



LIU FWS Electronics Budget

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Intro

Best budget estimation so far, based on

- Prototypes (SPS, PSB, PS) cabling costs scaled to new locations
- VME, VFC, GEFE 'standard' expected cost
- Power electronics as for prototypes
- 'Standard' electronics design office charges
- Need for test systems and spares

Cables

Position	Scanner name	estimated length	estimated price based on length	Copper TID	Optical TID	line total	Machine total
PSB							
4x	4L1	65	-	58200	9773	67973	
4x	11L1	?	-	0	10000	10000	77973

4 scanners in 11L1 included?

PS		Estimation based on PS54					
PS54	54	150	-	19100	13639	32739	
PS64	64	250	54565			54565	
PS65	65	250	54565			54565	
PS68	68	230	50199.8			50199.8	
PS85	85	220	48017.2			48017.2	240086

Estimated cost based on prototype and scaling on cable length
Is this correct? i.e.: cost is dominated by copper or manpower

SPS		Estimation based on SPS517 / 1.5 (less cables)					
51740	517	88	-	22420	13000	35420	
41677	416H	190	50983.3			50983.33	
41677	416V	190	50983.3			50983.33	
51995	519H	215	57691.6			57691.67	
51995	519H	215	57691.6			57691.67	252770

Estimated cost based on prototype and scaling on cable length / 1.5

867 Calibration and test bench		Estimation (half the cables of PS installation)					
		220	9550			9550	9550
Total injectors						580379	

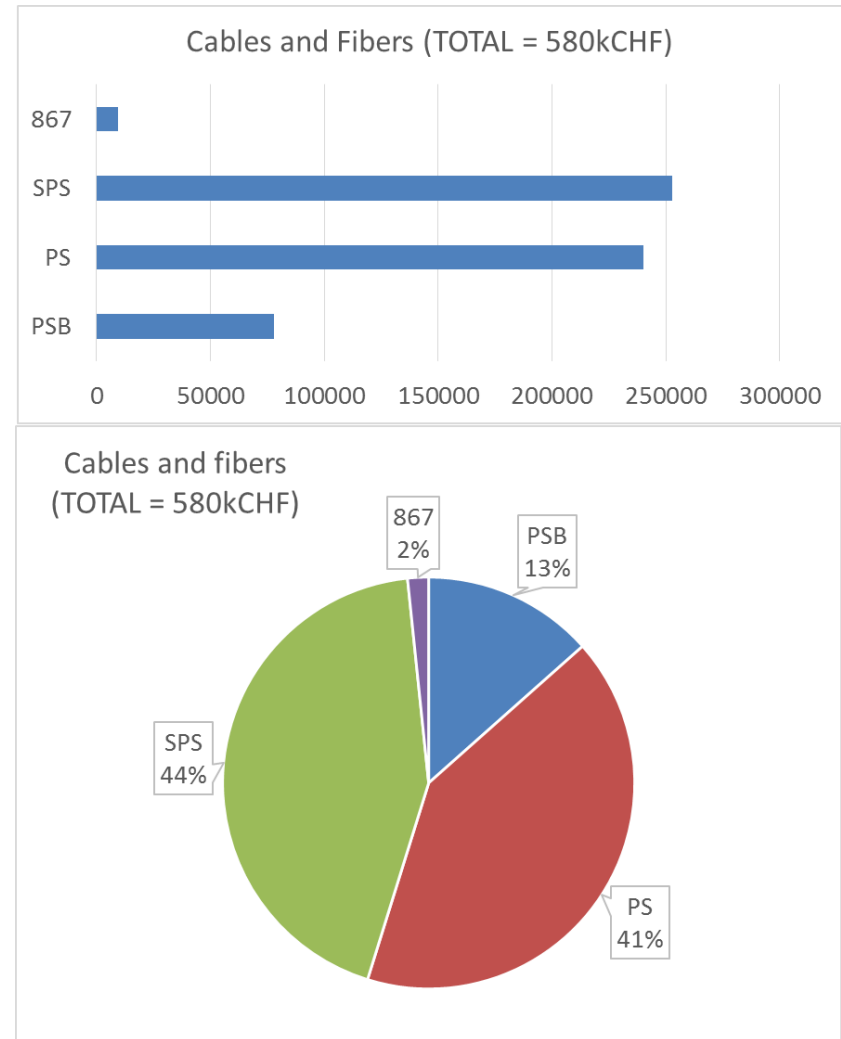
Cables

Prototypes cables:

- 5 for motors ctrl and wire signal + 15 for Acq.

