



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 8, 2020 – 04:36 PM BST

PDB ID : 2A75
Title : Trypanosoma rangeli Sialidase In Complex With 2,3- Difluorosialic Acid (Covalent Intermediate)
Authors : Amaya, M.F.; Alzari, P.M.; Buschiazzi, A.
Deposited on : 2005-07-04
Resolution : 1.95 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 : 2.13.1
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) : 2.13.1

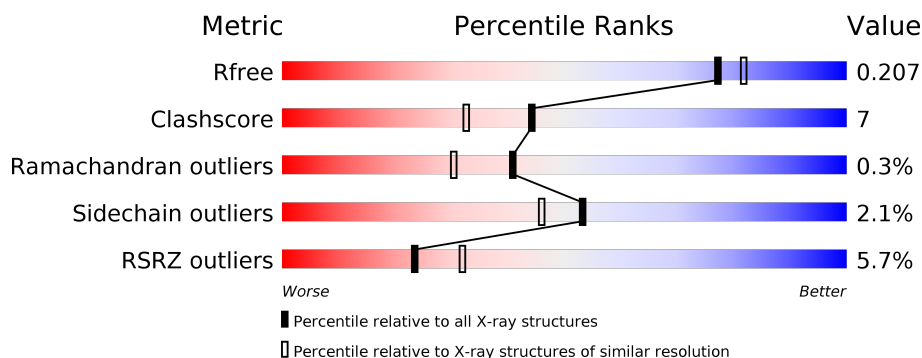
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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 ≥ 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	652	<div> <div>6%</div> <div>84%</div> <div>11%</div> <div>• •</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5564 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.

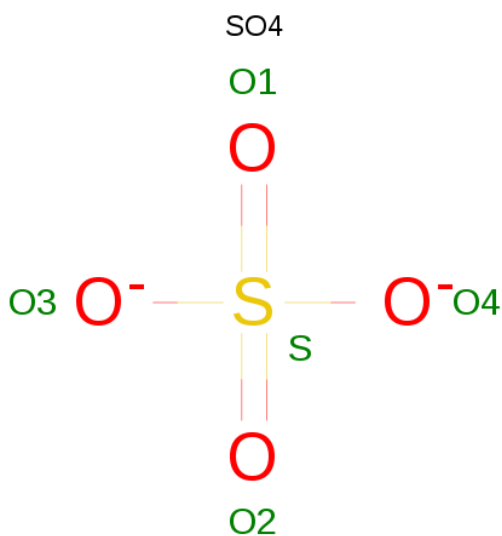
- Molecule 1 is a protein called sialidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	632	4918	3099	869	934	16	0	6	0

There are 18 discrepancies between the modelled and reference sequences:

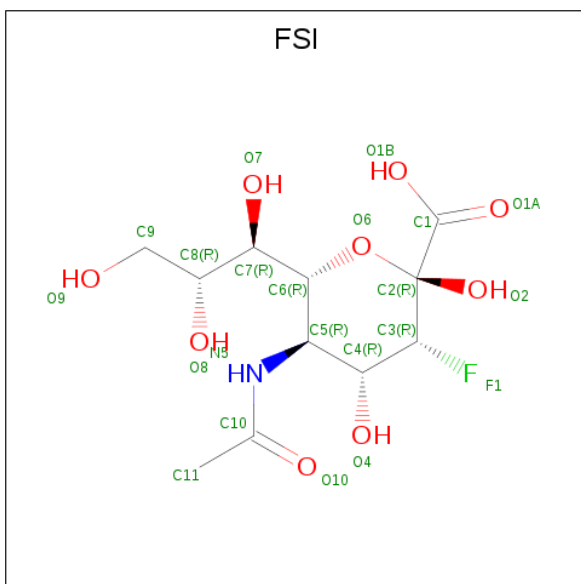
Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	MET	-	cloning artifact	UNP O44049
A	-12	GLY	-	cloning artifact	UNP O44049
A	-11	GLY	-	cloning artifact	UNP O44049
A	-10	SER	-	cloning artifact	UNP O44049
A	-9	HIS	-	expression tag	UNP O44049
A	-8	HIS	-	expression tag	UNP O44049
A	-7	HIS	-	expression tag	UNP O44049
A	-6	HIS	-	expression tag	UNP O44049
A	-5	HIS	-	expression tag	UNP O44049
A	-4	HIS	-	expression tag	UNP O44049
A	-3	GLY	-	cloning artifact	UNP O44049
A	-2	MET	-	cloning artifact	UNP O44049
A	-1	ALA	-	cloning artifact	UNP O44049
A	0	SER	-	cloning artifact	UNP O44049
A	50	ILE	THR	SEE REMARK 999	UNP O44049
A	186	ALA	GLY	SEE REMARK 999	UNP O44049
A	372	LEU	PHE	SEE REMARK 999	UNP O44049
A	606	VAL	ILE	SEE REMARK 999	UNP O44049

