Damping Rings Studies at Daresbury

Vacuum design – wake fields – low emittance tuning

Andy Wolski

The Cockcroft Institute/University of Liverpool

Damping Rings WebEx

4 March 2009

The Cockcroft Institute
of Accelerator Science and Technology

UNIVERSITY OF LIVERPOOL

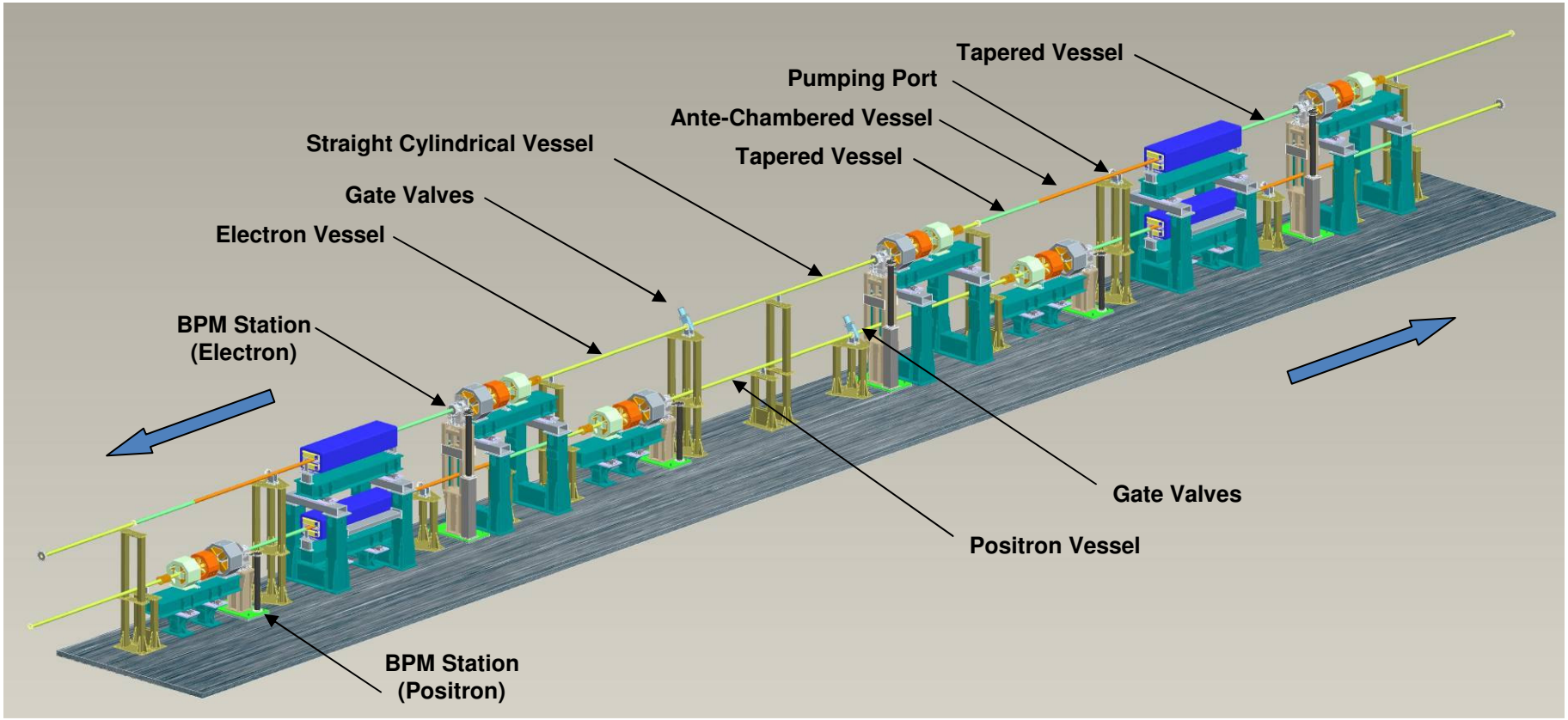
Personnel

Andy Wolski	U. Liverpool	0.2 FTE	Coordination and beam dynamics
Maxim Korostelev	U. Liverpool	1.0 FTE	Lattice design and impedance modelling
Kosmas Panagiotidis	U. Liverpool	PGR Student	Low-emittance tuning
James Jones	STFC/ASTeC	0.2 FTE	Low-emittance tuning
Oleg Malyshev	STFC/ASTeC	0.1 FTE	Vacuum design
Norbert Collomb	STFC/Technology	0.1 FTE	Vacuum design
John Lucas	STFC/Technology	0.9 FTE	Vacuum design

Total: 2.5 FTE + 1 PGR Student

Vacuum design

Goal: to design and cost vacuum system and vacuum/bpm/magnet supports.



