Numerical Modeling of Oil/Gas Flow in the Pipes in Deep Sea

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NDDC
Niger Delta Development Commission
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1. Motivation

- The activities involved in oil and gas exploration and delivery are centred around pipes for the flow of oil/gas.
- Different types and sizes of pipes are used, like the drill pipes, risers and the horizontal pipes. The dimensions could be 30" (76cm) or more as they are large capacity pipelines.
- The earliest known oil wells were drilled in China in 347 AD or earlier. They had depths of up to about 800 feet (240 m) and were drilled using bits attached to bamboo poles.
- The history of oil exploration dates to 1891 when the first oil well was drilled at Grand Lake St Mary's, Ohio.
- The Arctic Sea is one of the world's largest remaining areas where oil and gas are accessible.
- The planet's undiscovered natural gas reserves is up to 30%, and the Arctic Sea has 13% of it (USGS).
- Most of the reserves are projected to be in less than 500 metres of water - roughly a third of a mile deep. Up to 160 billion barrels of oil could lay undiscovered beneath the Arctic - compared to 90 billion barrels previously estimated in the region.
- The US estimates the world uses around 30 billion barrels of oil a year.
- The oil and gas sector is very depended upon globally and the US confirmed to use about 60% on it, despite other sources.

2. Objectives

- To develop a model for pipes used in oil/gas industry,
- To develop a model to visualise the flow of oil/gas in pipes in deep sea,
- To optimize the pipeline layouts and pumping systems.