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0

- Molecule 3 is 5-acetamido-3,5-dideoxy-3-fluoro-D-erythro-alpha-L-manno-non-2-ulopyranosonic acid (three-letter code: FSI) (formula: $C_{11}H_{18}FNO_9$).

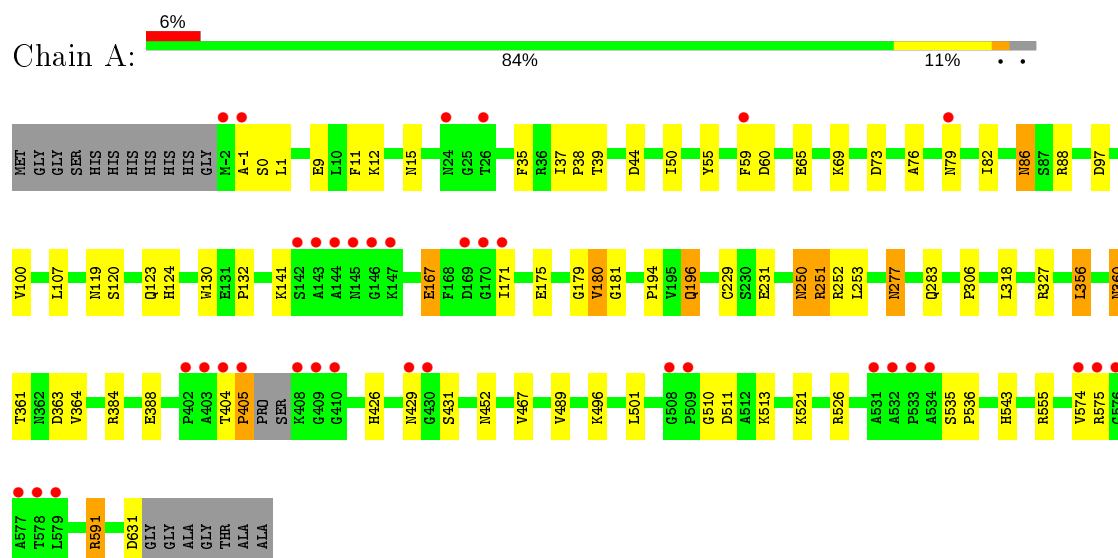


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	F	N	O	0	0
			21	11	1	1	8		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	615	Total 615	O 615	0	0

- Molecule 1: sialidase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.22Å 96.10Å 106.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.04 – 1.95 39.48 – 1.95	Depositor EDS
% Data completeness (in resolution range)	85.1 (29.04-1.95) 85.1 (39.48-1.95)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.59 (at 1.95Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.174 , 0.216 0.164 , 0.207	Depositor DCC
R_{free} test set	2413 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	9.1	Xtriage
Anisotropy	0.599	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 55.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5564	wwPDB-VP
Average B, all atoms (Å ²)	11.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.19% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: FSI, 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	0.68	0/5025	0.84	7/6825 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	251	ARG	NE-CZ-NH1	-6.64	116.98	120.30
1	A	82	ILE	N-CA-C	-6.19	94.29	111.00
1	A	364	VAL	N-CA-C	-5.59	95.92	111.00
1	A	405	PRO	N-CA-CB	5.33	109.70	103.30
1	A	194	PRO	N-CA-C	-5.29	98.34	112.10
1	A	510	GLY	N-CA-C	-5.25	99.97	113.10
1	A	251	ARG	NE-CZ-NH2	5.24	122.92	120.30

