Advanced European Infrastructures for Detectors at Accelerators

L. Serin

- Generalities on FP7 Infrastructure Activity call
- Context of AIDA call :
  - *DevDet referee comments*
  - *Organisation*
- AIDA Work Package description
- Schedule

Overview of the 2010 FP7 Call for RIs

- Call identifier: FP7-INFRASTRUCTURES-2010-1
- Date of publication: 30 July 2009
- Deadline: 3 December 2009, at 17:00
- Activity: 1.1 Support to existing research infrastructures

  1.1.1 Integrating Activities (IA)
- Indicative budget for IAs: 162 M€
- "Targeted" mode for IA projects: only projects in 35 pre-selected fields (topics) are eligible to apply. Only one project per topic expected.
- AIDA will be submitted under topic: Physics Astronomy and particle physics
  - INFRA-2010-1.1.32: Research Infrastructures for Nuclear Physics.
  - INFRA-2010-1.1.33: Detectors for future accelerators.
  - INFRA-2010-1.1.34: Research Infrastructures for dark matter search, neutrinos, gravitational waves.
  - INFRA-2010-1.1.35: Research Infrastructures for high energy astrophysics.
- Expected success rate of ~ 60% $\Rightarrow$ average funding of 8 M€ per project (maximum possible funding is 10 M€ (max 2.5/ year), total budget around 30 M€)

- Should contain Management package, Network activity, Transnational access and Joint Research Activity

Reimbursement rate

Usual rule to receive some EU budget :
- Commit some budget : direct cost (manpower, travel, material)
  + overhead (country dependent, but ~60 %)
- Receive from EU : (committed budget)* rate

Activity	Rate
MGT (WP1)	< 50 %
NA/COORD (WP 2,3,4)	30 %
TA (WP 5,6,7)	≥ 75 %
JRA(RTD) (WP 8,9)	30 %

Below 50 kE expected to be received from EU, ask institute to be only associate partner (no direct fund received from EU, travel + subsistence for meetings/beam test). Need to maximize efficiency of funding.
Ask National contact/country to focus on a few activities and possibly give priority if reduction needs to be implied.

Any priority from ILC/CLIC community ?

Referee comments to DevDet (12.5/15)

- Scientific and/or technological excellence : 4.5/5

The general concept of stewarding a broad technology base of detector development and testing is an extremely good one, and necessary for the long-term health of the field of high energy physics.

For this reason, on the whole, this is a very good proposal. This premise needs some qualification however, particularly in light of the significant resources requested from the EC. Within the four areas identified within the European Strategy for Particle Physics (SLHC, LC, Neutrinos and Super-B) **there is a wide range of how immediately and with what priority R&D needs to be accomplished**. The LHC Luminosity Upgrade requires prompt attention, and one or more major neutrino facility projects will certainly begin soon for which structuring and technical work must also begin soon. **On the other hand, the situation with the ILC and higher energy Linear Colliders has become rather complex, and what (if anything) will be built needs to await results from the LHC.** The Super-B is intended as a regional rather than a European project.

There are several aspects of this proposal which are pushing the state-of-the-art, for example in the areas of simulations, and radiation-hard and 3D-integrated semiconductor detectors. Regarding the Networking activities, the coordination of long baseline neutrino experiments looks like a very worthy idea. **A project office for linear collider detectors may be less interesting for a few reasons; in addition to the comments above, one might worry that it would preempt or work at crosspurposes with the GDE**. **Also, by definition, detectors for linear colliders are much less technologically stressing than those for hadron machines such as the LHC**.

Regarding the Transnational access, the point is well made that test beams potentially represent a choke-point, and upgrading and expanding access to them should be given high priority. There is a question about how much total demand the DetDev program will make, and whether all of the smaller facilities are needed.

The JRAs (NA?) are outstanding. In particular, of highest value are the studies of rad-hard and 3Dintegrated semiconductor detectors; simulation tools that allow for realistic misalignments of detector systems, and pile-up due to high rate; **and the European Vertical Integration Facility (EUVIF).**

Referee comments

- Quality and efficiency of management : 4.0/5

CERN provides the backbone of the management and the overall plan is very professional. The individuals and institutions involved are first-rate and successful implementation can be assured.

