



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 15, 2026 – 10:08 AM EST

PDB ID : 9PR8 / pdb\_00009pr8  
Title : Crystal Structure of the Clostridioides difficile CspC-CspA heterodimer.  
Authors : Heldwein, E.E.; Gonzalez-Del Pino, G.L.  
Deposited on : 2025-07-23  
Resolution : 3.35 Å(reported)

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

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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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) : 2.0  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.47

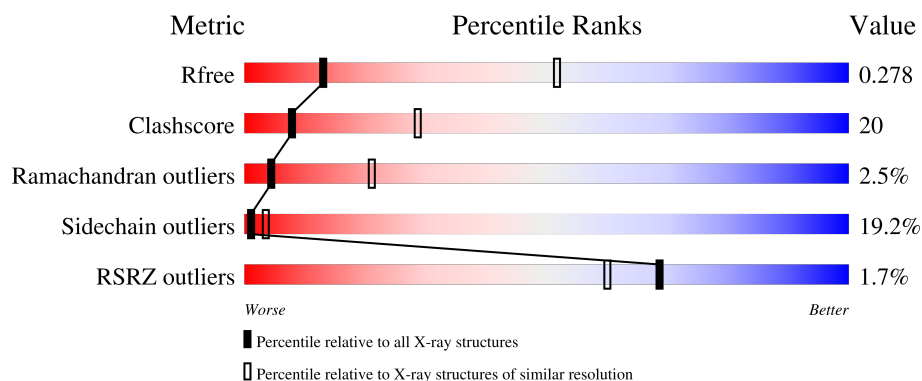
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.35 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))
$R_{free}$	164625	1012 (3.40-3.32)
Clashscore	180529	1035 (3.40-3.32)
Ramachandran outliers	177936	1037 (3.40-3.32)
Sidechain outliers	177891	1037 (3.40-3.32)
RSRZ outliers	164620	1012 (3.40-3.32)

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  $\geq 3$ , 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	551	<div> <div>0.278</div> <div> <div></div> <div>48%</div> <div>38%</div> <div>10%</div> <div>.</div> </div> </div>
1	B	551	<div> <div>3%</div> <div> <div></div> <div>49%</div> <div>41%</div> <div>7%</div> <div>.</div> </div> </div>
2	C	565	<div> <div>0.278</div> <div> <div></div> <div>52%</div> <div>39%</div> <div>7%</div> <div>..</div> </div> </div>
2	D	565	<div> <div>0.278</div> <div> <div></div> <div>54%</div> <div>37%</div> <div>6%</div> <div>.</div> </div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 15999 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 Germination-specific protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	528	Total	C	N	O	S	0	0	0
			3886	2465	634	777	10			
1	B	530	Total	C	N	O	S	0	0	0
			3838	2446	622	760	10			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP A0A9R0BLF4
A	363	GLU	PHE	conflict	UNP A0A9R0BLF4
A	511	GLU	TYR	conflict	UNP A0A9R0BLF4
B	1	MET	-	initiating methionine	UNP A0A9R0BLF4
B	363	GLU	PHE	conflict	UNP A0A9R0BLF4
B	511	GLU	TYR	conflict	UNP A0A9R0BLF4

- Molecule 2 is a protein called Germination-specific protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	556	Total	C	N	O	S	0	0	0
			4171	2652	680	832	7			
2	D	551	Total	C	N	O	S	0	0	0
			4102	2601	664	830	7			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	558	LEU	-	expression tag	UNP A0A9R0BLE1
C	559	GLU	-	expression tag	UNP A0A9R0BLE1
C	560	HIS	-	expression tag	UNP A0A9R0BLE1
C	561	HIS	-	expression tag	UNP A0A9R0BLE1
C	562	HIS	-	expression tag	UNP A0A9R0BLE1
C	563	HIS	-	expression tag	UNP A0A9R0BLE1

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Chain	Residue	Modelled	Actual	Comment	Reference
C	564	HIS	-	expression tag	UNP A0A9R0BLE1
C	565	HIS	-	expression tag	UNP A0A9R0BLE1
D	558	LEU	-	expression tag	UNP A0A9R0BLE1
D	559	GLU	-	expression tag	UNP A0A9R0BLE1
D	560	HIS	-	expression tag	UNP A0A9R0BLE1
D	561	HIS	-	expression tag	UNP A0A9R0BLE1
D	562	HIS	-	expression tag	UNP A0A9R0BLE1
D	563	HIS	-	expression tag	UNP A0A9R0BLE1
D	564	HIS	-	expression tag	UNP A0A9R0BLE1
D	565	HIS	-	expression tag	UNP A0A9R0BLE1