Series cables (per device)

- 3 for motors ctrl and wire signal + 6 for Acq.
- Can reduce Acq. Signals to 1 HV cable per PMT (1 to 4 PMT foreseen per device)
 - It means GEFE everywhere



Electronics

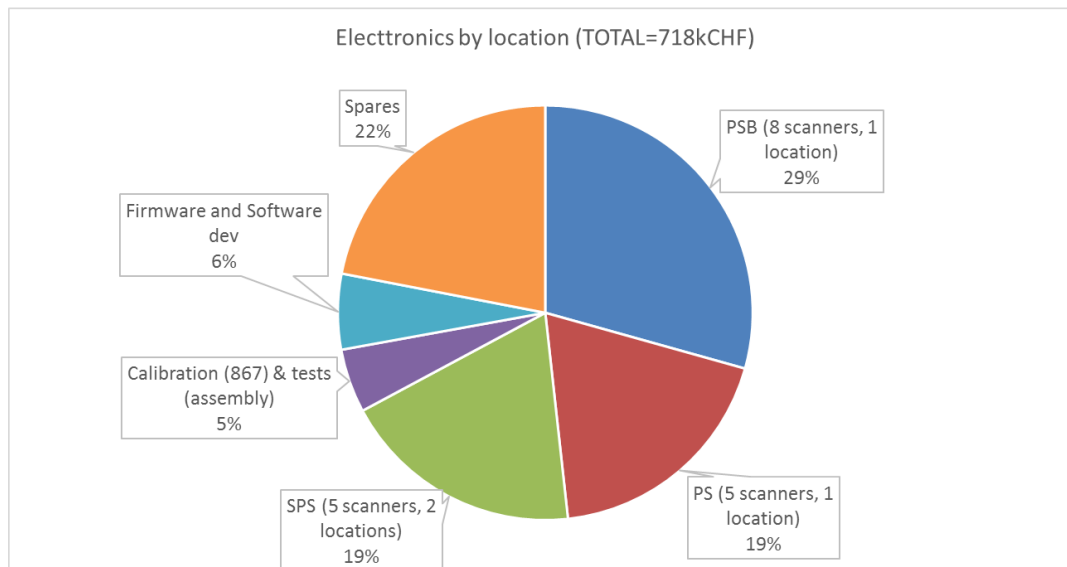
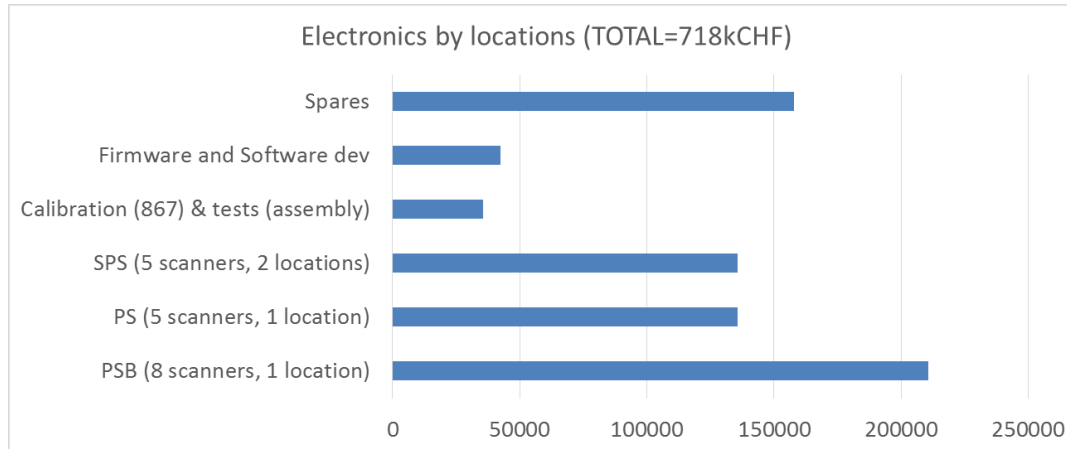
VME crate (4 scanners)	cost	quantity	line total
ELMA crate	3000	1	3000
CPU MAN + CTR	2500	1	2500
			5500

OASIS systems (1 scanner)	cost	quantity	line total
Fast ADC channel	2000	2	4000
			4000

