



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 6, 2017 – 07:25 AM EST

PDB ID : 4JFE  
Title : Preservation of peptide specificity during TCR-MHC contact dominated affinity enhancement of a melanoma-specific TCR  
Authors : Rizkallah, P.J.; Cole, D.K.; Madura, F.; Sewell, A.K.  
Deposited on : unknown  
Resolution : 2.70 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20030345  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20030345

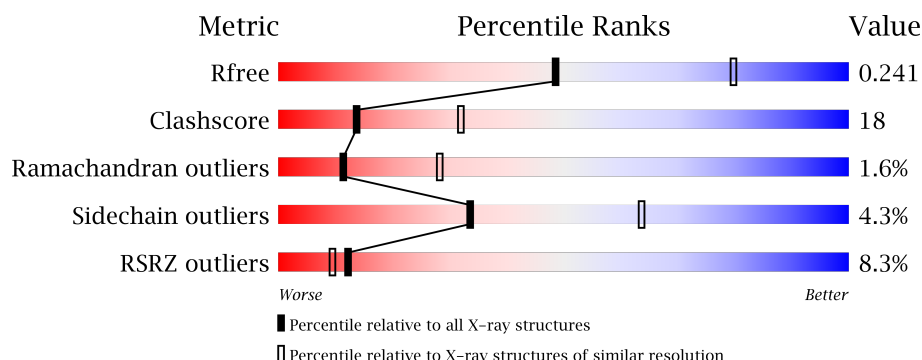
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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))
$R_{free}$	100719	2259 (2.70-2.70)
Clashscore	112137	2590 (2.70-2.70)
Ramachandran outliers	110173	2550 (2.70-2.70)
Sidechain outliers	110143	2550 (2.70-2.70)
RSRZ outliers	101464	2275 (2.70-2.70)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	276	<div> <div>16%</div> <div> <div></div> <div>71%</div> <div>25%</div> <div>.</div> </div> </div>
2	B	100	<div> <div>11%</div> <div> <div></div> <div>84%</div> <div>13%</div> <div>.</div> </div> </div>
3	C	10	<div> <div></div> <div> <div>60%</div> <div>30%</div> <div>10%</div> </div> </div>
4	D	197	<div> <div>7%</div> <div> <div></div> <div>70%</div> <div>23%</div> <div>7%</div> </div> </div>
5	E	245	<div> <div>0%</div> <div> <div></div> <div>78%</div> <div>19%</div> <div>.</div> </div> </div>

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	SO4	A	302	-	-	-	X
6	SO4	D	202	-	-	-	X
6	SO4	E	302	-	-	-	X

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 6765 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 HLA class I histocompatibility antigen, A-2 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2253	1408	410	426	9			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	100	Total	C	N	O	S	0	0	0
			837	533	141	159	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	INITIATING METHIONINE	UNP P61769

- Molecule 3 is a protein called Melanoma peptide L7A.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	10	Total	C	N	O	0	0	0
			66	42	10	14			

- Molecule 4 is a protein called High Affinity TCR Alpha Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	197	Total	C	N	O	S	0	0	0
			1536	956	256	316	8			

- Molecule 5 is a protein called High Affinity TCR Beta Chain.

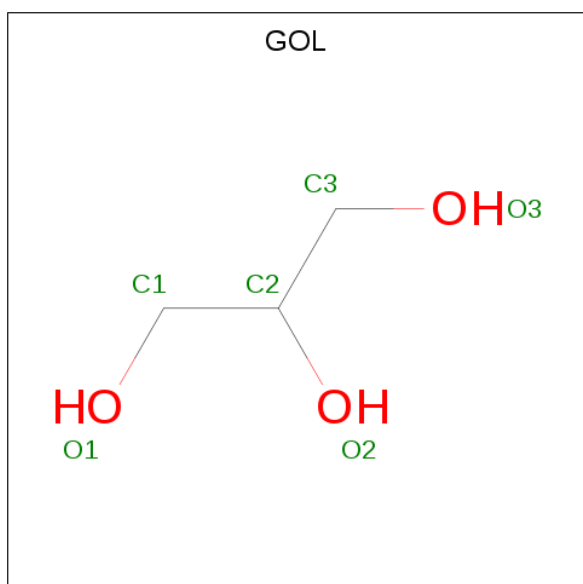
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	245	Total	C	N	O	S	0	3	0
			1975	1253	344	371	7			

- Molecule 6 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	O	S	0	0
			5	4	1		
6	A	1	Total	O	S	0	0
			5	4	1		
6	D	1	Total	O	S	0	0
			5	4	1		
6	E	1	Total	O	S	0	0
			5	4	1		

- Molecule 7 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	D	1	Total	C	O	0	0
			6	3	3		
7	E	1	Total	C	O	0	0
			6	3	3		

