Full wwPDB X-ray Structure Validation Report ⓘ

Jun 20, 2021 – 04:09 AM BST

PDB ID	:	6THH
Title	:	Crystal structure of type I-D CRISPR-Cas nuclease Cas10d in complex with the SIRV3 AcrID1 (gp02) anti-CRISPR protein
Authors	:	Manav, M.C.; Brodersen, D.E.
Deposited on	:	2019-11-20
Resolution	:	3.48 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

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

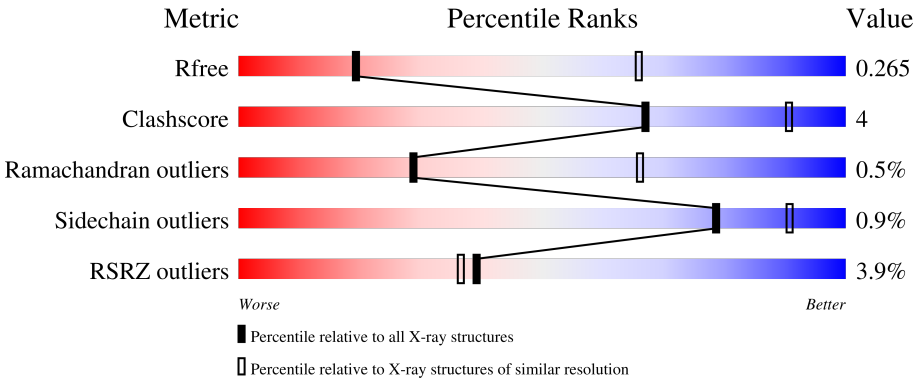
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.20
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.20

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.48 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	1379 (3.56-3.40)
Clashscore	141614	1461 (3.56-3.40)
Ramachandran outliers	138981	1424 (3.56-3.40)
Sidechain outliers	138945	1425 (3.56-3.40)
RSRZ outliers	127900	1289 (3.56-3.40)

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 >=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 <=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	104	3% 79% 12% • 8%
1	B	104	% 87% 6% 8%
2	C	855	4% 84% 11% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 8243 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 SIRV3 AcrID1 (gp02) anti-CRISPR protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	96	Total	C	N	O	S	0	0	0
			849	558	125	163	3			
1	B	96	Total	C	N	O	S	0	0	0
			849	558	125	163	3			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	97	LEU	-	expression tag	UNP A0A1B3SN05
A	98	GLU	-	expression tag	UNP A0A1B3SN05
A	99	HIS	-	expression tag	UNP A0A1B3SN05
A	100	HIS	-	expression tag	UNP A0A1B3SN05
A	101	HIS	-	expression tag	UNP A0A1B3SN05
A	102	HIS	-	expression tag	UNP A0A1B3SN05
A	103	HIS	-	expression tag	UNP A0A1B3SN05
A	104	HIS	-	expression tag	UNP A0A1B3SN05
B	97	LEU	-	expression tag	UNP A0A1B3SN05
B	98	GLU	-	expression tag	UNP A0A1B3SN05
B	99	HIS	-	expression tag	UNP A0A1B3SN05
B	100	HIS	-	expression tag	UNP A0A1B3SN05
B	101	HIS	-	expression tag	UNP A0A1B3SN05
B	102	HIS	-	expression tag	UNP A0A1B3SN05
B	103	HIS	-	expression tag	UNP A0A1B3SN05
B	104	HIS	-	expression tag	UNP A0A1B3SN05

