



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:09 AM UTC

PDB ID : 2ER9 / pdb_00002er9
Title : X-RAY STUDIES OF ASPARTIC PROTEINASE-STATINE INHIBITOR COMPLEXES.
Authors : Cooper, J.B.; Foundling, S.I.; Boger, J.; Blundell, T.L.
Deposited on : 1990-10-20
Resolution : 2.20 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	:	2022.3.0, CSD as543be (2022)
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

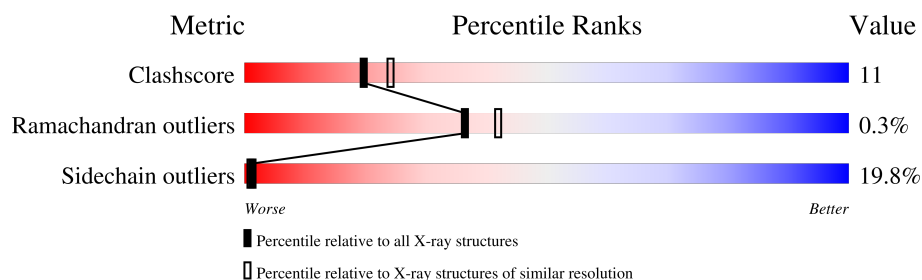
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)

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	E	330	
2	I	8	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2776 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 ENDOTHAPEPSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	E	330	Total	C	N	O	S	0	0	0
			2389	1514	366	507	2			

- Molecule 2 is a protein called L363,564.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	I	8	Total	C	N	O	0	0	1
			65	45	11	9			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	E	321	Total	O	0	0
			321	321		
3	I	1	Total	O	0	0
			1	1		

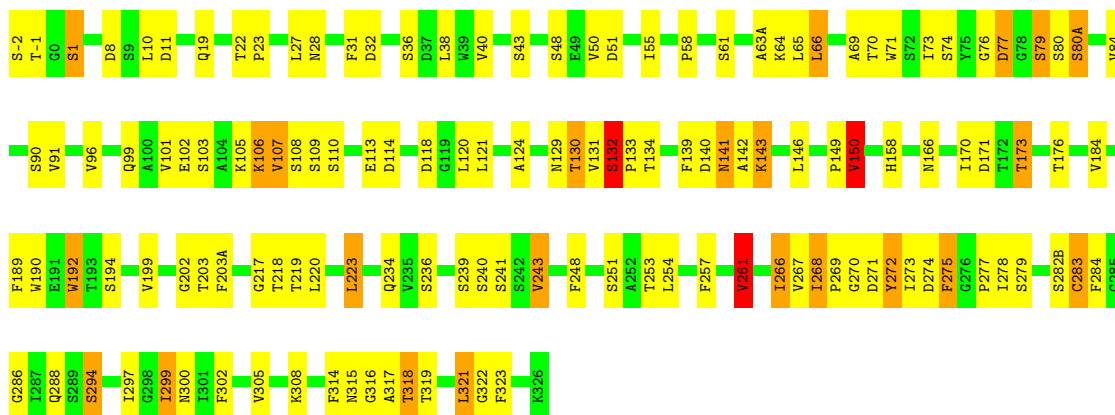
3 Residue-property plots

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.

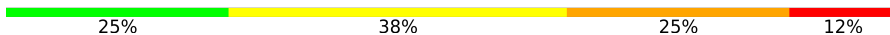
Note EDS was not executed.

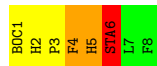
• Molecule 1: ENDOTHAPEPSIN

Chain E: 



• Molecule 2: L363,564

Chain I: 



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	53.50Å 73.90Å 45.60Å 90.00° 109.10° 90.00°	Depositor
Resolution (Å)	10.00 – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.20)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.170 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2776	wwPDB-VP
Average B, all atoms (Å ²)	0.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	E	1.29	9/2445 (0.4%)	1.72	45/3345 (1.3%)
2	I	2.50	4/49 (8.2%)	1.81	2/65 (3.1%)
All	All	1.32	13/2494 (0.5%)	1.72	47/3410 (1.4%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	I	0	2

