CALIFA Electronics & DAQ

Tobias Jenegger

R3BWeek Paris
12.11.2024

Inner Cabling

Preamplifier Status

DAQ status & Upgrade

LED System

Documentation Status

Supported by BMBF 05P15WOFNA and 05P19WOFN1.

The results presented here are based on the experiment s444/s473, which was performed at the beam line/infrastructure Cave C at the GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt (Germany) in the frame of FAIR Phase-0.

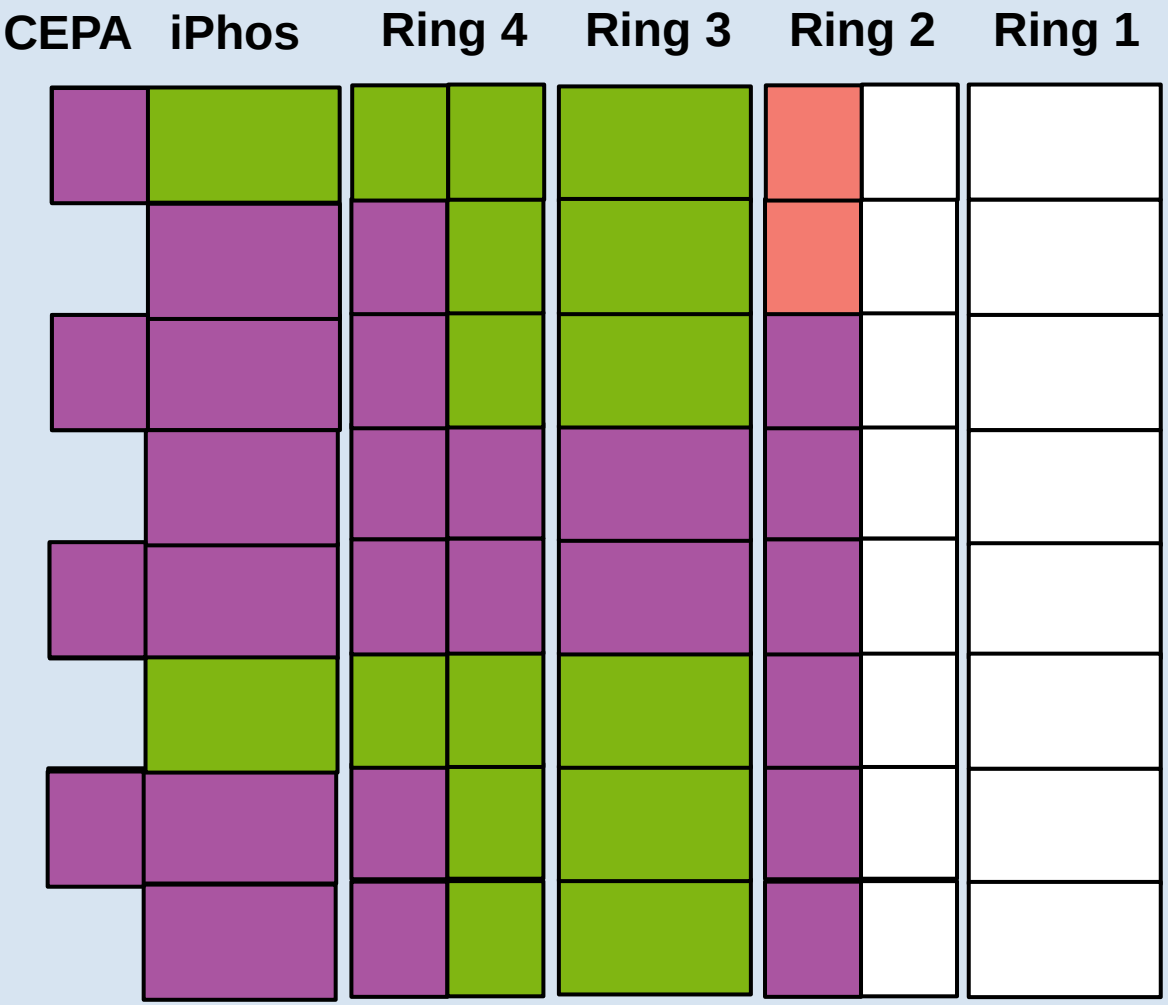
GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

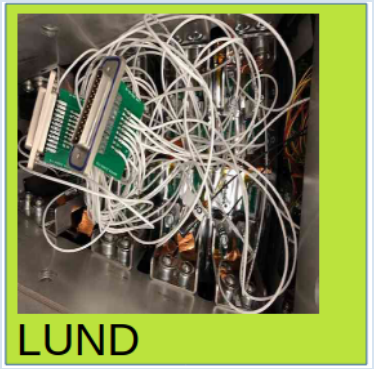
GSI

FAIR Phase 0 Research Program

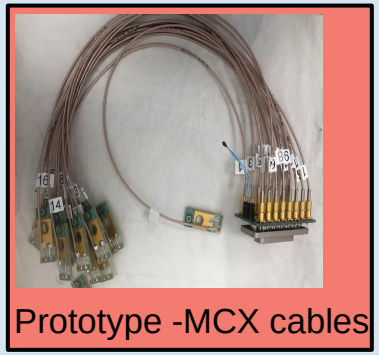
TUM Members:
Roman Gernhäuser,Philipp Klenze,Mrunmoy Jena, Gero Bollmann,Tobias Jenegger

