



News from LARP

S. Peggs

Snapshot

“Joint IR Studies” Working Group
Potential Upgrade Contributions
Summary

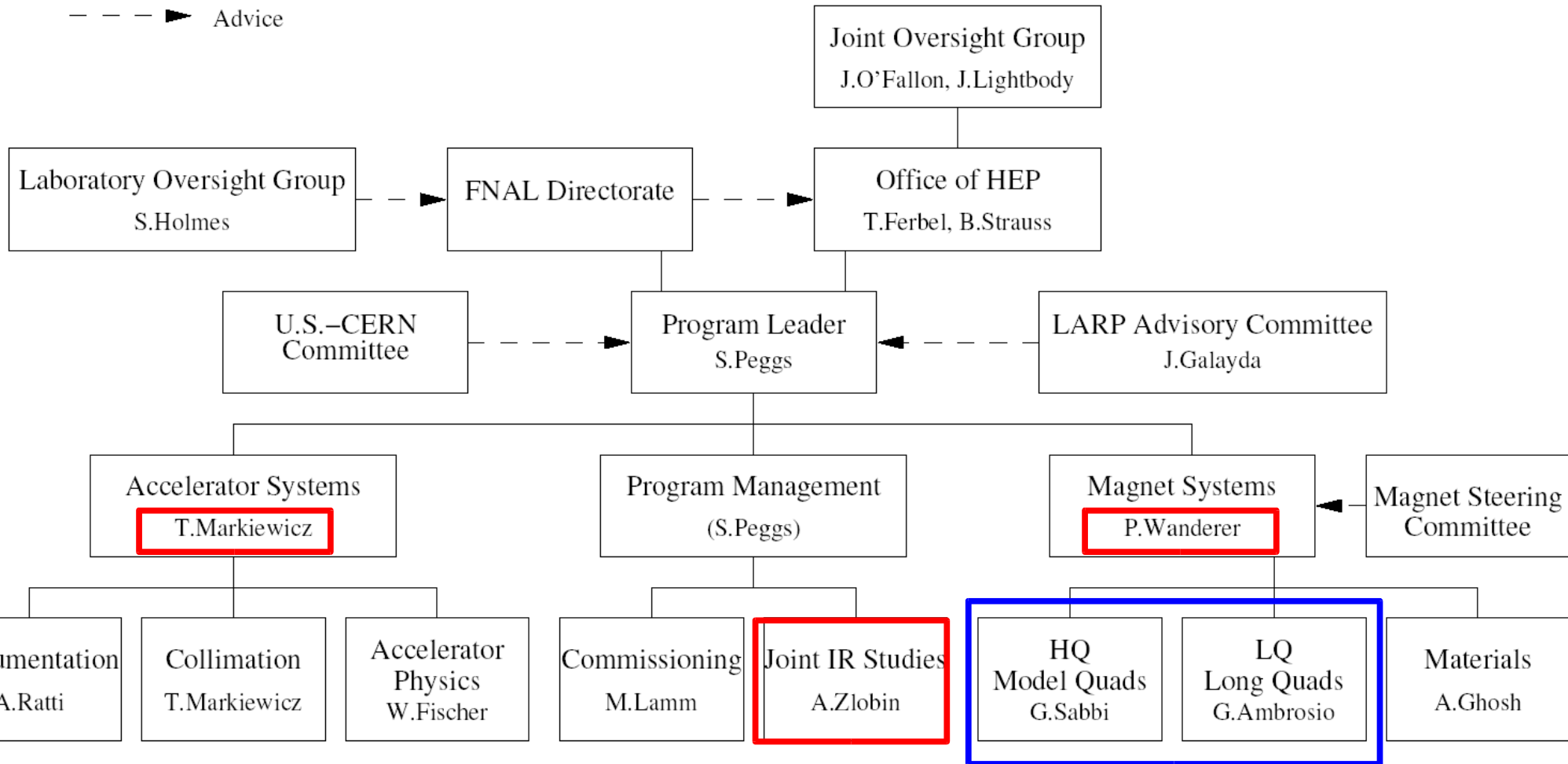


Arrivals, departures, re-structuring

US LHC Accelerator Research Program (LARP) Organization Chart

Sep 6, 2007

———— Direction and reporting
- - - - Advice



Jim Kerby replaced Limon as LARPs "Local Leader" at CERN



LQ Magnetic Structure Review

Nov 28-29, chair D. Tomasini

DOE Review: “LARP should ... proceed with both collar and shell-structure designs ... clarified by early fall 2007 through a formal technical review of results-to-date.”

