



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 14, 2017 – 01:24 am GMT

PDB ID : 5DP4  
Title : Crystal Structure of EV71 3C Proteinase in complex with compound 3  
Authors : Wu, C.; Zhang, L.; Li, P.; Cai, Q.; Peng, X.; Li, N.; Cai, Y.; Li, J.; Lin, T.  
Deposited on : 2015-09-12  
Resolution : 2.21 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

<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 : trunk28620  
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) : recalc28949

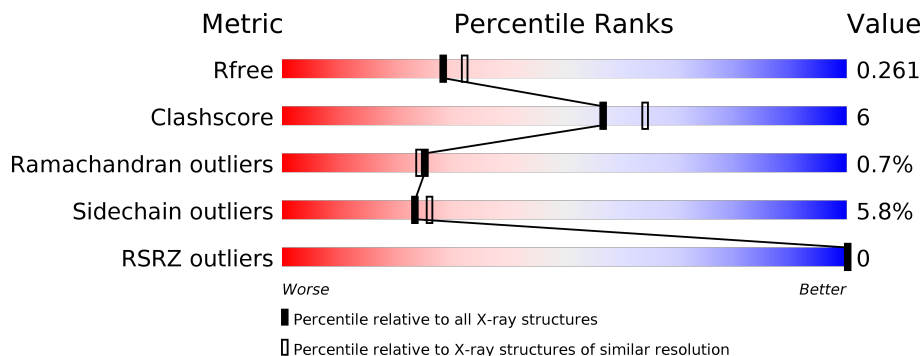
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.21 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	4744 (2.24-2.20)
Clashscore	112137	5509 (2.24-2.20)
Ramachandran outliers	110173	5427 (2.24-2.20)
Sidechain outliers	110143	5428 (2.24-2.20)
RSRZ outliers	101464	4776 (2.24-2.20)

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 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	192	
1	B	192	
1	C	192	
1	D	192	

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	5E8	B	201	-	-	-	X
2	5E8	D	201	-	-	-	X

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6075 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 3C proteinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	181	Total	C	N	O	S	0	0	0
			1401	888	249	256	8			
1	B	181	Total	C	N	O	S	0	0	0
			1401	888	249	256	8			
1	C	181	Total	C	N	O	S	0	0	0
			1401	888	249	256	8			
1	D	181	Total	C	N	O	S	0	0	0
			1401	888	249	256	8			

There are 36 discrepancies between the modelled and reference sequences:

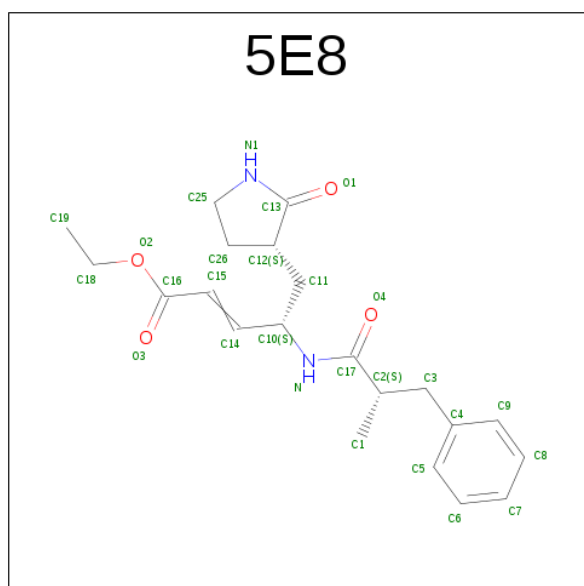
Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	expression tag	UNP A9XG43
A	184	LEU	-	expression tag	UNP A9XG43
A	185	GLU	-	expression tag	UNP A9XG43
A	186	HIS	-	expression tag	UNP A9XG43
A	187	HIS	-	expression tag	UNP A9XG43
A	188	HIS	-	expression tag	UNP A9XG43
A	189	HIS	-	expression tag	UNP A9XG43
A	190	HIS	-	expression tag	UNP A9XG43
A	191	HIS	-	expression tag	UNP A9XG43
B	0	MET	-	expression tag	UNP A9XG43
B	184	LEU	-	expression tag	UNP A9XG43
B	185	GLU	-	expression tag	UNP A9XG43
B	186	HIS	-	expression tag	UNP A9XG43
B	187	HIS	-	expression tag	UNP A9XG43
B	188	HIS	-	expression tag	UNP A9XG43
B	189	HIS	-	expression tag	UNP A9XG43
B	190	HIS	-	expression tag	UNP A9XG43
B	191	HIS	-	expression tag	UNP A9XG43
C	0	MET	-	expression tag	UNP A9XG43
C	184	LEU	-	expression tag	UNP A9XG43
C	185	GLU	-	expression tag	UNP A9XG43

