Beam Stabilization Project Planning, FY08 - FY12 - Synopsis

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In October of 2005, a white paper entitled “Five-year plan for APS beam stabilization” was put forward by John Carwardine, Frank Lenkszus, Glenn Decker, and Om Singh. This paper enumerated specific goals and an upgrade path aimed at achieving these goals in a 5-year time frame. Since that time, a number of projects recommended in the white paper have been at least partially funded, while others were deferred. At the time it was written, the white paper asserted that “the APS no longer provides the best orbit stability amongst the three large third-generation light source worldwide”. In the case of SPring-8, the focus has been on the passive elimination of beam disturbances which has resulted in vertical rms motion 40% lower than the APS in at least one instance. At ESRF, a new fast global orbit feedback system was commissioned in 2004, resulting in closed-loop bandwidth extending up to 150 Hz, compared with the aging APS system which has a bandwidth of about 60 Hz. As a result, rms noise at ESRF is a factor of 2 or more lower than at APS, in the frequency band from 0.1 to 200 Hz. Shown in Table 1 is a comparison of AC performance between the three facilities.

Table 1: RMS Beam Motion, 0.1-200 Hz

	APS 2008	**ESRF c. 2005**	**SPring-8 c. 2004**
Horizontal (μm)	**4.8**	**1.2 - 2.2**	**3 - 4**
Vertical (μm)	**1.6**	**0.8 - 1.2**	**1**

While the APS is lagging in the area of AC orbit stability, it is the only facility of the three which takes advantage of insertion device photon beam position monitors on a large scale. As a result, a majority of APS insertion device beamlines enjoy long-term pointing stability better than 0.6 microradians peak-to-peak over a 24-hour period. One of the challenges articulated in 2005 was to extend this level of long-term stability to the one-week time scale, including reproducibility following machine studies periods. Shown in Table 2 are the beam stability goals quoted from the October 2005 white paper.

Table 2: APS Beam Stability Goals

	AC Motion, 0.1 - 200 Hz		**Long-term Drift, (One week)**	
	microns rms	**μrad rms**	**microns p--p**	**μrad p-p**
Horizontal	**3.0**	**0.53**	**5.0**	**1.0**
Vertical	**0.42**	**0.22**	**1.0**	**0.5**

It is hoped that with sufficient application of resources the above-stated goals can be comfortably met within the next five years. A series of nine subprojects have been proposed to address present conditions limiting our ability to stabilize the beam. Several of them have developed to the point that large-scale deployment can begin within the next 12 to 18 months, while others will require significant development work to finalize upgrade plans.