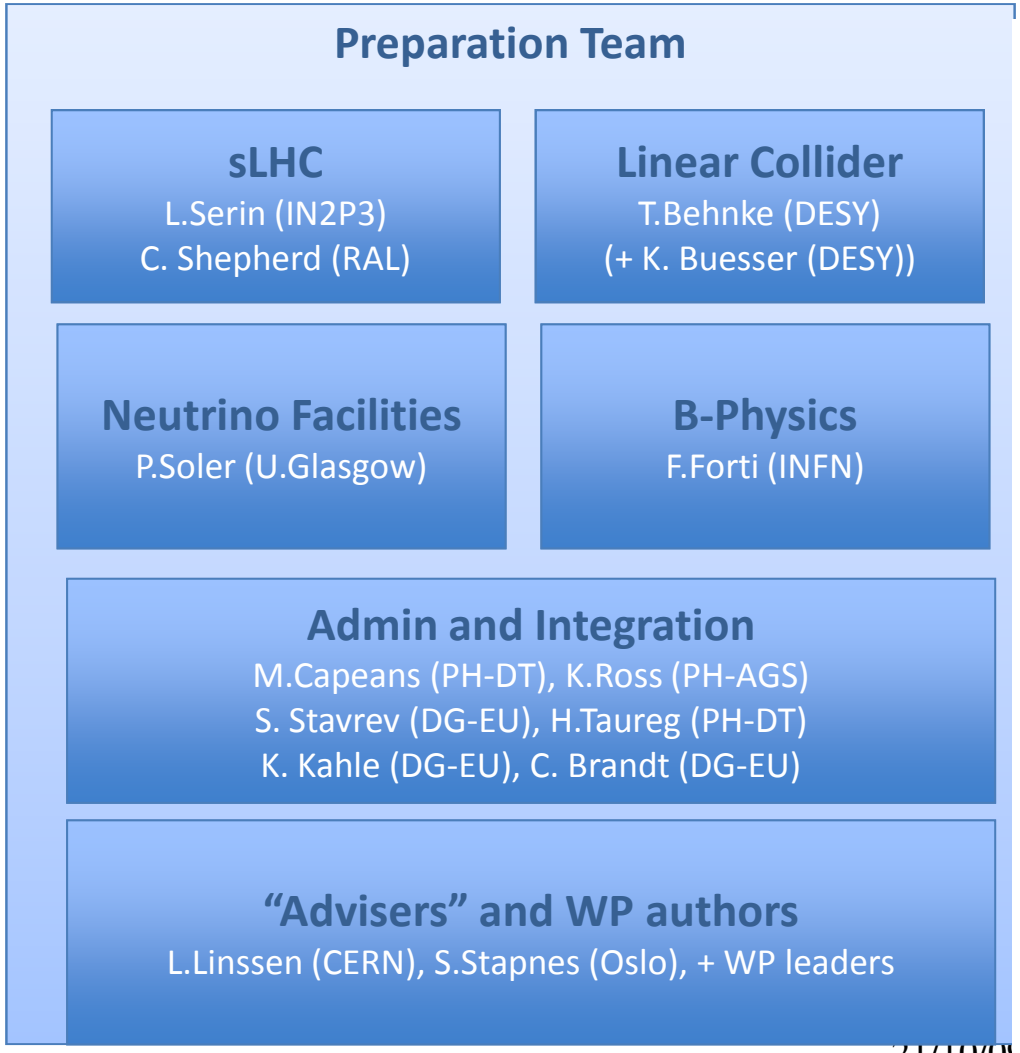
For reasons stated above, it is of concern that the resources towards the LC component of the program (~35% of the proposal) may be disproportionate.
Also, we are somewhat skeptical that all of he 7 smaller facilities need to be supported, especially in the name of redundancy. Their capabilities have significant overlaps and no estimate was made for the total program need for DevDet.

