



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:02 PM UTC

PDB ID : 5UBT / pdb_00005ubt
Title : CRYSTAL STRUCTURE OF PI3K DELTA IN COMPLEX WITH A 7-(3-(PIPERAZIN-1-YL)PHENYL)PYRROLO[2,1-F][1,2,4] TRIAZIN-4-AMINE DERIVATIVE
Authors : Sack, J.S.
Deposited on : 2016-12-21
Resolution : 2.83 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

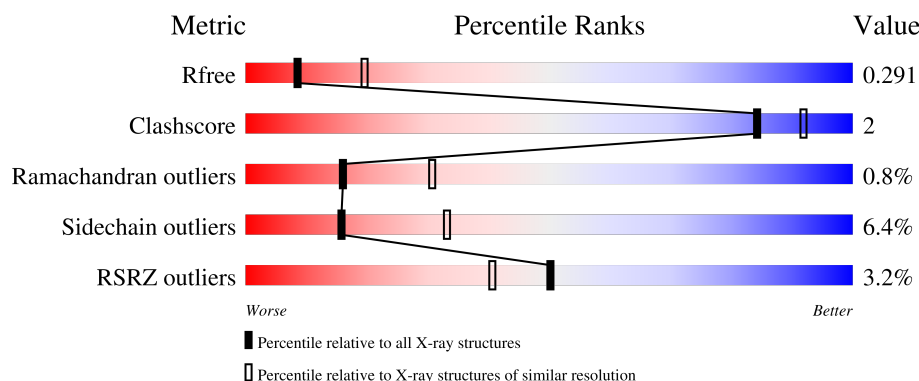
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.83 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}	180053	1520 (2.86-2.82)
Clashscore	190562	1559 (2.86-2.82)
Ramachandran outliers	187476	1517 (2.86-2.82)
Sidechain outliers	187428	1518 (2.86-2.82)
RSRZ outliers	180081	1521 (2.86-2.82)

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 $\leq 5\%$. 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	1013	
2	B	168	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 8531 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 Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	911	Total	C	N	O	S	319	0	0
			7106	4546	1207	1301	52			

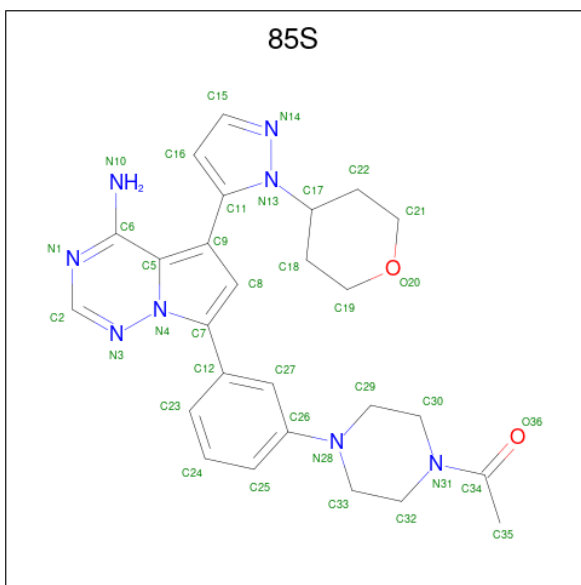
- Molecule 2 is a protein called Phosphatidylinositol 3-kinase regulatory subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	163	Total	C	N	O	S	113	0	0
			1376	857	248	266	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	469	ASP	GLU	engineered mutation	UNP P27986
B	519	THR	LYS	engineered mutation	UNP P27986
B	529	GLU	ASP	engineered mutation	UNP P27986
B	539	VAL	ILE	engineered mutation	UNP P27986

- Molecule 3 is 1-[4-(3-{4-amino-5-[1-(oxan-4-yl)-1H-pyrazol-5-yl]pyrrolo[2,1-f][1,2,4]triazin-7-yl}phenyl)piperazin-1-yl]ethan-1-one (CCD ID: 85S) (formula: C₂₆H₃₀N₈O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			36	26	8	2		

