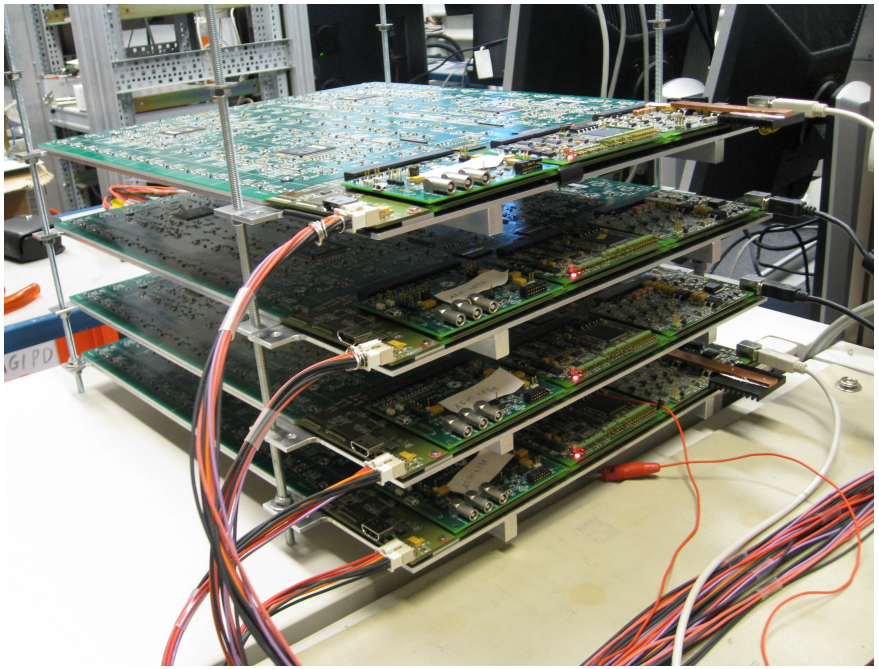
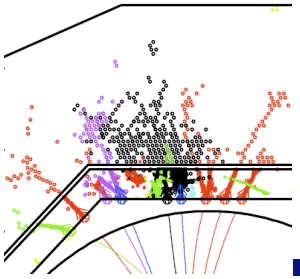
AHCAL Future Plans

Felix Sefkow

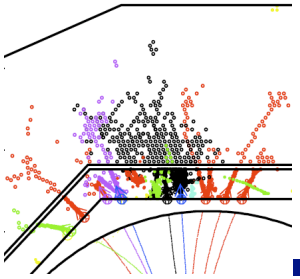


CALICE Collaboration Meeting
Hamburg, March 21, 2013



Outline

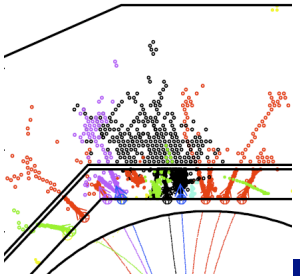
- Plans for publishing test beam results
- Overall goals of the project (given the possibility of a Japanese Higgs factory): milestones, timelines...
- Activities of the next year (or so): R&D, construction, bench tests,design work, simulation studies...
- Plans for test beams after the FNAL/CERN shutdowns



Publication plans

- In the journals:
  - Construction and commissioning
  - electromagnetic response
  - hadronic resolution and software compensation
  - Pandora two particle separation (ECAL + HCAL)
  - TCMT
- On the way / circulating:
  - Pions vs Geant 4
  - track segments
- Preliminary (almost):
  - T3B
  - tungsten
  - (protons)
  - (uniformity)
  - *leakage estimation*
- To be analyzed:
  - scintillator ECAL and HCAL FNAL data

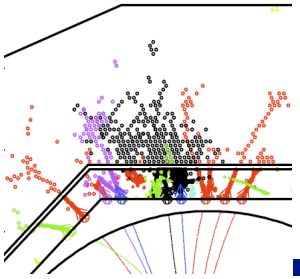
~5 more papers possible



What we learnt

- The technology works, it is robust and reliable.
- The detector simulations are verified with electromagnetic data.
- The hadronic performance is as expected, including software compensation.
- The Geant 4 shower models reproduce the data with few % accuracy.
- Shower substructure can be resolved and is also reproduced by shower simulations.
- Time structure is reproduced by HP simulations.
- Particle flow algorithms are validated with test beam data.

