SciTil/BarrelTOF Status

Ken Suzuki, Stefan-Meyer-Institut, ÖAW
09.12.2014 PANDA LI. Collaboration Meeting at FZ-Jülich

News from Vienna

- Lukas Gruber

  - just finished his PhD

- Stefan Brunner

  - moved to Philips Aachen, working closely with dSiPM team

- Doris Stückler

  - CAD Technician

Sub-PSP code	Work Package	Next Milestone	Achievements	Current Activity	Critical Items	Schedule Status
1.4.1.06	Detector		Prototype met the goal timing performance	Further optimisation going	The new technique of SiPM serial connection and an anticipated cheaper price of sensor, leading a new design of detector.	on time
1.4.1.06	Radiation Hardness		Communication channel with Manufacturer established. EU-project proposal for a comprehensive study of radiation hardness submitted (HPH2020)	Literature Study, Organising a test beamtime opportunity	Sensor may not have a sufficient radiation hardness.	risk of delay
1.4.1.06	Electronics		TOF-PET evaluation kit arrived. Collaboration with Mainz group started	Improving electronics performance	Man power (Vienna looking for a student)	risk of delay
1.4.1.06	Mechanics		First design (shared with DIRC) exists. One CAD technician in team (Vienna).	Reviewing the current design.		on time
1.4.1.06	Infrastructure		Planning for cabling and supplies not started yet		Waiting for the freezing of the design	on time
1.4.1.06	Prototypes		Detector prototype is in good shape	Radiation hardness, readout electronics	Radiation hardness	risk of delay
1.4.1.06	Offline Software: Simulation		1 FTE (PhD) assigned for software development	developping (time based simulation ..)		on time
1.4.1.06	Offline Software: Reconstruction		same as above	developping		on time
1.4.1.06	Online Software		same as above	developping		on time
1.4.1.06	TDR	M3: 6/2016	Collection of materials has started	Writing text, collecting information		on time
1.4.1.06	Project management		New system coordinator	developping		on time

Work packages

- Detector R&D

- Physics Simulation

- Radiation Hardness Test

- Readout Electronics

- Mechanics

- TDR

Work packages

- **Detector R&D**

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MEG2 Scintillator Tile Detector

- While staying at PSI in October 2014, I had a chance to visit the MEG experiment at πE5 beamline, where they were having a test beam time of their new ToF Barrel.