Flow domain inlet

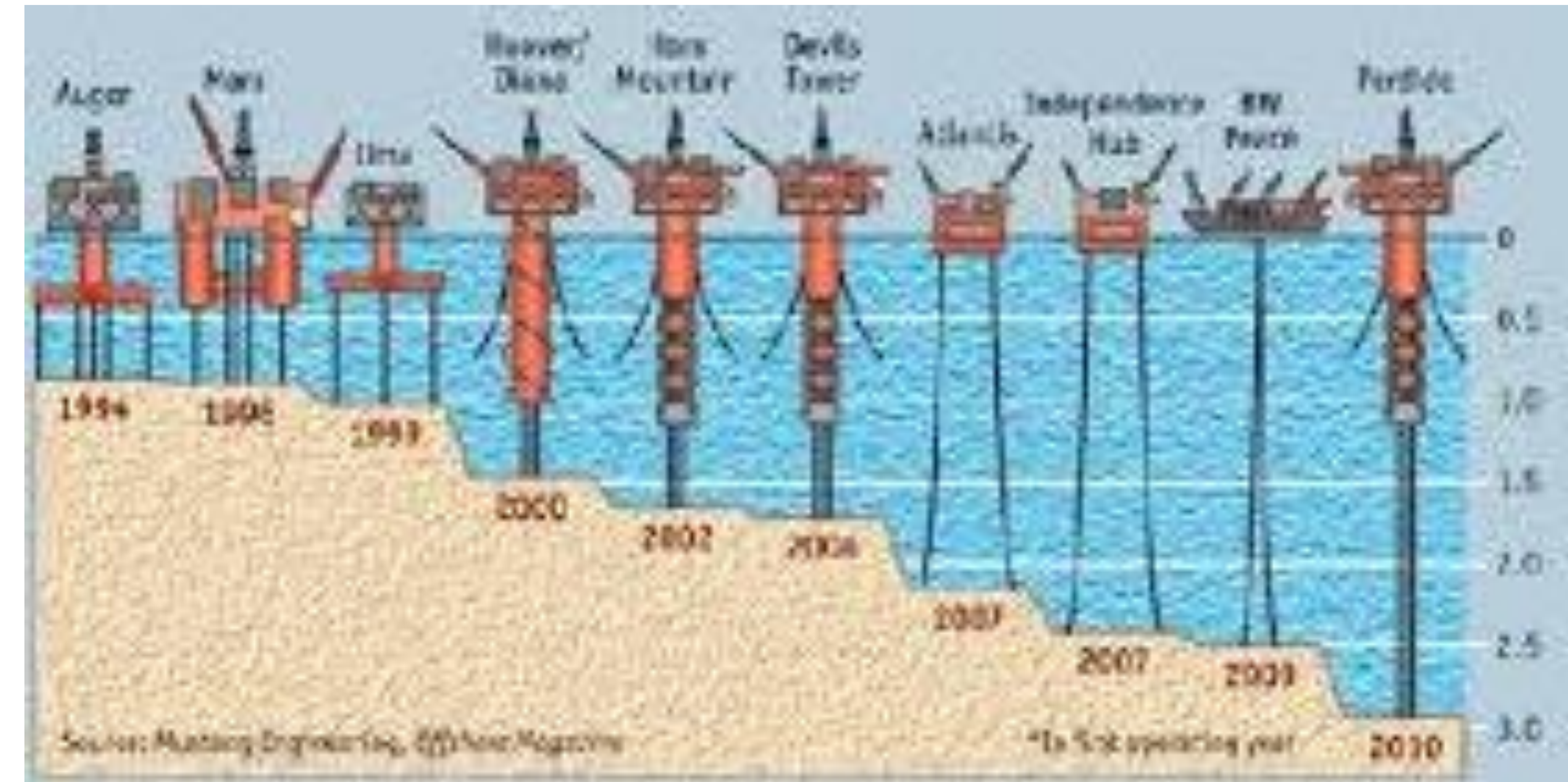Pipe Structure domain