all on this page:
done



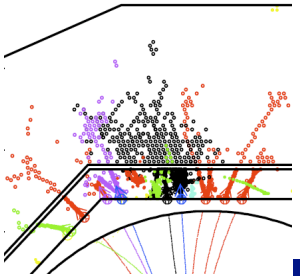
Things to improve

- Test bench characterisation of SiPMs
  - saturation parameters
  - temperature coefficients
- Real-time monitoring
  - layer-based, T corrected
  - real-time compensation

- SiPMs
  - reduce temperature dependence
  - increase dynamic range
  - improve sample uniformity

continuous evaluation at Hamburg lab

- **Scalablity and industrialisation**



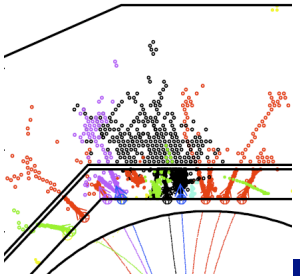
Overall Goals

- Propose a scintillator-based HCAL for the ILC
- Exploit the synergies with scintillator-based ECAL
- Understand advantages and short-comings w.r.t. other options

- Next step: Technological prototype

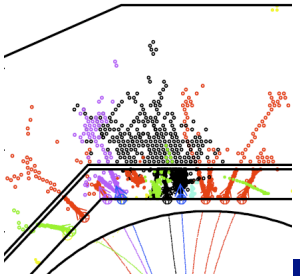
- Proceed in **parallel** on
  - **sensor technology frontier**
  - **integration and industrialisation frontier**
  - possible thanks to versatile electronics

remain open for progress
as long as possible / reasonable



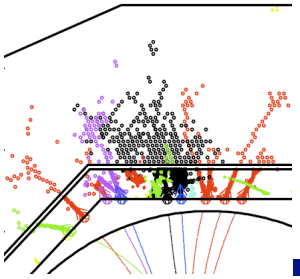
AHCAL groups in CALICE

thanks, Katja!



The AHCAL in CALICE

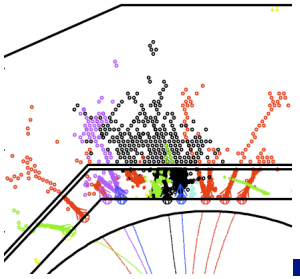
- DESY: steel structures, electronics and integration, test beam support, software, project management
- Hamburg: SiPMs and tile optimisation, test beam and commissioning w/ DESY
- Heidelberg: high gain ASICs, SiPM mass tests and characterisation
- MPI Munich: SiPM development, tile optimisation, cassettes, tungsten timing
- Wuppertal: embedded LED electronics and test stands
- Mainz: DAQ central components, AHCAL data concentrator, mass production
- Omega@LLR: SPIROC ASICs
- CERN: tungsten absorber, testbeam and Geant4 support
- ITEP: tiles and SiPMs, test bench characterisation
- Dubna: power supplies and distribution
- Prague: fibre based LED system, T compensation
- NIU: alternative SiPM coupling, DAQ interface
- Bergen: calibration studies
- Matsumoto, Japan: scintillator strip alternative, photosensors



Case for completing the technological prototypes

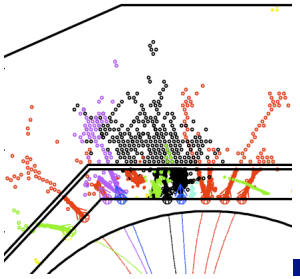
- Performance validation
  - need to re-establish stable operation, perform calibration and time-dependent corrections, measure linearity and resolution and understand in terms of simulation
  - auto-trigger and zero-suppresion represent new challenges
- Test and demonstrate the **scalability**
  - in construction, quality assurance, commissioning, calibration
- Complete the **integration** tasks
  - ASICs, data concentrators, power distribution and cooling
- Progress in industrialisation and **cost**
  - 8000 m^2 of 6-layer PCB
- New **physics**:
  - hadron shower timing
  - needs beam time to exploit the potential

all on this page:
still to be done



Time scale and milestones

- As usual: resource driven
- Yet, one has to set goals:
- 2013: electromagnetic stack
- 2014: partially instrumented HCAL
- 2015: full HCAL module *technically* possible



