



**Collaboration Meeting
Computing session
GSI, March 8, 2010**

Thomas Würschig

Implementation of a dedicated geometry for the inner tracker (MVD)



- New versions for the inner tracker available
 - Rapid progress of **mechanics** development *
 - Geometry based on all recent updates
 - Overall support concept: Input of 1st prototypes
 - Dedicated **routing concept** ($z = 0.4 \text{ m} \dots - 1 \text{ m}$) included
 - Scaling with number of channels
 - Based on specifications of actual **electronics and detector development** **
 - Implementation of **additional components** */**
 - Additional Silicon forward disks included in full version:
 - Geometry optimized for the MVD part
 - Additional disks represent conceptual design only

Main versions available



- **Mvd-2.1_AddDisks_FullVersion**

- Full version of extended inner tracker:
MVD + Additional disks

- **Mvd-2.1_FullVersion**

- Full version of MVD

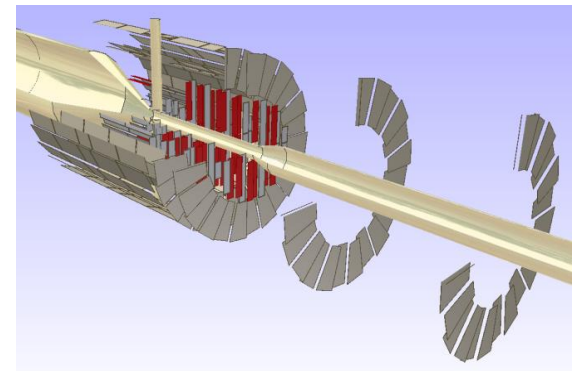
of volumes:
70.458
of different volume types:
597

- **Mvd-2.1_AddDisks_Sensitive**

- MVD + Additional disks:
Active detector volumes only

- **Mvd-2.1_Sensitive**

- Active MVD detector volumes only

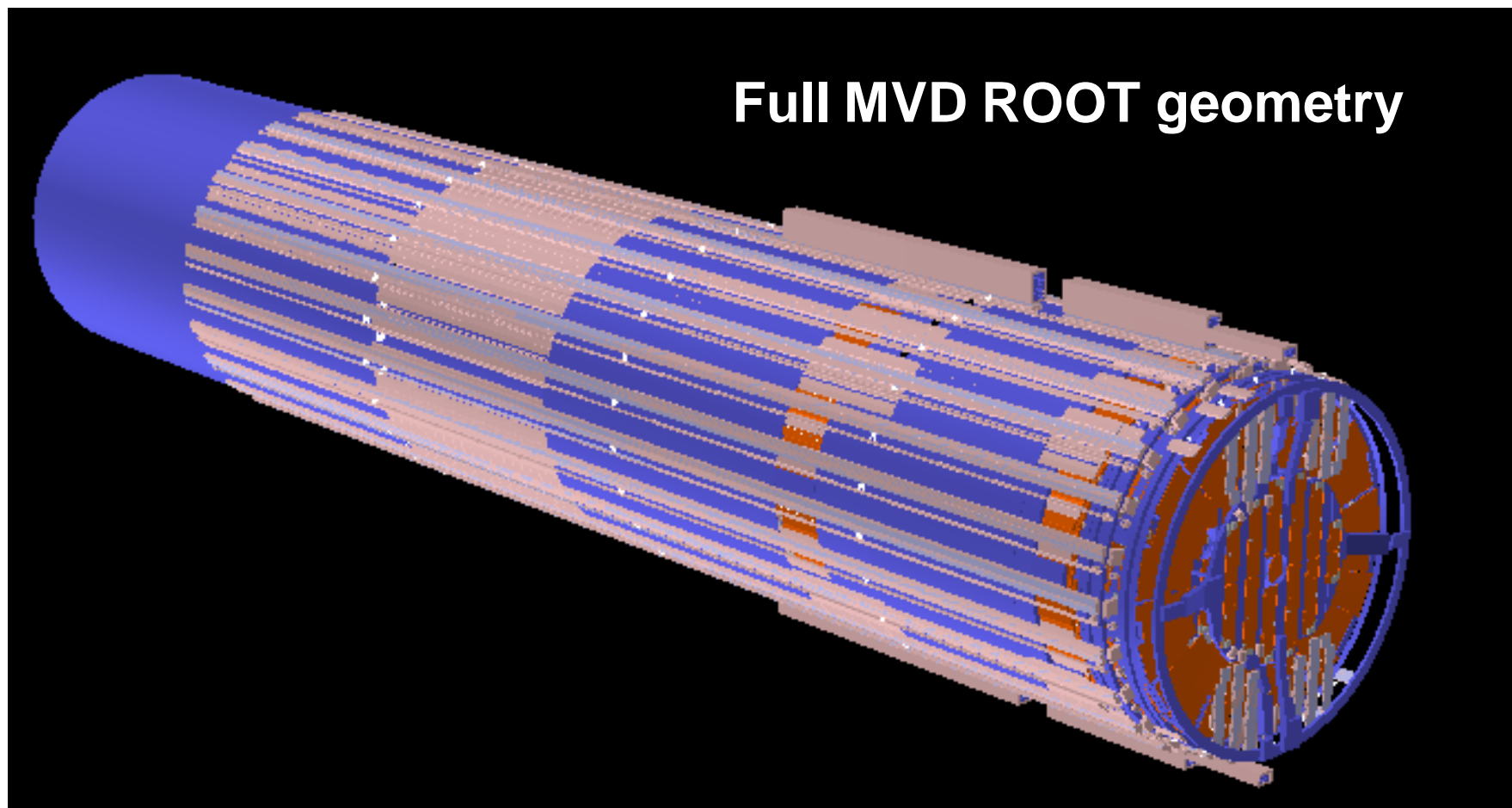


General comments



- Location of geometry files: SVN /trunk/geometry
- Complete material definition of all components
 - New materials: Density-weighted modification
 - ✓ Z and A defined referring to main element
 - ✓ Density modulation of 2nd material:
$$\rho_{\text{eff}} = x \cdot \rho_1 + (1-x) \cdot \rho_2$$
 - ✓ Added to global material file *media_pnd.geo*
- Running extensive collision check
 - Before conversion in CAD software
 - After conversion with function *CheckOverlaps -S*
 - ✓ High statistic (fine scanning): 1 million events
 - ✓ High precision: Overlap threshold 0.00001 cm

