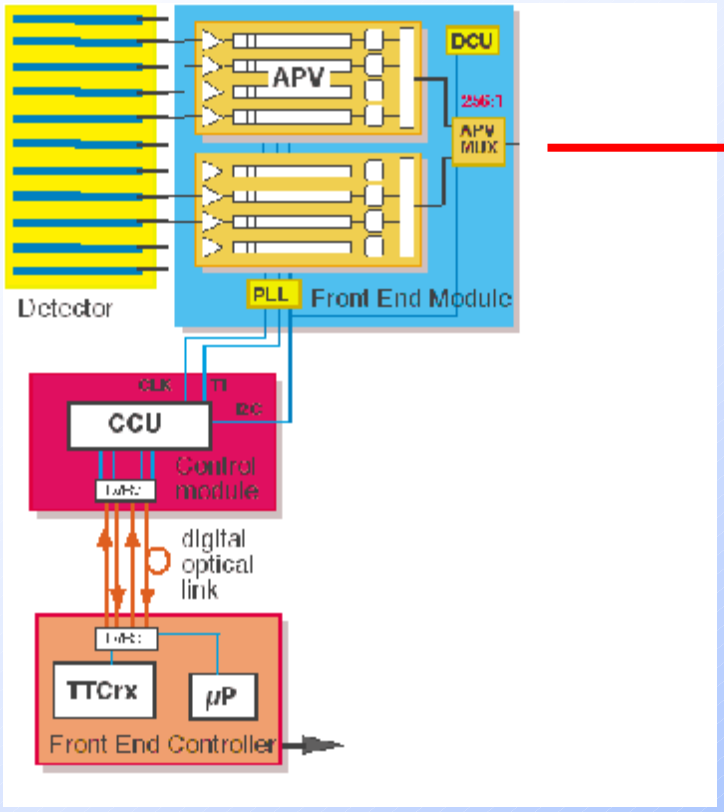
Analogue Optical Link Overview

- Requirements
- Implementation
- Responsibilities
- Project Roadmap
- Scope of the Review

Requirements: a) FE Environment

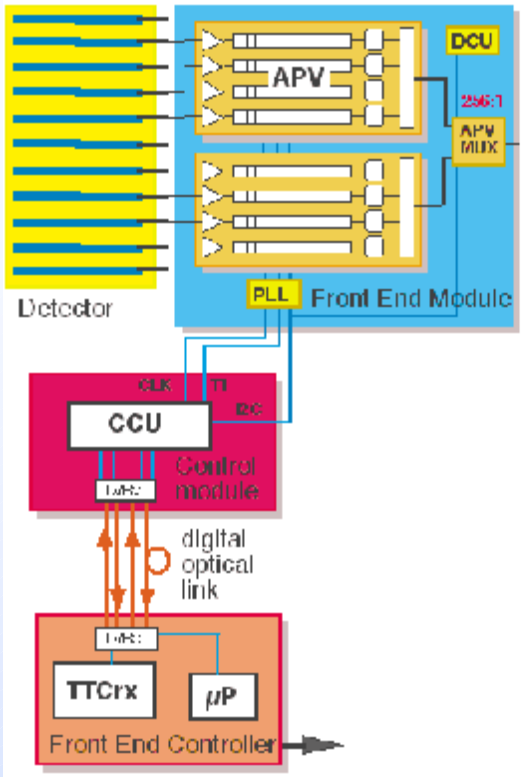


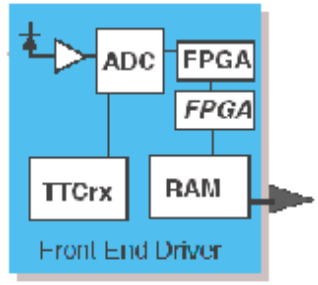
Experimental Constraints:
(micro-strip tracker front-end)

Hadronic Fluence*	3e14 cm^{-2}
Ionising Dose*	1.5e5 Gy
Temperature	-10 °C
B-Field	4T

