DESY Lab Talk.

2019 LLRF Workshop, Chicago

Sept. 29 - Oct. 03 2019

Holger Schlarb,
for the DESY LLRF team

Chicago, 09/29/2019

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

DESY Accelerators & News

DESY on a glance

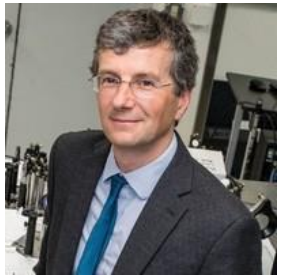
DESY Accelerators & News

DESY on a glance

- **M-Director has changed:**

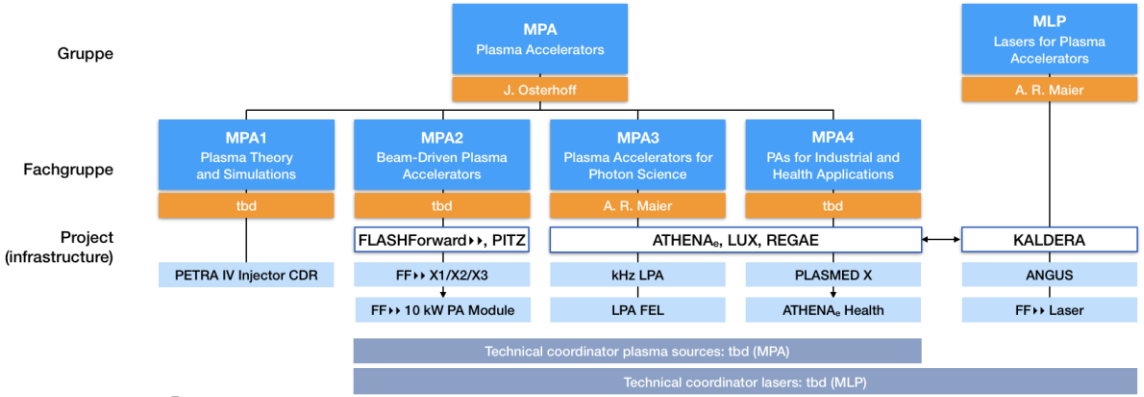
Reinhard Brinkmann

02/2019



Wim Leemans

- **Plasma Accelerator Group:**



~ kHz, ~ J
Class laser

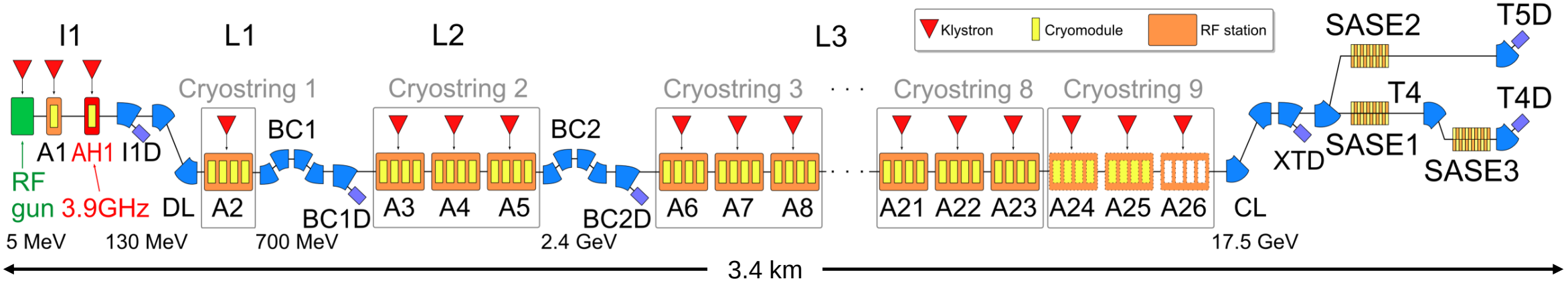
- **Large conventional accelerator projects:**

-	**FLASH2020+**	2020	(Und/Energy/Adv. FEL/Seeding/Synchr.)
-	**PETRAIV**	2025	(CDR compl.; MBA, x100 brilliance)
-	**EuXFEL-CW**	>2030	(CW operation at EuXFEL)

