Collimator BPMs and their electronics in Run 3

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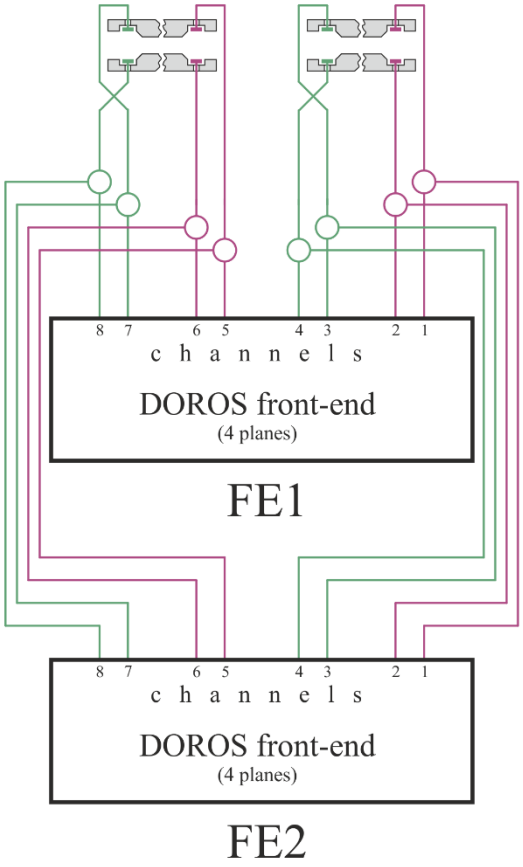
Introduction

- During run 2, some DOROS channels have been equipped with an interlock acting via the SIS:
  - **LSS1:** TCTPH/V.4L1.B1, TCTPH/V.4R1.B2
  - **LSS5:** TCTPH/V.4L5.B1, TCTPH/V.4R5.B2
  - **LSS6:** TCSP.A4L6.B2, TCSP.A4R6.B1
- In order to avoid spurious beam dumps and downtime, the system has been made redundant:
  - BPM signals are split to two DOROS front-ends installed in parallel
  - Interlock logic implemented such that if one front-end fails, the second can provide the interlock functionality alone
  - Avoids blocking operation and allows intervention to repair/replace the front-end to be scheduled at a convenient time
- Note, no failures observed during run 2.



LS2 collimator installations

- New LS2 collimators:
  - 14 in P7 with cables coming to TZ76
  - 2 in P2 with cables coming to UA23 and UA27

- P7 collimators with interlocks
  - all collimation planes with redundant front-ends
  - all orthogonal planes without redundancy

- P2 collimators with or without interlocks ?

Work progress and plans

- All collimators installed, except two in P7
- All cables ready
- All cables in P7 connected to the installed collimators, P2 cables will be connected soon
- About half of the BPM electronics already in TZ76, connections to be finalised
  - The rest is in production, planned to be installed in spring 2021
  - Already available electronics will be used for early system tests by the end of this year
- P2 small installation will be done within next few weeks
- Ongoing work to put all the existing software infrastructure back into operation
- Software polishing and reliability tests from the beginning of 2021

New potential options for LS3 P7 installation

- LS3 plan: ≈ 30 new collimators:
  - ≈ 10 in P1
  - ≈ 10 in P5
  - ≈ 10 in P7

- So far all LS3 P7 electronics have been planned to be installed in TZ76, in addition to the current installation
  - Two DOROS front-ends operating in Run 2 in RR77 and UJ76 moved to TZ76

