



Reliability of Accelerator Physics?? – models

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- GLOBAL STATE VECTOR – sufficient?
- LOCAL ANALYSIS – necessary?
- MODELS – off and on
- PHASE LOCK LOOP – make it stop

THIS IS NOT A SEMINAR

but 4 transparencies up for discussion:

“Are the following hypotheses True or False?”

GLOBAL STATE VECTOR – sufficient?

DYNAMICS RELIABILITY *merely* needs adequate global state vector restoration, stone by stone:

	$(C\vec{O}_{x,y}$	$Q_{x,y}$	$\Delta Q_{1,2}$	$\chi_{x,y}$
“typical” achieved	1 mm	.01	.004 – .02	5? \pm !
required RAMP (\vec{p} ?)	1 mm	.01	.01	3
required TRANSITION	1 mm	.01	.01	1
required STORE	0.1 σ	.001	.002	1

1. **How reliable is the restoration of each component?** (reproducibility, speed, convenience, drift, step size, ...) Grade as **RED**, **BLUE**, or **GREEN**.
2. **Additional components** will soon be needed? Skew chromaticity? Octupolar detuning?
3. Comments on **tighter polarized proton requirements, achievements?**

LOCAL ANALYSIS – necessary?

Devils advocate: “**Local optics information/understanding/correction was not truly necessary in the 2001 run.**”

Prioritize the following LOCAL list in order of urgency for **2002:**

1. **Vertical dispersion** driven by triplet errors(?)
2. $\Delta\beta/\beta$ errors driven by triplet errors.
3. **Automated collision steering** at storage arrival
4. **Vertical closed orbit correction** for polarized protons
5. **Local decoupling** – triplet skew quads. (Is there consensus on the list of triplet roll angles?)
6. **Nonlinear triplet correctors**
7. **Other ??**

What is the equivalent prioritized GLOBAL list?

MODELS – off and on

On line: control system model + some ramp manager

Off line: simulation/tracking + magnet instantiation

1. **On-line model is just used to calculate** $(\vec{\beta}_{x,y}, \vec{\phi}_{x,y}, Q_{x,y}, \chi_{x,y})$
(and inverted matrices) from the stone optics vector
2. **Remove systematic model errors** (transfer function, persistent current) by hook or crook. **Kluge it.**
3. **Off line question (eg):** do added sextupole families (for transition crossing) destroy the dynamic aperture? **Instantiation is irrelevant**
4. **Compare beam with magnet harmonic database:**
excellent/ok/**unknown?** Dead reckoned triplet correction?

Devils advocate: “Off-line **instantiation has never been used** with real stone vectors. **instantiation need not be maintained.**”

PHASE LOCK LOOP – make it stop

1. A lot of hope circulates in support of **feedback based largely on the PLL** (orbits, tunes, chromaticity)
2. But **can the PLL be a RELIABLE diagnostic?**
3. **HISTORY is pessimistic:** CESR, HERA, SPS, Tevatron, RHIC, (ask the operators, not the physicists ...)
4. **FUTURE must be optimistic:** RHIC, LHC, VLHC, ...
5. **Wet Wednesday afternoon/“that violates Newtons laws”.** Engineering designs are single-shot proved, while physics models are single-shot disproved.
6. **RELIABILITY requires close integration of Instrumentation and Accelerator Physics** models: “TPOT + LABVIEW”
7. **Does a $\Delta Q_{min} = 0.01$ break the PLL? Or a χ of 10?**

GOAL: controlled beam experiments to PREDICT and TEST how to break the PLL.