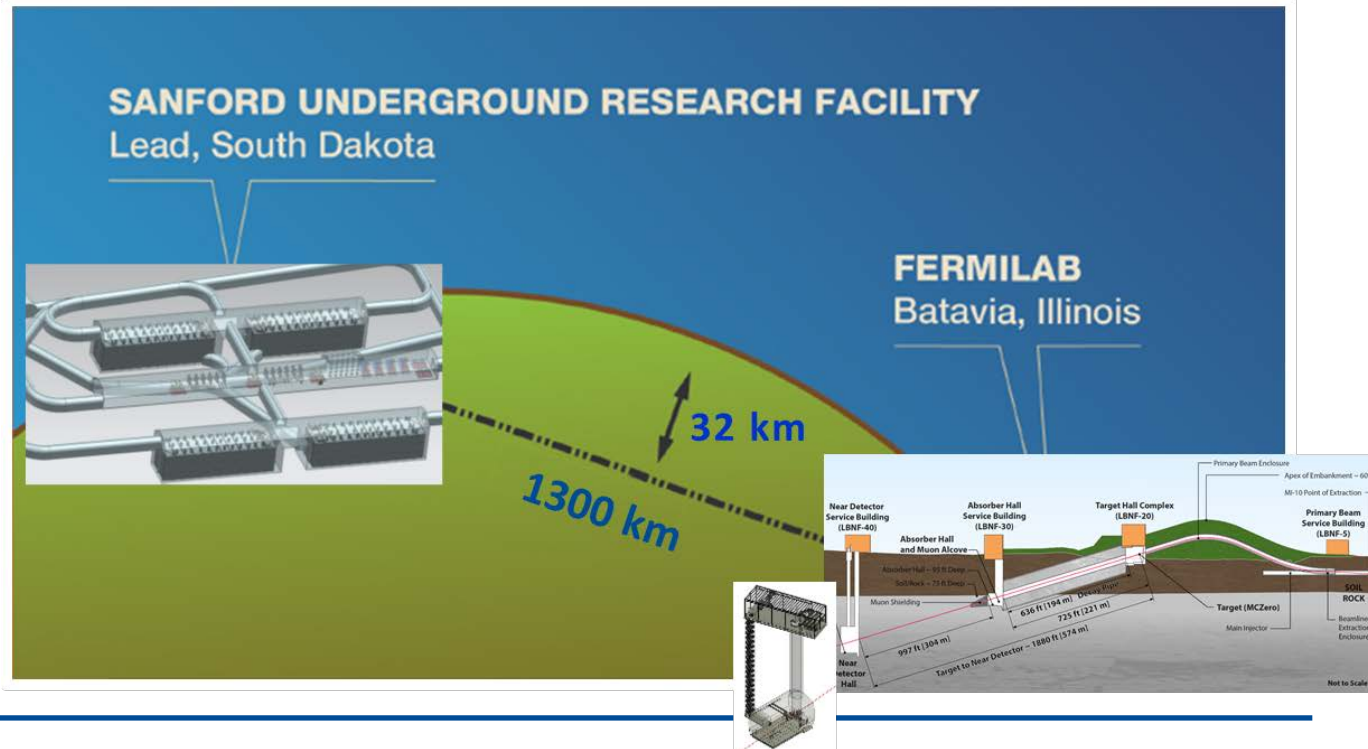


LBNC: oversight and assessment of LBNF and DUNE

David MacFarlane,
LBNC Chair

Report to HEPAP
December 9, 2015



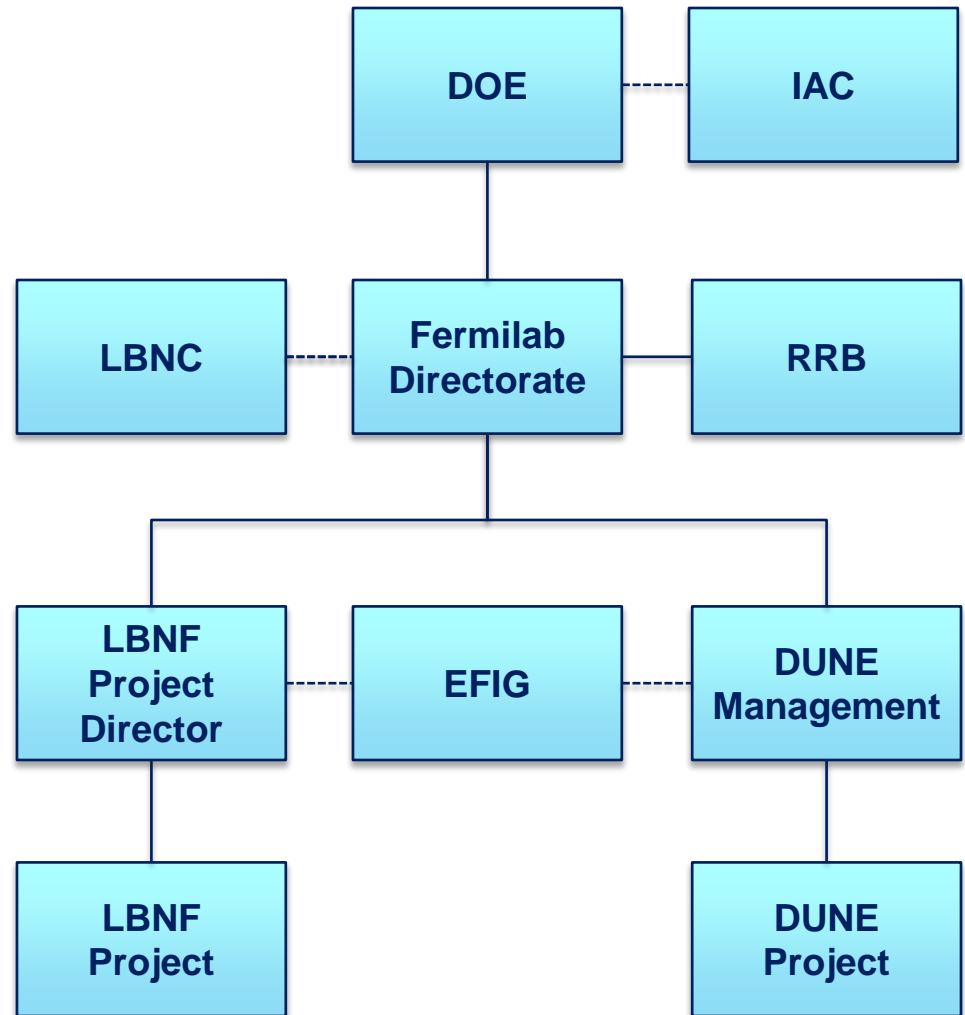
Genesis, scope and membership

- Recommended by Fermilab PAC in January as a new advisory committee focused specifically on LBNF/DUNE
 - Modeled after the successful LHCC at CERN
- Scope includes scientific, technical and managerial decisions/preparations of the experiment & facility
- Provides continuous oversight, reports to Fermilab Director
- Membership:
 - Chair, David MacFarlane (SLAC)
 - Ursula Bassler (IN2P3)
 - Sampa Bhadra (York)
 - Francesca Di Lodovico (Queen Mary)
 - Patrick Huber (Virginia Tech)
 - Mike Lindgren (FNAL)
 - Naba Mondal (TIFR)
 - Tsuyoshi Nakaya (Kyoto)
 - David Nygren (UT Arlington)
 - Marco Pallavicini (Genova)
 - Stephen Pordes (FNAL)
 - Kem Robinson (LBNL)
 - Nigel Smith (SNOLAB)
 - David Wark (Oxford)

DUNE/LBNF organization and oversight

Organization and oversight structure adapted from the successful LHC model:

- IAC: International Advisory Council
- RRB: Resources Review Board (international funding agencies + DOE)
- LBNC: Long-Baseline Neutrino Committee
- EFIG: Experiment-Facility Interface Group
- Fermilab Directorate: The Fermilab Director and the 2 Deputy Directors



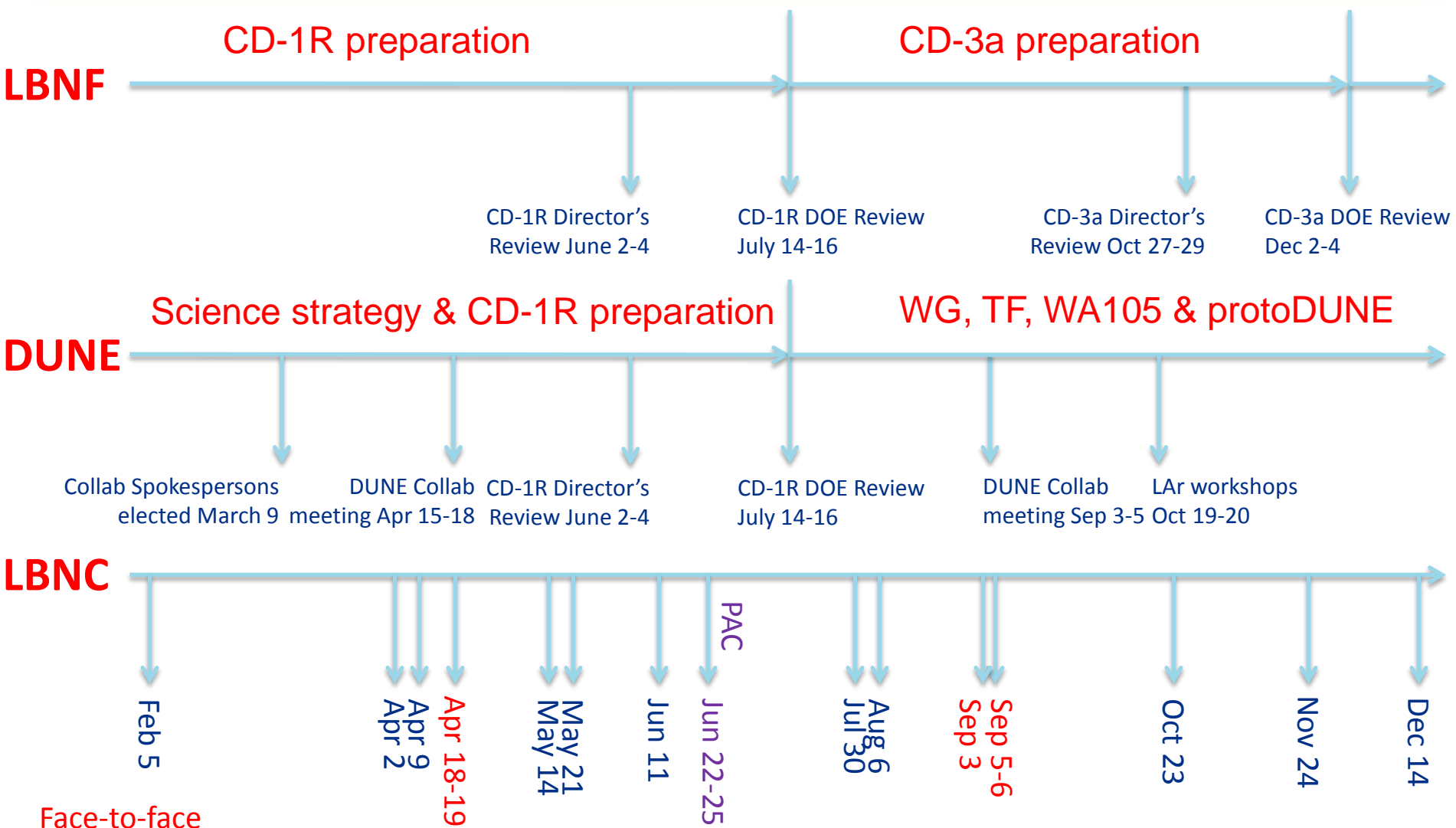
A lot has been accomplished by the LBNF and DUNE team

