CTA
CHERENKOV TELESCOPE ARRAY

ELEC @ SST

General considerations and recommandations

LPNHE
PARIS

General wishes of ELEC WP

- Good performance to achieve physics goal
- homogenous design across various telescope size; without loosing performance.
- Same electronics, or at least similar components if possible,

  even with other technical groups, prefer homogeneous devices (hardware and software).

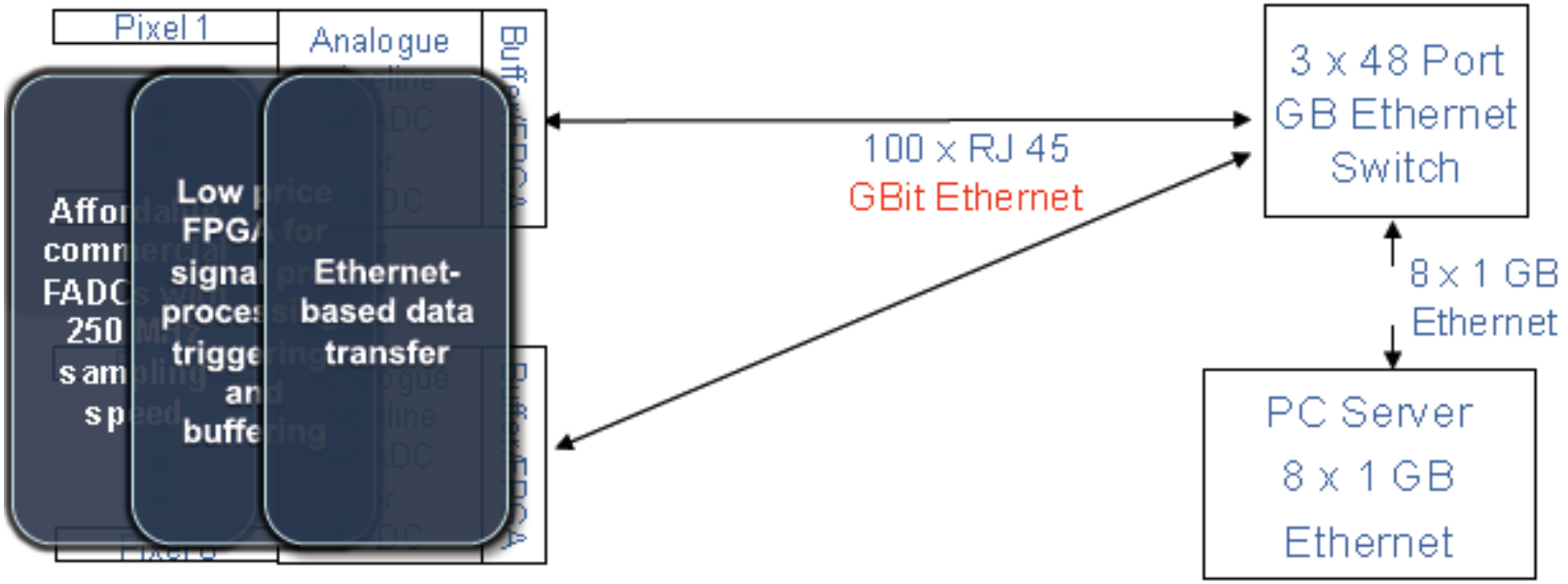
  Lower the cost also for maintenance
- low electric power consumption, man power on site ...
- Easy to maintain (accessible in safety condition)
- Known technology
- Can be upgrade (15-20 years of operation is a long time)

