

Status of the FLASH

Free Electron Laser Control System

Kay Rehlich

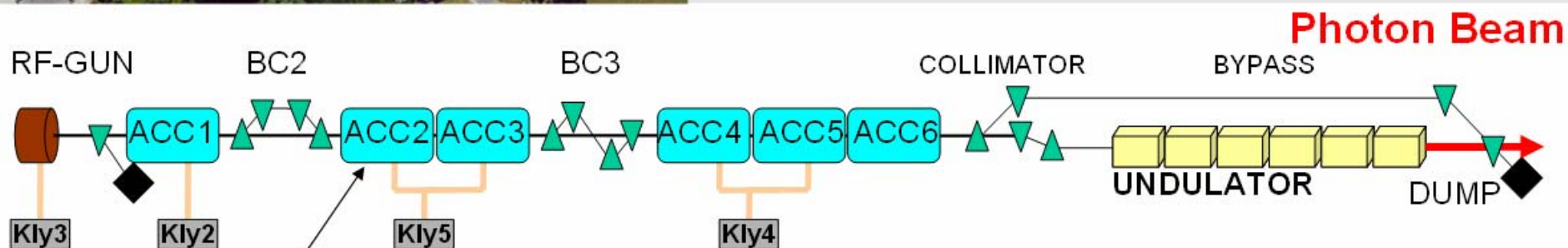
DESY

Content:

- **Introduction**
- **Architecture**
- **Future developments for XFEL**



Energy:	0.4 .. 1 GeV
Peak current:	1-2kA
Wave length:	32 .. 6 nm
Photon:	$6 \cdot 10^{15}$ W/cm ²



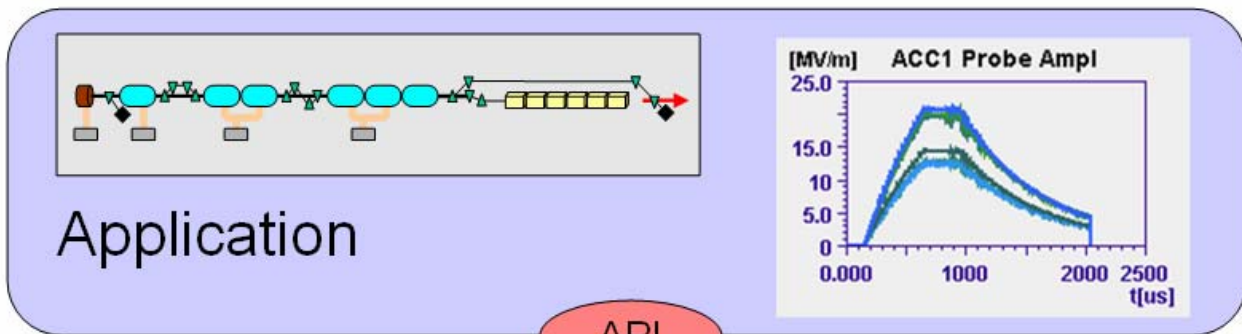
6 Cryo Modules
with 8 Superconducting Cavities each
1.3 Ghz

250m

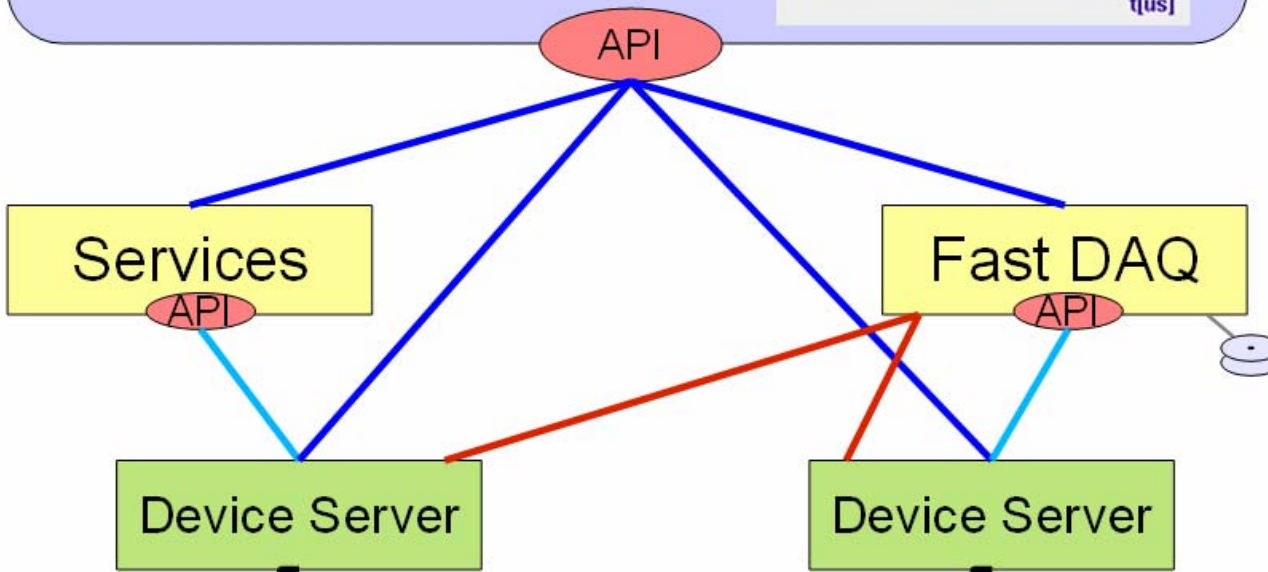
XFEL Project started 2007: 20GeV, 0.1nm, 3 km

A Challenge for new Linear Accelerators:

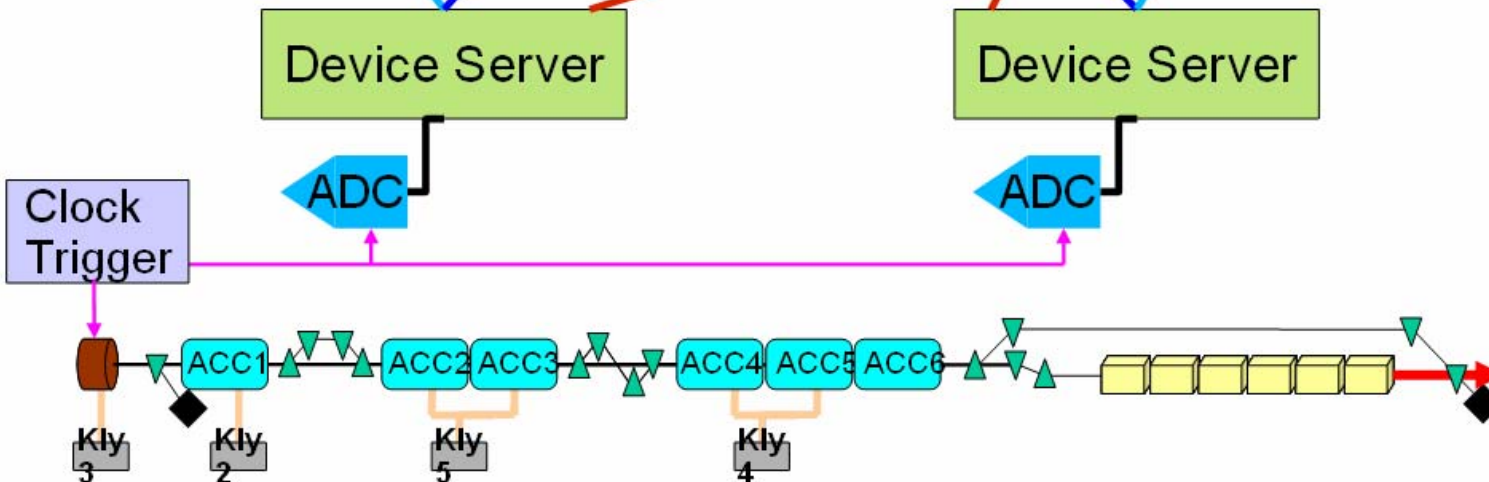
- Provide **bunch synchronous distributed data processing** for ADCs and Images for the **accelerator** and the **experiments**



