Information collected from the Workshop questionnaire

1. General information about the Numerical Method

a) Code Designation

Istituto Nazionale per Sudie ed Esperienze di Architettura Navale, INSEAN	XSHIP
National Maritime Research Institute, NRMI	SURF
West Virginia University, WVU	FLUENT
Ecole Centrale de Nantes, ECN	ISIS
Bulgarian Ship Hydrodynamics Centre, BSHC	FLUENT
Instituto Superior Técnico, IST Maritime Research Institute Netherlands, MARIN	PARNASSOS

b) Mathematical Formulation

INSEAN	Pseudo Compressibility
NRMI	Pseudo Compressibility
West Virginia University	Strong Conservation Form
Ecole Centrale de Nantes	Strong Conservation Form
BSHC	Strong Conservation Form
IST/MARIN A	Contravariant form, weak formulation
IST/MARIN B	Strong Conservation Form

c) Discretization Technique

INSEAN	Finite Volume, ENO scheme + implicit Euler
NRMI	Finite Volume
West Virginia University	Finite Volume
Ecole Centrale de Nantes	Finite Volume
BSHC	Finite Volume
IST/MARIN A	Finite Differences
IST/MARIN B	Finite Volume

d) Linearization Procedure

INSEAN	Picard
NRMI	
West Virginia University	Picard
Ecole Centrale de Nantes	Picard
BSHC	Picard
IST/MARIN A	Newton
IST/MARIN B	Newton

e) Method of solution of the linear systems of equations

INSEAN	LU + Full MultiGrid + Full Approximation Storage
NRMI	Symmetric Gauss-Seidel
West Virginia University	Algebraic Multigrid
Ecole Centrale de Nantes	PGMRES + ILU-k preconditioner
BSHC	Algebraic Multigrid
IST/MARIN A	GMRES + ILU preconditioner
IST/MARIN B	GMRES + ILU preconditioner

f) Convergence Criteria (Details given below)

INSEAN	L_2 norm of residual and L_{max} norm of variable variation
NRMI	Residuals reduced to machine precision
West Virginia University	Scaled residual of continuity equation
Ecole Centrale de Nantes	Residuals reduced to machine precision
BSHC	Normalized residuals
IST/MARIN A	L_{max} norm of variable variation reduced to machine accuracy + check of L_{max} of normalized residuals
IST/MARIN B	L_{max} norm of variable variation reduced to machine accuracy + check of L_{max} of normalized residuals

2. Detailed information about the calculation procedure

a) Order of accuracy of the discretization of the continuity and momentum equations

INSEAN	Second order
NRMI	Second order
West Virginia University	Second order
Ecole Centrale de Nantes	Second order
BSHC	Second order
IST/MARIN A	Second order
IST/MARIN B	Second order

b) Order of accuracy of the discretization of the turbulent quantities transport equations

INSEAN	Second order
NRMI	First order
West Virginia University	Second order
Ecole Centrale de Nantes	Second order
BSHC	Second order
IST/MARIN A	First order
IST/MARIN B	Second order

c) Order of accuracy of the interpolation schemes applied in the post-processing of the data

INSEAN	Fourth order
NRMI	First order
West Virginia University	1 < order of the method < 2
Ecole Centrale de Nantes	Fourth order
BSHC	First order
IST/MARIN A	Third order for hill case, First order for step
IST/MARIN B	Third order for hill case, First order for step

d) Order of accuracy of the integration schemes applied in the post-processing of the data

INSEAN	Second order
NRMI	First order
West Virginia University	First order
Ecole Centrale de Nantes	Second order
BSHC	First order
IST/MARIN A	Second order
IST/MARIN B	Second order

3. Boundary Conditions

a) Walls

	U^1	U^2	P	ν_t	k	ε
INSEAN	0	0		0	0	$\partial\varepsilon/\partial n=0$
NRMI	0	0	$\partial p/\partial n=0$	0		
West Virginia University	0	0	$\partial p/\partial n=0$	0		
Ecole Centrale de Nantes	0	0	$\partial p/\partial n=0$	0		
BSHC	0	0	$\partial p/\partial n=0$	0		
IST/MARIN A	0	0		0		
IST/MARIN B	0	0	$\partial^2 p/\partial n^2=0$	0		

a) Inlet

	U^1	U^2	P	ν_t	k	ε
INSEAN	CD val	CD val	Extrap.	CD val	CD val	CD val
NRMI	CD val	CD val	$\partial p/\partial n=0$	CD val		
West Virginia University	CD val	CD val		CD val		
Ecole Centrale de Nantes	CD val	CD val	$\partial p/\partial n=0$	CD val		
BSHC	CD val	CD val		CD val		
IST/MARIN A	CD val	CD val	$\partial^2 p/\partial n^2=0$	CD val		
IST/MARIN B	CD val	CD val	$\partial^2 p/\partial n^2=0$	CD val		

CD val stands for the values given by the inlet profiles generated by the organizers of the Workshop

a) Outlet

	U^1	U^2	p	ν_t	k	ε
INSEAN	Extra.	Extra.	0	Extra.	Extra.	Extra.
NRMI	$\partial U^1/\partial n=0$	$\partial U^2/\partial n=0$	0	$\partial \nu_t/\partial n=0$		
West Virginia University	$\partial U^1/\partial n=0$	$\partial U^2/\partial n=0$	0	$\partial \nu_t/\partial n=0$		
Ecole Centrale de Nantes	$\partial U^1/\partial n=0$	$\partial U^2/\partial n=0$	0	$\partial \nu_t/\partial n=0$		
BSHC	$\partial U^1/\partial n=0$	$\partial U^2/\partial n=0$	0	$\partial \nu_t/\partial n=0$		
IST/MARIN A	$\partial^2 U^1/\partial n^2=0$	$\partial^2 U^2/\partial n^2=0$	0	$\partial \nu_t/\partial n=0$		
IST/MARIN B	$\partial^2 U^1/\partial n^2=0$	$\partial^2 U^2/\partial n^2=0$	0	$\partial \nu_t/\partial n=0$		

4. Uncertainty estimation method

INSEAN	Grid Convergence Index with Least squares method
NRMI	Grid Convergence Index with Least squares method
West Virginia University	Grid Convergence Index with Least squares method
Ecole Centrale de Nantes	Error Equation Method
BSHC	Grid Convergence Index with Grid Triplets
IST/MARIN A	Grid Convergence Index with Least squares method
IST/MARIN B	Grid Convergence Index with Least squares method

5. Calculations performed

	C-18, Hill flow		C-30, Backward facing step		
	A	**B**	**A**	**B**	**C**
INSEAN	SA k-ε	SA k-ε	SA k-ε	SA k-ε	SA k-ε
NRMI	SA	SA		SA	SA
WVU				SA	
ECN	SA	SA	SA	SA	SA
BSHC	SA				
IST/MARIN A	SA MT	SA MT	SA MT	SA MT	SA MT
IST/MARIN B	SA	SA	SA	SA	SA

SA – Spalart & Allmaras one-equation model.
k-ε – Chang Hsieh and Chen k-ε model
MT – Menter's one-equation model.

6. Results submitted

a) General information

	Round-off error	Iterative error	Convergence Criteria
INSEAN	Negligible.	<0.1%	SA, $L_2(res) \leq 10^{-6}$, $L_{max}(\Delta\phi) \leq 0.1\%$ k-ε, $L_2(res) \leq 10^{-5}$, $L_{max}(\Delta\phi) \leq 0.1\%$
NRMI	Negligible	Negligible	Residuals reduced to machine p.
WVU	2.22E-16, Double P.	$<10^{-12}$	Scaled residual continuity$<10^{-12}$
ECN	Negligible	Negligible	Residuals reduced to machine p.
BSHC		$<10^{-13}$	Normalized residuals<EPS
IST/MARIN A	Negligible, Double P.	$< 10^{-10}$	$L_{max}(\Delta\phi)<10^{-12}$, $L_{max}(res)<10^{-10}$
IST/MARIN B	Negligible, Double P.	$< 10^{-9}$	$L_{max}(\Delta\phi)<10^{-10}$, $L_{max}(res)<10^{-9}$

All the flow variables are non-dimensional. The reference length, L_{ref}, is the hill and step heights. The reference velocity, U_{ref}, is the mean centreline velocity at the inlet for the hill flow and the velocity of the uniform incoming flow for the backward facing step.

The pressure coefficient is defined in the usual way $C_p=(p-p_{ref})/(1/2\ \rho U^2_{ref})$, where the p_{ref} is the pressure at the outlet boundary. The eddy-viscosity value is made non-dimensional by the product $L_{ref}U_{ref}$. Friction and pressure resistance coefficients are obtained using $\rho U^2_{ref}L_{ref}$ as the reference force.

The uncertainties including a * mean that apparent divergence has been observed. In the cases that apparent divergence is observed and no uncertainty has been estimated the symbols are not filled.

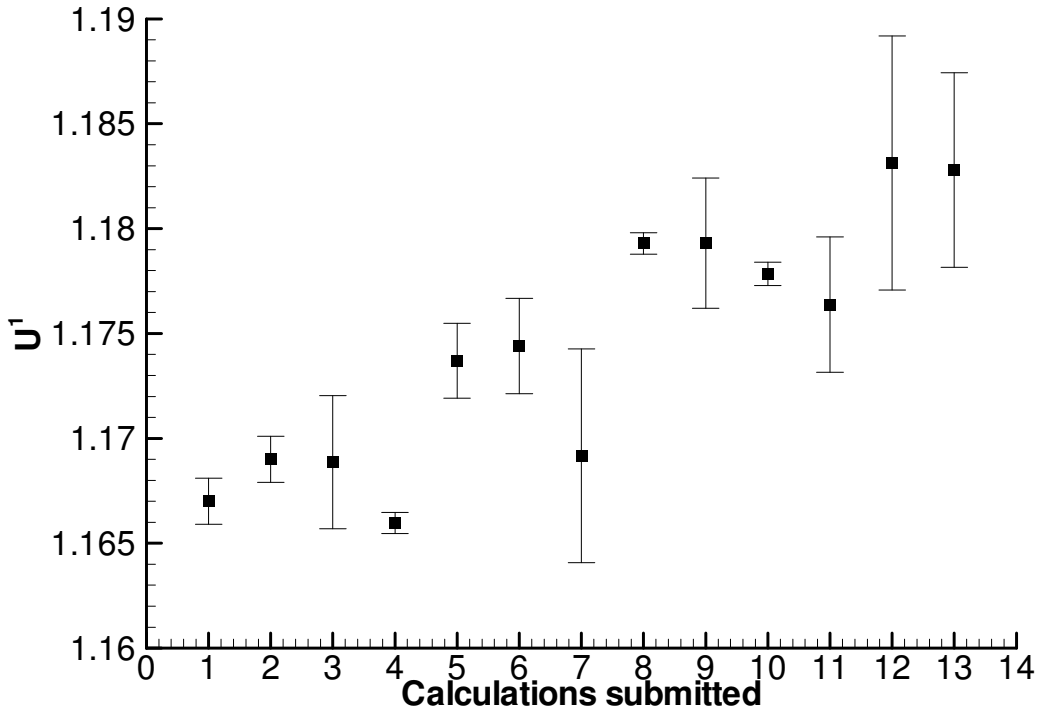
6.1 Test case C-18, Hill Flow

a) Spalart and Allmaras Turbulence model

Local flow quantities:

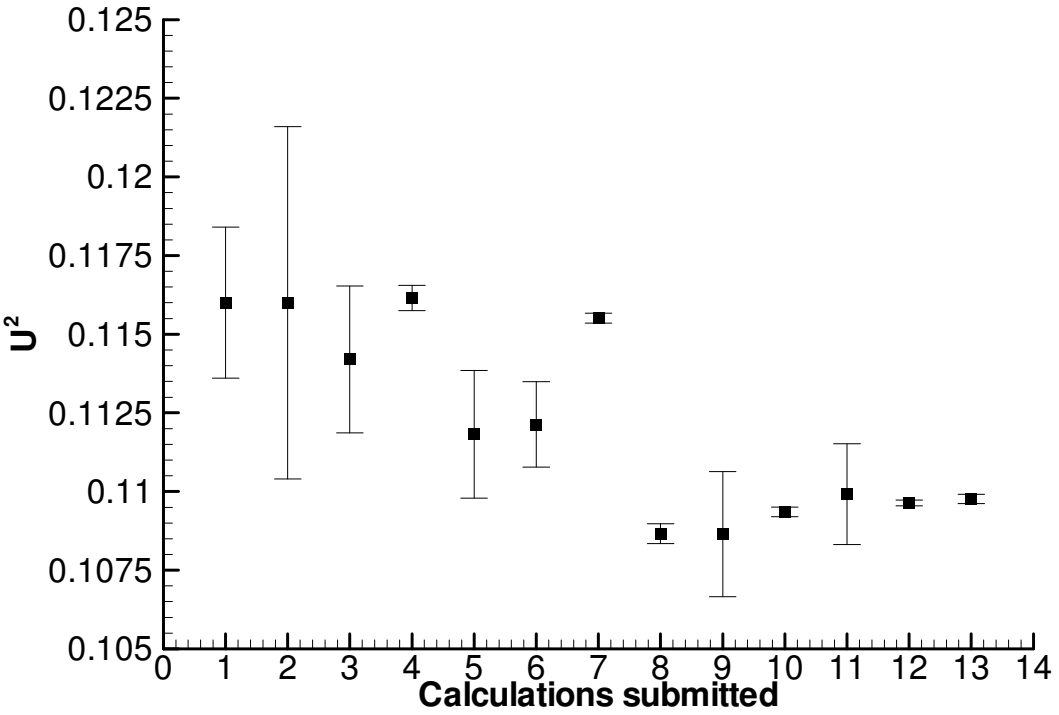
U^1 velocity component at ***x=0, y=1.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	1.1670	0.00110	1.16590	1.16810
2	INSEAN	401x401	B	1.1690	0.00110	1.16790	1.17010
3	NRMI	401x401	A	1.1689	0.00317	1.16569	1.17203
4	NRMI	401x401	B	1.1660	0.00051	1.16546	1.16647
5	ECN	401x401	A	1.1737	0.00179	1.17191	1.17549
6	ECN	401x401	B	1.1744	0.00227	1.17213	1.17667
7	BSHC	361x361	A	1.1692	0.00510	1.16407	1.17427
8	IST/MARIN A	401x401	A	1.1793	0.00052	1.17877	1.17981
9	IST/MARIN A	201x201	A	1.1793	0.00311	1.17620	1.18242
10	IST/MARIN A	401x401	B	1.1778	0.00056	1.17728	1.17839
11	IST/MARIN A	201x201	B	1.1764	0.00323	1.17314	1.17960
12	IST/MARIN B	281x281	A	1.1831	0.00606	1.17706	1.18919
13	IST/MARIN B	281x281	B	1.1828	0.00464	1.17815	1.18742



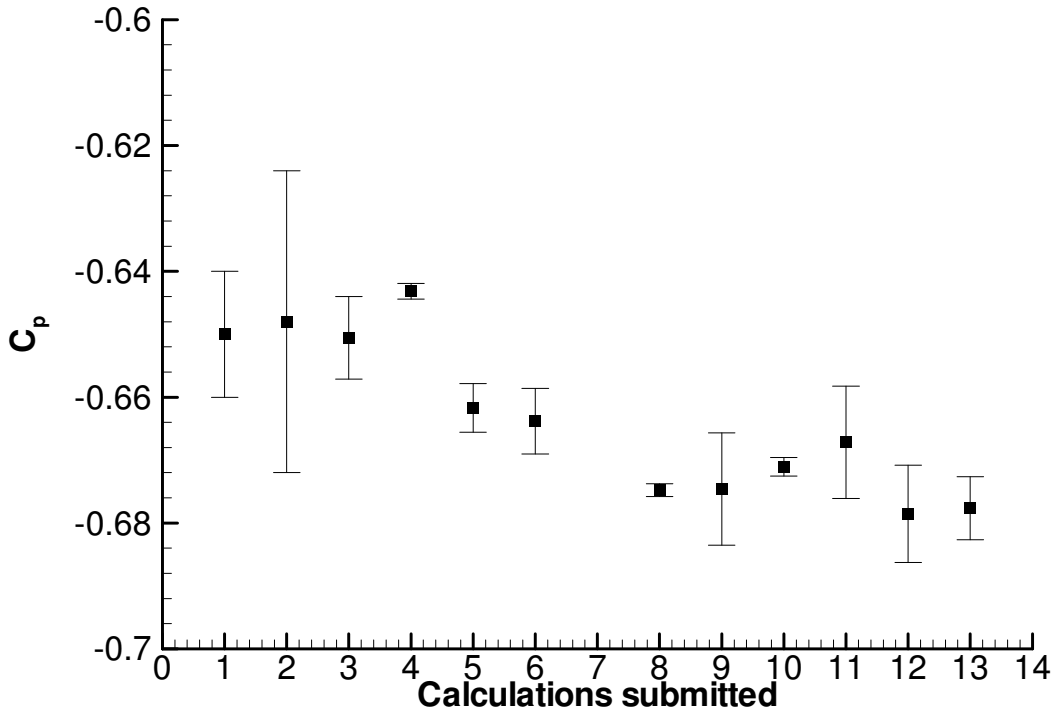
U^2 velocity component at ***x=0, y=1.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	0.1160	0.00240	0.11360	0.11840
2	INSEAN	401x401	B	0.1160	0.00560	0.11040	0.12160
3	NRMI	401x401	A	0.1142	0.00233	0.11187	0.11653
4	NRMI	401x401	B	0.1161	0.00040	0.11575	0.11655
5	ECN	401x401	A	0.1118	0.00203	0.10979	0.11385
6	ECN	401x401	B	0.1121	0.00136	0.11077	0.11349
7	BSHC	361x361	A	0.1155	0.00016	0.11535	0.11567
8	IST/MARIN A	401x401	A	0.1087	0.00032	0.10834	0.10898
9	IST/MARIN A	201x201	A	0.1086	0.00199	0.10666	0.11063
10	IST/MARIN A	401x401	B	0.1094	0.00015	0.10920	0.10950
11	IST/MARIN A	201x201	B	0.1099	0.00160	0.10832	0.11151
12	IST/MARIN B	281x281	A	0.1096	0.00009	0.10955	0.10973
13	IST/MARIN B	281x281	B	0.1098	0.00015	0.10961	0.10991



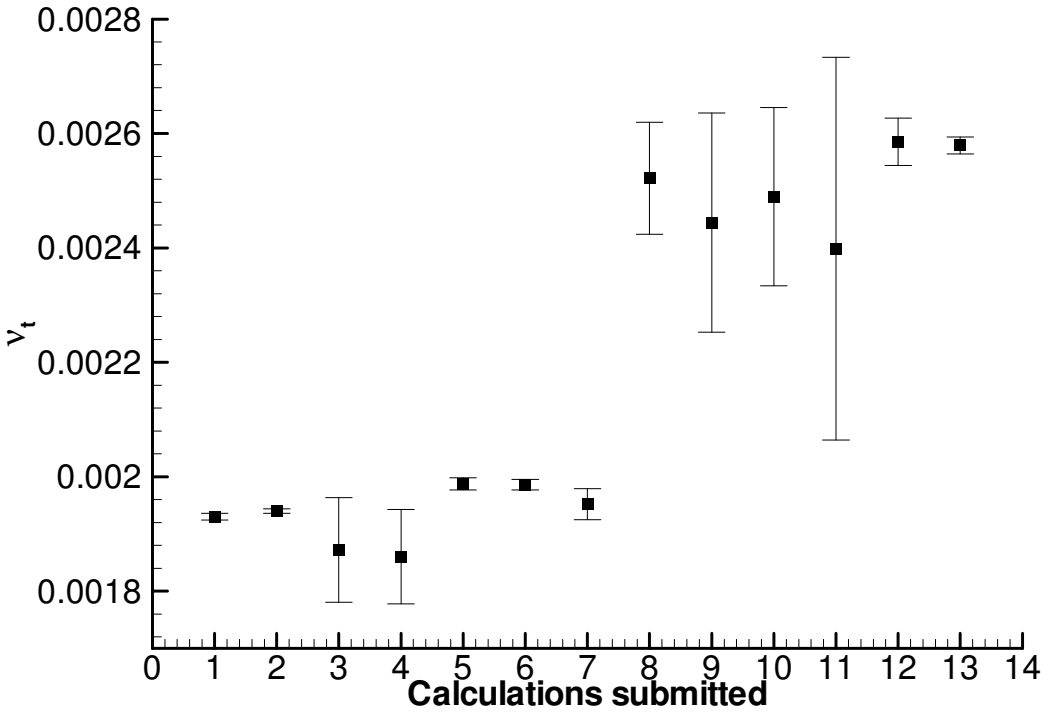
Cp at ***x=0, y=1.25h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	INSEAN	401x401	A	-0.6500	0.01000	-0.66000	-0.64000
2	INSEAN	401x401	B	-0.6480	0.02400	-0.67200	-0.62400
3	NRMI	401x401	A	-0.6506	0.00657	-0.65714	-0.64400
4	NRMI	401x401	B	-0.6432	0.00124	-0.64440	-0.64193
5	ECN	401x401	A	-0.6617	0.00386	-0.66558	-0.65786
6	ECN	401x401	B	-0.6638	0.00520	-0.66901	-0.65861
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	-0.6748	0.00101	-0.67580	-0.67377
9	IST/MARIN A	201x201	A	-0.6746	0.00894	-0.68353	-0.66565
10	IST/MARIN A	401x401	B	-0.6711	0.00146	-0.67252	-0.66959
11	IST/MARIN A	201x201	B	-0.6672	0.00892	-0.67607	-0.65823
12	IST/MARIN B	281x281	A	-0.6785	0.00774	-0.68627	-0.67080
13	IST/MARIN B	281x281	B	-0.6777	0.00502	-0.68267	-0.67263



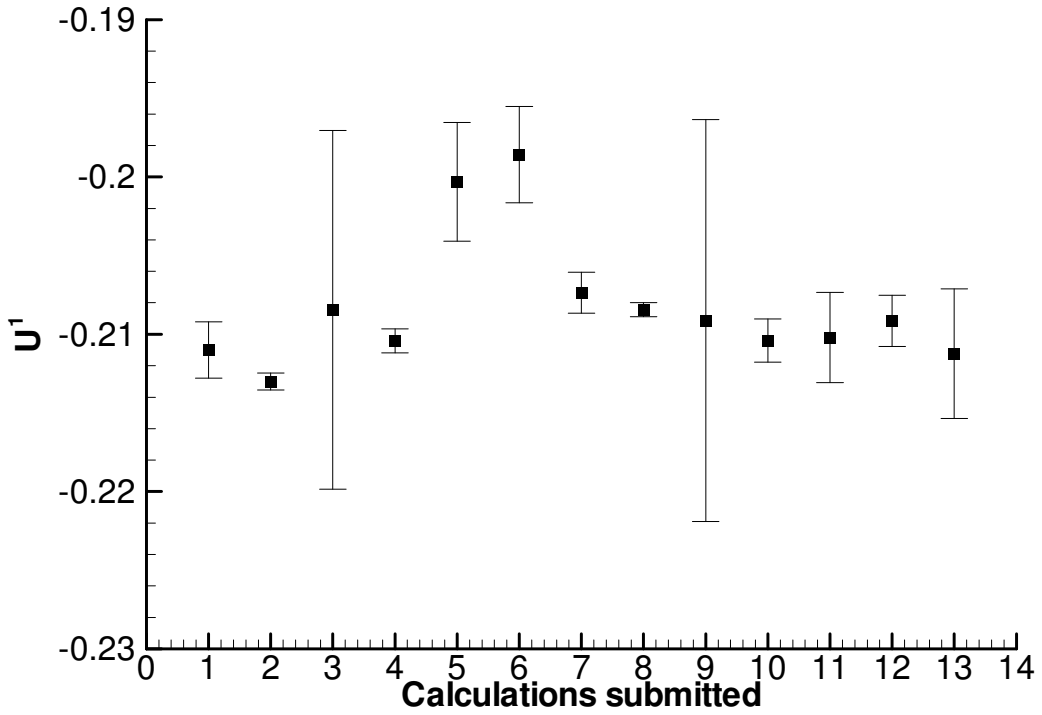
ν_t at ***x=0, y=1.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.00193	0.000006	0.001924	0.001936
2	INSEAN	401x401	B	0.00194	0.000004	0.001936	0.001944
3	NRMI	401x401	A	0.00187	0.000091	0.001780	0.001963
4	NRMI	401x401	B	0.00186	0.000082	0.001778	0.001943
5	ECN	401x401	A	0.00199	0.000011	0.001977	0.001998
6	ECN	401x401	B	0.00199	0.000009	0.001977	0.001995
7	BSHC	361x361	A	0.00195	0.000027	0.001925	0.001979
8	IST/MARIN A	401x401	A	0.00252	0.000098	0.002424	0.002620
9	IST/MARIN A	201x201	A	0.00244	0.000191	0.002253	0.002636
10	IST/MARIN A	401x401	B	0.00249	0.000156	0.002334	0.002645
11	IST/MARIN A	201x201	B	0.00240	0.000334	0.002064	0.002733
12	IST/MARIN B	281x281	A	0.00259	0.000041*	0.002544	0.002627
13	IST/MARIN B	281x281	B	0.00258	0.000015	0.002564	0.002594



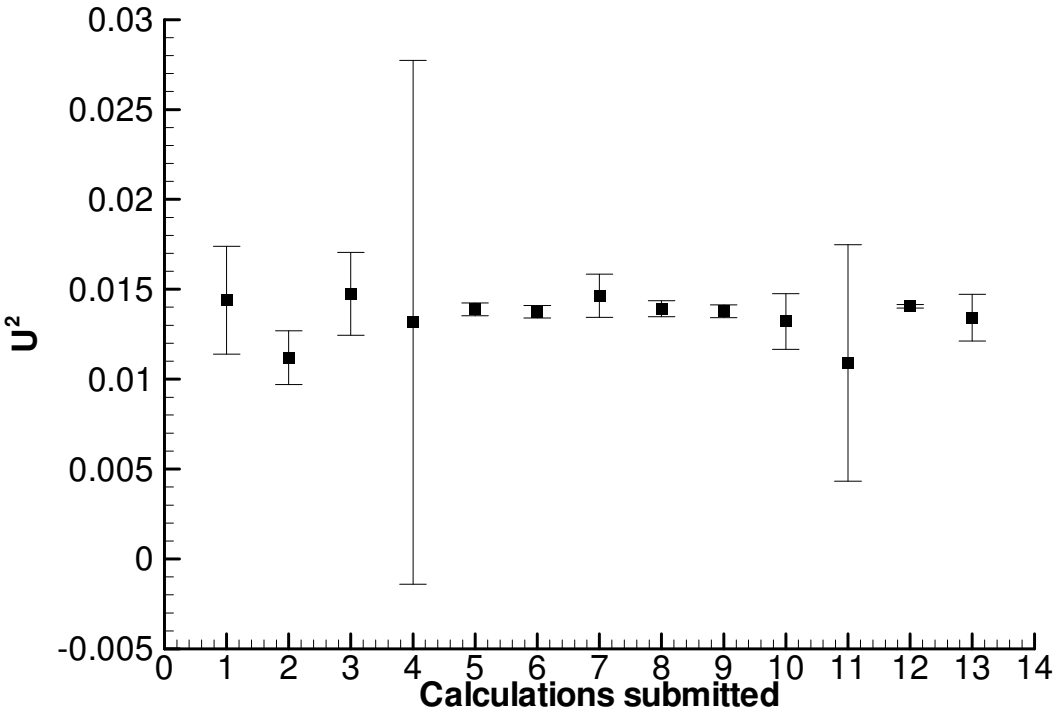
U^1 velocity component at ***x=2.5h, y=0.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	-0.2110	0.00180	-0.21280	-0.20920
2	INSEAN	401x401	B	-0.2130	0.00054	-0.21354	-0.21246
3	NRMI	401x401	A	-0.2085	0.01140	-0.21986	-0.19705
4	NRMI	401x401	B	-0.2104	0.00076	-0.21119	-0.20966
5	ECN	401x401	A	-0.2003	0.00377	-0.20408	-0.19654
6	ECN	401x401	B	-0.1986	0.00305	-0.20163	-0.19553
7	BSHC	361x361	A	-0.2074	0.00130	-0.20867	-0.20607
8	IST/MARIN A	401x401	A	-0.2084	0.00045	-0.20887	-0.20798
9	IST/MARIN A	201x201	A	-0.2091	0.01278	-0.22191	-0.19635
10	IST/MARIN A	401x401	B	-0.2104	0.00138	-0.21178	-0.20902
11	IST/MARIN A	201x201	B	-0.2102	0.00287	-0.21308	-0.20734
12	IST/MARIN B	281x281	A	-0.2092	0.00163	-0.21078	-0.20753
13	IST/MARIN B	281x281	B	-0.2112	0.00412	-0.21536	-0.20712



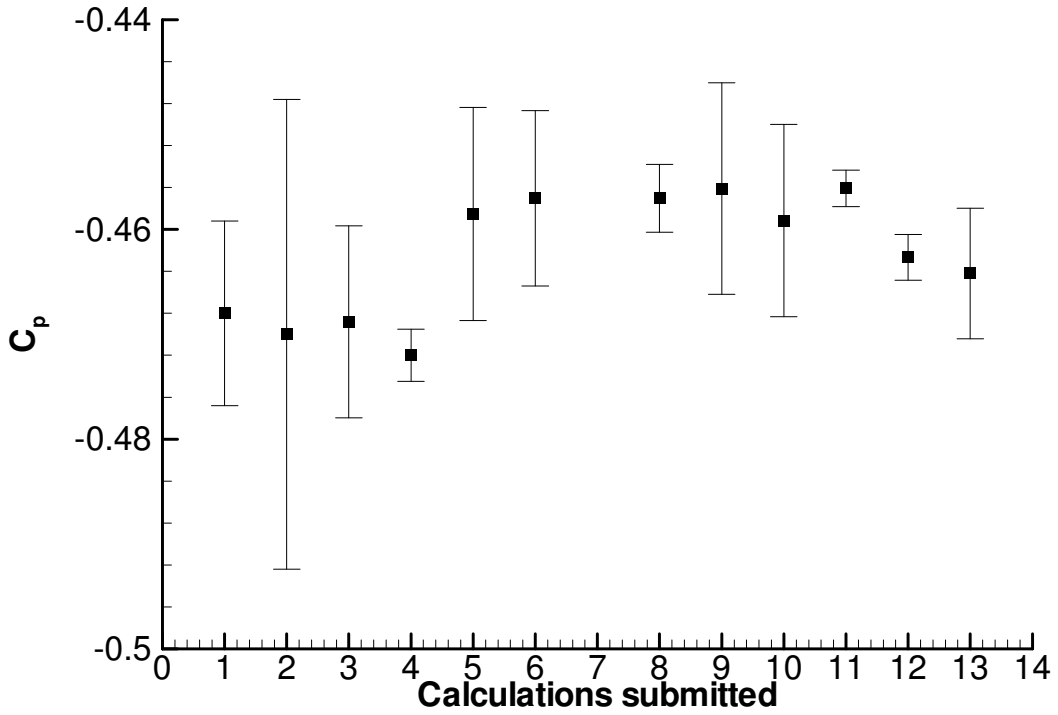
U^2 velocity component at ***x=2.5h, y=0.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	0.0144	0.00300	0.01140	0.01740
2	INSEAN	401x401	B	0.0112	0.00150	0.00970	0.01270
3	NRMI	401x401	A	0.0148	0.00231	0.01245	0.01706
4	NRMI	401x401	B	0.0132	0.01456	-0.00140	0.02773
5	ECN	401x401	A	0.0139	0.00036	0.01352	0.01425
6	ECN	401x401	B	0.0137	0.00035	0.01340	0.01410
7	BSHC	361x361	A	0.0146	0.00120	0.01344	0.01584
8	IST/MARIN A	401x401	A	0.0139	0.00045*	0.01347	0.01437
9	IST/MARIN A	201x201	A	0.0138	0.00036	0.01341	0.01413
10	IST/MARIN A	401x401	B	0.0132	0.00155	0.01165	0.01476
11	IST/MARIN A	201x201	B	0.0109	0.00658	0.00432	0.01749
12	IST/MARIN B	281x281	A	0.0141	0.00010*	0.01396	0.01415
13	IST/MARIN B	281x281	B	0.0134	0.00130	0.01212	0.01473



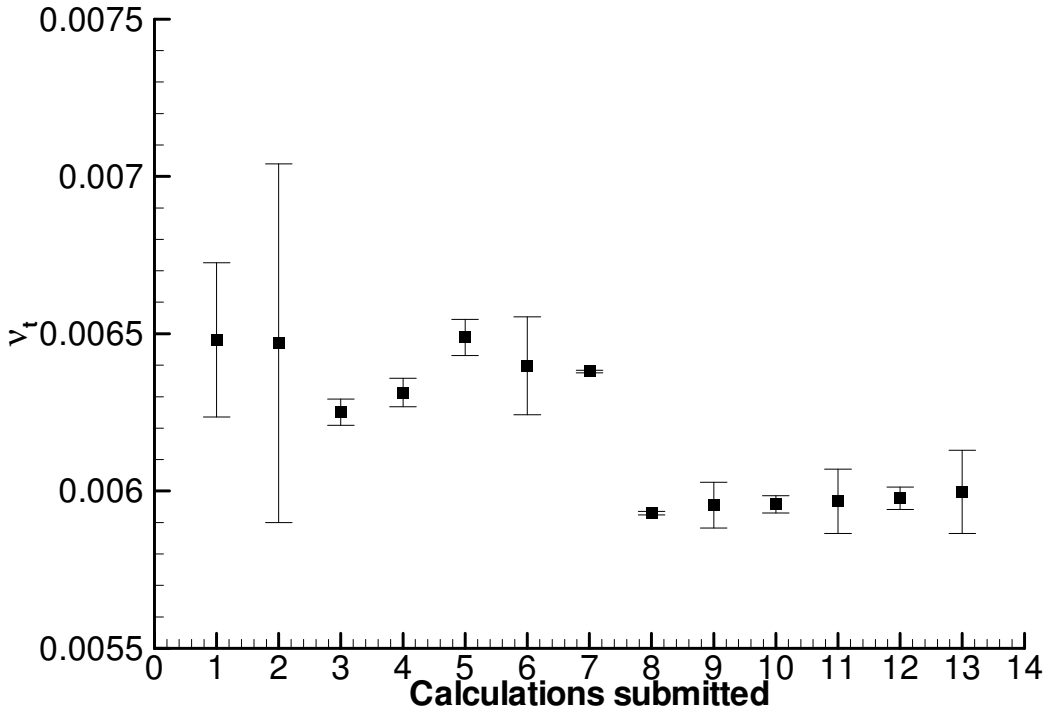
Cp at ***x=2.5h, y=0.25h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	INSEAN	401x401	A	-0.4680	0.00880	-0.47680	-0.45920
2	INSEAN	401x401	B	-0.4700	0.02240	-0.49240	-0.44760
3	NRMI	401x401	A	-0.4688	0.00915	-0.47798	-0.45968
4	NRMI	401x401	B	-0.4720	0.00249	-0.47449	-0.46951
5	ECN	401x401	A	-0.4585	0.01016	-0.46870	-0.44838
6	ECN	401x401	B	-0.4571	0.00836	-0.46541	-0.44869
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	-0.4570	0.00325*	-0.46029	-0.45379
9	IST/MARIN A	201x201	A	-0.4561	0.01009	-0.46620	-0.44602
10	IST/MARIN A	401x401	B	-0.4592	0.00918*	-0.46833	-0.44998
11	IST/MARIN A	201x201	B	-0.4561	0.00173	-0.45783	-0.45436
12	IST/MARIN B	281x281	A	-0.4627	0.00217	-0.46484	-0.46050
13	IST/MARIN B	281x281	B	-0.4642	0.00622	-0.47042	-0.45798



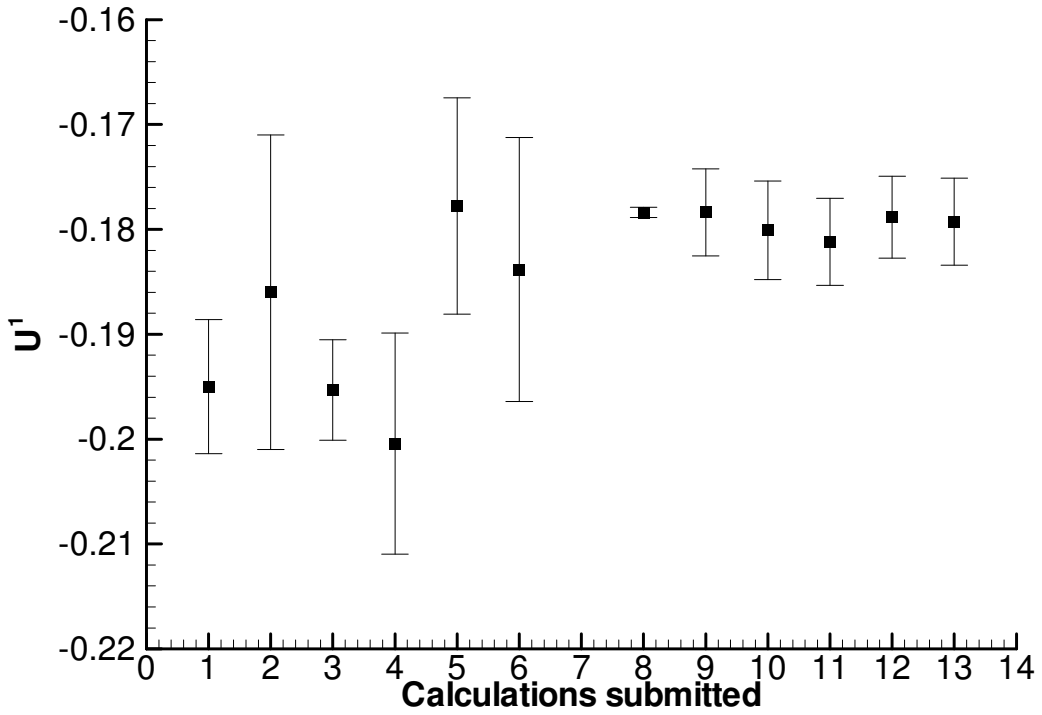
ν_t at ***x=2.5h, y=0.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.00648	0.000245	0.006235	0.006725
2	INSEAN	401x401	B	0.00647	0.000570	0.005900	0.007040
3	NRMI	401x401	A	0.00625	0.000042	0.006209	0.006293
4	NRMI	401x401	B	0.00631	0.000045	0.006268	0.006358
5	ECN	401x401	A	0.00649	0.000057	0.006431	0.006545
6	ECN	401x401	B	0.00640	0.000156	0.006242	0.006554
7	BSHC	361x361	A	0.00638	0.000004	0.006376	0.006384
8	IST/MARIN A	401x401	A	0.00593	0.000006	0.005924	0.005935
9	IST/MARIN A	201x201	A	0.00596	0.000073	0.005882	0.006028
10	IST/MARIN A	401x401	B	0.00596	0.000027	0.005930	0.005984
11	IST/MARIN A	201x201	B	0.00597	0.000102	0.005865	0.006069
12	IST/MARIN B	281x281	A	0.00598	0.000035	0.005941	0.006012
13	IST/MARIN B	281x281	B	0.00600	0.000132	0.005866	0.006130