General considerations

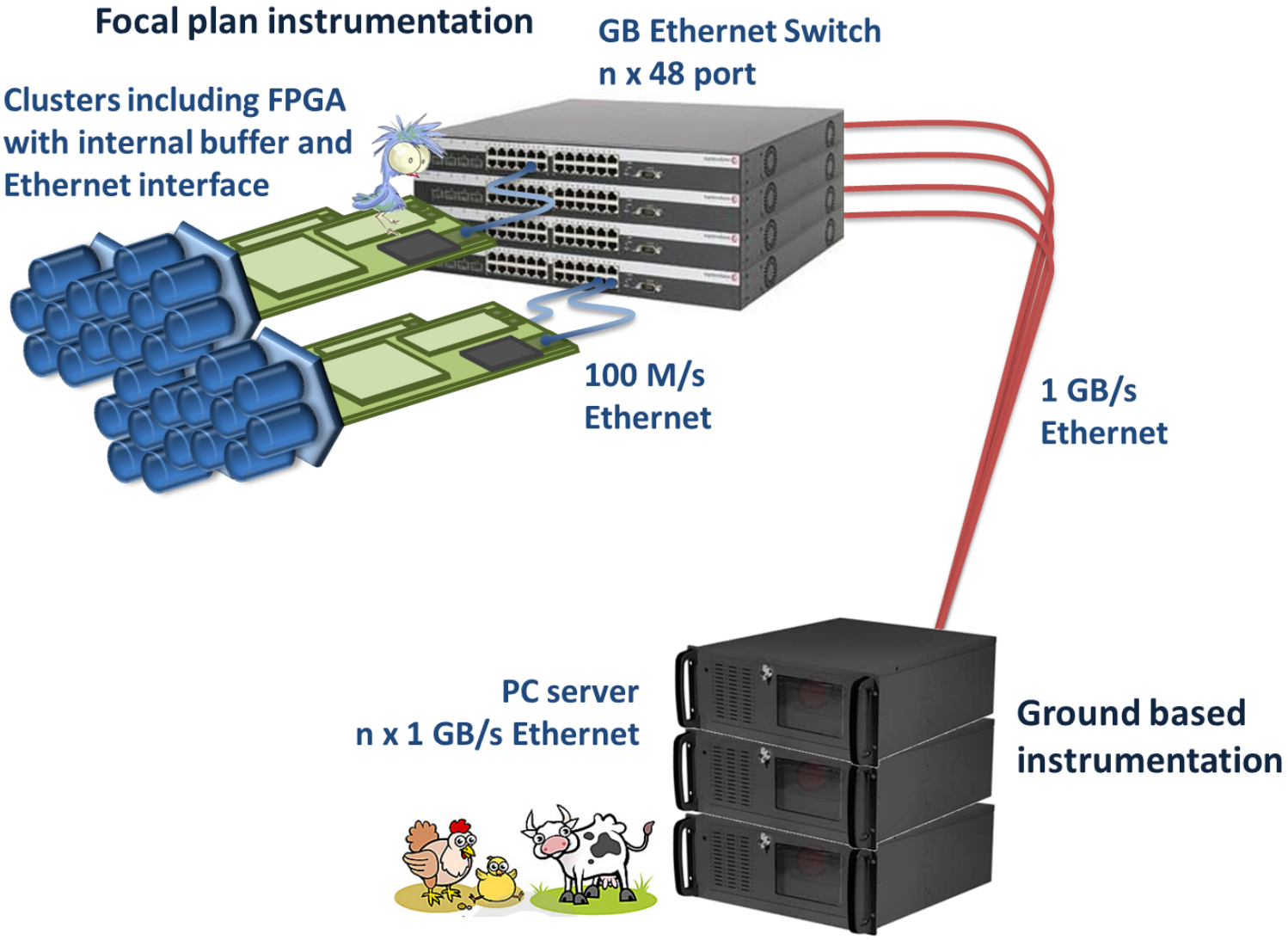
		FE	L0	L1
1	D	DESY/MPIK Heidelberg/AIT/ETH/U. Zurich/AGH/Krakow/Leeds.		
2	A/D	Pisa	Zeuthen	Zeuthen
3	A	Pisa	IFAE-UAB	UM/CIEMAT
4	A	IRFU/LPNHE/LPTA/ICC-UB	IFAE-UAB	UM/CIEMAT
5	A/D	CTA-US (AGIS)		
6	-	-		

	DAQ	Central Trigger
7	MPIK Heidelberg	APC
8		Iowa state U.

