



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:51 PM UTC

PDB ID : 1DKY / pdb_00001dky
Title : THE SUBSTRATE BINDING DOMAIN OF DNAK IN COMPLEX WITH A
SUBSTRATE PEPTIDE, DETERMINED FROM TYPE 2 NATIVE CRYSTALS
Authors : Zhu, X.; Zhao, X.; Burkholder, W.F.; Gragerov, A.; Ogata, C.M.; Gottesman,
M.E.; Hendrickson, W.A.
Deposited on : 1996-06-03
Resolution : 2.80 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
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

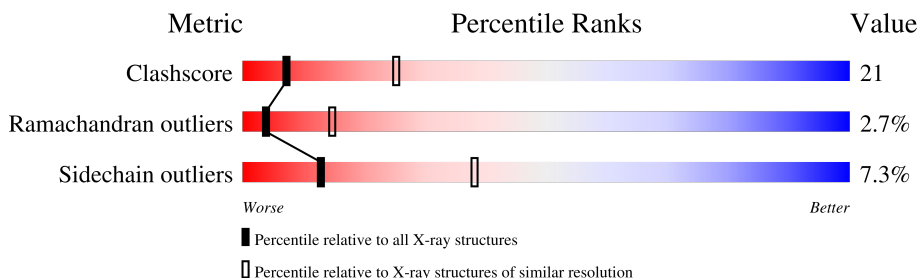
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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))
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	219	
1	B	219	
2	C	7	
2	D	7	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2999 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 DNAK.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	211	Total	C	N	O	S	0	0	0
			1483	912	258	308	5			
1	B	203	Total	C	N	O	S	0	0	0
			1430	878	249	298	5			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	437	SER	THR	conflict	UNP P0A6Y8
B	437	SER	THR	conflict	UNP P0A6Y8

- Molecule 2 is a protein called PEPTIDE SUBSTRATE.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	4	Total	C	N	O	0	0	0
			29	21	4	4			
2	D	4	Total	C	N	O	0	0	0
			29	21	4	4			

- Molecule 3 is water.

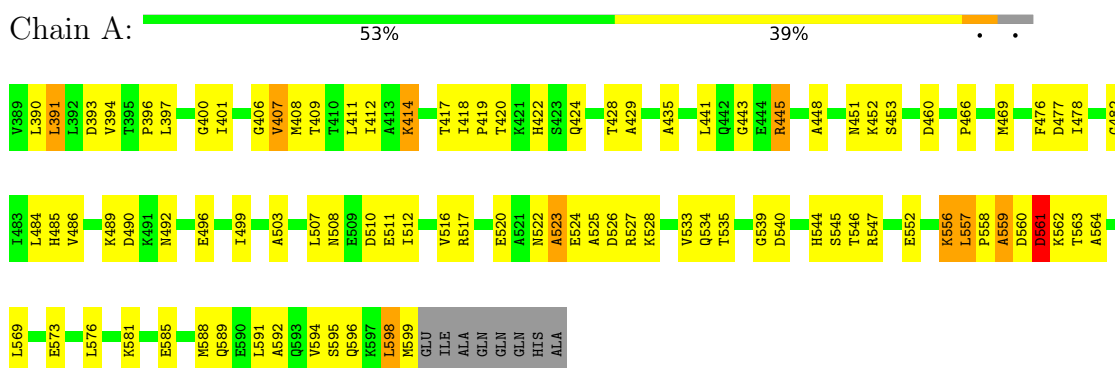
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	16	Total	O	0	0
			16	16		
3	B	12	Total	O	0	0
			12	12		