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	5	HIS	ND1-CE1	7.92	1.40	1.32
2	I	2	HIS	CE1-NE2	7.61	1.40	1.32
2	I	2	HIS	ND1-CE1	7.47	1.40	1.32
1	E	158	HIS	CE1-NE2	7.22	1.39	1.32
1	E	158	HIS	ND1-CE1	6.70	1.39	1.32
1	E	19	GLN	CD-OE1	6.39	1.35	1.23
1	E	141	ASN	CG-OD1	5.98	1.34	1.23
1	E	99	GLN	CD-OE1	5.60	1.34	1.23
1	E	192	TRP	NE1-CE2	-5.28	1.31	1.37
1	E	190	TRP	NE1-CE2	-5.26	1.31	1.37
2	I	5	HIS	CE1-NE2	5.18	1.37	1.32
1	E	288	GLN	CD-OE1	5.13	1.33	1.23
1	E	234	GLN	CD-OE1	5.12	1.33	1.23

All (47) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	261	VAL	CA-CB-CG2	10.47	128.19	110.40
1	E	302	PHE	CA-C-N	9.78	131.95	122.27
1	E	302	PHE	C-N-CA	9.78	131.95	122.27
1	E	107	VAL	CA-CB-CG2	9.54	126.61	110.40
1	E	243	VAL	CA-CB-CG2	7.42	123.01	110.40
1	E	141	ASN	OD1-CG-ND2	-7.26	115.34	122.60
1	E	51	ASP	CA-CB-CG	6.93	119.53	112.60
1	E	91	VAL	N-CA-C	6.50	115.70	106.53
1	E	274	ASP	N-CA-C	6.19	118.27	108.67
1	E	267	VAL	CA-CB-CG2	6.17	120.88	110.40
1	E	257	PHE	CA-CB-CG	-6.15	107.65	113.80
1	E	139	PHE	CA-CB-CG	-6.12	107.68	113.80
1	E	40	VAL	CA-CB-CG2	6.08	120.74	110.40
1	E	275	PHE	CA-CB-CG	-6.05	107.75	113.80
1	E	149	PRO	N-CA-CB	-6.00	98.57	102.65
1	E	271	ASP	CA-CB-CG	-6.00	106.60	112.60
1	E	322	GLY	CA-C-O	-5.93	115.52	120.92
1	E	189	PHE	CA-CB-CG	-5.90	107.90	113.80
1	E	28	ASN	CA-CB-CG	-5.88	106.72	112.60
1	E	150	VAL	CA-CB-CG2	5.84	120.34	110.40
2	I	5	HIS	CB-CG-CD2	-5.66	123.84	131.20
2	I	4	PHE	CA-CB-CG	-5.65	108.15	113.80
1	E	51	ASP	CB-CA-C	-5.62	98.73	111.83
1	E	284	PHE	CA-CB-CG	-5.61	108.19	113.80
1	E	184	VAL	CA-CB-CG2	5.58	119.88	110.40
1	E	8	ASP	CA-CB-CG	5.56	118.16	112.60
1	E	132	SER	CB-CA-C	5.50	117.57	109.22
1	E	55	ILE	O-C-N	5.47	128.93	122.69
1	E	302	PHE	CA-CB-CG	-5.47	108.33	113.80
1	E	-1	THR	CA-C-O	-5.41	115.21	121.49
1	E	84	VAL	CA-CB-CG2	5.41	119.59	110.40
1	E	283	CYS	CA-C-O	-5.32	114.89	121.11
1	E	199	VAL	CA-CB-CG2	5.31	119.43	110.40
1	E	139	PHE	CA-C-N	5.29	127.64	120.44
1	E	139	PHE	C-N-CA	5.29	127.64	120.44
1	E	202	GLY	CA-C-N	5.20	128.26	120.87
1	E	202	GLY	C-N-CA	5.20	128.26	120.87
1	E	321	LEU	CA-C-N	-5.18	117.33	122.36
1	E	321	LEU	C-N-CA	-5.18	117.33	122.36
1	E	101	VAL	CA-CB-CG2	5.13	119.12	110.40
1	E	11	ASP	CA-CB-CG	5.08	117.68	112.60
1	E	31	PHE	CA-CB-CG	-5.02	108.78	113.80
1	E	142	ALA	CA-C-N	5.02	127.31	120.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	142	ALA	C-N-CA	5.02	127.31	120.54
1	E	302	PHE	CA-C-O	-5.01	115.80	121.66
1	E	140	ASP	CA-C-N	5.00	128.61	120.60
1	E	140	ASP	C-N-CA	5.00	128.61	120.60

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	I	6	STA	Peptide,Mainchain

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	E	2389	0	2280	53	5
2	I	65	0	64	6	0
3	E	321	0	0	2	21
3	I	1	0	0	0	0
All	All	2776	0	2344	55	21

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 11.

