



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 16, 2024 – 12:23 PM EDT

PDB ID : 5EDN  
Title : Structure of HOXB13-DNA(TCG) complex  
Authors : Morgunova, E.; Yin, Y.; Jolma, A.; Popov, A.; Taipale, J.  
Deposited on : 2015-10-21  
Resolution : 3.20 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 : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.37.1  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.37.1

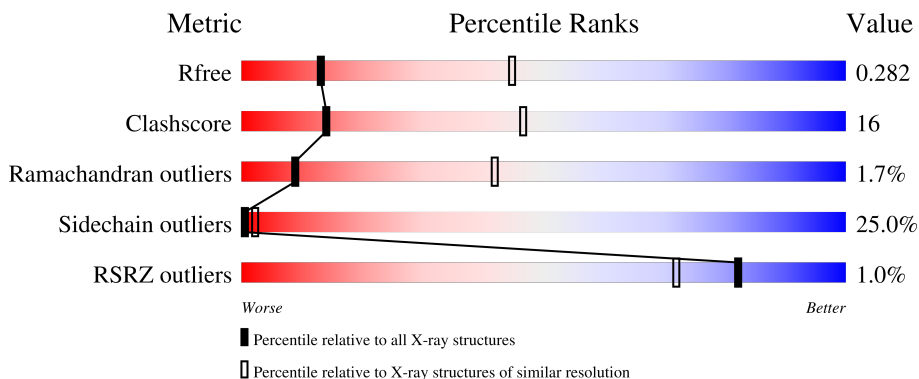
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.20 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



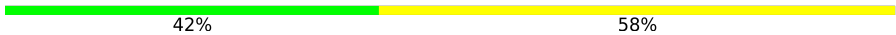
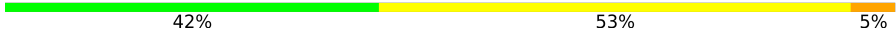
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1133 (3.20-3.20)
Clashscore	141614	1253 (3.20-3.20)
Ramachandran outliers	138981	1234 (3.20-3.20)
Sidechain outliers	138945	1233 (3.20-3.20)
RSRZ outliers	127900	1095 (3.20-3.20)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	76	 50% 26% 5% 1% 18%
1	B	76	 47% 30% 5% 1% 17%
1	G	76	 49% 24% 5% 1% 21%
1	J	76	 49% 24% 5% 1% 21%
2	C	19	 63% 37%

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Mol	Chain	Length	Quality of chain
2	D	19	 47% 47% 5%
2	H	19	 32% 68%
2	K	19	 37% 63%
3	E	19	 42% 58%
3	F	19	 42% 53% 5%
3	I	19	 5% 37% 58% 5%
3	L	19	 42% 53% 5%

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5197 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 Homeobox protein Hox-B13.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	60	512	323	103	86	0	0	0
1	B	61	517	326	104	87	0	0	0
1	G	60	506	320	100	86	0	0	0
1	J	61	521	329	105	87	0	0	0

- Molecule 2 is a DNA chain called DNA (5'-D(P\*GP\*TP\*TP\*GP\*TP\*GP\*TP\*TP\*TP\*TP\*AP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	C	19	391	187	65	120	19	0	0	0
2	D	19	391	187	65	120	19	0	0	0
2	H	19	391	187	65	120	19	0	0	0
2	K	19	391	187	65	120	19	0	0	0

- Molecule 3 is a DNA chain called DNA (5'-D(P\*GP\*GP\*AP\*CP\*CP\*TP\*CP\*GP\*TP\*AP\*AP\*AP\*AP\*CP\*AP\*CP\*AP\*AP\*C)-3').

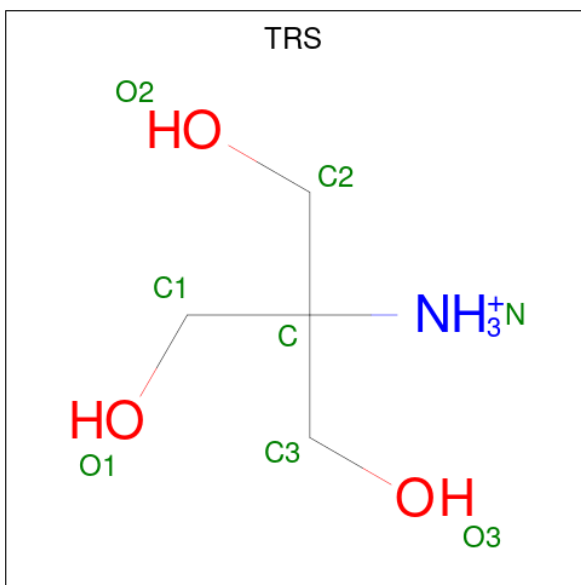
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	E	19	388	184	77	108	19	0	0	0
3	F	19	388	184	77	108	19	0	0	0
3	I	19	388	184	77	108	19	0	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	L	19	388	184	77	108	19	0	0	0