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	4918	0	4827	65	0
2	A	10	0	0	0	0
3	A	21	0	16	0	0
4	A	615	0	0	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5564	0	4843	65	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 7.

All (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:A:250:ASN:HD22	1:A:251:ARG:H	1.16	0.93
1:A:426:HIS:HD2	1:A:452:ASN:H	1.26	0.80
1:A:404:THR:HG22	1:A:405:PRO:N	2.00	0.77
1:A:360:ASN:HD21	1:A:363:ASP:H	1.35	0.75
1:A:50:ILE:HD13	1:A:100:VAL:HG21	1.69	0.73
1:A:543:HIS:HE1	4:A:2058:HOH:O	1.71	0.72
1:A:86:ASN:HD22	1:A:88:ARG:H	1.42	0.67
1:A:250:ASN:HD22	1:A:251:ARG:N	1.92	0.64
1:A:426:HIS:CD2	1:A:452:ASN:H	2.11	0.62
1:A:250:ASN:ND2	1:A:251:ARG:H	1.93	0.62
1:A:575:ARG:HG3	1:A:575:ARG:HH11	1.65	0.61
1:A:86:ASN:ND2	1:A:88:ARG:H	1.99	0.61
1:A:360:ASN:HD22	1:A:361:THR:N	2.00	0.60
1:A:526:ARG:CZ	1:A:536:PRO:HG3	2.32	0.59
1:A:37:ILE:HG21	1:A:97:ASP:HA	1.84	0.58
1:A:44:ASP:OD2	1:A:141:LYS:HE2	2.03	0.58
1:A:86:ASN:HD22	1:A:86:ASN:C	2.06	0.58
1:A:360:ASN:HD21	1:A:363:ASP:N	2.02	0.58
1:A:555:ARG:HG2	1:A:574:VAL:HG13	1.88	0.56
1:A:591:ARG:HD3	1:A:591:ARG:O	2.07	0.55
1:A:360:ASN:C	1:A:360:ASN:HD22	2.08	0.55
1:A:130:TRP:CZ2	1:A:132:PRO:HD3	2.42	0.54
1:A:404:THR:CG2	1:A:405:PRO:N	2.70	0.53
1:A:73:ASP:CG	1:A:76:ALA:HB3	2.30	0.52
1:A:277:ASN:ND2	1:A:283:GLN:H	2.07	0.51
1:A:360:ASN:C	1:A:360:ASN:ND2	2.65	0.50
1:A:123:GLN:CB	4:A:1960:HOH:O	2.59	0.50
1:A:426:HIS:CD2	1:A:631:ASP:HB2	2.47	0.50
1:A:59[B]:PHE:HD2	1:A:60:ASP:N	2.09	0.50
1:A:59[B]:PHE:CD2	1:A:60:ASP:N	2.80	0.49
1:A:69:LYS:HA	1:A:79:ASN:O	2.12	0.49
1:A:11:PHE:HB3	1:A:35:PHE:CG	2.48	0.48
1:A:252:ARG:NH1	4:A:2411:HOH:O	2.46	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:360:ASN:ND2	1:A:363:ASP:H	2.07	0.48
1:A:39:THR:OG1	1:A:181:GLY:HA2	2.14	0.48
1:A:38:PRO:HB2	1:A:356:LEU:HD13	1.96	0.48
1:A:229:CYS:SG	1:A:253:LEU:HD12	2.54	0.48
1:A:306:PRO:HA	1:A:318:LEU:HA	1.96	0.48
1:A:196:GLN:NE2	1:A:231:GLU:H	2.11	0.47
1:A:38:PRO:CB	1:A:356:LEU:HD13	2.45	0.46
1:A:429:ASN:OD1	1:A:431:SER:N	2.42	0.46
1:A:179:GLY:O	1:A:180:VAL:HB	2.15	0.46
1:A:511:ASP:OD1	1:A:513:LYS:HE2	2.15	0.46
1:A:-1:ALA:O	1:A:0:SER:OG	2.32	0.46
1:A:384:ARG:O	1:A:388[B]:GLU:HG3	2.17	0.45
1:A:277:ASN:HD21	1:A:283:GLN:H	1.65	0.44
1:A:360:ASN:ND2	1:A:363:ASP:HA	2.33	0.44
1:A:575:ARG:CG	1:A:575:ARG:HH11	2.28	0.43
1:A:86:ASN:C	1:A:86:ASN:ND2	2.71	0.43
1:A:55:TYR:HE1	1:A:65:GLU:HG3	1.82	0.43
1:A:388[B]:GLU:HG3	4:A:2258:HOH:O	2.19	0.43
1:A:489:VAL:HG21	1:A:501:LEU:HD21	2.00	0.43
1:A:86:ASN:HD21	1:A:88:ARG:HD3	1.84	0.43
1:A:360:ASN:HD21	1:A:363:ASP:HA	1.85	0.42
1:A:555:ARG:HG2	1:A:574:VAL:CG1	2.50	0.42
1:A:496:LYS:O	1:A:521:LYS:HD2	2.20	0.42
1:A:167[A]:GLU:HA	1:A:171:ILE:O	2.20	0.42
1:A:535:SER:HA	1:A:536:PRO:HD3	1.85	0.42
1:A:9:GLU:OE1	1:A:12[B]:LYS:HG3	2.20	0.41
1:A:124:HIS:HD2	1:A:175:GLU:OE2	2.04	0.41
1:A:0:SER:O	1:A:1:LEU:C	2.59	0.41
1:A:119:ASN:O	1:A:124:HIS:HE1	2.04	0.40
1:A:12[A]:LYS:NZ	4:A:2417:HOH:O	2.54	0.40
1:A:12[A]:LYS:HB2	1:A:15:ASN:HB3	2.03	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	634/652 (97%)	602 (95%)	30 (5%)	2 (0%)	41	30