3 Residue-property plots

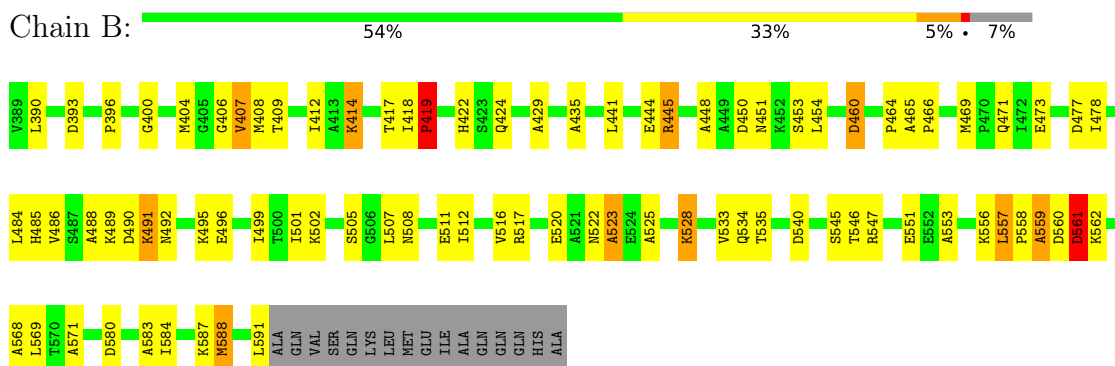
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

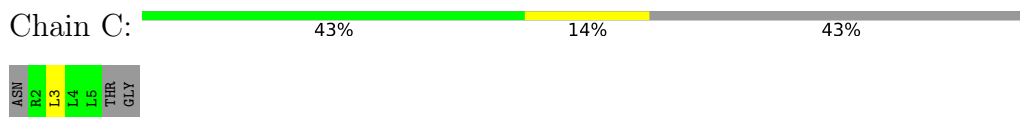
• Molecule 1: DNAK



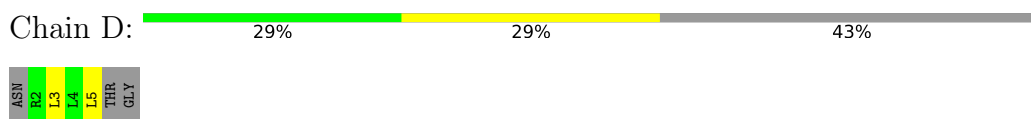
• Molecule 1: DNAK



• Molecule 2: PEPTIDE SUBSTRATE



• Molecule 2: PEPTIDE SUBSTRATE



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	96.40 Å 117.00 Å 36.20 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.80	Depositor
% Data completeness (in resolution range)	79.3 (8.00-2.80)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.225 , 0.309	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2999	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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	0.63	0/1495	1.26	13/2029 (0.6%)
1	B	0.65	0/1442	1.90	11/1956 (0.6%)
2	C	0.71	0/28	0.81	0/37
2	D	0.59	0/28	1.03	0/37
All	All	0.64	0/2993	1.60	24/4059 (0.6%)

There are no bond length outliers.

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	418	ILE	CA-C-N	47.88	179.69	119.84
1	B	418	ILE	C-N-CA	47.88	179.69	119.84
1	A	418	ILE	C-N-CD	-17.27	82.60	120.60
1	A	418	ILE	CA-C-N	14.98	162.95	127.00
1	A	418	ILE	C-N-CA	14.98	162.95	127.00
1	B	418	ILE	C-N-CD	-11.67	77.17	125.00
1	B	561	ASP	N-CA-C	-7.91	93.95	110.80
1	A	466	PRO	N-CA-CB	7.31	109.85	103.27
1	A	557	LEU	CA-C-N	7.12	127.52	119.83
1	A	557	LEU	C-N-CA	7.12	127.52	119.83
1	A	561	ASP	N-CA-C	-6.92	96.05	110.80
1	B	466	PRO	N-CA-CB	6.91	109.46	103.31
1	B	419	PRO	CA-N-CD	-6.61	102.75	112.00
1	B	557	LEU	CA-C-N	6.43	126.78	119.83
1	B	557	LEU	C-N-CA	6.43	126.78	119.83
1	A	406	GLY	N-CA-C	-6.24	106.52	115.64
1	B	540	ASP	N-CA-C	-6.04	104.62	111.14
1	A	556	LYS	N-CA-C	-5.79	105.48	112.54
1	B	406	GLY	N-CA-C	-5.44	107.76	115.43
1	A	540	ASP	N-CA-C	-5.40	105.08	110.97
1	A	588	MET	N-CA-C	-5.26	105.54	111.28
1	A	526	ASP	N-CA-C	-5.13	105.77	111.36
1	A	393	ASP	N-CA-C	-5.09	101.46	109.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	588	MET	N-CA-C	-5.05	105.69	111.14

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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	1483	0	1387	61	0
1	B	1430	0	1334	65	0
2	C	29	0	34	2	0
2	D	29	0	34	3	0
3	A	16	0	0	2	0
3	B	12	0	0	0	0
All	All	2999	0	2789	119	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 21.