- Molecule 4 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: C<sub>4</sub>H<sub>12</sub>NO<sub>3</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	C	1	8	4	1	3	0	0

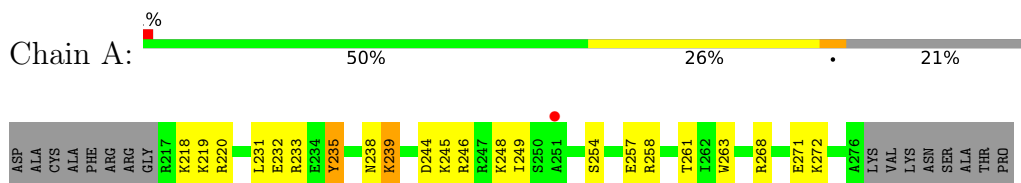
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	4	Total	O	0	0
			4	4		
5	E	2	Total	O	0	0
			2	2		
5	F	2	Total	O	0	0
			2	2		
5	H	2	Total	O	0	0
			2	2		
5	J	2	Total	O	0	0
			2	2		
5	K	3	Total	O	0	0
			3	3		
5	L	2	Total	O	0	0
			2	2		

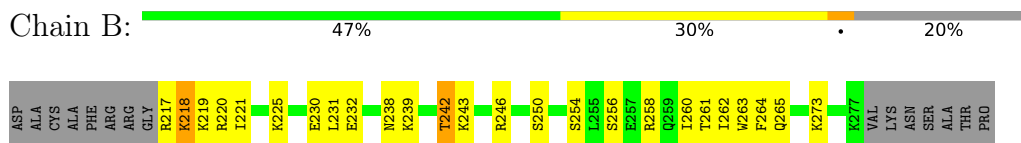
### 3 Residue-property plots [i](#)

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.

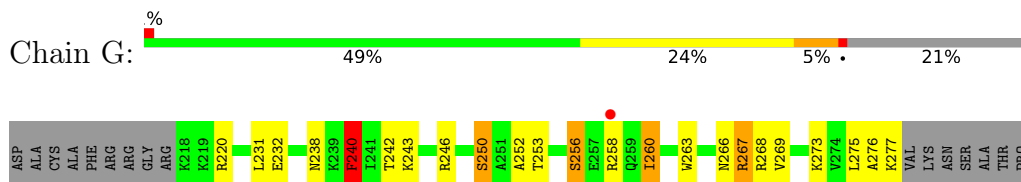
- Molecule 1: Homeobox protein Hox-B13



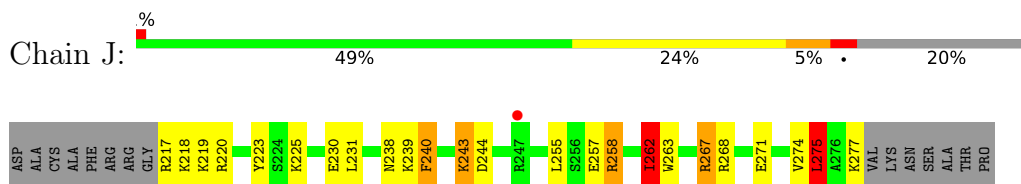
- Molecule 1: Homeobox protein Hox-B13



- Molecule 1: Homeobox protein Hox-B13



- Molecule 1: Homeobox protein Hox-B13

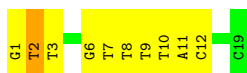


- Molecule 2: DNA (5'-D(P\*GP\*TP\*TP\*GP\*TP\*GP\*TP\*TP\*TP\*TP\*AP\*CP\*GP\*AP\*GP\*GP\*TP\*CP\*C)-3')



