Update on Tuning Studies for the ATF2

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Overview

- At the previous meeting, discussions centred on:
  - The effect of higher order terms not present in MAD-8
  - The effects of errors on the generation of tuning knobs
  - Application to the ATF2 control system

- Work has been slow in the past year
- New Post-Graduate student has begun work
  - Anthony Scarfe, joint CASE student between Manchester University and STFC Daresbury Laboratory
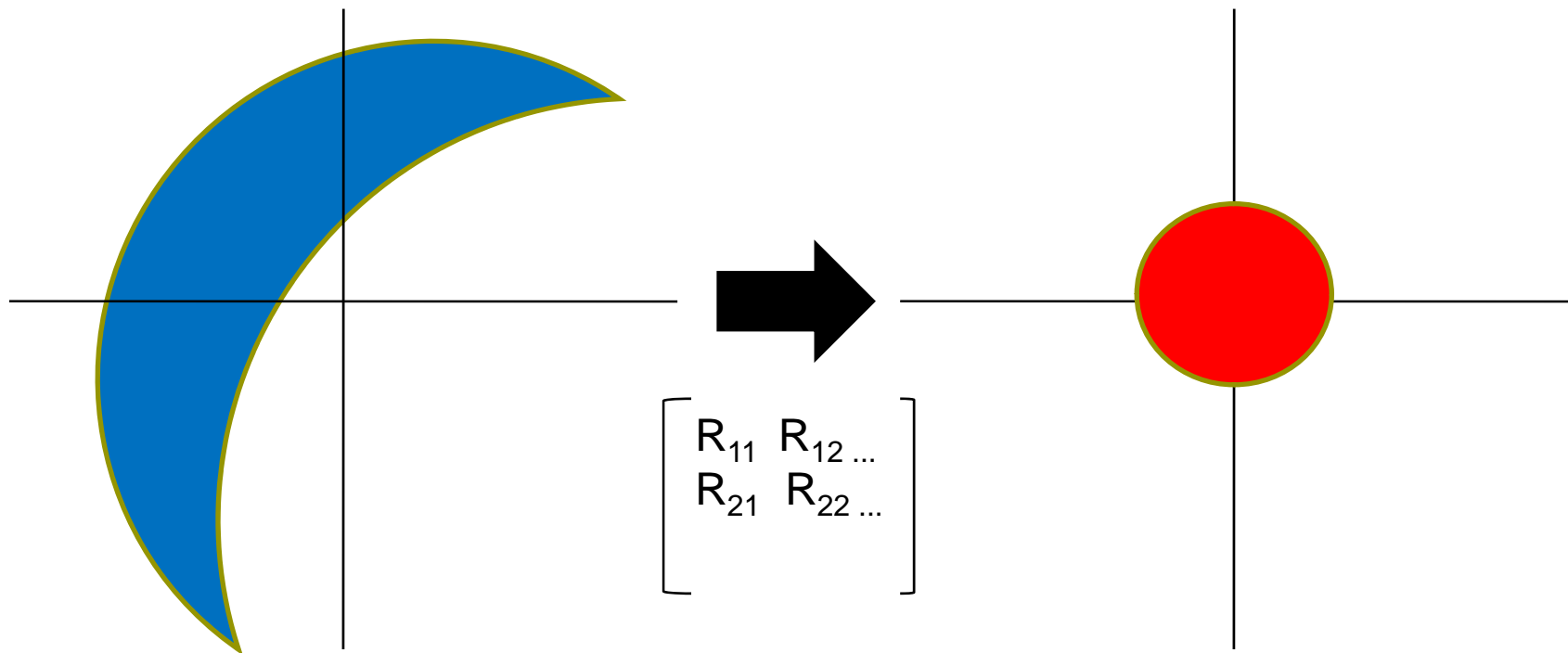
Beam Rotation Matrix

- Create tuning knobs from $beam_{err} \to beam_0$ rotation matrix:

$$R = beam_0^{-1}.beam_{err} - I$$

- Where the beams are normalised to 0 at the centre.
- From the 4 response matrices (one for each degree of freedom), tuning knobs are created.
- Have 36 (6x6) possible tuning knobs –
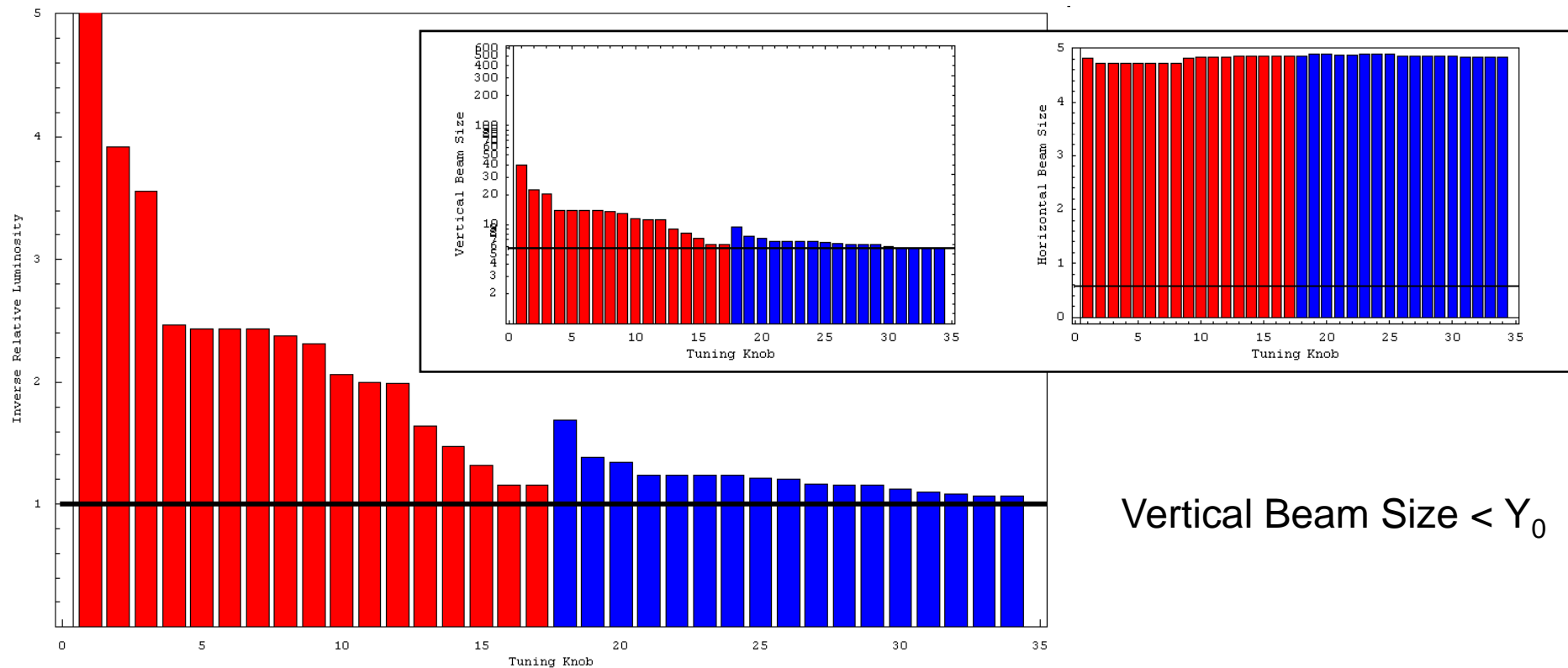 - To improve orthogonality choose 17

    dpx, dpx', dpy, dpy', xx, xx', xy, xy'

    x'x, x'x', x'y, x'y', yx', yy, y'x, y'y, y'y'

$$\begin{bmatrix} R_{11} & R_{12\ \dots} \\ R_{21} & R_{22\ \dots} \end{bmatrix}$$

Beam Rotation Matrix

- Results in simulation are better than the traditional method.

Vertical Beam Size < Y_0

	DX	DY	DΨ	DK/K	Read Error
Quadrupole	50μm	20μm	0.1mrad	0.25%	~
Sextupole	50μm	20μm	0.3mrad	1%	~
BPM	*30μm*	*30μm*	~	~	*30μm*

DIMAD

- Initial thoughts were that DIMAD was the correct higher order tracking code to use
  - Similar input to MAD-8
  - Rapid use of existing infrastructure
  - Experience within group

- Experience so far:
  - Comparison to MAD-8 has been less than stellar
  - Many difficulties not expected
  - Lead-in time much longer than expected

Orbit Correction

- Anthony Scarfe has been progressing DIMAD code
  - Optimisation of MAD-8 code to DIMAD
  - Optimisation of trajectory correction
    - Which is a limiting factor in the tuning simulations

- Code is almost ready to run now
- Have produced a DIMAD-to-Mathematica package
  - Available to everyone

- Some computations still needs to be done in MAD-8

Next Steps

- We need to understand the ATF/ATF-2 control system

  - Most important factor in applying technique to actual beam at KEK

  - Attendance this year will allow us to understand the implementation and limitations of control system

  - Implement requisite changes in simulations

- Specifications of the movers and power supplies is also important

  - Could be the limiting factor in achieving minimal emittance at IP

Conclusions

- We know from previous work that the simulation technique "works"

- Additional cross-checks with higher-order tracking code is still ongoing

- Progress is really dependant on implementation with the ATF2 control system and the limitations on the movers and magnet power supplies

- As I have been saying for many years,
  - Would like an integrated simulation, to make better comparisons with the work of Glen White
  - Never had enough manpower before now...