Standby Services or Reliance on Experts for Accelerator control?

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PS Complex Controls Standby service: case study

Plan:

- Organisation
- Domain of intervention
- Statistics of interventions
- Tools
- Some comparative evaluation
- Perspectives for LHC era
- Conclusions

Organisation

- Team of 5 to 6 technicians
- Each member on service during one week
- Callable by CCC Operation 24/24 during accelerator run (~ 32 weeks)
- Applies to ‘standard CO’ controls (hardware/software), mostly Front-end
- Manages spare parts
- Tracing: E-logbook, Follow-ups

Requirements

For proper functioning, this service needs:

- Training: Basic skills, knowledge of geographical, technical details
- Regular information from CO sections (SW or HW updates, new installations, planned interruptions)
- Weekly Contact with Operations team (planned changes, follow-ups)

Domain of intervention

- Quality assurance: ensure new systems put in exploitation are correctly delivered (files, startup) configured and documented.
- Diagnostic: identify causes of failure within the different layers of control system
- Procedures: non-destructive resets, setting-ups
- Hardware interventions: identify and replace failing components, re-initialize systems
- Software: Restoring operational data, correct configuration of front-end equipments or generic applications, FE startup sequences

Significant Numbers

			Camac		1553		GPIB		
Domain	**Accel**	**FECs**	loop	crates	loop	crates	crates	**Devices**	**Description**
PS	ADE	24	3	3	12	189	9	2067	Antiproton Decelerator
PS	CPS	63	5	8	29	393	4	4453	Cern Proton Synchrotron & beam xfer lines
PS	LEI	32	0	0	5	58		1157	LEIR Low Energy Ion Ring
PS	LN3	10	0	0	6	106	1	427	Lead Ion Linac
PS	ISO	6	0	0	2	3	4	650	ISOLDE facility
PS	LIN	10	2	4	9	156	1	956	Proton Linac
PS	PSB	56	6	9	12	231	8	3648	Proton Synchrotron Booster
TEST	CTF	21	2	11	13	115	0	6228	CLIC Test Facility
TEST	REX	4	0	0	0	0	0	122	REX facility
GEN	MCR	11						195	Equipment common to several accelerators
Total PS Complex		**237**	**18**	**35**	**88**	**1251**	**27**	**19903**	

Operational indicators

An ideal list would include:

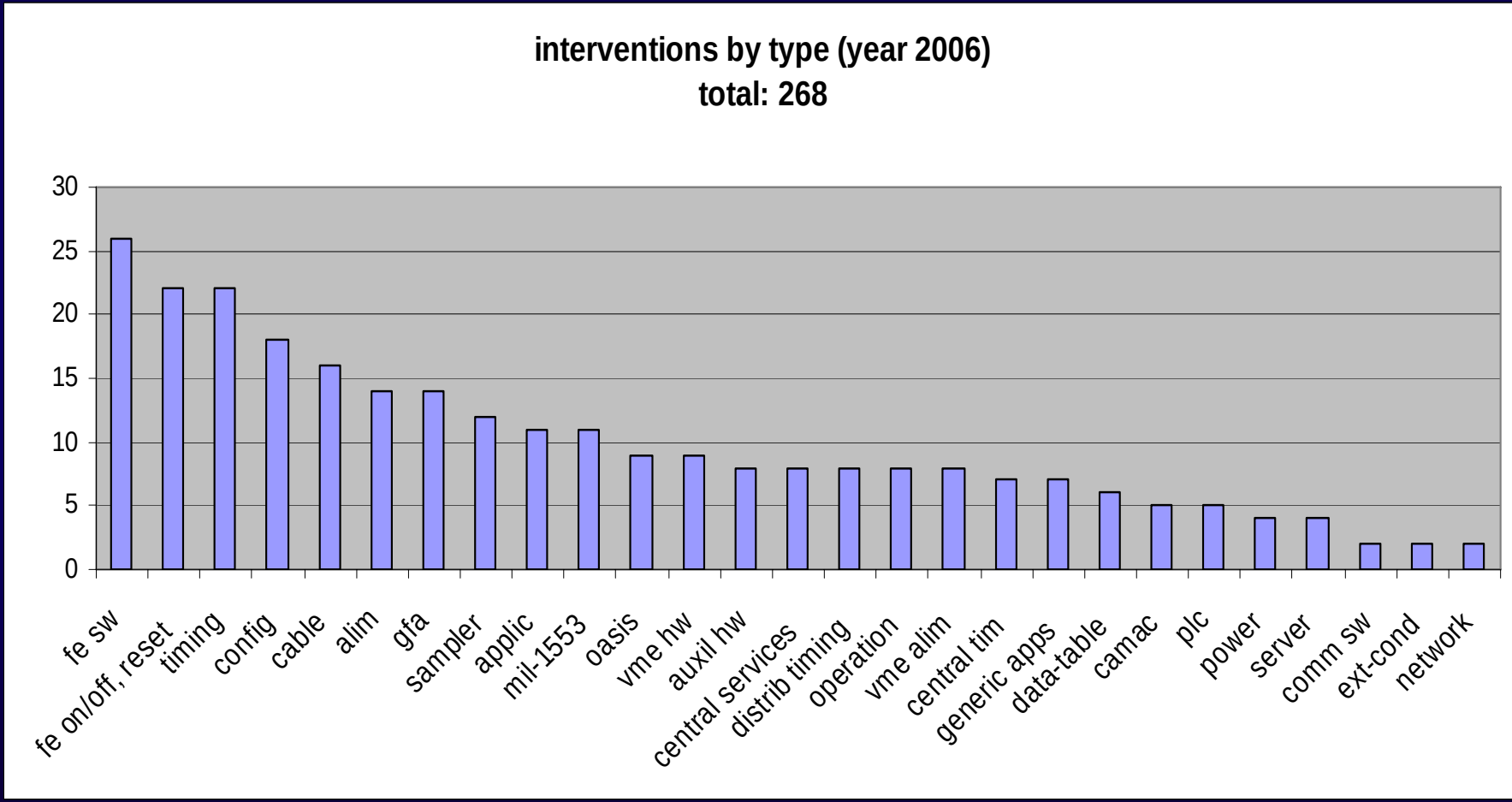
- Number / duration of interventions outside working hours ☺
- Effectiveness of interventions 😐
- Beam time lost due to controls ☹
- Manpower cost involved ☺