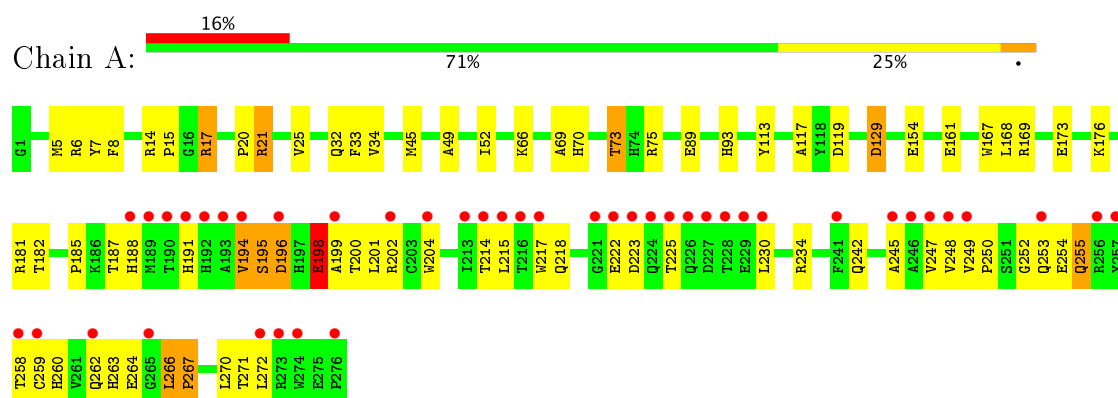
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	16	Total	O	0	0
			16	16		
8	B	10	Total	O	0	0
			10	10		
8	D	17	Total	O	0	0
			17	17		
8	E	23	Total	O	0	0
			23	23		

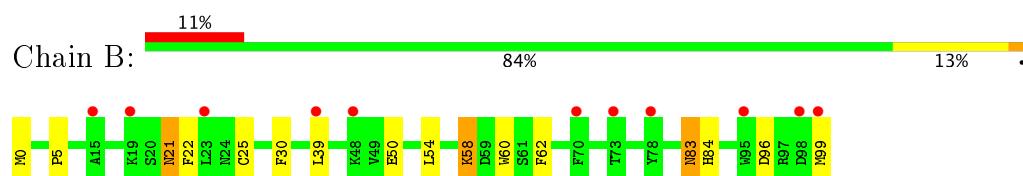
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: HLA class I histocompatibility antigen, A-2 alpha chain



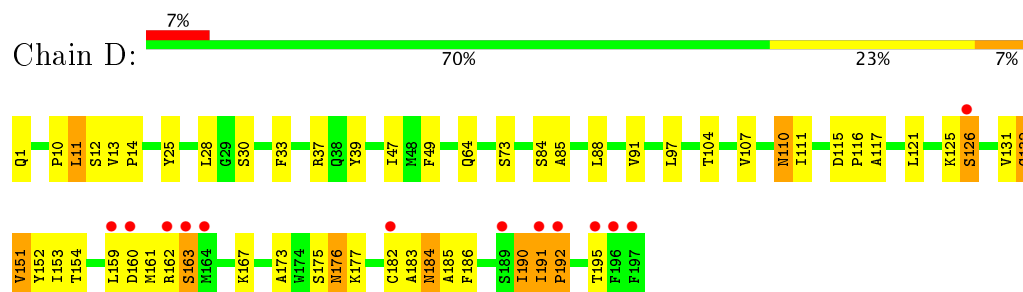
- Molecule 2: Beta-2-microglobulin



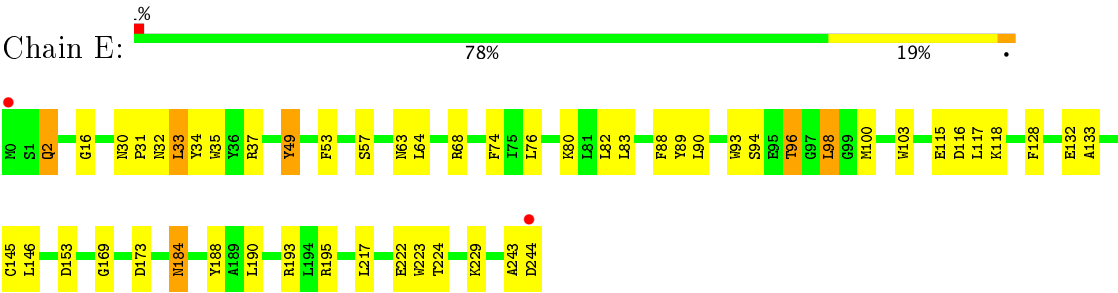
- Molecule 3: Melanoma peptide L7A



- Molecule 4: High Affinity TCR Alpha Chain



- Molecule 5: High Affinity TCR Beta Chain





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	121.61Å 121.61Å 82.25Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	68.13 – 2.70 68.13 – 2.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (68.13-2.70) 99.9 (68.13-2.70)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.69 (at 2.69Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.202 , 0.250 0.197 , 0.241	Depositor DCC
$R_{free}$ test set	1674 reflections (5.35%)	DCC
Wilson B-factor (Å <sup>2</sup> )	54.0	Xtriage
Anisotropy	0.212	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 49.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.037 for h,-k,-l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	6765	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.06% 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: GOL, SO4