Advise the LARP Program Leader & Magnet Systems Leader

Charge:

- 1) “Evaluate both support structures against the list of technical selection criteria that has been developed ('Criteria for LQ Support Structure Selection') and for risks due to cost overruns and delays in the schedule.”
- 2) “Evaluate the LQ R&D plan against alternative plans, including development of only one support structure.”

Garoby's closing message at BEAM'07

Conclusion

- The pace of work is good and will accelerate in the near future.
- We have to strengthen our links with the community and establish new collaborations.



We need You!

R.G. – 2/10/2007

LHC injectors' upgrade plan

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The DGs 3 themes

- 3) LARP Magnet R&D **strategy** aims mainly at Nb₃Sn magnets in **Theme-3/Phase-2 IR Upgrade**
- 2) Magnet R&D plan may include **Theme-2/Phase-1 IR Upgrade**
- 1) Acc. Systems topics to include **Theme-1 Paper Studies, eg PS2?**

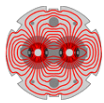
Always, **LARP R&D should enable U.S. contributions** to LHC accelerator components, if/when the DOE so decides

- Cold masses
- Rotatable collimators
- Crab cavities
- Electron lenses ...

Contributions could commence well before 2016.



Joint IR Studies



LARP

JIRS: early Nb3S magnets

DOE Review: “The importance of establishing closer relations between the magnet and accelerator sectors of LARP cannot be overstated, especially in view of the fact that it is not clear what should follow the completion of the LQ magnet.”

“**Joint IR Studies**” merges Magnet & Accelerator folk.

One goal: define & evaluate short list of potential Nb3Sn locns.

According to de Rijk:

- *New magnets are needed for the LHC phase 2 upgrade in about 10 years*
 - *Quadrupoles for the low-beta insertions*
 - *Corrector magnets for the low-beta insertions*
and possibly
 - *Dogleg dipoles for the cleaning insertions*
 - *Q6 for cleaning insertions*
 - *10 m dipoles for the dispersion suppressors*
 - *Early separation dipole (D0)*



JIRS: crab cavities

DOE Review: “The crab cavity effort seems well matched to the LARP program, and **should be given sufficient resources** to move forward.”

Initial JIRS activities do not include crab cavity issues, although:

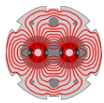
- LARP participates in a **broad crab cavity collaboration**
- CERN & U.S. **enthusiasm is mounting**
- A crab task may be added to **JIRS, eg in FY09.**

Advanced Energy Systems Small Business (**SBIR**) proposal would build a prototype LHC cavity (800 MHz).

Calaga, on the **Shanghai** workshop (2008), will help merge “**deflecting cavity**” (light source) and **crab** (ILC, LHC) topics.



Potential Upgrade Contributions



LARP

Responding to the challenge

In Rossi's “[hybrid proposal](#)” the U.S. would provide 4 or 8 Nb₃Sn quads out of 16 required for the Phase-1 upgrade, with the NbTi complement made at CERN.

[This memo ...](#)

Date:	October 26, 2007
To:	File
From:	S. Peggs
Subject:	<u>U.S. accelerator components for LHC luminosity upgrades</u>

... responds to the challenge,

1) in the **larger context of magnet deliverables** for the Phase-2



“Executive Summary”

The Phase-1 upgrade is expected to lead to “ultimate” lumis well beyond “nominal”, in the range 2×10^{34} to 3×10^{34} cm⁻² sec⁻¹.

The hybrid proposal is an exciting challenge, but must receive **careful evaluation & discussion** (CERN, DOE, LARP) before any commitment.

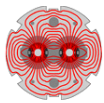
Any delivery of Nb₃Sn magnets, in Phase-1 or -2, would need additional funding to a **construction project separate from LARP**.

Some LARP R&D re-programming would be necessary if the hybrid proposal is accepted, beyond current LARP guidance.

A clear U.S. response to the hybrid proposal challenge should be possible by **June 2008**.

Accelerator components such as **Rotatable Collimators**, could also be delivered on the timescale of the Phase-1 upgrade.

Efforts towards CD-0 for a construction project should begin immediately, even though the challenge may need to be declined.