General considerations



General considerations



General considerations

Electronics		
Power consumption (all camera)	< 3 W/channel	SITE
Power consumption per channel	< 1 W/channel	SITE
band width before digitalization	> 300 MHz	MC
Sampling rate	250 MHz to 2 GHz	MC
Dynamic range vs telescope size	5 000 photo-electron?	MC
Single photo-electron resolution (electronics noise)	pic/valley > 1.5	FPI
Dead time at 10 kHz	< 5 %	ELEC
Maximum acquisition rate (1-fold)	10. kHz	MC
stereoscopy	(20% of GHz network)	ELEC
crosstalk for the electronics	< 0.1%	ELEC
Trigger region size (sector or super cluster)	14-28 pixels (investigate more)	MC
Trigger window as function of telescope size	2 – 5 ns	MC
Time stamp accuracy for telescope	< 80 ns	DATA
Local time stamp accuracy in case of autonomous clusters	< 15 ns	ELEC
Response stability of operation	signal calibrated at 2%	ELEC
Maximum temperature	< 50°C	FPI
Temperature stability under acquisition	Assuming < +/- 1°C during a run of 25 mn	FPI
Data needed to be saved on disk		MC
LST	Sampling	
MST	Charge or parameterization (? Mb/s)	
SST	Charge	
Data reduction		MC
Pixel readout window		MC
Full camera readout window as function of the energy		MC

Weight		
Sector and pixel trigger monitoring		
Anode current		
Temperature monitoring		
Commissioning		
Modularity		
Remote control		
Reliability – Low failure rate		
Mass Production		
Manpower for characterization/monitoring	less than 2 persons	
Manpower for operation	Low maintenance	
Cost (from PM to network)	? € / channel vs telescope size	MC
Peripheral infrastructure needed		

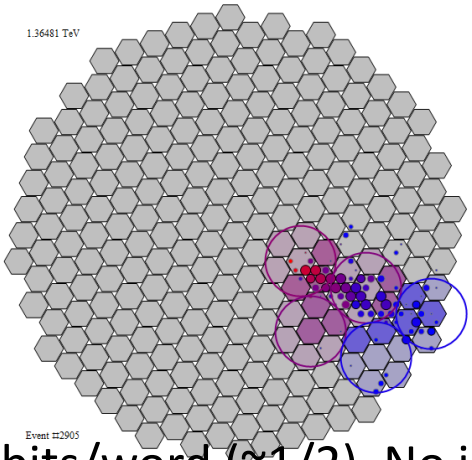
SST should achieve

- ~32 telescopes of about 1 000 channels

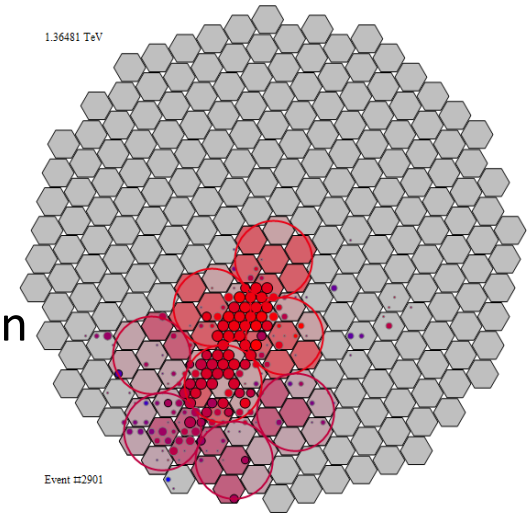
SST should achieve – data flow

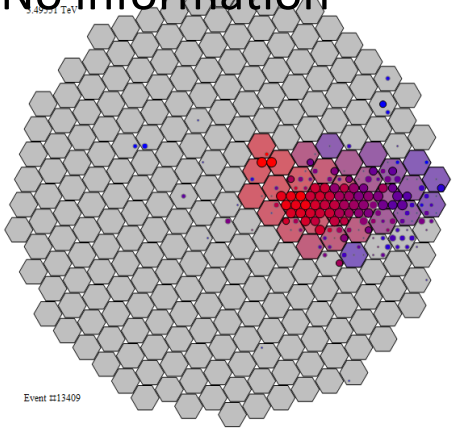
- 1 000 pixels x 1 kHz x 16 bits = 16 Mb/s
- 1 000 pixels x 1 kHz x 16 bits x 2gains= 32 Mb/s
- 1 000 pixels x 1 kHz x 16 bits x 2gains x 50 ns = 1,6 Gb/s
- 100 tel. x 1 000 pixels x 1 kHz x 16 bits x 2gains x 50 ns = 160 Gb/s
- 600 TBytes/night

