Science & Technology Facilities Council
Central Laser Facility

Inertial Fusion Research in the CLF's Plasma Physics Group

March 2011 Update

A.P.L.Robinson

Hello

- Peter Norreys apologizes... presently in LLNL
- CLF PPG is involved in *Fast Ignition relevant* research through *two* routes.
- First is User Support Function
- Second is 'own' research programme

Who and What?

Prof.Peter Norreys

Robbie Scott

Dr. Kate Lancaster (ESG)

Fast e- Transport Experiments
e.g. Beam collimation
Absorption
Channel Boring

Dr.Raoul Trines

Channel Boring Theory and Simulation

Who and What (2) ?

Prof.Tony Bell (Oxford)

→ Fast Electron Transport
Shock Ignition
OSHUN code with
M.Tzoufras

Dr.Alex Robinson

→ Fast Electron Focusing
Schemes
e.g. “Magnetic Switchyard”

User Support

- We have provided collaborative support to a number of university groups
- This includes : QUB,York, Strathclyde
- “Support” includes:
  - Simulation and Interpretation of User Experiments.
  - Hosting PhD students for theory studies.
  - Providing computational resources.
  - Collaborative Theory Research

Examples of User Support

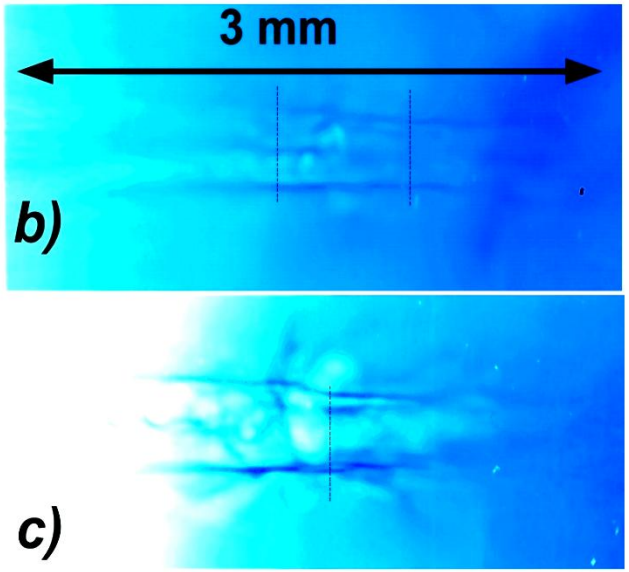
1. Direct Theoretical Support for publications, e.g. Kar et al., PRL 2009, Ramakrishna et al., PRL 2010 + Raoul's support of Channel Boring expt.
2. Hosting PhD Students – Ian Bush from York (recently published, see I.Bush PPCF 2010)
3. Computational Resources – QUB and Strathclyde have had access to SCARF resources
4. Theoretical Collaboration – Joint theory papers with QUB and Imperial, e.g. Robinson et al. NJP 2008

Channel Boring (1) – R.Trines

- HiPER experiment performed on VULCAN
- Relevant to original (pre-cone) FI concept
- Results published by QUB PhD student (G.Sarri PoP **17** 113303 (2010))

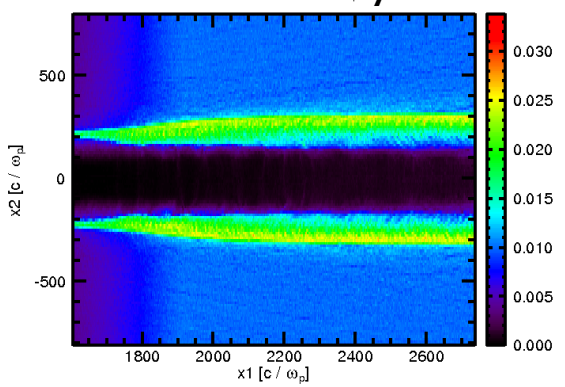
"A comparison with G. Sarri's experiment shows good agreement: bifurcation occurs at earlier times, is smoothed out later (pulse moves right to left here)"