Facility overview

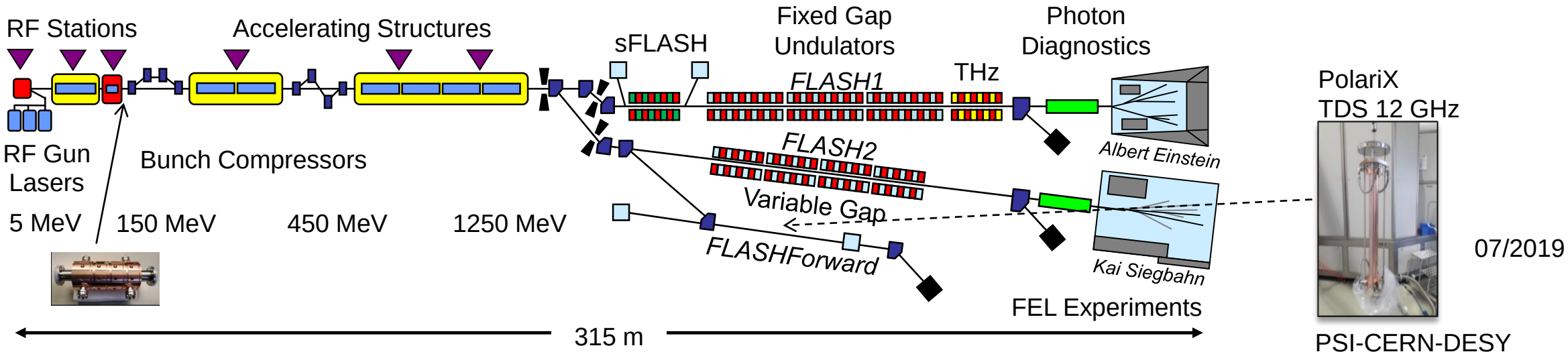
LLRF user facility: EuXFEL

784 SRF cavities / 1.3 & 3.9 GHz / 26 RF stations / pulsed / ~ mA; 1 NRF gun; 2 TDS at 3 GHz



LLRF user facility: FLASH

60 SRF cavities / 1.3 & 3.9 GHz / 5 RF stations / pulsed / ~ mA; 1 NRF gun; 1 TDS/1 NRF 3 GHz; 1 PolariX 12GHz

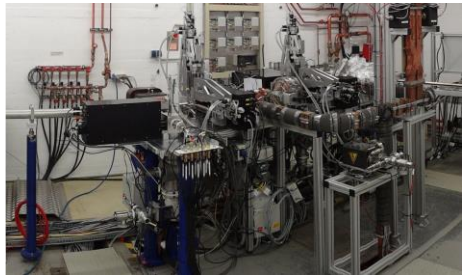


Facility overview

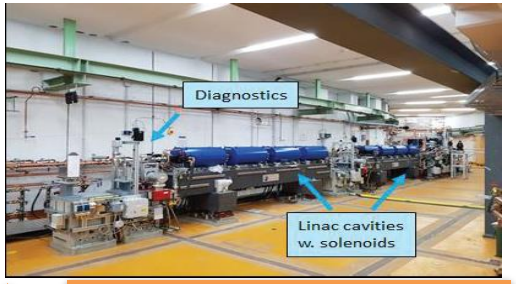
LLRF for smaller accelerators and test facilities

PITZ
NRF Gun/booster/TDS
1.3 GHz, 1 ms/ 3 GHz

REGAE (UED)
NRF Gun/booster/TDS
3.0 GHz



SINBAD (ARD)
NRF gun/3xTWS/PolariX
3.0 GHz / 12 GHz



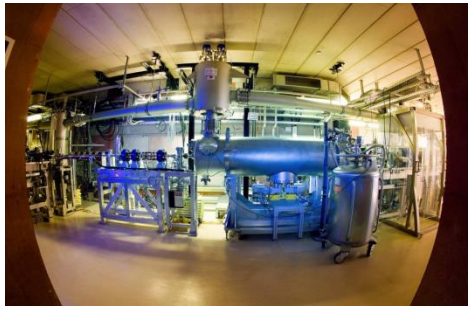
AMTF
SRF Cryo-M./ 3rd / gun
1.3 GHz / 3.9 GHz

CMTB
SRF Cryo-Module CW
1.3 GHz, IOT

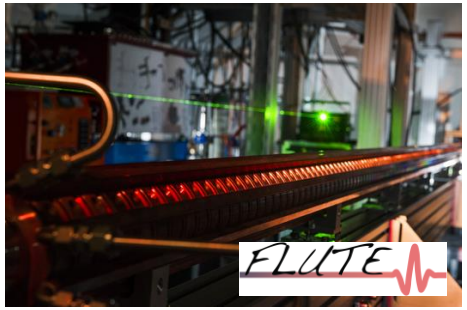
Poster M. Urbanski;

LLRF for external accelerator facilities (construction/support/consulting…)

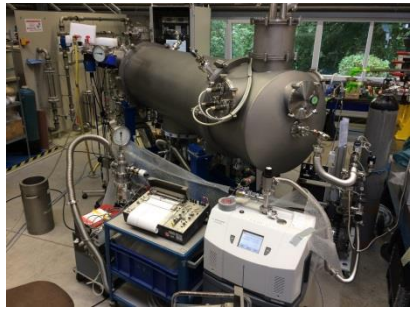
ELBE (HZDR)
SRF / NRF 6 cav.
1.3 GHz / 260 MHz