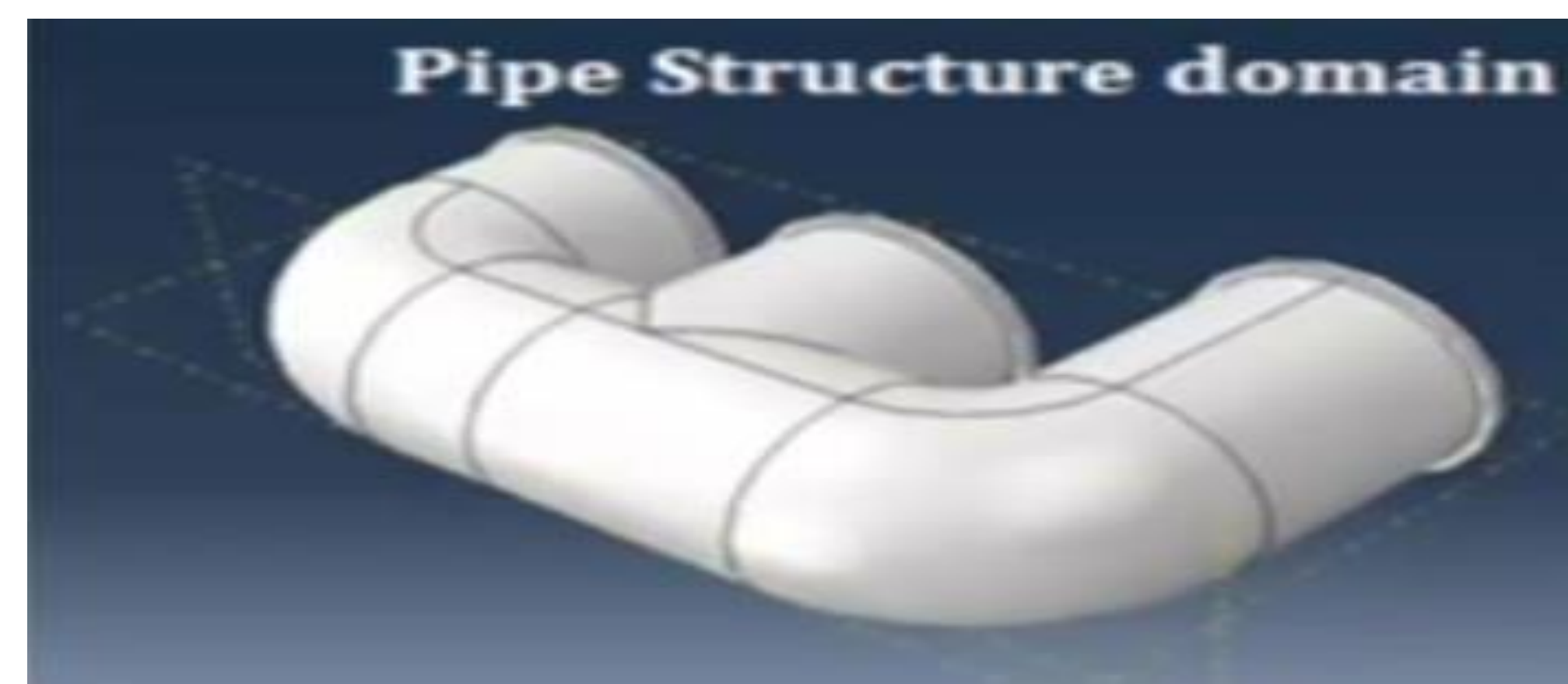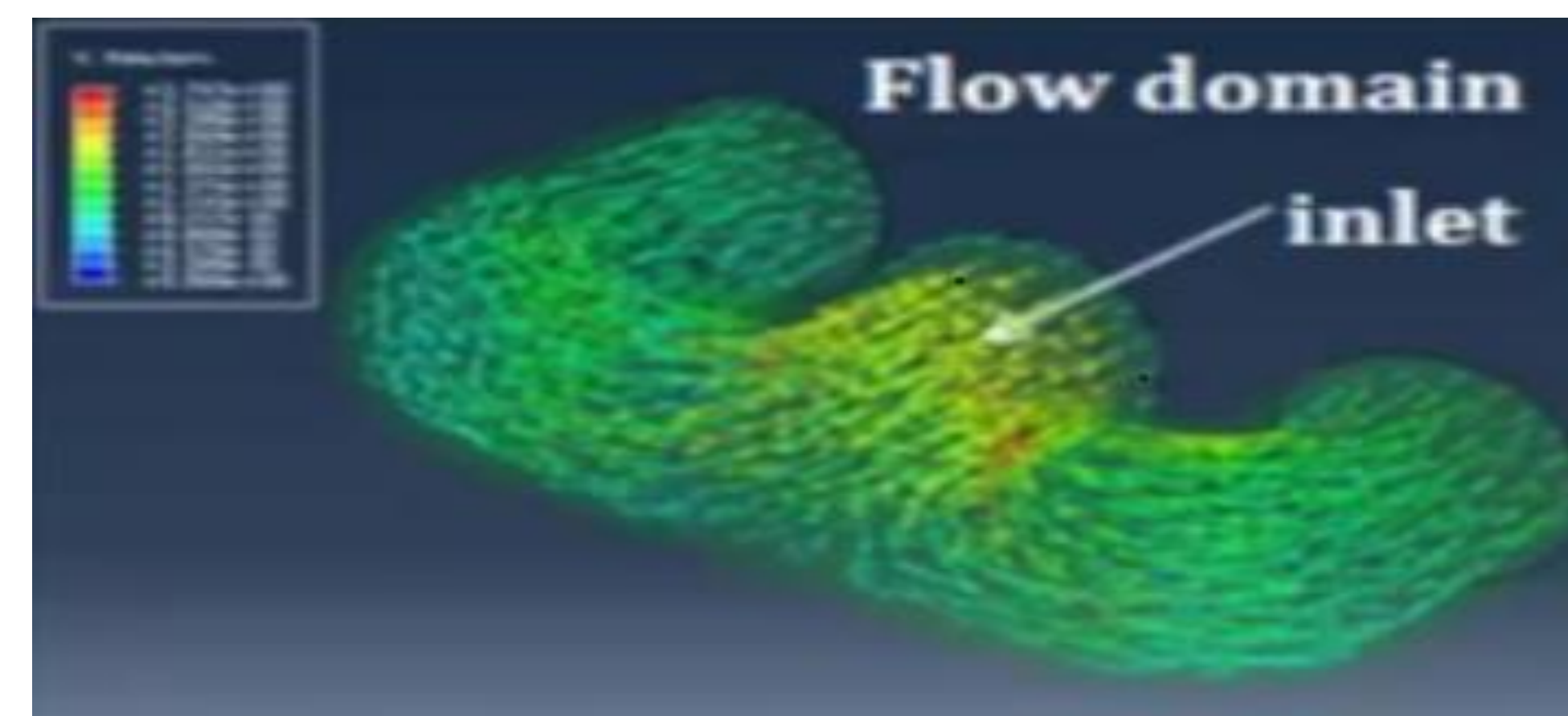
4. Basis of the flow

