ATLAS ID status - March 2005

Will cover:

✓ TRT, SCT and Pixel status and critical items
✓ Integration progress in SR1
✓ Schedule critical items
✓ Installation work
✓ PIXEL 3rd layer, TRT C-wheels, organisational points
✓ Conclusions
Barrel TRT in SR1 (the surface building)

Feb. 8 snap shot and status now

- **Type 1:**
  - ✓ All modules installed & tested
  - ✓ All electronics installed
  - ✓ All modules cooling tube installed

- **Type 2:**
  - ✓ All modules installed & tested
  - ✓ 18 side A electronics installed

- **Type 3:**
  - ✓ All modules installed & tested
  - ✓ 2 side A electronics installed

- Barrel outer cylinder will be installed in March
SCT status - barrel

- B3 completed at Oxford (384 modules mounted and tested)
- B6 and B5 next (both at Oxford)
- Very good performance results
  - Total channels with problems 1943 / 58,9824 (0.3%)
  - Barrel module building completed

- B4 last; current plan Sept/Oct in Cern. This is too late and requires new planning. Shifts and decrease the scope of the testing are being considered
## Milestones Barrel

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRT Barrel ready for insertion</td>
<td>Aug 2005</td>
</tr>
<tr>
<td>SCT Barrel ready for insertion</td>
<td>Sept 2005</td>
</tr>
<tr>
<td>Start of Barrel insertion</td>
<td>3 Oct 2005</td>
</tr>
<tr>
<td>Start of combined testing</td>
<td>23 Dec 2005</td>
</tr>
<tr>
<td>Remove Barrel from TA</td>
<td>6 Feb 2006</td>
</tr>
</tbody>
</table>

### Planning must be tuned to meet this

<table>
<thead>
<tr>
<th>ID</th>
<th>Barrel integration</th>
<th>Duration</th>
<th>Start</th>
<th>End</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>ID trolley, service support, service checks</td>
<td>60 days</td>
<td>Mon 5/2/05</td>
<td>Fri 7/22/05</td>
</tr>
<tr>
<td>2</td>
<td>Insertion of SCT to TRT</td>
<td>15 days</td>
<td>Mon 10/3/05</td>
<td>Fri 10/21/05</td>
</tr>
<tr>
<td>3</td>
<td>Cabling and Test preparation</td>
<td>15 days</td>
<td>Mon 10/24/05</td>
<td>Fri 11/11/05</td>
</tr>
<tr>
<td>4</td>
<td>Function check on SCT barrel</td>
<td>15 days</td>
<td>Mon 11/14/05</td>
<td>Fri 12/2/05</td>
</tr>
<tr>
<td>5</td>
<td>Function check on TRT barrel</td>
<td>15 days</td>
<td>Mon 12/5/05</td>
<td>Fri 12/23/05</td>
</tr>
<tr>
<td>6</td>
<td>Combined noise tests</td>
<td>10 days</td>
<td>Mon 12/26/05</td>
<td>Fri 1/6/06</td>
</tr>
<tr>
<td>7</td>
<td>Cross talk tests</td>
<td>10 days</td>
<td>Mon 1/19/06</td>
<td>Fri 1/20/06</td>
</tr>
<tr>
<td>8</td>
<td>Detector Stability check</td>
<td>10 days</td>
<td>Mon 1/23/06</td>
<td>Fri 2/3/06</td>
</tr>
<tr>
<td>9</td>
<td>Uncabling</td>
<td>10 days</td>
<td>Mon 2/6/06</td>
<td>Fri 2/17/06</td>
</tr>
<tr>
<td>10</td>
<td>PST trial assembly</td>
<td>5 days</td>
<td>Mon 2/20/06</td>
<td>Fri 2/24/06</td>
</tr>
<tr>
<td>11</td>
<td>Prepare Trolley for move to pit</td>
<td>5 days</td>
<td>Mon 2/27/06</td>
<td>Fri 3/3/06</td>
</tr>
<tr>
<td>12</td>
<td>Transport to pit</td>
<td>0 days</td>
<td>Fri 3/3/06</td>
<td>Fri 3/3/06</td>
</tr>
</tbody>
</table>
TRT EC wheel production

Wheel production in Russia
TRT endcap stacking also well started

- On the left: TRT wheel stacking started, all wheels for first EC (C) at CERN.
- First FE boards plugged in and tested but electronics production still the holding item.
- Stacking of wheels for EC(C) to be completed by end April; wheel stacking for EC(A) starts in May. 4 wheels(A) + 2 wheels(B) for EC(A) are now in transit from Russia to CERN.
- Second endcap (A) remain critical but probably ok if current wheel delivery schedule is kept (as we have seen lately this is feasible).
New technical worry:

- HV fuse problem to be watched - lead to loss of channels if fuses fails as a function of time
- Accessible until last moment for the barrel but not accessible in the EC after electronics mounting
- Below is list of lost fuses in the wheels now at CERN over the last 12 months - 1.6%/year (situation worse for barrel but see point above)
- Training of fuses (integrating few C) under evaluation seems to improve \( \tau \times 10 \).
- New fuse production possible for barrel (see this after EC-fuses completed) with better metallic interfaces.