FLUTE (KIT)
NRF gun/booster
3.0 GHz



TARLA (Uni Ankara)
SRF /NRF 6 cav.
1.3 GHz / 260 MHz



NICA (Dubna)
NRF, 5 cav.
162 MHz

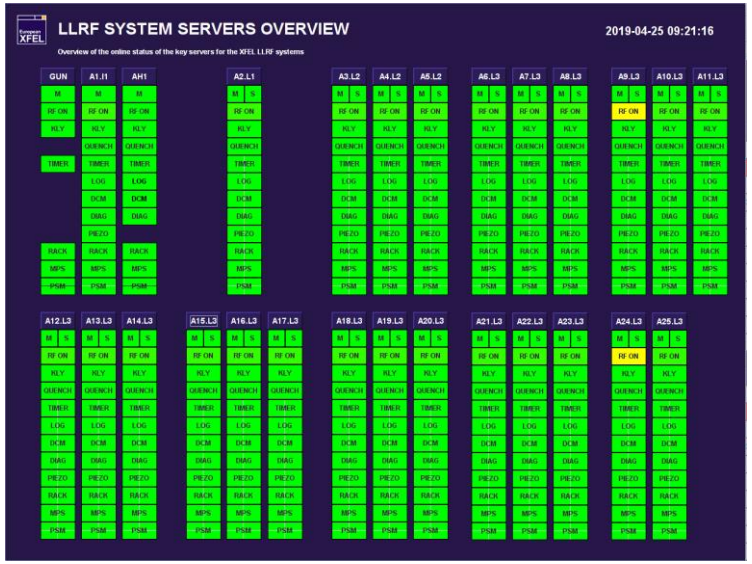
+…

MICROTCA TECHNOLOGY LAB
A HELMHOLTZ INNOVATION LAB

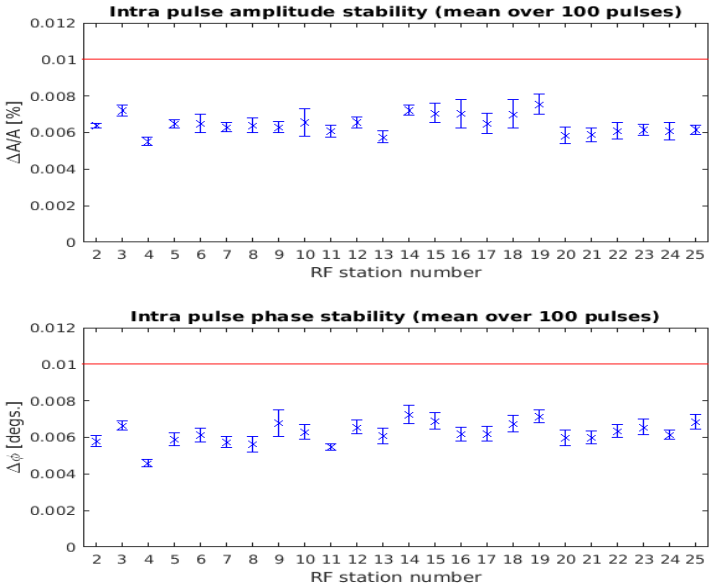
Poster C. Gümüs;