Main HW Intervention areas

- Front-End Hardware diagnostic/replacing of:
  - Crate
  - Power supply
  - Cpu
  - CO standard cards (list TBD, test pgms)
- Timing:
  - Distribution: repeaters, cables
  - Reception (TG8/CTRx)
  - Specific LTIM config check (no changes)
- Communication / fieldbuses diagnostic/replacing of CO-specific parts (Bus drivers, repeaters, RTI cards):
  - Mil1553
  - FIP
  - Ethernet (->PLCs)

  (NOTE: fieldbus agents are normally not CO responsibility)

Piquet Interventions



Interventions (2004/2006 figures)

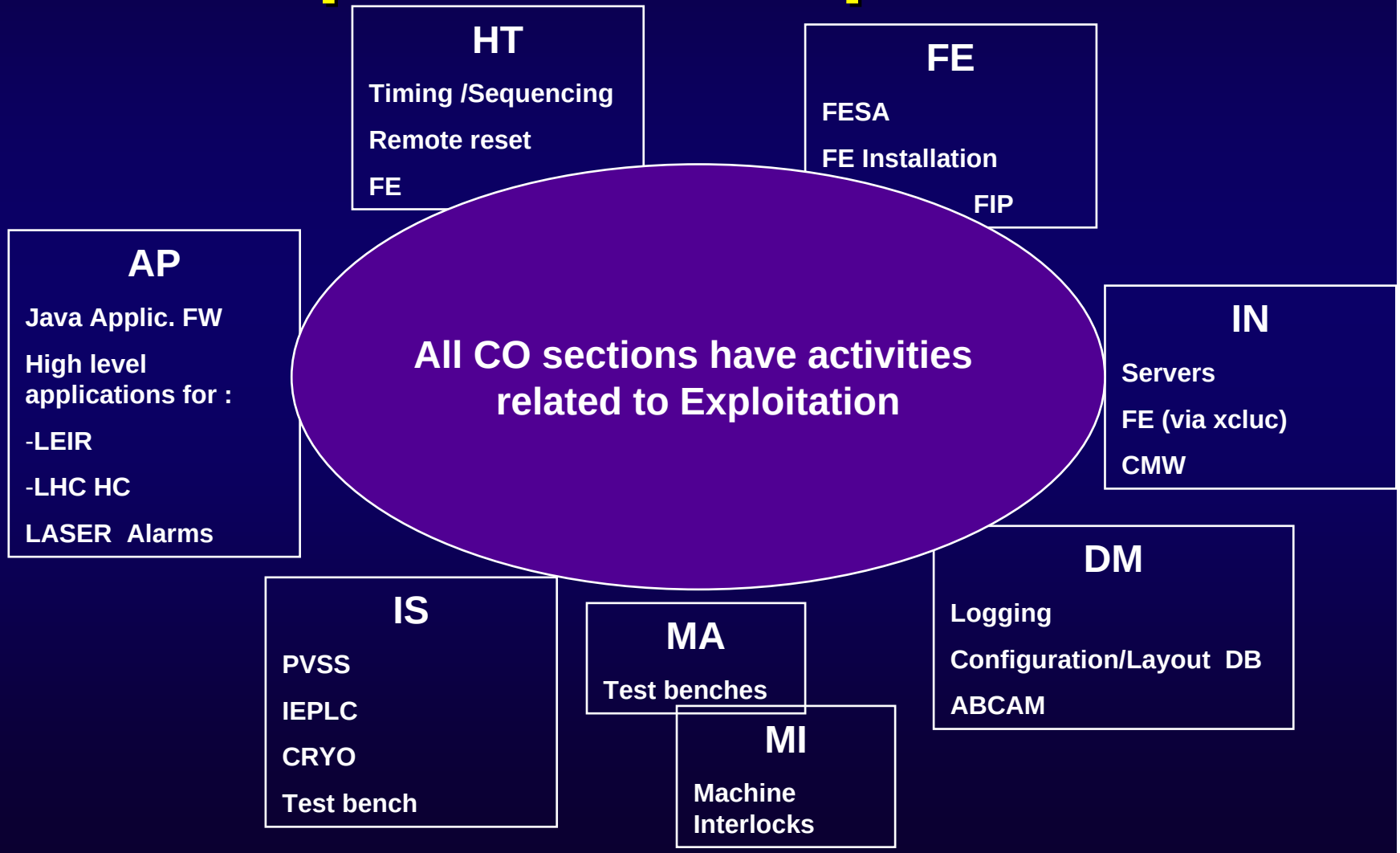
Year:	2004	2006
Yearly total (registered):	-na-	268
HW		111
SW		133
External		15
Outside working hours*:	43	35
Duration (h)	66	53
Mean duration:	1h30	1h30
Requiring follow-up:	---	67

* not counting issues solved by phone/rlogin

Tools & Technologies

- Shared knowledge via:
  - E-logbook intervention list
  - Web-based ‘tips and tricks’
- Currently, collection of separate diagnostic tools
  - Building a unified set of tools is a main work area during this year
  - Could become usable by operators
- New/extended tools needed for LHC domain
  - FIP, FESA, PLCs, Industrial controls, 3-tier

CO operational responsibilities per sections



Positive aspects of Standby service

- Guaranteed response & single entry point for OP
- Is a link between sections (if piquet spread in whole group)
- Pushes for better & common processes, documentation, diagnostic tools
- Gives wider view of control system to piquet team members
- Globally more efficient in CERN resources (CO piquet can solve basic FE problems for all equipment domains conforming to standard)
