



# Application Development for Operations in the Coming Years

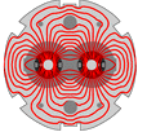
Mike Lamont



# Audit of the operation of LHC and its injectors

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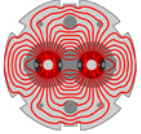
- **The development of operational application software by BE-OP does not systematically follow standard software development processes**
- In order to ensure that operators are equipped with reliable software for the operation of LHC and its injectors, during the lifetime of the LHC, the Head of BE-OP should ensure that the processes used in BE-OP for future operational software development and for reporting problems follow the highest professional quality standards and are coherent across the four islets of the CCC.
- To this end, the head of BE-OP should reinforce the collaboration and the sharing of best practices in software development between BE-OP and BE-CO.



# Present situation

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- PS: “Pas mal”
- LHC: bloody impressive
- SPS: pretty good
- PSB: Needs INCAfying, but OK
- AD: eek!
- ISOLDE: heroes at work
- LEIR: INCA & LSA and it still works
- TI: excellent job in a heterogeneous world



# Present situation

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## ■ LSA

- Deployed in SPS, LHC, LEIR, transfer lines
- Huge core – **skeleton support**
- Many associated applications
- Improvements, maintenance continually ongoing

## ■ INCA

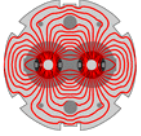
- Deployed in PS, LEIR
- PSB incoming
- LSA inside – support critical

## ■ Some excellent standard facilities in use across the complex:

- eLogbook, fixed displays, SIS, YASP...

## ■ Stand alone applications

- Many, many (beam instrumentation, RF, working point control etc. etc.) plus legacy, orphans etc.



# Present situation

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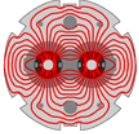
- A mountain has been climbed and huge mountain of software has been developed over the last few years
- Excellent and good natured collaboration between OP and CO (and BI, ABT, PO, ABP, MA...)
- This software is valuable asset and allows proper exploitation of a very valuable resource (the accelerator complex)
- **Important: this software needs TLC and an appropriate level of support**
- Clearly there are issues and a continuing need for improvements



# Typical issues

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- The functioning of the **PS complex** is still **relying heavily** on a large number of **X-Motif applications**, which are extremely important operational tools and need good support in case of problems.
- These applications **will gradually be replaced**, but this will take time. Progress will depend on system renovation, INCA implementation and available resources
- AD also uses archives, but **problems** with the **archiving** created a substantial **loss of time** in order to ensure that the data in the archives were correct



