So what have we learned and what's the roadmap?

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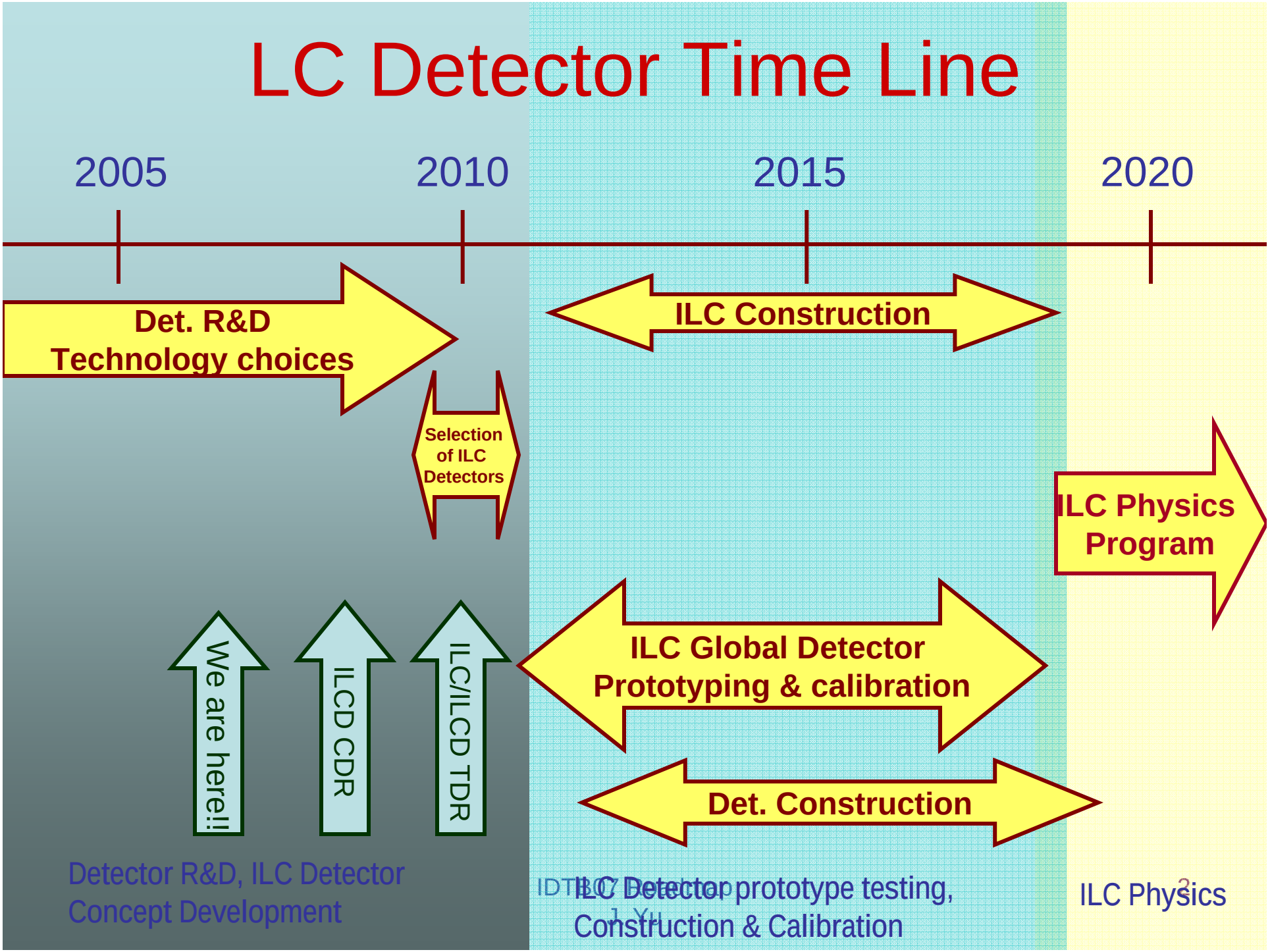
The ultimate goal: To provide a roadmap document to world-wide beam test facility managers, the ILC leadership and funding agencies for ILC detector R&D test beams to be in synch with the time scale of the accelerator

