



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 22, 2026 – 07:10 pm BST

PDB ID : 9SIS / pdb_00009sis
Title : THE CRYSTAL STRUCTURE OF HUMAN MUSCLE ALPHA-ACTININ-2
R457C mutant
Authors : Nouredine, M.; Pinotsis, N.; Mikolajek, H.; Gehmlich, K.; Mohammed, F.
Deposited on : 2025-08-29
Resolution : 3.70 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.015 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.50

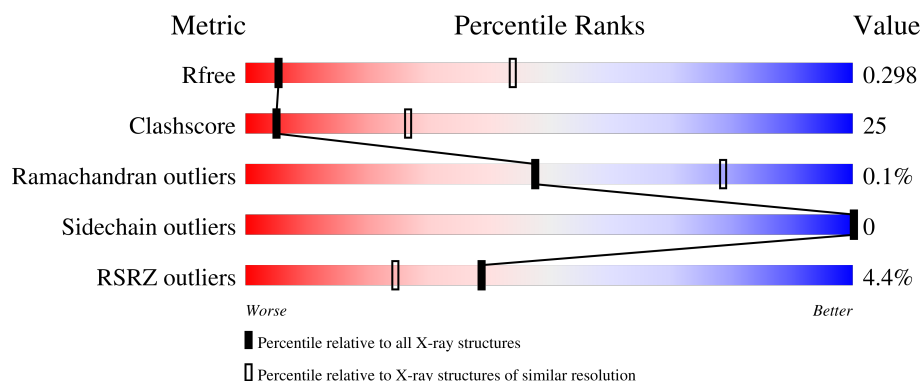
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.70 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1131 (3.80-3.60)
Clashscore	190562	1171 (3.80-3.60)
Ramachandran outliers	187476	1129 (3.80-3.60)
Sidechain outliers	187428	1126 (3.80-3.60)
RSRZ outliers	180081	1130 (3.80-3.60)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	861	4% 56% 44%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 6844 atoms, of which 0 are hydrogens and 0 are deuteriums.

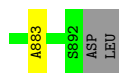
In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Alpha-actinin-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	859	Total	C	N	O	S	0	0	0
			6844	4290	1220	1300	34			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	457	CYS	ARG	engineered mutation	UNP P35609



4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α , β , γ	73.33Å 102.70Å 181.83Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	73.33 – 3.70 73.33 – 3.70	Depositor EDS
% Data completeness (in resolution range)	99.3 (73.33-3.70) 99.9 (73.33-3.70)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.36 (at 3.67Å)	Xtriage
Refinement program	PHENIX 1.21.1_5286	Depositor
R, R_{free}	0.243 , 0.291 0.250 , 0.298	Depositor DCC
R_{free} test set	780 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å ²)	145.9	Xtriage
Anisotropy	0.489	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 198.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.35$, $\langle L^2 \rangle = 0.19$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	6844	wwPDB-VP
Average B, all atoms (Å ²)	189.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.90% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MLZ

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.24	0/6858	0.56	0/9265

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	6844	0	6661	335	0
All	All	6844	0	6661	335	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 25.

All (335) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:688:TYR:HD2	1:A:724:TRP:CZ3	1.80	1.00
1:A:688:TYR:HD2	1:A:724:TRP:HZ3	1.10	0.95
1:A:177:HIS:CD2	1:A:178:THR:HG23	2.07	0.89