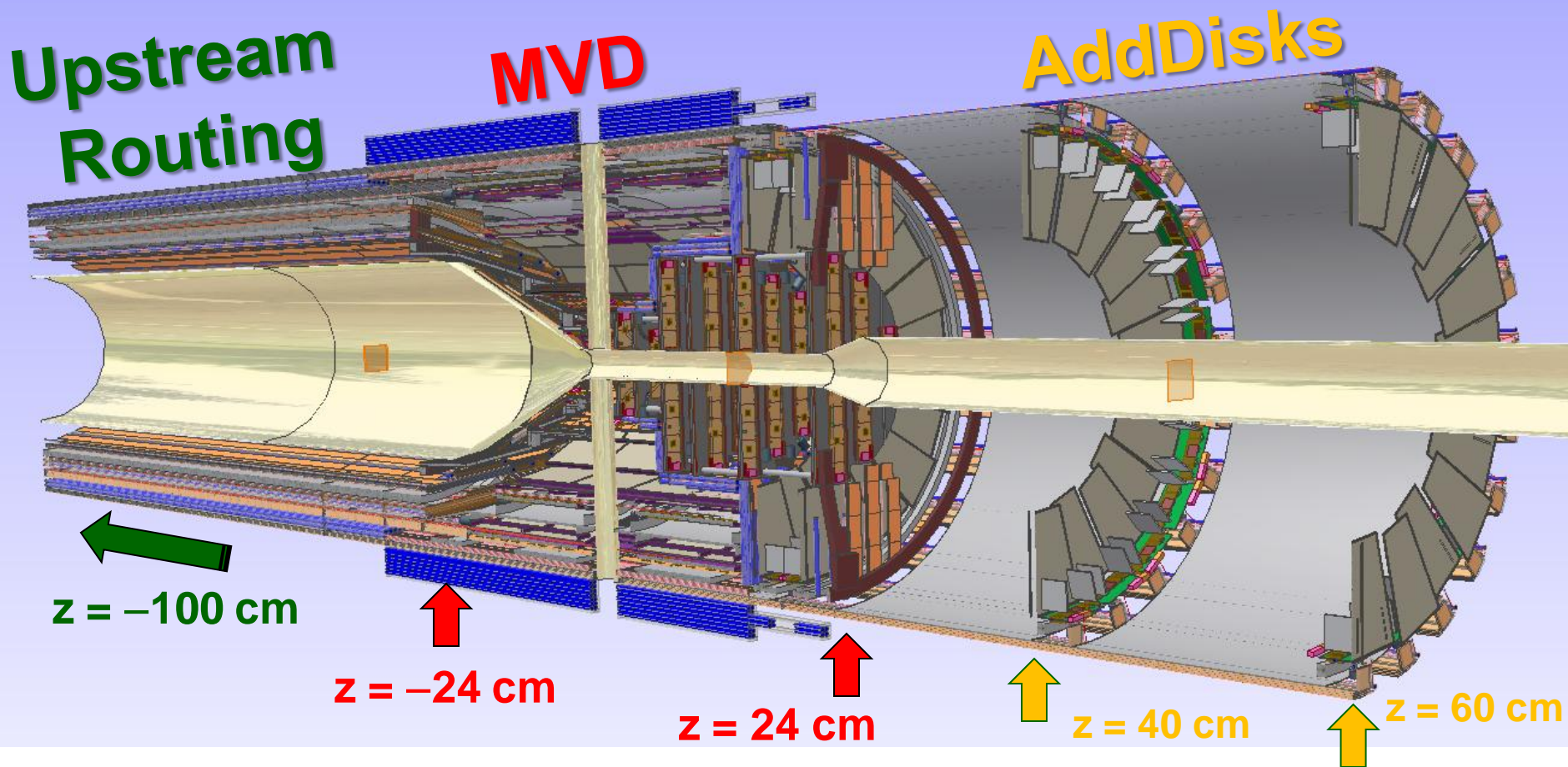
- Illustration of MVD



Main versions available



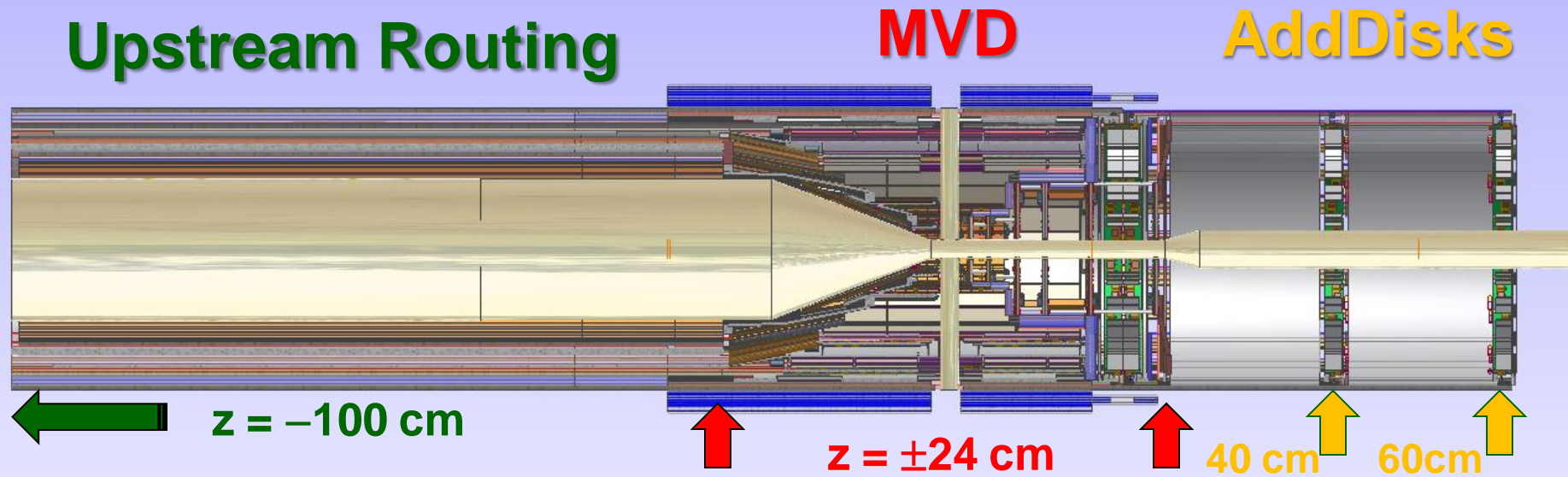
- Illustration of MVD and additional forward disks



Main versions available



- Illustration of MVD and additional forward disks



- MVD: 4 barrel layer / 6 disk layer
 - ✓ Detailed documentation available (ask me...)
- Additional disks: 2 disks further downstream (40 cm / 60 cm)
 - ✓ Copy of MVD strip disks (layer 5 +6)

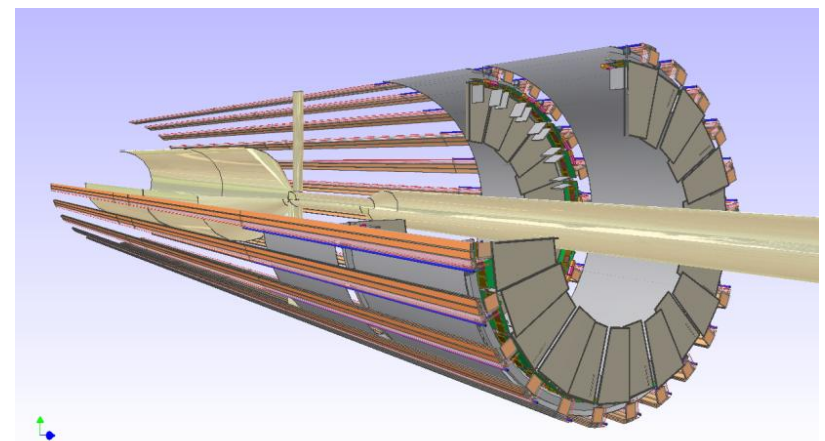
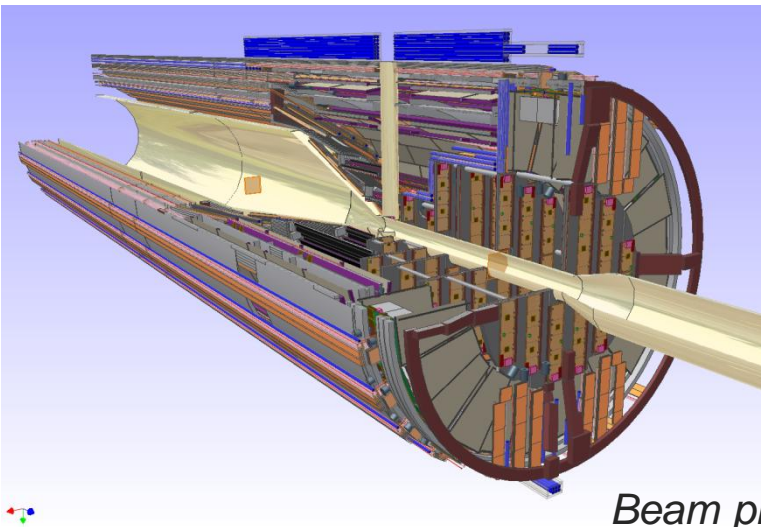
Main structure