Developments & upgrades for user facility

EuXFEL: LLRF health monitoring

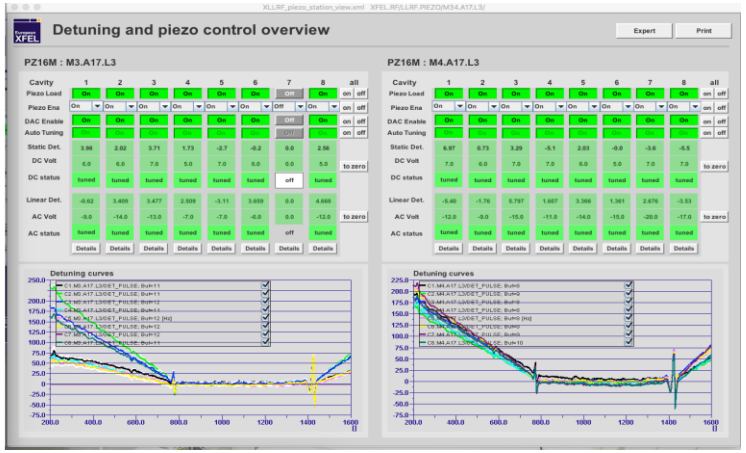


Performance tracking

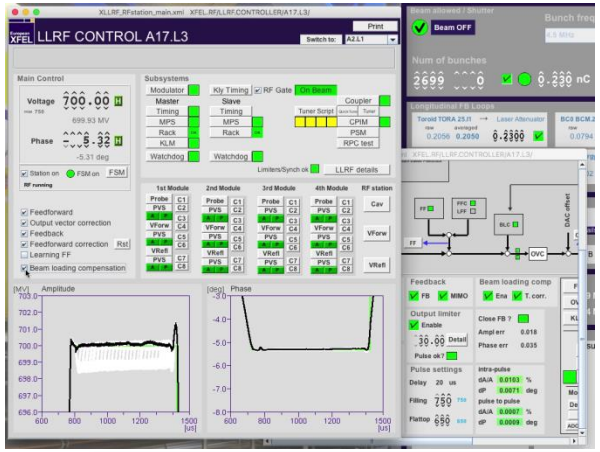


Multi-beamline operation

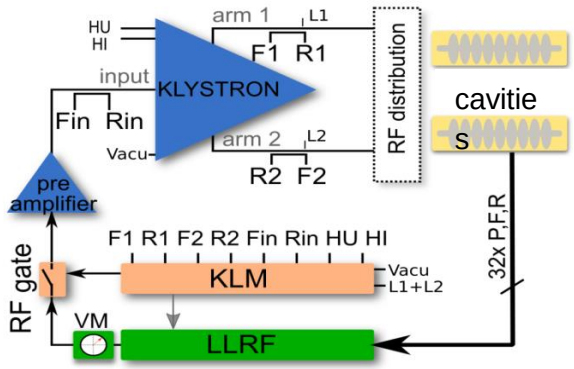
EuXFEL: Piezo operation



Beam loading compensation



Klystron lifetime management



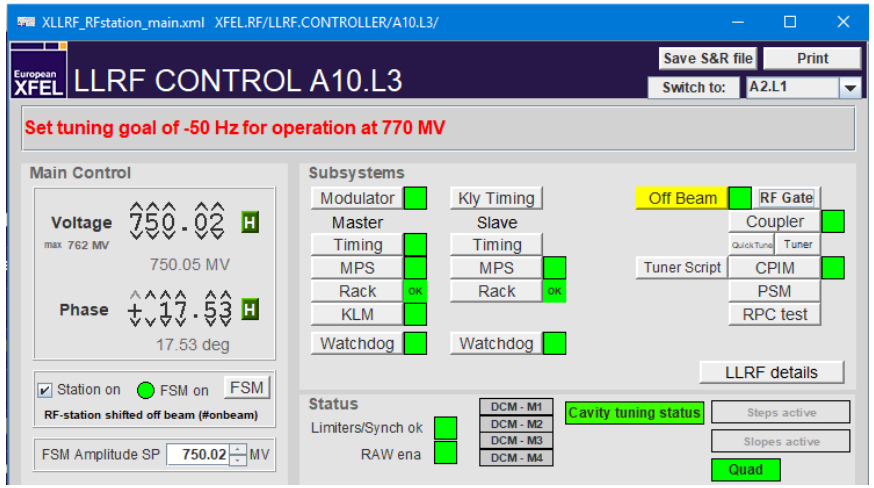
Greatly reduced downtime

Talk M. Omet given by Julian; Th

Poster L. Butkowski;

Developments & upgrades for user facility

EuXFEL: LLRF automation… basic operation → advanced operation



Automation for routine operation

- Automatic setup / calibration / tuning

Automation for FB and RF operation

- Phase modulation/Output Vector Correction
- RF – Cryo operations / Finite State Machine

Automation for fault detection and analysis

- Post mortem statistics / Run-time detection / Anomalies

Overview talk J. Branlard; Mo

Talk M. Grecki; Tu

Poster S. Pfeiffer;