LC Detector Time Line



Charges

- Review and assess the current status, capabilities and plans of facilities

Testbeam Availability

Laboratory	Energy Range	Particles	Availability and plans
CERN PS	1 - 15 GeV	e, h, μ	LHC absolute priority
CERN SPS	10 - 400 GeV	e, h, μ	LHC absolute priority
DESY	1 - 6.5 GeV	e^-	> 3 months per year
Fermilab	1-120	e, π, K, p; μ	continuous (5%), except summer shutdown
Frascati	25-750 MeV	e	6 months per year
IHEP Beijing	1.1-1.5 GeV (primary) 0.4-1.2 GeV (secondary)	$e^{\pm}$ $e^{\pm}$, $\pi^{\pm}$, p	Continuous after March 2008 (unavailable before then)
IHEP Protvino	1-45 GeV	e, π, K, p; μ	one month, twice per year
J-PARC	Up to 3GeV	????	Available in 2009 earliest
KEK Fuji	0.5 - 3.4 GeV	e	Available fall 2007, 240 days/year
LBNL	1.5 GeV < 55 MeV < 30 MeV	e p n	Continuous
SLAC	28.5 GeV (primary) 1.0 - 20 GeV (secondary)	e $e^{\pm}$, $p^{\pm}$, p	Parasitic to Pep II, non-concurrent with LCLS

Demarteau

Testbeam Parameters

Laboratory	Primary Beam	# Beamlines	Δp/p	Rep. Rate (Hz)	Diagnostics
CERN PS	1 - 15 GeV	4			Cherenkov, TOF, MWPC
CERN SPS	10 - 400 GeV	4			Cherenkov, TOF, MWPC
DESY	e^- / 7 GeV	3	1% ?	12.5	Pixels
Fermilab	p / 120 GeV	1	1% > 10 GeV		Cherenkov, TOF, MWPC, Si Strips, Pixels
Frascati	25-750 MeV	1			
IHEP Beijing	e^- / 1.5 GeV	3	<1% 1%	25 1.5	Cherenkov, TOF, MWPC
IHEP Protvino	1-45 GeV	4			Ckov, Diff. Ckov, TOF, MWPC
J-PARC					
KEK Fuji	8 GeV	1	0.4%	100.0	
LBNL	e^- / 1.5 GeV	1		1.0	Pixel telescope
SLAC	28.5 GeV	1	0.2%	10.0	

Demarteau

Facilities

- Six low energy (<10GeV), electron facilities available at various time periods
- One med energy (<28GeV) available up to 2008 but uncertain beyond 2008
- Two med to low E (<45GeV) hadron facility
  - Limited availabilities once LHC turns on till the operation stabilizes
- Two high E hadron facilities available
  - SPS limited once LHC turns on till the operation stabilizes

Charges

- ✓Review and assess the current status, capabilities and plans of facilities
- Review and assess the current and planned detector test beam activities
- Identify requirements for test beams to meet adequately the detector R&D needs