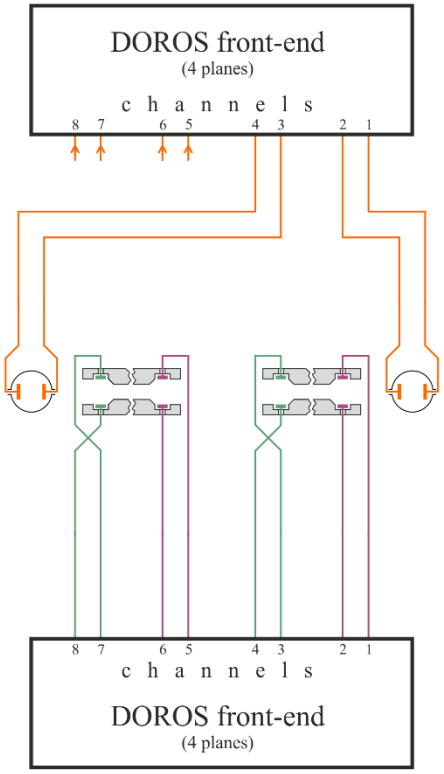
- **NEW:** available radiation estimations for UJ76 for Run 3 (EDMS 2302154)
  - 1 Gy as annual total integrated dose during HL operation
  - When used in redundant configuration DOROS front-ends are expected to work fine in such environment

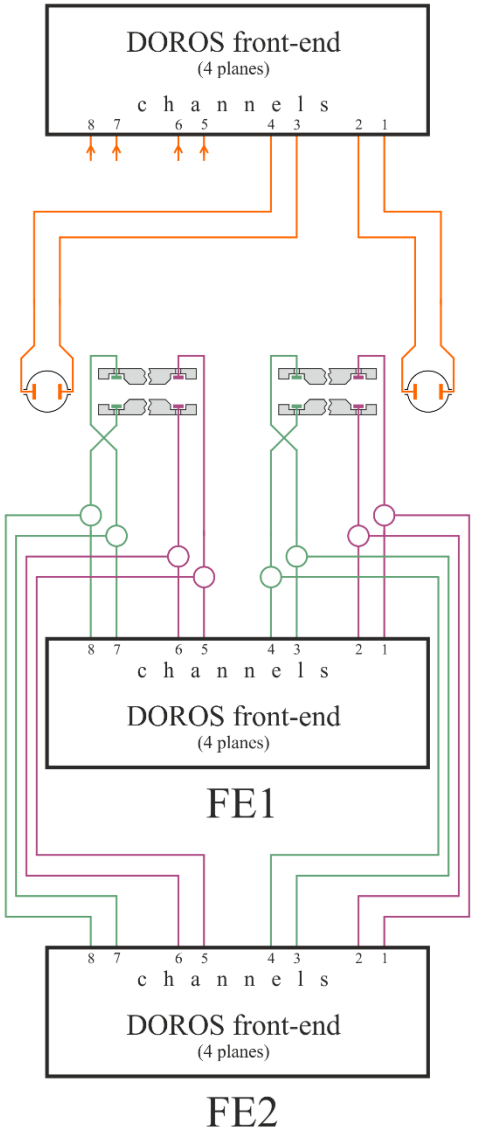
- We should consider the option of putting LS3 P7 electronics to UJ76 instead of TZ76, with the following benefits:
  - shorter cables = less money + more signal
  - A lot of rack space in UJ76 and quite limited in TZ76
  - For the installation of the LS3 collimators with their cables coming to TZ76 the LS2 electronics already installed there would have to be temporarily removed

- Investigations to be done in UJ76 during Run 3 to take the decision at the beginning of LS3:
  - Detailed radiation monitoring
  - Test operation of a couple of extra DOROS front-ends