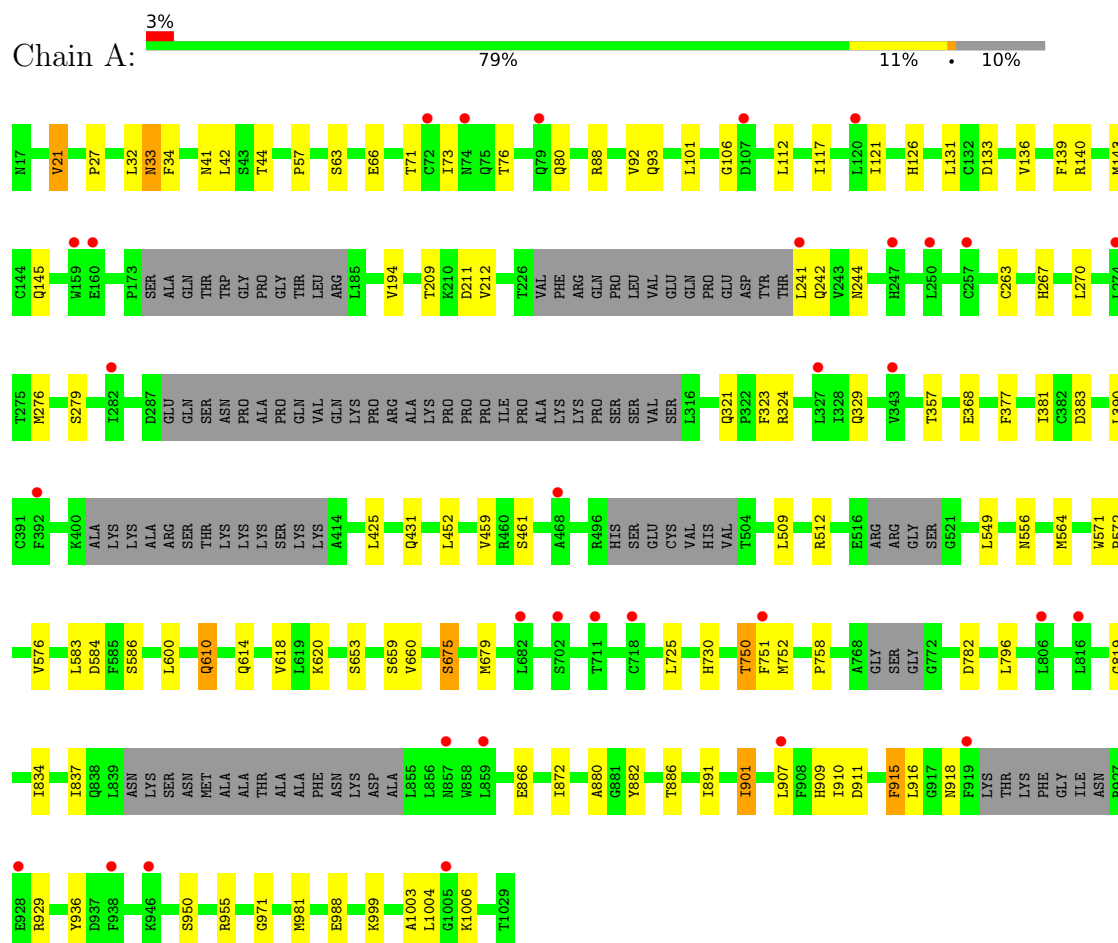
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	13	Total	O	0	0
			13	13		

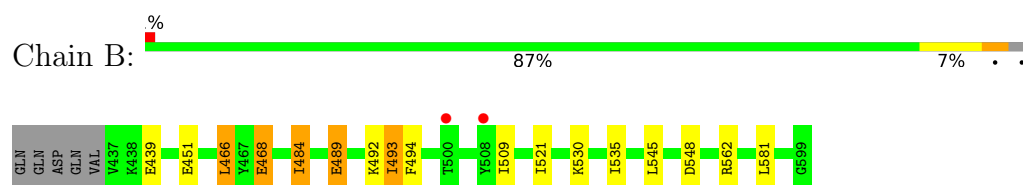
3 Residue-property plots [i](#)

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: Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform



- Molecule 2: Phosphatidylinositol 3-kinase regulatory subunit alpha



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	90.66Å 108.60Å 142.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.86 – 2.83 37.86 – 2.83	Depositor EDS
% Data completeness (in resolution range)	97.1 (37.86-2.83) 97.1 (37.86-2.83)	Depositor EDS
R_{merge}	0.03	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.75 (at 2.81Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.215 , 0.268 0.233 , 0.291	Depositor DCC
R_{free} test set	688 reflections (2.06%)	wwPDB-VP
Wilson B-factor (Å ²)	91.1	Xtriage
Anisotropy	0.478	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 81.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	8531	wwPDB-VP
Average B, all atoms (Å ²)	104.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.33% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 85S

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	0.80	0/7257	1.35	21/9836 (0.2%)
2	B	0.78	0/1394	1.51	5/1862 (0.3%)
All	All	0.80	0/8651	1.38	26/11698 (0.2%)

There are no bond length outliers.