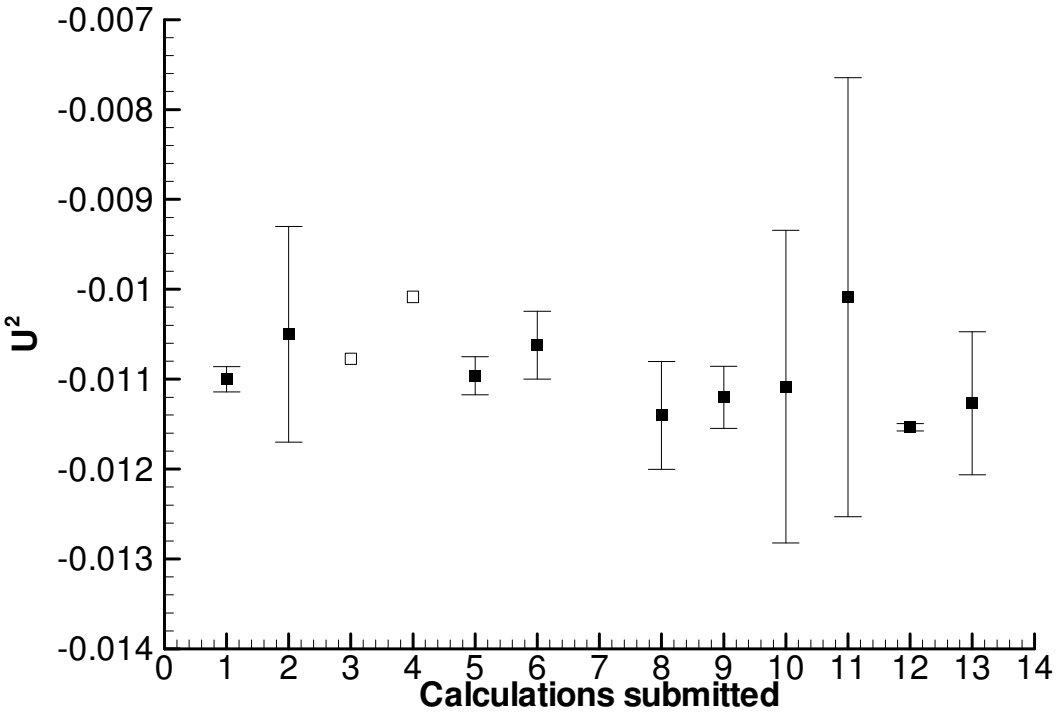
U^1 velocity component at ***x=5.357h, y=0.107h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	-0.1950	0.00640	-0.20140	-0.18860
2	INSEAN	401x401	B	-0.1860	0.01500	-0.20100	-0.17100
3	NRMI	401x401	A	-0.1953	0.00480	-0.20012	-0.19052
4	NRMI	401x401	B	-0.2004	0.01055	-0.21098	-0.18988
5	ECN	401x401	A	-0.1778	0.01032	-0.18809	-0.16745
6	ECN	401x401	B	-0.1838	0.01259	-0.19642	-0.17124
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	-0.1784	0.00050	-0.17889	-0.17790
9	IST/MARIN A	201x201	A	-0.1784	0.00415*	-0.18252	-0.17421
10	IST/MARIN A	401x401	B	-0.1801	0.00471*	-0.18479	-0.17538
11	IST/MARIN A	201x201	B	-0.1812	0.00415	-0.18532	-0.17703
12	IST/MARIN B	281x281	A	-0.1788	0.00391	-0.18275	-0.17493
13	IST/MARIN B	281x281	B	-0.1793	0.00415	-0.18342	-0.17511



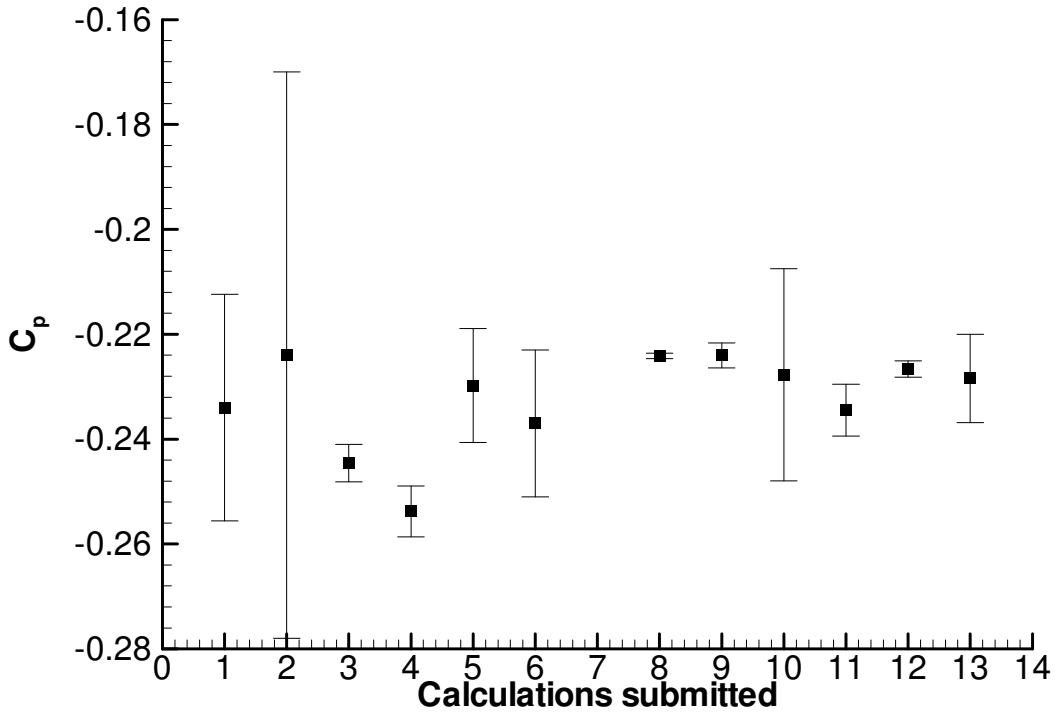
U^2 velocity component at ***x=5.357h, y=0.107h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	-0.0110	0.00014	-0.01114	-0.01086
2	INSEAN	401x401	B	-0.0105	0.00120	-0.01170	-0.00930
3	NRMI	401x401	A	-0.0108	---	---	---
4	NRMI	401x401	B	-0.0101	---	---	---
5	ECN	401x401	A	-0.0110	0.00021	-0.01117	-0.01075
6	ECN	401x401	B	-0.0106	0.00038	-0.01100	-0.01025
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	-0.0114	0.00060*	-0.01200	-0.01080
9	IST/MARIN A	201x201	A	-0.0112	0.00035	-0.01155	-0.01086
10	IST/MARIN A	401x401	B	-0.0111	0.00174	-0.01282	-0.00934
11	IST/MARIN A	201x201	B	-0.0101	0.00244*	-0.01253	-0.00764
12	IST/MARIN B	281x281	A	-0.0115	0.00004	-0.01158	-0.01149
13	IST/MARIN B	281x281	B	-0.0113	0.00080*	-0.01206	-0.01047



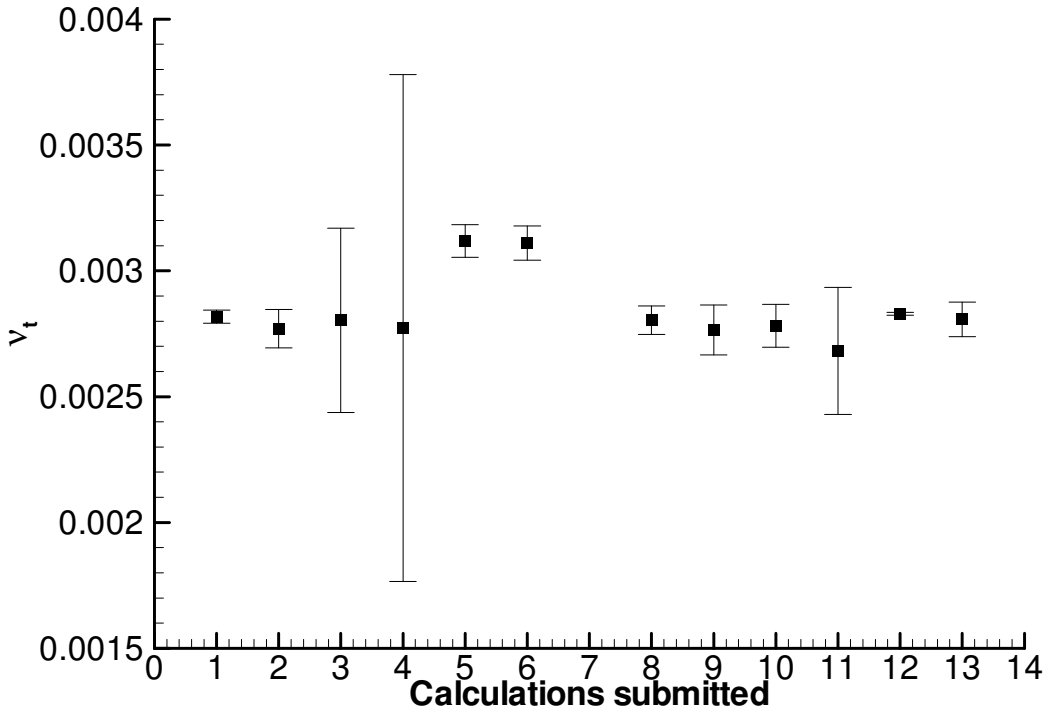
Cp at ***x=5.357h, y=0.107h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	INSEAN	401x401	A	-0.2340	0.02160	-0.25560	-0.21240
2	INSEAN	401x401	B	-0.2240	0.05400	-0.27800	-0.17000
3	NRMI	401x401	A	-0.2446	0.00358	-0.24817	-0.24101
4	NRMI	401x401	B	-0.2538	0.00482	-0.25861	-0.24898
5	ECN	401x401	A	-0.2298	0.01085	-0.24064	-0.21894
6	ECN	401x401	B	-0.2370	0.01400	-0.25102	-0.22302
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	-0.2241	0.00053	-0.22466	-0.22361
9	IST/MARIN A	201x201	A	-0.2240	0.00239	-0.22644	-0.22165
10	IST/MARIN A	401x401	B	-0.2277	0.02021*	-0.24794	-0.20752
11	IST/MARIN A	201x201	B	-0.2345	0.00495	-0.23942	-0.22952
12	IST/MARIN B	281x281	A	-0.2267	0.00153	-0.22819	-0.22512
13	IST/MARIN B	281x281	B	-0.2284	0.00845	-0.23688	-0.21999



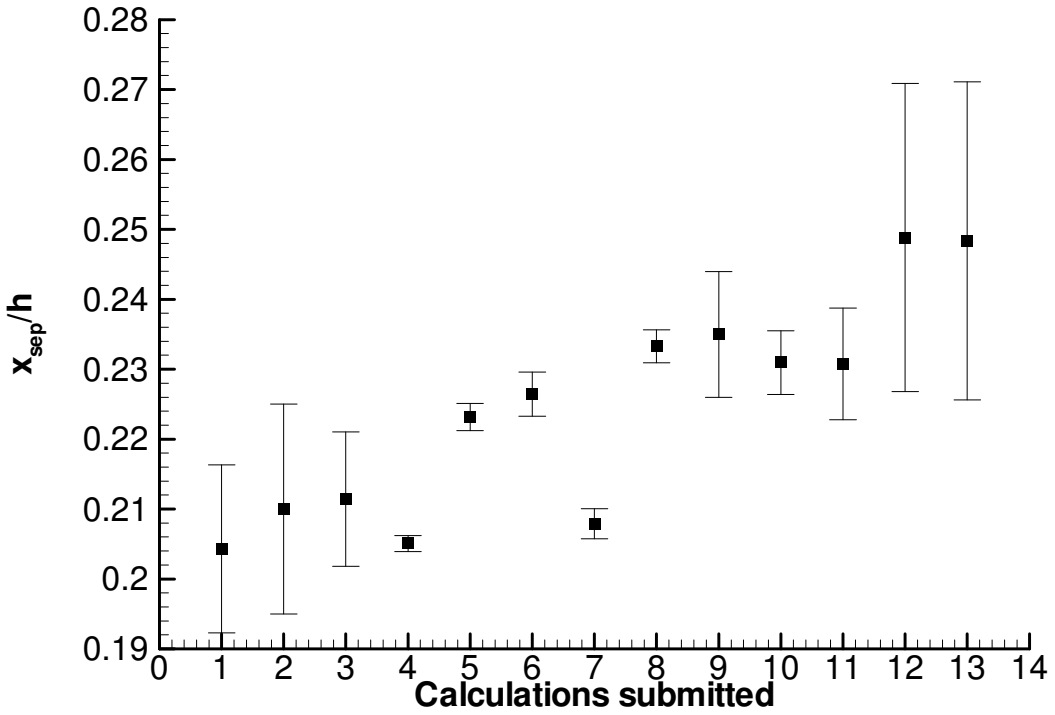
ν_t at ***x=5.357h, y=0.107h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.00282	0.000026	0.002792	0.002844
2	INSEAN	401x401	B	0.00277	0.000076	0.002694	0.002846
3	NRMI	401x401	A	0.00280	0.000366	0.002437	0.003169
4	NRMI	401x401	B	0.00277	0.001007	0.001765	0.003779
5	ECN	401x401	A	0.00312	0.000065	0.003054	0.003183
6	ECN	401x401	B	0.00311	0.000068	0.003042	0.003178
7	BSHC	361x361	A	---	---	---	---
8	IST/MARIN A	401x401	A	0.00280	0.000056	0.002747	0.002860
9	IST/MARIN A	201x201	A	0.00277	0.000099*	0.002666	0.002864
10	IST/MARIN A	401x401	B	0.00278	0.000085	0.002696	0.002866
11	IST/MARIN A	201x201	B	0.00268	0.000252	0.002430	0.002934
12	IST/MARIN B	281x281	A	0.00283	0.000006*	0.002823	0.002835
13	IST/MARIN B	281x281	B	0.00281	0.000068	0.002739	0.002876



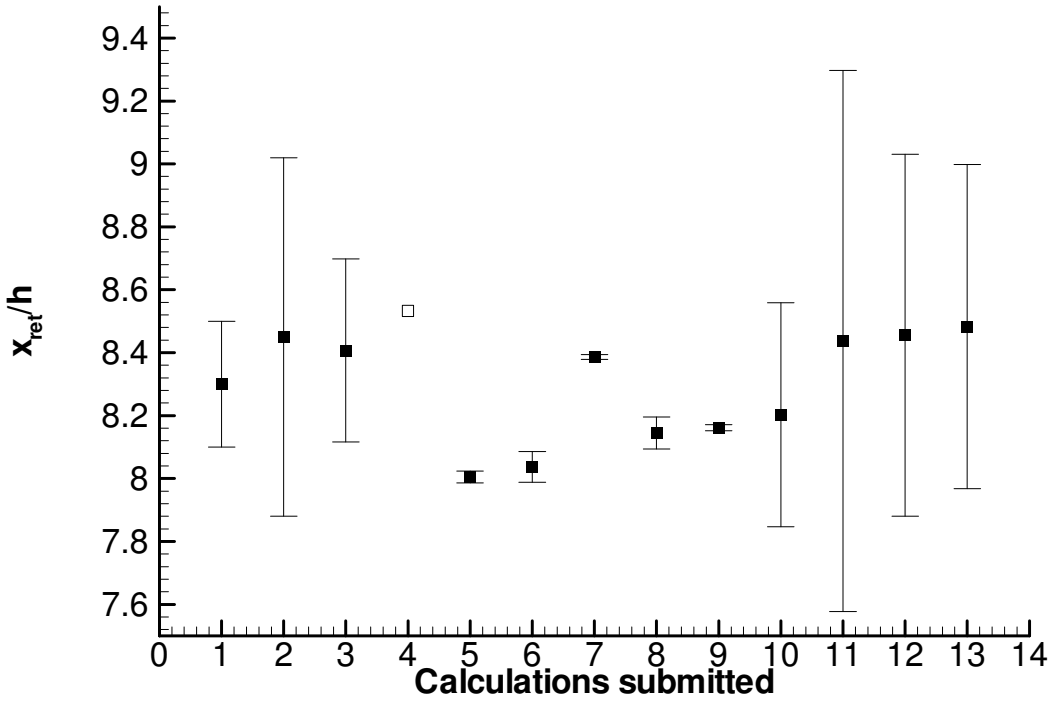
Separation point

x_{sep}		Grid	Set	x_{sep}	U	x_{sep} -U	x_{sep} +U
1	INSEAN	401x401	A	0.204	0.0120	0.1923	0.2163
2	INSEAN	401x401	B	0.210	0.0150	0.1950	0.2250
3	NRMI	401x401	A	0.211	0.0096	0.2018	0.2210
4	NRMI	401x401	B	0.205	0.0011	0.2039	0.2062
5	ECN	401x401	A	0.223	0.0019	0.2212	0.2251
6	ECN	401x401	B	0.226	0.0032	0.2233	0.2296
7	BSHC	361x361	A	0.208	0.0021	0.2058	0.2100
8	IST/MARIN A	401x401	A	0.233	0.0024	0.2309	0.2356
9	IST/MARIN A	201x201	A	0.235	0.0090	0.2260	0.2440
10	IST/MARIN A	401x401	B	0.231	0.0046*	0.2264	0.2355
11	IST/MARIN A	201x201	B	0.231	0.0080	0.2228	0.2388
12	IST/MARIN B	281x281	A	0.249	0.0220*	0.2268	0.2709
13	IST/MARIN B	281x281	B	0.248	0.0228	0.2256	0.2711



Re-attachment point

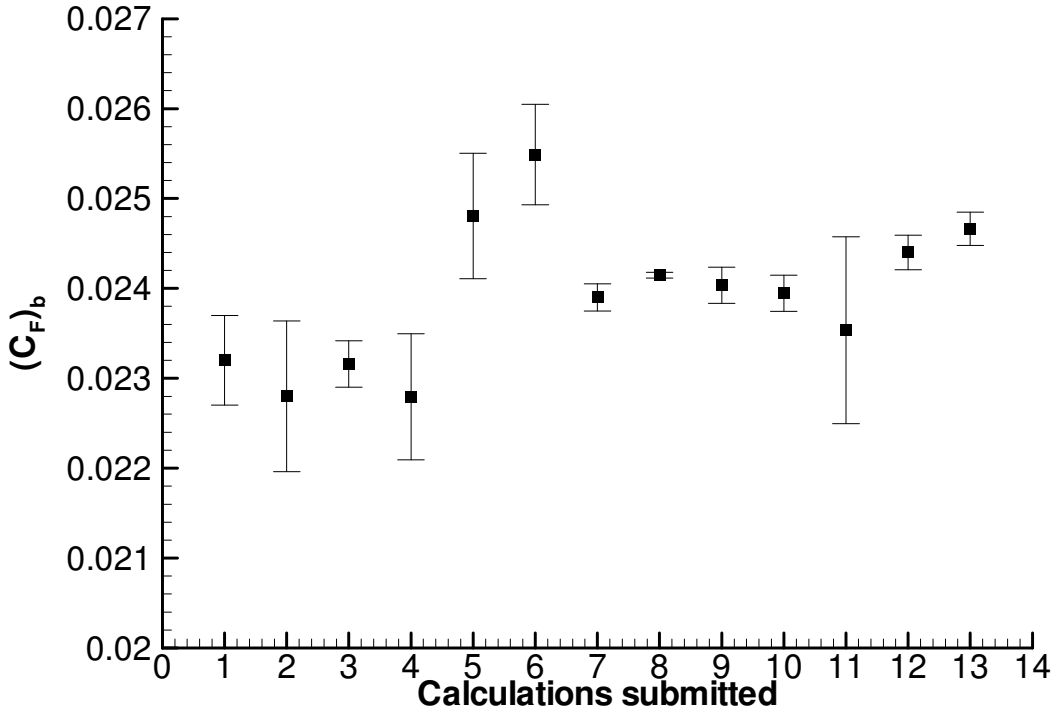
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	INSEAN	401x401	A	8.300	0.2000	8.1000	8.5000
2	INSEAN	401x401	B	8.450	0.5700	7.8800	9.0200
3	NRMI	401x401	A	8.407	0.2909	8.1162	8.6980
4	NRMI	401x401	B	8.533	---	---	---
5	ECN	401x401	A	8.005	0.0188	7.9857	8.0233
6	ECN	401x401	B	8.037	0.0488	7.9884	8.0860
7	BSHC	361x361	A	8.386	0.0075	8.3785	8.3935
8	IST/MARIN A	401x401	A	8.145	0.0507*	8.0942	8.1956
9	IST/MARIN A	201x201	A	8.162	0.0097	8.1520	8.1715
10	IST/MARIN A	401x401	B	8.203	0.3560	7.8467	8.5587
11	IST/MARIN A	201x201	B	8.437	0.8597*	7.5776	9.2970
12	IST/MARIN B	281x281	A	8.456	0.5756	7.8801	9.0312
13	IST/MARIN B	281x281	B	8.483	0.5154	7.9674	8.9981



Integral flow quantities:

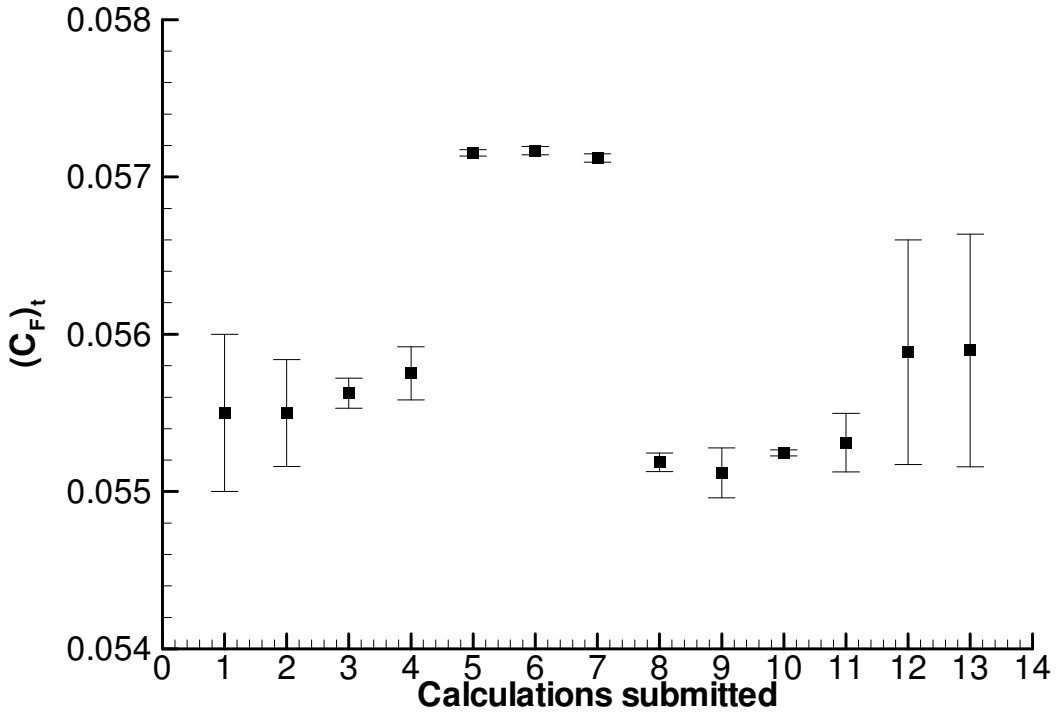
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$ -U	$(C_F)_b$ +U
1	INSEAN	401x401	A	0.0232	0.00050	0.02270	0.02370
2	INSEAN	401x401	B	0.0228	0.00084	0.02196	0.02364
3	NRMI	401x401	A	0.0232	0.00026	0.02290	0.02342
4	NRMI	401x401	B	0.0228	0.00070	0.02209	0.02350
5	ECN	401x401	A	0.0248	0.00070	0.02411	0.02550
6	ECN	401x401	B	0.0255	0.00056	0.02493	0.02605
7	BSHC	361x361	A	0.0239	0.00015	0.02375	0.02405
8	IST/MARIN A	401x401	A	0.0241	0.00003	0.02411	0.02418
9	IST/MARIN A	201x201	A	0.0240	0.00020	0.02383	0.02424
10	IST/MARIN A	401x401	B	0.0239	0.00020	0.02375	0.02415
11	IST/MARIN A	201x201	B	0.0235	0.00104	0.02250	0.02457
12	IST/MARIN B	281x281	A	0.0244	0.00019	0.02421	0.02459
13	IST/MARIN B	281x281	B	0.0247	0.00019	0.02448	0.02485



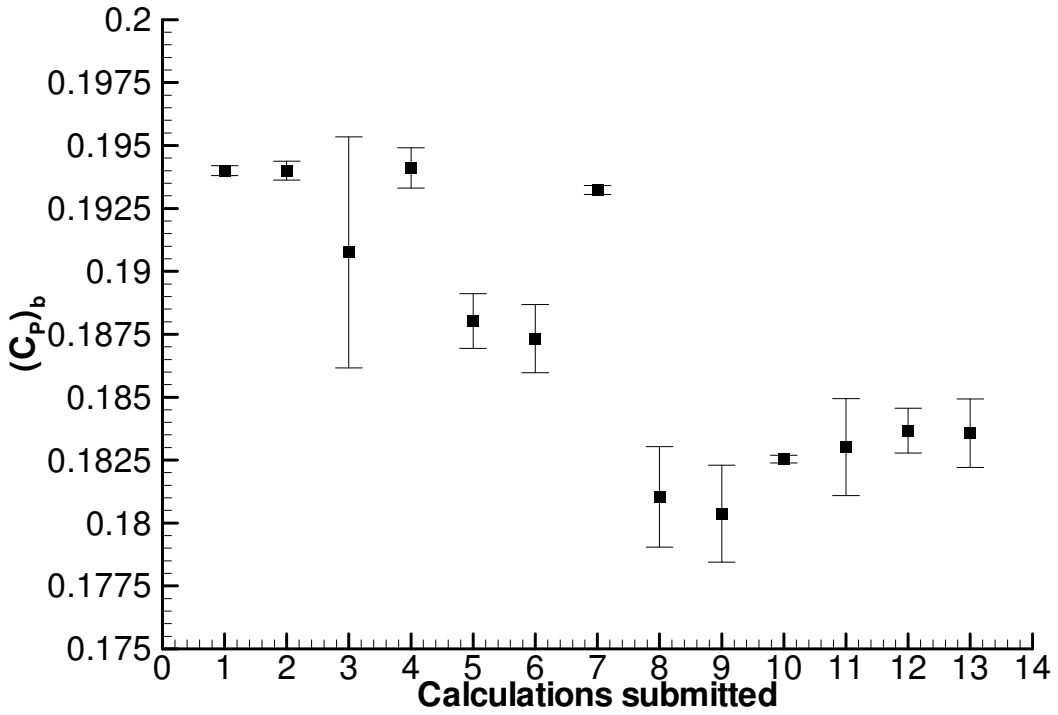
Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$ -U	$(C_F)_t$ +U
1	INSEAN	401x401	A	0.0555	0.00050	0.05500	0.05600
2	INSEAN	401x401	B	0.0555	0.00034	0.05516	0.05584
3	NRMI	401x401	A	0.0556	0.00010	0.05553	0.05572
4	NRMI	401x401	B	0.0558	0.00017	0.05558	0.05592
5	ECN	401x401	A	0.0572	0.00002	0.05713	0.05717
6	ECN	401x401	B	0.0572	0.00003	0.05714	0.05719
7	BSHC	361x361	A	0.0571	0.00003	0.05709	0.05715
8	IST/MARIN A	401x401	A	0.0552	0.00006	0.05513	0.05525
9	IST/MARIN A	201x201	A	0.0551	0.00016	0.05496	0.05528
10	IST/MARIN A	401x401	B	0.0552	0.00002	0.05523	0.05526
11	IST/MARIN A	201x201	B	0.0553	0.00019	0.05512	0.05550
12	IST/MARIN B	281x281	A	0.0559	0.00071	0.05517	0.05660
13	IST/MARIN B	281x281	B	0.0559	0.00074	0.05516	0.05664



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$ -U	$(C_P)_b$ +U
1	INSEAN	401x401	A	0.1940	0.00020	0.19380	0.19420
2	INSEAN	401x401	B	0.1940	0.00038	0.19362	0.19438
3	NRMI	401x401	A	0.1908	0.00459	0.18617	0.19534
4	NRMI	401x401	B	0.1941	0.00080	0.19331	0.19491
5	ECN	401x401	A	0.1880	0.00109	0.18694	0.18912
6	ECN	401x401	B	0.1873	0.00135	0.18598	0.18868
7	BSHC	361x361	A	0.1932	0.00018	0.19305	0.19341
8	IST/MARIN A	401x401	A	0.1810	0.00200*	0.17904	0.18303
9	IST/MARIN A	201x201	A	0.1804	0.00193	0.17844	0.18230
10	IST/MARIN A	401x401	B	0.1825	0.00015	0.18239	0.18269
11	IST/MARIN A	201x201	B	0.1830	0.00193	0.18108	0.18494
12	IST/MARIN B	281x281	A	0.1837	0.00089	0.18278	0.18456
13	IST/MARIN B	281x281	B	0.1836	0.00136	0.18220	0.18493

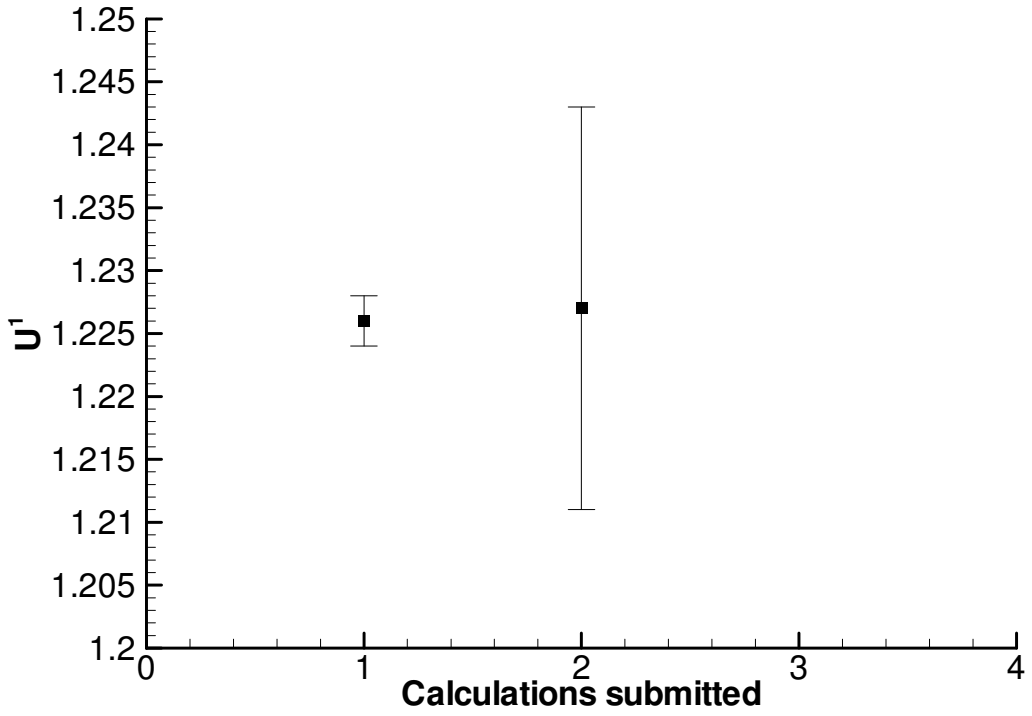


b) Chang, Hsieh and Chen k-ε Turbulence model

Local flow quantities:

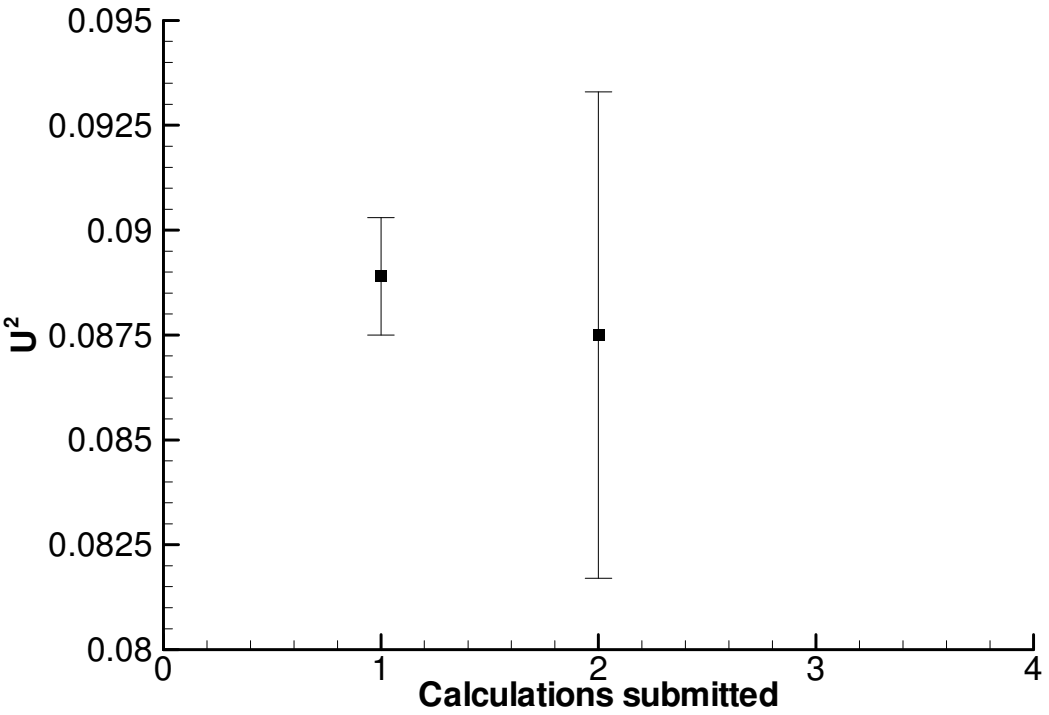
U^1 velocity component at ***x=0, y=1.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	1.226	0.002	1.224	1.228
2	INSEAN	401x401	B	1.227	0.016	1.211	1.243



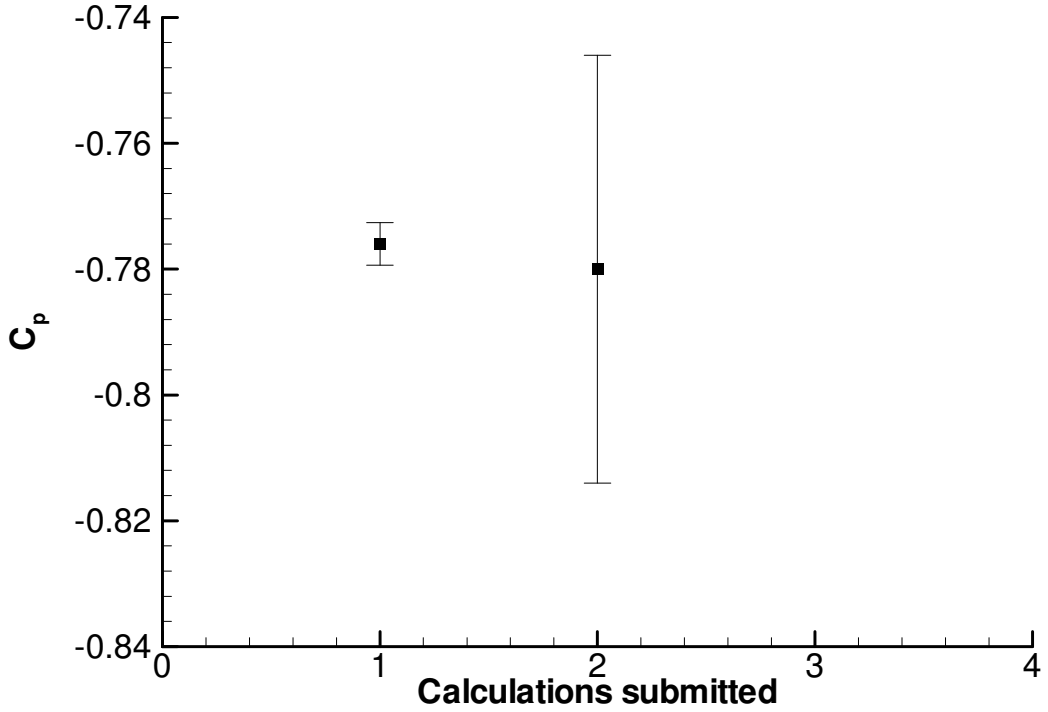
U^2 velocity component at ***x=0, y=1.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	0.0889	0.0014	0.00875	0.00903
2	INSEAN	401x401	B	0.0875	0.0058	0.00817	0.00933



