Opportunities arising from EPICS 7, Ophyd and Bluesky Integration of Libera Instruments

Pierre Schnizer, Waheedullah Sulaiman Khail, Günther Rehm

Helmholtz-Zentrum Berlin (HZB), Germany

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Beam position ↔ orbit

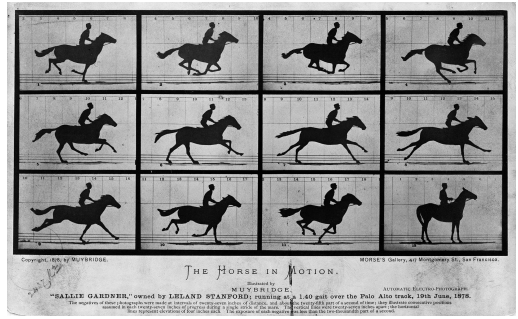
Pixel vs Line

Galopp: horse airborne

- no film → cameras sequence
- horse: triggers
- combined → result: horse airborne

Orbit

- beam position monitor → position (vs. time)
- tagged by turn
- combination → physics ready data = orbit → start of analysis

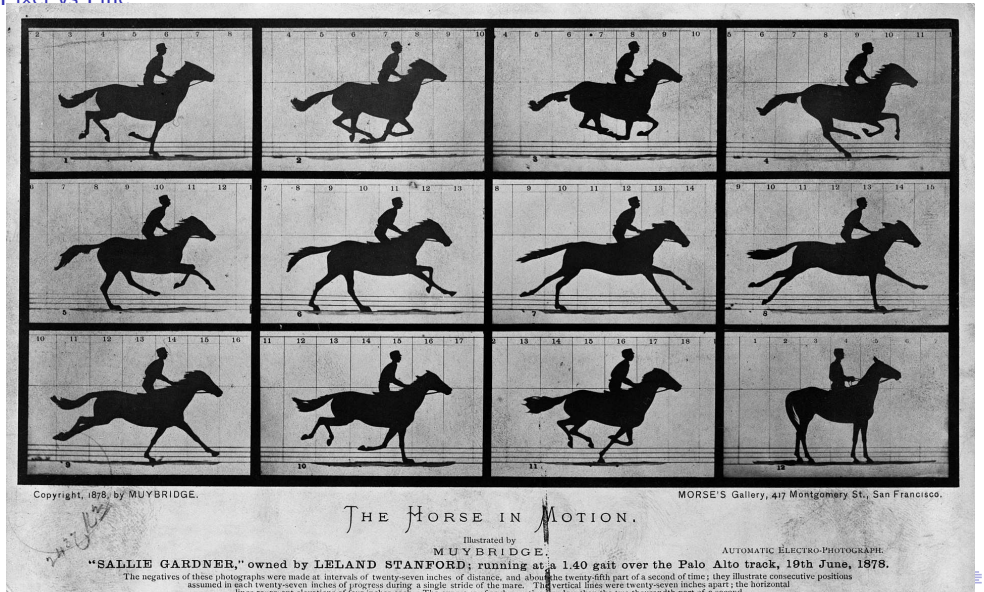


Common

pictures / data set
→ combination
→ physics / analysis ready data

Beam position ↔ orbit

Pixel vs Line



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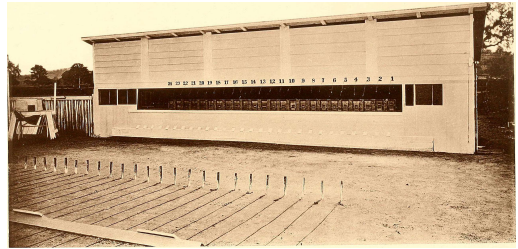