All (119) 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:429:ALA:HA	2:C:3:LEU:HD13	1.60	0.83
1:A:396:PRO:O	1:A:414:LYS:HD2	1.79	0.82
1:A:441:LEU:HD11	1:A:448:ALA:HB1	1.61	0.80
1:B:507:LEU:HB3	1:B:511:GLU:HB2	1.64	0.80
1:A:489:LYS:HG3	1:A:496:GLU:HB2	1.61	0.80
1:A:557:LEU:HD23	1:A:562:LYS:HG3	1.70	0.74
1:B:396:PRO:O	1:B:414:LYS:HD2	1.89	0.71
1:B:569:LEU:HD23	1:B:591:LEU:HD11	1.73	0.71
1:B:512:ILE:O	1:B:516:VAL:HG23	1.92	0.69
1:B:489:LYS:HG3	1:B:496:GLU:HB2	1.75	0.68
1:A:595:SER:OG	1:A:598:LEU:HD21	1.94	0.68
1:A:545:SER:HB3	1:B:469:MET:SD	2.35	0.67
1:A:507:LEU:HB3	1:A:511:GLU:HB2	1.78	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:478:ILE:HG12	1:B:484:LEU:HD13	1.79	0.65
1:A:573:GLU:HA	1:A:576:LEU:HD12	1.78	0.64
1:A:424:GLN:OE1	1:B:534:GLN:NE2	2.30	0.63
3:A:2114:HOH:O	1:B:422:HIS:HB3	2.00	0.62
1:B:404:MET:CE	2:D:3:LEU:HD12	2.29	0.62
1:A:516:VAL:O	1:A:520:GLU:HG3	2.00	0.61
1:B:441:LEU:HD11	1:B:448:ALA:HB1	1.82	0.61
1:B:507:LEU:HB3	1:B:511:GLU:CB	2.32	0.60
1:B:393:ASP:O	1:B:417:THR:HA	2.02	0.59
1:A:517:ARG:HA	1:A:520:GLU:OE1	2.02	0.58
1:B:429:ALA:HB3	2:D:5:LEU:HD23	1.85	0.57
1:A:507:LEU:HD22	1:A:511:GLU:HB3	1.86	0.57
1:A:428:THR:O	2:C:3:LEU:HD22	2.05	0.57
1:A:589:GLN:HG3	1:B:491:LYS:O	2.04	0.57
1:B:569:LEU:HD23	1:B:591:LEU:CD1	2.35	0.56
1:A:469:MET:SD	1:B:545:SER:HB3	2.45	0.56
1:B:396:PRO:HB2	1:B:512:ILE:HD13	1.88	0.56
1:B:404:MET:HE1	2:D:3:LEU:HD12	1.88	0.55
1:B:412:ILE:HG12	1:B:422:HIS:ND1	2.23	0.53
1:A:546:THR:HG21	1:A:591:LEU:HD11	1.90	0.53
1:B:435:ALA:HB2	1:B:460:ASP:HB3	1.91	0.53
1:A:397:LEU:CD1	1:A:507:LEU:HD12	2.38	0.53
1:A:408:MET:HG3	1:A:441:LEU:HD12	1.90	0.53
1:A:441:LEU:CD1	1:A:448:ALA:HB1	2.35	0.53
1:A:564:ALA:O	1:A:594:VAL:HG11	2.09	0.53
1:A:564:ALA:C	1:A:594:VAL:HG11	2.35	0.52
1:B:407:VAL:HG13	1:B:408:MET:N	2.23	0.52
1:B:558:PRO:O	1:B:561:ASP:HB2	2.09	0.52
1:A:558:PRO:O	1:A:561:ASP:HB2	2.10	0.52
1:B:547:ARG:HG3	1:B:569:LEU:HD13	1.92	0.52
1:A:435:ALA:HB2	1:A:460:ASP:HB3	1.92	0.52
1:B:557:LEU:HD23	1:B:562:LYS:HG3	1.93	0.51
1:A:412:ILE:HG12	1:A:422:HIS:ND1	2.26	0.51
1:A:391:LEU:O	1:A:391:LEU:HG	2.04	0.51
1:A:596:GLN:C	1:A:598:LEU:H	2.19	0.50
1:B:477:ASP:HB3	1:B:485:HIS:HB2	1.94	0.50
1:B:508:ASN:O	1:B:512:ILE:HG13	2.12	0.50
1:B:486:VAL:HB	1:B:499:ILE:HG22	1.93	0.50
1:A:539:GLY:HA3	1:A:576:LEU:HD21	1.94	0.50
1:B:445:ARG:HG3	1:B:450:ASP:HB3	1.93	0.50
1:B:490:ASP:C	1:B:492:ASN:H	2.20	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:482:GLY:O	1:A:503:ALA:HB2	2.11	0.50
1:A:508:ASN:O	1:A:512:ILE:HG13	2.12	0.49
1:B:408:MET:HG3	1:B:441:LEU:HD12	1.93	0.49
1:B:507:LEU:HA	1:B:511:GLU:OE1	2.11	0.49
1:B:507:LEU:HD22	1:B:511:GLU:HB3	1.93	0.49
