ESO Science Archive Facility - Phase 3 Data Release Description
ESO programme MUSE Deep mosaic observations of the dwarf galaxy NGC1427A in the Fornax Cluster, Data Release IN PROGRESS
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Deep MUSE Mosaic of NGC 1427A in the Fornax Cluster

Abstract

This release provides a reduced VLT/MUSE integral-field spectroscopic mosaic of the dwarf galaxy NGC 1427A in the Fornax Cluster, together with its associated white-light image. The data are based on ESO programmes 094.B-0612(A), 110.23VM.001, and 111.24R5.001. The released science product is a deep MUSE cube covering the wavelength range 470–935 nm, with a barycentric spectral reference frame. The input exposures include both WFM-AO and WFM-noAO observations. The total exposure time included in the combined cube is 44,681 s from 67 science exposures.

The data support the analysis of the stellar populations, ionised gas, and environmental transformation of NGC 1427A, a gas-rich dwarf galaxy likely undergoing infall into the Fornax Cluster. The release accompanies the article Carvajal et al. (2026) available at arXiv:2605.00988.

Overview of Observations

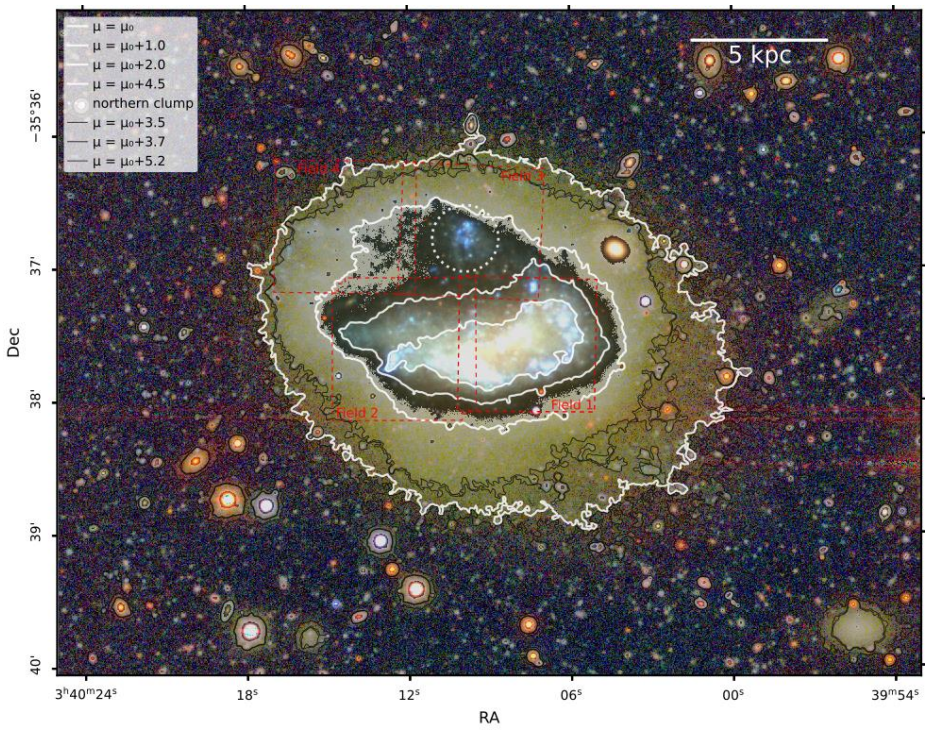


Figure 1. Next Generation Fornax Survey i'-g'-u' view of NGC 1427A showing the footprint of the released MUSE mosaic.

The released data are based on VLT/MUSE observations of NGC 1427A obtained under ESO programmes 094.B-0612(A), 110.23VM.001, and 111.24R5.001. The data set combines observations taken over multiple observing runs and instrumental configurations. It includes both MUSE wide-field observations obtained without adaptive optics and observations obtained in AO mode. The sky-subtraction strategy is also not uniform across the full data set: different pointings and programmes required different treatments, including the use of dedicated sky exposures where available and model-based sky correction for other parts of the mosaic.

The final product is therefore a homogenized deep MUSE mosaic assembled from a heterogeneous set of input exposures. The mosaic covers the main stellar body of NGC 1427A, its ionised-gas emission, and surrounding low-surface-brightness structures. A full description of the observing strategy and reduction choices is given in Carvajal et al. (2026).

The released cube has a spatial sampling of 0.2 arcsec per pixel and covers the wavelength range 470–935 nm. The spectral coordinate system is barycentric.

Release Content

This release contains two FITS files: one science cube and one associated white-light image. No additional cubes, catalogues, or ancillary products are included.

File name	Product category	Description
NGC1427A_MUSE-DEEP_CUBE_IFS.fits	SCIENCE.CUBE.IFS	Reduced MUSE integral-field spectroscopic mosaic of NGC 1427A
NGC1427A_MUSE-DEEP_WHITELIGHT.fits	ANCILLARY.IMAGE.WHITELIGHT	White-light image generated by averaging the science cube along the wavelength axis

The main properties of the released science cube are:

Quantity	Value
Target	NGC 1427A
J2000 right ascension	55.031417 deg
J2000 declination	-35.626140 deg
Instrument	VLT/MUSE
Product type	Integral-field spectroscopic cube
Wavelength range	470-935 nm
Spectral reference system	Barycentric
Representative spectral resolving power	R = 3000
Spatial sampling	0.2 arcsec pixel-1
Total exposure time	44,681 s
Number of combined science exposures	67
Observing date range	2015-01-10 to 2023-09-02
Spatial resolution (average)	0.797 arcsec FWHM
Uncertainty on spatial resolution	0.128 arcsec
White-light 5-sigma limiting magnitude	ABMAGLIM = 26.015
Median cube background pixel noise	1.867063 x 10^-20 erg s^-1 cm^-2 Angstrom^-1

The white-light image has the same spatial footprint and astrometric solution as the science cube. It is provided to support quick inspection of the mosaic.

