

RF Synchronization

General Schedule and Possible Issues Discussion

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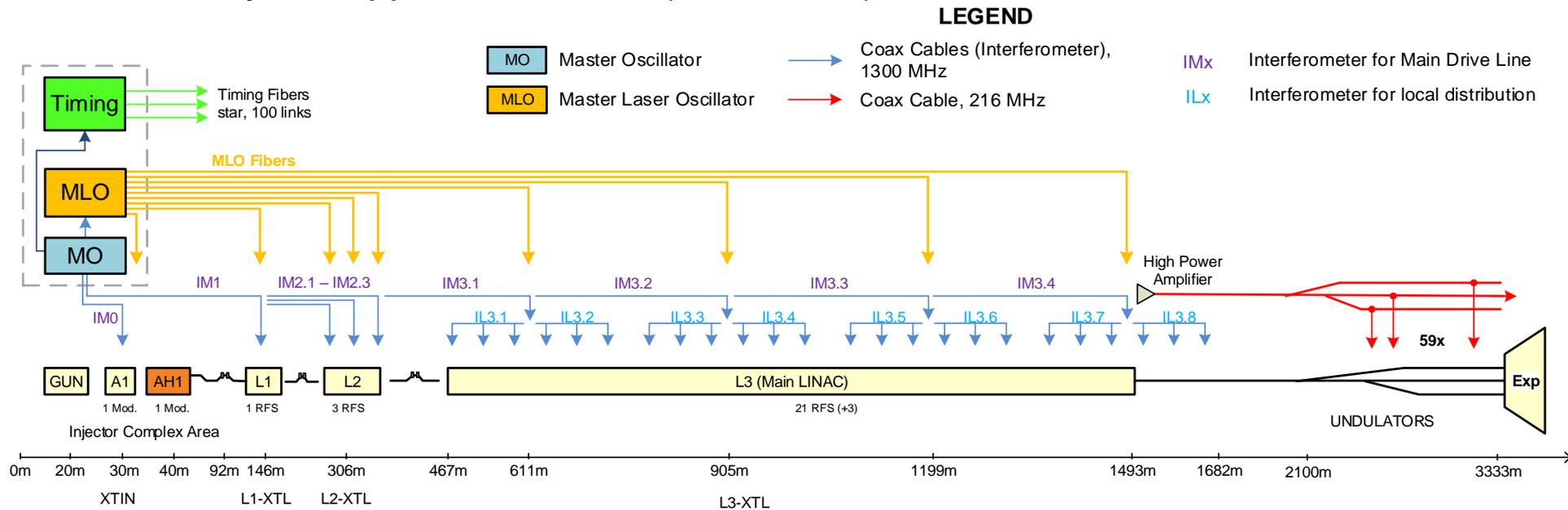
Institute of Electronic Systems

MSK Collaboration Workshop 2015



System Layout

General layout. Approved in 2014 (CDR, PRR)



- > Worked out as a compromise between signal loss, distribution distance and unification of system components for manufacturing
- > Biggest Issue: series connection of main (IMx.y) links – single point of failure
- > Cabling designed for redundant links but doubling electronics and adding switches would create large complexity and not sure if would warranty better reliability of the system – see last slide.

