Conventional Magnets Technology Discussion Summary At the LCFOA meeting, 1May at SLAC

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Overview of Conventional Magnets Discussions, held jointly with "Electronics" group

- Two magnet manufacturing companies represented plus one that specializes in power cables & non-magnetic materials
- ILC asked "what else do you need to know?"
- Industry answered: "how can we actually help you?"
  - Summary on following slides, but first, as the huge quantity of conventional magnets needed for the ILC, colors the situation:
- Here is the INAUGURAL table of ILC MAGNET QUANTITIES

ILC MAGNET COUNT: Inaugural Publication

Magnet Type	Grand Totals		Sources			Damping Rings			2 RTML		2 Linacs		2 BeamDel	
	Styles	Quantity	Styl	e- Qty	e+ Qty	Style	e-DR Qty	2e+DR Qty	Style	Qty	Style	Qty	Styl	Qty
Dipole	35	2008	7	12	134	1	192	384	1	676	0	0	15	610
Quad	76	7326	11	47	3267	32	784	1566	7	670	3	560	23	432
Sextupole	14	1608	1	0	16	4	520	1040	0	0	0	0	9	32
Solenoid	7	55	6	8	39	0	0	0	1	8	0	0	0	0
Corrector	17	11000	1	0	6534	2	784	1566	8	1276	6	840	0	0
Pulsed/Kickers/Septa	12	278	2	0	21	4	3	6	3	20	0	0	3	228
Wiggler	1	234	0	0	0	1	78	156	0	0	0	0	0	0
Octupole/Undulator	1	35	1	1	1	0	0	0	0	0	0	0	0	34
Totals	163	22544	2	67	10012	44	2361	4718	31	2650	9	1400	50	1336
Totals w/o correctors	146	11544												

ILC Magnet count for 250Gev on 250Gev beams with baseline configuration
Compiled by Cherrill Spencer, ILC Magnet Systems Group, Inaugural Publication: 1May 2006

The LCFOA is the first entity, worldwide, to see the inaugural ILC Magnet Count : quantities are **PRELIMINARY** and **WILL change**!

Summary of discussions, page 1/3

- Putting aside the 10,160 correctors leaves 10,840 conventional magnets of 146 different styles to be designed and fabricated in 5-7 year – focus on the required high availability of the magnet system (= magnets + power supplies)
- We have a 2-3 year window now during which ILC magnet engineers are allowed to work with magnet vendors on improving the reliability of conventional magnets and designing them for easier manufacture

ILC says: To meet these production challenges we will:

- Have uniform standards for common materials such as ferrite, steel, conductor, cooling hoses
- Have a restricted list of approved off-the-shelf parts: water fittings, insulation, epoxies

Summary of discussions, page 2/3

- Magnet vendors can deal with “edicts” about materials to be used- as long as ILC has done its homework and the material (e.g. potting epoxy) really works, and it has been optimized for large quantities. Cost savings possible if the magnet engineering has been done with bulk production in mind.
- Concern expressed by industry: will the ILC management not say “Magnets and power supplies are mature technologies and so don’t need a lot of R&D money spent on them”?
- Spencer’s opinion: our management already appreciates the importance of the need for significantly improved reliability of magnets and PS and I expect to be able to secure some R&D funding to carry out some tests and design & build some prototype magnets.

Summary of discussions, page 3/3

- Discussed : how can the LCFOA and US magnet companies help us with our present cost estimating exercise? If ILC sends them drawing packages of magnets similar to ILC ones they can provide ILC with cost estimates.
- Conclusion: ILC magnet engineers and interested US magnet companies will get together regularly to have roundtable (i.e. not too many formal presentations) discussions about detailed magnet engineering with the goals of improving conventional magnets' manufacturability, reliability, repairability and minimizing cost (without ruining companies' profitability!).
- Spencer will take these conclusions back to the ILC Magnet Systems group and make sure we arrange some meeting in the next few months.

A CHALLENGING ASPECT OF ALL ILC COMPONENTS IS MAKING THEM RELIABLE ENOUGH

- Some examples of scaling of availability using actual SLAC magnet power supply's MTBF (~100,000 hours) and MTTR (~1.5 hours)

$$Availability \quad (A) = \frac{Uptime}{Uptime + Downtime} = \frac{MTBF}{MTBF + MTTR}$$

Availability of one PS = 0.999985

A of 400 PS = $0.999985^{400} = 0.994$ or 99.4%

A of 4000 PS = $0.999985^{4000} = 94.2$ %

A of 10,000 PS = $0.999985^{10000} = 86.1$ %

Most recent availability model of the ILC demands 97.1% availability of all the power supplies – clearly not met if PS system not modified.

Note to ILC Availability Group: need to re-run the model with the latest magnet and PS counts!