- Establish of a new, vigorous and truly international science collaboration DUNE
 - New Spokespersons (Mark Thomson and Andre Rubbia), TC (Eric James), and RC (Chang-Kee Jung)
- Further develop the LBNF organization
 - Addition of Chris Mossey (Director), to LBNF team of Elaine McCluskey (PM), Mike Headley (FS Manager)
- Develop suitable management structures, interfaces and oversight for LBNF and DUNE
- Develop science strategy satisfying P5 requirements and achieve CD-1R approval for LBNF/DUNE project
- Complete preliminary design work & planning for LBNF far site construction & pass DOE CD-3a review with flying colors

This talk: How has the LBNC provided oversight to date?

- Initial LBNC focus: development & preparation of deliverables for CD-1R
 - Overall strategy for achieving the physics goals laid out by P5 and credibility of projected physics performance
 - Realistic implementation plan and timeline for LBNF and DUNE, with international participation from the beginning
 - Technical choices developed and documented along with R&D plans in a coherent Conceptual Design Report (CDR)
 - Management structures devised and in place to execute the construction projects and integrate the science collaboration
- Subsequently LBNC has turned to CD-3a for LBNF; and
- Monitoring Task Forces, R&D efforts, and developing international partners for DUNE

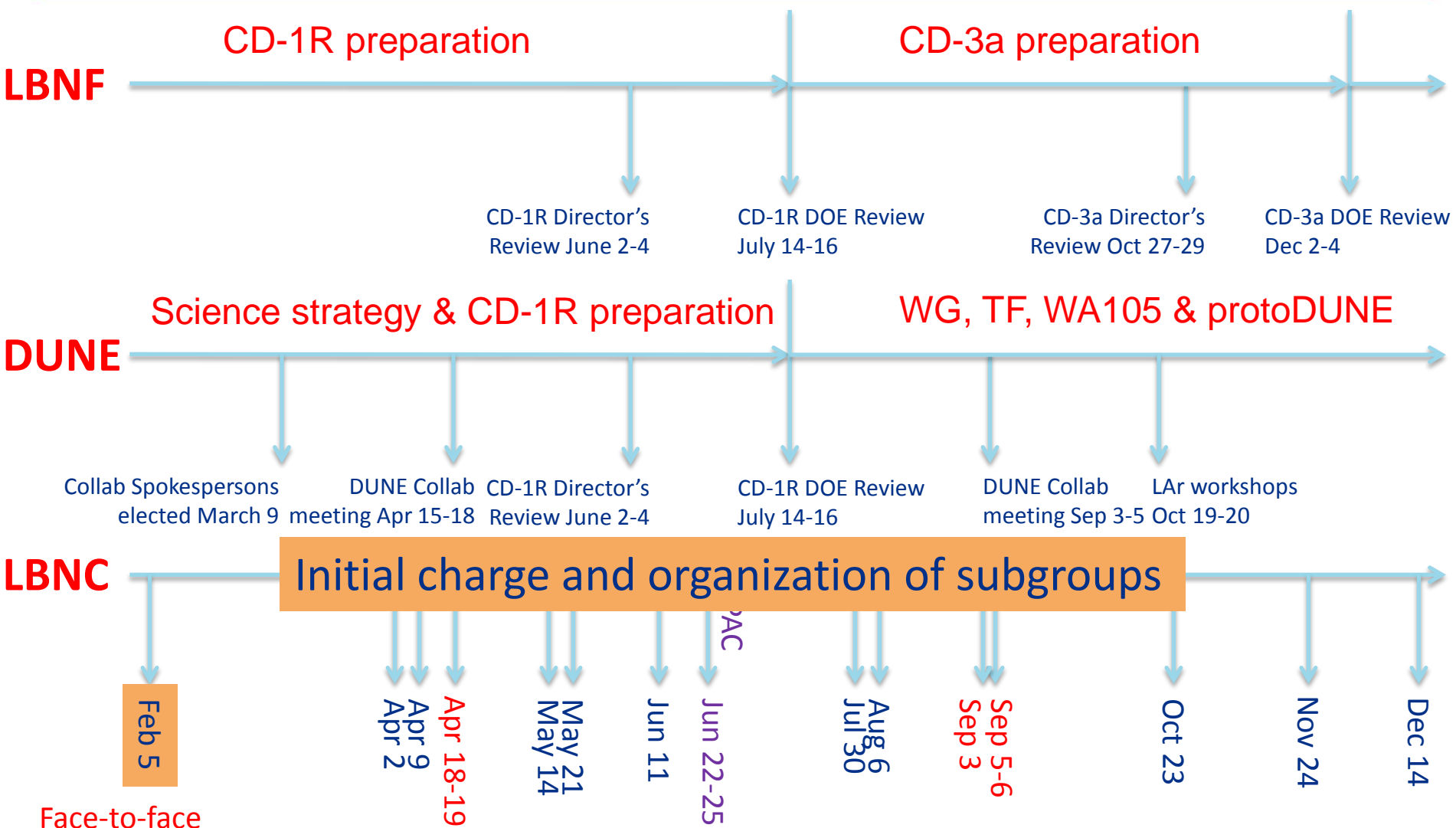
Overview of the year for LBNF and DUNE



Not shown: weekly Saturday morning calls with LBNC Chair, Fermilab, LBNF, & DUNE management



Overview of the year for LBNF and DUNE

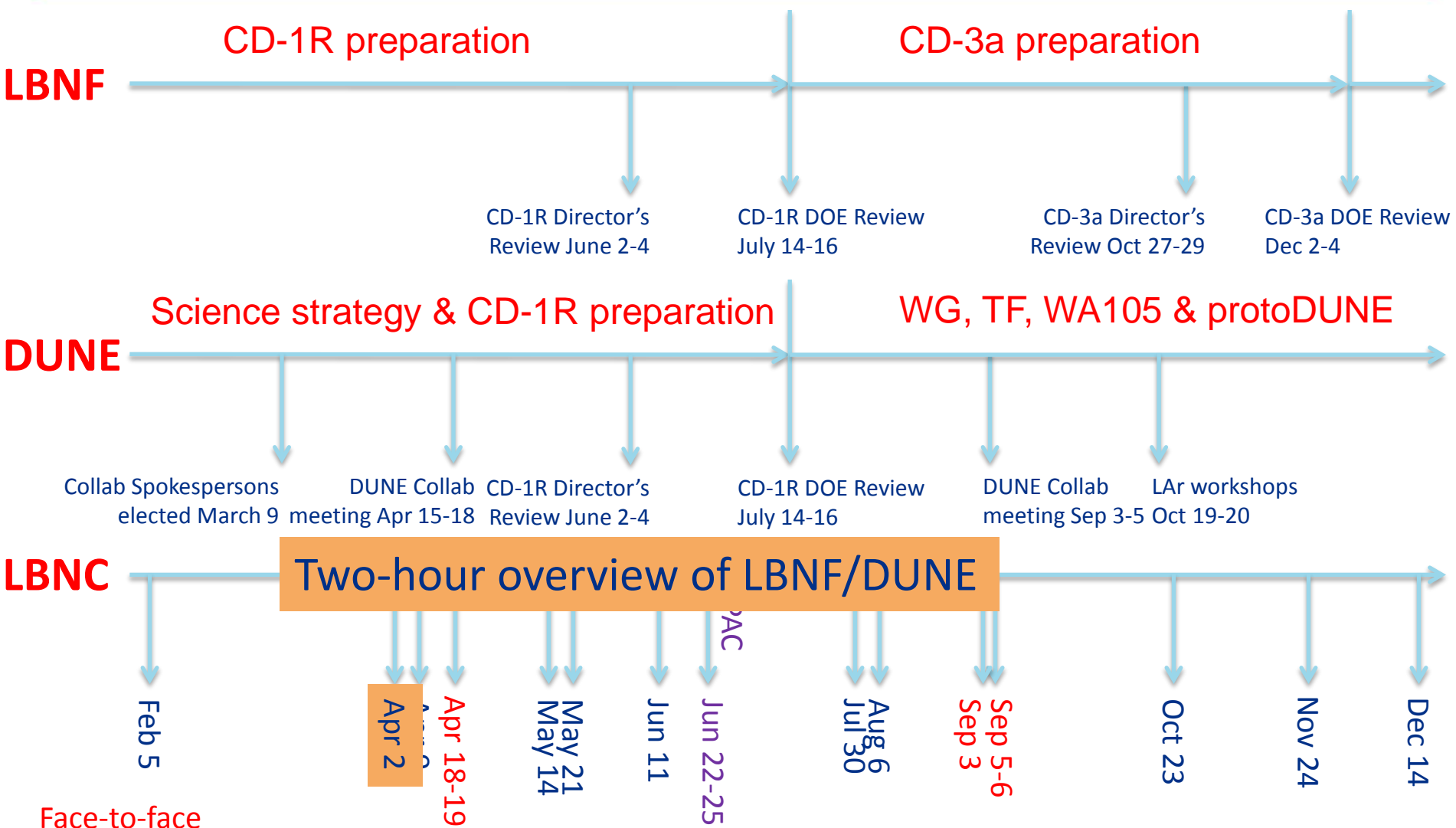


Face-to-face

Not shown: weekly Saturday morning calls with LBNC Chair, Fermilab, LBNF, & DUNE management