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	0.92	3/2319 (0.1%)	0.54	0/3149
2	B	0.82	0/860	0.54	0/1162
3	C	1.19	0/65	0.66	0/86
4	D	1.01	1/1568 (0.1%)	0.58	0/2123
5	E	0.95	0/2036	0.58	0/2776
All	All	0.94	4/6848 (0.1%)	0.56	0/9296

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	132	CYS	CB-SG	-9.78	1.65	1.82
1	A	161	GLU	CG-CD	6.88	1.62	1.51
1	A	154	GLU	CB-CG	-5.13	1.42	1.52
1	A	89	GLU	CG-CD	5.13	1.59	1.51

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	2253	0	2103	107	0
2	B	837	0	803	13	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	66	0	73	7	0
4	D	1536	0	1448	82	0
5	E	1975	0	1872	53	0
6	A	10	0	0	1	0
6	D	5	0	0	0	0
6	E	5	0	0	0	0
7	D	6	0	8	0	0
7	E	6	0	8	0	0
8	A	16	0	0	0	0
8	B	10	0	0	0	0
8	D	17	0	0	0	0
8	E	23	0	0	0	0
All	All	6765	0	6315	232	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 18.

All (232) 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:263:HIS:O	1:A:266:LEU:HD22	1.27	1.26
1:A:215:LEU:HD12	1:A:215:LEU:O	1.44	1.18
4:D:190:ILE:HD13	4:D:191:ILE:N	1.65	1.11
2:B:21:ASN:HD22	2:B:22:PHE:N	1.47	1.10
2:B:21:ASN:ND2	2:B:22:PHE:H	1.47	1.09
4:D:150:ASP:O	4:D:151:VAL:HG22	1.52	1.08
1:A:258:THR:HG23	1:A:272:LEU:O	1.53	1.08
1:A:187:THR:HB	1:A:272:LEU:HD21	1.34	1.03
4:D:190:ILE:CD1	4:D:191:ILE:H	1.71	1.02
1:A:69:ALA:O	1:A:73:THR:HG22	1.63	0.96
4:D:190:ILE:HD13	4:D:191:ILE:H	0.80	0.94
1:A:263:HIS:O	1:A:266:LEU:CD2	2.18	0.90
1:A:17:ARG:HG3	1:A:17:ARG:HH11	1.34	0.89
1:A:270:LEU:HD23	1:A:271:THR:N	1.89	0.88
4:D:190:ILE:HG23	4:D:192:PRO:HD3	1.55	0.87
4:D:183:ALA:C	4:D:184:ASN:HD22	1.78	0.86
1:A:199:ALA:O	1:A:250:PRO:CG	2.24	0.86
4:D:190:ILE:O	4:D:192:PRO:HD2	1.73	0.86
1:A:266:LEU:HD23	1:A:266:LEU:O	1.75	0.85
4:D:147:LYS:NZ	4:D:147:LYS:HA	1.92	0.85
1:A:199:ALA:O	1:A:250:PRO:HG2	1.75	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:167:TRP:CE2	3:C:1:GLU:HG3	2.13	0.84
1:A:222:GLU:OE2	1:A:223:ASP:N	2.08	0.84
1:A:187:THR:CB	1:A:272:LEU:HD21	2.08	0.83
1:A:201:LEU:HB2	1:A:247:VAL:CG2	2.10	0.82
4:D:49:PHE:CD2	5:E:100:MET:HE2	2.16	0.81
4:D:150:ASP:OD2	4:D:151:VAL:N	2.12	0.81
4:D:159:LEU:HD11	5:E:169:GLY:HA2	1.66	0.78
1:A:255:GLN:HA	1:A:255:GLN:HE21	1.49	0.76
1:A:258:THR:HG23	1:A:272:LEU:C	2.07	0.74
1:A:249:VAL:N	1:A:250:PRO:HD3	2.02	0.74
5:E:16:GLY:HA2	5:E:80:LYS:HG3	1.69	0.74
1:A:247:VAL:O	1:A:247:VAL:HG23	1.85	0.73
1:A:191:HIS:HB2	1:A:201:LEU:HD23	1.69	0.73
4:D:184:ASN:HD22	4:D:184:ASN:N	1.85	0.73
1:A:201:LEU:HB2	1:A:247:VAL:HG22	1.72	0.70
4:D:147:LYS:HA	4:D:147:LYS:HZ1	1.54	0.70
2:B:21:ASN:ND2	2:B:22:PHE:N	2.21	0.70
4:D:150:ASP:O	4:D:151:VAL:CG2	2.38	0.70
1:A:215:LEU:CD1	1:A:215:LEU:O	2.33	0.69
2:B:21:ASN:HD22	2:B:22:PHE:H	0.74	0.68
1:A:254:GLU:N	1:A:254:GLU:OE1	2.27	0.68
5:E:30:ASN:O	5:E:96:THR:HB	1.94	0.67
1:A:191:HIS:CB	1:A:201:LEU:HD23	2.23	0.67