Mvd-2.1_AddDisks_FullVersion

Mvd-2.1 (*Full version*)

AddDisks (*Full version*)



Beam pipe not included, just for illustration

Main structure



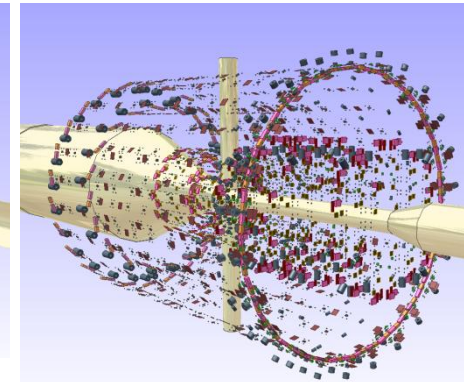
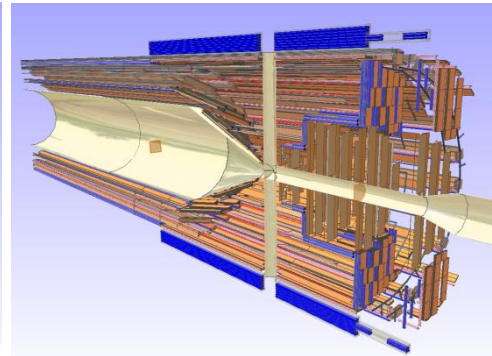
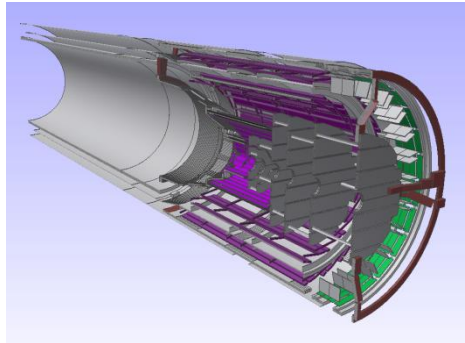
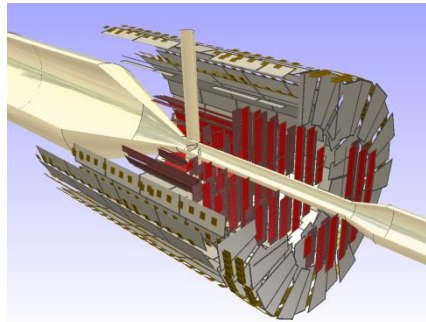
Mvd-2.1 / AddDisks (Full version)

Silicon

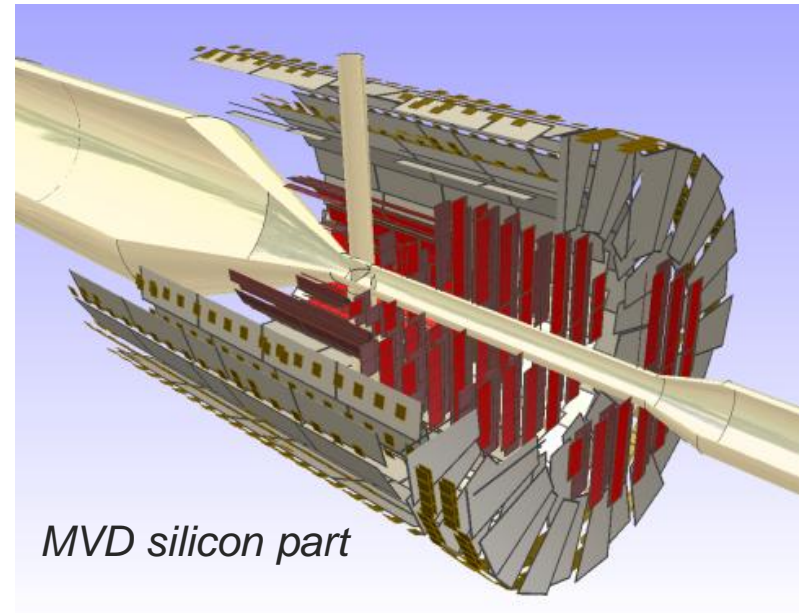
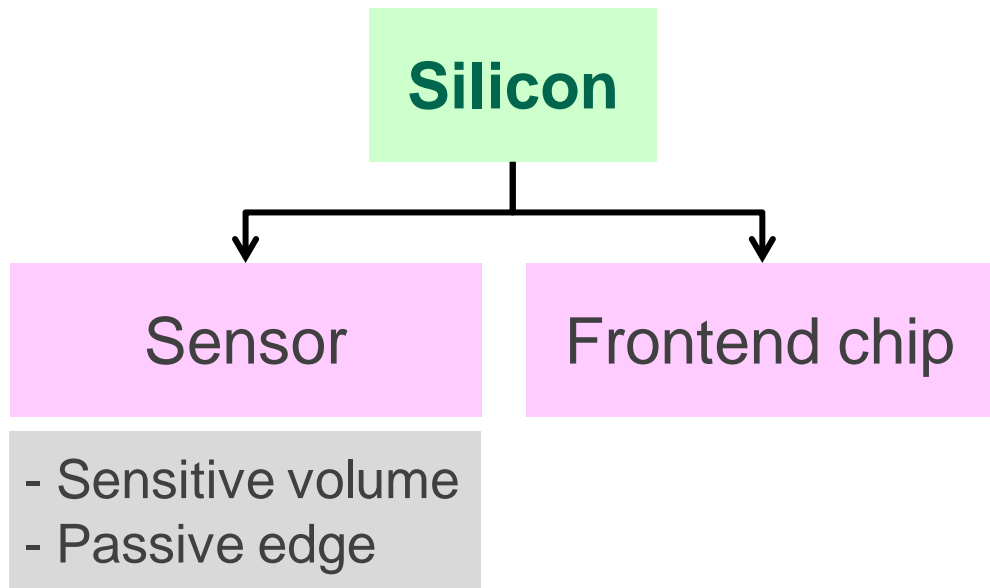
Support

Routing

Components



Structure of main parts



- Defined material: Silicon
- Substructure (MVD): Half-shells including barrel layer, Forward part including half-disks
- Design optimized for MVD part
→ Number of frontends defined by pixel cell size + strip pitch

