

ATF2 Laserwire update Oct – Dec 2011

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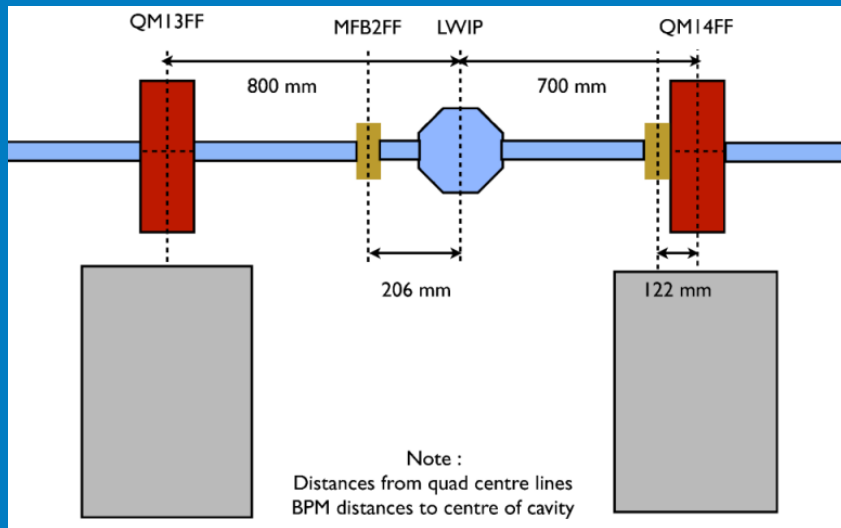


Outline

- New laserwire commissioning
- Autumn shift reports
- Future plans



New laserwire experiment

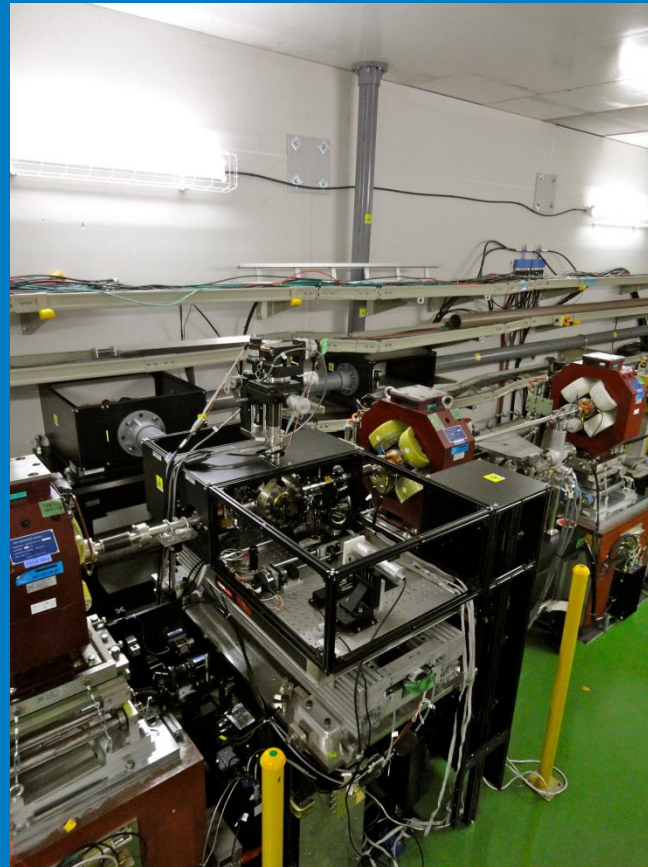


- Pre running visit October 2011.
- Laserwire experiment moved from previous position.
- Essentially new experimental set up.
- Lots of commissioning work.

- New position between QM14FF and QM13FF.
- Just upstream of MFB2FF – feedback bpm at IP vertical phase.
- Run under ATF2 optics and get vertical beam size of few μm – can test resolution properly.
- No special LW optics, run parasitically on normal operation – more data taking time.
- OTR also moved – independent check of beam size and test of OTR system.
- Large aspect ratio so need to use full overlap integral to extract beam size.

October commissioning

- Lots of hardware work – cables/screens/table levelling.
- Checking all movers etc. still worked.
- Check on laser operation after earthquake.
- Improvements to DAQ software and planning for data taking.