* *incl. 1.5 safety factor*

Requirements: b) Functionality

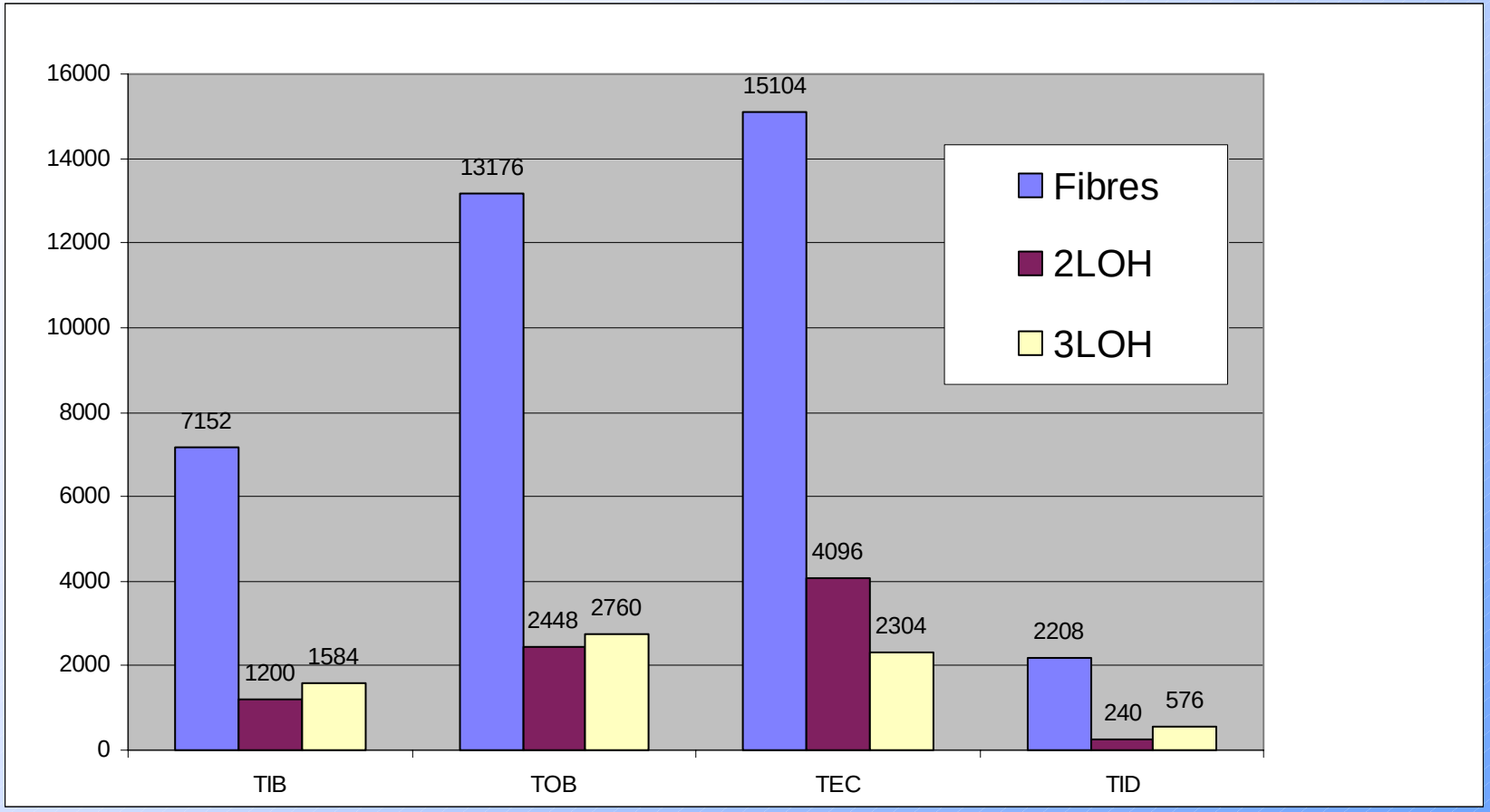




Analogue Tracker micro-strip readout:

Linearity	1-2%
Dynamic Range	7-8 bits
Settling Time	<20ns
Gain	TBD

Requirements: c) Quantities

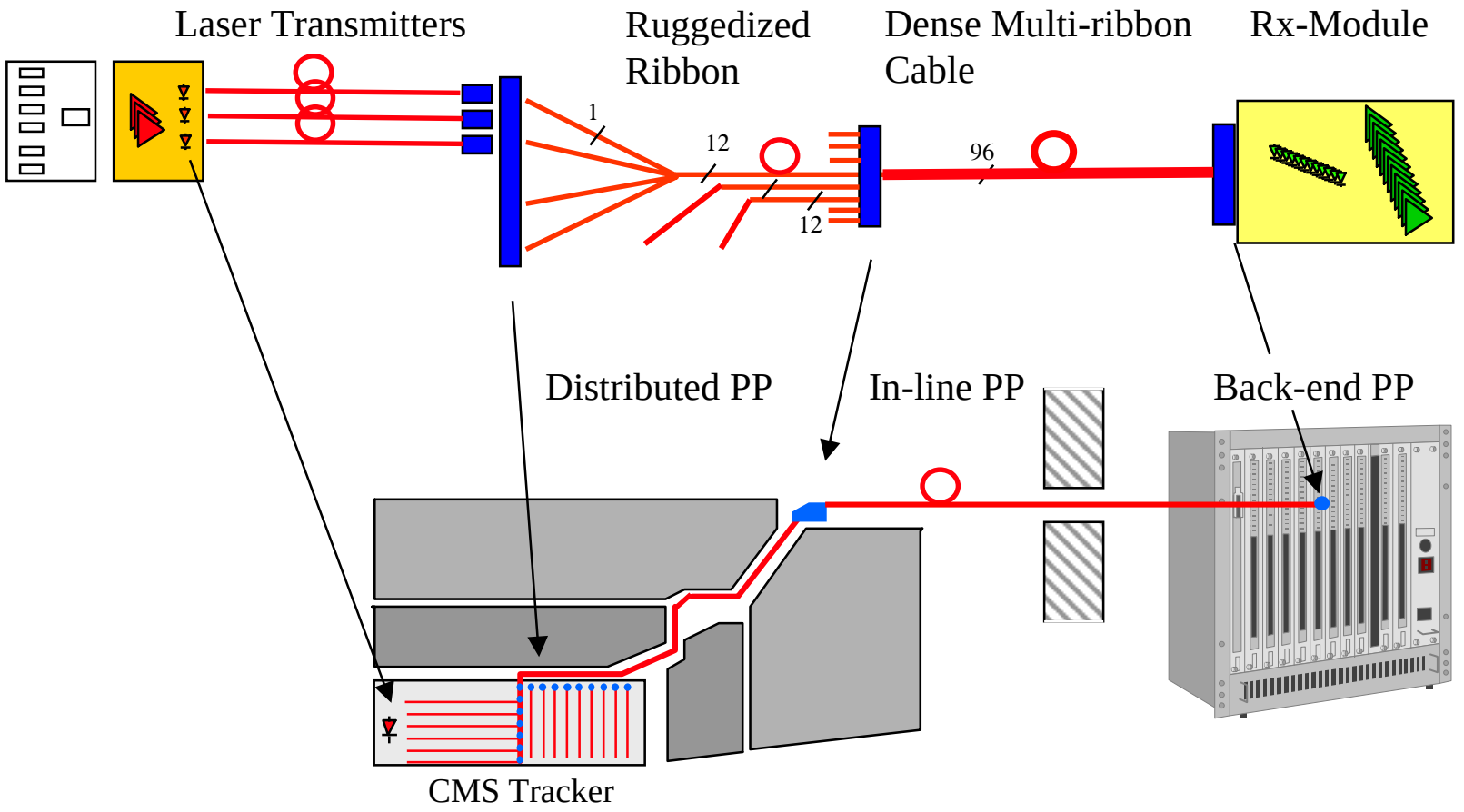


- Tracker micro-strip readout only
- Excluding contingency

Implementation: a) Technology

Requirement	⇒ Technology Choice
Linearity	⇨Edge emitting Laser
Dynamic Range	⇨Single Mode System, 1310nm Wavelength
Settling Time	⇨Fast Electronics (BiCMOS or CMOS-Subμ)
Gain	⇨10bit ADC & Equalization
Magnetic Field	⇨Non-magnetic connectors and packages
Radiation	⇨Extensive qualification of COTS-based components
Density	⇨Semi-Customized laser package
	⇨Fibre ribbon & array connectors
	⇨Customized multi-ribbon cable
	⇨Semi-Customized Rx-module