Spare slides

Run 3: Potential optimisation of the installations

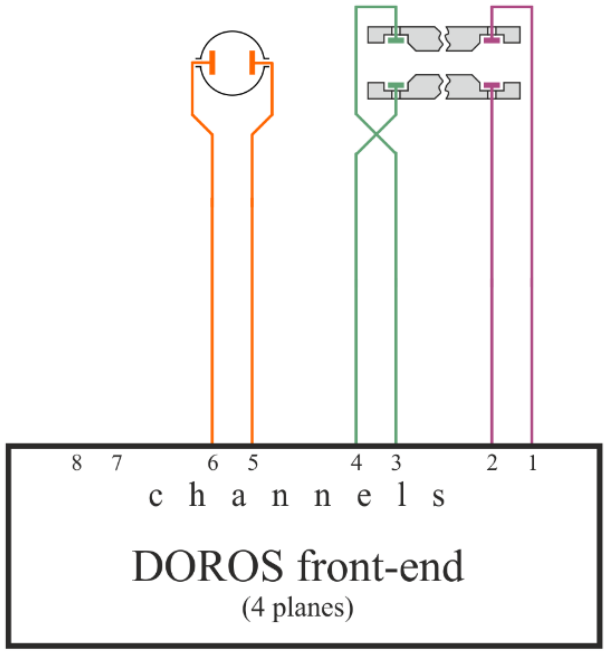




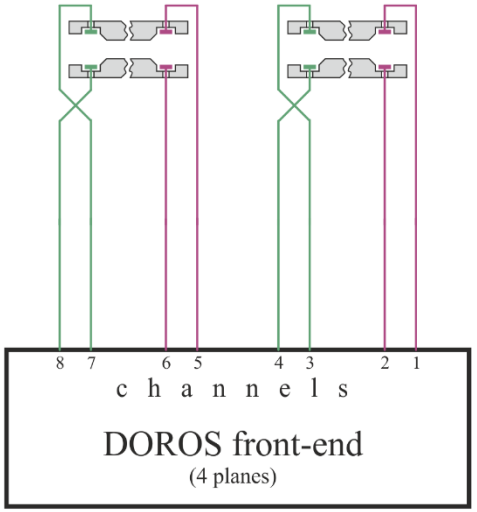
- 2019 assumption: one 3-plane collimator = one front-end
- Optimised installation for 3-plane collimators in dense TZ76:
  - standard: one collimator = 3/4 × front-end
  - redundant: one collimator = 5/4 × front-end

Collimator BPM installations in Run 3

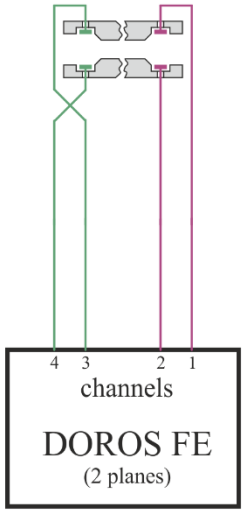
- Most dense and difficult installation is in TZ76, only three rack installed due to very limited space
- In total there are planned 30 collimators with cables going to TZ76:
  - 14 during LS2
  - 16 during LS3
- At the beginning of 2019, when we had to start the production of electronic boards for the DOROS front-ends, we assumed that each collimator will be served by one front-end, so the TZ76 infrastructure has been prepared for 30 front-ends, 10 per rack



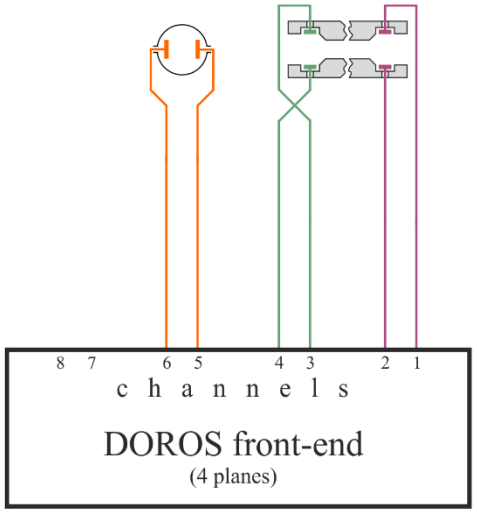
Collimator FEs in Run 2 – standard installations