1:B:517:ARG:HA	1:B:520:GLU:OE1	2.13	0.49
1:A:544:HIS:O	1:A:545:SER:C	2.56	0.48
1:A:478:ILE:HG12	1:A:484:LEU:CD1	2.43	0.48
1:B:525:ALA:HA	1:B:528:LYS:HE3	1.96	0.48
1:B:546:THR:CG2	1:B:569:LEU:HD21	2.43	0.48
1:A:477:ASP:HB3	1:A:485:HIS:HB2	1.96	0.47
1:A:445:ARG:HB3	3:A:2017:HOH:O	2.14	0.47
1:A:592:ALA:HB2	1:B:471:GLN:NE2	2.30	0.47
1:A:556:LYS:O	1:A:558:PRO:HD3	2.14	0.47
1:A:443:GLY:HA3	1:A:451:ASN:OD1	2.15	0.47
1:A:507:LEU:HB3	1:A:511:GLU:CB	2.45	0.47
1:B:400:GLY:HA3	1:B:409:THR:O	2.15	0.47
1:A:546:THR:HG22	1:A:569:LEU:HD11	1.97	0.47
1:B:478:ILE:HG12	1:B:484:LEU:CD1	2.44	0.47
1:A:490:ASP:C	1:A:492:ASN:H	2.24	0.46
1:B:516:VAL:O	1:B:520:GLU:HG3	2.16	0.46
1:A:411:LEU:HD22	1:A:476:PHE:CD1	2.51	0.46
1:A:396:PRO:HB2	1:A:512:ILE:HD13	1.97	0.46
1:B:454:LEU:HB3	1:B:501:ILE:HD13	1.97	0.46
1:A:400:GLY:HA3	1:A:409:THR:O	2.16	0.45
1:A:412:ILE:HD13	1:A:420:THR:HG23	1.97	0.45
1:A:507:LEU:HA	1:A:511:GLU:OE1	2.16	0.45
1:A:525:ALA:HA	1:A:528:LYS:HE3	1.97	0.45
1:B:522:ASN:O	1:B:523:ALA:C	2.59	0.45
1:B:568:ALA:HB3	1:B:591:LEU:CD2	2.46	0.45
1:A:522:ASN:O	1:A:523:ALA:C	2.59	0.45
1:B:489:LYS:HG3	1:B:495:LYS:O	2.16	0.45
1:B:553:ALA:HB1	1:B:556:LYS:HB2	1.98	0.45
1:B:396:PRO:CB	1:B:512:ILE:HD13	2.47	0.45
1:A:407:VAL:HG13	1:A:408:MET:N	2.31	0.45
1:A:441:LEU:HD23	1:A:453:SER:HA	1.98	0.45
1:A:534:GLN:NE2	1:B:424:GLN:OE1	2.49	0.44
1:B:407:VAL:O	1:B:448:ALA:HB2	2.17	0.44
1:A:558:PRO:O	1:A:559:ALA:C	2.60	0.44
1:B:490:ASP:O	1:B:492:ASN:N	2.50	0.44
1:B:441:LEU:HD23	1:B:453:SER:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:502:LYS:O	1:B:505:SER:HB2	2.17	0.44
1:B:473:GLU:O	1:B:488:ALA:HA	2.18	0.44
1:B:584:ILE:O	1:B:588:MET:HG3	2.18	0.43
1:A:401:ILE:O	1:A:409:THR:N	2.47	0.43
1:B:408:MET:SD	1:B:451:ASN:ND2	2.92	0.42
1:A:486:VAL:HB	1:A:499:ILE:HG22	2.01	0.42
1:B:486:VAL:HB	1:B:499:ILE:CG2	2.49	0.42
1:B:580:ASP:HB3	1:B:583:ALA:HB3	2.01	0.42
1:A:408:MET:SD	1:A:451:ASN:ND2	2.93	0.42
1:A:508:ASN:OD1	1:A:510:ASP:HB2	2.20	0.42
1:B:558:PRO:O	1:B:559:ALA:C	2.63	0.42
1:B:587:LYS:HD3	1:B:587:LYS:HA	1.76	0.41
1:B:417:THR:O	1:B:419:PRO:HD2	2.20	0.41
1:A:599:MET:O	1:B:465:ALA:HA	2.19	0.41
1:B:557:LEU:HD12	1:B:557:LEU:HA	1.91	0.41
1:A:394:VAL:HG12	1:A:417:THR:HG22	2.02	0.41
1:B:551:GLU:C	1:B:553:ALA:H	2.29	0.41
1:A:581:LYS:O	1:A:585:GLU:HG3	2.21	0.40
1:B:556:LYS:O	1:B:558:PRO:HD3	2.21	0.40
1:A:441:LEU:HA	1:A:452:LYS:O	2.21	0.40
1:A:478:ILE:HG12	1:A:484:LEU:HD12	2.02	0.40
1:A:524:GLU:O	1:A:527:ARG:N	2.54	0.40
1:B:568:ALA:O	1:B:571:ALA:N	2.54	0.40
1:B:414:LYS:HD3	1:B:444:GLU:OE2	2.21	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	209/219 (95%)	188 (90%)	16 (8%)	5 (2%)	4 17