1:A:270:LEU:HD22	1:A:272:LEU:CD1	2.25	0.67
1:A:201:LEU:HB2	1:A:247:VAL:HG21	1.76	0.66
4:D:159:LEU:HD11	5:E:169:GLY:CA	2.26	0.66
1:A:270:LEU:HD23	1:A:271:THR:H	1.59	0.65
4:D:190:ILE:C	4:D:192:PRO:HD3	2.16	0.65
4:D:161:MET:HE1	5:E:195:ARG:HG2	1.77	0.65
1:A:187:THR:HB	1:A:272:LEU:CD2	2.19	0.65
1:A:248:VAL:O	1:A:248:VAL:HG12	1.97	0.65
1:A:187:THR:HG21	1:A:272:LEU:HD11	1.78	0.65
1:A:25:VAL:HG23	1:A:32:GLN:HE21	1.61	0.64
1:A:66:LYS:HE2	3:C:2:LEU:HB2	1.77	0.64
4:D:195:THR:HG21	5:E:133:ALA:CB	2.28	0.64
1:A:194:VAL:O	1:A:195:SER:CB	2.44	0.64
4:D:190:ILE:C	4:D:192:PRO:CD	2.66	0.64
4:D:161:MET:CE	5:E:195:ARG:HD3	2.28	0.64
4:D:190:ILE:O	4:D:192:PRO:CD	2.45	0.63
1:A:249:VAL:N	1:A:250:PRO:CD	2.61	0.63
1:A:33:PHE:CD2	1:A:34:VAL:HG13	2.34	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:188:HIS:HB3	1:A:204:TRP:HB2	1.80	0.62
1:A:270:LEU:HD22	1:A:272:LEU:HD12	1.81	0.62
4:D:162:ARG:O	4:D:163:SER:CB	2.46	0.62
1:A:215:LEU:HD11	1:A:245:ALA:HB2	1.80	0.62
1:A:198:GLU:O	1:A:198:GLU:OE2	2.17	0.62
4:D:195:THR:HG21	5:E:133:ALA:HB1	1.82	0.62
4:D:176:ASN:HD22	4:D:177:LYS:N	1.99	0.61
1:A:230:LEU:C	1:A:230:LEU:HD12	2.20	0.61
4:D:110:ASN:C	4:D:110:ASN:HD22	2.03	0.61
1:A:258:THR:HG21	1:A:271:THR:OG1	2.01	0.61
1:A:195:SER:O	1:A:196:ASP:HB3	2.00	0.61
4:D:161:MET:HE1	5:E:195:ARG:CG	2.31	0.61
4:D:159:LEU:HD11	5:E:169:GLY:C	2.21	0.60
1:A:17:ARG:NH1	1:A:17:ARG:HG3	2.13	0.60
2:B:83:ASN:HD22	2:B:84:HIS:H	1.50	0.59
1:A:191:HIS:HB2	1:A:200:THR:O	2.02	0.59
4:D:147:LYS:HA	4:D:147:LYS:HZ2	1.66	0.59
4:D:152:TYR:O	4:D:173:ALA:HA	2.03	0.59
1:A:7:TYR:OH	3:C:1:GLU:N	2.23	0.58
1:A:17:ARG:CG	1:A:17:ARG:HH11	2.12	0.58
4:D:159:LEU:HD12	4:D:160:ASP:N	2.19	0.58
1:A:182:THR:HG23	1:A:182:THR:O	2.03	0.58
4:D:153:ILE:HD13	4:D:186:PHE:CE2	2.38	0.58
1:A:266:LEU:O	1:A:266:LEU:CD2	2.52	0.57
2:B:96:ASP:HB3	2:B:99:MET:HB3	1.86	0.57
5:E:184:ASN:HD22	5:E:184:ASN:C	2.07	0.57
2:B:5:PRO:HB3	2:B:30:PHE:HB3	1.87	0.57
4:D:49:PHE:CD2	5:E:100:MET:CE	2.86	0.57
1:A:247:VAL:O	1:A:247:VAL:CG2	2.52	0.57
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.40	0.57
1:A:270:LEU:CD2	1:A:272:LEU:HD12	2.34	0.56
1:A:169:ARG:O	1:A:173:GLU:HG3	2.05	0.56
5:E:243:ALA:O	5:E:244:ASP:OD1	2.23	0.56
1:A:255:GLN:HA	1:A:255:GLN:NE2	2.20	0.56
1:A:234:ARG:HE	1:A:242:GLN:HE21	1.52	0.56
4:D:184:ASN:N	4:D:184:ASN:ND2	2.54	0.55
5:E:117:LEU:HD22	5:E:217:LEU:HD21	1.89	0.55
4:D:131:VAL:HG12	4:D:132:CYS:N	2.21	0.55
1:A:258:THR:CG2	1:A:271:THR:OG1	2.54	0.55
5:E:224:THR:O	5:E:224:THR:HG22	2.06	0.55
4:D:37:ARG:HB2	4:D:47:ILE:HD11	1.89	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:201:LEU:HD11	1:A:254:GLU:HB3	1.89	0.55
1:A:217:TRP:CZ2	1:A:259:CYS:SG	3.00	0.55
5:E:173:ASP:HB2	5:E:190:LEU:HD11	1.89	0.54
1:A:25:VAL:HG23	1:A:32:GLN:NE2	2.22	0.54
1:A:194:VAL:HG22	1:A:199:ALA:HA	1.88	0.54