The tests done during stacking:

- Dimensional checks
- Gas Tightness
- Electrical (ground, HV connections, fuses)
- HV behavior
- Cooling and T-sensors readout

The results are good
SCT status - EC (C) progress very good, EC(A) schedule critical

- Disks 8 and 9 completed at Liverpool
- Move on to next disks, D7+D6 at Liverpool
- 73% of modules now started, 80% of these tested with 92% yield
- Schedule tight for first EC (C) from Liverpool but currently acceptable - to CERN in October.
- Second EC (A) from NIKHEF currently late by 5 months - attempt to work more in parallel to save time - also consider moving disks into cylinders at CERN.
SCT EC summary from Liverpool

- 144 (~15% of Endcap C) modules mounted on 2 disks.
  - No module REMOVED after testing (yet)

- ~2% failed mounts
  - All Recoverable
  - Procedures & tooling modified to reduce risk - used effectively on 8C uppers.

- Disk 9c: Gone to cylinder (see below) and successful testing
- Disk 8c: (52 outer and 40 short-middle modules)
  - confirmation test done on all modules
  - redundancy links tested on all modules (2 replaced)
  - 3 modules need to be read through single link.
  - IV test to be done
  - thermal measurements to be done
  - finish by end of the week
# Milestones Endcap C

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
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<tbody>
<tr>
<td>TRT EC C ready for insertion</td>
<td>Sept 2005</td>
</tr>
<tr>
<td>SCT EC C ready for insertion</td>
<td>27 Dec 2005 (i.e EC to CERN in Oct)</td>
</tr>
<tr>
<td>Start of EC C insertion</td>
<td>3 Jan 2006</td>
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<tr>
<td>Start of combined testing</td>
<td>28 Mar 2006</td>
</tr>
<tr>
<td>Remove Barrel from TA</td>
<td>24 Apr 2006</td>
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<table>
<thead>
<tr>
<th>ID</th>
<th>Endcap C Integration</th>
<th>Days</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ID trolley, service support, service checks</td>
<td>60</td>
<td>Mon 7/4/05</td>
<td>Fri 9/23/05</td>
</tr>
<tr>
<td>2</td>
<td>Insertion of SCT to TRT</td>
<td>20</td>
<td>Tue 1/3/06</td>
<td>Mon 1/30/06</td>
</tr>
<tr>
<td>3</td>
<td>Move to TA and Cabling</td>
<td>20</td>
<td>Tue 1/31/06</td>
<td>Mon 2/27/06</td>
</tr>
<tr>
<td>4</td>
<td>Function check on SCT EC C</td>
<td>10</td>
<td>Tue 2/28/06</td>
<td>Mon 3/1/06</td>
</tr>
<tr>
<td>5</td>
<td>Function check on TRT EC C</td>
<td>10</td>
<td>Tue 3/1/06</td>
<td>Mon 3/27/06</td>
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<tr>
<td>6</td>
<td>Combined Noise Tests</td>
<td>5</td>
<td>Tue 3/28/06</td>
<td>Mon 4/3/06</td>
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<td>7</td>
<td>Combined Crosstalk tests</td>
<td>5</td>
<td>Tue 4/4/06</td>
<td>Mon 4/10/06</td>
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<td>8</td>
<td>Detector stability</td>
<td>5</td>
<td>Tue 4/11/06</td>
<td>Mon 4/17/06</td>
</tr>
<tr>
<td>9</td>
<td>Uncasing</td>
<td>5</td>
<td>Tue 4/13/06</td>
<td>Mon 4/24/06</td>
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<tr>
<td>10</td>
<td>Prepare Trolley for move to pit</td>
<td>5</td>
<td>Tue 4/25/06</td>
<td>Mon 5/1/06</td>
</tr>
<tr>
<td>11</td>
<td>Transport to pit</td>
<td>0</td>
<td>Mon 5/1/06</td>
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Milestones Endcap A

<table>
<thead>
<tr>
<th>Event</th>
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<tr>
<td>TRT EC A ready for insertion</td>
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<tr>
<td>SCT EC A ready for insertion</td>
<td>Feb 2006</td>
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<tr>
<td>Start of EC A insertion</td>
<td>Mar 2006</td>
</tr>
<tr>
<td>Start of combined testing</td>
<td>Apr/May 2006</td>
</tr>
<tr>
<td>Remove EC A from TA</td>
<td>June 2006</td>
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</table>

Present plan: SCT ECA is ready in NIKHEF in March 06, too late! Currently trying to move some activity (disk into cylinders and tests) to SR1.

