

# 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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Motivation

Steps towards  
an integrated  
approach

What's  
brewing

Conclusion

# Beam position $\leftrightarrow$ orbit

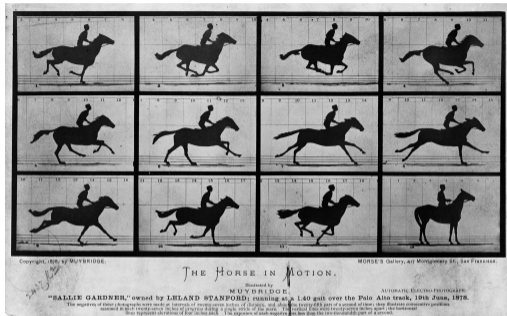
Pixel vs Line

## Galopp: horse airborne

- ▶ no film  $\rightarrow$  cameras sequence
- ▶ horse: triggers
- ▶ combined  $\rightarrow$  result: horse airborne

## Orbit

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



## Common

- pictures / data set
- $\rightarrow$  combination
- $\rightarrow$  physics / analysis ready data

Data model,  
EPICS 7 and  
Bluesky

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*et al.*

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Historic example  
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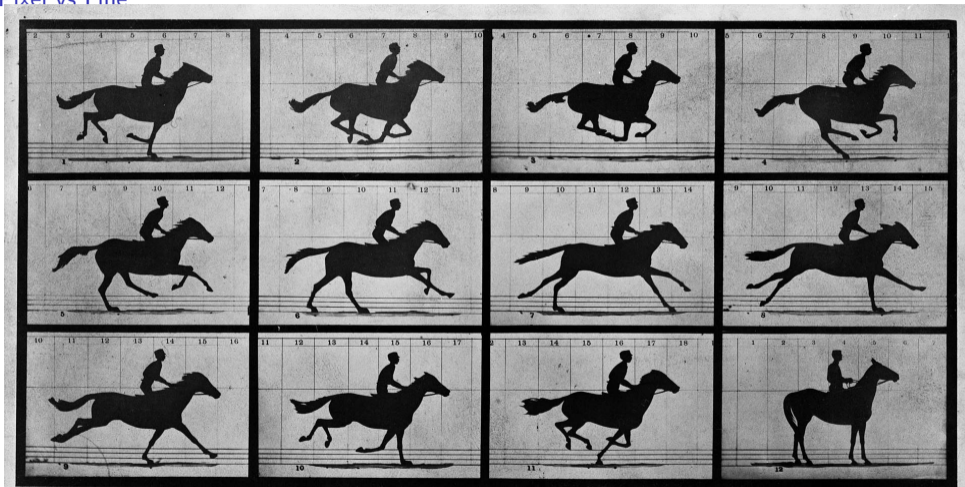
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Copyright, 1878, by MUYBRIDGE.

MORSE'S Gallery, 417 Montgomery St., San Francisco.

## THE HORSE IN MOTION.

Illustrated by  
MUYBRIDGE.

AUTOMATIC ELECTRO-PHOTOGRAPH.

“SALLIE GARDNER,” owned by LELAND STANFORD; running at a 1.40 gait over the Palo Alto track, 19th June, 1878.

The negatives of these photographs were made at intervals of twenty-seven inches of distance, and about the twenty-fifth part of a second of time; they illustrate consecutive positions assumed in each twenty-seven inches of progress during a single stride of the mare. The vertical lines were twenty-seven inches apart; the horizontal



# Beam position $\leftrightarrow$ orbit

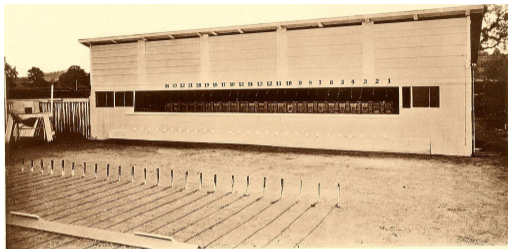
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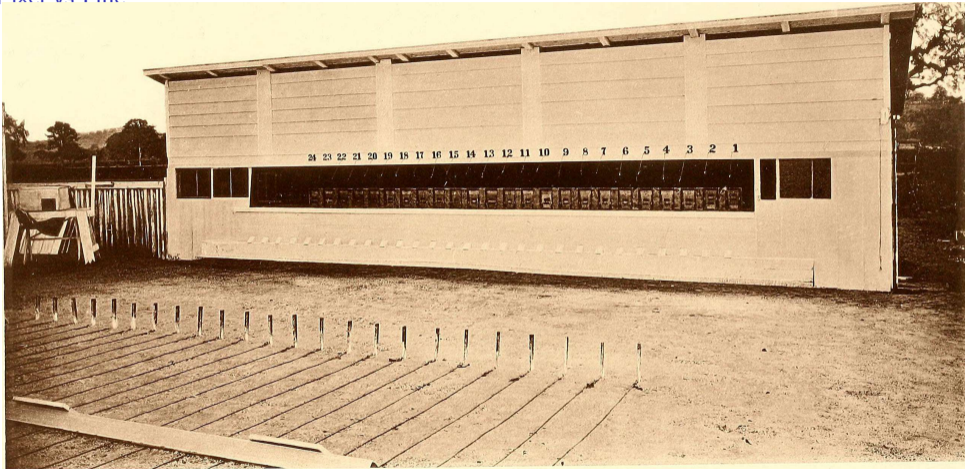
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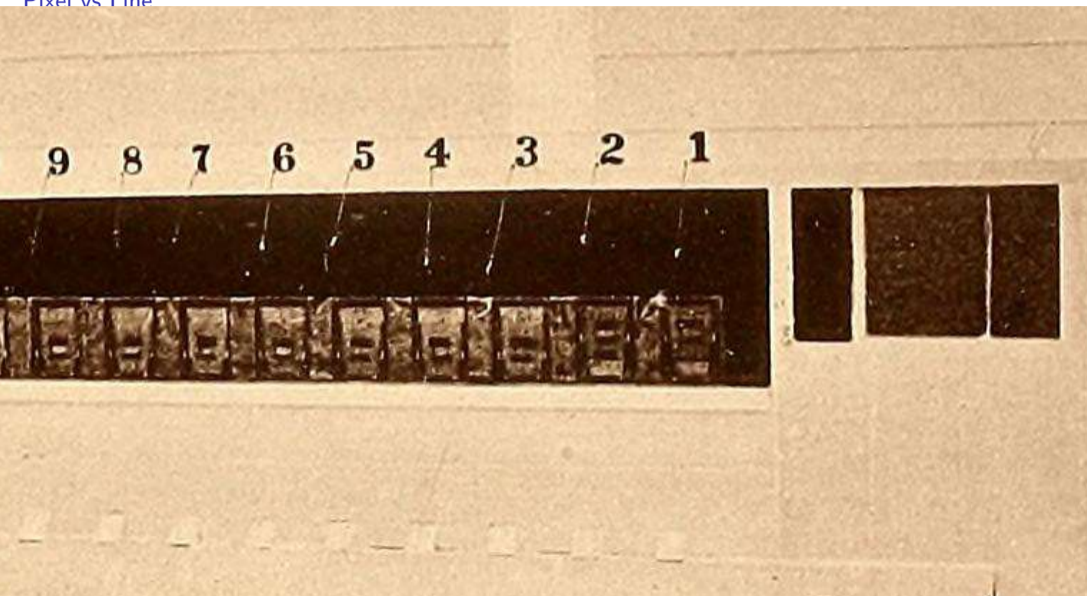
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# Beam position monitor: a different view