- Molecule 2: DNA (5'-D(P\*GP\*TP\*TP\*GP\*TP\*GP\*TP\*TP\*TP\*TP\*AP\*CP\*GP\*AP\*GP\*G P\*TP\*CP\*C)-3')

Chain D:  47% 47% 5%



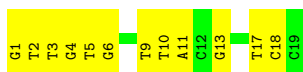
- Molecule 2: DNA (5'-D(P\*GP\*TP\*TP\*GP\*TP\*GP\*TP\*TP\*TP\*TP\*AP\*CP\*GP\*AP\*GP\*G P\*TP\*CP\*C)-3')

Chain H:  32% 68%



- Molecule 2: DNA (5'-D(P\*GP\*TP\*TP\*GP\*TP\*GP\*TP\*TP\*TP\*TP\*AP\*CP\*GP\*AP\*GP\*G P\*TP\*CP\*C)-3')

Chain K:  37% 63%



- Molecule 3: DNA (5'-D(P\*GP\*GP\*AP\*CP\*CP\*TP\*CP\*GP\*TP\*AP\*AP\*AP\*AP\*CP\*AP\*C P\*AP\*AP\*C)-3')

Chain E:  42% 58%



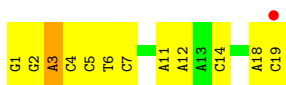
- Molecule 3: DNA (5'-D(P\*GP\*GP\*AP\*CP\*CP\*TP\*CP\*GP\*TP\*AP\*AP\*AP\*AP\*CP\*AP\*C P\*AP\*AP\*C)-3')

Chain F:  42% 53% 5%



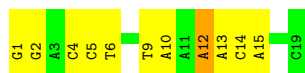
- Molecule 3: DNA (5'-D(P\*GP\*GP\*AP\*CP\*CP\*TP\*CP\*GP\*TP\*AP\*AP\*AP\*AP\*CP\*AP\*C P\*AP\*AP\*C)-3')

Chain I:  5% 37% 58% 5%



- Molecule 3: DNA (5'-D(P\*GP\*GP\*AP\*CP\*CP\*TP\*CP\*GP\*TP\*AP\*AP\*AP\*AP\*CP\*AP\*CP\*AP\*AP\*C)-3')

Chain L:  42% 53% 5%





## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	52.62Å 52.52Å 389.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.29 – 3.20 46.29 – 2.87	Depositor EDS
% Data completeness (in resolution range)	92.5 (46.29-3.20) 79.7 (46.29-2.87)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.79 (at 2.86Å)	Xtriage
Refinement program	REFMAC 5.8.0123	Depositor
R, $R_{free}$	0.216 , 0.281 0.219 , 0.282	Depositor DCC
$R_{free}$ test set	1077 reflections (5.23%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	112.4	Xtriage
Anisotropy	0.193	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.21 , 42.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.42$ , $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	0.378 for k,h,-l	Xtriage
Reported twinning fraction	0.613 for H, K, L 0.387 for K, H, -L	Depositor
Outliers	0 of 20590 reflections	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5197	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	124.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.02% 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: TRS

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	0/518	1.00	0/686
1	B	0.65	0/523	0.99	0/693
1	G	0.72	1/512 (0.2%)	1.04	3/679 (0.4%)
1	J	0.75	0/527	1.06	1/697 (0.1%)
2	C	0.39	0/436	0.82	1/672 (0.1%)
2	D	0.45	0/436	0.88	1/672 (0.1%)
2	H	0.41	0/436	0.87	0/672
2	K	0.48	0/436	0.95	1/672 (0.1%)
3	E	0.50	0/436	0.93	0/669
3	F	0.32	0/435	0.80	1/665 (0.2%)
3	I	0.46	0/435	0.80	1/665 (0.2%)
3	L	0.51	0/435	0.87	1/665 (0.2%)
All	All	0.55	1/5565 (0.0%)	0.92	10/8107 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	252	ALA	C-O	-5.20	1.13	1.23

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	F	19	DC	C1'-O4'-C4'	-6.40	103.70	110.10
1	J	262	ILE	CB-CA-C	6.07	123.73	111.60
1	G	240	PHE	N-CA-CB	5.88	121.19	110.60
3	L	12	DA	C1'-O4'-C4'	-5.87	104.23	110.10
2	K	2	DT	C1'-O4'-C4'	-5.84	104.26	110.10

