



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 29, 2021 – 03:13 pm BST

PDB ID : 7A9V  
Title : Crystal structure of human phosphodiesterase 4D2 catalytic domain with inhibitor NPD-635  
Authors : Singh, A.K.; Blaazer, A.R.; Zara, L.; de Esch, I.J.P.; Leurs, R.; Brown, D.G.  
Deposited on : 2020-09-02  
Resolution : 2.17 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](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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.23.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0267  
CCP4 : 7.1.010 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

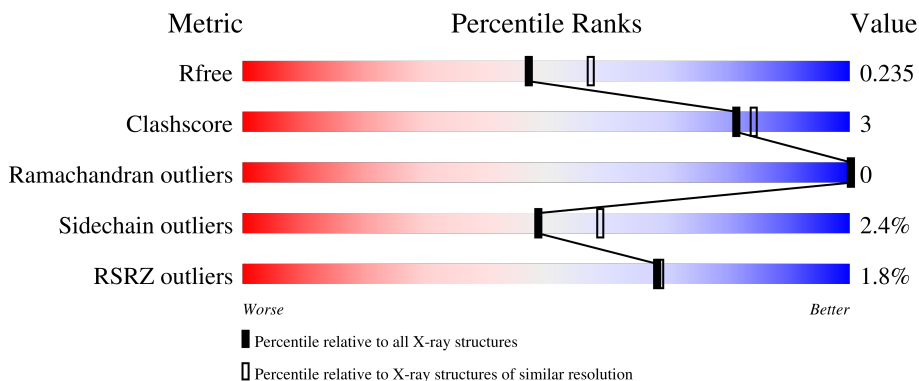
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.17 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))
$R_{free}$	130704	6864 (2.20-2.16)
Clashscore	141614	7689 (2.20-2.16)
Ramachandran outliers	138981	7564 (2.20-2.16)
Sidechain outliers	138945	7564 (2.20-2.16)
RSRZ outliers	127900	6738 (2.20-2.16)

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	364	 2% 83% 7% 10%
1	B	364	 2% 82% 6% 11%
1	C	364	 2% 82% 7% 11%
1	D	364	 2% 82% 7% 11%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	R5Z	B	508	X	-	-	-
6	R5Z	C	509	X	-	-	-
6	R5Z	D	513	X	-	-	-

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 11373 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 cAMP-specific 3',5'-cyclic phosphodiesterase 4D.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	329	Total 2658	C 1681	N 454	O 509	S 14	0	0	0
1	B	324	Total 2622	C 1659	N 448	O 501	S 14	0	0	0
1	C	325	Total 2631	C 1664	N 449	O 504	S 14	0	0	0
1	D	325	Total 2631	C 1664	N 450	O 503	S 14	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	75	GLY	-	expression tag	UNP Q08499
A	76	SER	-	expression tag	UNP Q08499
A	77	HIS	-	expression tag	UNP Q08499
A	78	MET	-	expression tag	UNP Q08499
B	75	GLY	-	expression tag	UNP Q08499
B	76	SER	-	expression tag	UNP Q08499
B	77	HIS	-	expression tag	UNP Q08499
B	78	MET	-	expression tag	UNP Q08499
C	75	GLY	-	expression tag	UNP Q08499
C	76	SER	-	expression tag	UNP Q08499
C	77	HIS	-	expression tag	UNP Q08499
C	78	MET	-	expression tag	UNP Q08499
D	75	GLY	-	expression tag	UNP Q08499
D	76	SER	-	expression tag	UNP Q08499
D	77	HIS	-	expression tag	UNP Q08499
D	78	MET	-	expression tag	UNP Q08499

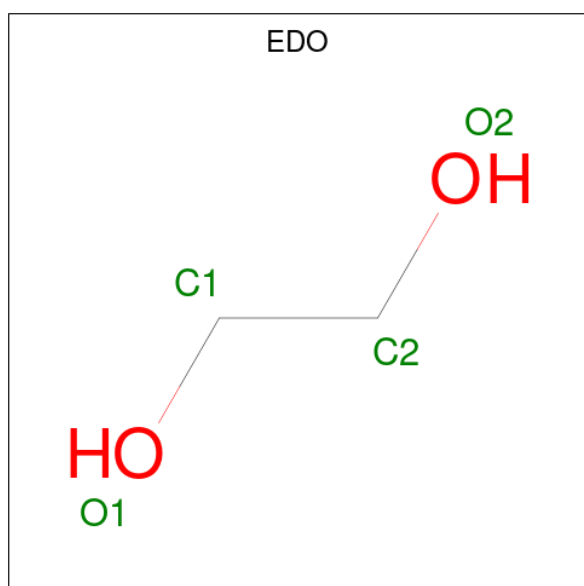
- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		
2	B	1	Total	Zn	0	0
			1	1		
2	C	1	Total	Zn	0	0
			1	1		
2	D	1	Total	Zn	0	0
			1	1		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	1		
3	B	1	Total	Mg	0	0
			1	1		
3	C	1	Total	Mg	0	0
			1	1		
3	D	1	Total	Mg	0	0
			1	1		

- Molecule 4 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			4	2	2		
4	A	1	Total	C	O	0	0
			4	2	2		

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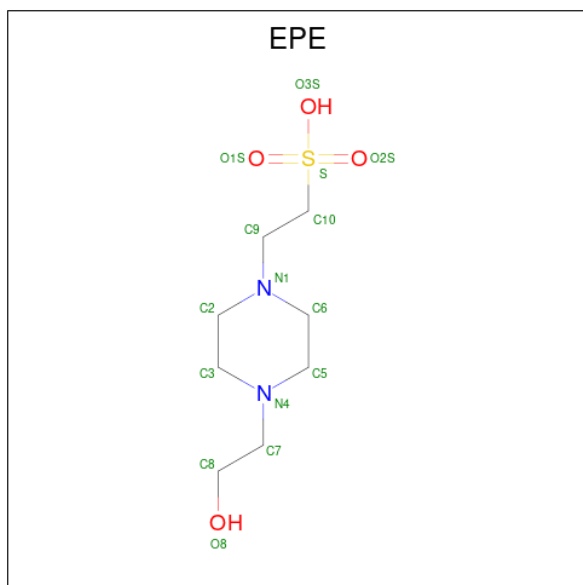
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	D	1	Total C O 4 2 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		

- Molecule 5 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: C<sub>8</sub>H<sub>18</sub>N<sub>2</sub>O<sub>4</sub>S).