User Interface



Middle Layer

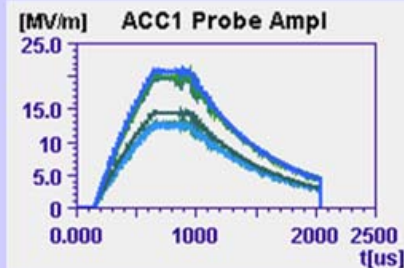


Front-end Tier

Accelerator, Experiments

Device Server

- Readout triggered by timing system
- DMA data transfer
- MultiThreaded server library
- Run-time creation of Devices and properties possible
- ~70 VME crate + PCs
- Local archive (one value / shot)[†]
 - ~30 000 values



User Interface

Fast DAQ

API

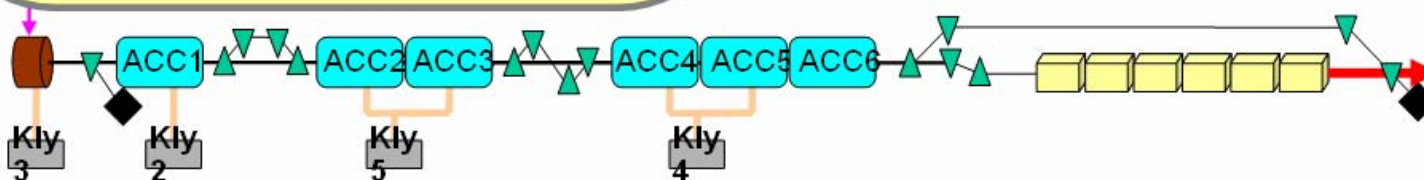
Device Server

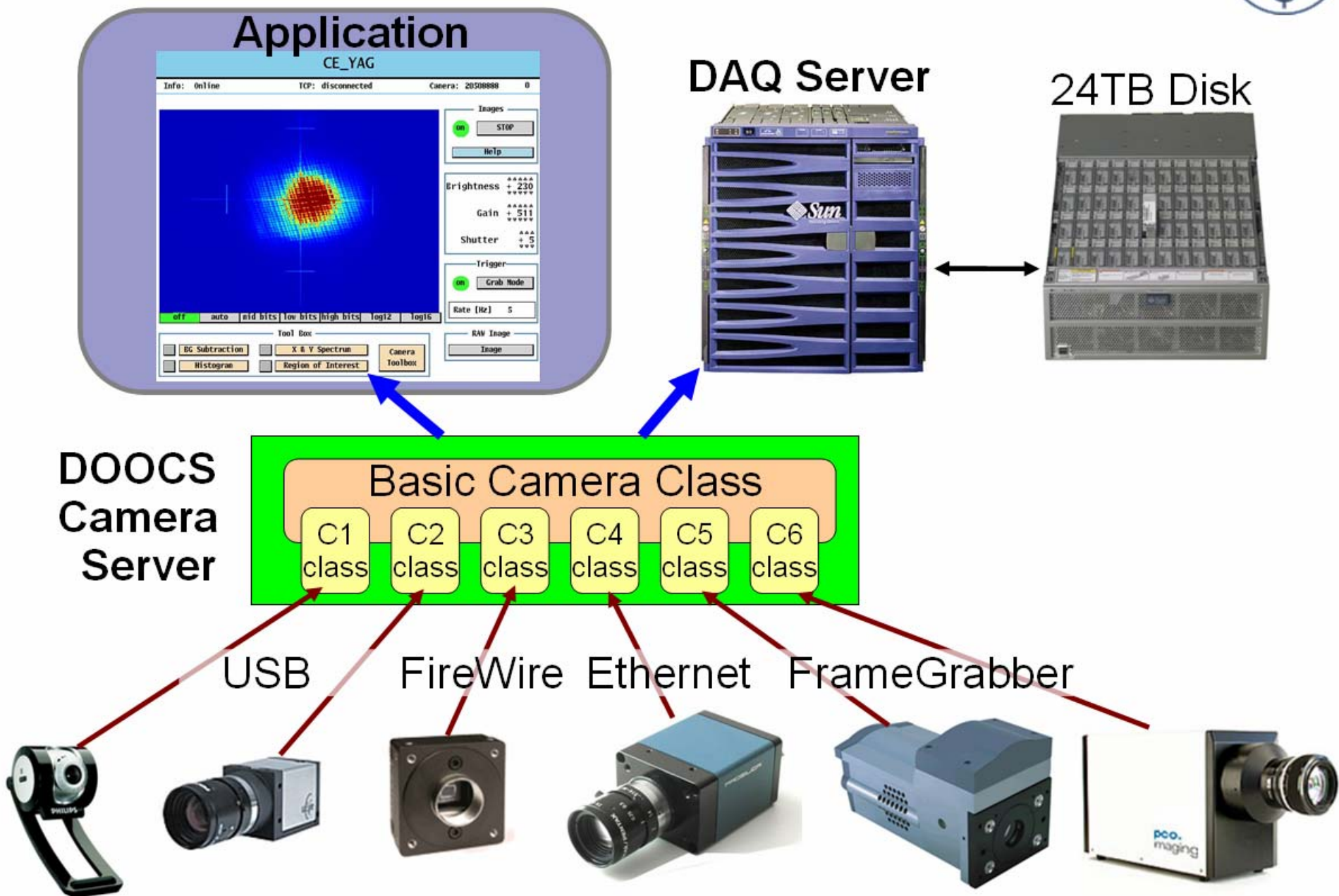
ADC

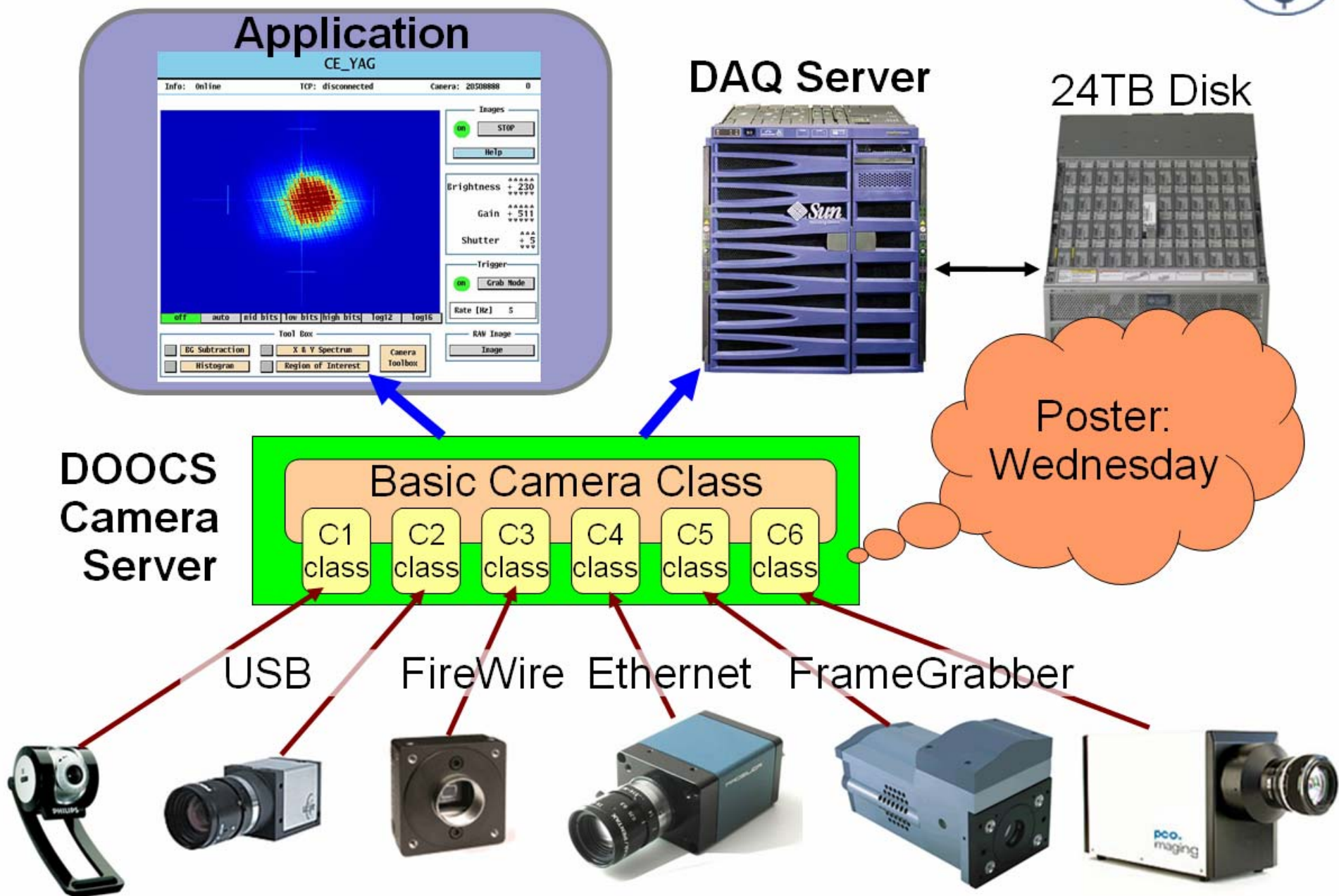
Middle Layer