LARP

“Statement of need & CD-0”

LARP magnet R&D has a single strategic goal: **making Nb₃Sn magnet technology fully mature for use in Phase-2.**

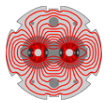
Any LARP magnet R&D for Phase-1 must enhance progress towards this goal, rather than compromising it.

Delivery of Nb₃Sn cold-masses is not R&D, and so would require one or two **construction projects separate to LARP.**

Launching a construction project is synonymous with achieving a **“Critical Decision 0” (CD-0)**, which crucially requires a clear official **“statement of need” from CERN.**

Nb₃Sn magnets provided in Phase-1 would have to perform at least as well as the NbTi magnets built at CERN, **otherwise they would not be worth installing.**

While Phase-1 tin magnets would be state-of-the-art in 2012, they would be intermediate R&D prototypes on the path to Phase-2.



LARP

“Component deliverables in Phases 1 & 2”

It is not clear that the U.S. can commit to delivering even just 4 Nb₃Sn quads, **absolutely guaranteed to be ready and reliable, by 2012 date, even in scenarios unconstrained by funding limits.**

Nonetheless, LARP will immediately begin to evaluate the delivery of (at least) 4 Nb₃Sn quadrupoles, or Nb₃Sn D1 dipoles.

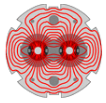
ROTATABLE COLLIMATORS

Second generation collimators will also be required to achieve “ultimate” luminosities.

Parallel R&D paths are being pursued in LARP and at CERN, in preparation for the construction of as many as **30 such collimators**, to be installed on the Phase-1 IR timescale.

Rotatable Collimator prototype RC2 is scheduled for beam tests alongside CERN's design soon after delivery to CERN in **Jan 09**.

The U.S. should consider delivering many such RCs, at a relatively modest cost, as part of a Phase-1 construction project.



“Component deliverables in Phases 1 & 2”

CRAB CAVITIES

Crabs are **required** for one of the two Phase-2 schemes.

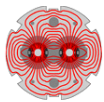
They increase luminosity in any **stand-alone installation**.

LARP could be the basis for U.S. participation in this **strategic emerging enabling technology**.

Current LARP funding prohibits significant R&D participation, beyond maintaining observer status in the **nascent international collaboration**, and despite strong & growing interest at CERN.

LARP would like to take a significant role in crab cavity R&D, with explicit support from CERN, & additional funds from DOE.

Much crab cavity R&D remains to be performed. Nonetheless, the **U.S. should consider delivering crab cavities**.



“Evaluation Process”

Sasha Zlobin leads **JIRS**.

Ranko Ostojic chairs CERN's “**LHC Insertions Working Group**”, evaluating all aspects of the Phase-1 upgrade.

JIRS & LIUWG will maintain broad and unrestricted communications, but will work independently.

Magnet Systems will perform most of the cost and schedule analyses, lead by Peter Wanderer, ready at about the same time as the LIUWG report.

A final commitment to Phase-1 deliverables could only occur after a stringent independent cost & schedule review.

Different potential formats include LARPAC, Lehman, & a joint review with CERN.



“Evaluation Process” for Phase-1 deliverables

2007

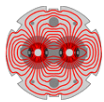
- Nov 7-9 CARE-HHH-APD IR07, Frascati
- Dec 5 DOE Mini-Review, Germantown
- Dec 6 Executive Committee meeting, Fermilab
- Dec 18 CERN-U.S. Meeting, CERN

2008

- April LARP Collaboration Meeting 10, Port Jefferson
- June ? CERN “LHC Insertions Working Group” report
- June LARP “Joint IR Studies” report release
- June DOE full-scale review
- June ? Phase-1 construction project review.



Summary



Summary

LARP must move with “speed but not haste” to present to DOE possibilities for **U.S. deliverables on the Phase-1 timescale.**

Rotatable Collimators (& crab cavities) prosper.

Potential Nb₃Sn cold mass locations include **triplet quads & collimation quads.** **D1 dipoles** are a significant alternative.

What will beam say?

CERN will definitively state upgrade parameters, on a **timescale** perhaps informed, but not driven, by LARP R&D.

JIRS must work closely with:

- LARP Magnet Liaison (Rossi)
- CERN-AB & AT divisions (many)
- “LHC Insertions Upgrade Working Group” (Ostojic)

Mantra: LARP Magnet R&D strategy focuses on Nb₃Sn magnets for Phase 2, in collaboration with CERN/CARE.