Implementation: b) Architecture

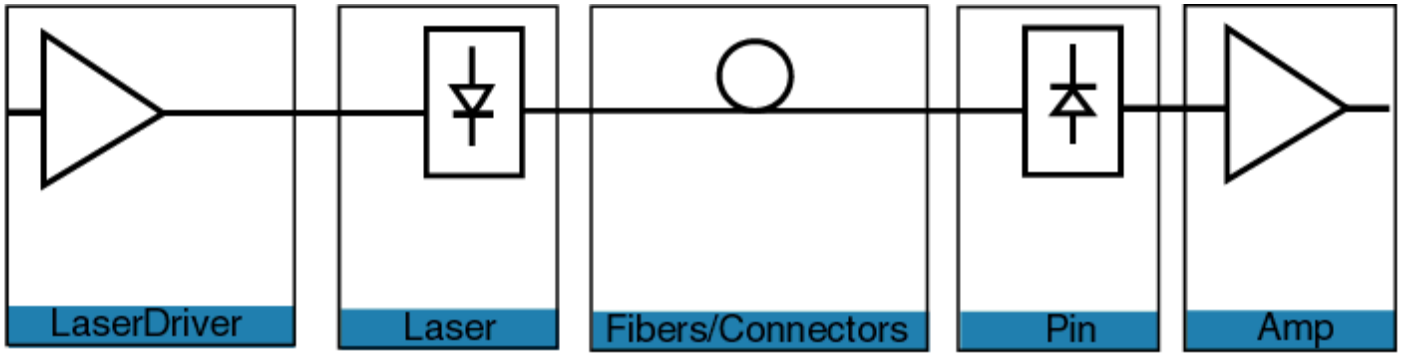


Implementation: c) Specifications

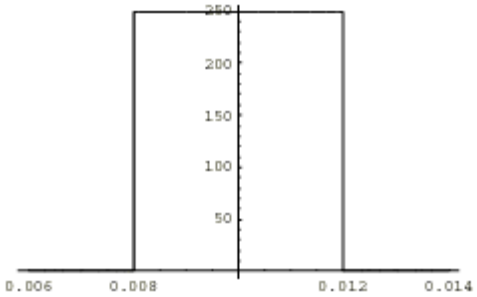
Spec	System	A-OH	Rx-module
INL (2MIP)	1% typ.	1.5% max	0.5%
S_pNR (6MIP)	48dB typ.	46 dB min (in system)	60dB
BW	70 MHz	90 MHz min	100 MHz
Gain	0.8 V/V		

Implementation: d) Simulation (1)

Distribution of Gain G=0.8V/V and Tolerances



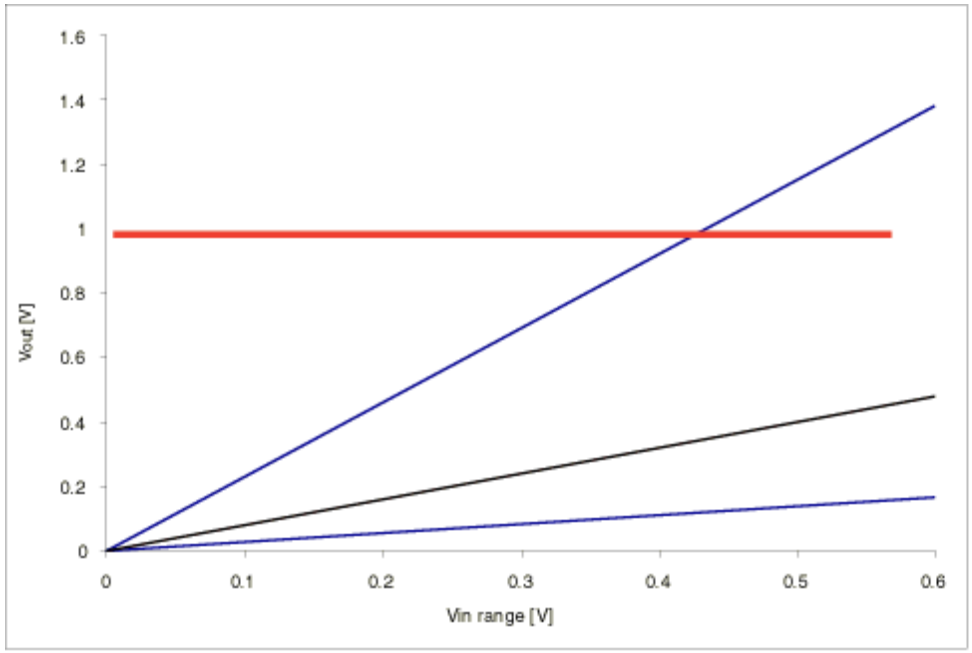
0.008...0.012 A/V	0.032...0.048 W/A	0.5...0.95	0.6...1.0 A/W	3600...4400V/A
±20%	±25%	±30%	±25%	±10%



