

II Forum delle Ricerca Sperimentale e Tecnologica

Bringing FORS into the ELT era: control software and electronics



M. Porru, A. Sulich, P. Di Marcantonio, G. Calderone, I. Coretti, V. Baldini, S. Bertocco, R. Cirami, V. Strazzullo

Osservatorio Astronomico di Trieste



FORS-Up

FORS2 (FOcal Reducer/low dispersion Spectrograph) is a multi-mode (imaging, polarimetry, long slit and multi-object spectroscopy) optical instrument mounted on the Cassegrain focus of the UT1 of ESO's Very Large Telescope (VLT) in Chile. Despite its 24 years of operation, it is still one of the most requested VLT instruments. To ensure its long-term operation, an upgrade project was launched: its decommissioned twin FORS1 is now undergoing a complete refurbishment at INAF-OATs. Once the upgrade is finished, FORS1 will replace FORS2 at the VLT.

Graphical User Interfaces

The development of Graphical User Interfaces (GUIs) makes use of the Control User Interface Toolkit (CUT) provided by ESO, to ensure a similar appearance to the GUIs of other instruments. Graphical applications are created using Qt and Python, while data binding between device datapoints and widgets is performed with *Taurus*.

SUP Operational Idle OCM Operational Idle FCS Operational Idle DPM Operational Idle PCS Operational Idle DPM Operational Idle eleescope Object Name: SDSS J145917.72+28174 Target RA: 0.01667 DEC (arcsec): 0 ‡ / Target DEC: -81.98333 ROT Ang. (deg): 0 ‡ / Rotator Angle: 0.00000 ROT Ang. (deg): 0 ‡ SI Instrument Mode IMG Imm mesta HgCd2 Ar2 mos1 0.00 2.00 Imm Ne1 FFBI mos5 0.00 0.00 Imm Ne2 FFRe Warnings 0.00 0.00 Imm Spec. Optics wos1 0.00 0.00 Imm Spec. Optics wos1 0.00 0.00 Imm CCD Temperature wos2 0.00 0.00 Imm Cryogenics mos11 0.00 0.00 Imm Cryogenics	atus											
SUP Operational Idle OCH Operational Idle FCS Operational Idle DPM Operational Idle PCS Operational Idle DPM Operational Idle PCS Operational Idle DPM Operational Idle PCS Operational Ready Object Name: SDSS J145917.72+28174 Target RA: 0.01667 DEC (arcsec): 0 ‡ S Rotator Angle: 0.00000 ROT Ang. (deg): 0 ‡ S Notator Angle: 0.00000 Imm MG MG HgCd2 Ar1 Optics MOS Slits and Masks Imm HgCd2 Ar2 PFBI Mos2 3.00 2.00 Imm Med2 PFBI mos1 0.00 0.00 Imm Med2 PFBI mos1 0.00 0.00 Imm Mos1 Spec. Optics mos13 0.00 0.00 Imm Med2 <td></td> <td>Operatio</td> <td>nal</td> <td>Idle</td> <td></td> <td>OCM</td> <td>Operational</td> <td colspan="5">Idle</td>		Operatio	nal	Idle		OCM	Operational	Idle				
FCS Operational Idle DPM Operational Idle elescope TCS Attached Operational Ready Object Name: SDSS J145917.72+28174 Target RA: 0.01667 DEC (arcsec): 0 # / / Target DEC: -81.98333 DEC (arcsec): 0 # / / Rotator Angle: 0.00000 ROT Ang. (deg): 0 # / / Instruments Imm mos1 10.00 2.00 Imml mos2 3.00 4.00 Imml Ne1 # FFBI mos3 5.00 2.00 Imml Ne2 # FFBI mos4 -8.00 4.00 Imml Ne2 # FFBI mos10 7.00 6.00 Imml Ne2 # FFBI mos11 0.00 0.00 Imml Ne2 # FFBI mos12 0.00 0.00 Imml Ne2 # FFBI mos13 0.00 0.00 Imml Ne2 # FFBI mos13 0.00		operació										
alescope TCS Attached Operational Ready Object Name: SDSS J145917.72+28174 Target RA: 0.01667 Target DEC: -81.98333 Rotator Angle: 0.00000 Instruments Offset RA (arcsec): Instrument Mode IMG Optics MOS Silts and Masks device center mos1 10.00 2.00 Imml mos5 5.00 3.00 4.00 mos3 5.00 10.00 2.00 mml mos4 8.00 6.00 mos1 0.00 0.00 0.00 mos1 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mml mos6 10.00 0.00 mos6 1.00 0.00 0.00 mos10	FCS C	Operatio	nal	Idle		DPM	Operational	Idle				
TCS Attached Operational Ready Object Name: SDS5 J145917.72+28174 Target RA: 0.01667 DEC (arcsec): 0 # A Target DEC: -81.98333 ROT Angle: 0.00000 FROT Angle: 0 # Instruments Instrument Mode IMG IMG BC (arcsec): 0 # SI Instrument Mode IMG IMG Image: 0.00000 Image: 0 Image: SI Optics MOS Slits and Masks Image: Calibration Unit Image: Ima	lescope											