Release Notes

The release is based on a heterogeneous set of MUSE exposures, including both AO and non-AO wide-field observations. Different sky-subtraction strategies were required for different parts of the data set, including the use of dedicated sky exposures where available and model-based sky correction for other exposures. Fields 2 and 3 had dedicated offset sky exposures, Field 4 had sufficiently large sky region within the FoV, and the sky of Field 1 was modeled using the overlapping

region with Fields 2 and 3, due to the galaxy filling the entire cube. The final release therefore represents a combined science product built from a heterogeneous set of input exposures.

The cube was reduced using ESO/MUSE pipeline recipes (Weilbacher et al. 2020) in a custom Python workflow that aligned the exposure-level cubes, applied the field-dependent sky treatment, cleaned residual sky features with ZAP (Soto et al. 2016), and combined the final mosaic using MPDAF (Bacon et al. 2016).

The released cube uses a barycentric spectral reference system (SPECSYS = BARYCENT). The wavelength axis follows the MUSE air-wavelength convention (CTYPE3 = AWAV) and is given in Angstrom in the FITS header. Fluxes are provided in units of 10^-20 erg s^-1 cm^-2 Angstrom^-1.

This is the first Phase 3 release for this NGC1427A_MUSE-Deep data collection. For a more detailed description of the observations, reduction, and scientific analysis, see Carvajal et al. (2026).

Data Reduction and Calibration

The reduction started from the standard ESO/MUSE pipeline products for the individual exposures. These products include the usual instrumental calibrations: bias correction, flat-fielding, illumination correction, wavelength calibration, geometric calibration, flux calibration, and telluric correction.

The exposure-level cubes were then processed with a custom Python workflow. The main additional steps were astrometric registration onto a common reference frame, field-dependent sky-background treatment, residual sky-line suppression with ZAP, and final cube combination with MPDAF.

The final product stores the science data in the DATA extension and the associated variance information in the STAT extension. The wavelength solution is given in air wavelengths and the flux calibration is stored in physical flux-density units as specified in the FITS headers.

Data Quality

The quality of the mosaic was checked at the level of the individual exposure products and the final combined cube. The astrometric registration was inspected using exposure-level alignment previews against the reference imaging, and exposures with problematic alignment or data quality were excluded before the final combination.

The sky subtraction was checked through inspection of the sky models, residual sky features, and reconstructed white-light images of the individual exposure-level cubes. Residuals from bright sky features were mitigated with ZAP before the final coaddition. The final cube was also inspected for large-scale background artifacts and discontinuities between fields.

The relative flux calibration between the main overlapping fields was checked by comparing the flux levels in common regions across wavelength. Fields 1, 2, and 3 agree to within approximately 8% over the entire wavelength range. This level is taken as a practical estimate of the residual field-to-field flux-calibration uncertainty.

The spatial resolution was estimated from point sources in the white-light image. The average measured FWHM is 0.797 arcsec, with an estimated uncertainty of 0.128 arcsec across the main fields. The 5-sigma limiting magnitude for unresolved sources in the white-light image is ABMAGLIM = 26.015. The median background pixel-to-pixel noise of the cube is PIXNOISE = 1.867063 x 10^-20 erg s^-1 cm^-2 Angstrom^-1.

Known issues

Field 4 is significantly shallower than the rest of the mosaic. It is based on only two science exposures obtained under poorer image quality than the other fields. This lower depth and image quality are reflected in the STAT extension of the released cube. Users should treat measurements in Field 4 with additional caution, especially for low-surface-brightness features.

Previous Releases
This is the first Phase 3 release of the NGC1427A_MUSE-Deep data collection. There are no previous releases.

Data Format

File Types
This release contains two FITS files.

The science cube, NGC1427A_MUSE-DEEP_CUBE_IFS.fits, is a three-dimensional MUSE integral-field spectroscopic data cube. The primary HDU contains the Phase 3 metadata. The science data are stored in the DATA extension, and the associated variance information is stored in the STAT extension. The science data are provided in units of 10^-20 erg s^-1 cm^-2 Angstrom^-1.

The associated white-light image, NGC1427A_MUSE-DEEP_WHITELIGHT.fits, is a two-dimensional FITS image generated from the science cube. It has the same spatial footprint and astrometric solution as the cube. Both files are provided in standard ESO Phase 3 FITS format.

Catalogue Columns
No catalogue is included in this release.

Acknowledgements
According to the Data Access Policy for ESO data held in the ESO Science Archive Facility, all users are required to acknowledge the source of the data with an appropriate citation in their publications.

Based on observations collected at the European Southern Observatory under ESO programmes 094.B-0612(A), 110.23VM.001, and 111.24R5.001.

The dataset and data reduction associated with this data release are described in detail in Carvajal et al. (2026), accepted for publication in Astronomy & Astrophysics and associated with arXiv:2605.00988. Please cite this paper when making use of this dataset.

Based on data obtained from the ESO Science Archive Facility with DOI: https://doi.org/10.18727/archive/109

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