EuXFEL: Maximum Gradient Task Force

Systematic study of gradient limits

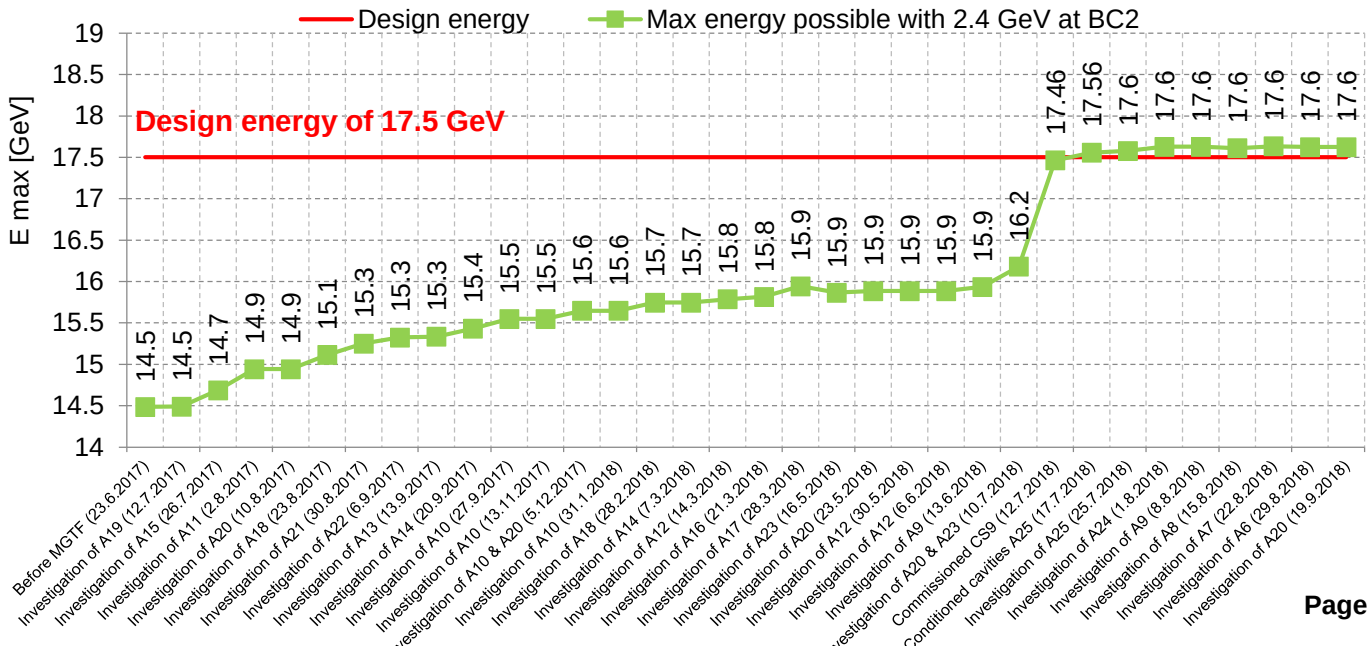
- Cavity / waveguide / klystron

Tuning to reach max gradients

- Cavity detuning / Coupler conditioning etc

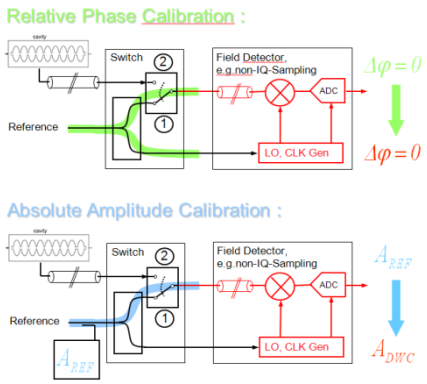
Successfully reached design energy

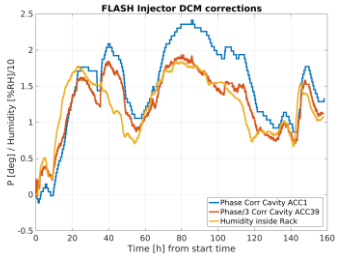
Talk from M. Omet given by Julian; Th



Developments & upgrades for user facility

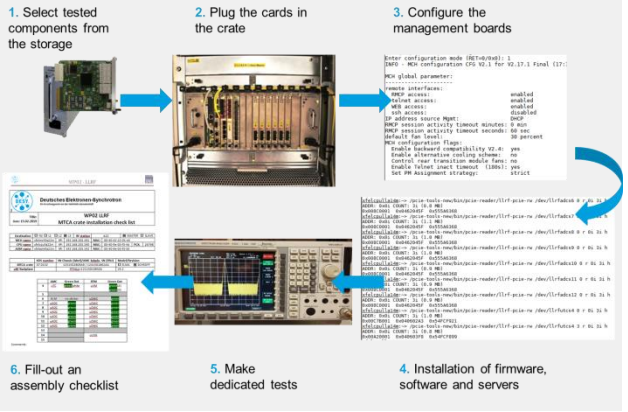
Drift Calibration Module





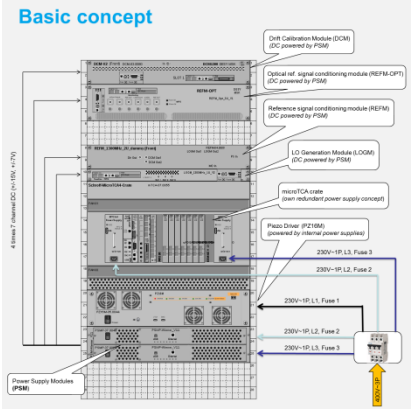
Poster Ch. Schmidt;

Maintenance/Inventory Management



Poster A. Rosner;