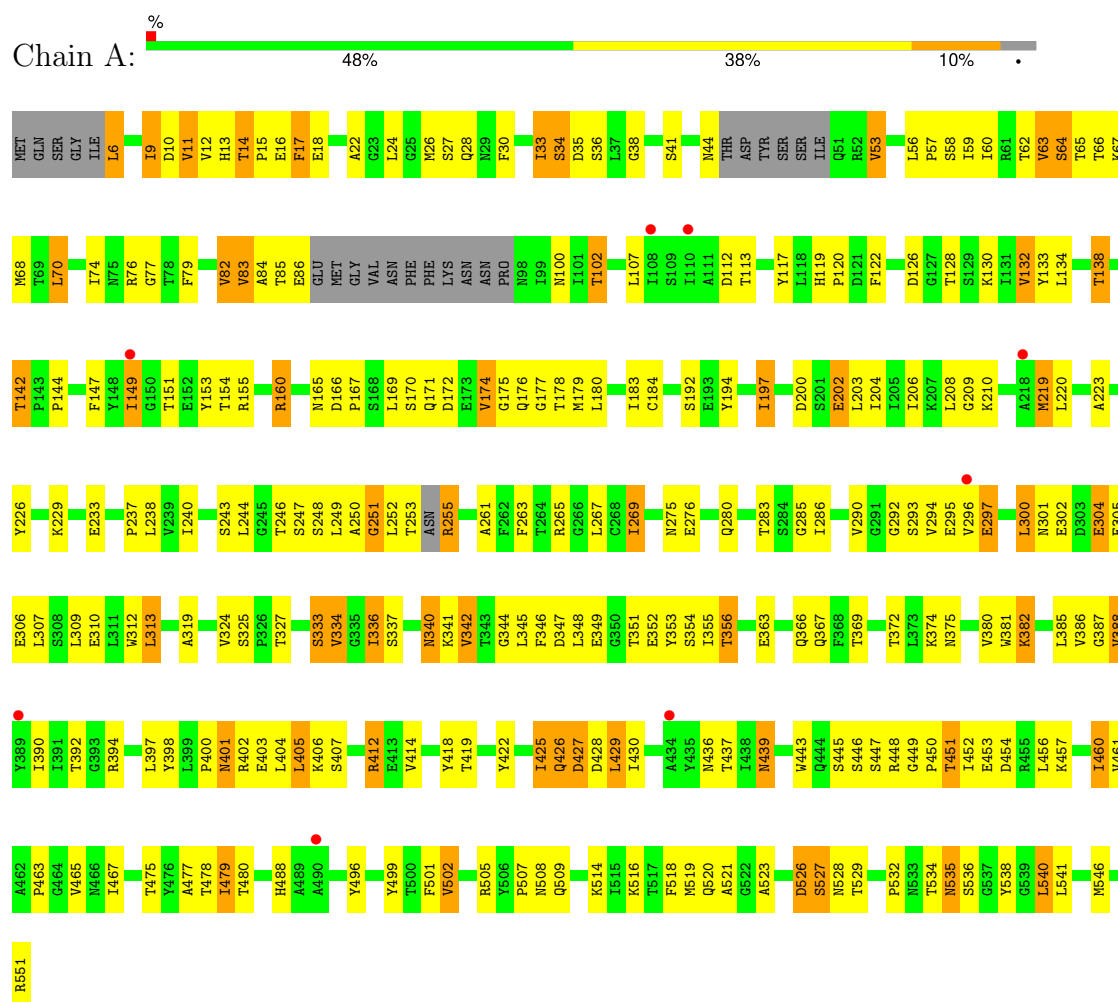
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	2	Total O 2 2	0	0