<table>
<thead>
<tr>
<th>ID</th>
<th>Endcap A integration</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>ID trolley, service support, service checks</td>
<td>60 days</td>
<td>Mon 9/26/05 to Fri 12/16/05</td>
</tr>
<tr>
<td>2</td>
<td>Insertion of SCT to TRT</td>
<td>20 days</td>
<td>Tue 2/21/06 to Mon 3/20/06</td>
</tr>
<tr>
<td>3</td>
<td>Move to TA and Cabling</td>
<td>15 days</td>
<td>Tue 4/4/06 to Mon 4/24/06</td>
</tr>
<tr>
<td>4</td>
<td>Function check on SCT EC A</td>
<td>10 days</td>
<td>Tue 4/25/06 to Mon 5/9/06</td>
</tr>
<tr>
<td>5</td>
<td>Function check on TRT EC A</td>
<td>10 days</td>
<td>Tue 5/8/06 to Mon 5/22/06</td>
</tr>
<tr>
<td>6</td>
<td>Any remaining Tests?</td>
<td>10 days</td>
<td>Tue 5/23/06 to Mon 6/5/06</td>
</tr>
<tr>
<td>7</td>
<td>uncabling</td>
<td>5 days</td>
<td>Tue 5/8/06 to Mon 6/12/06</td>
</tr>
<tr>
<td>8</td>
<td>Prepare Trolley for move to pit</td>
<td>5 days</td>
<td>Tue 6/13/06 to Mon 6/19/06</td>
</tr>
<tr>
<td>9</td>
<td>Transport to pit</td>
<td>0 days</td>
<td>Mon 6/19/06 to Mon 6/19/06</td>
</tr>
</tbody>
</table>
PIXEL progress good, pointing toward a 3-layer system

- The PIXEL barrel dry-assembly in SR1 done in November - very impressive
- All FE chips now delivered, yield excellent (90% tested with 81% yield) already enough good chips for 3 layers
- Sensors for 2 layers available and orders for the rest has gone out
- Hybrids for 3 layers available
- More than 600 bare modules delivered
- Sector assembly started well, stave loading still slow

Module rate improves, but needs continuous watching
PIXEL sector loading

- 12/48 Sectors have been already loaded (2 pre-prod + 10 prod.)
  - Rate is about linear with 0.5 modules/day → 1 sector / 13 days.
  - Average rate is below the planned 1 sector/week.

Higher sector loading speed possible. Rate is still limited by production of modules.
PIXEL stave loading

- 9/112 staves have been already loaded (3 pre-prod + 6 prod.)
  - 1 stave/week per site (CPPM, Genoa, Wuppertal) proven, still limited by module production rate
  - Trial half-barrel (Layer2) loading to begin on April in SR1 and go on for 2-months (26 staves) to verify timing, tools and teams
  - 5 FTE should allow to integrate 4 staves on an half-shell per week (see below)

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Durata</th>
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<tr>
<td>1</td>
<td>Bi-stave Assembling</td>
<td>2.75 giorni</td>
</tr>
<tr>
<td>2</td>
<td>Cables connections on the first stave</td>
<td>0.5 giorni</td>
</tr>
<tr>
<td>3</td>
<td>Connectivity Check on the first stave</td>
<td>0.25 giorni</td>
</tr>
<tr>
<td>4</td>
<td>Cables connections on the second stave</td>
<td>0.5 giorni</td>
</tr>
<tr>
<td>5</td>
<td>Connectivity Check on the second stave</td>
<td>0.25 giorni</td>
</tr>
<tr>
<td>6</td>
<td>Bi-stave Mechanical Assembling</td>
<td>0.5 giorni</td>
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<tr>
<td>7</td>
<td>Geometrical Inspection</td>
<td>0.25 giorni</td>
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<tr>
<td>8</td>
<td>Leak Check</td>
<td>0.5 giorni</td>
</tr>
<tr>
<td>9</td>
<td>Bi-stave into the HalfShell</td>
<td>2 giorni</td>
</tr>
<tr>
<td>10</td>
<td>Bi-stave fastening</td>
<td>0.5 giorni</td>
</tr>
<tr>
<td>11</td>
<td>Testing</td>
<td>1.5 giorni</td>
</tr>
<tr>
<td>12</td>
<td>Connect cooling</td>
<td>0.25 giorni</td>
</tr>
<tr>
<td>13</td>
<td>Module Testing</td>
<td>1 giorno</td>
</tr>
<tr>
<td>14</td>
<td>Disconnect Cooling</td>
<td>0.25 giorni</td>
</tr>
</tbody>
</table>
Status in a few words:
- TRT barrel completed, electronics inst. ongoing
- TRT wheels are on the stacking table
- PIXEL trial assembly completed
- SCT B3 arrived to CERN in January.
- Services, power and readout, DCS and DAQ work well advanced
Tooling for integration coming along

- Example of tooling: TRT moved over SCT, the ID trolleys now at CERN
Integration and schedule key issues in SR1