worst case assumption: uniform distribution

Implementation: d) Simulation (2)

Link transfer characteristic (Vout vs. Vin)

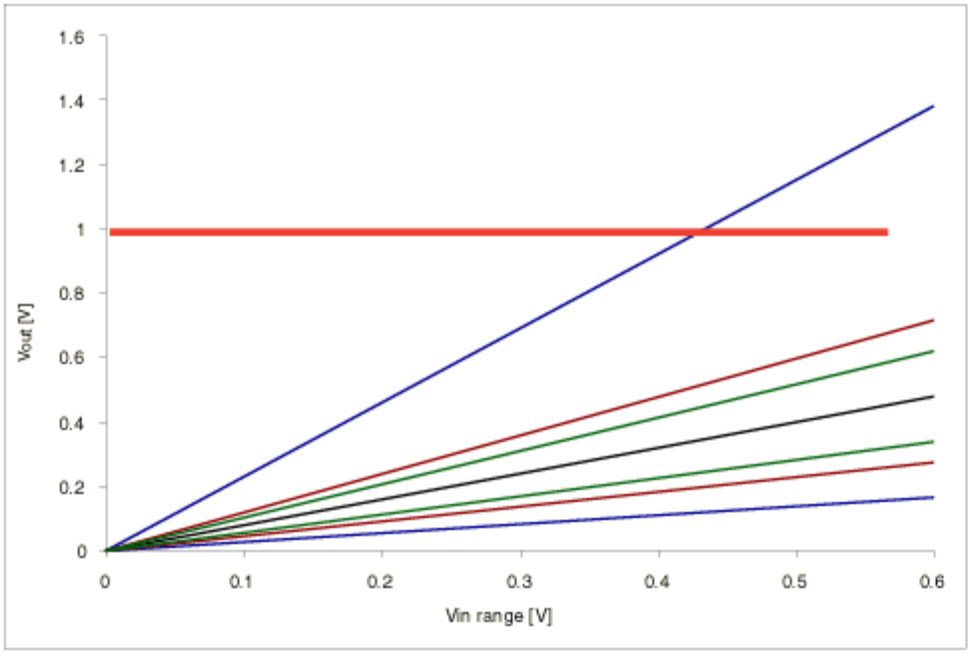


blue... high/low case without driver gain compenstion

black. typical case

Implementation: d) Simulation (3)