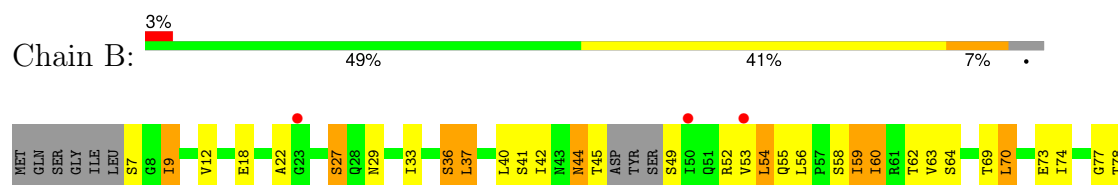
### 3 Residue-property plots

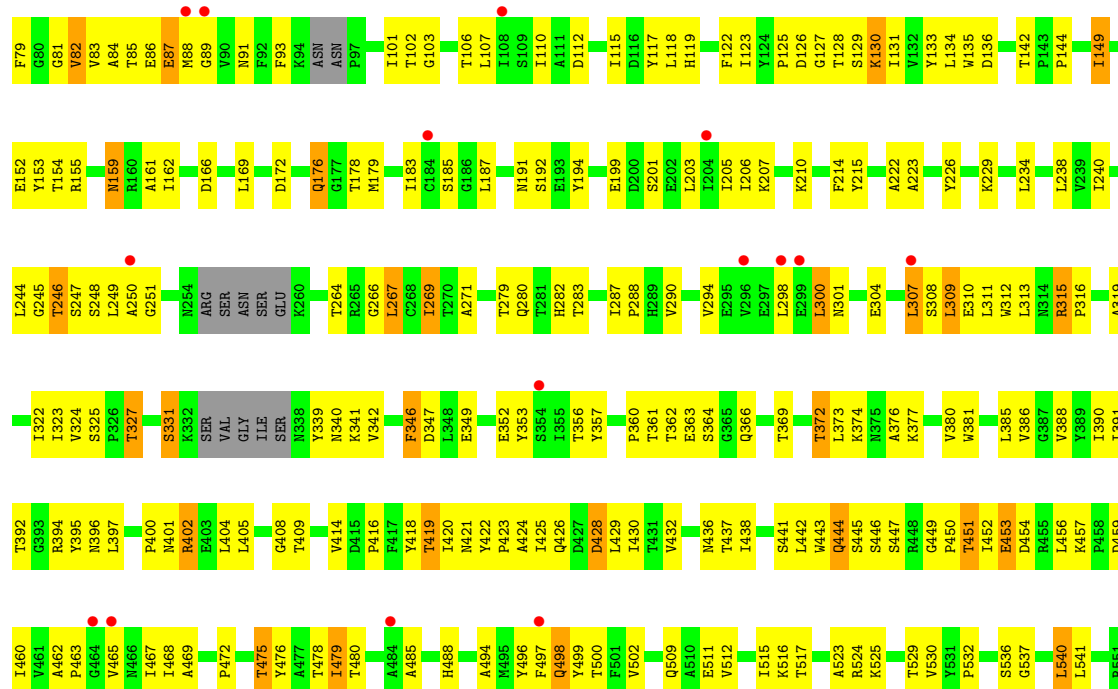
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). 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.

