

# Summary of the



# Technical Board

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*PANDA CM52, Gießen, Mar 20 2015*

Milestone Schedule

System Status Overview

Other News

TDR Progress

GBT for PANDA

## Time-critical PANDA Components

- Solenoid magnet
  - Start of funding
  - construction time
- Barrel EMC:
  - Crystal production
- Dipole magnet

## Update procedure: both top-down and bottom-up

- Top-down: Boundary conditions
  - Funding constraints
  - Civil construction, accelerator
  - Interference between systems
- Bottom-up: Project correlation
  - Feedback from system responsables accompanied by schedule checks

## Two separate schedules: Construction and Installation

# Construction Schedule



| Subsystem                           | 2015 |    |    |                      | 2016 |                    |       |      | 2017 |    |    |    | 2018  |    |    |    | 2019 |    |    |    | 2020 |    |    |    |
|-------------------------------------|------|----|----|----------------------|------|--------------------|-------|------|------|----|----|----|-------|----|----|----|------|----|----|----|------|----|----|----|
|                                     | Q1   | Q2 | Q3 | Q4                   | Q1   | Q2                 | Q3    | Q4   | Q1   | Q2 | Q3 | Q4 | Q1    | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 |
| Dipole                              |      |    |    |                      |      |                    | M7/8  |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Luminosity Detector                 |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward Range System                |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward Shashlyk Calorimeter        |      |    |    |                      |      |                    | M7/8  |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward TOF                         |      |    |    |                      | M4/7 |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Supports                            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Supplies                            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Controls                            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Computing                           |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| DAQ                                 |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Solenoid                            |      |    |    | Conductor production |      |                    |       |      |      |    |    |    | M8/9  |    |    |    |      |    |    |    |      |    |    |    |
| Cluster Jet Target                  |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| TS Barrel Muon Detectors            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| TS Endcap Muon Detectors            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Muon Filter                         |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward Tracking                    |      |    |    |                      |      | M4/7               |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Barrel EMC                          |      |    |    |                      |      | Crystal production |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Pellet Target                       |      |    |    |                      |      |                    |       |      |      |    |    |    | M8/10 |    |    |    |      |    |    |    |      |    |    |    |
| Barrel DIRC                         |      |    |    |                      |      |                    | 8     |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Barrel Time of Flight (TOF)         |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Interaction Region                  |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Micro Vertex Detector (MVD)         |      |    |    |                      |      |                    |       | M4/8 |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Straw Tube Tracker (STT)            |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Backward Endcap EMC                 | M3/7 |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Planar GEM Trackers                 |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward Endcap EMC                  | M3/8 |    |    |                      |      |                    | M9/10 |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Endcap Disc DIRC                    |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Hypernuclei Primary Target          |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Hypernuclei Germanium Detector      |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Hypernuclei Secondary Active Target |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Silicon Lambda Disks                |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |
| Forward RICH                        |      |    |    |                      |      |                    |       |      |      |    |    |    |       |    |    |    |      |    |    |    |      |    |    |    |

- R&D, **M3**: TDR approved
- Tendering, Contract Preparation, **M4**: Contracts signed
- Construction design, **M7**: Planning completed
- Prototype/Pre-series construction, **M8**: Prototype/Pre-series testing complete, production readiness
- Component construction & testing, Module assembly & testing, **M9**: Acceptance test completed
- Pre-assembly, off-site testing, Transport to FAIR, site-acceptance tests, **M10**: Ready for installation