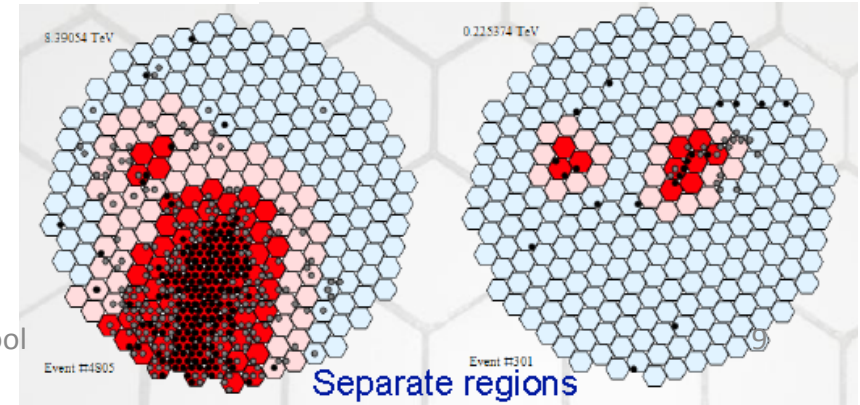
General considerations



- Data reduction
  - Data compression algorithm 16->8 bits/word (~1/2). No information lose.
  - zero suppression
  - readout selected region