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	512	0	555	11	0
1	B	517	0	557	10	0
1	G	506	0	544	12	0
1	J	521	0	568	15	0
2	C	391	0	218	5	0
2	D	391	0	218	16	0
2	H	391	0	218	11	0
2	K	391	0	218	13	0
3	E	388	0	212	28	0
3	F	388	0	213	18	0
3	I	388	0	213	18	0
3	L	388	0	213	12	0
4	C	8	0	12	0	0
5	D	4	0	0	0	0
5	E	2	0	0	0	0
5	F	2	0	0	0	0
5	H	2	0	0	1	0
5	J	2	0	0	0	0
5	K	3	0	0	0	0
5	L	2	0	0	0	0
All	All	5197	0	3959	140	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 16.

The worst 5 of 140 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)
3:E:5:DC:C2'	3:E:6:DT:H71	1.33	1.57
3:E:5:DC:H2''	3:E:6:DT:C7	1.06	1.51
3:E:5:DC:C2'	3:E:6:DT:C7	1.87	1.42
3:E:5:DC:C2'	3:E:6:DT:H73	1.73	1.06
2:D:9:DT:H2''	2:D:10:DT:O5'	1.56	1.01

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	58/76 (76%)	55 (95%)	3 (5%)	0	100	100
1	B	59/76 (78%)	54 (92%)	4 (7%)	1 (2%)	9	42
1	G	58/76 (76%)	54 (93%)	2 (3%)	2 (3%)	3	24
1	J	59/76 (78%)	55 (93%)	3 (5%)	1 (2%)	9	42
All	All	234/304 (77%)	218 (93%)	12 (5%)	4 (2%)	9	42

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	G	253	THR
1	B	221	ILE
1	G	250	SER
1	J	275	LEU

### 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	54/66 (82%)	42 (78%)	12 (22%)	1	4
1	B	54/66 (82%)	40 (74%)	14 (26%)	0	2
1	G	53/66 (80%)	41 (77%)	12 (23%)	1	4
1	J	55/66 (83%)	39 (71%)	16 (29%)	0	1
All	All	216/264 (82%)	162 (75%)	54 (25%)	0	2

5 of 54 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	238	ASN
1	G	269	VAL
1	J	262	ILE
1	G	240	PHE
1	G	250	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	G	266	ASN
1	J	227	GLN
1	J	238	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	TRS	C	101	-	7,7,7	0.76	0	9,9,9	0.78	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	TRS	C	101	-	-	3/9/9/9	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	C	101	TRS	C1-C-C3-O3
4	C	101	TRS	C2-C-C3-O3
4	C	101	TRS	N-C-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
3	I	1
3	L	1
3	F	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	I	18:DA	O3'	19:DC	P	3.13
1	L	18:DA	O3'	19:DC	P	2.96
1	F	18:DA	O3'	19:DC	P	2.66

## 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	60/76 (78%)	-0.59	1 (1%) 70 57	94, 124, 158, 182	0
1	B	61/76 (80%)	-0.62	0 100 100	66, 107, 138, 147	0
1	G	60/76 (78%)	-0.53	1 (1%) 70 57	99, 128, 155, 203	0
1	J	61/76 (80%)	-0.52	1 (1%) 72 59	69, 106, 132, 147	0
2	C	19/19 (100%)	-1.19	0 100 100	98, 134, 173, 174	0
2	D	19/19 (100%)	-1.07	0 100 100	75, 114, 137, 150	0
2	H	19/19 (100%)	-1.05	0 100 100	102, 125, 187, 204	0
2	K	19/19 (100%)	-1.10	0 100 100	63, 110, 181, 205	0
3	E	19/19 (100%)	-0.99	0 100 100	89, 112, 188, 197	0
3	F	19/19 (100%)	-1.06	0 100 100	116, 131, 147, 173	0
3	I	19/19 (100%)	-0.76	1 (5%) 26 14	111, 136, 173, 353	0
3	L	19/19 (100%)	-0.79	0 100 100	89, 104, 147, 228	0
All	All	394/456 (86%)	-0.73	4 (1%) 82 72	63, 121, 166, 353	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	I	19	DC	5.6
1	G	258	ARG	3.2
1	A	251	ALA	2.4
1	J	247	ARG	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 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
4	TRS	C	101	8/8	0.97	0.08	79,83,89,93	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.