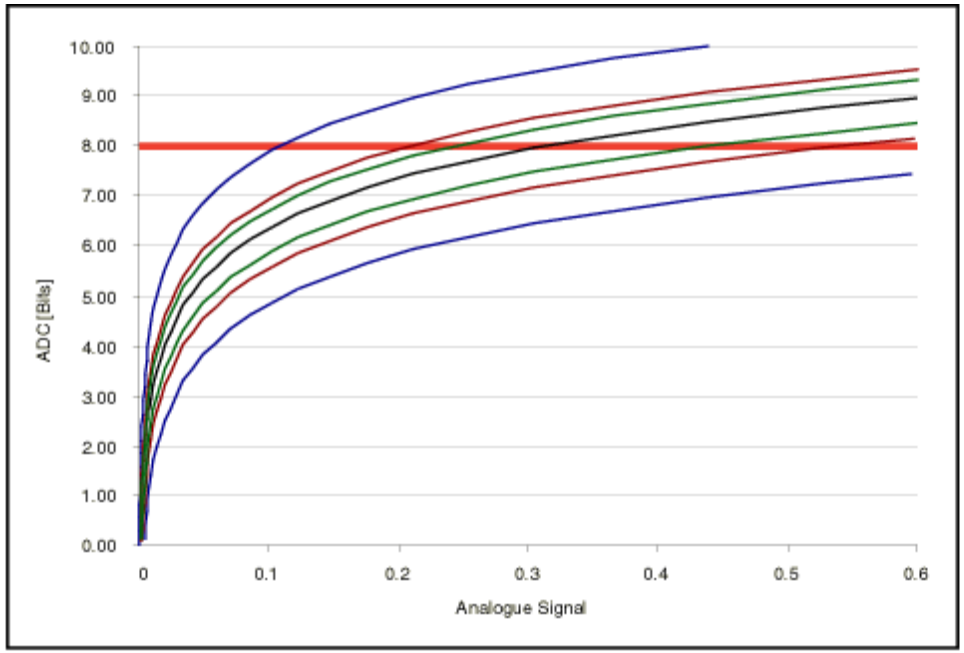
Toleranced link transfer characteristic with switch-able driver gain



blue... high/low case without driver gain compenstion
red... high/low case with driver gain compensation
green.. ±2 Sigma of high/low case with driver gain compensation
black.. typical case

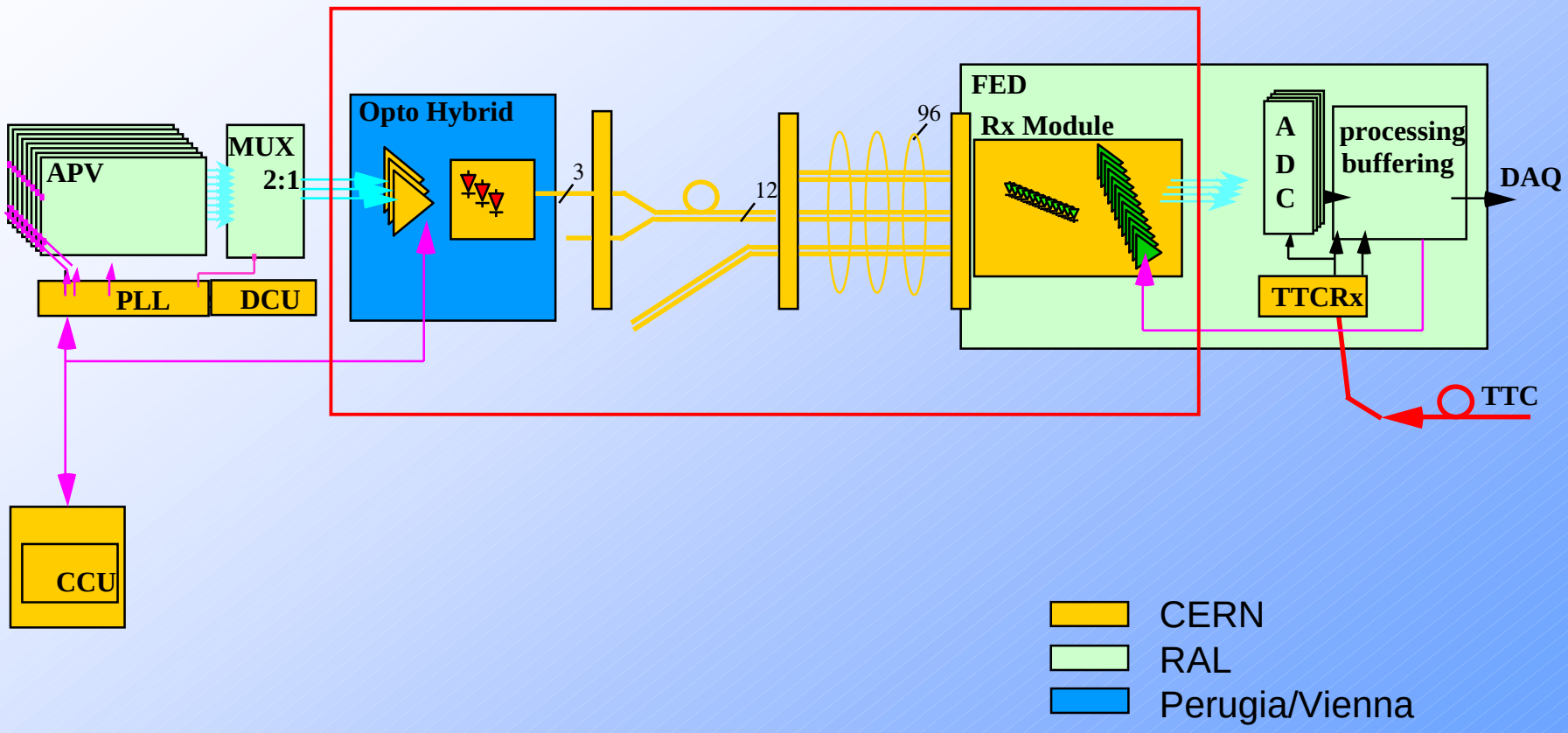
Implementation: d) Simulation (4)