Structure of main parts



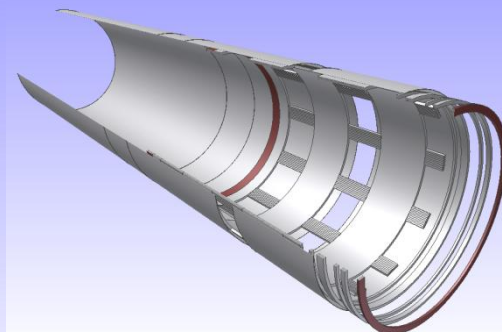
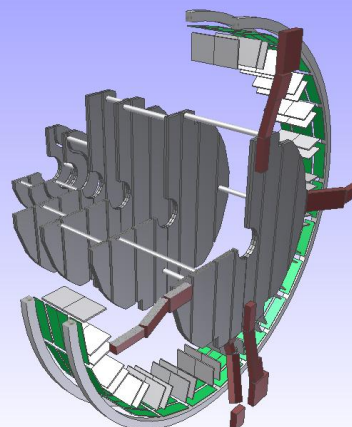
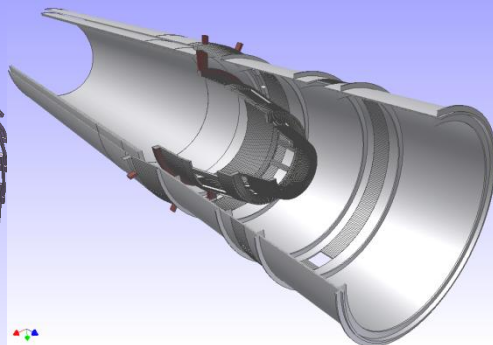
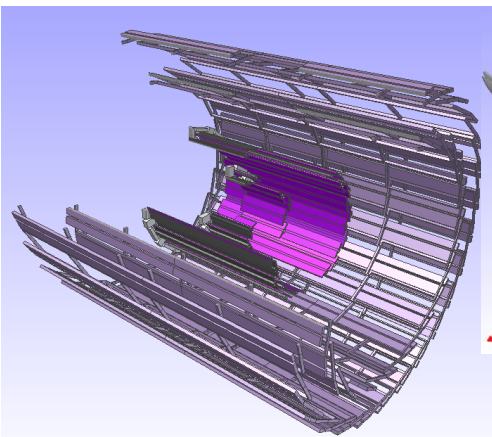
Support

Barrel staves*

Barrel layer*

Disk layer

Global frame



* MVD part only

Structure of main parts



Support

Barrel staves*

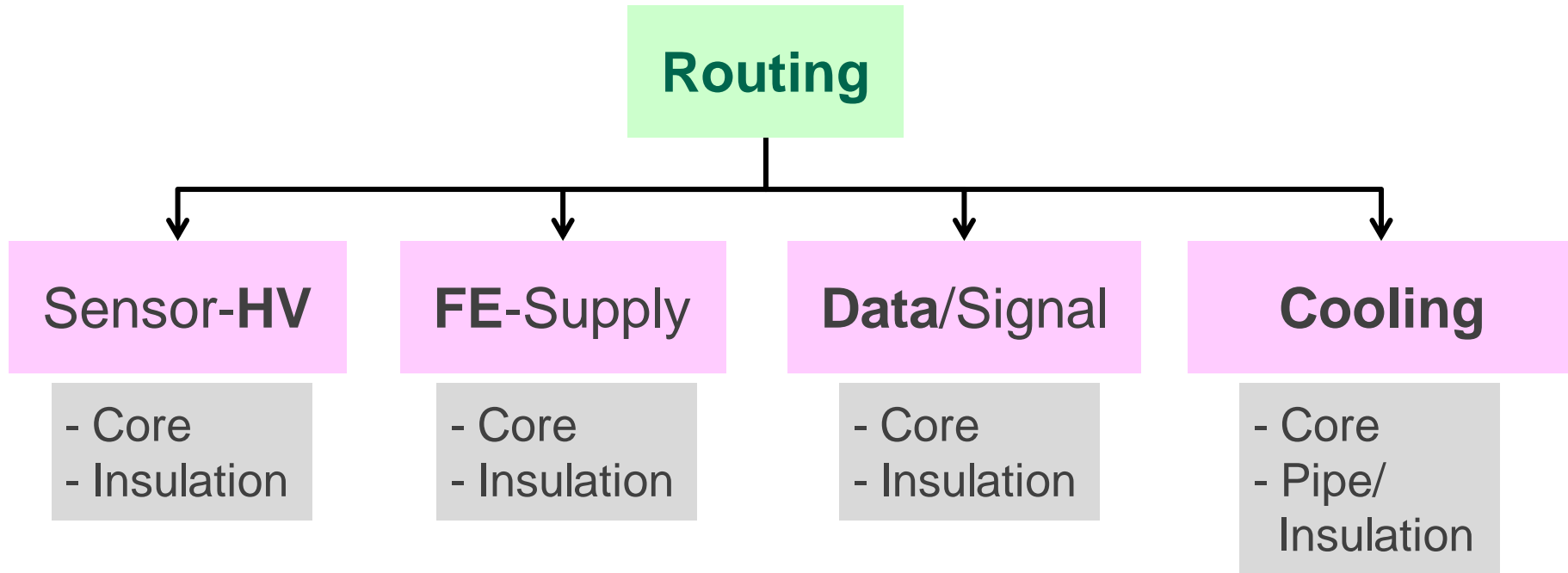
Barrel layer*

Disk layer

Global frame

- Defined material: Carbon foam, Carbon,
Different “light carbon” materials
- Substructure (MVD):
Single barrel layer (1...4), Pixel part, Strip part