Inner Cabling – Wixhausen Half



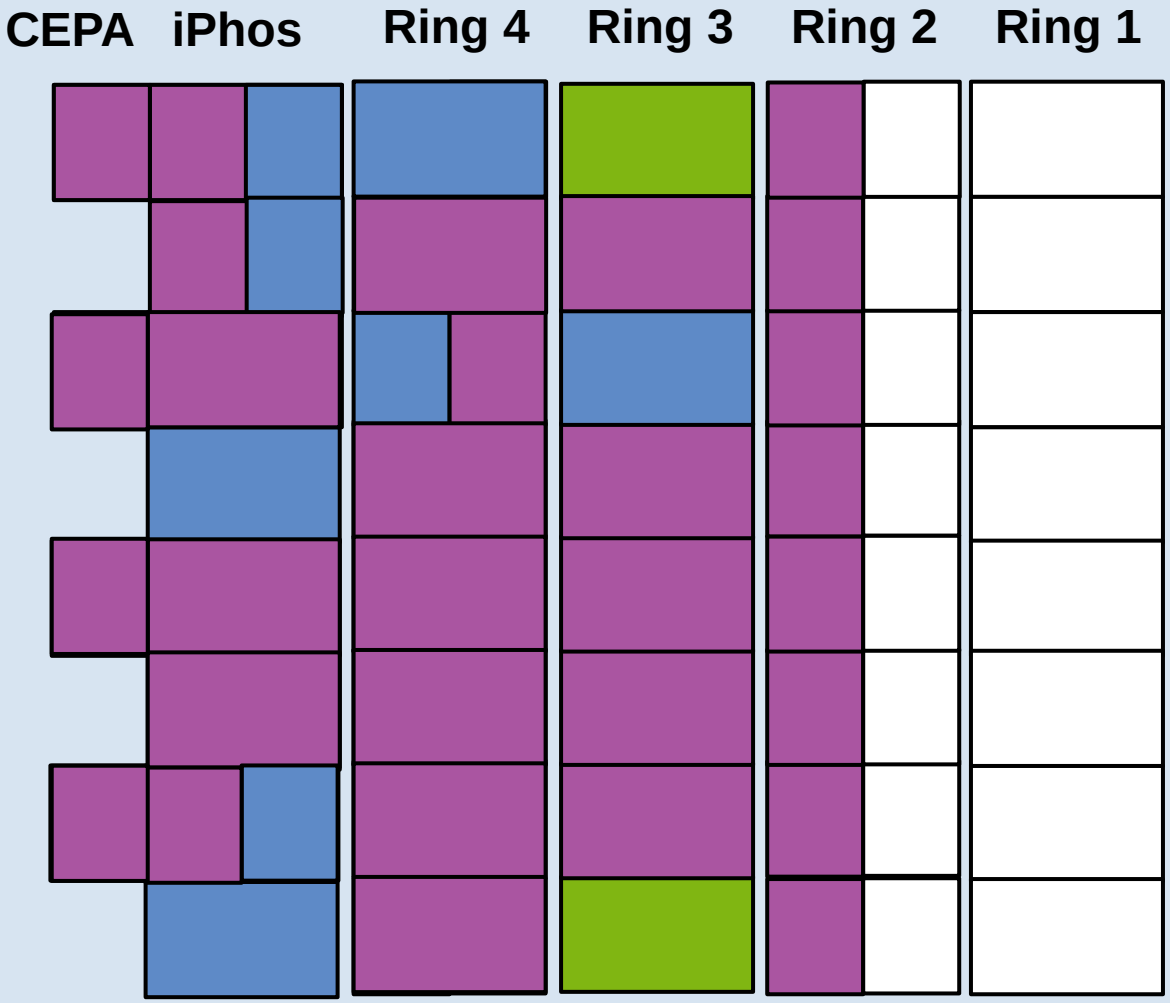

LUND

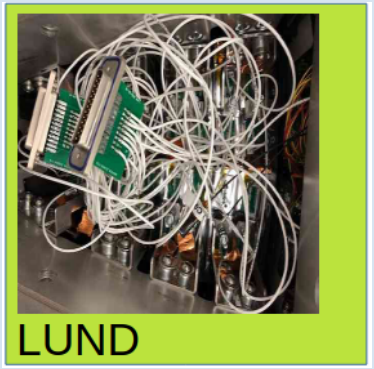

New Coax

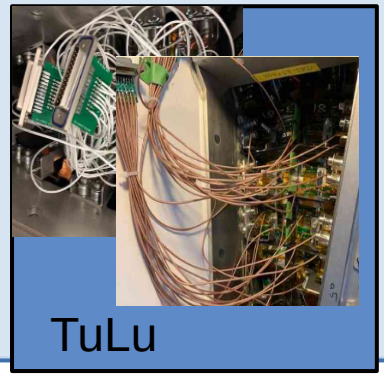

Prototype -MCX cables

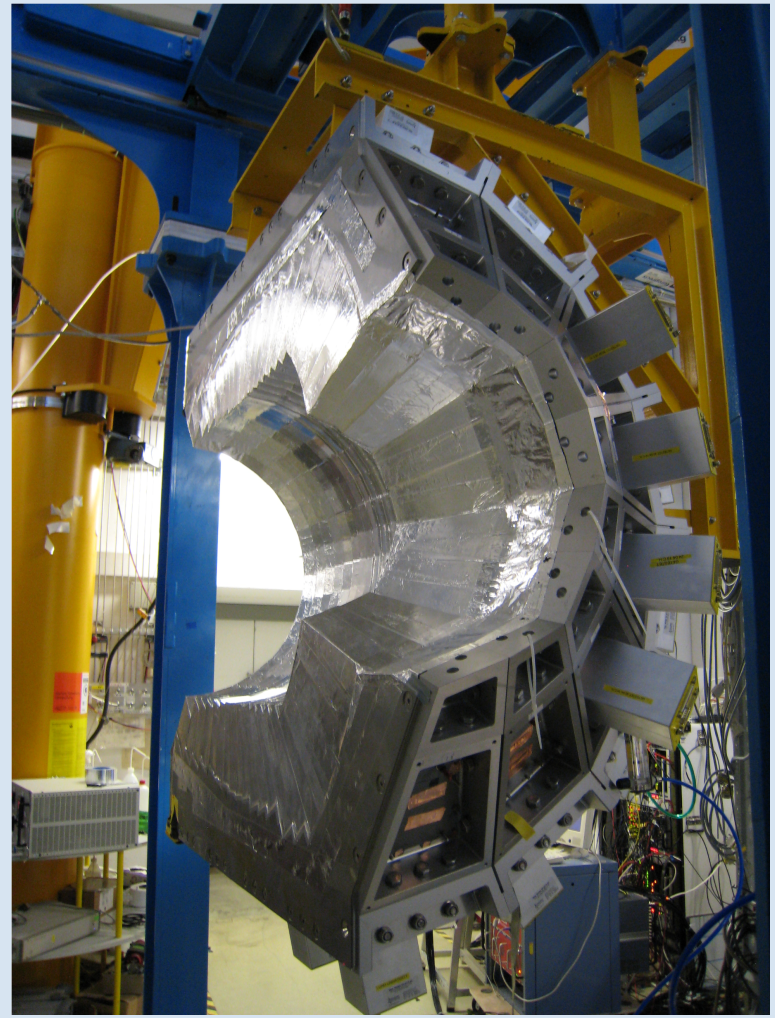
Credits to Anna-Lena & TuDa group

Inner Cabling – Messel Half



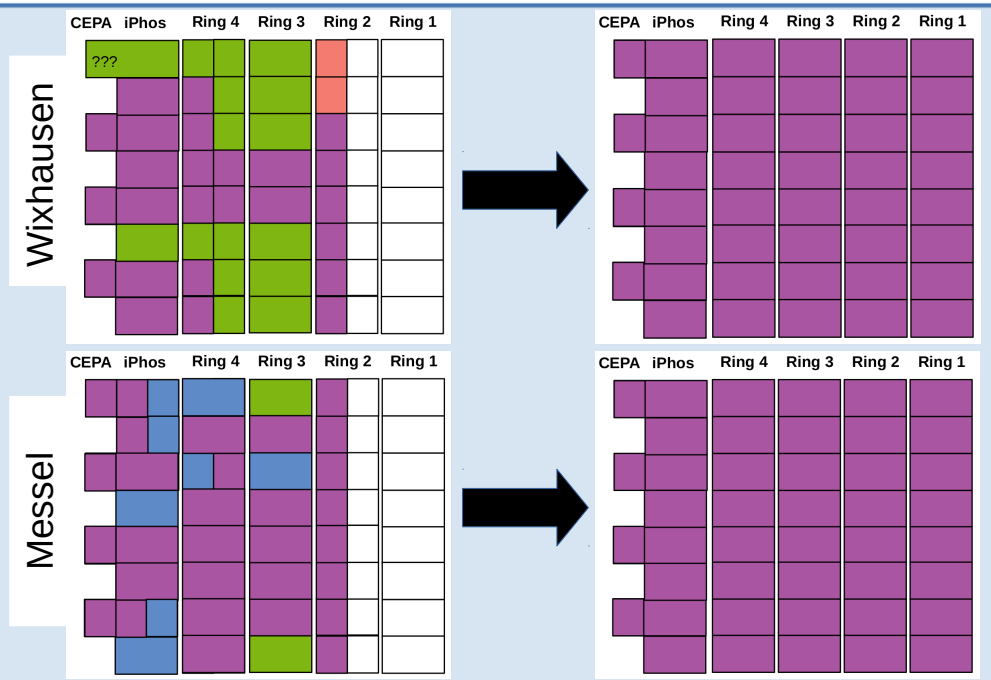






Credits to Anna-Lena & TuDa group

Inner Cabling – Upgrade Backward Barrel + Refurbishment



Shopping List:

Connectors **1.6 k€**
(SubD 25Pin, socket strip,…)

Cables **9.3k€**
(Coax cables,APD PCBs,
Fiber connector & additional PCBs)

11k€

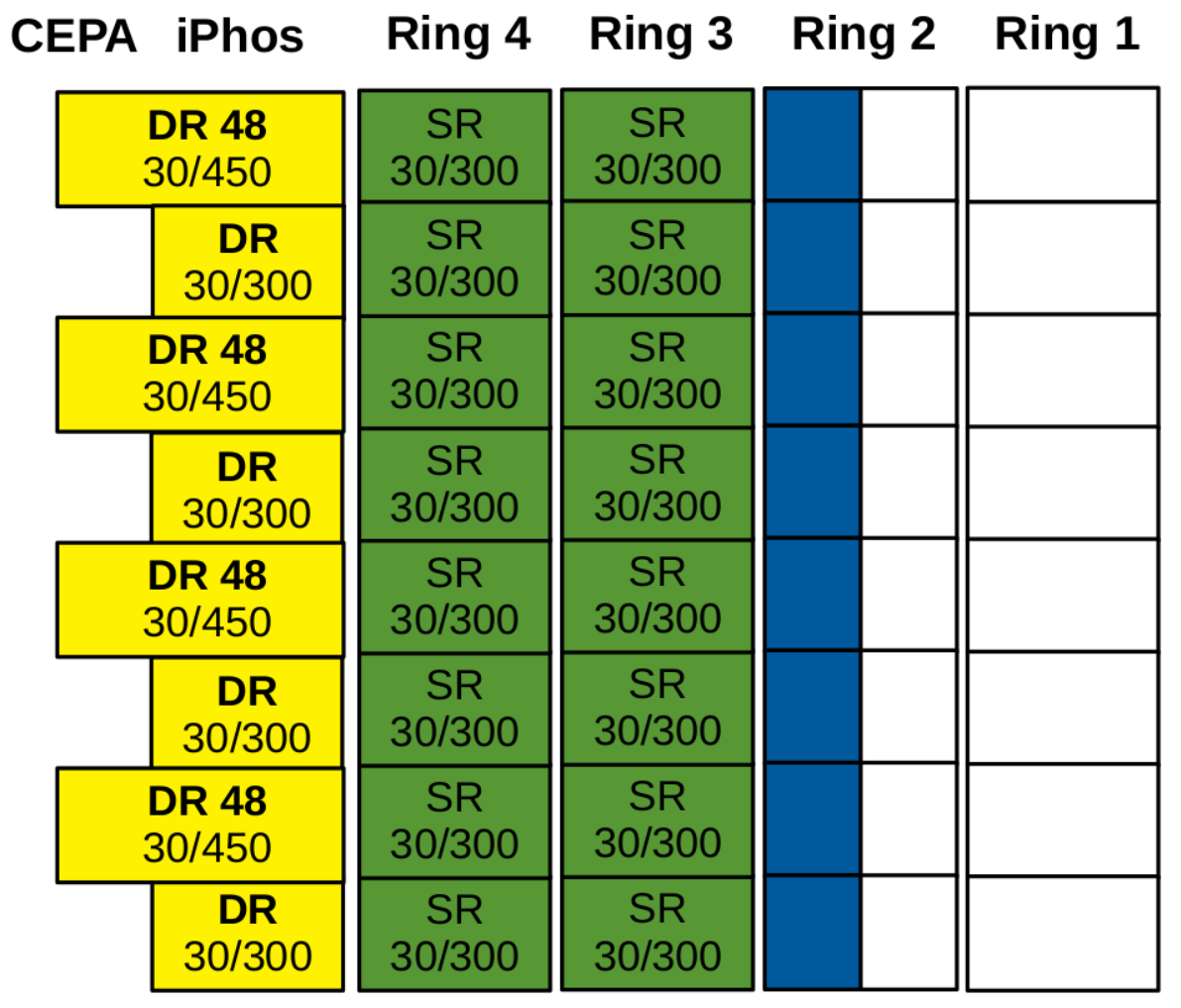
Production:

Only producer at the moment: TuDa workshop ~ several weeks

Financial resources unclear

Installation time ~ 3 months

CALIFA Preamplifier Status for Exp. S091/118 - 2024



→ **CEPA**: 8 x 3/45pC DR Preamplifier

→ **iPhos:** mixed configuration:

8 x 3/45pC DR PA

8 x 3/30pC DR PA

→ **Barrel – Ring 4&3**: 32 x 3/30pC SR PA

→ **Backward Barrel (BB) – Ring 2:**

Bricolage of 16 PA (SR/DR)

What is still needed?

32 x SR 3/30pC PA for BB
(the current BB are spares for different applications)

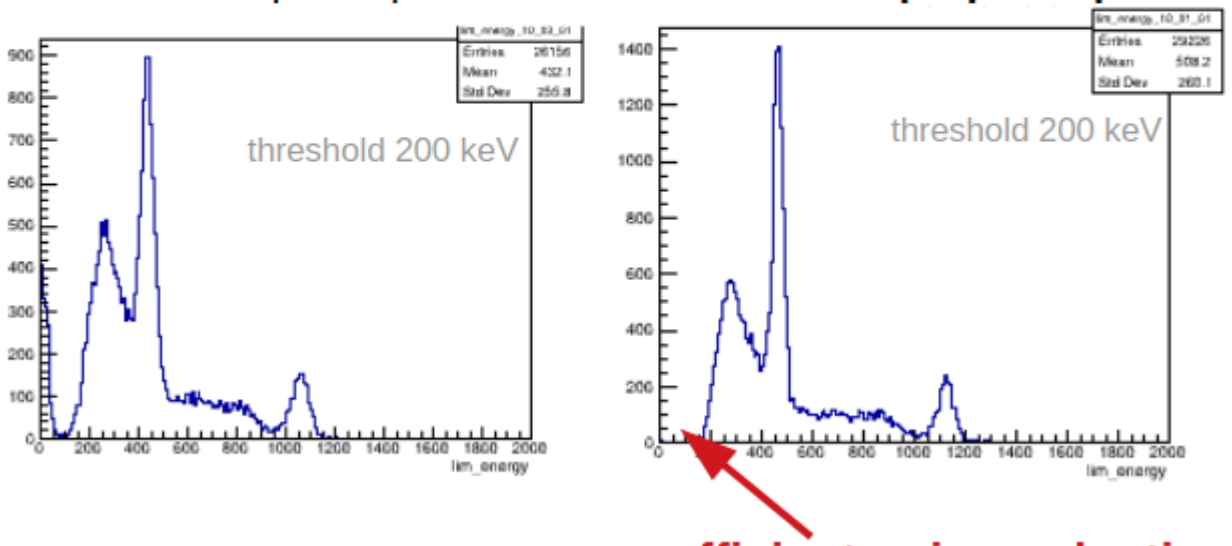
Modifications:
12x DR → to low noise input and 3/45pC range
32x SR → lower noise input stage