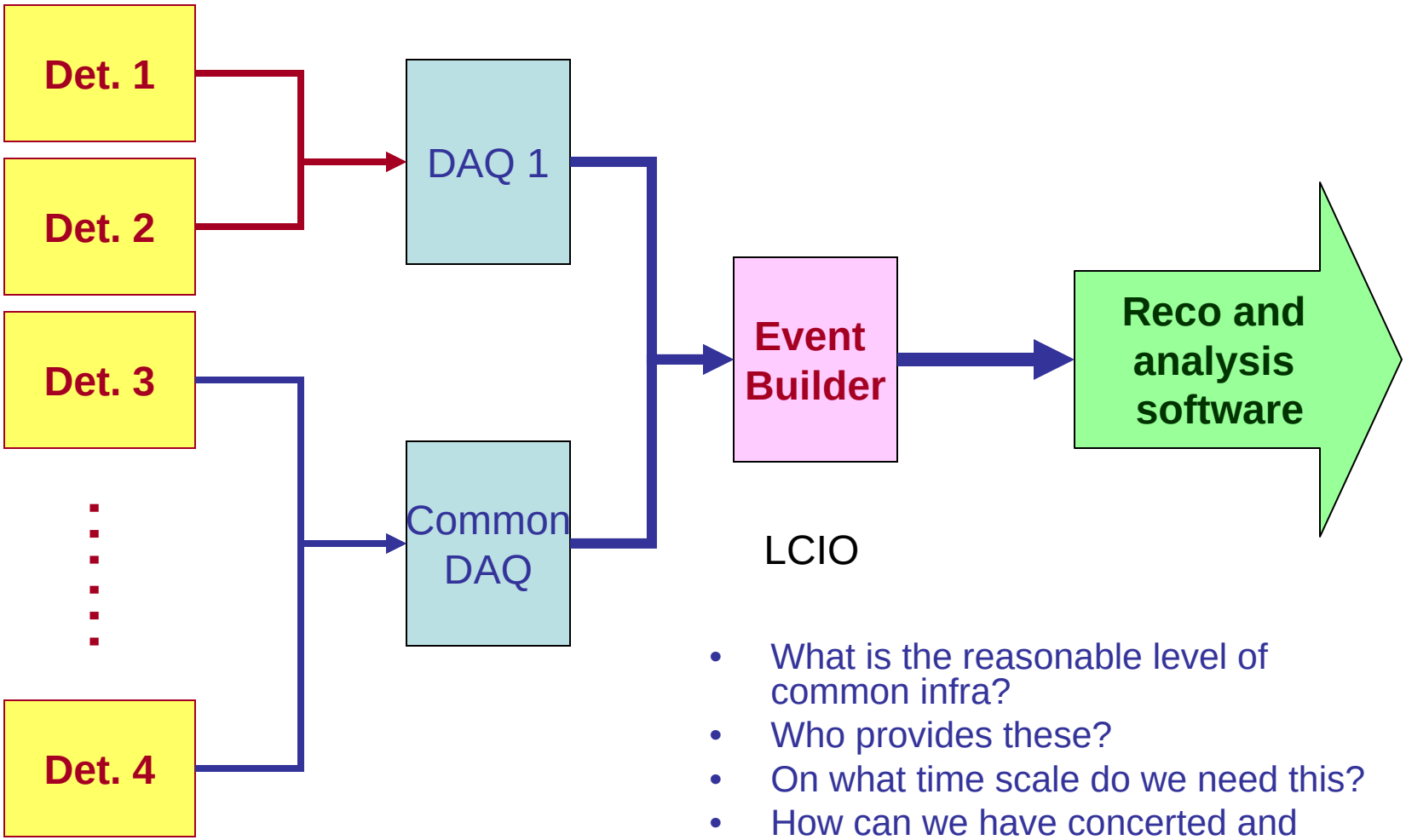
Defining R&D Requirements

- BI&MDI groups' requirements well understood
- Vertex groups begun defining their requirements
- Tracking groups
  - TPC performed beam test many times ➔ Well positioned to clearly define the requirements
  - Si-based tracker needs are being formulated but can use better coordination
- Calorimeters and Muons
  - Requirements defined 3 years ago
  - Need to update given the anticipated change in focusses

Notable requests at this workshop

- Large bore, high field magnet (up to 5T)
  - VTX and tracking groups
- ILC beam time structure (1ms beam + 199ms blank)
  - VTX, TRK and CAL electronics
- Mimicking hadron jets
  - VTX, TRK and CAL
- Common DAQ hardware and software
- Common online and offline software
  - Reconstruction and analysis software

Point of Merge for Commonality



- What is the reasonable level of common infra?
- Who provides these?
- On what time scale do we need this?
- How can we have concerted and coordinated effort?
- Do we need this at all?

