HGF Detector Portfolio WP5

„Innovative Detektorstrukturmaterialien“

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HGF Detector Portfolio Pillar 1 Meeting, 13/06/2012

Introduction

*Tabelle 3.1: Liste der Arbeitspakete und der beteiligten Zentren. Ein fettgedrucktes „**X**“ kennzeichnet die Leitung, ein normales „X“ die aktive Beteiligung am Arbeitspaket. Generelles Interesse ist durch ein „+“ gekennzeichnet.*

		DESY	FZJ	GSI	HIJ	HIM	HZB	HZDR	HZG	KIT
S1	**Technologien zum Aufbau hochintegrierter Detektoren**									
1	3D-ASICs	**X**	+	X			+		+	X
2	Mixed-signal ASICs	X	X	**X**	X	+	+		+	X
3	3D / Hoch-Z Sensoren	X	+	+			+	+	+	**X**
4	Aufbau- und Verbindungstechnologien	X	X	X						**X**
5	Innovative Detektorstrukturmaterialien	**X**	X	X		X			+	
S2	**Ultraschnelle Datenübertragung und -auswertung**									
6	Intelligente programmierbare Hardware	X	**X**	X			X	X	X	X
7	Detektornahe optische Signalübertragung	+	X	X						**X**
8	Schnellste Datenverarbeitung mit hochparallelen Architekturen	X	+	X				X	**X**	X
S3	**Exemplarische Detektortypen**									
9	Schnelle Licht- und Röntgendetektoren	**X**	X	X		+	X	X		
10	Diamantdetektoren	X		**X**	X					X
11	Detektoren für thermische Neutronen		X				**X**		X	
12	Kompakte Gasdetektoren	**X**	+	X			+	X		