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	180	VAL
1	A	467	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	530/540 (98%)	518 (98%)	12 (2%)	50	42

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	86	ASN
1	A	107	LEU
1	A	120	SER
1	A	167[A]	GLU
1	A	167[B]	GLU
1	A	196	GLN
1	A	250	ASN
1	A	277	ASN
1	A	327	ARG
1	A	356	LEU
1	A	360	ASN
1	A	591	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	79	ASN
1	A	86	ASN
1	A	124	HIS
1	A	196	GLN
1	A	250	ASN
1	A	277	ASN
1	A	284	GLN
1	A	325	ASN
1	A	360	ASN
1	A	377	GLN
1	A	426	HIS
1	A	543	HIS
1	A	605	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](#)

3 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	SO4	A	1802	-	4,4,4	0.33	0	6,6,6	0.10	0
3	FSI	A	700	1	18,21,22	1.84	5 (27%)	18,30,33	1.18	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	SO4	A	1801	-	4,4,4	0.29	0	6,6,6	0.22	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
3	FSI	A	700	1	-	0/14/38/43	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	700	FSI	C5-N5	-5.16	1.37	1.45
3	A	700	FSI	C3-C2	3.39	1.55	1.52
3	A	700	FSI	F1-C3	-3.05	1.33	1.40
3	A	700	FSI	C3-C4	2.43	1.54	1.52
3	A	700	FSI	C6-C5	2.12	1.56	1.53

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	700	FSI	F1-C3-C2	3.01	111.90	108.26
3	A	700	FSI	O7-C7-C6	-2.29	104.55	109.50