Improving DevDet → AIDA

- Concerns about R&D priorities in term of schedule with respect to European strategies for particle physics :
  → can be improved with more emphasis on possible synergy between different communities for same technologies (micro pattern gas detector, vertex detector), and justifying better why these R&D are important now even for a project starting in 20xx…
- Disproportionate resource towards LC (35 %)
  → Try to better balance WP budgets
  → Minimise WP/tasks only LC oriented and make JRA more transversal
- Too many irradiations facilities :
  → Need to reduce by one or two + better justification of users requests over the project
- RadHard 3D semiconductor detectors, simulation/software tools and EUVIF considered as high value :
  → Should keep these WP similar (EUVIF→LC test beam coordination)
- To improve score on impact through the development and dissemination and use of project results
  → Include a survey of industrial involvement in detector construction

Organisation of the AIDA call

Coordination group has been endorsed by RECFA meeting at EPS conference in Krakow, discussed at CERN council (Sep) :

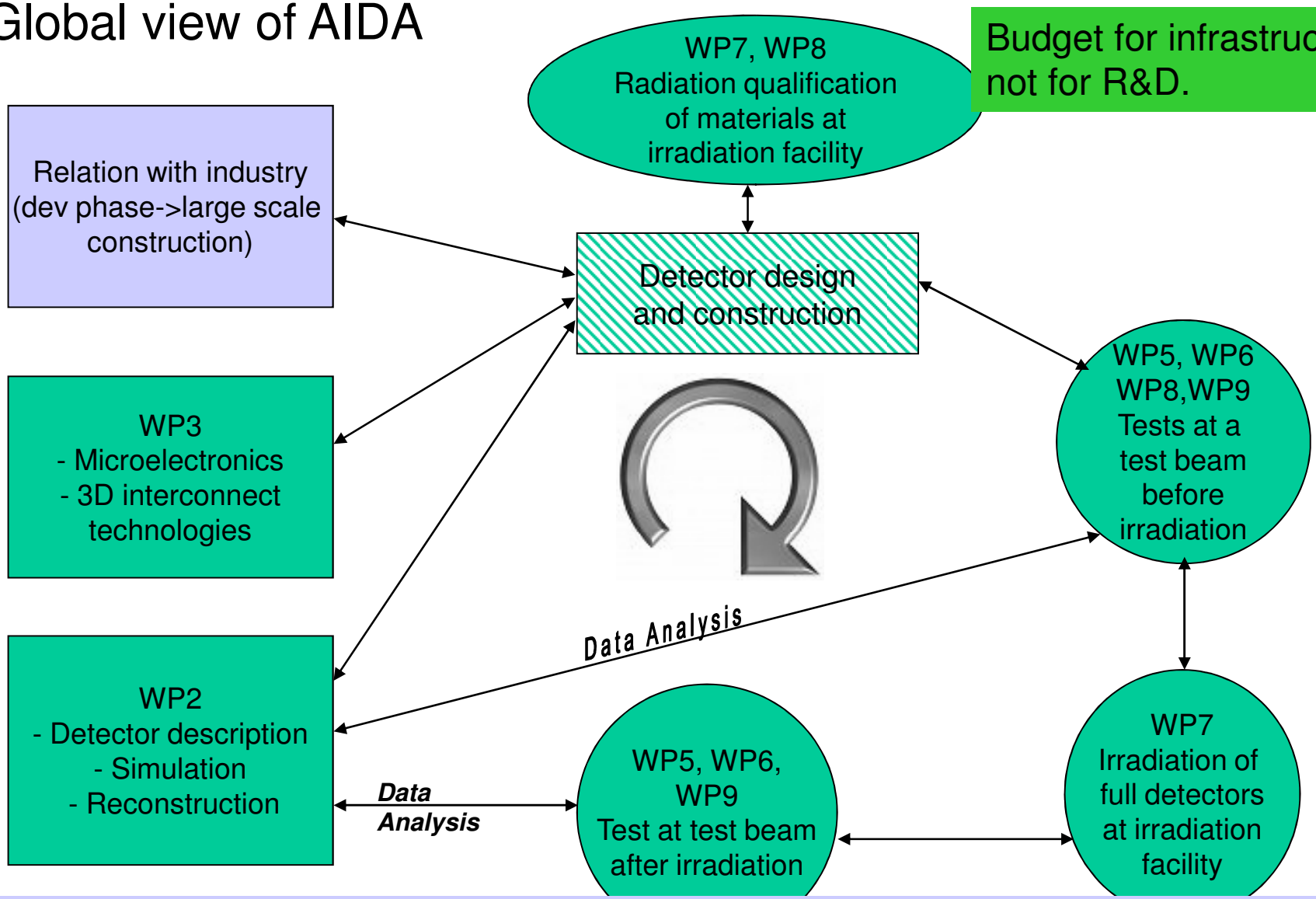


Preparation group work started since end August only…

→Proposal is expected to cover Infrastructure needs for R&D for new detectors at sLHC, LC/CLIC + neutrino/flavour physics projects.
→Need to have the proposal correctly balanced between sLHC and LC/CLIC
→ Information is going trough the National Contact for each country (23) and through the experiments
→Important that every actor is participating to the call but do not forget 10 M € for > 100 Institutes

Global view of AIDA

Budget for infrastructure not for R&D.



