fibre (choice of standard and rad hard fibre types)

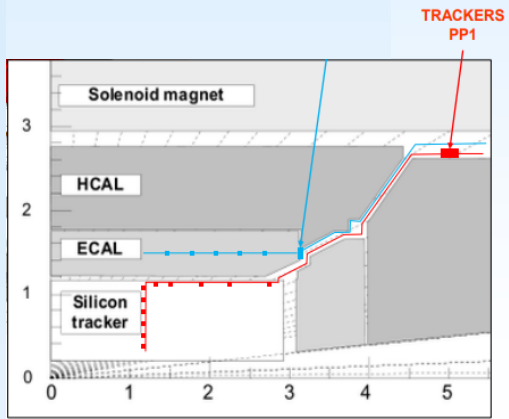
- a. If RIA is below 0.5dB > select **Standard Grade**
- b. If RIA is above 0.5dB > select **Extended Grade**

➔ 3. If unsure, contact VL+ team with:

- detector ionising radiation map
- fibre route and patch panel locations
- Position of Cold / Warm transition (if applicable)

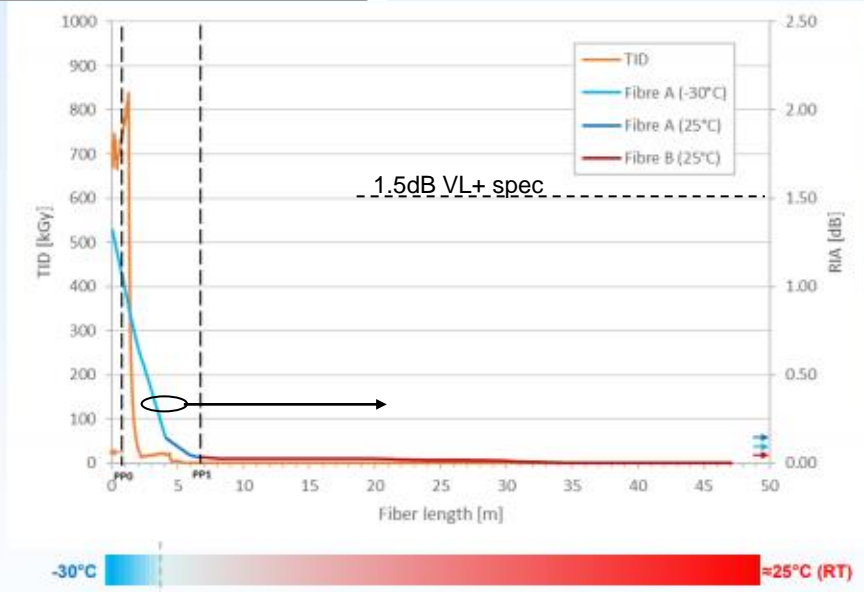
To determine fibre type(s), calculate total RIA, and select VL+ grade

4.4 Cumulative Radiation Induced Attenuation

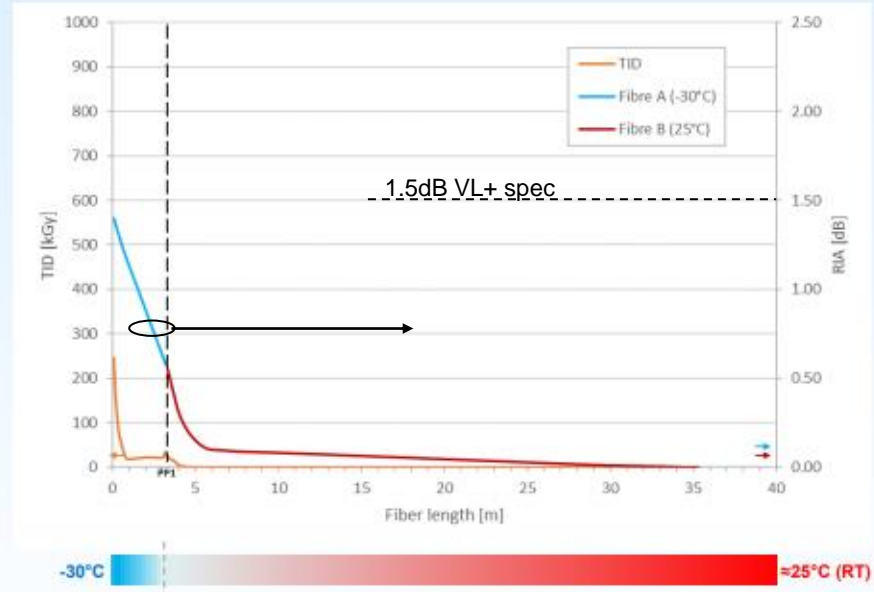


CMS

ATLAS



Temperature Scale (approximation)



Temperature Scale (approximation)

→ Total RIA ≈ 1.32 dB

→ Total RIA ≈ 1.40 dB