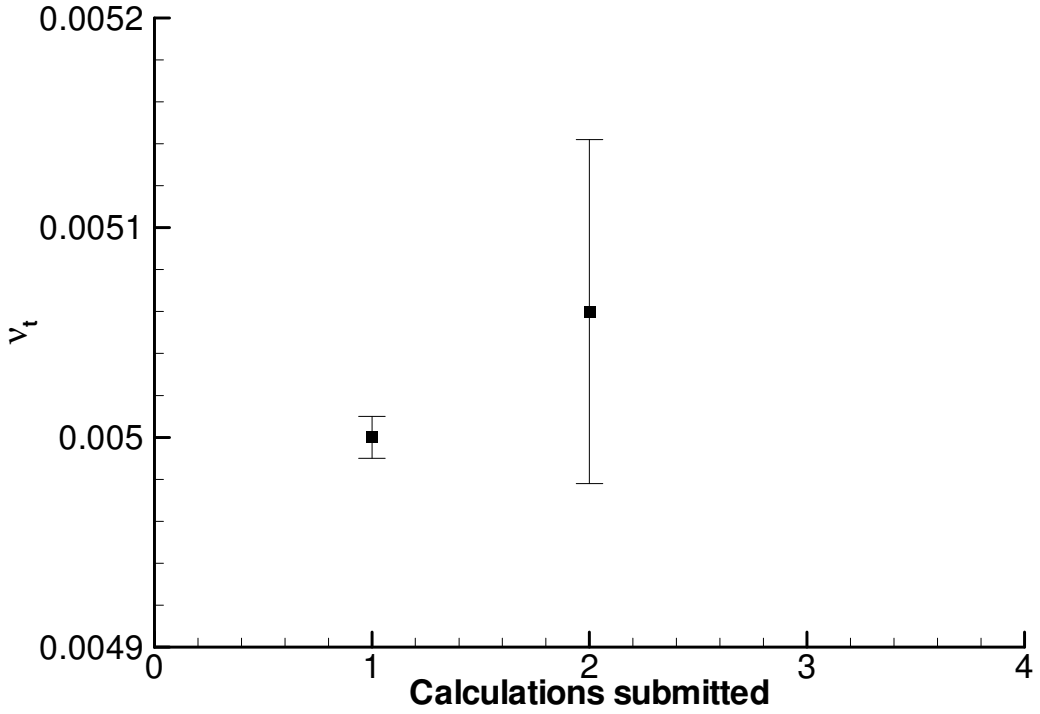
Cp at ***x=0, y=1.25h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	INSEAN	401x401	A	-0.776	0.0034	-0.7794	-0.7726
2	INSEAN	401x401	B	-0.780	0.0340	-0.8140	-0.7460



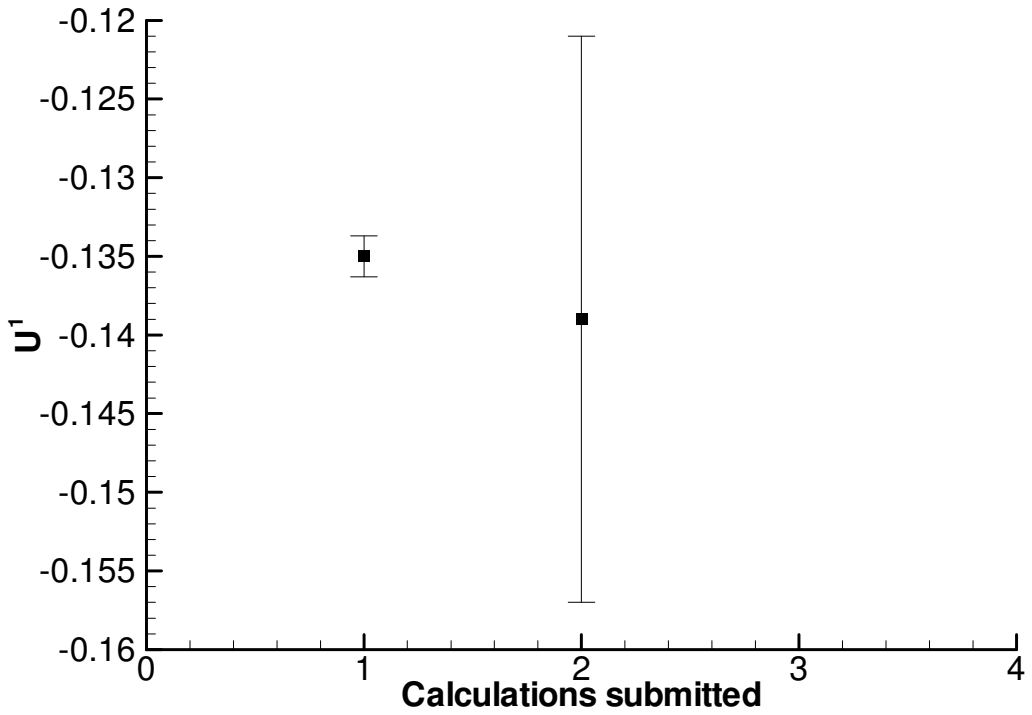
ν_t at ***x=0, y=1.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.00500	0.00001	0.00499	0.00501
2	INSEAN	401x401	B	0.00506	0.000082	0.004978	0.005142



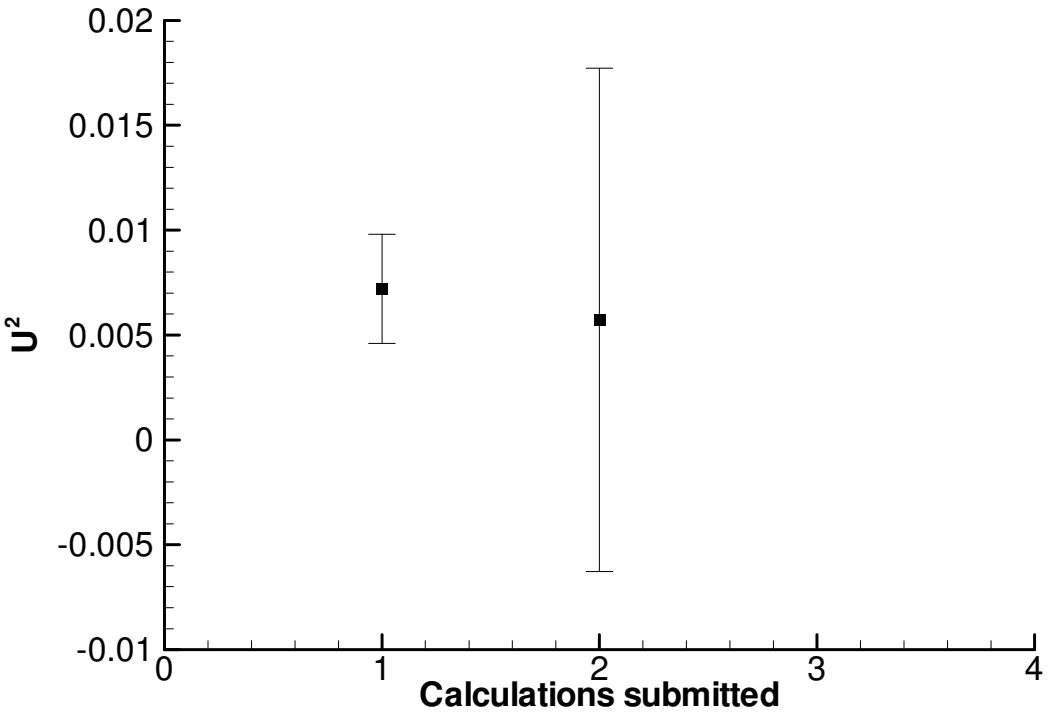
U^1 velocity component at ***x=2.5h, y=0.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	-0.135	0.0013	-0.1363	-0.1337
2	INSEAN	401x401	B	-0.139	0.018	-0.157	-0.121



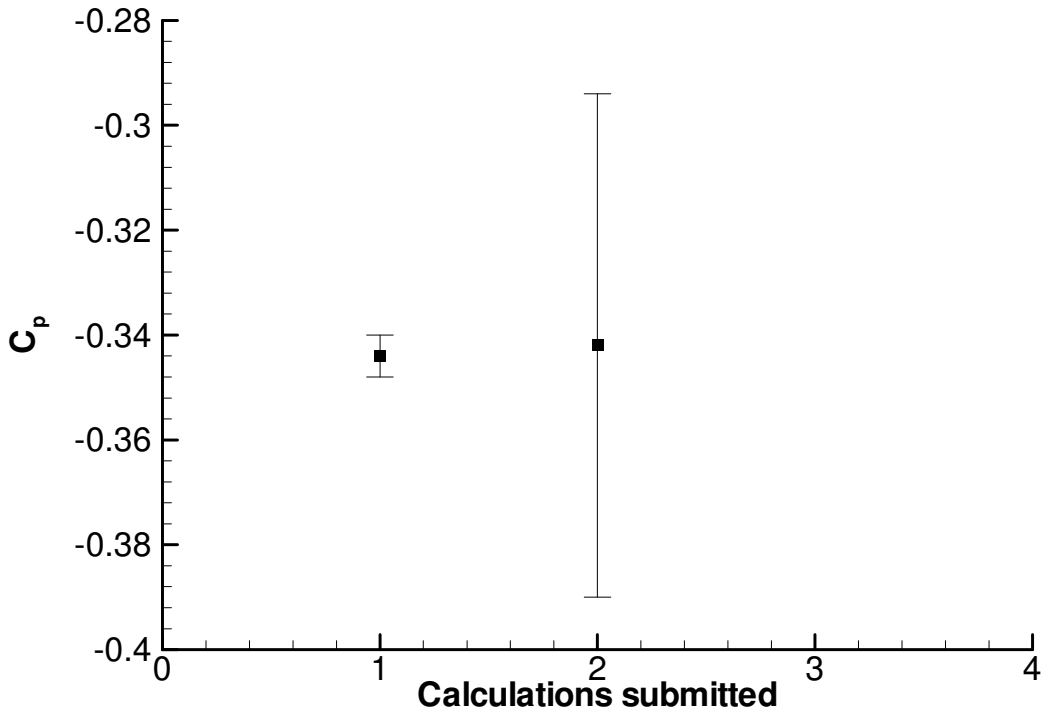
U^2 velocity component at ***x=2.5h, y=0.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	0.0072	0.0026	0.0046	0.0098
2	INSEAN	401x401	B	0.00572	0.012	-0.00628	0.01772



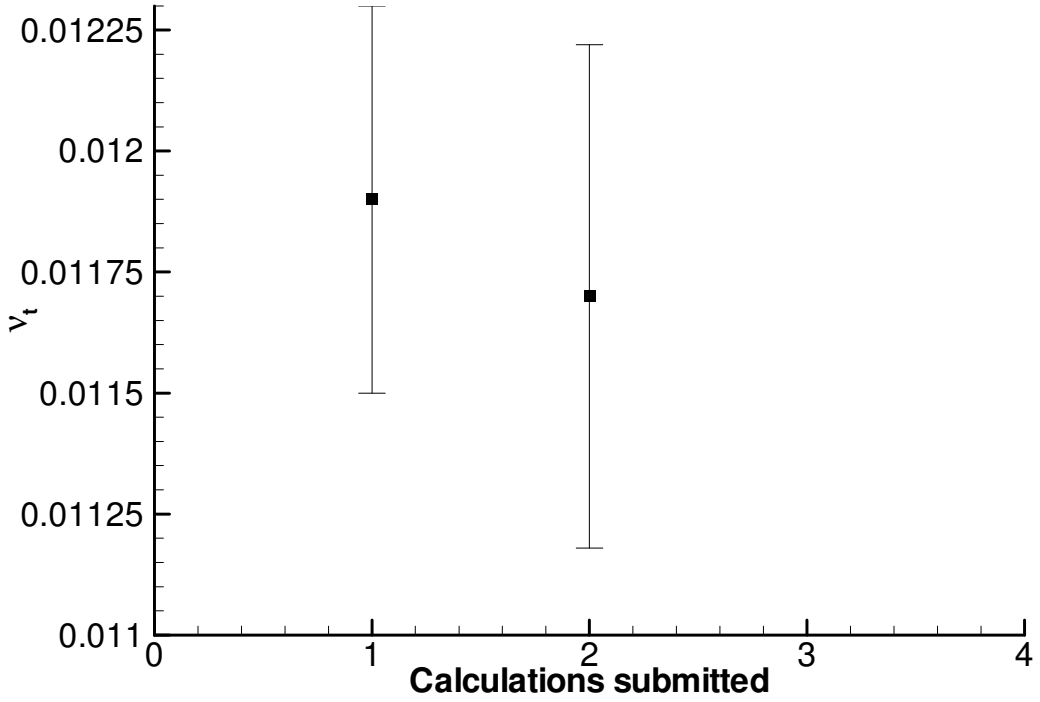
Cp at ***x=2.5h, y=0.25h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	INSEAN	401x401	A	-0.344	0.004	-0.348	-0.340
2	INSEAN	401x401	B	-0.342	0.048	-0.390	-0.294



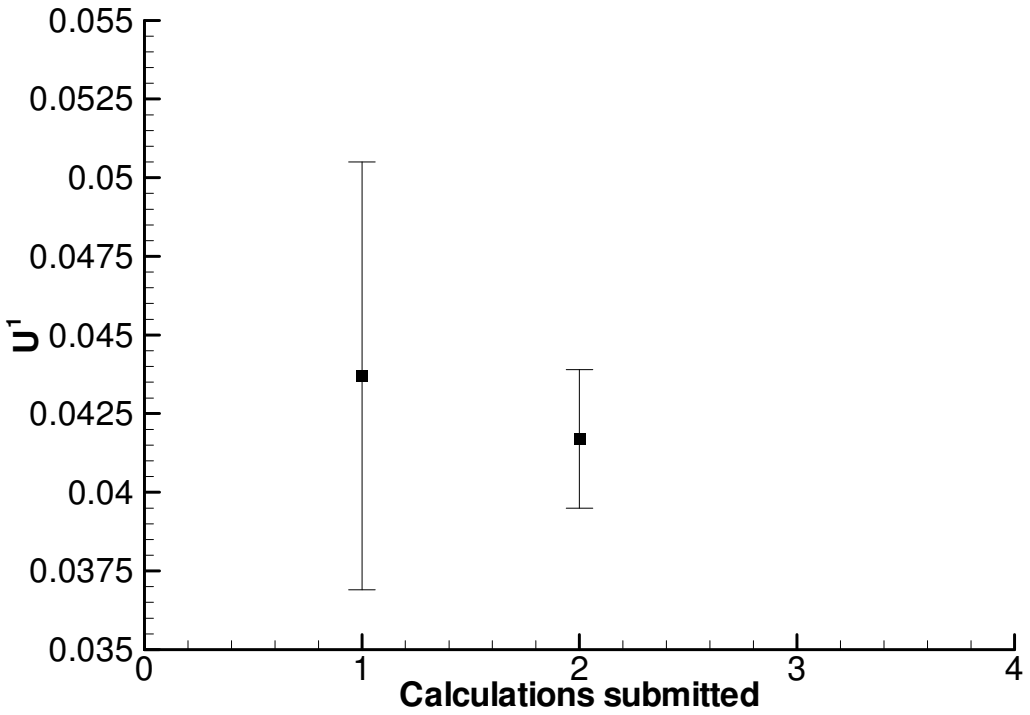
ν_t at ***x=2.5h, y=0.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.0119	0.0004	0.0115	0.0123
2	INSEAN	401x401	B	0.0117	0.00052	0.01118	0.01222



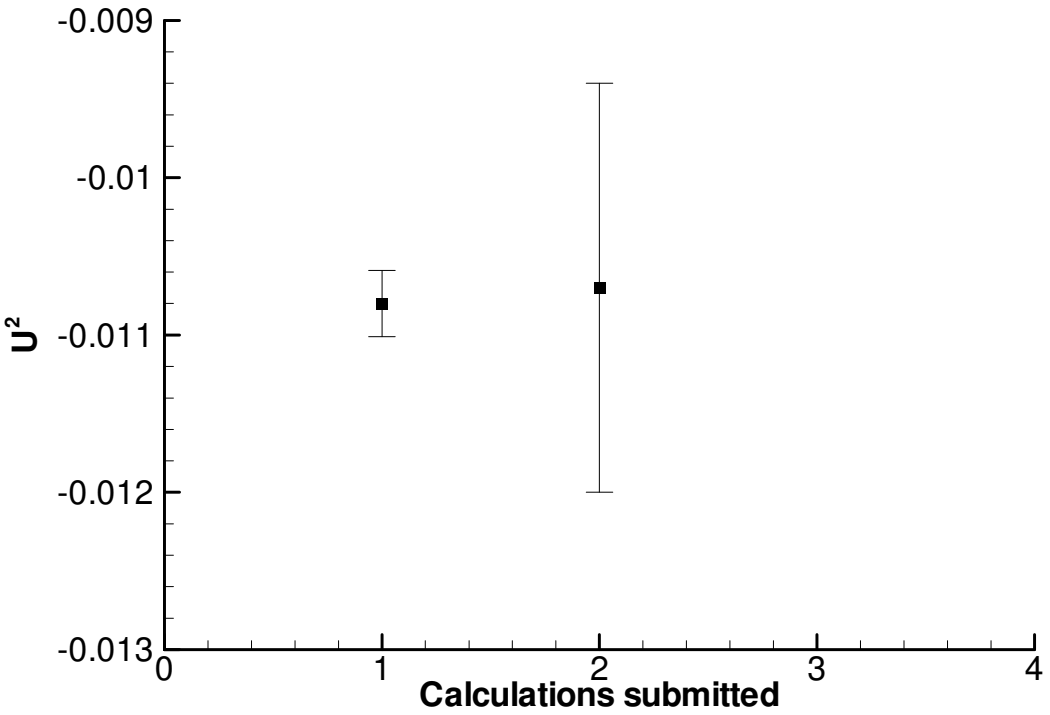
U^1 velocity component at ***x=5.357h, y=0.107h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	401x401	A	0.0437	0.0068	0.0369	0.0505
2	INSEAN	401x401	B	0.0417	0.0022	0.0395	0.0439



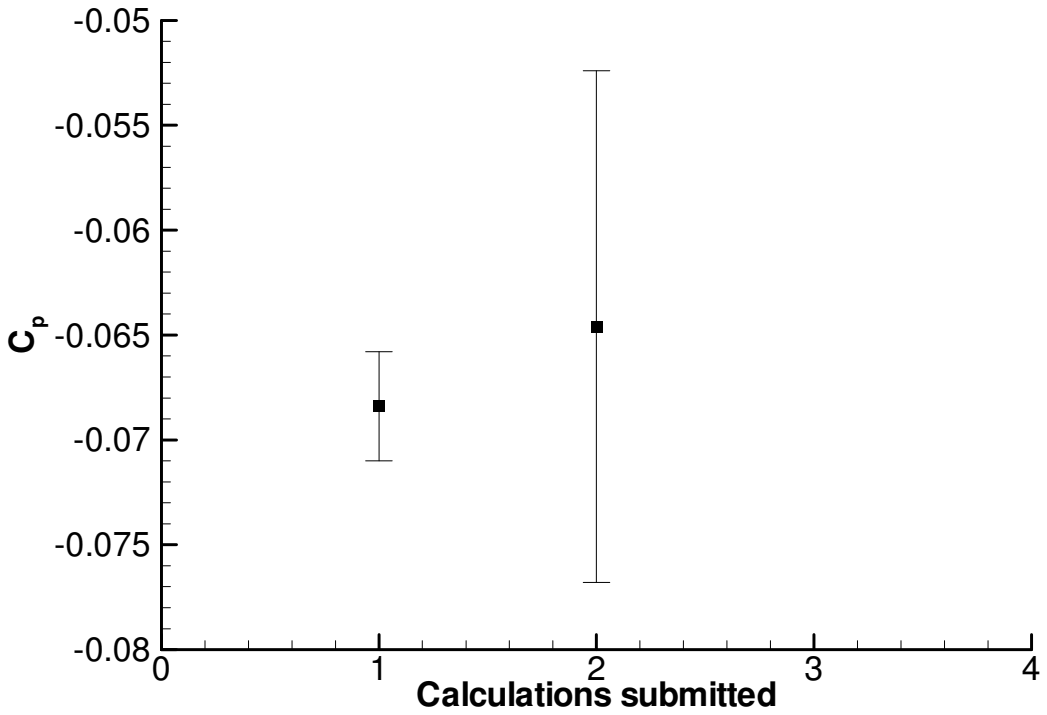
U^2 velocity component at ***x=5.357h, y=0.107h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	401x401	A	-0.0108	0.00021	-0.01101	-0.01059
2	INSEAN	401x401	B	-0.0107	0.0013	-0.012	-0.0094



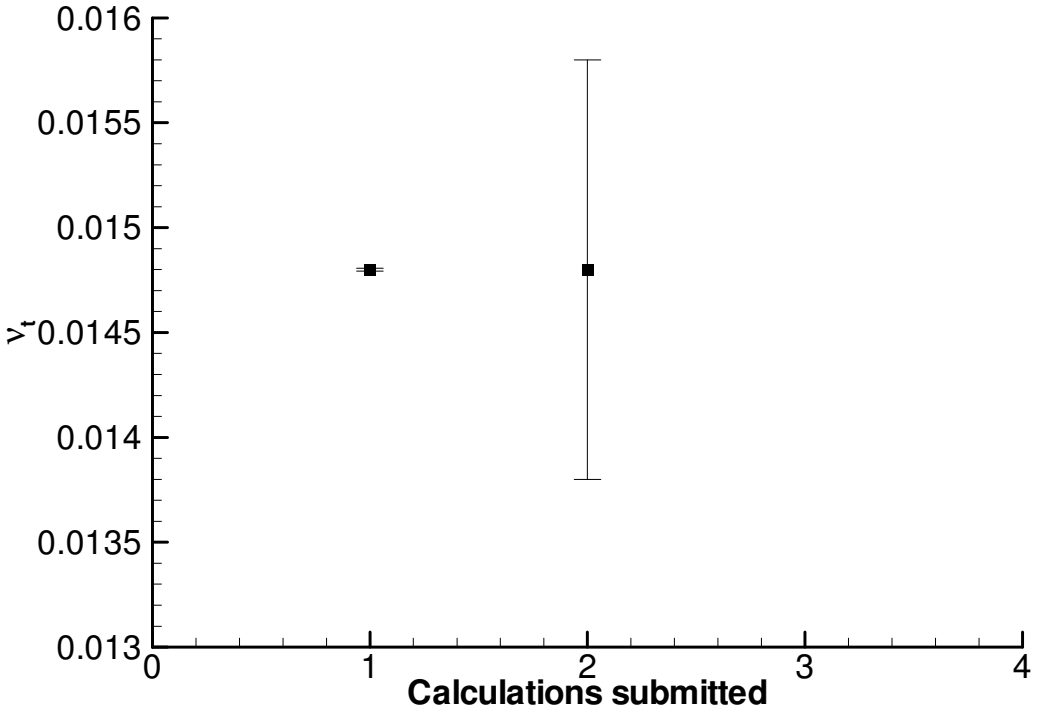
Cp at ***x=5.357h, y=0.107h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	INSEAN	401x401	A	-0.0684	0.0026	-0.0710	-0.0658
2	INSEAN	401x401	B	-0.0646	0.0122	-0.0768	-0.0524



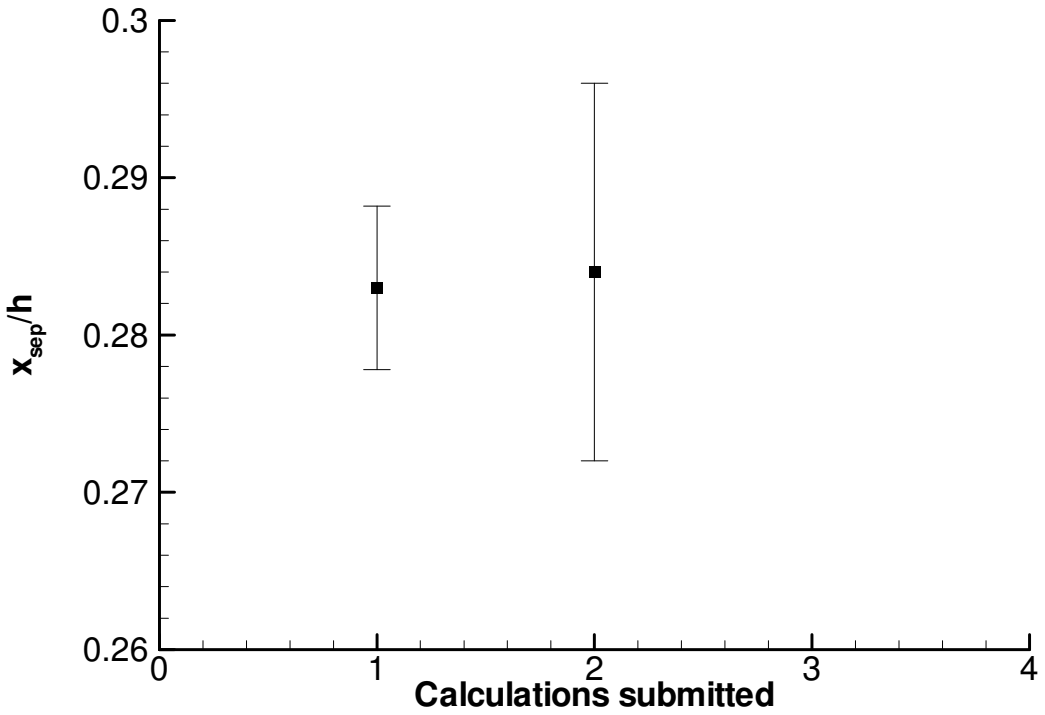
ν_t at ***x=5.357h, y=0.107h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	401x401	A	0.0148	0.000007	0.014793	0.014807
2	INSEAN	401x401	B	0.0148	0.001	0.0138	0.0158



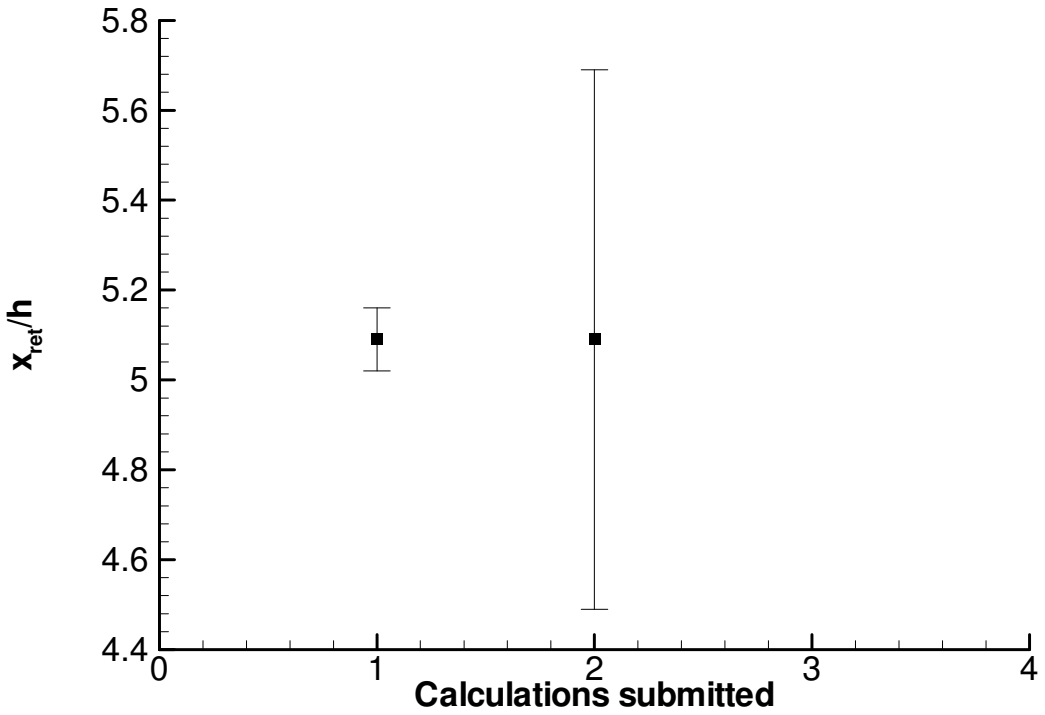
Separation point

x_{sep}		Grid	Set	x_{sep}	U	x_{sep} -U	x_{sep} +U
1	INSEAN	401x401	A	0.283	0.0052	0.2778	0.2882
2	INSEAN	401x401	B	0.284	0.012	0.272	0.296



Re-attachment point

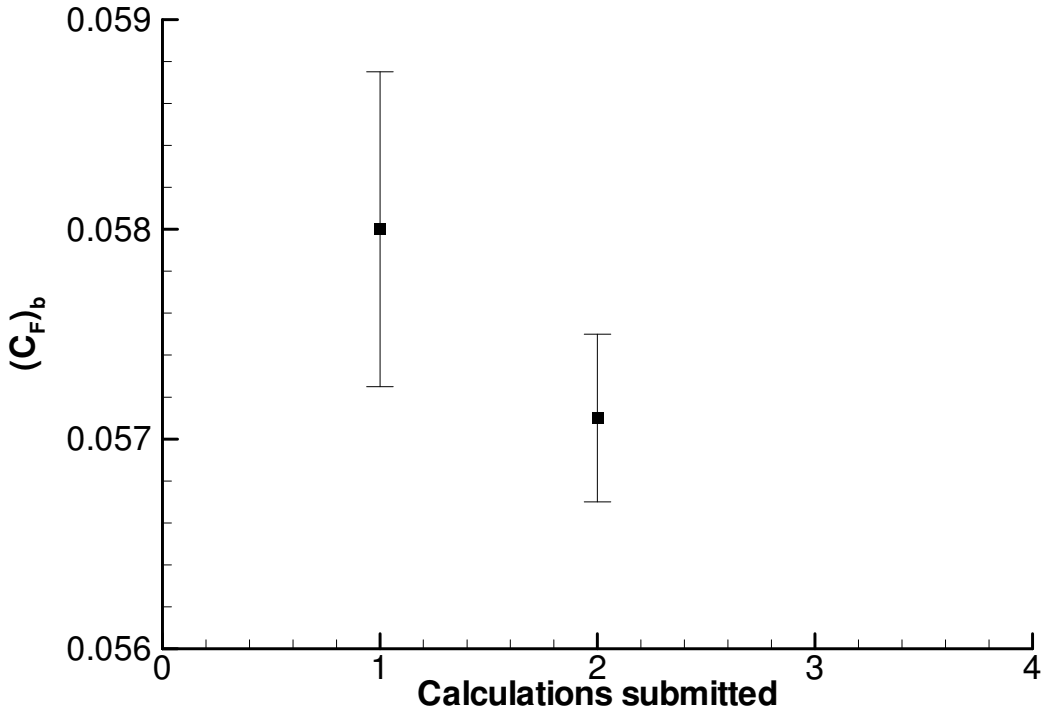
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	INSEAN	401x401	A	5.09	0.07	5.02	5.16
2	INSEAN	401x401	B	5.09	0.6	4.49	5.69



Integral flow quantities:

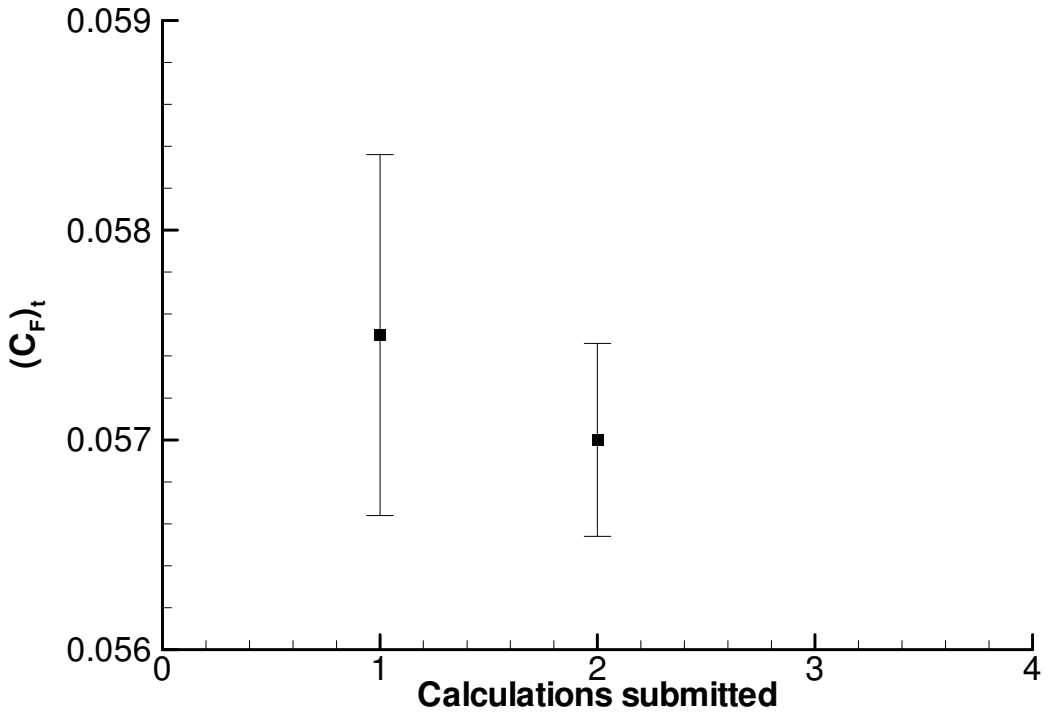
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$ -U	$(C_F)_b$ +U
1	INSEAN	401x401	A	0.0580	0.00075	0.05725	0.05875
2	INSEAN	401x401	B	0.0571	0.00040	0.0567	0.0575



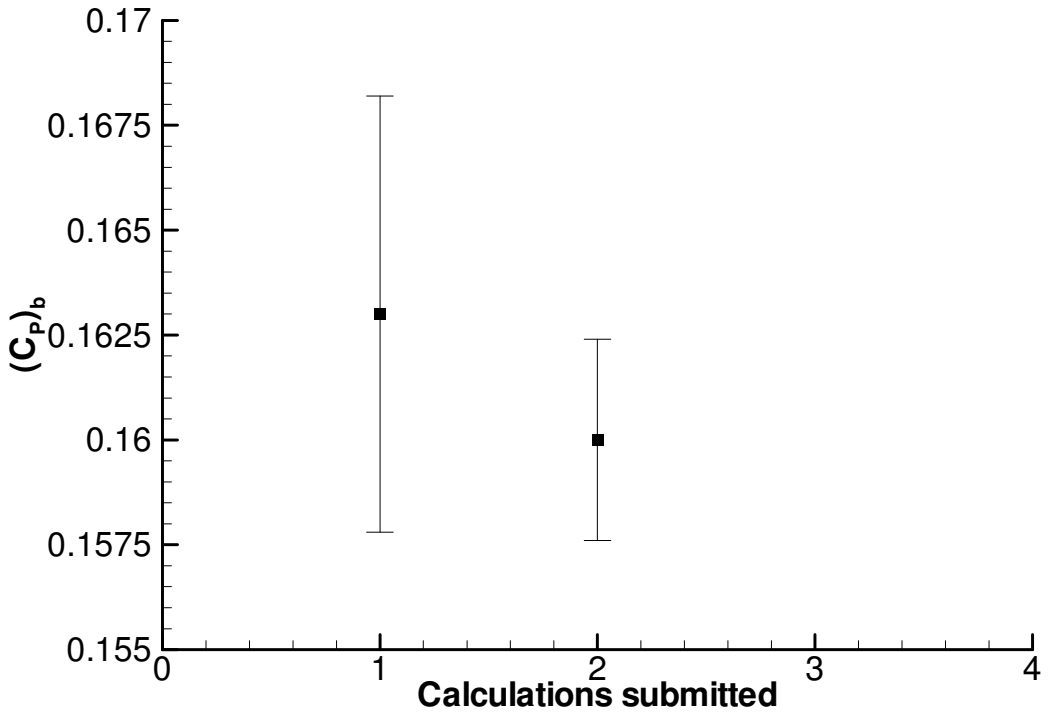
Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$ -U	$(C_F)_t$ +U
1	INSEAN	401x401	A	0.0575	0.00086	0.05664	0.05836
2	INSEAN	401x401	B	0.0570	0.00046	0.05654	0.05746



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$ -U	$(C_P)_b$ +U
1	INSEAN	401x401	A	0.163	0.0052	0.1578	0.1682
2	INSEAN	401x401	B	0.160	0.0024	0.1576	0.1624

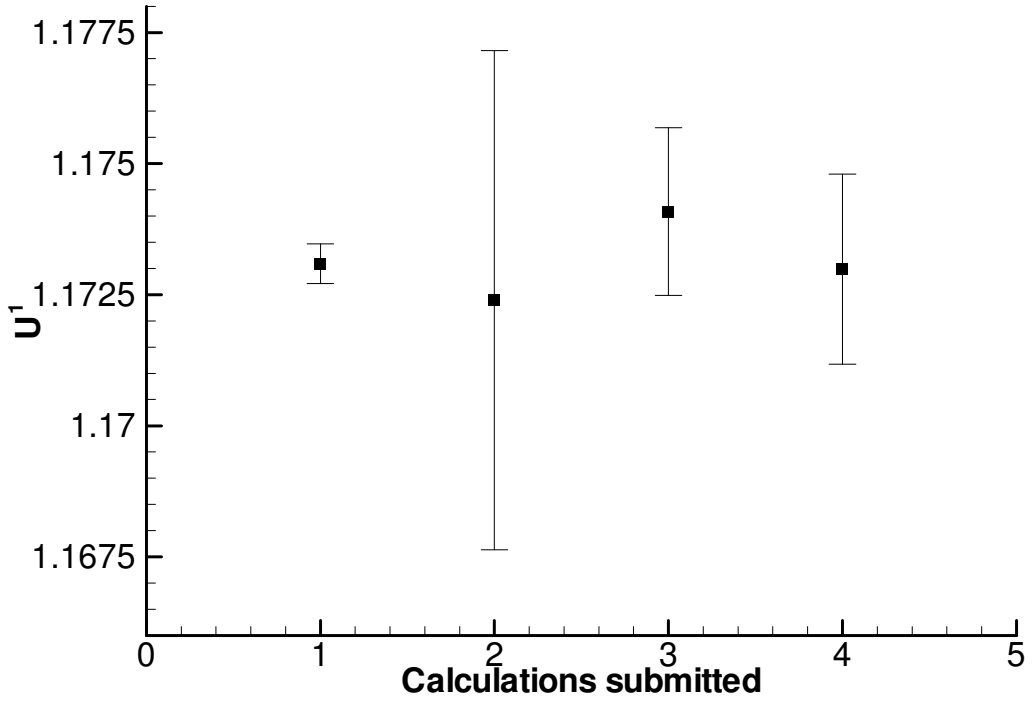


c) Menter's one-equation turbulence model

Local flow quantities:

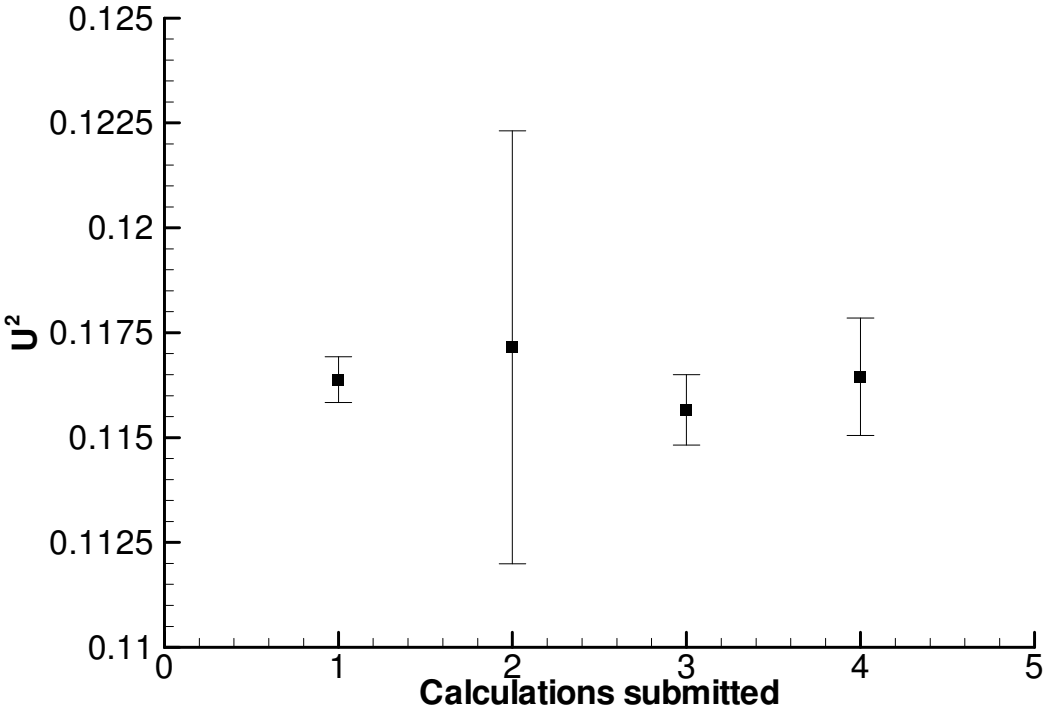
U^1 velocity component at ***x=0, y=1.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	401x401	A	1.1731	0.00038	1.17271	1.17347
2	IST/MARIN A	201x201	A	1.1724	0.00476	1.16763	1.17715
3	IST/MARIN A	401x401	B	1.1741	0.00160	1.17248	1.17568
4	IST/MARIN A	201x201	B	1.1730	0.00181	1.17117	1.17480



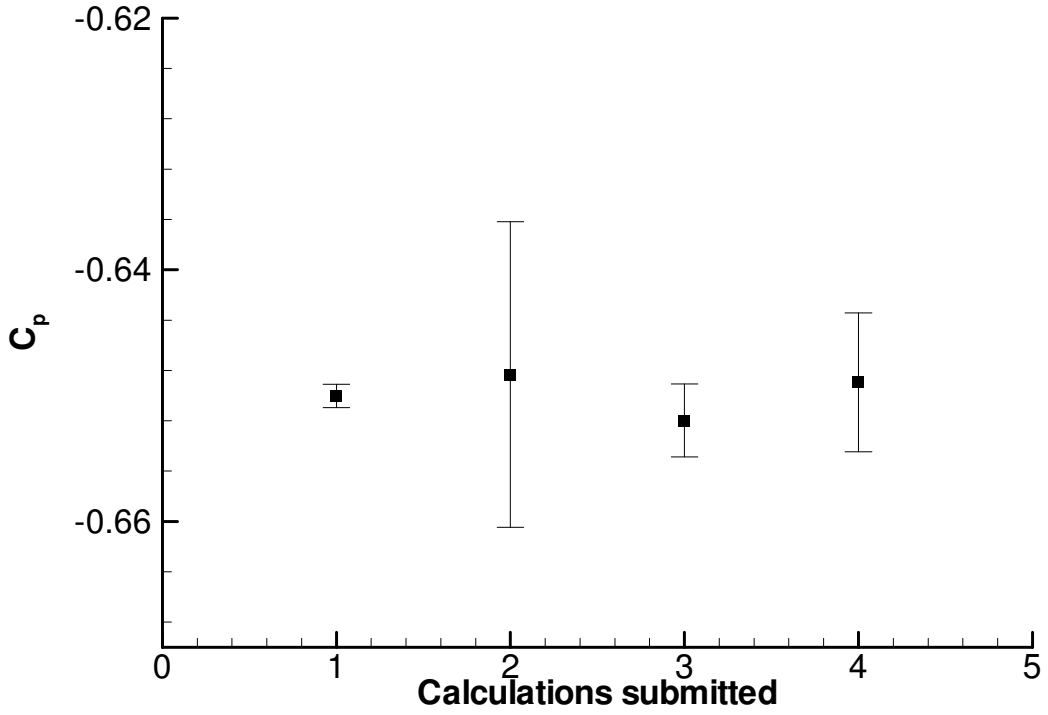
U^2 velocity component at ***x=0, y=1.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	401x401	A	0.1164	0.00054	0.11584	0.11692
2	IST/MARIN A	201x201	A	0.1171	0.00516	0.11199	0.12231
3	IST/MARIN A	401x401	B	0.1157	0.00084	0.11482	0.11650
4	IST/MARIN A	201x201	B	0.1164	0.00140	0.11505	0.11785



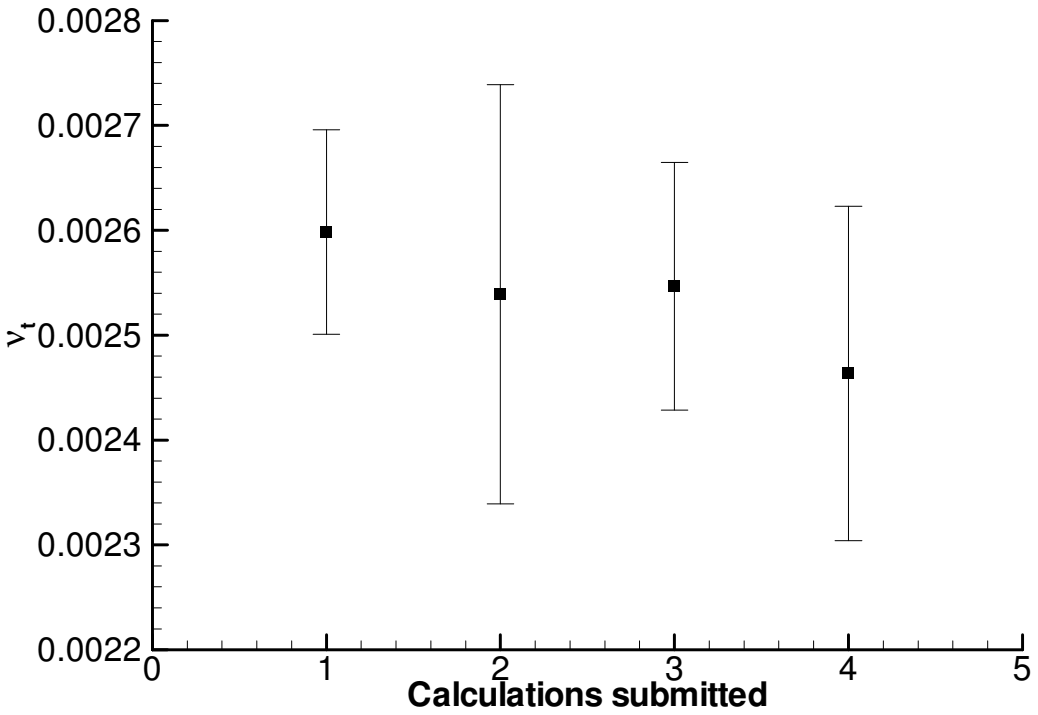
Cp at ***x=0, y=1.25h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	IST/MARIN A	401x401	A	-0.6500	0.00093	-0.65095	-0.64910
2	IST/MARIN A	201x201	A	-0.6483	0.01215	-0.66047	-0.63617
3	IST/MARIN A	401x401	B	-0.6520	0.00290	-0.65488	-0.64909
4	IST/MARIN A	201x201	B	-0.6489	0.00551	-0.65445	-0.64343



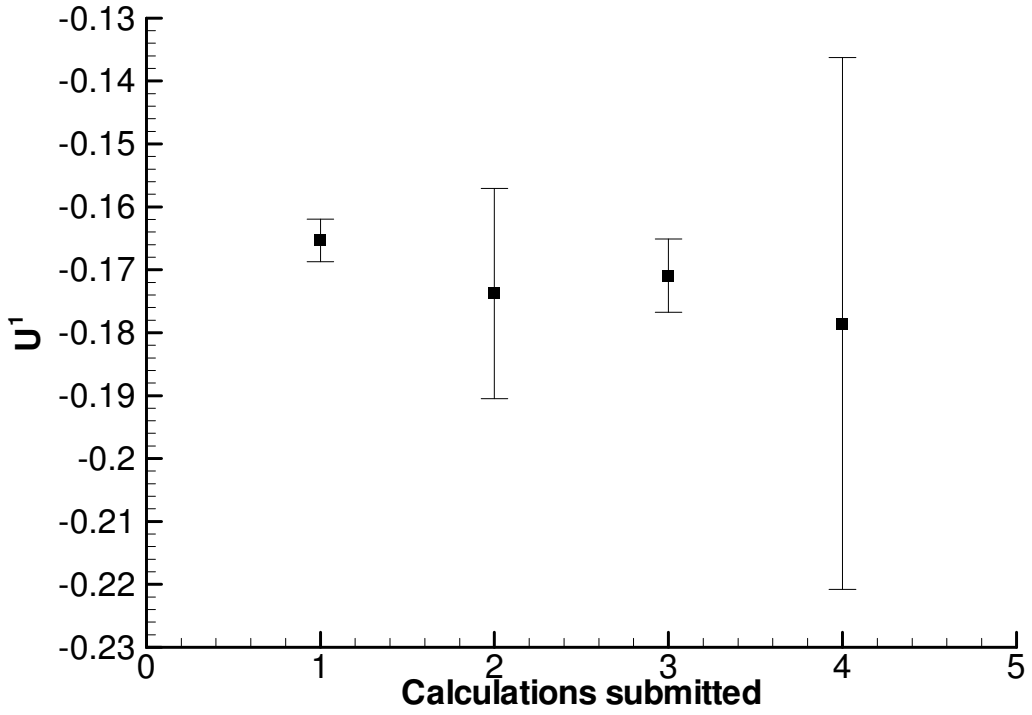
ν_t at ***x=0, y=1.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	401x401	A	0.00260	0.000098	0.002501	0.002696
2	IST/MARIN A	201x201	A	0.00254	0.000200	0.002339	0.002739
3	IST/MARIN A	401x401	B	0.00255	0.000118	0.002428	0.002665
4	IST/MARIN A	201x201	B	0.00246	0.000159	0.002304	0.002623



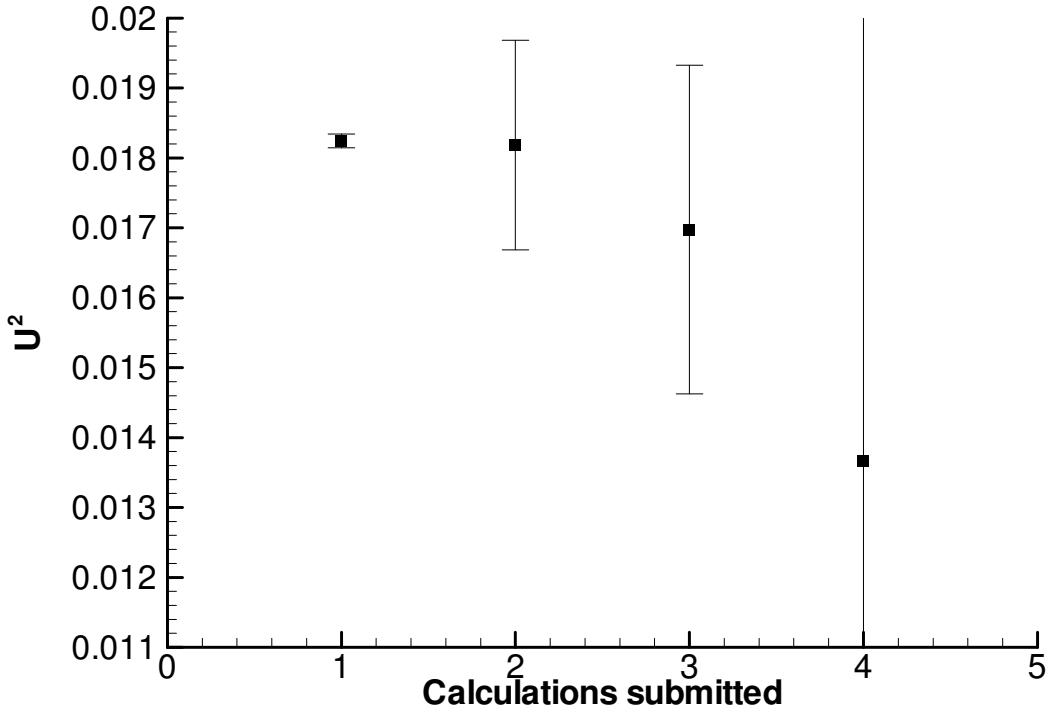
U^1 velocity component at ***x=2.5h, y=0.25h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	401x401	A	-0.1653	0.00337	-0.16872	-0.16198
2	IST/MARIN A	201x201	A	-0.1738	0.01670	-0.19047	-0.15707
3	IST/MARIN A	401x401	B	-0.1709	0.00583	-0.17674	-0.16509
4	IST/MARIN A	201x201	B	-0.1785	0.04225	-0.22079	-0.13629



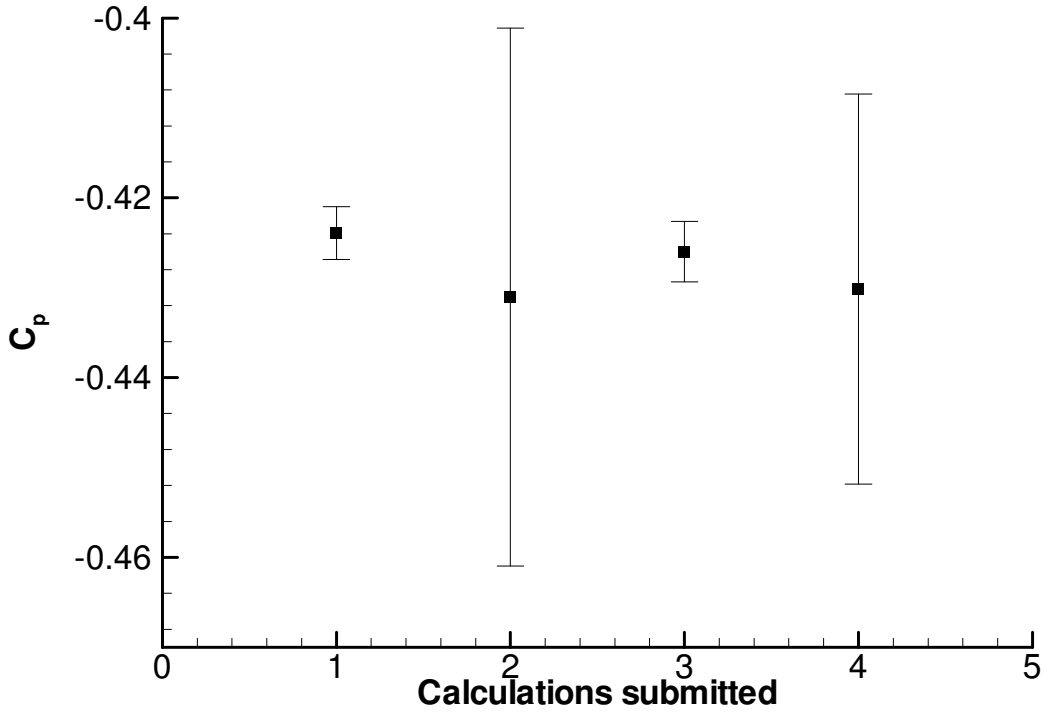
U^2 velocity component at ***x=2.5h, y=0.25h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	401x401	A	0.0182	0.00010	0.01814	0.01834
2	IST/MARIN A	201x201	A	0.0182	0.00150	0.01669	0.01968
3	IST/MARIN A	401x401	B	0.0170	0.00235	0.01462	0.01933
4	IST/MARIN A	201x201	B	0.0137	0.01776	-0.00410	0.03143



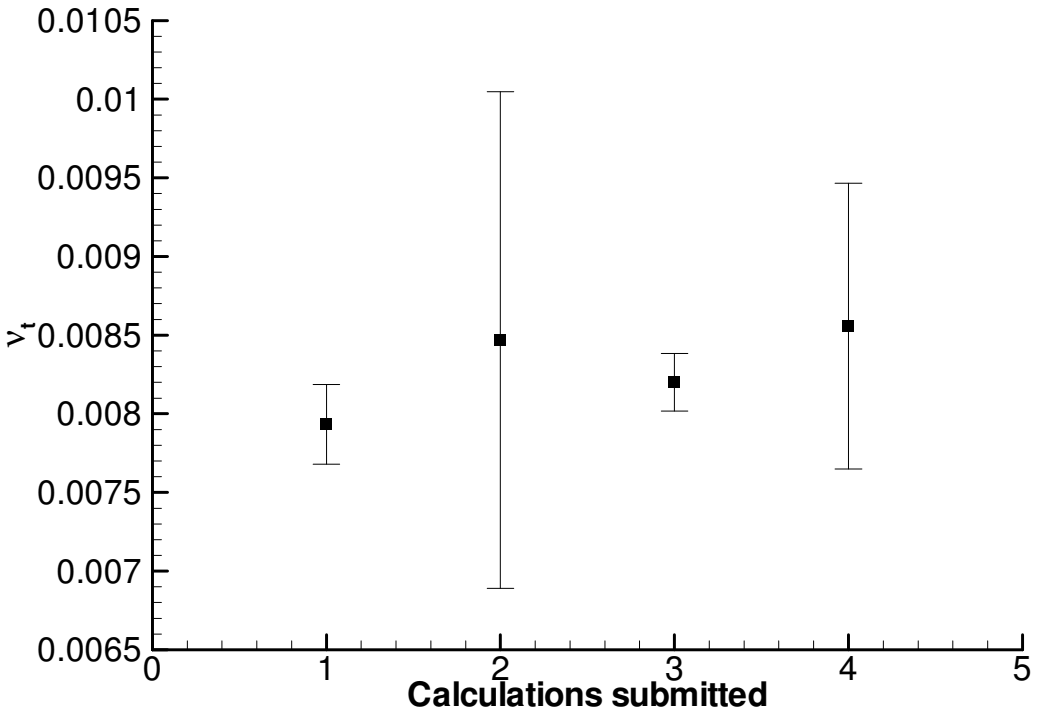
Cp at ***x=2.5h, y=0.25h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	IST/MARIN A	401x401	A	-0.4239	0.00294	-0.42687	-0.42099
2	IST/MARIN A	201x201	A	-0.4310	0.02993	-0.46097	-0.40110
3	IST/MARIN A	401x401	B	-0.4260	0.00335	-0.42934	-0.42263
4	IST/MARIN A	201x201	B	-0.4301	0.02169	-0.45184	-0.40845



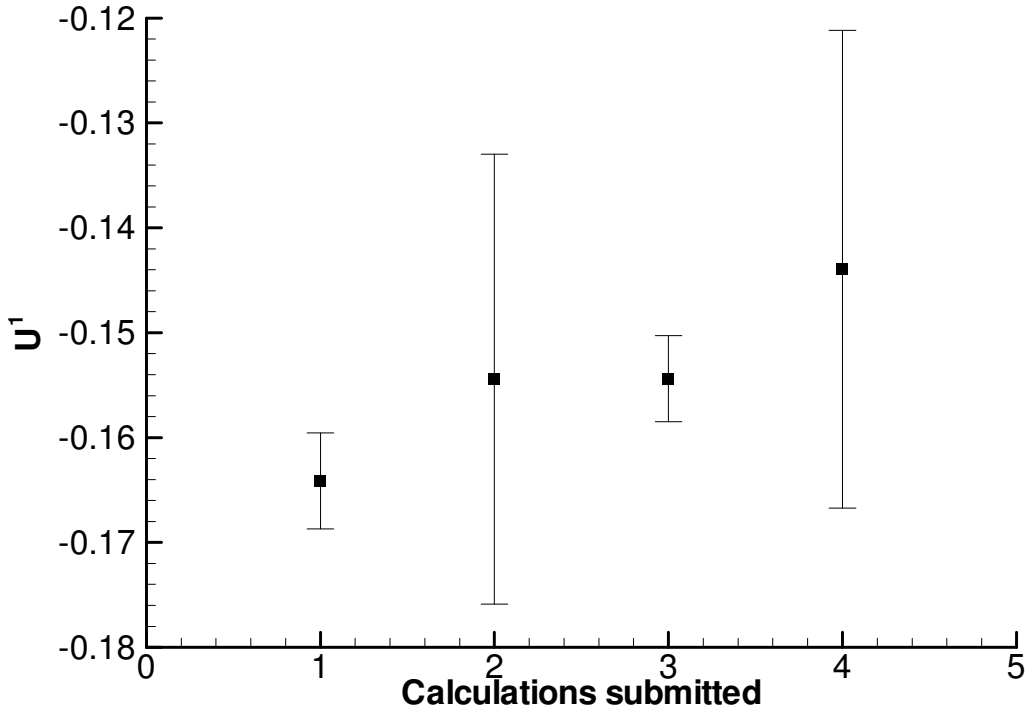
ν_t at ***x=2.5h, y=0.25h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	401x401	A	0.00793	0.000254	0.007679	0.008186
2	IST/MARIN A	201x201	A	0.00847	0.001578	0.006891	0.010047
3	IST/MARIN A	401x401	B	0.00820	0.000183	0.008018	0.008384
4	IST/MARIN A	201x201	B	0.00856	0.000908	0.007649	0.009466



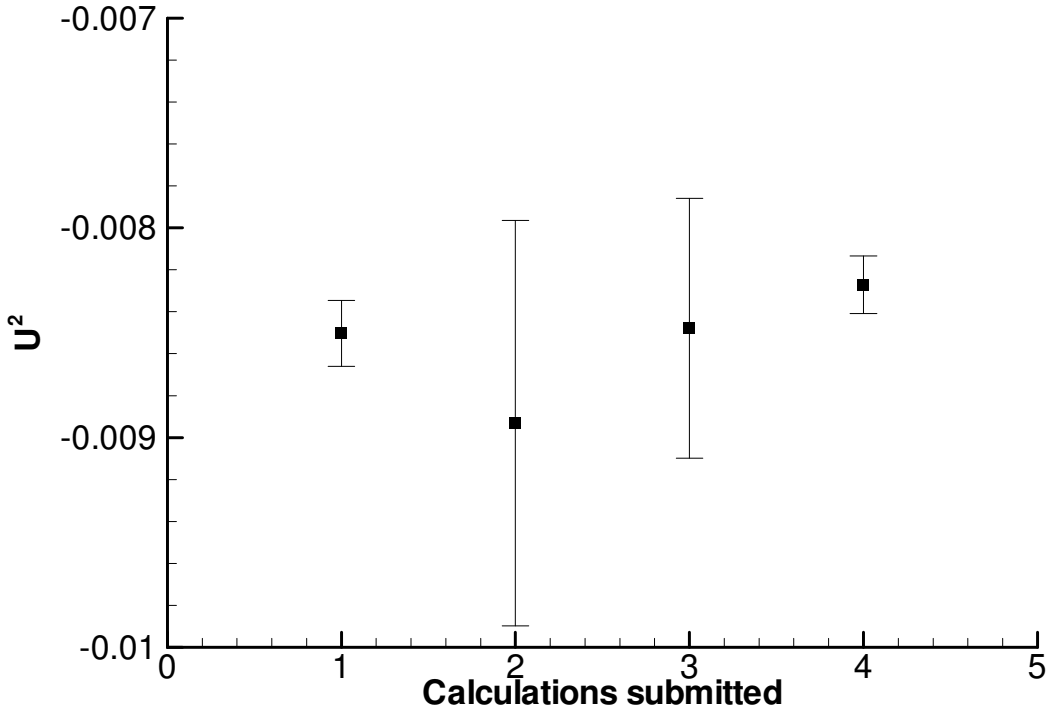
U^1 velocity component at ***x=5.357h, y=0.107h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	401x401	A	-0.1641	0.00458	-0.16872	-0.15956
2	IST/MARIN A	201x201	A	-0.1544	0.02145	-0.17588	-0.13298
3	IST/MARIN A	401x401	B	-0.1544	0.00410	-0.15849	-0.15029
4	IST/MARIN A	201x201	B	-0.1440	0.02277	-0.16673	-0.12119



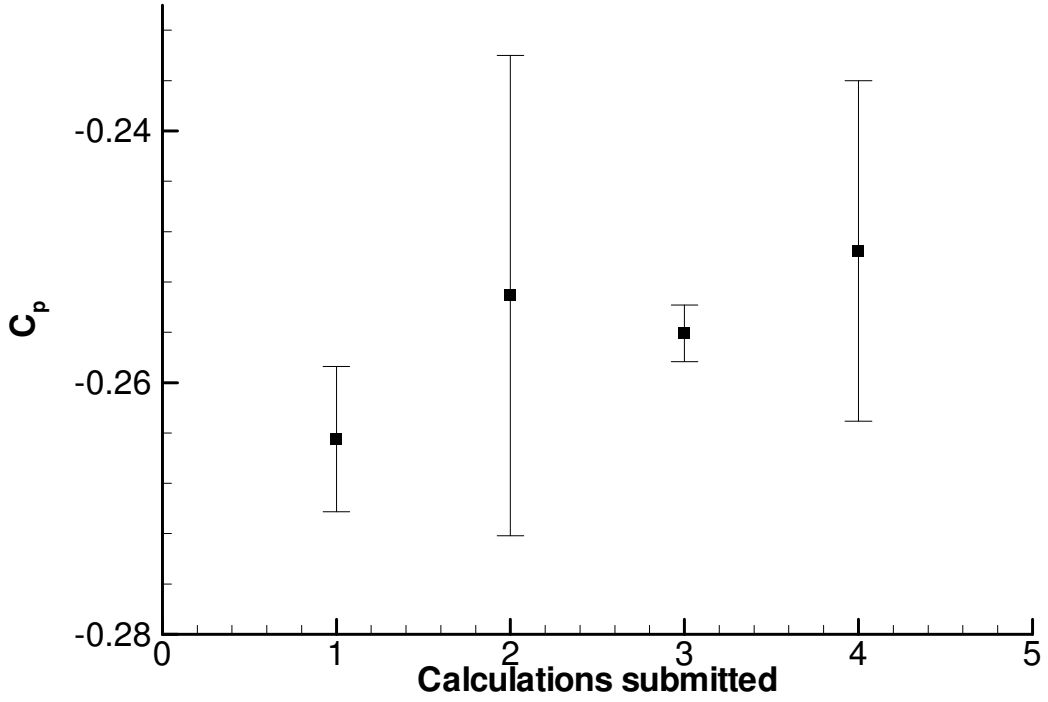
U^2 velocity component at ***x=5.357h, y=0.107h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	401x401	A	-0.0085	0.00016	-0.00866	-0.00835
2	IST/MARIN A	201x201	A	-0.0089	0.00097	-0.00990	-0.00796
3	IST/MARIN A	401x401	B	-0.0085	0.00062*	-0.00910	-0.00786
4	IST/MARIN A	201x201	B	-0.0083	0.00014	-0.00841	-0.00813



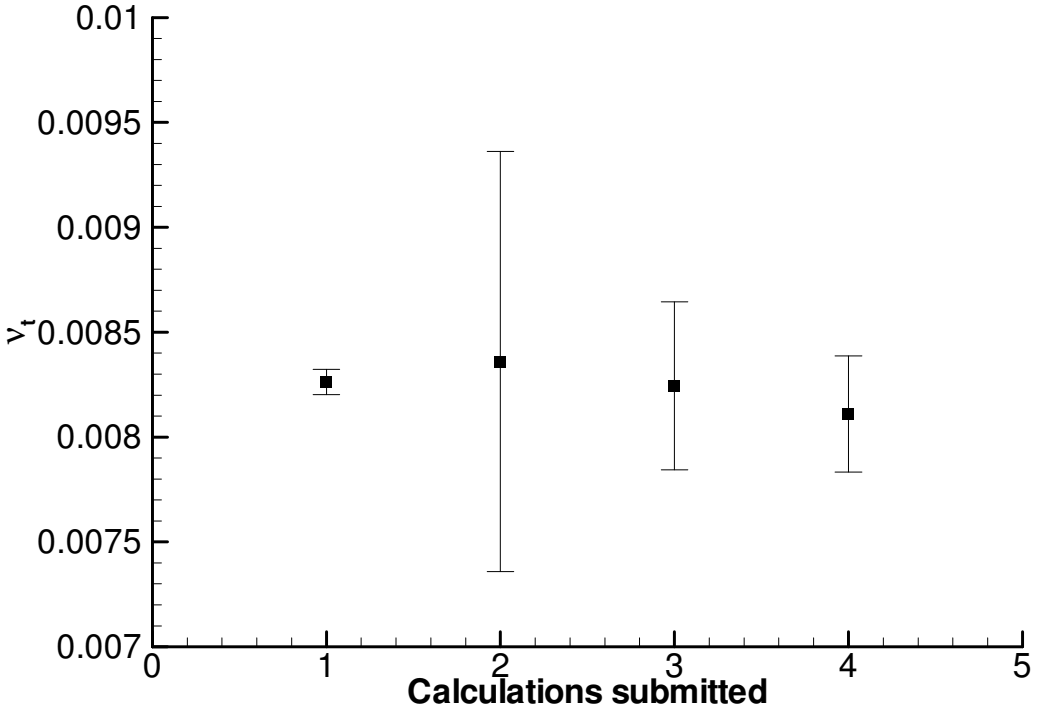
Cp at ***x=5.357h, y=0.107h***

C_p		Grid	Set	C_p	U	C_p -U	C_p +U
1	IST/MARIN A	401x401	A	-0.2645	0.00578	-0.27027	-0.25871
2	IST/MARIN A	201x201	A	-0.2531	0.01908	-0.27216	-0.23400
3	IST/MARIN A	401x401	B	-0.2561	0.00224	-0.25834	-0.25385
4	IST/MARIN A	201x201	B	-0.2495	0.01353	-0.26307	-0.23602



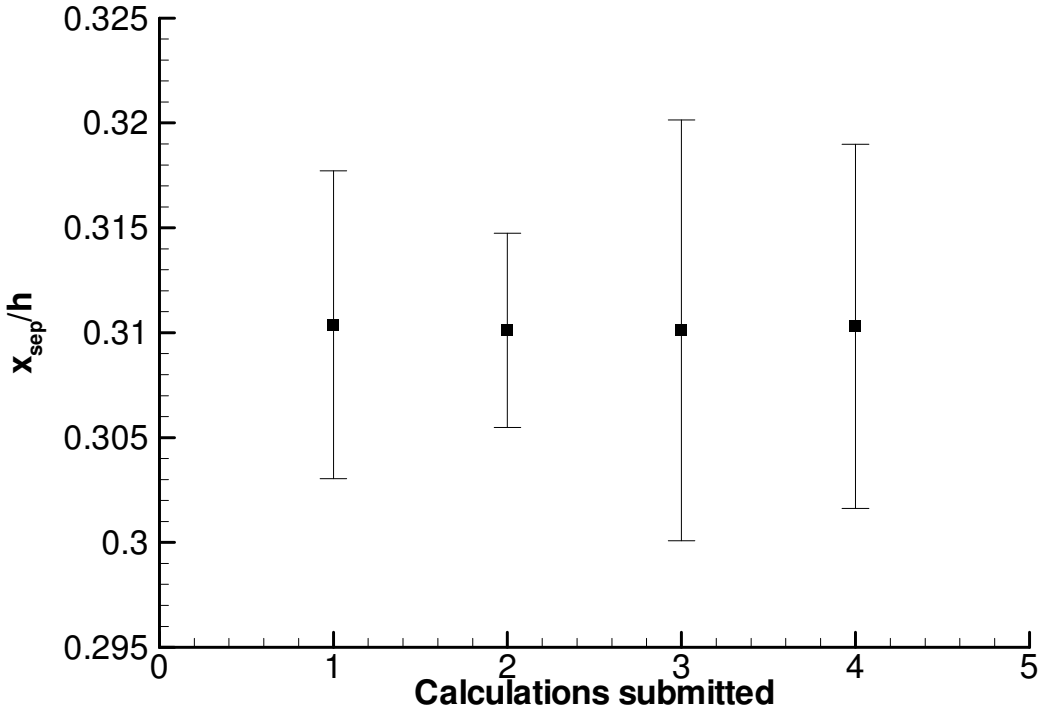
ν_t at ***x=5.357h, y=0.107h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	401x401	A	0.00826	0.000060	0.008203	0.008323
2	IST/MARIN A	201x201	A	0.00836	0.001001*	0.007359	0.009361
3	IST/MARIN A	401x401	B	0.00824	0.000401*	0.007843	0.008644
4	IST/MARIN A	201x201	B	0.00811	0.000276*	0.007834	0.008386



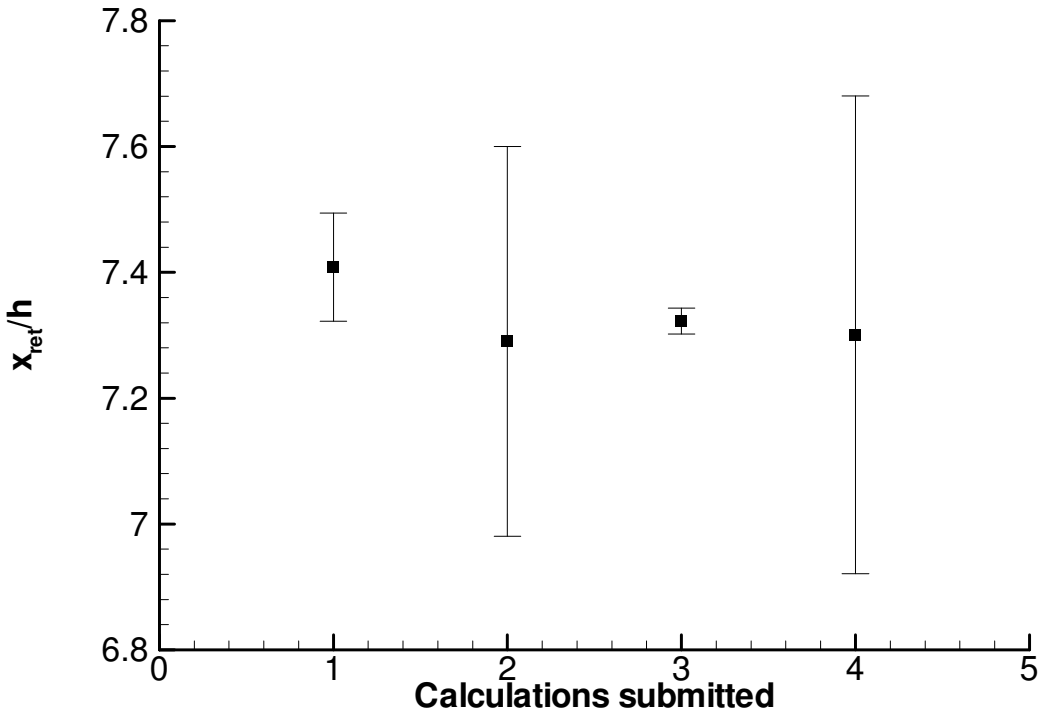
Separation point

x_{sep}		Grid	Set	x_{sep}	U	x_{sep} -U	x_{sep} +U
1	IST/MARIN A	401x401	A	0.310	0.0073*	0.3030	0.3177
2	IST/MARIN A	201x201	A	0.310	0.0046	0.3055	0.3147
3	IST/MARIN A	401x401	B	0.310	0.0100*	0.3001	0.3201
4	IST/MARIN A	201x201	B	0.310	0.0087	0.3016	0.3190