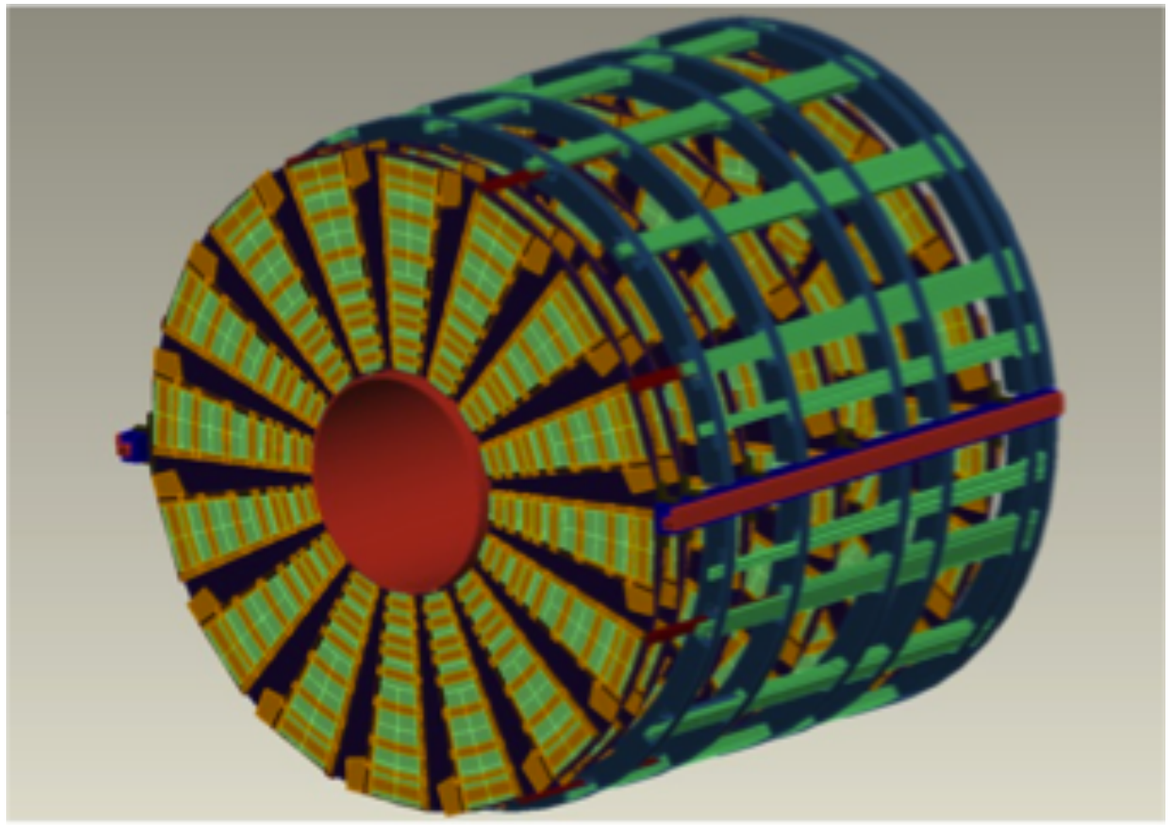
GSI - Activities & Plans

- planning for investigation of properties of fibre reinforced materials is ongoing
- technologies for electro-etching of thin foils are being established
- technologies for the weight-optimization of fibre reinforced structures are being established
- lack of manpower

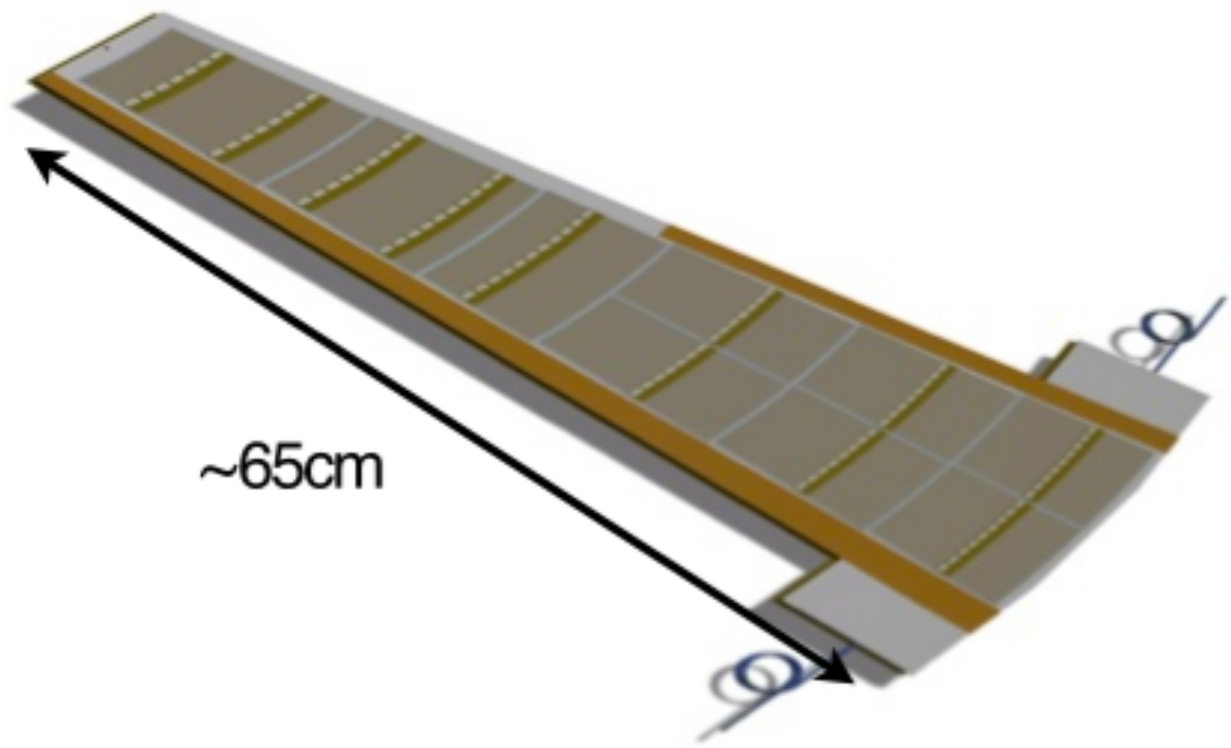
- Dedicated infrastructure is in planning for
  - non-destructive investigation of GEM-foils
  - inspection of volume conductive materials to be used as structural detector elements

DESY - ATLAS Upgrade Activities

- Longterm plan of DESY ATLAS group: construction of a full Silicon strip end-cap
  - About 40m^2 of Silicon
  - One end-cap with 7 disks segmented into „petals“
  - About 9000 Silicon modules