DESY Schedule

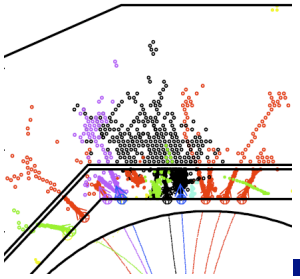
DESY Testbeam Schedule 2013 - version of December 14 2012

	Week		TB21		TB22		TB24/1		TB24
			DATURA (telescope)	none	Telescope	CAL	Telescope PCMAG	PCMAG	none
	2		---	---	---	---	---	---	---
14-Jan	3		---	ITER	Tele setup				
	4		X0		---	CALICE AHCAL			
	5		CMS Pix-irrad	---	---	CALICE AHCAL	---	TPC MMG	ECAL
2-Feb	6		CMS Pix-fwd	---	ATLASPix	---	---	TPC MMG	---
	7		CLICpix	---	---	SiPM	LorAngle	---	---
	8		---	SiW ECAL	---	SiPM	LorAngle	---	---
	9		---	Sc ECAL	EUTelescope	---	---	DESY TPC	---
4-Mar	10								
	11		ALICE ITS	---	MuPix 2	---	---	DESY TPC	---
	12		CMS Pix-irrad	---	APIX PPS	---	---	DESY TPC	---
	13		CMS Pix-KA	---	APIX PPS	---	---	LCTPC Time	---
1-Apr	14		---	GRPC-SDHCAL	APIX IBL	---	---	LCTPC Time	---
	15		---	GRPC-SDHCAL	APIX DBM	---			
	16		X0		ILCPOL				
	17		---	SiW ECAL	ILCPOL		SBS GEM		
	18		---	SC ECAL	---	RD50	SBS GEM		
6-May	19		DEPFET	---	---	RD50	LorAngle		
	20		FE-I4		---	CAL MMG	---	GridPix	---
	21		CMS Pix-ro		---	CAL MMG	---	---	Belle 2 PID
	22		X0			CALICE AHCAL			
3-Jun	23		CLICpix	---	---	CALICE AHCAL			
	24		CLICpix	---	MuPix 3	CALICE AHCAL			
	25		ALICE ITS	---	APIX 3D		---	---	PICSEL
	26		CMS Trk II	---	DIA-SiGe	---	---	---	PICSEL