Re-attachment point

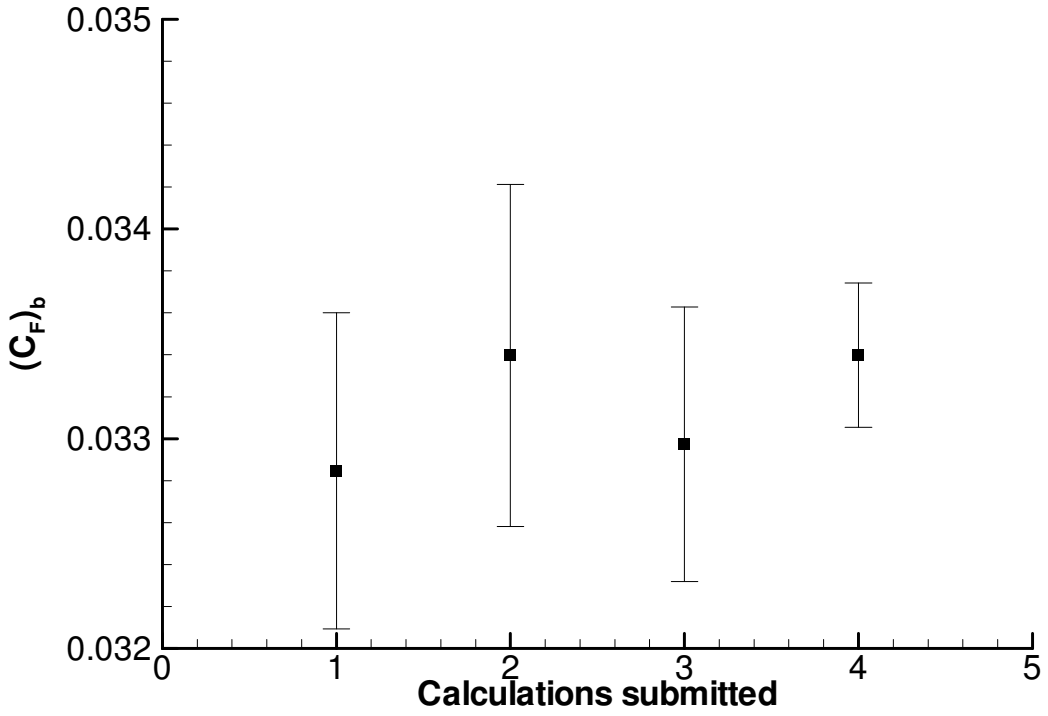
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	IST/MARIN A	401x401	A	7.408	0.0862	7.3220	7.4944
2	IST/MARIN A	201x201	A	7.290	0.3096	6.9806	7.5998
3	IST/MARIN A	401x401	B	7.323	0.0208	7.3018	7.3434
4	IST/MARIN A	201x201	B	7.301	0.3799	6.9208	7.6805



Integral flow quantities:

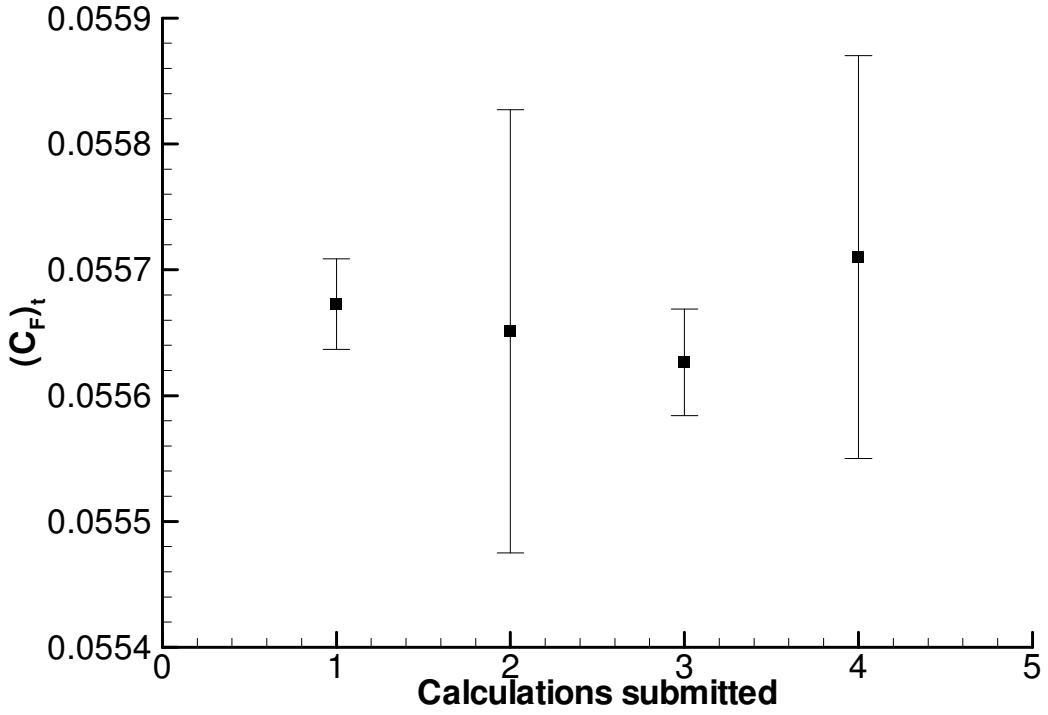
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$ -U	$(C_F)_b$ +U
1	IST/MARIN A	401x401	A	0.0328	0.00075	0.03209	0.03360
2	IST/MARIN A	201x201	A	0.0334	0.00082	0.03258	0.03421
3	IST/MARIN A	401x401	B	0.0330	0.00065	0.03232	0.03363
4	IST/MARIN A	201x201	B	0.0334	0.00034	0.03305	0.03374



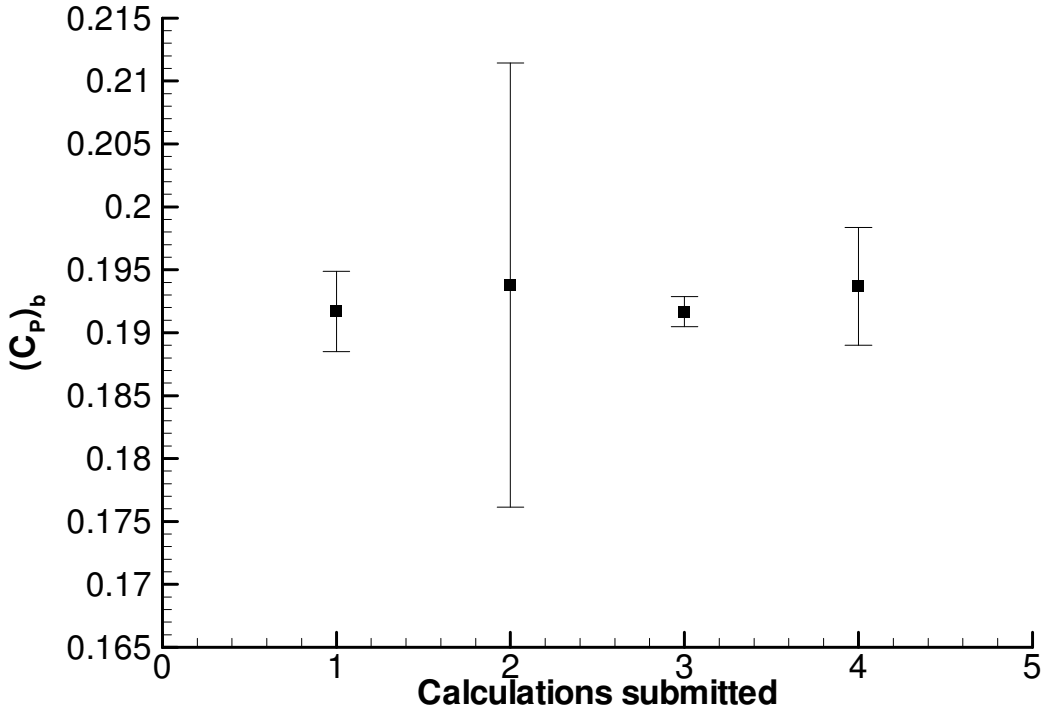
Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$ -U	$(C_F)_t$ +U
1	IST/MARIN A	401x401	A	0.0557	0.00004	0.05564	0.05571
2	IST/MARIN A	201x201	A	0.0557	0.00018	0.05547	0.05583
3	IST/MARIN A	401x401	B	0.0556	0.00004	0.05558	0.05567
4	IST/MARIN A	201x201	B	0.0557	0.00016	0.05555	0.05587



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$ -U	$(C_P)_b$ +U
1	IST/MARIN A	401x401	A	0.1917	0.00320	0.18849	0.19489
2	IST/MARIN A	201x201	A	0.1938	0.01765*	0.17614	0.21144
3	IST/MARIN A	401x401	B	0.1917	0.00120	0.19048	0.19288
4	IST/MARIN A	201x201	B	0.1937	0.00469	0.18899	0.19837



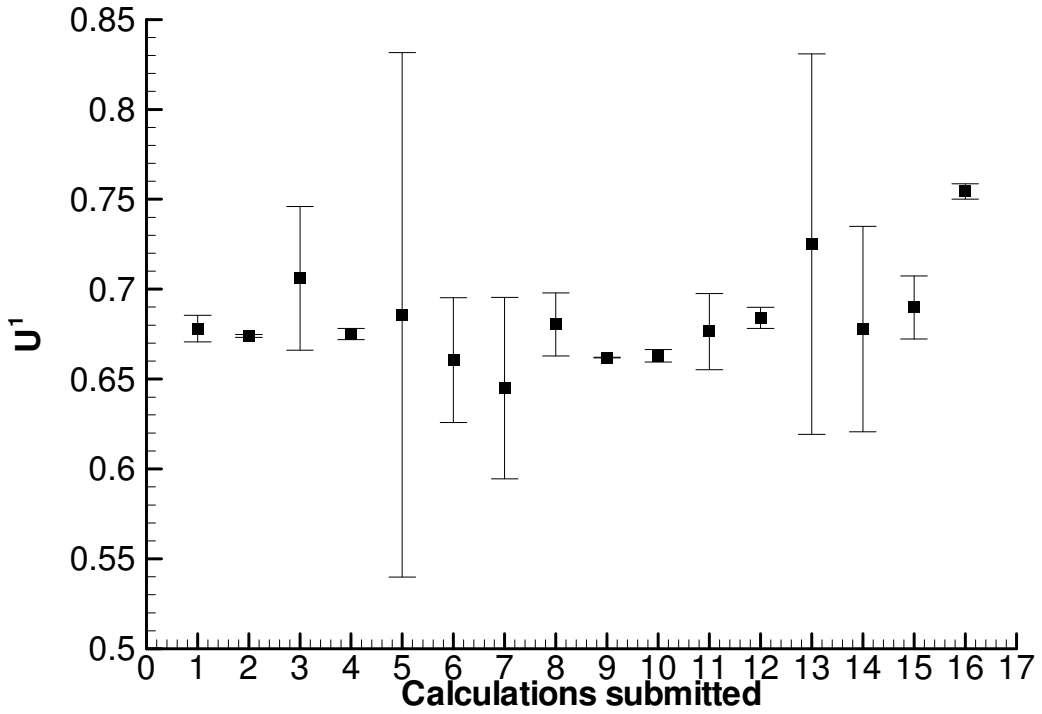
6.2 Test case C-30, Backward Facing Step

a) Spalart and Allmaras Turbulence model

Local flow quantities:

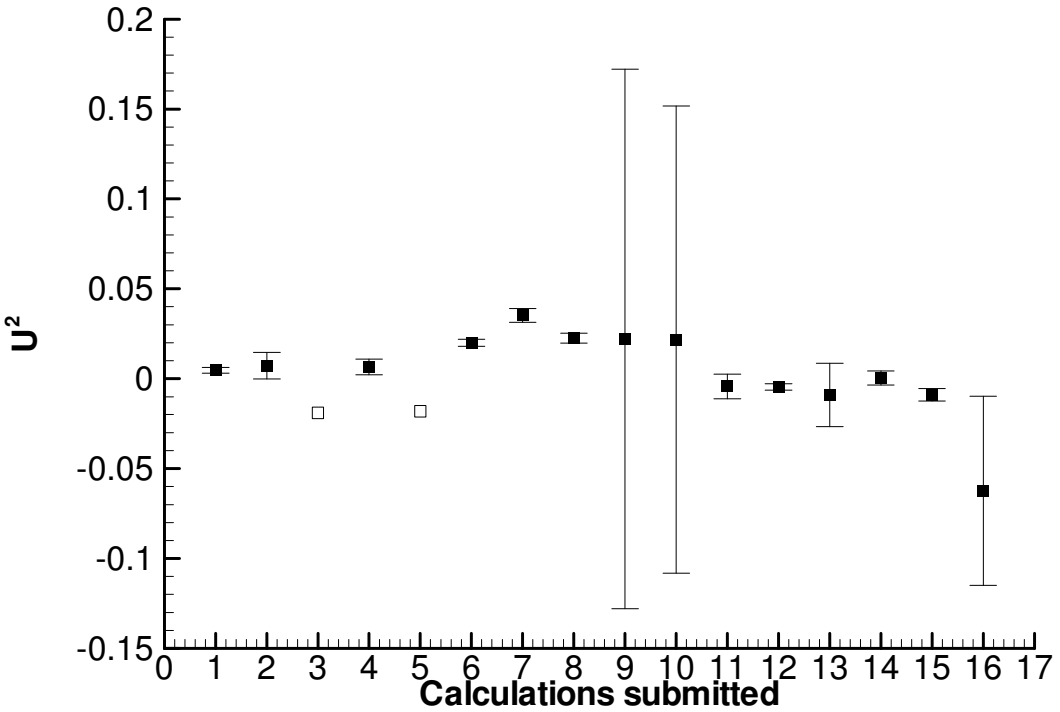
U^1 velocity component at ***x=0, y=1.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	0.6780	0.00740	0.67060	0.68540
2	INSEAN	241x241	B	0.6740	0.00084	0.67316	0.67484
3	INSEAN	241x241	C	0.7060	0.04000	0.66600	0.74600
4	NRMI	241x241	B	0.6751	0.00317	0.67192	0.67826
5	NRMI	241x241	C	0.6857	0.14583	0.53987	0.83153
6	ECN	241x241	A	0.6605	0.03476	0.62576	0.69528
7	ECN	241x241	B	0.6450	0.05039	0.59458	0.69536
8	ECN	241x241	C	0.6804	0.01759	0.66284	0.69802
9	WVU 7 grids	241x241	B	0.6619	0.00017	0.66173	0.66207
10	WVU 4 grids	241x241	B	0.6629	0.00350	0.65940	0.66640
11	IST/MARIN A	241x241	A	0.6764	0.02115	0.65524	0.69754
12	IST/MARIN A	241x241	B	0.6841	0.00583	0.67826	0.68991
13	IST/MARIN A	241x241	C	0.7250	0.10580	0.61920	0.83081
14	IST/MARIN B	241x241	A	0.6778	0.05712	0.62072	0.73496
15	IST/MARIN B	241x241	B	0.6898	0.01755*	0.67224	0.70735
16	IST/MARIN B	241x241	C	0.7543	0.00433	0.75001	0.75867



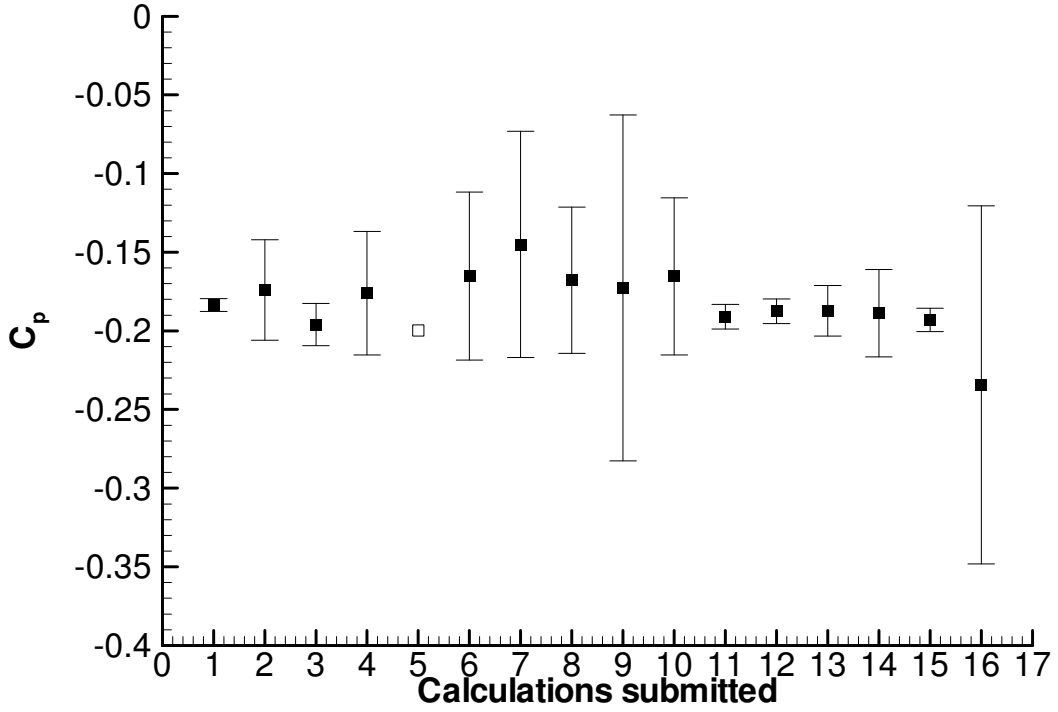
U^2 velocity component at ***x=0, y=1.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	0.0047	0.00160	0.00310	0.00630
2	INSEAN	241x241	B	0.0072	0.00740	-0.00020	0.01460
3	INSEAN	241x241	C	-0.0190	---	---	---
4	NRMI	241x241	B	0.0065	0.00438	0.00213	0.01090
5	NRMI	241x241	C	-0.0182	---	---	---
6	ECN	241x241	A	0.0200	0.00197	0.01803	0.02198
7	ECN	241x241	B	0.0352	0.00382	0.03136	0.03900
8	ECN	241x241	C	0.0225	0.00280	0.01974	0.02533
9	WVU 7 grids	241x241	B	0.0221	0.15000	-0.12792	0.17208
10	WVU 4 grids	241x241	B	0.0218	0.13000	-0.10824	0.15176
11	IST/MARIN A	241x241	A	-0.0043	0.00682	-0.01111	0.00254
12	IST/MARIN A	241x241	B	-0.0046	0.00177	-0.00642	-0.00288
13	IST/MARIN A	241x241	C	-0.0090	0.01761*	-0.02662	0.00861
14	IST/MARIN B	241x241	A	0.0004	0.00396	-0.00354	0.00439
15	IST/MARIN B	241x241	B	-0.0089	0.00340	-0.01234	-0.00554
16	IST/MARIN B	241x241	C	-0.0623	0.05262	-0.11493	-0.00969



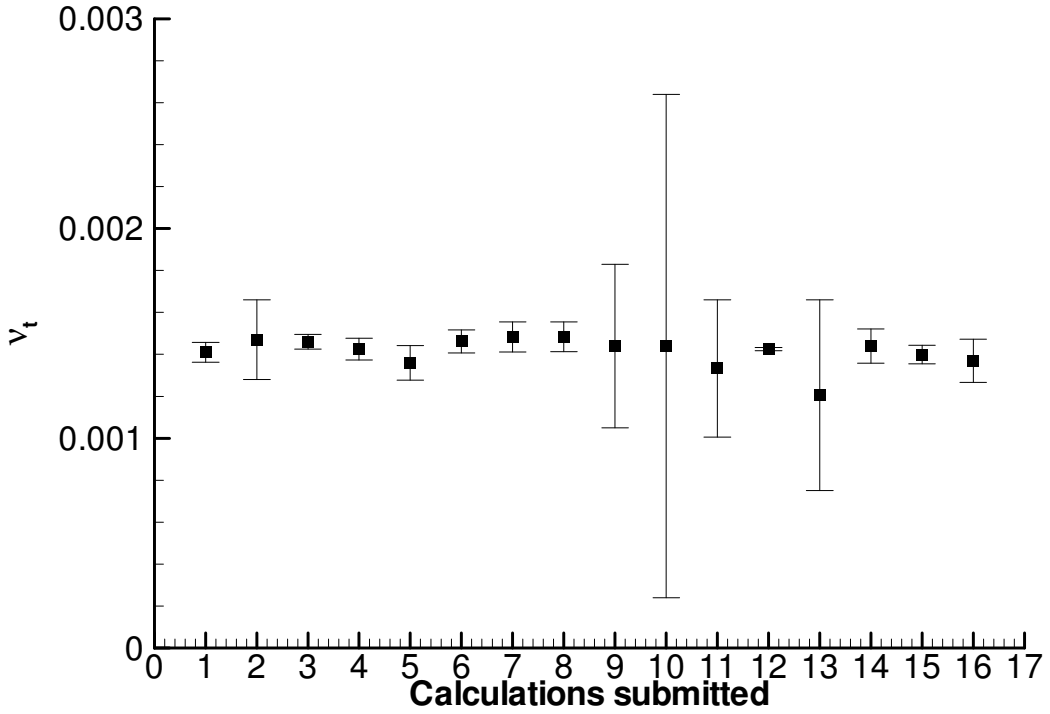
Cp at ***x=0, y=1.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p +U
1	INSEAN	241x241	A	-0.1836	0.00400	-0.18760	-0.17960
2	INSEAN	241x241	B	-0.1740	0.03200	-0.20600	-0.14200
3	INSEAN	241x241	C	-0.1960	0.01340	-0.20940	-0.18260
4	NRMI	241x241	B	-0.1761	0.03921	-0.21528	-0.13686
5	NRMI	241x241	C	-0.1997	---	---	---
6	ECN	241x241	A	-0.1652	0.05341	-0.21861	-0.11179
7	ECN	241x241	B	-0.1451	0.07194	-0.21703	-0.07315
8	ECN	241x241	C	-0.1678	0.04651	-0.21436	-0.12134
9	WVU 7 grids	241x241	B	-0.1727	0.11000	-0.28270	-0.06270
10	WVU 4 grids	241x241	B	-0.1654	0.05000	-0.21540	-0.11540
11	IST/MARIN A	241x241	A	-0.1910	0.00785	-0.19889	-0.18319
12	IST/MARIN A	241x241	B	-0.1875	0.00782	-0.19528	-0.17964
13	IST/MARIN A	241x241	C	-0.1873	0.01608	-0.20340	-0.17124
14	IST/MARIN B	241x241	A	-0.1887	0.02767*	-0.21642	-0.16108
15	IST/MARIN B	241x241	B	-0.1930	0.00741	-0.20044	-0.18563
16	IST/MARIN B	241x241	C	-0.2343	0.11376	-0.34810	-0.12058



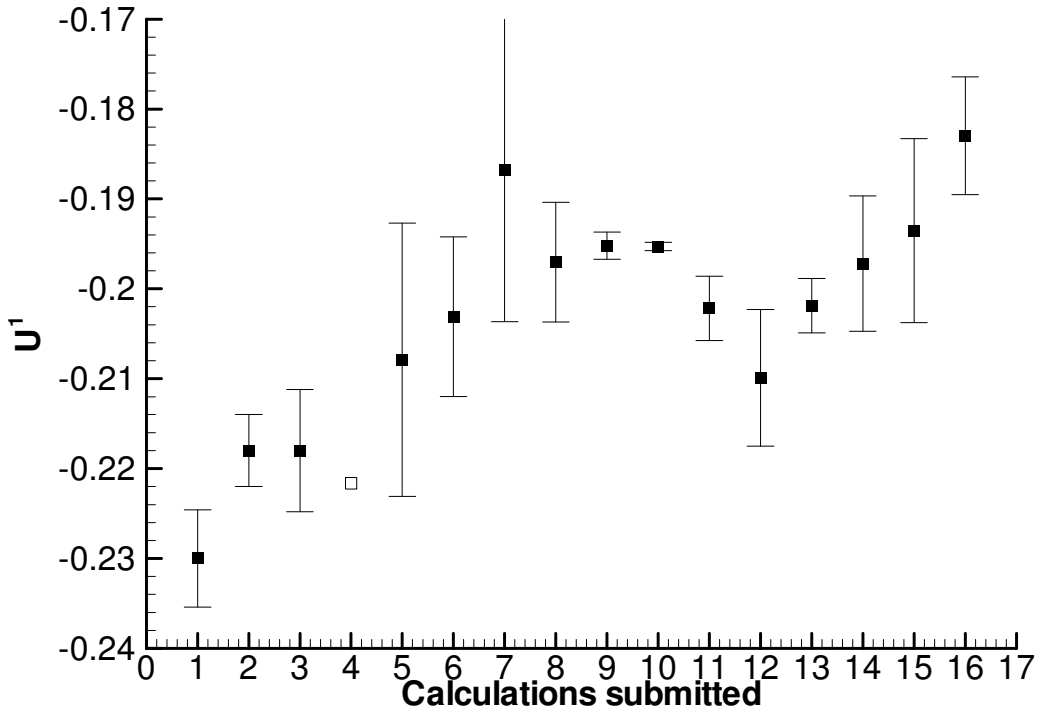
ν_t at ***x=0, y=1.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.00141	0.000047	0.001363	0.001457
2	INSEAN	241x241	B	0.00147	0.000190	0.001280	0.001660
3	INSEAN	241x241	C	0.00146	0.000035	0.001425	0.001495
4	NRMI	241x241	B	0.00143	0.000052	0.001373	0.001477
5	NRMI	241x241	C	0.00136	0.000083	0.001276	0.001442
6	ECN	241x241	A	0.00146	0.000055	0.001407	0.001517
7	ECN	241x241	B	0.00148	0.000072	0.001410	0.001554
8	ECN	241x241	C	0.00148	0.000071	0.001412	0.001555
9	WVU 7 grids	241x241	B	0.00144	0.000390	0.001049	0.001829
10	WVU 4 grids	241x241	B	0.00144	0.001200	0.000240	0.002640
11	IST/MARIN A	241x241	A	0.00133	0.000328*	0.001005	0.001660
12	IST/MARIN A	241x241	B	0.00142	0.000008*	0.001417	0.001433
13	IST/MARIN A	241x241	C	0.00121	0.000455	0.000750	0.001660
14	IST/MARIN B	241x241	A	0.00144	0.000082	0.001357	0.001521
15	IST/MARIN B	241x241	B	0.00140	0.000044*	0.001354	0.001443
16	IST/MARIN B	241x241	C	0.00137	0.000103	0.001267	0.001473



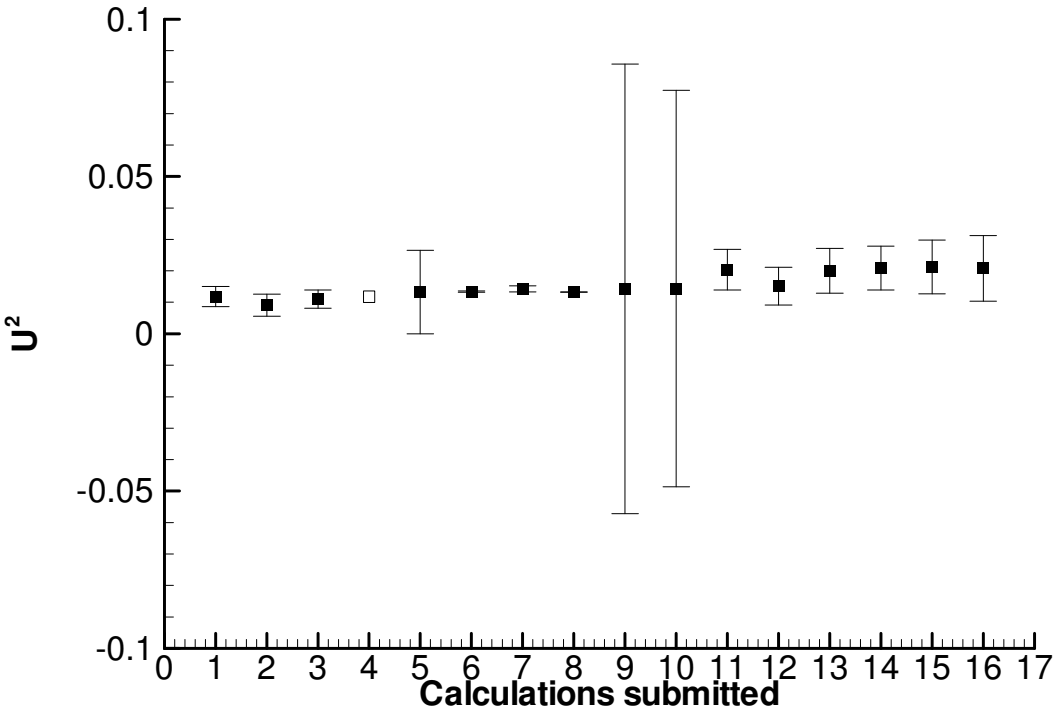
U^1 velocity component at ***x=h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	-0.2300	0.00540	-0.23540	-0.22460
2	INSEAN	241x241	B	-0.2180	0.00400	-0.22200	-0.21400
3	INSEAN	241x241	C	-0.2180	0.00680	-0.22480	-0.21120
4	NRMI	241x241	B	-0.2216	---	---	---
5	NRMI	241x241	C	-0.2079	0.01519	-0.22308	-0.19270
6	ECN	241x241	A	-0.2031	0.00888	-0.21199	-0.19423
7	ECN	241x241	B	-0.1868	0.01688	-0.20366	-0.16990
8	ECN	241x241	C	-0.1971	0.00666	-0.20371	-0.19039
9	WVU 7 grids	241x241	B	-0.1952	0.00151	-0.19671	-0.19369
10	WVU 4 grids	241x241	B	-0.1953	0.00046	-0.19576	-0.19484
11	IST/MARIN A	241x241	A	-0.2022	0.00357	-0.20576	-0.19861
12	IST/MARIN A	241x241	B	-0.2099	0.00761	-0.21751	-0.20229
13	IST/MARIN A	241x241	C	-0.2019	0.00302	-0.20490	-0.19886
14	IST/MARIN B	241x241	A	-0.1972	0.00754	-0.20474	-0.18967
15	IST/MARIN B	241x241	B	-0.1935	0.01022	-0.20375	-0.18331
16	IST/MARIN B	241x241	C	-0.1830	0.00655	-0.18952	-0.17642



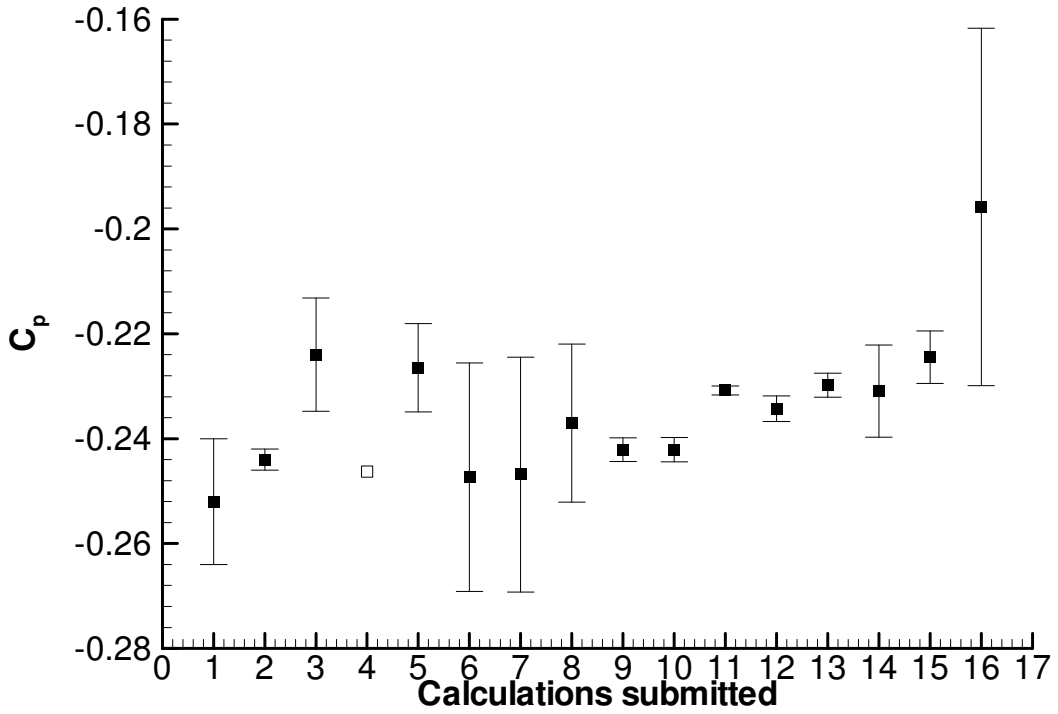
U^2 velocity component at ***x=h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	0.0118	0.00320	0.00860	0.01500
2	INSEAN	241x241	B	0.0090	0.00350	0.00554	0.01254
3	INSEAN	241x241	C	0.0110	0.00290	0.00810	0.01390
4	NRMI	241x241	B	0.0118	---	---	---
5	NRMI	241x241	C	0.0132	0.01325	-0.00003	0.02648
6	ECN	241x241	A	0.0134	0.00019	0.01321	0.01360
7	ECN	241x241	B	0.0143	0.00095	0.01333	0.01524
8	ECN	241x241	C	0.0132	0.00005	0.01319	0.01329
9	WVU 7 grids	241x241	B	0.0143	0.07150	-0.05724	0.08576
10	WVU 4 grids	241x241	B	0.0144	0.06300	-0.04865	0.07735
11	IST/MARIN A	241x241	A	0.0204	0.00647*	0.01392	0.02685
12	IST/MARIN A	241x241	B	0.0151	0.00602	0.00909	0.02114
13	IST/MARIN A	241x241	C	0.0200	0.00712*	0.01292	0.02716
14	IST/MARIN B	241x241	A	0.0209	0.00693*	0.01393	0.02780
15	IST/MARIN B	241x241	B	0.0212	0.00853	0.01269	0.02976
16	IST/MARIN B	241x241	C	0.0208	0.01041	0.01036	0.03118



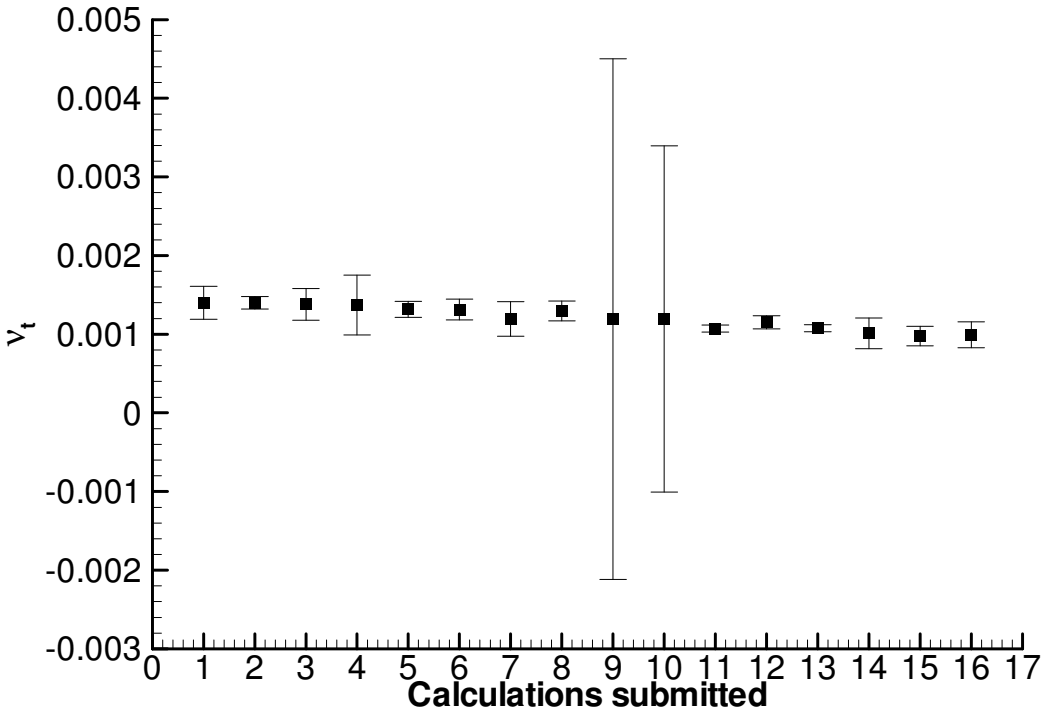
Cp at ***x=h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p +U
1	INSEAN	241x241	A	-0.2520	0.01200	-0.26400	-0.24000
2	INSEAN	241x241	B	-0.2440	0.00200	-0.24600	-0.24200
3	INSEAN	241x241	C	-0.2240	0.01080	-0.23480	-0.21320
4	NRMI	241x241	B	-0.2463	---	---	---
5	NRMI	241x241	C	-0.2265	0.00840	-0.23488	-0.21808
6	ECN	241x241	A	-0.2474	0.02179	-0.26917	-0.22559
7	ECN	241x241	B	-0.2469	0.02240	-0.26925	-0.22445
8	ECN	241x241	C	-0.2371	0.01508	-0.25213	-0.22197
9	WVU 7 grids	241x241	B	-0.2421	0.00226	-0.24436	-0.23984
10	WVU 4 grids	241x241	B	-0.2421	0.00230	-0.24440	-0.23980
11	IST/MARIN A	241x241	A	-0.2308	0.00085	-0.23165	-0.22995
12	IST/MARIN A	241x241	B	-0.2343	0.00246	-0.23676	-0.23184
13	IST/MARIN A	241x241	C	-0.2298	0.00230	-0.23210	-0.22750
14	IST/MARIN B	241x241	A	-0.2309	0.00877	-0.23972	-0.22218
15	IST/MARIN B	241x241	B	-0.2245	0.00499	-0.22946	-0.21947
16	IST/MARIN B	241x241	C	-0.1958	0.03407	-0.22988	-0.16173