Cover detector design from first R&D ideas (simulation, choice of material, beam test + analysis) up to detector construction (needs of tight links with Industry) while pushing some technologies which are at the state of the art (3D semiconductor and electronics…)

AIDA work package breakdown

WP#	Type	Task	Description	WP Editors	Budget (kE)
1	MGT		**Project managemement and communication**	**S. Stavrev**	
		1,1	Project managemement and administration	**L. Serin**	
		1,2	Communication, documentation and outreach		500
2	COORD		**Development of common software tools**	F. Gaede	
		2,1	Geometry toolkit for HEP	P. Mato	
		2,2	Reconstruction toolkit for HEP		1100
3	COORD		**Microelectronics and detectors/electronics integration**	H-G Moser	
		3,1	3D Interconnection of microelectronics and semiconductor detectors	V. Re	
		3,2	Shareable IP blocks for HEP		1100
4	COORD		**Relation with industry**	**S. Stapnes**	
		4,1	Coordination	P. Sharp	
		4,2	User/topical working groups (to be defined)		300
5	SUPP		**Transnational access DESY**	I. Gregor	
		5,1	Test beams		100
6	SUPP		**Transnational access CERN**	H. Taureg	150
		6,1	Test beams and irradiation facilities		
7	SUPP		**Transnational access European irradiation facilites**	M. Mikuz	
		7,1	Facility 1		
		7,2	Facility 2		
		7,3	Facility 3		
		7,4	Facility 4		
		7,5	Facility 5		650
8	RTD		**Improvement and equipment of irradiation and beam lines**	E.Gschwendtner	2600
		8,1	Test beams at CERN and Frascati	H. Taureg	
		8,2	Upgrade of proton and neutron irradiation facilities at CERN		
		8,3	Qualification of components and common database		
		8.4	General beam and irradiation lines equipment		
		8.5	Coordination of combined beam test		
9	RTD		**Advanced Infrastructure for for detector R&D**	H. Videau	3000
		9,1	Gas detector facilities	M. Vos	
		9,2	Precision pixel infrastructure		
		9,3	Granular calorimeter studies infrastructure		
		9.4	Common DAQ infrastructure		9500