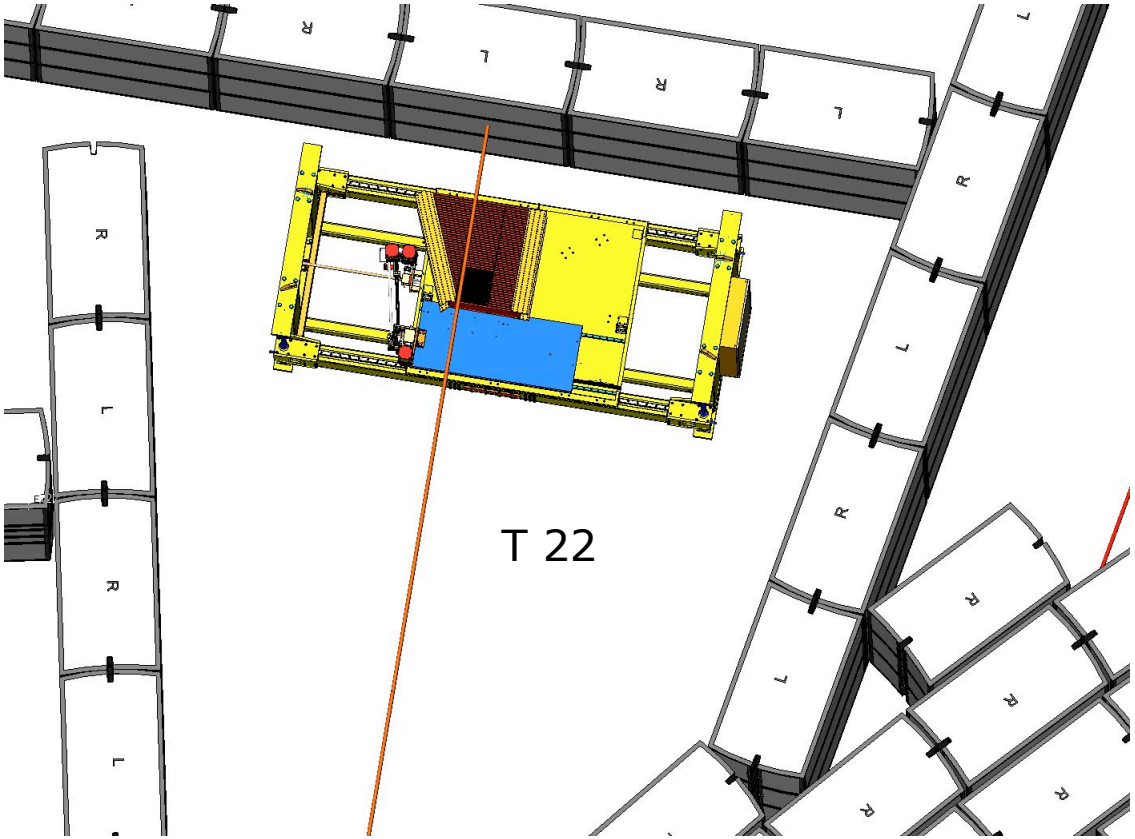
ECFA-LC13

- shut-down 1.9.-31.12.