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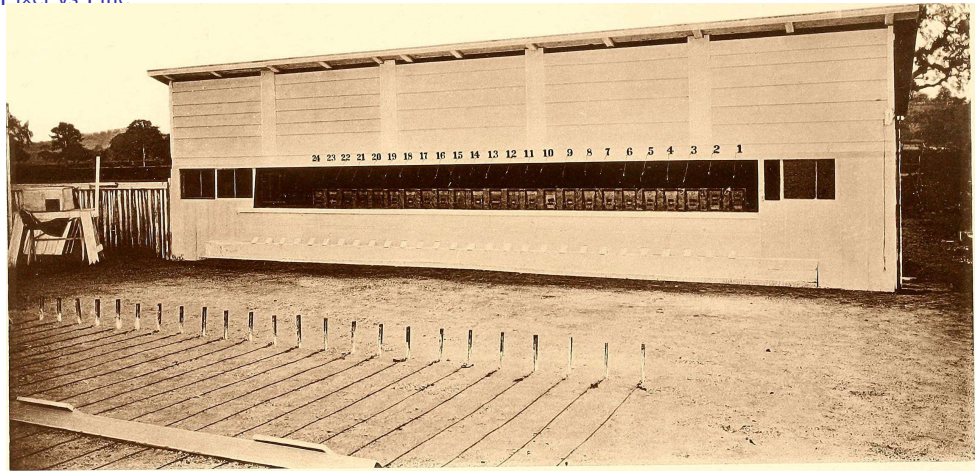

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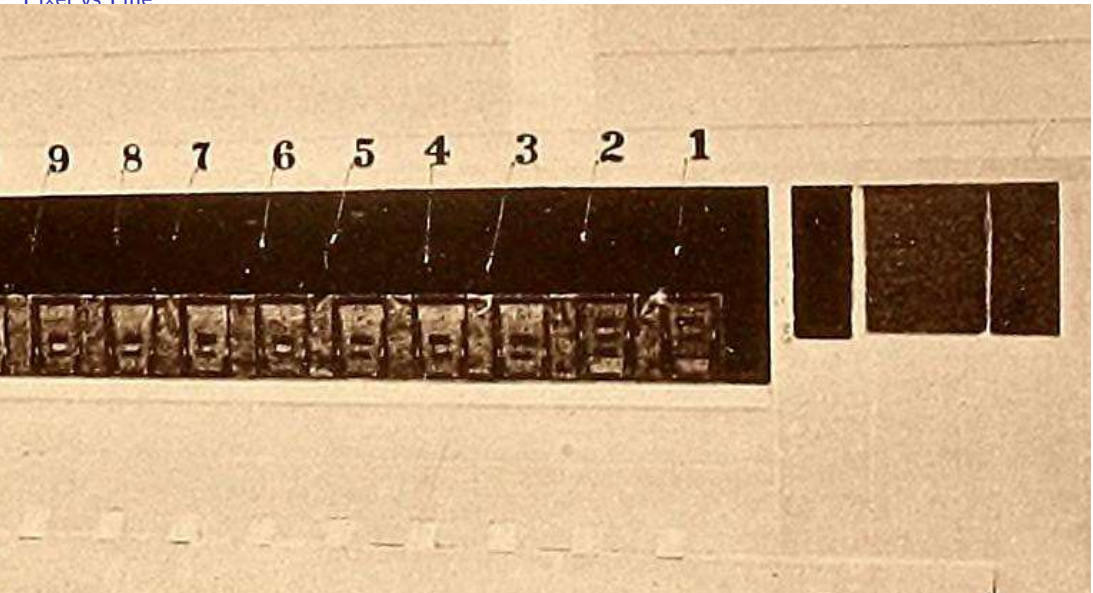


Beam position monitor: a different view

What's a beam position monitor?

A Theory of Forms view

Stroboscope flashed at it properly

Optics a little peace of paper placed in vacuum

Postion sensitve device voltages → triggered

Beam one of the locations (along the ring), periodically updated, → "line camera"

Control regulation input

When is a beam position monitor useful?