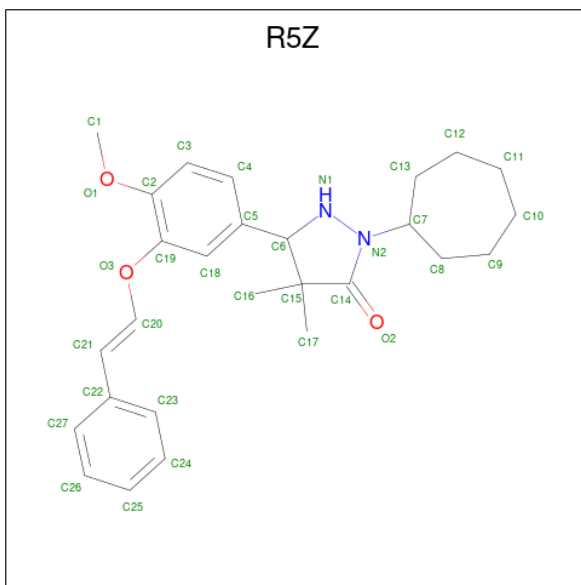
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	C	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
5	D	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

- Molecule 6 is 1-cycloheptyl-3-[4-methoxy-3-(2-phenylethoxy)phenyl]-4,4-dimethyl-4,5-dihydro-1H-pyrazol-5-one (three-letter code: R5Z) (formula:  $C_{27}H_{34}N_2O_3$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	B	1	Total	C	N	O	0	0
			32	27	2	3		
6	C	1	Total	C	N	O	0	0
			32	27	2	3		
6	D	1	Total	C	N	O	0	0
			32	27	2	3		

- Molecule 7 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula:  $C_4H_{10}O_3$ ).





Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	D	1	Total C O 7 4 3	0	0
7	D	1	Total C O 7 4 3	0	0

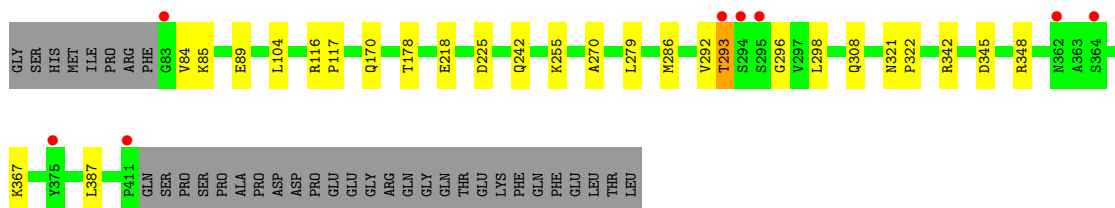
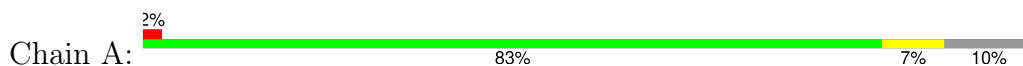
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	145	Total O 145 145	0	0
8	B	111	Total O 111 111	0	0
8	C	108	Total O 108 108	0	0
8	D	172	Total O 172 172	0	0

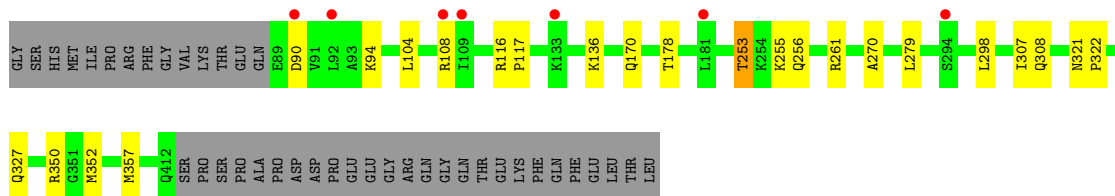
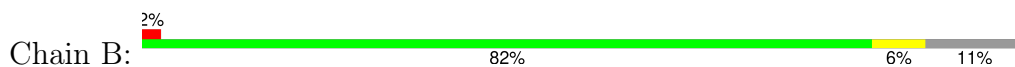
### 3 Residue-property plots [i](#)

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.

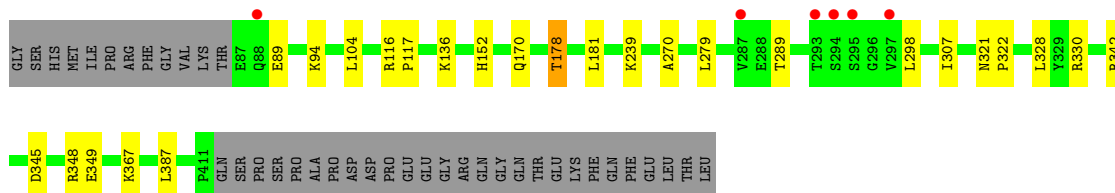
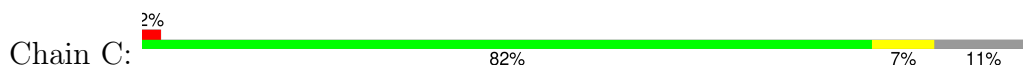
- Molecule 1: cAMP-specific 3',5'-cyclic phosphodiesterase 4D



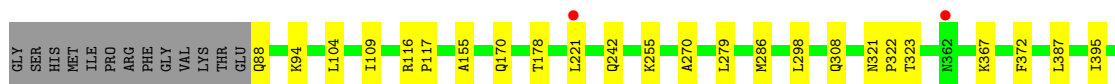
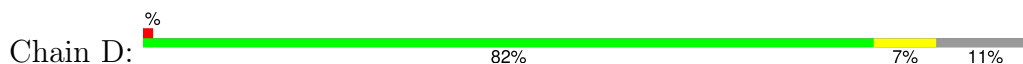
- Molecule 1: cAMP-specific 3',5'-cyclic phosphodiesterase 4D



- Molecule 1: cAMP-specific 3',5'-cyclic phosphodiesterase 4D



- Molecule 1: cAMP-specific 3',5'-cyclic phosphodiesterase 4D



0412  
SER  
PRO  
SER  
PRO  
ALA  
PRO  
ASP  
ASP  
PRO  
GLU  
GLU  
GLY  
ARG  
GLN  
GLY  
GLN  
THR  
GLU  
LYS  
PHE  
GLN  
PHE  
GLU  
LEU  
THR  
LEU

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	99.20Å 111.16Å 159.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.29 – 2.17 91.23 – 2.17	Depositor EDS
% Data completeness (in resolution range)	100.0 (91.29-2.17) 100.0 (91.23-2.17)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.18 (at 2.16Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, $R_{free}$	0.189 , 0.229 0.195 , 0.235	Depositor DCC
$R_{free}$ test set	4819 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	40.8	Xtriage
Anisotropy	0.110	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	(Not available) , (Not available)	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	11373	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.04% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG, EPE, R5Z, PEG, ZN, EDO

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	0.69	0/2712	0.73	0/3684
1	B	0.68	0/2676	0.73	0/3636
1	C	0.68	0/2685	0.72	1/3648 (0.0%)
1	D	0.70	0/2685	0.74	0/3648
All	All	0.69	0/10758	0.73	1/14616 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	349	GLU	CB-CA-C	-6.12	98.17	110.40

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	2658	0	2616	18	0
1	B	2622	0	2578	11	0
1	C	2631	0	2584	13	0
1	D	2631	0	2586	15	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	36	0	54	3	0
4	B	24	0	36	2	0
4	C	28	0	42	1	0
4	D	44	0	66	0	0
5	A	15	0	18	0	0
5	C	15	0	18	1	0
5	D	15	0	17	0	0
6	B	32	0	0	1	0
6	C	32	0	0	1	0
6	D	32	0	0	2	0
7	D	14	0	20	2	0
8	A	145	0	0	3	0
8	B	111	0	0	1	0
8	C	108	0	0	0	0
8	D	172	0	0	0	0
All	All	11373	0	10635	56	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 3.

