



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**
- ◆ **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: Know 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

| Domain | Accel | FECs | Camac | | 1553 | | GPIB | Devices | Description |
|-------------------------|-------|------------|-----------|-----------|-----------|-------------|-----------|--------------|---|
| | | | loop | crates | loop | crates | crates | | |
| 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

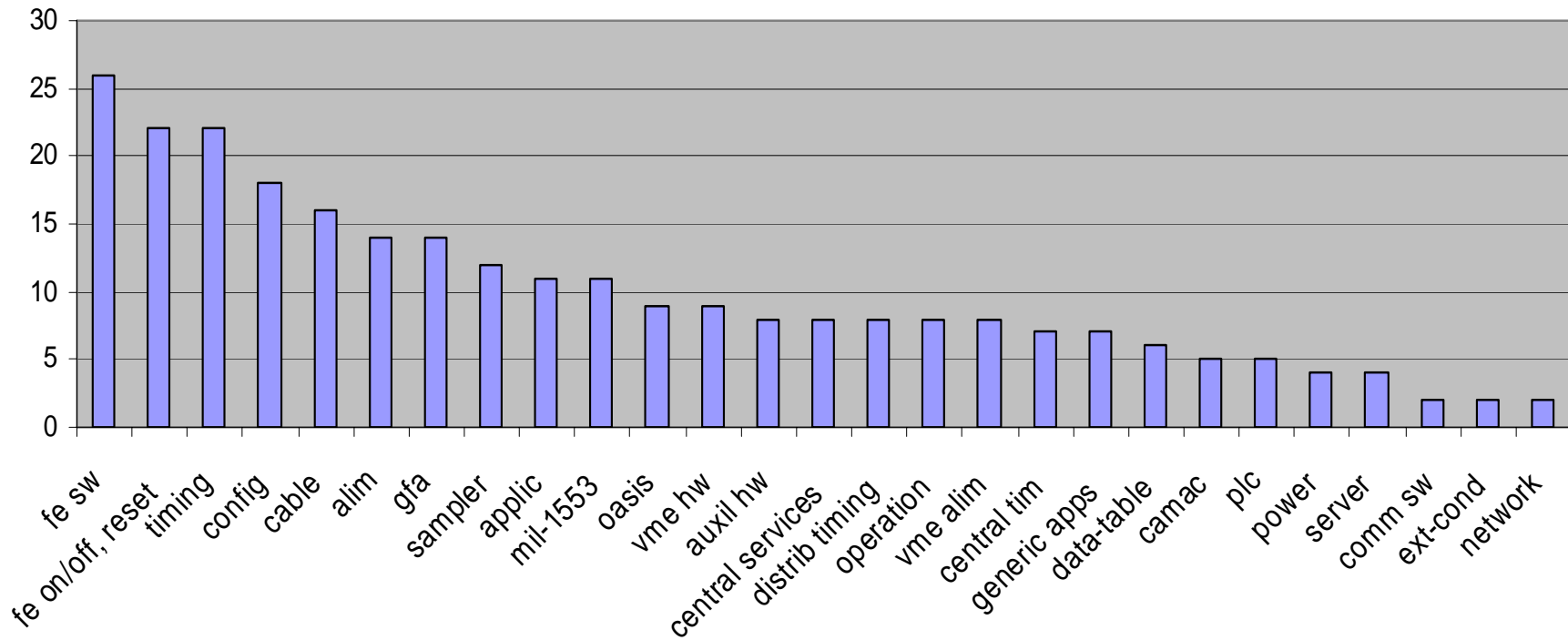
- ◆ **Front-End Hardware diagnostic/replacing of:**
 - ◆ **Crate**
 - ◆ **Power supply**
 - ◆ **Cpu**
 - ◆ **CO standard cards (list TBD, test pgms)**
- ◆ **Timing:**
 - ◆ **Distribution: repeaters, cables**
 - ◆ **Reception (TG8/CTR_x)**
 - ◆ **Specific LTIM config check (no changes)**
- ◆ **Communication / 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 by type (year 2006)
total: 268





Interventions (2004/2006 figures)

| ◆ Year: | 2004 | 2006 |
|------------------------------|------|------|
| ◆ Yearly total (registered): | -na- | 268 |
| ◆ Outside working hours*: | 43 | 35 |
| ◆ Duration (h) | 66 | 53 |
| ◆ Mean duration: | 1h30 | 1h30 |
| ◆ Requiring follow-up: | --- | 67 |