Target RA: 0.01667 Target DEC: -81.98333 Rotator Angle: 0.00000 Instruments ROT Ang. (deg): Instrument Mode IMG Optics MOS Slits and Masks HgCd2 Arz Optics MOS Slits and Masks HgCd2 Optics MOS Slits and Masks HgCd2 Mos Slits and Masks Optics MOS Slits and Masks HgCd2 Mos Slits and Masks Mosi 10.00 2.00 Imml mos1 0.00 3.00 Imml mos5 0.00 0.00 0.00 mos1 0.00 0.00 0.00 mos11 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos16 <td>TCS Atta</td> <td>ched</td> <td>Operat</td> <td>ional</td> <td>Ready</td> <td>Objec</td> <td>t Name: SDSS J1</td> <td>45917.72+281749.2</td>	TCS Atta	ched	Operat	ional	Ready	Objec	t Name: SDSS J1	45917.72+281749.2				
Target DEC: -81.98333 Rotator Angle: 0.00000 Instruments ROT Ang. (deg): Instrument Mode IMG Optics MOS Slits and Masks HgCd2 device center mos1 0.00 mos1 0.00 0.00 0.00 mos11 0.00 0.00 0.00 mos12 0.00 0.00 0.00 mos11 0.00 0.00 0.00 mos12 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos14 0.00 0.00 0.00 mos13 0.00 0.00 0.00 mos14 0.00	Target I	RA:		0.01667	7		DEC (arcsec): 0 🗘 🗛				
Rotator Angle: 0.00000 ROT Ang. (deg): is Si Rotator Angle: 0.00000 ROT Ang. (deg): is Si Instruments Instrument Mode IMG image: single sis single si <	Target D	DEC:		-81.9833	3	v off	fset RA (arcsec):					
Rotator Angle: 0.00000 Iter Angl. (deg); 0 Instruments Instrument Mode IMG Optics MOS Slits and Masks device center width units mos1 10.00 2.00 [mm] mos2 3.00 4.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos10 7.00 3.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] Det	Dototor A			0.00000			BOT Ang. (de	a): 0 ≜ SET				
Instruments Calibration Unit Instrument Mode IMG Optics MOS Slits and Masks hel1 Ar1 HgCd2 Ar2 Ne1 HgCd2 Ar2 Ne1 FFBI Ne3 5.00 2.00 (mm) mos3 5.00 2.00 (mm) mos3 0.00 0.00 (mm) mos6 18.00 6.00 (mm) mos6 18.00 (mm) mos7 5.00 3.00 (mm) mos6 18.00 (mm) mos1 0.00 (mm) mos11 0.00 (mm) mos12 0.00 0.00 (mm) mos13 0.00 (mm) (mos13 0.00 (mm) (mos14	ROLALOF A	ingle:		0.00000	,		NOT Ang. (de	g/. 0 ¥				
Instrument Mode IMG Optics MOS Slits and Masks device center width units mos1 10.00 2.00 [mm] mos2 3.00 4.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos5 0.00 0.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos10 7.00 6.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] Exposure Status: UNKNOWN <td< td=""><td>strument</td><td>s</td><td></td><td></td><td></td><td></td><td>Calibrati</td><td>on Unit</td></td<>	strument	s					Calibrati	on Unit				
Optics MOS Slits and Masks device center width units mos1 10.00 2.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm]	Instrume	nt Mode		IMG]		🚔 hal	1 🚔 Ar1				
device center width units mos1 10.00 2.00 [mm] mos2 3.00 4.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos1 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] Exposure Status: UNKNOWN Remaining Exp. Time: 100 kHz <td< td=""><td>Optics</td><td>MOS</td><td>Slits a</td><td>nd Masks</td><td></td><td></td><td>Tier</td><td></td></td<>	Optics	MOS	Slits a	nd Masks			Tier					
mos1 10.00 2.00 [mm] mos2 3.00 4.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector 200 3600 50 Exposure Status: </td <td>dev</td> <td>ice</td> <td>center</td> <td>width</td> <td>units</td> <td></td> <td>🔴 Hg</td> <td>Cd2</td>	dev	ice	center	width	units		🔴 Hg	Cd2				
mos2 3.00 4.00 [mm] mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] Detector DCS Operational Idle Current Exp. Time: 3600 3600 ‡ Si Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END Age Exposure Type: SKY FLAT Binning: 1 x 10 <td>mo</td> <td>sl</td> <td>10.00</td> <td>2.00</td> <td>[mm]</td> <td></td> <td></td> <td></td>	mo	sl	10.00	2.00	[mm]							
mos3 5.00 2.00 [mm] mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19	mo	s2	3.00	4.00	[mm]		🛑 Ne	1 🔴 FFBlue1				
mos4 -8.00 4.00 [mm] mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END AB0 Exiposure Type: SKY FLAT	mo	s3	5.00	2.00	[mm]			-				
mos5 0.00 0.00 [mm] mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] DCS S Operational Idle Current Exp. Time: 3600 3600 ‡ Si Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 100 Fi	mo	s4	-8.00	4.00	[mm]		🛑 Ne	2 🛑 FFRed1				
