EIROforum Workshop on Management of Instrumentation Projects, ESO, Garching 19.05.2014

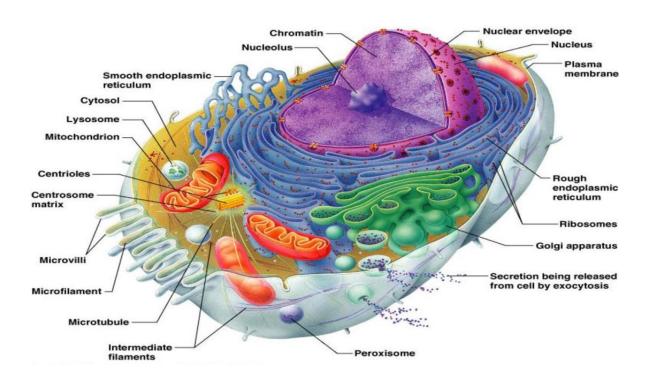
# Smaller instrumentation projects – smaller science?

Stefan Fiedler EMBL Hamburg



## Central research object of EMBL

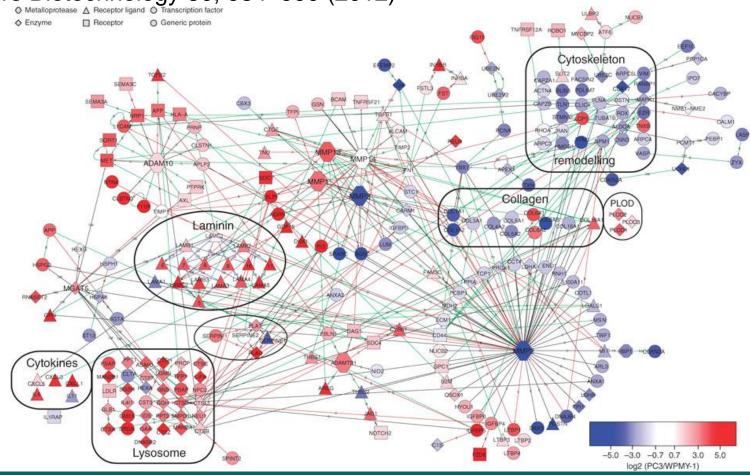
#### Structure of a Generalized Cell





# Investigation of protein interaction networks (interactomes)

Selective enrichment of newly synthesized proteins for quantitative secretome analysis Katrin Eichelbaum, Markus Winter, Mauricio Berriel Diaz, Stephan Herzig & Jeroen Krijgsveld; Nature Biotechnology 30, 984–990 (2012)





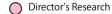
## Structure of EMBL and consequences for projects

• EMBL has many independent research groups (~100) following different different research directions.

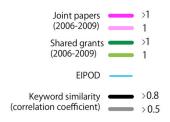


#### Structure/Interactome of EMBL Research Groups

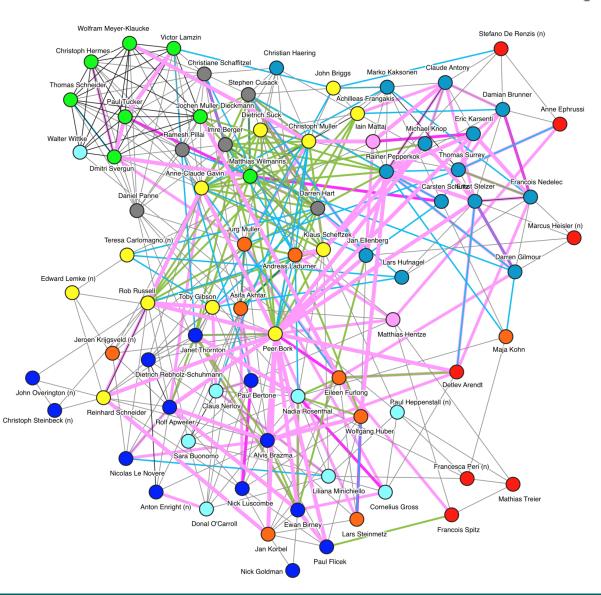
2006-9



- Developmental Biology Unit
- Cell Biology & Biophysics
- Structural & Computational Biology
- Grenoble
- EBI
- Hamburg
- Monterotondo
- Gene Expression Unit