- The last SCT barrel (B4) arrives too late to have a complete acceptance tests and then SCT/TRT barrel insertion taking place in sequence - as foreseen earlier.
- Need to shorten SCT barrel final tests time one way or another (use only 1000 cables, i.e. cable only half barrel?), experience with B3,B5,B6 will help us in choosing the best strategy.
- A lot of activities converge to SR1 and plans must be flexible to cope with problems. Space conflicts might become an issue and must be closely monitored.
ID installation/commissioning work

Stage 1 (services) - several intensive campaigns:

- Services supports (completed) inside barrel cryostat.
- First layer of services on end flange (Spring 05) - most of the pipes.
- Type IV services between platforms and counting rooms (Spring 05).
- Services from detector to platforms, second layer going along tile barrel (when calorimeter is in position autumn 05 - starting in September).
- Services from detector to platforms, third/fourth layer going to PP2 and out (when calorimeter is in position autumn 05 - starting in October)
- Patch-panels on similar timescales.

Followed in weekly meeting with TC (Wednesday mornings).
Stage 2 (off detector systems)

- ID cooling systems and thermal enclosures
- Heaters and their control
- ID gas overview
- Off-detector power and readout

More details in the following
ID cooling systems and thermal enclosures

- The cooling systems have passed their FDRs and PRRs over the last year:
  - Evaporative system for PIXELs and SCT cooling
    - First system with final compressor running in SR1 now
    - Have finalised/frozen all operational parameters.
    - Large effort over the last year to test and qualify capillaries, heat-exchangers (space limitations close to detector), heaters (used to remove excess liquid in return lines in order to keep them above dew point) - significant projects on their own.
  - Monophase systems for TRT and cable cooling
    - Fairly standard, early prototype installed and operational in SR1.

- The cooling systems are being built by ST/CV and the work-packages were agreed a year ago.
- The installation and commissioning sequence have been preliminarily outlined (M.Olcese). Large scale and long term tests are foreseen in SR1 this spring/summer.
- We have also simplified the thermal enclosure designs for the SCT very significantly in the last 12 months after reviews - they remain on the critical path. Recently there has been good progress in this area.
Heaters and their control

- 290 heating pads for the thermal enclosures (in production)
- 204 heaters for the evaporative system in the experiment (proto ordered, mid-April delivered, final order in May). Heaters in SR1 included in cooling racks.

- Design of power supply and control system well advanced and tested, final prototypes ongoing (S. Mc Mahon)
ID gas overview

- Work-packages for the ID gas systems “agreed” with CERN gas group:
  - TRT active gas: Xe (70), CO₂ (27), O₂ (3)
    - System design agreed
    - Qualification and validation handled by ATLAS in collaboration with gas group
  - SCT and pixels: Dry N₂ inside gas-tight thermal enclosures
    - Keep water vapour below 600 ppm inside enclosures
      - Critical to avoid condensation on cold components (modules, cooling pipes,...)
  - Flush ID global volume with up to 10 m³/hour of dry CO₂
    - Remove N₂ leaking from SCT/pixel thermal enclosures (spec 6 l.mbar/hour),
    - Keep dew point in all ID gaps below -25 C to avoid condensation on cold tube joints
      that cannot be insulated (particularly important for pixel PP1)
  - TRT: ‘Envelope’ gas around straws is CO₂ - remain not agreed WP
    - Used for cooling (endcap) and ventilation (remove Xe which absorbs TR photons)
    - Keep concentration of N₂ in envelope below 1%, water vapour below 500 ppm
  - Have passed FDRs/PPRs for these systems providing the basis for the WPs
    mentioned above.

- Have also passed FDR for the ID endplate sealing the overall volume, and
  follow recommendations in this review to finalize design but struggle
  finding designer effort to complete in time
Off-detector power and readout

- Note that all three systems took part in the CTB this year so on the readout side one first integration exercise is done.
- Furthermore, Power Supplies, DCS systems, RODs and DAQ developments are used in macro-assembly sites (in large numbers in some cases) and at SR1.
  - SCT use final RODs and final PSs
  - PIXEL aim for the same, but do not have final PSs yet.
  - TRT use temporary RODs and temporary PSs but will change Sept/Oct to final parts.
  - Problems are observed in operation but also solved - very important experience for us.
- Combined running in SR1 late in 2005 gives us another integrated run - with more final off-detector components.
- However, from middle of this year we will start to move as much as possible of the off-detector components into their final home in the pit.
Combined running (and cosmics) HW preparation

- We are preparing for combined running in SR1 by Oct/Nov; cosmics run is also foreseen if time allows.