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:553:SER:HA	1:A:556:THR:HG22	1.55	0.88
1:A:495:THR:HA	1:A:498:GLN:HE22	1.39	0.86
1:A:216:MET:HE3	1:A:227:LYS:HB2	1.58	0.86
1:A:219:ALA:HA	1:A:223:LEU:CD2	2.06	0.85
1:A:114:LEU:HD21	1:A:117:ILE:HG13	1.61	0.83
1:A:833:ALA:HA	1:A:836:ARG:HD2	1.60	0.83
1:A:189:LEU:HD11	1:A:252:PHE:HD2	1.44	0.82
1:A:688:TYR:CD2	1:A:724:TRP:HZ3	1.98	0.80
1:A:59:ILE:HG22	1:A:71:MLZ:HD2	1.65	0.78
1:A:219:ALA:HA	1:A:223:LEU:HD21	1.66	0.77
1:A:111:GLY:HA3	1:A:140:ARG:HE	1.53	0.74
1:A:867:PRO:HG2	1:A:880:ASP:HB3	1.70	0.74
1:A:591:ILE:HG22	1:A:593:ILE:H	1.52	0.73
1:A:295:GLU:HG3	1:A:299:ARG:HH11	1.54	0.71
1:A:320:LEU:HD22	1:A:389:LEU:HD12	1.73	0.71
1:A:618:VAL:HG22	1:A:619:PRO:HD3	1.71	0.71
1:A:690:ASN:OD1	1:A:691:ASN:N	2.24	0.71
1:A:468:LEU:HG	1:A:473:TYR:CE1	2.26	0.70
1:A:151:THR:HG23	1:A:156:GLY:HA2	1.74	0.69
1:A:539:LEU:HD21	1:A:618:VAL:HG12	1.75	0.69
1:A:741:GLN:HE21	1:A:812:GLN:HE21	1.41	0.69
1:A:688:TYR:CD2	1:A:724:TRP:CZ3	2.73	0.68
1:A:495:THR:O	1:A:499:LYS:NZ	2.27	0.68
1:A:736:ASN:O	1:A:740:THR:HG23	1.94	0.68
1:A:622:ASP:OD1	1:A:623:GLN:N	2.27	0.67
1:A:276:ASN:HB2	1:A:357:ARG:HH12	1.59	0.67
1:A:86:LYS:H	1:A:86:LYS:HD2	1.59	0.67
1:A:352:LEU:HD22	1:A:360:PHE:HD1	1.58	0.67
1:A:293:LEU:HD21	1:A:371:ILE:HD11	1.77	0.67
1:A:189:LEU:HA	1:A:192:ARG:HB3	1.75	0.67
1:A:45:THR:O	1:A:49:ASN:ND2	2.22	0.67
1:A:673:ASP:OD1	1:A:674:GLN:N	2.28	0.66
1:A:649:ILE:HG13	1:A:688:TYR:OH	1.96	0.66
1:A:528:PHE:CE2	1:A:532:MET:HE3	2.31	0.66
1:A:175:ASN:OD1	1:A:177:HIS:NE2	2.29	0.66
1:A:652:TRP:HE3	1:A:653:ILE:HD12	1.61	0.66
1:A:467:GLU:HA	1:A:470:GLU:HB3	1.77	0.66
1:A:197:LEU:HD23	1:A:222:HIS:CD2	2.30	0.65
1:A:518:HIS:NE2	1:A:597:ASN:HA	2.12	0.65
1:A:741:GLN:HA	1:A:744:THR:HG22	1.78	0.65
1:A:120:GLU:OE1	1:A:120:GLU:N	2.27	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:219:ALA:HA	1:A:223:LEU:HD23	1.79	0.65
1:A:758:PHE:O	1:A:762:PHE:N	2.28	0.64
1:A:466:GLN:HG3	1:A:467:GLU:N	2.12	0.64
1:A:73:MET:HG2	1:A:103:ALA:HB2	1.80	0.64
1:A:827:THR:HG22	1:A:828:ALA:H	1.62	0.64
1:A:498:GLN:OE1	1:A:498:GLN:N	2.29	0.64
1:A:844:TYR:CZ	1:A:874:SER:HA	2.33	0.63
1:A:278:GLU:O	1:A:282:LEU:N	2.31	0.63
1:A:845:ILE:HG12	1:A:849:GLU:OE2	1.98	0.62
1:A:173:ILE:HA	1:A:179:SER:HB3	1.81	0.62
1:A:216:MET:SD	1:A:229:LEU:HB2	2.40	0.62
1:A:177:HIS:CD2	1:A:178:THR:CG2	2.82	0.61
1:A:282:LEU:HB3	1:A:348:LEU:HD11	1.82	0.61