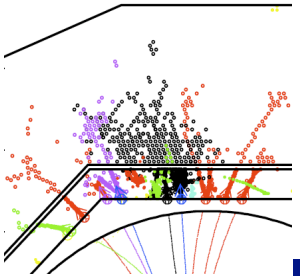
grey = MD



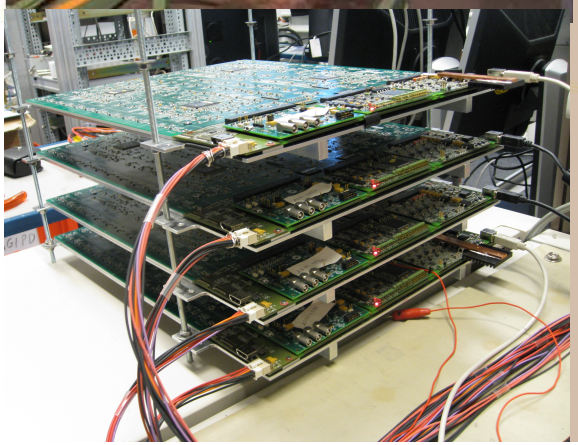
Location

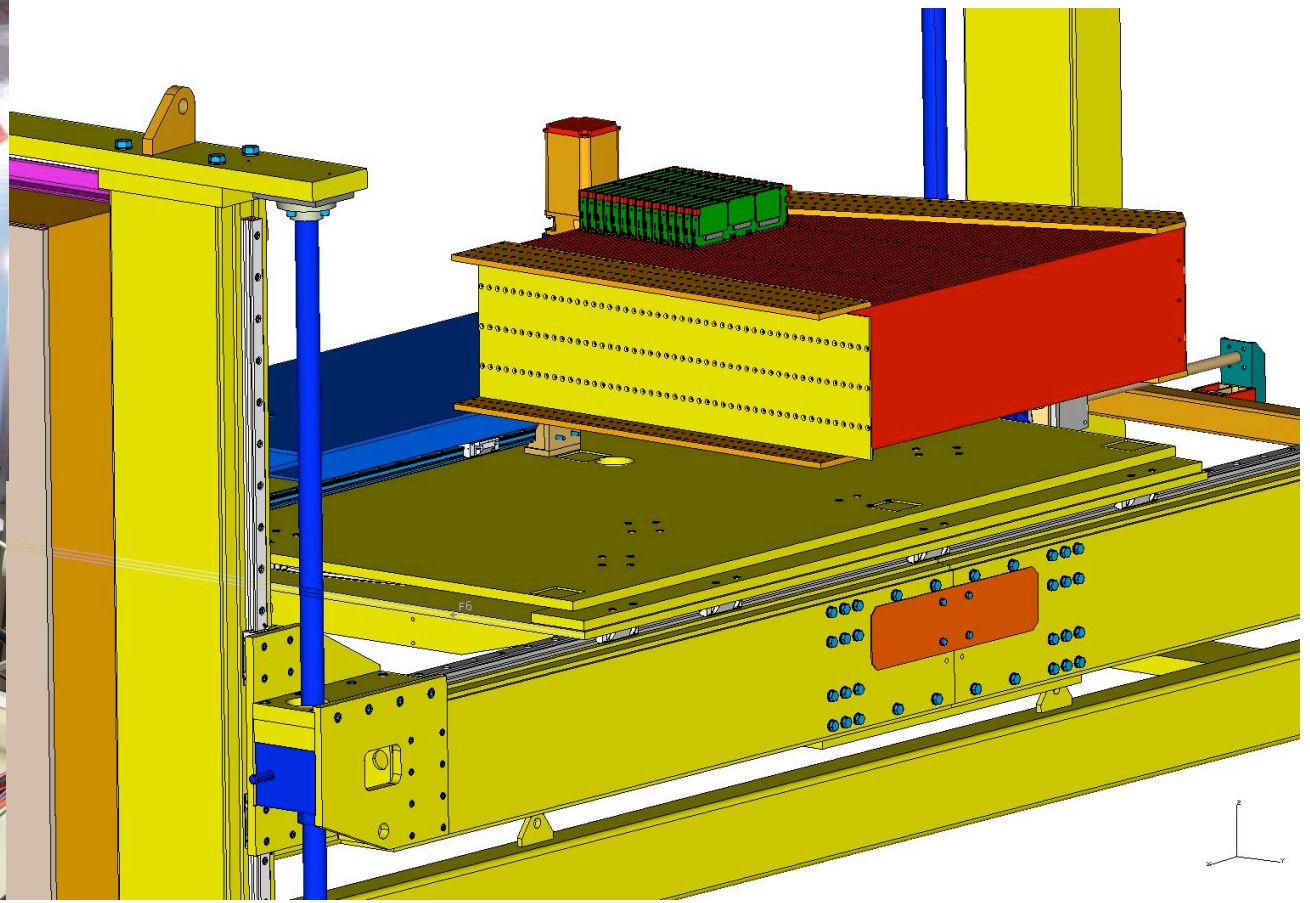


- had to move closer to back wall
- no rotations

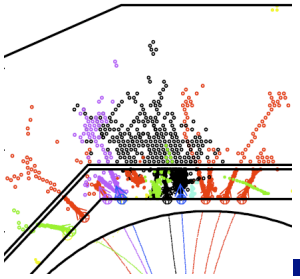


Set-up for May



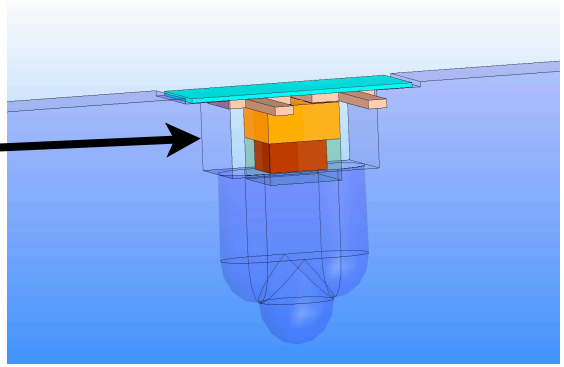


- work on stage and 1-HBU cassettes on track

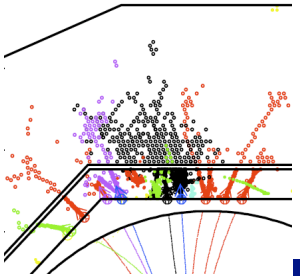


Inventory

- HBUs
  - 4 CERN test beam
  - 1 more with ITEP tiles characterized at Heidelberg
  - 8 boards ordered, to be delivered in April
- more tiles (in units of HBUs)
  - 2 ITEP fibreless w/ KETEK produced