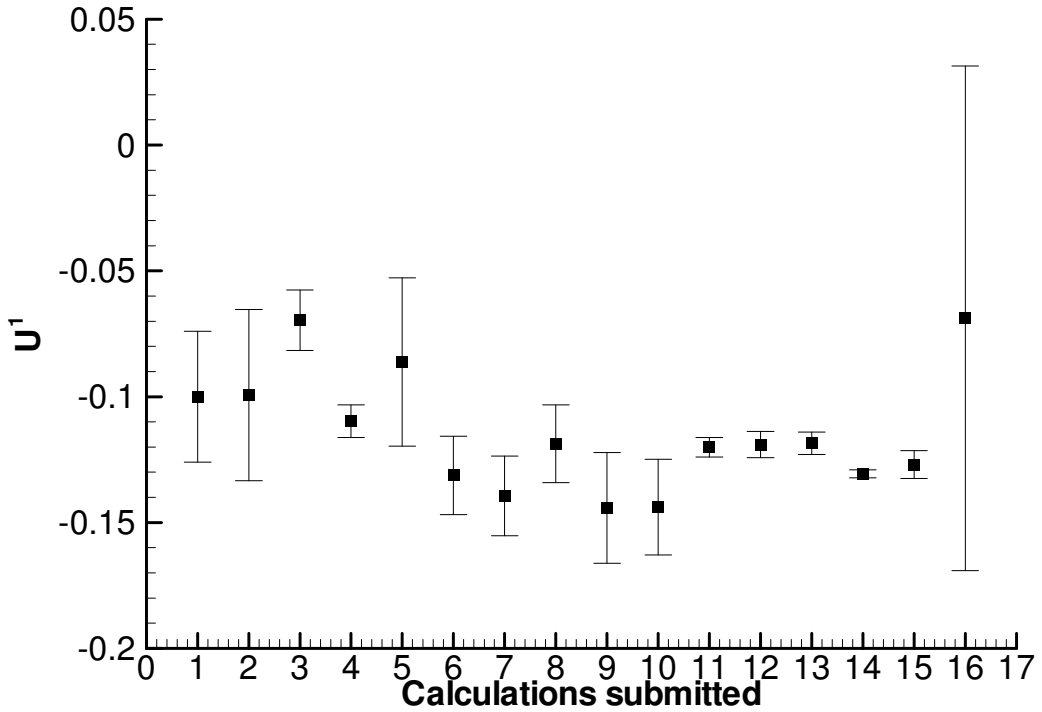
ν_t at ***x=h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.00140	0.000210	0.001190	0.001610
2	INSEAN	241x241	B	0.00140	0.000080	0.001320	0.001480
3	INSEAN	241x241	C	0.00138	0.000200	0.001180	0.001580
4	NRMI	241x241	B	0.00137	0.000381	0.000992	0.001754
5	NRMI	241x241	C	0.00132	0.000101	0.001216	0.001418
6	ECN	241x241	A	0.00131	0.000131	0.001183	0.001445
7	ECN	241x241	B	0.00119	0.000219	0.000975	0.001413
8	ECN	241x241	C	0.00130	0.000126	0.001169	0.001421
9	WVU 7 grids	241x241	B	0.00119	0.003310	-0.002118	0.004502
10	WVU 4 grids	241x241	B	0.00119	0.002200	-0.001007	0.003393
11	IST/MARIN A	241x241	A	0.00107	0.000045	0.001027	0.001117
12	IST/MARIN A	241x241	B	0.00115	0.000084	0.001067	0.001236
13	IST/MARIN A	241x241	C	0.00108	0.000043	0.001033	0.001119
14	IST/MARIN B	241x241	A	0.00101	0.000195	0.000816	0.001206
15	IST/MARIN B	241x241	B	0.00098	0.000124	0.000852	0.001100
16	IST/MARIN B	241x241	C	0.00099	0.000166	0.000828	0.001159



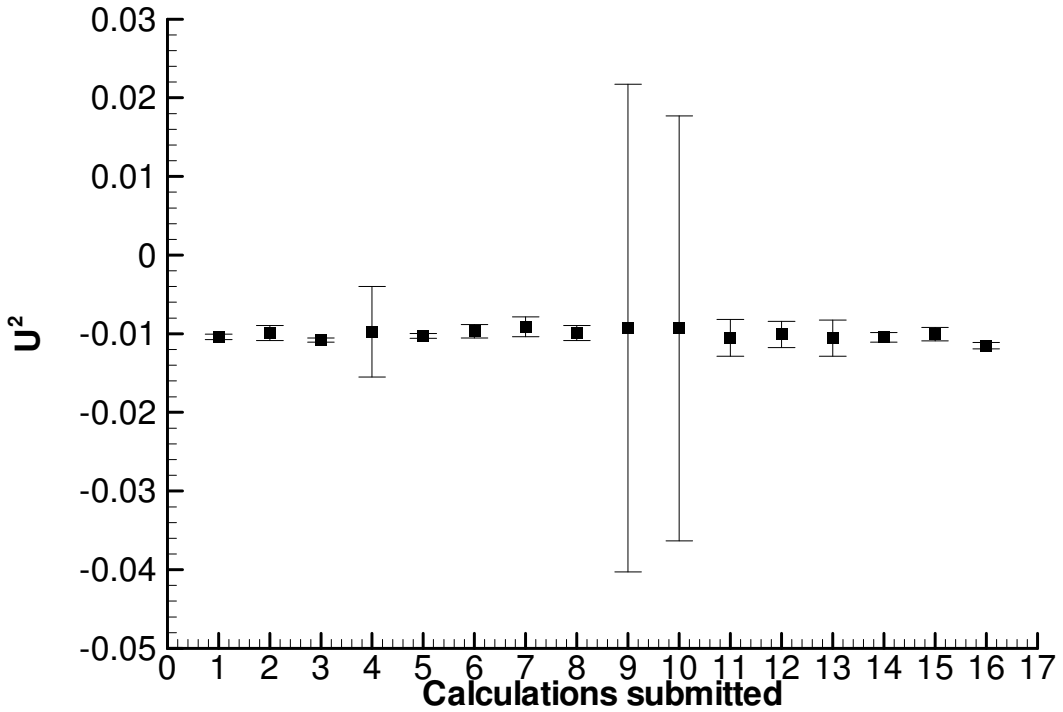
U^1 velocity component at ***x=4h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	-0.1000	0.02600	-0.12600	-0.07400
2	INSEAN	241x241	B	-0.0994	0.03400	-0.13340	-0.06540
3	INSEAN	241x241	C	-0.0696	0.01200	-0.08160	-0.05760
4	NRMI	241x241	B	-0.1097	0.00648	-0.11622	-0.10326
5	NRMI	241x241	C	-0.0862	0.03341	-0.11960	-0.05278
6	ECN	241x241	A	-0.1313	0.01556	-0.14683	-0.11571
7	ECN	241x241	B	-0.1394	0.01581	-0.15523	-0.12361
8	ECN	241x241	C	-0.1187	0.01544	-0.13409	-0.10321
9	WVU 7 grids	241x241	B	-0.1442	0.02200	-0.16620	-0.12220
10	WVU 4 grids	241x241	B	-0.1439	0.01900	-0.16290	-0.12490
11	IST/MARIN A	241x241	A	-0.1202	0.00388	-0.12403	-0.11627
12	IST/MARIN A	241x241	B	-0.1190	0.00524	-0.12426	-0.11377
13	IST/MARIN A	241x241	C	-0.1185	0.00447	-0.12295	-0.11400
14	IST/MARIN B	241x241	A	-0.1306	0.00161	-0.13225	-0.12903
15	IST/MARIN B	241x241	B	-0.1270	0.00549	-0.13248	-0.12150
16	IST/MARIN B	241x241	C	-0.0689	0.10025	-0.16911	0.03138



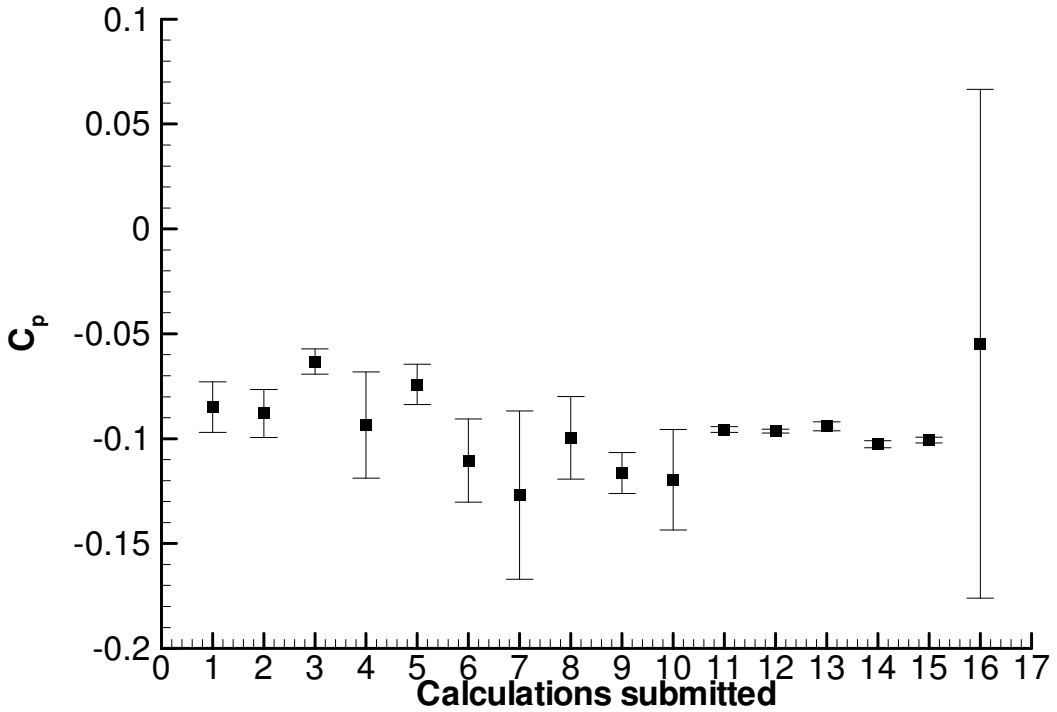
U^2 velocity component at ***x=4h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	-0.0104	0.00034	-0.01074	-0.01006
2	INSEAN	241x241	B	-0.0099	0.00095	-0.01085	-0.00895
3	INSEAN	241x241	C	-0.0108	0.00027	-0.01107	-0.01053
4	NRMI	241x241	B	-0.0097	0.00576	-0.01550	-0.00398
5	NRMI	241x241	C	-0.0103	0.00029	-0.01056	-0.00997
6	ECN	241x241	A	-0.0097	0.00085	-0.01053	-0.00883
7	ECN	241x241	B	-0.0091	0.00127	-0.01039	-0.00785
8	ECN	241x241	C	-0.0099	0.00094	-0.01085	-0.00896
9	WVU 7 grids	241x241	B	-0.0093	0.03100	-0.04029	0.02171
10	WVU 4 grids	241x241	B	-0.0093	0.02700	-0.03632	0.01768
11	IST/MARIN A	241x241	A	-0.0105	0.00235*	-0.01286	-0.00817
12	IST/MARIN A	241x241	B	-0.0101	0.00166	-0.01175	-0.00842
13	IST/MARIN A	241x241	C	-0.0105	0.00230*	-0.01284	-0.00825
14	IST/MARIN B	241x241	A	-0.0105	0.00060*	-0.01106	-0.00987
15	IST/MARIN B	241x241	B	-0.0100	0.00086	-0.01089	-0.00918
16	IST/MARIN B	241x241	C	-0.0115	0.00040	-0.01191	-0.01111



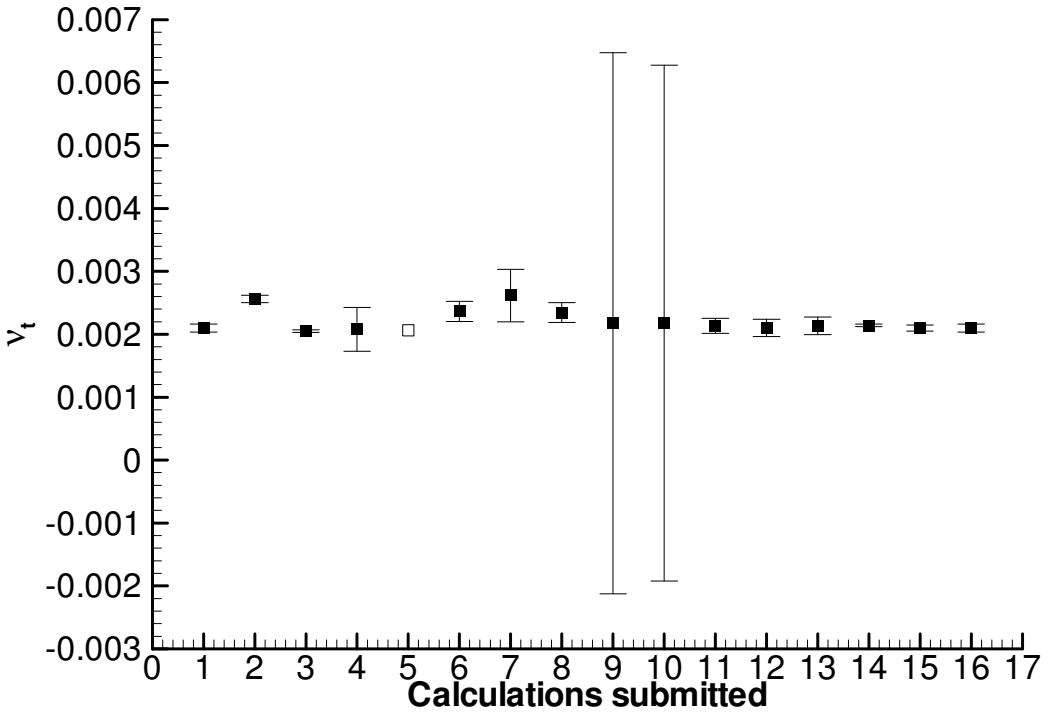
Cp at ***x=4h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	INSEAN	241x241	A	-0.0850	0.01200	-0.09700	-0.07300
2	INSEAN	241x241	B	-0.0880	0.01140	-0.09940	-0.07660
3	INSEAN	241x241	C	-0.0632	0.00600	-0.06920	-0.05720
4	NRMI	241x241	B	-0.0935	0.02530	-0.11884	-0.06824
5	NRMI	241x241	C	-0.0742	0.00961	-0.08381	-0.06459
6	ECN	241x241	A	-0.1104	0.01983	-0.13027	-0.09061
7	ECN	241x241	B	-0.1269	0.04011	-0.16698	-0.08676
8	ECN	241x241	C	-0.0997	0.01972	-0.11938	-0.07993
9	WVU 7 grids	241x241	B	-0.1164	0.00970	-0.12610	-0.10670
10	WVU 4 grids	241x241	B	-0.1196	0.02400	-0.14360	-0.09560
11	IST/MARIN A	241x241	A	-0.0956	0.00139	-0.09703	-0.09425
12	IST/MARIN A	241x241	B	-0.0964	0.00091	-0.09729	-0.09546
13	IST/MARIN A	241x241	C	-0.0942	0.00218	-0.09635	-0.09198
14	IST/MARIN B	241x241	A	-0.1026	0.00168	-0.10431	-0.10094
15	IST/MARIN B	241x241	B	-0.1007	0.00141	-0.10209	-0.09927
16	IST/MARIN B	241x241	C	-0.0548	0.12127	-0.17605	0.06650



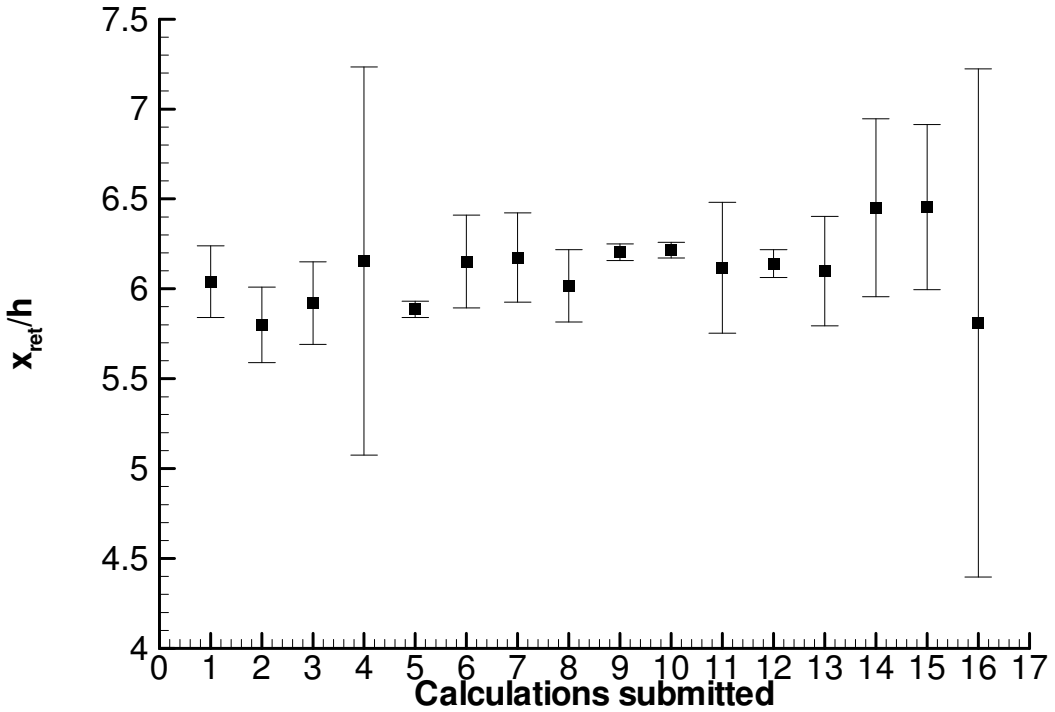
ν_t at ***x=4h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.00210	0.000063	0.002037	0.002163
2	INSEAN	241x241	B	0.00256	0.000059	0.002501	0.002619
3	INSEAN	241x241	C	0.00205	0.000020	0.002030	0.002070
4	NRMI	241x241	B	0.00208	0.000348	0.001731	0.002427
5	NRMI	241x241	C	0.00206	---	---	---
6	ECN	241x241	A	0.00236	0.000160	0.002203	0.002523
7	ECN	241x241	B	0.00261	0.000418	0.002197	0.003033
8	ECN	241x241	C	0.00234	0.000157	0.002186	0.002501
9	WVU 7 grids	241x241	B	0.00218	0.004300	-0.002123	0.006477
10	WVU 4 grids	241x241	B	0.00218	0.004100	-0.001923	0.006277
11	IST/MARIN A	241x241	A	0.00213	0.000119	0.002014	0.002252
12	IST/MARIN A	241x241	B	0.00210	0.000139	0.001961	0.002239
13	IST/MARIN A	241x241	C	0.00213	0.000140	0.001994	0.002274
14	IST/MARIN B	241x241	A	0.00214	0.000021	0.002119	0.002160
15	IST/MARIN B	241x241	B	0.00210	0.000048	0.002050	0.002147
16	IST/MARIN B	241x241	C	0.00210	0.000063	0.002036	0.002162



Re-attachment point

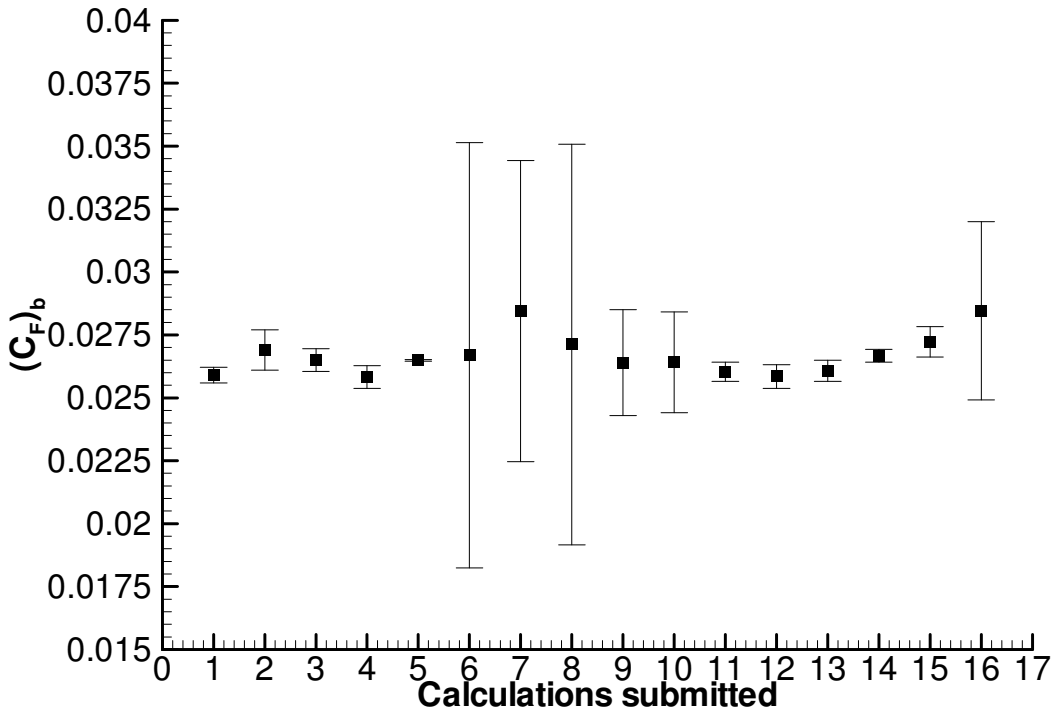
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	INSEAN	241x241	A	6.040	0.2000	5.8400	6.2400
2	INSEAN	241x241	B	5.800	0.2100	5.5900	6.0100
3	INSEAN	241x241	C	5.920	0.2300	5.6900	6.1500
4	NRMI	241x241	B	6.155	1.0795	5.0750	7.2341
5	NRMI	241x241	C	5.885	0.0455	5.8397	5.9308
6	ECN	241x241	A	6.152	0.2577	5.8938	6.4092
7	ECN	241x241	B	6.174	0.2487	5.9250	6.4224
8	ECN	241x241	C	6.017	0.2013	5.8160	6.2186
9	WVU 7 grids	241x241	B	6.203	0.0460	6.1570	6.2490
10	WVU 4 grids	241x241	B	6.215	0.0440	6.1710	6.2590
11	IST/MARIN A	241x241	A	6.117	0.3645*	5.7525	6.4814
12	IST/MARIN A	241x241	B	6.140	0.0772	6.0626	6.2171
13	IST/MARIN A	241x241	C	6.099	0.3049	5.7941	6.4038
14	IST/MARIN B	241x241	A	6.451	0.4942*	5.9567	6.9452
15	IST/MARIN B	241x241	B	6.455	0.4596*	5.9951	6.9143
16	IST/MARIN B	241x241	C	5.810	1.4134*	4.3967	7.2235



Integral flow quantities:

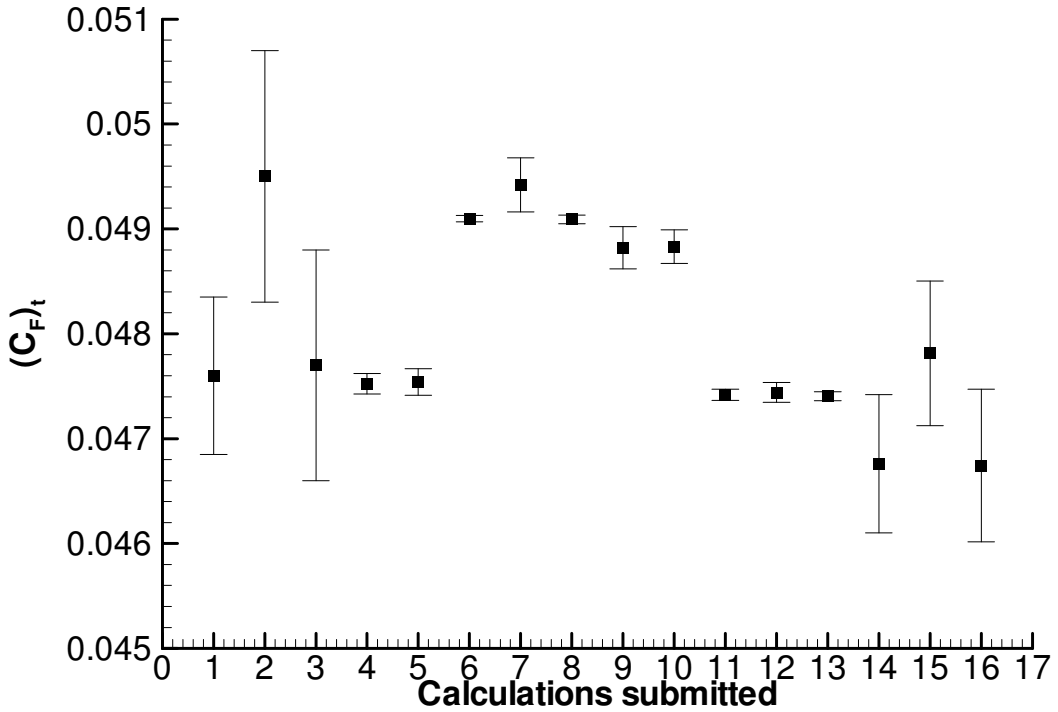
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$-U	$(C_F)_b$ +U
1	INSEAN	241x241	A	0.0259	0.00031	0.02559	0.02621
2	INSEAN	241x241	B	0.0269	0.00080	0.02610	0.02770
3	INSEAN	241x241	C	0.0265	0.00045	0.02605	0.02695
4	NRMI	241x241	B	0.0258	0.00045	0.02538	0.02628
5	NRMI	241x241	C	0.0265	0.00003	0.02646	0.02652
6	ECN	241x241	A	0.0267	0.00845	0.01824	0.03514
7	ECN	241x241	B	0.0284	0.00598	0.02246	0.03443
8	ECN	241x241	C	0.0271	0.00796	0.01916	0.03508
9	WVU 7 grids	241x241	B	0.0264	0.00210	0.02430	0.02850
10	WVU 4 grids	241x241	B	0.0264	0.00200	0.02441	0.02841
11	IST/MARIN A	241x241	A	0.0260	0.00038	0.02565	0.02642
12	IST/MARIN A	241x241	B	0.0258	0.00047	0.02538	0.02632
13	IST/MARIN A	241x241	C	0.0261	0.00042	0.02565	0.02649
14	IST/MARIN B	241x241	A	0.0267	0.00026	0.02641	0.02693
15	IST/MARIN B	241x241	B	0.0272	0.00060	0.02662	0.02782
16	IST/MARIN B	241x241	C	0.0285	0.00354	0.02492	0.03200



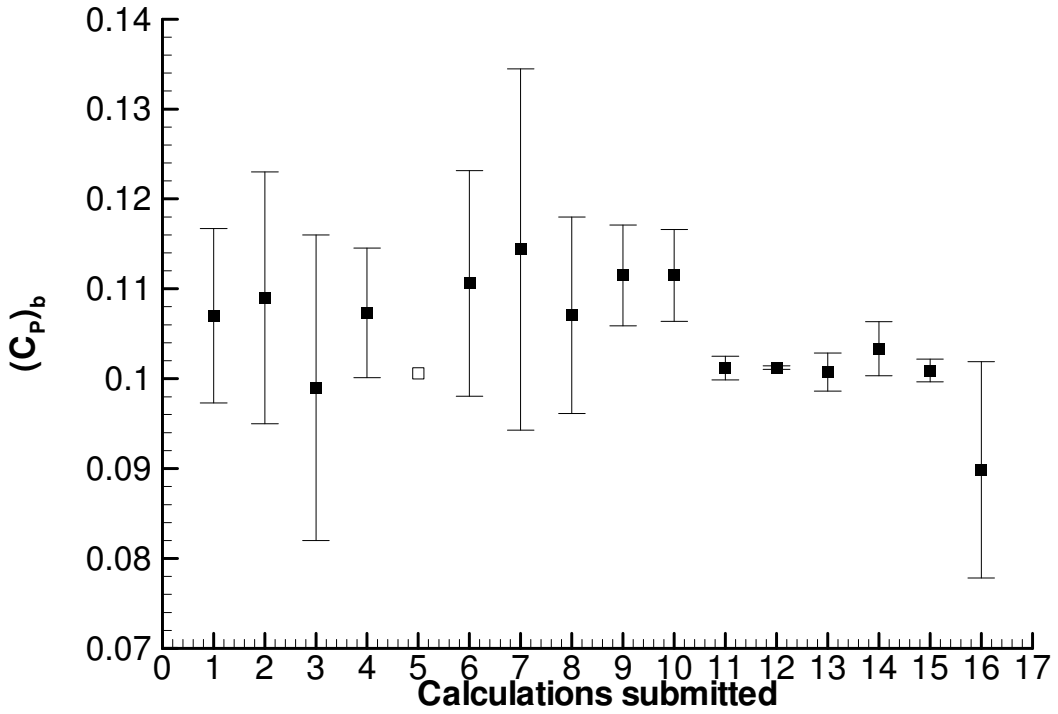
Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$-U	$(C_F)_t$ +U
1	INSEAN	241x241	A	0.0476	0.00075	0.04685	0.04835
2	INSEAN	241x241	B	0.0495	0.00120	0.04830	0.05070
3	INSEAN	241x241	C	0.0477	0.00110	0.04660	0.04880
4	NRMI	241x241	B	0.0475	0.00010	0.04743	0.04762
5	NRMI	241x241	C	0.0475	0.00013	0.04741	0.04767
6	ECN	241x241	A	0.0491	0.00003	0.04907	0.04913
7	ECN	241x241	B	0.0494	0.00026	0.04916	0.04968
8	ECN	241x241	C	0.0491	0.00004	0.04905	0.04913
9	WVU 7 grids	241x241	B	0.0488	0.00020	0.04862	0.04902
10	WVU 4 grids	241x241	B	0.0488	0.00016	0.04867	0.04899
11	IST/MARIN A	241x241	A	0.0474	0.00005	0.04737	0.04747
12	IST/MARIN A	241x241	B	0.0474	0.00009	0.04734	0.04753
13	IST/MARIN A	241x241	C	0.0474	0.00004	0.04736	0.04745
14	IST/MARIN B	241x241	A	0.0468	0.00066	0.04610	0.04742
15	IST/MARIN B	241x241	B	0.0478	0.00069	0.04712	0.04850
16	IST/MARIN B	241x241	C	0.0467	0.00073	0.04602	0.04747



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$-U	$(C_P)_b$ +U
1	INSEAN	241x241	A	0.1070	0.00970	0.09730	0.11670
2	INSEAN	241x241	B	0.1090	0.01400	0.09500	0.12300
3	INSEAN	241x241	C	0.0990	0.01700	0.08200	0.11600
4	NRMI	241x241	B	0.1073	0.00721	0.10010	0.11453
5	NRMI	241x241	C	0.1006	---	---	---
6	ECN	241x241	A	0.1106	0.01255	0.09806	0.12315
7	ECN	241x241	B	0.1144	0.20094	-0.08656	0.31532
8	ECN	241x241	C	0.1071	0.01093	0.09614	0.11800
9	WVU 7 grids	241x241	B	0.1115	0.00560	0.10590	0.11710
10	WVU 4 grids	241x241	B	0.1115	0.00510	0.10640	0.11660
11	IST/MARIN A	241x241	A	0.1012	0.00131	0.09987	0.10249
12	IST/MARIN A	241x241	B	0.1012	0.00018	0.10105	0.10141
13	IST/MARIN A	241x241	C	0.1007	0.00212	0.09861	0.10286
14	IST/MARIN B	241x241	A	0.1033	0.00300	0.10033	0.10633
15	IST/MARIN B	241x241	B	0.1009	0.00127	0.09963	0.10216
16	IST/MARIN B	241x241	C	0.0899	0.01204	0.07783	0.10190

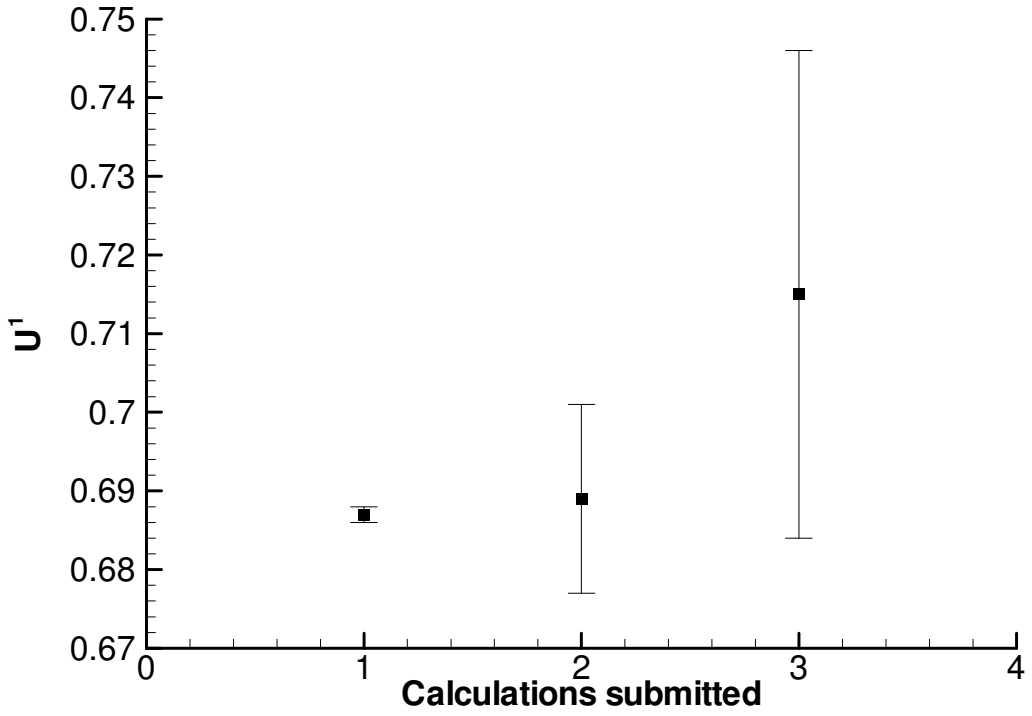


b) Chang, Hsieh and Chen k-ε Turbulence model

Local flow quantities:

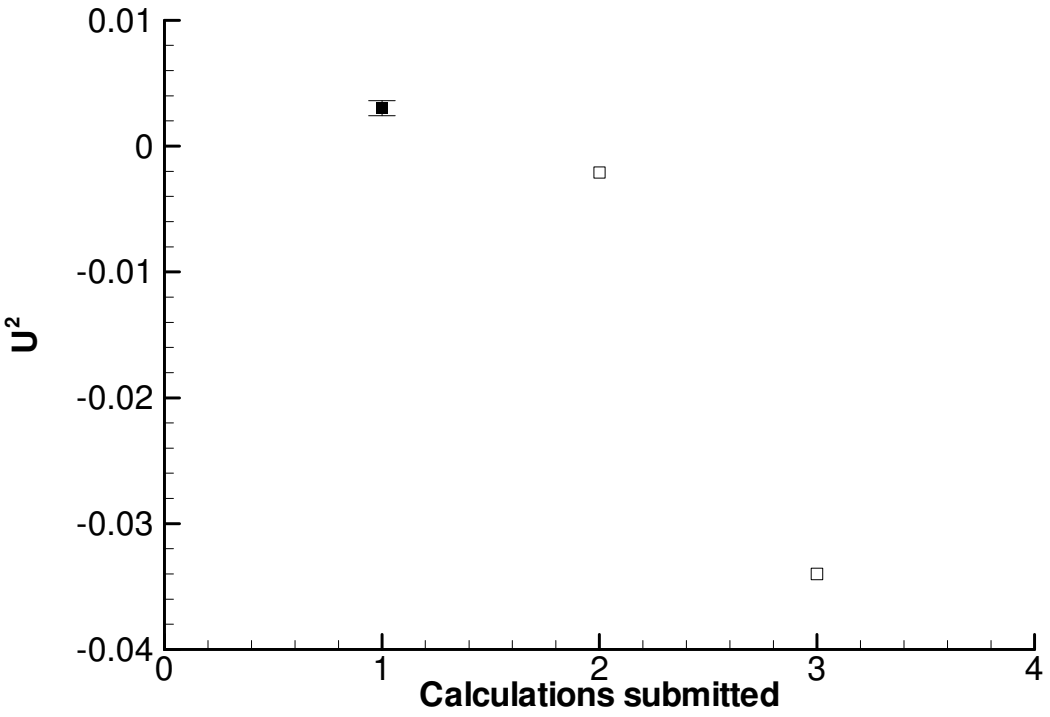
U^1 velocity component at ***x=0, y=1.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	0.687	0.001	0.686	0.688
2	INSEAN	241x241	B	0.689	0.012	0.677	0.701
3	INSEAN	241x241	C	0.715	0.031	0.684	0.746



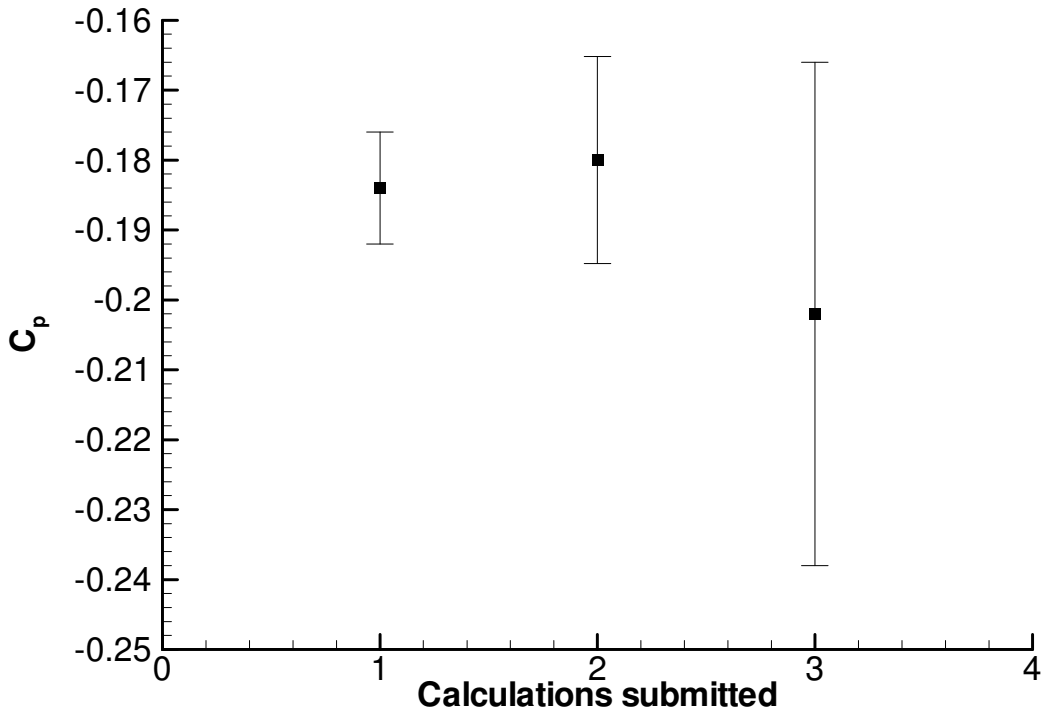
U^2 velocity component at ***x=0, y=1.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	0.00301	0.0006	0.00241	0.00361
2	INSEAN	241x241	B	-0.0021	---		
3	INSEAN	241x241	C	-0.034	---		