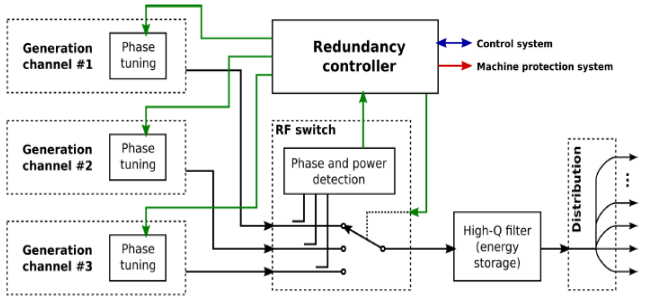
PS Redundancy/Remote Control



Poster B. Szczepanski;

MO Redundancy Controller

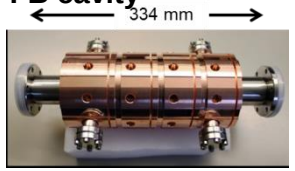
Planned installation 2020, EuXFEL



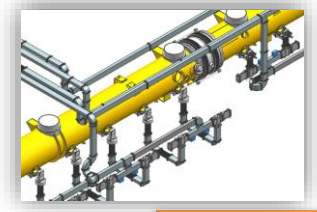
Poster B. Gasowski;

FLASH: LLRF status & upgrades

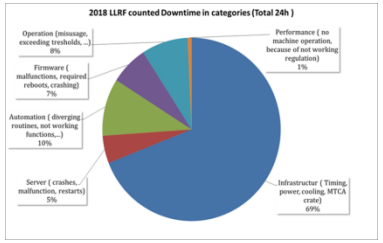
FB cavity



WG distr.



Oper. Statistics



Performance monitor
MO upgrade
PZT operation
… many more

Talk Ch. Schmidt; Th

X-band LLRF PolariX

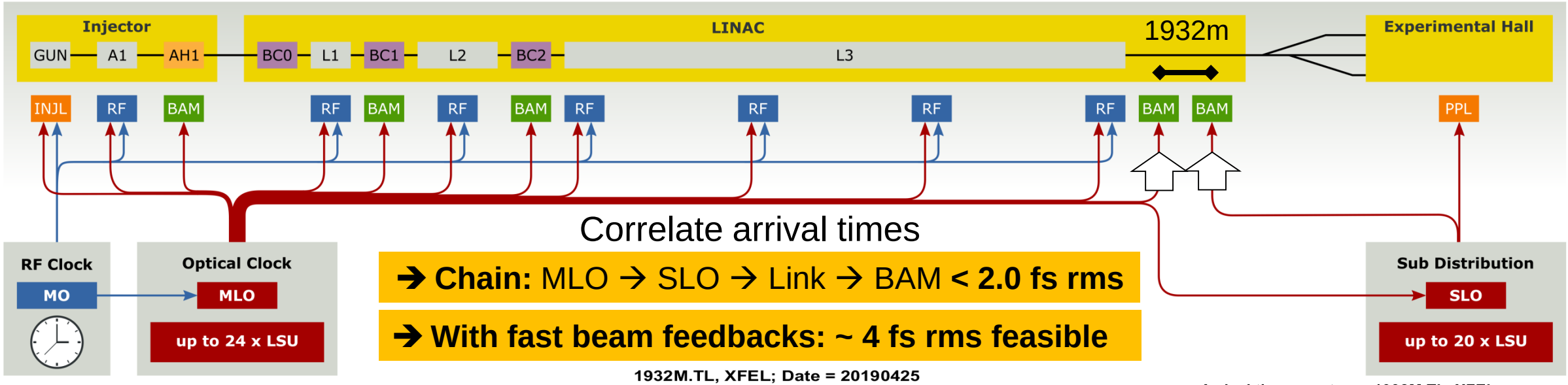
XDWC:12 GHz → 3 GHz
XUPC: 3 GHz → 12 GHz
XLOG: 3 GHZ → 9 GHz

< 2 fs add. jitter

Talk & Poster M. Reukauff; Tu/We

Developments & upgrades for user facility

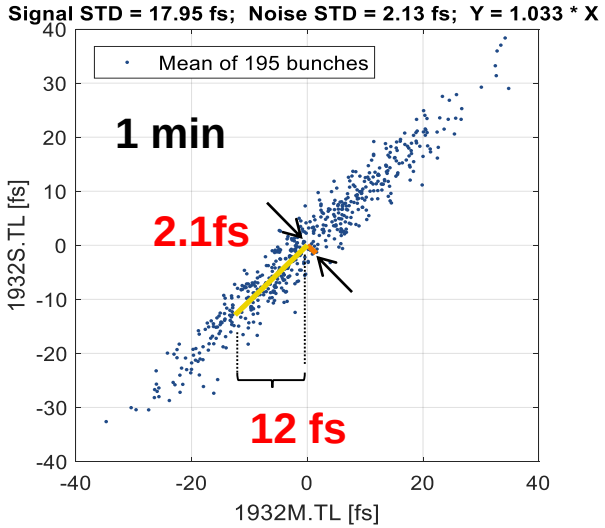
EuXFEL: Hybrid RF-Optical synchronization reference system