All (56) 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:286:MET:HE3	8:A:616:HOH:O	1.75	0.86
1:A:218:GLU:OE1	4:A:506:EDO:H11	1.85	0.76
1:A:218:GLU:OE1	4:A:506:EDO:C1	2.36	0.74
1:D:412:GLN:H	1:D:412:GLN:CD	1.93	0.72
1:C:345:ASP:OD1	1:C:348:ARG:NH2	2.30	0.64
1:A:321:ASN:HB2	1:A:322:PRO:HD3	1.80	0.63
1:A:85:LYS:HB2	1:A:89:GLU:HB3	1.87	0.56
1:A:242:GLN:OE1	1:D:242:GLN:OE1	2.25	0.54
1:A:292:VAL:HG12	1:A:293:THR:O	2.09	0.53
1:D:155:ALA:HB2	7:D:515:PEG:H32	1.91	0.52
1:B:357:MET:SD	6:B:508:R5Z:C21	2.98	0.52
1:D:372:PHE:HB2	6:D:513:R5Z:C22	2.40	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:298:LEU:HD11	1:A:387:LEU:HG	1.94	0.50
1:D:286:MET:CE	1:D:308:GLN:OE1	2.60	0.50
1:C:270:ALA:HB1	1:C:279:LEU:HD11	1.93	0.49
1:A:345:ASP:OD1	1:A:348:ARG:NH2	2.46	0.49
1:B:270:ALA:HB1	1:B:279:LEU:HD11	1.95	0.49
1:D:395:ILE:HG13	7:D:514:PEG:H32	1.95	0.49
1:C:289:THR:O	1:C:289:THR:HG22	2.13	0.48
1:A:218:GLU:OE1	4:A:506:EDO:H12	2.10	0.48
1:A:270:ALA:HB1	1:A:279:LEU:HD11	1.96	0.48
1:C:116:ARG:N	1:C:117:PRO:CD	2.78	0.47
1:A:116:ARG:N	1:A:117:PRO:CD	2.78	0.47
1:C:321:ASN:HB2	1:C:322:PRO:HD3	1.96	0.47
1:B:104:LEU:HD22	1:B:170:GLN:HG3	1.96	0.47
1:D:270:ALA:HB1	1:D:279:LEU:HD11	1.97	0.47
1:B:352:MET:HE2	4:B:505:EDO:H21	1.95	0.47
1:D:104:LEU:HD22	1:D:170:GLN:HG3	1.97	0.47
1:C:330:ARG:HH11	1:C:330:ARG:HG2	1.80	0.47
1:D:116:ARG:N	1:D:117:PRO:CD	2.79	0.46
1:B:116:ARG:N	1:B:117:PRO:CD	2.79	0.46
1:C:104:LEU:HD22	1:C:170:GLN:HG3	1.97	0.46
1:D:298:LEU:HD11	1:D:387:LEU:HG	1.98	0.46
1:A:286:MET:CE	8:A:616:HOH:O	2.47	0.46
1:A:292:VAL:CG1	1:A:296:GLY:HA2	2.46	0.46
1:C:328:LEU:HD23	5:C:511:EPE:O2S	2.16	0.45
1:C:298:LEU:HD11	1:C:387:LEU:HG	1.99	0.45
1:C:152:HIS:HE1	4:C:506:EDO:C1	2.30	0.45
1:A:225:ASP:CG	1:B:261:ARG:HH12	2.19	0.45
1:A:308:GLN:HB3	8:A:616:HOH:O	2.17	0.45
6:C:509:R5Z:C21	6:C:509:R5Z:C18	2.96	0.44
1:D:321:ASN:HB2	1:D:322:PRO:HD3	1.98	0.43
1:D:372:PHE:HB2	6:D:513:R5Z:C21	2.47	0.43
1:B:321:ASN:HB2	1:B:322:PRO:HD3	2.00	0.43
1:C:178:THR:HG22	1:C:181:LEU:HD12	2.00	0.43
1:D:323:THR:HB	1:D:395:ILE:HG23	2.00	0.42
1:B:253:THR:HG23	1:B:256:GLN:HG3	2.01	0.42
1:B:350:ARG:HB3	8:B:614:HOH:O	2.18	0.42
1:C:330:ARG:HG2	1:C:330:ARG:NH1	2.35	0.41
1:A:104:LEU:HD22	1:A:170:GLN:HG3	2.01	0.41
1:B:307:ILE:HD12	1:B:307:ILE:HA	1.94	0.41
1:B:352:MET:HE1	4:B:505:EDO:C1	2.51	0.41
1:D:279:LEU:HD23	1:D:279:LEU:HA	1.97	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:84:VAL:HG22	1:A:85:LYS:H	1.86	0.40
1:C:307:ILE:HD12	1:C:307:ILE:HA	1.97	0.40
1:D:104:LEU:HD11	1:D:109:ILE:HD11	2.03	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	327/364 (90%)	321 (98%)	6 (2%)	0	100	100
1	B	322/364 (88%)	317 (98%)	5 (2%)	0	100	100
1	C	323/364 (89%)	318 (98%)	5 (2%)	0	100	100
1	D	323/364 (89%)	317 (98%)	6 (2%)	0	100	100
All	All	1295/1456 (89%)	1273 (98%)	22 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	300/331 (91%)	295 (98%)	5 (2%)	60	72
1	B	296/331 (89%)	286 (97%)	10 (3%)	37	44

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	297/331 (90%)	290 (98%)	7 (2%)	49	59
1	D	297/331 (90%)	290 (98%)	7 (2%)	49	59
All	All	1190/1324 (90%)	1161 (98%)	29 (2%)	49	59

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	178	THR
1	A	255	LYS
1	A	293	THR
1	A	342	ARG
1	A	367	LYS
1	B	90	ASP
1	B	94	LYS
1	B	108	ARG
1	B	136	LYS
1	B	178	THR
1	B	253	THR
1	B	255	LYS
1	B	298	LEU
1	B	308	GLN
1	B	327	GLN
1	C	89	GLU
1	C	94	LYS
1	C	136	LYS
1	C	178	THR
1	C	239	LYS
1	C	342	ARG
1	C	367	LYS
1	D	88	GLN
1	D	94	LYS
1	D	178	THR
1	D	221	LEU
1	D	255	LYS
1	D	367	LYS
1	D	412	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	308	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 monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

Of 49 ligands modelled in this entry, 8 are monoatomic - leaving 41 for Mogul analysis.