Charge density

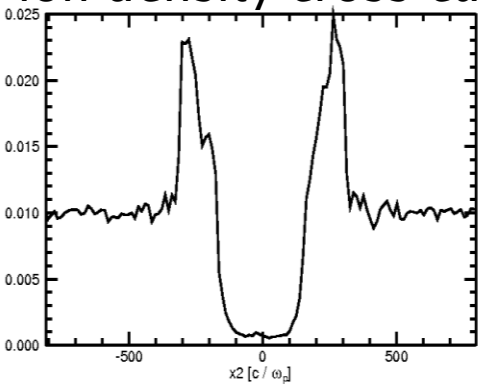


Channel Boring (2) – R.Trines

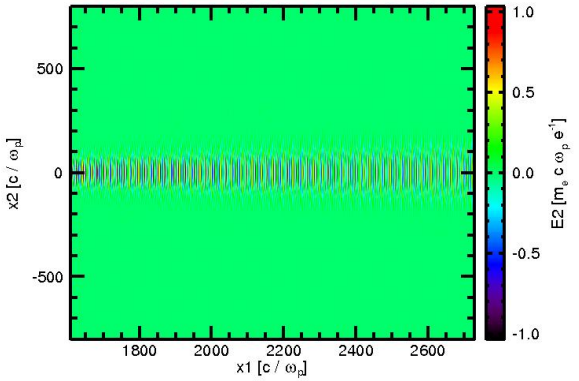
ion density

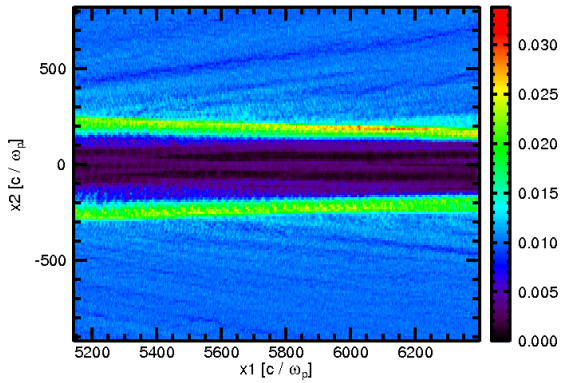


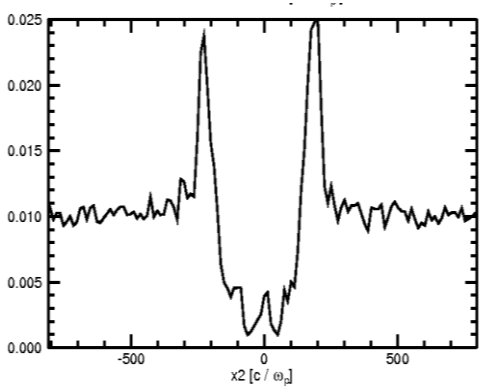
ion density cross-cut

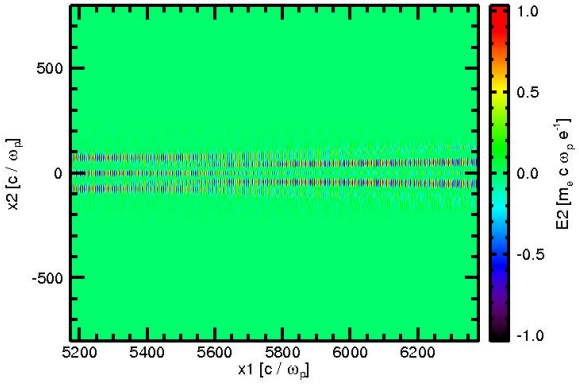


transverse E-field





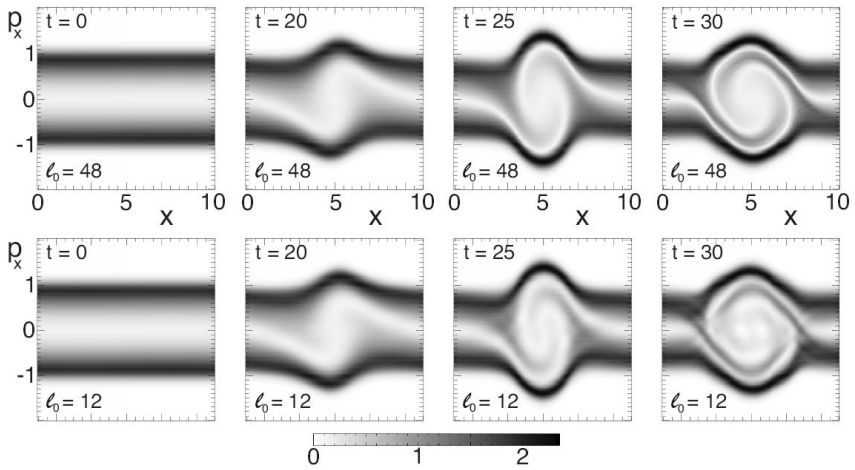


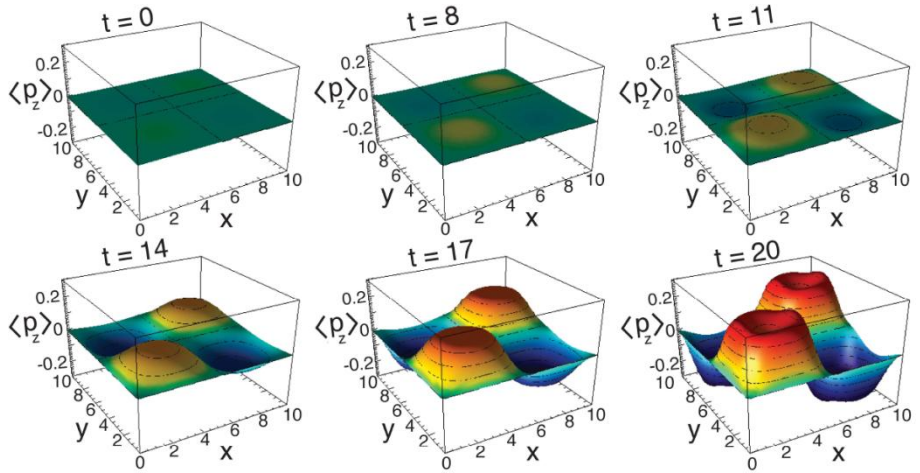


