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Cost and Schedule Review AD Stochastic cooling follow-up

W. Hofle

Acknowledgement:
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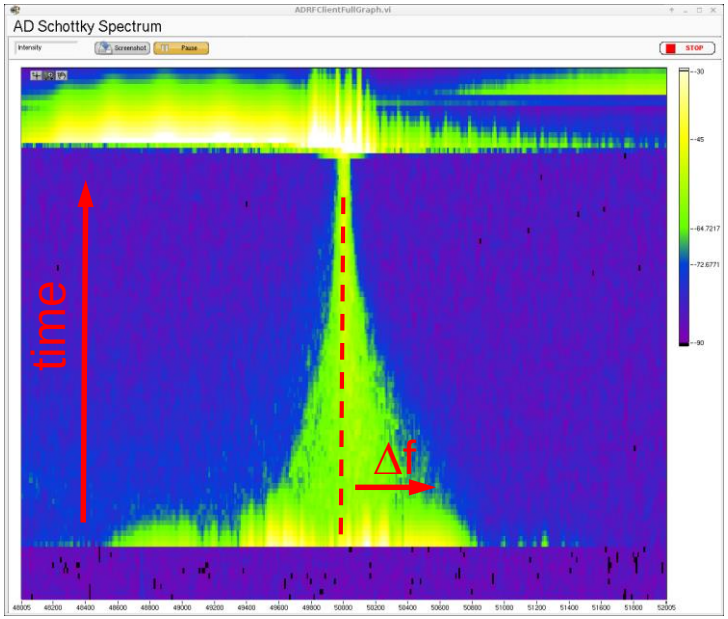
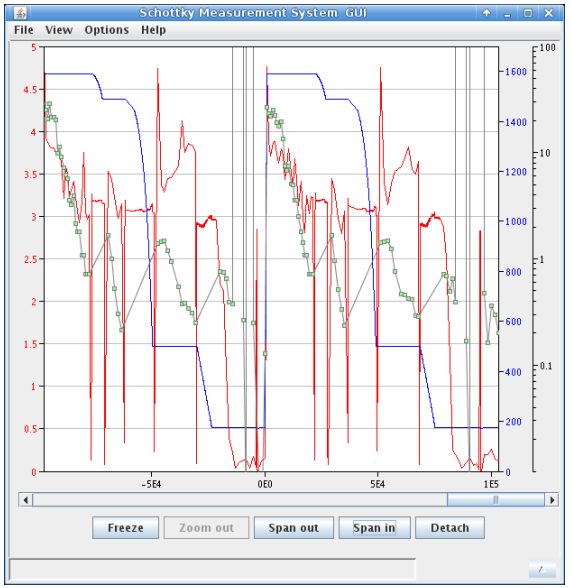
RF equipment during AD cycle

- C10 Cavity system for bunch rotation at injection
  - reduction of momentum spread at 3.5 GeV/c
- Stochastic Cooling at 3.5 GeV/c and 2 GeV/c
- Main C02 system for deceleration and bunch rotation at extraction
- Longitudinal pick-up systems for LLRF, tomoscope, Schottky and intensity measurement
- Transverse damper equipment for excitation



Stochastic Cooling at 3.5 GeV/c with new optical delay line notch



Schottky and intensity measurement to be replaced in LS2 (see talk by Maria-Elena Angoletta)