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	$\# Z  > 2$
4	EDO	D	511	-	3,3,3	0.27	0	2,2,2	0.13	0
4	EDO	A	510	-	3,3,3	0.18	0	2,2,2	0.26	0
4	EDO	B	506	-	3,3,3	0.18	0	2,2,2	0.34	0
4	EDO	A	512	-	3,3,3	0.11	0	2,2,2	0.29	0
4	EDO	B	509	-	3,3,3	0.36	0	2,2,2	0.67	0
4	EDO	D	507	-	3,3,3	0.14	0	2,2,2	0.39	0
5	EPE	A	511	-	15,15,15	1.63	1 (6%)	18,20,20	1.45	2 (11%)
4	EDO	C	503	-	3,3,3	0.12	0	2,2,2	0.07	0
6	R5Z	D	513	-	32,35,35	1.63	6 (18%)	36,49,49	1.57	1 (2%)
4	EDO	B	504	-	3,3,3	0.11	0	2,2,2	0.22	0
5	EPE	D	517	-	15,15,15	1.73	1 (6%)	18,20,20	1.93	3 (16%)
4	EDO	C	505	-	3,3,3	0.13	0	2,2,2	0.21	0
4	EDO	D	504	-	3,3,3	0.18	0	2,2,2	0.50	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	EDO	C	510	-	3,3,3	0.21	0	2,2,2	0.24	0
4	EDO	A	504	-	3,3,3	0.31	0	2,2,2	0.40	0
4	EDO	D	509	-	3,3,3	0.12	0	2,2,2	0.33	0
4	EDO	A	508	-	3,3,3	0.47	0	2,2,2	0.52	0
4	EDO	C	507	-	3,3,3	0.30	0	2,2,2	0.34	0
4	EDO	B	507	-	3,3,3	0.15	0	2,2,2	0.40	0
4	EDO	D	505	-	3,3,3	0.20	0	2,2,2	0.27	0
5	EPE	C	511	-	15,15,15	1.77	1 (6%)	18,20,20	2.31	4 (22%)
4	EDO	D	510	-	3,3,3	0.07	0	2,2,2	0.15	0
4	EDO	D	503	-	3,3,3	0.14	0	2,2,2	0.18	0
6	R5Z	C	509	-	32,35,35	1.63	5 (15%)	36,49,49	1.62	2 (5%)
4	EDO	A	506	-	3,3,3	0.20	0	2,2,2	0.27	0
4	EDO	C	506	-	3,3,3	0.33	0	2,2,2	0.49	0
7	PEG	D	515	-	6,6,6	0.32	0	5,5,5	0.21	0
6	R5Z	B	508	-	32,35,35	1.64	6 (18%)	36,49,49	1.84	5 (13%)
4	EDO	A	507	-	3,3,3	0.20	0	2,2,2	0.48	0
4	EDO	B	505	-	3,3,3	0.46	0	2,2,2	1.00	0
4	EDO	C	508	-	3,3,3	0.16	0	2,2,2	0.05	0
7	PEG	D	514	-	6,6,6	0.72	0	5,5,5	0.44	0
4	EDO	B	503	-	3,3,3	0.19	0	2,2,2	0.12	0
4	EDO	D	516	-	3,3,3	0.45	0	2,2,2	0.75	0
4	EDO	C	504	-	3,3,3	0.25	0	2,2,2	0.61	0
4	EDO	D	508	-	3,3,3	0.25	0	2,2,2	0.45	0
4	EDO	A	505	-	3,3,3	0.53	0	2,2,2	0.58	0
4	EDO	A	509	-	3,3,3	0.22	0	2,2,2	0.43	0
4	EDO	A	503	-	3,3,3	0.09	0	2,2,2	0.22	0
4	EDO	D	506	-	3,3,3	0.16	0	2,2,2	0.04	0
4	EDO	D	512	-	3,3,3	0.75	0	2,2,2	0.73	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
4	EDO	D	511	-	-	1/1/1/1	-
4	EDO	A	510	-	-	0/1/1/1	-
4	EDO	B	506	-	-	0/1/1/1	-
4	EDO	A	512	-	-	1/1/1/1	-
4	EDO	B	509	-	-	1/1/1/1	-
4	EDO	D	507	-	-	0/1/1/1	-
5	EPE	A	511	-	-	6/9/19/19	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	R5Z	D	513	-	1/1/5/8	5/12/45/45	0/4/4/4
4	EDO	C	503	-	-	0/1/1/1	-
4	EDO	B	504	-	-	1/1/1/1	-
5	EPE	D	517	-	-	3/9/19/19	0/1/1/1
4	EDO	C	505	-	-	1/1/1/1	-
4	EDO	D	504	-	-	0/1/1/1	-
4	EDO	C	510	-	-	0/1/1/1	-
4	EDO	A	504	-	-	0/1/1/1	-
4	EDO	D	509	-	-	1/1/1/1	-
4	EDO	A	508	-	-	1/1/1/1	-
6	R5Z	C	509	-	1/1/5/8	6/12/45/45	0/4/4/4
4	EDO	B	507	-	-	1/1/1/1	-
4	EDO	C	507	-	-	1/1/1/1	-
4	EDO	D	505	-	-	1/1/1/1	-
4	EDO	D	510	-	-	1/1/1/1	-
4	EDO	D	503	-	-	0/1/1/1	-
5	EPE	C	511	-	-	2/9/19/19	0/1/1/1
4	EDO	A	506	-	-	1/1/1/1	-
4	EDO	C	506	-	-	1/1/1/1	-
7	PEG	D	515	-	-	3/4/4/4	-
6	R5Z	B	508	-	1/1/5/8	7/12/45/45	0/4/4/4
4	EDO	A	507	-	-	0/1/1/1	-
4	EDO	B	505	-	-	1/1/1/1	-
4	EDO	C	508	-	-	0/1/1/1	-
7	PEG	D	514	-	-	2/4/4/4	-
4	EDO	B	503	-	-	0/1/1/1	-
4	EDO	D	516	-	-	1/1/1/1	-
4	EDO	C	504	-	-	0/1/1/1	-
4	EDO	D	508	-	-	0/1/1/1	-
4	EDO	A	505	-	-	1/1/1/1	-
4	EDO	A	509	-	-	1/1/1/1	-
4	EDO	A	503	-	-	1/1/1/1	-
4	EDO	D	506	-	-	1/1/1/1	-
4	EDO	D	512	-	-	0/1/1/1	-