- Preparation for Test area
  - Dismount (or raise) SCT test enclosure
  - Installation of additional services for SCT
  - Move TRT services & patch panels to test-area + installation of new services
  - Add detector specific supplies
    - Gas system
    - Cooling (C6F14 for TRT, C3F8 for SCT), DCS, interlock
    - Readout & supply cables/fibres + patchpanels

- Preparation of Readout and Control systems
  - Increase ROD & PS system for SCT
  - New ROD system for TRT
  - New: LTP & TTC systems
  - Scintillator and trigger system
  - Combined DAQ (RCD and/or RCD/ROS readout)
  - Combined DCS

- Software/monitoring work also substantial … see link next slide
Performance and software

- On going work to understand the as-built ID still suffering from lack of human resources but nevertheless receiving much more attention:
  - Note by Richard Hawkings on as-built accuracy and alignment issues at:
  - Talk by M.Elsing on off-line software progress and organization:
    - http://agenda.cern.ch/askArchive.php?base=agenda&categ=a042357&id=a042357s11t2/moreinfo

Summary of R. Hawkings' talk:
- As built accuracy is good enough to begin alignment procedure with tracks
  - Radial misalignments (e.g. pixel module bow) must be measured as they are difficult to be corrected

Summary of M.Elsing's talk:
- Schedule 2005/2006 for ID Software developments is packed
  - Latest example: rigid Release 10.0.0 timeline is very problematic for ID software
- Combined Test Beam resulted in several improvements in software
- High Level Trigger software has to become a higher priority
- "As built" material update is an important deliverable (for $X_0$, activation and b-field map)
- The first commissioning phase for the ID is the combined SCT+TRT run at SR1 in November 2005 (Cosmics)
  - We will use the strategy like for the CTB software preparation
- Software preparations have started but
  - Need to start dedicated simulation now!
  - A lack of manpower is clear in several areas
  - Monitoring, Alignment and Conditions Database issues need to be addressed
PIXEL 3rd layer

- The PIXEL 3rd layer parts are coming along, FE chips, hybrids and sensors, and also mechanics with very impressive help from the leading PIXEL FAs and a good push from the PIXEL community.
- Thanks to ScheduleV7 allowing late pixel installation we now have a plan for the 3-layer integration and installation.

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Temporary AREA Available in SR1</td>
<td>0 days</td>
<td>Fri 2/4/05</td>
<td>Fri 2/4/05</td>
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<tr>
<td>2</td>
<td>Area Set up</td>
<td>40 days</td>
<td>Fri 2/4/05</td>
<td>Thu 3/3/05</td>
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<tr>
<td>3</td>
<td>General Facilities</td>
<td>20 days</td>
<td>Fri 2/4/05</td>
<td>Thu 3/3/05</td>
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<td>4</td>
<td>HalfShell equipment</td>
<td>20 days</td>
<td>Fri 3/4/05</td>
<td>Thu 3/31/05</td>
</tr>
<tr>
<td>5</td>
<td>Bi-stave assembling equipment</td>
<td>10 days</td>
<td>Fri 3/4/05</td>
<td>Thu 3/17/05</td>
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<tr>
<td>6</td>
<td>HalfShell_L2_Bottom</td>
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<td>Mon 6/13/05</td>
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<td>7</td>
<td>Final Area Ready</td>
<td>0 days</td>
<td>Fri 7/1/05</td>
<td>Fri 7/1/05</td>
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<tr>
<td>8</td>
<td>CMM to SR1</td>
<td>16 days</td>
<td>Mon 7/4/05</td>
<td>Mon 7/25/05</td>
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<td>50.75 days</td>
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<td>Fri 9/23/05</td>
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<td>HalfShell_BL_Bottom</td>
<td>24.5 days</td>
<td>Fri 9/23/05</td>
<td>Thu 10/27/05</td>
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<td>11</td>
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<td>20.75 days</td>
<td>Fri 10/28/05</td>
<td>Fri 11/25/05</td>
</tr>
<tr>
<td>12</td>
<td>HalfShell_L1_Bottom</td>
<td>39.5 days</td>
<td>Fri 11/25/05</td>
<td>Fri 2/3/06</td>
</tr>
<tr>
<td>13</td>
<td>HalfShell_L1_Top</td>
<td>35.75 days</td>
<td>Fri 2/3/06</td>
<td>Fri 3/24/06</td>
</tr>
<tr>
<td>14</td>
<td>HalfShells Survey</td>
<td>183 days</td>
<td>Tue 7/26/05</td>
<td>Thu 4/6/06</td>
</tr>
<tr>
<td>15</td>
<td>Half Shell L2 Bottom Survey</td>
<td>13 days</td>
<td>Tue 7/26/05</td>
<td>Thu 8/11/05</td>
</tr>
<tr>
<td>16</td>
<td>Half Shell L2 Top Survey</td>
<td>13 days</td>
<td>Fri 9/23/05</td>
<td>Wed 10/12/05</td>
</tr>
<tr>
<td>17</td>
<td>Half Shell L1 Bottom Survey</td>
<td>10 days</td>
<td>Fri 2/3/06</td>
<td>Fri 2/17/06</td>
</tr>
<tr>
<td>18</td>
<td>Half Shell L1 Top Survey</td>
<td>9 days</td>
<td>Mon 3/27/06</td>
<td>Thu 4/6/06</td>
</tr>
<tr>
<td>19</td>
<td>Half Shell BL Bottom Survey</td>
<td>6 days</td>
<td>Fri 10/28/05</td>
<td>Fri 11/4/05</td>
</tr>
<tr>
<td>20</td>
<td>Half Shell BL Top Survey</td>
<td>5 days</td>
<td>Fri 11/25/05</td>
<td>Fri 12/2/05</td>
</tr>
<tr>
<td>21</td>
<td>Barrel Integration</td>
<td>40 days</td>
<td>Fri 4/7/06</td>
<td>Thu 6/1/06</td>
</tr>
<tr>
<td>22</td>
<td>Services and Beam Pipe Panels Integration</td>
<td>20 days</td>
<td>Fri 6/2/06</td>
<td>Thu 6/29/06</td>
</tr>
<tr>
<td>23</td>
<td>Final System Test</td>
<td>40 days</td>
<td>Fri 6/30/06</td>
<td>Thu 8/24/06</td>
</tr>
<tr>
<td>24</td>
<td>INSTALLATION DATE</td>
<td>0 days</td>
<td>Thu 10/5/06</td>
<td>Thu 10/5/06</td>
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</tbody>
</table>
TRT C-wheels