4:D:190:ILE:CG2	4:D:192:PRO:HD3	2.32	0.54
5:E:83:LEU:HD11	5:E:115:GLU:HG2	1.89	0.54
1:A:49:ALA:O	1:A:52:ILE:HG22	2.07	0.54
1:A:230:LEU:HD12	1:A:230:LEU:O	2.09	0.53
1:A:70:HIS:HA	1:A:73:THR:CG2	2.38	0.53
5:E:2:GLN:HG2	5:E:93:TRP:CH2	2.44	0.53
5:E:173:ASP:HB2	5:E:190:LEU:CD1	2.39	0.53
4:D:121:LEU:HD12	4:D:121:LEU:N	2.24	0.53
5:E:49:TYR:HB3	5:E:57:SER:HB3	1.91	0.52
4:D:110:ASN:HD22	4:D:111:ILE:N	2.06	0.52
4:D:88:LEU:HD12	4:D:88:LEU:N	2.24	0.52
1:A:202:ARG:HG2	1:A:204:TRP:NE1	2.26	0.51
1:A:5:MET:HB2	1:A:168:LEU:HD13	1.91	0.51
1:A:6:ARG:NE	1:A:113:TYR:OH	2.43	0.51
4:D:131:VAL:HG23	5:E:128:PHE:CE2	2.44	0.51
1:A:69:ALA:CB	5:E:98:LEU:HD11	2.40	0.51
1:A:225:THR:HG23	1:A:225:THR:O	2.10	0.51
1:A:75:ARG:HD2	5:E:53:PHE:CZ	2.45	0.51
1:A:8:PHE:HB2	1:A:25:VAL:HG12	1.93	0.50
1:A:198:GLU:HA	1:A:250:PRO:HB2	1.92	0.50
4:D:153:ILE:HD13	4:D:186:PHE:HE2	1.73	0.50
4:D:11:LEU:HD23	4:D:12:SER:N	2.27	0.50
1:A:270:LEU:HD22	1:A:272:LEU:HD11	1.93	0.50
1:A:194:VAL:O	1:A:195:SER:OG	2.28	0.50
5:E:35:TRP:CD1	5:E:74:PHE:CE2	2.99	0.50
1:A:199:ALA:O	1:A:250:PRO:HG3	2.06	0.50
4:D:161:MET:HE3	5:E:195:ARG:HD3	1.93	0.50
5:E:33:LEU:HD22	5:E:68:ARG:CZ	2.42	0.50
4:D:49:PHE:C	4:D:49:PHE:CD2	2.85	0.49
1:A:218:GLN:HB2	1:A:260:HIS:NE2	2.27	0.49
1:A:187:THR:CG2	1:A:270:LEU:HD13	2.43	0.49
4:D:97:LEU:HD13	5:E:103:TRP:CZ3	2.48	0.48
4:D:161:MET:CE	5:E:195:ARG:HB3	2.44	0.48
4:D:191:ILE:O	4:D:192:PRO:O	2.31	0.48
4:D:30:SER:HB3	4:D:91:VAL:HG13	1.96	0.48
5:E:116:ASP:CG	5:E:118:LYS:HG2	2.33	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:195:SER:O	1:A:196:ASP:CB	2.62	0.48
4:D:153:ILE:CD1	4:D:186:PHE:HE2	2.27	0.48
1:A:187:THR:CG2	1:A:272:LEU:HD11	2.44	0.47
1:A:272:LEU:N	1:A:272:LEU:HD12	2.28	0.47
4:D:190:ILE:HD13	4:D:191:ILE:HG12	1.95	0.47
1:A:194:VAL:O	1:A:195:SER:HB2	2.14	0.47
4:D:162:ARG:O	4:D:163:SER:OG	2.32	0.47
5:E:30:ASN:N	5:E:31:PRO:CD	2.76	0.47
1:A:253:GLN:OE1	1:A:253:GLN:N	2.48	0.47
1:A:167:TRP:CD2	3:C:1:GLU:HG3	2.50	0.46
1:A:234:ARG:HE	1:A:242:GLN:NE2	2.13	0.46
1:A:248:VAL:C	1:A:250:PRO:HD3	2.35	0.46
1:A:263:HIS:CD2	1:A:264:GLU:O	2.68	0.46
1:A:270:LEU:CD2	1:A:272:LEU:CD1	2.93	0.46
5:E:153:ASP:HB3	5:E:188:TYR:CE2	2.51	0.46
1:A:20:PRO:HG2	1:A:75:ARG:HG3	1.96	0.46
1:A:218:GLN:HB3	1:A:222:GLU:O	2.16	0.46
4:D:159:LEU:HD12	4:D:160:ASP:H	1.80	0.46
4:D:162:ARG:O	4:D:163:SER:HB2	2.15	0.46
4:D:176:ASN:H	4:D:176:ASN:ND2	2.14	0.46
4:D:117:ALA:HA	4:D:192:PRO:HB3	1.97	0.46
4:D:151:VAL:HG12	4:D:175:SER:HB2	1.98	0.46
5:E:193:ARG:N	5:E:193:ARG:HD2	2.31	0.46
4:D:88:LEU:N	4:D:88:LEU:CD1	2.78	0.46
5:E:224:THR:O	5:E:224:THR:CG2	2.64	0.45
4:D:161:MET:HE1	5:E:195:ARG:HB3	1.98	0.45
4:D:176:ASN:HD22	4:D:177:LYS:H	1.61	0.45
4:D:161:MET:CE	5:E:195:ARG:CG	2.94	0.45
4:D:190:ILE:CD1	4:D:191:ILE:N	2.49	0.45
1:A:14:ARG:O	1:A:15:PRO:C	2.54	0.45