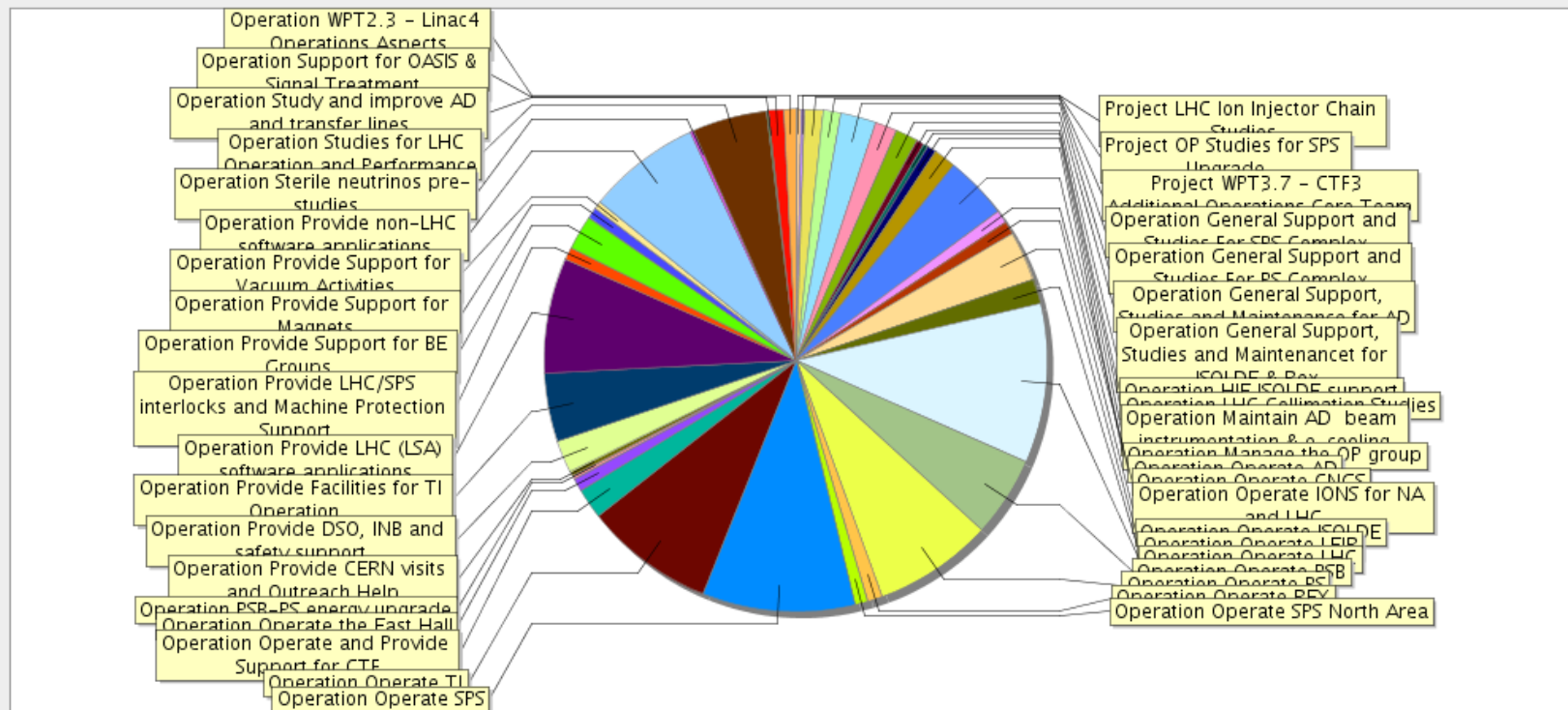
# Development

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- Application development more-or-less handed over to OP
  - “Second job”
  - Fellows, Ph.D.s, external collaboration
  - Other groups (BI, ABP...)
- Note that this is not just “GUIs”
  - Some serious, very good stuff...
  - IQC, BQM, YASP, Settings Generation, BLMs, Lumi scan, Fidel
- Long operational years recently mean less time for development
- Evitable turnover of personnel
- Resulting in some orphans and less than ideal support of the big pile