Structure of main parts



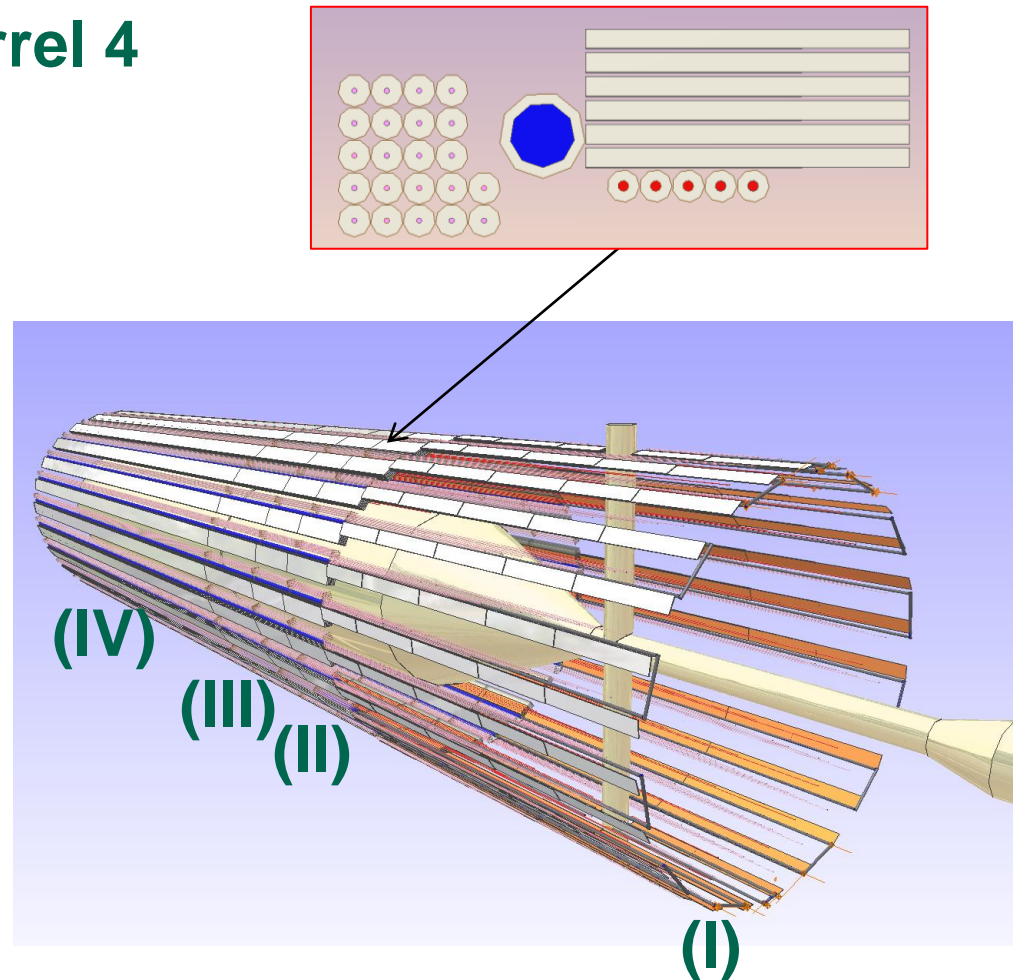
- Defined material
 - ✓ Core: Aluminium (HV, Data) / Copper (FE) / Water (Cooling)
 - ✓ Insulation: PVC / Pipe (Cooling): Steel
- Substructure (MVD): Single barrel layer, Pixel disks, Strip disks

Structure of main parts



Routing Example: Barrel 4

- Implementation:
“Packets” for individual super-modules
- Routing regions:
 - Within active region
(super-module)
 - Within MVD volume
(MVD global frame)
 - Until $z = -30$ cm
(End of central frame)
 - Until $z = -100$ cm
(End of EMC BW EC)



Structure of main parts



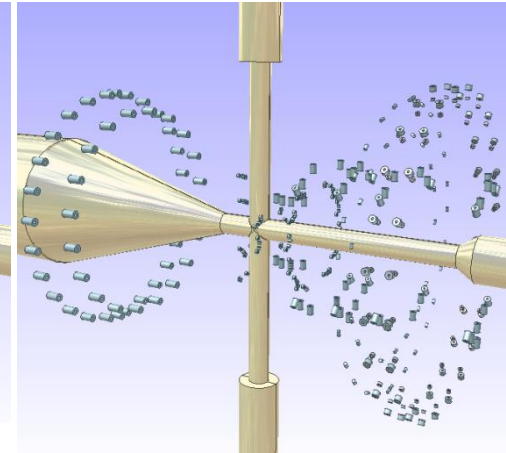
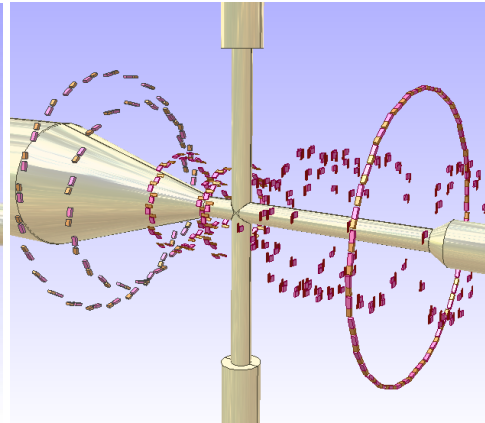
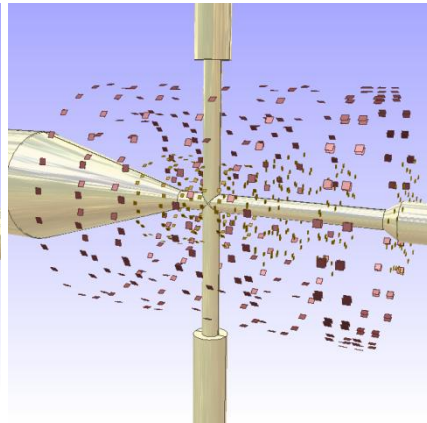
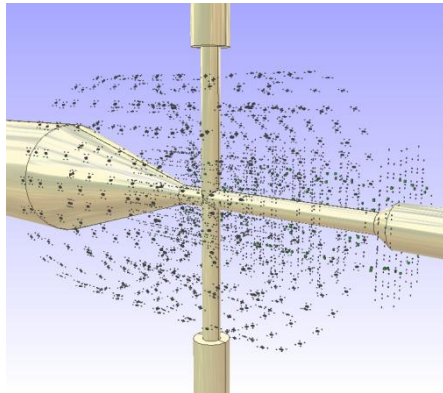
Components