Design and costing for the arc cells will be complete by end of April.

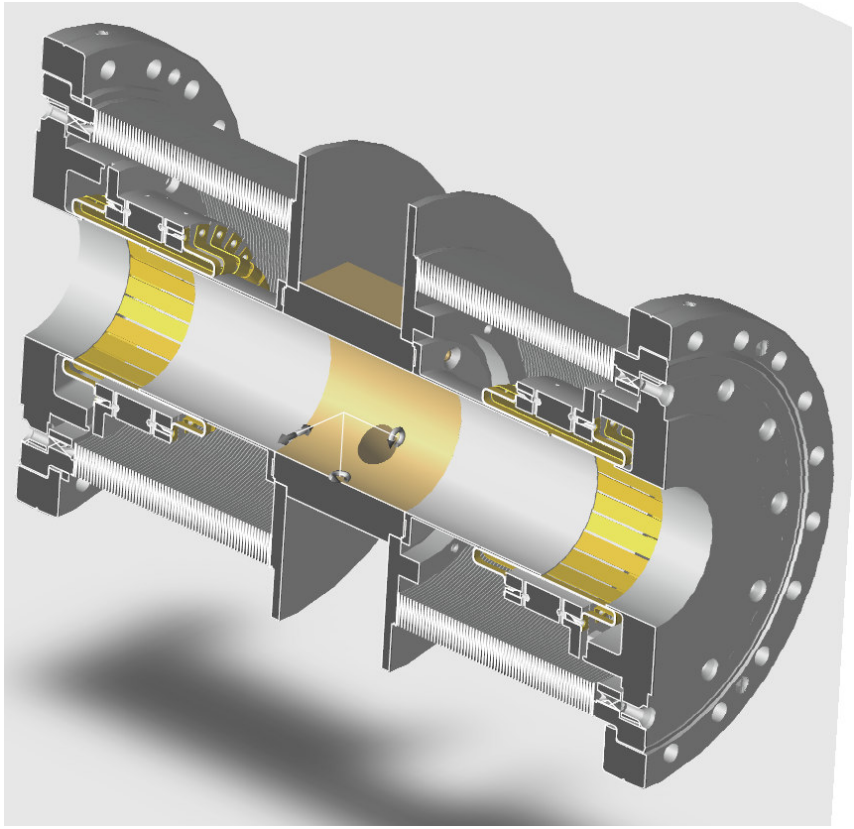
Work will then begin on the straight sections.

Vacuum design

Design work includes components expected to make dominant contributions to the machine impedance, e.g. bpms and bellows.

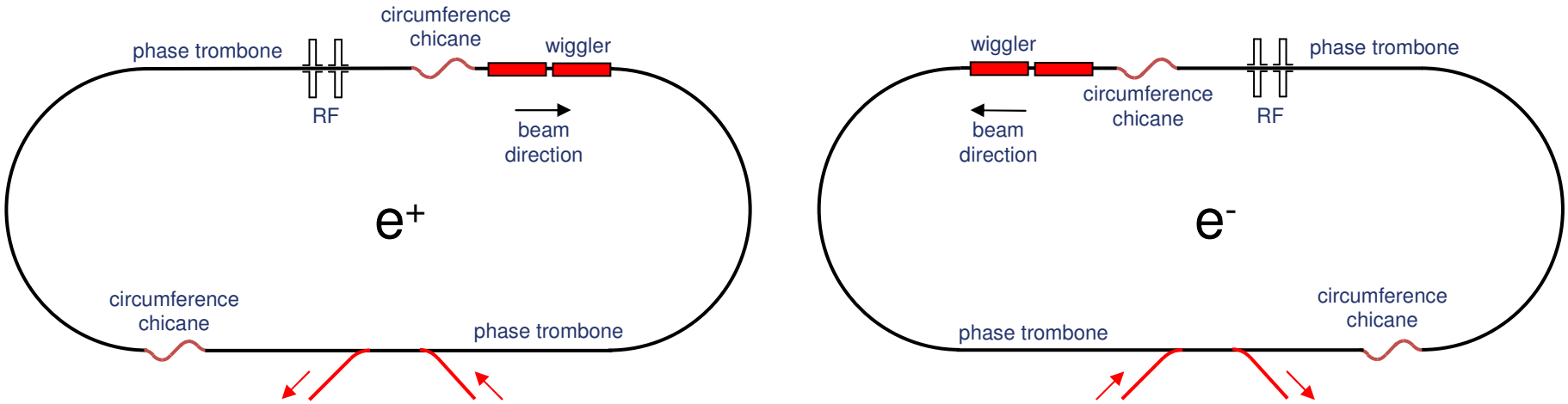
Studies in 2008 raised concerns about the impedance from the bellows.