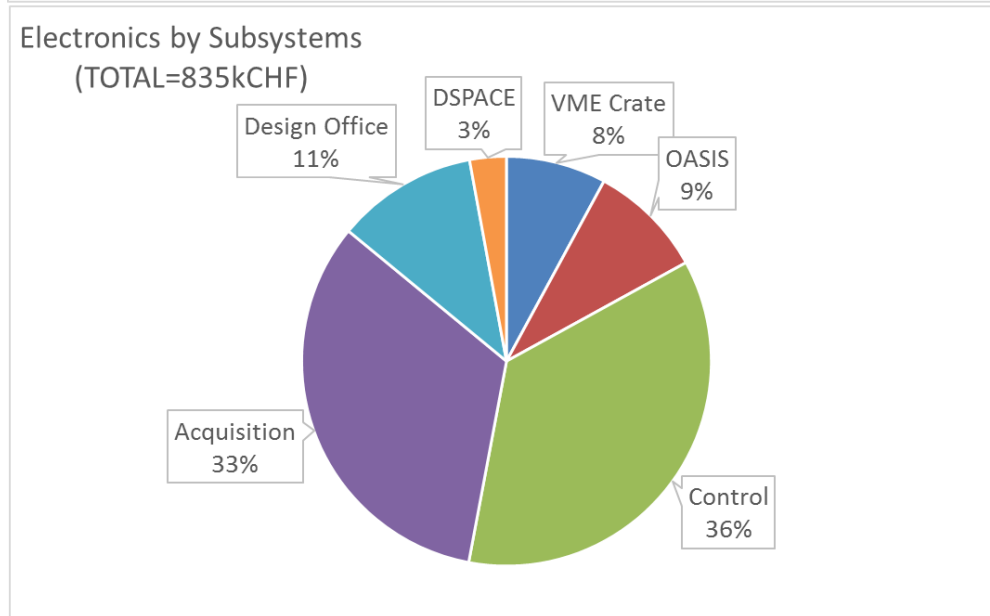
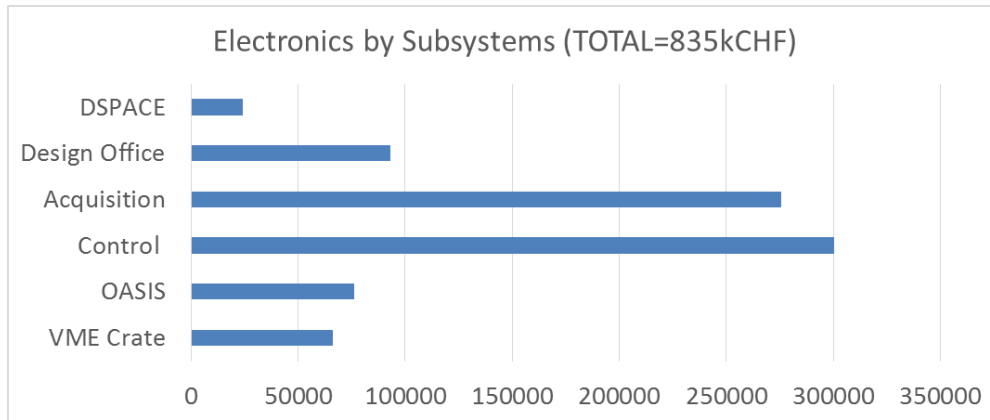
Control electronics (1 scanner)	cost	quantity	line total
VFC-HD	1500	2	3000
BWS mezzanine	1800	1	1800
BWS Inverter	1000	1	1000
BWS DC bus charger	250	1	250
Capacitor	200	2	400
Sinus filter	305	1	305
connectors	500	1	500
cables, relay, fan	200	1	200
Power supplies	200	1	200
crate (surface & tunnel)	300	2	600
Front panels	100	2	200
Cabling and assembly (h)	50	30	1500
Test and validation	50	8	400
			10355

Acquisition electronics (1 scanner)	cost	quantity	line total
VFC-HD	1500	1	1500
Fast ADC mezzanine (4 CH)	2000	1	2000
Custom analog front-end	1000	1	1000
GEFE card (if tunnel digitalisation is done)	1500	1	1500
4 Channels HV VME card	1700	1	1700
photomultipliers	600	4	2400
Mechanical assembly	500	1	500
			10600

Electronics by 'Locations'



Electronics by 'Sub-systems'



Acquisition system

Two options

1. Digitize in the tunnel (GEFE)
 - transport to the VME with optical fibers
 - Still need PMT HV cables
 - Can GEFE be powered in the tunnel? If not, need multi-wire cable
2. Digitize in the VME
 - Need more than 1 copper cable to the surface, per PMT

Design Office and DSPACE

Design office costs and tools	cost per iteration	quantity	line total
BWS mezzanine	10000	2	20000
BWS Inverter	10000	2	20000
BWS DC bus charger	4000	2	8000
Tester mezzanine	5000	2	10000
Tester inverter and charger	5000	2	10000
BWS Assembly Intelligent drive	5000	1	5000
BWS acquisition analog front end	10000	2	20000
			93000

Dspace control system for serie testing/validations	cost	quantity	line total
Dspace base system	20000	1	20000
Computer for the test system	1200	1	1200
Resolver control system	1000	1	1000
Basic inverter	2000	1	2000
			24200

Grand Total (Electronics)

PSB (8 scanners, 1 location)	line total
Cables copper and fiber optics	CHF 77,973.00
Electronics	CHF 210,640.00

PSB (5 scanners, 1 location)	line total
Cables copper and fiber optics	CHF 240,086.00
Electronics	CHF 135,775.00