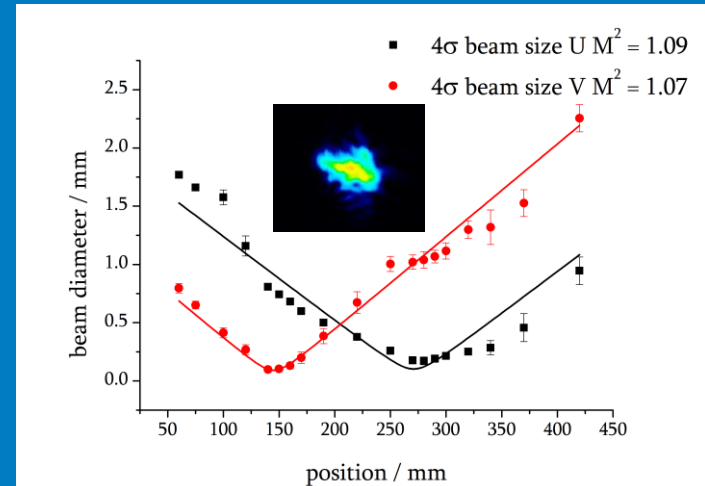
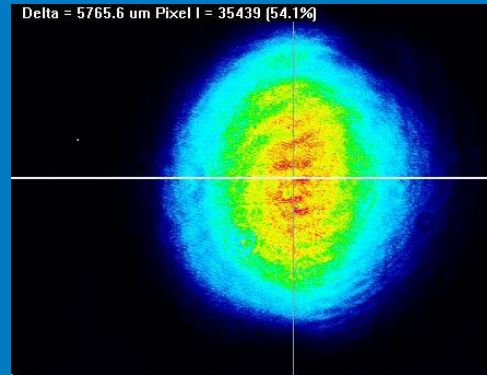
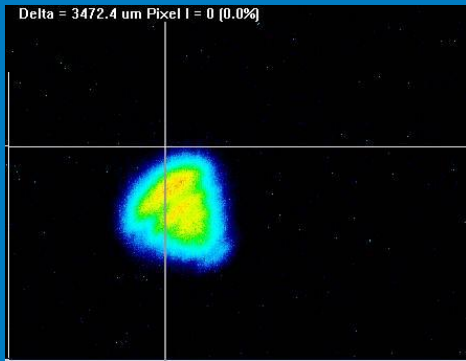


ATF2 project meeting 11th Jan 2012



December visit and shifts

- First running week no shifts requested – preparation time.
- Visit of Coherent engineer to tune up laser.
- Further laser measurement and improvement.
- Poor spatial quality of regen greatly improved.



- M^2 at test IP in laser lab 1.07/1.09 – cf. previous measurements of ~ 2 .
- Reduces beam size at focus by factor of 2.
- This measurement is scaled version of LWIP focus – predicts $\sigma_{IV} = 0.8\mu\text{m}$.
- Laser energy in green up to 220mJ – fine for experiments.
- Telescope in lab fitted with actuator for remote control of laser beam size on final focus lens.



Further first week commissioning tasks

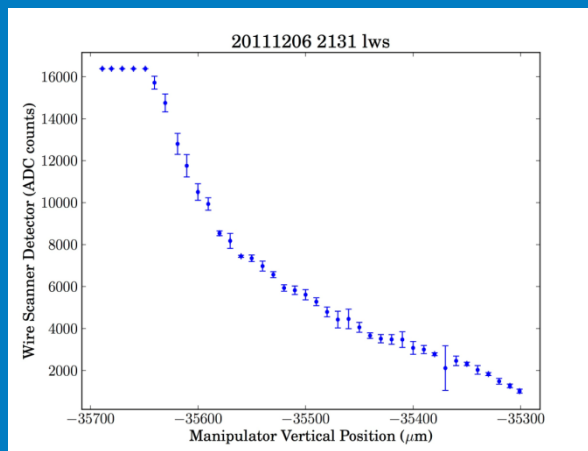
- 4 new computers installed.
- All movers programmed.
- DAQ software checked and upgraded.
- Laser aligned from upstairs lab to LWIP.
- Detector operation checked.
- Laser post-IP path aligned.
- OTR path aligned to new OTR camera with alignment laser.
- Laser position and focus referenced to position of OTR screen.



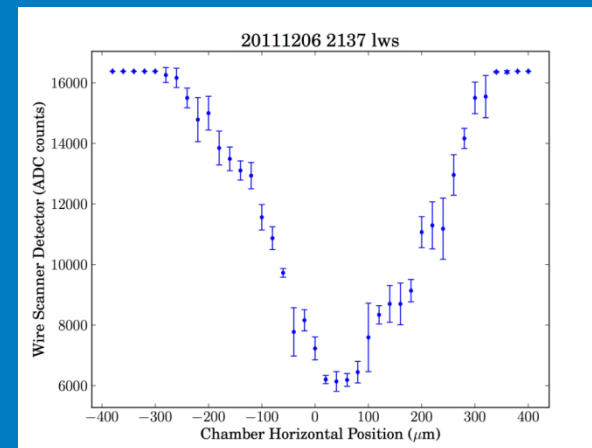
OTR screen illuminated with alignment laser showing notch

Shift 1 – 6th Dec

- Background $\sim 1V$ on detector (cf 500mV last year).
- Alignment procedures – temporal: overlap signal from attenuated laser pulse and OTR from screen near beam on post-IP APD as before.
- Spatial alignment: notch in OTR screen and wire scanner detector used to find position of beam $\sim \pm 50\mu\text{m}$ horizontally and vertically.
- Larger horizontal beam size at this location means vertical position harder to find ($\sim \pm 10\mu\text{m}$ at previous location).
- Several vertical scans performed at different horizontal positions – no signal.
- Upstream IPBPM scanned across full mover range – no effect on background.
- LWIP- detector alignment problem?