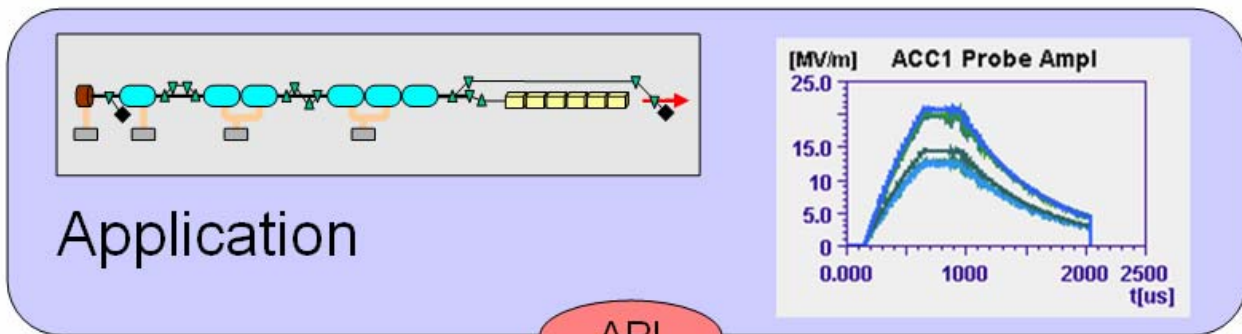
Front-end Tier

Accelerator, Experiments

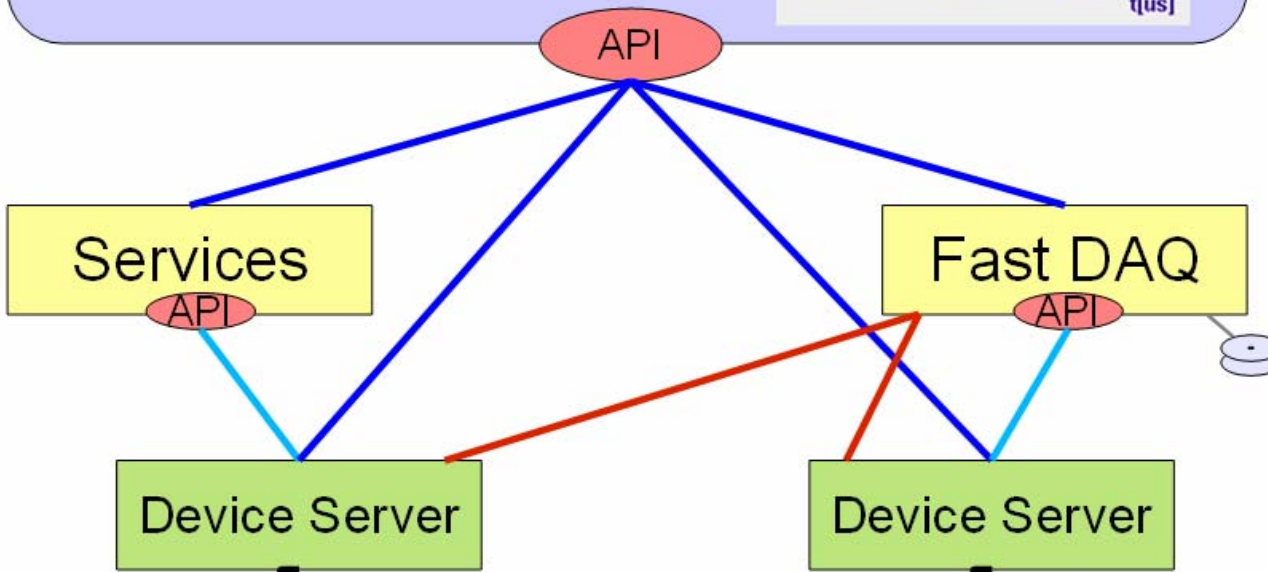






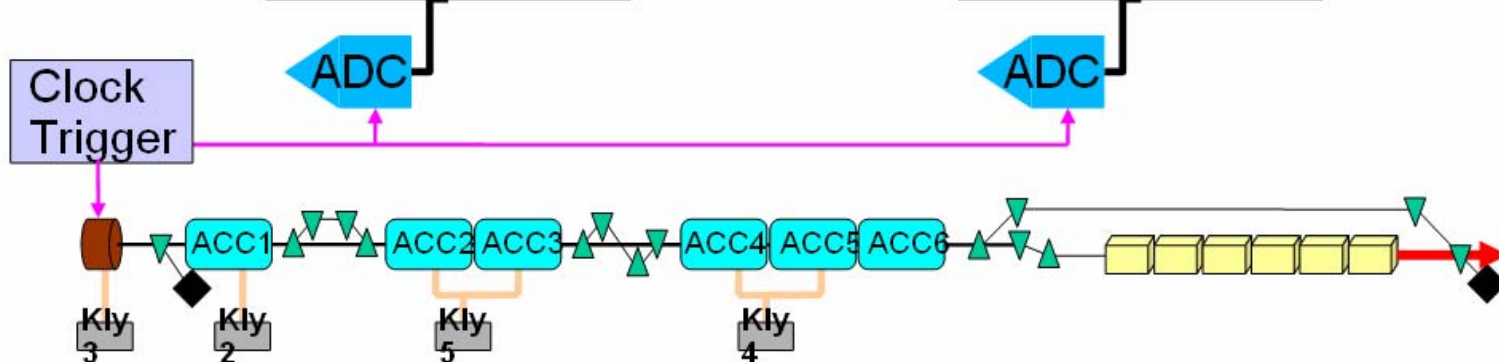


User Interface



Middle Layer

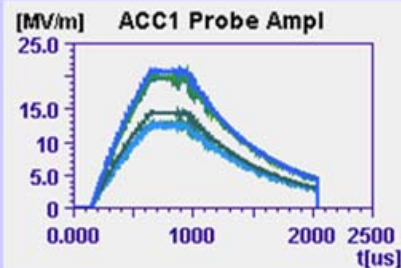
Front-end Tier



Accelerator, Experiments

Fast Data Acquisition System

- MultiThreaded
- Multiprocessor (16 CPUs)
- Shared Memory (32GB)
- Data receiver: push protocol
- Sync data from front-ends
- 24TB local Disk (~ 3 weeks)
- 50MB/sec data rate
- Feedback and Measurement processes are attached to it