- Their ToF Barrel (e.g. arXiv:1301.7225) has a similar concept as the PANDA SciTil and showing a good performance (Δt~60ps).
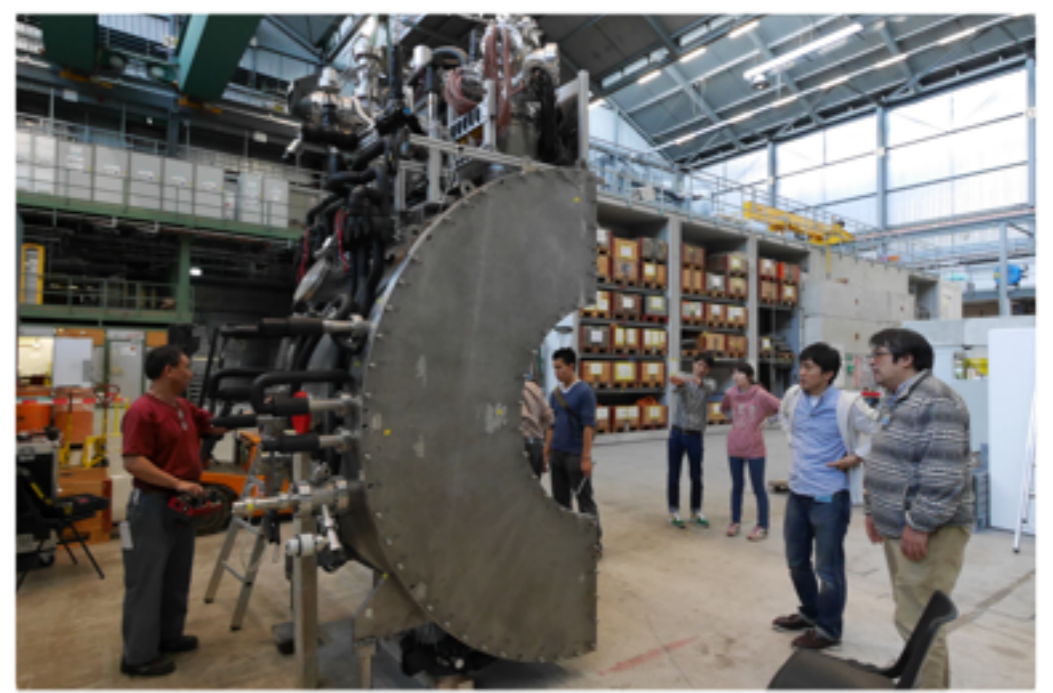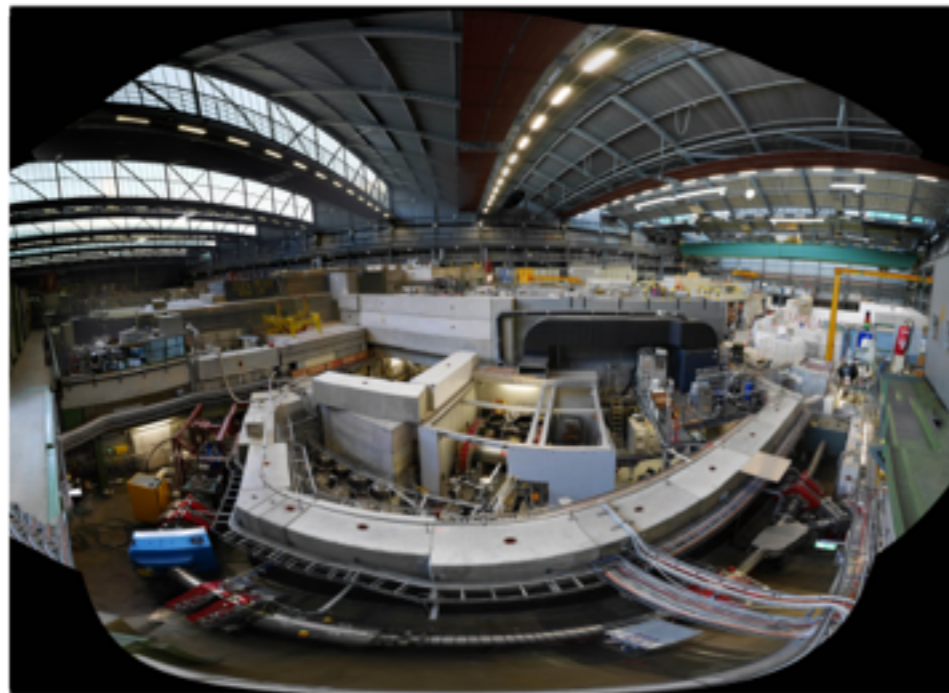
- They are using the FBK SiPM. That action is pushed by their Italian colleagues who'll finances the sensors. The detector R&D is lead by Japanese group.

- They (also) say Hamamatsu MPPC is better. Though they also agreed on our result that KETEK is superior in terms of time resolution, the overall performance of MPPC is better.

- They admitted they have some (how?) difficulties with FBK sensors. Anyway it's working. (They are in the final phase of detector R&D)

- One clear push to go to FBK device is the price. It's around 10€/piece.

- They guessed a single sensor price on a massive quantity order (e.g. PANDA SciTil) could drop to an order of 1€/piece!! (not confirmed by the company)

- They use scintillator EJ-232 (BC-422 equivalent) of 40x120x5 mm^3 dimension.