General To Do List

> Design Interferometer Links

- General layout
- Modular hardware (InCon, TapPoint, ...)
- Software

> Design cabling

> Design REFM boxes

> Build prototypes

> Test

> Mass Production

> Installations

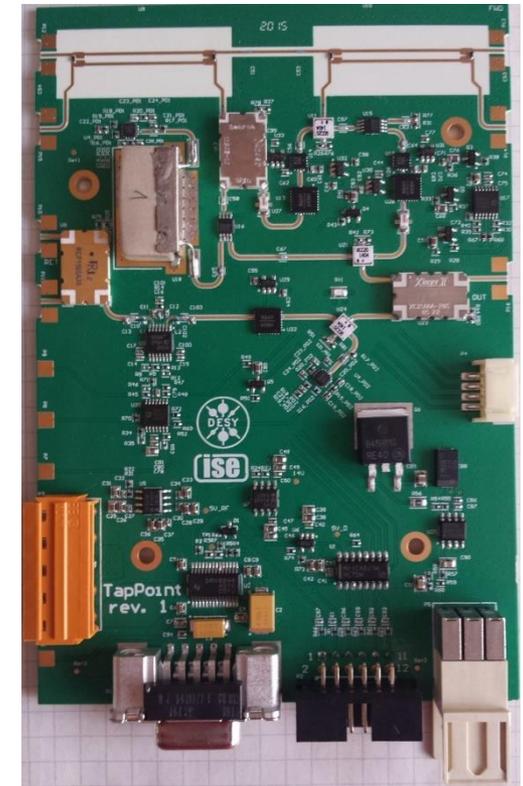
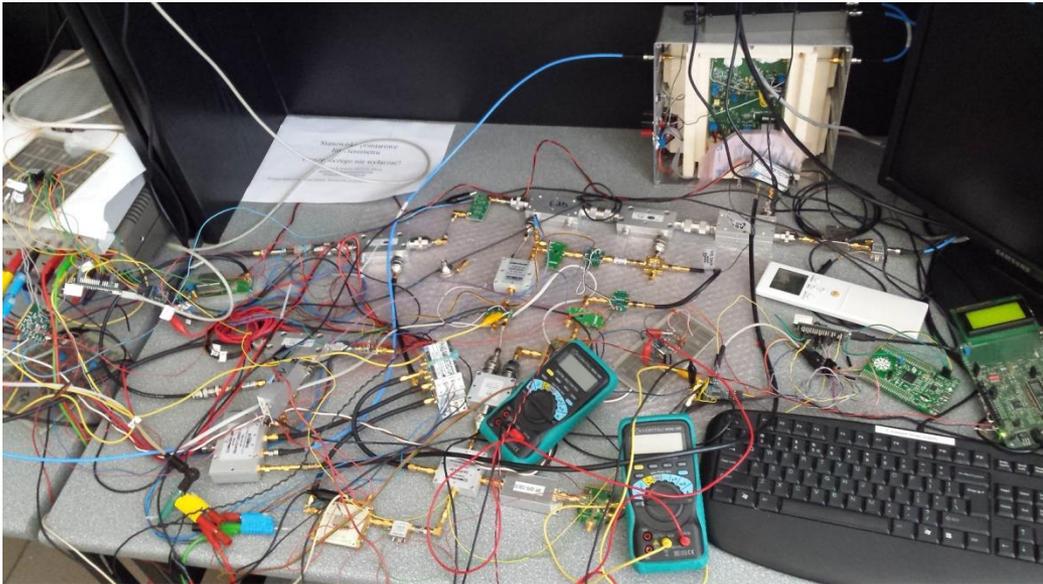
Due to late beginning and lack of manpower must be done in parallel risking mistakes and necessity of unplanned iterations

Interferometer Links

- > Relatively simple principle. Robust. Proven by Fermilab.
- > Very time consuming manual tuning/adjustments
- > We have 44 interferometer links with total of 65 tap points
 - Manual adjustments would be a disaster
- > Need to implement automatic tuning (previous talk by P. Kownacki)
 - Demonstrated working
 - Complicated hardware and software
 - Fortunately developed scheme with unbreakable operation. Even, if software fails, signal will be there with limited performance!

Interferometer Development and Integration

- Despite of obvious limitations the „mess” shown below gives good results
- Work delayed but this will improve soon
- We expect significant progress after running PCB versions



Interferometer Development and Integration - Status

- > TapPoint v1 debugging and tests started (P. Jatczak)
- > Board must be proven in June
- > TapPoint v2 design in progress (adding one signal branch for interruptible operation) (T. Owczarek)
- > TapPoint v2 review and production after proving v1
- > InCon v1 produced and tested successfully
- > InCon v2 in design (D. Kołcz)
 - correcting bugs and adding automatic adjustment features
 - start of production planned in June, aiming for final version
- > Biggest Issue: software development and integration tests
 - Must be done in short time, will be possible with Incon v2 and TapPoint v2
 - Must assemble team for extensive tests in July/August



- > There is 83 boxes to be designed and produced
- > Fortunately design is modular, all will be done by small modifications after one is designed.
- > Main issues:
 - Missing final shape of all internal components (fixed recently)
 - Missing mechanical designer. Daniel too busy. There was proposal of Robert Wedel to take care about it, but this is still not clarified
 - Preparing documentation for mass production -> we need to deal with it in parallel with extensive testing and developments (lack of manpower)
 - Mass production (see next slides)
 - Quality assurance, tests...

General Plan

> Interferometer development

- InConv2 design, production and tests
- TapPoint v1 tests
- TapPoint v2 design, production and tests
- Sftware development and integral tests

- aim end of July

- end of June

- July/August

- June-August

Steps critical for further activities.
Hard to guarantee time schedule

> REFM mechanical design

- ASAP but probably untill August

> Diagnostics

- All time in parallel (see next slide)

> Prototype production

- September

> Documentation

- All time in parallel

> Mass production

- Autumn (see next slide)

> Installations

- After production

> Tests (how to verify performance?)