Overview of the year for LBNF and DUNE

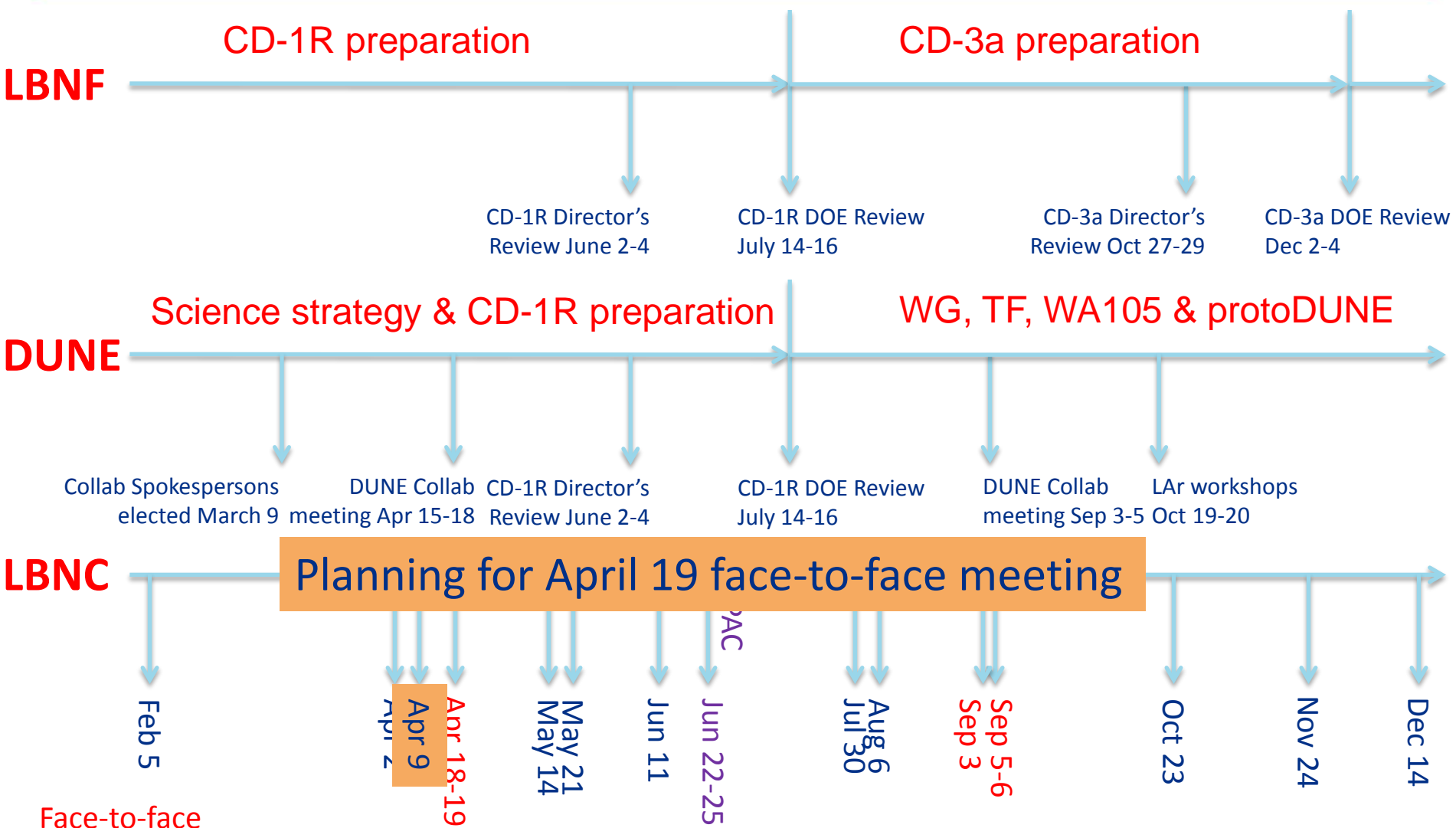


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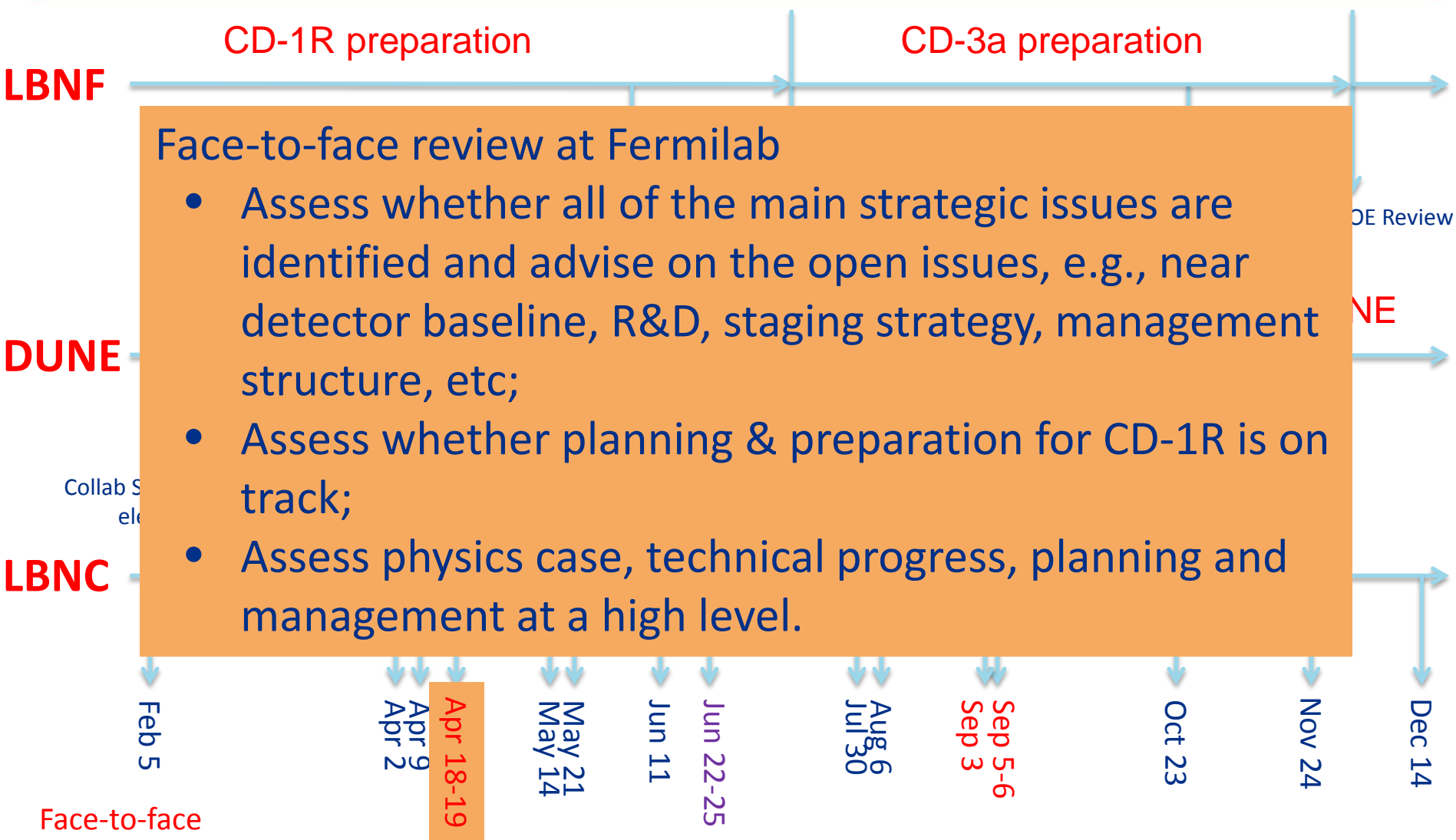
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Overview of the year for LBNF and DUNE



Face-to-face

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April 19: LBNC agenda

Preceded by DUNE
Collaboration plenary
summary session on
April 18

	Speaker	Topic	Start
Closed		LBNC Executive Session	8:00
Plenary	Nigel	Overview	9:00
Plenary	Joe	Overall organization and planning	9:30
		Break	10:00
Plenary	Jim/Elaine	CD-1 scope and timeline: LBNF update and progress	10:20
Plenary	Mark/Andre	CD-1 scope and timeline: DUNE update and progress	11:00
		Lunch	11:40
Breakout 1		Management & EFIG	
Breakout 2			12:40
	Session 1	DUNE Physics	
	Session 2	DUNE Technical, cost and schedule	
	Session 3	LBNF Technical, cost and schedule	
Breakout 3			14:00
Closed	Session 1	DUNE Physics Subgroup	
Closed	Session 2	DUNE Technical, cost and schedule	
Closed	Session 3	LBNF Technical, cost and schedule	
Closed		LBNC Executive Session	14:40
		Break	15:40
Closed		LBNC Executive Session	16:00
Closed		LBNC Executive Session	16:30
Closed		Feedback to LBNF/DUNE	17:30
Closed		Feedback to Fermilab management	18:00

[[Link](#)]

LBNC feedback from April [1]: LBNF

- LBNF has a credible path towards CD-1R, with good progress to date against planned milestones
- Risk management process evolving, with very strong start to collating risks across both projects
 - Several high level risks identified in the risk workshop have yet to be assimilated and mitigated in order to be retired
- Scope of LBNF may evolve with operational responsibility for Sanford Lab to be assumed by Fermilab
- Construction and deployment sequence not yet finalized, with potential collisions on resources (shaft, drifts) and time (contractors) during excavation and construction underground
- Detector design for modules 3 & 4 may impact required excavation topology
- Expansion of near detector cavern strongly supported for potential additional science capability