# Installation Schedule



| Subsystem                           | 20XX |    |    |    | 20XX+1 |    |    |    |
|-------------------------------------|------|----|----|----|--------|----|----|----|
|                                     | Q1   | Q2 | Q3 | Q4 | Q1     | Q2 | Q3 | Q4 |
| Dipole                              |      |    |    |    |        |    |    |    |
| Luminosity Detector                 |      |    |    |    |        |    |    |    |
| Forward Range System                |      |    |    |    |        |    |    |    |
| Forward Shashlyk Calorimeter        |      |    |    |    |        |    |    |    |
| Forward TOF                         |      |    |    |    |        |    |    |    |
| Supports                            |      |    |    |    |        |    |    |    |
| Supplies                            |      |    |    |    |        |    |    |    |
| Controls                            |      |    |    |    |        |    |    |    |
| Computing                           |      |    |    |    |        |    |    |    |
| DAQ                                 |      |    |    |    |        |    |    |    |
| Solenoid                            |      |    |    |    |        |    |    |    |
| Cluster Jet Target                  |      |    |    |    |        |    |    |    |
| TS Barrel Muon Detectors            |      |    |    |    |        |    |    |    |
| TS Endcap Muon Detectors            |      |    |    |    |        |    |    |    |
| Muon Filter                         |      |    |    |    |        |    |    |    |
| Forward Tracking                    |      |    |    |    |        |    |    |    |
| Barrel EMC                          |      |    |    |    |        |    |    |    |
| Pellet Target                       |      |    |    |    |        |    |    |    |
| Barrel DIRC                         |      |    |    |    |        |    |    |    |
| Barrel Time of Flight (TOF)         |      |    |    |    |        |    |    |    |
| Interaction Region                  |      |    |    |    |        |    |    |    |
| Micro Vertex Detector (MVD)         |      |    |    |    |        |    |    |    |
| Straw Tube Tracker (STT)            |      |    |    |    |        |    |    |    |
| Backward Endcap EMC                 |      |    |    |    |        |    |    |    |
| Planar GEM Trackers                 |      |    |    |    |        |    |    |    |
| Forward Endcap EMC                  |      |    |    |    |        |    |    |    |
| Endcap Disc DIRC                    |      |    |    |    |        |    |    |    |
| Hypernuclei Primary Target          |      |    |    |    |        |    |    |    |
| Hypernuclei Germanium Detector      |      |    |    |    |        |    |    |    |
| Hypernuclei Secondary Active Target |      |    |    |    |        |    |    |    |
| Silicon Lambda Disks                |      |    |    |    |        |    |    |    |
| Forward RICH                        |      |    |    |    |        |    |    |    |

- Pre-assembly, off-site testing, Transport to FAIR, site-acceptance tests, **M10**: Approval for installation
- Installation at FAIR, commissioning without beam, **M11**: Ready for beam
- Commissioning with beam, **M12**: Ready for operations
- Magnet field mapping

## Assumptions:

- CC delayed
- Start of installation once hall available
- Dipole first: HESR
- TS and FS separate
- FS: from downstream towards upstream
- TS sequence:
  - Solenoid
  - Barrel EMC
  - Inner systems
  - Endcap

## Conclusions

- Plan pre-assembly & pre-commissioning
- Compress installation schedule
- Goal: be ready for beam quickly

# System Status Overview



| PSP code   | Component                    | Next Milestone | Achievements                                       | Current Activity   | Critical Items  | Schedule Status |
|------------|------------------------------|----------------|--|--|---|-----------------|
| 1.4.1.01   | Pellet Target                | M3: 7/2015     | Pellet tracking TDR                                | R&D  |   | on time         |
| 1.4.1.02   | Cluster Jet Target           |                | Record density $2 \times 10^{15} / \text{cm}^2$    | Setup and test of cluster jet target generator   | Resources from FZJ  | on time         |
| 1.4.1.03   | MVD                          |                | Production design close to completion              | Revision of ToPiX, design of PASTA   | Validation of strip readout   | on time         |
| 1.4.1.04.1 | STT                          |                | Straw mass production ongoing                      | System design completion, pre-series readout syst  | Mechanical integration, maintenance concept                                       | on time         |
| 1.4.1.04.2 | Planar GEM Trackers          | M3: 12/2015    | Revised design of layout                           | Prototyping (GEM foils, readout foil)  | Design validation (simulation & prototype), readout design. Increase of manpower. | risk of delay   |
| 1.4.1.04.3 | Silicon Lambda Disks         |                | EOI  |  |   |                 |
| 1.4.1.05   | Barrel DIRC                  | M3: 6/2016     | Baseline design validated                          | Prototype tests  | Final design validation   | risk of delay   |
| 1.4.1.06   | Barrel Time of Flight (TOF)  | M3: 12/2016    | Prototype goal met. Two new institutes joined.     | Technical design, readout concept, software development  | Radiation hardness of SiPM  | on time         |
| 1.4.1.07   | Forward Tracking             | M3: 3/2016     | Baseline design complete                           | Prototype tests, simulations of tracking   | Full simulation, prototype validation   | risk of delay   |
| 1.4.1.08.1 | Endcap Disc DIRC             | M3: 12/2016    | Review, 1st stage complete                         | Project planning, readout  | Design validation   | risk of delay   |
| 1.4.1.08.2 | Forward RICH                 |                | EOI  |  |   |                 |
| 1.4.1.09   | Forward TOF                  | M3: 9/2015     | Beam tests finished. Prototype goal met            | TDR drafting. SiPM KETEK tests   | DAQ tests with TRB-3, dipole TOF  | on time         |
| 1.4.1.10.1 | Barrel EMC                   | M7: 6/2015     | APD Contract, mechanical design                    | Pre-series slice design  | APD Screening, crystal production   | risk of delay   |
| 1.4.1.10.2 | BWE EMC                      | M8: 7/2015     | APD Contract, Prototype in testbeam                | Mechanical design  | APD Screening, mechanical integration   | on time         |
| 1.4.1.10.3 | FWE EMC                      |                | Crystals ready, mechanics, prototype validation    | Production   | APD Screening   | on time         |
| 1.4.1.11   | Forward Shashlyk Calorimeter | M3: 6/2015     | Module design validated                            | Design revision, TDR compilation   |   | risk of delay   |
| 1.4.1.12   | Luminosity Detector          | M3: 12/2015    | Baseline design complete                           | TDR in review  | Validation of digital readout   | on time         |
| 1.4.1.13   | Muon System                  | M4: Contract   | Approval of TDR                                    | Contract preparation, prototyping  | Digital readout   | on time         |
| 1.4.1.14   | Hypernuclear Setup           | M3: 12/2015    | Prototype goal met, project management established | Prototyping, Preparing TDR, Mechanical Design and Integration, simulations of tracking and of physics performance, Design of DAQ | Software trigger concept, Mechanical Integration                                  | risk of delay   |
| 1.4.1.15   | Solenoid                     |                | Conductor design                                   | Cold mass design   | Contract, conductor production  | risk of delay   |
| 1.4.1.16   | Dipole                       |                | Work package assignment                            | Design validation  |   | on time         |
| 1.4.1.17   | Interaction Region           |                | Design concept                                     | Prototype design   | design validation   | risk of delay   |
| 1.4.1.18.1 | Supports                     |                |  |  |   |                 |
| 1.4.1.18.2 | Supplies                     |                |  |  |   |                 |
| 1.4.1.18.3 | Controls                     | M3:09/2016     | Preliminary Prototype concepts                     | Prototype interfaces   | Development of sub-systems controls   | 9 months shift  |
| 1.4.1.19   | DAQ                          | M3: 12/2016    | DAQ scheme   | Design of prototype building blocks  | validation of concept   | on time         |
| 1.4.1.20   | Computing                    | M3: 12/2016    | Fair Computing TDR                                 | Evaluation of computing requirements   | Funding   | on time         |