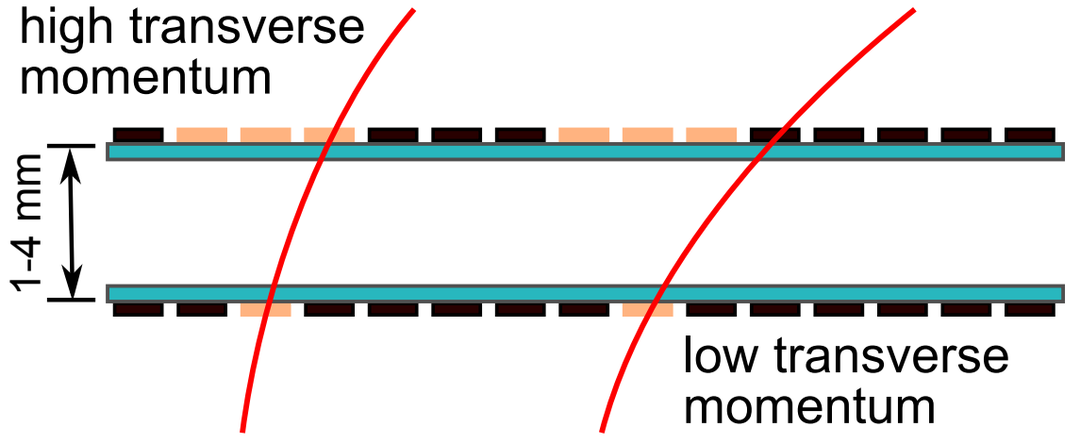


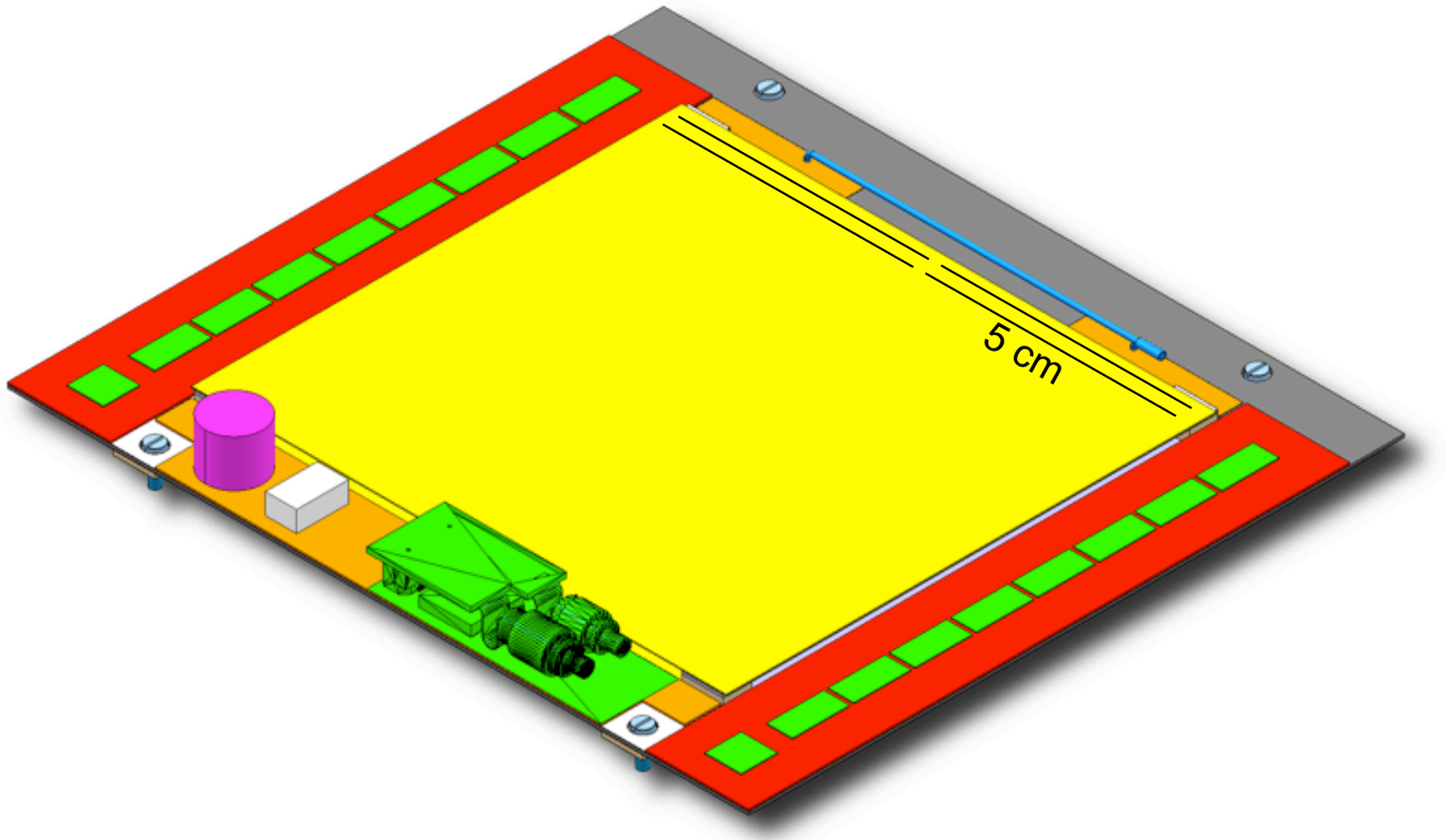
- Silicon is directly glued onto carbon facings
- R&D program on going at DESY for detailed mechanical and electrical design
- Full system tests are planned
  - Test beam studies
  - Deformation and vibration tests
  - Ageing studies