Optimization of S/N in Preamplifiers

Noise Optimization by Mesytec:

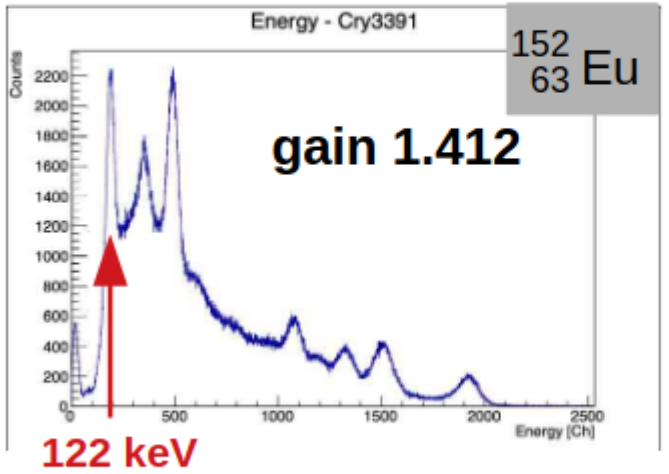
more current in input FET improve S/N ratio

reference preamplifier **low noise DR 3/45pC preamplifier**



Gain Optimization:

Stefan Eder's talk in R^{3}B Week in Budapest



larger APD gain – constant electronic noise

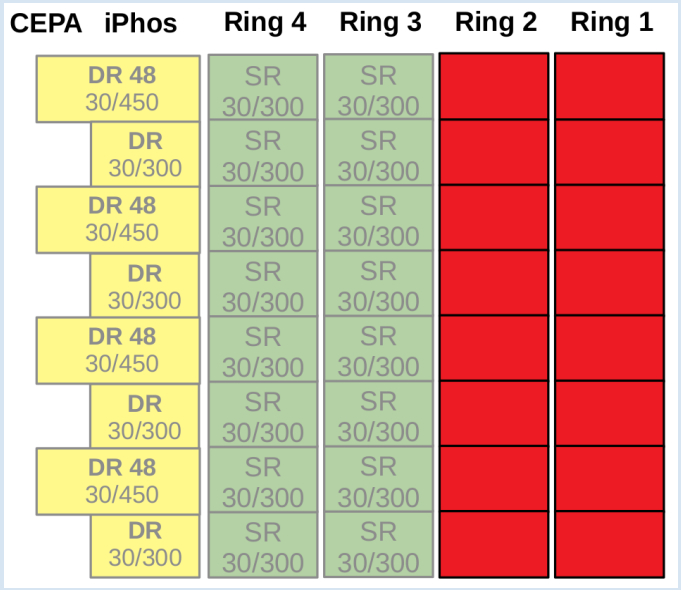
gain ~ S/N with N= const

3/45pC DR Preamplifiers:

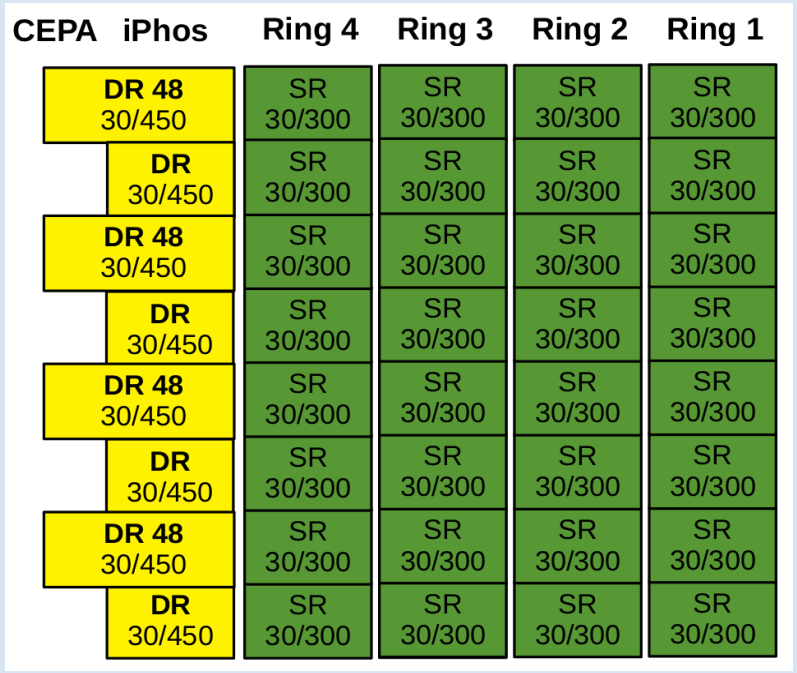
→ allow to increase gain → lower thresholds

→ 45pC covers full range up to 300 MeV

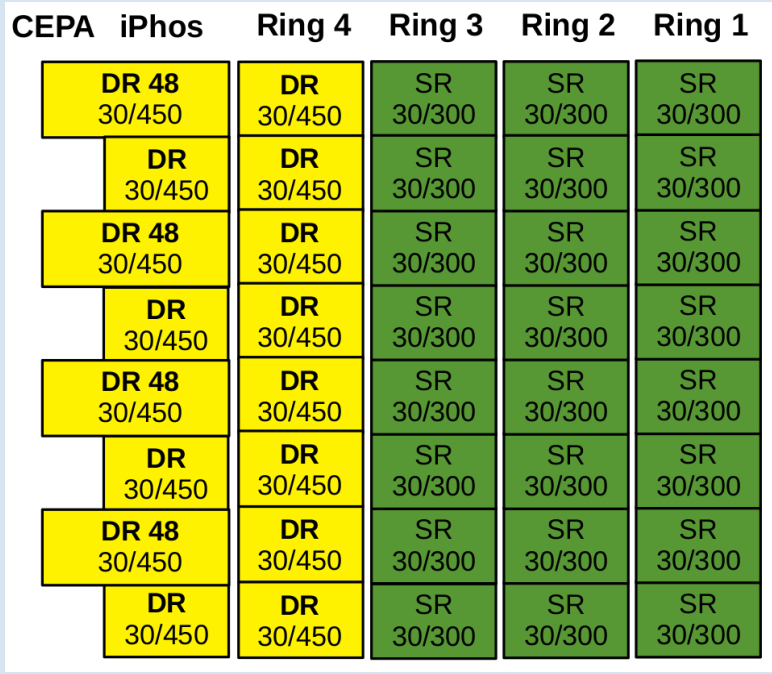
What we still need:



“Default Config.”



“4π Config.”