SPS (5 scanners, 2 locations)	line total
Cables copper and fiber optics	CHF 252,770.00
Electronics	CHF 135,775.00

Design, production and tests costs	line total
Design office costs and tools	CHF 93,000.00
DSPACE control system for serie testing/validations	CHF 24,200.00

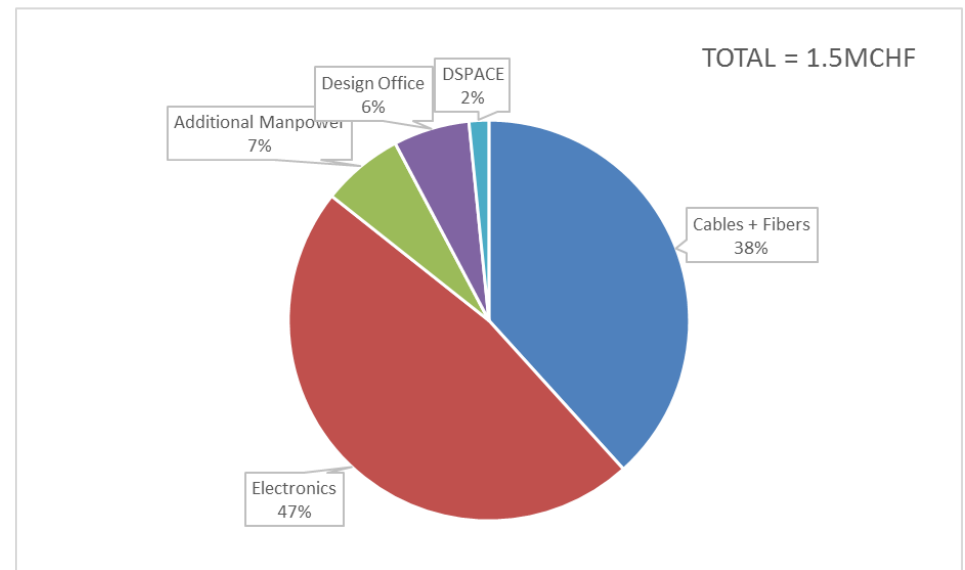
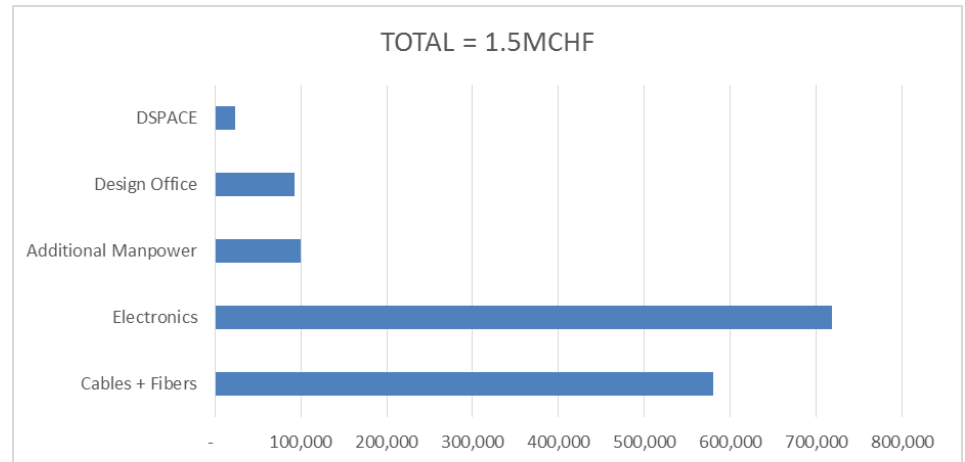
Spares, development, tests and calibration (7 systems)	line total
Cables copper (867)	CHF 9,550.00
Electronics	CHF 235,705.00

Additional man power	line total
Technician for procurement, prod. and tests (6m)	CHF 50,000.00
Technician for installation and validations (6m)	CHF 50,000.00

Grand total	CHF 1,515,474.00
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Already charged (Cables for proto SPS, PS, PSB) CHF 136,132.00

To be funded CHF 1,379,342.00



Discussion

- Total estimated cost of cables $\approx 0.5\text{MCHF}$
 - Need to check with EN-EL accuracy of this estimation, copper costs vs manpower, possible savings
 - Need to be sure about PSB 11L1 cables are included
- GEFE or not GEFE likely with little impact on budget
- 1 PMT vs 4 PMT per system impact $\approx 40\text{-}50\text{kCHF}$ saving
- Design Office 100k (to be checked?)
- OASIS, recent (new) request from OP = 80kCHF?
- Spares $\approx 150\text{ kCHF}$
- Apart from copper cables and fibers TIDs, how much did we spend already?
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