mos6 -18.00 6.00 [mm] mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector 200 200 [mm] Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1	mo	s5	0.00	0.00	[mm]							
mos7 5.00 3.00 [mm] mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos14 Idle Current Exp. Time: 3600 3600 ‡ Si Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Beadout Mode: 100 kHz 1x1 High	mo	s6	-18.00	6.00	[mm]			-				
mos8 -11.00 2.00 [mm] mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] metector DCS S Operational Idle Current Exp. Time: 3600 3600 ‡ SI Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Pacdout Mode: 100 kHz 1x1 High	mo	s7	5.00	3.00	[mm]		warning	5				
mos9 0.00 0.00 [mm] mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] metector DCS S Operational Idle Current Exp. Time: 3600 \$60 Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mo	s8	-11.00	2.00	[mm]		0	D Tomporaturo				
mos10 7.00 6.00 [mm] mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 [mm] [mm] etector DCS Operational Idle Current Exp. Time: 3600 \$600 \$\$ \$60 Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABO Exposure Type: SKY FLAT Binning: 1 x 100 kHz 1 x1 High	mo	s9	0.00	0.00	[mm]			Diemperature				
mos11 0.00 0.00 [mm] mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ Sector Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	510	7.00	6.00	[mm]		Spe	ec. Optics				
mos12 0.00 0.00 [mm] mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ St Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABO Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	511	0.00	0.00	[mm]							
mos13 0.00 0.00 [mm] mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ Si Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABO Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	512	0.00	0.00	[mm]		🔘 Ves	ssel				
mos14 0.00 0.00 [mm] mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ SI Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABG Exposure Type: SKY FLAT Binning: 1 x 3 File Transfer: 22% Beadout Mode: 100 kHz 1x1 High	mos	513	0.00	0.00	[mm]							
mos15 0.00 0.00 [mm] mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ St Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Beadout Mode: 100 kHz 1x1 High	mos	514	0.00	0.00	[mm]		Cry	ogenics				
mos16 0.00 0.00 [mm] mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ St Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	s15	0.00	0.00	[mm]							
mos17 0.00 0.00 [mm] mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 \$600 \$600 Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END AB0 Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	s16	0.00	0.00	[mm]							
mos18 0.00 0.00 [mm] mos19 0.00 0.00 [mm] etector DCS S Operational Idle Current Exp. Time: 3600 3600 \$ Si Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	517	0.00	0.00	[mm]							
mos19 0.00 [mm] etector DCS Operational Idle Current Exp. Time: 3600 3600 \$ SE Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	mos	518	0.00	0.00								
etector DCS S Operational Idle Current Exp. Time: 3600 3600 SE Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Beadout Mode: 100 kHz 1x1 High	mos	519	0.00	0.00	[mm]							
DCS S Operational Idle Current Exp. Time: 3600 3600 St Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	etector											
DCS S Operational Idle Current Exp. Time: 3600 3600 + SE Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 100 kHz 1x1 High						_						
Exposure Status: UNKNOWN Remaining Exp. Time: 1080 END ABC Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Beadout Mode: 100 kHz 1x1 High	DCS S Operational Idle				dle	Current Exp	. Time: 3600	3600 \$ SET				
Exposure Type: SKY FLAT Binning: 1 x 1 File Transfer: 22% Readout Mode: 100 kHz 1x1 High	Exposure	e Status	:	UNKNOW	N	Remaining Ex	(p. Time: 1080	END ABORT				
File Transfer: 22% Readout Mode: 100 kHz 1x1 High	Exposure Type: SKY FLAT				Г	Binning	g: 1	1 x 1				
	File Transfer: 22%			22%		Readout M	100 lode:	kHz, 1x1, High				
Filename: skyflat_1234.fits Readout: 22%	Filename: skyf			skyflat_1234	l.fits	Readou	ut:	22%				