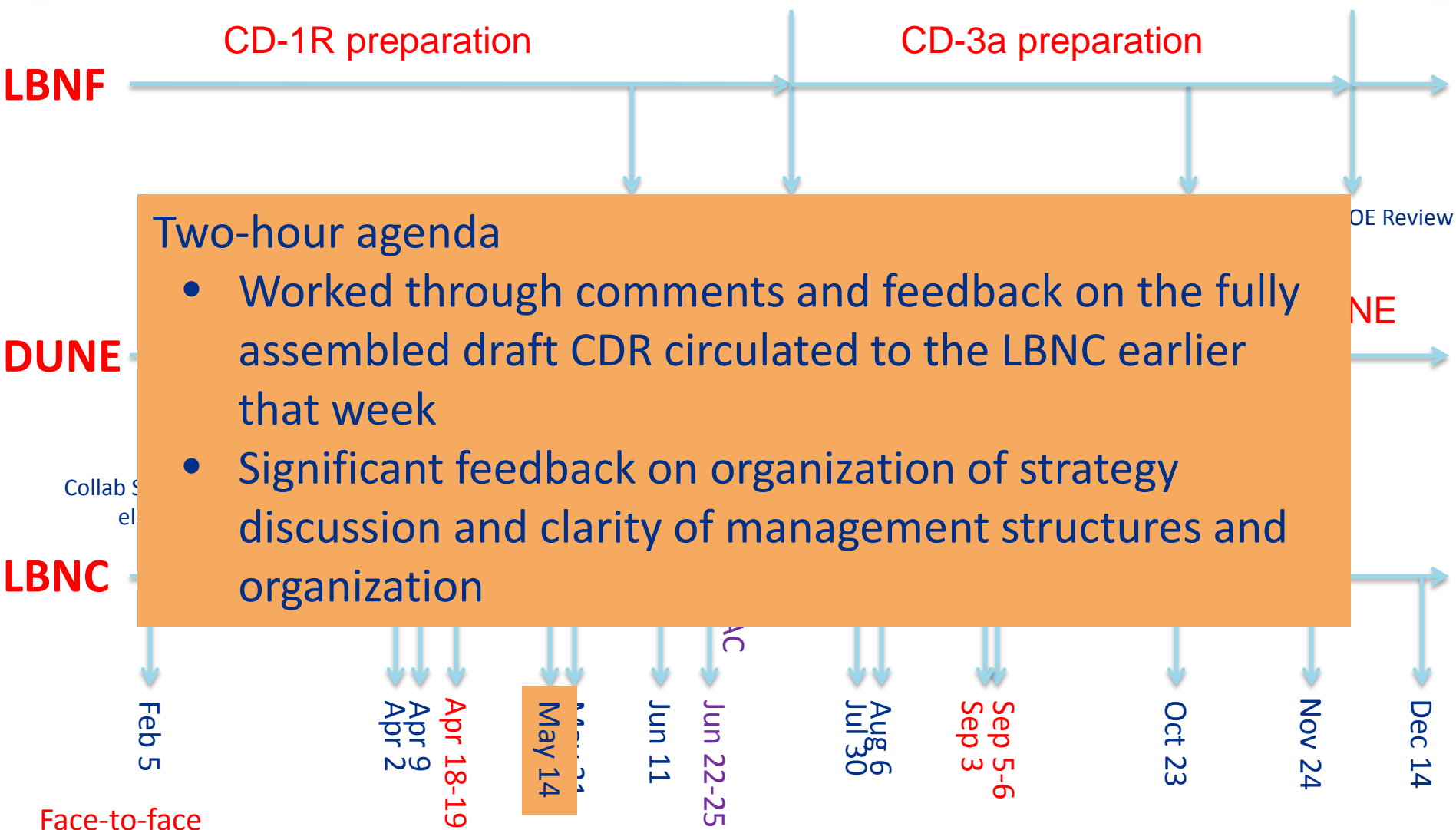
LBNC feedback from April [2]: DUNE

- Excellent strides in forming an international long-baseline neutrino program and organizing preparations for CD-1R
- Physics case generally well documented and compelling
- Concern about the underlying arguments for the claimed factor of 3 improvement on T2K systematic uncertainties in the modelling of neutrino interactions
 - Corresponding concern about definition of the performance & physics requirements for the near detector
- Concern about the scope of the CERN test program and possible schedule problems for the DUNE LAr TPC construction start
- Concern about logistics planning for detector assembly and how this might impact underground construction

April LBNC Recommendations on Management [3]

- Develop a written proposal for the overall governance and organizational structure of the combined DUNE + LBNF project by May 5
 - Should address project reporting and oversight, integration and interface management, interactions with the RRB and IAC, role of the EFIG, relationship between DUNE project and the collaboration, role of the DUNE EC, etc.
 - An analysis of how this management structure would respond to various plausible project challenges should be considered, e.g., global optimization, funding or schedule shortfalls, etc.
- *Significant work during May to clarify organizational structure and process, now reflected in management plan and CDR*

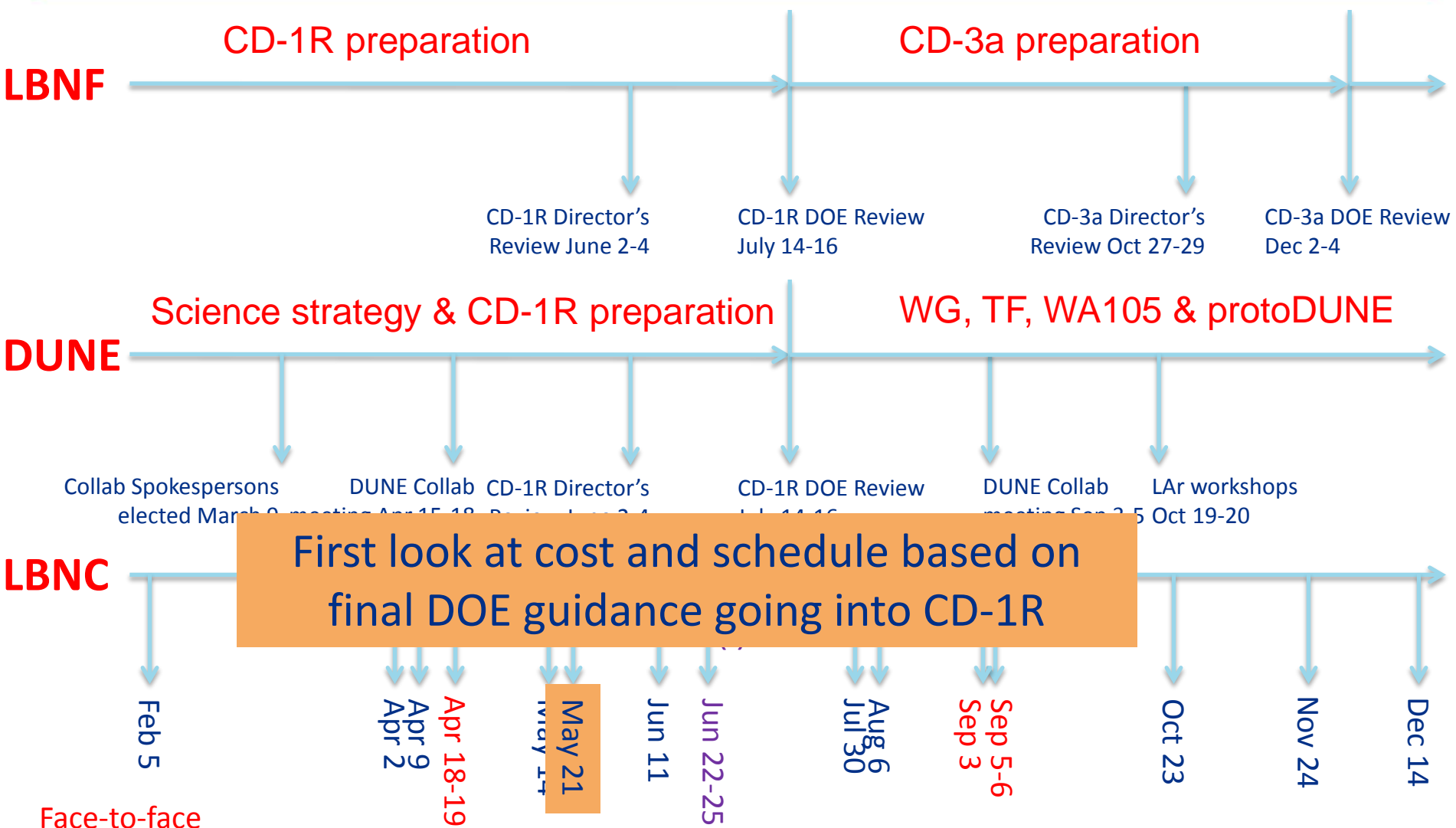
Overview of the year for LBNF and DUNE



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Overview of the year for LBNF and DUNE