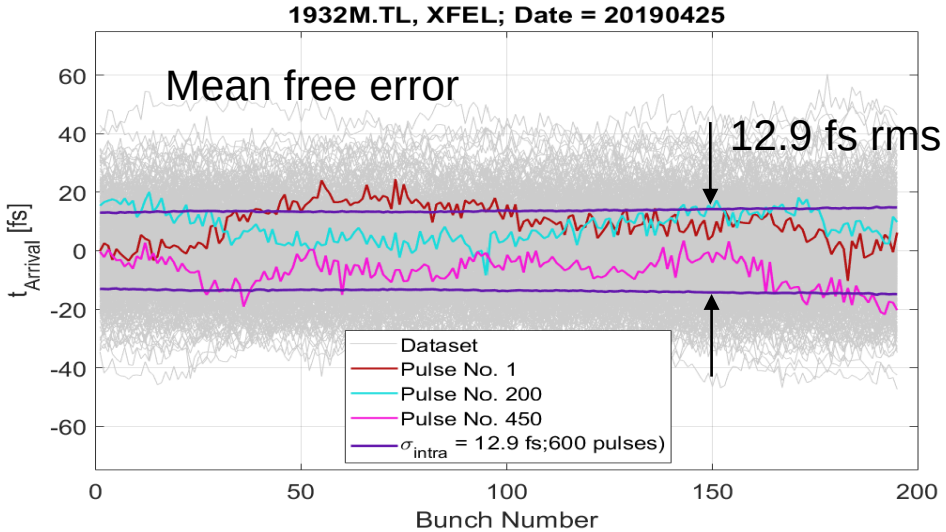


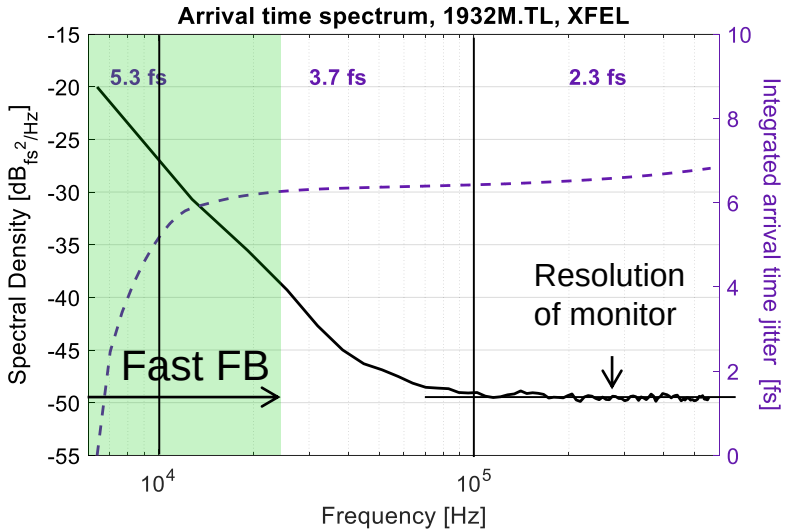
Correlate arrival times

➔ **Chain:** MLO → SLO → Link → BAM **< 2.0 fs rms**

➔ **With fast beam feedbacks: ~ 4 fs rms feasible**



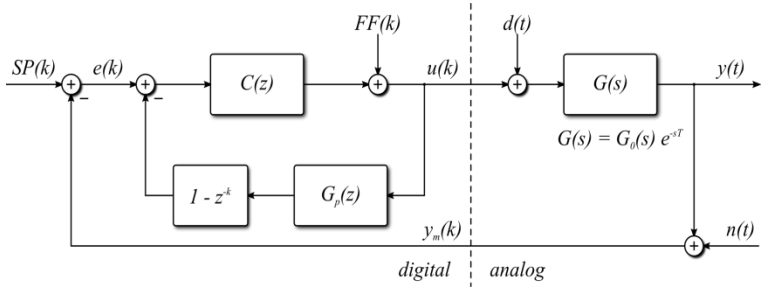




Poster H. Schlarb;