<sup>\* (</sup>n) means new group leaders





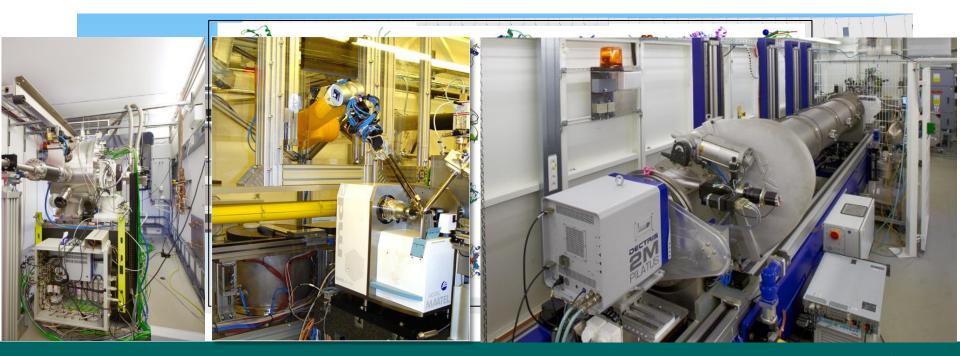
## Structure of EMBL and consequences for projects

- EMBL has many independent research groups (~100) following different different research directions.
- No common 'big' instrument.
- Central resarch infrastructure provided through 'Core Facilities'
  (Advanced Light microscopy, (Cryo) electron microscopy, Chemical
  Biology, Flow Cytometry, Protein Expression & Purification, Genomics,
  Proteomics, Transgenics).
- Major instrumentation projects take place in core facilities.
- Synchrotron based structural biology performed in Grenoble & Hamburg Unit.



# Synchrotron beamlines for structural biology

- User facilities for in-house and external research.
- Synchrotron beamlines are highly productive more than 100000 protein structures deposited in PDB databank and 90% are determined from synchrotron data.
- Beamlines are multi-component facilities. To each instrument a project is related.





#### SR instrumentation projects at EMBL HH

#### **General approach:**

- Break down larger projects in sub-projects
- Outsource wherever possible to commercial suppliers.
- Development in collaboration with other EMBL groups, institutes or companies.
- Pure in-house developments where critical mass is available.

#### **Use of simple planning tools:**

GANTT charts for project layout and FTE resource planning.

To-do lists for project monitoring.

Purchase lists for following-up flow of funds.

Steering, advisory, review committees for control.

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No	Daretion	Work	Assigned to	Status / Comment
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1)	- Week 22	Finish construction F23 & F24 stages	Thoras	In progress
0	M/ees 22 - 24	Martening of in-house productive parts for F13 & F14	George + Donis	Started
0	- 19 mei: 25	Ordering and delivery of all material/parts for P12	Thorat	In progress, parts ordered
4)	Week 21	P14 intermediate solution: Construction of interface + presumatic protection shield	Thomas	In-program
5)	- Winek 25	F14 intermediate solution: Ordering + delinery machined parts, presentation	Thomas	in progress
N:	+ Week 24	F14 temporary solution: Machining	George	
7)	Wirek 23	F14 temporary solution: Off-line installation of shutter	George (Thomas on holiday)	9
80	Wnek24-25	F14 temporary solution; software integration and off-line test	Anatoly * Uwe	
**	(Shusdown)	Delivery & installation of F14 PILATUS detector	Oleb + Thomas	j.
100	Minek 36/07	PS4 temporary solution: On-line texts	Anatoly + Live	1
	16/ret 27 - 37 ar 44	Operation with temporary solution until September (1. scenario) or October (2 <sup>nd</sup> scenario)	Gleb	
11)	- Week 26	Prepare Beckhoff control electronics rack for P13	Jechen	Marted
21	-Work 24	Clean up F14-3 hutch, prepare storage on meccanine	All, Marr Jordens shelves	Started
130	Wiret 36-29	Mechanical installation P13 stage off-line in P14-3	Thewas	
140	Week 23 - 28	Propore control software and safety logic and test installation of long IROSCH translation off-line	Uwe - Asasaly	Started
15)	Week 29-31	Implement control software and test F13 stage off-line including safety logic	Anaroly + Thomas + Jochen	
16)	(ahundown)	De-install preliminary table and install P13 detector grants	Thomas + George Giuseppe	
17)	Winek 30/31	Transfer/install mechanically stage and electronics and catting of motion control on F13 beamline	Thomas + George + Jechen	P13 down
18)	Week 31 - 32	Implement and on line tests of control software and safety logic on P13 beamline	Anatoly * Thomas + Uwe + Michele	P13 down
19)	Week 32/33	Calibrate and commissions P13 stage with Rayonix detector	Michele * Anatoly	
0.0	100mm 33-36	Operation with Reports detector	Michele	
NO.	Wirek 37 (shundown)	Delivery P13 PILATUS and installation on detector stage and test on-line	Themas + Anatoly + Michele	Course to the last
21)	-Work 21	Ordering and delivery of all material/parts for FS4	Thorax	In progress
235	-Week 22	Propare Beckhoff control electronics rack for FS4	Justien	