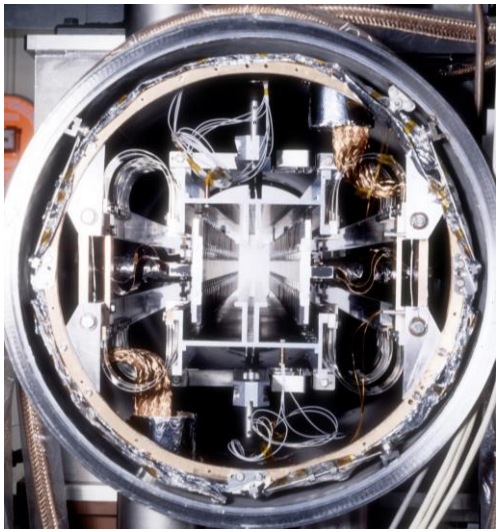
Beam Dynamics – reminder

plan as presented in 2018 → resource allocated in BE-BR: S. Albright

- Rebuild expertise and prepare cycles for Finemet system that will replace the C02 main RF system for deceleration
  - C10 RF system
    - simulation and optimisation of bunch rotation at injection (3.5 GeV/c) as function of available voltage
    - Establish procedure for phasing of cavities and diagnostics
  - C02 replacement by Finemet
    - adiabatic capture & de-bunching simulations at 3.5 GeV/c, 2 Gev/c, 300 MeV/c and 100MeV/c, plus bunch rotation at 100 MeV/c extraction
    - recommend the best adapted voltage program to capture the beam at each of the energies
    - simulations using the phase and radial loops for the ramps 3.5 GeV/c to 2 GeV/c, 2 Gev/c to 300 MeV/c and from 300 MeV/c to 100 MeV/c; recommend the best adapted phase and radial loop gain settings plus harmonic number for each of the ramps.

Controls (PLC) RF and Stochastic Cooling

- **TFB (Damper)**: New controls already in place → no actions foreseen
- **Stochastic Cooling pick-up movement control:** New controls in place
  - Move PLC from Siemens to Beckhoff for start-up (BE-RF-CS)
  - repair cryo temperature probes → not in LS2, inspection in LS3



Stochastic Cooling - Controls

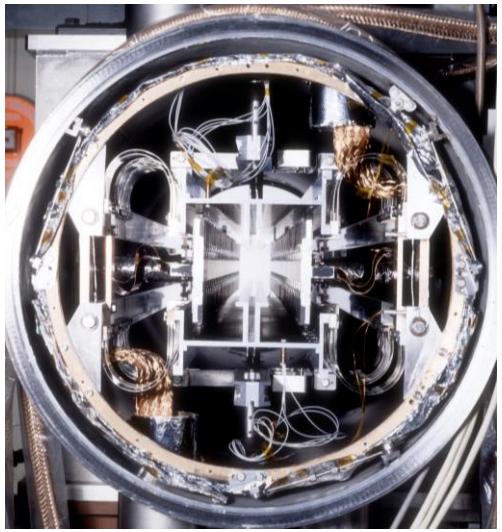
- **Platform “Fritz”**
  - controls renovation to replace with modern Beckhoff PLC (C. Oliveira, BE-RF-CS)
- **Optical delay line notch filter validated in 2018 with beam**
  - Implementation of two operational systems and one spare with Beckhoff PLC controls started, will be ready for start-up
- **Scool Amplifiers & controls**
  - considering prototype a PCB for the amplifiers bias control (bad contacts) → estimated 20KCHF, could extend lifetime of amplifiers
  - Repair and test of 48 amplifiers (P. Freyermuth, R. Louwerse + FSU team)
  - move to FESA3

