COST BENEFIT ANALYSIS OF MACHINE DEVELOPMENT

RHIC Retreat 2009

MD time charged after physics begins.

Two modes of Machine development:

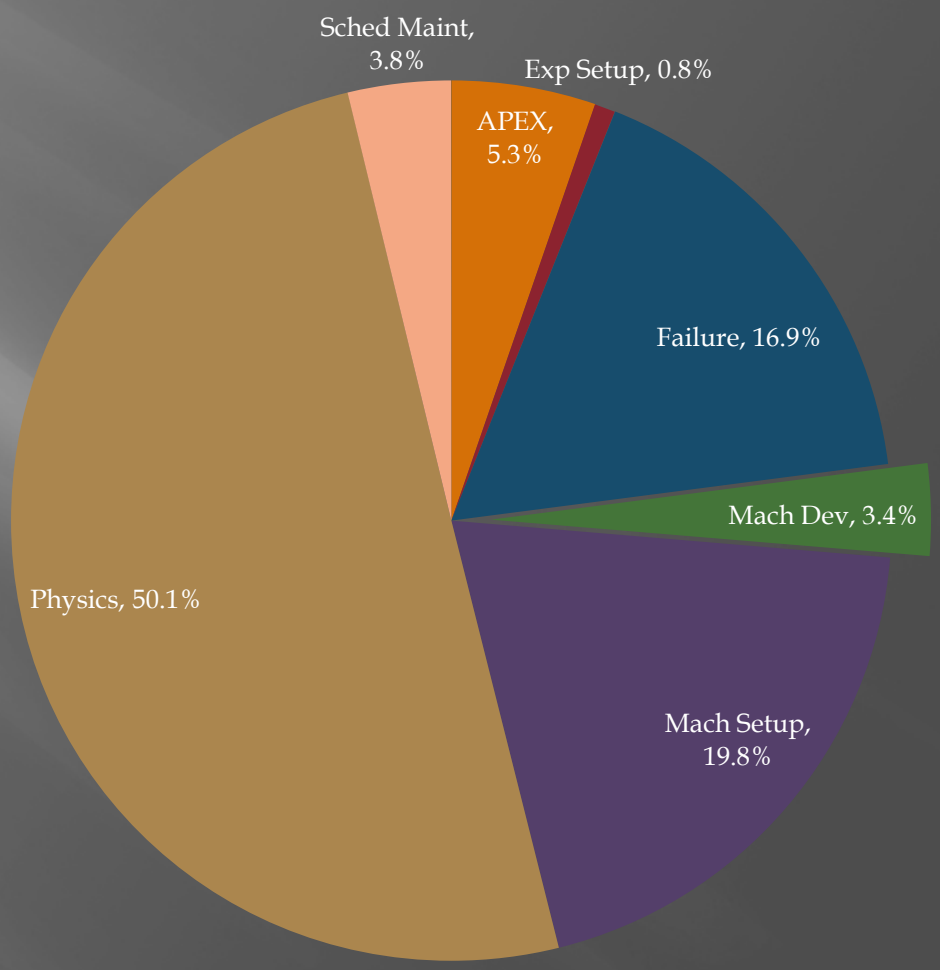
Long range development.

- Testing of future systems upgrades and configurations for future runs. (spin flipper, low level Rf…)
- ~50% of charged MD time.
- Usually has time allotment but quality of planning varies.

Short range development.

- Attempts to improve current machine conditions.
- Often hides under the Machine Setup Label. Including this "Stealth MD" easily brings MD up to APEX levels.
- Usually not planned before 0900 with no end in sight.

200GeV run MD 3.4% of total program



What are we doing wrong?

- No Work Planning.
  - 9am meeting spawns most development sessions. Work begins at 930.
  - No formal submission, approval or appraisal process.
- No communication
  - Operations, Experiments and even people directly involved in work often not in the loop before work starts.
- Unrealistic time estimates.
  - Estimates always seem to be "blue sky".
    - Machine Failure rate not factored into estimates.
    - Recovery from possible damage done by development not included in time estimates. (if they even exist.)
- No cost benefit analysis.
  - Often success is not easily measured and failure not an option.