Smd

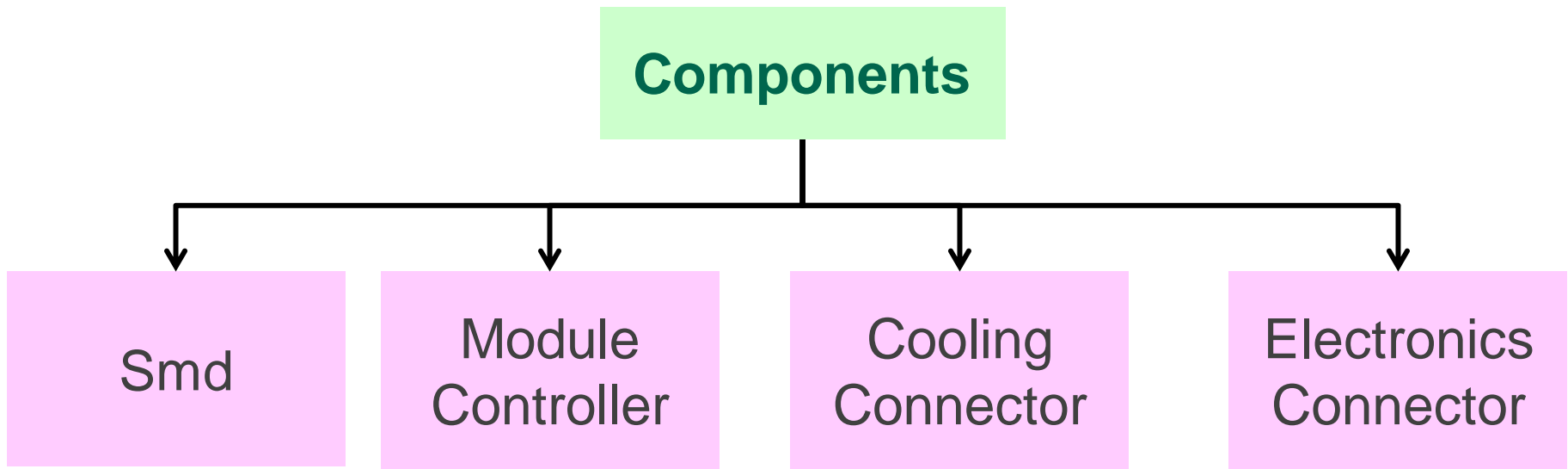
Module
Controller

Cooling
Connector

Electronics
Connector



Structure of main parts



- Defined material

Cooling connector: PVC / Module controller: Silicon

“Light” aluminium (Smd),

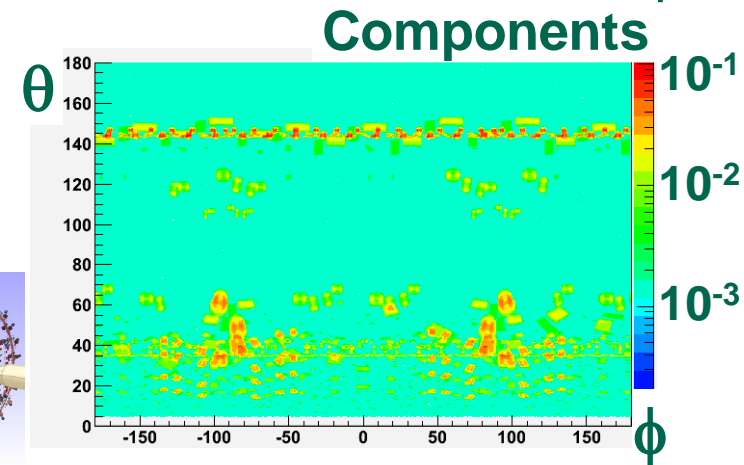
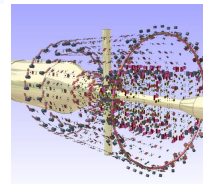
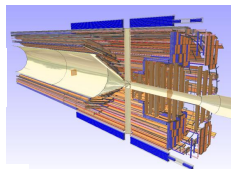
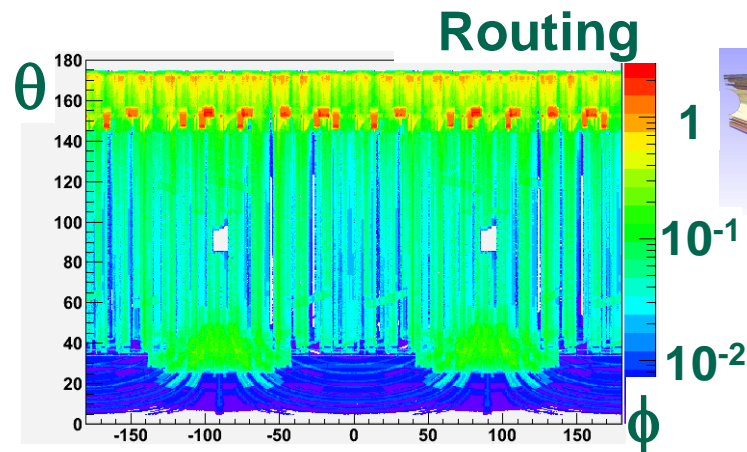
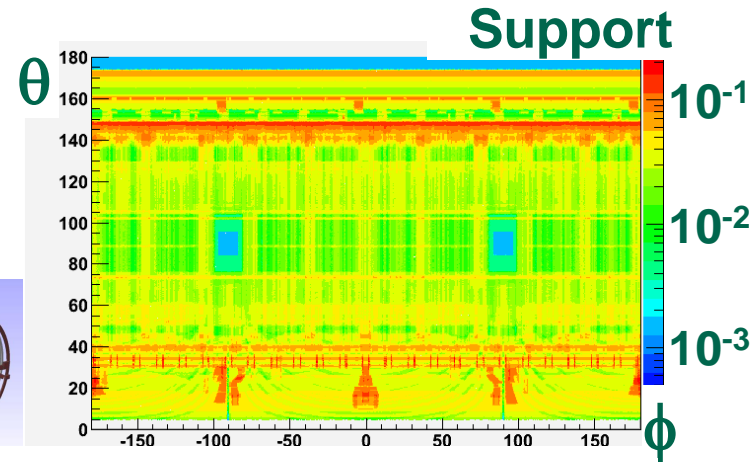
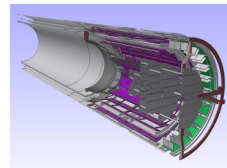
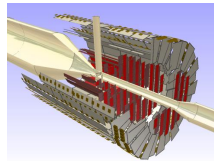
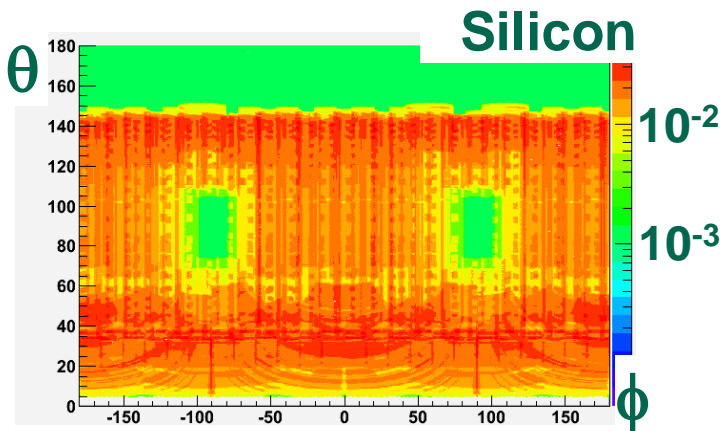
“Heavy” PVC (Electronics connectors)