#### • Molecule 1: Germination-specific protease

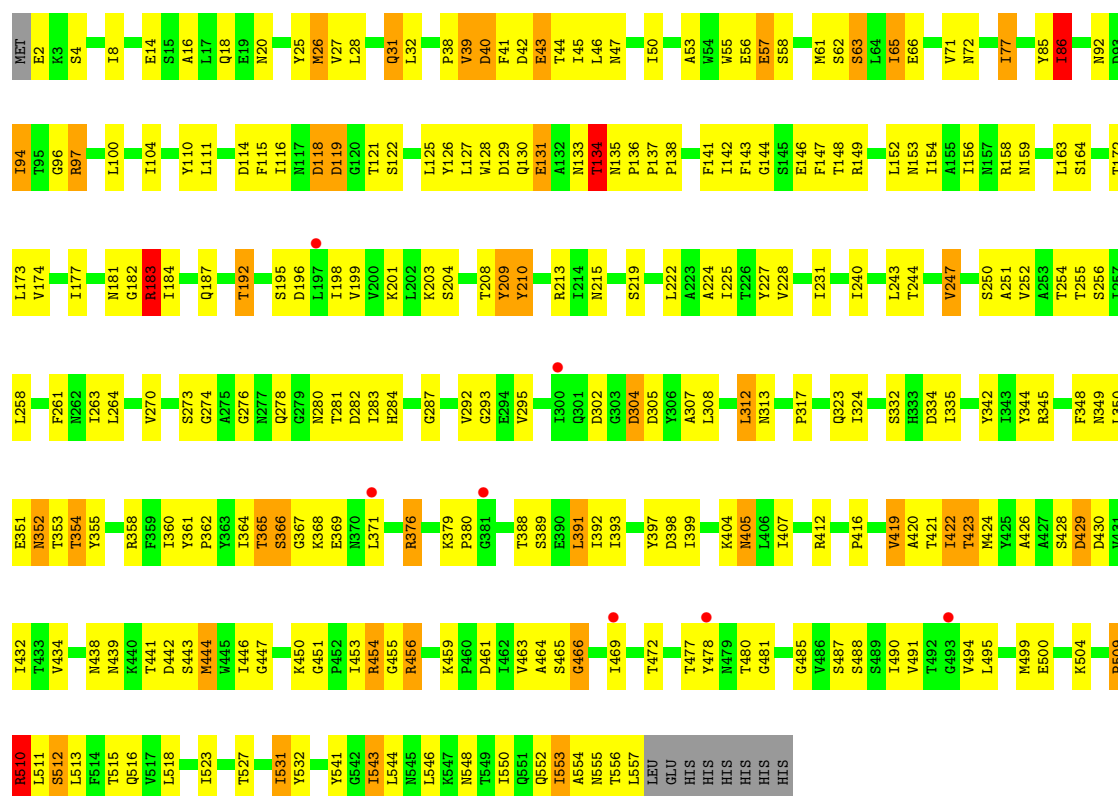


#### • Molecule 1: Germination-specific protease

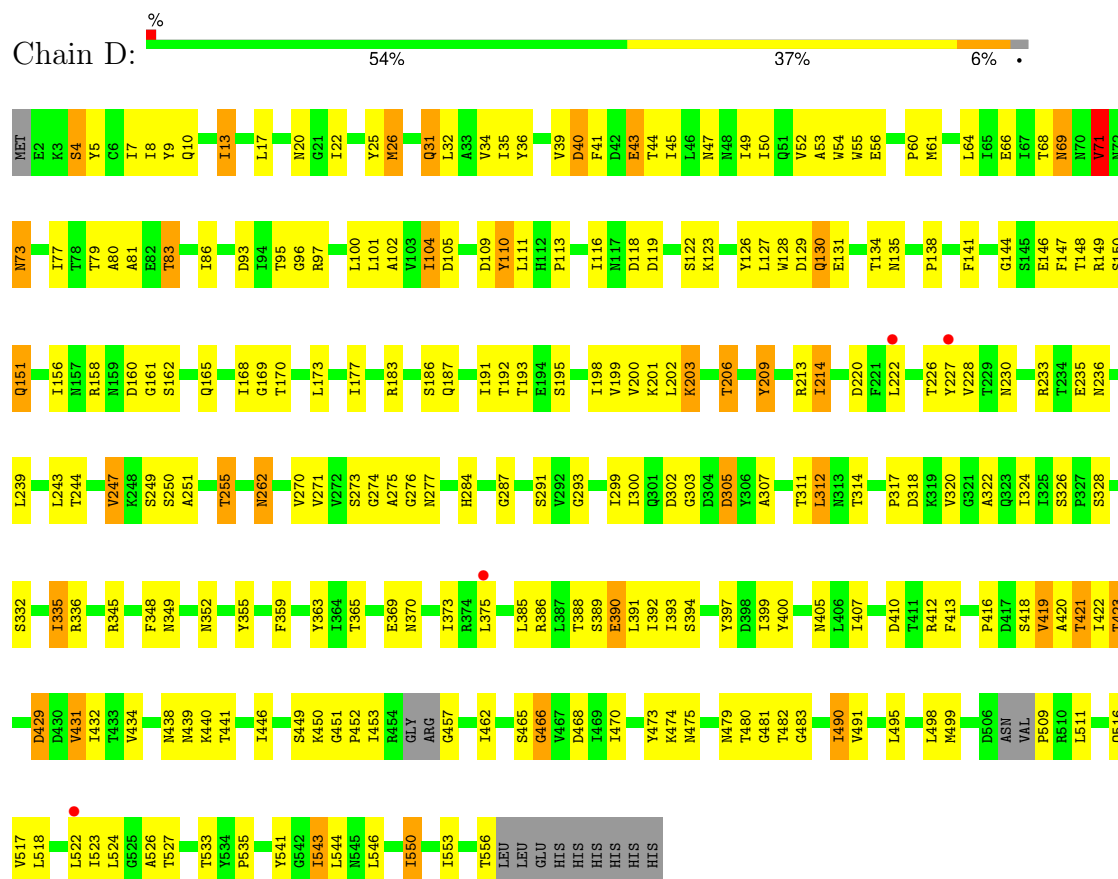




• Molecule 2: Germination-specific protease



• Molecule 2: Germination-specific protease



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	71.14Å 105.50Å 311.32Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	99.92 – 3.35 99.92 – 3.35	Depositor EDS
% Data completeness (in resolution range)	99.7 (99.92-3.35) 99.7 (99.92-3.35)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.24 (at 3.33Å)	Xtriage
Refinement program	PHENIX 1.21.2_5419	Depositor
R, $R_{free}$	0.246 , 0.278 0.246 , 0.278	Depositor DCC
$R_{free}$ test set	1735 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	86.2	Xtriage
Anisotropy	0.485	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 34.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.41$ , $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	15999	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	81.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.07% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.59	0/3960	0.86	0/5407
1	B	0.50	0/3915	0.78	0/5355
2	C	0.56	0/4247	0.80	0/5810
2	D	0.51	0/4172	0.76	0/5711
All	All	0.54	0/16294	0.80	0/22283

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	3886	0	3672	168	0
1	B	3838	0	3574	156	0
2	C	4171	0	4043	163	0
2	D	4102	0	3939	141	0
3	A	2	0	0	0	0
All	All	15999	0	15228	610	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 20.

The worst 5 of 610 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:246:THR:HG22	1:A:248:SER:H	1.28	0.97
2:C:420:ALA:H	2:C:451:GLY:HA3	1.36	0.90
2:D:420:ALA:H	2:D:451:GLY:HA3	1.36	0.89