User Interface

Fast DAQ

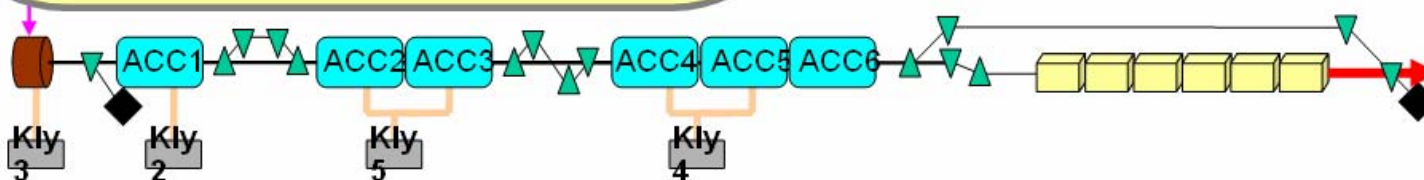
Middle Layer

Device Server

Front-end Tier

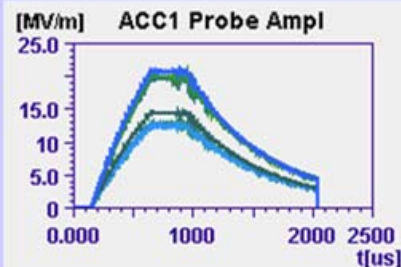
ADC

Accelerator, Experiments

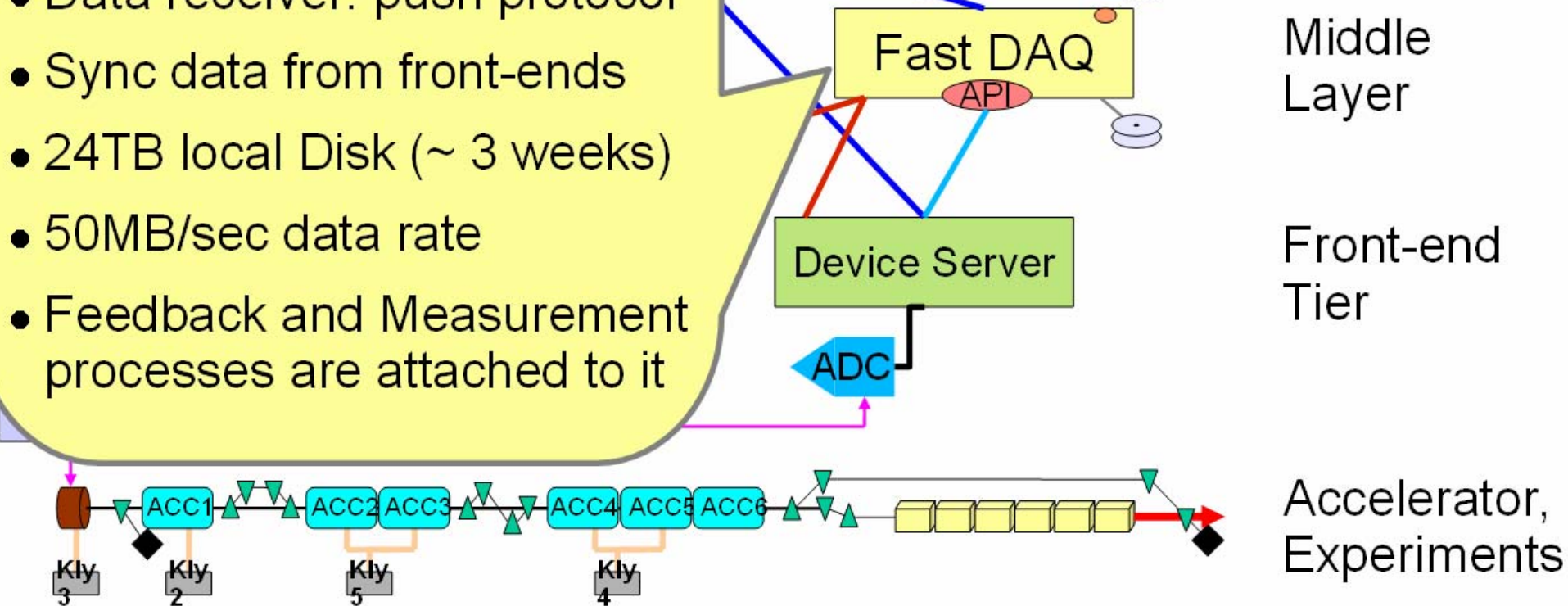


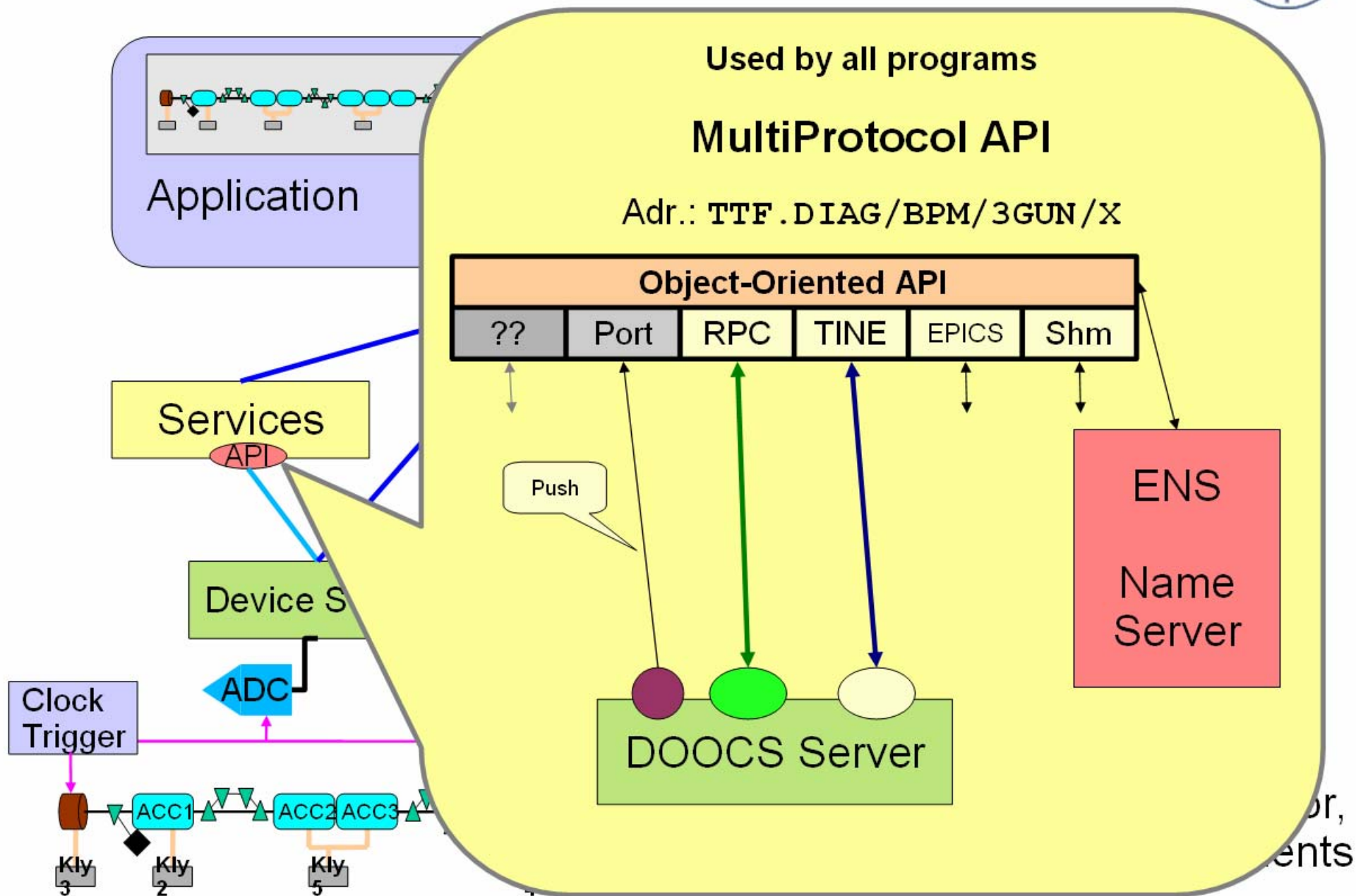
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Poster:
Thursday