  - 1 megatile NIU w/ MPPC
  - 8 on the way at HamburgU, wrapped, with KETEK
  - 4 planned with ITEP fibreless / new MPPC
- DIFs: 9+12 prod @ NIU till summer
- CIB, CALIB, POWER: 8-9, re-designed and new production ongoing
- LDA on the way
- DAQ critical, ongoing

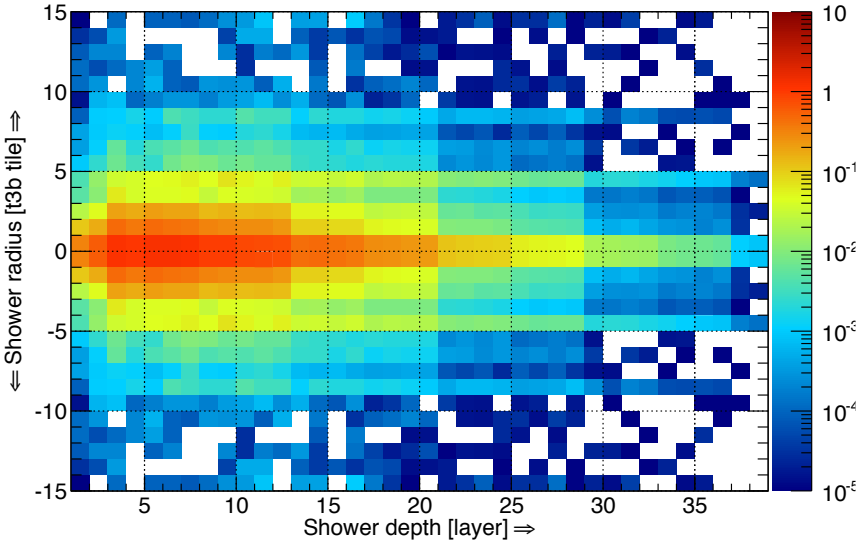


- What can we do with ~20 HBUs?



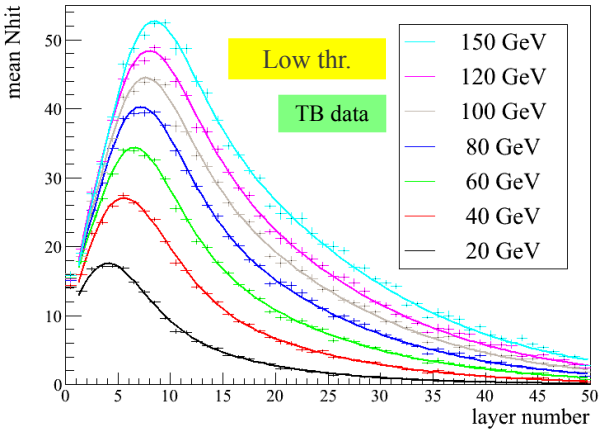
Examples

- T3B
  - 15 tiles

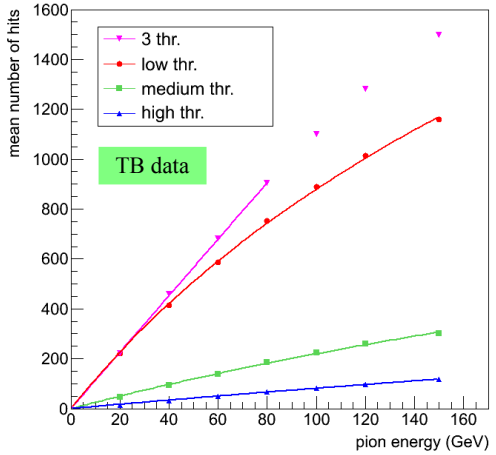


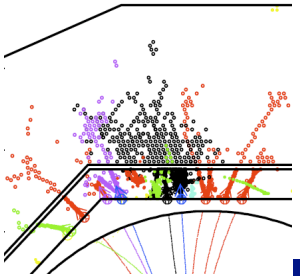
- Micromegas
  - 4 layers

Pion shower profile measured with 4 Micromegas chb.