1:A:9:ILE:HD11	1:A:62:THR:HB	1.57	0.87
2:D:138:PRO:HG3	2:D:146:GLU:HB2	1.57	0.86

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	520/551 (94%)	409 (79%)	98 (19%)	13 (2%)	4	21
1	B	520/551 (94%)	411 (79%)	98 (19%)	11 (2%)	5	24
2	C	554/565 (98%)	469 (85%)	64 (12%)	21 (4%)	2	15
2	D	545/565 (96%)	478 (88%)	59 (11%)	8 (2%)	8	29
All	All	2139/2232 (96%)	1767 (83%)	319 (15%)	53 (2%)	4	21

5 of 53 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	17	PHE
1	A	305	GLU
1	B	444	GLN
2	C	39	VAL
2	C	40	ASP

### 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	398/460 (86%)	303 (76%)	95 (24%)	0	1
1	B	383/460 (83%)	302 (79%)	81 (21%)	1	2
2	C	448/491 (91%)	380 (85%)	68 (15%)	2	9
2	D	439/491 (89%)	363 (83%)	76 (17%)	1	6
All	All	1668/1902 (88%)	1348 (81%)	320 (19%)	1	3

5 of 320 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	446	ILE
2	D	305	ASP
2	C	512	SER
2	D	83	THR
2	D	419	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
2	C	545	ASN
2	D	439	ASN
1	B	301	ASN
1	B	421	ASN
1	B	498	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates ⓘ

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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	528/551 (95%)	-0.12	8 (1%) 71 64	62, 72, 88, 98	0
1	B	530/551 (96%)	0.03	18 (3%) 48 41	77, 93, 108, 118	0
2	C	556/565 (98%)	-0.13	7 (1%) 74 67	63, 76, 92, 102	0
2	D	551/565 (97%)	-0.15	4 (0%) 84 78	65, 81, 98, 105	0
All	All	2165/2232 (96%)	-0.09	37 (1%) 69 60	62, 80, 101, 118	0

The worst 5 of 37 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	197	LEU	3.9
1	B	298	LEU	3.7
2	C	478	TYR	3.7
2	D	227	TYR	3.6
1	A	434	ALA	3.5

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

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

### 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.