



# ALIGNMENT OF THE FIRST 7 FRONT-ENDS AT SSRF



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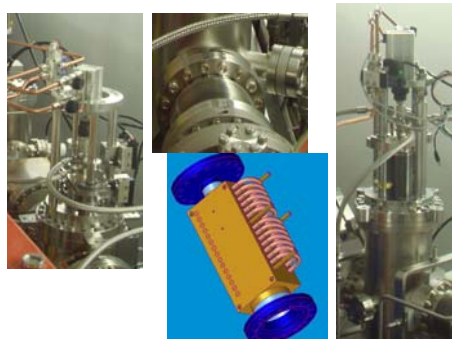
The 10th International Workshop on Accelerator Alignment  
February 11-15, 2008  
KEK, Tsukuba, Japan

## Introduction

Shanghai Synchrotron Radiation Facility, SSRF, is a 3.5 GeV third-generation of synchrotron radiation light source with 200~300 mA beam current and 3.9nm-rad emittance, which is the biggest scientific platform for science research and technology development in China up to now. The maximum capability of SSRF can hold more than 60 beamlines. For phase I 7 beamlines will be installed. For the moment the 7 front-ends have been installed without insertion devices.

Due to the tight time schedule and limited accessibility, alignment staff participated in the design from the beginning. When doing alignment, fiducialization, pre-alignment, setout, installation in tunnel and realignment were performed, the instruments were used including laser tracker, articulated arm, total station, precision optical Level and jig transit.

The commissioning of storage ring is going on, rather smoothly, and synchrotron radiation light was observed from most of the first fluorescence for the 7 front-ends on 21<sup>st</sup> January, 2008.



### FIDUCIAL MARKS

- Most components such as fixed mask, photon shutter, BPM, fluorescence, safety shutter have fiducial marks.
- At least 4 survey fiducial marks are mounted at each component to give facility for easier observation by instrument.
- The diameter of reference holes are 8mm and an adapter with 8mm shank to hold 1.5" corner cube reflector or adapter sphere that probe of articulated arm can insert.
- Cylinders or cubes with the same holes as mentioned above for fluorescence, photon shutter and safety shutter are jointed to the flange.



### FIDUCIALIZATION

- The correct fiducialization of components is an important prerequisite to successful alignment.
- Articulated arm is more convenient than laser tracker for small, complicated front-ends' components, it is used to map the reference line, plane and fiducial marks. Then a local frame relative to the centerline of components will be defined.
- For reliability, most components should be measured twice with a maximum deviation of 0.05mm. For photo shutter, center plane will be measured and adjusted iteratively as high as the vacuum chamber.
- Some critical shapes and dimensions of the components have to be checked by Level N3, total station TDM5005 and Brunson jig transit.



### PRE-ALIGNMENT

- Due to the tight time schedule and limited accessibility, pre-alignment is done for every front-end.
- The components' relative coordinates are calculated according to each front-end's layout.
- Measuring the fiducial marks on components and adjusting them according to their reference coordinates within the tolerance of about 0.1mm.



### INSTALLATION ON SITE & REALIGNMENT

- When the supports are ready, co-girder components having been pre-aligned and girders would be craned to tunnel.
- Measuring the network and building the frame as the same manner as the setout procedure.
- Embedded the anchor bolts, poured the support and aligned the non-standard girders. After pouring, the concrete will be maintained for about a week.
- Absolute accuracies of about 0.2mm are expected.
- When performing the realignment, some components are readjusted and all components' final position are confirmed.
- The procedure is done by laser tracker mostly. But at rather narrow place, articulated arm is used.



### SETOUT

- Firstly, measuring the network of storage ring and doing best fit to construct the frame.
- Secondly, creating the local frame with the definition: the origin is at light source point, Y is along the beam direction, Z is the vertical direction, and X is ascertained according to right hand rule.
- Then, marking the beamaxis and the positions for girders' supports.
- This procedure is done by laser tracker.

### Conclusion and future work

The linac, booster and storage ring all are commissioning smoothly, on 24th December, 2007, beam current was stored with 3GeV and on 3rd Jan, 2008, 100mA beam current was reached. And synchrotron radiation light was observed from most of the first fluorescence for the 7 front-ends.

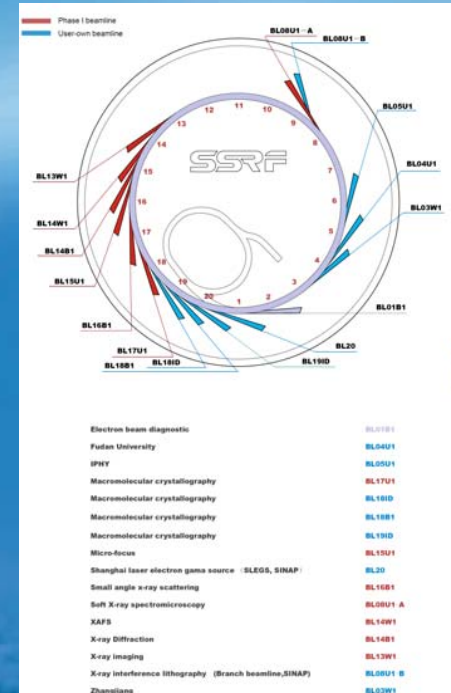
During the alignment of the first 7 front-ends, laser tracker and articulated arm are main tools. A real 3D measurement manner was applied for positioning and aligning.

In the near recent months, installation and alignment of the 7 beamlines will started with the same manner by using the control network of experimental hall.

8 new beamlines will be installed in the near future.

### Acknowledgement

The authors would like to thank for staff of Beijing LeyFond Vacuum Company, SKY Technology Development Co.Ltd, CAS, and Shanghai Equipment Installation Company who did their best for survey and alignment of SSRF.



Question? Ask us...

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