1:A:741:GLN:HG3	1:A:812:GLN:HG3	1.82	0.61
1:A:746:ASP:OD1	1:A:747:ALA:N	2.33	0.61
1:A:134:ILE:O	1:A:138:ILE:HG13	2.01	0.61
1:A:736:ASN:HA	1:A:739:GLU:HB3	1.82	0.61
1:A:175:ASN:OD1	1:A:177:HIS:CE1	2.54	0.60
1:A:352:LEU:HG	1:A:357:ARG:HB2	1.82	0.60
1:A:363:SER:HB2	1:A:366:LYS:HB2	1.84	0.60
1:A:84:LEU:HB2	1:A:85:PRO:HD2	1.83	0.60
1:A:671:LEU:HD21	1:A:742:ILE:HD11	1.84	0.60
1:A:219:ALA:O	1:A:223:LEU:HD23	2.01	0.59
1:A:785:MET:HE3	1:A:785:MET:HA	1.84	0.59
1:A:52:LEU:HD12	1:A:57:THR:HG22	1.83	0.59
1:A:730:THR:HA	1:A:733:ARG:HD2	1.83	0.59
1:A:796:ARG:O	1:A:800:LEU:N	2.36	0.59
1:A:293:LEU:HD11	1:A:371:ILE:HD12	1.85	0.58
1:A:192:ARG:HD2	1:A:192:ARG:O	2.02	0.58
1:A:74:LEU:O	1:A:78:VAL:HG23	2.03	0.58
1:A:121:GLU:HG2	1:A:129:MET:HE2	1.85	0.58
1:A:528:PHE:CZ	1:A:572:ARG:HB2	2.39	0.58
1:A:93:ARG:NH1	1:A:124:ASP:OD1	2.28	0.58
1:A:69:GLY:C	1:A:73:MET:HG3	2.29	0.58
1:A:295:GLU:HG3	1:A:299:ARG:NH1	2.19	0.58
1:A:559:GLU:N	1:A:559:GLU:OE1	2.37	0.57
1:A:197:LEU:HD23	1:A:222:HIS:HD2	1.69	0.57
1:A:762:PHE:CE1	1:A:815:ILE:HG21	2.39	0.57
1:A:177:HIS:HD2	1:A:178:THR:CG2	2.16	0.57
1:A:87:PRO:HG2	1:A:89:ARG:HH22	1.69	0.57
1:A:223:LEU:HG	1:A:225:ILE:HG12	1.86	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:41:ARG:HG2	1:A:62:ILE:HG21	1.87	0.57
1:A:257:ALA:C	1:A:259:ALA:H	2.12	0.57
1:A:50:SER:HB3	1:A:226:PRO:HG3	1.86	0.57
1:A:70:LEU:HD12	1:A:71:MLZ:N	2.19	0.57
1:A:642:PHE:CE2	1:A:699:HIS:HB2	2.40	0.57
1:A:840:SER:H	1:A:842:LYS:HE3	1.70	0.57
1:A:867:PRO:HG3	1:A:883:ALA:HB3	1.87	0.56
1:A:785:MET:HG3	1:A:786:GLY:H	1.70	0.56
1:A:52:LEU:HB3	1:A:57:THR:O	2.04	0.56
1:A:242:GLU:HG2	1:A:246:MET:HE2	1.86	0.56
1:A:301:ILE:HD13	1:A:378:LEU:HA	1.88	0.56
1:A:761:SER:HA	1:A:764:HIS:HB3	1.88	0.56
1:A:274:ALA:O	1:A:278:GLU:HG2	2.06	0.56
1:A:528:PHE:CE2	1:A:572:ARG:HB2	2.41	0.56
1:A:773:MET:SD	1:A:773:MET:N	2.79	0.56
1:A:100:VAL:O	1:A:104:LEU:N	2.35	0.56
1:A:799:THR:HB	1:A:809:VAL:HG22	1.88	0.56
1:A:160:TRP:HZ2	1:A:193:HIS:HE1	1.53	0.55
1:A:875:VAL:HB	1:A:878:ALA:HB2	1.89	0.55
1:A:545:VAL:HG21	1:A:551:ILE:HB	1.88	0.55
1:A:699:HIS:O	1:A:702:ILE:HG12	2.07	0.55
1:A:421:GLU:OE1	1:A:421:GLU:N	2.33	0.55
1:A:383:LYS:O	1:A:387:GLU:HG2	2.06	0.55
1:A:496:LEU:HD12	1:A:499:LYS:HZ1	1.72	0.55
1:A:163:ARG:HE	1:A:163:ARG:HA	1.72	0.55
1:A:293:LEU:HD21	1:A:371:ILE:CD1	2.36	0.55
1:A:845:ILE:HG21	1:A:866:MET:HE1	1.88	0.54
1:A:220:GLU:OE1	1:A:226:PRO:HA	2.08	0.54
1:A:491:ASP:O	1:A:495:THR:HG22	2.08	0.54