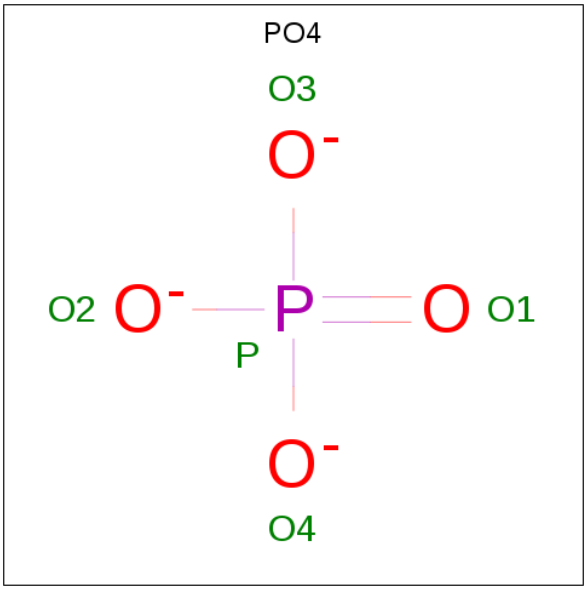
- Molecule 2 is a protein called CRISPR-associated protein, CscA.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	C	816	Total	C	N	O	S	Se	0	0	0
			6539	4222	1053	1237	9	18			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	848	LEU	-	expression tag	UNP M9U4Y8
C	849	GLU	-	expression tag	UNP M9U4Y8
C	850	HIS	-	expression tag	UNP M9U4Y8
C	851	HIS	-	expression tag	UNP M9U4Y8
C	852	HIS	-	expression tag	UNP M9U4Y8
C	853	HIS	-	expression tag	UNP M9U4Y8
C	854	HIS	-	expression tag	UNP M9U4Y8
C	855	HIS	-	expression tag	UNP M9U4Y8

- Molecule 3 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	C	1	Total O P 5 4 1	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

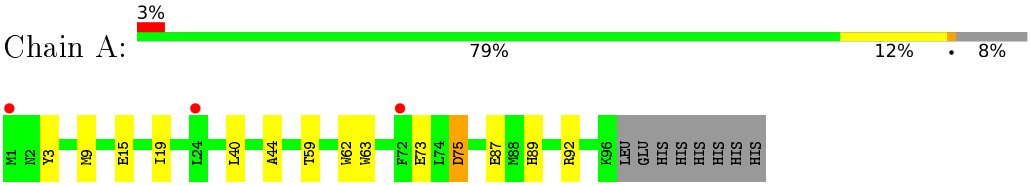
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	1	Total Zn 1 1	0	0

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.

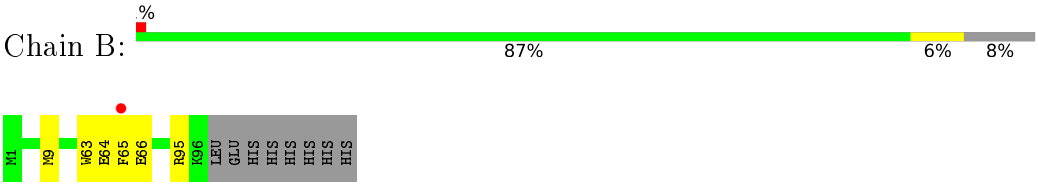
- Molecule 1: SIRV3 AcrID1 (gp02) anti-CRISPR protein

Chain A:



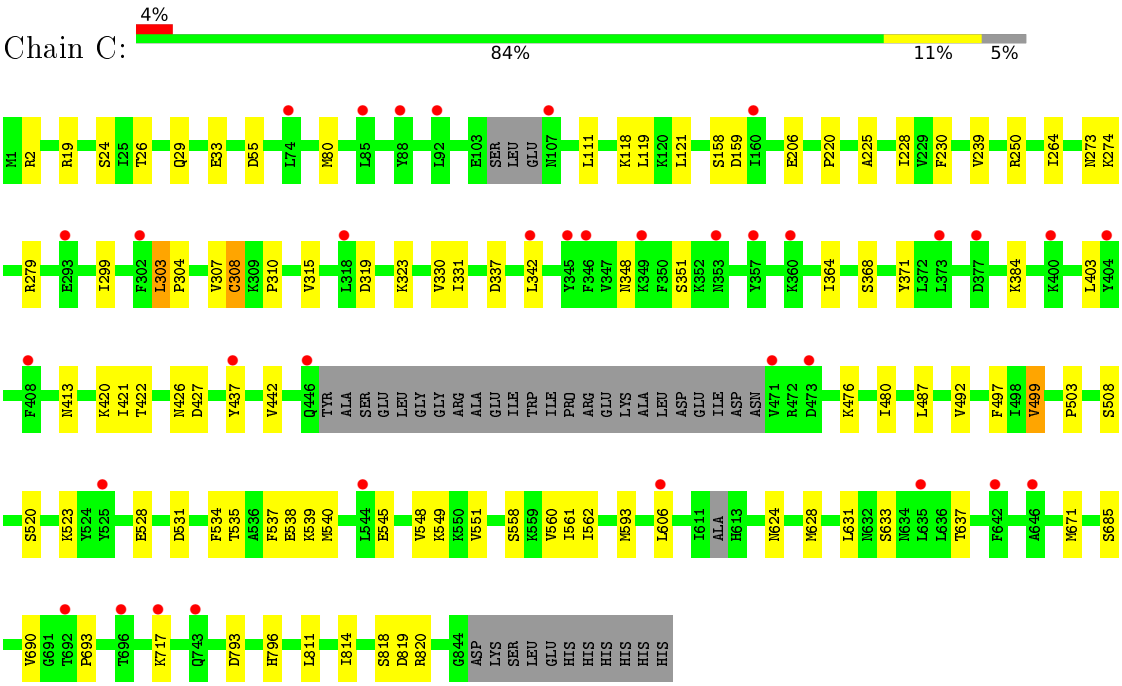
- Molecule 1: SIRV3 AcrID1 (gp02) anti-CRISPR protein

Chain B:



- Molecule 2: CRISPR-associated protein, CscA

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	157.99Å 157.99Å 130.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	67.54 – 3.48 84.79 – 3.48	Depositor EDS
% Data completeness (in resolution range)	99.9 (67.54-3.48) 90.6 (84.79-3.48)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.96 (at 3.49Å)	Xtriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.236 , 0.254 0.237 , 0.265	Depositor DCC
R_{free} test set	1869 reflections (8.61%)	wwPDB-VP
Wilson B-factor (Å^2)	124.4	Xtriage
Anisotropy	0.264	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 86.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	8243	wwPDB-VP
Average B, all atoms (Å^2)	137.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.94% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: ZN, PO4

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	0.23	0/871	0.39	0/1173
1	B	0.24	0/871	0.41	0/1173
2	C	0.24	0/6647	0.40	0/8938
All	All	0.24	0/8389	0.40	0/11284

There are no bond length outliers.

There are no bond angle outliers.

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	849	0	810	8	0
1	B	849	0	810	4	0
2	C	6539	0	6649	54	0
3	C	5	0	0	0	0
4	C	1	0	0	0	0
All	All	8243	0	8269	64	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 4.