* in both versions all preamps are upgraded to lower noise input stage

Workload & Costs

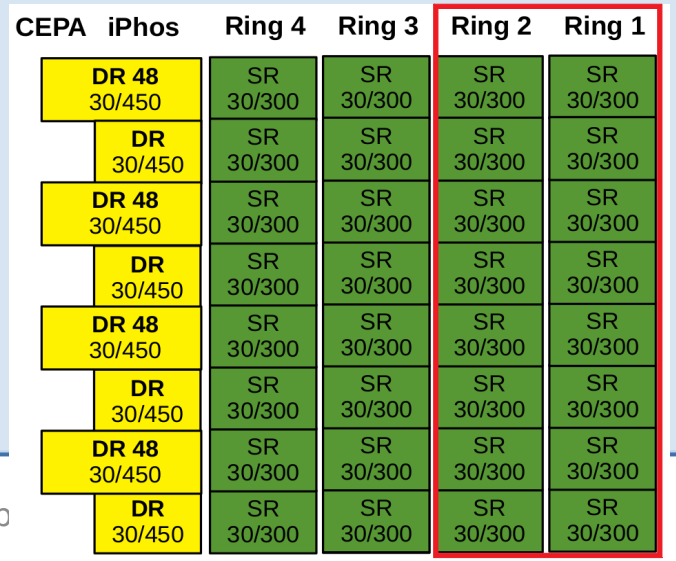
“Default Config.”

To Buy:

32 x 3/30pC SR PA for BB	224k€

To Modify:

12x DR → to low noise input and 3/45pC range	10k€
32x SR → low noise input stage	26k€
	260k€



“4π Config.”

To Buy:

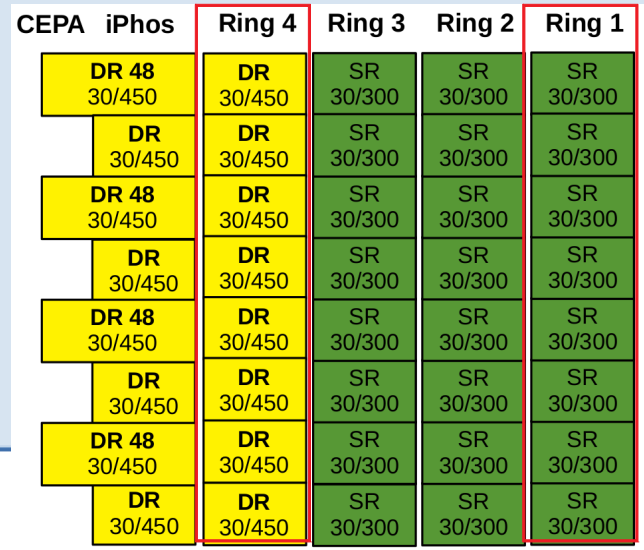
16 x 3/45pC **DR** PA for Ring4	128k€
16 x 3/30pC **SR** PA for Ring1	112k€

To Modify:

12x DR → to low noise input and 3/45pC range	10k€
32x SR → low noise input stage	26k€

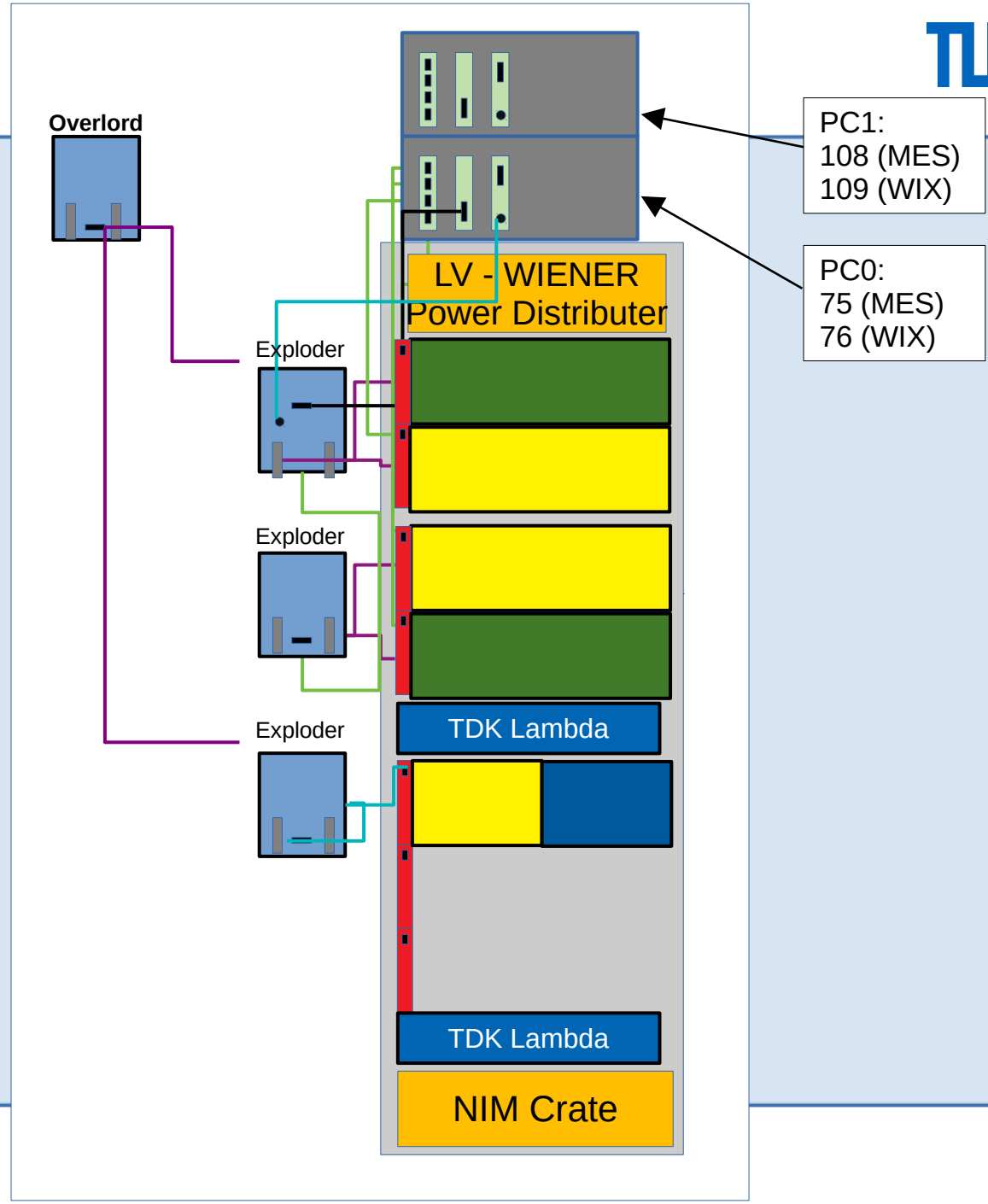
Note:

+ 32 FEBEX cards are needed for this configuration	47k€
	323k€



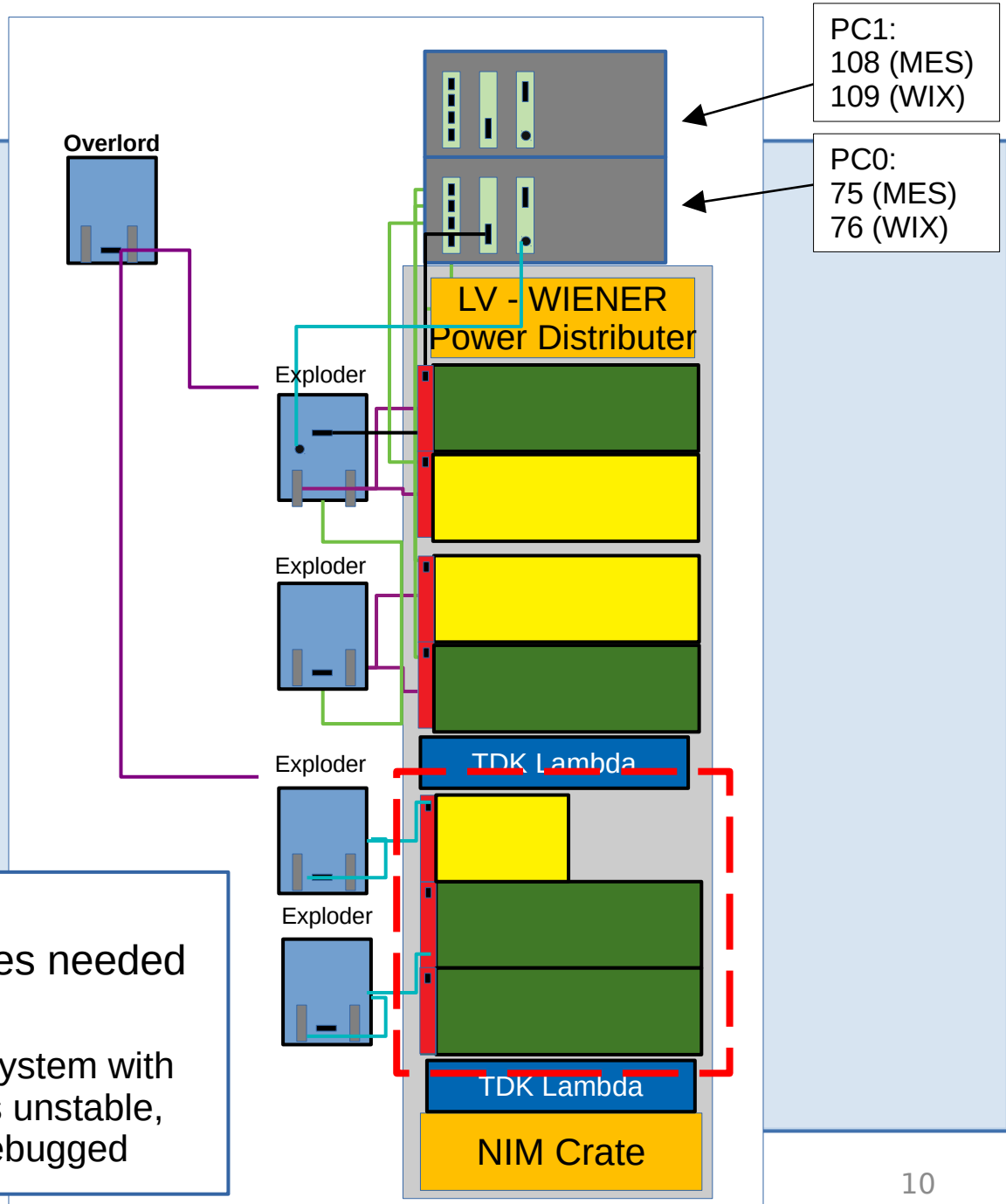
DAQ Status for Exp. S091/118 - 2024

CEPA	iPhos	Ring 4	Ring 3	Ring 2	Ring 1
DR 48 30/450		SR 30/300	SR 30/300		
	DR 30/300	SR 30/300	SR 30/300		
DR 48 30/450		SR 30/300	SR 30/300		
	DR 30/300	SR 30/300	SR 30/300		
DR 48 30/450		SR 30/300	SR 30/300		
	DR 30/300	SR 30/300	SR 30/300		
DR 48 30/450		SR 30/300	SR 30/300		
	DR 30/300	SR 30/300	SR 30/300		



DAQ – Future Upgrades - “Default Config”

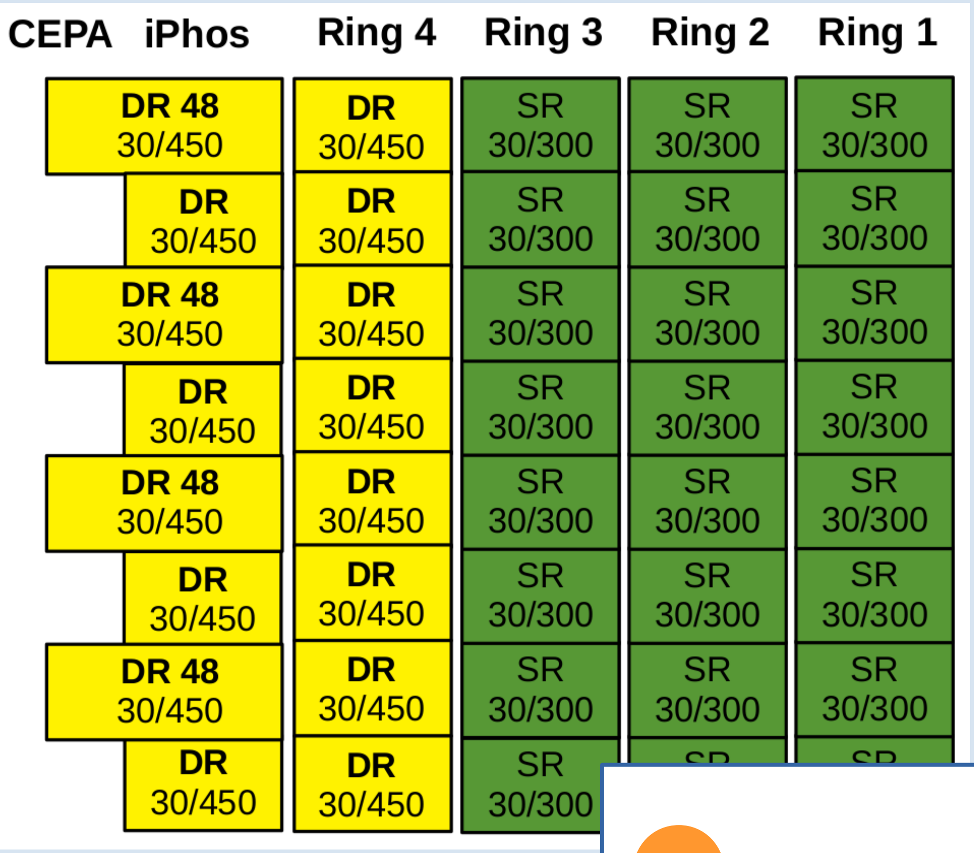
CEPA	iPhos	Ring 4	Ring 3	Ring 2	Ring 1
DR 48 30/450		SR 30/300	SR 30/300	SR 30/300	SR 30/300
	DR 30/450	SR 30/300	SR 30/300	SR 30/300	SR 30/300
DR 48 30/450		SR 30/300	SR 30/300	SR 30/300	SR 30/300
	DR 30/450	SR 30/300	SR 30/300	SR 30/300	SR 30/300
DR 48 30/450		SR 30/300	SR 30/300	SR 30/300	SR 30/300
	DR 30/450	SR 30/300	SR 30/300	SR 30/300	SR 30/300
DR 48 30/450		SR 30/300	SR 30/300	SR 30/300	SR 30/300
	DR 30/450	SR 30/300	SR 30/300	SR 30/300	SR 30/3