WP1 : Project management and documentation

S. Stavrev (CERN/EU), L. Serin (IN2P3/LAL)

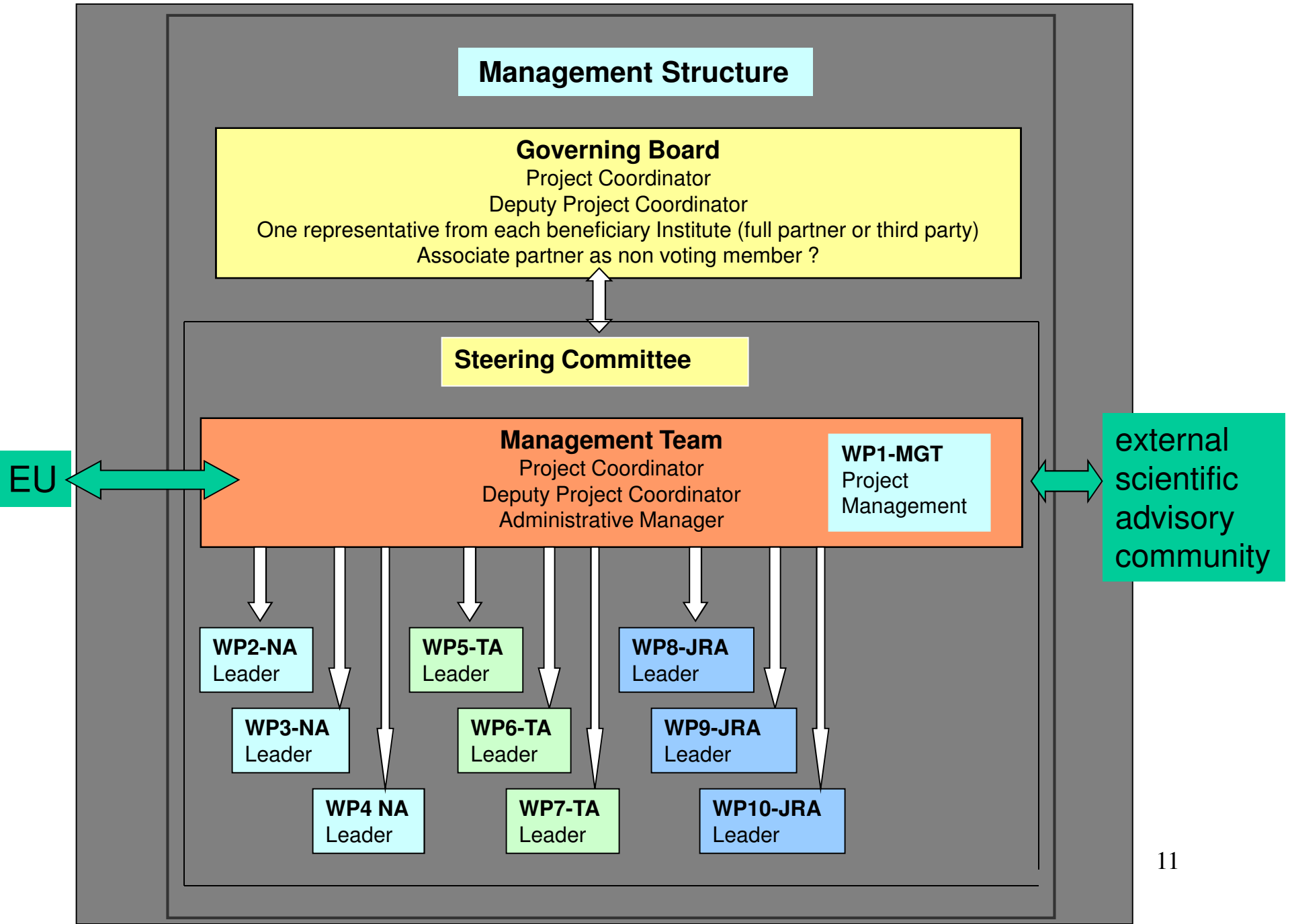
Goal : management and steering of the whole project (monitoring/reporting, financial follow-up of the project)
Documentation (web page, outreach)
Organisation of steering committee and plenary annual meetings

CERN being coordination lab of the AIDA project, main partner of this package is CERN

Budget ~500 kE :
1FTE over 4 years (0.5 project coordinator, 0.5 project assistant)
Support for Project Progress Tool (used in EUCARD, SLHC PP).
Outreach and dissemination activities + plenary meeting organisation

CERN will provide additional support :