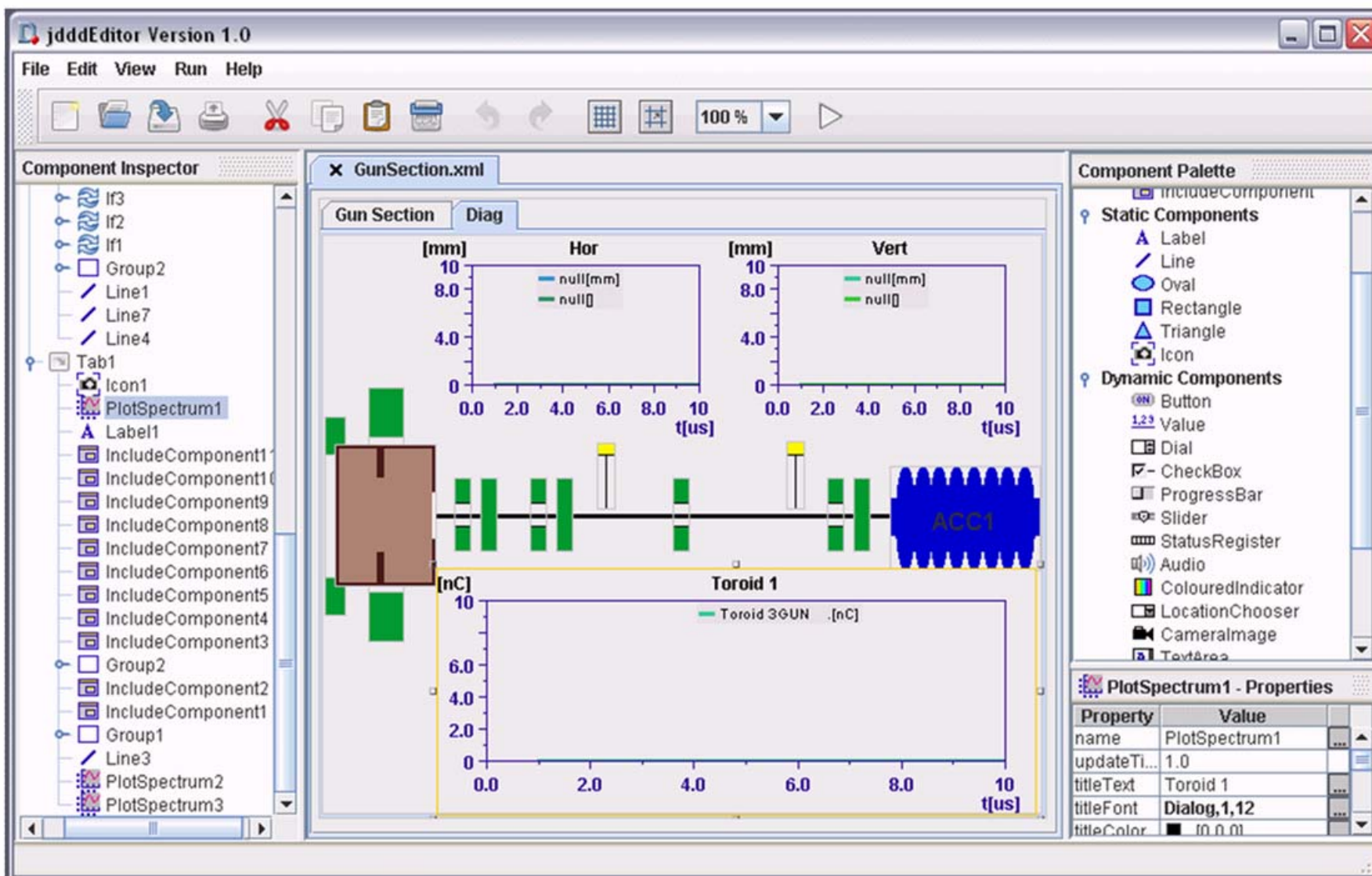
or,
ents

- The two accelerator control groups joined together

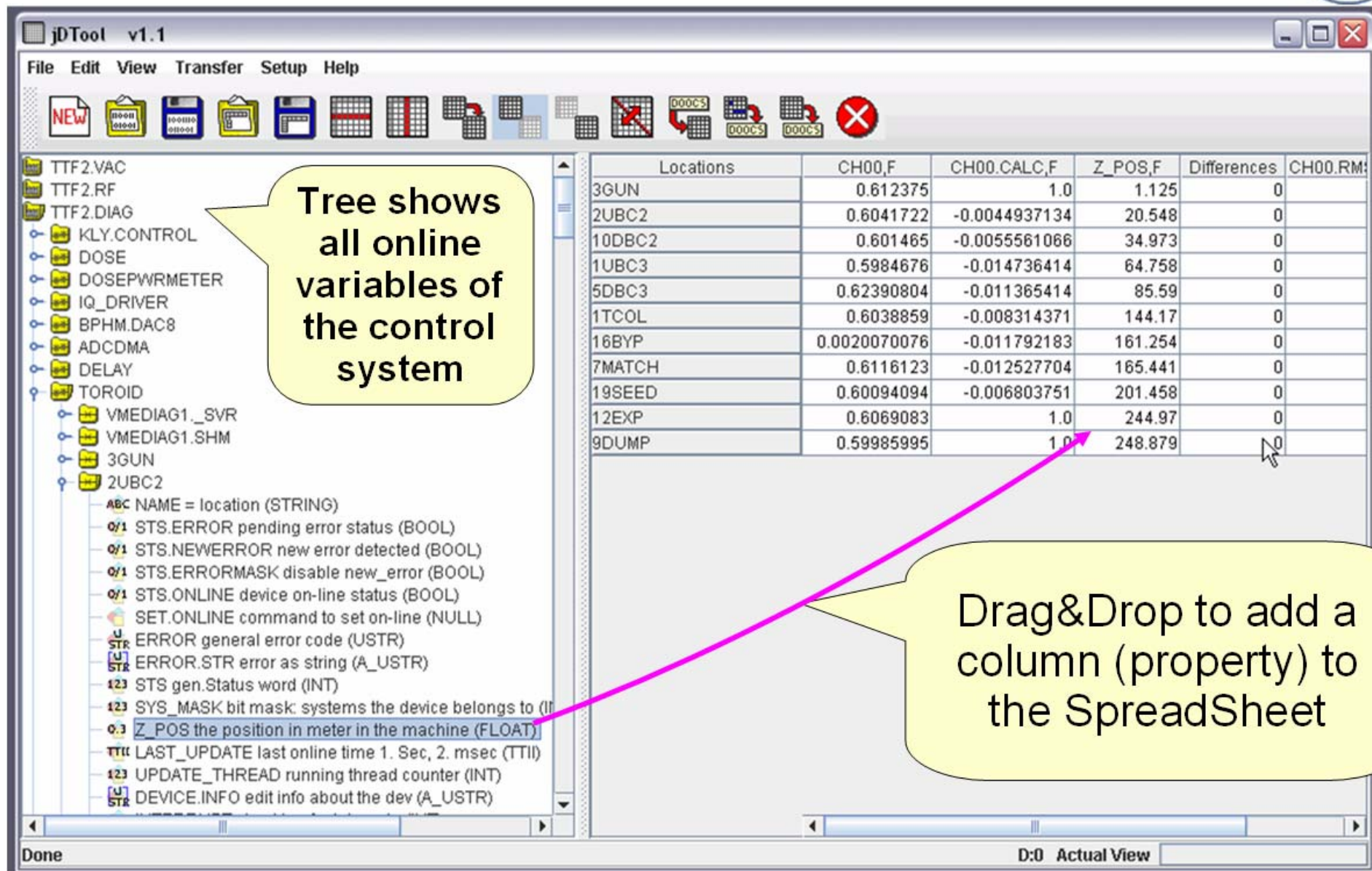


- Goal: benefit from the complementary strength of DOOCS and TINE

- GUI software based on JAVA
 - 3 projects
- Evaluation of a new crate standard: ATCA / μ TCA
 - Modern GigaLink communication (no bus)
 - Redundant design (up to 99.999% availability)
 - Management infrastructure is part of the specification
 - IPMI on board and crate level
- DOOCS server development
 - Management server and display
 - Redundant device server or subsystem operation



**jddd: data presentation, controls and analysis framework
to create complex operation panels without programming**



Tree shows all online variables of the control system

Locations	CH00,F	CH00.CALC,F	Z_POS,F	Differences	CH00.RM:
3GUN	0.612375	1.0	1.125	0	
2UBC2	0.6041722	-0.0044937134	20.548	0	
10DBC2	0.601465	-0.0055561066	34.973	0	
1UBC3	0.5984676	-0.014736414	64.758	0	
5DBC3	0.62390804	-0.011365414	85.59	0	
1TCOL	0.6038859	-0.008314371	144.17	0	
16BYP	0.0020070076	-0.011792183	161.254	0	
7MATCH	0.6116123	-0.012527704	165.441	0	
19SEED	0.60094094	-0.006803751	201.458	0	
12EXP	0.6069083	1.0	244.97	0	
9DUMP	0.59985995	1.0	248.879	0	

Drag&Drop to add a column (property) to the SpreadSheet

jDTool: Tool to display and modify all control system variables

DOOCS Alarm and Info Server Display, Version 3.0, 07.02.2007

Menu View Help

Device Tree: Filter ON

- Device Tree
 - TTF2.SYSTEM
 - TTF2.FEL
 - TTF2.RF
 - TTF2.EXP
 - TOSY.MOTOR
 - CRD.MOTOR
 - MBDEV1._SVR
 - MBDEV1
 - ERROR
 - DEVICE.INFO
 - MB.READ.Z.MB
 - MB.IP.RATE
 - MB.READ.1.MB
 - MB.READ.2.MB
 - MB.READ.Z.MB
 - MB.READ.1.MB
 - MB.READ.2.MB