All (55) 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:E:1:SER:HB3	1:E:166:ASN:ND2	1.92	0.84
1:E:171:ASP:OD2	1:E:173:THR:HB	1.86	0.75
2:I:1:BOC:O1	2:I:1:BOC:H13	1.87	0.74
1:E:150:VAL:HG23	1:E:315:ASN:HA	1.75	0.67
3:E:517:HOH:O	2:I:3:PRO:HG2	1.95	0.66
1:E:129:ASN:ND2	1:E:131:VAL:H	1.94	0.66
1:E:1:SER:HB3	1:E:166:ASN:HD22	1.64	0.62
1:E:270:GLY:HA2	1:E:273:ILE:HD12	1.82	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:317:ALA:O	1:E:318:THR:HB	2.01	0.60
1:E:61:SER:HB3	1:E:63(A):ALA:HB2	1.83	0.59
1:E:32:ASP:OD1	1:E:217:GLY:HA3	2.02	0.59
1:E:132:SER:HB2	1:E:133:PRO:HA	1.86	0.58
1:E:36:SER:OG	1:E:124:ALA:HB3	2.04	0.58
1:E:71:TRP:HB2	1:E:130:THR:CG2	2.34	0.58
1:E:43:SER:OG	1:E:58:PRO:HD2	2.04	0.57
1:E:71:TRP:HB2	1:E:130:THR:HG22	1.87	0.56
1:E:120:LEU:HD21	2:I:6:STA:HD12	1.87	0.56
1:E:150:VAL:CG2	1:E:315:ASN:HA	2.36	0.54
1:E:273:ILE:HG22	1:E:273:ILE:O	2.08	0.54
1:E:192:TRP:CH2	1:E:194:SER:HB2	2.42	0.54
1:E:272:TYR:CD1	1:E:272:TYR:N	2.75	0.54
1:E:132:SER:CB	1:E:133:PRO:HA	2.37	0.53
1:E:272:TYR:N	1:E:272:TYR:HD1	2.06	0.53
1:E:219:THR:O	1:E:305:VAL:HG23	2.09	0.52
1:E:27:LEU:HD23	1:E:118:ASP:HB3	1.92	0.52
1:E:131:VAL:HG12	1:E:134:THR:O	2.10	0.52
1:E:143:LYS:HA	1:E:146:LEU:HD12	1.90	0.52
1:E:220:LEU:HD22	1:E:286:GLY:HA2	1.92	0.52
1:E:218:THR:HA	2:I:4:PHE:O	2.11	0.51
1:E:261:VAL:HG21	1:E:323:PHE:HB2	1.93	0.51
1:E:77:ASP:HB3	1:E:79:SER:H	1.76	0.51
1:E:294:SER:HA	1:E:297:ILE:HD12	1.93	0.51
1:E:22:THR:HA	1:E:23:PRO:C	2.36	0.49
1:E:266:ILE:HD11	1:E:323:PHE:HB3	1.94	0.49
1:E:314:PHE:CD1	1:E:314:PHE:N	2.81	0.49
1:E:143:LYS:HE3	1:E:316:GLY:O	2.12	0.48
1:E:277:PRO:HA	1:E:282(B):SER:O	2.16	0.46
1:E:1:SER:HB3	1:E:166:ASN:HD21	1.75	0.46
1:E:38:LEU:C	1:E:38:LEU:HD23	2.40	0.46
1:E:71:TRP:HZ3	1:E:73:ILE:HG22	1.81	0.45
1:E:129:ASN:HD21	1:E:131:VAL:HB	1.80	0.45
1:E:248:PHE:CZ	1:E:254:LEU:HD11	2.52	0.44
1:E:96:VAL:HG11	1:E:141:ASN:HB3	2.00	0.44
1:E:66:LEU:HB3	1:E:69:ALA:HB3	1.99	0.44
1:E:261:VAL:HG21	1:E:323:PHE:CD1	2.52	0.44
1:E:299:ILE:HG13	3:E:501:HOH:O	2.18	0.44
1:E:71:TRP:CD1	1:E:102:GLU:HB3	2.53	0.43
1:E:129:ASN:HD21	1:E:131:VAL:H	1.66	0.43
1:E:223:LEU:HD12	1:E:223:LEU:HA	1.89	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:171:ASP:C	1:E:173:THR:H	2.26	0.42
1:E:294:SER:CB	1:E:300:ASN:ND2	2.82	0.42
1:E:275:PHE:O	2:I:1:BOC:H32	2.20	0.42
1:E:71:TRP:HH2	1:E:80(A):SER:HG	1.63	0.41
1:E:76:GLY:HA3	2:I:5:HIS:CD2	2.55	0.41
1:E:268:ILE:HA	1:E:269:PRO:HD3	1.97	0.40