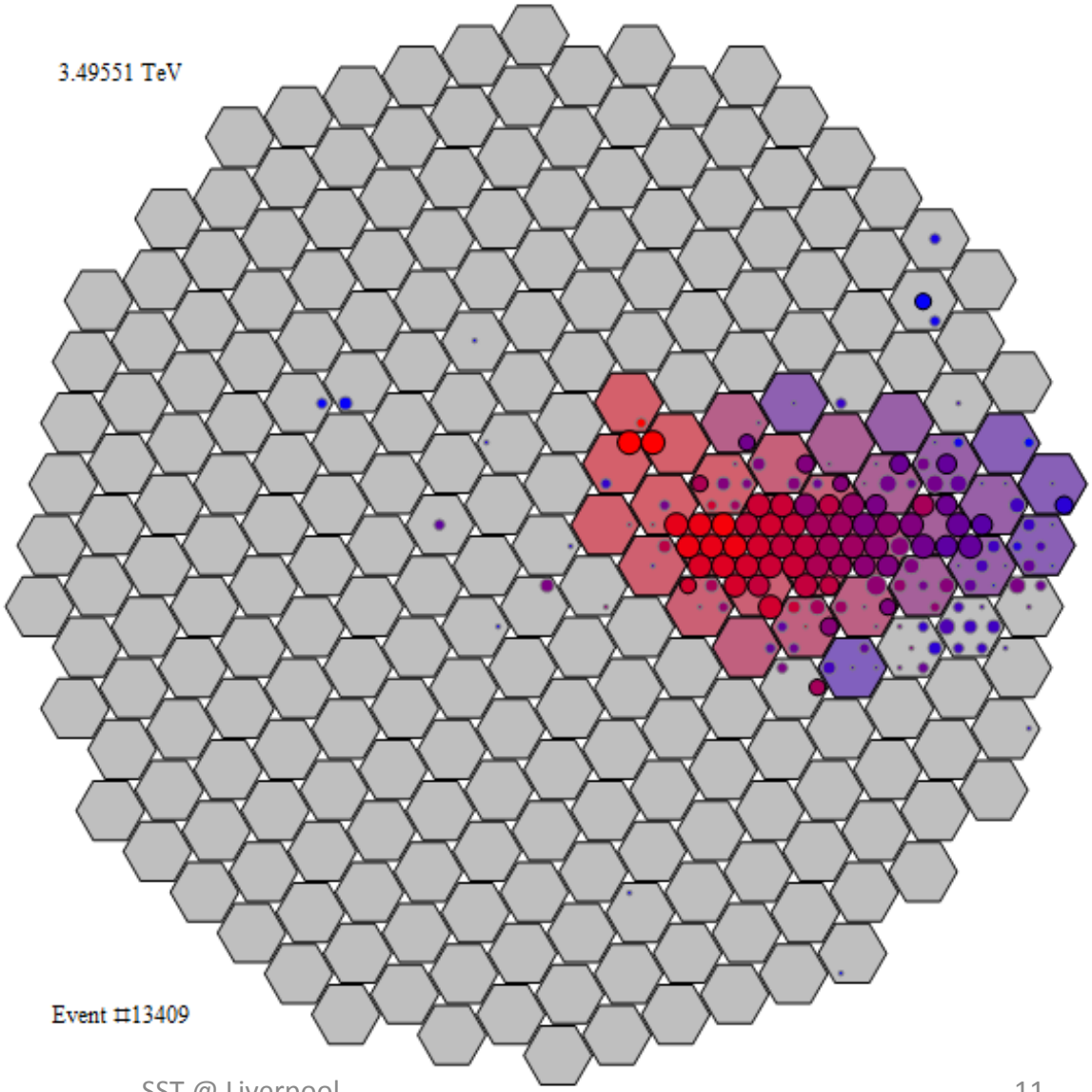


SST should achieve

- ~32 telescopes of about 1 000 channels
- High energy : few x 100 TeV
  - Large dynamics range
  - sophisticate readout and trigger

General considerations

- Data readout
  - **MC Trigger studies**



SST should achieve

- ~32 telescopes of about 1 000 channels
- High energy : few x 100 TeV
  - Large dynamics range
  - sophisticate readout and trigger
- reliability
  - Complete monitoring and slow control system
  - Accurate calibration
  - Compact design allows full construction and test in laboratory

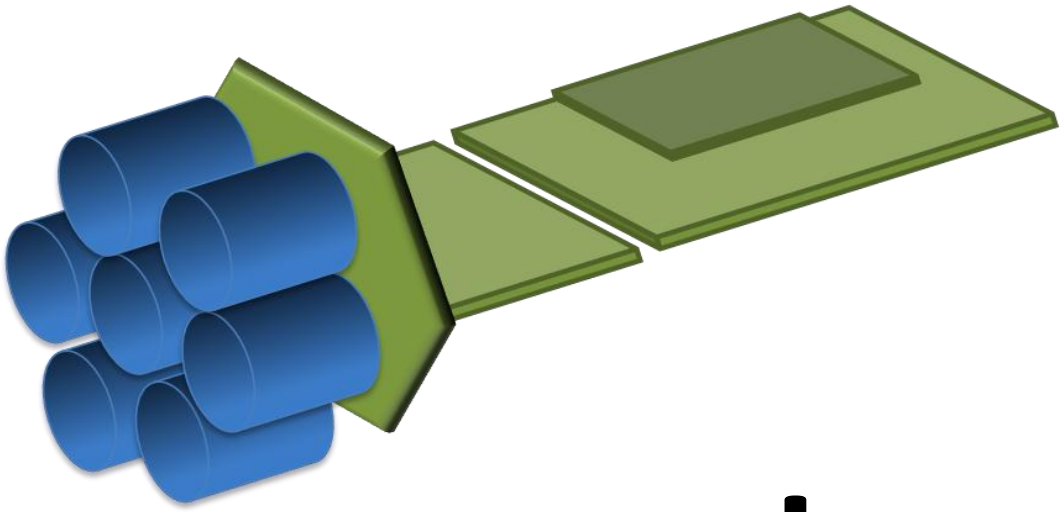
    Only power & network connection
  - Modularity facilitates the installation and maintenance