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	C	511	EPE	C10-S	-6.21	1.68	1.77
5	A	511	EPE	C10-S	-5.92	1.69	1.77
5	D	517	EPE	C10-S	-5.72	1.69	1.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	509	R5Z	C21-C20	5.66	1.52	1.32
6	B	508	R5Z	C21-C20	5.59	1.52	1.32
6	D	513	R5Z	C21-C20	5.47	1.52	1.32
6	C	509	R5Z	O3-C20	4.62	1.49	1.38
6	D	513	R5Z	O3-C20	4.58	1.49	1.38
6	B	508	R5Z	O3-C20	4.10	1.48	1.38
6	B	508	R5Z	C5-C6	-4.08	1.47	1.52
6	C	509	R5Z	C5-C6	-3.95	1.47	1.52
6	D	513	R5Z	C5-C6	-3.74	1.47	1.52
6	B	508	R5Z	C15-C6	-2.52	1.52	1.57
6	D	513	R5Z	C7-N2	2.38	1.50	1.48
6	D	513	R5Z	C15-C6	-2.38	1.52	1.57
6	B	508	R5Z	C22-C21	2.34	1.54	1.47
6	C	509	R5Z	C15-C6	-2.32	1.52	1.57
6	B	508	R5Z	C7-N2	2.24	1.50	1.48
6	D	513	R5Z	C22-C21	2.22	1.54	1.47
6	C	509	R5Z	C22-C21	2.15	1.53	1.47

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	508	R5Z	C15-C6-C5	8.50	130.58	116.49
6	C	509	R5Z	C15-C6-C5	8.06	129.86	116.49
6	D	513	R5Z	C15-C6-C5	7.54	128.99	116.49
5	C	511	EPE	O1S-S-C10	7.39	115.81	106.92
5	D	517	EPE	O3S-S-C10	6.11	115.66	105.77
5	A	511	EPE	O1S-S-C10	4.22	112.00	106.92
5	C	511	EPE	O2S-S-C10	-3.89	102.23	106.92
6	B	508	R5Z	O2-C14-C15	-3.43	124.60	126.43
5	C	511	EPE	O3S-S-C10	3.13	110.83	105.77
5	A	511	EPE	C9-N1-C2	2.69	118.12	111.23
6	B	508	R5Z	O3-C19-C2	2.50	124.73	116.87
5	C	511	EPE	O3S-S-O2S	-2.45	105.28	111.27
6	B	508	R5Z	C18-C5-C6	-2.35	116.46	120.49
6	B	508	R5Z	O3-C19-C18	-2.27	116.20	122.28
5	D	517	EPE	O2S-S-C10	-2.22	104.25	106.92
5	D	517	EPE	O1S-S-C10	2.14	109.49	106.92
6	C	509	R5Z	O2-C14-C15	-2.10	125.31	126.43

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	B	508	R5Z	C6
6	C	509	R5Z	C6
6	D	513	R5Z	C6

All (53) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	511	EPE	C10-C9-N1-C2
5	A	511	EPE	N4-C7-C8-O8
5	A	511	EPE	C9-C10-S-O1S
5	A	511	EPE	C9-C10-S-O3S
5	C	511	EPE	C8-C7-N4-C5
6	B	508	R5Z	C18-C5-C6-C15
6	B	508	R5Z	C4-C5-C6-C15
6	B	508	R5Z	C21-C20-O3-C19
6	B	508	R5Z	C20-C21-C22-C23
6	C	509	R5Z	C18-C5-C6-C15
6	C	509	R5Z	C4-C5-C6-C15
6	C	509	R5Z	O3-C20-C21-C22
6	C	509	R5Z	C21-C20-O3-C19
6	D	513	R5Z	C18-C5-C6-C15
6	D	513	R5Z	C4-C5-C6-C15
6	D	513	R5Z	O3-C20-C21-C22
7	D	514	PEG	O2-C3-C4-O4
7	D	515	PEG	O2-C3-C4-O4
4	B	505	EDO	O1-C1-C2-O2
4	C	507	EDO	O1-C1-C2-O2
4	A	505	EDO	O1-C1-C2-O2
4	B	504	EDO	O1-C1-C2-O2
4	C	505	EDO	O1-C1-C2-O2
4	D	509	EDO	O1-C1-C2-O2
4	D	511	EDO	O1-C1-C2-O2
6	C	509	R5Z	C18-C5-C6-N1
4	A	506	EDO	O1-C1-C2-O2
6	C	509	R5Z	C4-C5-C6-N1
5	A	511	EPE	C10-C9-N1-C6
6	D	513	R5Z	C4-C5-C6-N1
6	B	508	R5Z	C20-C21-C22-C27
5	A	511	EPE	C9-C10-S-O2S
7	D	515	PEG	O1-C1-C2-O2
5	D	517	EPE	C8-C7-N4-C5
4	A	512	EDO	O1-C1-C2-O2
4	B	509	EDO	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
4	D	510	EDO	O1-C1-C2-O2
4	D	516	EDO	O1-C1-C2-O2
7	D	515	PEG	C1-C2-O2-C3
5	D	517	EPE	C10-C9-N1-C6
4	A	503	EDO	O1-C1-C2-O2
6	B	508	R5Z	C18-C5-C6-N1
6	D	513	R5Z	C18-C5-C6-N1
5	C	511	EPE	C9-C10-S-O3S
7	D	514	PEG	C1-C2-O2-C3
4	B	507	EDO	O1-C1-C2-O2
5	D	517	EPE	C8-C7-N4-C3
4	A	508	EDO	O1-C1-C2-O2
4	C	506	EDO	O1-C1-C2-O2
4	D	505	EDO	O1-C1-C2-O2
6	B	508	R5Z	C18-C19-O3-C20
4	A	509	EDO	O1-C1-C2-O2
4	D	506	EDO	O1-C1-C2-O2