All (21) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:375:HOH:O	3:E:447:HOH:O[1_455]	0.15	2.05
3:E:468:HOH:O	3:E:542:HOH:O[2_655]	0.30	1.90
3:E:490:HOH:O	3:E:625:HOH:O[2_645]	0.31	1.89
3:E:415:HOH:O	3:E:526:HOH:O[2_645]	0.33	1.87
3:E:411:HOH:O	3:E:581:HOH:O[2_645]	0.59	1.61
3:E:481:HOH:O	3:E:599:HOH:O[1_455]	0.71	1.49
3:E:363:HOH:O	3:E:628:HOH:O[1_655]	0.76	1.44
3:E:562:HOH:O	3:E:608:HOH:O[2_646]	0.84	1.36
3:E:336:HOH:O	3:E:489:HOH:O[2_655]	0.95	1.25
3:E:345:HOH:O	3:E:409:HOH:O[2_655]	0.96	1.24
3:E:368:HOH:O	3:E:494:HOH:O[1_655]	1.10	1.10
3:E:330:HOH:O	3:E:365:HOH:O[1_455]	1.17	1.03
1:E:106:LYS:CD	3:E:504:HOH:O[1_655]	1.18	1.02
1:E:251:SER:OG	3:E:358:HOH:O[1_454]	1.22	0.98
3:E:527:HOH:O	3:E:643:HOH:O[1_554]	1.54	0.66
1:E:106:LYS:CG	3:E:504:HOH:O[1_655]	1.69	0.51
3:E:457:HOH:O	3:E:612:HOH:O[1_556]	1.86	0.34
3:E:359:HOH:O	3:E:615:HOH:O[1_655]	1.92	0.28
1:E:106:LYS:NZ	3:E:494:HOH:O[1_655]	2.03	0.17
1:E:106:LYS:CE	3:E:494:HOH:O[1_655]	2.03	0.17
3:E:367:HOH:O	3:E:479:HOH:O[1_655]	2.03	0.17

5.3 Torsion angles

5.3.1 Protein backbone

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	E	328/330 (99%)	313 (95%)	14 (4%)	1 (0%)	36	42
2	I	5/8 (62%)	5 (100%)	0	0	100	100
All	All	333/338 (98%)	318 (96%)	14 (4%)	1 (0%)	36	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	319	THR

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	E	263/263 (100%)	210 (80%)	53 (20%)	1	1
2	I	5/6 (83%)	5 (100%)	0	100	100
All	All	268/269 (100%)	215 (80%)	53 (20%)	1	1

All (53) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	-2	SER
1	E	1	SER
1	E	10	LEU
1	E	48	SER
1	E	50	VAL
1	E	64	LYS
1	E	65	LEU
1	E	66	LEU
1	E	70	THR
1	E	74	SER
1	E	77	ASP
1	E	79	SER

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Mol	Chain	Res	Type
1	E	80	SER
1	E	80(A)	SER
1	E	90	SER
1	E	103	SER
1	E	105	LYS
1	E	106	LYS
1	E	107	VAL
1	E	108	SER
1	E	109	SER
1	E	110	SER
1	E	113	GLU
1	E	114	ASP
1	E	121	LEU
1	E	130	THR
1	E	132	SER
1	E	143	LYS
1	E	150	VAL
1	E	170	ILE
1	E	173	THR
1	E	176	THR
1	E	203	THR
1	E	203(A)	PHE
1	E	223	LEU
1	E	236	SER
1	E	239	SER
1	E	240	SER
1	E	241	SER
1	E	243	VAL
1	E	253	THR
1	E	261	VAL
1	E	266	ILE
1	E	268	ILE
1	E	272	TYR
1	E	278	ILE
1	E	279	SER
1	E	283	CYS
1	E	294	SER
1	E	299	ILE
1	E	308	LYS
1	E	318	THR
1	E	321	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such

sidechains are listed below:

Mol	Chain	Res	Type
1	E	99	GLN
1	E	129	ASN
1	E	141	ASN
1	E	166	ASN
1	E	300	ASN
2	I	5	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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
2	STA	I	6	2	10,10,11	1.15	1 (10%)	9,12,14	1.11	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
2	STA	I	6	2	-	4/11/11/12	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	6	STA	CB-CA	-2.91	1.48	1.53

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	I	6	STA	N-CA-CB-CG
2	I	6	STA	O-C-CM-CH
2	I	6	STA	CA-CH-CM-C
2	I	6	STA	OH-CH-CM-C

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	I	6	STA	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

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.