- provides reliable data
- consistent with other devices in family
- fast

Feedback info

- e.g. orbit stabilsation
- → machine learning
- → streaming approach

BPM data models

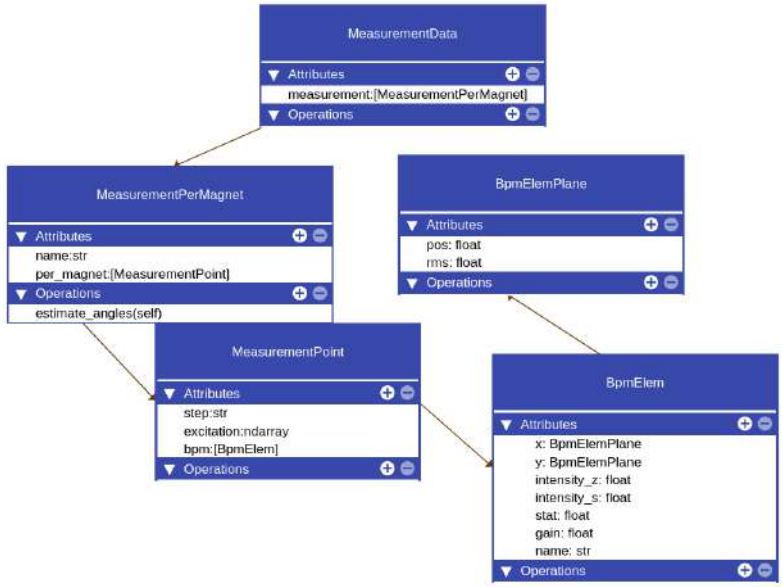
Simplify usage

Definition

- intuitve schema of used data
- uses:
  - sub data models
  - primitive types

Examples

- BBA (see right)
- “single shot BBA”
- → BPM / Orbit data: “pouring in”, reactions happening



Steps towards an integrated approach

- beam position monitors
  - "atomic data": positions (x, y), time count
  - atomic within EPICS control system: v3: vector, v7: normative types
- data combiner: collector, combiner, accumulator, data update $\rightarrow$ focus on consistency by time stamp $\rightarrow$ provide data when available
- line camera, orbit: combined data: input to regulation algorithms
- convienient data taking $\rightarrow$ stabilisation beyond (electron) beam
- machine / reinforcement learning / streaming $\rightarrow$ "new kid on the block"

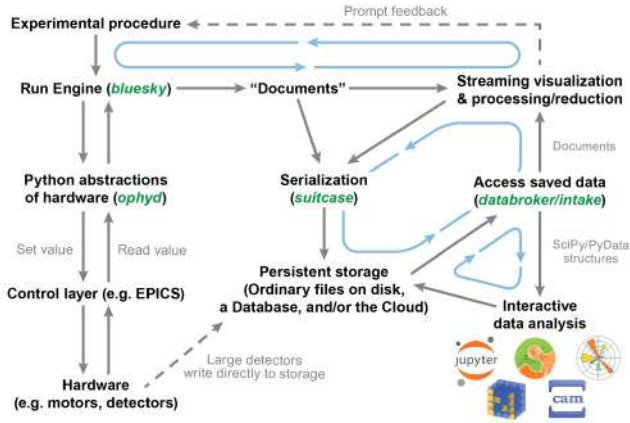
High level implementation, bluesky

Data model

- Id
- Pay load: x, y,. . .

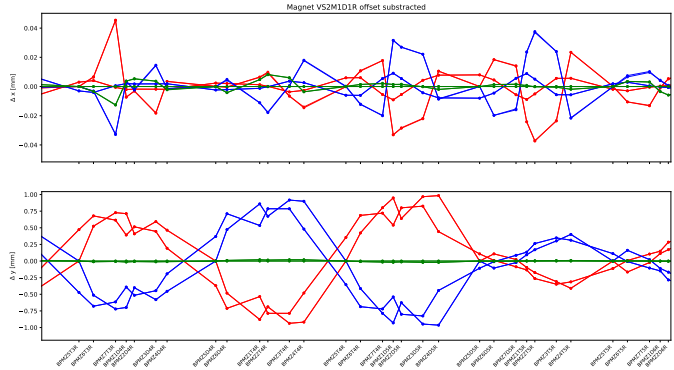
Motivation

- data model → control system
- consistent in: control system, data processing, storage, database
- access by name



Does one need it?

Well not absolutly but makes life more easier



Fit of steerer response: bpm indices: model $\leftrightarrow$ machine off by one

Compare: polarity meter for magnets

What's brewing

- Learning to build IOC's: thx to virtual box, podman image (v 3.24)
- Towards EPICS 7 $\rightarrow$ pvacess based, combined on spark box, dedicated records $\rightarrow$ consistent data delivery
- $\rightarrow$ delay in data delivery: (ca monitor client time stamps)
- based on id: bpm data combiner: now reliable, not mixed of network delays ...
- qsrv2 as possible solution (Thx. Heinz Junkes) $\rightarrow$ work in progress

Conclusion

- libera IOC: combine data to vec $\rightarrow$ identifier, sort data
- towards EPCIS V7 $\rightarrow$ represent data model $\rightarrow$ consitent data model: control system, measurement, analysis
- data model: supports combination: from single pixel to line camera
- data model: simplifies usage: towards integrated facility stabilisation?