All (64) 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:C:561:ILE:HD13	2:C:606:LEU:HD22	1.75	0.68
2:C:811:LEU:HD23	2:C:814:ILE:HD11	1.77	0.67
1:B:64:GLU:O	1:B:66:GLU:N	2.29	0.65
2:C:24:SER:HA	2:C:118:LYS:HD3	1.80	0.63
1:A:19:ILE:O	1:A:92:ARG:NH1	2.34	0.59
2:C:29:GLN:HE21	2:C:111:LEU:HD23	1.68	0.59
2:C:497:PHE:HB2	2:C:562:ILE:HB	1.86	0.57
1:A:44:ALA:HB2	1:A:62:TRP:CE2	2.39	0.57
2:C:426:ASN:ND2	2:C:437:TYR:O	2.35	0.56
2:C:818:SER:OG	2:C:819:ASP:N	2.37	0.56
1:A:75:ASP:HB2	1:A:87:GLU:HG2	1.87	0.55
2:C:671:MSE:HG2	2:C:685:SER:HB2	1.88	0.55
2:C:331:ILE:HD13	2:C:342:LEU:HD13	1.88	0.55
2:C:520:SER:HB2	2:C:523:LYS:HE3	1.90	0.54
2:C:273:ASN:OD1	2:C:274:LYS:NZ	2.40	0.54
2:C:2:ARG:NH1	2:C:538:GLU:OE2	2.39	0.54
2:C:310:PRO:HB2	2:C:351:SER:HB2	1.91	0.52
2:C:545:GLU:OE2	2:C:549:LYS:NZ	2.37	0.52
1:A:9:MET:HG3	1:B:9:MET:HG3	1.91	0.52
2:C:319:ASP:O	2:C:323:LYS:HG3	2.08	0.52
2:C:119:LEU:HB3	2:C:121:LEU:HG	1.92	0.52
2:C:159:ASP:HA	2:C:503:PRO:HB3	1.92	0.51
2:C:279:ARG:NH1	2:C:337:ASP:OD1	2.40	0.51
2:C:819:ASP:OD1	2:C:820:ARG:N	2.43	0.51
2:C:631:LEU:H	2:C:637:THR:HG22	1.77	0.50
2:C:420:LYS:O	2:C:422:THR:N	2.45	0.50
1:A:59:THR:HA	1:A:73:GLU:HA	1.94	0.49
2:C:264:ILE:HG23	2:C:330:VAL:HG22	1.95	0.49
2:C:304:PRO:HB2	2:C:307:VAL:HG22	1.95	0.49
2:C:303:LEU:HG	2:C:308:CYS:SG	2.55	0.47
2:C:403:LEU:HD11	2:C:480:ILE:HD13	1.96	0.47
2:C:220:PRO:HA	2:C:230:PHE:HB3	1.97	0.46
2:C:793:ASP:HB2	2:C:796:HIS:HB2	1.98	0.45
2:C:624:ASN:HA	2:C:628:MSE:HE2	1.97	0.45
2:C:593:MSE:HE2	2:C:593:MSE:HB3	1.83	0.45
2:C:528:GLU:OE2	2:C:717:LYS:NZ	2.29	0.45
2:C:26:THR:HB	2:C:29:GLN:HB2	1.99	0.44
2:C:364:ILE:HB	2:C:368:SER:HB3	1.99	0.44
2:C:499:VAL:HG13	2:C:560:VAL:HG13	1.99	0.44
2:C:531:ASP:HB2	2:C:535:THR:OG1	2.17	0.44
2:C:80:MSE:SE	2:C:121:LEU:HD22	2.68	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:384:LYS:HA	2:C:384:LYS:HD2	1.85	0.44
2:C:631:LEU:N	2:C:637:THR:HG22	2.31	0.44
2:C:206:GLU:OE2	2:C:250:ARG:NH1	2.50	0.44
2:C:487:LEU:HB3	2:C:492:VAL:HG22	2.00	0.43
2:C:55:ASP:OD2	2:C:508:SER:OG	2.28	0.43
2:C:315:VAL:HG21	2:C:323:LYS:HA	2.01	0.43
2:C:548:VAL:CG2	2:C:551:VAL:HB	2.49	0.43
1:A:63:TRP:CZ3	2:C:531:ASP:HB3	2.53	0.42
2:C:633:SER:O	2:C:637:THR:HG23	2.19	0.42
2:C:442:VAL:HA	2:C:476:LYS:HG2	1.99	0.42
1:A:3:TYR:HE1	1:A:40:LEU:HD11	1.85	0.42
2:C:19:ARG:HG3	2:C:534:PHE:CZ	2.54	0.42
2:C:225:ALA:H	2:C:558:SER:HB3	1.85	0.42
2:C:539:LYS:HG3	2:C:540:MSE:HE2	2.02	0.42
2:C:299:ILE:HD13	2:C:348:ASN:HB3	2.03	0.41
2:C:534:PHE:HA	2:C:537:PHE:HB3	2.02	0.41
2:C:528:GLU:H	2:C:528:GLU:HG3	1.64	0.41
2:C:671:MSE:HG2	2:C:685:SER:CB	2.51	0.41
2:C:239:VAL:HB	2:C:413:ASN:HB3	2.04	0.40
1:B:63:TRP:NE1	1:B:66:GLU:O	2.55	0.40
2:C:33:GLU:H	2:C:33:GLU:CD	2.25	0.40
1:A:73:GLU:HG2	1:A:89:HIS:HB2	2.04	0.40
1:B:95:ARG:HD2	1:B:95:ARG:HA	1.90	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	94/104 (90%)	87 (93%)	7 (7%)	0	100 100
1	B	94/104 (90%)	89 (95%)	4 (4%)	1 (1%)	14 50