Majority

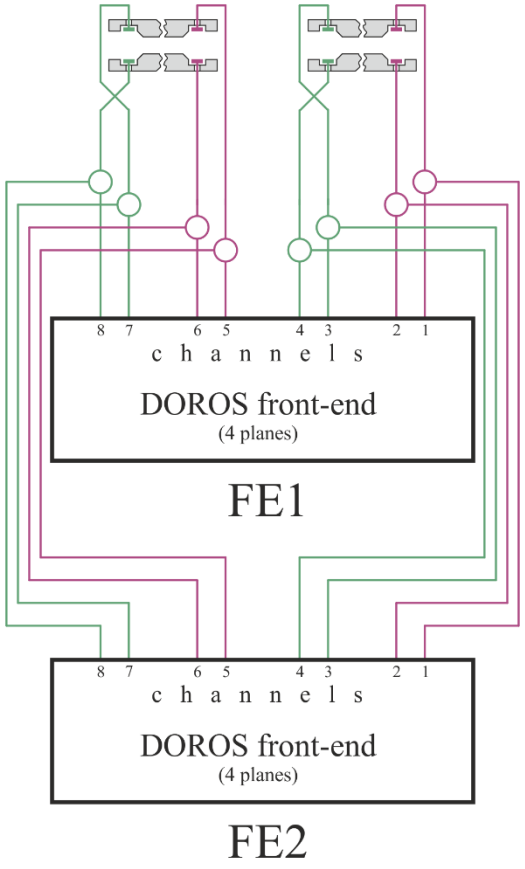


Some cases

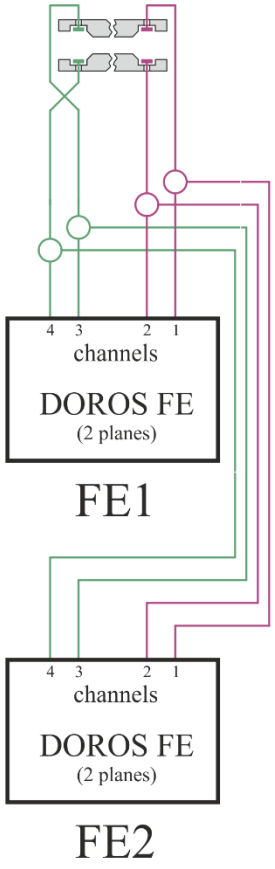


One case
(TCSPM, P7R)