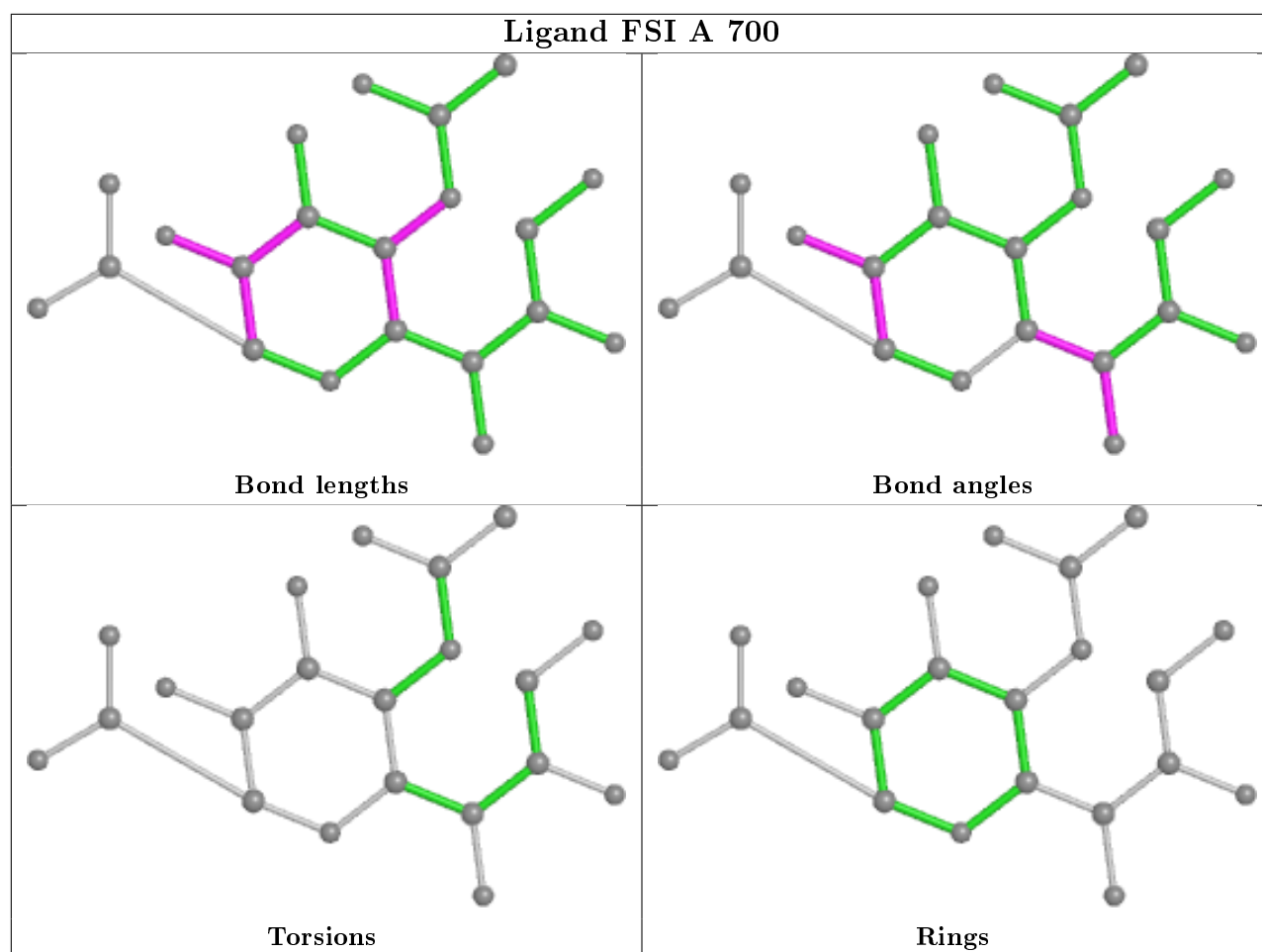
There are no chirality outliers.

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 than 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.



