

Block 4 vertical test facility: status and perspectives

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Outline

- Facilities
 - Cryogenics
 - Power supplies
- Recent upgrades and achievements
- Support to the LHC project and post LHC perspectives
- Running costs
- Concluding remarks

General information on the vertical test facility



- Installations in building 892 occupy $\sim 600 \text{ m}^2$
- Contiguity with 927 and 904 halls
- MTM-B4 section has 4 staff + 9 FSU collaborators + 2 visiting associates
- Support from AT ECR, AB PO, AB CO and TS CV
- Running cost (not including CERN staff and support) at the end of the LHC era is of the order of 1.4 MCHF/year

Cryogenics



- Helium liquefier (3000 l/day) pretty old: only running costs
- Roots pumping group for sub cooling at 1.9 K, 1.6 g/s
- 3 cryostats for 1.9 K operation and 1 for 4.4 K only
- Shared He purifier
- Controls based on PLC (step7)+Supervision (PCVue)



Vertical cryostats

Cryostat	Long Cryostat	Siegtal Cryostat	Auxiliary Cryostat	New St4 Cryostat
Useful height (mm)	3800	1400	2150	1600
Useful diameter (mm)	600	800	280	500
Cool-down time 300 K - 4 K (hours)	44	32	8	5
Cool-down time 4 K – 1.9 K (hours)	12	8	3.5	-
Consumption for 1 working day (liters)	8400 (4.4K) 10600 (1.9K)	5100 (4.4K) 6400 (1.9K)	1500 (4.4K) 2000 (1.9K)	2000 (4.4K)
Consumption for 2 working days (liters)	10700 (4.4K) 13300 (1.9K)	6500 (4.4K) 8300 (1.9K)	2300 (4.4K) 3100 (1.9K)	3800 (4.4K)

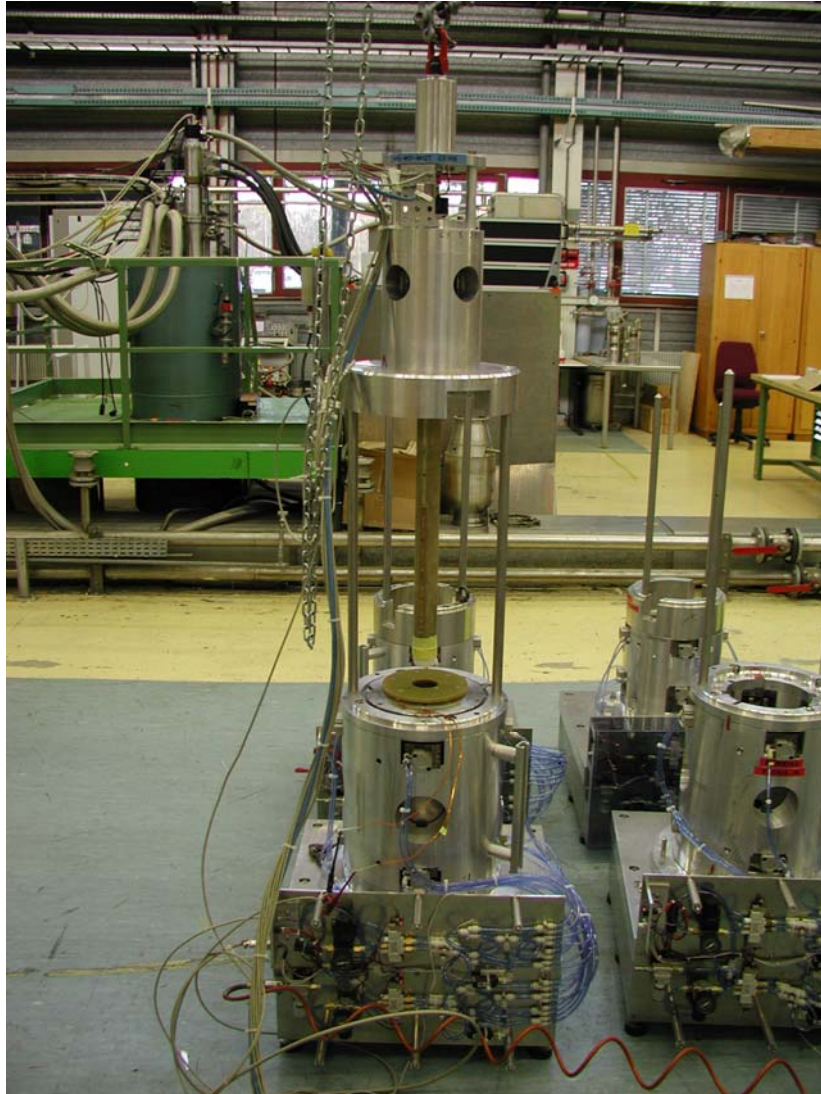


Power supplies

Number	Maximum current	Maximum voltage	Accuracy	Ripple output voltage
1	20kA	25V	10ppm	200mV pp
2	± 2 kA	± 10 V	100ppm	150mV pp
3	± 600 A	± 12 V	100ppm	10 mV pp

Courtesy H. Thiesen

Magnetic measurement equipment



- 12 benches for Axis, angle and field measurements of LHC correctors
- Numerous shafts for cold magnetic measurements
- Bench for LINAC 4 PMQ
- Hall probes mapping


Recent upgrades and achievements

- Long cryostat
 - Costs
 - Civil engineering ~ 90 kCHF
 - Mechanics ~ 30 kCHF
 - MM equipment ~ 50 kCHF
 - Outcomes:
 - besides baseline goals (green light for production, in particular to ACCEL), almost all DS and MS quads pre tested → two faulty magnets discovered → no CM opening
 - MM measurements for LHC operations
- New pumping group (*shut down 2004*)
- Digital controls of PC +MMP6 (*shut down 2005*)
- New Cryostat for MQTL replaced Diodes Cryostat (2005)
- PLC upgrade S5→S7 (*shut down 2006*)
- Cryogenics supervision PCVue → PVSSII (*foreseen for 2007*)
- MCBX: contractor underestimated cold test costs if no existing facility is available → test and measurements of the series (27 items) took about 1 year
- MQTL: the whole series of 120 modules
- Nb-Ti SC Undulators R/D program: number of iterations difficult to anticipate: vertical tests handy for quick feedback. Ongoing since July 2004



Workload for 2006 and perspectives for 2007

- Finish tests of series and spares
- Extended MM program for DS and MS:
decay and snapback, fields as a function
of injection currents and history; squeeze,
unbalanced powering.
- Characterization of SC correctors
- **Nb₃Sn Undulators**
- **FAIR**
- Orbit correctors of “new” low β triplets
- ...



Running costs for minimal scenario (~ 4 tests/month)

- Annual maintenance cost and operation cost for our liquefier has been estimated to be 70 kCHF and 340 kCHF respectively (courtesy K. Barth)
- Not including electricity
- Material 15 kCHF
- Manpower FSU (175 kCHF)
- CERN staff (2.5 FTE)

- Total 600 kCHF + CERN staff

Conclusions



- The vertical test facility was constantly maintained and upgraded over the past years, following the evolution of CERN needs
- The 4 vertical cryostats offer a vast range of possibilities for atypical tests
- Relevant resources downsizing due to happen at the end of 2006
- For 2007, contribute to FIDEL, Nb₃Sn Undulators, and keep ability to test and measure any kind of LHC SC magnet (except MB, MQML, MQX)
- Potential for future projects: the facility has a natural vocation for supporting R/D on SC magnets