- Solenoid magnet
  - CERN team has made significant contribution to improved design, needs to continue.
  - Conductor and afterwards coil winding need to be tendered asap
  - Contract urgent, but cannot be concluded before summer
- Interaction region: vacuum with cluster jet target critical
- DAQ: Factorize detector readout and event selection

- Most critical: Barrel EMC
  - Crystal production (money, speed, quality)
  - Barrel installation procedure impacts on all inner detectors
  - Readout chain not validated for optimal resolution
  - Integration issues not solved, noise issues, cooling design, cables
  - Mechanics not fully validate but production ongoing
  - APD screening: behind schedule, open criteria
- Forward Tracking:
  - Urgent need for full simulation with realistic pattern recognition
  - Possible delay of TDR just for this
- GEM Tracker:
  - Urgently more manpower needed
  - Open engineering questions

## EDMS for PANDA

- Defined release procedures
- Updated groups
- Automated notificatons

## PANDA Dates 2015

- Internal review of Forward Shashlyk: late spring '15
  - External reviewers not yet known
- PANDA DAQ/FEE Workshop: April 9/10
- PANDA MEC Workshop: April 27/28
- PANDA Russia Meeting at FRRC Moscow in May 25-27



## Status TDR

PANDA

Status 5. Jan 2015

### Submission 2015:

- Q2: Luminosity Detector } **June**
- Q2: Forward Shashlyk }
- Q3: Forward Time of Flight
- Q3: Forward Tracking
- Q3/4: Pellet Target Addendum

### Submission late 2015 / early 2016:

- GEM Tracker
- Detector Controls

### Submission 2016/17:

- Barrel DIRC
- Hypernuclear Setup
- SciTil / Barrel ToF
- DAQ and Computing
- Disc DIRC