- Continuity Equation
- Conservation of Energy
- Navier Stokes Equation
- The Boundary Condition are then applied using ABAQUS.

$$\frac{\partial \vec{v}}{\partial t} + \vec{v} \cdot \nabla \vec{v} = -\frac{1}{\rho_0}\nabla p + \nu \nabla^2 \vec{v} + \frac{\rho}{\rho_0}\vec{g} - 2(\vec{\Omega}\times\vec{v}) + \frac{1}{c\rho_0}\vec{j}\times\vec{B}$$

The movement of fluid depends upon:
pressure — viscosity — gravity — rotation — magnetic term (associated with the Lorentz Force)

3. Oil /Gas Flow in Pipes

5. References

- Ake, R. (2014). Paraffin deposition under two-phase gas-oil slug flow in horizontalpipes. The University of Tulsa, ProQuest Dissertations Publishing.
- Azar, J. (2006). Drilling Problems and Solutions. In R. F. Larry W. L., *Petroleum Engineering Handbook; Volume II - Drilling Engineering* (pp. 433-454). Texas: Society of Petroleum Engineers.
- Cowling, J. (2011). *Arctic oil exploration: Potential riches and problems*. Retrieved from BBC: http://www.bbc.co.uk/news/business-14728856
- Kadafa, A. A. (2012). Oil Exploration and Spillage in the Niger Delta of Nigeria. *Civil and Environmental Research, Vol 2, No.3,*.

6. Acknowledgment

@ Christmas Poster Conference, 15 Dec. 2015

Faculty of Science & Technology
Christmas Conference
Imaging: from molecules to galaxies
Tuesday 15th December, 9am-4.30pm
Management School Hub

Time	Speaker	Title of Talk	Venue
9.10am	Professor Jamshed Anwar	Welcome	Lecture Theatre 1
9.15am	**Chair: Dr Alan Collins**	**Session One**	**Lecture Theatre 1**
9.15am	Professor Oleg Kolosov	Scanning probe microscopy - revealing hidden secrets of the nanoscale world	Lecture Theatre 1
9.40am	Dr Amanda Turner	From lichen to lightning - modelling and visualising random growth	Lecture Theatre 1
10.05am	Dr Lorna Ashton	Live cell Raman imaging	Lecture Theatre 1
10.30am	Tea, coffee and pastries		Hub Area
11.00am	**Chair: Dr Chris Edwards**	**PhD Talks** Short talks from 15 final year PhD students	**Lecture Theatre 1**
12.00pm	Lunch	Posters on display	Hub Area
1.15pm	**Chair: Dr Richard Haley**	**Session Two**	**Lecture Theatre 1**
1.15pm	Dr Francesca Citron	Neuroimaging evidence for a role of figurative expressions in conveying emotion	Lecture Theatre 1
1.40pm	Dr Farid Aiouache	Integrated approach for multiscale design strategy of reactor systems	Lecture Theatre 1
2.05pm	Dr Mike James	4D imaging of active volcanoes	Lecture Theatre 1
2.30pm	Dr Anastasios Noulas	Computational cartography and the digital heartbeat of our cities	Lecture Theatre 1
2.55pm	Mulled Wine and Mince Pies	Presentation of Dean's Award for Excellence in PhD Studies, poster prizes and PhD speaker prizes	Hub Area
3.20pm	**Professor Tim O'Brien**	**Guest Speaker: Imaging the invisible universe**	**Lecture Theatre 1**
4.20pm	Professor Peter Atkinson	Close	Lecture Theatre 1