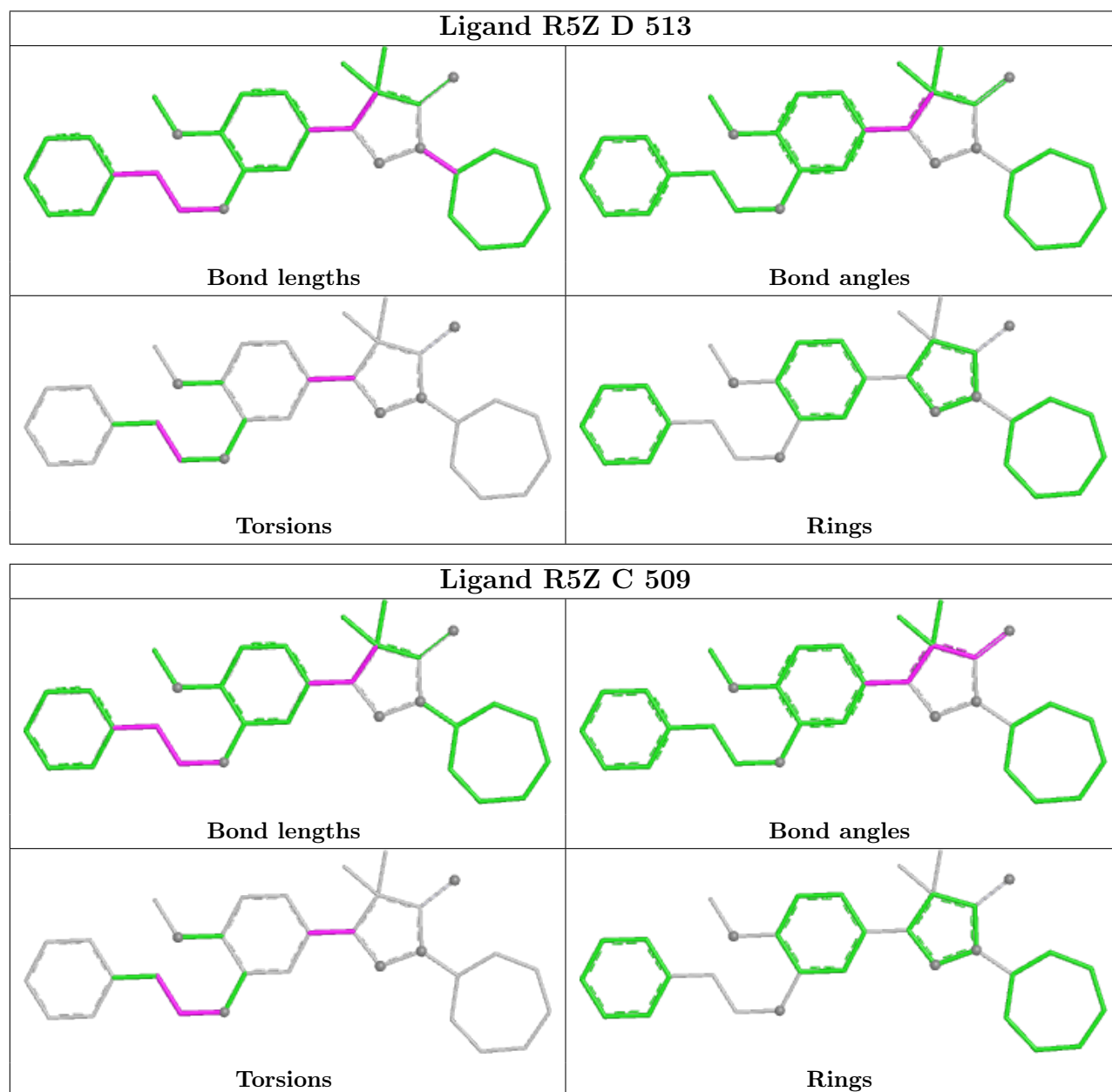
There are no ring outliers.

9 monomers are involved in 13 short contacts:

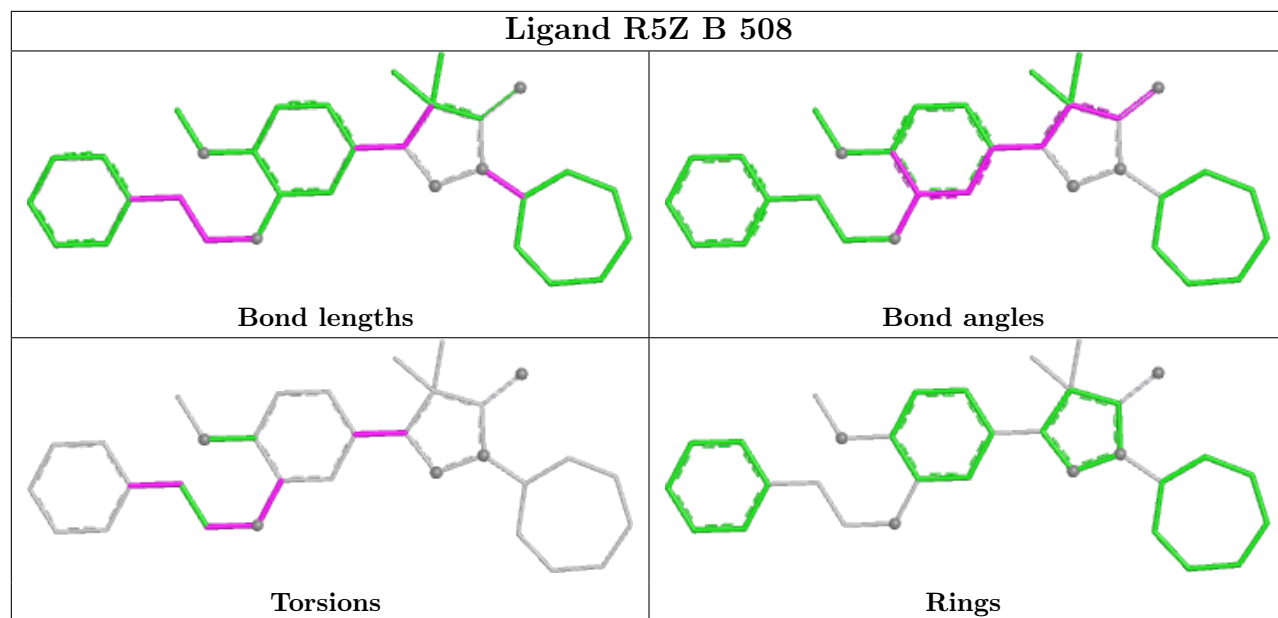
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	D	513	R5Z	2	0
5	C	511	EPE	1	0
6	C	509	R5Z	1	0
4	A	506	EDO	3	0
4	C	506	EDO	1	0
7	D	515	PEG	1	0
6	B	508	R5Z	1	0
4	B	505	EDO	2	0
7	D	514	PEG	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier.