### Project-Operation/Workunit Description by Year (FTE)



2011

22 March 11, 22:31:10

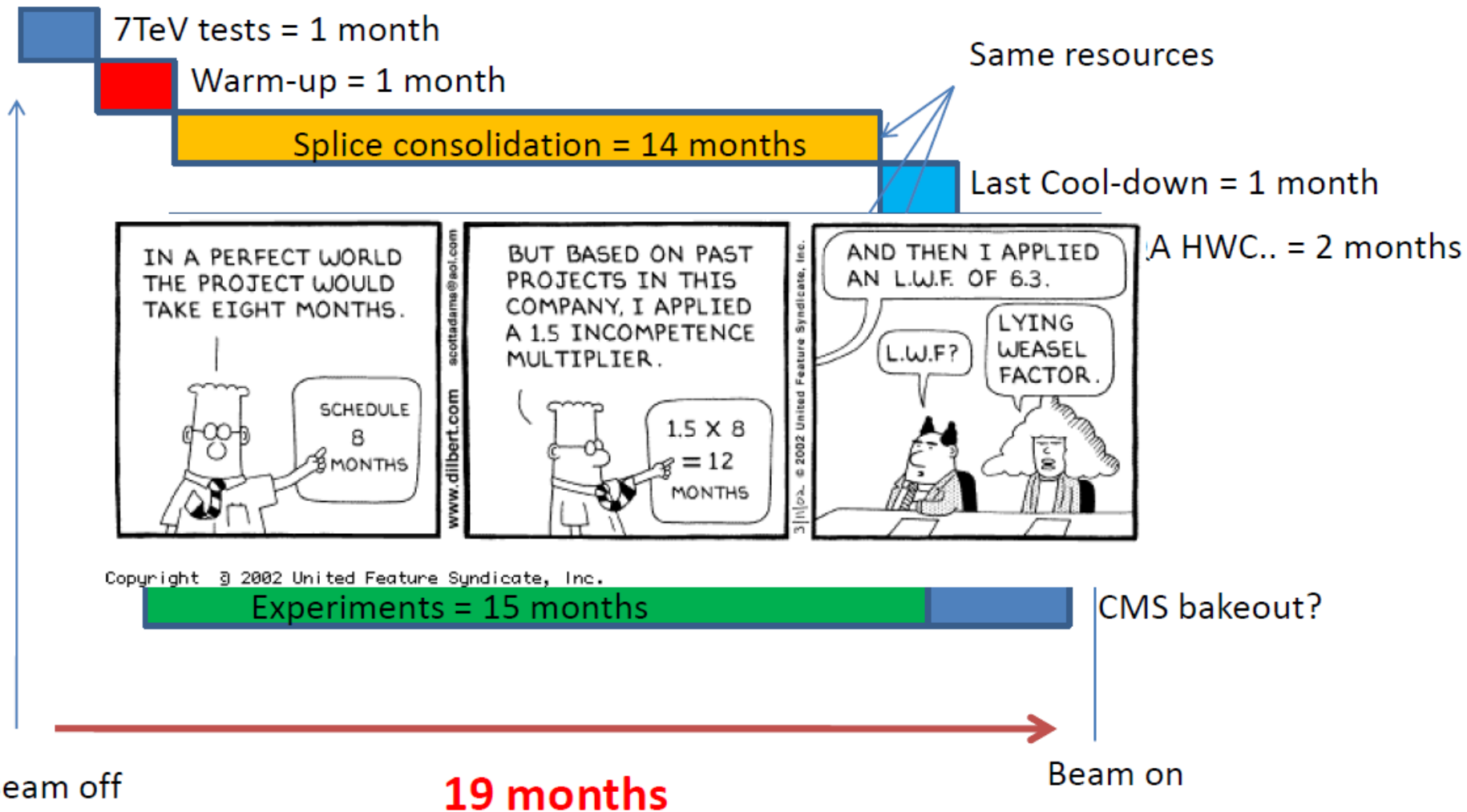
- Project LHC Ion Injector Chain Studies
- Project OP Studies for SPS Upgrade
- Project WPT3.7 - CTF3 Additional Operations Core Team
- Operation General Support and Studies For SPS Complex
- Operation General Support and Studies For PS Complex
- Operation General Support, Studies and Maintenance for AD
- Operation General Support, Studies and Maintenance for ISOLDE & Rex
- Operation HIE ISOLDE support
- Operation LHC Collimation Studies
- Operation Maintain AD beam instrumentation & e-cooling
- Operation Manage the OP group
- Operation Operate AD
- Operation Operate CNGS
- Operation Operate IONS for NA and LHC
- Operation Operate ISOLDE
- Operation Operate LEIR
- Operation Operate LHC
- Operation Operate PSB
- Operation Operate PS
- Operation Operate REX
- Operation Operate SPS North Area
- Operation Operate SPS
- Operation Operate TI
- Operation Operate and Provide Support for CTF
- Operation Operate the East Hall
- Operation PSB-PS energy upgrade
- Operation Provide CERN visits and Outreach Help
- Operation Provide DSO, INB and safety support
- Operation Provide Facilities for TI Operation
- Operation Provide LHC (LSA) software applications
- Operation Provide LHC/SPS interlocks and Machine Protection Support
- Operation Provide Support for BE Groups
- Operation Provide Support for Magnets
- Operation Provide Support for Vacuum Activities
- Operation Provide non-LHC software applications
- Operation Sterile neutrinos pre-studies
- Operation Studies for LHC Operation and Performance
- Operation Study and improve AD and transfer lines
- Operation Support for OASIS & Signal Treatment
- Operation WPT2.3 - Linac4 Operations Aspects





# Incoming LS1 – 2013/2014

Simon Baird



Exactly what and how long – the subject of intense discussion



# LS1 software deliverables

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AD,	LSA at least
ISOLDE HIE ISOLDE	High level controls
LINAC4	High level controls
PSB	INCAify booster LINAC4/PSB diagnostics
PS	INCA consolidation, renovation of various classes Continued LSAfication Xmotif eradication
SPS & LEIR	Consolidation, GUIs
LHC	Consolidation Re-work GUIs & improvements Cherries on cakes, fully integrated on-line model, etc...
TI	Operational

Manpower requirements to be established



# L4: standard software

what	priority	resources	when	who
E-logbook	1	Extension of existing software (elogbook, LASER, PVSS etc), xx months??	01/2011	Existing..
Logger/archive				?
Alarms				LASER team?
Interlocks				?
Watchdog				?
Vacuum				VAC cntrl
Radiation monitoring				RAMSES team?