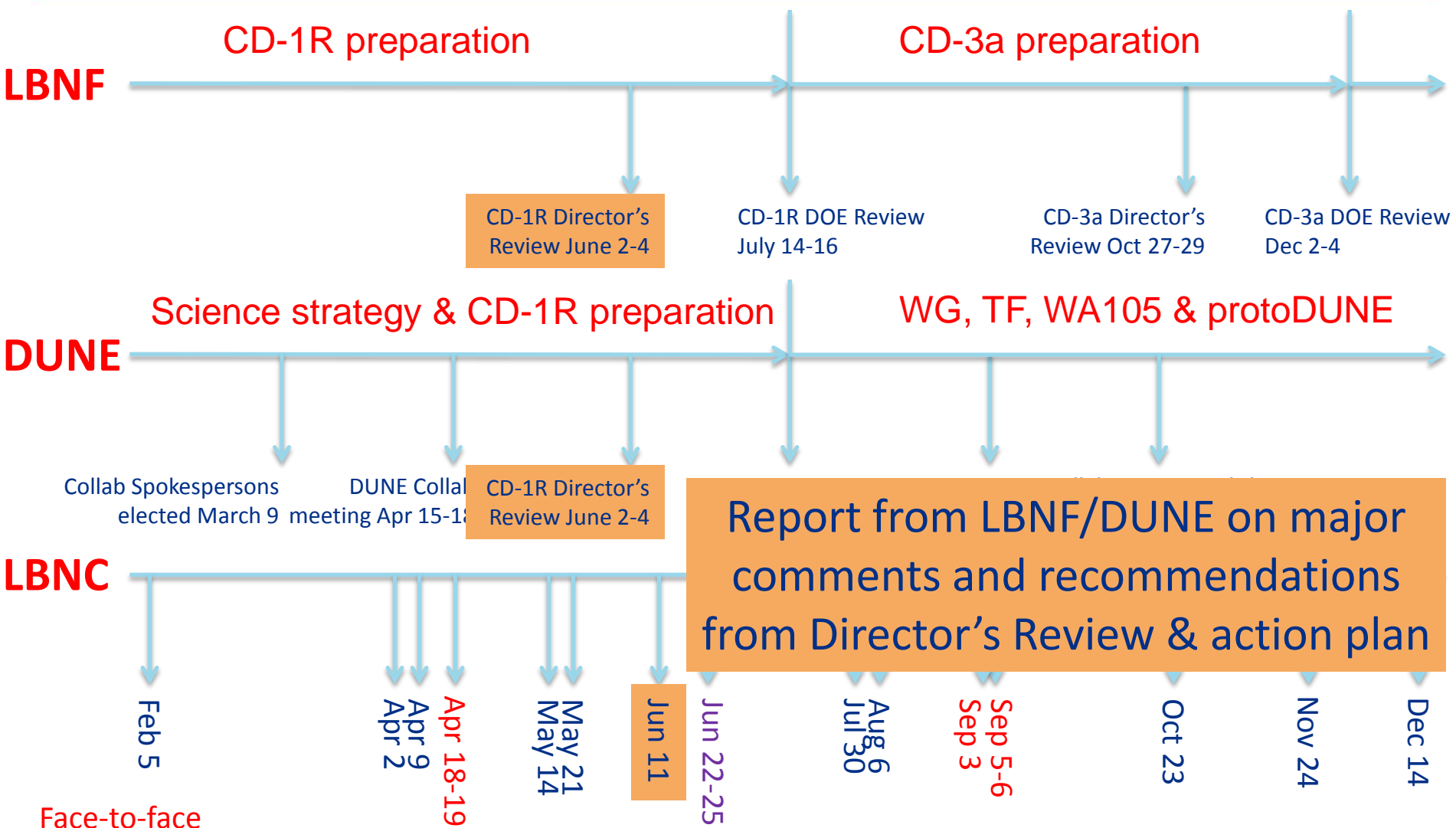


First look at cost and schedule based on final DOE guidance going into CD-1R

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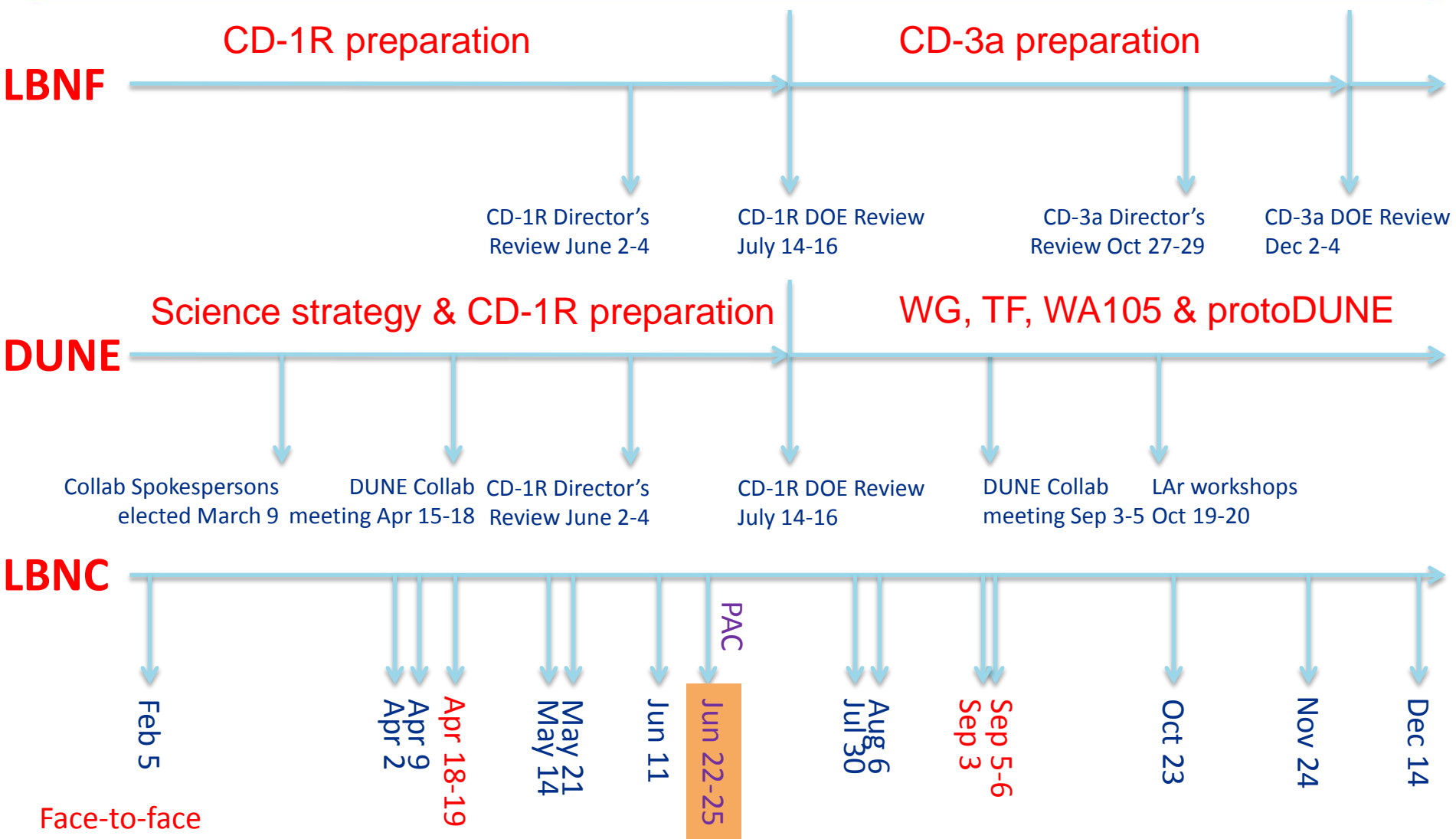
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Areas of LBNC focus over next 6 months post CD-1R

Presented to PAC, June 22

- LBNF preparation for CD-3a
 - Maturity of design within scope for CD-3a
 - Definition of relevant interfaces and associated risks for physics performance (DUNE) or cost/schedule (LBNF)
- Implementation of DUNE FD development plan [FDTF]
 - Technology roadmap, 35-ton Prototype, ProtoDUNE (single phase), WA105 (dual phase)
 - Technical issues: photon detection system, wire spacing
 - Manpower, resource and logistics planning
- DUNE ND design and optimization [NDTF]
 - Meeting physics and systematic error requirements
 - Broaden collaboration participation while studying technology choices & design concepts to meet requirements

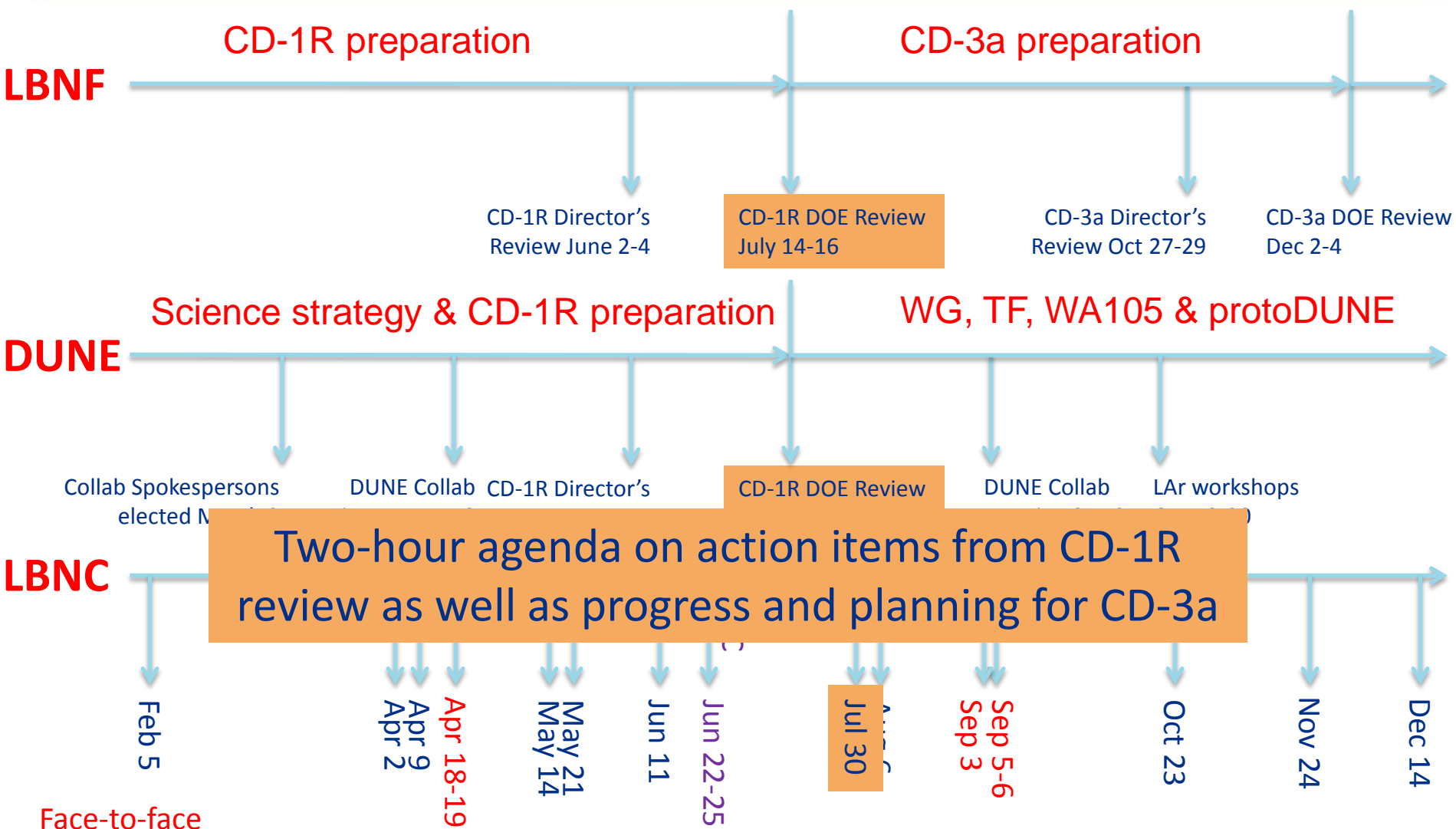
Areas of LBNC focus over next 6 months post CD-1R

- Beamline optimization [Beam TF]
 - Enhanced physics performance based on new designs
- DUNE physics and performance [FDTF]
 - Developing end-to-end simulation and reconstruction capability
 - Roadmap for software and computing resources to support development and future needs
- Connections & synergies with broad short-baseline program
 - Includes physics, detector optimization, and optimal workforce deployment, e.g., graduate students and postdocs
- Developing an international funding and responsibility matrix for DUNE and LBNF
 - Plan and initial steps for lining up national and institutional roles on the DUNE construction project starting with FD prototypes