1:A:514:ILE:O	1:A:518:HIS:HB2	2.07	0.54
1:A:52:LEU:HD12	1:A:57:THR:CG2	2.37	0.54
1:A:61:ASN:OD1	1:A:63:GLU:N	2.39	0.54
1:A:388:TRP:HE3	1:A:389:LEU:HD22	1.72	0.54
1:A:301:ILE:CD1	1:A:378:LEU:HA	2.38	0.53
1:A:759:ARG:O	1:A:762:PHE:HB3	2.07	0.53
1:A:43:THR:HA	1:A:228:MET:HB2	1.90	0.53
1:A:169:ARG:HA	1:A:169:ARG:NE	2.22	0.53
1:A:258:GLY:HA2	1:A:261:GLN:HB2	1.89	0.53
1:A:761:SER:O	1:A:764:HIS:ND1	2.41	0.53
1:A:398:ARG:HA	1:A:401:HIS:HB2	1.91	0.53
1:A:572:ARG:NH2	1:A:608:ARG:HH21	2.05	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:572:ARG:HH21	1:A:608:ARG:HH21	1.57	0.53
1:A:493:LEU:O	1:A:497:THR:HG23	2.08	0.52
1:A:530:ASN:OD1	1:A:531:TRP:N	2.43	0.52
1:A:532:MET:HE1	1:A:611:TRP:HB2	1.92	0.52
1:A:212:ILE:HG21	1:A:234:ILE:HD11	1.91	0.52
1:A:343:ILE:O	1:A:347:THR:HG23	2.09	0.52
1:A:532:MET:HE2	1:A:611:TRP:HE3	1.73	0.52
1:A:498:GLN:HA	1:A:501:ARG:HB3	1.91	0.52
1:A:88:ASP:O	1:A:99:ASN:ND2	2.37	0.52
1:A:741:GLN:NE2	1:A:812:GLN:HE21	2.06	0.52
1:A:671:LEU:HD21	1:A:742:ILE:CD1	2.38	0.52
1:A:716:THR:O	1:A:718:GLU:N	2.43	0.52
1:A:731:ILE:HG13	1:A:735:ILE:HD13	1.92	0.52
1:A:306:ASN:OD1	1:A:307:ARG:N	2.42	0.52
1:A:481:ASP:OD1	1:A:482:ARG:N	2.42	0.52
1:A:500:ARG:O	1:A:504:LEU:HB2	2.09	0.52
1:A:232:GLU:HG3	1:A:233:ASP:N	2.24	0.52
1:A:160:TRP:CZ2	1:A:193:HIS:HE1	2.27	0.52
1:A:177:HIS:CD2	1:A:239:MLZ:HD3	2.45	0.52
1:A:327:ARG:NH2	1:A:386:GLU:OE2	2.39	0.51
1:A:294:LEU:HD13	1:A:366:LYS:HZ1	1.75	0.51
1:A:517:LEU:HD11	1:A:582:VAL:HB	1.93	0.51
1:A:817:PHE:O	1:A:821:GLU:N	2.43	0.51
1:A:673:ASP:O	1:A:677:GLN:HG2	2.10	0.51
1:A:163:ARG:HA	1:A:163:ARG:NE	2.26	0.51
1:A:485:LYS:O	1:A:489:GLN:NE2	2.29	0.51
1:A:466:GLN:HG3	1:A:467:GLU:H	1.75	0.51
1:A:536:MET:HE3	1:A:613:LYS:HD3	1.92	0.51
1:A:70:LEU:HD12	1:A:71:MLZ:H	1.75	0.51
1:A:509:LYS:HD2	1:A:509:LYS:O	2.11	0.51
1:A:719:HIS:O	1:A:723:GLY:N	2.24	0.51
1:A:273:LEU:O	1:A:276:ASN:N	2.44	0.51
1:A:158:LEU:O	1:A:162:GLN:HG2	2.11	0.50
1:A:296:TRP:HA	1:A:299:ARG:NH1	2.26	0.50
1:A:744:THR:HG21	1:A:816:ASP:OD2	2.11	0.50
1:A:48:CYS:O	1:A:52:LEU:HD23	2.11	0.50
1:A:388:TRP:CE3	1:A:389:LEU:HD22	2.46	0.50
1:A:705:ALA:O	1:A:706:LEU:HB2	2.10	0.50
1:A:859:ALA:O	1:A:863:ILE:HG12	2.12	0.50
1:A:74:LEU:O	1:A:77:GLU:HG2	2.11	0.50
1:A:521:PHE:HB2	1:A:578:ILE:HG21	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:558:HIS:C	1:A:558:HIS:CD2	2.90	0.50
1:A:657:MET:HG2	1:A:727:LEU:HD12	1.92	0.50