Collimator FEs in Run 2 – SIS redundant installations



P1 + P5



P6 L + R

Collimator DOROS front-ends in Run 2

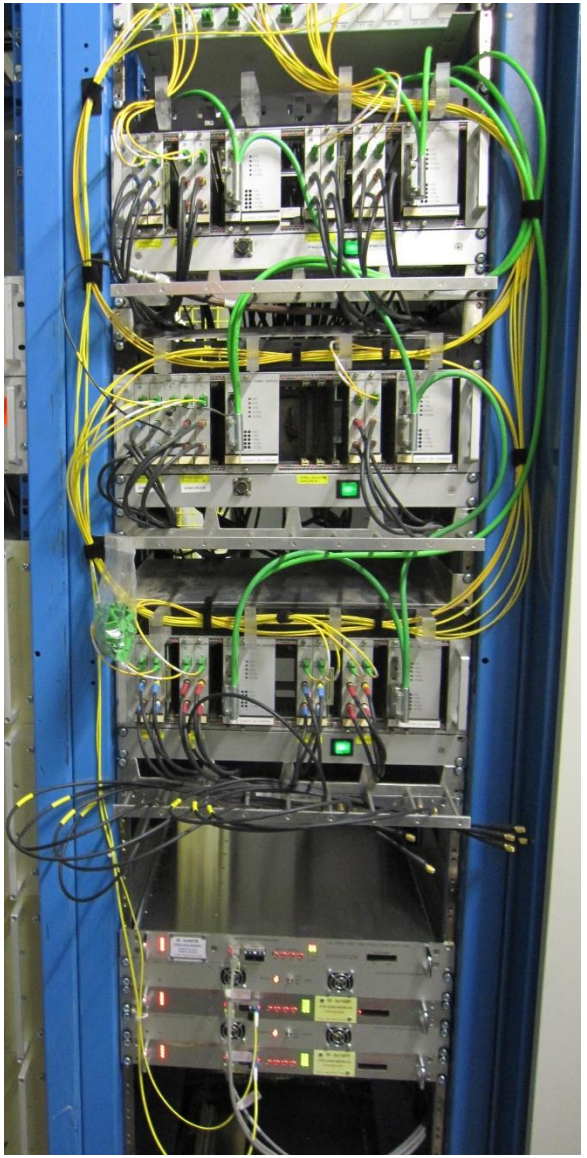
point	collimator	front-end	ID	rack	active ch. CH config	remarks	comments
P1 L	TCTP H + V B1	CFB-US152-BIDRC1A	0x11FF	BY01.US152	8 | 00	SIS A	prime SIS
P1 L	as above, split signals	CFB-US152-BIDRC1B	0x118F	BY01.US152	8 | 00	SIS B	redundant SIS, new 2018
P1 L	TCLVW.5L1.B2	CFB-US152-BIDRC3	0x11FE	BY01.US152	**4 | 10**	4 ch.	new 2018
P1 R	TCTP H + V B2	CFB-US152-BIDRC2A	0x1101	BY01.US152	8 | 00	SIS A	prime SIS
P1 R	as above, split signals	CFB-US152-BIDRC2B	0x1181	BY01.US152	8 | 00	SIS B	redundant SIS, new 2018
P2 L	TCTP H + V B1	CFB-UA23-BIDRC1	0x12FF	BY02.UA23	8 | 00		
P2 R	TCTP H + V B2	CFB-UA27-BIDRC1	0x1201	BY04.UA27	8 | 00		
P5 L	TCTP H + V B1	CFB-USC55-BIDRC1A	0x15FF	BY04.USC55	8 | 00	SIS A	prime SIS
P5 L	as above, split signals	CFB-USC55-BIDRC1B	0x158F	BY04.USC55	8 | 00	SIS B	redundant SIS, new 2018
P5 L	TCL H B2	CFB-USC55-BIDRC3	0x15FE	BY04.USC55	**4 | 10**	4 ch.	
P5 R	TCTP H + V B2 A	CFB-USC55-BIDRC2A	0x1501	BY04.USC55	8 | 00	SIS A	prime SIS
P5 R	TCTP H + V B2 B	CFB-USC55-BIDRC2B	0x1581	BY04.USC55	8 | 00	SIS B	redundant SIS, new 2018
P6 L	TCSP H B2	CFB-UA63-BIDRC1A	0x16FF	BY02.UA63	**4 | 10**	SIS A, 4 ch.	prime SIS
P6 L	as above, split signals	CFB-UA63-BIDRC1B	0x168F	BY02.UA63	**4 | 10**	SIS B, 4 ch.	redundant SIS, new 2018
P6 R	TCSP H B1	CFB-UA67-BIDRC1A	0x1601	BY02.UA67	**4 | 10**	SIS A, 4 ch.	prime SIS
P6 R	as above, split signals	CFB-UA67-BIDRC1B	0x1681	BY02.UA67	**4 | 10**	SIS B 4 ch.	redundant SIS, new 2018
P7 L	TCP H B1	CFB-UJ76-BIDRC1	0x17FF	BY03.UJ76	**4 | 10**	4 ch.	
P7 R	TCSPM V B2	CFB-RR77-BIDRC1	0x1701	BY01.RR77	**6 | 01**	6 ch.	
P8 L	TCTP H + V B1	CFB-UA83-BIDRC1	0x18FF	BY02.UA83	8 | 00		
P8 R	TCTP H + V B2	CFB-UA87-BIDRC1	0x1801	BY03.UA87	8 | 00		

front-ends	20	8-channel FE	12
		other	8

Collimator FEs in Run 2 – SIS redundant installations

BY01.US152

BY04.USC55



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