Stochastic Cooling - RF

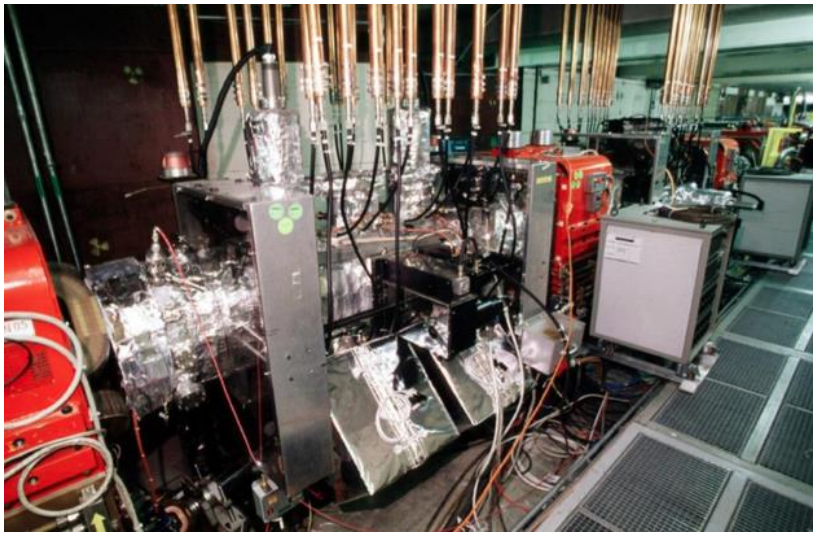
- **Pick-up and Kickers**
  - no consolidation possible before LS3
  - low probability of failure, possible high impact if kicker vacuum or pick-up movement fails
  - establish repair procedure for kicker vacuum failure (as was done in the year 2000)
  - assign a team in RF with mechanical expertise to “own these devices advised
    - establish then with this team the needed and possible consolidation and development of spares
- **Notch filter replacement with optical fiber delay lines**
  - successful tests with beam in 2018
    - http://accelconf.web.cern.ch/AccelConf/cool2019/papers/moy01.pdf
  - full deployment for 3.5 GeV/c and 2 GeV/c for re-start after LS2
  - dismantling of obsolete equipment in YETS 2021/2022
- **Amplifiers**
  - de-installation and reinstallation of equipment during LS2 to open AD ring
  - refurbish parts that are not performing or needing replacement during LS2
  - establish a replacement program for amplifiers once electrical delay margin clear after having fully commissioned the optical delay line notch filters

Stochastic Cooling - RF

- Pick-up and Kickers
  - no consolidation possible before LS3
  - low probability of failure, possible high impact if kicker vacuum or pick-up movement fails
  - establish repair procedure for kicker vacuum failure (as was done in the year 2000)
  - assign a team in RF with mechanical expertise to “own these devices”
    - establish then with this team the needed and possible consolidation and construction of spares (optional)
    - electromagnetic simulations for the design study needed