General considerations

- Something prepared and tested at home institutes or manufactories

General considerations

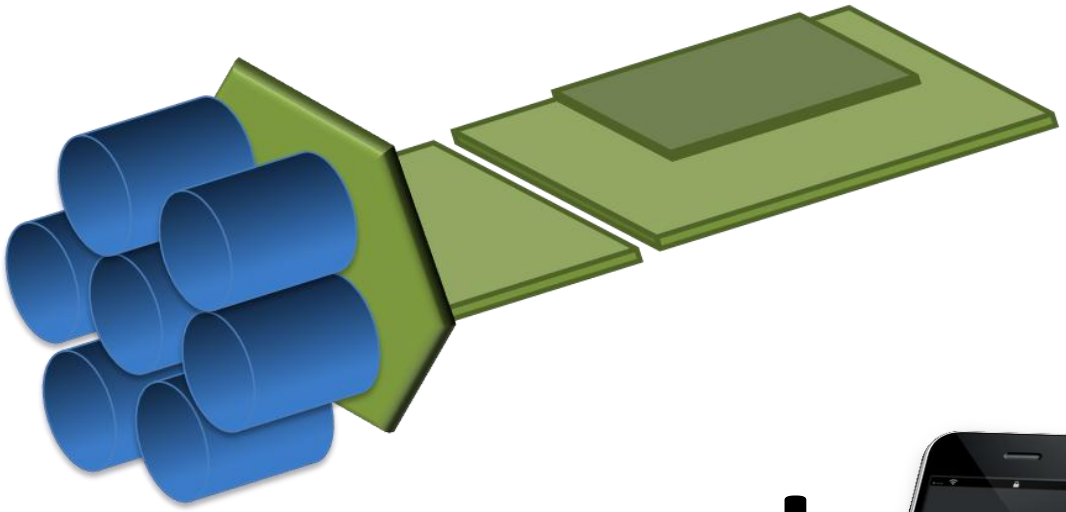
- Accessible (at the ground level ?) and easy to maintain (modular).



- standardized interfaces and software

General considerations

- Accessible (at the ground level ?) and easy to maintain : modular.



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CTA Store

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    Only power & network connection
  - Modularity facilitates the installation and maintenance
- **Capability to evolve:** maybe less critical for this telescope size.

Figures of merit

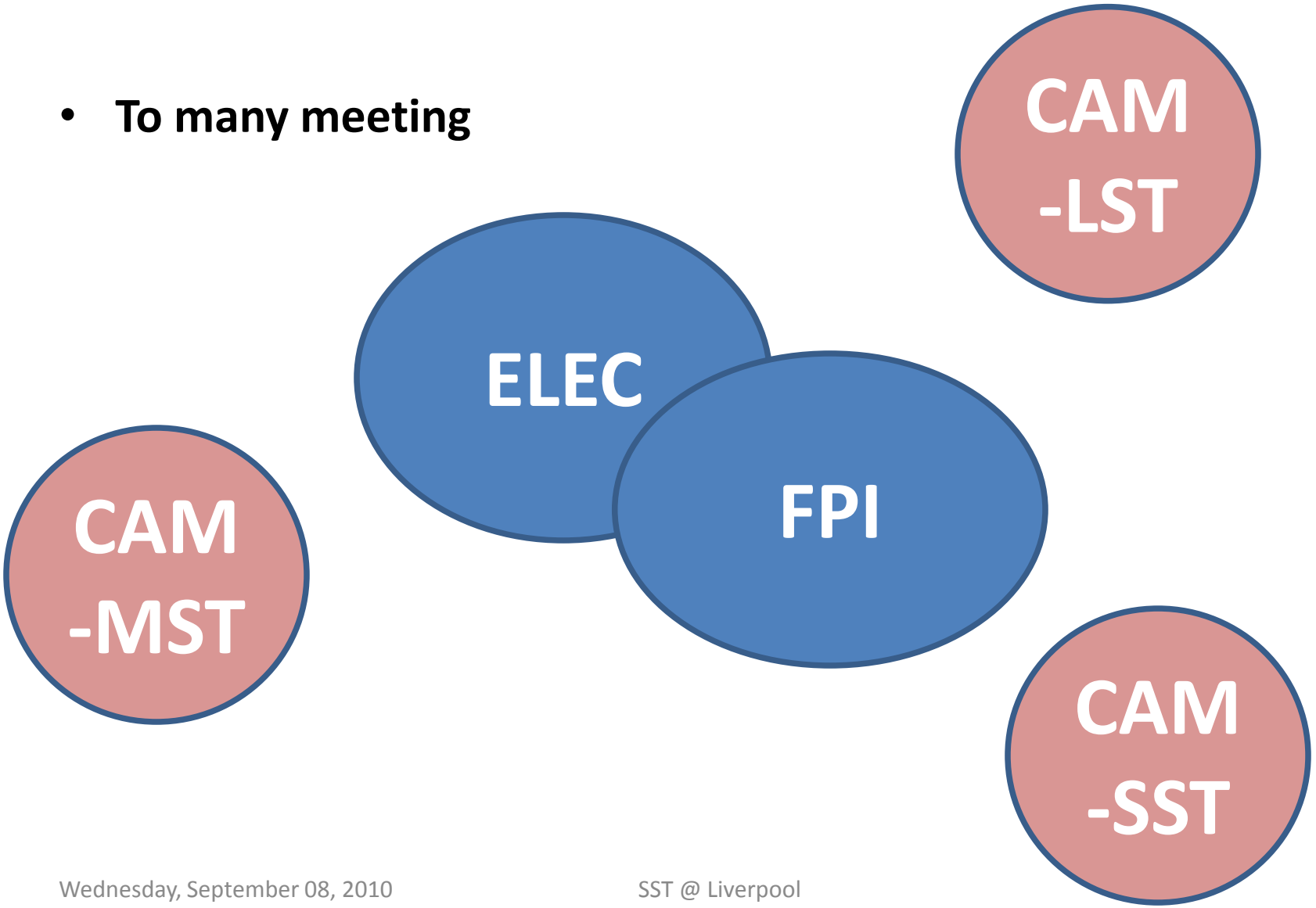
Telescope size	SST	MST	LST
Dead time	2	1	1
Linearity	1	1	1
Dynamics	1	1	2
Crosstalk	2	1	1
Electronics bandwidth	2	1	1
Trigger	3	2	1
Readout	1	2	1
Power consumption	2	1	3
Power dissipated	2	2	1
Modularity (evolution)	3	2	1
Modularity (maintenance)	1	1	2
Access to camera	1	1	2
Weight	3	2	1
Upgrade	2	2	1
Cost/channel	1	1	2