1:A:616:GLN:O	1:A:619:PRO:HD2	2.12	0.50
1:A:657:MET:O	1:A:660:ILE:HG22	2.12	0.50
1:A:569:ASP:OD1	1:A:572:ARG:NH1	2.44	0.49
1:A:495:THR:HA	1:A:498:GLN:NE2	2.17	0.49
1:A:291:SER:O	1:A:295:GLU:HB3	2.12	0.49
1:A:395:ARG:O	1:A:399:LEU:HD13	2.13	0.49
1:A:652:TRP:CE3	1:A:653:ILE:HD12	2.46	0.49
1:A:106:TYR:CE1	1:A:110:LYS:HD3	2.48	0.49
1:A:284:GLU:N	1:A:284:GLU:OE2	2.46	0.49
1:A:444:HIS:CE1	1:A:501:ARG:HB2	2.48	0.49
1:A:121:GLU:HG3	1:A:126:ASN:HB3	1.95	0.48
1:A:135:TRP:CG	1:A:243:ARG:HD3	2.48	0.48
1:A:555:ILE:HG13	1:A:625:LEU:HG	1.95	0.48
1:A:553:SER:CA	1:A:556:THR:HG22	2.38	0.48
1:A:67:ARG:NE	1:A:123:VAL:O	2.46	0.48
1:A:243:ARG:HA	1:A:246:MET:HE3	1.95	0.48
1:A:252:PHE:O	1:A:256:PHE:HB2	2.13	0.48
1:A:645:GLN:HG2	1:A:695:LEU:HB2	1.95	0.48
1:A:46:ALA:HB3	1:A:228:MET:HB3	1.95	0.48
1:A:432:ALA:HB3	1:A:437:VAL:HG23	1.95	0.48
1:A:450:ASP:OD1	1:A:451:LEU:N	2.47	0.48
1:A:796:ARG:HA	1:A:799:THR:HG22	1.95	0.48
1:A:169:ARG:HA	1:A:169:ARG:HE	1.79	0.47
1:A:399:LEU:HD11	1:A:471:LEU:HD23	1.96	0.47
1:A:411:SER:O	1:A:415:THR:HG23	2.14	0.47
1:A:120:GLU:O	1:A:123:VAL:HG22	2.14	0.47
1:A:305:GLU:OE1	1:A:381:ALA:HA	2.14	0.47
1:A:594:SER:O	1:A:595:SER:OG	2.26	0.47
1:A:742:ILE:HD13	1:A:742:ILE:HA	1.62	0.47
1:A:750:ILE:HD11	1:A:754:GLN:HG2	1.95	0.47
1:A:844:TYR:HB3	1:A:878:ALA:HB1	1.97	0.47
1:A:320:LEU:CD2	1:A:389:LEU:HD12	2.40	0.47
1:A:162:GLN:HG2	1:A:162:GLN:H	1.57	0.47
1:A:290:ALA:O	1:A:294:LEU:HB2	2.15	0.47
1:A:305:GLU:OE2	1:A:305:GLU:HA	2.15	0.47
1:A:399:LEU:CD1	1:A:471:LEU:HD23	2.44	0.47
1:A:510:LEU:HD11	1:A:589:TYR:HE2	1.80	0.47
1:A:737:GLU:O	1:A:741:GLN:HG2	2.14	0.47
1:A:848:GLU:OE1	1:A:848:GLU:N	2.39	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:84:LEU:C	1:A:84:LEU:HD12	2.39	0.47
1:A:189:LEU:HD11	1:A:252:PHE:CD2	2.35	0.47
1:A:316:MET:HB3	1:A:393:ILE:HD12	1.96	0.47
1:A:445:GLU:O	1:A:448:GLU:HG2	2.14	0.47
1:A:191:HIS:HB2	1:A:198:ILE:HG21	1.96	0.47
1:A:281:ARG:O	1:A:281:ARG:HG2	2.15	0.47
1:A:814:PHE:O	1:A:817:PHE:HB3	2.15	0.47
1:A:430:GLU:HA	1:A:507:MET:HE3	1.97	0.47
1:A:548:ILE:O	1:A:552:GLN:HG2	2.15	0.47
1:A:741:GLN:NE2	1:A:813:SER:HA	2.30	0.47
1:A:844:TYR:OH	1:A:871:GLY:O	2.32	0.47
1:A:839:ALA:HB1	1:A:842:LYS:HE3	1.97	0.46
1:A:464:ILE:O	1:A:468:LEU:HB2	2.15	0.46
1:A:835:PHE:HA	1:A:838:LEU:HD12	1.95	0.46
1:A:826:ASP:OD1	1:A:826:ASP:N	2.47	0.46
1:A:94:PHE:HA	1:A:97:ILE:HD12	1.97	0.46
1:A:564:THR:O	1:A:567:GLU:N	2.46	0.46