0.2 FTE project manager
0.2 FTE Administrative assistant
0.1 FTE Finance officer
0.2 FTE Dissemination/communication


Management Structure
Governing Board
Project Coordinator
Deputy Project Coordinator
One representative from each beneficiary Institute (full partner or third party)
Associate partner as non voting member ?
Steering Committee
Management Team
Project Coordinator
Deputy Project Coordinator
Administrative Manager
WP1-MGT
Project
Management
EU
external
scientific
advisory
community
WP2-NA
Leader
WP3-NA
Leader
WP4 NA
Leader
WP5-TA
Leader
WP6-TA
Leader
WP7-TA
Leader
WP8-JRA
Leader
WP9-JRA
Leader
WP10-JRA
Leader

WP2 : Development of common software tools (NA)

P. Mato (CERN), F. Gaede (DESY)

Goal: develop core software tools that are useful for the HEP community at large and in particular for the next big planned projects: sLHC and Linear Collider (ILC/CLIC)

Focus on two major tasks:

1) develop generic HEP - geometry toolkit :
   Description of description of complex shapes, materials and sensitive detectors
   Interfaces to full sim program (G4, flucka…), reconstruction program, detector geometry, visualization tools (ROOT, VRVL…), to allow misalignment/calibration (database)…..

2) develop – detector independent - reconstruction tools
   Generic alignment tool, tracking and vertexing toolkit with state of the art (GSF, Kalman, Hough transform…) and working in pile-up environment, generic particle flow algorithm…

Budget : 1.1 ME Today already about 10 partners identified mainly LC

WP3 : microelectronics and detector/electronics integration (NA)

H. G. Moser (MPI), V. Re (Univ Bergamo)

Goal : The main objective of this work package is to establish a network of groups working collaboratively on advanced microelectronics and integrated detector/electronics concepts.

Task 1: 3D Interconnection of microelectronics and semiconductor detectors

- Demonstration of the feasibility of 3D interconnection for applications in Particle Physics (using vias last instead of vias first in Fermilab effort)
- Subdivision of the final objectives into a set of well defined sub-tasks:
  - *Design of and production of dedicated ASIC and sensors*
  - *Preparation of wafer thinning and via etching.*
  - *Development of high density interconnection technology with direct chip-chip contact by different techniques*
  - *Organization of common Multi-Project-Wafer runs to evaluate different solutions developed by collaborating Institutes*

Task 2: Shareable IP Blocks for HEP → common access to MPW

- Might contain blocks 130 nm (90 nm) CMOS technology and BiCMOS SiGe for low noise application. Still to be discussed

Budget : 1.1 ME . Today 16 institutions involved… (sLHC + LC)

WP4 : Relations with industry

Goal : S. Stapnes (Oslo Univ), P. Sharp (STFC)

Overall goal: address for the 4 projects – sLHC, ILC/CLIC, ν Det., SuperB :

- Technology needs, specs, trends in several area (5-10 years?)
- Interactions with industry in development phase and during (large scale) constructions phase
- Transfer to industry, industry related spin-off, and collaboration with other fields where this is relevant.

Deliverable :

Create WEB overview and report covering in a matrix key technologies and specs (x-axis) versus the four projects mentioned (y-axis). Industry can link to these nodes describing their capacities.

Possible covered topics : Silicon sensors, Microelectronics technologies, Optoelectronics and Link Technologies, 3D integration and interconnecting technologies (use a group or two from WP3), Scintillators and SiPM (Photodetector in general?), Power distribution (on detector – use SLHC-PP WP8 groups), MicroPattern Gas Detectors (use RD51 ?)….