- Feb.03: TRT C-wheels staged due to project overcosts (4.6 MCHf) - a revised project plan defined with:
  - Full priority to initial TRT and new commitments on C-wheels stopped.

- The initial TRT project is now moving forward well, but, even after many discussions, resources for the C-wheels destaging could not be found. This is unfortunate as it will be difficult to restore activity after stop (in Summer).

- IDSG regrets this situation (and the loss in momentum and b_tagging performance) and decides not to install the cables for C-wheels. This may be possible later at the price (risk) of breaking the seal around the ID cables.

- Any potential change of ID in the very forward region will most likely happen on the timescale of the b_layer replacement (2012).
Conclusions

- Construction progress impressive, few of our technical problems reported earlier are left
  - TRT fuses is a new addition - watch it

- Schedule critical in several areas
  - PIXEL modules
  - SCT barrels and their assembly
  - SCT EC A - currently the most clear problem
  - SCT EC C on the critical path and TRT EC A currently a month or two late
  - ID cooling, environmental systems installation/demonstration critical as well

- Need to rationalize SR1 integration work now, unthinkable that we can gain significant time and we are already late - reduce scope (less testing), add more parallelism and focus on this reduced program.

- 3rd PIXEL layer within reach
- TRT C-wheels are becoming an upgrade option
- We have now a viable BCM and rad.monitoring planning for the ID (see slides of M.Mikuz in: [http://agenda.cern.ch/fullAgenda.php?ida=a05539](http://agenda.cern.ch/fullAgenda.php?ida=a05539))
- There is now a B-layer replacement note available: [https://edms.cern.ch/file/545603/2.0/Proposal_Draft_v2.pdf](https://edms.cern.ch/file/545603/2.0/Proposal_Draft_v2.pdf) with timescale 2012

- The CTB, cosmic running, as built documentation, field measurements, performance issues are becoming more important (and receive more attention) - future ID weeks will reflect this

- Resources are being redirected toward integration, installation, software and performance/software work.
Backup slides

- Heaters and their control
- Sequence of integration operations
- As built geometry
- B-field planning
- TRT C-wheels
- Manpower
Stage 2: Heaters and their control

### TABLE 1: heaters for the evaporative system

<table>
<thead>
<tr>
<th>Type</th>
<th>Stave</th>
<th>Opto board</th>
<th>Total power of heaters (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel</td>
<td>220</td>
<td>480</td>
<td>8</td>
</tr>
<tr>
<td>SCT barrel</td>
<td>504</td>
<td>960</td>
<td>44</td>
</tr>
<tr>
<td>SCT End Cap (1 of 2)</td>
<td>241.5</td>
<td>650</td>
<td>4</td>
</tr>
<tr>
<td>ID (Barrel &amp; 2 EC)</td>
<td>204.0</td>
<td>126.0</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2: design parameters for the ID heating pads