Vertical scan of screen



Horizontal scan of chamber



Shift 1 – 6th Dec: OTR

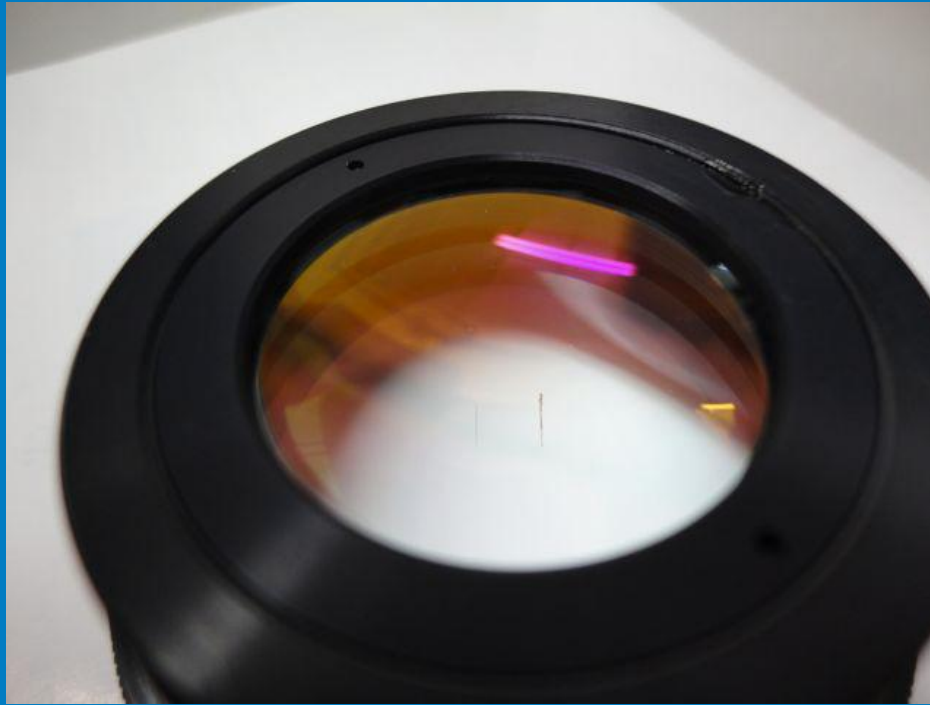
- No laserwire signal. Moved to OTR to check operation and beam position.
- No filter or polariser installed in OTR in this shift.
- No camera triggering so used 700ms exposure time to capture beam.
- Signal found very quickly and where expected from laserwire alignment.
- Confirms accuracy of spatial alignment procedure.
- OTR shows two images – not clear why this was.
- Large background from stray light.



OTR showing double beam image and top of notch in OTR screen.



Lens damage



- During weekend work after this shift it was noticed that the LW final focus lens was badly damaged.
- Suspect focused reflection from post-IP recollimating lens.
- This lens removed and post-IP laser simply turned onto beam dump.
- Final focus lens replaced with spare from RHUL kindly brought out by Pavel.



Shift 2 – 14th Dec

- Before running, alignment team surveyed dipole before LW detector.
- Moved ~ 1mm – too small to account for no observed laserwire signal.
- Access to replace final focus lens, realign system and install OTR filter and polariser.
- 1.5 hours to restore beam condition after previous shift.
- Tried new optics to move waist from MF2BFF closer to LWIP but this produced very large backgrounds so abandoned.
- Took OTR images with shorter (200ms) exposure time. Single beam image.



- Standard laserwire alignment carried out.
- No signal observed during scans.
- ZH10X and ZH1FF used to change beam angle but not position at LWIP in case scattered photons missing window and detector.
- Beam scanned +/- 500 μ m but no signal seen.



Discussion and conclusions

- No laserwire signal observed in two shifts (NB nearly half a shift lost for lens replacement access and beam restoration).
 - Similar problem as last year – alignment to detector?
 - Window 13mm radius, 13mrad angle at LWIP.
 - Opening angle of scattered photons $\sim 400\mu\text{rad}$.
 - Estimate of maximum angular offset (from BPMs) additional $500\mu\text{rad}$.
 - Unclear exactly what the problem is.
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- Future plans – check clear line from LWIP to detector with window removed out of running period.
 - Detailed numerical work to check if very different beam aspect ratio significantly affects photon flux.
 - Improve referencing of laser focus position – OTR screen $300\mu\text{m}$ thick, comparable to Rayleigh range of laser. Check in more detail where screen obscures laser.
 - Full commissioning of OTR to enable beam size tuning and position measurement.
 - More detailed work on beam orbit to reduce background to 2010 levels.