A new bellows design with improved rf shielding, based on a design from INFN-LNF, has been implemented in the model, and is now being studied.



Thanks to:
Fabio Marcellini,
Giancarlo Sensolini
(INFN-LNF).

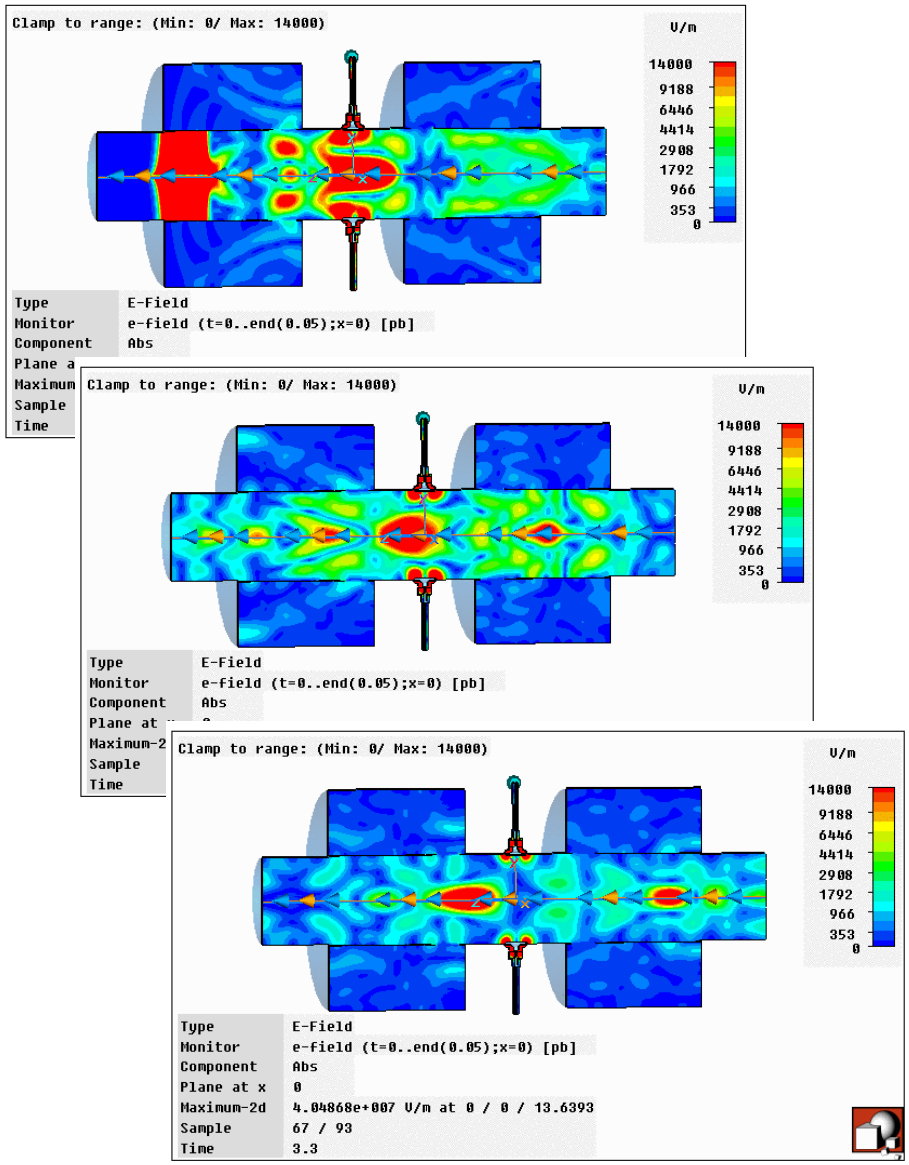
Lattice design



Modifications have been made to the straight sections, so that injection and extraction are now in a single straight in each ring.

Beams circulate in opposite directions in the two rings.

Wake field modelling



Initial impedance computation was done using HFSS.

Experience showed that it was difficult to obtain reliable results in the high frequency regime required to generate the wake function.

We are now starting to use Microwave Studio: experience so far is more positive than with HFSS for the parameter regime of interest.