DESY - CMS Upgrade Activities for HL-LHC

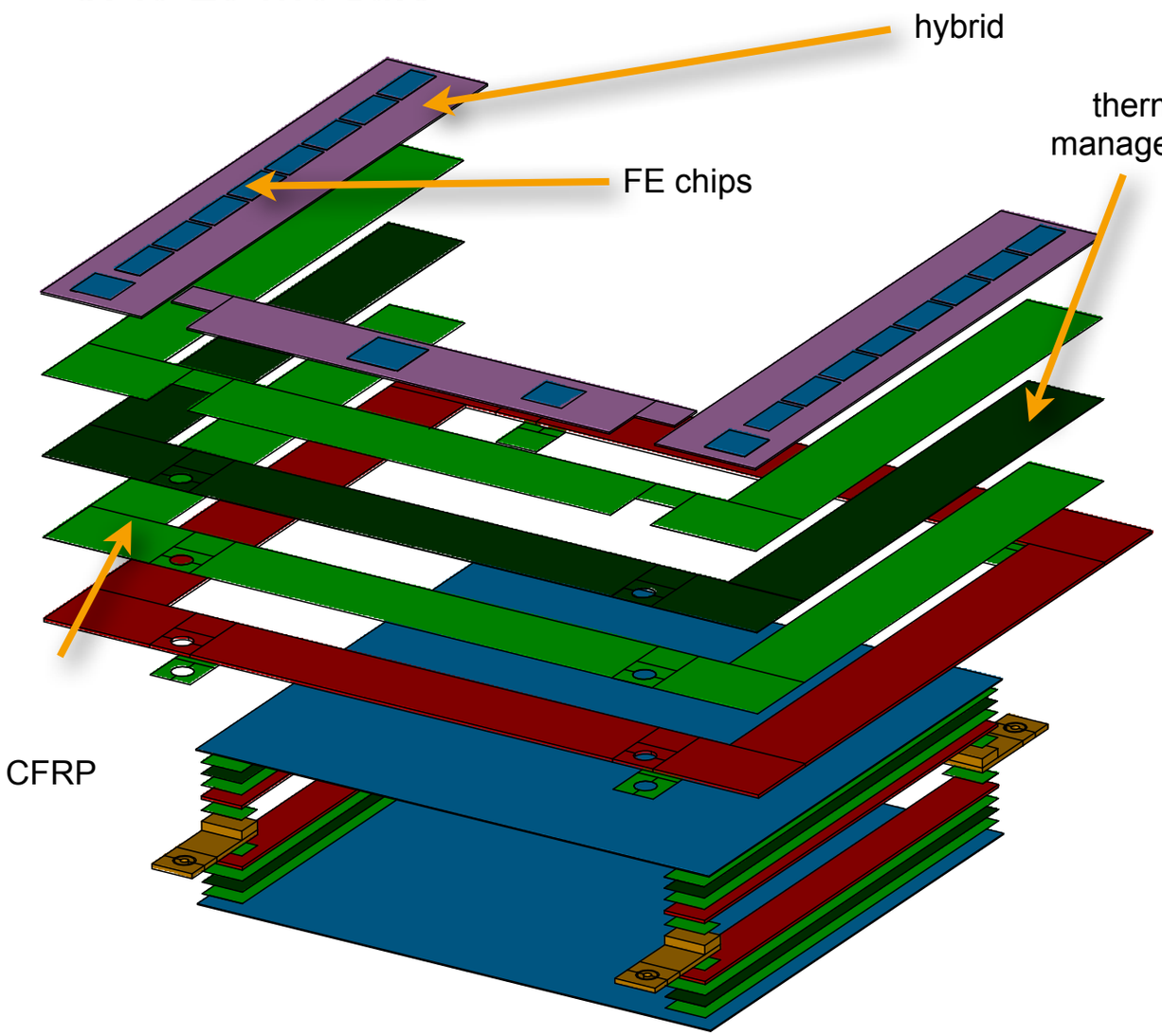
- Future tracker will be used in Level-1 trigger
- Each detector module will allow for a pT discrimination
  - > 35000 modules in total
- First mechanical prototype module to be built early next year



