

# Thoughts on Energy Chicane Design

Preliminary stuff by R. Arnold for the Energy Chicane Group

(no design yet, this is a discussion of issues)

## Issues to consider

- Design for  $10^{-4}$  energy error
- Number, length, location of magnets
- Desired dispersion
- System length needed, available in BDS
- BPM performance needed
- Design for low emittance growth
- Design for robust calibration and operation
- ....

## Basic plan is:

- Chicane kink to modest dispersion in BDS
- Be invisible to the luminosity
- Measure beam offset with precision BPM's
- Calibrate BPM's often
- Measure and/or average over beam jitter
- Measure B.dL and magnet positions precisely
- Control and monitor drifts
- Measure energy averaged over some pulses
- Sample beam energy frequently enough
- Calibrate out drifts often
- Build a system that will last, low maintainance, immune to radiation, needs few pit stops

Primary requirement is to limit emittance growth from SR

$$\frac{d\varepsilon}{ds} \approx \frac{\gamma^5}{R^3} \frac{\eta^2}{\beta}$$

Amount of Synch Rad

Dammage to emittance

$ds$  = path in bend field of radius  $R$

$\gamma = E/m_e c^2$

$\eta$  = local dispersion

$\beta$  = local betatron function

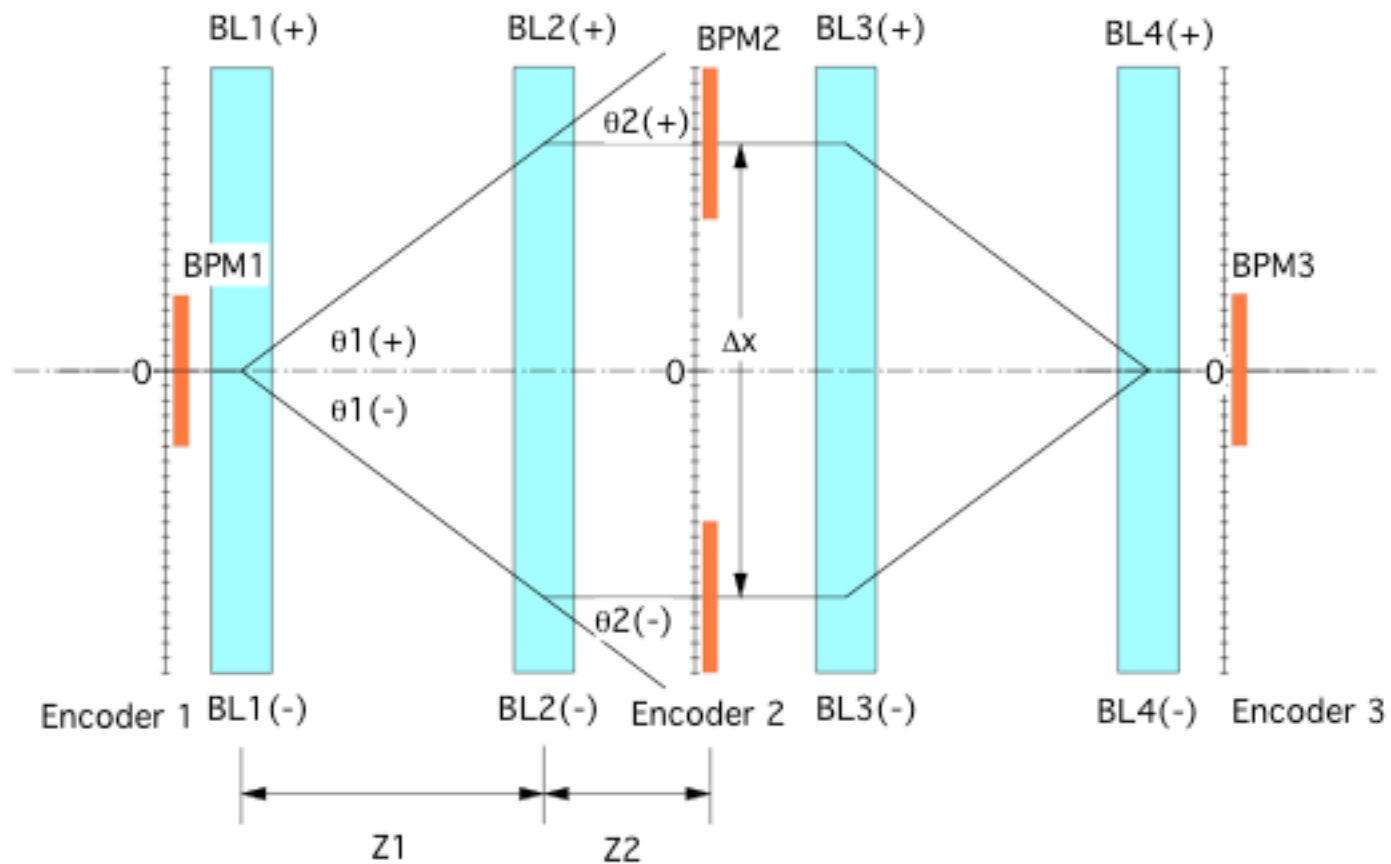


Long magnets, low B fields where  $\eta$  is large

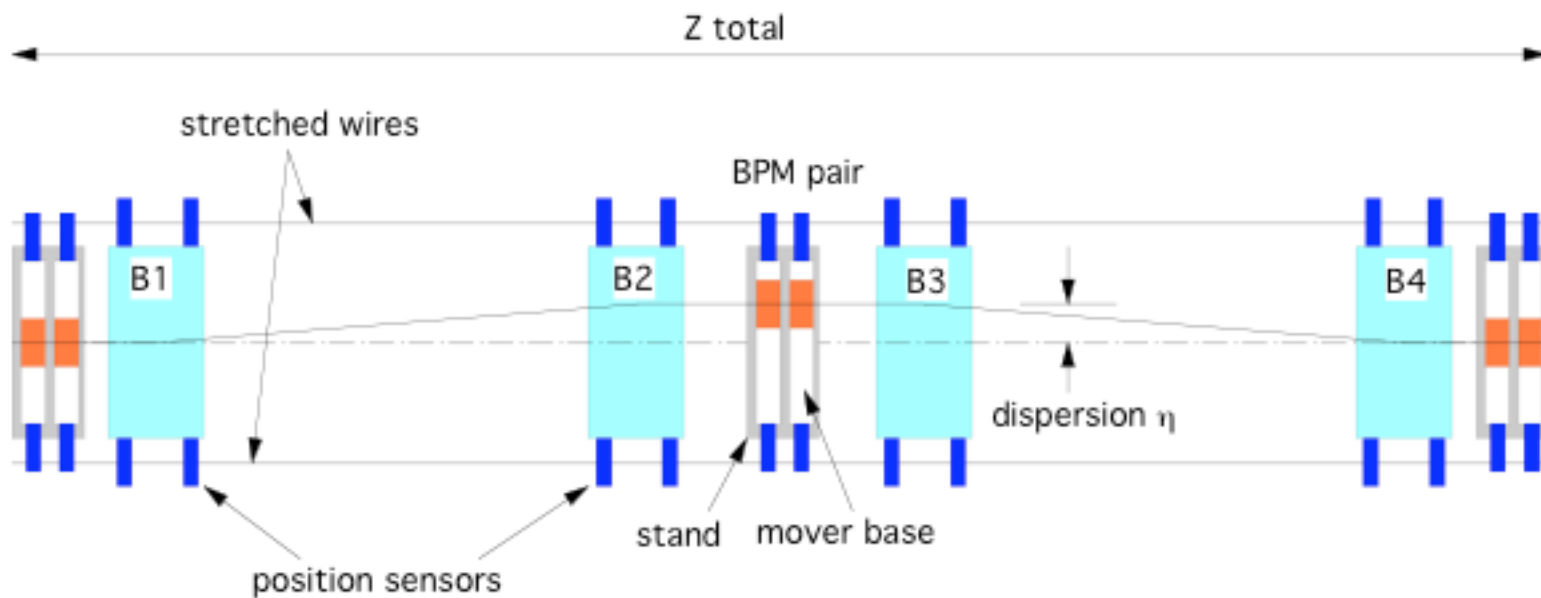
# Preliminary ideas for chicane design and measurement strategy

Four magnets, move and measure  $\Delta x$ , avoids rotation of BPM's  
Use +B and -B to reduce errors, BPM1 and BPM3 for beam jitter