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
2	C	808/855 (94%)	745 (92%)	59 (7%)	4 (0%)	29 66
All	All	996/1063 (94%)	921 (92%)	70 (7%)	5 (0%)	29 66

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	65	PHE
2	C	158	SER
2	C	421	ILE
2	C	690	VAL
2	C	693	PRO

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	94/102 (92%)	92 (98%)	2 (2%)	53 78
1	B	94/102 (92%)	94 (100%)	0	100 100
2	C	742/757 (98%)	736 (99%)	6 (1%)	81 92
All	All	930/961 (97%)	922 (99%)	8 (1%)	78 91

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	GLU
1	A	75	ASP
2	C	228	ILE
2	C	303	LEU
2	C	308	CYS
2	C	371	TYR
2	C	427	ASP
2	C	499	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are

no such sidechains identified.

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	$\#\|Z\| > 2$
3	PO4	C	901	-	4,4,4	0.91	0	6,6,6	0.39	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

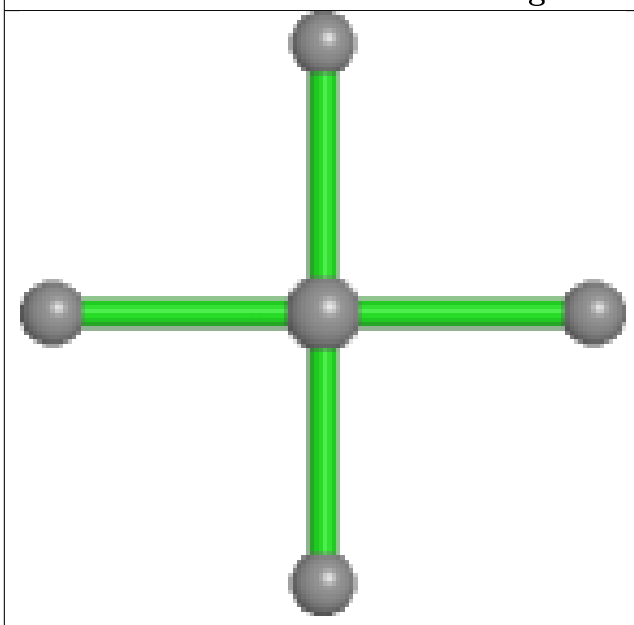
There are no ring outliers.

No monomer is involved in short contacts.

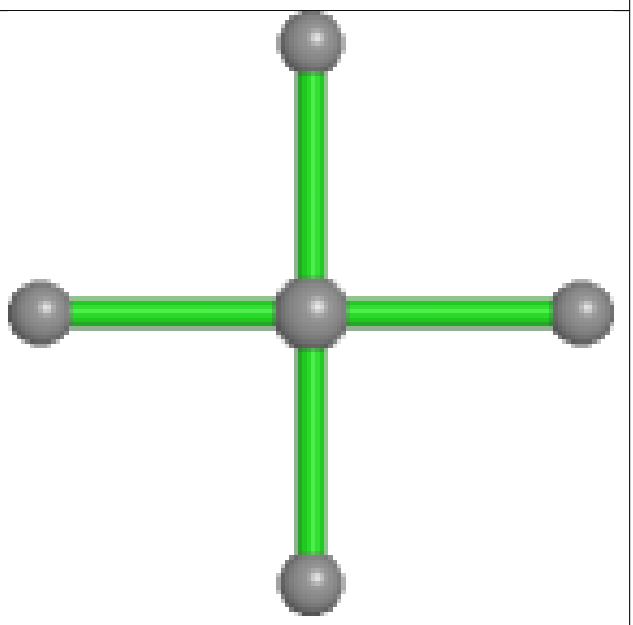
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 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.

