



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 7, 2021 – 01:42 pm BST

PDB ID : 7OX9  
Title : Target-bound SpCas9 complex with AAVS1 all-RNA guide  
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Deposited on : 2021-06-22  
Resolution : 2.45 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  
Xtrriage (Phenix) : 1.13  
EDS : **FAILED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.1



## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 13970 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 RNA chain called sgRNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	84	1772	790	331	568	83	0	0	1

- Molecule 2 is a protein called CRISPR-associated endonuclease Cas9/Csn1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	1338	10930	6962	1898	2048	22	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-3	GLY	-	expression tag	UNP Q99ZW2
B	-2	ALA	-	expression tag	UNP Q99ZW2
B	-1	ALA	-	expression tag	UNP Q99ZW2
B	0	SER	-	expression tag	UNP Q99ZW2
B	10	ALA	ASP	engineered mutation	UNP Q99ZW2
B	840	ALA	HIS	engineered mutation	UNP Q99ZW2

- Molecule 3 is a DNA chain called AAVS1 target DNA strand.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	C	28	559	268	98	166	27	0	0	0

- Molecule 4 is a DNA chain called AAVS1 non-target DNA strand.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	D	11	209	100	35	64	10	0	0	1

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	2	Total Mg 2 2	0	0

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	3	Total K 3 3	0	0
6	B	6	Total K 6 6	0	0
6	C	2	Total K 2 2	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	150	Total O 150 150	0	0
7	B	302	Total O 302 302	0	0
7	C	23	Total O 23 23	0	0
7	D	12	Total O 12 12	0	0

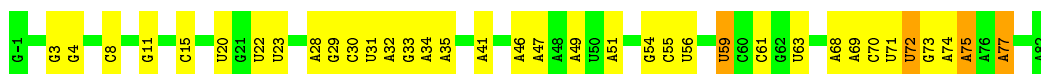
### 3 Residue-property plots [i](#)

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. 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. 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.


Note EDS failed to run properly.

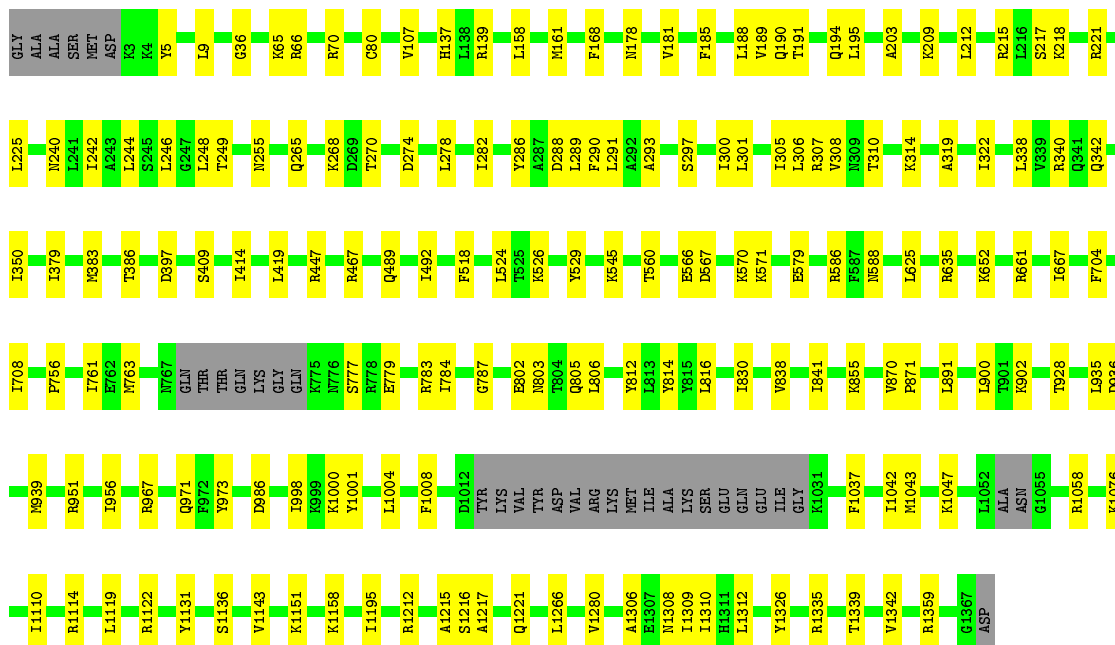
- Molecule 1: sgRNA

Chain A:  57% 38% 5%



- Molecule 2: CRISPR-associated endonuclease Cas9/Csn1

Chain B:  85% 12%




- Molecule 3: AAVS1 target DNA strand

Chain C:  75% 21%



- Molecule 4: AAVS1 non-target DNA strand

Chain D:  75% 17% 8%



## 4 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	178.08Å 68.20Å 187.77Å 90.00° 111.14° 90.00°	Depositor
Resolution (Å)	48.16 – 2.45	Depositor
% Data completeness (in resolution range)	99.2 (48.16-2.45)	Depositor
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.33 (at 2.45Å)	Xtrriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, $R_{free}$	0.195 , 0.233	Depositor
Wilson B-factor (Å <sup>2</sup> )	53.0	Xtrriage
Anisotropy	0.471	Xtrriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	13970	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.43% 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, K