- Simplified, more schematic implementation

Simulation



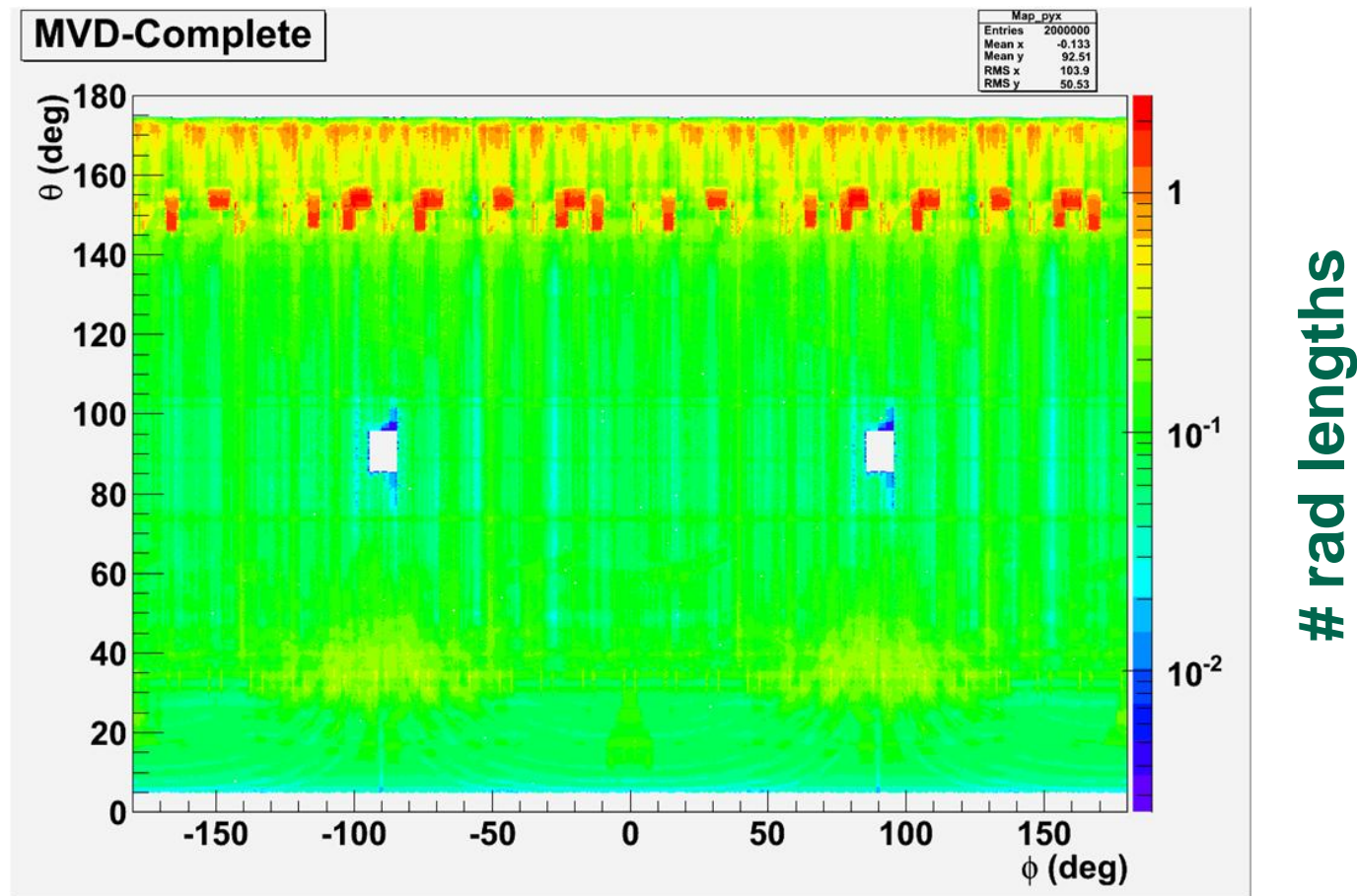
- Selected results of radiation length study (*Geantinos*)
 - 2D mapping of main parts (MVD)



Simulation



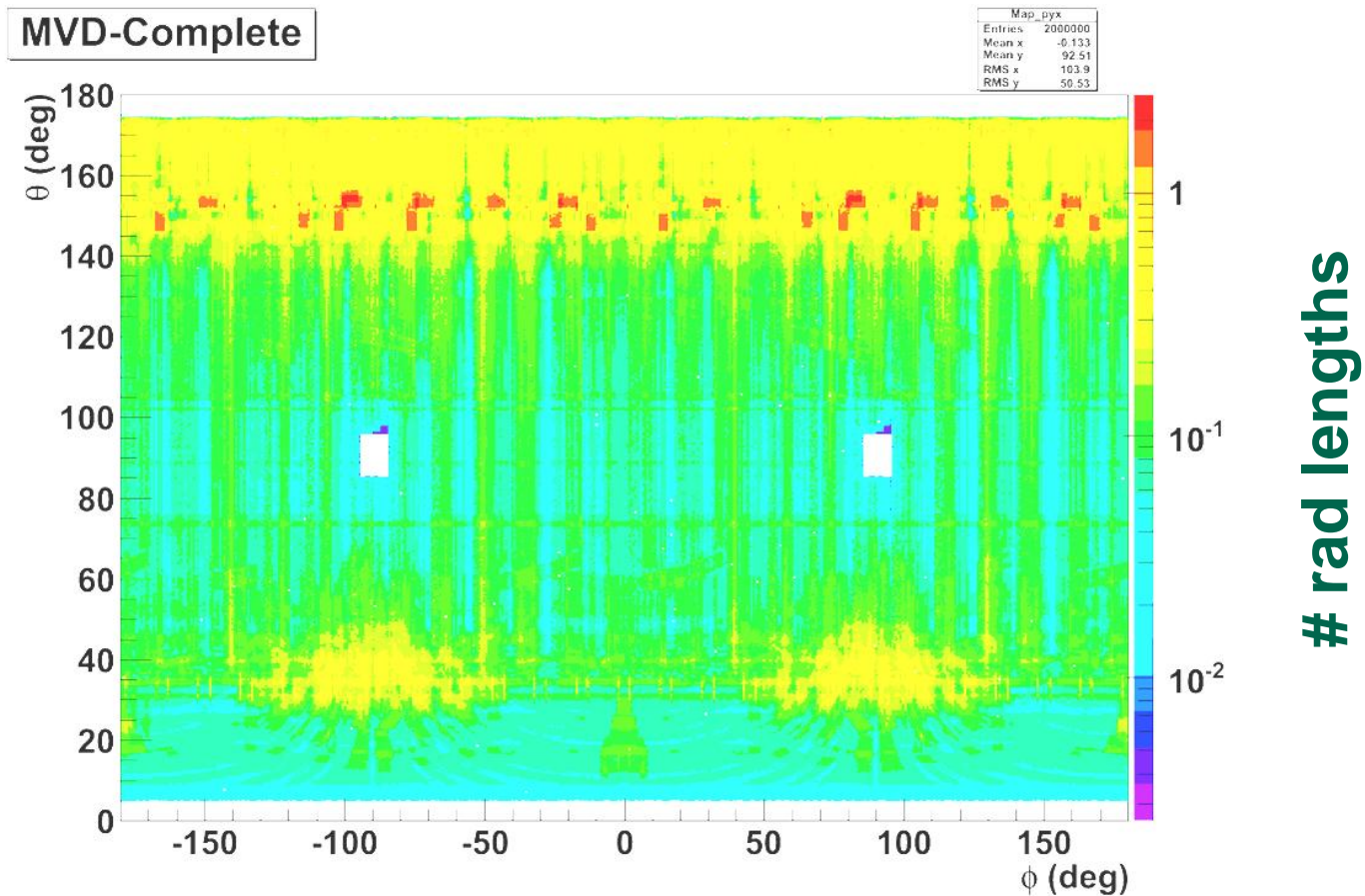
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Simulation