1:A:462:ALA:HA	1:A:483:CYS:SG	2.55	0.46
1:A:858:GLN:OE1	1:A:858:GLN:N	2.48	0.46
1:A:97:ILE:O	1:A:101:ASN:ND2	2.48	0.46
1:A:212:ILE:HG21	1:A:234:ILE:CD1	2.46	0.46
1:A:506:ARG:O	1:A:510:LEU:HD23	2.15	0.46
1:A:662:ARG:HD3	1:A:662:ARG:C	2.41	0.46
1:A:839:ALA:HB2	1:A:845:ILE:HG13	1.98	0.45
1:A:232:GLU:O	1:A:235:VAL:HG12	2.15	0.45
1:A:242:GLU:HG2	1:A:246:MET:CE	2.46	0.45
1:A:432:ALA:HB1	1:A:436:GLU:HB3	1.97	0.45
1:A:638:LEU:HB3	1:A:702:ILE:HG22	1.98	0.45
1:A:93:ARG:HA	1:A:96:MLZ:HD3	1.99	0.45
1:A:718:GLU:OE2	1:A:718:GLU:HA	2.17	0.45
1:A:59:ILE:O	1:A:59:ILE:HG13	2.16	0.45
1:A:835:PHE:CE1	1:A:845:ILE:HD12	2.51	0.45
1:A:205:LYS:O	1:A:205:LYS:HG2	2.17	0.45
1:A:476:ALA:O	1:A:480:ASN:ND2	2.50	0.45
1:A:868:ALA:HA	1:A:879:LEU:HA	1.98	0.45
1:A:155:GLU:CD	1:A:155:GLU:H	2.25	0.45
1:A:371:ILE:HD13	1:A:371:ILE:HA	1.74	0.45
1:A:749:GLY:HA3	1:A:820:ARG:HH22	1.82	0.45
1:A:101:ASN:O	1:A:105:ASP:N	2.41	0.45
1:A:192:ARG:HD2	1:A:192:ARG:C	2.42	0.45
1:A:608:ARG:O	1:A:608:ARG:HD3	2.17	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:52:LEU:HD22	1:A:75:LEU:HD13	1.99	0.45
1:A:38:LYS:HE3	1:A:232:GLU:OE2	2.17	0.44
1:A:352:LEU:HD22	1:A:360:PHE:CD1	2.47	0.44
1:A:374:ALA:HA	1:A:377:ARG:HE	1.82	0.44
1:A:416:TRP:O	1:A:420:LYS:NZ	2.38	0.44
1:A:846:LEU:N	1:A:849:GLU:OE2	2.32	0.44
1:A:45:THR:OG1	1:A:62:ILE:HB	2.18	0.44
1:A:87:PRO:HG2	1:A:89:ARG:NH2	2.32	0.44
1:A:476:ALA:HA	1:A:479:VAL:HG22	1.99	0.44
1:A:217:GLU:OE1	1:A:217:GLU:N	2.50	0.44
1:A:253:TYR:CD1	1:A:253:TYR:C	2.95	0.44
1:A:618:VAL:CG2	1:A:619:PRO:HD3	2.44	0.44
1:A:734:THR:HA	1:A:737:GLU:HB3	1.99	0.44
1:A:749:GLY:HA3	1:A:820:ARG:NH2	2.32	0.44
1:A:283:MET:SD	1:A:360:PHE:HB2	2.58	0.44
1:A:678:LEU:HD21	1:A:735:ILE:HG13	1.98	0.44
1:A:731:ILE:HG13	1:A:735:ILE:CD1	2.47	0.44
1:A:73:MET:SD	1:A:87:PRO:HB3	2.57	0.44
1:A:603:THR:HG1	1:A:606:GLU:H	1.63	0.44
1:A:845:ILE:HD13	1:A:850:LEU:HD21	1.99	0.44
1:A:52:LEU:CD2	1:A:75:LEU:HD13	2.48	0.44
1:A:408:GLN:O	1:A:412:THR:HG23	2.18	0.44
1:A:649:ILE:HG22	1:A:720:ILE:HD12	2.00	0.44
1:A:64:GLU:HA	1:A:67:ARG:HG3	1.99	0.43
1:A:265:ALA:O	1:A:269:ILE:HG12	2.17	0.43
1:A:516:GLN:OE1	1:A:516:GLN:HA	2.17	0.43
1:A:613:LYS:O	1:A:617:LEU:HD13	2.17	0.43
1:A:651:PRO:O	1:A:655:ASN:N	2.50	0.43
1:A:175:ASN:HB3	1:A:177:HIS:CE1	2.53	0.43
1:A:820:ARG:O	1:A:820:ARG:HG2	2.18	0.43
1:A:208:PRO:HG2	1:A:235:VAL:HG23	2.00	0.43
1:A:281:ARG:O	1:A:284:GLU:OE2	2.36	0.43
1:A:778:PHE:O	1:A:782:LEU:HD13	2.18	0.43