<table>
<thead>
<tr>
<th>Type</th>
<th>Area per pad (m2)</th>
<th>Number of pads</th>
<th>Total area (m2)</th>
<th>Redundancy</th>
<th>Required rating (W/m2)</th>
<th>Design rating (W/m2)</th>
<th>Design power per pad (W)</th>
<th>Total power (W)</th>
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</thead>
<tbody>
<tr>
<td><strong>Barrel SCT thermal enclosure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Outer Thermal Enclosure</td>
<td>0.64</td>
<td>8</td>
<td>5.12</td>
<td>N</td>
<td>100</td>
<td>1x100</td>
<td>64</td>
<td>512</td>
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<tr>
<td>End plates (2 off)</td>
<td>0.16</td>
<td>8</td>
<td>1.28</td>
<td>Y</td>
<td>300</td>
<td>2x200</td>
<td>64</td>
<td>512</td>
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<tr>
<td><strong>TOTAL Barrel SCT</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>1024</td>
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<tr>
<td><strong>EC SCT (1 off) thermal enclosure</strong></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Outer Thermal Enclosure</td>
<td>0.3</td>
<td>24</td>
<td>7.20</td>
<td>Y</td>
<td>300</td>
<td>2x200</td>
<td>120</td>
<td>2880</td>
</tr>
<tr>
<td>Front Wing top/bottom</td>
<td>0.32</td>
<td>2</td>
<td>0.64</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>64</td>
<td>128</td>
</tr>
<tr>
<td>Front Wing middle</td>
<td>0.14</td>
<td>2</td>
<td>0.28</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>28</td>
<td>56</td>
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<tr>
<td>Front Wing extension</td>
<td>0.08</td>
<td>4</td>
<td>0.32</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>16</td>
<td>64</td>
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<tr>
<td>Rear Wing top/bottom</td>
<td>0.31</td>
<td>2</td>
<td>0.62</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>62</td>
<td>124</td>
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<tr>
<td>Rear Wing middle</td>
<td>0.14</td>
<td>2</td>
<td>0.28</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>28</td>
<td>56</td>
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<tr>
<td>Rear Wing extension</td>
<td>0.06</td>
<td>4</td>
<td>0.24</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>12</td>
<td>48</td>
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<tr>
<td>Services feed through (cooling area)</td>
<td>0.030</td>
<td>8</td>
<td>0.29</td>
<td>Y</td>
<td>300</td>
<td>2x200</td>
<td>14</td>
<td>115</td>
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<tr>
<td>Services feed through (tape area)</td>
<td>0.06</td>
<td>16</td>
<td>0.96</td>
<td>Y</td>
<td>150</td>
<td>2x100</td>
<td>12</td>
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<td><strong>TOTAL EC SCT</strong></td>
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<td><strong>Pixel thermal enclosure</strong></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Barrel</td>
<td>0.08</td>
<td>28</td>
<td>2.24</td>
<td>N</td>
<td>115</td>
<td>1x810</td>
<td>65</td>
<td>1820</td>
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<tr>
<td>Forward A</td>
<td>0.09</td>
<td>36</td>
<td>3.24</td>
<td>N</td>
<td>115</td>
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<td>62</td>
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<td>Forward C</td>
<td>0.09</td>
<td>36</td>
<td>3.24</td>
<td>N</td>
<td>115</td>
<td>1x690</td>
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<td><strong>TOTAL Pixel</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>ID End Plate (1 off) thermal enclosure</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Outer anular cover plate</td>
<td>0.285</td>
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<td>2.28</td>
<td>Y</td>
<td>200</td>
<td>2x150</td>
<td>86</td>
<td>688</td>
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<td>Inner circular plate</td>
<td>0.304</td>
<td>4</td>
<td>1.22</td>
<td>Y</td>
<td>300</td>
<td>2x200</td>
<td>122</td>
<td>488</td>
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<tr>
<td>Beam pipe bellow</td>
<td>0.245</td>
<td>1</td>
<td>0.25</td>
<td>Y</td>
<td>400</td>
<td>2x250</td>
<td>122</td>
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<td><strong>TOTAL ID End Plates</strong></td>
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<tr>
<td><strong>ID services feed-through (per)</strong></td>
<td>0.027</td>
<td>10</td>
<td>0.27</td>
<td>N</td>
<td>18290</td>
<td>1X18290</td>
<td>500</td>
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<td><strong>GRAND TOTAL ID</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27230</td>
</tr>
</tbody>
</table>
Sequence of integration operations foreseen in SR1

- **TRT Barrel/EC C/EC A**
- **SCT Barrel/EC C/EC A**

**SCT-TRT Insertion & Final Seal**

**Transfer To Testarea & Cabling**

**SCT readout checks**

**Combined Tests**
- Noise
- X-talk
- Operation & Stability
- Cosmic

**TRT readout checks**

**Transport Prep & Transfer to pit**

- 2 wks
- 1+1 wks
- 3-4 wks
- Depending (4-7 wks)
- 3 wks
Pixel/SCT build precision – gaining knowledge as macro-assembly proceeds

- **Pixel detector – barrel and endcaps**
  - **Pixel barrel modules-to-stave:** CMM measurement wrt ruby balls at stave ends
    - Measurement precision 10/20 \( \mu m \) (r\( \phi \)/z); aim for mounting precision < 50 \( \mu m \) (not yet)
    - Major problem is stave bowing (r\( \phi \) and r) of up to 100 \( \mu m \) during mounting on half-shells and handling/transport – module-stave not re-measured after assembly
  - Studies show tracking alignment can 'get started' with such bowing, but significant degradation in tracking efficiency/precision ... would be useful to do better
  - **Pixel endcaps:** modules precisely mounted on disk sectors with precision < 25\( \mu m \)
    - Subsequent structure is stable and surveyed to ~ 20\( \mu m \) – good for getting started