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	201/219 (92%)	182 (90%)	13 (6%)	6 (3%)	3	12
2	C	2/7 (29%)	2 (100%)	0	0	100	100
2	D	2/7 (29%)	2 (100%)	0	0	100	100
All	All	414/452 (92%)	374 (90%)	29 (7%)	11 (3%)	4	15

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	419	PRO
1	A	559	ALA
1	B	419	PRO
1	B	559	ALA
1	A	598	LEU
1	B	491	LYS
1	B	523	ALA
1	A	523	ALA
1	A	552	GLU
1	B	560	ASP
1	B	561	ASP

5.3.2 Protein sidechains ⓘ

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	143/181 (79%)	132 (92%)	11 (8%)	12	36
1	B	138/181 (76%)	128 (93%)	10 (7%)	13	39
2	C	3/6 (50%)	3 (100%)	0	100	100
2	D	3/6 (50%)	3 (100%)	0	100	100
All	All	287/374 (77%)	266 (93%)	21 (7%)	13	38

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	390	LEU
1	A	391	LEU
1	A	407	VAL
1	A	414	LYS
1	A	445	ARG
1	A	533	VAL
1	A	535	THR
1	A	547	ARG
1	A	560	ASP
1	A	561	ASP
1	A	563	THR
1	B	390	LEU
1	B	407	VAL
1	B	414	LYS
1	B	445	ARG
1	B	460	ASP
1	B	464	PRO
1	B	528	LYS
1	B	533	VAL
1	B	535	THR
1	B	561	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	458	ASN
1	B	534	GLN
1	B	538	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.