Link dynamic range with switch-able driver gain



blue...	high/low case without driver gain compenstion
red...	high/low case with driver gain compensation
green..	±2 Sigma of high/low case with driver gain compensation
black..	typical case

Responsibilities: a) Institutes in charge

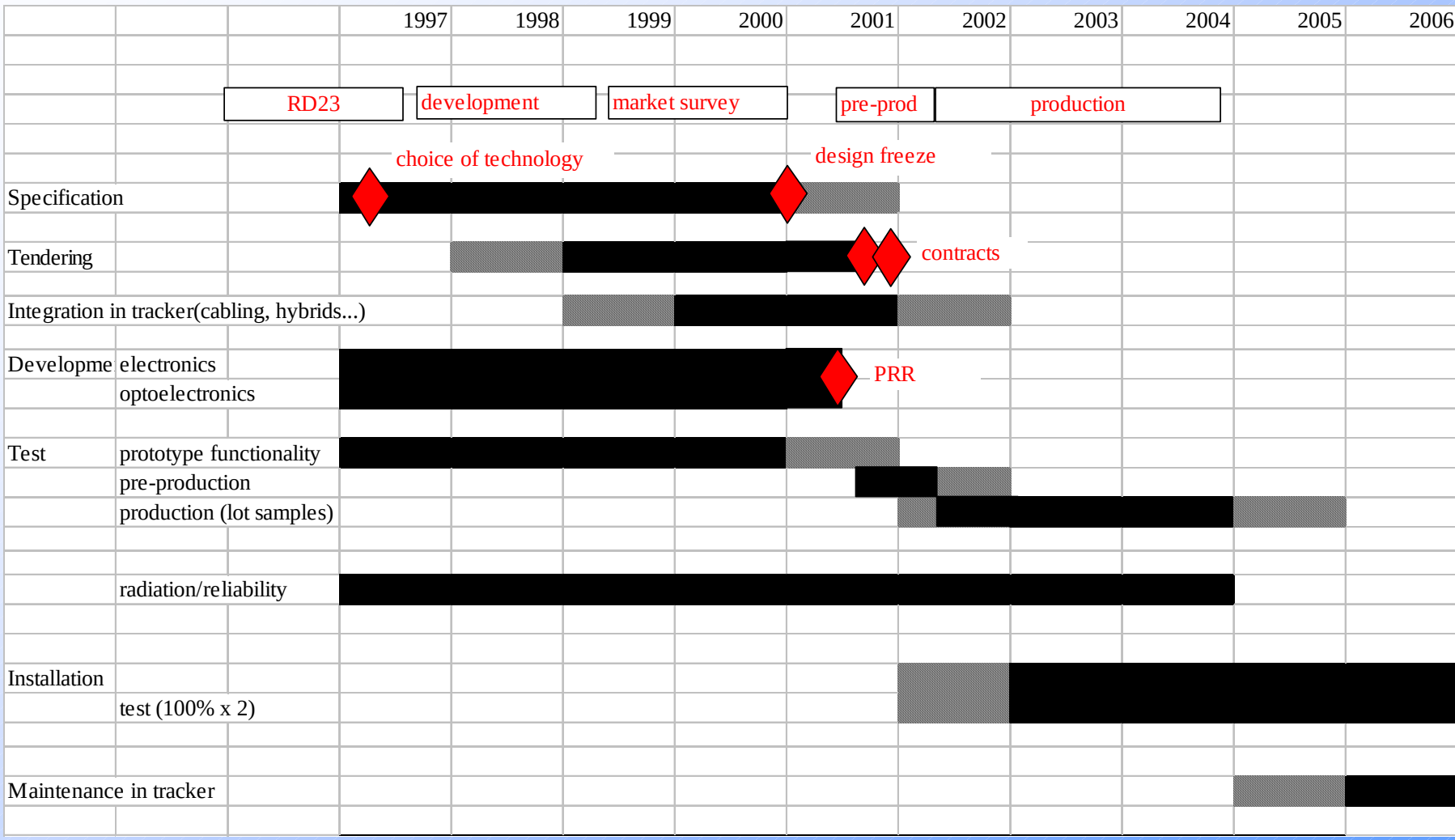


Responsibilities: b) Interfaces

#	electrical specifications	min	typ	max	unit	note
1.21	Operating* input voltage	-300		+300	mV	Differential, In^+–In^-
1.22	Input voltage	-500		+500	mV	Differential, In^+–In^-
1.23	Input impedance		100		Ω	
1.24	Operating* output voltage range ΔU	180	480	800	mV	With equalized driver gain settings. Single-ended, output terminated with R_L=100Ω to Vee.
1.25	Output voltage	0.4		3	V	Single-ended, output terminated with R_L=100Ω to Vee.
1.26	Output loading		1.6	2.5	ns	$\tau = C_L * R_L$
