FETS Meeting Minutes
15 October 2014, RHUL Physics Dept, T125

Present: Saad Alsari, Mortezza Aslaninejad, Gary Boorman, Alessio Bosco, Mike Clarke-Gayther, Stephen Gibson, Konstantin Kruchinin, Ajit Kurip, Scott Lawrie, Jürgen Pozimski, Pete Savage, Jordan Taylor.

Apologies: John Back, Mike Dudman, Dan Faircloth, Simon Jolly, Alan Letchford.

http://fets.isis.rl.ac.uk/Meetings/2014_October15

1. **Administration**

1.1. Finances

Spend is currently on target, please inform Jürgen of any outstanding items / additional spend before the November FETS meeting.

1.2. Status of proposal for FETS extension

Proposal draft to be circulated within EB by next Friday, 24th October.
Plan to submit proposal to STFC on Monday 27th October.
Next Oversight Committee meeting: 27th November 2014.
Action: EB members to send Jürgen documentation for proposal by Monday 20th October.

1.3. Proton Accelerator Alliance

Trips planned

- ESS Lund planned on Friday 17th October: Jürgen / Alan.
- CERN: Rhodri Jones, CERN Beam Instrumentation, to visit UK & meet at RHUL, dates to be confirmed. Topics for discussion to include potential for laserwire longitudinal emittance measurements at 160 MeV for Linac4. Use of femtosecond pulsed laser with sub-ns detector.
- FNAL trip organised by Jürgen / Alan.

1.4. FETS Schedule – Stephen Gibson

R8 installation schedule:

- Construction of shielding wall began on Monday 13th October and has progressed very well. North Wall now built, East Wall to be completed by this Friday.
- Key decisions on alternative cable routing via top of wall made last month with provisional RPA approval, will enable progression with South Wall without the need to cut cable trenches.

Action: Mike / Pete to meet Paul Wright for final RPA approval of routing before starting South Wall build.

- *Imminent issue:* need to decide and arrange installation of essential infrastructure with ESO (especially, lighting / false floor) so that installation can occur in late November / December, before the beamline is needed for RFQ test from January.
- Interlocks can be installed later, before beam.

Action: Mike / Pete to investigate installation with ESO.

Development schedule:

- RFQ section 1 inspected and returned to NAB for re-machining as planned. RFQ section 2 arrived at RAL two weeks ago, but so far has not been inspected. Dave Wilsher says he cannot start the RFQ 2 inspection until at least 3 November, due to an external job from ElementSix. This creates a 5 week delay for FETS ...
  - Suggest to use time for RFQ off-axis bead pull test of section 2 and check of tuners.
  - Recovery plan: Pending successful verification of NAB survey with RAL detailed inspection of RFQ section 2, a quicker inspection at RAL on sections 3 and 4 may suffice, once we have confidence in the NAB surveys.

Action: Document procedure for rapid RFQ inspection (see item 3 below).

2. Ion Source and LEBT

2.1. First VESPA Beam Results – Scott Lawrie

Presented talk given at NIBS'14, Garching, Germany.

- ISIS Penning Ion Source: Suspect 30-50% of beam being lost in first bending magnet, from simulations, work at Los Alamos & impact of heat load on magnet. Mike C-G enquired on the developments of V. Dudnikov since 1980's? Nowadays, 300mA / 25mA CW operation possible? VEPSA starts from known design.
- New **V**essel for **E**xtraction and **S**ource **P**lasma **A**nalysis: Geometry with 12 deg source tilt and ~0.25T field, horizontal extraction. Einzel lens focuses divergent extracted beam, with close proximity to reduces beam loss. Geometry allows optical diagnostics via direct view of plasma.
- Presented particle tracking simulations and overview of test bed hardware. Stable high current pulsed arc achieved. HV conditions to 35kV & beam produced. So far achieved 60 mA of H- beam direct extraction from source. The beam loss (100mA was expected) may be due to high gas pressure leading to H- stripping.
- Measured emittance of sig_x 0.35 pi mm mrad, sig_y 0.28 pi mm mrad. Fibre coupled emission spectroscopy: low res (0.5nm) shows Halpha, Cs0 (and Hbeta, Cs+) and change in relative ratios of emission.