## **Example project: focusing mirrors**

#### **Technical background**

- Adaptive X-ray optics based on piezo actuators sandwiched between highly polished SiO<sub>2</sub> substrates (bimorph mirror).
- Similar layout for 3 beamlines (6 mirrors in KB geometry).
- System consists out of several principal components:
   Bimorph mirrors; mirror HVBPS; precision positioning mechanics; UHV vessels and supports; mirror electronics; motion control (electronics).









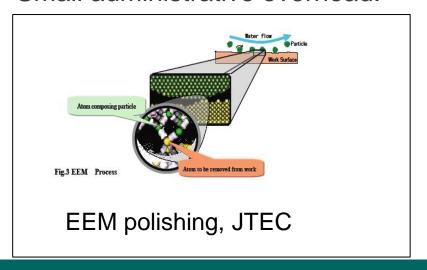
## Focusing mirrors project

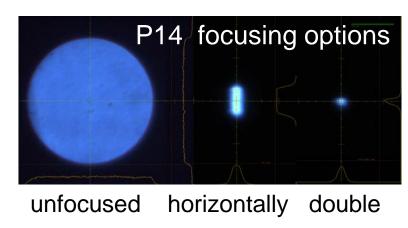
#### **Project parameters**

- Costs: 1.6 M€ estimation; 1.7 € (actual).
- Duration: 2 a (planned); 3.5 a (last mirror in operation).
- FTEs (in-house): 30 person months.

#### Strong points, challenges and risks

- High flexibility for modification in technology.
- Staggering of projects as a function of needs and resources possible.
- Small administrative overhead.







## **Challenges**

#### General and human resource related

- Technology risks: deliveries not in specs; loops between metrology and manufacturer.
- Late deliveries by suppliers, availability of supplier.
- In particular in case of delay: Crossfire from projects that compete for resources or are dependent on availability of primary project or resources become necessary for standard operation.
- Limited possibilities to put pressure on suppliers ('small' customers with respect to overall business).
- High turnover of personnel (time limited contracts).
- General risks like transport, currency ...
- Limitations in apparatus to follow up complex contracts.



#### **KB Mirrors: traffic of outsourced components**

**Consulting contract: BASC, Siegen** 

**HVBPS: ELETTRA,** 

**Trieste** 

Metrology: BESSY, Berlin

**EMBL Hamburg** 

Mechanics, vessels,

supports: BASC, Siegen

CINEL, Vincenza Bimorph mirrors: SESO, Aix-en-Provence

Superpolishing: JTEC, Osaka



## Challenges

#### **Grant related**

- Unrealistic timelines and spending profiles imposed by grants.
- 'Politically' motivated project budgets with unrealistic deliverables within available budget; insufficient planning period.
- Most grants don't include contingencies.
- Work-around: list of features that can be canceled or postponed and financed by follow-up grants.