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, 95th 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	632/652 (96%)	0.26	36 (5%)	23 32	2, 8, 29, 47	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	-1	ALA	9.9
1	A	577	ALA	7.7
1	A	405	PRO	6.9
1	A	144	ALA	5.7
1	A	575	ARG	5.2
1	A	145	ASN	5.2
1	A	578	THR	5.1
1	A	430	GLY	5.1
1	A	576	GLY	4.9
1	A	408	LYS	4.8
1	A	143	ALA	4.6
1	A	533	PRO	4.2
1	A	146	GLY	4.2
1	A	403	ALA	4.0
1	A	26	THR	3.9
1	A	147	LYS	3.9
1	A	579	LEU	3.8
1	A	404	THR	3.4
1	A	429	ASN	3.3
1	A	59[A]	PHE	3.2
1	A	532	ALA	3.1
1	A	24	ASN	3.0
1	A	509	PRO	2.8
1	A	142	SER	2.8
1	A	402	PRO	2.7
1	A	409	GLY	2.7
1	A	169	ASP	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	-2	MET	2.5
1	A	170	GLY	2.5
1	A	574	VAL	2.4
1	A	531	ALA	2.3
1	A	79	ASN	2.3
1	A	171	ILE	2.2
1	A	508	GLY	2.1
1	A	534	ALA	2.1
1	A	410	GLY	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](#)

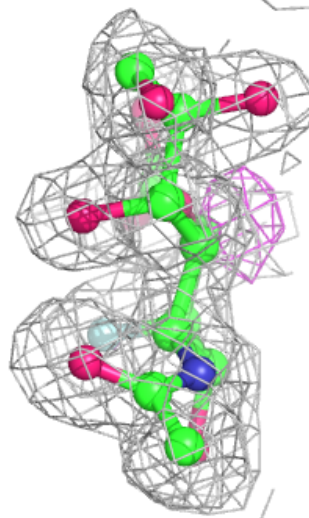
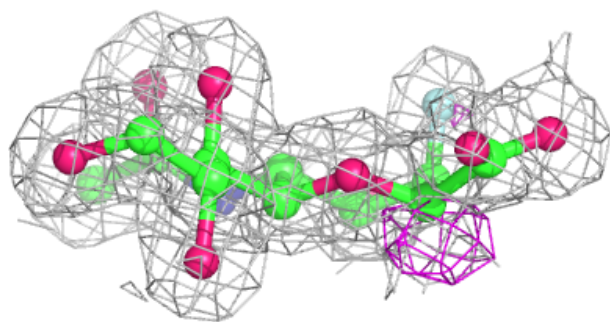
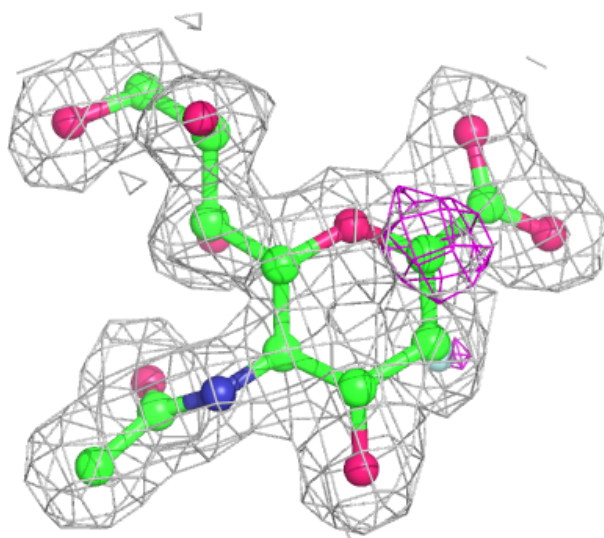
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	SO4	A	1802	5/5	0.93	0.24	56,56,56,56	0
3	FSI	A	700	21/22	0.95	0.12	6,8,10,17	0
2	SO4	A	1801	5/5	0.97	0.14	25,26,28,28	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 FSI A 700:

$2mF_o-DF_c$ (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.