| System                       | Approval   | Expected Approval |
|------------------------------|------------|-------------------|
| Target Spectrometer EMC      | 08/08/2008 | approved          |
| Barrel EMC                   | 08/08/2008 | approved          |
| Backward Endcap EMC          | 08/08/2008 | approved          |
| Forward Endcap EMC           | 08/08/2008 | approved          |
| Solenoid                     | 05/21/2009 | approved          |
| Dipole                       | 05/21/2009 | approved          |
| Micro Vertex Detector (MVD)  | 02/26/2013 | approved          |
| Straw Tube Tracker (STT)     | 01/29/2013 | approved          |
| Cluster Jet Target           | 08/28/2013 | approved          |
| Muon System                  | 09/22/2014 | approved          |
| Luminosity Detector          | <i>tba</i> | 12/2015           |
| Forward Shashlyk Calorimeter | <i>tba</i> | 12/2015           |
| Forward TOF                  | <i>tba</i> | 12/2015           |
| Forward Tracking             | <i>tba</i> | 03/2016           |
| Barrel DIRC                  | <i>tba</i> | 06/2016           |
| Hypernuclear Setup           | <i>tba</i> | 09/2016           |
| Pellet Target                | <i>tba</i> | 09/2016           |
| Controls                     | <i>tba</i> | 09/2016           |
| Planar GEM Trackers          | <i>tba</i> | 12/2016           |
| Barrel Time of Flight (TOF)  | <i>tba</i> | 12/2016           |
| DAQ                          | <i>tba</i> | 12/2016           |
| Computing                    | <i>tba</i> | 12/2016           |
| Endcap Disc DIRC             | <i>tba</i> | 12/2017           |
| Silicon Lambda Disks         | <i>tba</i> | <i>tba</i>        |
| Forward RICH                 | <i>tba</i> | <i>tba</i>        |

*tba*: to be announced

The items "Interaction Region", "Supports" and "Supplies" shown in previous reports have been removed from the list, since no TDRs are planned.

## Luminosity Detector

- Review was done, report is being written
- Implementation of recommendation till June
- Goal: Submission end of June

## Forward Time of Flight

*Stan Belostotski*

- Main chapter written
- DAQ tests to be done
- Time is tight for presentation in June

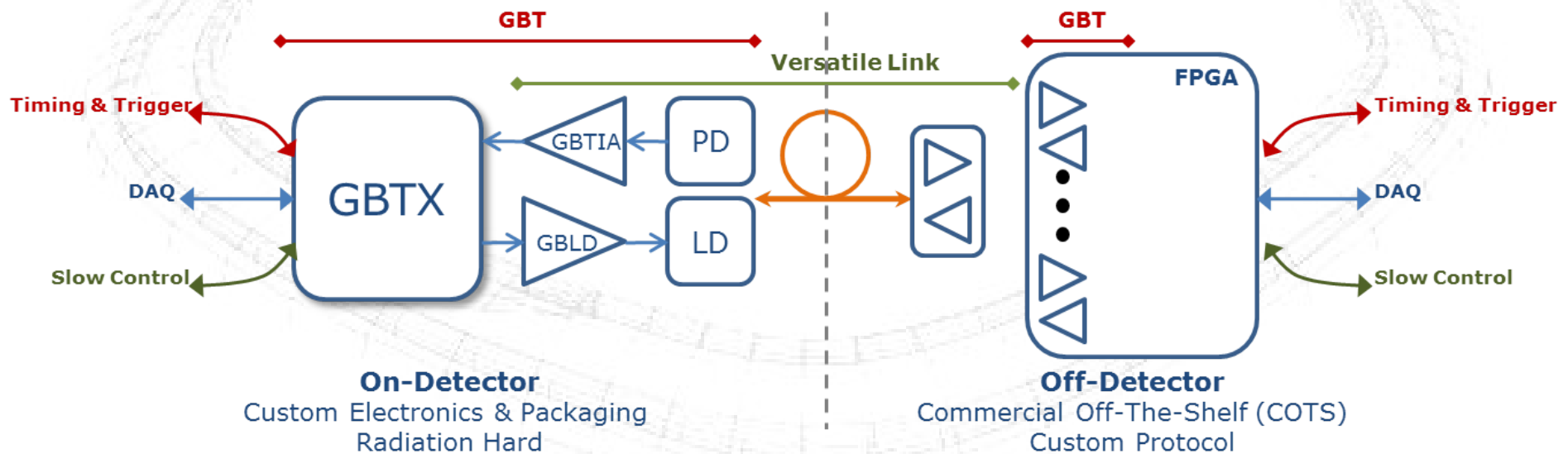
## Forward Tracker

*Jerzy Smyrski*

- Major parts are written, ToC explained in TB
- Prototypes built, tests imminent
- Main missing item: full simulation with pattern recognition  
*Help is needed!*
- Goal: Presentation in June

## GigaBit Transceiver

- Radiation hard data transmission chipset developed at CERN
- ASICs on-detector, FPGA off-detector electronics
- Electrical links from FEE to GBTx
- Optical link from GBTx



# Potential Usage in PANDA



## Microvertex Detector

- 192 links will be employed
- Components ordered

## Other Systems to consider:

- GEM Tracker
- Disc DIRC
- Barrel EMC

## Decisions urgent:

- Estimate of radiation level
- Layout of readout scheme
- Ordering within 2015!