OSIRIS simulations done by R.Trines to support HiPER experiment

OSHUN – M.Tzoufras and T.Bell

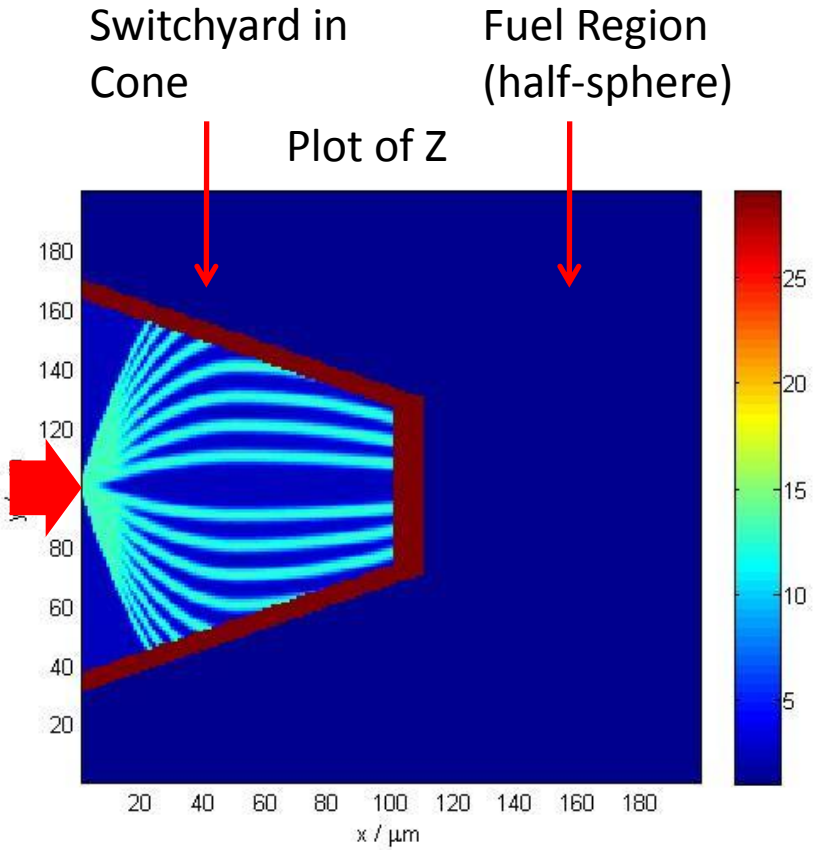
- New VFP code developed by M.Tzoufras during his time as Tony's HiPER PDRA
- Write up has been submitted to J.Comp.Phys.
- Michael now going to UCLA – plans to use OSHUN to look at electron smoothing in Shock Ignition, i.e. Is polar drive an option?