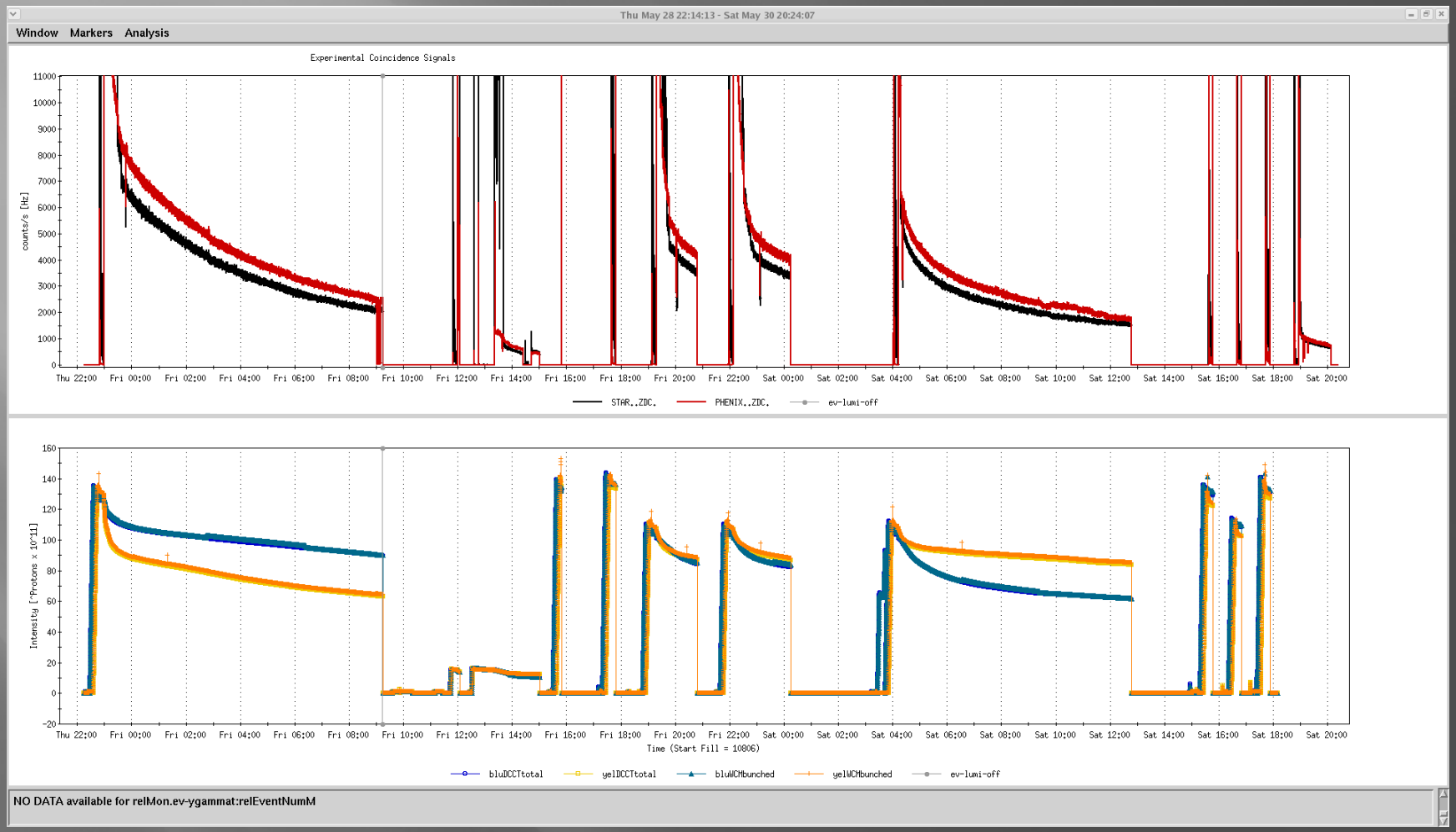
80cm beta* test. Adventures in Blue Sky Forcasting

- The "Plan" (from the 9am meeting.)
  - Load 80cm Beta* ramp. "It's in the can" (hour 0)
  - One 12x12 bunch test ramp. (hour 1)
  - One Physics store. (hour 2)
  - Observe Effect on Luminosity Lifetime.
  - Write Noble Prize acceptance speeches.

80cm beta* test. Adventures in Blue Sky Forcasting

- Reality….
  - 9:30 Machine development begins. (hour 0)
  - Ramp not exactly canned. Contacting experts.(hour 1)
  - 11:46 Ramp settings finalized. First 12x12 test ramp. (hour 3) Lost 15 min later.
  - 12:46 Second 12x12 ramp attempt. (hour 4)
  - 1446 12x12 bunch collisions established. (hour 6)
  - 15:47 First 109x109 ramp. (hour 7) Lost to QLI.
  - 17:36 Second 109x109 ramp. (hour 9) Lost to BLM.
  - 20:11 Low intensity 109x109 bunch fill. Physics running. (hour 11)
    - "Losses on ramp still bad, a tune feedback ramp is suggested"….One 9 hour store and several failed attempts to raise intensity later ….
  - 17:41 (the next day) Returned to 70cm Beta*. (hour 33)

Was this the plan?



What can to be done?

- Stop planning the day's development at the 9am meeting.
- Adopt the Maintenance work planning database model to machine development.
  - All development ideas (long and short range) are submitted in advance and approved with a clear plan of action. One partial or sub-par physics store while writing up and submitting a development plan is better than no store and a shift (or more) lost from a poorly planned development period that sounded good in the 9am meeting.

Development planning requirements

- Clear focus and scope of work.
  - Exactly what parameter are we trying to fix and how well can it be fixed?
    - Beam lifetime, luminosity lifetime, polarization, emittance, non-linear…..
    - The answer cannot not be "everything" and or you are unlikely to learn anything useful.
- Realistic plan.
  - Conservative time estimate.
  - Goals, metrics, and contingency plans need to be clear before commencement.
    - When have we succeeded or failed and when to throw in the towel?

Development planning requirements

- Clear communication
  - The plan must be available to anyone affected by the work even if they did not attend the planning meeting.
  - Clearly defined personnel requirements and rolls.
    - Who needs to be there, who will do what?
    - Ideally if the plan should be written well enough to allow anyone to complete required tasks. (probably wishful thinking)

- Post job review
  - A clear evaluation of results. (Not just one elog summary)
    - Did the development work? How well?
    - If it didn't , can it work next time?
    - Was it time/money well spent?