- Better spread of exploitation load among sections (reduces risk of overloaded ‘exploitation experts’)

Negative aspects of Standby service

- Experts need to provide documents & non-expert tools
- May add delays if piquet has to call expert
- Piquet team members only productive 80% of their time
- CO sections (and Eq groups) ‘delegate’ (drop?) some of their responsibility
- For efficiency, OP needs similar services from main equipment groups

Pros and cons of On-call experts

- ☹ OP may need to call several numbers to get an answer
- ☹ OP must first diagnose the right domain
- ☺ more in-depth knowledge => faster repair
- 😐 No need for Eq.Grp to provide centralised documentation or diagnostics
- ☺ One Call list may cover all machines & domains (not yet true!!!)

Future strategy?

- LHC uses same basic controls hw components (FE, timing generation & distribution) as PS (& SPS)
- Wider geographic zone, increased number of systems, different applications: need reviewing organisation (current team not sufficient)
- A reduction of supported scope (e.g, configuration/FE SW by eq groups or OP)
- Industrial systems in charge of CO could benefit from OP/TI support of PLCs for TS

Conclusive comments

- A coherent view (across machines) is needed for OP and other equipment groups (as aimed by Control Coordination Committee)
- Piquet team within CO can provide limited scope support (basically FE HW) for systems under CO responsibility across all machines
- Overlap between fields (outside CO)
  - CO Piquet supports of other groups (mostly PO) could be reduced
  - But anyway, efficient support needs some knowledge outside its own field
- Should investigate possible common domains with OP/TI (industrial controls support)