Clear ongoing interest to leverage existing functionality



# L4: beam instrumentation

System	What	Priority	Resources	Stand-alone?	When	Who
Wire scanners	Interlocks, movement, acquisition, display, simple sigma fit	1	Upgrade ISOLDE?	no	01/2011	L Jensen(FESA), Jose LSA (applic)
Emittance meter application	Slit/SEM grid movement, acquisition, emittance reconstruction	1	Existing, to be upgraded/main tained	Yes	01/2011	U Raich, maintenance A. Rijllart
Bunch shape monitor (Feshenko)	Interlocks, movement, acquisition, display	1	LabView provided, to be integrated/mai ntained	Yes, until final installation	01/2011	UR, LJ, JLSA
Halo monitor		1	Existing, need resp. for maintenance	Yes	01/2011	UR, K Hanke
BCTs	Acquisition, display, fixed display	1		No	01/2011	LJ, JLSA
BLMs	Acquisition, display, loss histogram	2		No	Mid 2012?	E B Holzer



# L4: beam instrumentation 2/2

System	What	Priority	Resources	Stand-alone?	When	Who
BPMs	Trajectory, orbit correction, fixed display, TOF	1		No	01/2011	LJ, L Soby, JLSA
TOF application	Energy from phase measurement, at FESA level?	1		No	01/2011	LJ, LSoby
Spectrometer	Input from Bfield, magnet cycling, quadrupoles, slit position; acquisition, display, sigma fit	1		Yes	01/2011	UR, LJ, JLSA
3 screens emittance	Acquisition, emittance reconstruction	2	Adapt Verena's application for transfer lines?	No	>2013	JLSA
LBE-LBS	Upgrade/extension of existing, re-use spectrometer applic?	2	Upgrade existing	no	>2013	UR, LJ, JLSA



# L4: equipment control

System	What	Priority	Resources	Stand-alone?	When	Who
Chopper	Voltage + sequence control	1		no	01/2011	P Baudrenghien
RF	LLRF, synchro, timings, cavities settings and acquisition	1		no	06/2012	J Marques, PB
PSB injection septum/kickers	Settings, acquisition, alarms, waveforms... tbd	3		no	Mid 2013	?
Beam dumps	Monitoring/alarms	2		no	2012	?
Foil	Monitoring/alarms	3		No	2014	?
Source/LEBT/pre-chopper	Source application	1		no	01/2011	JLSA, PB



# L4: general purpose

All standard and existing facilities

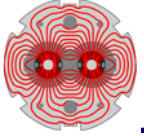
System	What	Priority	Resources	Stand-alone?	When	Who
OASIS	Triggered waveform display	1	Extension of existing	No	01/2011	OASIS team
EqpViewer	RF signals, BCTs	1		No	01/2011	JLSA
Orbit viewer	Display orbit, compare to model predictions, difference bw original and new acquisitions	1		No	01/2011	JLSA
1D-2D scan application	Correlate any 2-3 signals (quad scans included)	1		No	01/2011	JLSA
Fixed display	Transmission, BLMs loss maps, injection screens? Tbd	2		no	2013	JLSA



# L4: interfaces ++/RTUs

What	Priority	Resources	When	Who
"Fingerprint": take snapshot of machine state, show deviation from reference and save in PATH/TRACE input file format	2		04/2011	JLSA
Orbit correction : acquire BPMs readings, use steering algorithm to find corrector strenghts to reduce beam offsets- YASP?	3		2012	YASP team, Marine
Automated phase/amplitude longitudinal scans for setting RF points (calculating output phase and energy)	3		End 2012	JLSA
Online model application for transverse matching: acquire beam sizes at WS and compare to model predictions. Use iterative optimisation algorithm to solve for input Twiss parameters (input from live machine data and online model tracking- TRACE3D?)	3		End 2012	?
High level applications to control chopper sequences, synchronisation timings in PPM mode according to super-cycle specifications	4		2014	?