* not counting issues solved by phone/rlogin

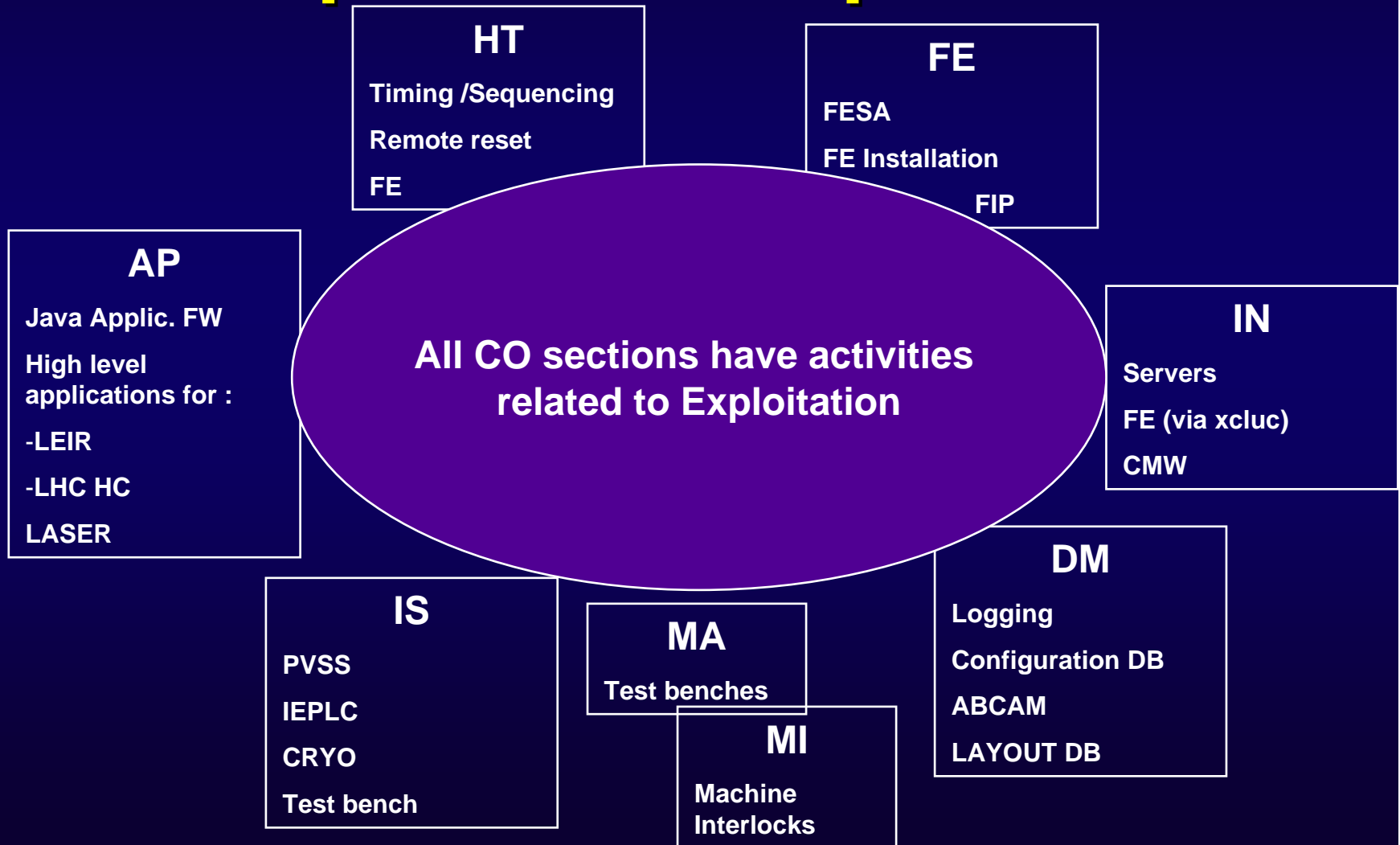


Tools & Technologies

- ◆ 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



Conclusive comments

- ◆ A coherent view (across machines) is needed for OP and other equipment groups (as aimed by Control Coordination Committee)
- ◆ Piquet team builds competence across control domains (within CO)
- ◆ Overlap between fields (outside CO)
 - ◆ CO Piquet supports other groups (mostly PO): could be reduced
 - ◆ But anyway, efficient support needs some knowledge outside own field
- ◆ Should investigate possible common domains with OP/TI