The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







## 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, 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	329/364 (90%)	0.16	8 (2%) 59 59	26, 42, 76, 120	0
1	B	324/364 (89%)	0.33	7 (2%) 62 62	29, 55, 83, 118	0
1	C	325/364 (89%)	0.15	6 (1%) 68 69	29, 50, 83, 115	0
1	D	325/364 (89%)	0.10	3 (0%) 84 84	24, 38, 70, 100	0
All	All	1303/1456 (89%)	0.19	24 (1%) 68 69	24, 47, 79, 120	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	294	SER	6.7
1	B	294	SER	4.9
1	C	297	VAL	4.7
1	C	287	VAL	4.0
1	A	295	SER	3.6
1	B	90	ASP	3.5
1	A	362	ASN	3.4
1	C	295	SER	3.0
1	A	411	PRO	3.0
1	C	294	SER	2.9
1	B	109	ILE	2.8
1	D	362	ASN	2.7
1	A	375	TYR	2.7
1	A	83	GLY	2.7
1	B	92	LEU	2.6
1	D	221	LEU	2.5
1	C	88	GLN	2.5
1	B	108	ARG	2.3
1	A	364	SER	2.3
1	D	412	GLN	2.1
1	C	293	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	293	THR	2.0
1	B	181	LEU	2.0
1	B	133	LYS	2.0

## 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 monosaccharides in this entry.

## 6.4 Ligands [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
6	R5Z	D	513	32/32	0.65	0.34	54,80,152,161	0
6	R5Z	B	508	32/32	0.66	0.29	62,94,114,124	0
4	EDO	D	512	4/4	0.67	0.26	46,50,56,58	0
4	EDO	A	505	4/4	0.71	0.23	48,65,67,68	0
7	PEG	D	514	7/7	0.73	0.20	51,58,66,74	0
4	EDO	A	508	4/4	0.75	0.22	51,51,57,58	0
4	EDO	C	505	4/4	0.76	0.19	72,73,78,79	0
6	R5Z	C	509	32/32	0.76	0.32	58,79,144,150	0
4	EDO	C	506	4/4	0.78	0.12	65,66,68,68	0
4	EDO	D	510	4/4	0.79	0.30	64,67,71,73	0
4	EDO	C	510	4/4	0.79	0.14	67,73,74,80	0
4	EDO	A	512	4/4	0.80	0.22	70,75,77,79	0
4	EDO	D	506	4/4	0.80	0.24	49,52,58,69	0
4	EDO	A	506	4/4	0.80	0.26	61,67,67,68	0
4	EDO	A	504	4/4	0.80	0.19	67,68,71,71	0
4	EDO	B	504	4/4	0.84	0.13	70,71,74,74	0
4	EDO	B	505	4/4	0.84	0.46	50,52,57,59	0
4	EDO	D	508	4/4	0.84	0.18	59,60,62,65	0
7	PEG	D	515	7/7	0.84	0.16	71,74,81,82	0
4	EDO	A	507	4/4	0.85	0.18	47,54,54,58	0

*Continued on next page...*

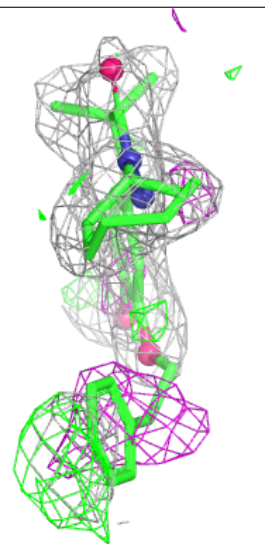
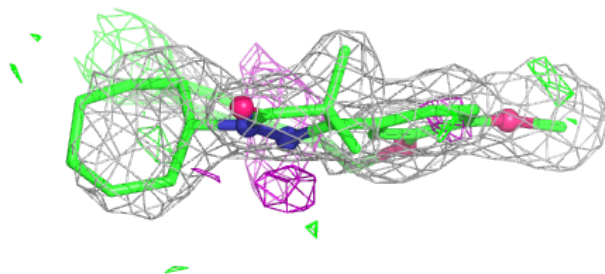
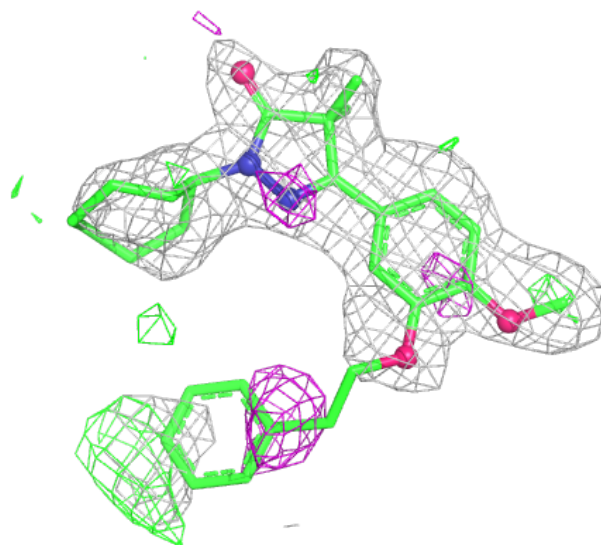
*Continued from previous page...*

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	EDO	B	507	4/4	0.85	0.18	64,65,67,78	0
4	EDO	D	516	4/4	0.85	0.22	40,53,56,59	0
4	EDO	C	507	4/4	0.85	0.24	61,62,70,71	0
4	EDO	D	511	4/4	0.86	0.16	44,55,55,60	0
4	EDO	C	504	4/4	0.86	0.13	65,66,69,71	0
4	EDO	B	506	4/4	0.88	0.16	62,64,71,73	0
5	EPE	A	511	15/15	0.89	0.41	55,108,142,144	0
4	EDO	A	503	4/4	0.89	0.15	57,58,59,60	0
4	EDO	D	504	4/4	0.89	0.16	53,55,55,57	0
4	EDO	A	510	4/4	0.90	0.17	42,46,50,50	0
4	EDO	D	505	4/4	0.91	0.15	74,75,78,78	0
5	EPE	D	517	15/15	0.92	0.22	37,99,110,110	0
4	EDO	D	507	4/4	0.92	0.18	42,45,49,50	0
4	EDO	C	503	4/4	0.93	0.15	61,62,64,67	0
4	EDO	D	503	4/4	0.93	0.14	43,44,44,46	0
4	EDO	A	509	4/4	0.94	0.17	50,56,59,66	0
4	EDO	B	503	4/4	0.94	0.15	41,43,49,55	0
4	EDO	C	508	4/4	0.94	0.15	64,71,72,76	0
5	EPE	C	511	15/15	0.94	0.23	55,91,101,101	0
4	EDO	B	509	4/4	0.94	0.21	64,65,66,69	0
3	MG	C	502	1/1	0.98	0.06	28,28,28,28	0
3	MG	D	502	1/1	0.98	0.11	30,30,30,30	0
4	EDO	D	509	4/4	0.98	0.18	45,47,48,53	0
2	ZN	B	501	1/1	0.98	0.12	43,43,43,43	0
3	MG	B	502	1/1	0.98	0.13	34,34,34,34	0
2	ZN	C	501	1/1	0.99	0.12	41,41,41,41	0
3	MG	A	502	1/1	1.00	0.10	27,27,27,27	0
2	ZN	A	501	1/1	1.00	0.13	36,36,36,36	0
2	ZN	D	501	1/1	1.00	0.13	35,35,35,35	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