1:A:201:LEU:O	1:A:247:VAL:HG22	2.17	0.45
1:A:266:LEU:O	1:A:267:PRO:C	2.55	0.45
1:A:187:THR:HG21	1:A:270:LEU:HD13	1.98	0.45
2:B:83:ASN:HD22	2:B:84:HIS:N	2.15	0.45
1:A:217:TRP:CZ3	1:A:258:THR:C	2.90	0.44
4:D:33:PHE:N	4:D:33:PHE:CD2	2.85	0.44
1:A:215:LEU:HD12	1:A:215:LEU:C	2.28	0.44
1:A:258:THR:CG2	1:A:272:LEU:N	2.80	0.44
4:D:159:LEU:CD1	5:E:169:GLY:C	2.86	0.44
1:A:254:GLU:N	1:A:254:GLU:CD	2.71	0.44
4:D:13:VAL:CG2	4:D:107:VAL:HG22	2.48	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:75:ARG:HD2	5:E:53:PHE:CE1	2.53	0.44
5:E:32:ASN:HB2	5:E:94:SER:OG	2.17	0.44
1:A:45:MET:CE	3:C:2:LEU:HD11	2.47	0.44
4:D:10:PRO:HA	4:D:104:THR:O	2.18	0.44
1:A:17:ARG:CG	1:A:17:ARG:NH1	2.77	0.44
1:A:191:HIS:CB	1:A:201:LEU:CD2	2.95	0.43
1:A:21:ARG:NH2	6:A:301:SO4:O1	2.51	0.43
2:B:58:LYS:CD	2:B:58:LYS:H	2.30	0.43
5:E:145:CYS:C	5:E:146:LEU:HD12	2.39	0.43
4:D:115:ASP:N	4:D:116:PRO:CD	2.82	0.43
3:C:7:ALA:O	3:C:8:LEU:HD23	2.18	0.43
5:E:30:ASN:N	5:E:31:PRO:HD3	2.32	0.43
4:D:37:ARG:HD3	4:D:39:TYR:CZ	2.54	0.43
4:D:161:MET:HE1	5:E:195:ARG:CB	2.49	0.42
4:D:64:GLN:HB2	4:D:73:SER:HB2	2.00	0.42
1:A:202:ARG:HG2	1:A:204:TRP:CE2	2.55	0.42
5:E:35:TRP:CE2	5:E:76:LEU:HB2	2.54	0.42
5:E:88:PHE:CE2	5:E:90:LEU:HD21	2.53	0.42
2:B:58:LYS:H	2:B:58:LYS:HD2	1.85	0.42
3:C:7:ALA:HB3	5:E:98:LEU:HB2	2.01	0.42
4:D:131:VAL:CG1	4:D:132:CYS:N	2.82	0.42
4:D:125:LYS:O	4:D:126:SER:C	2.58	0.42
2:B:54:LEU:HD11	2:B:62:PHE:CD1	2.55	0.42
4:D:25:TYR:CE1	4:D:33:PHE:CE1	3.08	0.42
4:D:159:LEU:O	4:D:167:LYS:HA	2.20	0.42
1:A:230:LEU:C	1:A:230:LEU:CD1	2.88	0.41
5:E:63:ASN:O	5:E:64:LEU:HD12	2.20	0.41
2:B:25:CYS:HB2	2:B:39:LEU:HD21	2.01	0.41
5:E:223:TRP:CB	5:E:229:LYS:HE2	2.50	0.41
1:A:93:HIS:HD2	1:A:119:ASP:OD1	2.03	0.41
4:D:153:ILE:HD12	4:D:154:THR:N	2.35	0.41
1:A:14:ARG:NH2	1:A:21:ARG:HG2	2.35	0.41
5:E:34:TYR:CE1	5:E:49:TYR:CD1	3.09	0.41
4:D:117:ALA:CA	4:D:192:PRO:HB3	2.51	0.41
1:A:185:PRO:HD3	1:A:263:HIS:CD2	2.56	0.41
5:E:222:GLU:HA	5:E:222:GLU:OE1	2.21	0.41
4:D:195:THR:HG21	5:E:133:ALA:HB2	2.03	0.41
5:E:16:GLY:HA2	5:E:80:LYS:CG	2.46	0.41
5:E:37[A]:ARG:HD3	5:E:89:TYR:CZ	2.56	0.41
1:A:214:THR:HB	1:A:262:GLN:HB2	2.03	0.40
4:D:131:VAL:HG23	5:E:128:PHE:CD2	2.56	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:13:VAL:HA	4:D:14:PRO:HD3	1.96	0.40
4:D:84:SER:O	4:D:85:ALA:HB2	2.21	0.40
4:D:190:ILE:CD1	4:D:191:ILE:HG12	2.51	0.40
1:A:129:ASP:O	1:A:129:ASP:CG	2.59	0.40
4:D:182:CYS:SG	4:D:185:ALA:HB2	2.62	0.40
4:D:191:ILE:N	4:D:192:PRO:CD	2.85	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	274/276 (99%)	239 (87%)	29 (11%)	6 (2%)	8	20
2	B	98/100 (98%)	91 (93%)	7 (7%)	0	100	100
3	C	8/10 (80%)	8 (100%)	0	0	100	100
4	D	195/197 (99%)	178 (91%)	10 (5%)	7 (4%)	4	9
5	E	246/245 (100%)	239 (97%)	7 (3%)	0	100	100
All	All	821/828 (99%)	755 (92%)	53 (6%)	13 (2%)	11	28