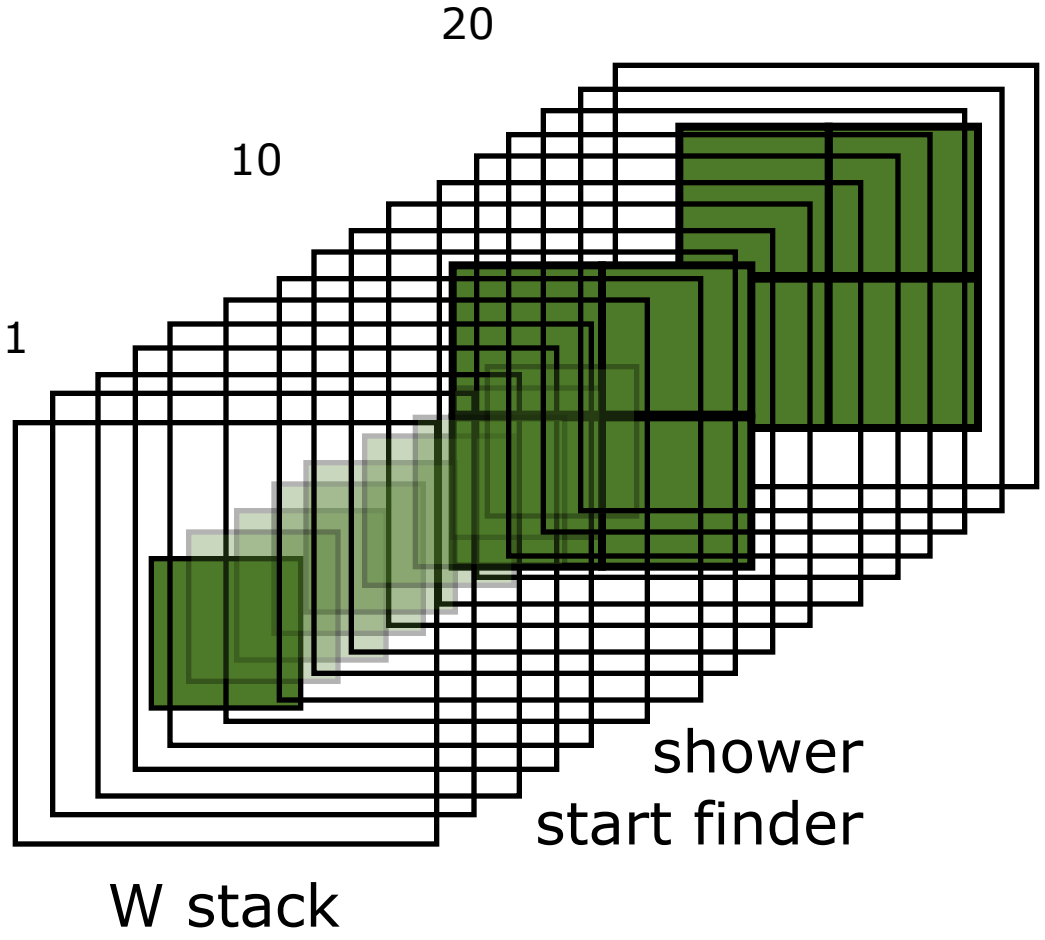


Response to pions of a virtual 50 layer Micromegas SDHCAL





Hadron TB in fall 2014



Minimum -
hope to get more

- 18 HBUs
- Showers layer 1-20
- Correlations