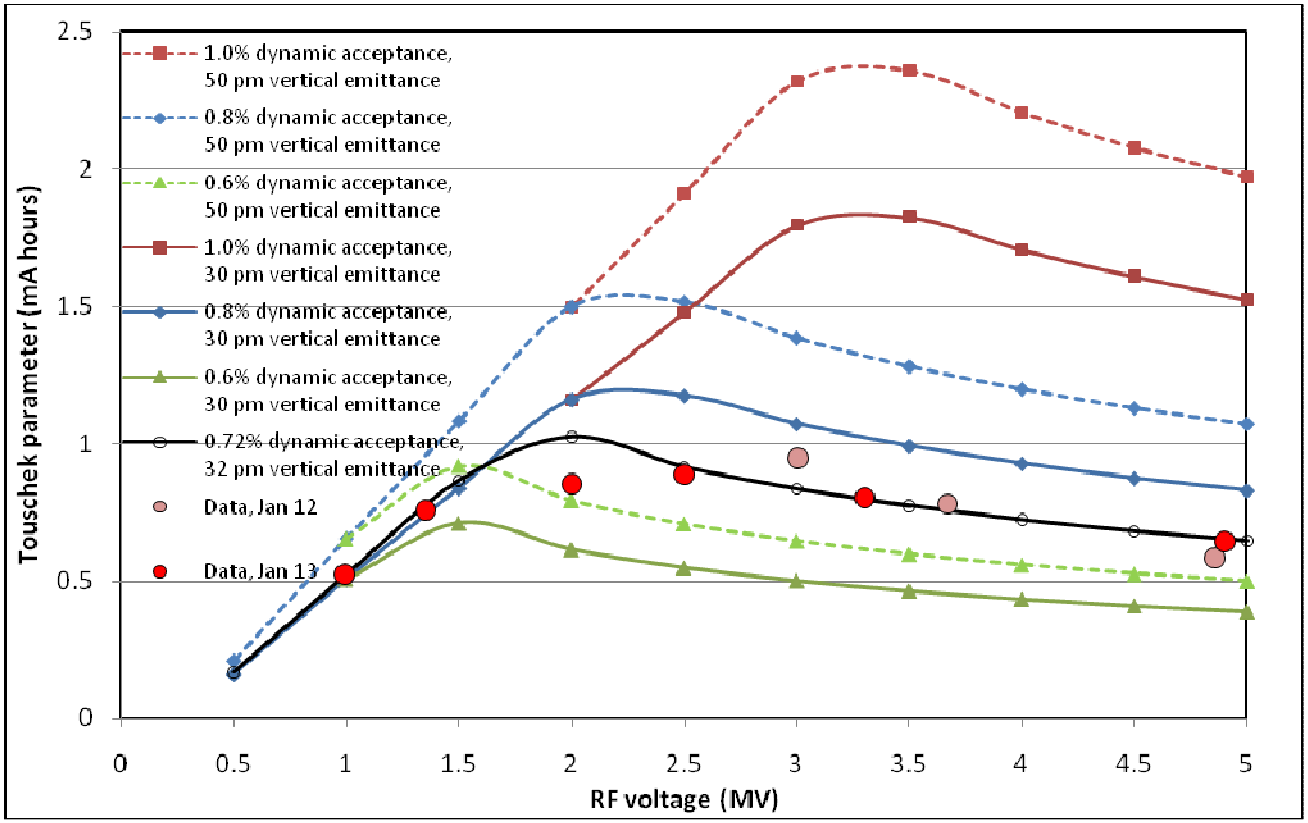
Goal: to develop an impedance model as vacuum designs become available, and evaluate beam stability. Work will proceed through the Technical Design Phase.

Low-emittance tuning: CesrTA

We participated in the CesrTA run in January 2009:

- investigated use of dispersion bumps for tuning;
- made initial estimates of vertical emittance using beam lifetime measurements.

We hope to continue our participation, in future runs.



Low-emittance tuning: ATF

- A vertical emittance of around 4 pm was achieved in 2004.
- Recently, the vertical emittance has been in the range 20 – 30 pm, despite some realignment and repeated tuning attempts.
- A renewed effort is underway, with a plan based on systematic application of:
  - correction of beta-beat;
  - beam-based alignment;
  - orbit and dispersion correction;
  - ORM (orbit response matrix) and other techniques for determining optimum skew quadrupole settings.
- Recent simulation studies (by Kosmas Panagiotidis) indicate that effective coupling correction should be possible based on ORM measurements using only the orbit correctors in the arcs.
  - This should halve the time taken for data collection (previously between two and four hours).

Summary: Future Goals

Produce cost estimate for vacuum system and magnet supports in damping rings arc cell	John Lucas	end of April 2009
Confirm lattice design for modified straight sections	Maxim Korostelev	mid March 2009
Proceed with technical design for vacuum system in straight sections	Oleg Malyshev, John Lucas, Norbert Collomb	April 2009 – December 2009
Continue to develop impedance model for damping rings vacuum system	Maxim Korostelev	through TDP
Continue contribution to low-emittance tuning studies at CesrTA	James Jones, Andy Wolski	through CesrTA program
Continue contribution to low-emittance tuning studies at KEK-ATF	Kosmas Panagiotidis, Andy Wolski	through ATF/ATF2 program