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	33	ASN	CA-CB-CG	6.56	119.16	112.60
1	A	329	GLN	CA-C-N	6.44	127.12	121.58
1	A	329	GLN	C-N-CA	6.44	127.12	121.58
2	B	492	LYS	CA-C-N	5.75	128.34	120.46
2	B	492	LYS	C-N-CA	5.75	128.34	120.46
1	A	929	ARG	CA-C-N	5.69	126.69	122.59
1	A	929	ARG	C-N-CA	5.69	126.69	122.59
1	A	21	VAL	N-CA-CB	5.58	116.61	110.53
1	A	133	ASP	CA-CB-CG	5.51	118.11	112.60
1	A	782	ASP	CA-C-N	5.41	129.87	121.26
1	A	782	ASP	C-N-CA	5.41	129.87	121.26
1	A	955	ARG	CA-C-N	5.41	127.47	120.44
1	A	955	ARG	C-N-CA	5.41	127.47	120.44
1	A	57	PRO	CA-C-N	5.29	131.56	123.47
1	A	57	PRO	C-N-CA	5.29	131.56	123.47
1	A	880	ALA	CA-C-N	5.29	125.81	119.94
1	A	880	ALA	C-N-CA	5.29	125.81	119.94
1	A	936	TYR	CA-C-N	5.28	127.61	120.38
1	A	936	TYR	C-N-CA	5.28	127.61	120.38
1	A	955	ARG	N-CA-C	-5.22	105.67	111.36
2	B	530	LYS	CA-C-N	5.21	127.22	120.44
2	B	530	LYS	C-N-CA	5.21	127.22	120.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	675	SER	CA-C-N	5.17	127.46	120.38
1	A	675	SER	C-N-CA	5.17	127.46	120.38
2	B	468	GLU	N-CA-C	-5.12	105.78	111.36
1	A	34	PHE	N-CA-C	5.05	114.11	108.25

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	7106	0	6897	32	0
2	B	1376	0	1356	6	0
3	A	36	0	0	0	0
4	A	13	0	0	0	0
All	All	8531	0	8253	36	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 2.

All (36) 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:549:LEU:HG	1:A:564:MET:HE1	1.58	0.84
2:B:484:ILE:HG13	2:B:545:LEU:HD23	1.77	0.65
2:B:466:LEU:HD21	2:B:562:ARG:HB3	1.82	0.61
1:A:549:LEU:HG	1:A:564:MET:CE	2.32	0.59
1:A:76:THR:O	1:A:126:HIS:HE1	1.87	0.58
1:A:390:LEU:HB2	1:A:425:LEU:HD21	1.89	0.55
1:A:583:LEU:HD11	1:A:600:LEU:HD11	1.89	0.54
1:A:999:LYS:HA	1:A:1004:LEU:HD12	1.88	0.54
1:A:610:GLN:HG2	1:A:796:LEU:HD13	1.91	0.52
1:A:571:TRP:CD1	1:A:572:PRO:HD2	2.46	0.51
1:A:549:LEU:CG	1:A:564:MET:HE1	2.35	0.49
1:A:614:GLN:HG3	1:A:981:MET:HG2	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:653:SER:HA	1:A:819:GLY:HA2	1.96	0.47
1:A:27:PRO:HD3	1:A:101:LEU:HB2	1.97	0.46
1:A:73:ILE:HD12	2:B:489:GLU:HG3	1.97	0.46
1:A:752:MET:HB2	1:A:758:PRO:HD2	1.98	0.46
1:A:971:GLY:HA3	1:A:1004:LEU:HD21	1.98	0.45
1:A:882:TYR:HB3	1:A:909:HIS:CD2	2.52	0.45
1:A:139:PHE:CZ	1:A:143:MET:HG3	2.52	0.45
1:A:323:PHE:HD2	1:A:377:PHE:CD2	2.35	0.45
1:A:321:GLN:HB3	1:A:324:ARG:HH12	1.81	0.44
1:A:1003:ALA:HB1	1:A:1006:LYS:HD2	1.97	0.44
1:A:42:LEU:HD11	1:A:92:VAL:HG21	2.00	0.44
2:B:509:ILE:HG23	2:B:521:ILE:HG12	2.00	0.44
1:A:41:ASN:HA	1:A:88:ARG:HA	2.00	0.43
1:A:73:ILE:HD11	2:B:493:ILE:HD12	2.00	0.43
1:A:583:LEU:HB3	1:A:618:VAL:HG11	2.01	0.43
1:A:750:THR:HG22	1:A:751:PHE:H	1.83	0.43
2:B:494:PHE:HB3	2:B:535:ILE:HG12	2.00	0.43
1:A:886:THR:HA	1:A:891:ILE:HD12	2.01	0.42
1:A:620:LYS:HE2	1:A:660:VAL:HG11	2.00	0.42
1:A:383:ASP:HB3	1:A:556:ASN:O	2.19	0.41
1:A:76:THR:O	1:A:126:HIS:CE1	2.69	0.41
1:A:136:VAL:O	1:A:140:ARG:HG3	2.20	0.41
1:A:834:ILE:HD11	1:A:901:ILE:HG23	2.03	0.41
1:A:117:ILE:HG13	1:A:679:MET:HE1	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	891/1013 (88%)	841 (94%)	42 (5%)	8 (1%)	14 27