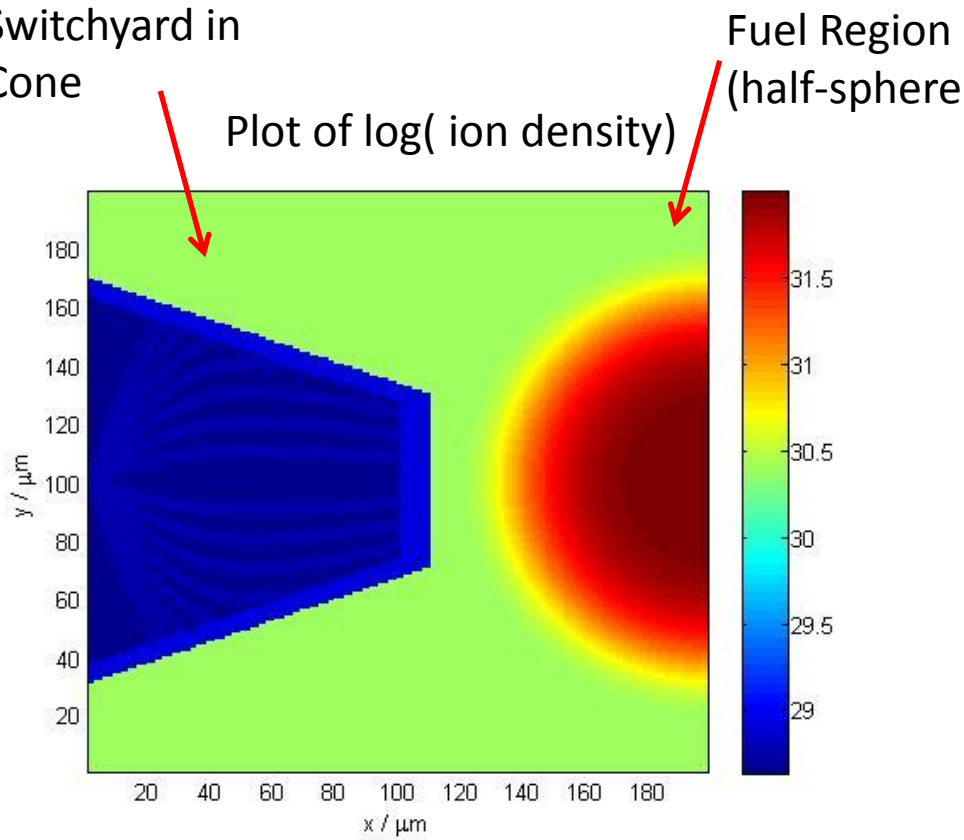




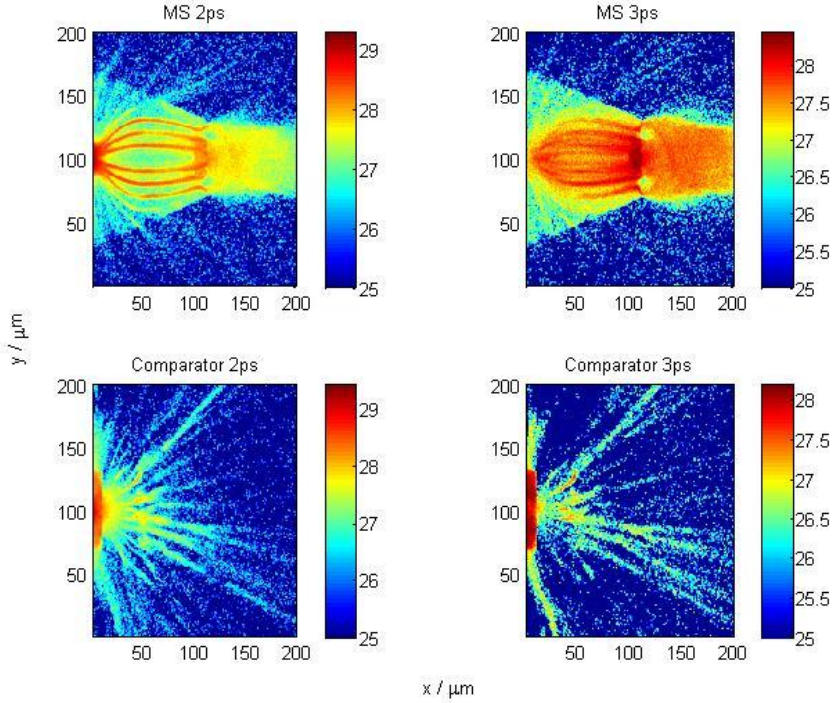
Magnetic Switchyard – A.Robinson

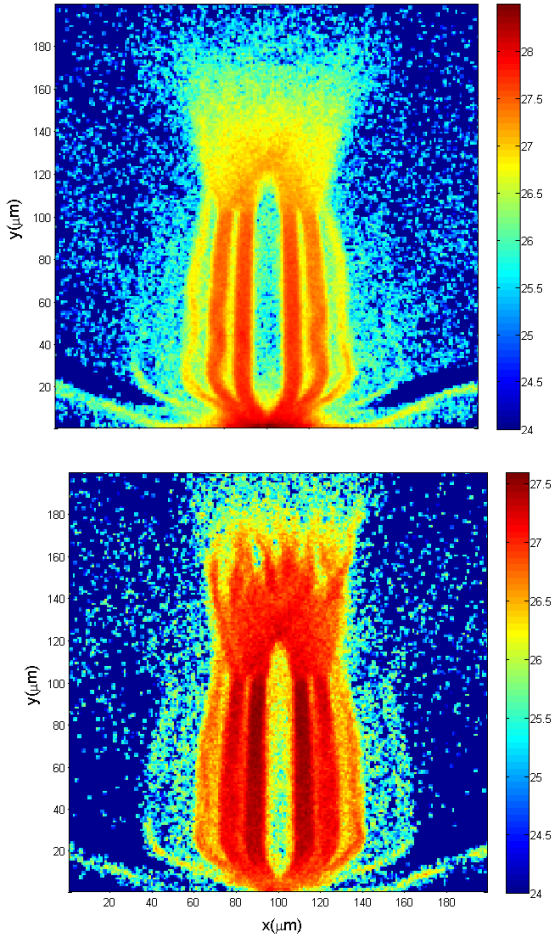
- Exploiting resistivity gradients to focus fast electrons from a highly divergent source.
- Follows on from Robinson & Sherlock PoP 2007





Magnetic Switchyard – A.Robinson (2)



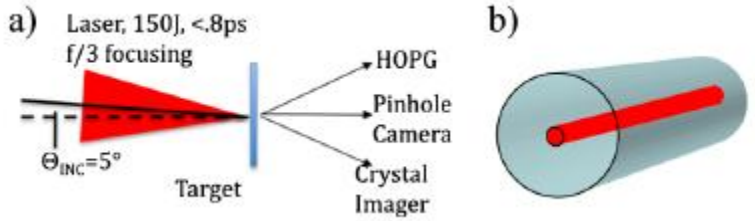


User Support

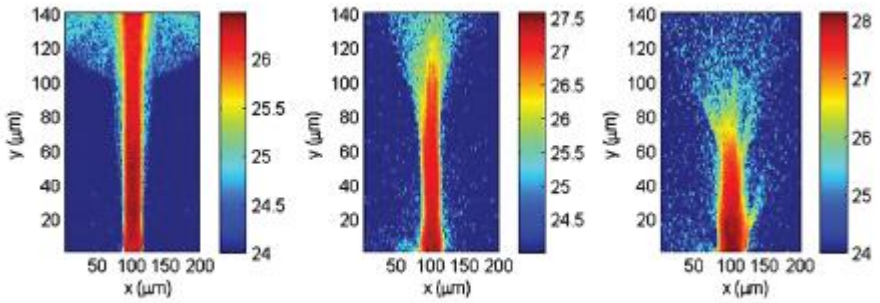
Laser-Driven Fast Electron Collimation in Targets with Resistivity Boundary