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- Common online and offline software
  - Reconstruction and analysis software
- Tagged neutral hadron beam

Detector R&D Needs

Detectors	N_Groups	Particle Species	P (GeV)	Magnet (Tesla)	N_Weeks/yr	ILC time structure	Note
BI&MDI	2E+8ESA+1F+2C+3BC	e	up to 100	Not specified	64		Mostly low E elec
Vertex	10	e, π, p; μ	up to 100	1 – 3	40	Yes	
Tracker	3TPC+ 2Si	e, π, p; μ	up to 100	1.5 - >3	20	Yes	
Cal*	5 ECALs+3 DHCALs + 5 AHCALs	e, n, π, K, p; μ	1 – >=120	Not specified	30 – 60	Yes	
Muon/TCMT	3	e, π, μ	1 – >=120	Not specified	12		

*Note: Most calorimeter R&D activities world-wide are organized under CALICE collaboration.

Can some of these work concurrently?

Improving Simulation

- Critical for ILC detector R&D, especially for PFA development
- Current models do not describe data too well, not just shower shapes
- Data incorporated into the models are from 70s
  - Work ongoing to incorporate data after 70s
- Turn around time seems to be quite long (typically over a decade??)
  - How can this turn around time shortened to be useful for ILC?
- Do fresh new x-sec data help?
- What kind of data do we need?
  - Will neutral hadrons in a prototype detector helpful?

Neutral Hadrons?

- Do we need beam test with neutral hadrons?
  - Successful PFA means the HCAL measures neutral hadrons
  - Simulation models need some neutral hadron data
  - Hadron calorimeter calibration can use momentum tagged neutral hadrons
- Can we trigger effectively?
- What energy range?
  - Which ones do we need to understand better?

LHC Experiences

- Must understand and minimize sources of systematic uncertainties
- Geometry must be well understood in MC
- Improvement and validation of MC must be incorporated in wide range of phase space
  - Still observe ~10% differences between data and MC with all corrections incorporated in
- Took long~~ time to reach current level of understanding
  - CMS took 66 weeks/yr
  - Dedicated areas and floor spaces

Charges

- ✓ Review and assess the current status, capabilities and plans of facilities
- ✓ Review and assess the current and planned detector test beam activities
- ✓ Identify requirements for test beams to meet adequately the detector R&D needs
- ✓ Plan and discuss for the future beam test activities
  - ✓ What have we learned from LHC beam tests?
  - ✓ What can we learn from existing ILC test beam activities?
  - ✓ What should the future beam test activities focus?
- Put together a team to write the ILC detector R&D test beam roadmap document which includes all sub-detector systems and the anticipated demands to facilities
  - This document should be completed by summer 2007

Roadmap Document Structure

- Introduction
  - Physics Needs
  - Time scale considered in the document
- Facilities
  - Summarize the current capabilities and plans
- Detector R&D ➔ Organized by detector types
  - Current activities
  - Requirements
  - Plans
- Computing, Simulation and Software
- Summary of requests to facilities

Who will work on this?

- Introduction ➔ WWTB Contacts
- Facilities ➔ D. MacFarlane
- Detector R&D
  - BI&MDI ➔ M. Woods
  - VTX ➔ Close link to the task force, C. Damerell
  - Tracker ➔ M. Demarteau
    - A. Savoy-Navarro, M. Dixit and R. Settles all agreed to participate
  - Cal ➔ F. Sefkow and J. Yu
  - Muon ➔ H.E. Fisk
- Computing, Simulation and software ➔ R. Poeschl
- Compilation of requests ➔ All primary contacts + WWTB contacts

On what time scale?

- First draft by LCWS 2007 at DESY
  - May 30 – June 1, 2007
- Final draft within 1 mo of LCWS2007
  - Release the final draft by July 1, 2007
- Deliver the document to facility managers and ILC leadership on July 1, 2007

How do we communicate and organize?

- Establish a wiki web page for WWTB
  - Documentation updated directly on the web page
  - Current activities directly updated by the R&D groups
- How do we organize?
  - Common DAQ, software, etc?
  - Scheduling among ourselves?

Conclusions

- We have learned tremendously
  - On supplies and needs
  - Significant differences between simulation models and with data
    - No new data incorporation into model beyond 70's?
- Impressive performance of GDN that allows remote participation
- Impressive upgrades in FNAL facilities
  - And the will of managements to work with the community
- Lots of dialogues amongst ourselves and with FNAL colleagues has begun
- Work toward finding answers to the needs and supplies as focus shifts
- And communicate to facilities