Definition of the Extended Measurement

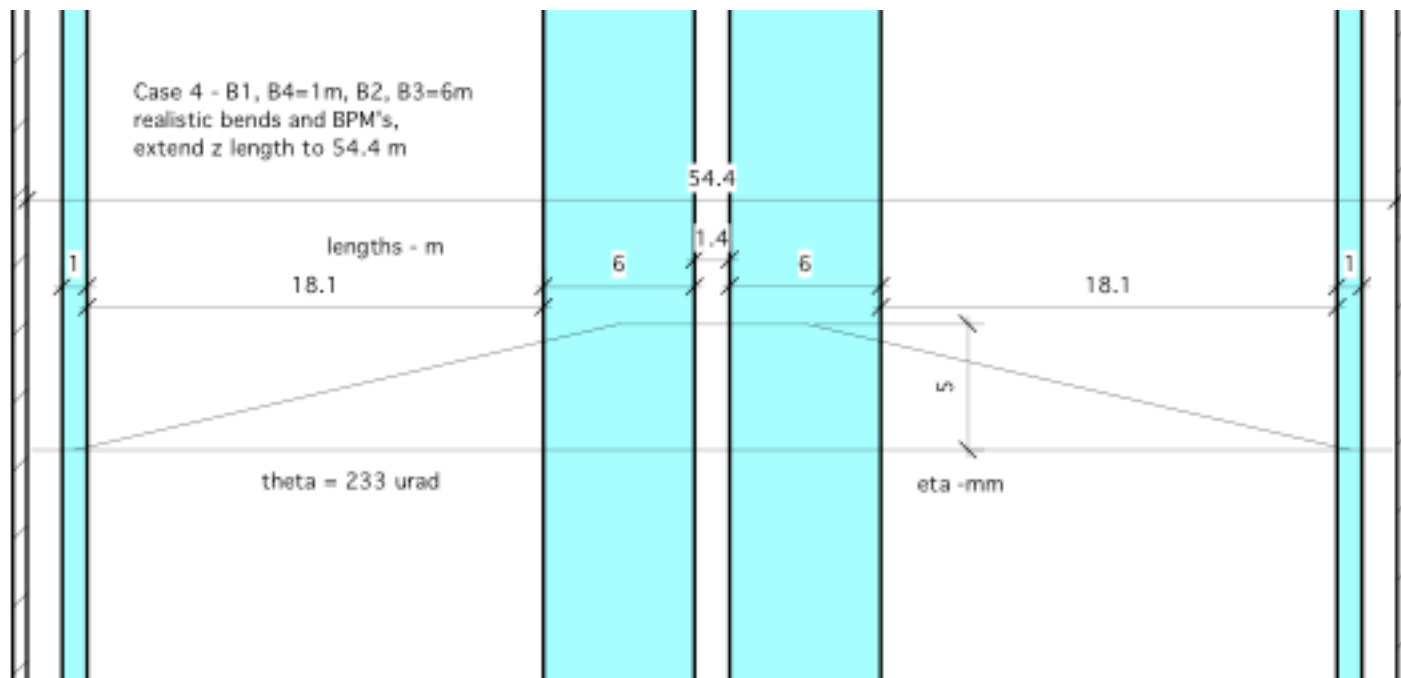


# Cartoon of chicane layout (not a design)



# Example of magnet configuration with small emittance growth

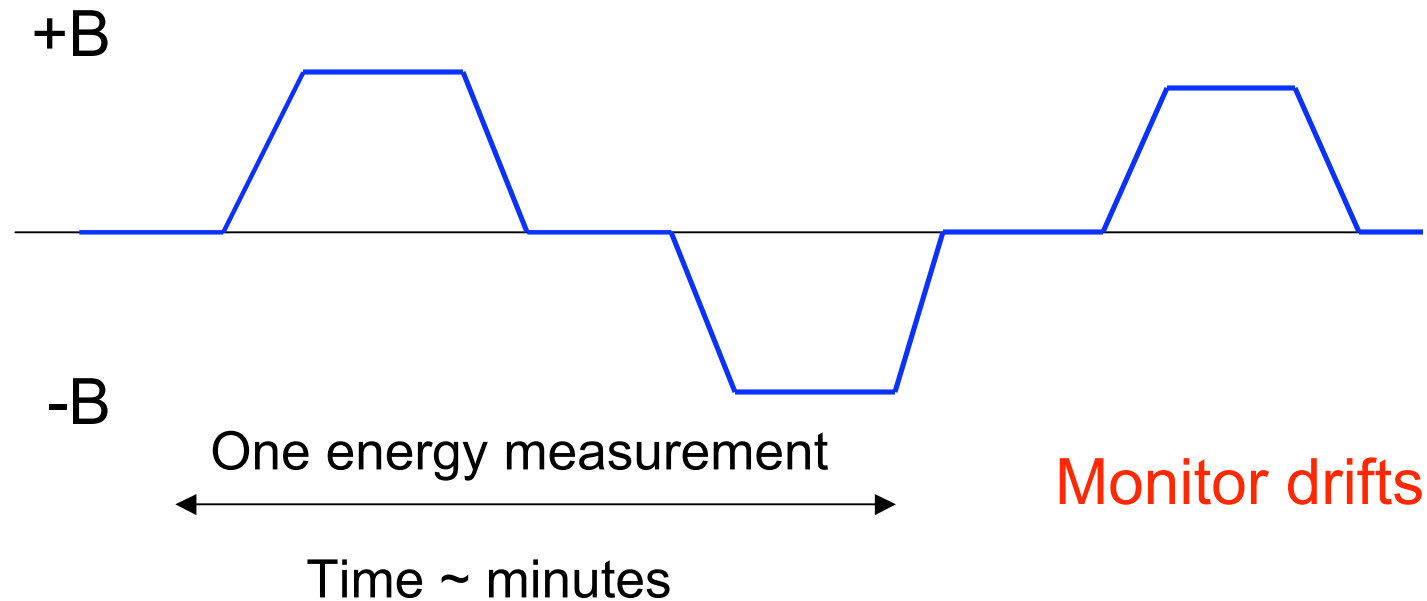
Much work yet to do on optimization



## Example of measurement cycles

Establish BPM encoder calibrations by moving BPMS's with beam stable

Measure energy, average over beam jitter and resolutions  
Cycle magnet B field



Much work to do yet to optimize design

- Length and strength of magnets
- Magnet type and design
- BDS optics, location of chicane
- Chicane length
- BPM design
- Encoders and position sensors
- Strategies for coping with drifts
- ....