Areas of LBNC focus over next 6 months post CD-1R

- Implementation & effectiveness of organizational structure
 - Decision making, resource planning and problem solving, particularly of EFIG, RRB, and CRB
- Monitoring recommendations and follow-up from project, Fermilab and DOE reviews

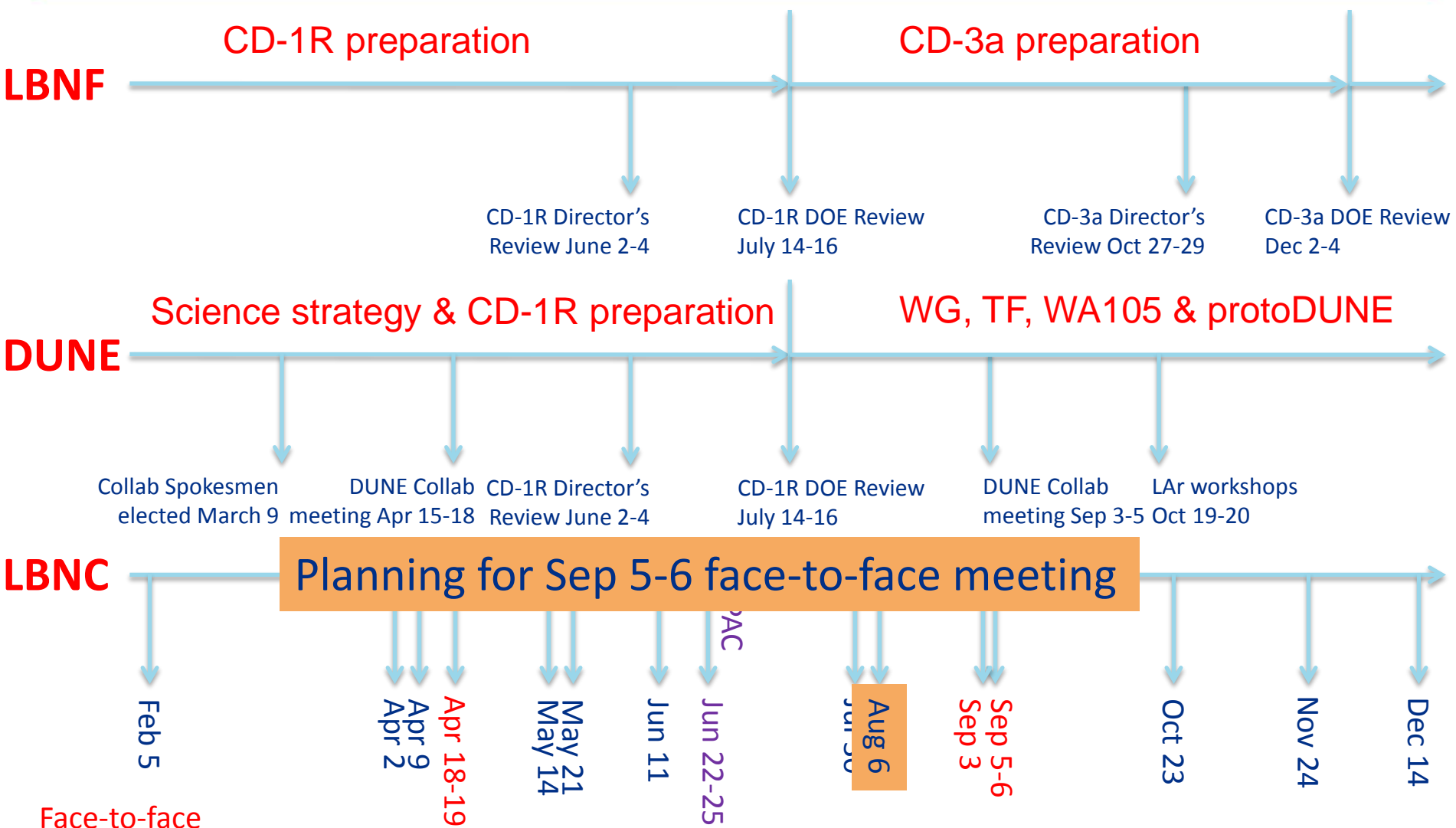
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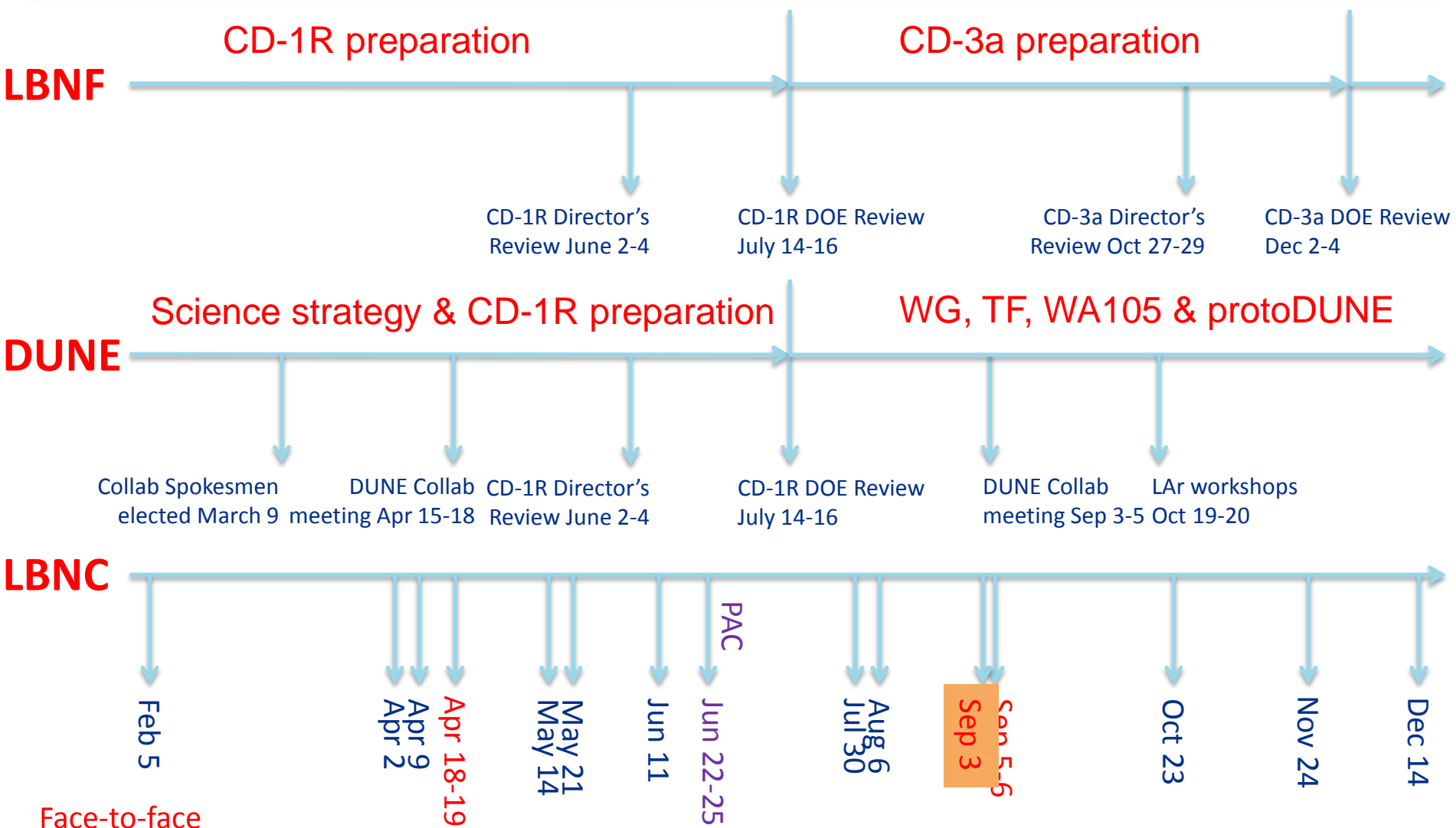
Overview of the year for LBNF and DUNE



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Overview of the year for LBNF and DUNE



Face-to-face

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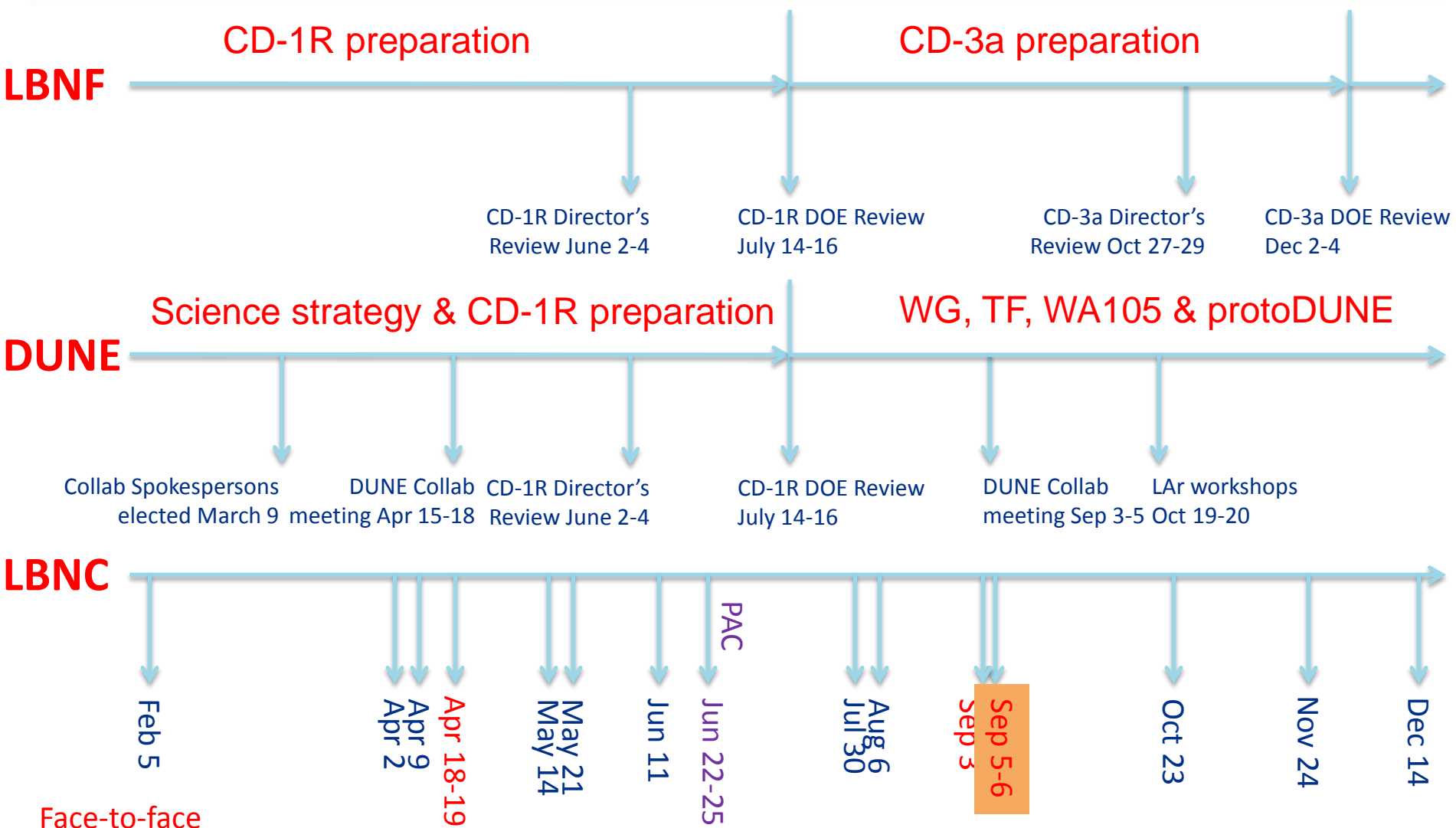
LBNC mini-review agenda for LBNF on Sep 3