- 6 SiPMs in serial connection covers one side of 40x5 mm^2 surface. Another chain of 6 SiPMs covers the other side. In total 12 SiPMs per tile.
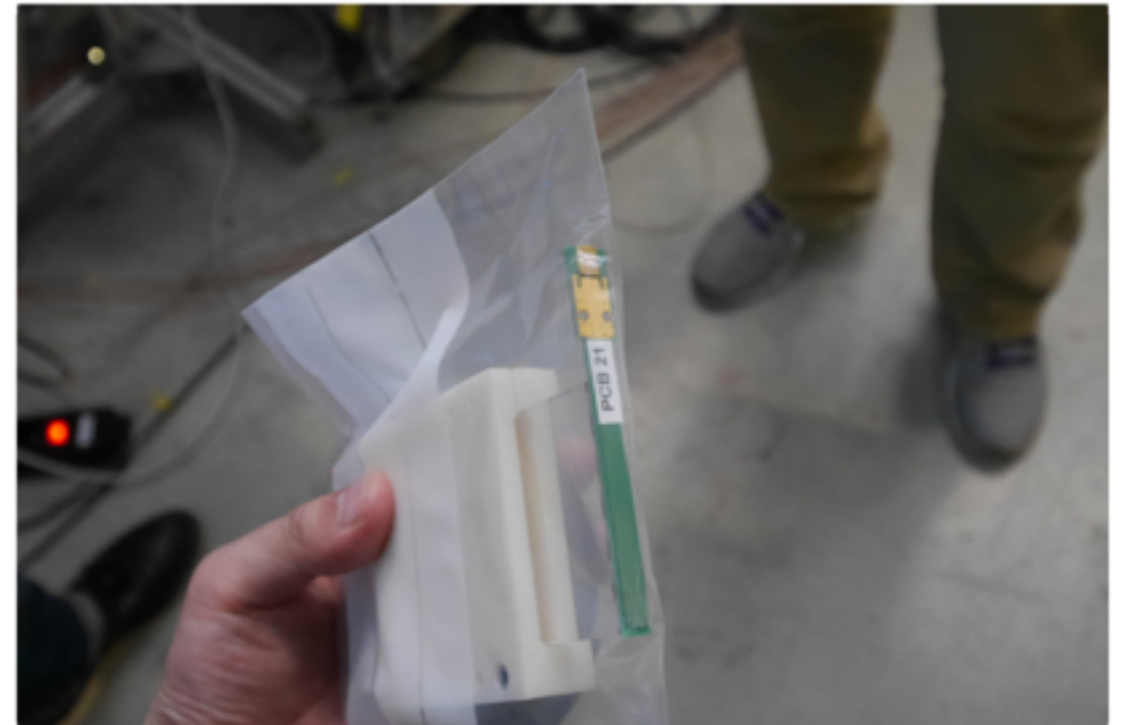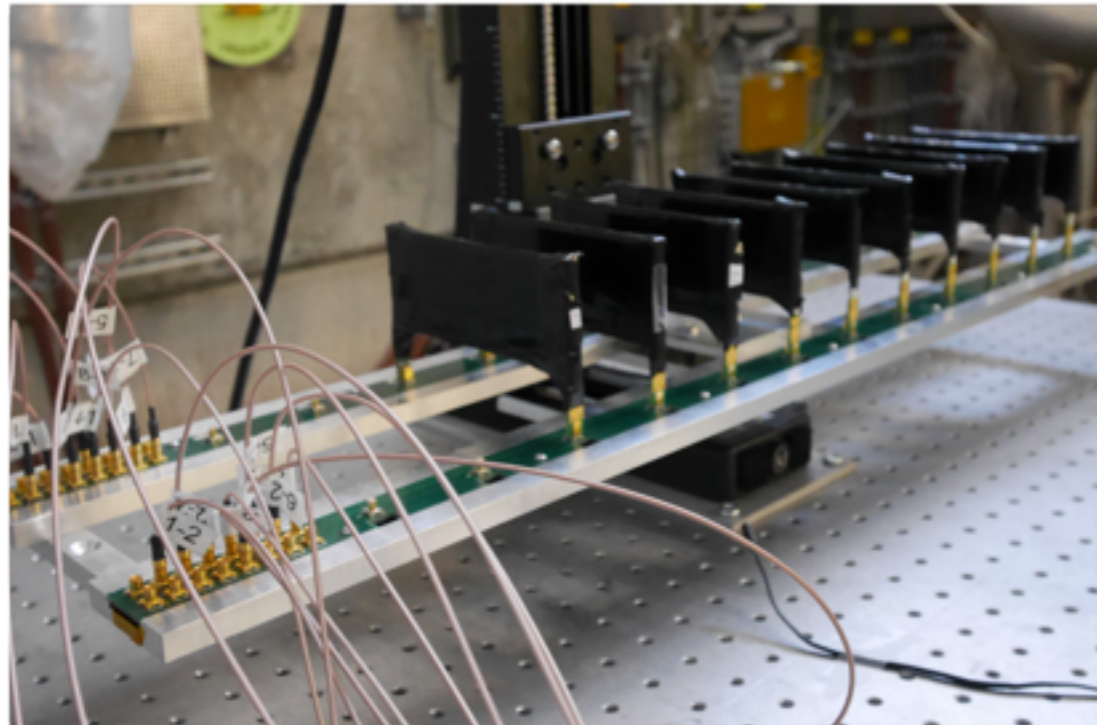
- A big impact on the cost estimation because of

  - cheaper sensor price

    - 1x12=12€ ?? instead of 2x30=60€

  - larger dimension of single tile. less number of channel needed

    - 30x30 mm^2, 6000 tiles

    - 120x40 mm^2, 1125 tiles

Cost Estimate

# Cost Estimate 5500 tiles, 2 SiPM each

Element	Unit cost (€)	Barrel (kEUR)	Endcap (kEUR)	Total (kEUR)
Scintillator Tiles	25	140	50	190
SiPM	30	330	120	450
Readout	20	220	80	300
Mechanics		50	20	70
Sum		740	270	1010

- Their goal is to reach 30 ps (sigma) time resolution.