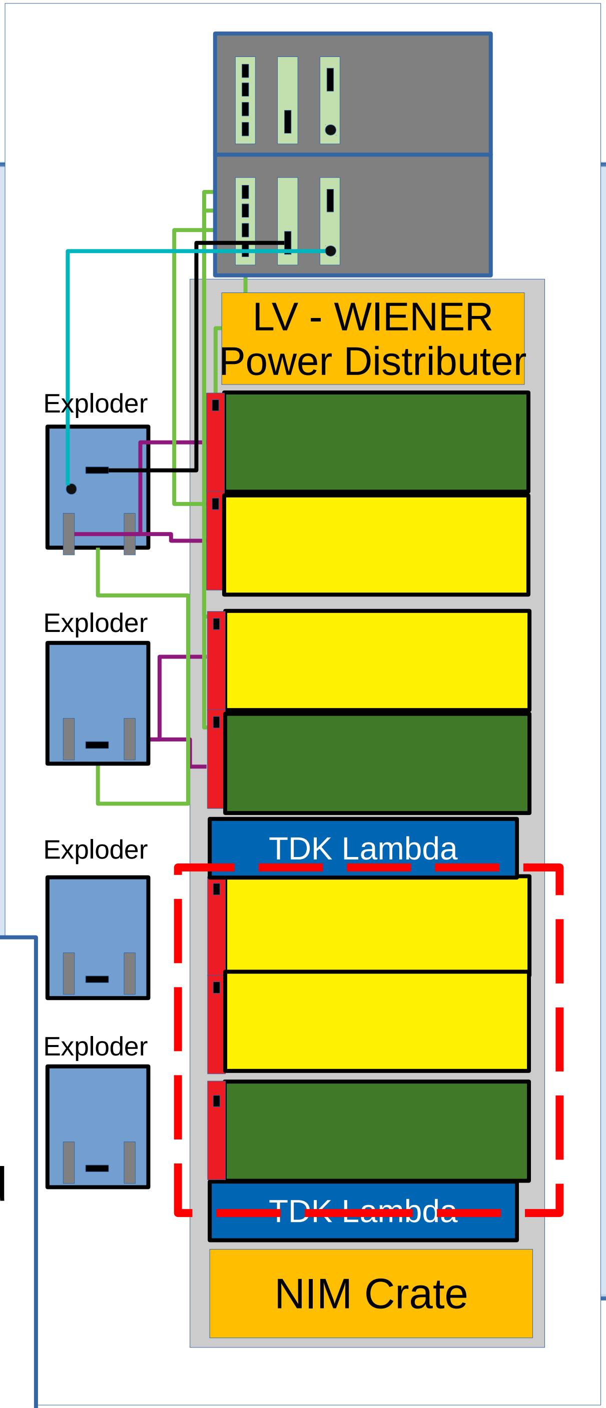


More about CALIFA DAQ Status:
Presentation Philipp Klenze,
Wed, 11am

- ✕ 2+ LV modules needed
- ✕ Running sub-system with all three crates unstable, needs to be debugged

DAQ – Future Upgrades - 4π Config.





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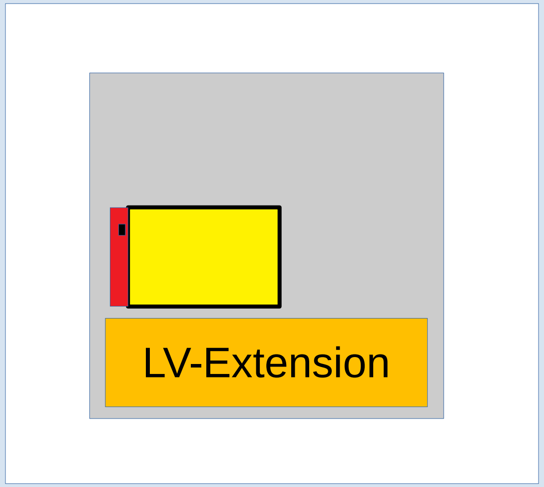


✓ Rack extension already available

- ✗ Load balancing
- ✗ 2+ LV modules needed
- ✗ Running sub-system with all three crates was not possible, unstable

Electronics for Extension

Already available or ordered:

- 5 Exploders
- 16+ FEBEX cards
- NIM Power Crate

Still to buy:

- LV Power Distributer Board
- 2 x PEXOR cards
- 2 x PEXARIA cards
- 2 x TRIXOR cards
- 2 x DAQ PCs
- 2 x TDK Lambdas

Costs: ~ 30k€

Outer Cabling for Backward Barrel

For **“Default Config.”:**

- 48+ SR cables need to be produced
- 16+ LV cables need to be produced

Components on stock or easily available

Workload: ~ 1 month

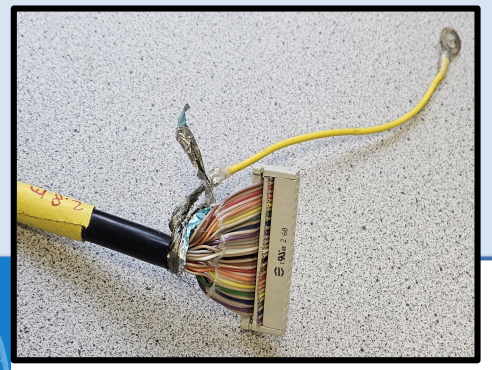
For **“4π Config.”:**

- 16+ SR cables need to be produced
- 16+ LV cables need to be produced
- 32+ DR SCSI cables for Ring 4 and according Febex PCB adapters

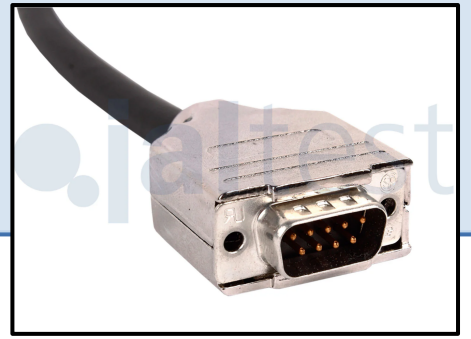
Workload: 2 weeks

No ~3.5 m SCSI cables available on the market !