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	161/168 (96%)	159 (99%)	2 (1%)	0	100	100
All	All	1052/1181 (89%)	1000 (95%)	44 (4%)	8 (1%)	16	31

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	242	GLN
1	A	279	SER
1	A	911	ASP
1	A	918	ASN
1	A	730	HIS
1	A	915	PHE
1	A	381	ILE
1	A	106	GLY

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	753/898 (84%)	704 (94%)	49 (6%)	15	32
2	B	147/159 (92%)	138 (94%)	9 (6%)	17	35
All	All	900/1057 (85%)	842 (94%)	58 (6%)	16	33

All (58) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	VAL
1	A	32	LEU
1	A	33	ASN
1	A	44	THR
1	A	63	SER
1	A	66	GLU
1	A	71	THR
1	A	80	GLN

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Mol	Chain	Res	Type
1	A	93	GLN
1	A	112	LEU
1	A	121	ILE
1	A	131	LEU
1	A	145	GLN
1	A	194	VAL
1	A	209	THR
1	A	211	ASP
1	A	212	VAL
1	A	241	LEU
1	A	244	ASN
1	A	263	CYS
1	A	267	HIS
1	A	270	LEU
1	A	276	MET
1	A	357	THR
1	A	368	GLU
1	A	431	GLN
1	A	452	LEU
1	A	459	VAL
1	A	461	SER
1	A	509	LEU
1	A	512	ARG
1	A	576	VAL
1	A	584	ASP
1	A	586	SER
1	A	610	GLN
1	A	659	SER
1	A	675	SER
1	A	725	LEU
1	A	750	THR
1	A	837	ILE
1	A	866	GLU
1	A	872	ILE
1	A	901	ILE
1	A	907	LEU
1	A	910	ILE
1	A	915	PHE
1	A	916	LEU
1	A	950	SER
1	A	988	GLU
2	B	439	GLU

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Mol	Chain	Res	Type
2	B	451	GLU
2	B	466	LEU
2	B	468	GLU
2	B	484	ILE
2	B	489	GLU
2	B	493	ILE
2	B	548	ASP
2	B	581	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	242	GLN
1	A	349	HIS
1	A	539	GLN
1	A	696	ASN
1	A	786	GLN
1	A	795	GLN
1	A	863	ASN
1	A	944	GLN
2	B	478	GLN

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 oligosaccharides 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	$\# Z > 2$
3	85S	A	4000	-	40,41,41	0.47	0	49,59,59	0.61	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	85S	A	4000	-	-	4/20/38/38	0/6/6/6