3. RFQ

3.1. Engineering update – Pete Savage

- Please see detailed engineering progress report added to FETS Meetings TWiki.
- Await ok from Dave Wilsher on section 2 inspection to check survey at manufacturer, NAB. (see item 1.4, under development schedule)

Action: Pete to investigate use of simple jigs to verify manufactured shape of RFQ, without need for detailed inspection by Dave.

- Delay in RFQ inspection, offers opportunity to make bead pull test of section 2, to check tuning procedure. Pete queried how to improve the low power couplers? Saad – need to reduce the diameter of couplers for a better fit (originals were for RFQ Cold Model, which had larger diameter ports).

Action: Saad / Pete to develop coupler modifications, produce drawings using coupler from RFQ cold model (return to RHUL next Tuesday).

- Need to schedule the order of forthcoming manufacture items. David Zakhar support need to balance workload and sequence of tasks.
- *Full power Klystron test*: Bob Greenaway will forklift second dummyload into place, while support legs are installed. Also install H-plane mitre. Waveguide run may happen (after shielding is installed) in the week of starting 20th October.

3.2. RFQ Tuning – Alan Letchford

Please see slides added to TWiki, post-meeting.

4. MEBT

4.1. Simulation of the FETS Beam Dump using MCNPX - Jordan Taylor, Rob Edgecok (Huddersfield)

- Geometry of beam dump updated after discussion with Alan.
- Jordan presented the production of photons, electrons and alpha particles and the flux of photons leaving the system as a function of energy.
- Shielding: composition from NIST assumed with density from Alan. (2.35). FETS shielding is a higher density concrete, without iron ore.

Action: Jordan to check with Pete for concrete composition.

- Concern: Q value: 11.85 -> Al27(p,g)Si28. 1.25MeV photon and high energy photons caused by photon de-excitation. Some 12MeV – 13 MeV photons escape from steel. Shielding reduced photons by factor 10^5. Assessment on going.

4.2. Engineering – Pete

- Vacuum manifold drawings completed by David Zakhar and will go out for manufacture next week.
- MEBT support frames drawing completed by Mike Pottle. Subsequent modifications to top rail to be included by David Zakhar.

4.3. Chopper – Mike Clarke-Gayther and Gary Boorman

- Discussed feedthroughs: Modelled capacitance and inductance in EM / CST Microwave Studio. Commercial feed-throughs purchased to check simulation.
- Models include complete electrode assembly. Work concentrating on 3D engineering drawings of the final structures of helical and planar design.
- Mike can make the models available to those interested.

- Gary and Mike have produced a list of tasks associated with the chopper electronics. They will define timescale for the tasks and if any other people need to be involved.

Action: Gary / Mike C-G to add timing for chopper tasks, ideally for inclusion in the schedule required for the FETS extension proposal: Stephen / Pete to meet on Tuesday 21st at RHUL.

- Timing synchronisation between RF and choppers:

Action: RF timing meeting proposed between Mike, Alan, Jürgen, Saad and Gary within next two weeks.

5. Beam Diagnostics

5.1. BPMs – Gary Boorman

- Presented BPM calibration and FPGA processing, details of wire rig. Linear region of almost +/- 5mm observed.
- Difference in sensitivity for each axis has been attributed to the metal frame of wire-rig causing a disturbance in the RF field seen by the BPM electrodes. The frame is now being replaced with a Perspex frame.
- Discussion on non-linearity for extended particle beam. Mike suggest to model with EM studio, with specific reference to how linearity changes with capacitance of source – effectively the beam radius. Also check the absolute sensitivity from the beam.

Action: Gary to discuss modelling of non-linearity with Alan.

- Processing time now reduced to 1.3 us. Offers excellent temporal resolution of rising edge of the 2ms beam pulse if required
- Presentation of data: Scott suggested cross hairs with display of beam position would be useful.
- CERN BPM to be installed alongside button BPMs for comparison. CERN BPM calibrated already at CERN.

5.2. Laser diagnostics

Brief update: Laserwire tests with Linac4 12 MeV beam to resume at CERN, trip expected in November.

6. AOB

None.

Next meetings: 12th November at RAL
17th December at RAL