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	0.30	0/1987	0.83	0/3100
2	B	0.27	0/11122	0.44	0/14942
3	C	0.67	0/624	1.04	1/958 (0.1%)
4	D	0.63	0/233	1.07	0/360
All	All	0.31	0/13966	0.58	1/19360 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	8	DC	O4'-C4'-C3'	-5.64	102.24	104.50

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	1772	0	883	23	0
2	B	10930	0	11106	110	0
3	C	559	0	316	7	0
4	D	209	0	116	3	0
5	A	2	0	0	0	0
6	A	3	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	6	0	0	0	0
6	C	2	0	0	0	0
7	A	150	0	0	1	0
7	B	302	0	0	8	0
7	C	23	0	0	0	0
7	D	12	0	0	0	0
All	All	13970	0	12421	132	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 5.

All (132) 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)
2:B:305:ILE:HD11	2:B:409:SER:HB2	1.64	0.79
2:B:215:ARG:HD2	2:B:307:ARG:HH21	1.56	0.71
2:B:158:LEU:HD22	2:B:419:LEU:HD12	1.74	0.69
2:B:80:CYS:SG	7:B:1750:HOH:O	2.51	0.68
1:A:71:U:H2'	1:A:72:U:C6	2.29	0.68
2:B:967:ARG:NH2	7:B:1502:HOH:O	2.25	0.68
2:B:1042:ILE:HG23	2:B:1043:MET:HG2	1.80	0.63
1:A:22:U:H2'	1:A:23:U:C6	2.35	0.62
2:B:1335:ARG:NH2	4:D:2:DG:O6	2.31	0.62
2:B:1047:LYS:O	2:B:1076:LYS:NZ	2.28	0.62
1:A:59:U:OP1	2:B:467:ARG:NH2	2.32	0.61
2:B:635:ARG:NH1	7:B:1504:HOH:O	2.32	0.61
2:B:870:VAL:HG21	2:B:902:LYS:HB3	1.83	0.61
2:B:240:ASN:ND2	2:B:255:ASN:OD1	2.34	0.60
3:C:-6:DA:H2'	3:C:-5:DA:C8	2.37	0.60
2:B:1215:ALA:HB2	2:B:1221:GLN:HG3	1.84	0.59
2:B:195:LEU:HD21	2:B:286:TYR:CD1	2.37	0.58
1:A:49:A:N3	2:B:1122:ARG:NH2	2.50	0.58
2:B:1212:ARG:NH2	2:B:1280:VAL:O	2.37	0.58
1:A:46:A:H2'	1:A:47:A:C8	2.40	0.57
2:B:178:ASN:HD21	2:B:310:THR:HG23	1.70	0.56
2:B:181:VAL:HB	2:B:209:LYS:HD2	1.85	0.56
2:B:195:LEU:HD21	2:B:286:TYR:HD1	1.69	0.56
2:B:297:SER:O	2:B:301:LEU:N	2.37	0.55
2:B:967:ARG:NH1	2:B:986:ASP:OD1	2.40	0.55
2:B:1110:ILE:HG23	2:B:1122:ARG:HD2	1.90	0.54
2:B:342:GLN:HB2	2:B:383:MET:HE3	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:181:VAL:HG13	2:B:300:ILE:HD11	1.90	0.54
2:B:779:GLU:O	2:B:783:ARG:HG2	2.08	0.53
2:B:704:PHE:O	2:B:708:ILE:HG12	2.08	0.53
2:B:168:PHE:CG	2:B:447:ARG:HD2	2.44	0.53
2:B:248:LEU:HG	2:B:265:GLN:HB2	1.92	0.52
2:B:567:ASP:HA	2:B:571:LYS:HD3	1.92	0.52
2:B:1136:SER:HA	4:D:2:DG:O3'	2.10	0.52
2:B:190:GLN:O	2:B:194:GLN:HG2	2.10	0.51
2:B:308:VAL:HG11	2:B:319:ALA:HB3	1.93	0.51
2:B:447:ARG:NH2	7:B:1512:HOH:O	2.44	0.51
2:B:1114:ARG:NH1	4:D:4:DA:OP1	2.44	0.51
2:B:288:ASP:O	2:B:291:LEU:HB3	2.11	0.50
2:B:218:LYS:HB3	2:B:246:LEU:HB3	1.92	0.50
2:B:489:GLN:NE2	7:B:1508:HOH:O	2.42	0.50
3:C:-5:DA:H4'	3:C:-4:DT:OP1	2.11	0.50