All (13) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	195	SER
4	D	163	SER
4	D	192	PRO
4	D	150	ASP
4	D	151	VAL
4	D	191	ILE
1	A	196	ASP
1	A	252	GLY

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Mol	Chain	Res	Type
4	D	126	SER
1	A	194	VAL
1	A	198	GLU
4	D	149	SER
1	A	267	PRO

### 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	232/232 (100%)	223 (96%)	9 (4%)	37	68
2	B	95/95 (100%)	90 (95%)	5 (5%)	26	54
3	C	6/6 (100%)	5 (83%)	1 (17%)	2	6
4	D	175/175 (100%)	167 (95%)	8 (5%)	31	61
5	E	214/211 (101%)	206 (96%)	8 (4%)	39	70
All	All	722/719 (100%)	691 (96%)	31 (4%)	33	64

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	17	ARG
1	A	21	ARG
1	A	73	THR
1	A	129	ASP
1	A	176	LYS
1	A	181	ARG
1	A	198	GLU
1	A	255	GLN
1	A	266	LEU
2	B	0	MET
2	B	21	ASN
2	B	50	GLU
2	B	58	LYS
2	B	83	ASN

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Mol	Chain	Res	Type
3	C	1	GLU
4	D	1	GLN
4	D	11	LEU
4	D	28	LEU
4	D	110	ASN
4	D	147	LYS
4	D	176	ASN
4	D	184	ASN
4	D	190	ILE
5	E	2	GLN
5	E	33	LEU
5	E	49	TYR
5	E	82	LEU
5	E	96	THR
5	E	98	LEU
5	E	132	GLU
5	E	184	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	32	GLN
1	A	70	HIS
1	A	86	ASN
1	A	93	HIS
1	A	145	HIS
1	A	174	ASN
1	A	180	GLN
1	A	191	HIS
1	A	218	GLN
1	A	226	GLN
1	A	242	GLN
1	A	255	GLN
1	A	262	GLN
2	B	8	GLN
2	B	21	ASN
2	B	83	ASN
2	B	89	GLN
4	D	70	GLN
4	D	110	ASN
4	D	112	GLN
4	D	140	GLN

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Mol	Chain	Res	Type
4	D	145	GLN
4	D	176	ASN
4	D	184	ASN
4	D	187	ASN
5	E	2	GLN
5	E	62	GLN
5	E	70	GLN
5	E	119	ASN
5	E	184	ASN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