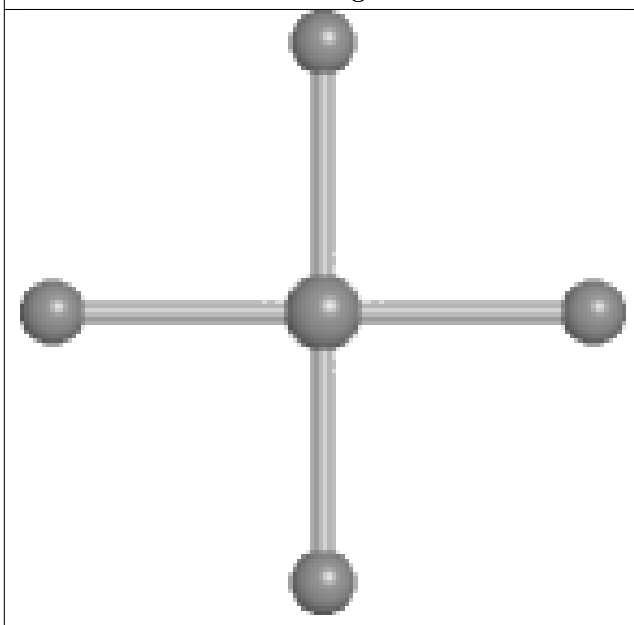
Ligand PO4 C 901



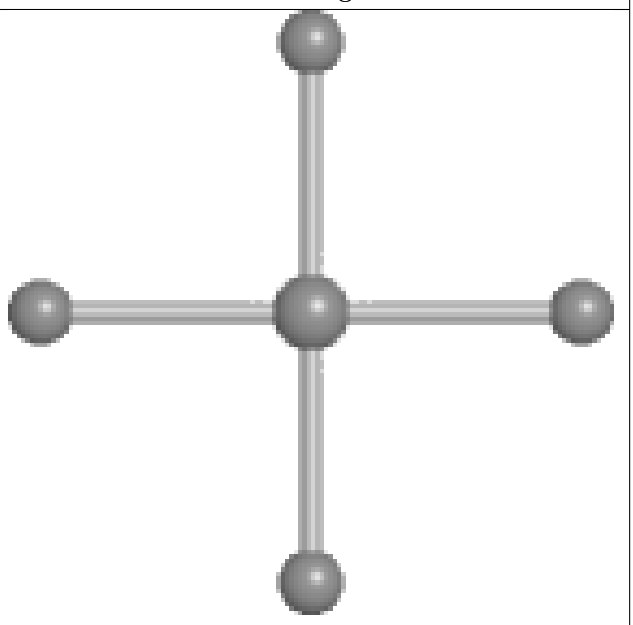
Bond lengths



Bond angles



Torsions



Rings

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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^{th} 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^2)	Q<0.9
1	A	96/104 (92%)	0.26	3 (3%)	49	45	86, 123, 159, 171	0
1	B	96/104 (92%)	0.33	1 (1%)	82	78	95, 117, 145, 167	0
2	C	798/855 (93%)	0.37	35 (4%)	34	32	88, 139, 190, 221	0
All	All	990/1063 (93%)	0.36	39 (3%)	39	36	86, 133, 185, 221	0

All (39) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	404	TYR	5.2
2	C	302	PHE	3.9
2	C	743	GLN	3.8
2	C	346	PHE	3.7
2	C	160	ILE	3.5
2	C	85	LEU	3.2
2	C	345	TYR	3.0
2	C	525	TYR	3.0
1	A	1	MET	2.9
2	C	107	ASN	2.9
1	B	65	PHE	2.9
2	C	353	ASN	2.9
2	C	437	TYR	2.9
2	C	642	PHE	2.8
2	C	473	ASP	2.8
2	C	318	LEU	2.7
2	C	357	TYR	2.7
2	C	692	THR	2.6
1	A	24	LEU	2.6
2	C	74	LEU	2.6
2	C	342	LEU	2.6
2	C	400	LYS	2.6
2	C	696	THR	2.5