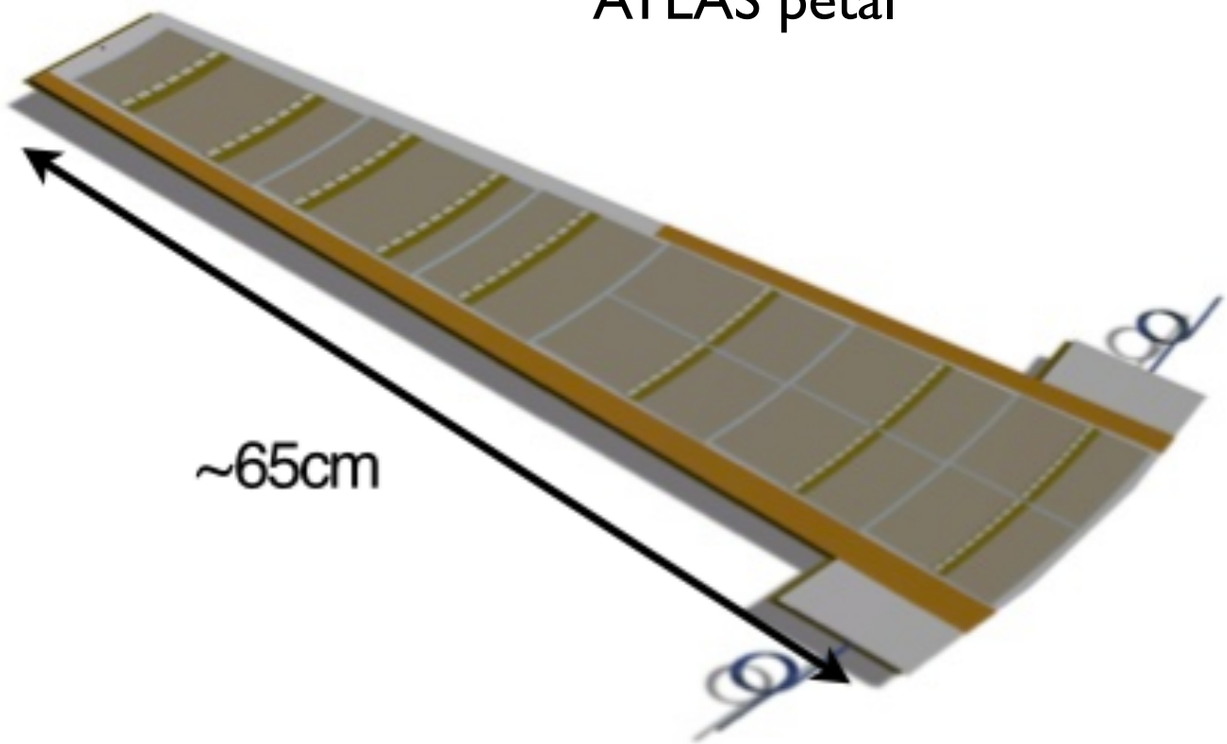


DESY - Upgrade Challenges Related to Materials

CMS 2S module



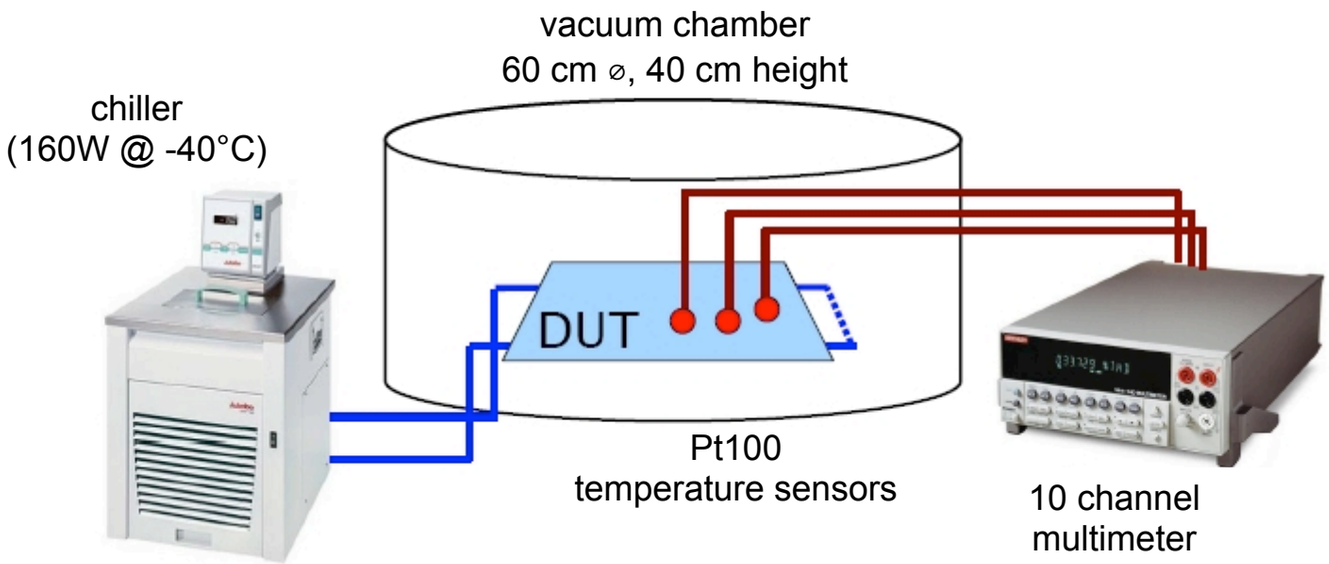
ATLAS petal



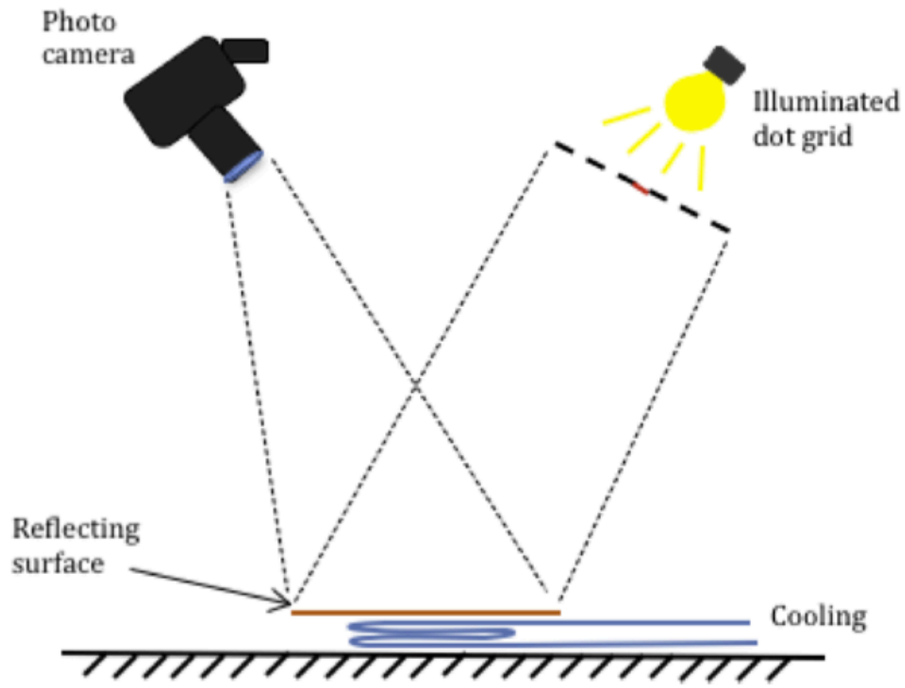
- Future modules and support structures will be multi-layer sandwiches
  - CTE miss-matches cause thermal stress - long-term stability has to tested
  - one key objective is the reduction of material budget - investigate novel materials for use in HEP
  - machinability & glueability of novel materials has to established