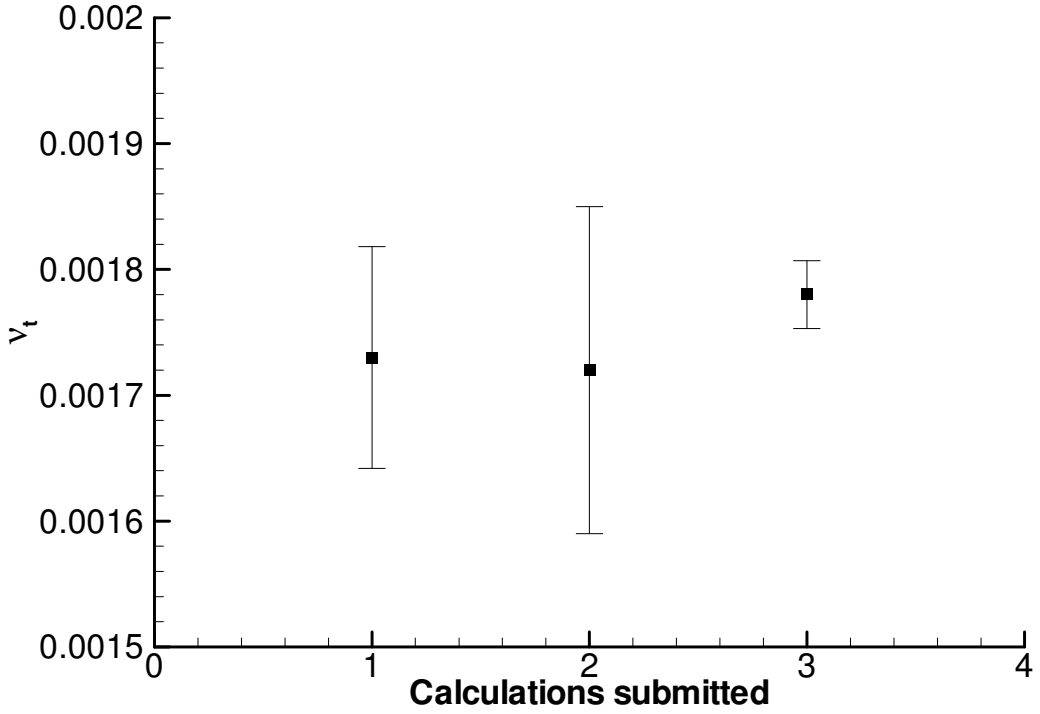
Cp at ***x=0, y=1.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	INSEAN	241x241	A	-0.184	0.008	-0.192	-0.176
2	INSEAN	241x241	B	-0.180	0.0148	-0.1948	-0.1652
3	INSEAN	241x241	C	-0.202	0.036	-0.238	-0.166



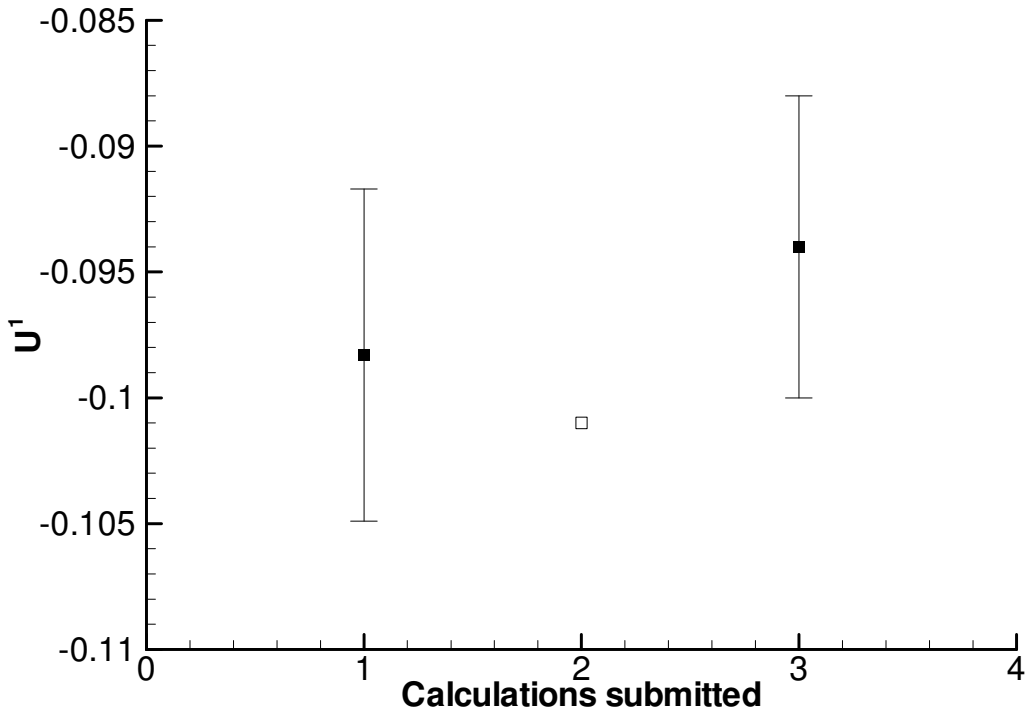
ν_t at ***x=0, y=1.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.00173	0.000088	0.001642	0.001818
2	INSEAN	241x241	B	0.00172	0.000130	0.001590	0.001850
3	INSEAN	241x241	C	0.00178	0.000027	0.001753	0.001807



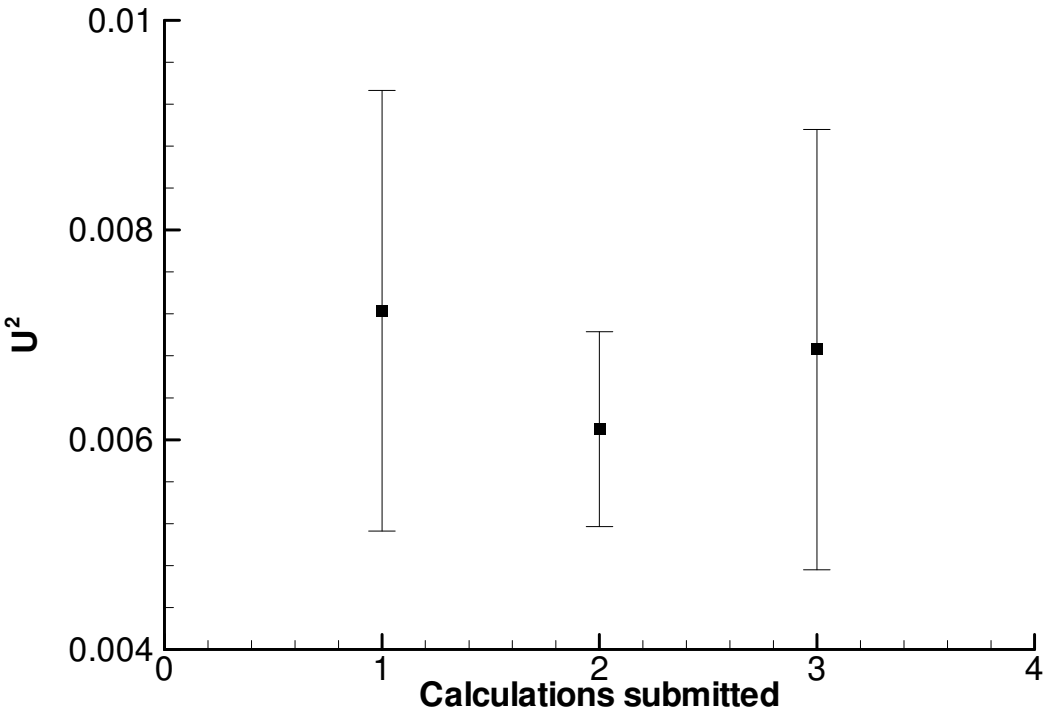
U^1 velocity component at ***x=h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	-0.0983	0.00660	-0.10490	-0.09170
2	INSEAN	241x241	B	-0.1010	---	---	----
3	INSEAN	241x241	C	-0.0940	0.00600	-0.10000	-0.08800



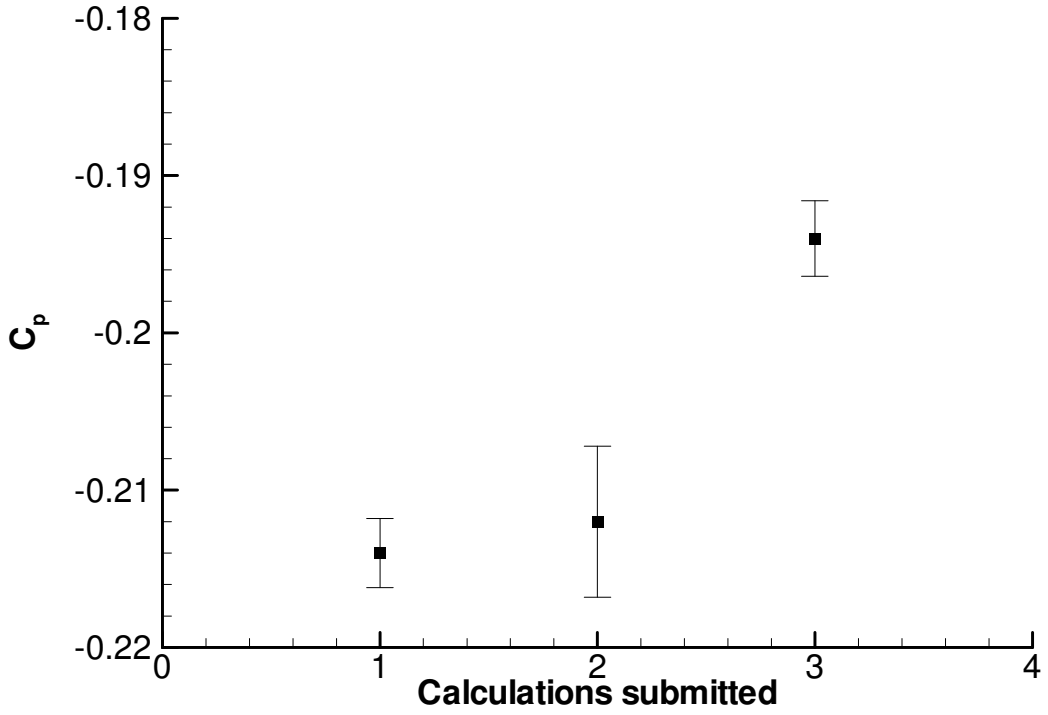
U^2 velocity component at ***x=h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	0.0072	0.00210	0.00513	0.00933
2	INSEAN	241x241	B	0.0061	0.00093	0.00517	0.00703
3	INSEAN	241x241	C	0.0069	0.00210	0.00476	0.00896



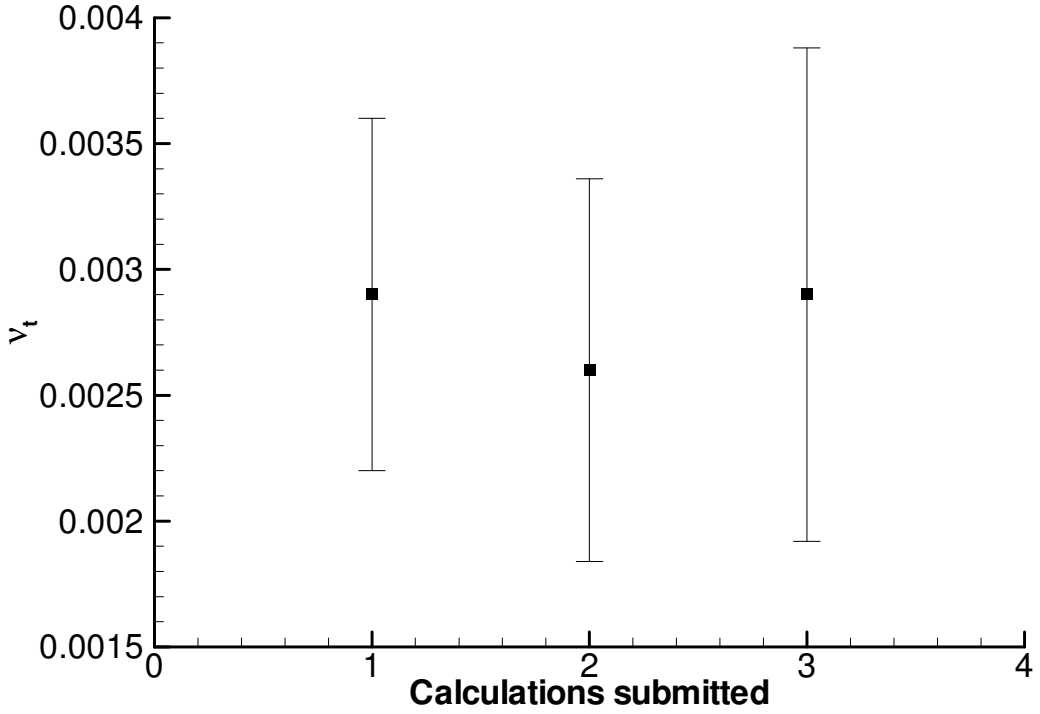
Cp at ***x=h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	INSEAN	241x241	A	-0.214	0.0022	-0.2162	-0.2118
2	INSEAN	241x241	B	-0.212	0.0048	-0.2168	-0.2072
3	INSEAN	241x241	C	-0.194	0.0024	-0.1964	-0.1916



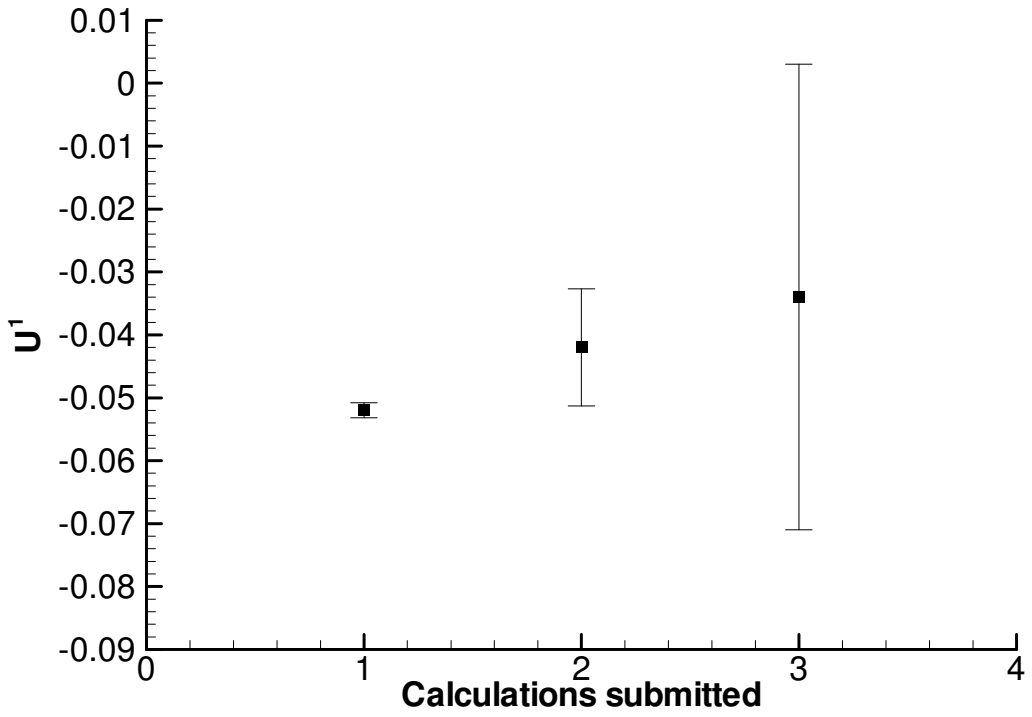
ν_t at ***x=h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.00290	0.000700	0.002200	0.003600
2	INSEAN	241x241	B	0.00260	0.000760	0.001840	0.003360
3	INSEAN	241x241	C	0.00290	0.000980	0.001920	0.003880



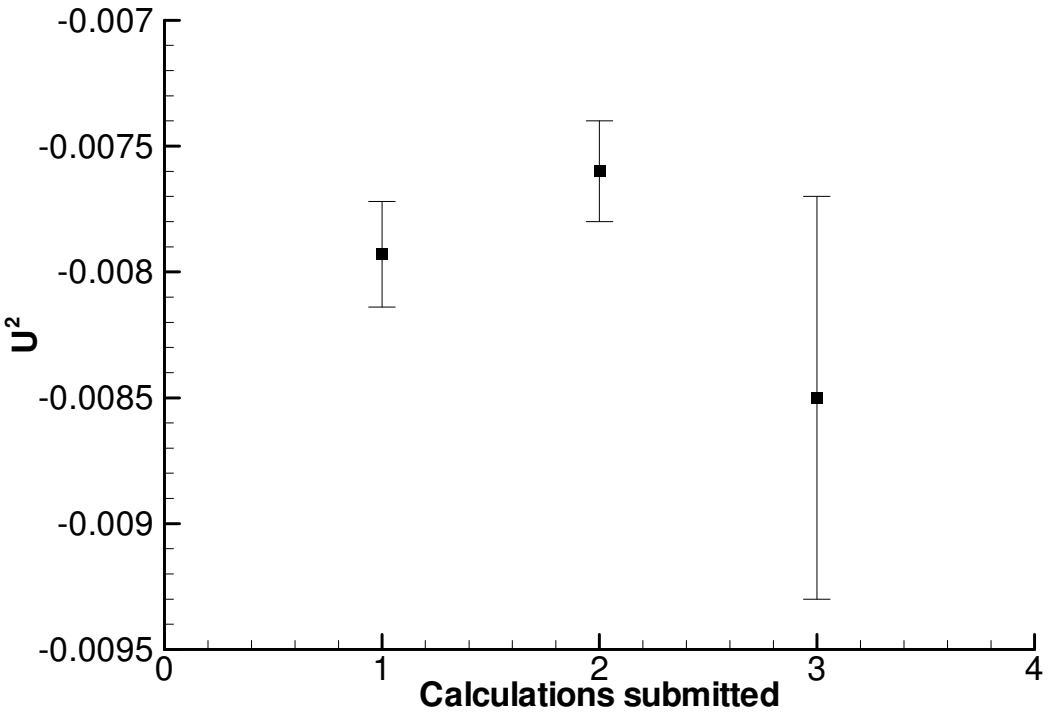
U^1 velocity component at ***x=4h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	INSEAN	241x241	A	-0.0520	0.00120	-0.05320	-0.05080
2	INSEAN	241x241	B	-0.0420	0.00930	-0.05130	-0.03270
3	INSEAN	241x241	C	-0.0340	0.03700	-0.07100	0.00300



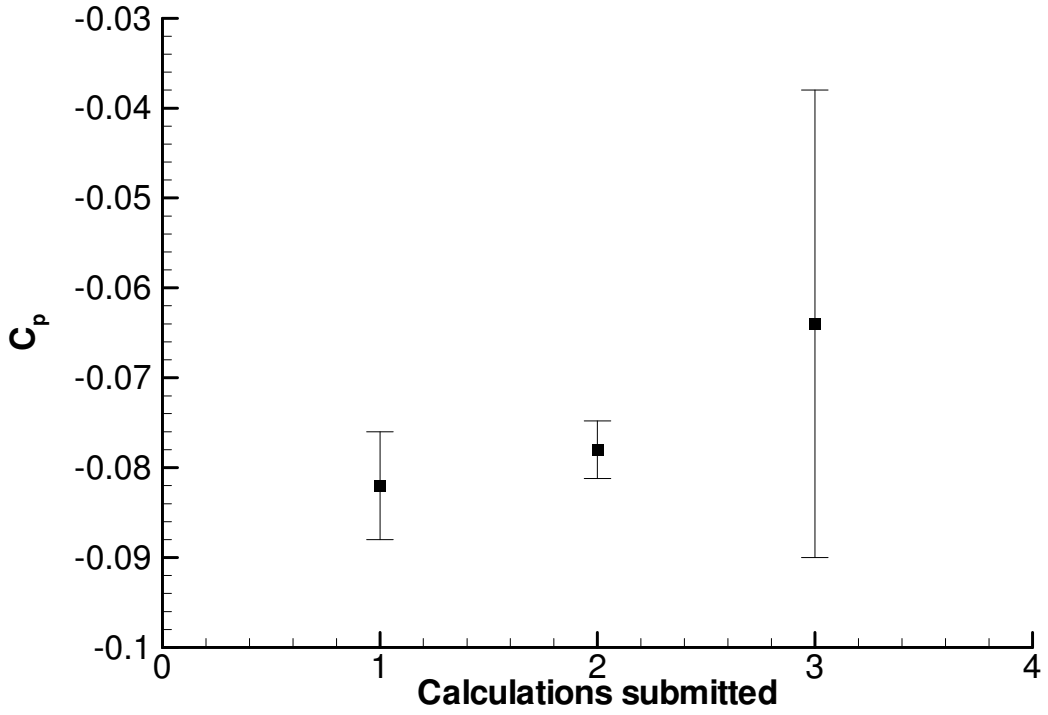
U^2 velocity component at ***x=4h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	INSEAN	241x241	A	-0.0079	0.00021	-0.00814	-0.00772
2	INSEAN	241x241	B	-0.0076	0.00020	-0.00780	-0.00740
3	INSEAN	241x241	C	-0.0085	0.00080	-0.00930	-0.00770



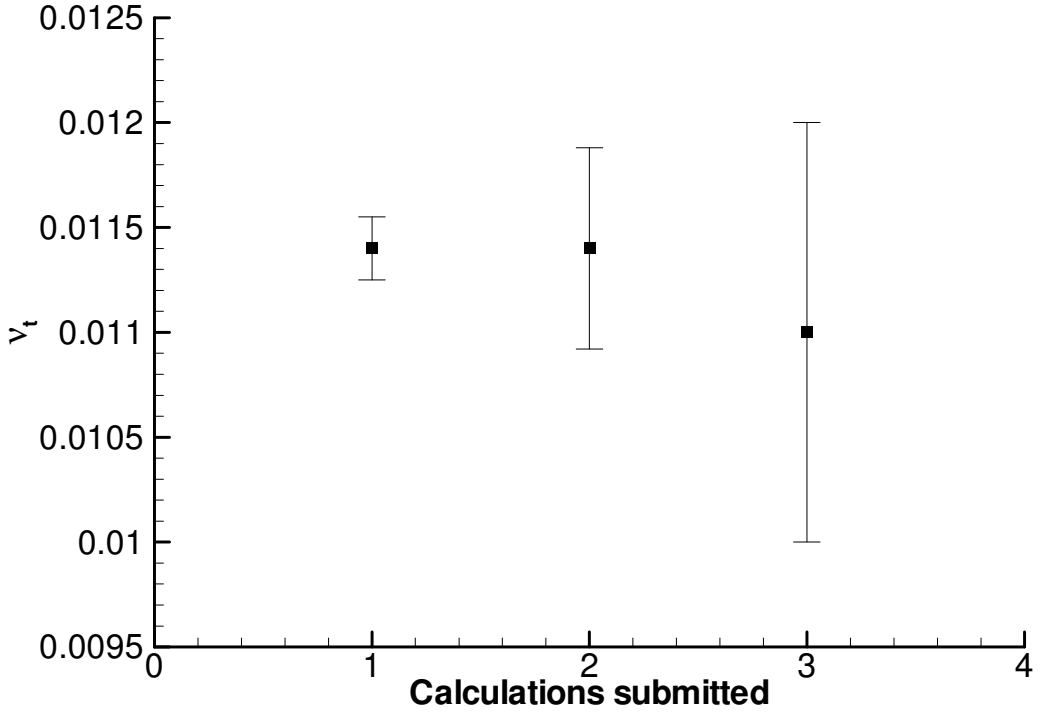
Cp at ***x=4h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	INSEAN	241x241	A	-0.0820	0.00600	-0.08800	-0.07600
2	INSEAN	241x241	B	-0.0780	0.00320	-0.08120	-0.07480
3	INSEAN	241x241	C	-0.0640	0.02600	-0.09000	-0.03800



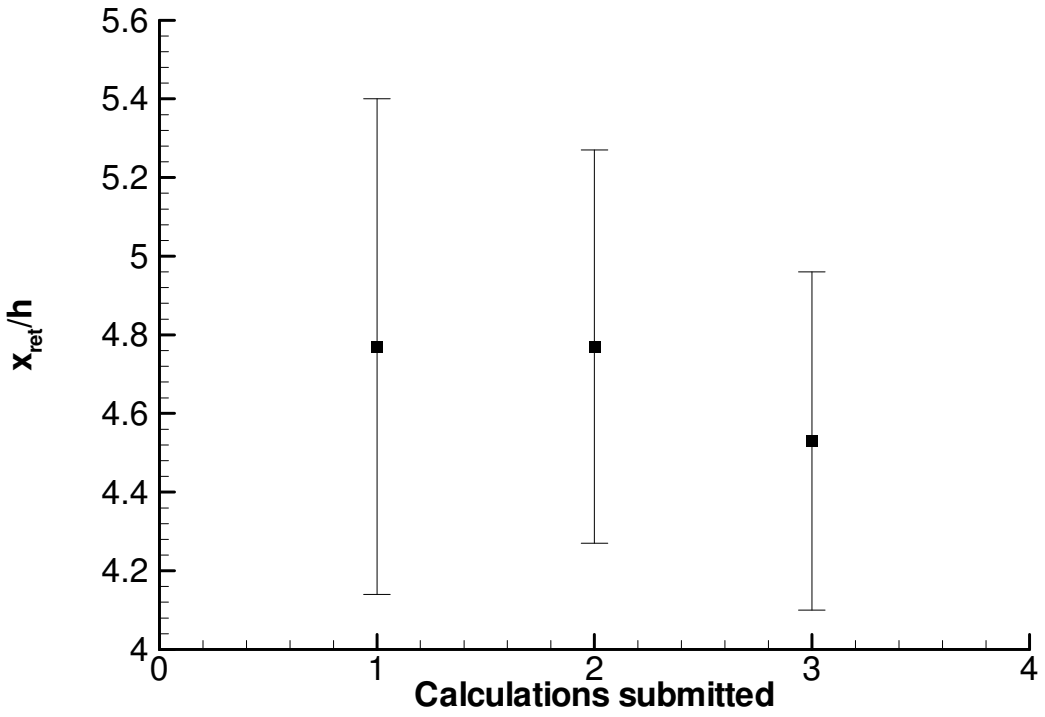
ν_t at ***x=4h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	INSEAN	241x241	A	0.01140	0.000150	0.011250	0.011550
2	INSEAN	241x241	B	0.01140	0.000480	0.010920	0.011880
3	INSEAN	241x241	C	0.01100	0.001000	0.010000	0.012000



Re-attachment point

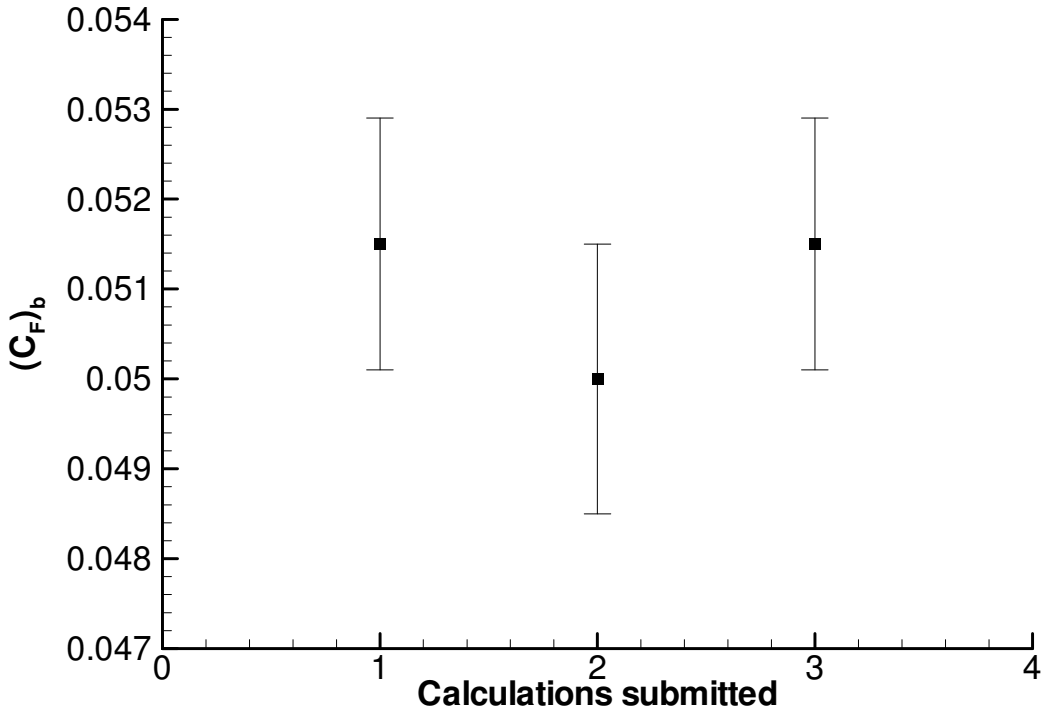
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	INSEAN	241x241	A	4.770	0.6300	4.1400	5.4000
2	INSEAN	241x241	B	4.770	0.5000	4.2700	5.2700
3	INSEAN	241x241	C	4.530	0.4300	4.1000	4.9600



Integral flow quantities:

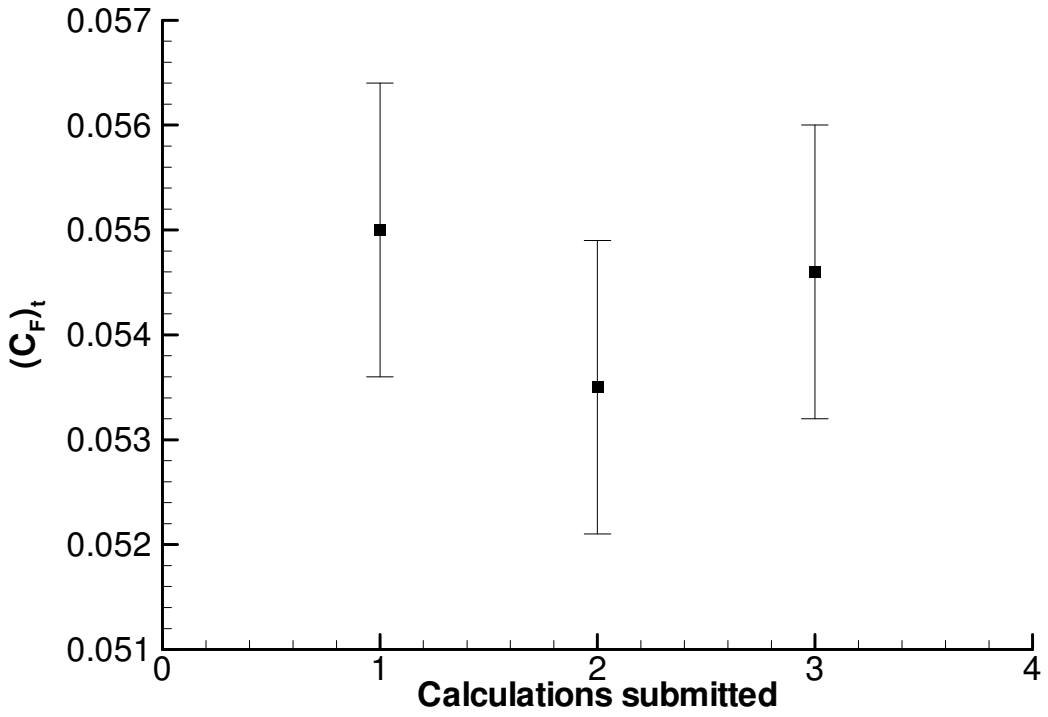
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$ -U	$(C_F)_b$ +U
1	INSEAN	241x241	A	0.0515	0.00140	0.05010	0.05290
2	INSEAN	241x241	B	0.0500	0.00150	0.04850	0.05150
3	INSEAN	241x241	C	0.0515	0.00140	0.05010	0.05290



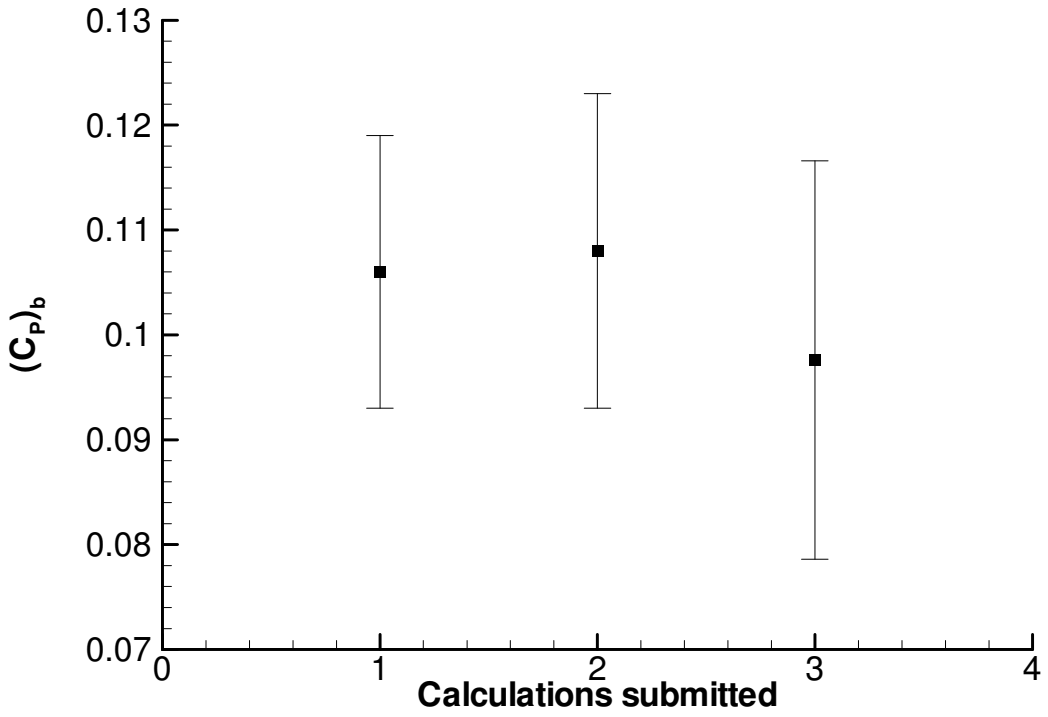
Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$ -U	$(C_F)_t$ +U
1	INSEAN	241x241	A	0.0550	0.00140	0.05360	0.05640
2	INSEAN	241x241	B	0.0535	0.00140	0.05210	0.05490
3	INSEAN	241x241	C	0.0546	0.00140	0.05320	0.05600



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$ -U	$(C_P)_b$ +U
1	INSEAN	241x241	A	0.1060	0.01300	0.09300	0.11900
2	INSEAN	241x241	B	0.1080	0.01500	0.09300	0.12300
3	INSEAN	241x241	C	0.0976	0.01900	0.07860	0.11660

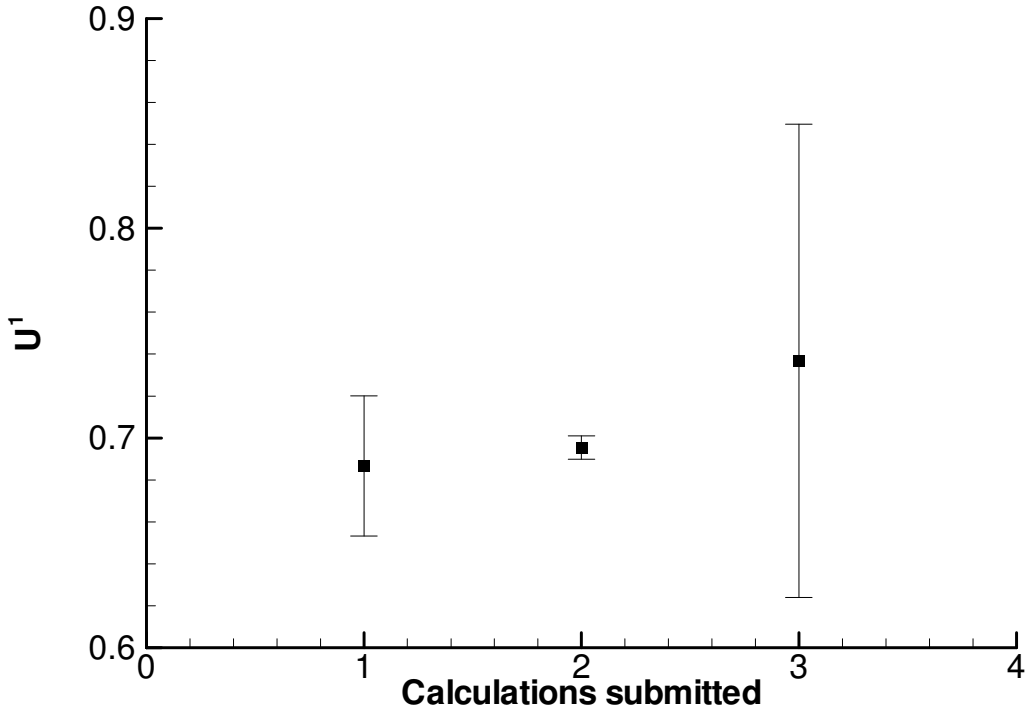


c) Menter's one-equation turbulence model

Local flow quantities:

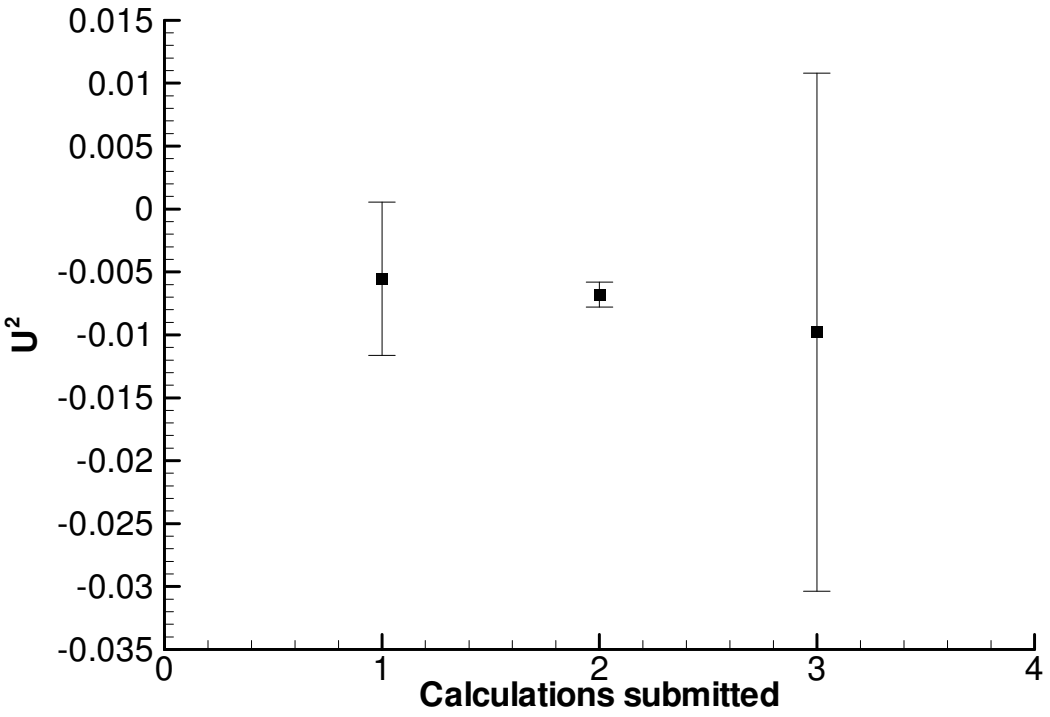
U^1 velocity component at ***x=0, y=1.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	241x241	A	0.6866	0.03345	0.65317	0.72006
2	IST/MARIN A	241x241	B	0.6955	0.00557	0.68989	0.70102
3	IST/MARIN A	241x241	C	0.7367	0.11282	0.62390	0.84954



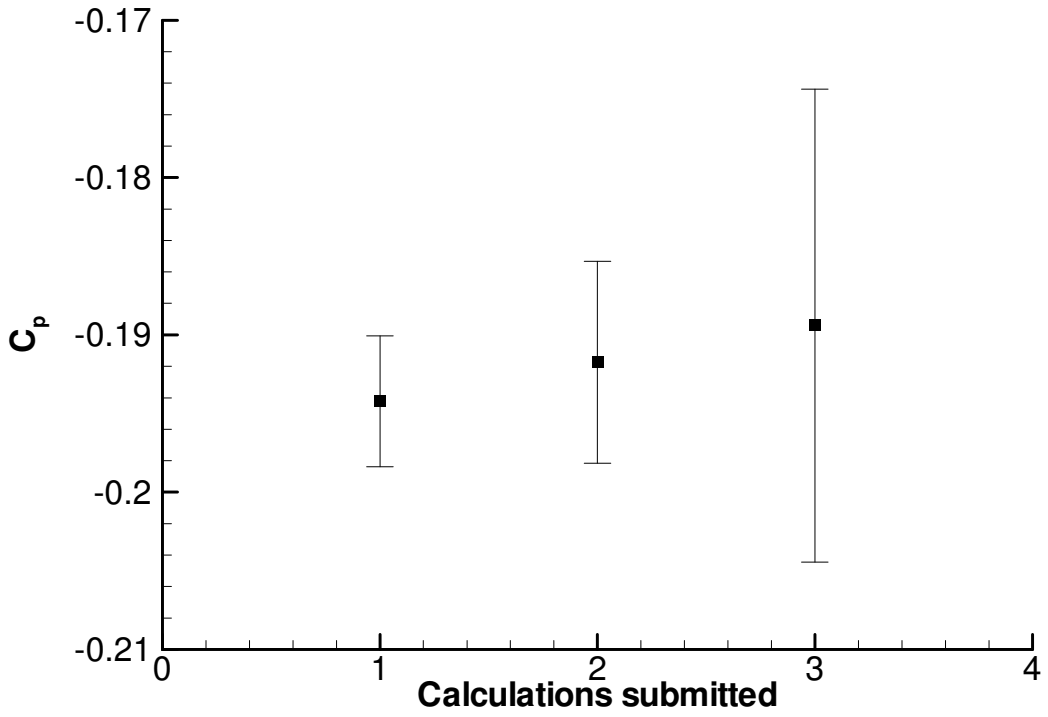
U^2 velocity component at ***x=0, y=1.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	241x241	A	-0.0056	0.00609	-0.01164	0.00054
2	IST/MARIN A	241x241	B	-0.0068	0.00100	-0.00780	-0.00580
3	IST/MARIN A	241x241	C	-0.0098	0.02059*	-0.03038	0.01080



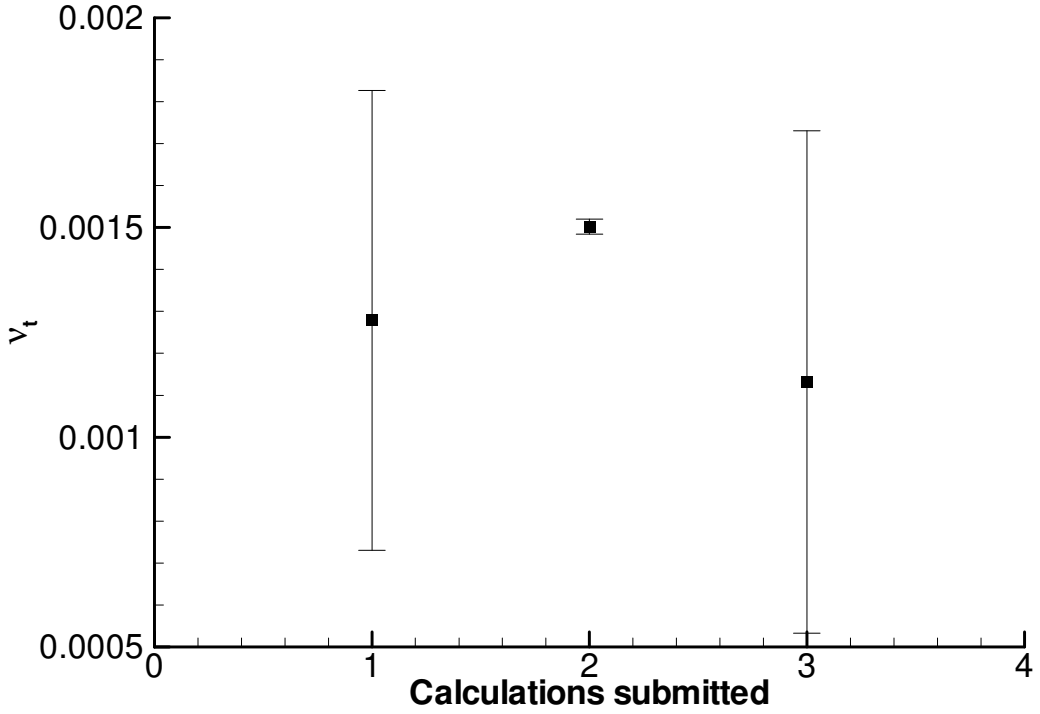
Cp at ***x=0, y=1.1h***

C_p		Grid	Set	C_p	U	C_p-U	C_p+U
1	IST/MARIN A	241x241	A	-0.1942	0.00416	-0.19840	-0.19007
2	IST/MARIN A	241x241	B	-0.1917	0.00641	-0.19816	-0.18533
3	IST/MARIN A	241x241	C	-0.1894	0.01503	-0.20444	-0.17438



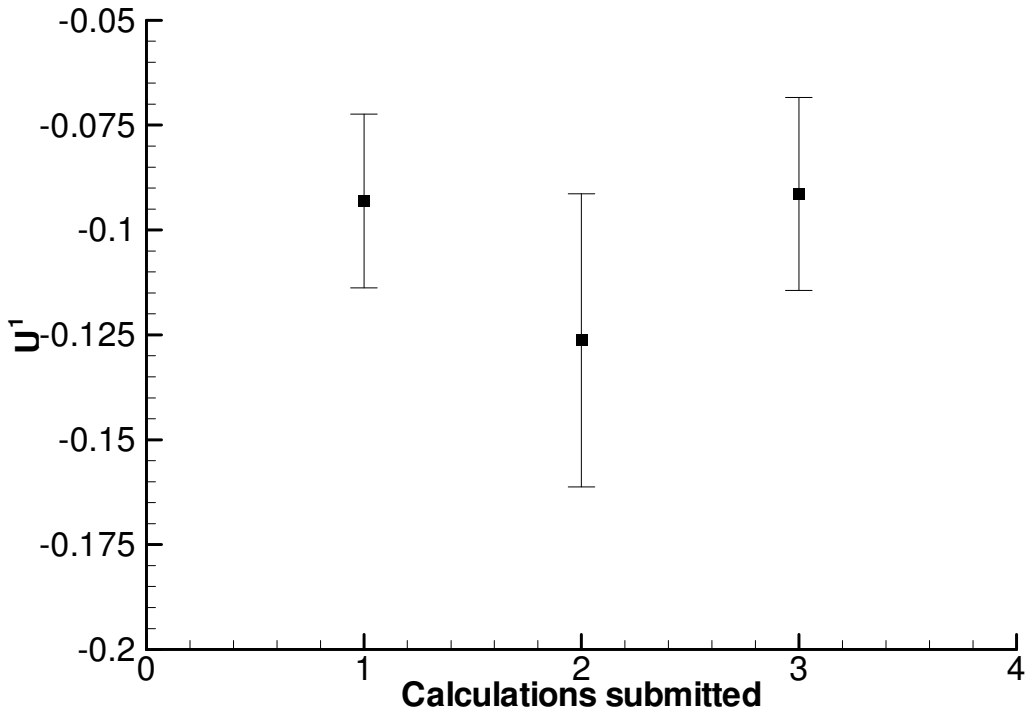
ν_t at ***x=0, y=1.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	241x241	A	0.00128	0.000548*	0.000730	0.001827
2	IST/MARIN A	241x241	B	0.00150	0.000018	0.001484	0.001520
3	IST/MARIN A	241x241	C	0.00113	0.000599*	0.000533	0.001731



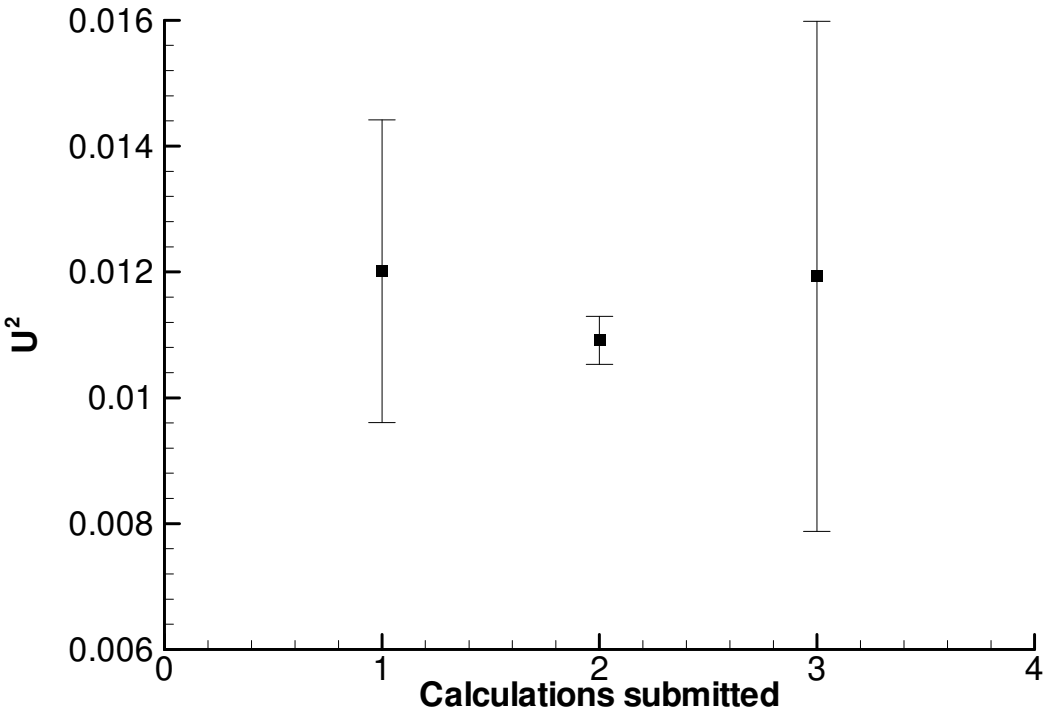
U^1 velocity component at ***x=h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	241x241	A	-0.0931	0.02071	-0.11383	-0.07241
2	IST/MARIN A	241x241	B	-0.1263	0.03495	-0.16128	-0.09137
3	IST/MARIN A	241x241	C	-0.0914	0.02299	-0.11443	-0.06845



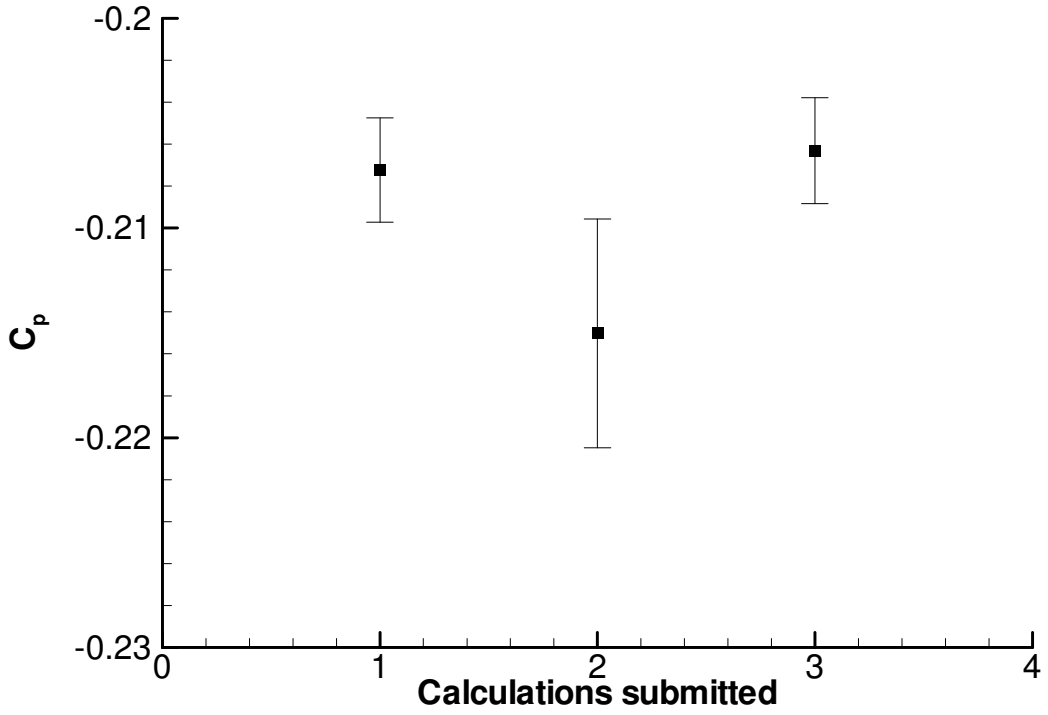
U^2 velocity component at ***x=h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	241x241	A	0.0120	0.00240	0.00961	0.01441
2	IST/MARIN A	241x241	B	0.0109	0.00038*	0.01053	0.01130
3	IST/MARIN A	241x241	C	0.0119	0.00405	0.00788	0.01598



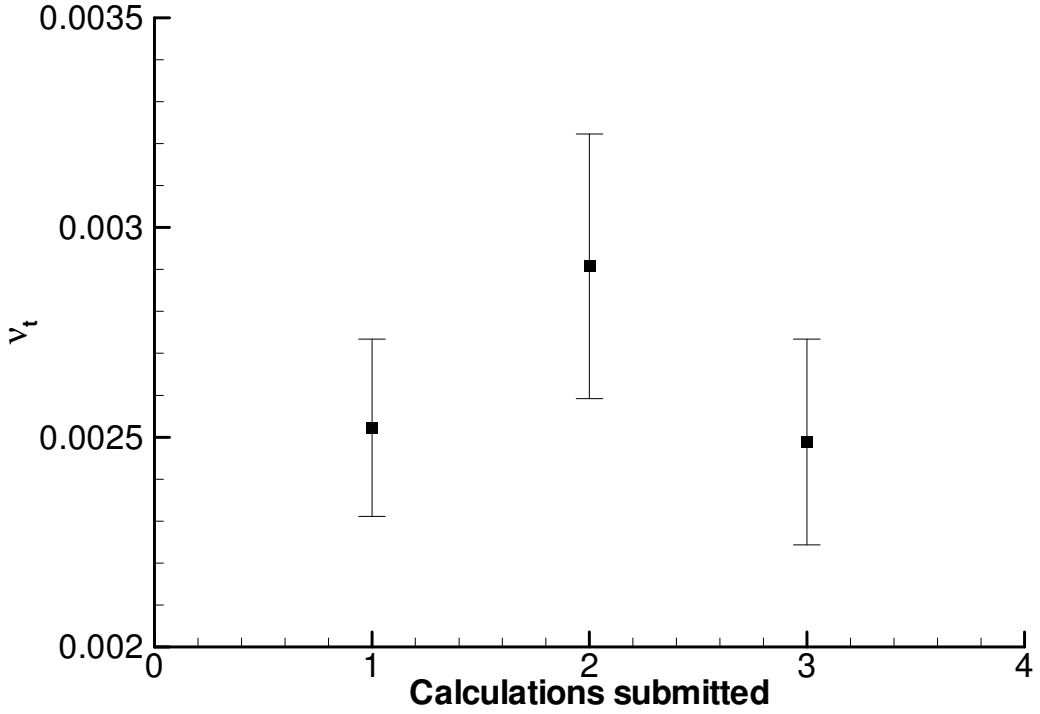
Cp at ***x=h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p -U	C_p+U
1	IST/MARIN A	241x241	A	-0.2072	0.00248	-0.20972	-0.20475
2	IST/MARIN A	241x241	B	-0.2150	0.00545	-0.22048	-0.20957
3	IST/MARIN A	241x241	C	-0.2063	0.00253	-0.20884	-0.20379



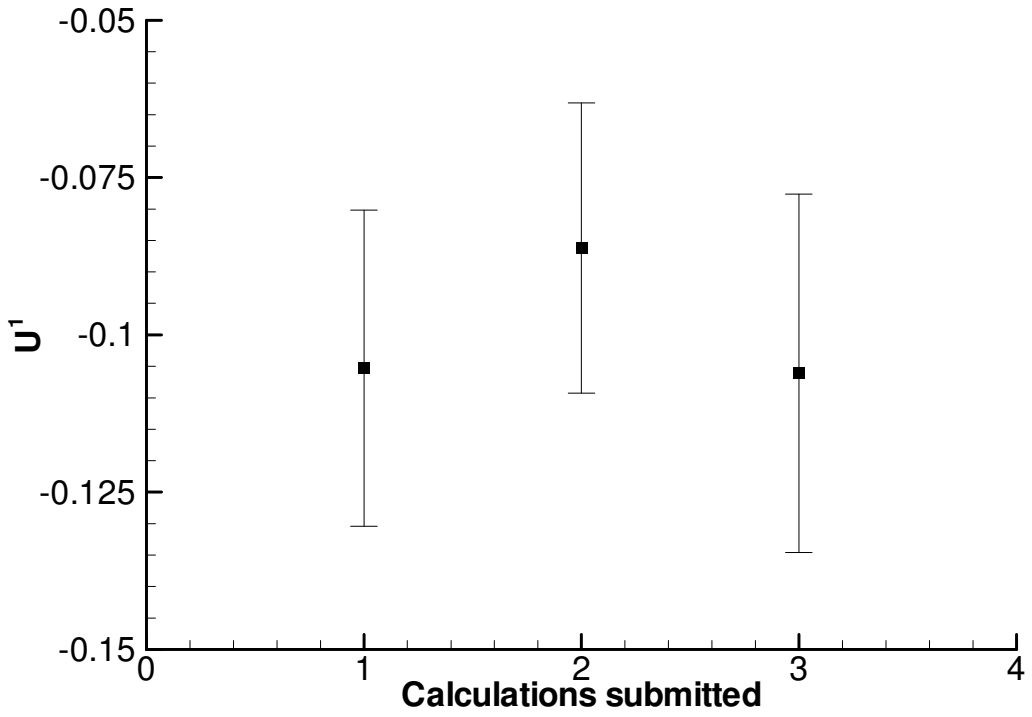
ν_t at ***x=h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	241x241	A	0.00252	0.000211	0.002311	0.002734
2	IST/MARIN A	241x241	B	0.00291	0.000316	0.002592	0.003223
3	IST/MARIN A	241x241	C	0.00249	0.000245	0.002244	0.002734



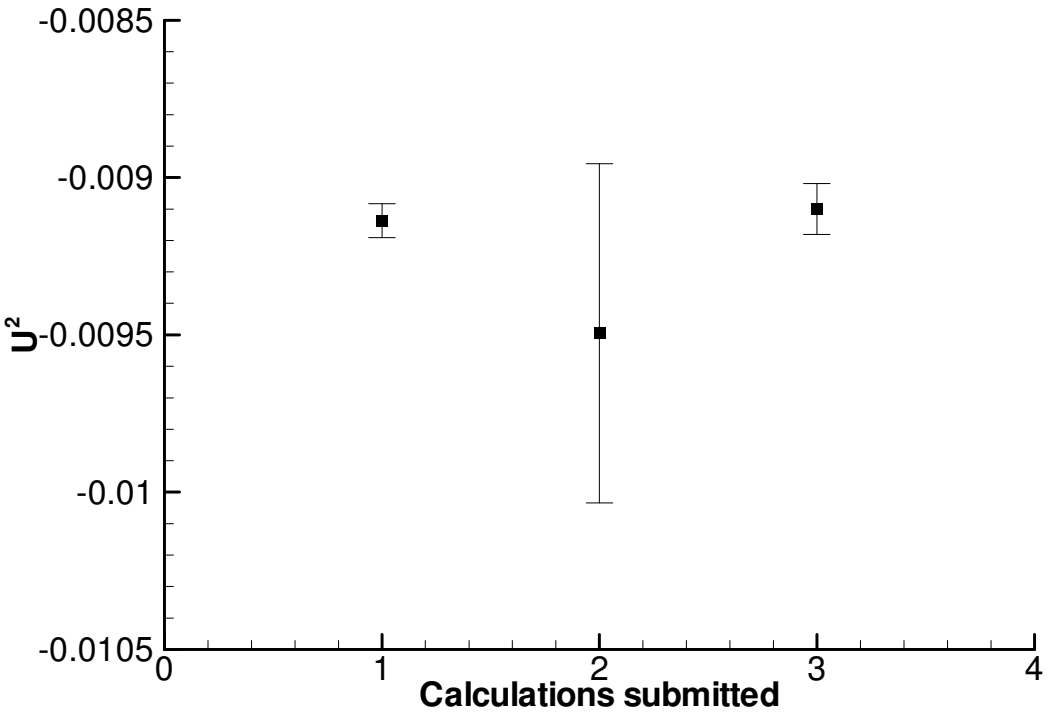
U^1 velocity component at ***x=4h, y=0.1h***

U^1		Grid	Set	U^1	U	U^1-U	U^1+U
1	IST/MARIN A	241x241	A	-0.1053	0.02510	-0.13041	-0.08021
2	IST/MARIN A	241x241	B	-0.0862	0.02307	-0.10925	-0.06311
3	IST/MARIN A	241x241	C	-0.1061	0.02848	-0.13459	-0.07764



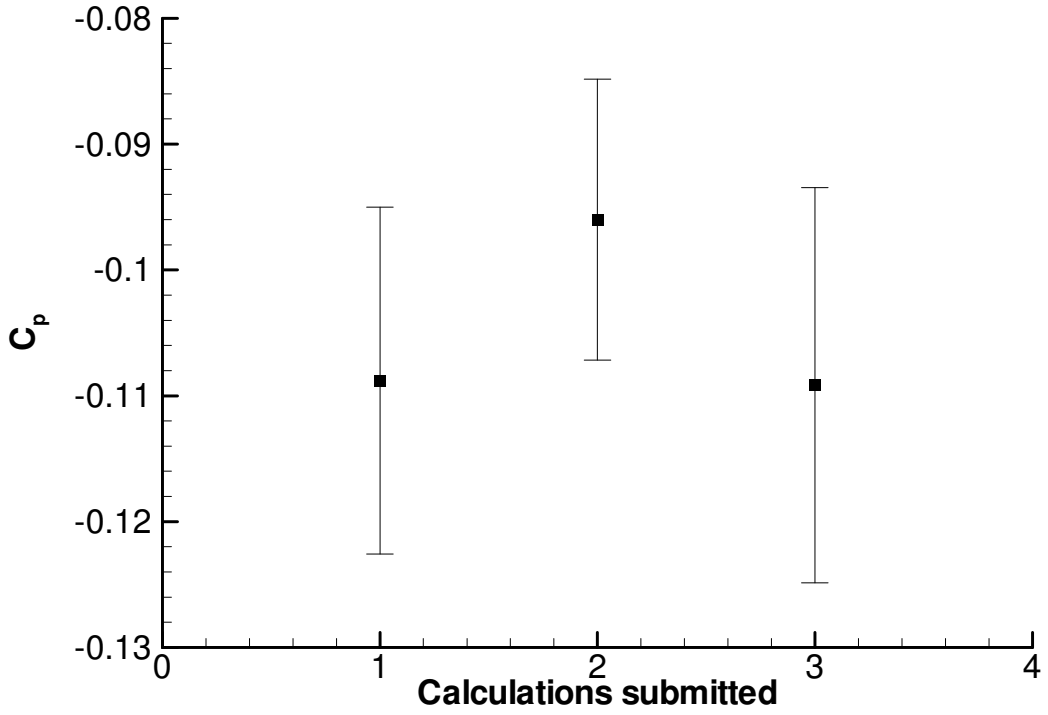
U^2 velocity component at ***x=4h, y=0.1h***

U^2		Grid	Set	U^2	U	U^2-U	U^2+U
1	IST/MARIN A	241x241	A	-0.0091	0.00005	-0.00919	-0.00908
2	IST/MARIN A	241x241	B	-0.0095	0.00054	-0.01003	-0.00896
3	IST/MARIN A	241x241	C	-0.0091	0.00008	-0.00918	-0.00902



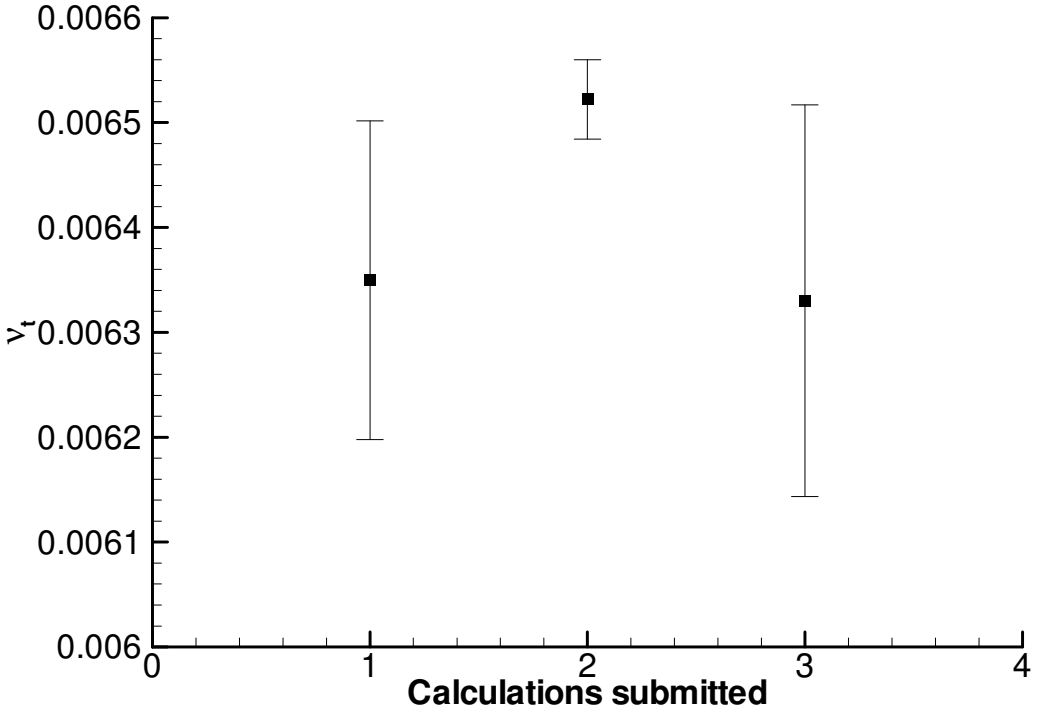
Cp at ***x=4h, y=0.1h***

C_p		Grid	Set	C_p	U	C_p -U	C_p+U
1	IST/MARIN A	241x241	A	-0.1088	0.01378	-0.12257	-0.09501
2	IST/MARIN A	241x241	B	-0.0960	0.01116	-0.10717	-0.08485
3	IST/MARIN A	241x241	C	-0.1092	0.01569	-0.12485	-0.09347



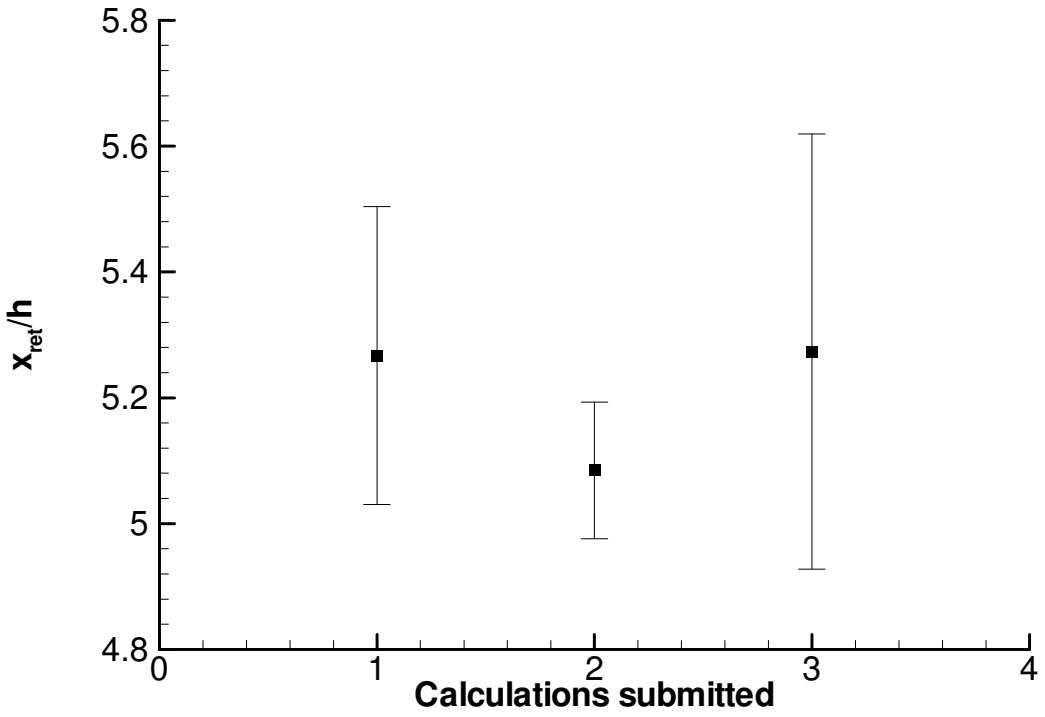
ν_t at ***x=4h, y=0.1h***

ν_t		Grid	Set	ν_t	U	ν_t -U	ν_t +U
1	IST/MARIN A	241x241	A	0.00635	0.000152	0.006198	0.006502
2	IST/MARIN A	241x241	B	0.00652	0.000038	0.006484	0.006560
3	IST/MARIN A	241x241	C	0.00633	0.000187	0.006143	0.006517



Re-attachment point

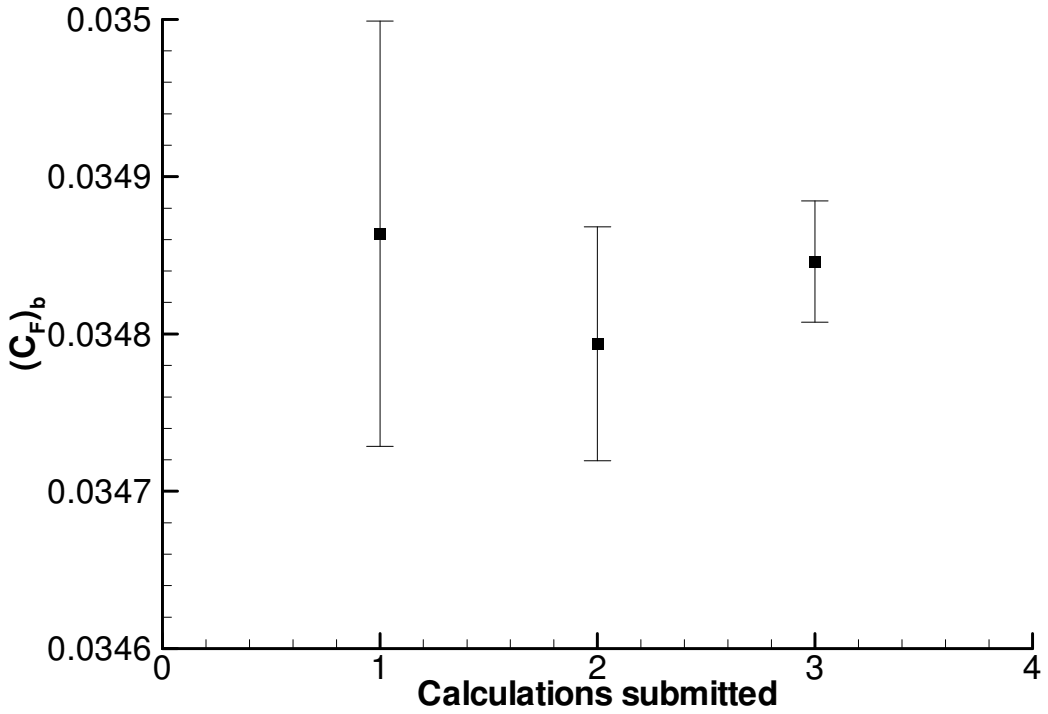
x_{ret}		Grid	Set	x_{ret}	U	x_{ret}-U	x_{ret} +U
1	IST/MARIN A	241x241	A	5.267	0.2368	5.0301	5.5037
2	IST/MARIN A	241x241	B	5.084	0.1086	4.9759	5.1930
3	IST/MARIN A	241x241	C	5.273	0.3459	4.9274	5.6193



Integral flow quantities:

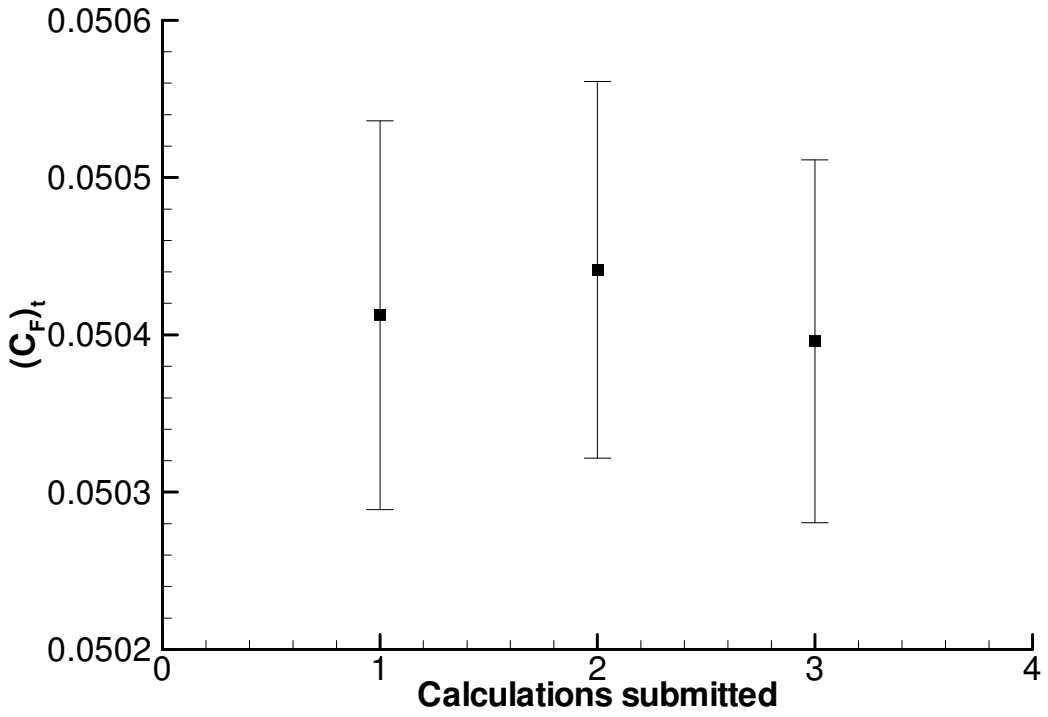
Friction resistance of the bottom wall

$(C_F)_b$		Grid	Set	$(C_F)_b$	U	$(C_F)_b$ -U	$(C_F)_b$ +U
1	IST/MARIN A	241x241	A	0.0349	0.00014	0.03473	0.03500
2	IST/MARIN A	241x241	B	0.0348	0.00007	0.03472	0.03487
3	IST/MARIN A	241x241	C	0.0348	0.00004	0.03481	0.03488



Friction resistance of the top wall

$(C_F)_t$		Grid	Set	$(C_F)_t$	U	$(C_F)_t$ -U	$(C_F)_t$ +U
1	IST/MARIN A	241x241	A	0.0504	0.00012	0.05029	0.05054
2	IST/MARIN A	241x241	B	0.0504	0.00012	0.05032	0.05056
3	IST/MARIN A	241x241	C	0.0504	0.00012	0.05028	0.05051



Pressure resistance of the bottom wall

$(C_P)_b$		Grid	Set	$(C_P)_b$	U	$(C_P)_b$ -U	$(C_P)_b$ +U
1	IST/MARIN A	241x241	A	0.1003	0.00016	0.10013	0.10045
2	IST/MARIN A	241x241	B	0.1019	0.00069	0.10121	0.10259
3	IST/MARIN A	241x241	C	0.0999	0.00060	0.09934	0.10054