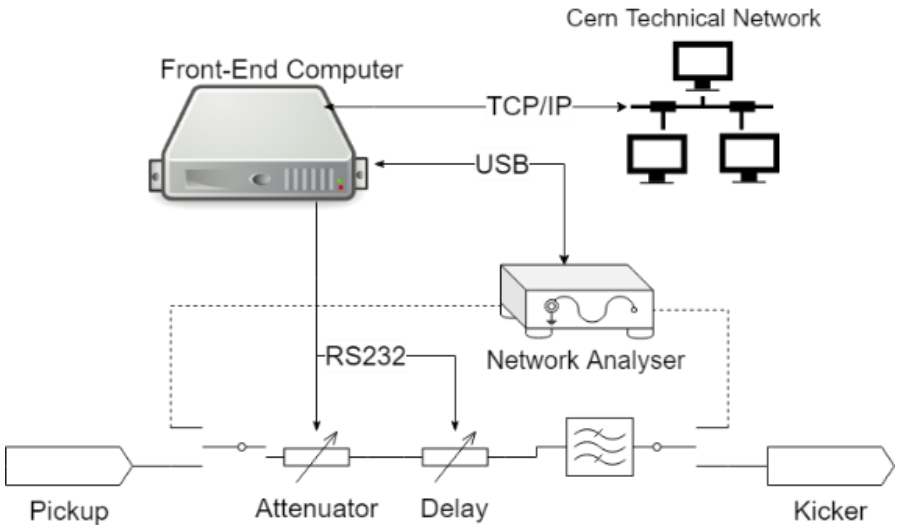


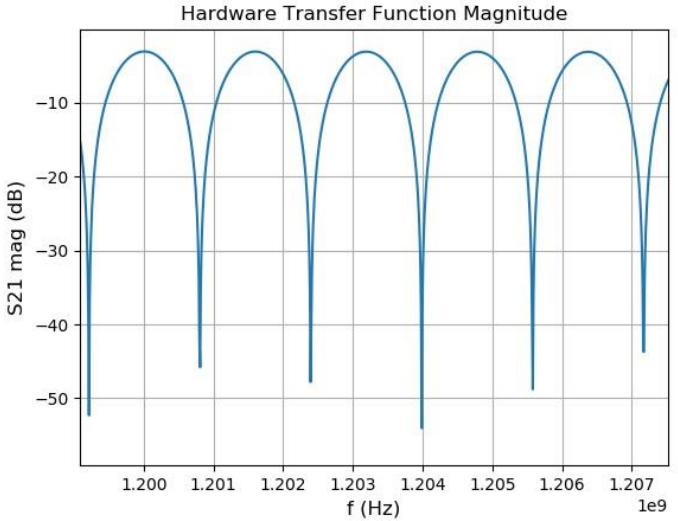
pick-up tank



kicker tank

Transfer function measurement set-up





FESA class being developed

- automation of measurement triggered by timings to be defined
- control-room application on top
- integration with timing

Vebjorn Myklebust

RF Consolidation in APT

budget provisions in APT

Status	WP	WPH		BC	Descr.	EDMS	spent	2020	2021	2022	2023	2024	2025	Total	Comments
Active	27	BE/RF	W.Hofle	69516	AD s-cooling	1689140	516	177							amplifiers?

- AD Stochastic Cooling
  - re-profiled budget to match resources to do the work
  - a healthy operational budget complements the consolidation
  - future items for consolidation: amplifiers and kickers (!)
    - this needs allocation of personnel for a study
  - in contact with AD-OP to establish a schedule for re-start and define the contributions by AD-OP for 2020 - 2021

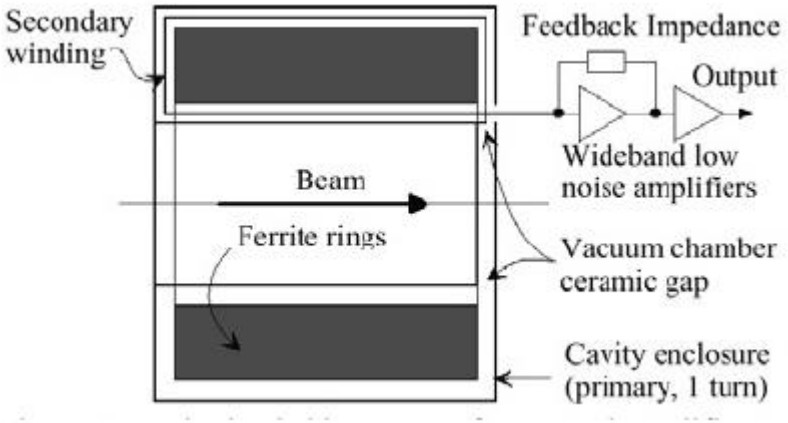
Needed Consolidation from other teams

- CV / AD cooling water
  - it was not possible in 2018 to run the AD machine at 3.5 GeV/c with stored beams for more than ~10 minutes; after this time magnets trip
  - tests showed that by increasing the cooling capacity this time period can be prolonged however its not possible to run at 3.5 GeV/c in cw mode
  - the cw mode is necessary to do meaningful studies and adjustments on the stochastic cooling system at 3.5 GeV/c; the cooling should be consolidated
  - if this is not possible (to pause the machine at 3.5 GeV/c) for the restart after LS2 we are in a situation “has never been done before”
  - we will prepare for this with automated tools for transfer function measurements as much as possible

Spare

Parts not (yet) needing consolidation

- AD longitudinal pick-up
  - Analog electronics interfacing to the longitudinal pick-up → re-visit any needed after LS2 when new LLRF operational
- Transverse kicker and equipment for BTF and tune measurement
  - relocated for ELENA installation done
  - presently no consolidation expected



3 pick-ups, 1 high frequency pick-up, 2 low frequency pick-ups
1 LF PU in transfer line; 1 HF PU and 1 LF PU in AD ring
used for Long Schottky (see presentation by Maria Elena Angoletta); extracted beam intensity intensity measurement and momentum spread of the beam in AD

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