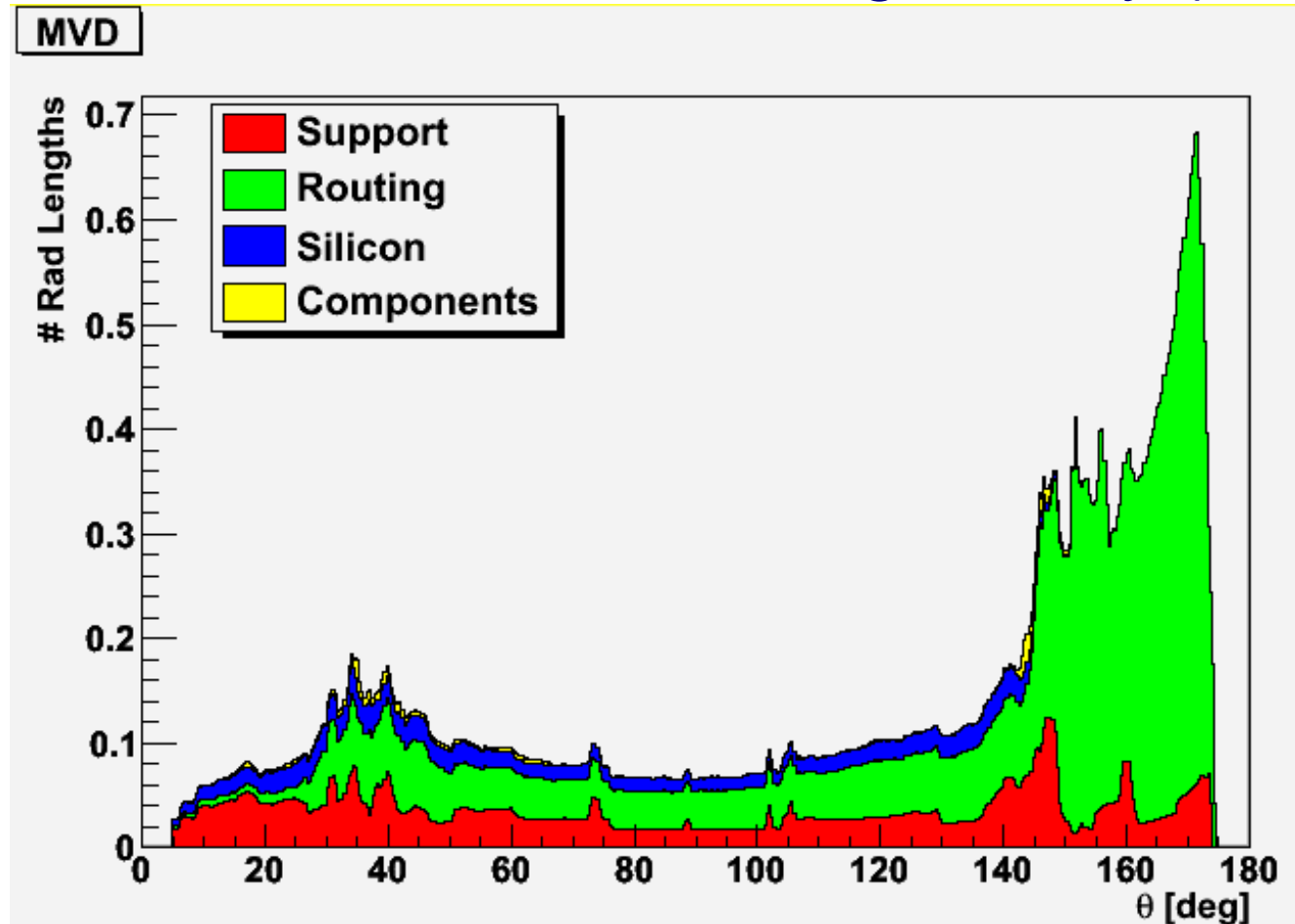
- Selected results of radiation length study (*Geantinos*)



Simulation



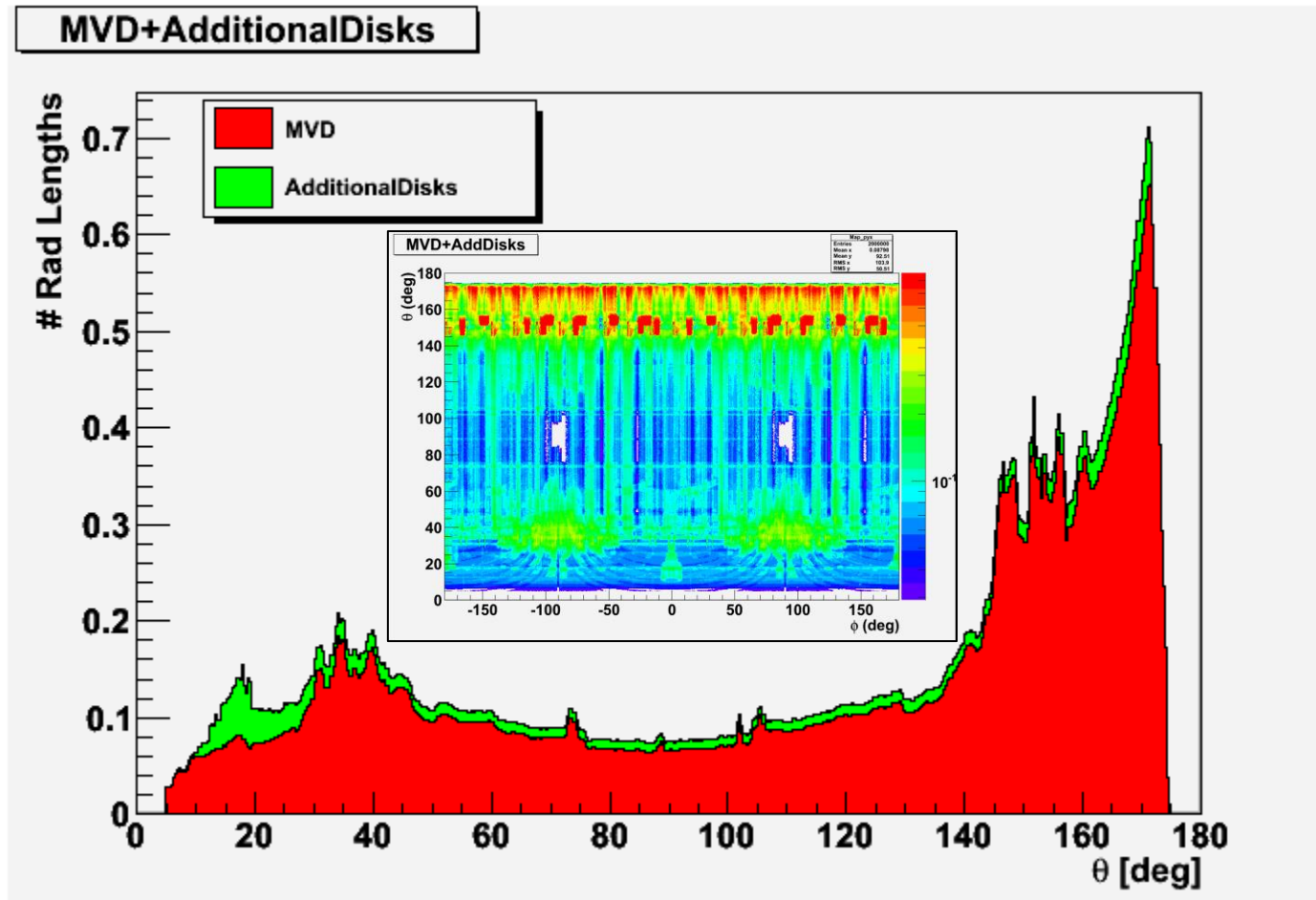
- Selected results of radiation length study (*Geantinos*)



Simulation



- Selected results of radiation length study (*Geantinos*)



Summary



- Detailed model for MVD and additional disks ready
 - Advanced description containing all information of current hardware development (MVD optimized)
 - Realistic input concerning overall material budget: Studies on material effects
 - Comfortable handling due to internal structure and naming conventions (see e.g. MVD-note 1)
 - Sensitive part of additional disks not optimized
- Feedback is welcome ... 😊
 - Appearance of collisions
 - Simulation results
 - Other wishes to extract sub-components?