B. Ramakrishna,[1] S. Kar,[1] A. P. L. Robinson,[3] D. J. Adams,[1] K. Markey,[1] M. N. Quinn,[2] X. H. Yuan,[2] P. McKenna,[2] K. L. Lancaster,[3] J. S. Green,[3] R. H. H. Scott,[3,4] P. A. Norreys,[3] J. Schreiber,[4] and M. Zepf[1]

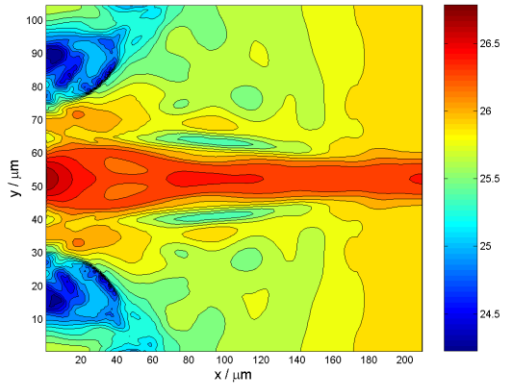
Experiment



Simulation Support



Followed from ...



Robinson & Sherlock
PoP 2007

Summary

- PPG has provided support to CLF user groups carrying out FI-relevant work.
- PPG carries out its own FI relevant work
- Number of areas are being looked at including
  - Channel boring (R.Trines)
  - Fast electron Guiding (A.Robinson)
  - Shock Ignition (T.Bell)
  - Experimental Studies (PAN, KLL, RS)