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Chain	Residue	Modelled	Actual	Comment	Reference
C	186	HIS	-	expression tag	UNP A9XG43
C	187	HIS	-	expression tag	UNP A9XG43
C	188	HIS	-	expression tag	UNP A9XG43
C	189	HIS	-	expression tag	UNP A9XG43
C	190	HIS	-	expression tag	UNP A9XG43
C	191	HIS	-	expression tag	UNP A9XG43
D	0	MET	-	expression tag	UNP A9XG43
D	184	LEU	-	expression tag	UNP A9XG43
D	185	GLU	-	expression tag	UNP A9XG43
D	186	HIS	-	expression tag	UNP A9XG43
D	187	HIS	-	expression tag	UNP A9XG43
D	188	HIS	-	expression tag	UNP A9XG43
D	189	HIS	-	expression tag	UNP A9XG43
D	190	HIS	-	expression tag	UNP A9XG43
D	191	HIS	-	expression tag	UNP A9XG43

- Molecule 2 is ethyl (2Z,4S)-4-[[[(2S)-2-methyl-3-phenylpropanoyl]amino}-5-[(3S)-2-oxopyrrolidin-3-yl]pent-2-enoate (three-letter code: 5E8) (formula: C<sub>21</sub>H<sub>28</sub>N<sub>2</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			27	21	2	4		
2	B	1	Total	C	N	O	0	0
			27	21	2	4		
2	C	1	Total	C	N	O	0	0
			27	21	2	4		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	D	1	Total	C	N	O	0	0
			27	21	2	4		

- Molecule 3 is water.

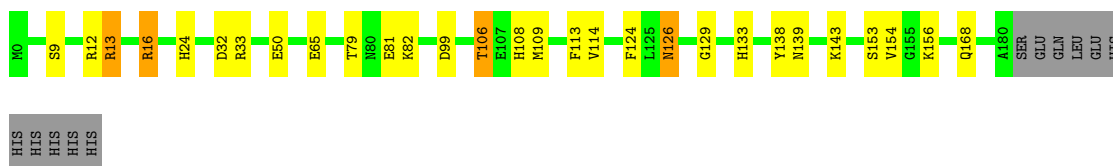
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	101	Total	O	0	0
			101	101		
3	B	116	Total	O	0	0
			116	116		
3	C	74	Total	O	0	0
			74	74		
3	D	72	Total	O	0	0
			72	72		

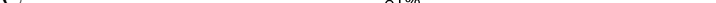


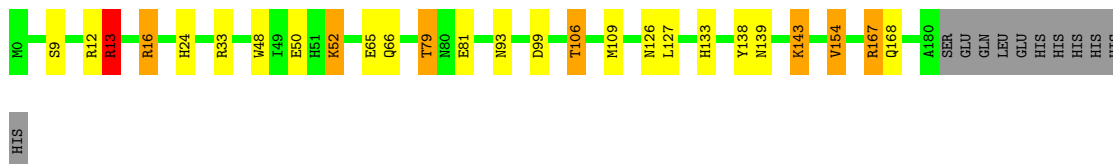
- Molecule 1: 3C proteinase



- Chain B:  79% 13% 6%



- Chain C:  81% 9% • • 6%



- Chain D:  84% 9% • 6%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	63.89Å 75.46Å 128.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.00 – 2.21 49.00 – 2.21	Depositor EDS
% Data completeness (in resolution range)	98.0 (49.00-2.21) 98.0 (49.00-2.21)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.62 (at 2.22Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.212 , 0.261 0.217 , 0.261	Depositor DCC
$R_{free}$ test set	1582 reflections (5.34%)	DCC
Wilson B-factor (Å <sup>2</sup> )	20.0	Xtriage
Anisotropy	0.259	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 40.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	6075	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 80.80 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 4.1183e-07. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 5E8

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	0.83	0/1428	0.89	1/1933 (0.1%)
1	B	0.84	1/1428 (0.1%)	0.93	4/1933 (0.2%)
1	C	0.84	1/1428 (0.1%)	0.94	4/1933 (0.2%)
1	D	0.81	0/1428	0.92	2/1933 (0.1%)
All	All	0.83	2/5712 (0.0%)	0.92	11/7732 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	65	GLU	CG-CD	5.08	1.59	1.51
1	B	65	GLU	CG-CD	5.05	1.59	1.51

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	16	ARG	NE-CZ-NH2	-6.77	116.92	120.30
1	A	16	ARG	NE-CZ-NH2	-6.66	116.97	120.30
1	C	12	ARG	NE-CZ-NH1	6.62	123.61	120.30
1	B	12	ARG	NE-CZ-NH1	6.25	123.43	120.30
1	B	16	ARG	NE-CZ-NH2	-6.08	117.26	120.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within

the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1401	0	1420	13	1
1	B	1401	0	1420	24	0
1	C	1401	0	1420	18	1
1	D	1401	0	1420	10	0
2	A	27	0	0	0	0
2	B	27	0	0	0	0
2	C	27	0	0	1	0
2	D	27	0	0	0	0
3	A	101	0	0	7	1
3	B	116	0	0	6	1
3	C	74	0	0	5	0
3	D	72	0	0	3	0
All	All	6075	0	5680	65	3

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 6.