3-Sep-15	duration	Topic	Presenter
8:00	30	LBNC Closed Session	
8:30	20	Overview of LBNF and DUNE projects	E McCluskey
8:50	30	Intro to FSF requirements, FSCF design, cost, schedule	J Willhite
9:20	45	FSCF Excavation Design	D Vardiman
10:05	40	FSCF Surface, Utilities, & Infrastructure Design	S DeVries
10:45	15	BREAK	
11:00	20	SURF Infrastructure Work - Risk Reduction Pre-Construction Start	M Headley
11:20	30	Interfaces Status & Management	J Willhite
11:50	30	Final Design Plan	T Lundin
12:20	60	LUNCH	
13:20	20	ESH Plan for FSCF & work at SURF	M Andrews
13:40	20	Construction Procurement & Management Plan	M Headley
14:00	20	Risks (Workshop 31Aug-1Sep)	E McCluskey
14:20	30	Cost and Schedule Status	J Willhite
14:50	30	Cryogenic Systems discussion	
15:20	30	Discussion	
15:50		LBNC Closed Session	

LBNC mini-review of LBNF on Sep 3

- Experts conducted a one-day assessment of planning and progress towards CD-3A
 - *A large fraction of the review committee have had little exposure to LBNF/DUNE prior to this review*
- Mini-review committee
 - *Dana Arenius, JLab (Cryogenics)*
 - *Richard Brummer, Itasca (Excavations/underground work)*
 - *Andrew Grigsby, ARUP (Cryogenics)*
 - Michael Lindgren, LBNC (ex officio)
 - Derek Martin, chair of the SURF CAB
 - Kem Robinson, LBNC
 - Nigel Smith LBNC

Overview of the year for LBNF and DUNE



Face-to-face

Not shown: weekly Saturday morning calls with LBNC Chair, Fermilab, LBNF, & DUNE management



LBNC agenda for DUNE on Sep 5-6

Preceded by DUNE
Collaboration plenary
sessions on Sep 4-5

	Speaker	Topic	Start
5-Sep			
Plenary	Weber	Beamline Optimization Task force: Q&A session	16:00
Plenary		General Q&A session	16:20
Closed			
		LBNC Executive Session	17:30
		LBNC dinner	19:00
6-Sep			
Closed			
		LBNC Executive Session	8:00
Plenary	Whitehead	FD Task force: Q&A session	9:15
Plenary	Brice	ND Task force: Q&A session	9:35
Plenary	Rucinski	Interfaces with LBNF CD-3A scope	9:55
		Break	10:15
Breakout 1			10:35
	Session 1	DUNE Physics Subgroup	
	Session 2	DUNE Technical, cost and schedule Subgroup	
		Lunch	12:35
Breakout 2			
			13:20
Closed	Session 1	DUNE Physics Subgroup	
Closed	Session 2	DUNE Technical, cost and schedule Subgroup	
Closed			
		LBNC Executive Session	14:50
		Break	16:50
Closed		Feedback to LBNF/DUNE	17:05
Closed		Feedback to Fermilab management	17:35

[\[Collab meeting\]](#)

LBNC feedback in September [1]: LBNF

- LBNF continues to make excellent progress towards CD-3a, following the plan outlined at the CD-1R review
 - Team has been extremely active over the last few months in the areas of preliminary design, interfaces, and risks as they relate to the CD-3a scope.
- Recommendations before CD-3a:
 - Consider whether the maturity of the cryogenic design supports the CF excavation volumes
 - Develop a complete approach on safety refuges
 - Reexamine the cavern excavation shape & secondary supports & provide additional documentation as needed
 - Implement a policy that ensures that there is a “logical fire-wall” between excavation and filling the detectors with LAr

LBNC feedback in September [2]: DUNE

- There has been ongoing substantial progress in establishing working groups and task force groups and corresponding leadership over the last two months
 - The organizational structure appears to be well thought out and conceived
- TF leadership will have a challenging job to coordinate development across many working groups, while the working groups themselves are also still recruiting manpower
 - The ambitious goals set out for the task forces are appropriate to address key questions prior to CD-2 and galvanize the collaboration around specific deliverables
- DUNE management should carefully monitor the ramp up of the TF efforts, and the 35T, protoDUNE, WA105 prototype efforts, & be prepared to establish priorities & adjust goals

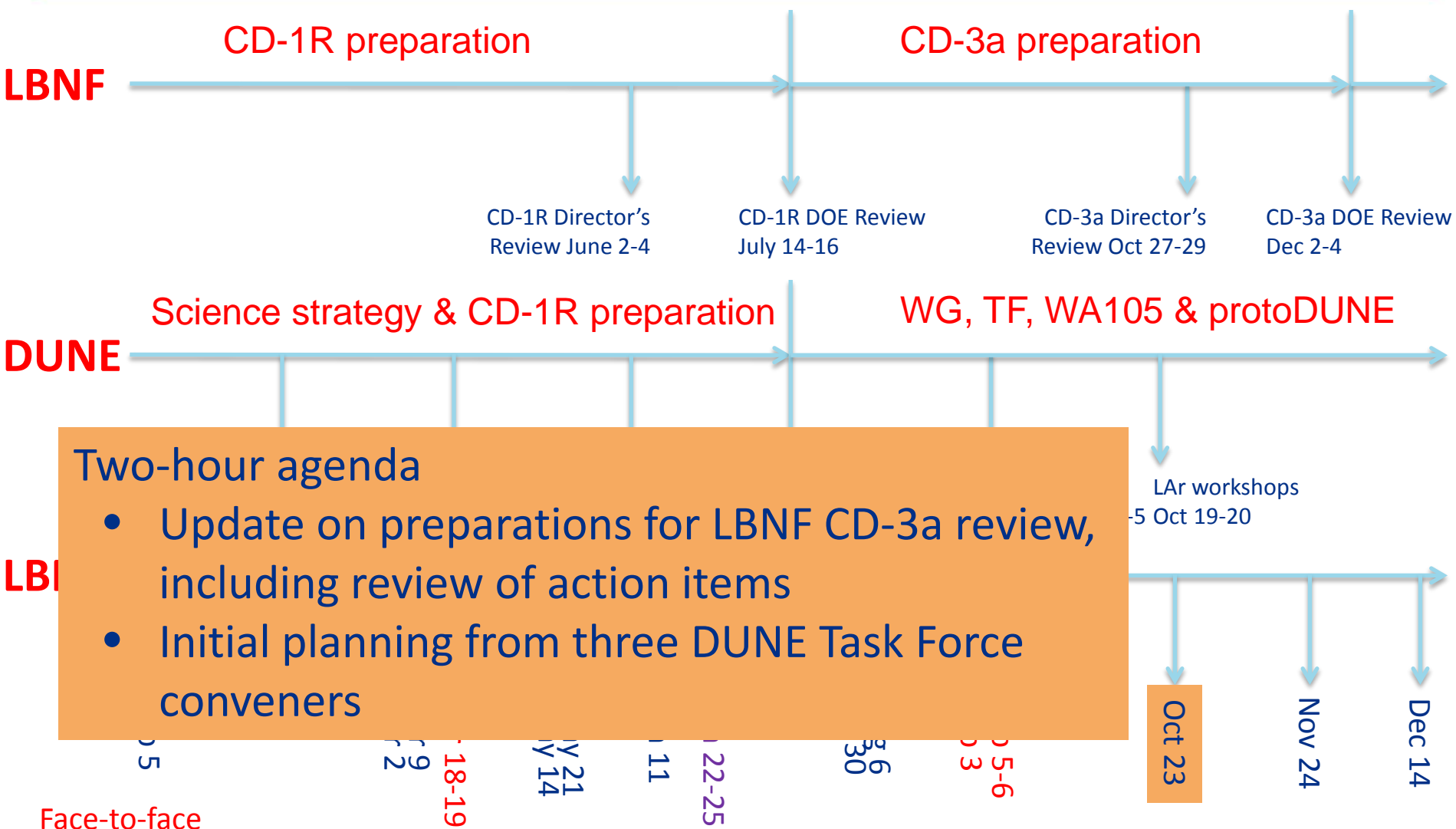
Specific advice on key DUNE FD Task Force

- Comments
 - The LBNC notes that the 80% efficiency for automated reconstruction for QE, RES and DIS events is a key assumption in the projected physics reach of DUNE. Much progress in demonstrating this capability should be accomplished by the TF within the next 18 months.
 - An important part of the FDTF planning would be to lay out a common understanding of the level of reconstruction sophistication needed at various stages during the 18 months and then beyond through the DUNE design phase leading up to CD-2