Templates

The execution of instrument procedures is organized into templates, namely *Python* scripts that operate individual instrument devices in the proper order, control detectors to gather scientific data and save them as FITS files on the IWS. Templates are the building units of the *Observation Blocks* (**OB**s), that are executed by the *Sequencer*.

Application	OB Otto Append He	n								
		Logs Filter: Seque	nce 🔻 wfors	1.oats.inaf.it:8	001					
Current Seq	Jence State									
Name			Description	1						
-	FORS1_img_cal_skyfl	at(0)								
-	FORS1_img_cal_s	kyflat template	FORS1 Cali	bration Sky Fla	at template					
-	FORS1 Skyflat									
	𝚫 F1_Templat	e.init	Initializes t	emplate						
	✓ F1_Templat	e.check_operational	Check that	SUP, FCS and	CCF are operational					
	ళ F1_Templat	e.load_olas	Load OLAS	receiver confi	guration from project con	figuration				
	🐼 F1_Templat	e.read_params	Reads tem	plate paramet	ers from json file					
	🟹 Tpl.read_ex	tra_params	Reads extra	a template par	rameters from json file					
	Tpl.setup_te	cs	Send comm	nand to TCS to	setup the telescope to A	LT/AZ coordinates				
	🗧 📣 first exposu	re								
	F1_Temp	late.monitor	Monitor ac	quisition statu	5					
	- Sequenc	e								
	Tpl.fi	rst_exptime	Set the exposure time for the first exposure							
	F1_Te	mplate.setup_dcs	e.setup dcs Setup the DCS							
	F1_Te	mplate.start_exposure	te.start exposure Start acquiring data							
	F1_Te	mplate.stop_exposure	Await end	Await end of exposure or abort after timeout						
	- D multiple ex	posure loop								
	V F1_Temp	late.check_expnum	Check how	Check how many exposures are left						
	- i 🗹 block									
	👻 💑 single	e skyflat exposure								
OB Variabl	es Logs									
FORS1_im	g_cal_skyflat(0)	Step/Variable		Data Type	Value	Unit				
		FORS1_img_cal_sky	/flat template	hoolean	false					
		DET.WIN1.STRX		integer	1					
		DET.WIN1.STRY		integer 1						
		DET.WIN1.NX		integer	100					
		DET.WIN1.NY		integer 100 konwerd 200kUz 202 kow						
		DET.READ.CLKIN	ID	D keyword 200kHz,2x2,low integer 30000 integer 3						
		SEQ.EXPLEVEL								
		SEQ.NEXPO								
				ALPHA numlist [10.0, 20.0, 30.0]						
		TEL ADC TYPE		keyword	d COORD					
		INS.FILT1.NAME		keyword OIII+50						
					· · · · · ·					