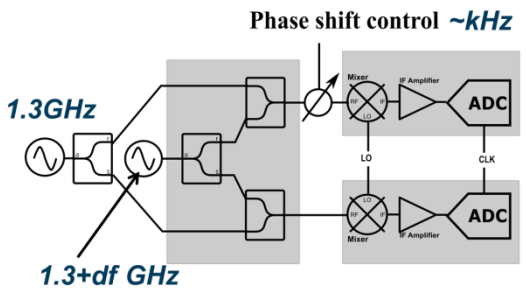
Ongoing R&D projects

Smith Predictor for LLRF controls



Talk M. Hoffmann; We

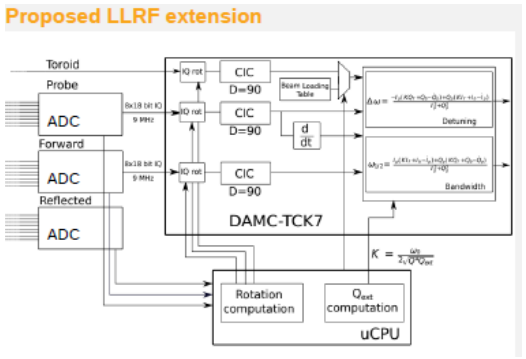
For CW: drift calibration



Pilot tone injection carefully studied

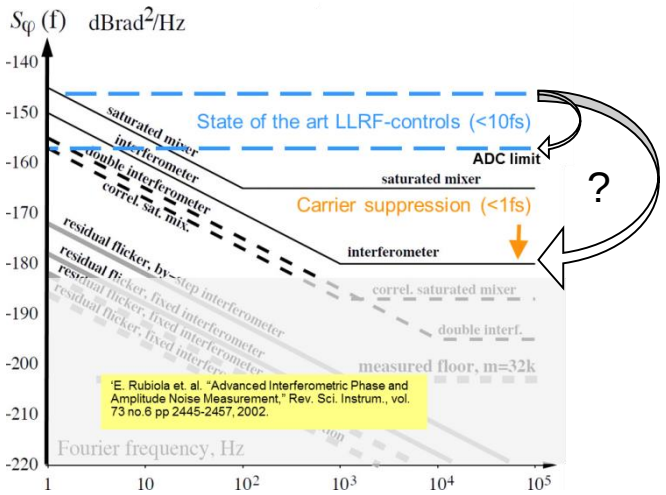
Poster U. Mavric;

For CW: $Q_L/\Delta\omega$/Quench detect.



Talk/Poster A. Bellandi; We/Tu

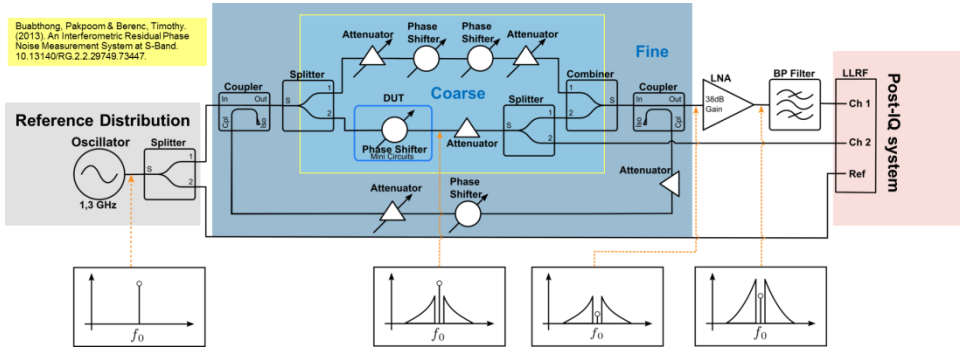
Next generation attosecond RF field receiver: Carrier Suppression Interferometer (CSI)

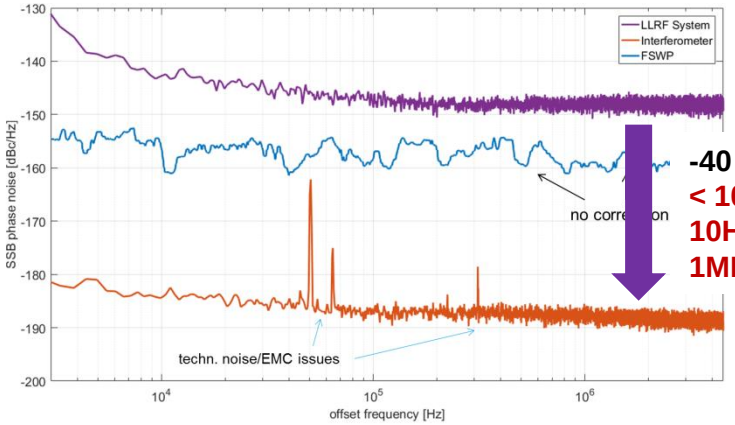


'E. Rubiola et. al. "Advanced Interferometric Phase and Amplitude Noise Measurement," Rev. Sci. Instrum., vol. 73 no.6 pp 2445-2457, 2002.

See E. Rubiola, FEMTO-ST Institute

Systematic component study …
Architecture tests … etc





Talk L. Springer; We

Thank you

Credits ➔ Accelerator Beam Controls team (MSK)

Contact

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