 - MB.IP.SELECT
 - 14ACC7.BR
 - 14ACC7.BU
 - 14ACC7.BL
 - 14ACC7.S4M1
 - 14ACC7.IO1
 - 14ACC7.S2M2
 - 14ACC7.S6M1
 - 14ACC7.S6M2
 - 14ACC7.S2M1
 - 14ACC7.S4M2
 - 14A...

Recent messages of all devices: STOP Filter ON

Location	Property	Time	Severity	Message
TTF2.FEL/PP.MOTOR/8SEED.TE0.ROT1	MOTOR.ERR...	23:04:59,234 06.10.2007	OK	No Error
TTF2.FEL/PP.MOTOR/8SEED.TE0.ROT1	MOTOR.ERR...	23:04:59,024 06.10.2007	ERROR	EndSwitch setting not correct
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	23:04:43,145 06.10.2007	ERROR	Write error in beckhofftestgeg_server.conf. ...
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	23:04:43,144 06.10.2007	ERROR	config file error
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:59:32,428 06.10.2007	OK	OK
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:58:41,529 06.10.2007	ERROR	Write error in beckhofftestgeg_server.conf. ...
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:58:41,528 06.10.2007	ERROR	config file error
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:54:32,450 06.10.2007	OK	OK
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:52:39,823 06.10.2007	ERROR	Write error in beckhofftestgeg_server.conf. ...
LAB.VAC/BK_GEG/TTF2LX1._SVR	ERROR	22:52:39,823 06.10.2007	ERROR	config file error
TTF2.DIAG/CHARGE.CALC/PROTECT.UND	ERROR	22:49:37,584 06.10.2007	OK	OK
TTF2.DIAG/CHARGE.CALC/PROTECT.DUMP	ERROR	22:49:37,474 06.10.2007	OK	OK
TTF2.DIAG/CHARGE.CALC/LINAC.PAIR	ERROR	22:49:35,284 06.10.2007	OK	OK
TTF2.DIAG/CHARGE.CALC/UND.PAIR	ERROR	22:49:35,174 06.10.2007	OK	OK
TTF2.DIAG/CHARGE.CALC/BC2.PAIR	ERROR	22:49:34,954 06.10.2007	OK	OK
TTF2.DIAG/CHARGE.CALC/PROTECT.DUMP	ERROR	22:49:34,845 06.10.2007	ERROR	Device error

