Overview

BABAR L1 DCT Upgrade FDR

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- Scope of the Project
- Current Status
- Schedule → Commissioning
DCT Upgrade – Motivation

- **Goal:** reduce the L1 trigger rate due to beam-related background by cutting on track $z_0$

- BABAR’s ability to run with higher luminosity is limited by the L1 rate
  - $< 5$ kHz if the data size unchanged
  - $< 3.5$ kHz with higher occupancy
DCT Upgrade – Scope

- Current DCT use only $r$-$\phi$ information

- New DCT expands this to 3-D
  - ZPD replaces PTD to add 3-D track fitting
  - TSF must ship fine-$\phi$ info for stereo layers → New TSF
  - Interface cards (TSFi, ZPDi, GLTi) handle added signals
DCT Upgrade – Deliverables

<table>
<thead>
<tr>
<th>What</th>
<th># in BABAR</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSFx/y</td>
<td>16 + 8</td>
<td>Manchester, Bristol, RAL</td>
</tr>
<tr>
<td>ZPD</td>
<td>8</td>
<td>Harvard</td>
</tr>
<tr>
<td>TSFi/ZPDi/GLTi</td>
<td>24 + 8 + 1</td>
<td>SLAC, Iowa</td>
</tr>
</tbody>
</table>

- **In addition, we need**
  - Test benches at SLAC and elsewhere
  - Online DAQ + calibration software (Iowa)
  - Reconfigure GLT (SLAC)

- **Another big task: simulation (Oregon, SLAC, Bristol, …)**
  - Rewriting the DCT simulation in C++
This Review

- We had a CDR (Sep ’01), but not a PDR
  - This makes the goal of this review broader than usual
    - Does the current design meet the performance goals?
    - Have we demonstrated readiness for production?
    - Are the production/test plans reasonable?

- Not all the items have been extensively tested
  - The Committee is asked to approve a list of “essentials” that need to be addressed before the production
  - Each component will be produced as it completes the list
## Scheduling Constraints

<table>
<thead>
<tr>
<th>2003</th>
<th>PEP-II</th>
<th>Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>Run</td>
<td>FDR → Recommendation</td>
</tr>
<tr>
<td>May</td>
<td>Run</td>
<td>Production, testing, debugging</td>
</tr>
<tr>
<td>June</td>
<td>Run</td>
<td>Parasitic commissioning run in IR2</td>
</tr>
<tr>
<td>July</td>
<td>Shutdown</td>
<td>All components delivered to SLAC</td>
</tr>
<tr>
<td>August</td>
<td>Shutdown</td>
<td>System test in IR2</td>
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<tr>
<td>Sept.</td>
<td>Run</td>
<td>Commissioning in IR2</td>
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<tr>
<td>Oct.</td>
<td>Run</td>
<td>Switch over from the old DCT</td>
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<tr>
<td>Nov.</td>
<td>Run</td>
<td></td>
</tr>
<tr>
<td>Dec.</td>
<td>Run</td>
<td></td>
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</table>

- Running in June will give us extremely valuable feedback
Commissioning

- **Parallel (parasitic) commissioning in IR2**
  - Run new DCT alongside the current one and take data
    - Validate the new DCT before switching over
    - Split fibers from DCH – Light level confirmed OK
    - Real estate, crate, ROMs “available” if not easy
  - Highly desirable to do this before summer shutdown
    - Data will teach us much ⇒ Fix things in summer
    - Must get ready **by mid June**
    - Not easy, but worth the effort
Current Status – TSF

- Prototype with 3 FPGAs (minimal set) produced
  - Finished electrical testing + boundary scan
  - Arrived SLAC this week for functional testing
- Firmware is nearly complete
  - 2 of the 3 FPGAs finished; Engine is almost done
- Need fast turnaround for the production
  - Not enough time for pre-summer commissioning
    - Produce more prototype boards to fill the gap
  - Full delivery in August
Current Status – ZPD

- Prototype has been built and tested successfully
  - PCB has been fully debugged
    - A few changes for the final production → done
  - Algorithm has been fully implemented
    - Can find & fit tracks correctly “most of the time”
    - Resource usage, speed, latency are OK
- Ready for PCB production
  - Production will take ~5 weeks
  - Test facilities ready at Harvard and SLAC
Current Status – Interface Cards

- TSFi/ZPDi/GLTi prototypes have been produced
  - Tested to varying levels depending on the availability
  - Minor problems found & fixed
    - PCB layout will be updated before production
- Produce each item as soon as the design is validated
  - TSFi critical for pre-summer commissioning
    - Hope to build production version in time
    - Being tested with the TSF now
  - Components with long lead time have been ordered
Current Status – Test Stand/DAQ

- SLAC test stand based on BABAR online system
  - ROM + Fast Control System + Trigger Crate + DCC + …
  - Test stand software has been written
    - Interactive ROM-level code + Tcl/Tk GUI
    - Automated online calibration system (“doctors”)
- Online DAQ software is under active development
  - Event data format (raw and TC) defined
  - FSM design in progress
  - Particular attention to support parasitic commissioning
    - i.e. to run new and old DCTs in IR2 and record data
Commissioning Readiness

- Full system unlikely before July
  - TSF will be prototype
  - Must assemble more
  - TSFi will be final
  - Must validate asap

- Goal: Instrument one quadrant
  - Needed for full $p_T$ acceptance
  - Learn as much as we can from the beams in June → More useful system test during the shutdown

<table>
<thead>
<tr>
<th></th>
<th>TSF + TSFi</th>
<th>ZPD + ZPDi</th>
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<tbody>
<tr>
<td>Minimal</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Goal</td>
<td>6</td>
<td>2</td>
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<tr>
<td>Full system</td>
<td>24</td>
<td>8</td>
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</table>
# Program Today

<table>
<thead>
<tr>
<th>Section</th>
<th>Duration</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>Overview</td>
<td>15'</td>
<td>Masahiro Morii</td>
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<tr>
<td>Performance Study</td>
<td>40'</td>
<td>Valerie Halyo</td>
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<td>TSF</td>
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<td>Hardware</td>
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<td>Scott Kolya</td>
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<td>Firmware</td>
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<td>Marc Kelly</td>
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<tr>
<td>Summary + Plans</td>
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<td>Nicolo de Groot</td>
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<td>Interface</td>
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<td>Design</td>
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<td>Jeff Olsen</td>
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<td>Xuedong Chai</td>
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<td>Overview</td>
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<td>Masahiro Morii</td>
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<tr>
<td>Testing + DAQ</td>
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<td>Eunil Won</td>
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<td>Algorithm + Summary</td>
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<td>Stephen Bailey</td>
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<tr>
<td>Test Stand + DAQ</td>
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<td>Gerald Grenier</td>
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<tr>
<td>Summary</td>
<td>15'</td>
<td>Su Dong</td>
</tr>
</tbody>
</table>

- **Coffee** during the Hardware and Algorithm + Summary sessions.
- **Lunch** during the Testing + DAQ session.
- **Coffee** during the Overview and Test Stand + DAQ sessions.