•



Hamburg; Elbphilharmonie



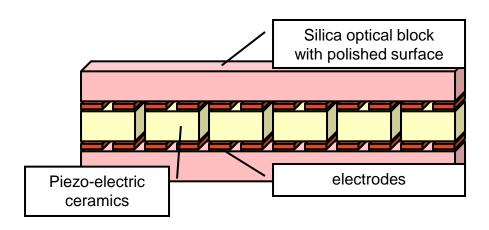
## Thank you for your attention!



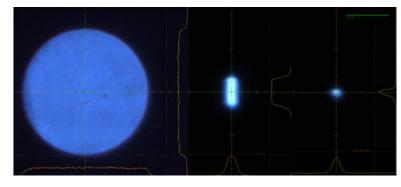
The galleons of the Spanish armada attacked by the English fleet







Beam size at focus	Vertical [µm] FWHM	Horizontal [µm] FWHM
BioSAXS/P12	113	200
MX1/P13	23	29
MX2/P14	5	7





#### PETRA III shutdown in 2014 & new facilities

- Storage ring shutdown 02/14 04/15
- PETRA III extension halls







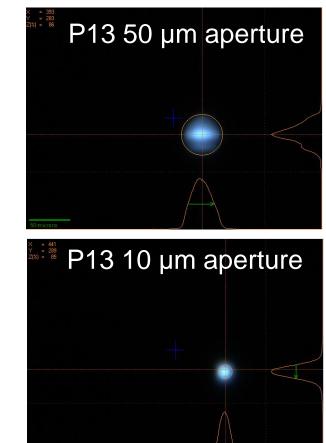
East hall North hall



## **KB mirrors: Focusing results**

Beam size at focus	Vertical [µm] FWHM	Horizontal [µm] FWHM
BioSAXS/P12	113	200
MX1/P13	23	29
MX2/P14	5	7

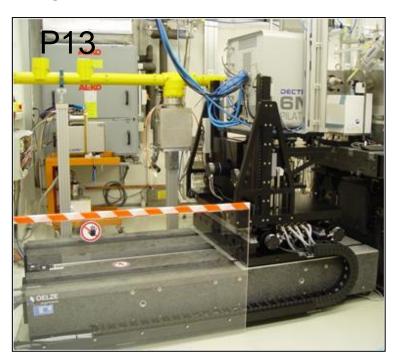
- Intensity in focus: beamline dependent, varies between 5x10<sup>12</sup> ph/s – 2x10<sup>13</sup> ph/s.
- Residual vertical beam structure in focus.
- Homogeneous part can be selected with pinhole.
- (Automatic) toggling between focused and unfocused beam possible (P14, P13).

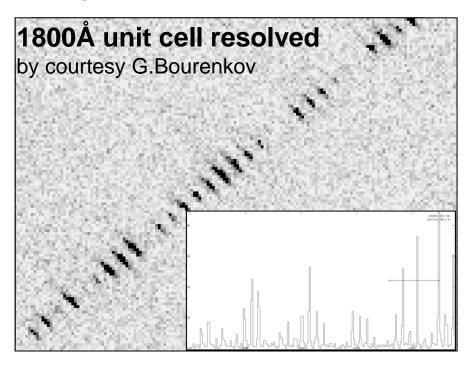




#### **Detectors (supports) for MX**

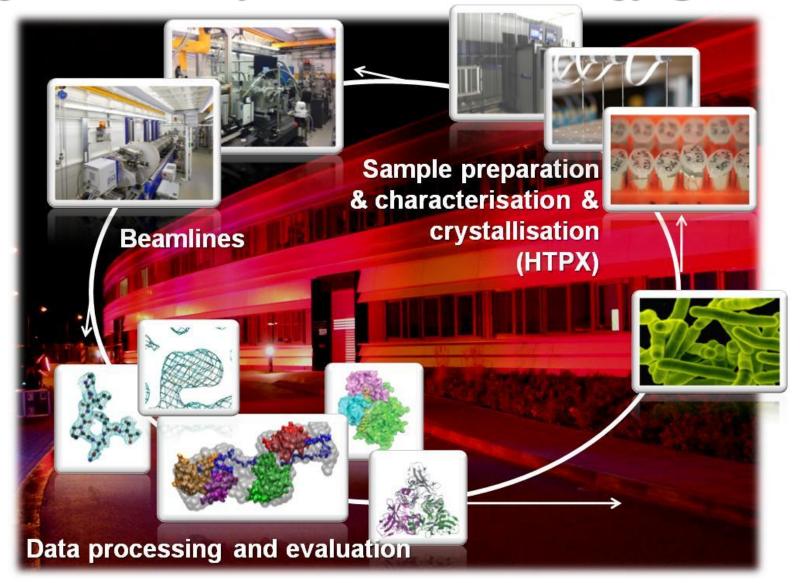
- PILATUS 6M pixel detectors (direct conversion)
- Detector stages with 4(5) motorized and encoded degrees of freedom mounted on long granite supports (1.5m P13; 4m P14).
- Large 2θ inclination (P13).
- Long lateral detector translation for swapping between detectors (P14).