1:A:426:GLN:O	1:A:500:ARG:NH1	2.45	0.43
1:A:671:LEU:CD2	1:A:742:ILE:HD11	2.48	0.43
1:A:73:MET:O	1:A:84:LEU:HD21	2.19	0.43
1:A:539:LEU:HD23	1:A:617:LEU:HB3	2.00	0.43
1:A:292:GLU:O	1:A:296:TRP:N	2.52	0.43
1:A:93:ARG:O	1:A:97:ILE:HG13	2.18	0.42
1:A:698:ASP:O	1:A:702:ILE:HG23	2.19	0.42
1:A:289:LEU:HD13	1:A:366:LYS:O	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:608:ARG:HD3	1:A:608:ARG:C	2.44	0.42
1:A:372:ALA:O	1:A:376:GLN:N	2.52	0.42
1:A:634:ALA:HA	1:A:637:ARG:HH11	1.84	0.42
1:A:148:VAL:O	1:A:151:THR:HG22	2.20	0.42
1:A:173:ILE:HA	1:A:179:SER:CB	2.49	0.42
1:A:434:LEU:N	1:A:511:LEU:HD13	2.34	0.42
1:A:536:MET:HG3	1:A:614:VAL:HG23	2.02	0.42
1:A:197:LEU:HD12	1:A:197:LEU:H	1.85	0.42
1:A:277:GLN:NE2	1:A:281:ARG:HB2	2.34	0.42
1:A:825:THR:HG22	1:A:826:ASP:OD1	2.20	0.42
1:A:301:ILE:HG22	1:A:302:PRO:HD3	2.01	0.42
1:A:117:ILE:HG22	1:A:129:MET:SD	2.59	0.42
1:A:184:LEU:HD11	1:A:205:LYS:HA	2.02	0.42
1:A:863:ILE:HG13	1:A:864:LYS:H	1.85	0.42
1:A:245:ILE:O	1:A:249:VAL:HG23	2.20	0.42
1:A:253:TYR:C	1:A:253:TYR:HD1	2.28	0.42
1:A:332:PRO:N	1:A:333:PRO:HD2	2.35	0.42
1:A:103:ALA:O	1:A:107:ILE:HG13	2.20	0.41
1:A:463:ALA:O	1:A:466:GLN:N	2.41	0.41
1:A:733:ARG:HG2	1:A:734:THR:N	2.35	0.41
1:A:41:ARG:NH1	1:A:63:GLU:OE2	2.53	0.41
1:A:107:ILE:HG22	1:A:112:VAL:CG1	2.50	0.41
1:A:456:ASP:O	1:A:459:GLU:HG2	2.21	0.41
1:A:733:ARG:O	1:A:737:GLU:N	2.45	0.41
1:A:496:LEU:HD12	1:A:499:LYS:NZ	2.35	0.41
1:A:636:GLU:OE1	1:A:639:ARG:HD2	2.21	0.41
1:A:642:PHE:HE2	1:A:699:HIS:HB2	1.86	0.41
1:A:688:TYR:HB3	1:A:724:TRP:CH2	2.56	0.41
1:A:699:HIS:CD2	1:A:717:MET:HG2	2.56	0.41
1:A:102:MLZ:HCM3	1:A:102:MLZ:HD3	1.80	0.40
1:A:181:MLZ:HCM3	1:A:181:MLZ:HD3	1.85	0.40
1:A:366:LYS:HA	1:A:366:LYS:HD3	1.73	0.40
1:A:372:ALA:O	1:A:376:GLN:HB2	2.21	0.40
1:A:762:PHE:CD1	1:A:815:ILE:HG21	2.56	0.40
1:A:36:TRP:CD1	1:A:37:GLU:H	2.39	0.40
1:A:467:GLU:O	1:A:471:LEU:HD13	2.20	0.40
1:A:741:GLN:HA	1:A:744:THR:CG2	2.49	0.40
1:A:748:LYS:O	1:A:820:ARG:NH2	2.46	0.40
1:A:863:ILE:HG13	1:A:864:LYS:N	2.37	0.40
1:A:186:LEU:HD22	1:A:215:ALA:HB1	2.02	0.40
1:A:724:TRP:CD1	1:A:724:TRP:C	2.99	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:52:LEU:HD21	1:A:75:LEU:HD22	2.03	0.40
1:A:518:HIS:O	1:A:597:ASN:ND2	2.53	0.40
1:A:518:HIS:CD2	1:A:597:ASN:HA	2.56	0.40
1:A:551:ILE:HG21	1:A:629:LEU:HA	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	847/861 (98%)	810 (96%)	36 (4%)	1 (0%)	48 78