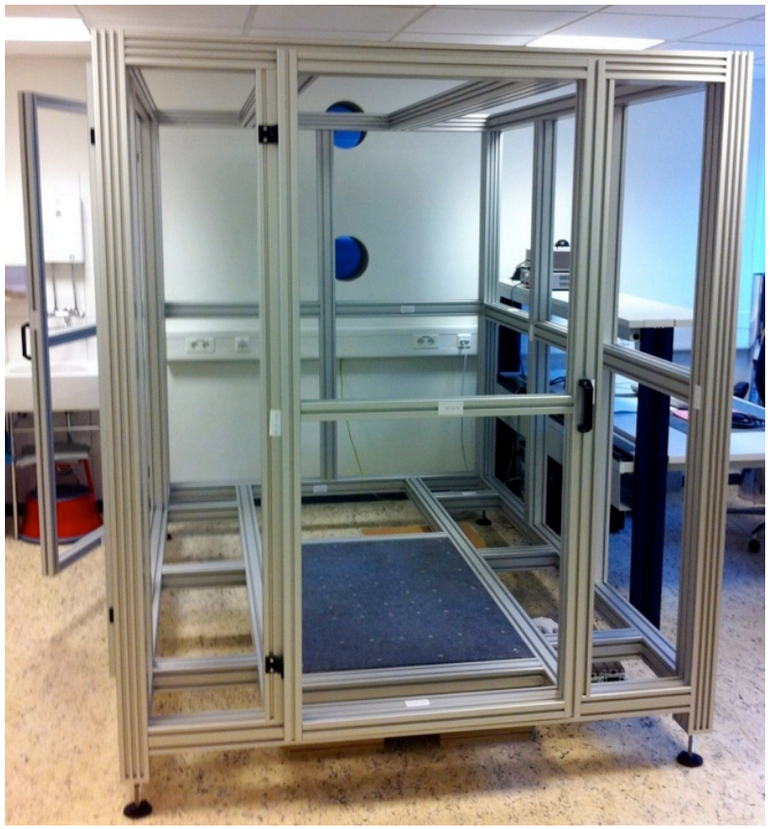
DESY - Lab Equipment

thermal measurements



deformation measurements





- thermal performance of test structures and modules can be tested in thermal measurement setup
- optical deformation setup allows for measurement of deformation due to thermal stress
  - object size <= 60 cm x 75 cm
  - expected precision approximatelly 5 um

DESY - Plans

- thermal and mechanical performance tests of sandwich test structures
  - e.g. CFRP <-> Pyrolytic Graphite Sheet <-> CFRP
- test novel materials for their usability for our application
  - e.g. carbon honeycomb, nano-modified composites, carbon based foams, etc.
- investigate long-term stability and integrity of test structures and prototypes
  - detector components have to withstand several thermo cycles and 10+ years of operation

Budgetplan Arbeitsgruppe: innovative Detektormaterialien (A.

Request	geplante Kosten in T €						
	FTE	Personalkos	Sachkosten	Investitionen	Summe	Overhead	Gesamt
DESY	1,5	112,5	55	0	167,5	0	168
FZJ	1	75	35	0	110	0	110
GSI	1,5	112,5	55	0	167,5	0	168
HIJ	0	0	0	0	0	0	0
HIM	0	0	45	0	45	0	45
HZB	0	0	0	0	0	0	0
HZDR	0	0	0	0	0	0	0
HZG	0	0	0	0	0	0	0
KIT	0	0	0	0	0	0	0
Summe	4	300	190	0	490		490

Eigen	geplante Kosten in T €						
	FTE	Personalkos	davon Sach	davon Inves	Summe		Gesamt
DESY	0	0	0	20	20	0	20
FZJ	2	150	0	0	150	0	150
GSI	1,2	90	0	50	140	0	140
HIJ	0	0	0	0	0	0	0
HIM	0	0	0	0	0	0	0
HZB	0	0	0	0	0	0	0
HZDR	0	0	0	0	0	0	0
HZG	0	0	0	0	0	0	0
KIT	0	0	0	0	0	0	0
Summe	3,2	240	0	70	310		310

- procurement of samples
- production of test structures
- irradiation campaigns

- 1.5 FTE ⇒ PhD student for 3 years