1:A:54:G:H2'	1:A:55:C:C6	2.47	0.50
2:B:1004:LEU:HD11	2:B:1042:ILE:HD11	1.94	0.49
3:C:-7:DC:H3'	3:C:-6:DA:H8	1.77	0.49
2:B:189:VAL:HG21	2:B:203:ALA:HB2	1.95	0.49
2:B:936:ASP:OD1	2:B:951:ARG:NH1	2.45	0.49
3:C:-7:DC:H2'	3:C:-7:DC:O2	2.12	0.49
1:A:77:A:N7	7:A:204:HOH:O	2.34	0.49
1:A:33:G:H5'	1:A:34:A:OP2	2.13	0.48
2:B:225:LEU:HD23	2:B:242:ILE:HG21	1.96	0.48
1:A:70:C:H2'	1:A:71:U:H6	1.78	0.48
2:B:290:PHE:O	2:B:293:ALA:HB3	2.14	0.48
1:A:63:U:N3	2:B:65:LYS:HD2	2.29	0.47
2:B:529:TYR:HA	2:B:579:GLU:O	2.13	0.47
2:B:956:ILE:HD11	2:B:998:ILE:HD13	1.97	0.47
2:B:518:PHE:CD1	2:B:667:ILE:HD12	2.50	0.47
2:B:586:ARG:NH2	7:B:1518:HOH:O	2.48	0.47
2:B:274:ASP:O	2:B:278:LEU:N	2.46	0.46
2:B:956:ILE:HA	2:B:1008:PHE:O	2.15	0.46
2:B:1212:ARG:NH1	7:B:1506:HOH:O	2.40	0.46
2:B:756:PRO:HD2	2:B:939:MET:CE	2.46	0.46
2:B:1151:LYS:HD2	2:B:1158:LYS:HD2	1.97	0.46
2:B:812:TYR:CZ	2:B:816:LEU:HD11	2.51	0.45
2:B:814:TYR:CZ	2:B:830:ILE:HG13	2.51	0.45
1:A:4:G:OP1	2:B:661:ARG:HD3	2.17	0.45
2:B:338:LEU:HD13	2:B:386:THR:HG22	1.98	0.45
2:B:526:LYS:HD3	2:B:526:LYS:HA	1.61	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:3:G:H2'	1:A:4:G:C8	2.51	0.45
2:B:217:SER:O	2:B:221:ARG:HG3	2.17	0.45
2:B:268:LYS:HG3	2:B:270:THR:H	1.81	0.45
2:B:107:VAL:HG23	2:B:1131:TYR:CE1	2.51	0.45
2:B:971:GLN:HG2	2:B:973:TYR:OH	2.16	0.45
3:C:-7:DC:H3'	3:C:-6:DA:C8	2.52	0.45
2:B:188:LEU:O	2:B:191:THR:HG22	2.16	0.45
2:B:350:ILE:HD11	2:B:379:ILE:HD13	1.99	0.44
2:B:178:ASN:ND2	2:B:310:THR:HG23	2.32	0.44
2:B:560:THR:HA	2:B:586:ARG:HA	1.98	0.44
2:B:777:SER:HB2	2:B:803:ASN:HB2	1.98	0.44
2:B:802:GLU:H	2:B:805:GLN:HE21	1.66	0.44
2:B:218:LYS:HD3	2:B:246:LEU:HA	1.99	0.44
2:B:787:GLY:HA3	2:B:891:LEU:HD21	1.99	0.44
2:B:9:LEU:HD12	2:B:761:ILE:HG22	1.98	0.44
2:B:870:VAL:HG22	2:B:871:PRO:HD2	1.99	0.44
2:B:1216:SER:OG	2:B:1217:ALA:N	2.51	0.43
1:A:22:U:H2'	1:A:23:U:H6	1.79	0.43
1:A:74:A:OP1	1:A:74:A:H8	2.00	0.43
2:B:278:LEU:O	2:B:282:ILE:HG12	2.18	0.43
2:B:212:LEU:HD22	2:B:246:LEU:HD11	2.00	0.43
2:B:1339:THR:O	2:B:1342:VAL:HG22	2.17	0.43
1:A:61:C:OP2	2:B:70:ARG:HD3	2.19	0.43
1:A:70:C:H2'	1:A:71:U:C6	2.52	0.43
2:B:652:LYS:HB3	2:B:652:LYS:HE2	1.80	0.43
2:B:841:ILE:HD13	2:B:900:LEU:HG	2.00	0.43
2:B:1037:PHE:HZ	2:B:1058:ARG:HH12	1.67	0.43
1:A:41:A:OP2	2:B:340:ARG:NH2	2.51	0.43
2:B:1143:VAL:HG13	2:B:1195:ILE:HG23	2.01	0.43
2:B:1266:LEU:HD22	2:B:1309:ILE:HD12	2.01	0.42
2:B:36:GLY:HA3	2:B:1359:ARG:O	2.19	0.42
2:B:305:ILE:HG22	2:B:306:LEU:HD23	2.01	0.42
2:B:586:ARG:NH2	2:B:588:ASN:HA	2.35	0.42
2:B:1306:ALA:O	2:B:1310:ILE:HG12	2.19	0.42
1:A:74:A:H3'	1:A:75:A:H8	1.84	0.42