CAM-SST should achieve

- constraints and need for High Energy
- specifications for the electronics
- cost model of a full telescope
- central triggering ?
- installation, maintenance model

Remark

- **To many meeting**

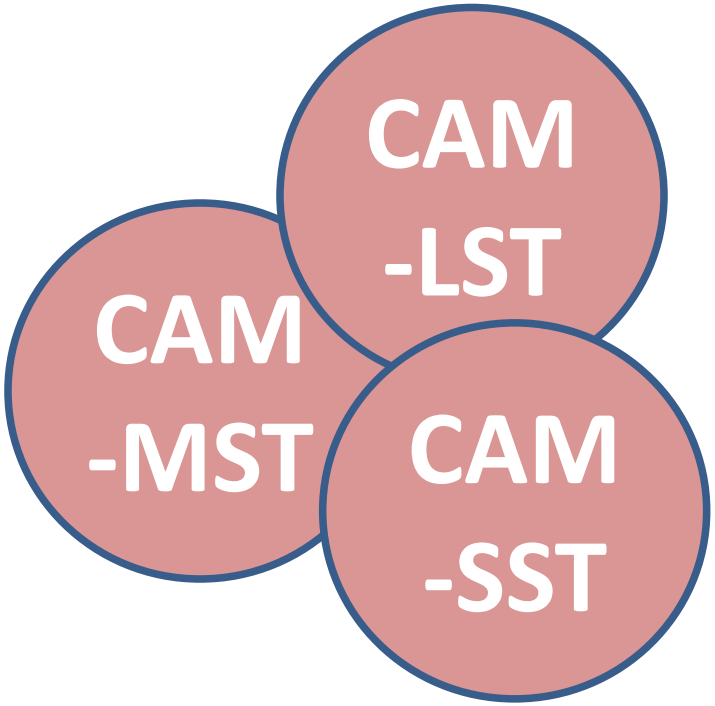


Remark

- **Inhomogeneous system**
- **expensive**

Remark

- **Back to the futur**



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