The first version of the FORS1 OCS Control GUI, designed to monitor the status of the instrument during regular science operations.

The Sequencer GUI, designed by ESO, dispatching commands to the subsystems during the execution of a calibration OB.

;1																	- 0	×
s Tools	View Themes He	elp																
onal lo	dle															STO	2 S	ETUP
						6	0 ×	Lamps										ð×
LE	Operational	Standstill	IN	280.02 [Degree] 0.000 ‡ uu	• <u>+</u>		✓ hel1	S E L	Operational	On	100.00	3.00	100 🌲	15	‡ ON ▼	¥	
LE	Operational	Standstill	lSlit1_0arcsec	-12.00 [Degree] 0.000 🗘 uu	• T		hgcdl2	S E L	Operational	Off	0.00	0.00	0	0	ON *	<u>↓</u>	
LE	Operational	Standstill		0.00 [Degree] 0.000 🗘 uu	 ▲ ▲		arl1	S E L	Operational	Off	0.00	0.00	0 \$	0	ON *	L D	
LE	Operational	Standstill		0.00 [Degree] 0.000 🗘 uu	 ▲ ▲ ■ 		arl2	S E L	Operational	Off	0.00	0.00	0 🌲	0	ON *	L D	
LE	Operational	Standstill	COLL_HR+7	100.00 [Degree] 0.000 COLL_HR+	7 🔹 🛓 🛄		nell	S F I F	Operational	Off	0.00	0.00	0	0	≜ ON ▼	J T	1

FORS1 Top Section, Collimator Unit and Filter/Camera Section in the integration hall of INAF-OATs.

Control Software

Despite being a VLT instrument, FORS1 will transition from the VLT software to the new ELT Instrument Control Software Framework (ELT-IFW), the standard foundation for implementing the control software system for all future instruments that is currently under development at ESO.

The Instrument Workstation (IWS) runs the main high-level processes, with several subsystems to manage and monitor the instrument and the data acquisition.

A Beckhoff **PLC** runs the low-level software to control the hardware devices; communication between the IWS and the PLC exploits the OPC UA Protocol.

A dedicated *Detector Workstation* (**DWS**) running the *New General* Controller 2 (NGC2) software (provided by ESO) will control the scientific detector.

FORS1 will communicate with the VLT via the **ELT-VLT Gateway**, that forwards telescope commands from the IWS to the VLT Telescope *Control System* (**TCS**) and returns telescope status and data products from the TCS to the IWS.



The first version of the FORS1 ICS GUI, designed to allow in-depth control of all devices for engineering operations.

Control Electronics

The upgrade of the control electronic for FORS involves the replacement of all motors, sensors and cabling, as well as a redesign of the calibration unit. The new electronics architecture, based on the Beckhoff PLC platform, is composed of an embedded CX2030 CPU with dedicated Beckhoff modules able to control all FORS functions, sensors and digital I/O. The embedded computer comes with the software TwinCAT and hosts the OPC UA server, enabling communication with the high-level software. Modules in the cabinets without a CPU are controlled via an EtherCAT connection and bus couplers. A custom low-level software library was developed to control the MOS unit and the exposure shutter.





The control software architecture of the upgraded FORS1.