- 30 ps is to be achieved with several layers.

- Single counter time resolution is ~60 ps.

- The signal without amplification is fed to a voltage amplifier over 6-7m coax cable,

- then DRS4 chip i.e. waveform digitizer (e.g. CAEN V1742)

scint. + sensor

ampl.+digitizer

6-7m coax
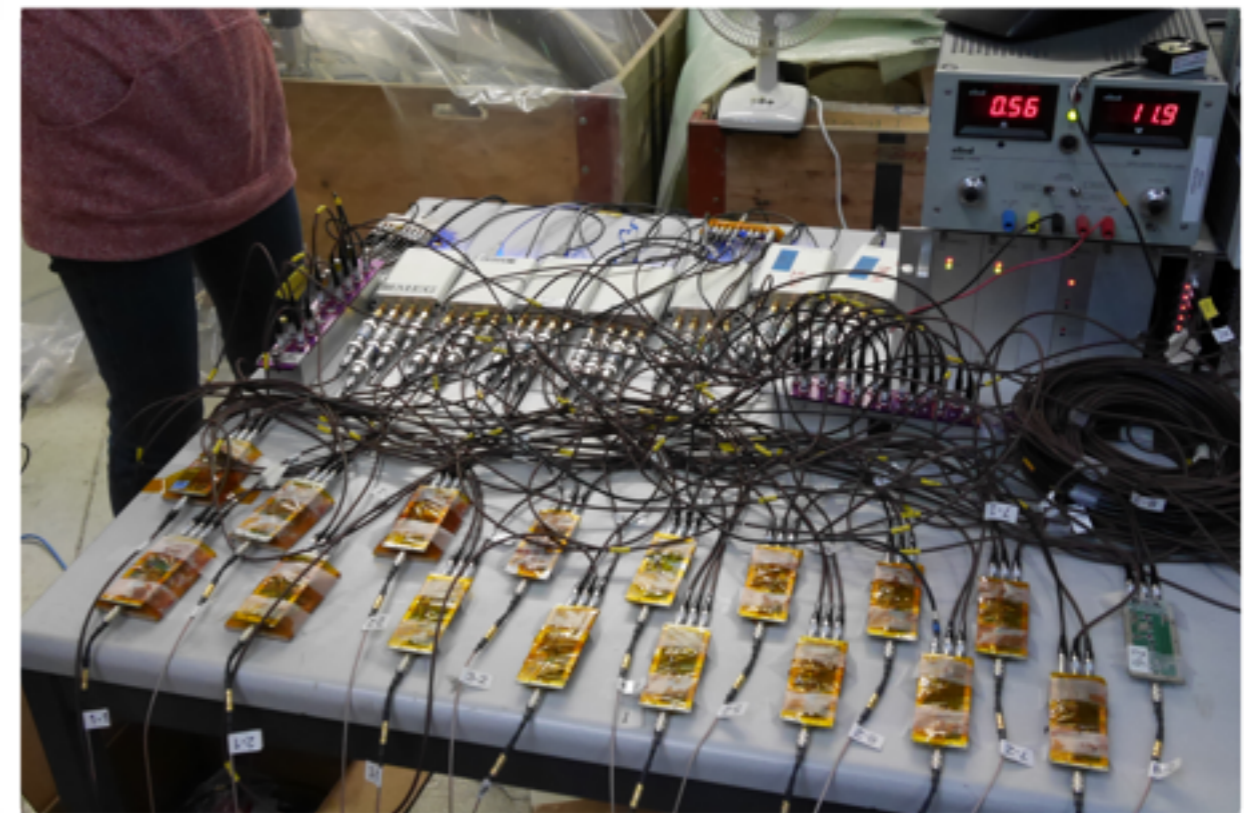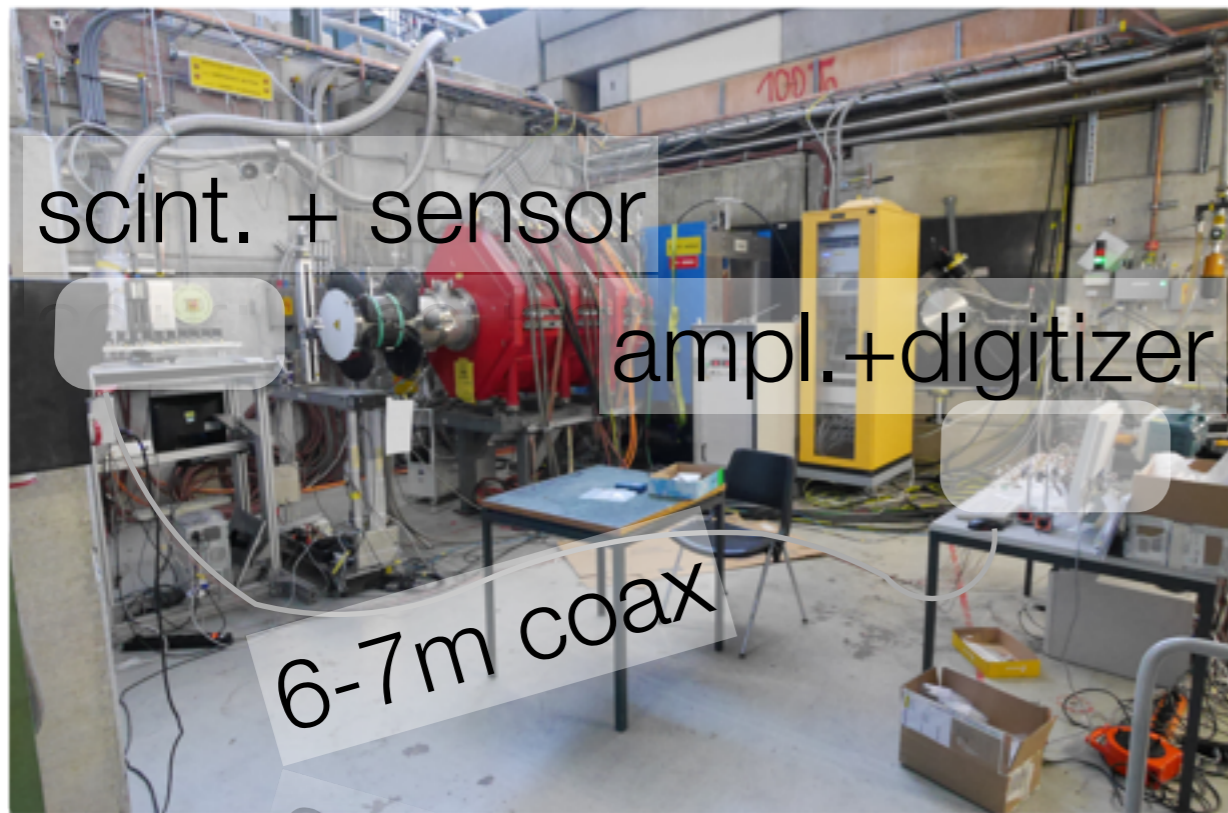
Work package
Detector R&D