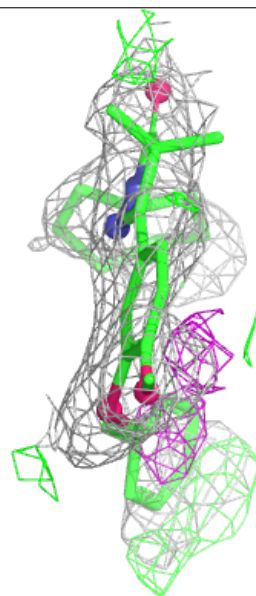
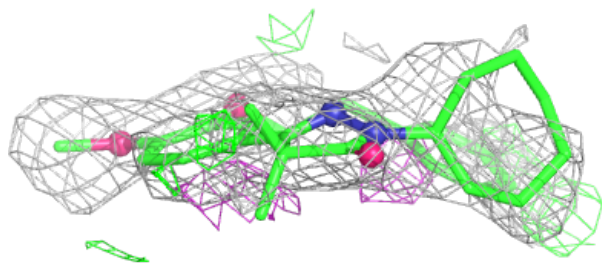
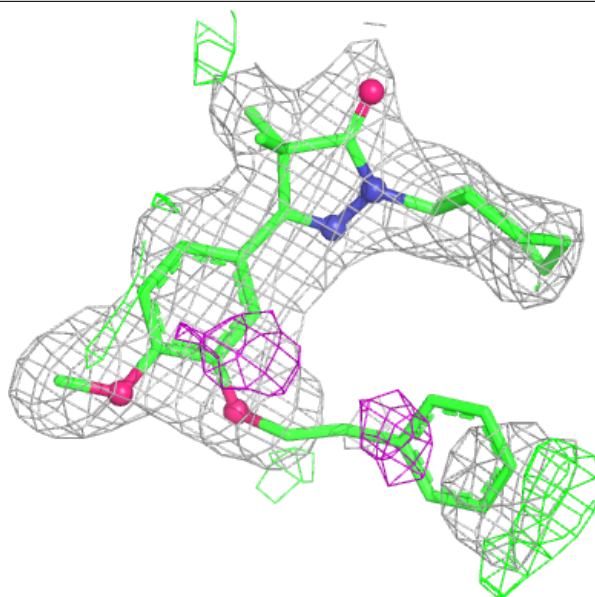
**Electron density around R5Z D 513:**

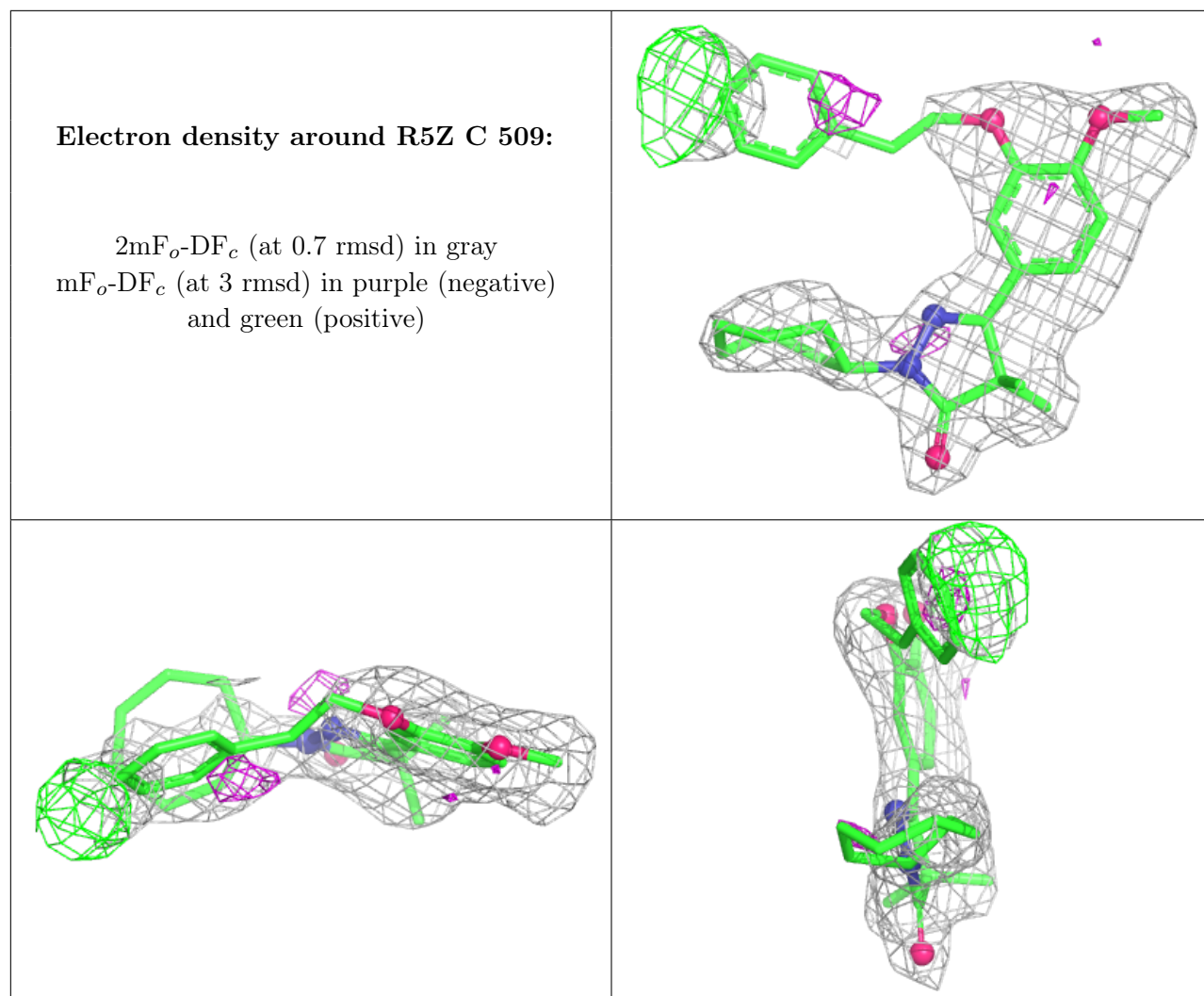
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around R5Z B 508:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.