The worst 5 of 65 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:D:93:ASN:HB2	3:D:368:HOH:O	1.45	1.14
1:A:106:THR:HG21	3:A:371:HOH:O	1.56	1.06
1:C:106:THR:HG21	3:C:341:HOH:O	1.64	0.98
1:D:106:THR:HG21	3:D:345:HOH:O	1.70	0.91
1:B:106:THR:HG21	3:B:371:HOH:O	1.69	0.90

All (3) 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:A:384:HOH:O	3:B:390:HOH:O[3_655]	1.72	0.48
1:C:93:ASN:OD1	1:C:93:ASN:OD1[2_556]	1.74	0.46
1:A:93:ASN:OD1	1:A:93:ASN:OD1[2_555]	1.93	0.27

## 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	A	179/192 (93%)	171 (96%)	7 (4%)	1 (1%)	28	28
1	B	179/192 (93%)	170 (95%)	8 (4%)	1 (1%)	28	28
1	C	179/192 (93%)	170 (95%)	7 (4%)	2 (1%)	17	13
1	D	179/192 (93%)	170 (95%)	8 (4%)	1 (1%)	28	28
All	All	716/768 (93%)	681 (95%)	30 (4%)	5 (1%)	25	24

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	50	GLU
1	D	50	GLU
1	B	50	GLU
1	C	50	GLU
1	C	154	VAL

### 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	155/166 (93%)	147 (95%)	8 (5%)	27	31
1	B	155/166 (93%)	146 (94%)	9 (6%)	23	26
1	C	155/166 (93%)	144 (93%)	11 (7%)	17	17
1	D	155/166 (93%)	147 (95%)	8 (5%)	27	31
All	All	620/664 (93%)	584 (94%)	36 (6%)	23	26

5 of 36 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	156	LYS
1	C	79	THR
1	D	126	ASN
1	C	13	ARG
1	C	99	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	139	ASN
1	C	24	HIS
1	D	24	HIS
1	B	126	ASN
1	C	139	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](#)

4 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
2	5E8	A	201	1	28,28,28	2.22	4 (14%)	29,36,36	2.32	5 (17%)
2	5E8	B	201	1	28,28,28	2.21	4 (14%)	29,36,36	2.31	8 (27%)
2	5E8	C	201	1	28,28,28	2.07	4 (14%)	29,36,36	2.02	6 (20%)
2	5E8	D	201	1	28,28,28	2.09	3 (10%)	29,36,36	2.29	7 (24%)

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	5E8	A	201	1	-	1/24/34/34	0/2/2/2
2	5E8	B	201	1	-	0/24/34/34	0/2/2/2
2	5E8	C	201	1	-	0/24/34/34	0/2/2/2
2	5E8	D	201	1	-	1/24/34/34	0/2/2/2

The worst 5 of 15 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	201	5E8	C12-C13	-3.86	1.47	1.52
2	A	201	5E8	C13-N1	-3.65	1.29	1.33
2	C	201	5E8	C13-N1	-2.73	1.30	1.33
2	B	201	5E8	C26-C25	2.02	1.56	1.53
2	D	201	5E8	C8-C9	2.05	1.42	1.38

The worst 5 of 26 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	201	5E8	C10-C14-C15	-9.60	109.39	125.82
2	D	201	5E8	C10-C14-C15	-9.47	109.61	125.82
2	B	201	5E8	C10-C14-C15	-8.56	111.17	125.82
2	C	201	5E8	C10-C14-C15	-6.88	114.05	125.82
2	C	201	5E8	C14-C15-C16	-4.77	111.53	122.74

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	201	5E8	C10-C14-C15-C16
2	D	201	5E8	C10-C14-C15-C16

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	201	5E8	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 [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	181/192 (94%)	-0.55	0 100 100	9, 16, 30, 45	0
1	B	181/192 (94%)	-0.48	0 100 100	10, 17, 31, 39	0
1	C	181/192 (94%)	-0.50	0 100 100	10, 17, 30, 40	0
1	D	181/192 (94%)	-0.52	0 100 100	10, 17, 29, 45	0
All	All	724/768 (94%)	-0.51	0 100 100	9, 17, 31, 45	0

There are no RSRZ outliers to report.

### 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
2	5E8	B	201	27/27	0.92	0.17	2.30	16,20,37,40	0
2	5E8	D	201	27/27	0.89	0.17	2.01	18,27,42,46	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	5E8	C	201	27/27	0.92	0.17	1.89	16,20,32,34	0
2	5E8	A	201	27/27	0.92	0.17	1.50	17,25,41,49	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.