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

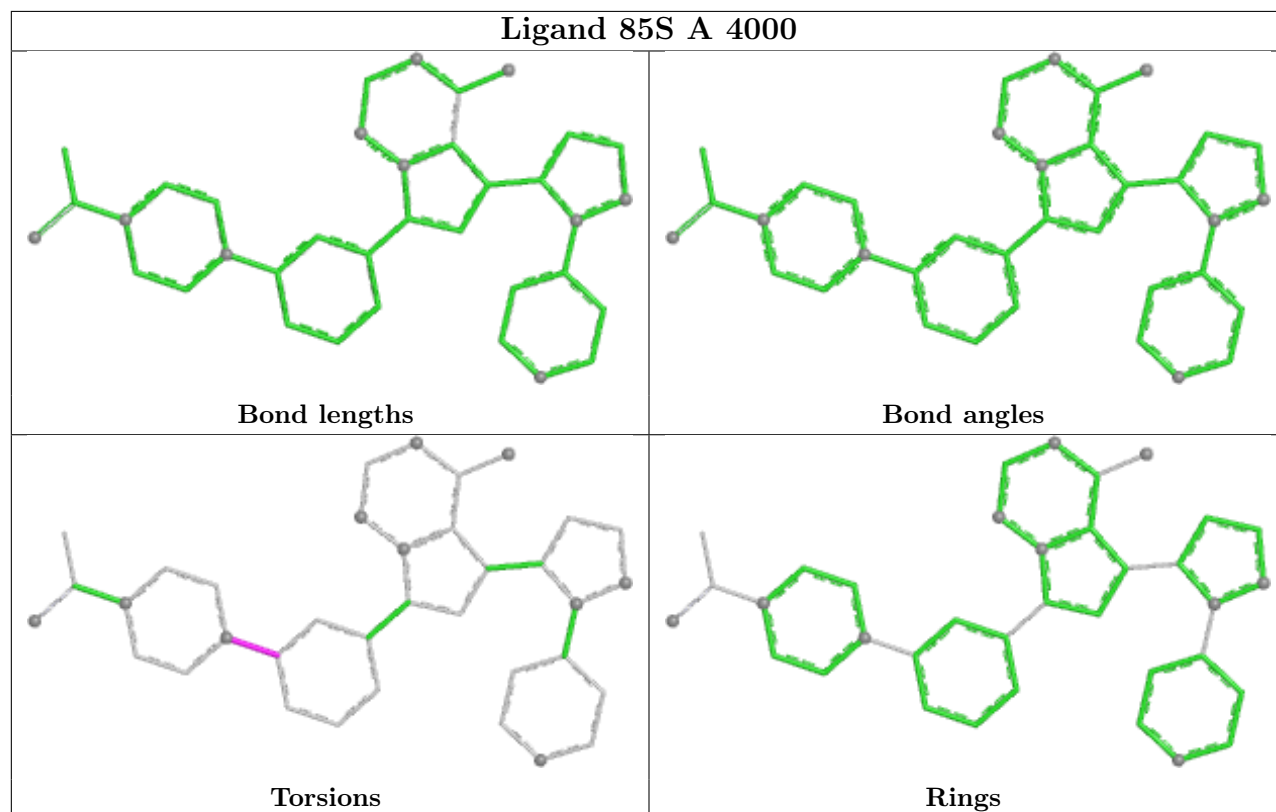
Mol	Chain	Res	Type	Atoms
3	A	4000	85S	C25-C26-N28-C33
3	A	4000	85S	C27-C26-N28-C33
3	A	4000	85S	C25-C26-N28-C29
3	A	4000	85S	C27-C26-N28-C29

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	911/1013 (89%)	0.26	32 (3%) 47 37	41, 97, 141, 176	87 (9%)
2	B	163/168 (97%)	0.03	2 (1%) 76 71	52, 97, 120, 142	33 (20%)
All	All	1074/1181 (90%)	0.22	34 (3%) 50 40	41, 97, 139, 176	120 (11%)

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	907	LEU	4.5
1	A	257	CYS	3.3
1	A	274	LEU	3.3
1	A	282	ILE	3.2
1	A	919	PHE	3.2
1	A	74	ASN	3.0
1	A	938	PHE	2.7
1	A	1005	GLY	2.6
1	A	241	LEU	2.6
1	A	392	PHE	2.6
1	A	751	PHE	2.5
1	A	946	LYS	2.4
1	A	250	LEU	2.4
1	A	327	LEU	2.4
1	A	682	LEU	2.4
1	A	72	CYS	2.4
1	A	79	GLN	2.4
1	A	247	HIS	2.4
1	A	857	ASN	2.3
1	A	107	ASP	2.3
1	A	928	GLU	2.3
1	A	702	SER	2.3
1	A	120	LEU	2.3
1	A	859	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	343	VAL	2.2
1	A	718	CYS	2.2
1	A	159	TRP	2.1
1	A	160	GLU	2.1
2	B	508	TYR	2.1
1	A	806	LEU	2.1
1	A	468	ALA	2.1
1	A	711	THR	2.0
2	B	500	THR	2.0
1	A	816	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](#)