- Further optimization of geometry, making use of recent studies, in order to

  - have a better time resolution

  - reduce cost

- Standalone detector simulation by Lukas

  - suggestions to Erlangen group

- System simulation and integration into PANDA Root by Dominik

- CAD Drawing and mechanics by Doris Stückler (SMI Technician)

Work packages (proposal)

- Detector R&D

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Work Package
Physics Simulation

- Software contact person of SciTil: Dominik

- Accelerating…

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Work Package
Radiation Hardness Test

- Pronto Irradiation Facility (PIF) at PSI

  - it has been demolished and converted to a medical facility (orz

  - still trying to get a help from the former PIF team to suggest us an alternative facility to perform a test

- Communication with manufacturer

  - they are all well aware of the importance

  - FBK, KEKEK, PDPC are in the HPH2020 proposal

  - Hamamatsu (NEW)

Work Package
Radiation Hardness Test: Radmap

- Karoly Makonyi (Uppsala)

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Status

- Mainz group offered a help

- Carsten/Herbert got an evaluation kit of TOF-PET chip

  - not gorgeous time resolution

  - rate capability: 100 kHz = 10 μs?

- Looking for a student in Vienna

Slow Control

- Brief list of what you're planning to monitor & control

  - HV (~100V) x ~10k channel and current

  - threshold x ~10k channel

  - temperature

- Status of development (HW and SW)

  - working on a conceptual design (coupled to readout electronics)

- Personal (in FTE)

  - 0.3 FTE

- Planned development 2015

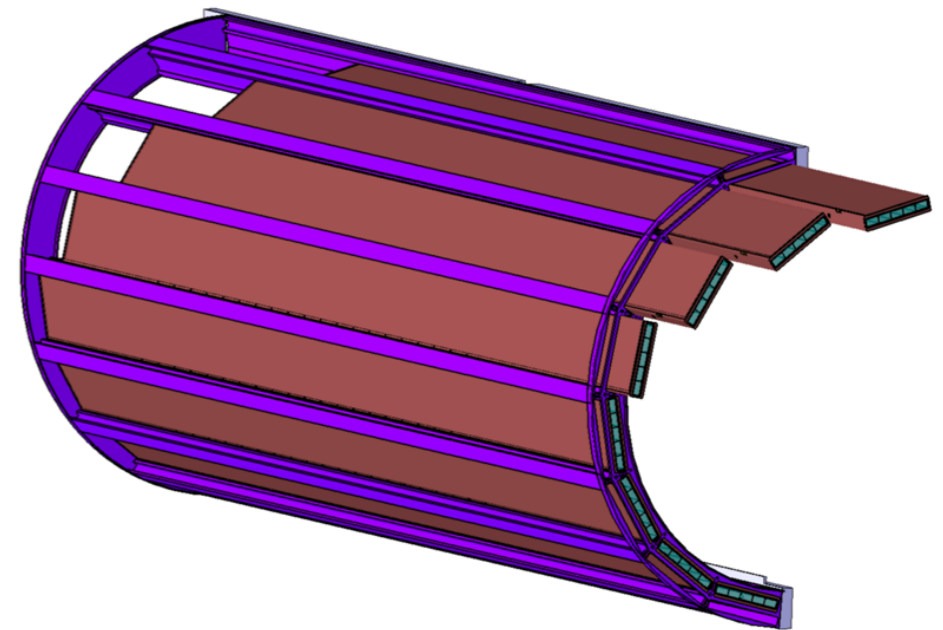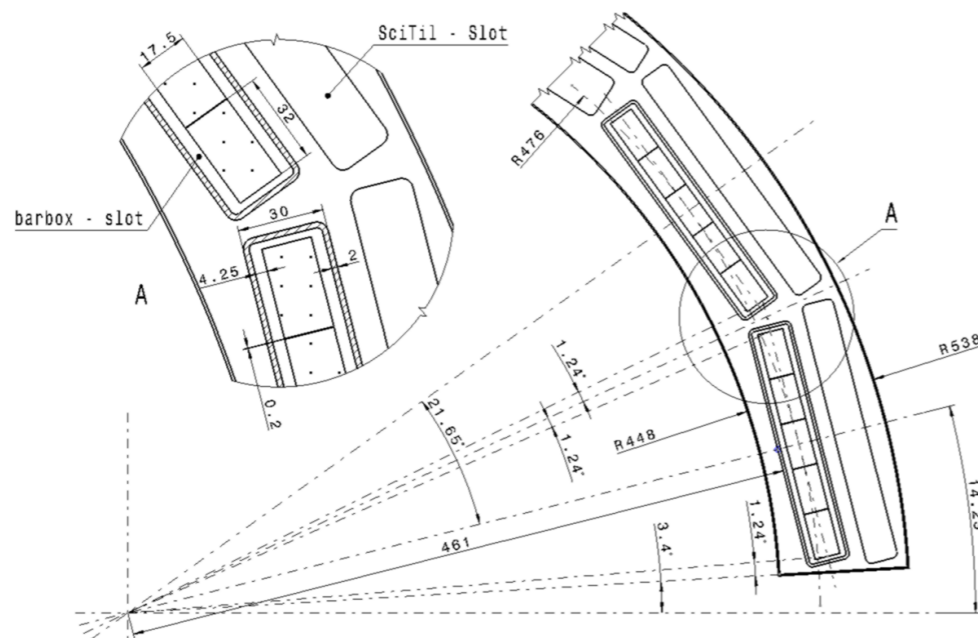 - TDR to be finished in 2015

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- **Mechanics**

- TDR

Workpackage Mechanics

- Doris Stückler (CAD technician) Vienna

- First SciTil CAD drawing done based on the original geometry. Not yet in the official repository (Andreas Gerhadt)

- Keep improving and being updated

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- **TDR**