History of selected location: TTF2.EXP/CRD.MOTOR 100/2579

Time	Name	Severity	Message
14:36:39 27.09.2007	MBDEV1/MB.IP.SELE...	OK	D_iiii change for MB.IP.SELECT_TIMEOUT from: 0, 500000, 0, 0 to: 1, 0, 0, 0 by dooc...
13:21:59 26.09.2007	MBDEV1/ERROR	ERROR	error in read_modbus: write to modbus, send error: Connection reset by peer
13:18:56 26.09.2007	MBDEV1/ERROR	OK	OK
13:18:56 26.09.2007	MBDEV1/ERROR	OK	OK
13:18:12 26.09.2007	MBDEV1/ERROR	ERROR	error in read_modbus: write to modbus, send error: Connection reset by peer
13:14:46 26.09.2007	MBDEV1/ERROR	OK	OK
13:14:21 26.09.2007	MBDEV1/ERROR	ERROR	error in read_modbus: write to modbus, send error: Connection reset by peer
13:05:53 26.09.2007	MBDEV1/ERROR	OK	OK
13:05:46 26.09.2007	MBDEV1/ERROR	ERROR	error in read_modbus: write to modbus, send error: Connection reset by peer
08:59:05 20.09.2007	MBDEV1/ERROR	OK	OK
08:59:01 20.09.2007	MBDEV1/ERROR	ERROR	fatal error in read_modbus: nothing to fetch ?
07:59:15 20.09.2007	MBDEV1/ERROR	OK	OK
20.09.2007	MBDEV1/ERROR	ERROR	fatal error in read_modbus: nothing to fetch ?
19.09.2007	MBDEV1/ERROR	OK	OK
19.09.2007	MBDEV1/ERROR	ERROR	fatal error in read_modbus: nothing to fetch ?
19.09.2007	MBDEV1/ERROR	OK	OK

Hierarchical view of all devices

Ticker of all alarms

Ticker of one device or group

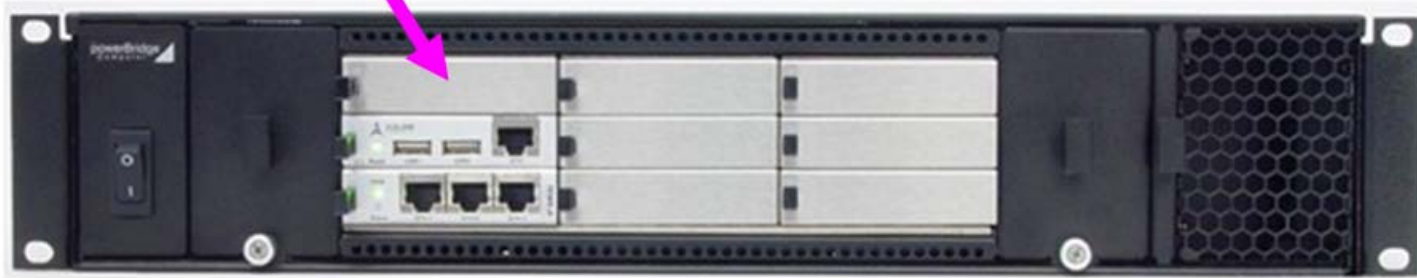
AdvancedMC™

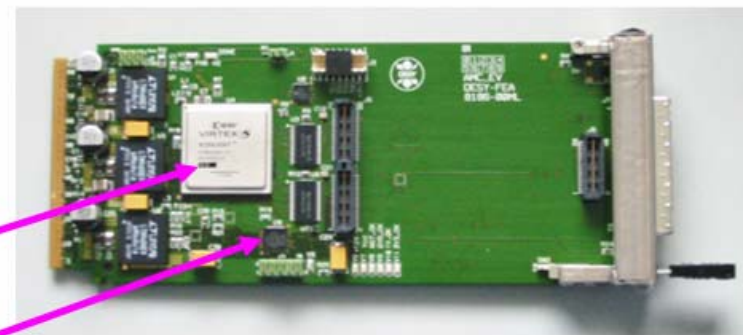


AdvancedTCA®



μ TCA™





- AMC modules

- Universal, Virtex 5 FPGA, I/O piggy-back ready

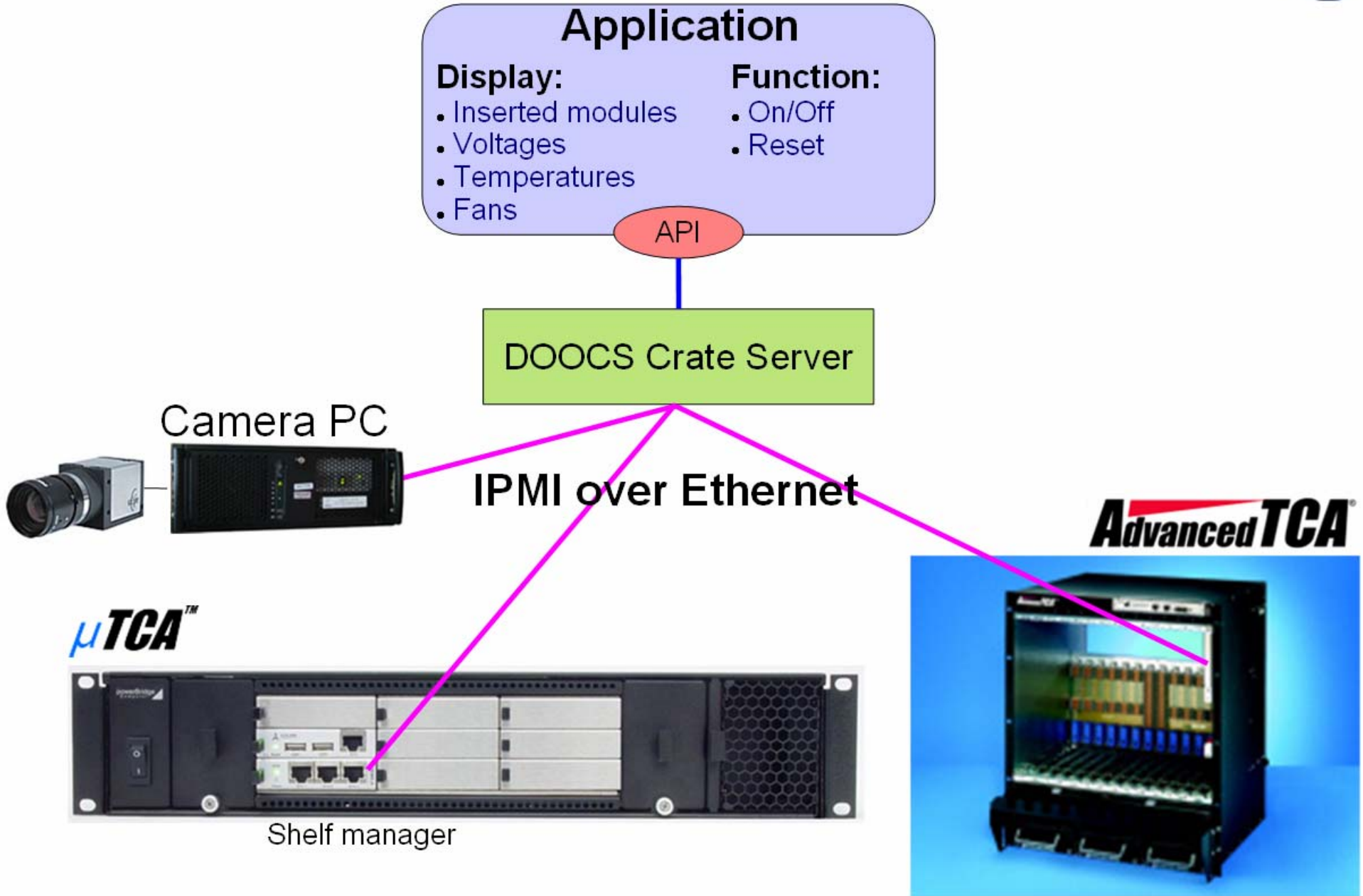
- IPMI code for MMC (Module Management Controller)
- PCIeexpress interface to DOOCS