6 ligands 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	$\# Z  > 2$
6	SO4	A	301	-	4,4,4	0.22	0	6,6,6	0.07	0
6	SO4	A	302	-	4,4,4	0.27	0	6,6,6	0.12	0
7	GOL	D	201	-	5,5,5	0.37	0	5,5,5	0.24	0
6	SO4	D	202	-	4,4,4	0.24	0	6,6,6	0.08	0
7	GOL	E	301	-	5,5,5	0.52	0	5,5,5	0.12	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
6	SO4	E	302	-	4,4,4	0.18	0	6,6,6	0.06	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
6	SO4	A	301	-	-	0/0/0/0	0/0/0/0
6	SO4	A	302	-	-	0/0/0/0	0/0/0/0
7	GOL	D	201	-	-	0/4/4/4	0/0/0/0
6	SO4	D	202	-	-	0/0/0/0	0/0/0/0
7	GOL	E	301	-	-	0/4/4/4	0/0/0/0
6	SO4	E	302	-	-	0/0/0/0	0/0/0/0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	301	SO4	1	0

## 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	276/276 (100%)	0.95	43 (15%) <span>2</span> <span>2</span>	22, 55, 199, 264	0
2	B	100/100 (100%)	0.69	11 (11%) <span>6</span> <span>5</span>	28, 67, 139, 158	0
3	C	10/10 (100%)	0.04	0 <span>100</span> <span>100</span>	26, 32, 36, 44	0
4	D	197/197 (100%)	0.38	13 (6%) <span>19</span> <span>17</span>	20, 44, 135, 210	0
5	E	245/245 (100%)	0.02	2 (0%) <span>86</span> <span>86</span>	22, 41, 82, 113	0
All	All	828/828 (100%)	0.50	69 (8%) <span>12</span> <span>9</span>	20, 48, 154, 264	0

All (69) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	248	VAL	12.3
1	A	276	PRO	11.4
1	A	228	THR	10.4
4	D	197	PHE	9.8
1	A	257	TYR	9.8
1	A	246	ALA	9.7
1	A	225	THR	6.7
2	B	99	MET	6.6
1	A	196	ASP	6.5
1	A	273	ARG	6.5
1	A	224	GLN	6.1
1	A	216	THR	6.1
1	A	272	LEU	5.8
1	A	204	TRP	5.7
1	A	191	HIS	5.3
1	A	226	GLN	4.8
1	A	247	VAL	4.8
1	A	229	GLU	4.7
1	A	249	VAL	4.5
1	A	192	HIS	4.4

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Mol	Chain	Res	Type	RSRZ
2	B	15	ALA	4.4
1	A	245	ALA	4.2
1	A	190	THR	4.1
1	A	188	HIS	3.8
5	E	0	MET	3.8
1	A	223	ASP	3.7
1	A	202	ARG	3.7
4	D	163	SER	3.6
5	E	244	ASP	3.6
1	A	259	CYS	3.5
2	B	70	PHE	3.5
1	A	258	THR	3.5
4	D	164	MET	3.3
4	D	192	PRO	3.3
4	D	195	THR	3.3
1	A	215	LEU	3.2
2	B	73	THR	3.2
4	D	162	ARG	3.2
1	A	256	ARG	3.2
4	D	160	ASP	3.2
1	A	227	ASP	3.1
2	B	95	TRP	3.1
1	A	189	MET	3.0
1	A	274	TRP	3.0
4	D	196	PHE	2.8
1	A	214	THR	2.7
1	A	213	ILE	2.7
1	A	230	LEU	2.7
1	A	222	GLU	2.7
2	B	98	ASP	2.7
1	A	193	ALA	2.6
1	A	199	ALA	2.6
2	B	23	LEU	2.6
1	A	241	PHE	2.5
2	B	39	LEU	2.5
4	D	159	LEU	2.5
2	B	48	LYS	2.5
4	D	191	ILE	2.4
2	B	19	LYS	2.4
1	A	262	GLN	2.4
4	D	182	CYS	2.4
1	A	217	TRP	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	221	GLY	2.3
1	A	265	GLY	2.3
2	B	78	TYR	2.3
4	D	189	SER	2.2
1	A	253	GLN	2.2
1	A	194	VAL	2.1
4	D	126	SER	2.1

## 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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
6	SO4	A	302	5/5	0.76	0.41	16.12	101,102,106,106	0
6	SO4	D	202	5/5	0.74	0.44	8.28	123,124,124,125	0
6	SO4	E	302	5/5	0.68	0.29	3.44	157,158,158,158	0
7	GOL	D	201	6/6	0.89	0.24	1.71	63,70,72,72	0
6	SO4	A	301	5/5	0.69	0.24	-	129,129,130,131	0
7	GOL	E	301	6/6	0.69	0.33	-	87,89,90,90	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.