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	801	VAL

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	702/742 (95%)	702 (100%)	0	100 100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such

sidechains are listed below:

Mol	Chain	Res	Type
1	A	170	ASN
1	A	222	HIS
1	A	344	ASN
1	A	552	GLN
1	A	683	HIS
1	A	687	ASN
1	A	741	GLN
1	A	770	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

10 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
1	MLZ	A	102	1	8,9,10	0.80	0	4,9,11	0.76	0
1	MLZ	A	42	1	8,9,10	0.80	0	4,9,11	0.70	0
1	MLZ	A	562	1	8,9,10	0.81	0	4,9,11	0.57	0
1	MLZ	A	443	1	8,9,10	0.83	0	4,9,11	0.96	0
1	MLZ	A	96	1	8,9,10	0.76	0	4,9,11	0.87	0
1	MLZ	A	181	1	8,9,10	0.76	0	4,9,11	0.62	0
1	MLZ	A	71	1	8,9,10	0.76	0	4,9,11	0.63	0
1	MLZ	A	239	1	8,9,10	0.81	0	4,9,11	0.65	0
1	MLZ	A	164	1	8,9,10	0.77	0	4,9,11	0.53	0
1	MLZ	A	689	1	8,9,10	0.76	0	4,9,11	0.57	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	MLZ	A	102	1	-	3/7/8/10	-
1	MLZ	A	42	1	-	1/7/8/10	-
1	MLZ	A	562	1	-	2/7/8/10	-
1	MLZ	A	443	1	-	5/7/8/10	-
1	MLZ	A	96	1	-	3/7/8/10	-
1	MLZ	A	181	1	-	2/7/8/10	-
1	MLZ	A	71	1	-	1/7/8/10	-
1	MLZ	A	239	1	-	2/7/8/10	-
1	MLZ	A	164	1	-	3/7/8/10	-
1	MLZ	A	689	1	-	2/7/8/10	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (24) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	71	MLZ	C-CA-CB-CG
1	A	96	MLZ	CD-CE-NZ-CM
1	A	164	MLZ	CD-CE-NZ-CM
1	A	443	MLZ	N-CA-CB-CG
1	A	443	MLZ	C-CA-CB-CG
1	A	562	MLZ	C-CA-CB-CG
1	A	443	MLZ	CG-CD-CE-NZ
1	A	689	MLZ	CG-CD-CE-NZ
1	A	239	MLZ	CE-CD-CG-CB
1	A	689	MLZ	CD-CE-NZ-CM
1	A	443	MLZ	CE-CD-CG-CB
1	A	164	MLZ	CA-CB-CG-CD
1	A	164	MLZ	CE-CD-CG-CB
1	A	181	MLZ	CD-CE-NZ-CM
1	A	562	MLZ	CG-CD-CE-NZ
1	A	96	MLZ	CE-CD-CG-CB
1	A	42	MLZ	CD-CE-NZ-CM
1	A	102	MLZ	CD-CE-NZ-CM
1	A	96	MLZ	N-CA-CB-CG
1	A	181	MLZ	CE-CD-CG-CB
1	A	102	MLZ	CG-CD-CE-NZ
1	A	102	MLZ	CA-CB-CG-CD
1	A	239	MLZ	CD-CE-NZ-CM

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Mol	Chain	Res	Type	Atoms
1	A	443	MLZ	CD-CE-NZ-CM

There are no ring outliers.

5 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	102	MLZ	1	0
1	A	96	MLZ	1	0
1	A	181	MLZ	1	0
1	A	71	MLZ	3	0
1	A	239	MLZ	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	849/861 (98%)	-0.03	37 (4%) 39 25	84, 182, 303, 383	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	819	THR	5.9
1	A	786	GLY	5.7
1	A	546	HIS	4.4
1	A	581	GLU	3.9
1	A	714	ASN	3.9
1	A	116	SER	3.8
1	A	635	ASN	3.8
1	A	645	GLN	3.5
1	A	787	TYR	3.4
1	A	784	SER	3.4
1	A	708	PHE	3.4
1	A	818	MET	3.4
1	A	709	ASP	3.3
1	A	707	VAL	3.3
1	A	694	LYS	3.3
1	A	788	ASP	3.2
1	A	580	ASN	3.2
1	A	393	ILE	3.1
1	A	821	GLU	3.1
1	A	397	GLU	3.0
1	A	822	THR	2.9
1	A	785	MET	2.7
1	A	582	VAL	2.6
1	A	706	LEU	2.6
1	A	639	ARG	2.6
1	A	828	ALA	2.4
1	A	578	ILE	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	631	ARG	2.3
1	A	641	GLN	2.2
1	A	698	ASP	2.2
1	A	594	SER	2.2
1	A	595	SER	2.2
1	A	68	ASN	2.1
1	A	418	TYR	2.1
1	A	816	ASP	2.1
1	A	584	LYS	2.1
1	A	517	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	MLZ	A	239	10/11	0.82	0.09	157,173,197,202	0
1	MLZ	A	71	10/11	0.83	0.17	89,133,143,174	0
1	MLZ	A	689	10/11	0.91	0.07	128,153,181,185	0
1	MLZ	A	102	10/11	0.92	0.11	128,139,165,182	0
1	MLZ	A	42	10/11	0.93	0.07	110,139,163,172	0
1	MLZ	A	181	10/11	0.93	0.08	104,162,178,182	0
1	MLZ	A	443	10/11	0.94	0.11	96,117,135,159	0
1	MLZ	A	562	10/11	0.94	0.10	93,106,124,139	0
1	MLZ	A	164	10/11	0.94	0.09	94,150,170,171	0
1	MLZ	A	96	10/11	0.96	0.07	93,126,153,162	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.