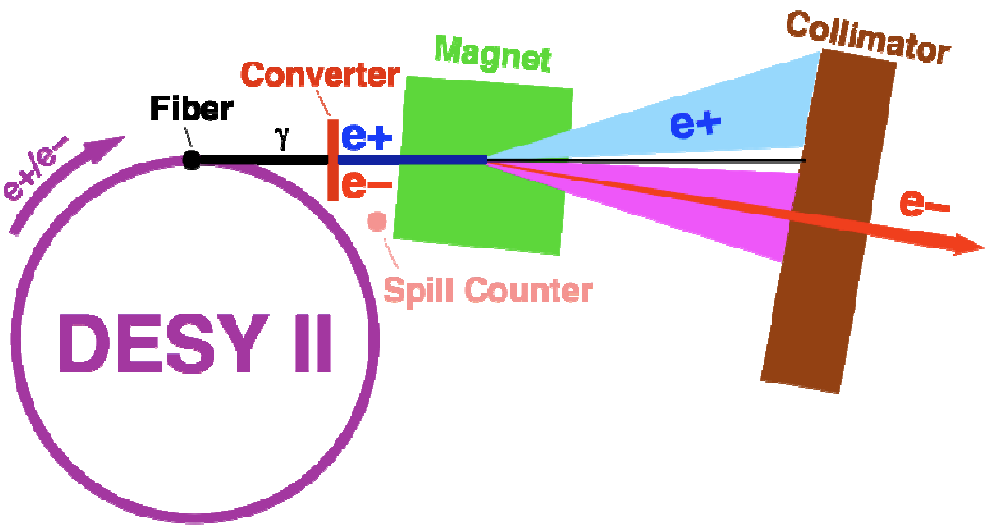
Need key participants from each "detector community" inside these areas in WG and topics to be decided by community.

Budget : 0.3 ME (mainly travel / meeting). Only a very few full partner, other will be associate

WP5 : Access to DESY testbeam (TA)

- **Three** test beam lines with **1-6** GeV/c electrons with up to **5kHz** particle rate + photon beam
- Infrastructure offered contains : beam line (magnet control, interlock systems, patch panels, gaz warning, fast internet connection) + user support (translation stages, gaz premix, magnet 1T, beam telescopes).
  5T magnet but not in beam

I. Gregor (DESY)



Complementary to CERN with more time availability beam with longer period (4 weeks).
Can be used especially for long first debugging phase of prototype

Budget : 100 kE (half for consumable + FTE, half for user support (travel + subsistence)

Budget might be slightly increased if a lot of associate partners in project

WP6 : Transnational Access to CERN beam and irradiation facilities (TA)

H. Taureg (CERN)

- Access to PS and SPS test beams

- Access to PS irradiation facilities
  - Proton beam
  - Mixed field (mainly neutron) irradiation

- Access to GIF ++

Budget : 150 kE (include some consumables + user access travel/subsistence)

Budget might be slightly increased in a lot of associate partners in project

Try to set up a light panel covering both DESY and CERN to manage beam priority/users if needed

Will give priority for travel/subsistence to people from associate partners (and students ?). Any experience from EUDET ?

WP7 : Access to irradiations facilities (TA)

M. Mikuz (Lubjana univ)

Main negative referee comment in DevDet was too many irradiations facilities supported in the project (7)…

We are in the process to limit them to 4-5 based :

- on their users statistics,
- On users needs. we are still trying to get the experiments needs over the next 4-5 years (fluence, particle mix, sample size…)
- Probably better to support multi-sources sites (Regional aspect ???)

Have to check with EU if one can have a user selection panel and finance on dedicated user requests some irradiation at other facilities (which then appear also in the proposal but not with direct fund).

Budget : 0.65 kE (mainly for user access to irradiation periods + beam cost)

Main interest from sLHC community

WP8: improvement and equipment of irradiation and beam lines

JRA

E. Gschwendtner (CERN), H. Taureg (CERN)

Group all communities needs about primary improvement & equipment of beam and irradiation lines.

Five tasks : Budget : 2.6 ME

8.1 : Beam line improvement Edda + Hans

CERN test beam : (Interest for LC/CLIC + neutrinos)

- *Enlarge particle choice (K0) & energy, improve particle identification*

- *Provide LC/CLIC like spill structure*

Frascati test beam *(Interest for flavour physics community)*

- *characterize BTF beam line for electrons and photon*

-*provide and install permanent control and monitoring system for beam position, width and energy in the BTF beam line*

Partners: CERN, LNF

WP8: improvement and equipment of irradiation and beam lines

E. Gschwendtner (CERN), H. Taureg (CERN)

8.2: Upgrade of proton & neutron irradiation facilities at CERN M.Moll

Design second beam line

Equip and test second beam line

Design and test cooling infrastructure for electronics tests

Partners: CERN, some British universities

8.3 : Qualification of components and common database S. Canfer

Review experience from LHC

Develop common data base for irradiation test results

Qualify materials and components of detector systems

(Recent contact with ATLAS/CMS about diamond R&D)

Populate and maintain the common database

Disseminate and publish irradiation results

Partner list not yet defined. Any interest from LC community ?