- 8 channel ADC, 14bit, 100MHz **ordered**

- Commercial product, ready this month

- Timing system (ps stability) **planned**

- Machine Protection System **planned**



Auto-detects modules and dynamical creates control system addresses and properties

ATCA_CRATE: /TEST.DOOCS/LOCALHOST_8888/

Test ATCA Crate in Lab

System Event Log

SAP TELCO ALARM

1	2	3	4	5	6	7	8	9	10	11	12	13	14
empty	empty	empty	empty	empty	empty	ATS0020	empty	empty	empty	empty	empty	empty	empty

HS OK ! W

SHM1

ATCA_module: TEST.DOOCS/LOCALHOST_8888

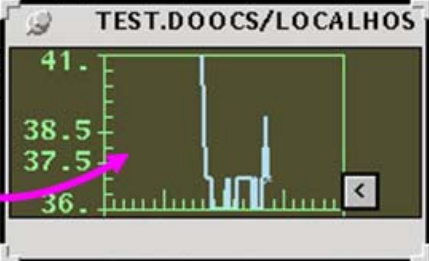
ATS0020

Temperature1	37.00000
Temperature2	24.00000
5V	4.97280
3_3V	3.44280
2_5V	2.41800
1_5V	1.49340
1_25	1.24450

Rear Transition Module absent

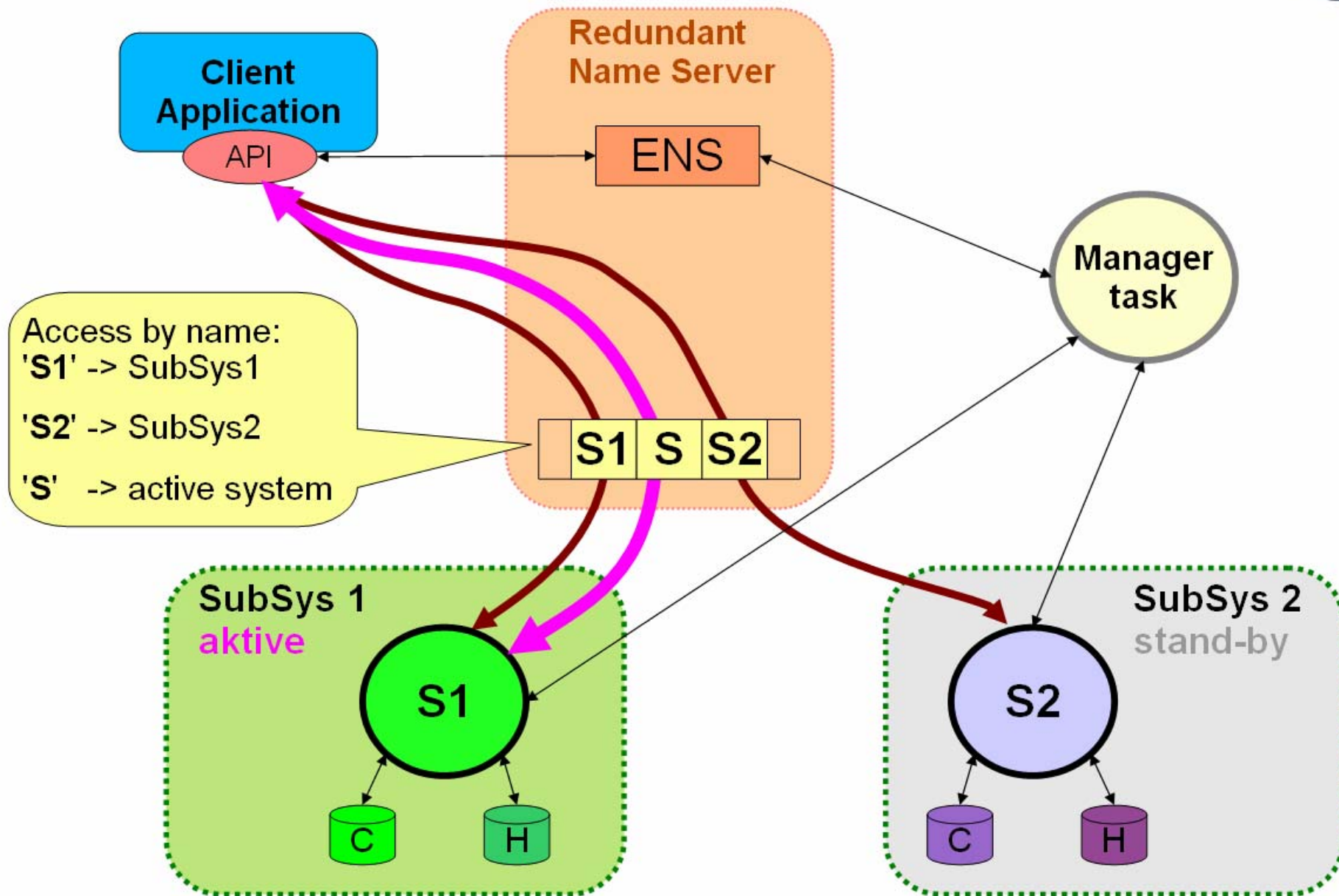
Inventory Information

TEST.DOOCS/LOCALHOST



Power

OK !



- **FLASH: First SASE in January 2005**
 - ▶ **Now: 1 GeV, 6.5 nm**
- **DOOCS @ FLASH:**
 - ▶ **Synchronous, high performance data recording**
 - ▶ **Runs reliable and is flexible / dynamic**
- **XFEL developments:**
 - ▶ **First JAVA applications**
 - ▶ **Evaluation of ATCA / μ TCA crate standard**
 - ▶ **Implementation for management and improved availability**

More info: <http://doocs.desy.de>