Please send your paper to iwaa2014@ihep.ac.cn

Before November
Future: CEPC+SppC

- Thanks to the discovery of the low mass Higgs boson, and stimulated by ideas of Circular Higgs Factories in the world, CEPC+SppC configuration was proposed in Sep. 2012.
Way to the future

1980s

1990s

2000s

2010s

2020s

BEPC

BFEL

BEPCII

BSRF

CSNS

ADS

HEPS

JUNO

LHAASO

HXMT

DYB

BESIII

YBJ

BES

HEPS

Higgs Factory
CEPC-SPPC
Alignment of the 12 GeV CEBAF Accelerator

Jefferson Lab Site c.2006
Alignment of Hefei Light Source
Preparing the SPS complex alignment for future LHC runs

92 Quadrupole Magnets aligned

SPS Final Vertical Profile
LS1 2014
Alignment of SESAME

Layout of SESAME Showing Phase1 Beamlines

Energy: 2.5 GeV
Circumference: 133m
12 Insertion Devices
13 Bending Magnet beamlines
Maximum beamline length: 37m
Space for future full energy injector in main ring tunnel
Alignment in CSNS

dX = -0.021

dY = 0.000

dZ = 0.006
Alignment and long Term Stability of Duke Free Electron Laser Switchyard
**KEKB injector linac**

- Laser fiducial
- QPD
- Tracker fiducial
- Mechanical jig for target
- Mechanical jig for tracker target
- Points to be aligned
- 400mm
Siam Photon Source

U60 permanent magnet planar undulator
(Hallback-type) 0.5467 T (g = 26.5 mm)
60 mm-period length, 41 periods

SPS electron storage ring
1.2 GeV storage ring
Double bend achromatic (DBA) lattice
81.3 m circumference
4 7-m straight sections

6.5T superconducting WLS from NSRRC, Taiwan
3 poles
Lhe consumption rate <2 L/hr

2.4T normal-conducting multipole wiggler
from ASTeC, United Kingdom
9 full strength poles

Synchrotron Light Research Institute (Public Organization)
Alignment of Superconducting Undulators at the APS
Accuracy assembly requirements to meet beam halo requirements are on the limit of instrumentation performances.

Linear IFMIF Prototype Accelerator LIPAc
NAPP Photon Beam Entrance Alignment

1. Introduction

1.1 ALBA Synchrotron Light facility

The ALBA Synchrotron light source is a 3GeV storage ring able to work in top up mode which delivers X-Ray beams to seven beamlines, already in operation.

- BL29 - BOREAS
  - Resonant Absorption and Scattering

- BL24 - CIRCE
  - Photoemission Spectroscopy and Microscopy

- BL22 - CLAESS
  - Core Level Absorption & Emission Spectroscopies

- BL04 - MSPD
  - Materials Science and Powder Diffraction Beamline

- BL09 - MISTRAL
  - Soft X-Ray Microscopy

- BL11 - NCD
  - Non-Crystalline Diffraction

- BL13 - XALOC
  - Macromolecular Crystallography

Marta Llonch

www.cells.es

14/05/2014
The g-2 Project at FNAL

Storage Ring

- The storage ring is now being re-assembled and the coils have been put in place.
- The cryo-plant and power supplies are being assembled for a first test to determine the performance of the super conducting coils early 2015.
- The precision alignment of the system will commence after the current accelerator service shutdown is completed end of October 2014.
Alignment in TPS

• There are three laser trackers in NSRRC.(Leica AT901, FARO Xi, Leica AT401)
• We align a lot of components within 0.1~0.2 mm according to the survey control network (girders, pedestals, vacuum chamber, FE element, magnets, BPM, supports)
A method of measuring mirror-tilt error in laser trackers
The Comparison of API T3 and Leica AT401
Basic Principle--Placed tracker target (i.e. retro-reflector) and interferometer reflector on the same workbench, when the workbench is moved to a certain distance, the displacement measured by the interferometer-L0 and coordinates of two target points measured by tracker --P1,P2 can be obtained. Then the distance between the 2 points (L) can be calculated by the following formula:

\[ L^2 = (d_1^2 + d_2^2) - 2d_1d_2 \cos A \]

in which A means angle between 2 target points.
1. Accuracy test experiment for laser tracker ---- in the transversal direction

The laser tracker stationed away from the horizontal device 9m and 3m separately. The target moves along the guide rail, from the difference between the laser tracker measuring distance and the standard distance given by laser interferometer, we can calculate the laser tracker accuracy in the transversal direction.
Alignment methods developed for the validation of the thermal and mechanical behavior of Modules

**Context of measurements**

Tunnel environment reproduced by air conditioning & ventilation system:

- $T^\circ$ from 20 °C to 40 °C
- Longitudinal air speed: 0.3 to 0.8 m/s

All components equipped with electric heaters to reproduce the power dissipation estimated in the module

Cooling system integrated in RF components (not in the DB quadrupole)

Finite Element Analysis prepared with ANSYS to simulate displacements (but ready during the measurements process)

1st operating scenario simulated:
- Zero position
- Power-up of DB quadrupole
- Unloaded conditions (RF but no beam)
- Loaded conditions (RF + beam)
Novel method of fiducialisation

The whole setup
Novel method of adjustment

Solution proposed
Iris diaphragm laser alignment system of the SPring-8

fiber-coupled diode laser

Iris diaphragms with remote control

CCD camera with CameraLink I/F

open

Close (iris)

open

open

10 m
Laser beam trajectory measurement with a CCD camera

IWAA2014 - Laser trajectory with a CCD camera
Beijing, October 2014
**KEKB linac layout and two laser fiducial lines**

- Two long straight sections, AB (125m) and C5 (475m)
- Two new laser-based alignment systems enable the high-precision alignment for each section independently.


\[ \text{e}^- \ E = 1.5 \text{ GeV} \]

\[ \text{Primary e}^- \ E = 3.5 \text{ GeV} \]

\[ \text{C5 straight laser line (500m)} \]
The control network of CSNS is classified into two grades: the primary network and the secondary network.

The primary network consists of 27 points, which are distributed over the whole area of CSNS. It is used for the layout of buildings and facility and to provide high accuracy control for the secondary network.
The Storage Ring Control Network of NSLS-II

C. Yu, F. Karl, M. Ilardo, M. Ke, C. Spataro, S. Sharma
Network for Long Beamlines at Diamond Light Source
The modified 3-D network adjustment (2/4)

1) the modified observations

The modified observations (also called Generation observation) is translated from the traditional observations like this.

2) the modified 3-D adjustment model

First, the translated relationship is between the theory value and the measured observations like this. It just have the coordinates (X,Y,Z) and the rotation matrix (R).

Second, the relationship could be changed to this because of the known value \( X_k, Y_k, Z_k \) get the modified model 1st if the each element is uncorrelated.
Δ slope distances

5 mm
A Floor Deformation of SACLA Building

Extensometer using super Inver wire (11m)

Floor concretes connects two building.

The border part is pushed from both side.
Thanks!