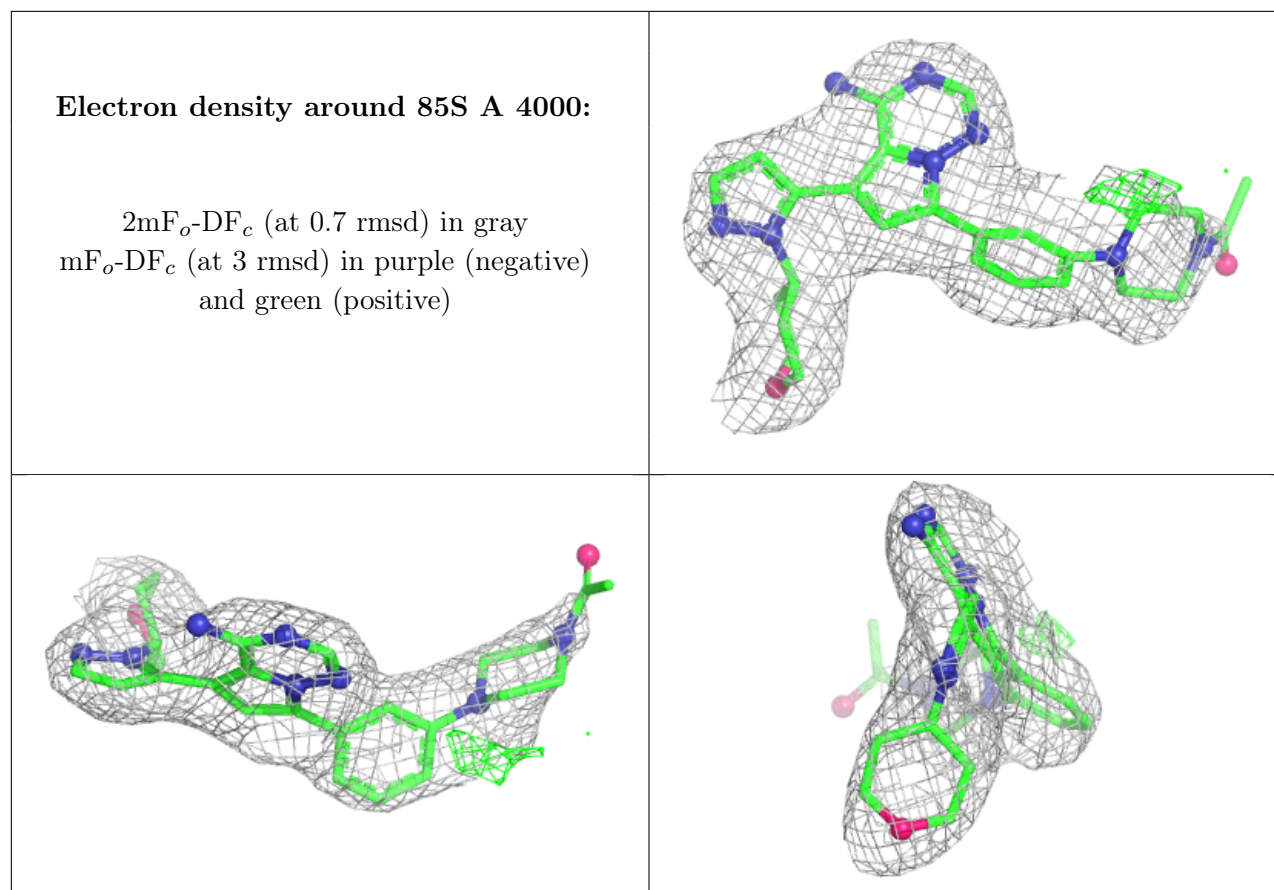
There are no oligosaccharides in this entry.

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($\text{\AA}^2$)	Q<0.9
3	85S	A	4000	36/36	0.90	0.13	91,103,131,132	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.



6.5 Other polymers ⓘ

There are no such residues in this entry.