# 2013-2014: OP resources

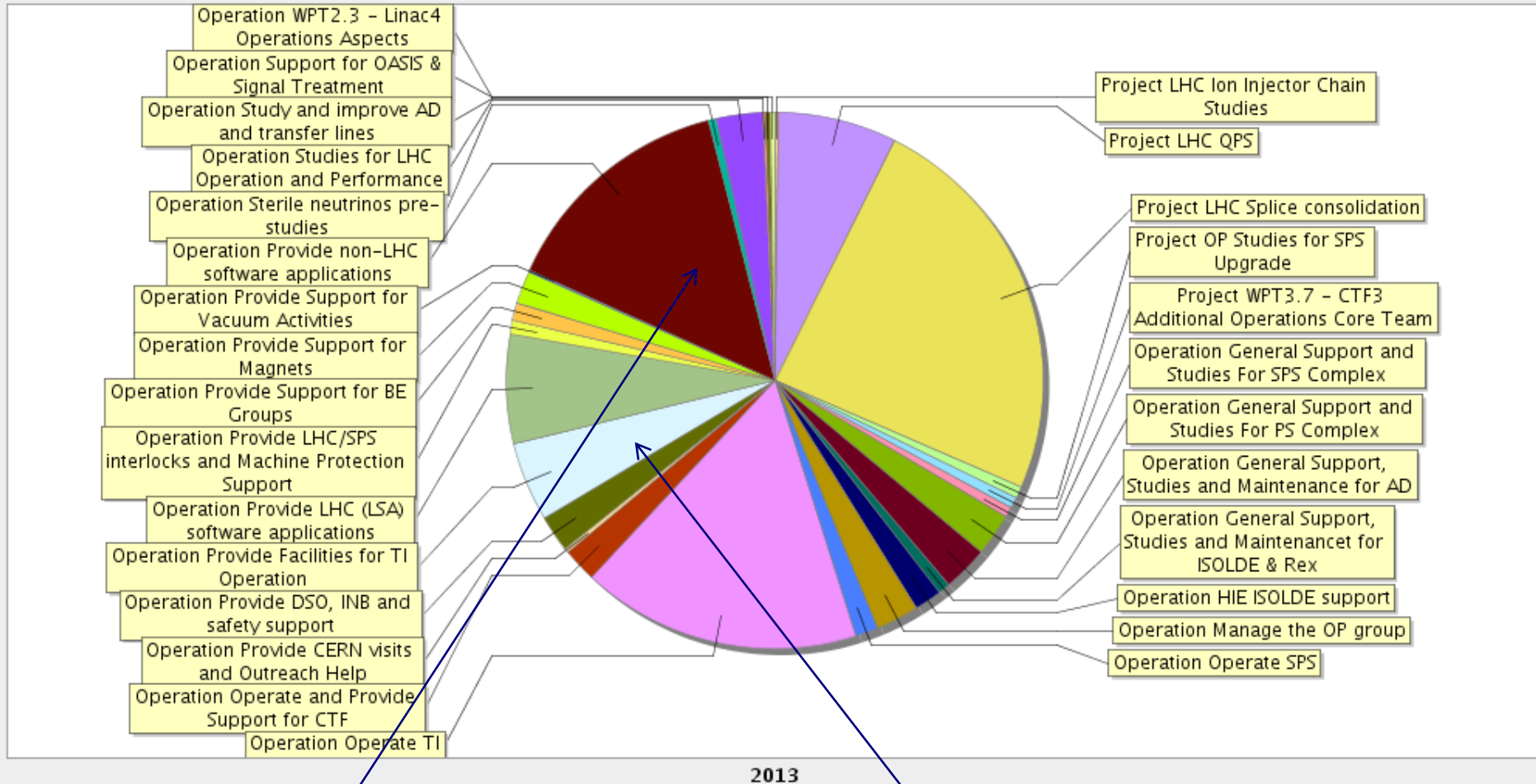
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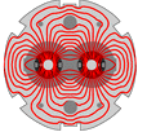
# When we get back from Barbados...

Project-Operation/Workunit Description by Year (FTE)



Provide non-LHC software applications [10.4 FTE]

Provide LHC (LSA) software applications [3.4 FTE]

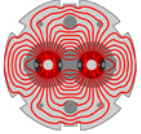


# Resources 2013 (& part of 2014)

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- 14 OP FTEs (to be confirmed)
  - Well-organized – serious progress possible
- Other groups
  - Specialized accelerator physics related applications
- External collaborations
  - LAFS...
- Fellows, VIAs, GETs, Ph.D.s
- Associates

At first sight, enough manpower to mop up  
foreseen deliverables



# Conclusions

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- Relatively healthy situation reflected in excellent performance of the complex
- Concerns about support levels in CO and a stretched OP group
- Foresee maintaining a holding pattern until the end of 2012
  - Maintenance and development at current levels
- Significant manpower to be made available in LS1
  - Should be sufficient to cover foreseen requirements:
  - LINAC4, Xmotif eradication... etc.