What's a beam position monitor?

A **Theory of Forms** view

**Stroboscope** flashed at it properly

**Optics** a little piece of paper placed in vacuum

**Position sensitive 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 stabilisation
- ▶ → machine learning
- ▶ → streaming approach

# BPM data models

Simplify usage

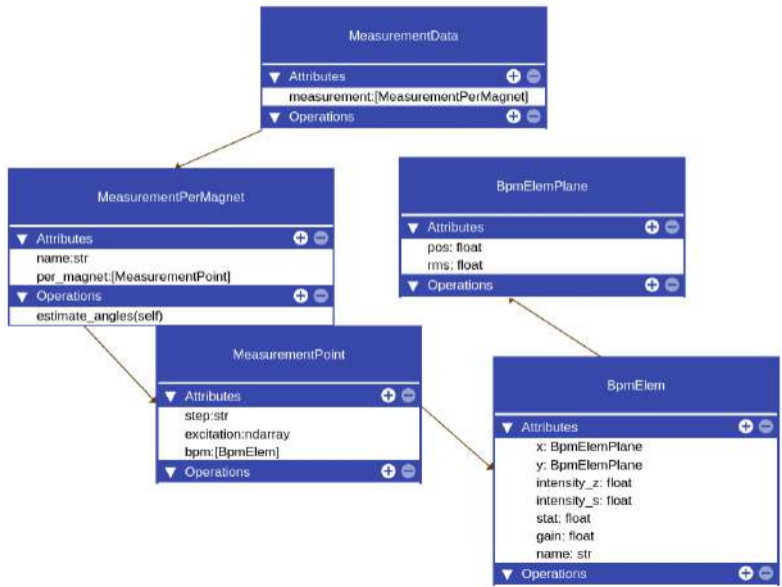
Data model,  
EPICS 7 and  
BlueSky

## Definition

- ▶ intuitive schema of used data
- ▶ uses:
  - ▶ sub data models
  - ▶ primitive types

## Examples

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



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# Steps towards an integrated approach

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- ▶ 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 → focus on consistency by time stamp → provide data when available
- ▶ line camera, orbit: combined data: input to regulation algorithms
- ▶ convenient data taking → stabilisation beyond (electron) beam
- ▶ machine / reinforcement learning / streaming → “new kid on the block”

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# Does one need it?

Well not absolutly but makes life more easier

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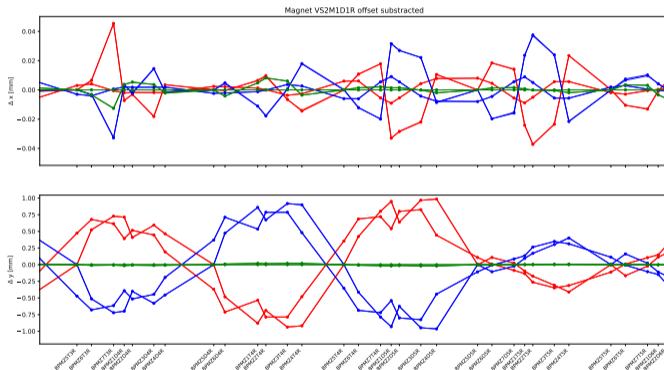
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Fit of steerer response: bpm indices: model ↔ machine off by one

Compare: polarity meter for magnets

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- ▶ Learning to build IOC's: thx to virtual box, podman image (v 3.24)
- ▶ Towards EPICS 7 → pvaccess based, combined on spark box, dedicated records  
→ consistent data delivery
- ▶ → 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) → work in progress

# Conclusion

- ▶ libera IOC: combine data to vec → identifier, sort data
- ▶ towards EPICS V7 → represent data model → consistent data model: control system, measurement, analysis
- ▶ data model: supports combination: from single pixel to line camera
- ▶ data model: simplifies usage: towards integrated facility stabilisation?