2:B:185:PHE:CE1	2:B:225:LEU:HD21	2.54	0.42
2:B:289:LEU:HD12	2:B:289:LEU:HA	1.84	0.42
2:B:314:LYS:HB3	2:B:314:LYS:HE2	1.76	0.42
2:B:838:VAL:HG12	2:B:855:LYS:HE2	2.00	0.42
2:B:137:HIS:HA	2:B:322:ILE:HD11	2.00	0.42
2:B:244:LEU:HA	2:B:249:THR:OG1	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:524:LEU:HG	2:B:545:LYS:HG2	2.01	0.42
3:C:8:DC:H2'	3:C:9:DC:C6	2.54	0.42
2:B:1308:ASN:HB3	2:B:1326:TYR:CD1	2.55	0.41
2:B:307:ARG:NH2	2:B:397:ASP:OD2	2.46	0.41
2:B:492:ILE:HD13	2:B:492:ILE:HA	1.92	0.41
2:B:1216:SER:OG	7:B:1501:HOH:O	2.22	0.41
1:A:69:A:H2'	1:A:70:C:C6	2.55	0.41
2:B:566:GLU:O	2:B:570:LYS:HB3	2.21	0.41
2:B:784:ILE:HD12	2:B:806:LEU:HD13	2.01	0.41
1:A:15:C:P	2:B:66:ARG:HH11	2.44	0.41
1:A:30:C:H2'	1:A:31:U:C6	2.55	0.41
1:A:32:A:H2'	1:A:33:G:O4'	2.21	0.41
1:A:69:A:H2'	1:A:70:C:H6	1.85	0.41
2:B:139:ARG:HG2	2:B:161:MET:HE3	2.02	0.41
2:B:526:LYS:HG3	3:C:18:DC:H2''	2.03	0.41
2:B:489:GLN:HG3	2:B:625:LEU:HD21	2.02	0.41
2:B:1119:LEU:HD23	2:B:1119:LEU:HA	1.93	0.41
2:B:1309:ILE:HA	2:B:1312:LEU:HD12	2.03	0.41
2:B:935:LEU:O	2:B:939:MET:HG2	2.21	0.41
2:B:1000:LYS:HG3	2:B:1001:TYR:CE1	2.56	0.41
2:B:306:LEU:HD21	2:B:414:ILE:HD13	2.03	0.40
2:B:5:TYR:OH	2:B:756:PRO:HD3	2.22	0.40
2:B:763:MET:SD	2:B:928:THR:HG22	2.61	0.40

There are no symmetry-related clashes.

### 5.3 Torsion angles [i](#)

#### 5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

#### 5.3.2 Protein sidechains [i](#)

There are no protein residues with a non-rotameric sidechain to report in this entry.

#### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	81/84 (96%)	14 (17%)	0

All (14) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	8	C
1	A	11	G
1	A	20	U
1	A	28	A
1	A	29	G
1	A	35	A
1	A	51	A
1	A	56	U
1	A	59	U
1	A	68	A
1	A	72	U
1	A	73	G
1	A	75	A
1	A	77	A

There are no RNA pucker outliers to report.

#### 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 13 ligands modelled in this entry, 13 are monoatomic - leaving 0 for Mogul analysis.

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.

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](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS failed to run properly - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS failed to run properly - this section is therefore empty.

### 6.3 Carbohydrates

EDS failed to run properly - this section is therefore empty.

### 6.4 Ligands

EDS failed to run properly - this section is therefore empty.

### 6.5 Other polymers

EDS failed to run properly - this section is therefore empty.