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Mol	Chain	Res	Type	RSRZ
2	C	377	ASP	2.5
2	C	92	LEU	2.4
2	C	471	VAL	2.4
2	C	373	LEU	2.4
1	A	72	PHE	2.3
2	C	293	GLU	2.3
2	C	446	GLN	2.3
2	C	408	PHE	2.3
2	C	349	LYS	2.2
2	C	646	ALA	2.1
2	C	360	LYS	2.1
2	C	544	LEU	2.1
2	C	88	TYR	2.1
2	C	606	LEU	2.1
2	C	717	LYS	2.0
2	C	635	LEU	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)

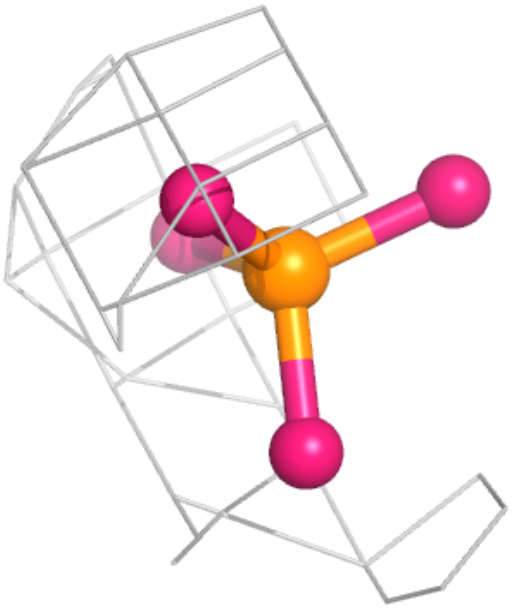
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

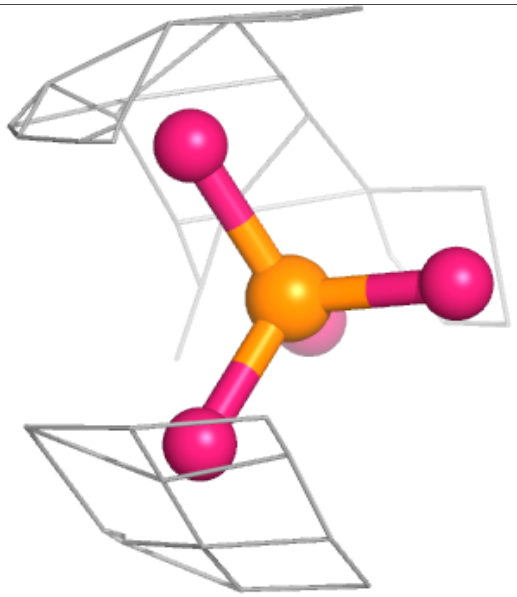
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	PO4	C	901	5/5	0.92	0.10	150,150,150,150	0
4	ZN	C	902	1/1	0.93	0.25	141,141,141,141	0

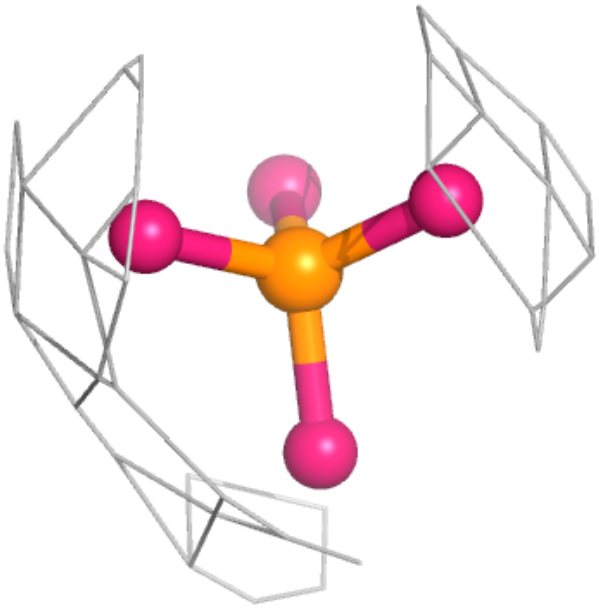
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around PO4 C 901:

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

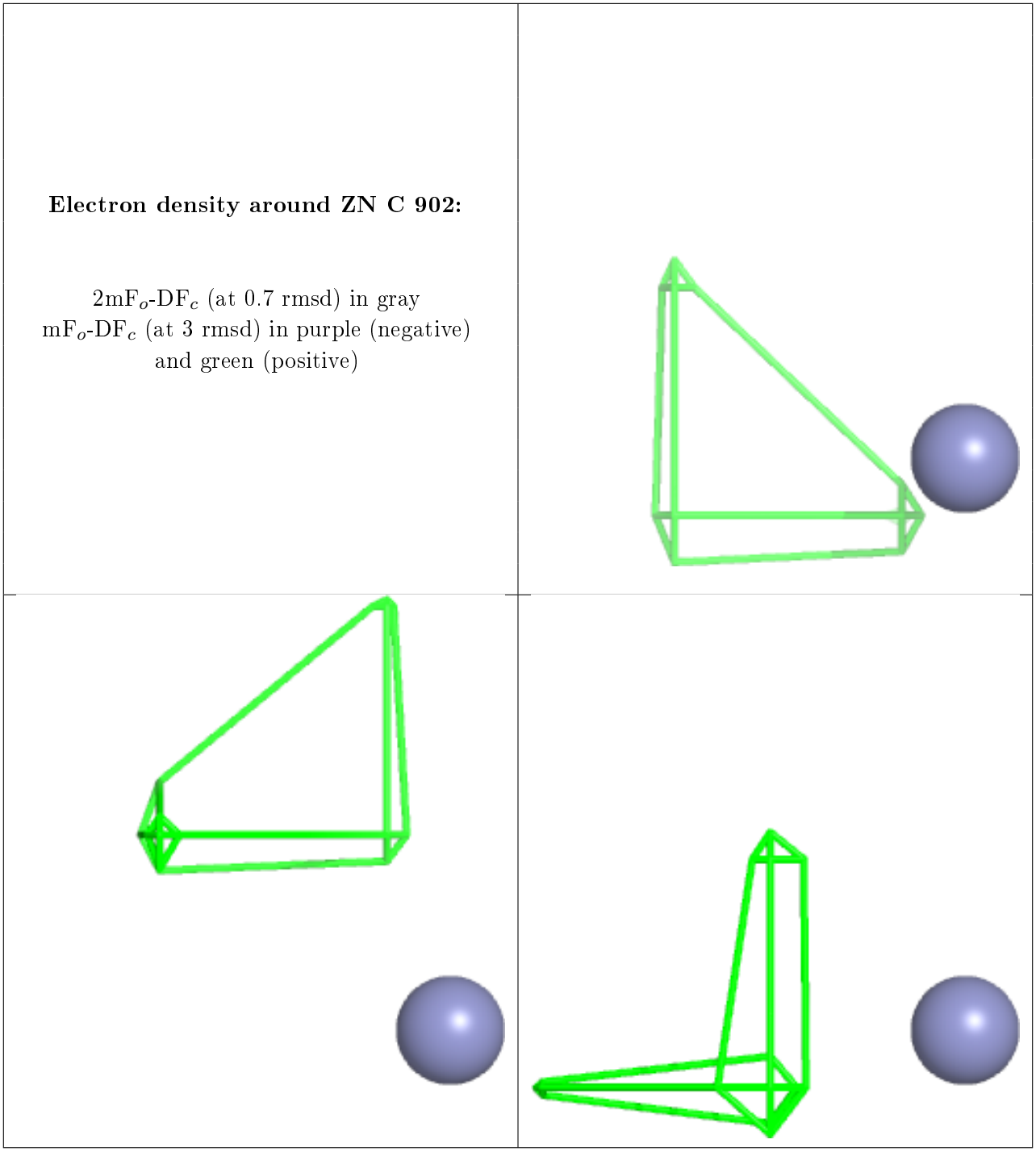






Electron density around ZN C 902:

$2mF_o$-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.