1.27	Quiescent operating point	user adjustable via a) IIC interface (front-end) and b) Rx module control logic (FED)				defined at 0V input signal
1.28	Tx hybrid power supply	2.25	2.5	2.7	V	Vss-Vdd
1.29	Rx module power supply	4.5	5.0	5.5	V	Vcc-Vee
	specs 1.30 to 1.40					unused

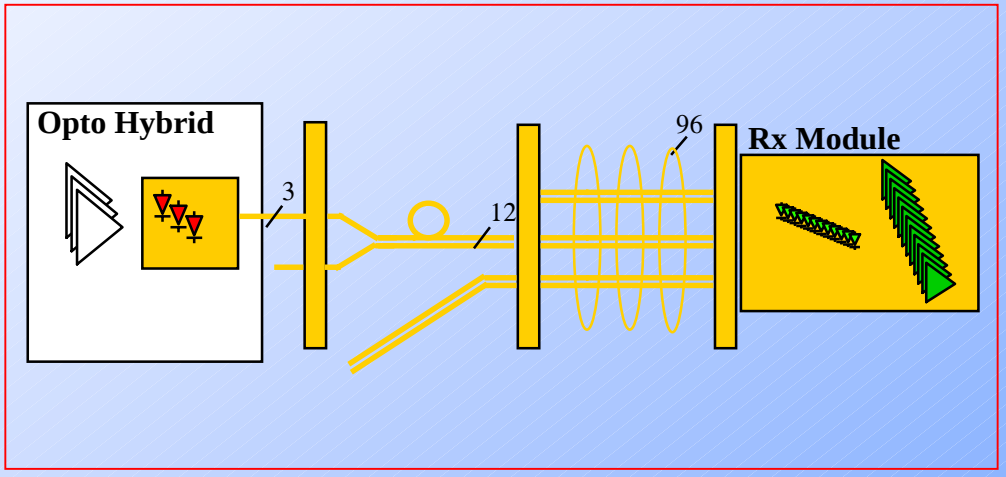
* The operating range is defined as the range where linearity is specified

Roadmap


1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
RD23
development
market survey
pre-prod
production
choice of technology
design freeze
Specification
Tendering
contracts
Integration in tracker(cabling, hybrids...)
Developme
electronics
optoelectronics
PRR
Test
prototype functionality
pre-production
production (lot samples)
radiation/reliability
Installation
test (100% x 2)
Maintenance in tracker

Scope of this Review

- Technical Readiness
- Quality Assurance
- Procurement Readiness
- Production Readiness



- Laser
- Fibre & Connectors
- Rx Module
- Analogue System