Single Range (SR) cables



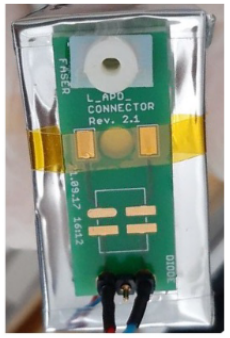
LV cables



SCSI cables

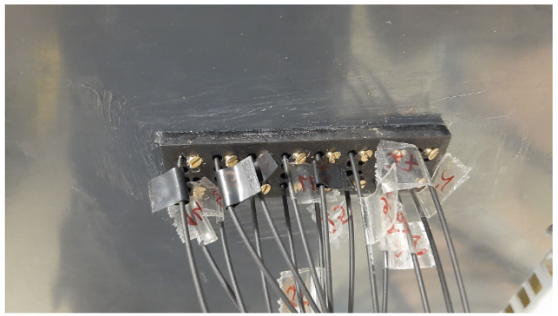
LED Gain Monitoring System

PCB-Boards with a mount for the fibre are installed/available

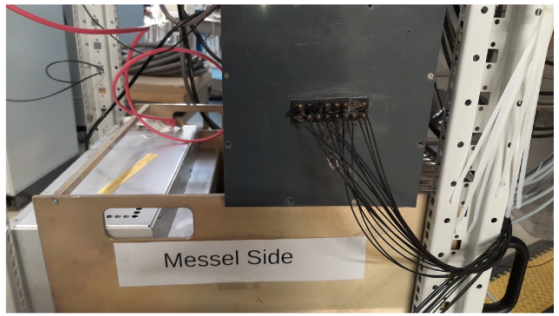


Revisioned
APD-PCB

LED-system is mounted on Messel side,
16 fibres are connected



(a) The fibres connected to the adapter, which was glued to the box



(b) The gain monitoring system connected on the Messel beam-side of CALIFA

Next steps for the implementation in the HEC need to be defined!

Electronics Documentation Status

Google Sheets:

info about FAB,FEBEX,PAs, Exploders

commercial, lifetime, availability

Google Sheets

ELog:

info CALIFA cabling and slow-control

difficult to keep track and search for

R3BWiki:

overview page, more or less well structured

good as overview page, not suitable to store expert-documentation

R³BWiki

Where to store documentation?

Cloud Storage for sharing and synchronising

GSI Seafile

EDMS - CERN's Engineering Data Management Service

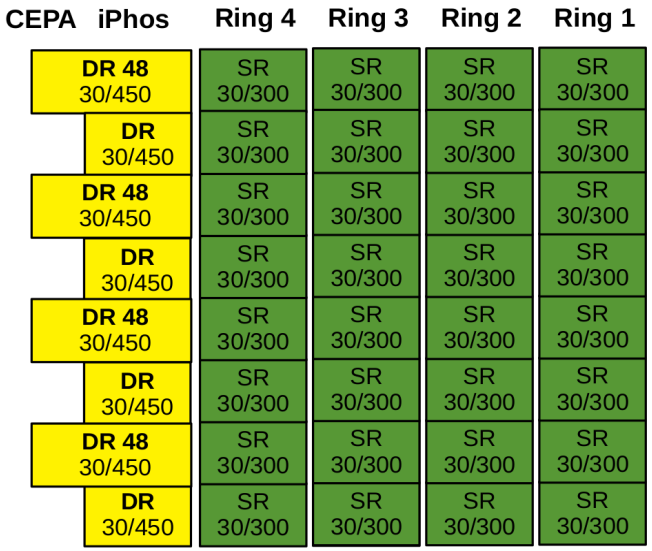
CERN EDMS

How is documentation done by other WGs ? Synergy effects..

Summary & To Dos

Decision has to be taken:

“Default Config.”



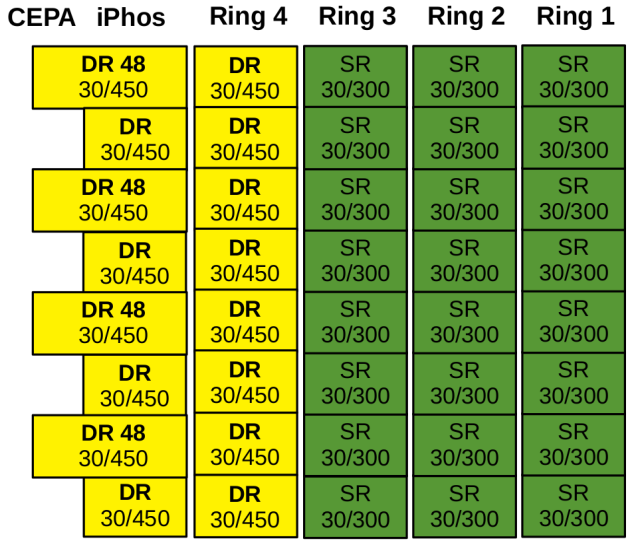
Costs:

260k€

Workload cable production:

2-3 weeks

“4π Config.”



Costs:

323k€

+ 3k€ (SCSI cables)

Workload cable production:

1-2 weeks

- Inner cables (11k€) - production ?
- Outer cabling for Backward Barrel (10k€)
- Provide electronics for extension (30k€)
- Implementation of LED System in HEC
- Documentation

Thank you!

CALIFA @ Technical University of Munich (TUM)

Roman Gernhäuser, Philipp Klenze, Mrunmoy Jena, Tobias Jenegger

ORIGINS Excellence Cluster

GEFÖRDERT VOM Bundesministerium für Bildung und Forschung

GSI

FAIR Phase 0 Research Program

BACKUP

Connectors

Parts needed for one connector:

	Quantity	Number	Supplier	~Price
Sub-D-Connector	1	D-SUB ST 25 IPS	Reichelt	11.8
Buchsenleiste	8	W+P 153PF-008-2	Reichelt	1.56
CALIFA_PIGTAIL2SU	1	AN-1621452	Multi-cb	1.31
T-Sensor(Sensor+Cab	1			
Buchse T-Sensor	1			
				25.59

Necessary connectors:

	R6	R5	R4	R3	R2	R1	
W	4	16	16	16	16	16	
M	4	16	16	16	16	16	spares
	8	32	32	32	32	32	8

Total	176
already in	77
ready to go	12
	87

Parts needed :

	missing	existing pa	order:	costs
Sub-D-Connector	87	53	34	401.2
Buchsenleiste	696	4	692	1079.52
CALIFA_PIGTAIL2SUBD	87	20	67	87.77
T-Sensor(Sensor+Cable)	87	118	-31	0
Buchse T-Sensor	87	0	87	0
				1568.49

Kind contribution by Anna-Lena Hartig

Cable

Cable

Parts needed for one cable pair:

	Quantity	Number	Supplier	~Price
CALIFA_Pigtail	1	AN-1621452	Multi-cb	0.21
Steckerleiste	1	MPE 087-2-008 0.21	Reichelt	0.21
Coax cable 40cm	2	AN-1621452	lemo	2.42
Fiber connector	2	038801580	0880 Mous	0.25
APD_Connector left	1	AN-16148	Multi-cb	0.5
APD_Connector right	1	AN-16148	Multi-cb	0.5
Leiterplattenbuchse	4	8579-0-15-15-11-27-10-0		
				6.76

Necessary cables:

	R6	R5	R4	R3	R2	R1	
W	56	256	256	256	256	208	
M	56	256	256	256	256	208	spares
	112	512	512	512	512	416	48

Total	2624
already in	1104
ready to go in	
	1520
number of	760
	3

Parts needed :

	missing	existing pa	order:	costs
CALIFA_Pigtail	1520	457	1063	223.23
Steckerleiste	1520	81	1439	302.19
Coax cable 40cm	3040	325	2715	6570.3
Fiber connector	3040	400	2640	660
APD_Connector left	760	0	760	380
APD_Connector right	760	0	760	380
Leiterplattenbuchse	6080		6080	730
				9245.72

Kind contribution by Anna-Lena Hartig