FST Christmas Conference: Poster Competition 2015

Name	Department	Poster Title	Poster Layout	Number
Ahmed Alhussein	Psychology	The effect of printed word attributes on Arabic reading	Landscape	1
Ofogh Tizno	Physics	A quest to develop Universal Memory: the Holy Grail of memories	Landscape	2
Babalola Bolanle	Lancaster Environment Centre	Adsorption Studies on the Removal of Metal Ions from Aqueous Solutions Using Delonix regia	Landscape	3
Faye Williamson	Mathematics and Statistics	Clinical Trial Design for Rare Diseases using Bayesian Bandit Models	Landscape	4
Irina Tache	Psychology	Cross Cultural Deception Detection	Landscape	5
Hannah Wilson	Psychology	Do Dark Objects Make Lower or Louder Sounds?	Landscape	6
Charles Weir	SCC	Educating software engineers in security	Landscape	7
Kay Rawlins	Psychology	Effects of dyslexia on problem solving: Strategies and interventions for syllogistic reasoning	Landscape	8
Zainelabideen Al-Milli	Physics	Functionalization mediated heat transport in graphene nanoflakes	Landscape	9
Peiwen Yeh	Psychology	Emotion perception from body expression and voice in 6.5-month infants	Landscape	10
Joseph Lindley	Computing and Communications	Game of Drones	Landscape	11
Maria Crespo Llado	Psychology	Infants' neural responses towards other baby's cry and laughter: Are they all the same?	Landscape	12
Charles Gell	Chemistry	Investigations into the Synthesis of Rotaxanes as Receptors for Polyatomic Guests	Landscape	13
John Shaw	Psychology	The Impact of Culture on Binding Memory	Landscape	14
Maxime Lucas	Physics	Living systems and chronotaxicity	Landscape	15
Anita Crompton	Engineering	Long range detection of alpha-induced air fluorescence	Landscape	16
Paul Sharkey	Mathematics and Statistics	Modelling North Atlantic Cyclone Tracks	Landscape	17
James Brand	Psychology	Predictors of lexical stability in an artificially learnt language	Landscape	18
Alan Harding	Engineering	Recovery of PGMs from spent fuel cells	Landscape	19
Emma Stubington	Mathematics and Statistics	Supporting the design of Radiotherapy Treatment Planning	Landscape	20
Christopher Woodhead	Physics	The challenges of single photon extraction	Landscape	21
Han Ke	Psychology	The Development of the Neural Correlates of Body Schema Processing During Childhood	Landscape	22
Oday Al-Owaedi	Physics	Towards low-carbon emission molecular-scale computing	Landscape	23
Andrew Moore	Computing and Communications	Trust and influence in the financial world: a layered approach for text mining	Landscape	24
Marina Loucaides	Psychology	Understanding parental attitudes towards early screening for autism spectrum disorders	Landscape	25
Amaechi Chiemela Victor	Engineering	Using The Fluid-Structure Interaction Model Of Abaqus To Analyse The Flow Of Oil/Gas In The Pipes In Deep Sea	Landscape	26
Matthew Ludkin	Mathematics and Statistics	Community detection in temporal networks	Landscape	27
Adam Lister	Physics	Neutrinos at LArTPCs	Portrait	28
Ann Kretzschmar	Lancaster Environment Centre	Reversing hydrology: extracting the signal from the noise	Portrait	29
Aiyeshah Alhodaib	Physics	Growth and Characterisation of Site-controlled InAsSb Nanowires on Silicon for Photonic Devices	Portrait	30
Chloe Newbury	Psychology	How does sleep and emotion influence false memory formation?	Portrait	31
Alex Jones	Physics	Superconducting Electron Pumps for Quantum Metrology	Portrait	32
Khalid Ali Ismael	Physics	Increasing the Thermopower of Crown-Ether-Bridged Anthraquinones	Portrait	33
Daniel Britton	Chemistry	Controlled Ring-opening Polymerisation of Cyclic Esters	Portrait	34
Dave Shaw	Physics	Neutrinos : Nature's Ghosts	Portrait	35
Hannah Laurens	Physics	Mapping Substorm Time Convection	Portrait	36
Gary Linnett	Engineering	The Micro-Optical Ring Electrode: A Sensor for Multiple Actinide Ions Monitoring	Portrait	37
Hayfaa Alradhi	Physics	Realization of InAs/AlSb core-shell NWs grown by MBE	Portrait	38
James Keen	Physics	Enhanced Photonic Devices By Surface Patterning	Portrait	39
James Taylor	Chemistry	Chiral Nematic Polymer Films	Portrait	40
Jonathan Doyle	Physics	Plasma Flow During Magnetospheric Substorms	Portrait	41
Michal Cieslak	Engineering	Critical Review of Coded-Aperture Imaging Systems	Portrait	42
Jonathan Roberts	Physics	Nano-identification: Fingerprints of the Future	Portrait	43
Laura Hanks	Physics	GaSb Devices: Old Technology, New Tricks	Portrait	44
Maria Crespo Llado	Psychology	Infants' mimicry of emotional facial expressions: imitation or interpretation?	Portrait	45
Nasser Almutlaq	Physics	Towards exohedral-fullerene-based bi-thermoelectricity	Portrait	46
Nilla Karlsen-Davies	Engineering	Regenerative Liquid Ring Pump Research	Portrait	47
Aleksandra Pidde	Physics	Dynamics of membrane potential oscillations.	Portrait	48
Robert Waring	Engineering	A Fast Model for a 1-D Nonlinear Beam-Wave Interaction for a 225 GHz TWT	Portrait	49
Rebecca Gray	Physics	Jupiter's Northern Lights Reveal Dynamics of Plasma Environment	Portrait	50
Simon Boothroyd	Chemistry	Why Do Some Molecules Form Solvates?	Portrait	51
Thomas Brindley	Engineering	Remote renewable energy generation utilising novel hydrokinetics	Portrait	52

Please vote for your top three posters!

- Pick up a voting card
- Browse the posters on display and speak with the presenter
- Note down you top three posters by adding the poster number to the voting card
- Drop your card into the voting box

Winners will be announced during the afternoon break!

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