

AD start-up 2014

A brief summary

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LS1 work (selected items)

- Controls:
 - ACCOR (almost) completed, including FESA, InCA and Java migration
 - Central timing renewal, AD is now de-coupled from accelerator complex
 - Cycle generation software adapted/re-newed
 - New Beam Request Server
- Magnets:
 - DR.BHN06 renovated
 - DR.DHV2904 & 2917 replaced by new type
 - DE.Q7020 & 7030 replaced by new type (+ re-shuffling of line)
- Vacuum system renovation (25% of consolidation pgm completed)
- Stochastic cooling HW/SW/electronics/Servo motors renovation
- RF C02 HV & tuning supplies and interlock system renewal
- New Access Points and interlock system separation
- Magnetic Horn stripline failure. Discovered late...

Planning

- Detailed planning by Technical Coordinator:
 - Regular meetings during LS1
 - Many modifications leading up to the start-up
- Access System tests done in advance in collaboration with op
- HW-tests and cold checkout planned by TC-team together with BE/OP
- HWT/CC/beam start-up done by op:s team from the ACR together with eq. specialists.
- HWT & CC activities flexible; faults/debugging duration not known in advance, planning not always followed
- Setting-up with beam by op-team from ACR, 2-shift rota
- No formal check-lists
- Hand over “back-up” operation to ccc once machine is stable and beam quality satisfactory

Progress (main steps..)

- Start-up with beam initially planned 1/8 – 19/8, Physics start 19/8
- Physics run actually started 16/9
 - 5/8: First beam on target after Horn strip-line repair completed.
 - 6/8: Circulating beam at 3.5 GeV/c w. good lifetime.
 - 8/8: C10 systems working, first signs of cooling.
 - 15/8: Beam cooled and decelerated to 2 GeV/c. after debugging of stochastic cooling and Schottky measurement system.
 - 20/8: Beam at 300 MeV/c
 - 24/8: Beam cooled at 300 MeV/c and decelerated to 100 MeV/c with decent efficiency.
 - 28/8: First signs of cooling at 100MeV/c
 - 4/9: Good cooling achieved at 100 MeV/c
 - 10/9: Beam ejected
 - 16/9: All ejection beam-lines set-up and beam delivered to experiments. Low ASACUSA and ALPHA efficiency due to Horizontal fluctuations.

Main issues

- Some additional delay due to the Magnetic Horn Strip-line repair. Started at low current while monitoring focusing effect with RP monitors.
- Lengthy debugging (days) of new timing/cycle/BRS system:
 - PS/AD cycle synchro
 - Pause/un-pause AD cycle
 - Cycle editing, plateau insertion
 - Ejection timing not configured at start-up
- Debugging timing + clocks for Schottky intensity measurement system
- Lengthy set-up of BCT timing
- C10 cavities start-up: HW problems and very low initial beam intensity
- C02 renovation with new HV and tuning power supplies & new electronics and interlock system.
 - Many (intermittent) bugs HW/SW
- C02 LL:
 - Frequency synthesiser replaced w/o our knowledge and with wrong setting
 - experts not always available, days lost for ejection set-up.

Main issues

- Stochastic cooling renovation:
 - p/u structure movement system motor drive/controls: much time spent to make it operational before abandoning and use expert-sw. FESA-class bugs resolved towards end of 2014 run.
 - Debugging static and dynamic parameter control & other issues related to new HW installation (PFF)
 - GSM noise re-appeared: new Cryo-temperature sensors removed on pickup tanks & discovered that gain for AD Hall system was back to max. (New GSM HW + contractor ?)
- Orbits: Polarity mess-up with the 4 H correctors around the electron cooler (a lot of time lost...):
 - Various configurations tried...
 - 2904 and 2917; new magnets (calibration curves)
 - Cables re-routed and patched (for B393) =>
 - Erratic connections made @ power supplies
 - Normally no big deal, but **orbit pickup calibration factor corruption** was discovered (2/9) after much struggling (HW problems with old orbit system, losses during ramps/plateaus, orbit bumps not local, orbit corrections sometimes converging and sometimes diverging, lengthy manual cross checks etc. etc.)
 - Large orbit jumps on some occasions, traced to DHZ2908 which after installing a field probe became stable
 - Orbit corrections are always necessary at low energies.
- ABS orbit correction no longer available
 - Lengthy YASP set-up: operational end August

Main issues

- Electron cooler set-up:
 - Cooling effect very sensitive to trajectory imperfections
 - New timing set-up (new beam loss scenarios discovered)
 - New HW fault: frequent drop-outs depending on e-beam trajectory. Not yet solved.
- Ejection lines:
 - Several **cabling errors** due to B393 re-routing
 - Crossed cables, labelling errors
 - Negative corrector settings in some elements not possible => CO bug
 - Large H fluctuations (detrimental to ASACUSA and ALPHA):
 - DR.DHZ2908
 - Neighbouring AEGIS solenoid ramping w/o info or agreement
 - DR.SME5306S: recent power supply mod with different regulation and steeper ramps: Believed to cause additional fringing fields outside septum blade.
 - Checks with various ramping rates seem to confirm this
 - Work-around installed; synchronous timing to have identical effect on each cycle.
 - => fluctuations reduced by a factor 2.5 (which is close to previous years values)

On the good side...

- Many systems did actually start-up w/o particular issues....
- Target area fully operational very fast
- Modified ejection line layout (preparation for ELENA) with new optics and some new magnets: set-up for all experiments was very smooth !
- Beamline to the new BASE experiment commissioned w/o problems !

Remaining (main) issues

- Residual fluctuations in ejection line trajectories
- Intensity still not optimal
- Electron cooler drop-outs
- Somewhat high V emittances at 2 GeV/c
- RP alarms due to new rules and detector placement
 - Lower alarm limits
 - weak points in ring shielding
 - losses when using BPM:s during s-u in experimental areas
 - monitoring of typical workplaces inside user barracks

General remarks / conclusion

- Large number of upgrades/modifications => It was really a re-commissioning ! This took > 6 months back in 1999....
- AD team works 2 shifts Mo – Fri, 1 shift (12h) shift Sat – Sun
- Start-up during holiday period
- A fair amount of PSB/PS down-time
- Equipment specialists not always available for AD issues (sometimes only 1 person has the expertise...)
- Equipment specialists sometimes busy with higher priority work
- Cumulative machine issues seem to have an exponential effect on start-up duration....

Outlook for 2015

- Late start-up due to re-location of kicker pulse generator equipment into B393.
- First beam to AD planned for 1/6, but is now delayed to ~17/6 with physics start ~6/7
- <3 weeks for setting-up leaves little time for studies.