## Integrated Facility for Structural Biology @PETRA III





## **User operation**

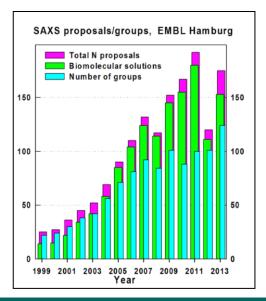
All beamlines in regular user operation.

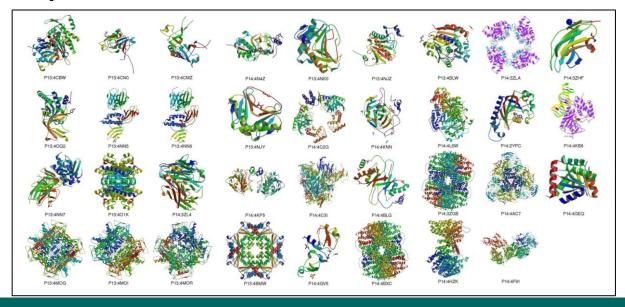
• P12 (09/12 – 02/14)

No of User visits: 491

No experiments: 225 (incl. HZG) +16 (remote)

- No of PDB depositions (P13+P14) > 35.
- No of publications for all beamlines > 50 (including Nature, Cell, PNAS).







# Summary

- Beamlines equipped with (nearly) all instruments from original design and performing excellently.
- Most of technical problems solved.
- Successful user operation on all beamlines.
- New projects under way to keep facilities at the cutting edge.



#### **Acknowledgments**

Thomas Schneider and group Gleb Bourenkov, Michele Cianci

Dmitri Svergun and group Clement Blanchet, Alessandro Spilotros, Ursula Tietze (HZG)

**Rob Meijers** 

**EMBL Grenoble Florent Cipriani and group** 

DESY
Horst Schulte-Schrepping
Ilya Sergeev, Ralf Doehrmann

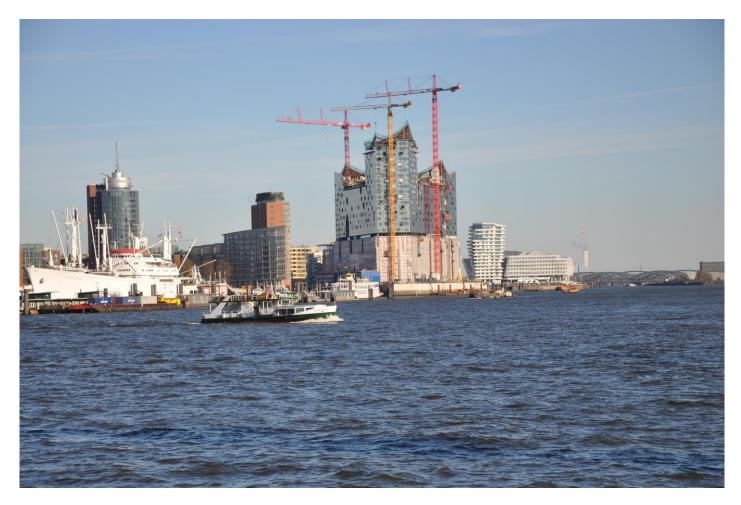


EMBL Hamburg instrumentation team





# Thank you!



Hamburg construction sites