- see next slides

> Diagnostics

- General plan exists, but many details to be worked out
- Still not decided how to finish it. AD plans to leave us in Autumn
- Automatic adjustment algorithms from Przemek should be integrated with server software. Still not decided on who and how will do it.

> Mass production of REFM boxes

- Need to prepare ASAP (mechanics, documentation, start collecting components)
- Some
- Not clear who will manufacture
- Shall we produce components (InCon, TapPoint, ...), assembly by ZE, company?
- Shall we start ordering long delivery time components (phase shifters, amplifiers, ...)?

> Installations

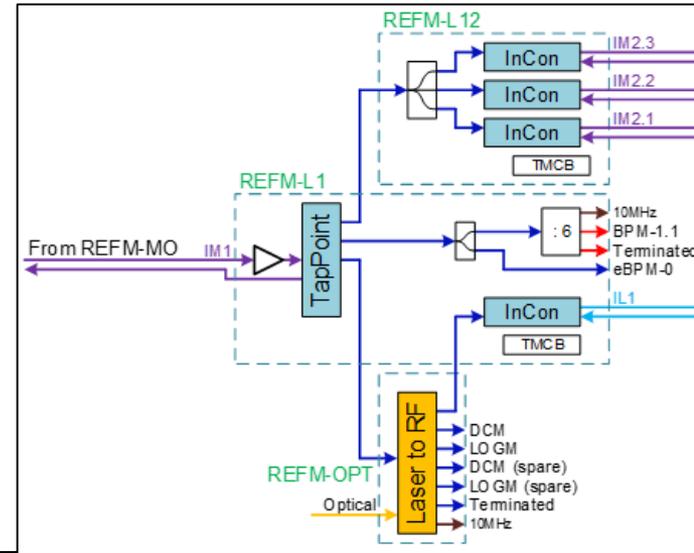
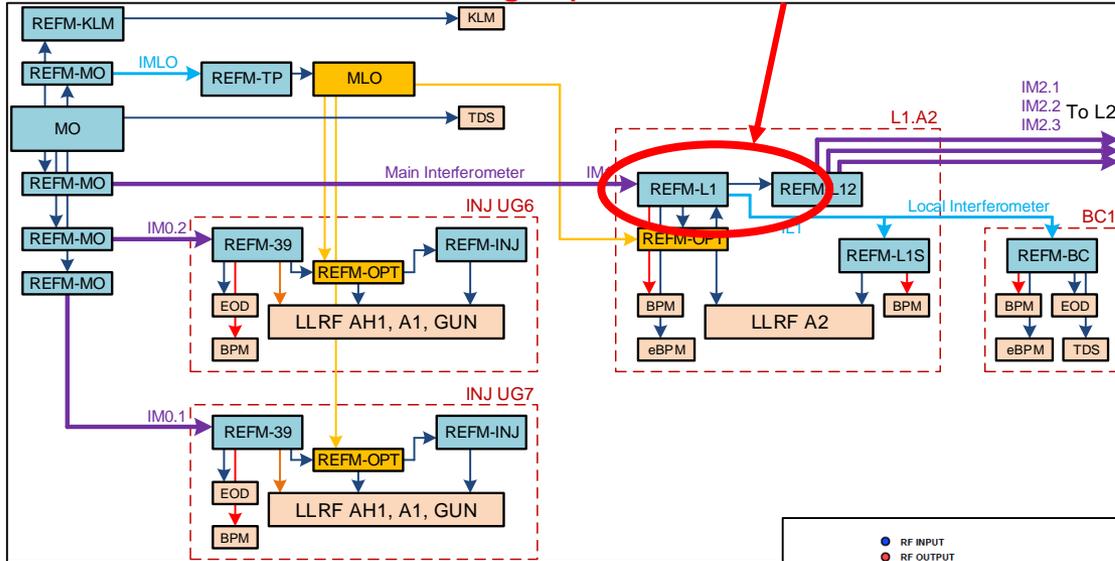
- **Bridging mixed out of order module installation:**
- either work out a temporary scheme with amplifiers. Do we have enough of them?
- or rely on temporary reference sources not synchronized to MO? We can easily build cheap (120 EUR) PLL with 1.3 GHz sources. Old student thesis design is ready.

> Commissioning

- A lot of work in the tunnel
- Even though automatic adjustments will save a lot of time
- **Link performance verification in the tunnel**
 - test against REF-M-OPT
 - Use Szymon's link in parallel? Will it be available end of 2015?

Open Points 3 – Redundancy of Main Links

Single point of failure for entire machine



- > Cables are there but limited space for doubling REF-M-L1 and L12
- > It will probably decrease performance
- > No clear benefit of redundancy but risk of not having it
- > Last chance to decide is now