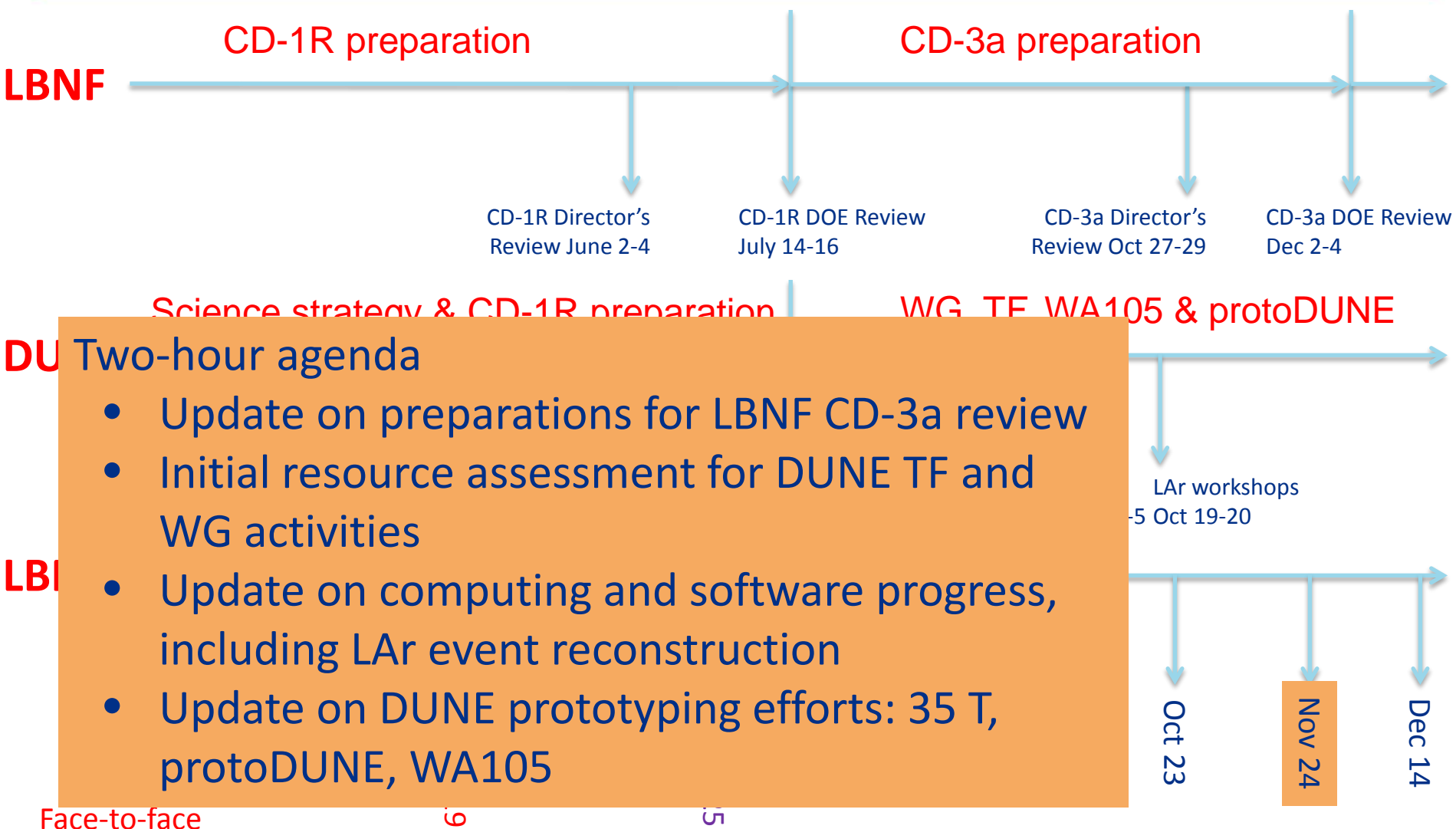
ND, FD, and Beamline Task Force Recommendations

- Task Force and Working Group leadership newly established at the Sept Collaboration meeting
 - Will monitor progress appropriately as leadership comes up to speed and formulates their plans
- Near-term recommendations:
 - Lay out a work plan for all three Task Force efforts with milestones by the time of the Director's CD-3a Review
 - By the time of the collaboration meeting in January, present detailed workforce requirements and more precise timeline that will be required to deliver the task force charge

Overview of the year for LBNF and DUNE



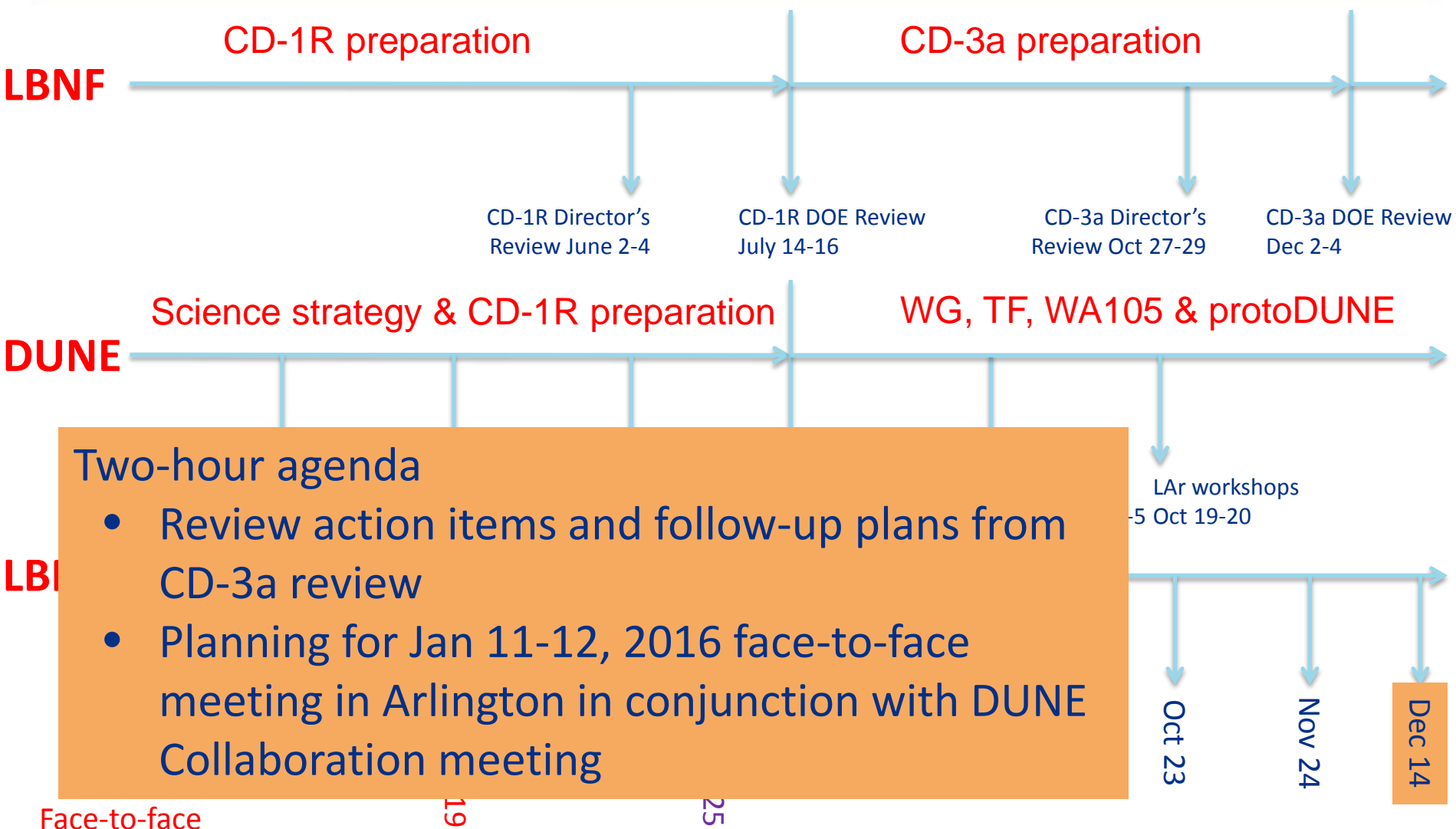
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Charge from Fermilab Director on SBN oversight: Initial steps taken on SBN program coordination

- LBNC met with SBN, DUNE spokespersons on Sep 2 & 17
 - Discussed steps to achieve greater coordination on automated LAr reconstruction, starting with an assessment workshop in October leading to development of a longer-term strategy
 - Will be held contiguous to a LArSoft framework requirements workshop jointly sponsored by the SBN/DUNE collaborations
 - SBN Executive Board will revive a Steering Committee to develop a concrete plan for a joint analysis strategy
 - LBNC will monitor discussions between SBND and DUNE on coordination of TPC hardware, electronics, and photon detection systems to the degree possible
- Will move to continuous oversight model, with some additional LBNC members to take on this scope

LAr TPC Reconstruction Assessment and Requirements

Workshops: Oct 19-20 at Fermilab

- Organized by the LArSoft Steering Group/Collaboration – spokespeople of most LArTPC experiments, Fermilab ND and SCD heads, LArSoft leads
- Very good attendance: ~40 attendees locally, 8 attendees remotely, 63 on the mail list. MicroBooNE, ICARUS, SBND, LArIAT, DUNE – including ProtoDUNE, WA105, 35ton – , CERN Neutrino Platform, Scientific Computing Division
- Goals:
 - Assess the current status of LAr TPC event reconstruction and analysis solutions
 - Write requirements for LArTPC reconstruction software, computing hardware, and human interaction (eco-system)

Next steps for SBN coordination

- Setting up monthly call with SBN and DUNE spokespersons
 - Regular SBN reporting to LBNC, starting with a summary talk on the LAr reconstruction & LArTPC software requirements workshop at the Oct 23 LBNC call
- Expect LArTPC requirements document to complete shortly, followed by development of an implementation plan
 - Fermilab will conduct an independent architectural review of the requirements and plan in early 2016
- Completion of LAr reconstruction assessment, planning for full LAr reconstruction workshop in spring 2016
 - Will follow initial experience with MicroBooNE data
- Review proposed governance for joint SBN physics planning and coordination

Summary

- LBNC is fully engaged as the main oversight committee to the Fermilab Director on DUNE and LBNF, and aspects of SBN program
 - Working closely with DUNE and LBNF, and starting up with SBN program
- Initial focus was CD-1R, then CD-3a for LBNF and now TF, R&D efforts, and developing international partners for DUNE
 - Enormous progress (Snowmass, P5, LBNF/DUNE) in setting the stage with DOE & the international community for a US hosted global neutrino facility
 - Outstanding performance at CD-1R was a first big test for the new paradigm followed quickly by crucial CD-3a in December
- Longer-term evolution to more in-depth review and advice on physics, technical, project execution & management