- **SCT detector – barrel and endcaps**
  - **SCT barrel modules-to-cylinder build precision** RMS ~100 \( \mu m \) in r\( \phi \) and z
    - No survey - could add optical survey steps to reduce this to ~50 \( \mu m \) precision, but preliminary tracking studies do not suggest this would improve initial alignment much
  - **SCT endcap modules-to-disk surveyed to ~10 \( \mu m \) using CMM**
    - Degraded to 20-50 \( \mu m \) by thermal, handling, transport, based on experience of 1st disks
    - Can still find tracks to 'get started', but significant degradation in precision

- Detailed reconstruction studies with misaligned geometries ongoing

B-field mapping and measurements

- B-field workshop now being planned for March 31st - April 1st
  - Organised by Witold Kozanecki (Saclay).
  - Covering physics requirements, solenoid and toroid field mapping and reconstruction, use of Hall and NMR probes, permeability/reproducibility and (perhaps) software/database issues
  - Agenda being constructed - presentation in TMB meeting on Thursday 3.2

- Foreseen inner detector contributions:
  - Report on Babar field mapping - a recent big solenoid, useful experience?
  - Mapping strategy and specification
  - Hall probe sensors - specification, calibration, readout
  - Cavern environment/schedule and survey issues
    - Including availability of endcap calorimeters - crucial to complete magnetic circuit
  - Field map fitting and interpolation - from measurements to software
  - Monitoring of solenoid field during operation - NMR system

- Use this as a 'push' for the solenoid field mapping project
  - Review design and specification, steps and schedule for production
TRT C-wheels

- Feb.03: TRT C-wheels staged due to project overcosts (4.6 MCHf) - a revised project plan defined with:
  - Full priority to initial TRT and new commitments on C-wheels stopped.
  - The initial TRT project is moving forward very well and for the C-wheels we must NOW decide what to do with C-wheel production in Russia and cables
  - The initial TRT today has a cost projection indicating a potential further overcost of around 200 KCHf wrt to the plan of Feb.03.

- Actions taken: Fido Dittus wrote a memo to the ATLAS management in December requesting to spend around 200 kCHf to purchase radiators, mechanical wheel structure assembly and cables from PP1 to PP2 for the C-wheels.
  - Then a larger sum of money would be needed later for WEBs to complete the wheels (an additional 900kCHf) and the total costs would add up to 2.3 MCHf. Some of this funding is linked to TRT spares M&O budget line (2007-2010).
  - The motivation is very clear: secure the C-wheel production as prod. capacity become free and make sure the C-wheels completion remain a viable option for the future, when funding might become available.

- The Feb. IDSG re-emphasised some of the points in memo: C-wheel physics impact, the risks of opening the services seals to install cables later in particular.
  - In the IDSG there was also agreement that without having a clear support for continuing C-wheel work in Russia as described in the proposal made by the TRT and ID, we will recommend not to put in the C-wheel cables now. The reason is that we considered that a negative reply at this point about moving ahead will turn the C-wheels into an upgrade option with a very uncertain timescale, it will reduce the chance for backing in the collaboration as a whole, and generally decrease the chance for successful completion very substantially.
TRT C-wheels

- The management answer to the request is that there cannot be any spending on the C-wheels now and for the next 2 years it looks impossible (given the budget outlook today). The reasons mentioned:
  - The physics impact is not considered significant enough
  - There are still risks on the initial TRT and the project is today not fully covered financially
  - None of FAs involved are able to find extra funds for this project and the projections are bleak for the next 2 years
  - The TRT C-wheel work can (even if we in the ID think it is very unlikely) taken up at a later stage, including the services installation
  - There is definitely also a signal effect wrt FAs and CB to be considered.
    - There are already substantial claims for new funding to ATLAS to cover MoU commitments and CtoC, with implicit and explicit priorities, and the C-wheel funds would need to come in addition

- **IDPL interpretation as of today:**
  - We bring the C-wheels to a “safe” completion level in Russia (very small amount of funding needed) - not clear today what is optimal
  - We stop the work on C-wheels cables but put in the pipes (in services layer one)
  - We will need a strong physics/performance motivation (in 2007?) to revive the C-wheel work
  - Any potential change of the ID in this region is today most likely to coincide with the B-layer replacement end 2012 (obviously if there are significant problems this scenario can change completely)
Human resources

- Need help in several areas:
  - A lot of focus on SR1 which is good BUT most critically is installation responsibilities
    - Not all glamorous but very much needed (examples: cables installation planning/supervision, patch-panels likewise, people who can take responsibilities to help ID groups in their detailed planning)
  - Software development for combined running and generally:
    - Material estimates, as build data collection, databases, alignment, etc, etc
  - In cooling and environmental area, huge amount of work to get all this under control - some fairly specialised work so not easy to find people with the right profile.
  - B-field mapping (here we have a core group but the project is more difficult than foreseen)
  - Mail me (or Leonardo) as soon as possible, or Markus in the software area!