WP8: improvement and equipment of irradiation and beam lines

E. Gschwendtner (CERN), H. Taureg (CERN)

8.4 : General infrastructure for test beam and irradiations lines Hans

- *Develop test beam tracking and trigger telescopes*

  (some interest from LC/CLIC and sLHC communities)

  overlap & fit better in with 9.2
- *Develop and test TASD target for neutrino tests*
- *Develop and test MIND spectrometer for muon identification*
- *Improve GIF++ users infrastructures for sLHC muon detector tests*

  (RPC, Drift tube…)

8.5 : Coordination of combined test beam T. Behnke

Only for LC/CLIC to ensure coherence between their various test and continuation of EUDET. Small budget

WP9: Advanced infrastructures for detector R&D (JRA)

M. Vos (Valencia Univ), H. Videau (IN2P3/LLR)

Divided in four tasks detector/technology oriented :
9.1 and 9.2 are expected to be balanced between ILC/CLIC + sLHC
9.3 and 9.4 are mainly ILC/CLIC

9.1 Gaseous tracking facilities

Complementary to 8.4 and GIF ++.
Might concentrate on MicroPatternGasDetectors in view of ILC/TPC and sLHC muon detectors (Interest from ATLAS/MicroMegas and CMS/GEM)

Could contain :
some improved infrastructure at DESY for LC TPC tests
Upgrade of CERN/EN-ICE workshop to overcome limitations to produce large area detector (MicroMegas and/or GEM…)

→ *Would need also non negligible contribution from CERN itself ?*
→ *Have to see if possible to involve non CERN partners.*
→ *Interest/support from LC community : TPC, Had calo ?*

WP9: Medium advanced infrastructures for detector R&D

9.2 Precision pixel infrastructure

Would like to build the task around common infrastructure for pixel detectors for both sLHC and LC/ILC community even if goals are quite different : radiation tolerant with high speed readout against very high accuracy and alignment method.

Could include :

- *One beam telescope as deliverable even if in fact two might be needed to cope both communities goal.*
- *Emphasis on integration aspects : cooling (dedicated boxes), use of CO2..*
- *Detector control systems to setup detectors parameters*
- *Mechanical support / scanning table to be used by different prototypes*

This task is crucial for the proposal to show synergy between community

WP9: Medium advanced infrastructures for detector R&D

9.3 Granular calorimeter studies infrastructure

Built around ILC calorimeter integrations (EM + HADs with Silicon strips in front) for validation of PFA (not directly in beam test but comparison to simulation, response to low energy particle of different types).

Test of electronics with ILC/CLIC like cycle to test power on/off + cooling

9.4 Common DAQ infrastructure

Dedicated to LC/CLIC integration of various sub-detectors

Proposal submission schedule

National contact meeting : October 6th

October 26th : Contents of WP finalized, first draft of WP text
& partners list
Preliminary budget breakdown for each WP

November 9th : Finalized list of partner in each WP
Iteration on budget sharing
National Contact texts
Second meeting with national contact

All WP contributions finalized November 23th

December 1st : Proposal submission

……

VERY TIGHT SCHEDULE

Selection results ~Apr/May 2010
If successful, negotiation phase (2-3 months), formal agreement (~3months). First budget delivery end 2010/beg 2011

WEB pages

- Link to AIDA public Web page :

  https://espace.cern.ch/aida/default.aspx

- Link to DevDet Web page with the proposal which was submitted

  http://project-fp7-detectors.web.cern.ch/project-FP7-detectors/